

# ANTÆUS

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*Communicationes ex Instituto Archaeologico  
Academiae Scientiarum Hungaricae*

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# INHALT – CONTENTS

Abbreviations	7
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*“Exchange and Cultural Contacts in the Neolithic Carpathian Basin and Around: Advances in the Research” Budapest, 30<sup>th</sup> 11. 2002.*

<i>Eszter Bánffy</i> : Neolithic Contacts: Adaptation, Exchange of Information (An Introduction)	11
--	----

<i>Alasdair Whittle</i> : Connections in the Körös Culture World: Exchange as an Organising Principle	17
---	----

<i>Florin Draşovean</i> : Transylvania and the Banat in the Late Neolithic. The Origins of the Petreşti Culture	27
---	----

<i>Georgeta El Susi</i> : Analogies and Differences between Animal Husbandry at the Late Vinča and Foeni Group Sites in the Banat (SW Romania)	37
--	----

<i>Eva Lenneis</i> : Erste Anzeichen der Regionalisierung sowie Nachweise von Fernkontakten in der älteren Linearbandkeramik	47
--	----

<i>Krisztián Oross</i> : Das neolithische Dorf von Balatonszárszó (Forschungen zwischen 2000–2002)	61
--	----

<i>Tibor Marton</i> : Material Finds from Balatonszárszó, Neolithic Settlement: Connections within and without the TLPC Territory	81
---	----

<i>László András Horváth</i> : Angaben zu den Haustypen des mittleren Neolithikums in Ungarn	87
--	----

<i>Katalin T. Biró</i> : Provenancing: Methods, Possibilities, Problems	95
---	----

Round Table November 30, 2002, Discussion (Compiled by <i>Eszter Bánffy</i> )	111
---	-----

*“Environmental Changes under the Neolithization Process in Central Europe: Before and After” Budapest, 28<sup>th</sup> – 29<sup>th</sup> 11. 2003.*

<i>Pál Sümegi</i> : Environmental Changes under the Neolithization Process in Central Europe. Before and After	117
--	-----

<i>Attila Barczy</i> : The Importance of Pedological Investigations in Holocene Palaeoecological Reconstructions. A Case Study (Hortobágy, Hungary)	129
---	-----

<i>Gábor Timár</i> : Space and GIS Technology in Palaeoenvironmental Analysis	135
---	-----

<i>Slobodan B. Marković – Dusan Mihajlović – Eric A. Ochse – Mladjen Jovanović – Tivadar Gaudényi</i> : The Last Glacial Climate, Environment and the Evidence of Palaeolithic Occupation in Vojvodina Province, Serbia: An Overview	145
--	-----

<i>Ruth Drescher-Schneider</i> : Changes in Vegetation and Climate in Eastern Austria from the Mesolithic to the Bronze Age: Reasons for the Migration of Neolithic Population?	153
---	-----

<i>Hansjörg Küster: The Effect of Neolithic Shifting Cultivation on Vegetation Development: "Landnam" and Secondary Succession</i>	165
<i>Dorota Nalepka: Pollen Evidence for Human Activity in the Surroundings of Early Neolithic Settlements in Kujawy Region (Central Poland) Based on Pollen Analysis</i>	171
<i>Gusztáv Jakab – Pál Sümegi – Enikő Magyar: A New Quantitative Method for the Palaeobotanical Description of Late Quaternary Organic Sediments (Mire-development Pathways and Palaeoclimatic Records from Southern Hungary)</i>	181
<i>Imola Juhász: Palynological Evidences of Preneolithization in South-Western Transdanubia</i>	213
<i>Sorina Fărcaș– Ioan Tanțău: The Human Presence in Pollen Diagrams from Romanian Carpathians</i>	227
<i>Paul C. Buckland – Eva Panagiotakopulu – Philip Ian Buckland: Fossil Insects and the Neolithic: Methods and Potential</i>	235
<i>László Bartosiewicz – Clive Bonsall: Prehistoric Fishing along the Danube</i>	253
<i>Erika Gál: The Neolithic Avifauna of Hungary within the Context of the Carpathian Basin</i>	273
<i>Renate Ebersbach: Agriculture, Stock Farming and Environment: Adaptation and Change during the Neolithic Lakeshore Period (4300 – 2400 BC cal) in Switzerland</i>	287
<i>Vesna Dimitrijević: Pleistocene Survivors in the Iron Gates Mesolithic/Neolithic Archaeofaunas</i>	293
<i>András Grynæus: Dendrochronology and Neolithic Research in Hungary</i>	303

#### Studies

<i>Pál Sümegi: Findings of Geoarchaeological and Environmental Historical Investigations at the Körös Site of Tiszapüspöki-Karancspart Háromág</i>	307
<i>Friderika Horváth: Römische bodenständige Keramik</i>	343
<i>Csilla Zatykó: Reconstruction of the Settlement Structure of the Medieval Nagyszakácsi (Somogy County)</i>	367

#### Discussiones

<i>Nándor Kalicz – Tibor Kemenczei – Pál Raczký: Opponent's Remarks on István Zalai-Gaál's Doctoral Thesis</i>	433
<i>István Zalai-Gaál: Possibilities of the Social-archaeological Studies of the Neolithic</i>	449

## ABBREVIATIONS

AAC	Acta Archaeologica Carpathica (Kraków)
AASzeged	Acta Antiqua et Archaeologica (Szeged)
AAusgrBW	Archäologische Ausgrabungen in Baden–Württemberg (Stuttgart)
AAWG	Abhandlungen der Akademie der Wissenschaften zu Göttingen (Göttingen)
ActaArchHung	Acta Archaeologica Hungarica Academiae Scientiarum Hungaricae (Budapest)
ActaBiolSzeged	Acta Biologica Szegediensis (Szeged)
ActaMN	Acta Musei Napocensis (Cluj)
ActaMP	Acta Musei Porolissensis (Zălau)
ActaMusPap	Acta Musei Papensis (Pápa)
ActaPaleobot	Acta Paleobotanica (Kraków)
ActaTechn	Acta Technica Academiae Scientiarum Hungaricae (Budapest)
AgrSz	Agrártörténeti Szemle (Budapest)
AI	Archaeologia Iugoslavica (Beograd)
AJB	Das archäologische Jahr in Bayern (Stuttgart)
AKorr	Archäologisches Korrespondenzblatt (Mainz)
Alba Regia	Alba Regia. A Szent István Király Múzeum Évkönyve (Székesfehérvár)
AnB	Analele Banatului (Timișoara)
AnnUnivSciBudapest	Annales Universitatis Scientiarum Budapestiensis de Rolando Eötvös Nominatae. Sectio Biologica (Budapest)
AnthrAnz	Anthropologischer Anzeiger (München)
AnthrK	Anthropológiai Közlemények (Budapest)
Antiquity	Antiquity. A Quartelny Review of Archaeology (Cambridge)
AP	Arheološki Pregled (Beograd)
APA	Acta Praehistorica et Archaeologica (Berlin)
APL	Analecta Praehistorica Leidensia (Leiden)
APolona,	Archaeologia Polona (Warszawa)
AqN	Aquileia Nostra (Aquileia)
AR	Archeologické Rozhledy (Praha)
ArchA	Archaeologia Austriaca (Wien)
ArchÉrt	Archaeologiai Értesítő (Budapest)
ArchHung	Archaeologia Hungarica (Budapest)
ArchKözl	Archaeologiai Közlemények (Budapest)
AuF	Ausgrabungen und Funde (Berlin)
AuN	Archäologie und Naturwissenschaft (Mainz)
AV	Arheološki Vestnik Ljubljana)
AVANS	Archeologické výskumy a nálezy na Slovensku (Nitra)
BalácaiKözl	Balácai Közlemények (Veszprém)
BÁMÉ	A Béri Balogh Ádám Múzeum Évkönyve (Szekszárd)
BAR BS	British Archaeological Reports. British Series (Oxford)
BAR IntSer	British Archaeological Reports. International Series (Oxford)
Ber. van de Rijksdienst	Berichte van de Rijksdienst voor het Oudheidkundig Bodemonderzoek (Amersfoort)
BékésMK	A Békés megyei Múzeumok Közleményei (Békéscsaba)
BHAB	Bibliotheca Historica et Archaeologia Banatica (Timișoara)
BJ	Bonner Jahrbücher des Rheinischen Landesmuseums in Bonn und des Vereins von Altertumsfreunden im Rheinlande (Köln)
BMA	Bibliotheca Musei Apulensis (Alba Iulia)



BMHB	Bulletin du Musée Hongrois des Beaux-Arts = A Szépművészeti Múzeum Közleményei (Budapest)
BMN	Bibliotheca Musei Napocensis (Cluj-Napoca)
BRGK	Bericht der Römisch-Germanischen Kommission (Berlin)
BudRég	Budapest Régiségei (Budapest)
BVbl	Bayerische Vorgeschichtsblätter (München)
CarnuntumJb	Carnuntum Jahrbuch (Graz)
CIL	Corpus inscriptionum Latinarum
CommArchHung	Communicationes Archaeologicae Hungaricae (Budapest)
ČMM	Časopis Moravského Múzea (Brno)
DissPann	Dissertationes Pannonicae (Budapest)
DocPraehist	Documenta Praehistorica (previously: Poročilo) (Ljubljana)
DolgSzeged	Dolgozatok a Szegedi Tudományegyetem Régiségtudományi Intézetéből (Szeged)
EAZ	Ethnographisch-Archäologische Zeitschrift (Berlin)
EJA	European Journal of Archaeology (London)
EMÉ	Az Egri Múzeum Évkönyve (Eger)
Emúz	Erdélyi Múzeum (Kolozsvár)
ÉttK	Értekezések a történeti tudományok köréből (Budapest)
FBBW	Fundberichte aus Baden-Württemberg (Stuttgart)
FBVFBD	Forschungen und Berichte zur Vor- und Frühgeschichte in Baden-Württemberg (Stuttgart)
FolArch	Folia Archaeologica (Budapest)
FontArchHung	Fontes Archaeologici Hungariae (Budapest)
FÖ	Fundberichte aus Österreich (Wien)
FrK	Földrajzi Közlemények (Budapest)
FtK	Földtani Közlöny (Budapest)
HelvA	Helvetia Archaeologica (Basel)
HOMÉ	A Herman Ottó Múzeum Évkönyve (Miskolc)
HOMK	Herman Ottó Múzeum Közleményei (Mitteilungen des Ottó-Herman-Museums) (Miskolc)
IPH	Inventaria Praehistorica Hungariae (Budapest)
JAA	Journal of Anthropological Archaeology (New York)
JAMÉ	A nyíregyházi Jósza András Múzeum Évkönyve (Nyíregyháza)
JAS	Journal of Archaeological Science (London)
JDA	Journal of Danish Archaeology (Odense)
JFA	Journal of Field Archaeology (London)
JMC	Journal of Material Culture (Thousand Oaks, CA)
JOÖMV	Jahrbuch des Oberösterreichischen Musealvereins (Linz)
JÖAI	Jahreshefte des Österreichischen Archäologischen Institutes in Wien (Wien)
JPMÉ	A Janus Pannonius Múzeum Évkönyve (Pécs)
JQS	Journal of Quaternary Science (Hoboken, NJ, USA)
JRAI	Journal of the Royal Anthropological Institute (London)
JRGZM	Jahrbuch des Römisch-Germanischen Zentralmuseums Mainz (Mainz)
JSGU	Jahrbuch der Schweizerischen Gesellschaft für Ur- und Frühgeschichte (Basel)
KJb	Kölner Jahrbuch für Vor- und Frühgeschichte (Köln)
MAGW	Mitteilungen der Anthropologischen Gesellschaft in Wien (Wien)
MÁFIJ	A Magyar Állami Földtani Intézet jelentése az ... évről (=Annual Report of the Geological Institute for the year ...) (Budapest)
Man	Man. A monthly Record of Anthropological Science (London)
MBV	Münchener Beiträge zur Vor- und Frühgeschichte (München)



MCA	Materiale și Cercetări Arheologice (București)
MFME	A Móra Ferenc Múzeum Évkönyve (Szeged)
MHB	Monumenta historica Budapestinensia (Budapest)
MhBV	Materialhefte zur Bayerischen Vorgeschichte (München)
MittArchInst	Mitteilungen des Archäologischen Instituts der Ungarischen Akademie der Wissenschaften (Budapest)
MKBKM	Múzeumi kutatások Bács-Kiskun Megyében (Kecskemét)
MMMK	A Magyar Mezőgazdasági Múzeum Közleményei (Budapest)
MMűv	Magyar Művészet (Budapest)
MÖAG	Mitteilungen der Österreichischen Arbeitsgemeinschaft für Ur- und Frühgeschichte (Wien)
MPK	Mitteilungen der Prähistorischen Kommission der Österreichischen Akademie der Wissenschaften (Wien)
MRT	Magyarország Régészeti Topográfiája (Archäologische Topografie Ungarns) (Budapest)
MTud	Magyar Tudomány (Budapest)
MűÉ	Művészettörténeti Értesítő (Budapest)
MűvtörtTan	Művészettörténeti Tanulmányok (Budapest)
MZ	Mainzer Zeitschrift (Mainz)
NAR	Norwegian Archaeological Review (Oslo)
NépK	Néprajzi Közlemények (Budapest)
NÉrt	Néprajzi Értesítő (Budapest)
NMME	Nógrád Megyei Múzeumok Évkönyve (Balassagyarmat)
NNU	Nachrichten aus Niedersachsens Urgeschichte (Hildesheim)
Offa	Offa. Berichte und Mitteilungen des Museums Vorgeschichtlicher Altertümer in Kiel (Neumünster)
OJA	Oxford Journal of Archaeology (Oxford)
ORL	Obergermanisch-Raetische Limes (Frankfurt am Main)
PA	Památky Archeologické (Praha)
PMMAE	Prace i Materiały Muzeum Archeologicznego i Etnograficznego, Ser. Archeologiczna (Łódź)
PPS	Proceedings of the Prehistoric Society (Cambridge)
PrzA	Przegląd Archeologiczny (Poznań – Wrocław)
PV	Přehled Výzkumů (Brno)
PWRE	Paulys Realencyklopädie der klassischen Altertumswissenschaft (Stuttgart)
PZ	Prähistorische Zeitschrift (Berlin – New York)
RCRF	Rei Cretariae Romanae Fautorum, Acta
RégFüz	Régészeti füzetek (Budapest)
RIB	R. G. Collingwood – P. R. Wright: The Roman Inscriptions of Britain (Oxford 1965-)
RLiÖ	Der römische Limes in Österreich (Wien)
RMuz	Revista Muzeelor (București)
RÖ	Römisches Österreich (Wien)
RVM	Rad Vojvodanskih Muzeja (Novi Sad)
SASTUMA	Saarbrücker Studien und Materialien zur Altertumskunde (Saarbrücken)
S&A	Science and Archaeology (Ashbourne)
SbNM	Sborník Národního Muzea v Praze. Ser. A (Praha)
SCIV	Studii și Cercetări de Istorie Veche (București)
SCIVA	Studii și Cercetări de Istorie Veche și Arheologie (București)
SIB	Studii de istorie a Banatului (Timișoara)
SJ	Saalburg Jahrbuch (Berlin)
SIA	Slovenská Archeológia (Bratislava)

SMK	A Somogy megyei Múzeumok Közleményei (Kaposvár)
SpecN	Specimina Nova: dissertationum ex Instituto Historico Universitatis Quinqueecclesiensis de Iano Pannonio nominatae (Pécs)
SprawArch	Sprawozdania Archeologiczne (Wrocław)
StComCar	Studi și Comunicări. Muzeul de Istorie Localăși Etnografie Caransebeș (Caransebeș)
StComit	Studia Comitatusia (Budapest)
StComSib	Studii și Comunicări. Muzeul Brukenthal (Sibiu)
StudArch	Studia archaeologica (Budapest)
SUBB	Studia Universitatis Babeș – Bolyai (Cluj – Napoca)
ŠZ	Študijné Zvesti Archeologického Ústavu Slovenskej Akademie Vied (Nitra)
SzSz	Székesfehérvári Szemle (Székesfehérvár)
TapolcaVMK	Tapolcai Városi Múzeum Közleményei (Tapolca)
TeltudK	Településtudományi Közlemények (Budapest)
Tibiscus	Tibiscus. Muzeul Banatului (Timișoara)
TrZ	Trierer Zeitschrift für Geschichte und Kunst des Trierer Landes und seiner Nachbargebiete (Trier)
TSz	Történelmi Szemle (Budapest)
TT	Történelmi Tár (Budapest)
UBA	Universitetet i Bergen Årbok (Bergen)
UPA	Universitätsforschungen zur Prähistorischen Archäologie (Bonn)
VAH	Varia Archaeologica Hungarica (Budapest)
VMMK	A Veszprém Megyei Múzeumok Közleményei (Veszprém)
VMP	Veröffentlichungen des Museums für Ur- und Frühgeschichte Potsdam (Potsdam)
VyP	Východoslovenský Pravek (Košice)
WiA	Wiadomości Archeologiczne (Warszawa)
WMMÉ	A Wosinsky Mór Múzeum Évkönyve (Szekszárd)
ZalaiMúz	Zalai Múzeum (Zalaegerszeg)
ZfA	Zeitschrift für Archäologie (Berlin – Heidelberg)
ZfAM	Zeitschrift für Archäologie des Mittelalters (Köln)
ZSNM	Zbornik Slovenského Národného Múzea. História (Bratislava)



## NEOLITHIC CONTACTS: ADAPTATION, EXCHANGE OF INFORMATION (AN INTRODUCTION)

Contacts between two cultures in a traditional archaeological sense means similarities in the types of pottery or in the motives of pottery decoration, perhaps also in the stone or metal tool kit. In the beginning of archaeological research, the synchronity and diachrony of prehistoric cultural formations in Europe were exactly based on these similarities. Conclusions, however, were rather drawn on the basis of chronological sequences in distant areas, while the nature of contacts was analysed only to a lesser extent.

These typological or cross-checking analyses usually set out from the assumption of two or more separate archaeological cultures. Beyond establishing similarities, co-existences and drawing some inferences about possible trade or cultural contacts, further questions are seldom posed. Issues concerning whether these cultures had an impact on each other's customs, ways of life, settlement structure; whether similar pot forms mean common features in food production and diet, whether similar stone or metal instruments mean similarities in the technology, are usually not raised.

In more recent research, the meaning of imported objects has been analysed. It is the provenance of raw material that poses one of the most interesting problems. Who had access to the sources, who were the "traders", if any, what could be the basis of exchange, i.e. what did people get for their raw materials? Certainly, most evidence for exchange comes from non-perishable materials, although assumptions can be made of trading with fur, food products or salt as well. At this point, another type of imported objects, those from extremely long distances, such as fossil shells and spondylus, marmor, obsidian, pottery, subsequently gold or copper, can also reflect of prestige. Objects of non-local origins can be understood as a sign of certain differences in social status.

The archaeological analysis of cultural, trade and social contacts is an important and urgent task for another reason as well. Namely, we are living at the time of various contact analyses in European prehistory, based on different, non-archaeological data and scientific information. To mention only a few examples: Problems of prehistoric migration are increasingly at the peak of interest of bone chemists who analyse different stable components of human bone collagene, such as nitrogen isotope, stable carbon or strontium isotopes. It is necessary to compare the results gained by these analyses with migration hypotheses put forward by archaeological research. Similarly, DNA investigations regarding both marker genes and MtDNA analyses, should be cross-checked with traditional artefact typological data provided by archaeologists. Soil chemists and geologists, archaeozoologists, palynologists and macro-botanists seek for an archaeological verification for their results as well. Also, we are faced with having to compare the calibrated  $^{14}\text{C}$  and dendrochronological data to our results. Palaeolinguists are also involved in this multidisciplinary research.

I should like to emphasize that prehistorians are urged to successfully research and define contacts in the Neolithic, in order to join the efforts of colleagues in other fields. Namely, should hard scientific data show a certain discrepancy with our results, it is worth going into further details, and co-operate. However, when due to the gaps in research, archaeological data concerning contacts between or within prehistoric societies are lacking, our colleagues working in hard science stand alone in the evaluation. This has already happened, causing confusion or misunderstanding, leading to bad reactions on both sides. Therefore, every step forward in the research of cultural contacts between bearers of prehistoric cultures, helps clarifying these misunderstandings, and solving controversies between the parallel results.

The notion "contact" also means mutual impact, interaction between two or among several groups of people. Here I should like to mention an example, where – apart from the



difficulties known from the beginning – another problem emerges. In this case, the contact can be taken for sure, nevertheless, one of the participating groups remains in hiding. The example is taken from my own research, the earliest neolithic period in Transdanubia.

One of the participants was the intrusive Starčevo-culture from the South, as it is known from the detailed publications by N. Kalicz.<sup>1</sup> On the basis of the new finds two territorial groups of the late Starčevo culture might be draughted in Transdanubia. Recently published finds from Southern Babarc<sup>2</sup> belong to a group, which is strictly bound to its southern relatives beyond the Drava river: its best parallels can be found in Croatian sites.

Contrasted to the aforementioned stylistic and typological features, two late Starčevo settlements in the Northwest: Vörs and Gellénháza, as well as finds from the Northern banks of Lake Balaton, seem to belong to a slightly different group, with less evidence of straight Balkan contacts. As to the excavators of Vörs, a number of these features become typical in the oldest Linear Pottery culture (e.g. deeply incised linear patterns), which occurs in an unusually high quantity, compared to the whole Starčevo area.<sup>3</sup>

A further argument for the existence of a Northern, specifically Starčevo group comes from the largest site excavated in the region: Szentgyörgyvölgy-Pityerdomb, close to the Slovenian–Austrian border. The settlement, which consisted of two houses and yards around, could be almost fully excavated and the find material has been evaluated, waiting for publication. The long houses evidently belong to early Central European types, whereas the pottery looks more like late Starčevo ware, or at most reflecting a mixture, a transition between the Spiraloid B phase of the Starčevo culture and the earliest Linear pottery. This concerns the way of firing, the temper and the surface of vessels, the cultic finds as well as the slightly incised decoration (*“einpolierte Ware”*), the majority of the biconic, strongly carinated forms, the polished fine ware and also the coarse ware. These typological parallels, as well as the similar geographical preferences, suggest not only a possible synchronicity but also live contacts between the late Starčevo people and the prehistoric inhabitants of Pityerdomb.

In the case of a cultural formation such as the Starčevo culture, that remained almost identical in a vast geographic area from Macedonia to the Pannonian hills, the differences observed at the North-western boundary cannot be neglected! Consequently, another participant in the Transdanubian neolithisation process may be assumed.

In the last few years my own research in Transdanubia, based on three microregional projects and investigations around Lake Balaton led me to the conclusion that Western Transdanubia formed a frontier zone in the mid-centuries of the 6<sup>th</sup> Millennium. This means that Starčevo farmers of southern origins came into a longer contact with local forager groups. Both groups were in the position on the one hand, were forced on the other, to make some serious changes in their lifeways. The Starčevo people met a considerably more Atlantic climate here, cooler summers and particularly wet winters, with much snow. This adaptation must have taken place as people settled in an almost Alpine environment, as is reflected by the case of Szentgyörgyvölgy-Pityerdomb, as well as in low, marshy areas, on islands in wet moorland, as was the case with the inhabitants of Vörs. Local groups, however, must have faced emerging water-levels and a wet climate, so that they had to move onto the new banks of the more extended lake Balaton, but they would have also quickly adopted techniques of food-producing and pottery making from the Starčevo immigrants. The result of these connections and interaction was most probably a mixed population which slowly extended its farming activity in Transdanubia, and meanwhile – or at least very soon – rushed through the

<sup>1</sup> N. Kalicz: Funde der ältesten Phase der Linienbandkeramik in Südtransdanubien. MittArchInst 8/9 (1978–79[1980]) 13–46; N. Kalicz: Die Körös-Starčevo-Kulturen und ihre Beziehungen zur Linearbandkeramik. NNU 52 (1983) 91–130; N. Kalicz: Frühneolithische Siedlungsfunde aus Südwestungarn. IPH 4. Budapest 1990. 40.

<sup>2</sup> E. Bánffy: Neue Funde der Starčevo-Kultur in Südtransdanubien, in: F. Draşovean (ed.): Festschrift für Gheorghe Lazarovici. Timişoara 2001, 41–58.

<sup>3</sup> N. Kalicz – Zs. M. Virág – K. T. Biró: The northern periphery of the early neolithic Starčevo culture in south-western Hungary: a case study of an excavation at Lake Balaton. DocPraehist 25 (1998) 164.



Danube valley to the inner part of Central Europe to participate in forming the LBK culture and adopting a sedentary life.

What phenomena make such inferences possible? I have found some direct and also some indirect hints that speak for the existence of the processes outlined above. Among these traces I consider the following indirect proofs especially important:

Direct hints:

1. Trapezoid microliths and other types of the late mesolithic tool-kit have been known from surface finds for many years, their pre-neolithic character has never been argued. Two regions seem to be especially rich in such surface finds: the Kapos valley in Southern Transdanubia and the Vázsony basin in the Balaton highland stretching north of the lake.

2. According to pollen sequences taken from the lake sediments and also from the marshy area of the so-called Little Balaton, the contribution of hazelnut increased in the 6<sup>th</sup> Millennium to the extent that around 5600 BC, 55% of the ligneous plant pollens were those of *Corylus*! Western Transdanubia must have been a refuge area for hazelnut during the last Ice Age but the sudden growth just before the early Neolithic most probably can be ascribed to human activity. The appearances of pollen from the first domestic cereals are inversely proportional with those of hazelnut pollen: the spread of wheat and barley went together with the decrease of hazelnut.

3. Near the site Szentgyörgyvölgy-Pityerdomb, on the marshy banks of the Szentgyörgy-stream, traces of intentional burning were identified during the course of soil analysis. These were dated to 8771 ±55 BP (=mid-7<sup>th</sup> Mill. BC). According to the calculations by M. Zvelebil,<sup>4</sup> burnt organic residue and the small extent of erosion may indicate rather frequent episodes of burning, i.e. not more than 15–30 years apart from each other.

4. During the course of topographic investigations carried out near the Western banks of lake Balaton, a flat based wooden boat has been mentioned, found deep in the soil of the marshy Keszthely region that once had belonged to the lake but got eutrophised definitely before the early neolithic. In this way the boat can be considered as a find belonging to the groups being active in the region before the Starčevo people's arrival.

Indirect hints:

1. Some features of the settlement structure seem to be of great importance in the mid-6<sup>th</sup> millennium. From sedimentological and palinological investigations it has become clear that, as has also visible in satellite photographs, the extent of the lake changed from time to time. At the beginning of the Holocene, in some periods water covered even the Tapolca Basin in the North and all the valleys to the South, reaching the Drava River. The bank of the Balaton has always been a moorland. While the final mesolithic period was fairly dry with surface of lake Balaton drawn back, around 5500–5400 BC the water level increased remarkably.

2. Accordingly, the late mesolithic sites most probably lie under the current water level. However, numerous early neolithic sites are known from the banks of lake Balaton, which are located in a very "mesolithic" way: i.e. within the swampy reeds or in small islands near the banks. There are a series of earliest "Linear Pottery" sites along long islands which did not emerge very much from the wetland – which could be a swamp, or, in the middle of the 6<sup>th</sup> Millennium, open water. The location of these settlements corresponds perfectly to the late mesolithic water-bound way of life. On the other hand it is also true, that this type of biotope is unsuitable for extended farming. Yet, almost all of the 65 earliest "Linear Pottery" sites lie in the marshy waterside area! Some, so-called late Starčevo sites can also be added to these.

3. In spite of this, quite a wide range of domestic plants could be identified in the earliest phase. Similarly to Pityerdomb: emmer and einkorn, common wheat (*Triticum aestivum*) and barley are present, in addition to some edible wild plants such as goose-foot. However, these cereal types did not occur in greater amounts at any of the sites. This phenomenon, the dimensions of farming activity, did not extend beyond the level of late mesolithic horticulture,

<sup>4</sup> M. Zvelebil: Plant use in the mesolithic and its role in the transition to farming. PPS 60 (1994) 35–74.



# CONTACTS IN THE FRONTIER ZONE OF EARLY NEOLITHIC WESTERN TRANSDANUBIA

after N. Kalicz, M. Zvelebil, E. Bánffy, R. Tringham

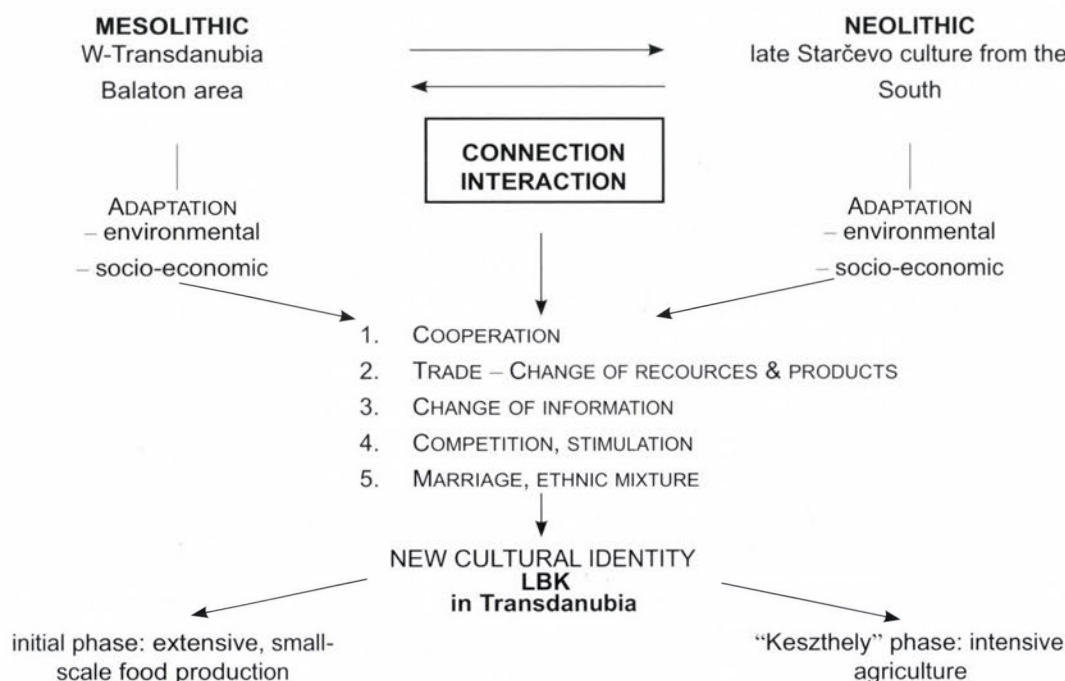


fig 1. Model of the neolithic transition in Transdanubia

i.e. small areas within or around the settlement, home to new domestic plant species received and the technology learnt from Starčevo immigrants. This all speaks for a qualitative change – but by no means a quantitative one – in this phase, concerning plant cultivation or especially life style. Thus, according to the settlement structure, autochthonous hunter-gatherer groups may be sought behind the earliest “Linear Pottery” sites.

4. To affirm the aforementioned hypothesis, the change in life-style happened indeed – but a phase later, at the time of the early/classical Transdanubian LBK. In the so-called Keszthely phase, people began moving upwards to higher terraces and hillsides, in search of good loess soils. A good example for this change is the densely settled Marcal valley north of lake Balaton, whereas the classical sites of this group may be found on loess terraces. Although no detailed macrobotanical analyses are yet available, pollen data speak for a more extended agriculture. The quantitative change in life ways must have happened, but not at the initial phase of the Transdanubian Neolithic. It became typical some three generations later. This also shows that there was no “revolutionary” process: the change to an intensive and irreversibly safe food-producing life lasted for over a century. Interestingly enough, its emergence was synchronous with the rise and flourishing of the Vinča–Tordos culture in the Mid-Balkans, characterised by efficient agriculture.

5. The thorough analysis of pottery yielded no information contradictory to this picture. In summary: I have found that in the emerging LBK sites only the proportion of the Starčevo pottery changes. At some sites, the strong Starčevo character most probably means real people of Southern origins. Pot sherds from other sites reveal, however, that they are of another character, of poorer quality. Types tend to be restricted to house ware. Linear decoration is negligible or completely absent on this pottery. On the basis of the analysis it seems that pottery of minor Starčevo character found at waterside sites, may represent the first attempts by local people who had adopted the know-how of pottery making.

6. A very similar observation can be made concerning the so-called cultic finds. Local, coarse imitations alternate with some real, elaborated Starčevo objects. Some elements of



the South East European cult life may have been adopted, while other elements – such as the manufacturing of figurines as mass products – diminished from the LBK cult life. These changes might not have happened unIndependently from the beliefs of local groups.

7. The transitory phase with a quasi mesolithic way of life seems to be perfectly reflected in flint assemblages. Both in the early and in the developed phases of the LBK community, the use of exactly identical types must have been adopted from local earlier, hunter-gatherer groups.

Some sceptical, or rather critical voices may be expected concerning what has been said above. The traces under discussion here can be doubted, in the absence of rich archaeological materials from the late Transdanubian Mesolithic, relevant settlement traces and stratified lithic tools in Western Transdanubia and around Lake Balaton. Nevertheless, I join to the opinions of M. Zvelebil, P. Bogucki, M. Jochim, A. Whittle and others, who all emphasize the absurdity of the idea that the first farmers would rush through the greater part of Europe in a vacuum, in a no man's land.<sup>5</sup>

In light of all this, I am concerned that two participants can be supposed in the mid-sixth millennium of Western Transdanubia. The late Starčevo people and indigenous groups must have been in contact with each other. I have already mentioned environmental adaptation. But, as the model shows, both groups also had to seriously adapt to each other (*fig. 1*).

During the course of contact and interaction between the mesolithic groups and the Starčevo culture, both went through an adaptation process to the new environmental, climatic circumstances as well as to the alien customs of the other group of people. As the aforementioned indirect and direct hints suggest, a sort of co-operation is to be assumed between them. In return for the generally distributed Szentgál red radiolarite, new information of the agricultural package must have been given, with the exchange of food, some other products, as well as the know-how of settled life such as architecture. In other words, a network of information must have developed. Not independently from all this, a twofold process may have been manifested in the form of personal contacts: marriages and kinship as well as a competing activity between the food producing and the forager lifeways. I should like to stress that I see trade and cultural connection as a form of social communication. In fact, it helps to reduce conflicts among different groups. Due to this complicated interaction a new cultural identity arose: that of the LBK in Transdanubia.

Within the Carpathian Basin, the Eastern, Alföld groups were in a far more advantageous position than those in Western Hungary in terms of nearly all parameters of life. So one day the question must be answered, why it was mainly the Western, Transdanubian groups participated in the neolithisation of Central European.

The differences might lie in the different ways of contacts and communication. While the Körös-early LBK in the Alföld region had good contacts to the East/Southeast they had little connection with Northern Transdanubia. Transdanubian groups, however, used long-distance routes to several hundred kilometers to the North and West. Szentgál flints in mesolithic sites in Southern Moravia, as well as pre-neolithic Danubian shell finds prove that these routes and

<sup>5</sup> M. Zvelebil: Mesolithic prelude and neolithic revolution, in: M. Zvelebil (ed.): *Hunters in Transition*. Cambridge 1986, 5–15; M. Zvelebil: On the transition to farming in Europe, or what was spreading with the Neolithic: a reply to Ammermann. *Antiquity* 63 (1989) 379–383; M. Zvelebil: The social context of the agricultural transition in Europe, in: C. Renfrew – K. Boyle (eds): *Archaeogenetics: DNA and the population of Europe*. McDonald Institute Monographs. Cambridge 2000, 57–79; P. Bogucki: *Forest Farmers and Stockherders*. Early Agriculture and its Consequences in North-Central Europe. Cambridge 1988; P. Bogucki: How agriculture came to North-central Europe, in: T. D.

Price (ed.): *Europe's First Farmers*. Cambridge 1998, 197–218; P. Bogucki: Recent research on the early farming of Central Europe. *DocPraehist* 28 (2001) 85–97; M. A. Jochim: A Hunter-Gatherer Landscape. Southwest Germany in the Late Palaeolithic and Mesolithic. New York – London 1998; M. A. Jochim: The origins of agriculture in South-central Europe, in: T. D. Price (ed.): *Europe's First Farmers*. Cambridge 1998, 183–196; M. A. Jochim: The mesolithic, in: S. Milisauskas (ed.): *European Prehistory. A Survey*. New York–Boston–London–Moscow 2002, 115–142; A. Whittle: *Europe in the Neolithic. The Creation of New Worlds*. Cambridge World Archaeology. Cambridge 1996.

contacts may have preceded the LBK period. Considering also the extremely quick spread of early LBK groups, I can only think of already existing old, pre-neolithic, well-known communication routes which were re-used by a mixed population, consisting of Starčevo immigrants and local hunter-gatherers. The groups would possibly not go the Unknown, but rather to familiar people and places along the Danube. It is exactly this point that may have defined the character of the neolithic process toward the inner part of Central Europe.



## CONNECTIONS IN THE KÖRÖS CULTURE WORLD: EXCHANGE AS AN ORGANISING PRINCIPLE

This short paper is an essay in speculation. I start with the known facts of movement of raw materials within and especially into the orbit of the Körös culture. I then reflect on what else might have been moving alongside and in exchange for these materials. From a possible sense of flow of other materials and of people, I consider whether ideas of connectedness and exchange could also have informed other aspects of what we could call the worldview of the people involved. I briefly discuss the historical setting of the emergence of the Körös culture, relations with the natural surroundings, connections with water and earth, various interchanges with animals, and linkages among and between the living and the dead.

The paper comes in the first instance out of our recent Hungarian–British project at the Körös culture occupation at Ecsegfalva 23, Co. Békés, which is nearing publication. I refer to results being prepared by several other colleagues, whose conclusions will be presented in our final report. I do not implicate them in this paper. In referring many times to ‘the Körös culture’, I do not mean to imply either a tightly bounded or closed entity in relation to what lay beyond the southern part of the Great Hungarian Plain in the first half of the sixth millennium BC, or any necessary sort of uniformity within the distribution of this archaeological grouping. Indeed, some of the ideas discussed here may serve to weaken the still strong hold of the concept of archaeological culture on interpretation of this world.

### *Movement of raw materials*

I begin therefore with the known facts of raw material movement within and especially into the Körös culture world from the outside.<sup>1</sup> There were, as is well known, no lithic resources within the Great Hungarian Plain, and lithic materials had to be imported from the fringes of the Carpathian Basin.<sup>2</sup> As movement from the outside, we can cite obsidian from the Hungarian and especially Slovak sources to the north-east, normally over a distance of at least 150–160 km to the main known distributions of Körös culture settlement in the Körös, Tisza and Maros river systems (though the position of the site of Méhtelek in the north-east of the Plain serves to reduce this figure).<sup>3</sup> Also from the outside came stone axes of various rocks, including from the eastern end of the Alps. There was also movement of limnoquartzite from the hills fringing the northern edge of the Great Hungarian Plain, some 110–120 km to the north of the main known distributions of Körös culture settlement. Finally, smaller quantities of radiolarite from the Szentgál source north of Lake Balaton have also been found in Körös culture sites. From the east, the rock for various stone axes can be found in the Apușeni hills in western Romania, and brown flint came from the Banat to the south, both over shorter but still significant distances.

These facts are well known. What remains striking is the diversity of movements. With this is implied a diverse range of contacts with other situations beyond or outside the Körös culture (whether or not that was closed or bounded system). Obsidian, limnoquartzite and radiolarite must have come in this situation from various Mesolithic contexts, the former two from the foragers who may be presumed to have co-existed with the Körös culture to its north, largely around the fringes of the Carpathian Basin rather than within it. Movement across the northern part of the Great Hungarian Plain may have been through

<sup>1</sup> E.g. Kaczanowska et al. 1981; Starnini – Szakmány 1998; cf. Mateiciucová 2001.

<sup>2</sup> Starnini – Szakmány 1998.

<sup>3</sup> E. Starnini: Typological and technological analyses of the Körös culture chipped, polished and ground

stone assemblage from Méhtelek-Nádas (north-eastern Hungary). Atti della Società per la Preistoria e Protostoria della Regione Friuli-Venezia Giulia 8 (1994) 29–96.



a largely little used region. Szentgál radiolarite may also be presumed to have come from a forager context,<sup>4</sup> though just beyond the known limits of Starčevo culture settlement in Transdanubia south of Lake Balaton.<sup>5</sup> The hills of western Romania were within the general orbit of the Criș culture, and the Banat firmly within the main area of the Starčevo culture. It may be noted how easy it is when using the terminology of archaeological cultures to think of rigidly separate situations, but it is clear, even if this kind of essentialism is removed, that materials were coming into the southern part of the Great Hungarian Plain in the first part of the sixth millennium BC from varying, at times impressive, distances, and from varying contexts.

At Ecsegfalva 23, close to the Hortobágy–Berettyó river near the known northern limits of the Körös culture, this same pattern is repeated; obsidian and limnoquartzite are dominant, and there are axes of probable eastern derivation.<sup>6</sup> Not far to the south-west, the cache of Banat flint in a pot at Endrőd 39<sup>7</sup> remains one of the most vivid illustrations of all these movements, and a reminder of how the pattern of movement can vary from site to site; there was very little Banat flint at Ecsegfalva 23.<sup>8</sup>

### *What (and who) else was moving?*

These sorts of patterns prompt a series of other questions. What other materials were moving? Who was engaged in making such movements, and can we narrow the range of actors involved? If in fact the people involved were diverse, can we say more about general principles of connectedness in the world of the Körös culture? Much of what follows is speculative, but it is not intended as pointless or self-indulgent imagining, since the questions asked here may serve on the one hand to make further sense of what is already known of the Körös culture world and on the other to frame programmes of research in the future.

One important lacuna in our knowledge of this situation is the extent of movement of materials or objects within the Körös culture. It is easy to assume that whereas there was extensive movement of lithic materials as shown above, pottery would have been made locally at this time. It is certainly true that it becomes easier by the later sixth millennium and into the fifth millennium BC to identify ceramic imports, as styles became more differentiated, but identifying the movement of pottery within and indeed between the Körös, Starčevo and Criș ‘cultures’ is an important goal for future research. A new programme of scientific investigation focused on Criș and Starčevo pottery may provide important further insights.<sup>9</sup> In the meantime, it is valid also to question what else may have accompanied the known lithic movements. This raises the central question of the nature of procurement. It is possible on the one hand that lithics (apart from pottery) were not the only substances on the move, and on the other that a variety of agents were involved, from foragers living beyond the northern limits of ‘Neolithic’ settlement, to people from the Körös–Starčevo–Criș worlds themselves ranging beyond their normal orbits to procure desired raw materials from distant sources. It is easy here to fall into the trap of essentialism, predetermining the separate existence of defined entities such as foragers and farmers.<sup>10</sup> Indeed, contact and exchange may have been means by which identities were kept fluid, permeable and open at this time. At this stage of research it is strictly speculation to wonder whether the small quantities of raw materials were accompanied, in various directions, by other substances and by people. Carbohydrate-protein exchanges are

<sup>4</sup> Mateiciucová 2001.

<sup>5</sup> E. Bánffy: Starčevo und/oder LBK ? Die ersten Ergebnisse der westungarischen Ausgrabungen aus der Entstehungsphase der Bandkeramik. *Varia neolithica* 1 (2000) 47–60; N. Kalicz – Zs. M. Virág – K. T. Biró: The northern periphery of the Early Neolithic Starčevo culture in south-western Hungary: a case study of an excavation at Lake Balaton. *DocPraehist* 25 (1998) 151–188.

<sup>6</sup> Inna Mateiciucová, pers. comm.; Elisabetta Starnini, pers. comm.

<sup>7</sup> Kaczanowska et al. 1981.

<sup>8</sup> Inna Mateiciucová, pers. comm.

<sup>9</sup> Stephen Shennan and Michela Spataro, pers. comm.

<sup>10</sup> D. Borić: Fuzzy horizons of change: Orientalism and the frontier model of the Meso-Neolithic transition, in: N. Milner – P.C. Woodman (eds): *The Mesolithic: new directions and alternative narratives*. Oxford. (forthcoming)



well documented ethnographically in this sort of situation,<sup>11</sup> as well as the movement of other materials or substances such as furs, feathers and shells. Recent isotope analyses further west in Europe suggest the possible movement of women, into LBK settlements in the Rhineland from the neighbouring hills, and into coastal parts of late Mesolithic Brittany from the interior.<sup>12</sup> It will be necessary to refine these analyses, but their eventual application to both human and animal samples within the Carpathian Basin will be of crucial importance.

### *Other forms of connectedness*

Is all such activity just to be reduced to the lack of lithic resources within the Great Hungarian Plain, or can it suggest, as already hinted, other forms of connectedness? Could we use the facts of lithic movement as an insight into other aspects of the worldview of people in the Körös culture?

#### THE HISTORICAL SETTING

All people are connected to greater or lesser extents. In the case of the Körös culture, there may have been particular reasons why, at a regional scale, history and contingency reinforced the nature or style of such relationships. Finding traces of the presence of later Mesolithic foragers within the Carpathian Basin, as opposed to in the surrounding uplands, in the Danube Gorges, or in Transdanubia, has proved enduringly difficult. The discoveries in the Jászság, north of the Tisza valley near Szolnok,<sup>13</sup> point the way to other possibilities in the future. Early radiocarbon dates from Topole-Baç in northern Serbia and Maroslele-Pana in the southern part of the Great Hungarian Plain,<sup>14</sup> as well as now Ecsefalva 23, might point also to sporadic visits by a pre-Neolithic population, though in each case these are single dates and might be dismissed as simply predictable statistical 'outliers'. Analysis of pollen and charcoal from sediments in the southern part of the Plain might also in the future give clues to the pre-Neolithic human presence,<sup>15</sup> that has already been investigated in the northern part of the Plain<sup>16</sup> and has recently been suggested through pollen analysis in Transdanubia, at Zalavár at the western end of Lake Balaton.<sup>17</sup> It remains the case, however, that it is likely that the Körös culture represents the first sustained Holocene occupation of the relevant parts of the Great Hungarian Plain. Moreover, the argument can be made that it also represents a fusion of both incoming population from the south and indigenous regional population drawn from areas around.<sup>18</sup> In this scenario, we could envisage historical precedent for connections in many directions, and continuation of such contacts could be seen as in part an active commemoration of what had gone before.

#### RELATIONS WITH THE NATURAL SURROUNDINGS

There is a danger in this view of seeing the character of existence in the Körös culture as simply a function of its past and its setting. A more subtle and layered view can be proposed. From what has been called a dwelling perspective, it is possible to see people as inherently likely to be closely in touch with their surroundings, alert to its possibilities or affordances.<sup>19</sup> It need not be the case that practice of particular techniques by itself defines the nature of how people perceived their environment or natural surroundings. The use of domesticated

<sup>11</sup> M. Zvelebil – M. Lillie: Transition to agriculture in eastern Europe, in: T. D. Price (ed.): *Europe's First Farmers*. Cambridge 2000, 57–92.

<sup>12</sup> T. D. Price – R. A. Bentley – J. Lüning – D. Gronenborn – J. Wahl: Prehistoric human migration in the Linearbandkeramik of Central Europe. *Antiquity* 75 (2001) 593–603; R. Schulting – M. Richards: Dating women and becoming farmers: new AMS and stable isotope evidence from the Breton Mesolithic cemeteries of Téviec and Hoëdic. *JAA* 20 (2001) 314–344.

<sup>13</sup> R. Kertész: The Mesolithic in the Great Hungarian Plain, in: L. Tóth (ed.): *At the Fringes of Three Worlds: hunter-gatherers and farmers in the middle Tisza valley*. Szolnok 1996, 5–34.

<sup>14</sup> Whittle et al. 2002.

<sup>15</sup> Kathy Willis, pers. comm.

<sup>16</sup> P. Sümegi: Reconstruction of flora, soil and landscape evolution, and human impact on the Bereg Plain from late-glacial up to the present, based on palaeoecological analysis, in: J. Hamar – A. Sárkány-Kiss (eds): *The Upper Tisza Valley*. Tisza monograph series. Szeged 1999, 173–204; Pál Sümegi, pers. comm.

<sup>17</sup> Imola Juhász, pers. comm.

<sup>18</sup> Whittle et al. 2002; Whittle 2003.

<sup>19</sup> Ingold 2000.



animals and plants in itself need not determine a conceptual separation between people and their surroundings. Ingold<sup>20</sup> cites several examples from the ethnographic record of people who practise horticulture but who see themselves as closely and intimately in touch with their setting, working within the metaphor of the giving or nurturing environment, in which the woodland or forest is conceived as a parent, or in which the whole woodland setting is thought of as a garden. These are all complex issues, but this is not the place to follow them in detail.<sup>21</sup> Here I want to sketch some of the emerging characteristics of the Ecsefalva situation (subject again to the qualification already noted above, that definitive details will be given in our final report) and to consider them from a dwelling perspective.

The occupation at Ecsefalva 23 was beside the Kiritó, a meander or oxbow lake formed in the former course of the Hortobágy-Berettyó river. By 6000 BC this was still, shallow water, perhaps only periodically inundated.<sup>22</sup> The wider landscape is very flat, with relief principally in the form of levées and terraces, of varying Pleistocene and Holocene origin. For wider comparison, a little to the south near Dévaványa, Körös culture occupations are to be found mainly on the terrace edges of the late Pleistocene alluvial delta,<sup>23</sup> and further to the southwest, in the Gyomaendrőd area, on a variety of Pleistocene terrace edges, isolated ridges, and the edge of the Holocene Körös river itself.<sup>24</sup> Such a landscape would have filled with water very easily, demonstrable by GIS analysis. A rise of 1 m would have connected much of the immediate surroundings of the Kiritó with the already low-lying region to the north of Ecsefalva,<sup>25</sup> and at such putative flood times the levée at Ecsefalva 23 would have become one of a small series of islands at the known northern limits of the Körös culture. This was potentially therefore a dynamic environment, but it has already been stressed that people chose to occupy such settings and that modern concepts of risk and danger are probably not helpful in our understanding of how people at that time perceived their environment.<sup>26</sup>

Judging from pollen analysis, plant remains and animal bones<sup>27</sup> the vegetation setting was a mosaic, with open woodland predominant. There is little sign of any major clearance impact.<sup>28</sup> While people probably ranged widely through their taskscapes,<sup>29</sup> as seen in the collection of shellfish from still- and flowing-water situations,<sup>30</sup> the perhaps opportunistic hunting of a very wide range of bird species,<sup>31</sup> and the hunting of game of various sizes,<sup>32</sup> the emerging picture is a concentration on the herding of sheep,<sup>33</sup> and the maintenance of small plots for the cultivation of cereals.<sup>34</sup> The presence of people at varying points through the year appears to be indicated by these kinds of evidence, though the flow of people through the taskcape at particular seasons remains a matter for debate.

A picture is therefore emerging of more rather than less settled people, who concentrated above all on the herding of sheep and the cultivation of cereals, while also being aware of other resources in their taskscapes. It may also be possible to propose that these people saw themselves as working within and with their environment, rather than conceiving themselves as separate from or dominant over it. Successful existence required attention to the rivers and waters beyond the perhaps 'safe' setting of the Kiritó, and was carried forward by investment of labour and attention in gardens or plots<sup>35</sup> as well as by time spent herding animals in open woodland, moving them seasonally, and from time to time perhaps folding

<sup>20</sup> Ingold 2000, chapters 3-5.

<sup>21</sup> Cf. Whittle 2003.

<sup>22</sup> Pál Sümegi and Kathy Willis, pers. comm.

<sup>23</sup> A. G. Sherratt: The development of Neolithic and Copper Age settlement in the Great Hungarian Plain. Part II: site survey and settlement dynamics. *OJA* 2 (1983) 13-41.

<sup>24</sup> Makkay 1992.

<sup>25</sup> Mark Gillings, pers. comm.

<sup>26</sup> M. Gillings: Embracing uncertainty and challenging dualism in the GIS-based study of a palaeo flood-plain. *EJA* 1 (1998) 117-144.

<sup>27</sup> Kathy Willis, Amy Bogaard and László Bartosiewicz.

<sup>28</sup> Cf. K. J. Willis: The impact of early agriculture upon the Hungarian landscape, in: J. Chapman - P. Dolukhanov (eds): *Landscapes in Flux: Central and Eastern Europe in Antiquity*. Oxford 1997, 193-207.

<sup>29</sup> Cf. Ingold 2000.

<sup>30</sup> Pál Sümegi, pers. comm.

<sup>31</sup> Erika Gál, pers. comm.

<sup>32</sup> László Bartosiewicz, pers. comm.

<sup>33</sup> László Bartosiewicz, pers. comm.

<sup>34</sup> Amy Bogaard, pers. comm.

<sup>35</sup> Cf. A. Bogaard: The Permanence, Intensity and Seasonality of Early Crop Cultivation in Western-Central Europe. Unpublished PhD thesis, Sheffield University 2002.



them close to occupations and gardens. This does not perhaps need to be seen as an intrusive or aggressive form of agriculture, rather an accommodation of new ways of doing things to the existing possibilities. If so, one can suggest here another fundamental form of connection or connectedness. In this perspective, people were in touch with the beyond not only in order to get lithic resources unavailable locally, but were tied to wider regions by memory of their past, while simultaneously being bound closely to the rhythms and character of their immediate setting.

This is a speculative model based in the first place on the study of one small microregion, but it may be applicable to many other settings within the distribution of the Körös culture. Future research that can link the so far separate studies at Ecsegfalva, Dévaványa and Gyomaendrőd, for example, would be highly desirable.

### *Connections with water and earth*

Further speculation can follow from this. In his study of people living beside the Amazon, Mark Harris<sup>36</sup> has drawn attention to the inherent importance of the rise and fall of the waters of the river for the rhythms of life. The state of the river conditions sociality. In the flood season, people are largely confined to their houses, a phase of low spirits and reflection, but also a time for the maintenance and repair of familial and other close social ties. As the waters recede, so people can begin again to move more freely, and a season of aggregation for festivals and other gatherings begins, a period of high spirits and elevated mood, but also one eventually of tension and conflict. If flooding can be proven to have been a recurrent feature of the Körös culture environment, something of the same possibilities might apply. People would have had to act in tune with changes in water level, moving themselves and their animals around the taskscape. In some settings, such as at Ecsegfalva 23 itself, water rise might have led to isolation, leaving at least some people on their own. This is to see water rise in a negative light, though it might also have facilitated communication and movement by boat. In other settings, such as around Dévaványa, where larger Körös culture occupations are known along the Pleistocene alluvial terrace edges, such putative changes in water levels might have led to periodic aggregation. These are at present merely speculative differences, but they could be amenable to future investigation.

There is no immediately obvious indicator in material culture to suggest the symbolic importance of water in the Körös culture worldview, such as one can suggest in the Danube Gorges only a little earlier, as indicated in the half-human, half-fish sculptured representations of Lepenski Vir. But the likely symbolic and conceptual importance of water (argued also by Banner<sup>37</sup>) remains.

There are more easily demonstrable connections with the earth, and some kind of duality between earth and water, dry and wet, might have been one of the basic nodes of thought<sup>38</sup> with which people in the Körös culture formed their view of the world. Pits of many shapes and sizes have been the literal stuff of excavations of Körös culture occupations (and of course also those in the Starčevo–Criș orbit). Their purposes, just as their individual histories, must have varied.<sup>39</sup> They need not be reduced to being only providers of material for building or receptacles for the deposition of material culture, though these uses may indeed have been major parts of their significance. Pit digging put people into direct symbolic as well as physical contact with the earth.<sup>40</sup> To construct buildings, to create place, people drew on the earth itself, and as part of the cycle of occupancy of place, they returned materials with histories and biographies to the ground. People at this time can be defined as well as by

<sup>36</sup> M. Harris: The rhythm of life on the Amazon floodplain: seasonality and sociality in a riverine village. *JRAI* 4 (1998) 65–82; M. Harris: Life on the Amazon: the anthropology of a Brazilian peasant village. Oxford 2000.

<sup>37</sup> J. Banner: Die Ethnologie der Körös Kultur. *Dolgszeged* 13 (1937) 32–49.

<sup>38</sup> Cf. M. Bloch: How We Think They Think: anthropological approaches to cognition, memory and literacy. Boulder 1998.

<sup>39</sup> Makkay 1992.

<sup>40</sup> Cf. J. Thomas: Understanding the Neolithic. London 1999.



their relationships with domesticated animals and plants and by their use of pottery, by their repeated and very direct use of material from the earth. At Ecsegfalva 23, the major pit so far excavated seems to have been dug early in the history of the occupation. It filled at first largely by natural processes, but was then filled up by the large-scale and probably rapid dumping of large quantities of silty clay (possibly unburnt daub), some burnt daub and selected spreads of pottery, shell and animal bone. The burnt daub is part of buildings or structures of some kind, probably including domestic shelters or residences, perhaps held on light wooden frames and certainly recurrently clothed with reeds covered with daub.<sup>41</sup> From this perspective, people were not only in an intimate and reciprocal relationship with their surroundings and taskscape, but specifically also with the very elements, which went to constitute the places by and through which they ordered their existence.

### *Interchanges with animals*

Animals were at the heart of existence in the Neolithic period, if not also in earlier and later times. Archaeologists have tended to give prominence to the use of animals for primary and secondary products, but it is the combination of different roles that made animals so powerful. Not only could they provide both while alive and after slaughter, sustenance for people, but they constituted living symbols, as carriers and creators of value. They can be seen as agents in their own right, and it is often a moot point whether people directed the movement of animals or the converse; an inextricably intertwined relationship is a fruitful perspective. Live animals can be shared, exchanged and stored with other people, as part of bride wealth and alliance transactions. We can see from the ethnographic record<sup>42</sup> innumerable examples of complex webs of value, in which animals played a central part in people's lives. These relationships are often ambiguous, since alongside honour, ritual value and sacred status, may also exist the desire to kill and consume.<sup>43</sup>

The animal bone assemblage from Ecsegfalva 23 will take its place alongside that from Endröd 119<sup>44</sup> as an important indicator of patterns of animal use in the Körös culture.<sup>45</sup> Once again, the final report will present definitive results, but a picture is emerging of sheep as the numerically dominant animal, with few cattle and pigs, and rather little game, though quite a wide range of species are represented.<sup>46</sup> The final report will also discuss all available details of age and sex structure, and the possible economics of sheep exploitation. In the context of this discussion about connectedness and exchange, I want here to offer some other reflections about further dimensions of the relationship with sheep and other animals.

Preliminary analysis of lipids (fatty acids) in a small sample of shards from Ecsegfalva 23 indicates the presence of ruminant dairy fats, and thus probably the practice of milking; preliminary analysis of proteins may implicate cattle, but at this stage sheep (or indeed goats) cannot categorically be excluded.<sup>47</sup> Taking these very preliminary results at face value, a complex set of relationships might be suggested. Sheep may have been the most numerous animal, and their tending and herding may have been a major concern from season to season. Their slaughter and consumption may have been a major feature of periodic aggregations if not also of daily life. Though it is often cattle and pigs that take centre stage in ethnographic accounts of animals, in the context of the Körös culture sheep might be thought of as having had two or three possible symbolic dimensions. Without any doubt, they originate from the south, and given an intimate human knowledge of the surroundings and the affordances of

<sup>41</sup> Ângela Carneiro and Inna Mateiciucová, pers. comm.

<sup>42</sup> E.g. D. P. Crandall: The role of time in Himba valuations of cattle. *JRAI* 4 (1998) 101–114; M. Parker Pearson: Eating money: a study in the ethnoarchaeology of food. *Archaeological Dialogues* 7 (2000) 217–232; P. Sillitoe: An Introduction to the Anthropology of Melanesia: culture and tradition. Cambridge 1998; Whittle 2003.

<sup>43</sup> M. Bloch: Almost eating the ancestors. *Man* 20 (1985) 631–646; Whittle et al. 1999.

<sup>44</sup> S. Bökönyi: The Early Neolithic vertebrate fauna of Endröd 119, in: S. Bökönyi (ed.): Cultural and Landscape Changes in South-East Hungary. 1. Reports on the Gyomaendröd Project. Budapest 1992, 195–299.

<sup>45</sup> László Bartosiewicz, pers. comm.

<sup>46</sup> László Bartosiewicz, pers. comm.

<sup>47</sup> Carl Heron and Oliver Craig, pers. comm.



the taskscape,<sup>48</sup> it is inconceivable that sheep were not recognised as coming from beyond, from the south. Within the spectrum of indigenous fauna in open woodland, sheep may have been quite distinctive in terms of size and herd behaviour. If they grouped together naturally at this time (which is of course uncertain), they could be seen as a kind of living solidarity, a metaphor for cohesion and togetherness.<sup>49</sup> Quite apart from their practical advantages (and disadvantages), sheep would therefore have presented people on a daily basis with a distinctive visual and aural reminder of history – living with the sound of the past – as well as a metaphor of their own sociality, itself in part created by the agency of animals.

In other regards, however, other animals may have been at least as important, even if numerically less frequent. If cattle were milked, then the most direct practical connection or exchange was with them, rather than sheep. And in the representations of animals on Körös culture pottery, it is deer and goats, which are figured.<sup>50</sup> Fragments of both appear in the pottery assemblage from Ecsegfalva 23.<sup>51</sup> This perhaps mythic dimension is barely accessible, but speculatively it might be to do with wildness and rarity respectively.

Through their relations with these and other animals, people may therefore have been connected to both the remembered past and myth, as well as valuing different animal species for perhaps differing reasons. Animals need not be excluded from the web of exchanges, which constituted existence in the Körös culture.

#### LINKAGES BETWEEN THE LIVING AND THE DEAD

The last dimension briefly to consider is that of people themselves, both living and dead. Identity may be a complex matter, and many notions of the individual and person can be found in the ethnographic record that run counter to the intuitions and 'common sense' of the modern western world. These have been debated at much greater length elsewhere.<sup>52</sup> Here it is useful above all to stress the often-relational nature of personal identity. The important studies of Marilyn Strathern<sup>53</sup> in Melanesia have evoked the notion of the individual, constituted in a web of relations and interchanges with others. Part of the conception of the singular person is its partibility, the way in which people are enchaind by shared labour, whose products, especially in the context of ceremonial exchange, can be conceived of as parts of persons, 'apprehended as detached from one and absorbed by another'.<sup>54</sup>

It is also important, however, to stress that these need not be seen as universal non-western notions. The contrast between southern India and Melanesia can be cited.<sup>55</sup> Gender in south India is fixed and stable, rooted in bodily difference and focused on the capacity for procreation. Relations between husband and wife are seen as a series of balanced exchanges, while relations with children depend on a sense of differently gendered substance; fathers feel closer to sons, and mothers to daughters.<sup>56</sup> The capacity for procreation and nurture is fundamental for male and female gendering, and while these conceptions are different, they are seen to greatest effect in transactions and exchanges between the genders; the person is conceived of as 'internally whole, but with a fluid and permeable boundary' and there are 'substantial connexions between persons who are not bounded individuals of the Western (stereo)type'.<sup>57</sup> In Melanesia, by contrast, the person is 'a mosaic of male and female substances, internally dividing up the body into differently gendered parts'.<sup>58</sup> In this sense, gender is performative, and relational, since relationships make persons.<sup>59</sup>

<sup>48</sup> Cf. Ingold 2000.

<sup>49</sup> Cf. C. Tilley: *An Ethnography of the Neolithic: early prehistoric societies in Southern Scandinavia*. Cambridge 1996, 63–65, 183–184.

<sup>50</sup> N. Kalicz: *Clay gods*. Budapest 1970.

<sup>51</sup> Krisztián Oross, pers. comm.

<sup>52</sup> E.g. J. Brück: *Monuments, power and personhood in the British Neolithic*. JRAI 7 (2001) 649–667; C. Fowler: *Personhood and social relations in the British Neolithic with a case study from the Isle of Man*. JMC 6 (2001) 137–163.; Whittle 1998; Whittle 2001; Whittle 2003.

<sup>53</sup> Strathern 1988; M. Strathern: *Parts and wholes: refiguring relationships in a post-plural world*, in: A. Kuper (ed.): *Conceptualizing Society*. London 1992, 75–104.

<sup>54</sup> Strathern 1988, 178.

<sup>55</sup> Busby 1997.

<sup>56</sup> Busby 1997, 263.

<sup>57</sup> Busby 1997, 269.

<sup>58</sup> Busby 1997, 270.

<sup>59</sup> Busby 1997, 272–273.



From this kind of perspective, life can be seen as made up of a series of interchanges and exchanges, which must be performed rather than given in advance. It is extraordinarily unlikely that the exchanges of materials discussed earlier in the paper were neutral, or without implications for the constitution and reconstitution of the individuals concerned. In conducting relationships of exchange, it has been argued that the Maneo of eastern Indonesia are concerned for the response of others.<sup>60</sup> Exchange among them is complex and important, objects circulating especially as marriage payments. Sociality in the sense of giving attention to others can be seen as an important factor. A disposition to generosity and an emphasis on expressing collective virtues by doing things openly have been part of Maneo sociality.<sup>61</sup> 'Moral sensibilities inform Maneo efforts to shape perceptions of actions and events precisely as a way to induce responsiveness and to mitigate the appearance of unresponsiveness'.<sup>62</sup>

It has also been argued that the emotional correlates of giving and receiving should be considered, through the case study of the Rauto people of coastal southwest New Britain in Melanesia.<sup>63</sup> Among them, the gift is something corporate, an important part of collective social time, linking the living and the dead. Identity is acquired through a 'narrative of exchange', which involves and evokes memory, emotion, custom and obligation. The person is contributed by others, including through gifts; 'persons are created by the gifts of others'.<sup>64</sup>

A useful final example is that of the Foi of Papua New Guinea, whose lives are permeated by a sense of flow. James Weiner has written strikingly about the way in which among the Foi, women interrupt the talk of men, calling, commenting and interrupting from their smaller houses which flank the longhouse, where the men reside and also sleep, when they are all together in their central settlement.<sup>65</sup> The people are not always together. In the drier half of the year, people are congregated in the central settlement, focused on both gardening and communal life based around the longhouse, with its attendant emphasis on 'gregariousness, competitiveness and confrontation'.<sup>66</sup> Public life in the longhouse collective is contrasted with the intimate sociality of the bush-house, never more than an hour away,<sup>67</sup> in which the smaller unit of man and wife and immediate family work closely in complementary ways to achieve their own production goals. The wetter season of the year was associated with dispersal, especially to remote and isolated hunting lodges, and men's experiences in this domain constituted much of the stuff of talk back in the longhouse.<sup>68</sup> The Foi orientate themselves partly with reference to the flow of the rivers along whose banks they garden, and they make sense of life in their songs and their myths by reference to ideas of flow and movement.

None of these examples need give direct or immediate insight into the sense of identity and personhood that may have prevailed in the world of the Körös culture. But, linked also to the historical contingency of the formation of this context, they may suggest ways of thinking about both routine, daily interchanges between people as well as less frequent, more dramatic, longer-range exchanges of non-local raw materials. People may have been constituted as persons through a web of interchange. I have suggested elsewhere,<sup>69</sup> arguing from such representations as are available on pottery and in the shape of figurines, that the concept of the individual in the Körös culture may have been fluid and even ambiguous. Figurine fragments from Ecsegfalva 23<sup>70</sup> include the typical elongated neck/head with schematic face, found frequently elsewhere. It might also be legitimate to connect mortuary practices. The sample is small, and excavations have been of limited extent. But a trend has been observed for more female and child than male burials.<sup>71</sup> At Ecsegfalva 23, only scattered human bones can be

<sup>60</sup> Hagen 1999.

<sup>61</sup> Hagen 1999, 366, 372.

<sup>62</sup> Hagen 1999, 362.

<sup>63</sup> Maschio 1998.

<sup>64</sup> Maschio 1998, 85-86, 96.

<sup>65</sup> Weiner 1991, 5; Weiner 1988.

<sup>66</sup> Weiner 1991, 8.

<sup>67</sup> Weiner 1988, 38.

<sup>68</sup> Weiner 1991, 35.

<sup>69</sup> Whittle 1998; Whittle 2001; Whittle 2003.

<sup>70</sup> Krisztián Oross, pers. comm.

<sup>71</sup> O. Trogmayer: Die Bestattungen der Körös-Gruppe. *MFME* 2 (1969) 5-15; J. Chapman: The living, the dead and the ancestors, time, life cycles and the mortuary domain in later European prehistory, in: J. Davies (ed.): *Ritual and Remembrance: responses to death in human societies*. Sheffield 1994, 40-85.

assigned to the Körös culture occupation<sup>72</sup> at Endrőd 119, there are certainly infant burials belonging to the occupation, and at least one adult, though sex is not yet established.<sup>73</sup> I have questioned elsewhere<sup>74</sup> therefore, whether conceptually the Körös female was in some way more closely linked to place, and the Körös male to the wider surroundings. Mortuary ritual may have been in part a final exchange, both an ending and a last settlement of connections.

### **Conclusion**

This brief paper has been deliberately speculative. Further, larger scale excavation of Körös culture occupations may refine or overturn many of the possibilities discussed here. My aim has been, however, to try to evoke something of the worldview of the people involved. The starting point was the observed facts of raw material movements, but I went on to suggest a series of connections, through the circumstances in which people came to occupy the southern part of the Great Hungarian Plain in the first place, and through the concept and practice of place, relations with the natural surroundings, including water and earth, various interchanges with animals, and linkages among the living and between the living and the dead. Raw material movements may be only part of a pervasive sense of connectedness, which helped to constitute this world.<sup>75</sup>

<sup>72</sup> Ildikó Pap, pers. comm.

<sup>73</sup> Makkay 1992, 132.

<sup>74</sup> Whittle 1998; Whittle 2001; Whittle 2003.

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## TRANSYLVANIA AND THE BANAT IN THE LATE NEOLITHIC. THE ORIGINS OF THE PETREȘTI CULTURE

As archaeological research developed at the beginning of the 20th century, large amounts of prehistoric painted ceramic materials came to light. Even from the beginning, these materials constituted a distinct cultural entity both in terms of their aesthetic value and the way they were formed and fired. This cultural entity was successively termed by the specialists who studied it “the western Romanian painted ceramics culture”,<sup>1</sup> or “central Transylvanian painted ceramic culture”,<sup>2</sup> or “the civilisation with painted ceramics within the western Dacian circle”,<sup>3</sup> “the Petrești type”<sup>4</sup> and, finally, “the Petrești culture”.<sup>5</sup>

The archaeologists who outlined the main features of this culture were Dumitru and Ion Berciu.<sup>6</sup> Iuliu Paul however, established the internal chronology of the Petrești culture. He divided the Petrești culture into three phases A, AB and B on the basis of the development the painted ceramics.<sup>7</sup>

The origin of the Petrești culture is disputed. Two opinions have been formulated as a result of the discussions concerning this complex problem. The first opinion defines the local origin of the Petrești culture in the painted pottery of the Starčevo-Criș culture transmitted via Vinča-Turdaș.<sup>8</sup> Based on a few vague analogies, the second opinion attempted to connect the appearance of the Petrești culture to the southern Thessalo-Macedonian world.<sup>9</sup> If the first hypothesis of the local origin could not be confirmed by the archaeological means, the second

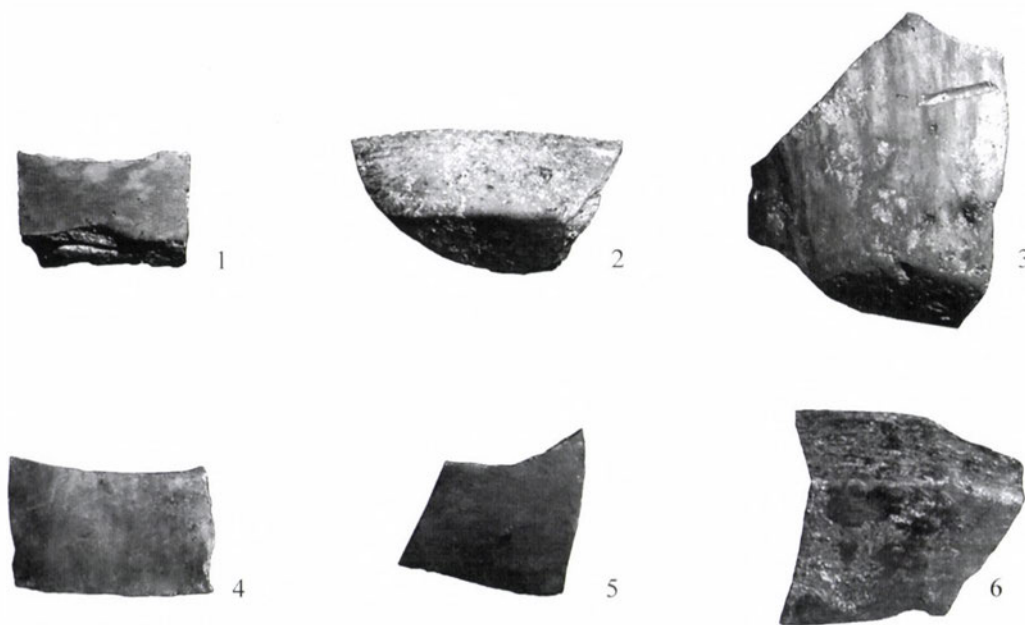


fig. 1. Red monochrome painted pottery from Foeni

<sup>1</sup> Nestor 1932, 25–39.

<sup>2</sup> Schroll 1933, 25–29.

<sup>3</sup> Berciu – Berciu 1946, 53–63.

<sup>4</sup> Berciu – Berciu 1949, 41.

<sup>5</sup> Berciu 1961, 24, 25, 26.

<sup>6</sup> Berciu – Berciu 1946, 58 sqq; Berciu – Berciu 1949, 11–13.

<sup>7</sup> Paul 1977; Paul 1981; Paul 1992.

<sup>8</sup> Berciu 1961, 25, 27, 29; Dumitrescu 1966, 440, 442; Vlăssă 1976, 34, 66, 135–136; Paul 1965, 296; Paul 1992, 130–131.

<sup>9</sup> Marinescu-Bîlcu 1975, 495; Lazarovici 1979, 168; Lazarovici 1987, 39–40; Draşovean 1994b, 167–168; Draşovean 1997, 77–78.

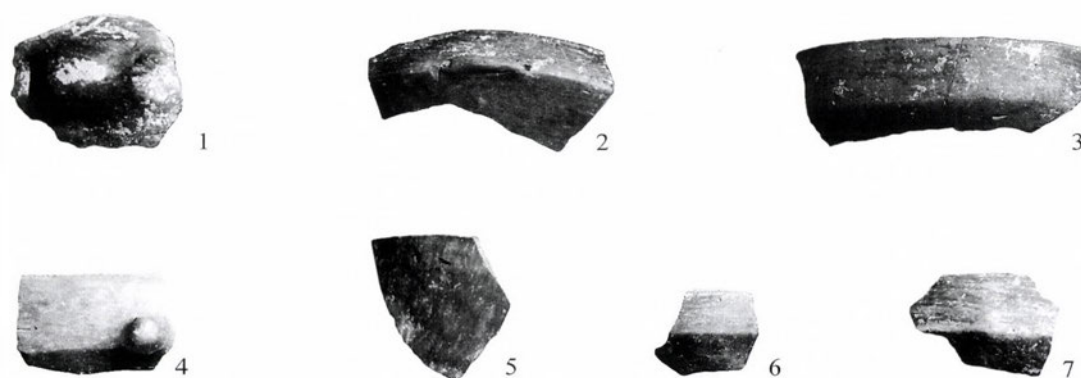


fig. 2. Red painted patterned pottery from Foeni

one, more credible, could not be demonstrated by the presence of links between Thessalo-Macedonia and Transylvania. Consequently, this matter remains to be resolved.

A possible answer to the problem of the origin of the Petrești culture comes from the region of the Banat. Here, in the 1980's, excavations resumed at Parța. Intensification of the investigations contributed to the discovery of some painted ceramic materials very similar to the Petrești culture.<sup>10</sup>

Discovery of these ceramic materials marked the beginning of some important systematic investigations at Foeni, Chișoda, Parța II, Sânmihaiu Român and other sites where so-called painted Petrești materials were recovered.<sup>11</sup>

After 1985, but especially during the last decade when excavations were carried out in parallel at the sites of Vinča and Foeni, the characteristics of the ceramics of the two cultures could be separated. That is why the cultural content of the Foeni group, named after the settlement with the most significant finds, could be specified and defined.<sup>12</sup>

The ceramics of the Foeni group is substantially different from that of the Neolithic cultures from the Banat. In spite of all these differences, in the 1980's, only the painted materials discovered here in the settlements of the Late Neolithic were regarded as a distinct cultural entity and considered imports from the Vinča milieu.<sup>13</sup> This was possible because the characteristics of the Foeni ceramics were unknown, especially the unpainted category derived from the coeval Vinča culture.

The technology of the Foeni group ceramics is distinct. Thus, the well-burnt paste is red-orange, orange-yellowish and black in colour. The vessel surface of the fine ware, almost without exception, is heavily polished. Some of the vessels had been fired using the black topped technique. Among the ceramic materials, those that are red-cherry and orange in colour stand out (*figs 1, 2*). They are associated with pottery with a white-limy background on which the painted ornament is executed. The ornament is painted with red, brown-reddish, cherry coloured, black, and rarely white colours. The decoration comprises thin lines grouped in angular motifs (*figs 2, 5, 6*). Inside the vessel, opposite the lip, there are scaled-down truncated triangles (*figs 4, 1; 6, 1, 2, 6*). Some bowls are painted inside with cherry-coloured comma shapes (*fig. 4, 5; 6, 2, 5, 6*) or parallel lines bordered by a straight line at the ends (*fig. 4, 3; 6, 3*). Besides the painting in red and black, the vessels are decorated with white angular motifs on a red-cherry background, (*fig. 7*). Rarely, some ceramic fragments are decorated with a red background applied after the vessel was fired. The painted ornaments represent 8% of the total ornaments at this point in the stage of research at the Foeni settlement.<sup>14</sup>

<sup>10</sup> Lazarovici 1979, 166–168; Lazarovici 1987, 39–40.

<sup>11</sup> Drașovean 1994a; Drașovean 1994b; Drașovean 1996a, 84–86; Drașovean 1997.

<sup>12</sup> Drașovean 1996a, 84–86; Drașovean 1997, 78.

<sup>13</sup> Lazarovici 1979, 166.

<sup>14</sup> Drașovean 1994b, 147; Drașovean 1997, 59.



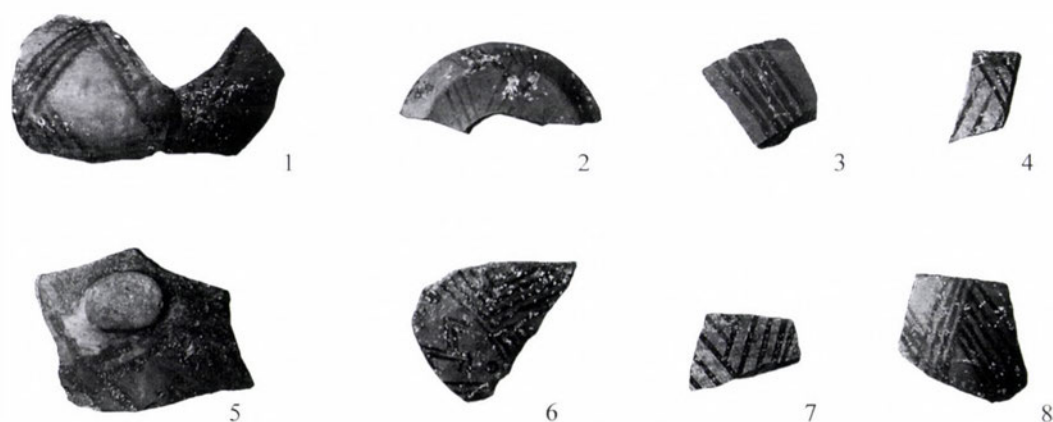


fig. 3. Red painted patterned pottery from Foeni

Besides the painted ornaments, the polished decorations executed inside the vessels represent another feature of the Foeni pottery group. These polished ornaments consist of lines or wide bands that start from the lip running down towards the base of the vessel (*fig. 9*). They include motifs within nets, hatched triangles and, more rarely, spirals. This type of decoration was believed to belong exclusively to the repertoire of Vinča ceramics, but subsequently it was also shown to be represented at Foeni comprising over 27% of the ornament ensemble.<sup>15</sup>

Incised ornamentation is very rare. Such motifs comprise only 6% of the ornaments on the pottery from Foeni<sup>16</sup> and they consist of angular incisions that seem to imitate some of the painted decorations.

In terms of vessel shapes the ceramics of the Foeni group are characterised by carinated bowls with profiled lips (B1-B4a type),<sup>17</sup> bi-conical bowls (B4c, B4d), two-handled pots (C4 type) and tri-conical pedestals (E3 type).<sup>18</sup> Besides these features, there are bi-conical dishes with profiled shoulders, flat trapezoidal handles and slightly raised edges (*fig. 3*).

Analysing the stratigraphical realities from Banat in which these materials appear, we see that the Foeni levels overlay Vinča C1 layers at Parța.<sup>19</sup> Painted ceramic imports typical of the Foeni group<sup>20</sup> were discovered at Chișoda Veche, in level II assigned to Vinča C1.<sup>21</sup> At Chișoda Veche too, the second level superimposes another level attributed to a beginning phase of Vinča C1.<sup>22</sup> These stratigraphical realities permit us to suggest that the Foeni group is in part contemporaneous with or later than some Vinča C1 settlements from Banat and contemporaneous with the classical Tisza settlements from Vésztő-Mágor<sup>23</sup> and Öcsöd<sup>24</sup> which are, in turn, synchronous with Vinča C1.<sup>25</sup> Consequently, the chronological moment of the Foeni group can be placed towards the end of Vinča C1.<sup>26</sup> Studying the spread of these ceramic materials in the neighbouring areas of the Banat, it was noted that the closest analogies to the Foeni group ceramics in Transylvania may be found in the pottery of the Petrești culture. In fact, as mentioned before, in the 1980's, this type of Banat painted ceramics were considered imports from the Petrești cultural milieu in Transylvania.<sup>27</sup>

Thus, the technology of the Foeni ceramics is so closed connected with the discoveries from Transylvania so that if some ceramic categories of the two cultures were artificially

<sup>15</sup> Drașovean 1994b, 147; Drașovean 1997, 59.

<sup>16</sup> Drașovean 1994b, 147; Drașovean 1997, 59.

<sup>17</sup> Drașovean 1997, fig. 2.

<sup>18</sup> Drașovean 1994b, 145, 147 and fig. 3; Drașovean 1997, 58–59 and fig. 2.

<sup>19</sup> Drașovean 1996a, 32.

<sup>20</sup> Drașovean 1996a, 30, 84.

<sup>21</sup> Drașovean 1996a, and Pl. LXXXIV/8, 9; Drașovean 2002, 76.

<sup>22</sup> Drașovean 1996a, 30.

<sup>23</sup> Hegedűs – Makkay 1987.

<sup>24</sup> Raczkó 1987.

<sup>25</sup> Kalicz – Raczkó 1987, 30; Kalicz 1989, 106–107; Drașovean 1996a, 88–89.

<sup>26</sup> Drașovean 1996, 84–86; Drașovean 2002, 77–78.

<sup>27</sup> Lazarovici 1979, 166; Lazarovici 1987, 39–40.



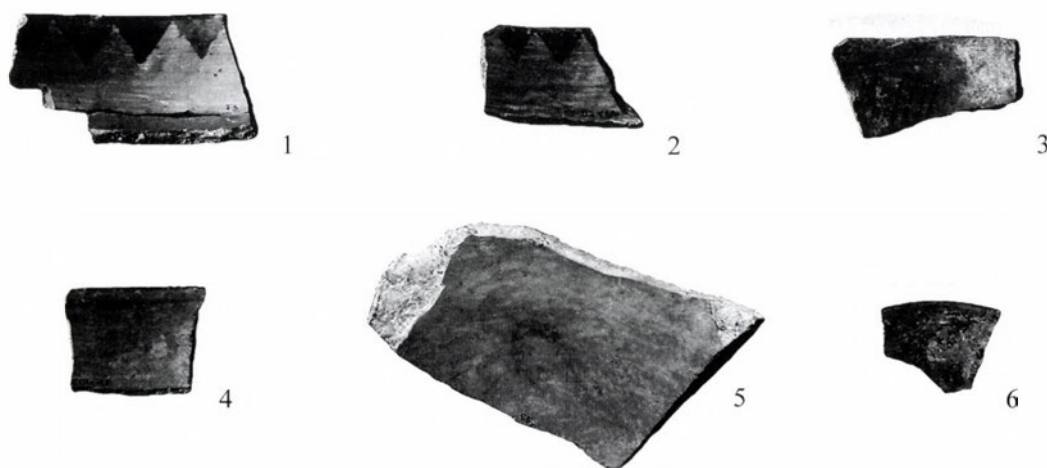


fig. 4. Vessels with painted decorations on the internal surface from Foeni

mixed, from the point of view of the firing technology, the colour of the vessels and the smoothing and polishing of their surfaces, it would hardly be possible to separate them.

An essential element in connecting the ceramics of the two archaeological cultures are the painted decorations on the potteries, especially those composed of thin lines grouped in angular motifs and “in rafters” in cherry-red or brown-reddish colours (*fig. 2; 4. 1–5; 5. 1, 2, 5, 6*). They share decorative elements with similar discoveries from Daia Română, Păuca and Ghirbom,<sup>28</sup> attributed to the oldest phase of the Petrești culture. Also, the polished decorations on pottery from Daia Română are identical to those from the Foeni area.<sup>29</sup> Besides these specimens, the polished incisions have analogies on pottery specimens from Mintia,<sup>30</sup> Daia Română and Păuca (Iuliu Paul, personal communication). Bi-conical vessels on whose lip there was a trapezoidal band-ear with the lateral edges slightly raised are met at Mintia (unpublished material), Șoimuș,<sup>31</sup> Turdaș II,<sup>32</sup> Baciul and Archiud.<sup>33</sup>

The vessels’ shapes in this sense are also eloquent concerning associations between ceramic types. Thus, the most frequent pot shape encountered in the Foeni group from Banat, B4d type,<sup>34</sup> has analogies in the Petrești A settlements, as well as in the bi-conical shapes with profiled lips (B type).<sup>35</sup> At the same time, the tall necked and round shouldered vessels that prefigure the Petrești carina correspond typologically with ceramics from the settlements of Daia Română and Păuca from phase A.<sup>36</sup>

As emphasised on other occasions, there are also differences between the materials from Banat and Transylvania because the former do not employ all possible genres of painted decorations typical of the phase A. On the other hand, white painted ornaments were discovered at Foeni and have, by now, been found in Transylvania, too.<sup>37</sup>

In spite of all these analogies, however, at first sight, a hypothetical organic connection between the Foeni group and the Petrești culture is impossible because the beginning of the was coeval with Vinča B2-end of Alföld-end of Precucuteni I.<sup>38</sup> Thus, the beginning of the Petrești culture would have been earlier than the time of the Vinča C1 to which the Foeni group is associated.<sup>39</sup> To back this opinion up, a series of arguments are provided by discoveries made at the investigated sites of that period in Transylvania.

<sup>28</sup> Paul 1981, Pl. 54/5, 6; Paul 1992, Pls. XXX/10–11, XXXI/1, 2, 8, XXXII/6.

<sup>29</sup> Drașovean 1994, 163.

<sup>30</sup> Drașovean – Luca 1990, figs. 1/5, 2/3, 4, 3/2, 4/10.

<sup>31</sup> Drașovean–Rotea 1986, 20, Pl. VI/8.

<sup>32</sup> Luca 2001, 150 and fig. 24/5, 6.

<sup>33</sup> Maxim 1999, Pl. XIX/1.

<sup>34</sup> Drașovean 1997, 56, fig. 2.

<sup>35</sup> Paul 1992, Pls. XXXIII/14, XXIV/16, XXVIII/2, 4, 9, 10, XXXI/1.

<sup>36</sup> Paul 1992, 53 and Pl. XXIII/9; XXVI/8; XXVIa/5; XXX/2; XXIX.

<sup>37</sup> Drașovean 1994, 163; Drașovean 1997, 72–73.

<sup>38</sup> Paul 1981, 231; Paul 1992, 125–127.

<sup>39</sup> Drașovean 1996a, 77, 84–86, 97–99, 107; Drașovean 2002, 77.

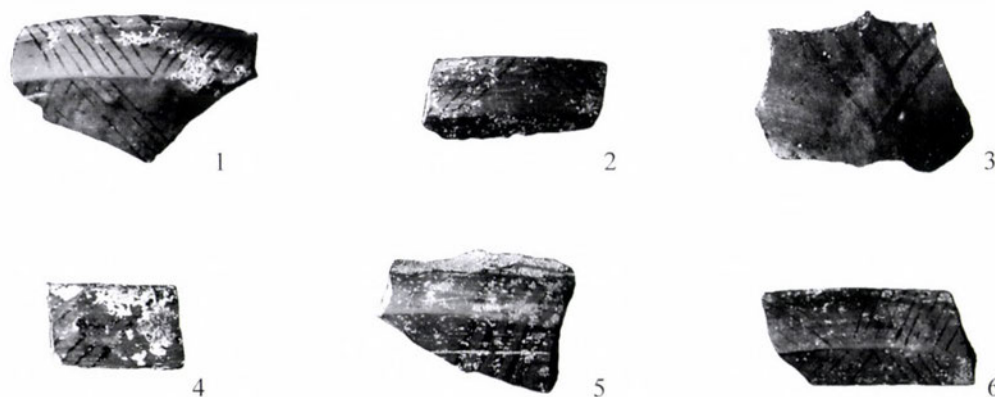


fig. 5. Cherry-red and brownish-red painted decorations from Foeni

We shall analyse the arguments brought to support this chronology in light of the new discoveries from the last ten years of excavation in Transylvania.

Thus, at the settlement from Daia Română, the Petrești A level is superimposed over another level from the Turdaș culture, more precisely Turdaș II, based on the system used by Iuliu Paul and synchronised with Vinča B2.<sup>40</sup> At that time, ceramic materials discovered in this level were considered “linear influences” and included in the final phase of the Alföld culture.<sup>41</sup> Ceramic fragments characteristic of phase I of the Precucuteni culture were found in that layer, too.<sup>42</sup>

Analysing the so-called late Alföld ceramics from Daia Română,<sup>43</sup> it is noteworthy that they have close analogies to ceramics from Turdaș, Valea Nandrului, Turdaș,<sup>44</sup> Orăștie<sup>45</sup> and Mintia.<sup>46</sup> As at Daia Română, Mintia, Turdaș and Orăștie the so-called Alföld elements are associated with Precucuteni I and II imports.<sup>47</sup> These levels, through the materials that they contain, belong to the Turdaș culture, the late phase of the Turdaș culture (Turdaș, Orăștie, Valea Nandrului), and to the Foeni group (Mintia). They are contemporary with the end of the Vinča C1 phase. Consequently, the attribution of these materials to the late Alföld culture is an artifact of the history of archaeological investigations in the region because this culture, that evolved in the south of the Tisza Plain, ends its development at the end of the Vinča B1 phase<sup>48</sup> when the Szakálhát culture appears.<sup>49</sup> It is in no way contemporary with Vinča B2. These linear decorations are not part of the motif repertoire of the Alföld culture, but of the ceramics from the late Turdaș cultural horizon which is, in turn, synchronous with the end of Vinča C1.<sup>50</sup>

Another argument for an early dating of the Petrești culture to the Vinča B2 horizon, was the presence of some Precucuteni I imports in the Turdaș level (I) at Daia Română.<sup>51</sup> The Precucuteni materials are a constant presence in the late Neolithic settlements of Transylvania.<sup>52</sup> They have been discovered at Iclod,<sup>53</sup> Lumea Nouă Ila,<sup>54</sup> Turdaș II,<sup>55</sup> Tăuălaș II<sup>56</sup> and Mintia

<sup>40</sup> Paul 1992, 51, 53, 127.

<sup>41</sup> Paul 1992, 53, 126.

<sup>42</sup> Paul 1981, 231; Paul 1992, 51, 53–54, 125, 127.

<sup>43</sup> Paul 1992, 53, 125, and Pl. XX/1–5.

<sup>44</sup> Luca 2001, figs. 25/2–6, 7; 26/1, 3, 5; 28/1–3; 29/2; 30/1; 34/7, 9, 17; 37/1.

<sup>45</sup> Luca 1997, Pls. XII/5, XVIII/2–4, 17, XIX/6, 10, XXXVII/14; XLIII/8, 12, 14; XLIV/3, 15; XLVI/6.

<sup>46</sup> Drașovean–Luca 1990, fig. 2/1, 3, 5.

<sup>47</sup> Drașovean–Luca 1990, 11 and fig. 3/4; Luca 2001, 149.

<sup>48</sup> Kalicz 1989, 105; Kalicz – Makkay 1977, Table 2; Kalicz – Raczky 1987, 30.

<sup>49</sup> Kutzián 1966, 264–265; Kalicz – Makkay 1977, 93–96, 106–110; Lazarovici 1975, 20; Lazarovici

1977, 225; Lazarovici 1979, 125, 132; Lazarovici 1984, 147, 151, 155, 157, 158; Horváth 1985, 91; Horváth 1989, 86–87; Raczky 1985, 103–104; Raczky 1992, 148; Kalicz – Raczky 1987, 30; Kalicz 1989, 104–105; Garašanin 1989, 59–62.

<sup>50</sup> Drașovean 1996a, 96; Luca 2001, 124.

<sup>51</sup> Paul 1981, 231 and fig. 18; Paul 1992, 54, 127.

<sup>52</sup> Marinescu-Bîlcu 1974, 131–134, 140; Mantu 1998, 112–113, 144; Luca 2001, 68, 132, 149.

<sup>53</sup> Lazarovici – Maxim 1993, 54–57.

<sup>54</sup> Marinescu-Bîlcu 1974, 133.

<sup>55</sup> Luca 1997, 66; Luca 2001, 68, 132, 149.

<sup>56</sup> Lazarovici – Dumitrescu 1986, 15.



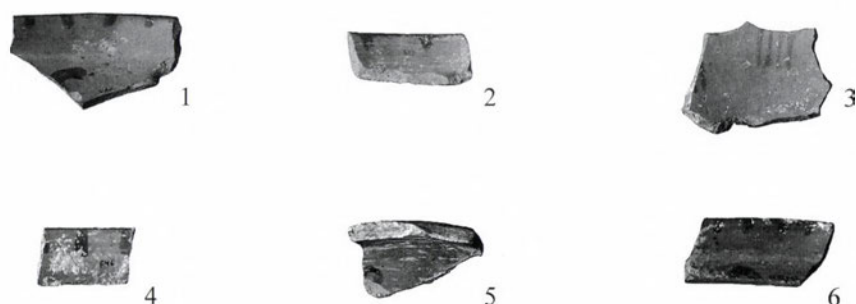


fig. 6. Vessel with red and dark painted decorations on the internal surface from Foeni

II.<sup>57</sup> If the association of the Vinča B2 phase with level IIa from Lumea Nouă is, in light of new investigations, disputable, all the other levels where Precucuteni I imports were found belong to the cultural medium subsuming the sites of Iclod (Iclod), Turdaș (Turdaș, Tăuălaș) and Foeni (Mintia) and are coeval as well with the Turdaș level from Daia Română associated with the Vinča C1 phase.

The third argument – and the most important one – used to place the beginning of the Petrești culture in the Vinča B2 phase<sup>58</sup> was the use of the old chronological sequence of the Turdaș culture. In the 1960s, this culture was divided into three phases: phase I contemporary with Vinča B1, phase II contemporary with Vinča B2 and phase III contemporary with Vinča C.<sup>59</sup> This chronological sequence was established by specialists who were not very familiar with the cultural content of the Vinča culture. From the point view of its derivation, the Turdaș culture is at the very least connected to the Vinča culture.<sup>60</sup> Over the last decade, as a result of detailed analysis by specialists familiar with the ceramics of the Vinča culture and new investigations at late Neolithic sites in the Mureș valley,<sup>61</sup> the cultural content of the Turdaș culture and its chronological and developmental sequence could be specified much more exactly.<sup>62</sup> Thus, at this stage in the research, the beginnings of the Turdaș culture and of its eponymous settlement can not be placed earlier than Vinča C1.<sup>63</sup> Consequently, the Turdaș level at the settlement of Daia Română, placed by its excavators in Vinča B2,<sup>64</sup> can not date to before the Vinča C1 phase. Moreover, on the basis of the Precucuteni I pottery imports, the lower level at Daia Română is contemporary with Turdaș II, Tăuălaș II and Mintia all dated to the end of the Vinča C1 phase.<sup>65</sup>

In conclusion, all the arguments brought to sustain a high chronology for the Petrești culture must fail before a detailed analysis of the new materials discovered over the last ten years in Transylvania. All these data make it clear that the beginning of the Petrești culture should fall during the Vinča C1 phase and not earlier. Thus it is also partly contemporaneous with the Foeni group from Banat.

Following the spread of the Foeni group ceramics, we find that they can be also found in a series of settlements from Transylvania and north of this province as well.

<sup>57</sup> Drașovean–Luca 1990, 13 and fig. 3/4; Drașovean 1996a, 92.

<sup>58</sup> Paul 1965; Paul 1981, 231; Paul 1992, 127.

<sup>59</sup> Paul 1981, 232, Table 21; Paul 1992, 125, 126, 129, 131 and Table 1 and 2.

<sup>60</sup> Lazarovici 1977a, 223; Lazarovici 1977b, 29–31; Luca 1997, 62, 66, 73, 75.

<sup>61</sup> Luca 1997; Luca 2001.

<sup>62</sup> Drașovean 1996a, 93–99; Drașovean 2002, 69–76; Drașovean – Mariș 1998, 99–100; Luca 1997, 71–77; Luca 2001, 96–97, 128–129.

<sup>63</sup> Kalmár-Maxim 1991, 5; Drașovean 1996a, 93–94, 97, 98; Drașovean 2002, 75; Drașovean – Mariș 1998, 97, 100; Luca 2001, 124.

<sup>64</sup> Paul 1981, 224 and fig. 18, 231; Paul 1992, 53, 125.

<sup>65</sup> Luca 2001, 148–150; Drașovean 2002, 77–78.

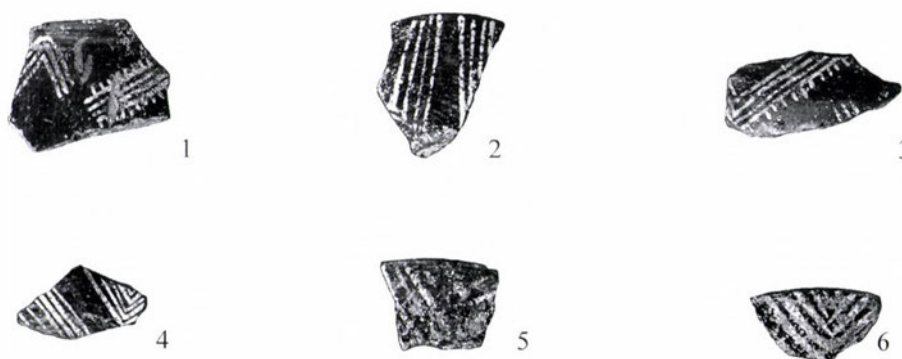


fig. 7. White on red painted patterns pottery from Foeni

This was probably the result of a process of migration of the Foeni communities, penetrating Transylvania at the end of the Vinča C1 phase.<sup>66</sup> The proportion and the dynamism of this migration are related to the fact that Foeni communities may be found from the Mureş valley to the north of Transylvania in the Cluj and Bistriţa areas.<sup>67</sup> This wave – the second one following the Vinča C1 phase, which comes into the area of Transylvania during the late Neolithic – determine the dissemination of the late Turdaş communities towards the northern Transylvania and stops the development of the Turdaş culture in the Mureş valley.<sup>68</sup>

From an archaeological perspective, results from excavations over the last five years in Transylvania demonstrated that Foeni materials appeared either in cultural layers of the Turdaş culture at Tăuălaş II,<sup>69</sup> Turdaş II<sup>70</sup> and Orăştie-Dealul Pemilor,<sup>71</sup> or as independent occupations at Mintia,<sup>72</sup> Zau de Câmpie,<sup>73</sup> Baci and Archiud.<sup>74</sup> The Turdaş layers, where Foeni ceramic imports appear to date to the Turdaş II phase, are contemporary with the end of the Vinča C1 phase.

The C14 dates also confirm this finding. Thus, dates for the Foeni group from the Banat are 5835±40 BP or 4726 cal BC (Deb-5725) and 5855±85 or 4739 cal BC (Deb-5771) and are partly contemporary with C14 dates for the Petreşti A phase.<sup>75</sup>

From a chronological perspective, the Turdaş II phase occurs before the early phase of the Petreşti culture. This means that the Foeni materials from Transylvania are earlier than the early phase of the Petreşti culture. This matter has been stratigraphically demonstrated as well, by finding a Petreşti A layer superimposed over a Foeni cultural layer at the tell of Zău de Câmpie.<sup>76</sup>

From an material culture perspective, these two archaeological cultures, the Petreşti and the Foeni, are similar in many ways.

On the basis of these similarities corroborated through stratigraphic and radiocarbon data, we can state that it was the Foeni group that substantially contributed to the appearance of the Petreşti culture.

The Foeni communities, within the developmental process culminating in the appearance of the Petreşti culture, had ceramics manufactured using the same firing and modelling technology, most vessel shapes, the same painting techniques and style, as well as similar plastic modelling in clay.

The development of the Foeni communities into the Petreşti culture took place in Transylvania within the ethno-cultural context of the presence of the Lumea Nouă group and

<sup>66</sup> Draşovean 1996a, 86, 98–99; Draşovean 2002, 76–78.

<sup>67</sup> Maxim 1999, 101 and Pl. XIX/1.

<sup>68</sup> Draşovean 1996a, 99; Draşovean 2002, 78.

<sup>69</sup> Dumitrescu 1986, 9 and fig. 2./13; Draşovean 1996a, 97–99.

<sup>70</sup> Luca 2001, 131, 145.

<sup>71</sup> Luca 2001, 124, 145.

<sup>72</sup> Draşovean – Luca 1990; Draşovean 2002, 78.

<sup>73</sup> Lazarovici 1997.

<sup>74</sup> Maxim 1999, 101; Draşovean 2002, 77.

<sup>75</sup> Mantu 1995, 226; Mantu 1998, 143.

<sup>76</sup> Lazarovici 1997; Maxim 1999, 103.



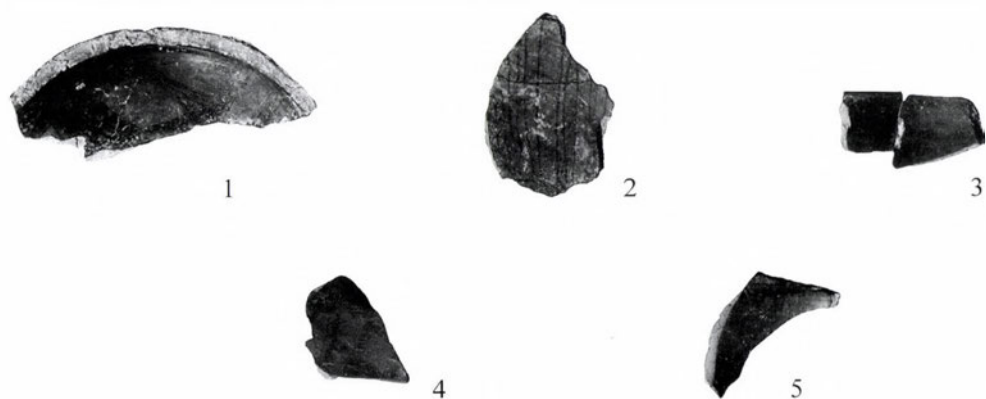


fig. 8. Grey ware with burnished patterns from Foeni

the stage of maximum dispersion of the Turdaș culture.<sup>77</sup> It is difficult for us to follow at this stage in the research, the role played by the Lumea Nouă group in the genesis of the Petrești culture. Nevertheless, on the basis of the data from Zău de Câmpie, where the Foeni materials seem to be associated with Lumea Nouă painted ceramic fragments,<sup>78</sup> and comparing some Lumea Nouă ornaments with some similar early Petrești ceramic ornaments, we can postulate that the Lumea Nouă ceramic inventory contributed to the constitution of some Petrești painted motifs. The people who created pottery associated with the Foeni ceramic group settled in Transylvania during a period when the ceramic material culture was undergoing a process of transformation towards the attributes of the future Petrești ceramic culture with the inclusion of the pointed-incised ornaments and the quadrilateral vessels, which would be a constant presence in ceramics of the Petrești settlements of phase A and AB.<sup>79</sup>

At this stage in the research it is possible to talk about a fully formed Petrești culture in the horizon represented by level II at Daia Română, at the chronological moment of 4750 cal BC,<sup>80</sup> that is, the Vinča C1/C2 phase.

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<sup>77</sup> *Lazarovici 1997.*

<sup>78</sup> *Lazarovici 1997.*

<sup>79</sup> *Vlassa 1976, 66; Luca 1997, 71; Maxim 1999, 81.*

<sup>80</sup> *Paul 1981, 233; Paul 1992, 127, 131; Mantu 1998, 143.*

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## ANALOGIES AND DIFFERENCES BETWEEN ANIMAL HUSBANDRY AT THE LATE VINČA AND FOENI GROUP SITES IN THE BANAT (SW ROMANIA)

This article focuses on results from faunal analyses of assemblages from Late Neolithic sites in the Banat. Animal remains were brought to light during excavations carried out in the following sites: Foeni – “Orthodox Cemetery” (Foeni Group)<sup>1</sup>, Parța, tell II<sup>2</sup> (Vinča C and Petrești cultures)<sup>3</sup>, Sânanđrei (Vinča C and post Vinča C) and Liubcova – “Ornița”<sup>4</sup> (Levels II–I, Vinča C). The settlements are located in different biotopes. Foeni, Parța, Sânanđrei are located in the lower Timiș Plain, on natural mounds rising slightly above the surrounding areas. Although, in the past, the Timiș, Bega, Bârzava rivers and their old branches caused frequent flooding and seasonal swamps and lakes, nowadays, they are canalised. Quaternary alluvio-deluvial deposits, loessy deposits, overlie the relief. At present, secondary meadows and agricultural crops, with scattered oak groves dominate the landscape. In the past it was a forest-steppe region, at least partially covered with plain forests, mostly along the watercourses. The settlement of Liubcova – “Ornița” is located in the southern Banat, on a middle terrace of the Danube, in the large depression of Sichevița. Argillic brown soils and luvic ones are spread along the Danube bank (beneath pastures) and on the basin slopes (under mixed oak patches). They are of a medium fertility, especially for grasslands. Alluvial soils developed on the lowest Danube bank, at present flooded.

### *The species frequencies at Foeni*

To date, about 30,963 bones have been brought to light during the excavations at the above-mentioned sites,<sup>5</sup> Foeni settlements furnishing the better part of the samples with about 23,565 fragments. First, beginning some words will be said about the Foeni assemblage, as a departure point for our discussion. It is the richest Neolithic sample in the Banat, accounting for some 23,565 bones from three cultural layers: lower, middle and upper (*Table 1*).

We should also add that a preliminary report was published some years ago,<sup>6</sup> supported by a smaller faunal assemblage. According to this latest data, cattle dominate the proportions in all contexts, comprising over one third of the assemblage. In term of number of specimens, their proportion visibly increased from 38.2% at the beginning of the habitation to 45.5% towards the upper layer. In contrast, the small ruminants appear to decrease in number. At the beginning of the habitation they total 22.7%, with their numbers decreasing to 14.2% (middle layer) and increasing to 16.7% later. A decrease of 6% during the lifetime of the site is significant in consistent assemblage. The number of domestic swine is also subject to important fluctuations. In the lowest layer pig is represented at 11.6%, clearly increases to 20% as the number of caprinae falls. Finally their numbers stabilize at 12.6%, a slightly higher value for that period on the Banat Plain. The question of whether dog was eaten at the site remains difficult to substantiate one way or the other. However, some dog skulls showed signs of having been opened intentionally to remove the brain for consumption.

<sup>1</sup> Drașovean 1994, 141.

<sup>2</sup> El Susi 1998c, 129–151.

<sup>3</sup> Idem, 151.

<sup>4</sup> El Susi 1991, 9–17.

<sup>5</sup> The faunal assemblages from Foeni and Parța will be enriched in the following years.

<sup>6</sup> El Susi 1998b, 139–163.



Species/group	Lower layer		Middle layer		Upper layer	
	Frgm.	%	Frgm.	%	Frgm.	%
<i>Bos taurus</i>	1,419	38.2	684	39	4,809	45.5
<i>Ovis/Capra</i>	844	22.7	249	14.2	1,769	16.7
<i>Sus scrofa dom.</i>	430	11.6	350	20	1,329	12.6
<i>Canis familiaris</i>	74	2	30	1.7	130	1.2
DOMESTICS	2,767	74.5	1,313	74.9	8,037	76
<i>Cervus elaphus</i>	602	16.2	293	16.7	1,527	14.5
<i>Sus scrofa fer.</i>	157	4.2	67	3.8	305	2.9
<i>Capreolus cap.</i>	59	1.6	20	1.1	210	2
<i>Bos primigenius</i>	102	2.8	44	2.5	418	4
<i>Lepus sp.</i>	9	0.2	7	0.4	49	0.5
<i>Castor fiber</i>	9	0.2			1	0.01
<i>Ursus arctos</i>					1	0.01
<i>Meles meles</i>	4	0.1	1	0.06	4	0.04
<i>Martes martes</i>	2	0.05	1	0.06	4	0.04
<i>Vulpes vulpes</i>	3	0.08	3	0.2	4	0.04
<i>Felix silvestris</i>	1	0.03	1	0.06	2	0.02
<i>Canis lupus</i>	1	0.03			2	0.02
<i>Lynx lynx</i>					1	0.01
Carnivora	1	0.03	3	0.2	2	0.02
WILD	950	25.5	440	25.1	2,530	24
TOTAL	3,717	100	1,753	100	10,567	100
<i>Bos sp.</i>	113		25		151	
<i>Bos/Cervus</i>	277		63		1,454	
<i>Sus sp.</i>	95		58		112	
Caprinae/Cap.	68		135		59	
Unident.	1,051		483		2,148	
Mammals	5,321		2,517		14,491	
Birds	8		3		13	
Reptiles	10		29		22	
Fish	69		15		73	
Molluscs	291		205		498	
TOTAL	5,699		2,769		15,097	

Table 1. The species frequencies at Foeni – “Orthodox Cemetery”

The domestic/wild ratio varies between 74.5–25.5% in the earlier layer and 76–24% later. In a way, the distribution of wild mammals undergoes few changes during the analysed period, but some trends have been observed. Red deer, a species requiring a forested environment (bushy woodlands, edge of woods – 180), was the most hunted mammal in all contexts; but a slight decrease in its frequency has been observed, from 16.2% to 14.5% during the habitation. The percentage of wild boar (for which the forest was “at most a fostering factor, a refuge against predators or during periods when sows have litters or are suckling their young”)<sup>7</sup> reduced from 4.2% to 2.9%. On the other hand, wild mammals as indicators of an open landscape (woodland-steppe) such as aurochs, roe deer (in some measure) increase in frequency towards the upper layer: from 2.5% to 4.0%. Bones of typical, forest-dwelling

<sup>7</sup> Bolomey – El Susi 2000, 159.

mammals<sup>8</sup> (lynx and wild cat) occurred in insignificant percentages, 0.1–0.02%. The above-mentioned data suggests that there was an intensification of clearing activities, as well as a reduction in the forested areas during the lifetime of the site. A review of the above-mentioned data suggests that some changes may have occurred in the animal husbandry practices of the Foeni inhabitants towards the upper layer. They could be summarised as a decline in the number of small ruminants number together with a better use of them; an increase in the proportion of cattle is an expression of a more settled economy.

### *The species frequencies in Banat sites*

The base of the animal economy at sites from the beginning of Late Neolithic comprised cattle, followed by caprovines and/or pig. This is the general schema but many there are many astonishing differences in the detail of the composition and proportion of species at each site for each culture. Cattle were, with a single exception, at Liubcova – “Ornița” the most commonly exploited mammal, totalling about 43–57% regardless of cultures. Only at Liubcova – “Ornița” does cattle rank second after red deer at 28.9% (*Table 2*).

Site	Sânandrei	Pața tell 2	Liubcova-O	Sânandrei	Foeni
Culture	Vinča C	Vinča C	Vinča C levels	Post Vinča C	Foeni group
<i>Bos taurus</i>	52.9	43.1	28.9	57	43.1
<i>Ovis/Capra</i>	7.9	15.8	9.8	6	17.9
<i>Sus scrofa dom.</i>	9.1	10.1	8.3	6.4	13.2
<i>Cervus elaphus</i>	13	18.8	29.5	20.4	15.1
<i>Sus scrofa fer.</i>	6.5	5.4	15.9	4.2	3.3
<i>Capreolus cap.</i>	8.5	3.7	2.8	2	1.8
<i>Bos primigenius</i>	0.6	1.1	2.7	2.8	3.5
Other species	1.6	2	2.1	1.2	2.1
Total sample	1,150	2,854	1,107	2,287	23,565

Table 2. The species frequencies at Late Neolithic sites in the Banat (Frgs.)

Beyond all doubt, the location of the site in a different and complex ecosystem (The Danube Valley) encouraged another type of economy focused on hunting. As a rule, the small ruminants rank second in almost all contexts. For all that, at Vinča C sites they were recorded in lower frequencies, 7.9–9.8% except for Foeni where their quota strongly increased up to 18%. Pața occupies an intermediate position with cattle comprising 15.8%. The inner development of the animal exploitation displays a strong increase in the percent of caprinae towards the Petrești layer at the site. Pig ranked third among the domestic mammals and its frequency, slightly oscillated within the faunal spectra. It never totals more than 10% at Vinča C sites. Even if a higher value has been estimated at Foeni (13.2%), pig never attained significant numbers throughout Neolithic, except in the Banat Culture (33–35%).<sup>9</sup>

The domestic/wild ratio little varies in the sites from the Banat Plain due, somehow, to their similar bio-geographic locations. Liubcova is an exception, with an increased share of game of over 50%.

Site	Sânandrei	Pața tell 2	Liubcova-O	Sânandrei	Foeni
Culture	Vinča C	Vinča C	Vinča C levels	Post Vinča C	Foeni Group
DOMESTIC	70.4	69.9	47.6	70	75.7
WILD	29.6	30	52.3	30	24.3

Table 3. Domestic/wild ratio at Neolithic sites from the Banat (as Frgs.)

<sup>8</sup> *Ibidem*

<sup>9</sup> *El Susi 1996a*, 311.



At the sites located on the Banat Plain, wild remains comprise no more than 25–30% of the samples. Red deer was the most common game animal, during Neolithic times it was widespread in the lower levels of sites. It attained higher percentages (17–24%) in the Banat Culture and visibly decreased to 20–13% during the Vinča C and Petrești periods. Perhaps, some alterations in its biotope related to intensification of clearing activity lie at the base of this assertion. In more southerly areas, its contribution to the meat supply was considerable, up to 29.5% at Liubcova. Wild swine always contributed less to the communities' meat supply, attaining just 3–6% in the plain. Liubcova is again an exception with wild swine comprising 15.9%. Roe deer and aurochs never exceed 4% of the total assemblage except for the Vinča C levels from Sânandrei, where roe deer comprised 8.5%.<sup>10</sup> A significant number of both small and large carnivores and rodents completes the faunal spectra. The group "other species" includes about 146 remains from nine taxa: hare (74 bones), beaver (14), fox (13), marten (13), badger (11), wildcat (8), bear (9), wolf (3) and lynx (1). In our quantification, dog remains were included within "other species" in addition to the afore-mentioned remains. Their contribution to the meat supply was insignificant. In connection with environmental conditions fishing, mollusc gathering and the capture of birds and pond-tortoise would have had a certain importance in the supply of meat. Generally, the lower proportion or the absence of these animal groups does not reflect the actual situation during prehistory. The location of sites in the vicinity of aquatic resources provided good conditions for their exploitation. Taking into account the inadequate method of bone collecting (hand collection) it may be that aquatic resources would have been much more important than the statistics presented here suggest (Table 4).

	Sânandrei	Pața tell 2	Sânandrei	Liubcova-O	Foeni
Mammals	99.4	98.3	99.9	93.3	94.7
Birds	0.6		0.04	0.9	0.1
Reptiles					0.3
Fish		0.3		3.3	0.7
Molluscs		1.3		2.3	4.2

Table 4. The animal group percentages at Neolithic sites

A comparison between Foeni and Sitagroi I and II<sup>11</sup> emphasises the great importance of caprinae exploitation at both sites. Some differences emerge in the details, related to dissimilarities in environmental conditions in both areas. Thus, in Greek sites (located in a drier climate) caprinae contribute 27–44%, followed by cattle at 25–30%. The Banat Plain was better for cattle breeding than for caprinae. Consequently, even if in the lower levels of the Foeni site small ruminants were an important component, during the period of habitation cattle breeding gained in importance as an adaptation to local resources. The same situation occurred during the Starčevo – Körös culture in the Banat.<sup>12</sup> In this respect, we believe that archaeozoological data provides supplementary evidence for the southern origin of the Petrești Culture,<sup>13</sup> implicitly that the Foeni group. In the same chronological context we attempted to compare our settlements to those of the Herpály culture. However, there is no resemblance. Hence, cattle total 12–20%, caprinae 2–5.6% and pig 9–10% at Herpály sites.<sup>14</sup> Domestic species account no more than 29–36%. Among hunted mammals, bones from aurochs contributed from 23–38% in the Pannonian area. As for the Vinča C sites, a comparison between the settlements from the Banat Plain and those from Vinča (late levels),<sup>15</sup> Gomolava, and Divostin II<sup>16</sup> exhibits some common features such as: the high proportion of bovines and lower values for pig and caprinae (below 11%). Also, in the

<sup>10</sup> Jongsma – Greenfield 1996, 302.

<sup>11</sup> Bökönyi 1977, 11.

<sup>12</sup> El Susi 1996b, 145.

<sup>13</sup> Drașovean 1994, 168.

<sup>14</sup> Bökönyi 1977, 12.

<sup>15</sup> Bökönyi 1990, 50.

<sup>16</sup> Bökönyi 1988, 420.

lower regions (where all the sites mentioned here lie) there was a rich hunted fauna, the wild species contributing up to between 62.4–85%. A similarly high proportion was apparent at Tisza and Herpály settlements<sup>17</sup> also.

### *The exploitation of domestic species*

Cattle management at the previously mentioned sites falls into two groups, despite the cultural uniformity. The former group includes Foeni and Parța, the second, Liubcova and Sânandrei. In the first case, we note a proportion of 40.4–41.8% animals killed before the age of reproduction (less than two years), values rather high for rational exploitation of a uniparous species. On the other hand, the small percent of very worn teeth suggest that few animals were exploited to the end of their useful life. The adult/young-mature specimens represent 61.8% at Foeni and 59.7% at Parța. These values suggests that the targeted objectives of the inhabitants were, aside meat, milk (and other dairy products) and draught power. At Foeni, a significant number of oxen was noted. Thus, on metapodii, out of 17 complete bones, 11.8% come from females, 35.3% from males and 52.9% from oxen. At the same site, of 70 horncores, 40% originate from cows, 57.1% from bulls and 2.9% from oxen. Consequently, an increased percent of males were emphasised in both cases. They were mostly slaughtered as adults, protecting the stock of cows. This fact supports the hypothesis of a balanced exploitation of species, despite the greater contribution of immature specimens: males for meat and females for dairy products. Unluckily, equally detailed information was not forthcoming from other sites due to the absence of complete bones. At Liubcova and Sânandrei the proportion of juveniles and subadults is smaller, 20% and 15.2% respectively. The percent of adults and mature individuals rises sharply to 80% in the former settlement and 84.6% in the second one.

That reflects better management of species as compensation for a lower number of individuals, mostly at Liubcova. At Sânandrei, cattle were numerous but they were the single important domestic mammal, and simply better care would have sustained the animal economy.

	Site	Juvenile	Subadult	Adult	Mature/senile
Cattle	Parța-tell 2	21.1	19.2	21.1	38.6
	Sânandrei	7.6	7.6	33.6	51.2
	Liubcova-Ornița	10	10	20	60
	Foeni	19.9	21.9	35.3	22.8
Caprinae	Sânandrei	29.4	41.1	17.6	11.7
	Parța-tell 2	20.5	35.9	28.3	15.2
	Liubcova-Ornița	40	25	25.8	9.2
	Foeni	22.7	14.4	45.5	17.4
Pig	Sânandrei	42.1	47.3	10.5	0
	Parța-tell 2	20	25.9	41.6	12.5
	Liubcova-Ornița	28.5	11.5	31.5	28.5
	Foeni	27.9	12.6	54	5.4

Table 5. The age class distribution in percentages

At sites where the breeding of small ruminants was of less importance, their exploitation was disadvantageous. Regarding kill-off patterns, the following should be noted: the young/subadult to adult/mature ratio differs from site to site. In this respect, the most significant proportions of young/subadults individuals occur at Sânandrei – 70.5%, Liubcova – 65%, followed by Parța with 56.4% and Foeni with 37%. In relation to this percentage, the adult/mature contribution increased in the same way. Foeni offered the most balanced animal

<sup>17</sup> Bökönyi 1988, 430.



exploitation, focusing on secondary products, without dropping their role in the meat supply. In contrast, the small ruminants were kept mostly for meat at Sănanndrei and Liubcova. This was also an important animal category at Parța. Among the Caprinae, there was a female/male ratio, of 41/7 (based on horncores). This reflects the prevalence of she-goats among killed animals, especially at a mature stage. It suggests also that females outnumbered males within flocks kept for dairy products. For the sheep, of the 53 horncores, 17 originate from ewes and 36 from rams. Many of male horncores come from subadult and young adult animals, killed for mutton. The different kill-off patterns has a connection with the frequency of each species; in this context caprovines are not very numerous at Liubcova and Sănanndrei and better represented at Parța and Foeni.

On the subject of age class distribution of the pig several differences between sites may be observed. Thus, the share of young/subadults is 40.5% while individuals killed as adults (54%) prevail at Foeni. The proportion of reproductive stock lays around 5.4%. A similar percentage of young/subadults was noted at Liubcova although mature individuals are more common. Taking into account the prolificacy of the species, in addition to the favourable environmental conditions for this species, the 28.5% share held by mature individuals would have been sufficient to maintain vigorous breeding at the site. Unexpectedly the percent of pig is low at sites. Similar exploitation of pig was noted at Sănanndrei although a different picture was offered by the Parța sample. There was an absence of mature individuals, a lower proportion of adults (10.5%) and the highest percentage of juvenile/subadults (89.4%). On the other hand, "pork from flat and skinny pigs with lean and dry meat resulting from traditional keeping, could be less easily prepared and consumed once the animals reached maturity".<sup>18</sup> In other words, the pursued purposes were to obtain meat, to maintain the stock (not to increase it, as the proportion quota of mature animals show) at most of the sites. As for the exploitation of wild mammals adult and mature animals are most important in almost all cases.

### *The species*

#### BOVINAE

About 9,330 remaining bones were collected from domestic species and 667 from aurochs. From the very beginning it the presence of three "bovine varieties" cattle, aurochs and crossbreeds<sup>19</sup> was observed at almost all the sites.<sup>20</sup> The phenomenon was most clearly expressed on the metapodials. In general, measurements suggest that cattle from this period were large or medium-sized with many values falling within the size limits of the wild population. During the Late Neolithic the bovines from the Banat Plain were more robust and taller compared to those from the Danube Valley (*fig. 1–2*). Unfortunately, few long bones were found at Vinča C sites so that most of the values were deduced from the Foeni sample. At a first sight, there were no substantial differences between sites with the same breed of cattle exploited throughout the low regions. On the whole, the withers' heights vary between 122.8–129.2 cm (Matolcsi) (mean – 126 cm) in the Danube Valley (estimation only for males) and between 120.3–138.8 cm (mean – 128 cm) in the Banat Plain. The mean withers height of bulls in the plain is higher than in the Danube Valley at 129.5 cm. It is also worth mentioning that the phenomenon of castration was widespread throughout the region, especially at Foeni.<sup>21</sup>

In brief, it appears that the same type of bovine could be found everywhere in the Banat at the beginning of the Late Neolithic regardless of cultural affiliation; however, their greater robustness seems to be a characteristic of cattle in the lower regions of the Banat as opposed to the situation in the south.<sup>22</sup> Also aurochs from the Banat Plain were more robust compared to those from southern regions. In their dimensions, they fit well within the size range calculated for the Pannonian area.<sup>23</sup>

<sup>18</sup> Vörös 1994, 172.

<sup>19</sup> Most probably this crossbreeding would have had a spontaneous character.

<sup>20</sup> The phenomenon is more emphasised at Foeni.

<sup>21</sup> The great number of cattle bones may influence this fact; the phenomenon was also pronounced at Sănanndrei and Parța.

<sup>22</sup> El Susi 1996b, 111.

<sup>23</sup> Bökönyi 1962, 175–214.



## OVINAE and CAPRINAE

About 3,450 remaining bones were collected from small ruminants, sheep being at least three times more numerous than goat. Three types of horncores related to sex distribution were documented on the basis of skull parts and horn cores. The males had heavy, three-edged horncores which twisted outward, the so-called "copper age type" (28 pieces). The form dominates at all sites. Characteristically, all the pieces are medium-sized. Means of 46.5 mm (40–56,  $n=28$ ), greatest diameter of the base; 33.6 mm (28–39,  $n=27$ ), the smallest diameter of the base; 135 mm (114–156,  $n=27$ ) and the circumference. Of the base were estimated. Females had rudimentary horn cores – "turbary types" (4 pieces) or were hornless (5 cases). Based on 24 complete long bones, the stature of sheep was estimated as being between 42.6–59.8 cm (Teichert) (mean – 49.6 cm), at Foeni. A slightly greater value for the mean was estimated for Parța at 52.1 cm. In the Neolithic sites from the Danube Valley values of 56.5–62.5 cm (mean – 61.1 cm)<sup>24</sup> were presumed. Unfortunately, no such values were recorded at Vinča C sites from the Danube Valley. As a general rule, the existing data seem to indicate the presence of the same type of sheep during the Neolithic in the Banat. However, it is no less true that the abundant material from Foeni contained sheep which were extremely gracile and smaller, compared to contemporaneous sites. This smaller type could be nicely tied to the populations from contemporary settlements from Greece.<sup>25</sup>

The goat horncores are mostly of a "aegagrus type" (females), with a typical morphology: scimitar forms, not twisted, biconvex or plano-convex in cross-section. Means of 34.3 mm (32.5–37;  $n=25$ ), greatest diameter at the base; 24.4 mm (19.5–27.5;  $n=25$ ), smallest diameter at the base; 96.5 mm (92–116;  $n=25$ ), circumference at the base were calculated. Another five pieces with large dimensions and with well-developed outwardly twisting ("prisca type") horns come from bill-goats. Means of 52.1 mm (49–61;  $n=5$ ), greatest diameter of the base; 34.8 mm (29–41;  $n=4$ ), smallest diameter of the base; 147.7 mm (137–163;  $n=25$ ) and the circumference of the base were estimated. Goat was more robust and taller than sheep as revealed by the data. No more than three wither' heights could be estimated in this period: 60.3, 60.6 and 61.5 cm (Schramm).

## SUIDAE

About 2,536 bone remains come from domestic species and 818 from the wild one. The existence of a mixed domestic pig-wild boar population (particularly in the Danube Valley) makes it difficult to separate them; consequently the group "Sus sp." includes a large number of bones. In terms of their size, many complete bones permitted the following appraisal: for the domestic species, values range between 64.2–73.4 cm (Teichert) (mean – 68.5 cm;  $n=12$ ) on the Banat Plain and 69–74 cm in more southerly regions. Despite some values exceeding 70 cm, domestic pig was small and slender throughout the Banat during Late Neolithic. Noseparate breeds could be differentiated in the faunal assemblages from northern or southern regions.

Wild swine was medium to large size; values of 79.3–110 cm (mean – 93.5 cm;  $n=38$ ) were approximated for animals from sites on the plain and 87.7–109 cm (mean – 98.7 cm;  $n=3$ ) at Liubcova–"Ornița."<sup>26</sup> The higher values of the withers height' mean at Liubcova versus the wild swine remains from sites on the Plain is explained by a greater percentage of males at the former site.

## CERVIDAE

The group includes the remains of 3,168 red deer and 421 roe deer bones. In terms of measurements, deer bones exhibit values that fall within the greater variability of the Neolithic species in Romania.<sup>27</sup> For all that, the means estimated on red deer material from the lower regions of the Banat exceed those from the southern regions.<sup>28</sup> The red deer population from the Banat Plain has good parallels in the Tisza and Lengyel materials from regions in Hungary.<sup>29</sup> The same situation is found for roe deer. As a general rule, the roe deer exploited

<sup>24</sup> *El Susi* 1996b, 121.

<sup>25</sup> *Bökönyi* 1989, 130.

<sup>26</sup> *El Susi* 1991, 12.

<sup>27</sup> *Necrasov – Haimovici* 1963, 131–144; *Bolomey* 1968, 21.

<sup>28</sup> *Bolomey* 1968, 330–334.

<sup>29</sup> *Bökönyi* 1963, 73–101.



at the Banat Plain sites was more robust than those from the Danube Valley (particularly at Liubcova–“Ornița”) and Divostin,<sup>30</sup> and matched the Hungarian roe deer population.

#### CANIDAE

A significant number of dog bones came to light at the sites discussed here, especially at Foeni (234 specimens). According to the basal length from Dahr, 52.6% of mandibles fall into the “palustris” class, 31.6% into the “ladogensis” and 15.8% into the “intermedius” ones. This supposes that over half of the estimated individuals were small in stature; fewer animals attained medium size.

#### *Conclusions*

In brief, the above-mentioned data suggest that a special kind of animal husbandry developed at the site of Foeni sustained by cattle exploitation, an increased proportion of small ruminants, and sustained hunting, lower by at least 5% lower than at other sites. However, cattle comprised an increased proportion with pig and caprinae of less importance at Vinča C settlements on the Banat Plain. A decrease in the percentage of cattle was balanced by an intensification in pig breeding and sustained hunting. A low contribution of caprinae in the supply of meat to the community was found in Vinča C sites from the Danube Valley.

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<sup>30</sup> Bökönyi 1988, 71.

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## ERSTE ANZEICHEN DER REGIONALISIERUNG SOWIE NACHWEISE VON FERNKONTAKTEN IN DER ÄLTEREN LINEARBANDKERAMIK

In dem Titel meines Beitrages scheinen zwei gegensätzliche Themenkreise vereint. Tatsächlich ergänzen die Hinweise auf die Regionalisierung und die bisher nachweisbaren Fernkontakte einander vortrefflich und eröffnen neue, lohnende Forschungsziele.

Ein kurzer Blick auf den derzeitigen Forschungsstand soll die Ausgangssituation klarstellen: die Kultur der Linearbandkeramik ist mit hoher Wahrscheinlichkeit in Transdanubien und seinen unmittelbaren Nachbargebieten entstanden, d.h. im nordwestlichen Vorland der Starčevo-Kultur. Entscheidende Entwicklungen für diese Neuformung dürften dabei im Umfeld des Balaton, also direkt im nördlichen Randbereich der Starčevo-Kultur stattgefunden haben, wie E. Bánffy so eindrucksvoll in ihrem Beitrag darlegte. Im Detail sind jedoch noch wesentliche Fragen offen:

wie dieser Entstehungsprozess genau vorzustellen ist und

wie die weitere Entwicklung, insbesondere die sehr rasche Ausbreitung von dem vermutlichen Entstehungsgebiet bis an den Rhein verlief.

Das Erscheinungsbild der Kultur der älteren oder ältesten Linearbandkeramik (LBK I) wirkt bei oberflächlicher Betrachtung sowohl bei den Haus- und Siedlungsbefunden als auch bei den Funden – besonders der namensgebenden Keramik – ungewöhnlich einheitlich. Dieser Eindruck beruht bei der Keramik, die hier zunächst im Mittelpunkt stehen soll, auf folgenden Fakten: dem kleinen Formenspektrum, das sich auf wenige, sehr einfache Grundformen beschränkt, und der dominanten Ausführung der Verzierungen in breiten, im Querschnitt U-förmigen Rillen. Selbst die Motive weisen nur eine geringe Variabilität auf und basieren weit überwiegend auf Spirale und Mäander.

Infolge mehrerer großflächiger Siedlungsgrabungen in den letzten 20 Jahren hat sich die Materialkenntnis der LBK I bedeutend vergrößert. Dadurch war es nun möglich, Motivvarianten und technische Details zu beobachten, die in einigen Regionen vorkommen und in anderen fehlen.<sup>1</sup> Vielfach sind diese keramischen Merkmale zu selten, um ein verwertbares Kartenbild zu ergeben, wie ich bei mehreren Versuchen, solche Karten zu zeichnen, feststellen musste. Nur vier Merkmale ergaben interessante Kartenbilder, die ich in weiterer Folge vorstellen und kurz kommentieren werde.

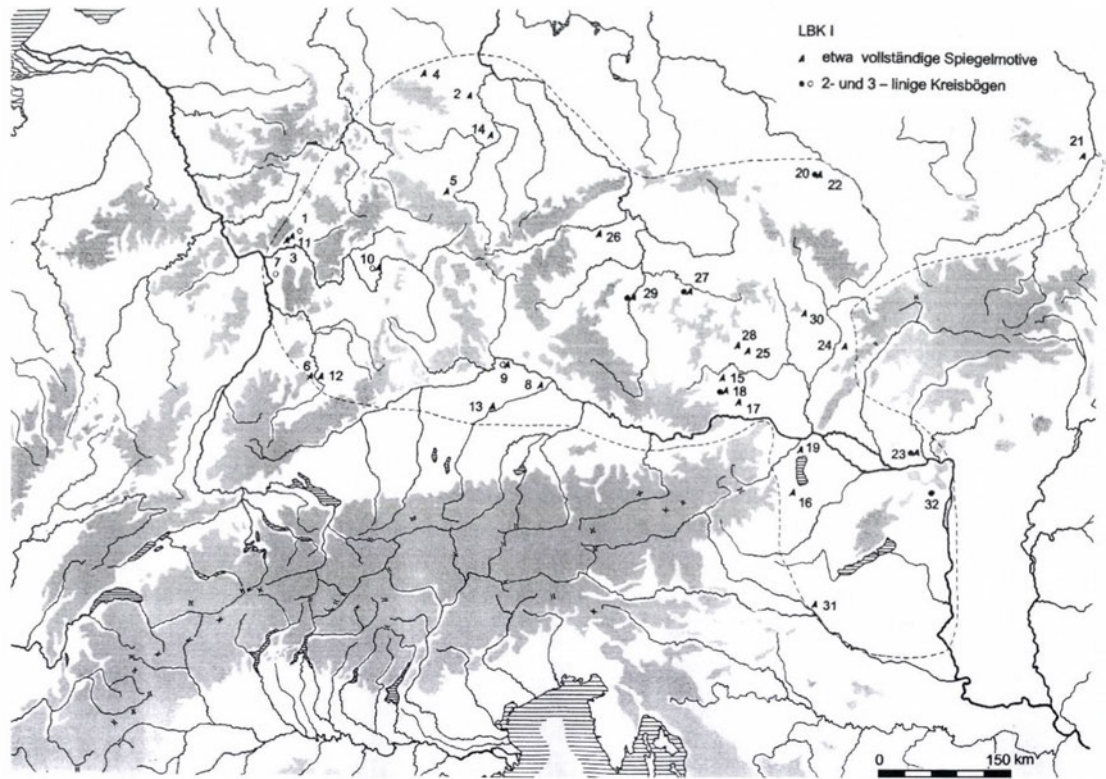
Ich möchte mit den *Spiegelmotiven* beginnen, die in großen Teilen des altbandkeramischen Verbreitungsgebietes so regelhaft vorkommen, dass sie viele als das typische Motiv der LBK I ansehen. Dabei sind die Stücke gar nicht so zahlreich, auf denen ein derartiger Dekor auch nur annähernd vollständig erhalten ist. Die Gestaltung des Motivs weist dabei eine beachtliche Variabilität auf (*Abb. 1*). Nur jene Fundplätze mit dem Nachweis eines annähernd vollständigen Spiegelmotivs sind auf Karte 1 eingetragen, bei Berücksichtigung der fragmentierten Nachweise ließe sich die Zahl der Punkte im Bereiche Deutschlands, Tschechiens, Polens und Österreichs sicher beachtlich verdichten. Wesentlich an diesem Kartenbild ist, dass es aus der Slowakei und aus Ungarn nicht nur je einen Fundpunkt, sondern nur je ein Stück gibt, das dieses Dekorationsprinzip aufweist.<sup>2</sup>

Ein durchaus gegensätzliches Bild ergibt die zweite Motivgruppe, die *nach unten gekrümmten Kreishögen*, deren exakte Erfassung im westlichen Teil des altbandkeramischen Verbreitungsgebietes vorläufig an dem schlechten Erhaltungszustand der relevanten Gefäße scheitert. Nur in Břaña in der Slowakei und in Bicske, Ungarn, ist dieses Motiv völlig eindeutig

<sup>1</sup> Cladders 2001, 111 und Abb. 87.

<sup>2</sup> Pavúk 1980, 31 Abb. 14/2; Kalicz 1980, Taf. 4/5.





Karte 1.

dokumentiert (Abb. 2). Bei den Beispielen aus Deutschland (Abb. 2: Schwanfeld, Mintraching, Goddelau) bleibt aufgrund der gering erhaltenen Gefäßfläche eine gewisse Unsicherheit, ob es sich nicht um Teile eines Spiral- oder Wellenbanddekors handelt. Diese Möglichkeit scheint mir bei den Gefäßen aus Strögen, Bylany und Gniechowice weniger wahrscheinlich, weswegen ich diese Fundplätze auf der Karte so wie jene von Biňa und Bicske mit vollen Punkten eingetragen habe, die Plätze in Deutschland hingegen nur mit Kreisen (Karte 1). Ein Kartenbild wie dieses mit nur 9 Fundpunkten erlaubt natürlich keine weitreichenden Schlüsse. Es könnte sein, dass sich diese Kreisbögen als ein in erster Linie – oder ausschließlich?? – im östlichen Teil des altbandkeramischen Verbreitungsgebietes vorkommendes Merkmal erweisen werden.

Die beiden anderen, verzierungstechnischen Merkmale zeigen deutlichere Verteilungsschwerpunkte, besonders dann, wenn man die Quantitäten der Nachweise an den einzelnen Fundstellen mit berücksichtigt. Das erste dieser Merkmale sind die Einglättverzierungen. Sie gehören in den altbandkeramischen Fundinventaren Ungarns zur Regelausstattung, wie dies beispielhaft an den entsprechenden Stücken aus Bicske zu ersehen ist (Abb. 3. 4). Von anderen ungarischen Plätzen gibt es nur einige Zeichnungen in einer leider noch immer unveröffentlichten Dissertation<sup>3</sup> und genaue Hinweise von Nándor Kalicz.<sup>4</sup> Aus der Slowakei sind vorläufig nur aus Biňa mehrere Beispiele dieser Verzierungs technik bekannt.<sup>5</sup> Es ist wohl nicht unwahrscheinlich, dass es in der Südwestslowakei noch mehrere Plätze dieser Art gibt.

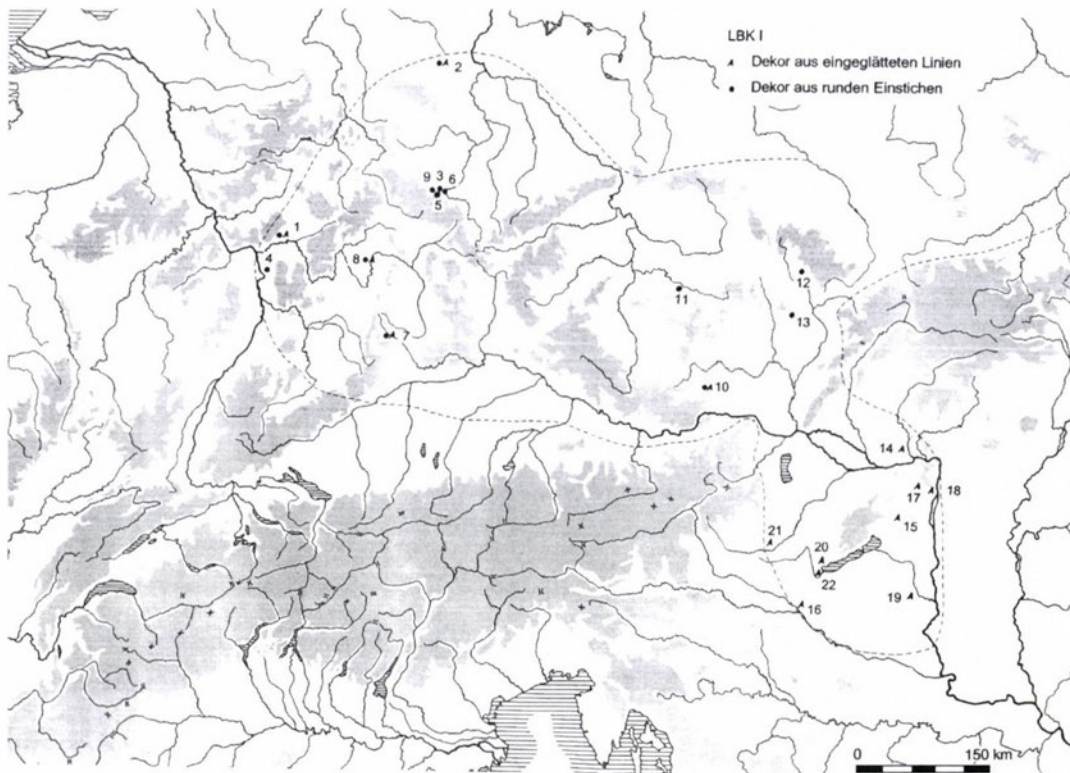
Während die entsprechenden Stücke aus Biňa (Abb. 2. 3) und aus Bicske (Abb. 3. 4) jeweils einen größeren Anteil innerhalb des Fundensembles stellen, handelt es sich bei den übrigen Nachweisen dieser Ziertechnik um Einzelstücke aus großen Grabungsinventaren (Abb. 3: Bruchenbrücken, Schwanfeld und Strögen) oder einem größeren Fundbestand (Abb. 3: Nördlingen). Diese Mengenrelation des Verzierungsmerkmals muss man unbedingt auch bei der Bewertung der Kartierung berücksichtigen (Karte 2). So markieren die Fundpunkte aus

<sup>3</sup> Gläser 1993.

<sup>4</sup> Kalicz 1993, 91.

<sup>5</sup> Pavúk 1980, Abb. 5, 6 und 13.





Karte 2.

Ungarn und der Slowakei jeweils den mehrfachen Nachweis innerhalb kleiner Fundinventare, während die übrigen Punkte für einzelne, oft sehr kleine Fragmente aus umfangreichen Grabungsinventaren stehen.

Ich denke also, dass wir mit dem Dekor aus eingeglätteten Linien ein nur für die östlichste Region der LBK I typisches keramisches Merkmal vor uns haben. Die vereinzelt Nachweise in weit entfernten Gebieten verdeutlichen wohl nur die Langstreckenkontakte, wie sie auch durch die Nachweise einzelner Silexrohmaterialien dokumentiert sind (siehe später).

Ähnliche regionale Schwerpunkte sind bei dem zweiten verzierungstechnischen Merkmal, dem Dekor aus runden Einstichen, zu beobachten. Die bisher reichsten Nachweise dieser Zierweise gibt es aus Bruchenbrücken (Abb. 5). Eine auffällige Konzentration von Fundpunkten zeigt sich im Raume Erfurt (Abb. 6: Erfurt, Mittelhausen; Karte 2) sowie allgemeiner im westlichsten Teil des altbandkeramischen Verbreitungsgebietes. Die geringe Zahl von nur vier Belegen dieses Dekors aus Mähren, Böhmen und Niederösterreich zusammen erstaunt etwas, wichtig ist das völlige Fehlen im Gebiet von Polen, der SW-Slowakei sowie in Ungarn.

Die eben kurz umrissenen Verteilungsschwerpunkte und Verteilungsgrenzen der vier keramischen Merkmale sind m.E. als erste Anzeichen der Regionalisierung aufzufassen, wie sie aus der nachfolgenden Entwicklung der jüngeren Linearbandkeramik auf der Basis eines um ein Vielfaches größeren Materialbestandes so gut bekannt ist.

Nachweise von Fernkontakten liegen bisher für die ältere/älteste Linearbandkeramik (LBK I) nur anhand von Sileximporten vor. Eine erste überregionale Studie dieser Art zeigte bereits beachtliche Fernverbindungen u.a. für den berühmten Szentgál-Radiolarit aus dem Bakony-Gebirge nördlich des Balaton auf.<sup>6</sup> Besonders auffällig ist, dass das Verteilungsmuster dieses Rohmaterials weitgehend jenem der Einglättverzierungen auf der Keramik entspricht. Neuere Untersuchungen zu diesem Thema ergaben nun nicht nur weitere Nachweise dieses

<sup>6</sup> D. Gronenborn: Silexartefakte der ältestbandkeramischen Kultur. UPA 37. Bonn 1997, Abb. 3. 45.



hochwertigen Rohmaterialies in der LBK I Mährens, sondern auch, dass das für das beginnende Neolithikum festgestellte Versorgungsnetz im östlichen Mitteleuropa bereits im Mesolithikum existierte.<sup>7</sup> Allein der Anteil der fremden Rohmaterialien ist an den mesolithischen Fundstellen etwas geringer. Diese Beobachtung beschränkt sich nicht auf den Szentgál-Radiolarit, sondern gilt auch für den Krakauer Jurahornstein, der über eine etwa gleich große Distanz nach Mähren und in das nördliche Niederösterreich gelangte.<sup>8</sup>

Erstaunlich ist an den eben kurz wiedergegebenen jüngsten Forschungsergebnissen, dass sich die aus Polen und Ungarn über so große Entfernungen importierten Silexrohmaterialien gerade in den altbandkeramischen Siedlungen des nördlichen Niederösterreich und in Mähren treffen. Betrachtet man die beiden hier vorgestellten Karten (*Karte 1 und 2*) so hat man den Eindruck, dass auch jene keramischen Merkmale, deren Verteilungsschwerpunkt im Osten liegt gerade in dieser Zone mit jenen zusammenkommen, deren Verteilungsschwerpunkt im Westen ist. Beide Beobachtungen zeigen m.E., dass diese mährisch/nordniederösterreichische Region für die Menschen des 6. Jahrtausends v. Chr. eine beachtliche Attraktivität besaß. Wir Archäologen sind herausgefordert zu ergründen, worin diese Attraktivität bestand. Ein wichtiger Schritt zur Beantwortung dieser Frage wäre es, zu klären, welche Güter als Gegengabe für den Silex nach Ungarn und Polen gelangten.

Selbstverständlich ist es möglich, dass diese Gegengaben zu einem beachtlichen Teil aus heute nicht mehr nachweisbaren Materialien bestanden. Die Region des nordwestlichen Niederösterreich ist ein extrem silexarmes Gebiet. Sie gehört geologisch ebenso wie Mähren zur „Böhmischen Masse“, in der hochwertige Rohmaterialien für Felssteingeräte wie Amphibolith und Serpentin anstehen wie der in dieser Zeit für die Keramikherstellung sehr geschätzte Graphit. Rohgraphitknollen sind in Niederösterreich an zwei altbandkeramischen Plätzen bisher nachgewiesen: Brunn, Fundstelle II,<sup>9</sup> und Rosenberg bei Horn.<sup>10</sup> Vorläufig gib es noch keine konkreten Nachweise für die Weitergabe der eben genannten Rohmaterialien z.B. nach W-Ungarn. Gerade die während des „round-tables“ so eindrucksvoll dokumentierte intensive Forschungsarbeit rund um den Balaton<sup>11</sup> hat hier sicher viel wertvolles Material ergeben, das zur Lösung dieser Frage beitragen kann. Für die nächste Zukunft wäre daher ein überregionales, internationales Forschungsprojekt zur Klärung der Rohmaterialversorgung der frühneolithischen Siedlungen sehr wünschenswert. Dadurch wären m.E. die Versorgungsnetze und damit auch die Kommunikationsstrukturen dieser spannenden Umbruchszeit zu klären und vielleicht auch ein Beitrag zur eingangs erwähnten offenen Frage über die Art und Weise der grundlegenden Veränderungen bei der Entstehung der LBK zu leisten.

### ***Fundstellenregister zu Karte 1 mit Literaturhinweisen***

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1. Bad Nauheim, Wetterau (*J. Kneipp*: Bandkeramik zwischen Rhein, Weser und Main. UPA 47. Bonn 1998, Taf. 40/5)
2. Bernburg, Kr. Bernburg (*Quitta 1960*, 12, Abb. 4)
3. Bruchbrücken (*Cladders 2001*, Taf. 10/1 b)
4. Eitzum (*Schwarz-Mackensen 1985*, Taf. 2/4, 5)
5. Erfurt (*Walter – Bücke – Schulze 1987*, 81, Abb. 2/16)
6. Gerlingen (*A. Neth*: Eine Siedlung der frühen Bandkeramik in Gerlingen. FBVFBW 79. Stuttgart 1999, Taf. 22/1, 84/1)
7. Goddelau (*Cladders 2001*, Taf. 32/2)
8. Irlbach, Lkr. Straubing (*Quitta 1960*, 37, Abb. 22 a)
9. Mintraching (*Cladders 2001*, Taf. 41/6)
10. Schwanfeld (*Cladders 2001*, Spiegelmotiv: Taf. 50/1, 50/5; Kreisbögen: Taf. 50/7)

<sup>7</sup> I. Mateiciucová: Časné neolitická štipaná industrie z osady kladníky Ivanovice na Moravě. PA Suppl. 13. Praha 2000, 218ff; *Mateiciucová 2001*.

<sup>8</sup> *Mateiciucová 2001*, Karten Abb. 4 und 5.

<sup>9</sup> unpubliziert. Freundliche Mitteilung DDR. P. Stadler.

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<sup>11</sup> siehe Beiträge E. Bánffy, K. Oross und T. Marton.

11. Steinfurt (*Cladders 2001*, Taf. 63/3)
12. Stuttgart - Bad Cannstatt (*H. C. Strien*: Untersuchungen zur Bandkeramik in Württemberg. UPA 69. Bonn 2000, Taf. 13/1)
13. Wang (*Cladders 2001*, Taf. 68/6)
14. Weißenfels (*Quitta 1960*, 165, Abb. 4h)

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16. Neckenmarkt, VB. Oberpullendorf (*Lenneis – Lüning 2001*, Taf. 9)
17. Ravelsbach (*Lenneis 1989*, Abb. 3/1)
18. Strögen VB Horn (*Lenneis – Lüning 2001*, Spiegelmotiv: Taf. 22; Kreisbögen Taf. 24)
19. Winden (*Lenneis 1989*, Abb. 2/1)

## POLEN

20. Gniechowice (*Kulczycka-Leciejewiczowa 1988*, Abb. 13u)
21. Samborzec (*Kulczycka-Leciejewiczowa 1988*, Abb. 18h)
22. Stary Zamek (*Kulczycka-Leciejewiczowa 1988*, Abb. 15g)

## TSCHECHIEN

23. Bojanovice (*Quitta 1960*, 6, Abb. 1a, g)
24. Boskovštejn (*Quitta 1960*, 6, Abb. 1b; 7, Abb. 2a)
25. Březno (*Pleinerová – Pavlů 1979*, Abb. 51/5)
26. Bylany (*Pavlů 1972*, Abb. 1; *Pavlů – Zápotocká – Soudský 1987*, 2194 a, b/79 380; 2250/81 217; 2243/81 145)
27. Moravski Krumlov (*Quitta 1960*, 7, Abb. 2e)
28. Praha – Bubenec (*Pavlů 1972*, Abb. 1)
29. Žopy, Kr. Holešov (*Tichý 1960*, 422, Abb. 10/2)

## SLOWAKEI

30. Biňa (*Pavúk 1980*, Spiegelmotiv: Abb. 14; Kreisbögen: Abb. 5/1, 2, 6/3, 23/3, 4)

## UNGARN

31. Becsehely (*Kalicz 1980*, Taf. 3/2 a, b)
32. Bicske (*Makkay 1978*, Kreisbögen: Pl. VI)

**Fundstellenregister zu Karte 2 mit Literaturhinweisen**

## DEUTSCHLAND

1. Bruchentrüben (*U. Kloos*: Die Tonware, in: J. Lüning: Ein Siedlungsplatz der Ältesten Bandkeramik in Bruchentrüben, Stadt Friedberg/Hessen. UPA 39. Bonn 1997, 151–255, Einstichdekor: 210 f. und Taf. 3/1, 10/3, 11/6, 12/1, 14/4, 17/4; Einglätverzierungen: Tafel 14/2+19/1)
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3. Erfurt (*Walter – Bücke – Schulze 1987*, 81, Abb. 2/1–7; *Quitta 1960*, 18, Abb. 10 b, c, f)
4. Goddelau (*Cladders 2001*, Taf. 59/8, 9)
5. Mittelhausen, Kr. Erfurt (*Quitta 1960*, 21, Abb. 12/e, h; 13b)
6. Nerkewitz, Kr. Jena (*Quitta 1960*, 167)
7. Nördlingen (*F. Krippner*: Nördlingen. BVbl Beiheft 4. München 1991, 43, Abb. 25/12)
8. Schwanfeld (*Cladders 2001*, Einstichdekor: Tafel 59/8, 9; Einglätverzierungen: Taf. 51/11)
9. Tüngeda, Kr. Gotha (*Quitta 1960*, 167)



## ÖSTERREICH

10. Strögen VB Horn (*Lenneis – Lüning 2001*, Einglättverzierung: Tafel 24: Einstichdekor: Taf. 23)

## TSCHECHIEN

11. Bylany (*Pavlu – Zápotocká – Soudský 1987*, 2105/301)  
12. Pavlice (*Tichý 1960*, Abb. 19/3, 26/7)  
13. Žopy, Kr. Holešov (*Tichý 1960*, 422, Abb. 10/2)

## SLOWAKEI

14. Bíňa (*Pavúk 1980*, Abb. 13, 26)

## UNGARN

15. Aba (*Gläser 1993*, Taf. 1/6)  
16. Becsehely (*Kalicz 1980*, Taf. 3/2 a, b)  
17. Bicske (*Makkay 1978*, Pl. VII - XIV)  
18. Budapest – Aranyhegyi Str. (*Kalicz 1993*, fig. 29/1, 4, 8, 9)  
19. Medina (*N. Kalicz: Die nördlichen Nachbarn der frühen Vinča-Kultur*, in: B. Čović (ed.): *Collection of Papers devoted to Academician A. Benac*. Sarajevo 1991, 133–150, Abb. 3/5)  
20. Sármellék (*Kalicz 1993*, Abb. 19/2)  
21. Sé (*Gläser 1993*, Taf. 212/4)  
22. Zalavár (*Gläser 1993*, Taf. 245/1, 246/4)

## Literaturnachweise zu den Abbildungen 1 – 6

*Abb. 1 – 2:* siehe Literaturangaben zu den einzelnen Fundstellen für Karte 1

*Abb. 3 – 6:* siehe Literaturangaben zu den einzelnen Fundstellen für Karte 2

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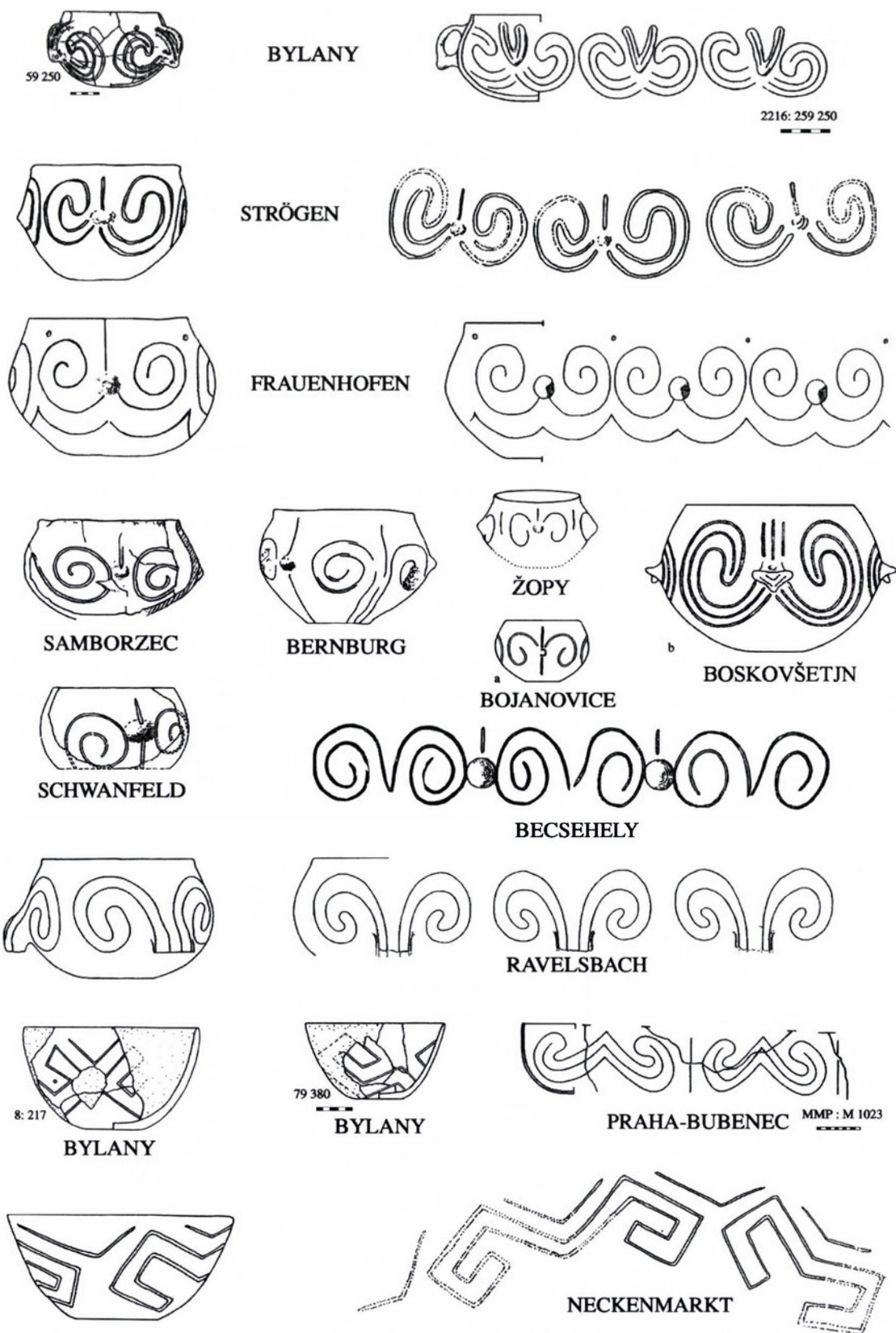


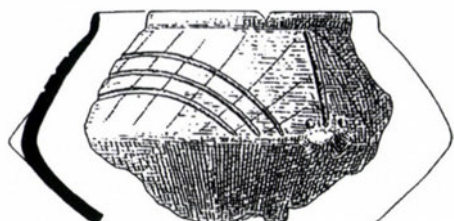
Abb. 1.



SCHWANFELD



SCHWANFELD



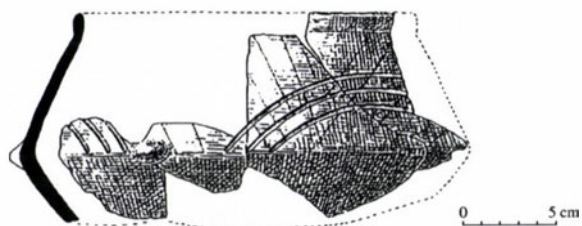
BŘINA



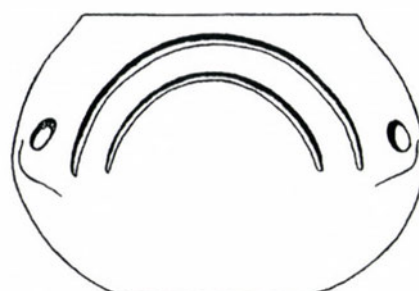
MINTRACHING



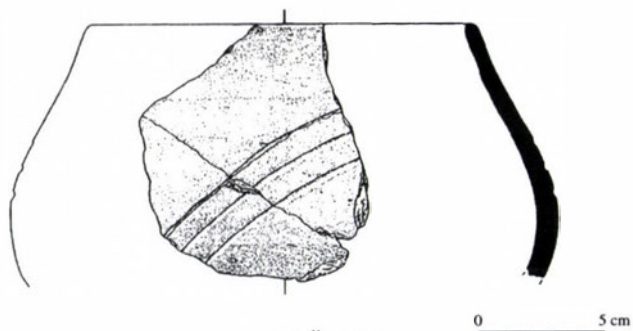
GODDELAU



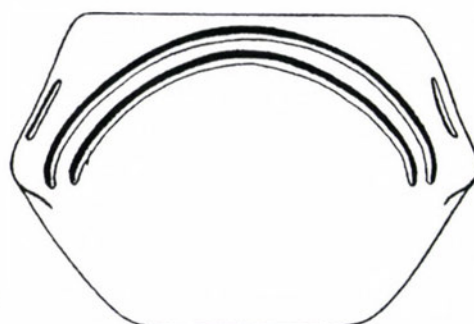
BŘINA



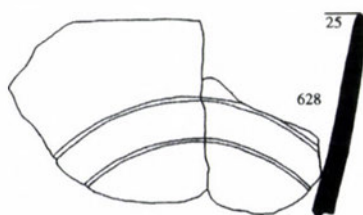
BICSKE



STRÖGEN



BICSKE



BYLANY



GNIECHOWICE

Abb. 2.



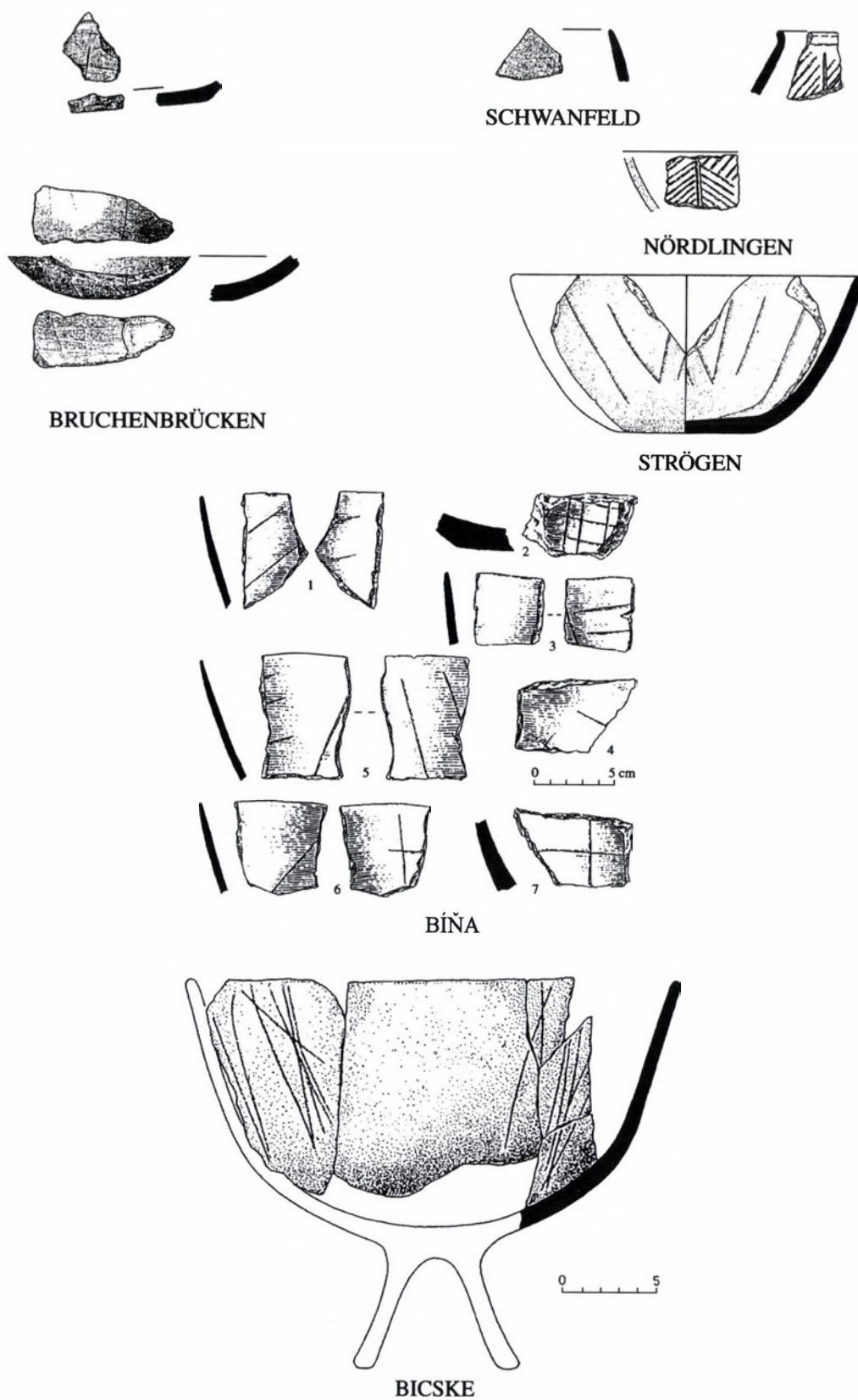


Abb. 3.

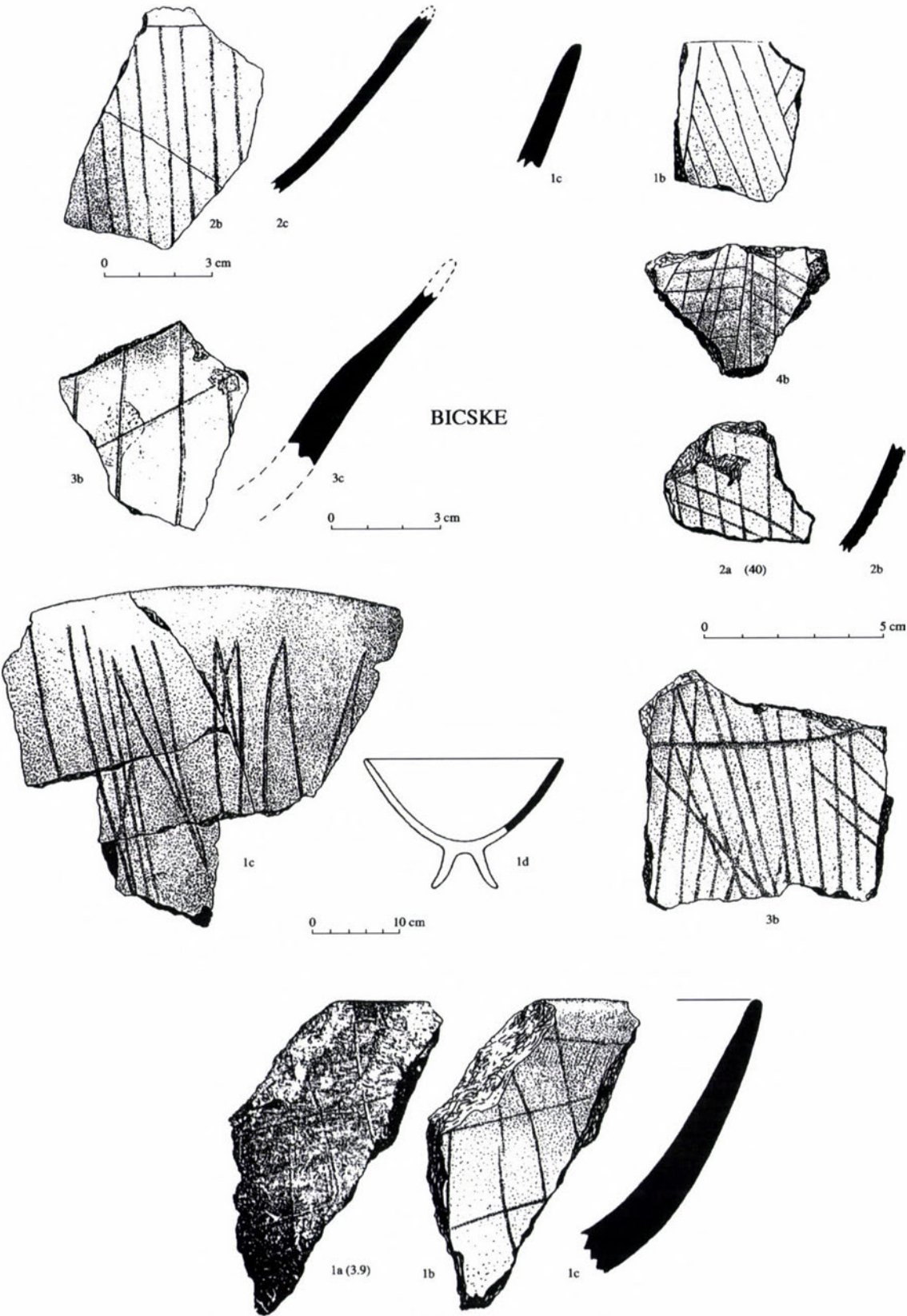
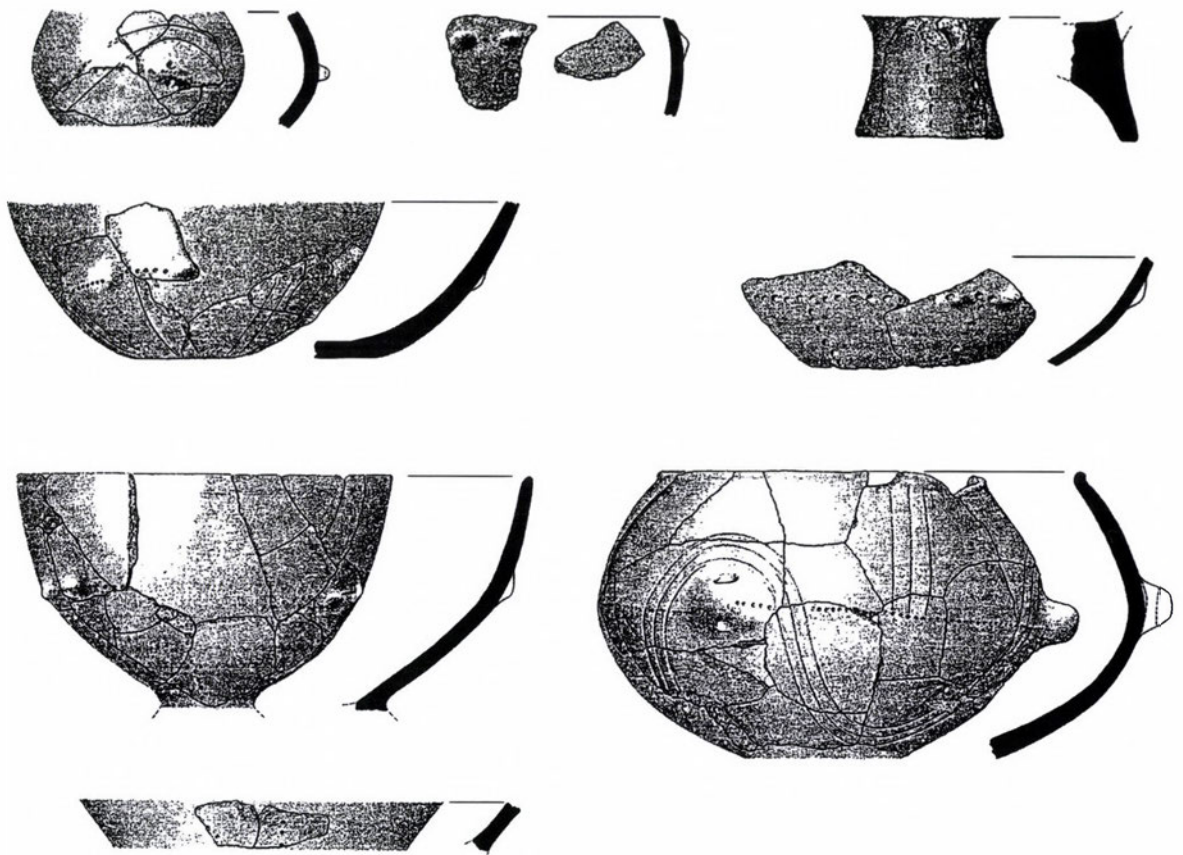
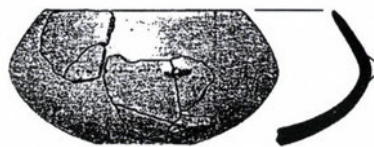


Abb. 4.

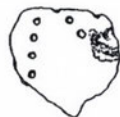




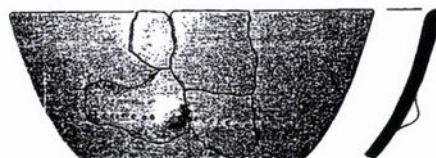
## BRUCHENBRÜCKEN



## GODDELAU



## NÖRDLINGEN



## SCHWANFELD

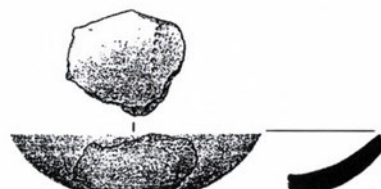


Abb. 5.

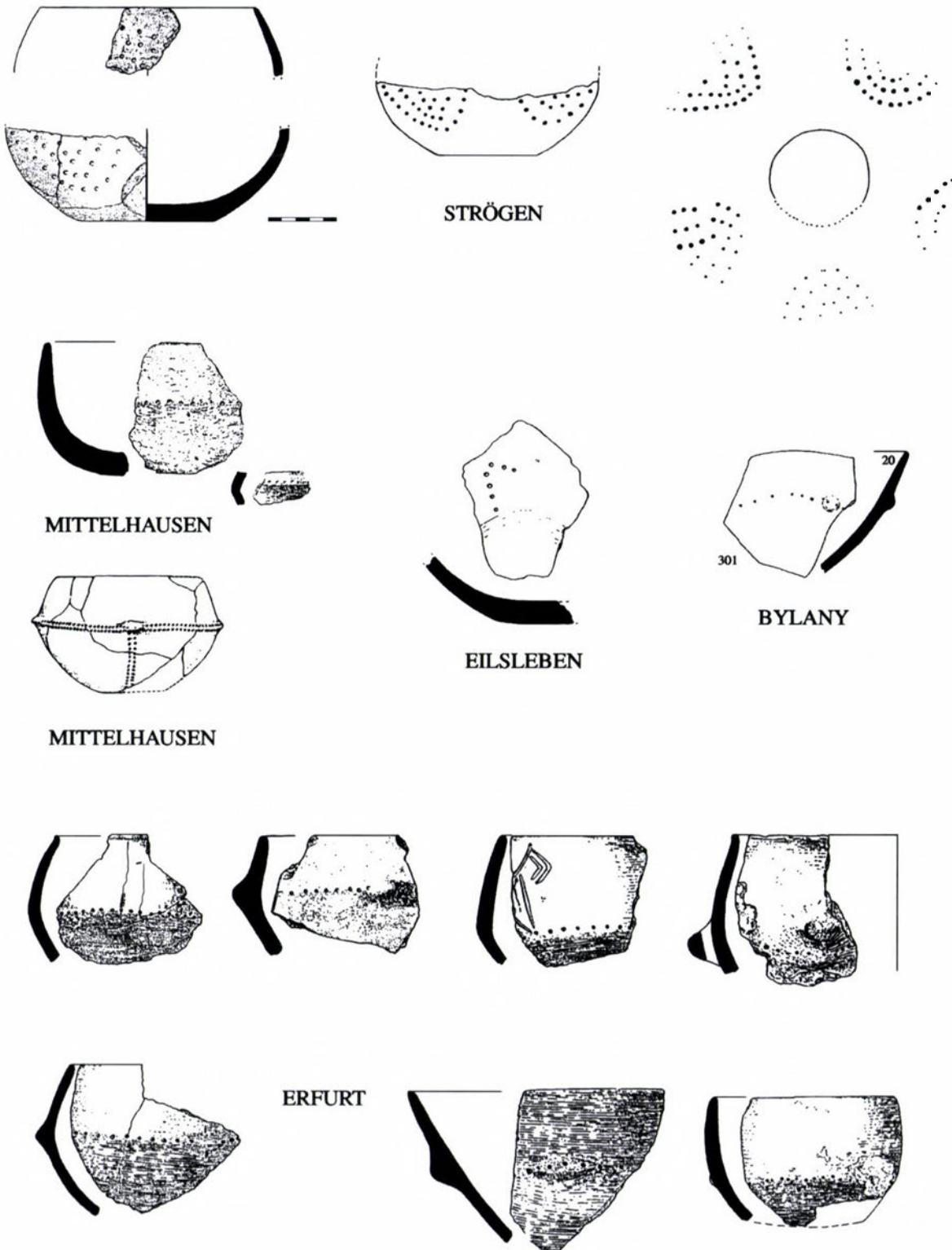


Abb. 6.





## DAS NEOLITHISCHE DORF VON BALATONSZÁRSZÓ (Forschungen zwischen 2000–2002)

Die Linearbandkeramik gehört zu den besterforschten prähistorischen kulturellen Einheiten in den mitteleuropäischen Ländern. Wir kennen zahlreiche großflächige Ausgrabungen mit freigelegten Hausgrundrissen, Grabenanlagen und anderen Befunden. Mit diesen Informationen ließ sich ein recht deutliches Bild über die Träger dieser Kultur – die Menschen, die westlich des Karpatenbeckens die ersten Bauer Mitteleuropas waren – zeichnen. In Transdanubien sind zwar über 600 bandkeramische Fundorte bekannt,<sup>1</sup> außer den Abfallgruben gab es jedoch jahrzehntenlang nur ganz wenige Befunde über die Siedlungen. Die großflächigen Rettungsgrabungen in Zusammenhang mit dem Bau der Autobahnen änderten den Forschungsstand der Transdanubischen Linearbandkeramik grundsätzlich. In unserer Arbeit versuchen wir einige Fragen der Siedlungsstruktur des in jüngerer Zeit freigelegten bandkeramischen Dorfes von Balatonszárszó–Kis-erdei-dűlő zu behandeln.<sup>2</sup> Der Fundort gehört wohl zu den bedeutendsten Siedlungen der Mitteleuropäischen Bandkeramik und bietet uns die einzigartige Möglichkeit einer Siedlungsanalyse.

### *Geographische und stratigraphische Verhältnisse des Fundortes*

Balatonszárszó liegt im zentralen Teil Transdanubiens, am südlichen Ufer des Balaton (dt. Plattensee). Der Fundort befindet sich südlich des heutigen Dorfes, auf einem Plateau, etwa 2–2,5 Kilometer vom heutigen Seeufer entfernt. In der Jungsteinzeit lag das Ufer mindestens um ein Kilometer näher an der Siedlung als heute.<sup>3</sup> Das Plateau öffnet sich nach Norden, in Richtung des Wasserspiegels mit einem Abhang von 3–4 Prozent. Auf der östlichen, südlichen und westlichen Seite ist es von etwa 15–22 Meter tiefen Tälern umschlossen, etwas ferner erheben sich dicht bewaldete Hügel. Das Plateau gilt als eine sehr günstige natürliche Festung, das sicherlich ganz bewußt von seinen neolithischen Bewohnern zum Heimatort ausgewählt wurde (*Abb. 1*).

Auf dem ganzen Fundort finden wir unter einer schmalen Humusschicht einen rotbraunen Waldboden, der durchschnittlich 40–60 Zentimeter, manchmal 1 Meter tief ist. Die Existenz dieser Schicht ist von großer Bedeutung, da der Waldboden das ganze neolithische Dorf bedeckte, wurde dieses bis in unsere Tage bewahrt. Das bedeutete aber auch, daß bei den Geländebegehungen vor den systematischen Freilegungen von diesem neolithischen Dorf Funde fehlten. Der Waldboden sank während der sieben Jahrtausende überall in die jungsteinzeitlichen Abfallgruben ein und verfärbte oft durch Bodenfeuchtigkeit die obersten Teile der Siedlungsobjekte. Dies erschwerte die Arbeiten wesentlich, da manche Funde oft in dieser Schicht zu finden sind.

### *Verlauf der Ausgrabungen*

Unsere Arbeit wurde durch den Bau der Autobahn M7 – die von Budapest bis an die kroatische Landesgrenze, ferner bis Zagreb (ung. Zágráb; dt. Agram) führen wird – möglich. Rettungsgrabungen dieser Art stellten die ungarische Archäologie vor gewaltige neue Aufgaben. Nie zuvor hatten wir die Möglichkeit, so viele Fundorte einer Region zu erschließen und Zehntausende von Quadratmetern an einem Fundort auszugraben. Gleichzeitig begebenen

<sup>1</sup> R. Gläser: Die Linienbandkeramik in Transdanubien. Beiträge zu ihrer Chronologie und Entstehung. Inauguraldissertation zur Erlangung der Doktorwürde. Manuskript. Heidelberg 1993.

<sup>2</sup> Unserer Vortrag auf der Internationalen Konferenz am runden Tisch in Budapest hat am 30. November

2002 die Ergebnisse von drei Grabungskampagnen zusammengefaßt.

<sup>3</sup> Für die Information möchte ich mich bei Herrn Dr. Pál Sümegi, bei dem Lehrstuhlleitern des Lehrstuhls für Geologie und Paläontologie der Universität von Szeged bedanken.



die Kollegen zahlreichen, bisher unbekannten Problemen. Sie sollten unglaublich große Oberflächen – oft 5000 m<sup>2</sup> in einem Monat – in kurzer Zeit ausgraben und dokumentieren. Durch die Entfernung der oberen Humusschicht mit Hilfe großen Geräts zerstört man häufig die obersten Siedlungsschichten und Grubenteile. So ist diese Methode zum Beispiel an einem neolithischen Fundort für feinchronologische Analysen nicht geeignet, da durch die Zerstörung möglicher Siedlungsschichten wichtige Informationen verloren gehen. In unserer Arbeit versuchen wir jedoch zu schildern, daß gewisse Siedlungstypen mit kleinflächigen Ausgrabungen nicht oder sehr schwierig erforscht werden können.

Die Forschungen des Archäologischen Instituts der Ungarischen Akademie der Wissenschaften begannen in Balatonszárszó am 11. September 2000. Der Platz der ehemaligen Pfarrkirche des mittelalterlichen Dorfes von Szárszó war längst gut bekannt. Die Arbeiten konzentrierten sich auf die östliche Hälfte des mittelalterlichen Gräberfeldes um die Kirche. Im Spätherbst 2000 kamen neben den mittelalterlichen Funden reiche Abfallgruben mit bemalten neolithischen Scherben und ein Hockergrab zum Vorschein.

Mit dem Ziel, neben den mittelalterlichen Befunden auch ein Bild über die neolithische Siedlung zu gewinnen, begannen im Frühling 2001 weitere ausgedehnte Forschungen. Anfangs beschränkte sich die prähistorische Grabungstätigkeit auf das Gebiet, das sich unmittelbar östlich des mittelalterlichen Gräberfeldes befindet. Hier entdeckten wir die erste Hausgruppe des bandkeramischen Dorfes. Danach wurden die Grabungsquadranten in südwestliche und südliche Richtung erweitert (*Abb. 3*). Bis Ende November 2001 konnten wir 24 neolithische Häuser, 16 weitere jungsteinzeitliche Gräber und den nördlichsten Teil einer Grabenanlage mit drei Eingängen freilegen.

Wegen einer Veränderung der Baupläne wurden die Arbeiten im Jahre 2002 fortgesetzt. Die Grabungskampagne dauerte acht Monate; wir arbeiteten auf der östlichen Seite und am westlichen Rande des Plateaus. Neben den zahlreichen jungsteinzeitlichen Abfallgruben wurden auf der östlichen Seite 15 bandkeramische Hausgrundrisse des bekannten Typs entdeckt (*Abb. 4*). Ein weiteres Haus mit einem differenten Grundriß stand allein, etwas nördlich von allen Hausgruppen. Außer den 16 Häusern lieferten uns die 24 neu freigelegten neolithischen Bestattungen auch wichtige Informationen. Von der jungsteinzeitlichen Grabenanlage wurden weitere Abschnitte freigelegt. Neben den neolithischen Befunden gab es auch einige kupferzeitliche, awarenzeitliche und mittelalterliche Objekte. Wir konnten ganz klar feststellen, daß die linearbandkeramische Gemeinschaft das Plateau vom östlichen bis zum westlichen Rand besiedelte. Im nordöstlichen Teil erreichten wir mit einem 25 Meter breiten erforschten Schnitt die Nordgrenze des gefährdeten Gebietes. Hier konnten wir nur bandkeramische Gruben, aber keine weiteren Spuren von Gebäuden finden. Das Keramikmaterial dieses Siedlungsteiles repräsentiert die ältere Phase der Transdanubischen Linearbandkeramik, hat also eine sehr große siedlungsgeschichtliche Bedeutung.

Im Jahre 2003 führten wir die vierte Grabungskampagne auf dem Fundort durch. Wir wollten in diesem Jahr den nördlichen Teil des Fundortes grundsätzlich erforschen.<sup>4</sup>

<sup>4</sup> Die Forschungen im mittelalterlichen Gräberfeld und in der Kirche wurden von unseren Kollegen Károly Belényesi durchgeführt, der auch im Jahre 2001 für das ganze Projekt als Grabungsleiter verantwortlich war. An dieser Stelle möchte ich mich auch bei ihm dafür bedanken, daß mein Kollege Tibor Marton und ich an der Freilegung des neolithischen Dorfes teilnehmen konnten. In den Jahren 2002 und 2003 wurden die neolithischen Ausgrabungen in Balatonszárszó von dem Verfasser geleitet, 2002 mit der wertvollen Hilfe der Archäologinnen Szilvia Fábíán und Anett Osztás. Die geodäsischen Arbeiten wurden von Zsolt Viemann durchgeführt,

die Fundortkarten und die Übersichtsgrundrisse der neolithischen Gebäude in diesem Artikel sind ebenfalls ihm zu verdanken. Zoltán Szabó nahm an allen Grabungskampagnen teil, für seine Hilfe bin ich auch sehr dankbar. Die Grabungsarbeiten wurden Ende November 2003 vollendet. Die Entdeckungen der neuesten Ausgrabung lieferten uns sehr wichtige Beiträge zur Siedlungsstruktur des prähistorischen Dorfes, vor allem über die ältere Phase der Transdanubischen Linearbandkeramik. Diese Ergebnisse und ein vollkommenes Bild über die Siedlungsstruktur werden wir zu einem späteren Zeitpunkt bekanntgeben.



## Häuser und Hausgruppen

In den Grabungskampagnen von 2001 und 2002 sind die Reste von insgesamt 40 neolithischen Häusern zum Vorschein gekommen. Die Gebäude entsprechen im großen und ganzen dem gut bekannten, allgemeinen Haustyp der Mitteleuropäischen Linearbandkeramik. Sie können durch ihre Pfostengruben und durch die Längsgruben entlang den Gebäuden identifiziert werden (*Abb. 5*).

Im Hausinneren laufen je drei parallele Reihen von Pfostengruben (*Abb. 6*). Diese Pfosten trugen das Gewicht des Satteldaches. Ihr Durchmesser beträgt normalerweise 40–75 cm, bei den größten Häusern kamen auch größere Pfostengruben vor. Die Daten über ihre Tiefe können wir als keine wertvolle Informationen betrachten, da wir den ehemaligen Fußboden nicht dokumentieren konnten. Bei den meisten Hausgrundrissen befanden sich die Pfostengruben und Pfostenreihen in einer regelmäßigen Ordnung, bei anderen fehlten hingegen einige Pfostengruben. Bei weiteren Gebäuden gab es Pfostengruben, die von den Pfostenreihen abwichen, wobei wir oft Reparaturspuren beobachten konnten. Das größte Haus (Haus 1) – welches ganz am Anfang der Ausgrabung freigelegt wurde – hatte insgesamt fünf parallele Pfostenreihen. In den äußeren zwei Reihen standen die Pfosten oft viel näher zueinander als in den inneren drei Reihen. Bei diesem Gebäude gab es einige Unsicherheiten in der Struktur, ein großer mittelalterlicher Graben zerstörte nämlich einen Teil des Hausgrundrisses. Erst später, bei einem anderen Haus (Haus 12) konnten wir eine weitere, vollkommene Reihe von Pfostengruben neben den drei inneren Reihen feststellen. Nach sorgfältiger Suche war es auch möglich, eine fünfte Reihe auf der anderen Hausseite freizulegen (*Abb. 7*). Dabei wurde klar, daß wir die Reste der Außenwände des Hauses entdeckt hatten (*Abb. 8*). Es gab insgesamt 8 Häuser, bei denen die Pfostengruben der Außenwände auf beiden Seiten freigelegt wurden. Bei vielen weiteren Häusern blieben nur Teile der Pfostenreihen oder nur einzelne Pfostengruben dieser Art übrig. Die Pfostengruben der Außenwände waren immer kleiner, als die der inneren Reihen.

Die Länge der Hausgrundrisse in Balatonszárszó variierte zwischen 7 und 25 Metern. Das größte, oben erwähnte Gebäude (Haus 1) war 25 Meter lang, die übrigen großen Gebäude (Haus 17 und 28) waren 16–17 Meter lang. Kleinere Gebäude, deren Länge zwischen 9 und 12,5 Metern betrug, gelten als typische Bauten auf dem Fundort. Die Hausbreite konnten wir in solchen Fällen feststellen, bei denen die Pfostenreihen der Außenwände auf beiden Seiten des Hauses verfolgbar waren. Die Entfernung zwischen den Außenseiten von Pfostengruben der Außenwände ergibt die Hausbreite. So waren die neolithischen Häuser in Balatonszárszó zwischen 6 und 7,5 Metern breit. Die gleiche Baustruktur dieser Pfostengebäude macht große Differenzen in ihrer Breite nicht möglich. In einigen früheren Arbeiten wurde die Breite der Häuser mit 8–10 Meter<sup>5</sup> bzw. 8–12 Meter<sup>6</sup> festgestellt, wobei es sich aber um die Entfernung zwischen den Längsgruben handelt. Es ist natürlich etwas größer als die wirkliche Breite des Gebäudes. Die Häuser sind im allgemeinen nach NNW–SSO gerichtet. Es gibt nur eine Ausnahme mit einer NNO–SSW Orientierung. Dieses Haus (Haus 39) befindet sich am östlichen Rande des Plateaus, in diesem Fall entspricht die Orientierung der Richtung des Plateaurandes.

Neben den meisten Hausgrundrissen konnten wir die oben erwähnten länglichen Gruben entlang der Pfostenkonstruktion finden. Diese Längsgruben werden in der Fachliteratur oft als „Lehmgruben“ interpretiert. Nach dieser allgemeinen Auffassung entstanden sie beim Bau des Hauses, die Flechtwände wurden mit dem Material dieser Gruben verputzt.<sup>7</sup> In Balatonszárszó sind die Längsgruben der Pfostenhäuser in den Löß- und Sandboden des

<sup>5</sup> K. Belényesi: Balatonszárszó, Kis-erdei-dűlő. Régészeti kutatások Magyarországon 2001 – Archaeological Investigations in Hungary 2001[2003]139.

<sup>6</sup> K. Belényesi – T. Marton – K. Oross: Balatonszárszó-Kis-erdei-dűlő, in: Sz. Honti – K. Belényesi – Zs. Gallina – V. Kiss – G. Kulcsár – T. Marton – Á. Nagy – P. G. Németh – K. Oross –

K. Sebők – K. Somogyi: A tervezett M7-es autópálya Somogy megyei szakaszán 2000–2001-ben végzett megelőző régészeti feltárások. Előzetes jelentés II (Rescue excavations in 2000–2001 on the Planned Route of the M7 Motorway in Somogy County. Preliminary Report II). SMK 15 (2002) 9.

<sup>7</sup> Modderman 1972, 77; Egry 2003, 104.



Plateaus eingetieft, so ist es völlig unmöglich, Hüttenlehm von diesen Gruben zu gewinnen. Nach unseren Untersuchungen wurden die Längsgruben mit dem Haushaltsabfall verfüllt, die Bewohner tiefen aber weitere Gruben in die Längsgruben hinein. Die andere oft erwähnte Funktion dieser Objekte, die Ableitung des Regenwassers, das vom Dach herunterfloß, scheint deshalb auch sehr fragwürdig zu sein.

Bei einem Hausgrundriß (Haus 38) gab es jedoch keine Pfostenreihen von Außenwänden und keine Längsgruben. Auf den westlichen, nördlichen und östlichen Seiten des Hauses lief dagegen ein Wandgraben. Die südliche Seite – wo wir den Eingang vermuten – ist offen geblieben. Im Wandgraben fanden wir weitere kräftige Pfostengruben. Von bandkeramischen Fundorten Westeuropas kennen wir zahlreiche Hausgrundrisse mit Wandgräben. Zu einer Variante dieses Haustyps gehören Gebäude, bei denen Wandgräben auf allen vier Seiten des Hauses umlaufen (Sittard 3; Elsloo 13, 27, 55). Bei der zweiten Variante finden wir den Wandgraben nur auf der nördlichen Kurzseite und auf dem nördlichen Teil der beiden Längsseiten (Sittard 2, 34, 45; Elsloo 58, 76).<sup>8</sup> Die Variante mit dem umlaufenden Wandgraben fehlt bisher auf den bandkeramischen Fundorten Mitteleuropas. Im Karpatenbecken konnte man in Štúrovo (ung. Párkány) Wandgräben bei Hausgrundrissen beobachten. Hausgrundriß 184 hatte einen Wandgraben ausschließlich auf der nördlichen Kurzseite.<sup>9</sup> Im Hausgrundriß 390 setzt sich der Wandgraben neben der Nordseite auch im nördlichsten Teil der östlichen und westlichen Längswände fort.<sup>10</sup> Der Hausgrundriß mit dem Wandgraben in Balatonszárszó ist eine einzigartige Erscheinung, da der Wandgraben die Längsseiten in ihrer ganzen Länge begleitete, während die kurze, südliche Seite offen blieb.

Bei drei Häusern (Haus 2, 11 und 12) fanden wir ungewöhnliche Pfostenkonstruktionen auf der südlichen (süd-südöstlichen) Seite des Gebäudes. Zwei Konstruktionen (Haus 2, 11) bestanden aus zweimal drei Pfostengruben am südlichen Ende. Sie standen viel dichter nebeneinander, als die Pfostengruben im Hausinneren. Das dritte Haus (Haus 12) hatte eine Querreihe von drei Pfostengruben, wo sich die Längsgruben und die Pfostenreihen der Längswände nicht mehr fortsetzten (*Abb. 8*). Diese Konstruktionen betrachten wir als einen Hinweis auf einen Eingang an der Südseite der Gebäude. Als Beweis für einen möglichen südlichen bzw. südöstlichen Eingang der bandkeramischen Häuser kann zum Beispiel der Bau Sittard 45 gelten.<sup>11</sup> Bei den Häusern von Mosonszentmiklós–Egyéni földék vermutet die Verfasserin auch einen Eingang auf der südlichen, vor dem Wind geschützten Seite.<sup>12</sup>

Spuren von Hausböden konnten wir im Inneren der Häuser nie finden. Bisher gibt es leider keine zuverlässigen Hausbodenbeobachtungen von den Siedlungen der Mitteleuropäischen Linearbandkeramik. Bei ihrer Zerstörung kann die Erosion die entscheidende Rolle gespielt haben. Wegen der Vernichtung der oberen Schichten durch schweres Gerät hatten wir sowieso keine Chance, derartige Befunde zu erlangen. So konnte auch im Inneren der Häuser keine Feuerstelle beobachtet werden.

Von den 40 Gebäuden befanden sich 39 im südlichen Teil des freigelegten Geländes. Die Hausgrundrisse lagen oft nebeneinander und bildeten Hausgruppen. Sie sehen auf dem Übersichtsplan des Fundortes (*Abb. 2*) wie echte Hausreihen aus (*Abb. 9–10*). Nach der allgemeinen Auffassung über die Struktur der linearbandkeramischen Siedlungen bestanden diese neolithischen Dörfer aus Hofplätzen. Das Wohngebäude und die umliegenden Befunde – vor allem Abfallgruben – bildeten einen Hofplatz. Dieses Areal konnte den Platz für die verschiedenen wirtschaftlichen Tätigkeiten der Bewohner sichern. Das System, das von U. Boelicke ausgearbeitet wurde,<sup>13</sup> schließt die Möglichkeit einer Siedlung mit straßenartigen Hausgruppen völlig aus, die zeitgenössischen Gebäude stehen dabei immer in einer gewissen Entfernung voneinander. Wir kennen zahlreiche innere chronologische Systeme ausgedehnter linearbandkeramischer Siedlungen, die nach diesen Kriterien aufgebaut wurden. Auf

<sup>8</sup> Modderman 1972, 79, *Abb. 49*.

<sup>9</sup> Pavúk 1994, 36–38.

<sup>10</sup> Pavúk 1994, 49–50.

<sup>11</sup> Modderman 1972, 81, *Abb. 49*.

<sup>12</sup> Egry 2003, 104.

<sup>13</sup> U. Boelicke: Gruben und Häuser: Untersuchungen zur Struktur bandkeramischer Hofplätze, in: B. Chropovský (red.): Siedlungen der Kultur mit Linearkeramik. Internationales Kolloquium Nové Vozokany 1981. Nitra 1982, 17–28.



dem Fundort Langweiler 8 wurden zwei verschiedene Versionen für die Entwicklung des Siedlungsplatzes ausgearbeitet. Das erste Modell gliedert die Befunde in 12 Phasen auf 15 Wohnplätzen, während die zweite Version mit 14 Phasen und mit 12 Wohnplätzen rechnet.<sup>14</sup> In Štúrovo (ung. Párkány) konnte man 10 Siedlungshorizonte und 7 Bauareale feststellen.<sup>15</sup>

Wenn wir die Hausgrundrisse einer Hausreihe als Gebäudereste des gleichen Hofplatzes in verschiedenen Bauperioden der Siedlung interpretieren, dann müssen wir uns mit weiteren Problemen beschäftigen. In Balatonszárszó sind neben einem großen Hausgrundriß sehr oft die Spuren eines oder mehrerer kleiner Häuser zu finden. Die Differenzen zwischen den Gebäuden sind so groß, daß wir wohl Unterschiede in der Funktion dieser Häuser vermuten müssen. In diesem Fall wäre es doch möglich, daß auf einem Hofplatz in der gleichen Bauperiode nicht nur ein einziges Gebäude stand. Diese Möglichkeit schließt J. Lüning aus, nach seinen Forschungen war das bandkeramische Haus ein Wohnspeicherhaus ohne Nebengebäude, und der Hof der bandkeramischen Bauern ein Einhaushof.<sup>16</sup> Viele Fragen der Siedlungschronologie können erst nach einer eingehenden Analyse des Keramikmaterials der Längsgruben und anderer – mit einem Haus in unmittelbarem Kontakt stehenden – Abfallgruben beantwortet werden.

Es ist eine weitere wichtige Tatsache bei der Analyse der chronologischen Stellung der Häuser, daß wir zwischen den Gebäuden der Siedlung keine Überschneidungen beobachten konnten. Ganz ähnlich ist die Situation in der linearbandkeramischen Siedlung von Mosonszentmiklós–Egyéni földék.<sup>17</sup> In Štúrovo (ung. Párkány) schnitten dagegen zahlreiche Hausgrundrisse die Reste früherer Gebäude.<sup>18</sup>

Südlich vom freigelegten Teil der neolithischen Siedlung von Balatonszárszó setzen sich die Bauareale der Häuser fort. Bei drei Häusern entfällt eine Hälfte oder sogar zwei Drittel des Hausgrundrisses auf nicht freigelegtes Gelände. Das Haus mit dem Wandgraben (Haus 38) fällt, gemessen an dem oben beschriebenen Areal mit 39 Häusern, völlig aus der Reihe und liegt davon nördlich 80 Meter entfernt.

Die größten linearbandkeramischen Häuser sind in Mitteleuropa 30–40 Meter lang. So sind also zur Erforschung der bandkeramischen Siedlungsstrukturen großflächige Ausgrabungen unentbehrlich. Das Fehlen dieser großflächigen Freilegungen hat die Möglichkeiten der linearbandkeramischen Siedlungsforschung in Ungarn bis in die jüngste Zeit begrenzt. Die Zahl der freigelegten Häuser war auch sehr gering, die Ausgrabungen von Győr–Pápai vám spielten jahrzehntenlang eine Schlüsselrolle. S. Mithay identifizierte die Grubenkomplexe als in die Erde eingetieft Hütten. Damit nahm er die Idee der bandkeramischen Grubenwohnungen an, die damals von W. Buttler durch moderne ethnographische Beispiele aus Südosteuropa ausgearbeitet wurde.<sup>19</sup> Mithay entdeckte aber zwischen zwei Grubenkomplexen einen 9,3 Meter langen Abschnitt eines typischen Hauses der Linearbandkeramik mit Pfostengruben. Unter den Keramikfunden des Fundortes überwog die Verzierung der Zseliz-Kultur.<sup>20</sup> In Bicske–Galagonyás rekonstruierte J. Makkay ein weiteres Grubenhaus im frühen linearbandkeramischen Horizont.<sup>21</sup> Viel später wurden die zwei Häuser in Szentgyörgyvölgy–Pityerdomb von E. Bánffy freigelegt. Sie repräsentieren die älteste Phase der Transdanubischen Linearbandkeramik.<sup>22</sup> Wir kennen aus verschiedenen Publikationen weitere linearbandkeramische Häuser; jedoch wurden die Hausgrundrisse in diesen Fällen nicht publiziert.

Die Rettungsarbeiten vor dem Bau der Autobahnen eröffneten ein neues Kapitel in der Forschung der Linearbandkeramik in Transdanubien. Die Entdeckung des Fundortes

<sup>14</sup> U. Boelcke – D. v. Brandt – J. Lüning – P. Stehli – A. Zimmermann: Struktur und Entwicklung des Siedlungsplatzes, in: U. Boelcke – D. v. Brandt – J. Lüning – P. Stehli – A. Zimmermann: Die bandkeramische Siedlungsplatz Langweiler 8. Gemeinde Aldenhoven, Kreis Düren. Rheinische Ausgrabungen 28. Köln 1988, 900–931.

<sup>15</sup> Pavúk 1994, 181–224.

<sup>16</sup> Lüning 1980, 54.

<sup>17</sup> Egry 2003, 105, Bild 4.

<sup>18</sup> Pavúk 1994, Beilage I.

<sup>19</sup> W. Buttler: Gruben und Grubenwohnungen in Südosteuropa. BJ 139 (1934) 140–142, Beilage 3; W. Buttler: Pits and Pit-dwellings in Southeast Europe. Antiquity 10 (1936) 31–34; Buttler – Haberey 1936, 32–60.

<sup>20</sup> Mithay 1966.

<sup>21</sup> Makkay 1978, 12–16, Fig. 1.

<sup>22</sup> E. Bánffy: The Late Starčevo and the Earliest Linear Pottery Groups in Western Transdanubia. DocPræhist 27 (2000) 176–177.



Mosonszentmiklós–Egyéni földek kann als echter Durchbruch betrachtet werden. In den Jahren 1993 und 1994 legte I. Egry ausgedehnte Teile einer bandkeramischen Siedlung frei,<sup>23</sup> wo nach einem Grabungsbericht die Spuren von insgesamt 18 linearbandkeramischen Gebäuden zum Vorschein kamen.<sup>24</sup> Später rekonstruierte sie 20 Hausgrundrisse.<sup>25</sup> Weitere Siedlungsteile mit Hausgrundrissen kamen auch in Törökbálint–Dulácska,<sup>26</sup> in Kóny–Barbacsai tó<sup>27</sup> und in Dunakeszi–Székesdűlő<sup>28</sup> zum Vorschein. Aus der Großen Ungarischen Tiefebene (ung. Alföld) muß die Ausgrabung in Füzesabony–Gubakút erwähnt werden. Dort wurden Hausgrundrisse der frühen Phase der Alföld Linearbandkeramik freigelegt.<sup>29</sup>

Archäologische Erforschungen bandkeramischer Fundorte in den Nachbarländern lieferten uns in den vergangenen Jahrzehnten wesentliche Ergebnisse. Aus dem slowakischen Štúrovo (ung. Párkány) publizierte J. Pavúk insgesamt 32 Hausgrundrisse.<sup>30</sup> In der Westslowakei kamen die Reste von 26 Gebäuden in Blatné (ung. Pozsonysárfő) zum Vorschein. Die meisten Hausgrundrisse sind hier durch Gruben zerstört.<sup>31</sup> Zwei weitere große Gebäude sind aus dem benachbarten Čataj (ung. Csataj), aus der Nähe von Bratislava (ung. Pozsony; dt. Preßburg) bekannt.<sup>32</sup> Aus Österreich möchten wir zwei große Siedlungen erwähnen. Die linearbandkeramischen Fundorte im Burgenland und im Wiener Becken gehören geographisch unmittelbar zum Siedlungsgebiet des Karpatenbeckens. Brunn am Gebirge gilt als größte Siedlung der Linearbandkeramik im Osten Österreichs. Es wurden ca. 43 Hausgrundrisse der Linearbandkeramik freigelegt, die Häuser waren im Durchschnitt 20 Meter lang und 7–8 Meter breit. Das Keramikmaterial gehört nach P. Stadler zur älteren Linearkeramik.<sup>33</sup> Der zweite Fundort mit mehreren Hausgrundrissen ist Neckenmarkt (ung. Sopronnyék). Die Siedlung liegt direkt an der ungarischen Grenze, südlich der ungarischen Stadt Sopron (dt. Ödenburg).<sup>34</sup>

### Die Grabenanlage

Im südwestlichen Teil des erforschten Geländes befinden sich die Spuren einer ausgedehnten neolithischen Grabenanlage. Während der drei Grabungskampagnen konnten wir einen fast 160 Meter langen Abschnitt des Grabens freilegen (*Abb. 11*). Die Südgrenze des künftigen Autobahnknotenpunktes machte es unmöglich, in der Umgebung und im Inneren des Grabens weiterzugraben. Der Graben war 2–3 Meter breit, seine Tiefe variierte zwischen 40 und 80 Zentimetern. Die freigelegte Grabenstrecke wurde von vier, vielleicht von fünf Eingängen unterbrochen. Der größte Eingang war 13,5 Meter breit, drei weitere Eingänge hatten eine Breite von 2,4–2,8 Metern. Der fünfte, vermutete Eingang befand sich am westlichen Ende des freigelegten Grabenabschnittes, an dem wir nicht mehr weitergraben konnten. Auf beiden

<sup>23</sup> I. M. Egry: Mosonszentmiklós–Egyéni földek. RégFüz Ser. I:47 (1996) 17–18; Egry 1997; Egry 2003.

<sup>24</sup> Egry 1997, 19.

<sup>25</sup> Egry 2003, 105 Bild 4, 106.

<sup>26</sup> A. Endrődi: Törökbálint–Dulácska. RégFüz Ser. I:46 (1994) 28.

<sup>27</sup> I. Egry: Preliminary report about a new site of the Transdanubian Linear Pottery. Kóny–Bartacsi Lakeside. Archaeological Reports 1997. (RégFüz Ser. I:51 1998) Budapest 2001, 7–13; E. Szőnyi – P. Tomka – K. Takács: Kóny–Gázvezeték I. Archaeological Reports 1997. (RégFüz Ser. I:51 1998) Budapest 2001, 38–39.

<sup>28</sup> L. A. Horváth: Neolithische Funde und Befunde in der Gemarkung von Dunakeszi. ActaArchHung 53 (2002) 1–40.

<sup>29</sup> L. Domboróczki: Füzesabony–Gubakút. Újkőkori falu a Kr. e. VI. évezredből (Neolithic village from the 6<sup>th</sup> Millennium B.C.), in: P. Raczky – T. Kovács – A. Anders (eds): Utak a múltba (Path into the Past). Budapest 1997, 19–25; L. Domboróczki: The

excavation at Füzesabony–Gubakút. Preliminary Report, in: R. Kertész – J. Makkay (eds): From the Mesolithic to the Neolithic. Proceedings of the International Archaeological Conference ... Szolnok. Budapest 2001, 193–214.

<sup>30</sup> Pavúk 1994.

<sup>31</sup> J. Pavúk: Výskum neolitického sídliska v Blatnom. AVANS 1979. Nitra 1980, 206–211.

<sup>32</sup> Pavúk 1986.

<sup>33</sup> Lenneis 1995, 16; P. Stadler: Die älterlinearbandkeramische Fundstelle von Brunn am Gebirge, Flur Wolfholz (5620–5200 v. Chr.). Ausstellung in Brunn im August 1999.

<sup>34</sup> E. Lenneis – J. Lüning: KG Neckenmarkt, MG Neckenmarkt, VB Oberpullendorf. FÖ 23 (1984[1986]) 223–224; E. Lenneis – J. Lüning: KG Neckenmarkt, MG Neckenmarkt, VB Oberpullendorf. FÖ 24/25 (1985/86[1988]) 207, Abb. 1; Lenneis 1995, 16; E. Lenneis – J. Lüning: Die altbandkeramischen Siedlungen von Neckenmarkt und Strögen. UPA 82. Bonn 2001.



Seiten der Eingänge konnten wir die Pfostengruben von eigenartigen Konstruktionen freilegen. Direkt bei der Eingangslücke fanden wir immer eine sehr große Pfostengrube, hinter diesen vier weitere Pfostengruben in trapezförmiger, in einem Fall in rechteckiger Formation. Zwischen den Eingängen wiederholten sich im Graben nach 1–2 Meter Entfernung die Spuren von je drei Pfosten. In der Mittelachse des Grabens stand danach einst ein senkrechter Pfosten, der mit zwei weiteren, schrägen Pfosten verstärkt wurde (*Abb. 12*). Gegenüber den Eingängen fanden wir freie Plätze mit sehr wenigen Gruben zwischen den Hausgruppen. Die Grabenanlage hatte einen „U“-förmigen Querschnitt, und schnitt mehrere neolithische Objekte. Sie ist wohl eine relativ späte Erscheinung und ihre Errichtung kann mit irgendeiner Bauperiode des großen südlichen Areals gleichzeitig sein.

Das beste Beispiel für einen bandkeramischen Graben ist in Ungarn aus Becsehely I. bekannt. N. Kalicz erforschte dort einen 30 Meter langen Abschnitt einer Grabenanlage. Der Graben hatte einen „V“-förmigen Querschnitt, war 2,5 Meter breit und 2,5–3,0 Meter tief. Er ist von einem 3,5 Meter breiten Eingang unterbrochen, beide Enden bei den Eingängen sind abgerundet. Im Eingang wurden mehrere Pfostengruben freigelegt, deren Pfosten nach Kalicz die Toranlage hielten. Er datierte den Graben in eine Phase der Linearbandkeramik, als die Zseliz-Kultur noch nicht entstanden war. Der Graben von Becsehely ist also die älteste bekannte neolithische Grabenanlage in Transdanubien.<sup>35</sup> Weitere bandkeramische Grabenabschnitte wurden in Békásmegyer<sup>36</sup> und in Mosonszentmiklós–Egyéni földek freigelegt. Der freigelegte Graben von Mosonszentmiklós verläuft gerade, er gehört wohl nicht zu den Kreisgrabenanlagen der Linearbandkeramik. Im Graben konnte man die Spuren einer Pfostenreihe beobachten.<sup>37</sup> In Bicske–Galagonyás befindet sich auch ein Graben, dessen kulturelle Zugehörigkeit fragwürdig war.<sup>38</sup> In jüngster Zeit wurde der Graben endgültig mit der Sopot–Bicske-Kultur verbunden.<sup>39</sup> In den bandkeramischen Fundorten Mitteleuropas kamen zahlreiche ausgedehnte Grabensysteme zum Vorschein. Die Grabenanlagen von Köln–Lindenthal,<sup>40</sup> Eilsleben<sup>41</sup> und Asparn an der Zaya<sup>42</sup> sind wohl die bekanntesten.

Über die Funktion dieser Schanzwerke gibt es mehrere Vorstellungen. Manchmal werden sie als Wehranlagen interpretiert, andere betonen eine kultische oder eine Wirtschaftsfunktion. Nach N. Kalicz befinden sich die Graben von Becsehely, Bicske und Békásmegyer nicht auf strategisch wichtigen Plätzen. Er äußerte eine wirtschaftliche Funktion dieser Gräben.<sup>43</sup> Wegen der zahlreichen Eingänge, unter denen sich auch ein außerordentlich breiter Eingang befindet, halten wir eine Wehrfunktion der Grabenanlage von Balatonszárszó auch für sehr unwahrscheinlich.

### Die Bestattungen

Im erforschten Teil des neolithischen Dorfes konnten wir 41 jungsteinzeitliche Bestattungen freilegen. Aus einer Grube kennen wir Skeletteile eines weiteren Menschen, die nicht in anatomischer Ordnung lagen, aber wohl von einem weiteren, zerstörten Grab stammen. Erst im Laufe der anthropologischen Untersuchungen wurde eindeutig, daß es sich dabei um menschliche Gebeine handelt. Zur Zeit sind also die Überreste von 42 Personen aus Balatonszárszó bekannt. Die Bewohner des jungsteinzeitlichen Dorfes bestatteten ihre Verstorbenen in die obersten Teile der Abfallgruben der Siedlung. Sie stampften die Verfüllung der Grube nieder und legten den Körper auf diese Oberfläche. Die Skelette lagen deshalb meist

<sup>35</sup> N. Kalicz: Übersicht über den Forschungsstand der Entwicklung der Lengyel-Kultur und die ältesten „Wehranlagen“ in Ungarn. *MÖAG* 33–34 (1983–84) 272–273, Taf. 2; Kalicz 1988, 193.

<sup>36</sup> V. G. Csánk: Budapest III. Békásmegyer. *RégFüz* Ser. I:20 (1966) 9; Kalicz 1988, 193.

<sup>37</sup> Egry 2003, 106.

<sup>38</sup> Makkay 1978, 11; Kalicz 1988, 193; Makkay – Starnini – Tulok 1996, 17–19.

<sup>39</sup> Makkay – Starnini – Tulok 1996, 12–13, 17–19.

<sup>40</sup> Buttler – Haberey 1936, 14–32.

<sup>41</sup> D. Kaufmann: Zu einigen Ergebnissen der Ausgrabungen im Bereich des linienbandkeramischen Erdwerks bei Eilsleben, Kreis Wanzleben, in: B. Chropovský (red.): *Siedlungen der Kultur mit Linearkeramik in Europa. Internationales Kolloquium Nové Vozokany 1981*. Nitra 1982, 69–72.

<sup>42</sup> H. J. Windl: Grabungen in einem Siedlungsareal der Linearbandkeramik in Asparn/Zaya, BH Mistelbach, Niederösterreich. *ZalaiMúz* 2 (1990) 19–21.

<sup>43</sup> Kalicz 1988, 194.



ziemlich hoch, die obersten Gebeine fanden wir in vielen Fällen in der oben erwähnten Schicht des rotbraunen Waldbodens. Bei der Entfernung der oberen Humusschichten beschädigten die Maschienen oft die Knochen, vor allem die Schädel. Der Erhaltungszustand der Skelette war sehr unterschiedlich, die im Waldboden liegenden Skeletteile waren häufig in schlechtem Zustand.

Manche Gräber befinden sich in unmittelbarer Nähe der Gebäude, sie kommen aber auch außerhalb der engen Bauareale vor. Sie liegen einzeln oder bilden kleine Gruppen, die aus zwei bis drei Gräbern bestehen. In drei Fällen wurden zwei Menschen in der gleichen Abfallgrube bestattet. In einer Grube lagen drei Skelette. Es ist unmöglich, in der Orientierung der Gräber klare Tendenzen festzustellen. Die Spuren von richtigen Grabgruben beobachteten wir nur ganz selten. Die Bestattungen sind mit zwei Ausnahmen alle Hockergräber. In Ausnahmefällen können wir aus der Lage der Skelette darauf schließen, daß die Leichen in die Abfallgruben hinein geworfen sind.

Wenige Gräber enthielten echte Beigaben. In einigen Fällen fanden wir in der Erde der Gräber Gefäßbruchstücke, Knochen und Abfall der Steingerätproduktion. Diese Gegenstände stammen aber höchstwahrscheinlich aus den Abfallgruben. Ein Mensch (Grab S-531) wurde mit außerordentlich reichen Beigaben: mit zwei Gefäßen, einer Steinaxt und zwei weiteren Steingeräten bestattet. Der Mann spielte sicherlich eine führende Rolle in der neolithischen Dorfgemeinschaft. Im Grab eines Kindes (Grab S-779) lag ein halbes Gefäß mit der typischen eingeritzten Verzierung der Keszthely-Gruppe der Transdanubischen Linearbandkeramik (*Abb. 13*). Zwei Kinder wurden in der selben Grube bestattet. Eines (Grab S-288) hatte einen zweiteiligen Spondylusschmuck, das andere (Grab S-289) ein Bruchstück eines eingeritzten Knochengerätes, vermutlich einer Knochnadel. Ein Skelett (Grab S-780) ist mit einer Knochnadel auf dem Schädel, mit einem Knochenpfriem und mit einer Klinge aus Radiolarit neben dem Körper zum Vorschein gekommen (*Abb. 14*). Unter dieser Bestattung lag in der selben Grube ein weiteres Skelett (Grab S-782), wobei die untere Leiche in die Grube eingeworfen wurde. In einem weiteren Grab (Grab S-770) fanden wir eine Perle.<sup>44</sup>

Aus Transdanubien sind nur wenige Siedlungsbestattungen der Linearbandkeramik bekannt, zum Beispiel aus Sukoró,<sup>45</sup> Kaposvár,<sup>46</sup> Kaposvár-Túskevár,<sup>47</sup> Letkés<sup>48</sup> und Békásmegyer.<sup>49</sup> In anderen Regionen Mittel- und Westeuropas kamen neben den Siedlungsbestattungen auch Gräberfelder mit zahlreichen Bestattungen außerhalb der bandkeramischen Siedlungen zum Vorschein. Ohne alle Fundorte aufzählen zu wollen, können die Nekropolen von Flomborn,<sup>50</sup> Aiterhofen-Ödmühle,<sup>51</sup> Schwetzingen<sup>52</sup> und Wandersleben<sup>53</sup> erwähnt werden. Das größte Gräberfeld der Mitteleuropäischen Linearbandkeramik im Karpatenbecken ist vom slowakischen Fundort Nitra-Priemyslova ulica (ung. Nyitra; dt. Neutra) bekannt. Von den 76 Bestattungen gehört ein Grab zur Badener Kultur, es konnten also 75 Bestattungen der Linearbandkeramik identifiziert werden, von denen ein Grab vor der Ausgrabung zerstört wurde.<sup>54</sup> Ein weiteres, wesentlich kleineres Gräberfeld wurde im benachbarten Dorf Mlynárce (heute Nitra-Mlynárce, ung. Molnos) entdeckt.<sup>55</sup> Z. Farkaš

<sup>44</sup> Die Gräber des mittelalterlichen Gräberfeldes und die der neolithischen Siedlung wurden auf dem Fundort in einem einheitlichen System numeriert, deshalb haben manche jungsteinzeitliche Gräber eine Nummer über 700.

<sup>45</sup> J. Makkay: Sukoró-Tóra dűlő. RégFüz. Ser. I:22 (1969) 20–21; Kalicz 1988, 195.

<sup>46</sup> Draveczy 1966, 29; Kalicz 1988, 195.

<sup>47</sup> Draveczy 1966, 29; Kalicz 1988, 195.

<sup>48</sup> L. Papp: Eine jungsteinzeitliche Siedlung und Gräber in Letkés. MittArchInst 3 (1972[1973]) 42–43; Kalicz 1988, 195.

<sup>49</sup> V. Gábori-Csánk: Újkőkori sír és szarvastemetés Békásmegyeren (Jungsteinzeitliches Grab und Hirschbestattung in Békásmegyer). BudRég 22 (1971) 287–292; Kalicz 1988, 195.

<sup>50</sup> I. Richter: Die bandkeramischen Gräber von Flomborn, Kreis Alzey, und vom Adlerberg bei Worms. MZ 63/64 (1969) 158–179; Peschel 1992, 39–55.

<sup>51</sup> Nieszery 1995, 53–57, 264–304.

<sup>52</sup> R.-H. Behrends: Ein Gräberfeld der Bandkeramik von Schwetzingen, Rhein-Neckar-Kreis. AusgrBW 1989 (1990) 45–48; Peschel 1992, 60–63.

<sup>53</sup> Peschel 1992, 11; Nieszery 1995, 246.

<sup>54</sup> J. Pavúk: Neolithisches Gräberfeld in Nitra. SIA 20 (1972) 39.

<sup>55</sup> E. Plesl: Pohřebiště lidu s volutovou keramikou v Mlynárcích na Slovensku (Néropole du peuple à céramique spirale à Mlynárce (Mlynartsè) en Slovaquie). AR 4 (1952) 9–15, 18–20, 92–93.



erwähnt in seinem Aufsatz – der auch als Zusammenfassung der linearbandkeramischen Bestattungen in der Slowakei gilt – zwei weitere slowakische Fundorte mit Gräberfeld der Linearbandkeramik aus Nitra–Mikov dvor (ung. Nyitra; dt. Neutra)<sup>56</sup> und aus Lipová–Ondrochov (ung. Nyitramalomszeg).<sup>57</sup> In Österreich wurden neben den zahlreichen Siedlungsbestattungen zwei größere Gräberfelder der Linearbandkeramik in Rutzing<sup>58</sup> und in Kleinhadersdorf<sup>59</sup> freigelegt. In Balatonszárszó konnten wir die Spuren eines möglichen Gräberfeldes außerhalb der Siedlung leider nicht finden.

### Schlußfolgerungen

Nach drei Ausgrabungsjahren waren uns 40 bandkeramische Hausgrundrisse, 42 Bestattungen und ein fast 160 Meter langer Abschnitt der Grabenanlage auf dem Fundort bekannt. Die wissenschaftliche Bearbeitung der Befunde und Funde steht gerade am Anfang, und die Ausgrabung von 2003 bereicherte uns um weitere neue Informationen. Trotzdem können wir einige Interpretationen über die Siedlungsstruktur wagen. Im südwestlichen Teil des Fundortes finden wir im Keramikmaterial die Scherben der Keszthely-Gruppe der Transdanubischen Linearbandkeramik zusammen mit den Gefäßfragmenten der Zseliz-Kultur, oft in der gleichen Abfallgrube. N. Kalicz stellte schon fest, daß das Keramikmaterial der Keszthely-Gruppe in den Fundorten Zentraltransdanubiens gemeinsam mit dem Material der Zseliz-Kultur erscheint.<sup>60</sup> Im südöstlichen Teil des Fundortes dominiert das Material der Keszthely-Gruppe. Die Gefäße und Keramikbruchstücke im nordöstlichen Teil gehören eindeutig zur älteren Linearbandkeramik. Alle diese Äußerungen treffen wir, noch bevor das Keramikmaterial statistisch ausgewertet ist, und sie beruhen meist auf den Beobachtungen bei der Feldarbeit. Im Nordosten, der frühen Phase, ist die Siedlung nicht so intensiv; bis Ende 2002 konnten wir hier keine Spuren von Gebäuden finden.<sup>61</sup> Die 39 Hausgrundrisse im südlichen Teil des Geländes und die anderen Befunde mit dem Material der Keszthely-Gruppe und der Zseliz-Kultur bilden ein einheitliches Areal und haben eine gemeinsame Baustruktur. Die Grabenanlage im Südwesten entstand in einer der Bauphasen dieses Areals. Der Hausgrundriß mit dem Wandgraben (Haus 38) befand sich recht weit entfernt von den übrigen 39 Häusern. Er lag viel näher an den Abfallgruben der älteren Linearbandkeramik. Diese Eigenheiten können auch auf eine chronologische Differenz deuten.

Die Hausgrundrisse in Balatonszárszó sind im Durchschnitt wesentlich kleiner als im westlichen und im zentralen Bereich der Kultur. Dieser Unterschied besteht auch bei einem Vergleich mit den Hausgrundrissen von Nordtransdanubien und mit denen der Südwestslowakei. In Mosonszentmiklós–Egyéni földek erreichte die Länge mehrerer Gebäude sogar 40 Meter.<sup>62</sup> Das Haus der Zseliz-Kultur in Almásfüzitő–Foktorok war 29 Meter lang.<sup>63</sup> In Štúrovo (ung. Párkány) betrug von den vollständigen Bauten das längste 37 Meter.<sup>64</sup> In Čataj (ung. Csataj) beträgt die Länge der zwei freigelegten Hausgrundrisse 34,6 und 30,0 Meter.<sup>65</sup>

Nach der Aufteilung von P. J. R. Modderman und H. T. Waterbolk haben die bandkeramischen Gebäude drei Haupttypen: Großbauten, Bauten und Kleinbauten, die

<sup>56</sup> G. Březinová: Neolitické nálezy z Nitry–Mikovho dvora, in: I. Kuzma (ed.): Otázky neolitu a eneolitu našich krajín – 1998. Nitra 1999, 19–38; Farkaš 2002, 24, 42.

<sup>57</sup> A. Točík: Prieskumy a záchranné výskumy na juhozápadnom Slovensku v roku 1980 (Geländebegehungen und Rettungsgrabungen in der Südwestslowakei). AVANS 1980. Nitra 1981, 303, 308; Farkaš 2002, 26, 42.

<sup>58</sup> Á. Kloiher – J. Kneidinger: Die neolithische Siedlung und die neolithischen Gräberfundplätze von Rutzing und Haid, Ortsgemeinde Hörsching, Politischer Bezirk Linz-Land, OÖ. JOÖMV 114 (1969) 19–28; Lenneis 1995, 34–37.

<sup>59</sup> Ch. Neugebauer-Maresch: Der bandkeramische Friedhof von Kleinhadersdorf bei Poysdorf, NÖ.

Archäologie Österreichs 3/1 (1992) 5–11; Lenneis 1995, 34–37.

<sup>60</sup> N. Kalicz: Die Keszthely-Gruppe der Transdanubischen (Mitteleuropäischen) Linienbandkeramik im Lichte der Ausgrabung in Kustánszeg (Westungarn). CommArchHung 1991, 5–32, Abb. 1.

<sup>61</sup> Im Jahre 2003 konnten wir auch hier bandkeramische Hausgrundrisse freilegen.

<sup>62</sup> Egry 2003, 104.

<sup>63</sup> É. V. Vadász: Almásfüzitő–Foktorok. RégFüz Ser. I:25 (1971) 3.

<sup>64</sup> Pavúk 1994, 63.

<sup>65</sup> Pavúk 1986, 367.



Großbauten haben immer drei Teile (NW-Teil, Mittelteil, SO-Teil).<sup>66</sup> Nur Großbauten verfügen über einen Südostteil, wo sehr oft ovale und rechteckige Pfostengruben beobachtet wurden. Sie können auf einen doppelten Pfosten weisen, die Südostteile der Großbauten werden oft als Getreidespeicher interpretiert.<sup>67</sup> Dieses System beruht auf den Gebäuden im westlichen Bereich der Linearbandkeramik, die länglichen Pfostengruben sind aber auch in den Hausgrundrissen mehrerer Fundorte im nordwestlichen Karpatenbecken und in Österreich zu finden, so zum Beispiel in Győr-Pápai vám,<sup>68</sup> in Mosonszentmiklós,<sup>69</sup> in Štúrovo (ung. Párkány),<sup>70</sup> in Čataj (ung. Csataj)<sup>71</sup> und in Strögen.<sup>72</sup> In Balatonszárszó fehlen dagegen diese länglichen oder doppelten Pfostengruben. Danach können wir auf unserem Fundort über Großbauten mit einem südöstlichen Teil nicht sprechen, die Länge der Konstruktionen entspricht auch dieser Beobachtung. Trotzdem gab es Gebäude, die in einigen Funktionen der großen Gebäude der anderen bandkeramischen Regionen entsprechen konnten.

Das allgemeine Fehlen der Überschneidungen unter den Hausgrundrissen kann unserer Auffassung nach als Beweis für eine kontinuierliche Besiedlung mindestens im südlichen Teil des Fundortes gelten. Den jüngeren Generationen waren die Hofplätze und die Häuser der Ahnen gut bekannt, sie wurden nach den gleichen Bauprinzipien in allen Bauperioden errichtet.

Mit zahlreichen Analysen versuchte man in der bandkeramischen Forschung die Bewohnerzahl der einzelnen Bauten und die Größe der Bevölkerung von Dorfgemeinschaften zu bestimmen. Die Pfostenbauten des Kulturkreises mußten mindestens 5–7 Bewohner haben, auch wenn man in jedem Haus mit einer Kleinfamilie rechnet.<sup>73</sup> In Balatonszárszó konnten wir fast genauso viele Hausgrundrisse, wie Bestattungen freilegen. Die von uns freigelegten Siedlungsbestattungen können nur einen kleinen Anteil der Verstorbenen der Gemeinschaft bedeuten. Das ist eine allgemeingeltende Erscheinung auf den Siedlungen der Linearbandkeramik.<sup>74</sup> Es gibt dagegen Siedlungen mit Siedlungsbestattungen, in deren unmittelbarer Nähe ein Gräberfeld der Kultur entdeckt wurde. Auf dem mährischen Fundort Vedrovice legte V. Ondruš am Rand einer ausgedehnten Siedlung zwei Gräberfelder der Linearbandkeramik frei.<sup>75</sup> In Stephansposching entdeckte K. Schmotz neben dem bekannten Gräberfeld<sup>76</sup> mit Brand- und Körpergräbern eine Siedlung mit Gebäuden und mit Körpergräbern in Hockerstellung.<sup>77</sup> In Balatonszárszó bestatteten die neolithischen Bewohner nur einige, nach unbekannten Kriterien bestimmte Personen in der Siedlung. Unter ihnen finden wir sowohl Kinder, als auch Erwachsene beiden Geschlechts. Die Gräber von mindestens 80 Prozent der ehemaligen Bewohner müssen wir in einem unbekannten Gräberfeld auf dem Plateau oder auf den benachbarten Hügeln suchen. Das Fehlen der bandkeramischen Gräberfelder in Transdanubien kann als eine Forschungslücke interpretiert werden, die Situation ist der des ehemaligen Forschungsstandes der bandkeramischen Gebäude ähnlich.

Im allgemeinen können wir in der Siedlungsstruktur und unter den Befunden von Balatonszárszó–Kis-erdei-dűlő alle wesentlichen Merkmale eines bandkeramischen Dorfes finden. Die Baukultur der Linearbandkeramik erscheint in einer ganz entwickelten Form auf dem südlichen, großen Bauareal des prähistorischen Dorfes. Einige Besonderheiten

<sup>66</sup> H. T. Waterbolk – P. J. R. Modderman: Die Grossbauten der Bandkeramik. *Palaeohistoria* 6–7 (1958–59) 163; Modderman 1972, 80, 84.

<sup>67</sup> Modderman 1972, 80–81.

<sup>68</sup> Mithay 1966, Abb. 5.

<sup>69</sup> Egry 2003, 104.

<sup>70</sup> Pavúk 1994, 40–41, Abb. 18.

<sup>71</sup> Pavúk 1986, Abb. 1–4.

<sup>72</sup> Lenneis 1995, 17, Abb. 2, 4.

<sup>73</sup> Lüning 1980, 57; P. J. R. Modderman: Die Bandkeramik im Graetheidegebiet, Niederländisch – Limburg. *BRGK* 66 (1985) 88; P. J. R. Modderman: The Linear Pottery Culture: diversity in uniformity. *Ber. van de Rijksdienst* 38 (1988) 76–77.

<sup>74</sup> Nieszery 1995, 16–18.

<sup>75</sup> V. Podborský a kol.: Dvě pohřebišť neolitického lidu s lineární keramikou ve Vedrovicích na Moravě. Zwei Gräberfelder des neolithischen Volkes mit Linearbandkeramik in Vedrovice in Mähren. Brno 2002.

<sup>76</sup> Peschel, 1992, 77–78.

<sup>77</sup> K. Schmotz: Bestattungsformen des 6. und 5. Jahrtausends im Landkreis Deggendorf (Niederbayern) – Erkenntnisse aus 20 Jahren kommunaler archäologischer Denkmalpflege. *AR* 54 (2002) 266–267.

der Häuser, wie bei Fundorten beidseits der Donau, in der Kleinen Tiefebene (ung. Kisalföld) des Karpatenbeckens oder in den Siedlungen fernerer Regionen fehlen jedoch in Balatonszárszó. Diese kleinen Differenzen stehen vielleicht damit in Zusammenhang, daß Balatonszárszó am Rande des bandkeramischen Kulturkreises liegt, auf einem Territorium, das als mögliches Entstehungsgebiet und Ausgangspunkt der Linearbandkeramik betrachtet wird.<sup>78</sup> Die Bedeutung der Siedlung liegt vor allem in ihrer Komplexität, da die Gebäude, die Grabenanlage, die Abfallgruben, die Bestattungen und das Fundmaterial sich als eine Einheit untersuchen lassen.

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<sup>78</sup> Lüning 1980, 46–47.



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Abb. 1. Die Umgebung der Ausgrabung von Balatonszárszó





Abb. 2. Übersichtsplan des südlichen Teiles der freigelegten Oberfläche von Balatonszárszó



Abb. 3. Luftbildaufnahme über die Ausgrabung im Sommer 2001



Abb. 4. Luftbildaufnahme über die östliche Oberfläche im Jahre 2002



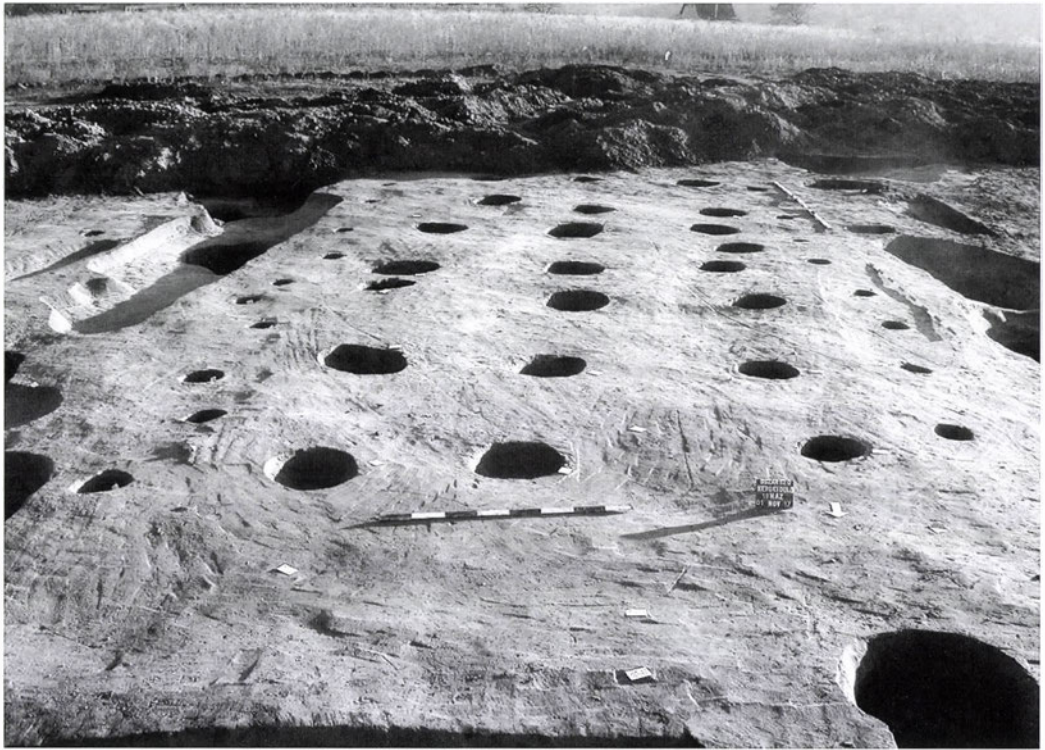


Abb. 5. Haus 18



Abb. 6. Pfostensystem des Hauses 6



Abb. 7. Pfostengruben der Westwand im Haus 12

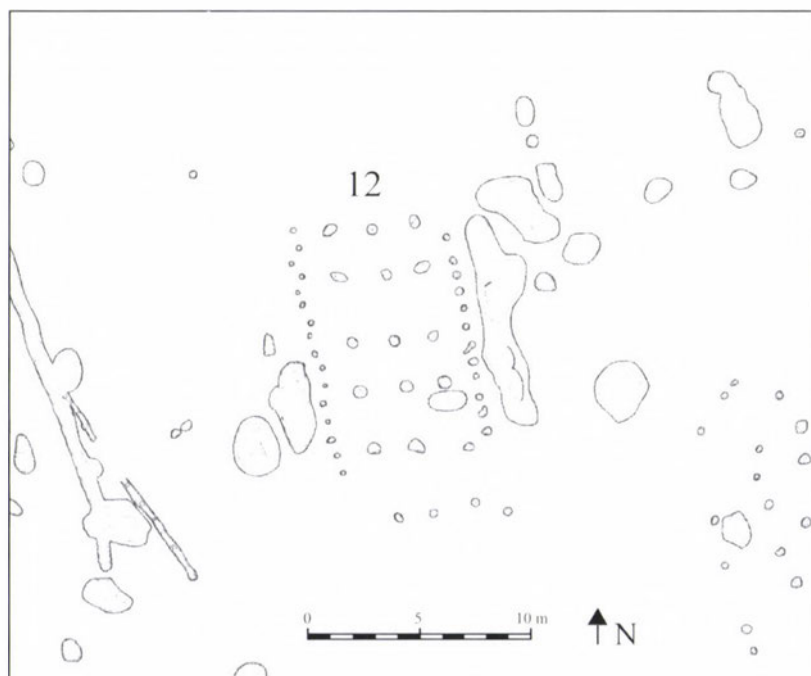


Abb. 8. Grundriß des Hauses 12





Abb. 9. Luftbildaufnahme über die Hausgruppe mit den bandkeramischen Gebäuden 10, 4, 3 und 9

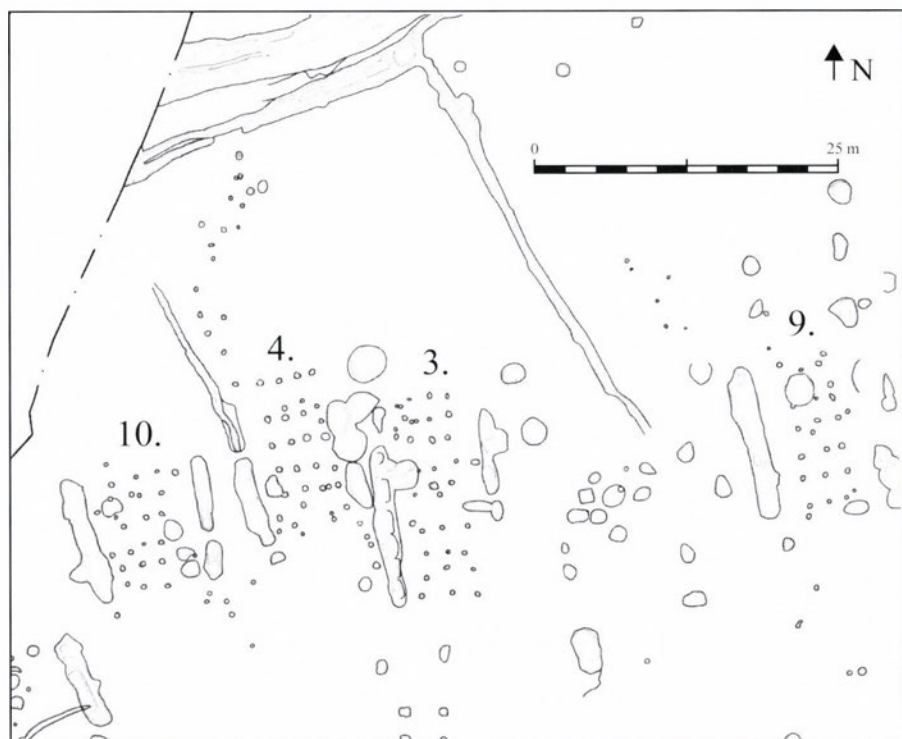


Abb. 10. Grundrisse der Häuser 10, 4, 3 und 9



Abb. 11. Abschnitt der Grabenanlage mit Eingang 5

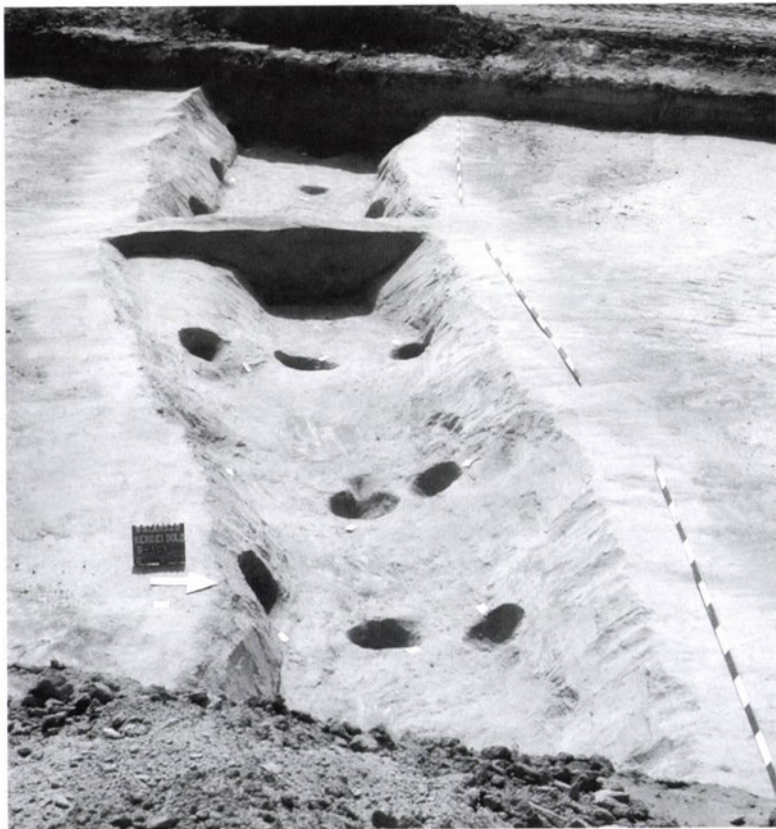


Abb. 12. Abschnitt der Grabenanlage mit Pfothengruben





Abb. 13. Grab S-779



Abb. 14. Grab S-780



## MATERIAL FINDS FROM BALATONSZÁRSZÓ, NEOLITHIC SETTLEMENT: CONNECTIONS WITHIN AND WITHOUT THE TLPC TERRITORY

The present paper is a summary – like a preliminary analysis – of the material finds from the Neolithic settlement of Balatonszárszó where excavations were carried out from 2000 until the present as part of rescue excavations on the planned route of the M7 motorway in County Somogy. The settlement is located in an enclosed area on a loess plateau running along the southern shore of lake Balaton. During the three seasons of excavations a very large Middle Neolithic settlement was unearthed revealing the complete settlement structure of the site including house remains, as well as graves and other settlement features.<sup>1</sup>

I would like to discuss some of the possible connections of these material finds based on the study of the small finds; bone and stone objects, and then offer some first impressions about the pottery. Unfortunately, at present, ceramic typological dating of the site has not been completed.<sup>2</sup> This is a very important aspect of our research because the selection of the material reflects a more general problem: we were unable to detect any kind of vertical stratigraphy within the settlement. The best interpretive approach involves the statistical analyses of the finds within each settlement feature as well as across the whole territory of the Neolithic settlement.

The bone tools and worked bones were not the most common artifact groups in the find material. We brought to light only a few half finished pieces of antlers, formal bone tool types which were generally rare (circa 40 pieces), and bone points which are very characteristic of Middle Neolithic settlements in the Carpathian Basin.<sup>3</sup> Another type of bone tool recovered was a “mattock head” in which a ground stone axe blade may have been hafted. This bone “mattock head” is unusual in the sense that at other Neolithic settlements they are generally made from antler; however, this atypical piece reflects the overall absence of antler at the site as a whole. One hairpin was also recovered ‘in situ’ from a burial. Based upon its position in relation to the skull, it was probably used to hold the hair of the deceased in a bun.

From the standpoint of bone tool production: the distribution, accumulation, and segregation of animal bones inside the territory of the settlement seems to have been significant. We could detect three different situations which may be interpreted as some kind of part-specific distribution system. First, a young pig’s skull was deposited at the bottom of a circular ditch which was located the southern part of the settlement. Based upon our reconstructions of this feature and the internal stratigraphy, we suggest that the skull was deposited at the time the ditch was constructed and not as secondary fill. This phenomena can be explained as some kind of ritual behavior; for example, as a building sacrifice.

The second and third examples are – if these settlement features are contemporary – most probably associated with an independent household system. In a pit near a house we discovered many complete pairs of sheep or goat horns still attached to the frontal bones. The pit seemed to be a common rubbish pit with many other kinds of material deposited together with the horns. The situation was the same in another pit which was also structurally

<sup>1</sup> Sz. Honti – K. Belényesy – Zs. Gallina – V. Kiss – G. Kulcsár – T. Marton – Á. Nagy – P. G. Németh – K. Oross – K. Sebők – K. Somogyi: A tervezett M7-es autópálya Somogy megyei szakaszán 2000–2001-ben végzett megelőző régészeti feltárások. Előzetes jelentés II (Rescue excavations in 2000–2001 on the Planned Route of the M7 Motorway in Somogy County. Preliminary report II). SMK 15 (2002) 9–10.

<sup>2</sup> The pottery material have been cleaned but have not yet been selected and remain unrestored at present.

<sup>3</sup> J. Makkay – E. Starnini – M. Tulok: Excavations at Bicske–Galagonyás (Part III). The Notenkopf and Sopot–Bicske cultural phases. Società per la Preistoria e Protostoria della Regione Friuli–Venezia Giulia. Quaderno 6. Trieste 1996, 244.



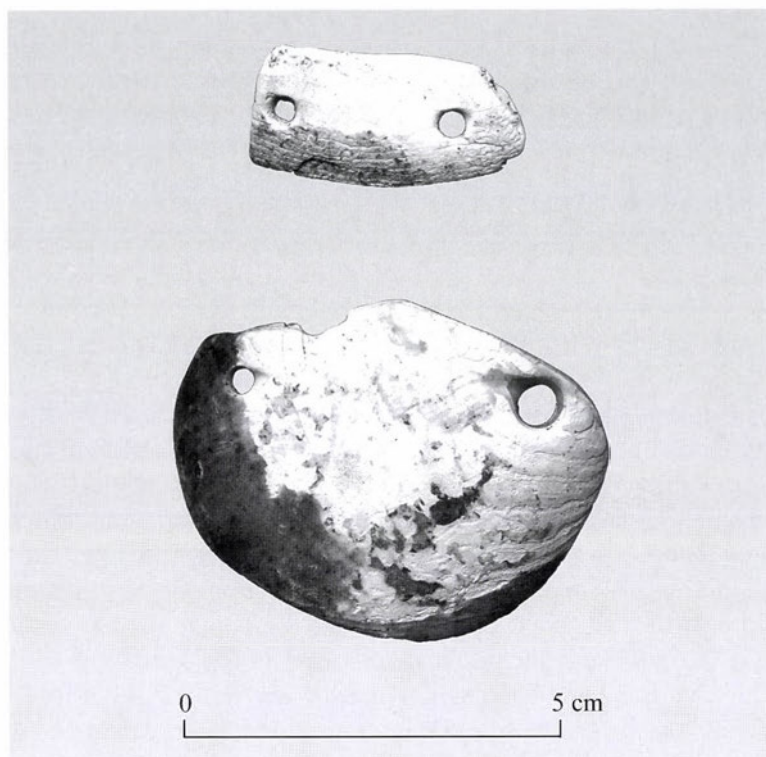


fig. 1. Bracelet, made on Spondylus-shell and consisted of two sections:  
a double bored oval disk and a band (grave 288)

associated with the same household system (inside the long ditch of the house); however, in this instance many mandible fragments were found together with other kinds of material. This type of accumulation and deposition can most probably be interpreted as some kind of workshop activity.

Spondylus or carved shell objects were found very rarely. They include one bracelet fragment and few beads recovered from settlement features. Only one bracelet was found as a burial offering and consisted of two sections (a double bored oval disk and a band) which were found on the leg of an infant skeleton (*fig. 1*).

Many pieces and different types of grindstones were brought to light from settlement features. Their size and shape are diverse. The most typical form is the so-called "bread-like" type, occasionally with a rim at the narrow ends and sometimes recovered with burnt grain on the grinding surface. Not so well-shaped, but more functioned pieces are also known. A relatively smaller and finer type of grindstone functioned for grinding red ochre mineral paint. The raw material of these tools is predominantly Permian red sandstone, which derives from the northern shore of lake Balaton.

The other types of ground stone tools are the ground stone axes which were found representing a relatively low percentage of the total ground stone at the site. We found the smaller trapeze-form, the so-called "shoe-last" type and only a few pieces of the bored variant.

Many thousand fragments of chipped stone tools were found in the settlement features and additionally these types of tools were also part of the grave goods.

Their distribution inside the settlement territory seems to be fairly homogeneous with only a few pits exhibiting unusual concentrations.

The general forms of chipped stone production are the relatively large, conical or prismatic blade cores (*fig. 2. 4–5*). Precores or nodules of raw material are also very rare. Many pieces of core rims and rejuvenation flakes were brought to light, both of which are associated with local workshop activity. Further evidence for workshop activity includes a high percentage of flakes, blanks and irregular flakes.

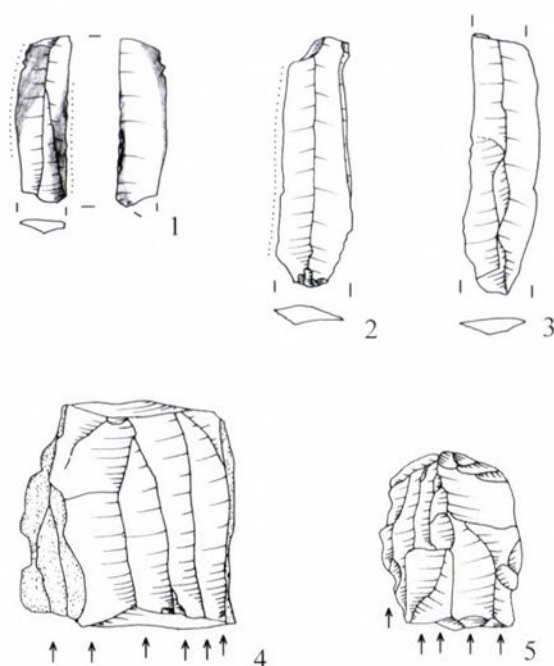


fig. 2. Chipped stone implements from the Balatonszárszó settlement.  
1. Unretouched blade – sickle insert (pit 4275); 2–3. Unretouched blades  
(pit 4585 and stray find); 4–5. Cores (stray find and pit 3000)

Relatively regular flakes have been used as simple cutting edges although the most characteristic forms and the basis of the chipped stone industry at the settlement were regular blades (fig. 2. 2–3). We can suggest two main ways to utilize regular blades. First, the very thin, narrow and long blades seem to be technological blanks (which can be associated any kind of exchange system and used only after secondary working). These were very frequently found with no retouch or end flaking while the edges have significant wear derived from use on plants or as sickle inserts (fig. 2. 1). End scrapers, side scrapers and truncated implements are also frequently encountered while the ratio of borers and retouched points is relatively high.

The dominant raw material is the so-called Szentgál type red radiolarite<sup>4</sup> and the Úrkút–Eplény and Tevel types<sup>5</sup> are also present. Rarer raw materials imported from greater distances include obsidian and hydroquartzite. One piece of Kraków – Jurassic flint – was also found.

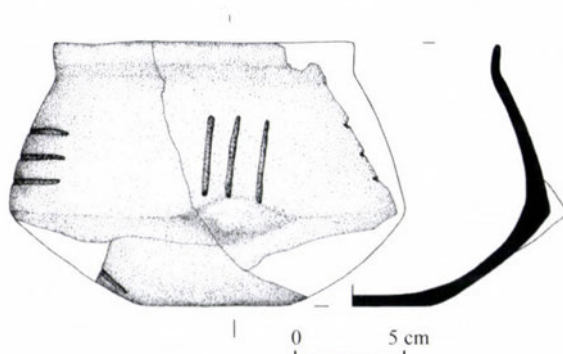


fig. 3. Pottery find from the Balatonszárszó settlement. Biconical vessel with incised and incrustated motifs (pit 4960, early phase of the Linear Pottery Culture)

<sup>4</sup> K. T. Biró – J. Regenye: Prehistoric workshop and exploitation site of Szentgál–Tűzköveshegy. *ActaArchHung* 43 (1991) 337–375.

<sup>5</sup> K. T. Biró. – M. Pálósi: A pattintott kőeszközök nyersanyagának forrásai Magyarországon (Sources of lithic raw materials for chipped stone artifacts in Hungary). *MÁFIJ* 1983 (1986) 425.



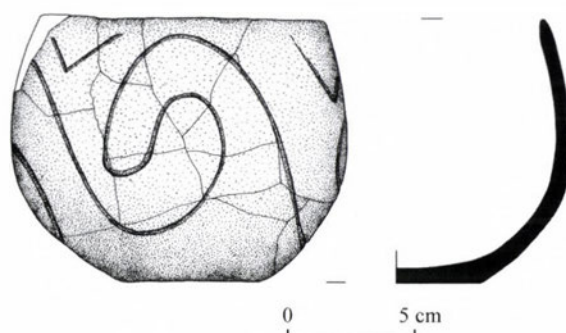


fig. 4. "Bomb-shaped" vessel with linear motifs (grave 779, Keszthely group)

We can try to present a preliminary general picture about the pottery finds which form the most numerous group within the find material from the excavations. In conjunction with this we would also like to discuss the potential for connecting and separating the ceramic material in hopes of identifying different "cultural phases" within the Balatonszárszó settlement.

There are many ceramic sherds, which accumulated in settlement features and, in few situations, were deposited as grave goods too. In general, we found sherds and only a few whole pots, as well as idol and altar fragments.

The soil of the site was favorable for the preservation of painted and the organic decorations.

During the first excavation season we found material of the Zseliz culture, which has been identified as a late phase of the TLPC, but after the last season this picture became more complex. Of course, in the future we will use more accurate numerical data. Here, however, we will attempt to demonstrate our current impressions of the cultural–chronological sequence which may be as follows:

The earliest phase of the settlement is contemporary with the so-called "early phase of the LPC". This period is characterized by biconical forms (*fig. 3*), black-burnished and black



fig. 5. Pottery fragment, with incised motifs, incrustated and painted decoration (pit 2820, Keszthely group)



fig. 6. Pottery finds from the Balatonszárszó settlement (grave 531). 1. Globular vessel with fine incised motifs; 2. "Bomb-shaped" vessel with linear motifs (Zseliz culture)

polished technology, a relatively high percentage of "barbotine" ("slickwurf") decoration and, quite simple linear motifs. This cultural phase seems to have analogies with the material from Budapest III.–Aranyhegyi Road,<sup>6</sup> the earliest phase of Bicske–Galagonyás,<sup>7</sup> Bína (Bény)<sup>8</sup> and contemporary with the early Vinča culture.<sup>9</sup> This horizon is also represented at the neighboring excavation of Balatonszemes–Bagódomb.<sup>10</sup>

The second phase is characterized by material of the so-called Keszthely group ("middle or classical phase of the TLPC") with a few imported sherds of the Notenkopf periode. The most common forms are the conical, globular and the so-called "bomb-like" vessels all decorated with deep incised linear motifs (fig. 4). The relatively high percentage of red painting is a unusual phenomenon in comparison with earlier data. We can identify a very local element in decoration too. Many pieces of sherds had incised linear motifs with incrustation inside, often together with painting (fig. 5). The cores of a wild plant, the so-called millet, were used in this type of incrustation. This cultural horizon is associated with material from other settlements of the Keszthely group (e.g. Kustánszeg,<sup>11</sup> Becsehely<sup>12</sup>), the Flomborn and Ačkový cultural sphere in Southeast German and Czech territories,<sup>13</sup> and contemporaneous with the Notenkopf phase in Northern Transdanubia.

We can isolate a characteristic third phase, which is not entirely independent from the preceding one. Typical Keszthely material was found together with elements of the early and classical phase of the Zseliz culture.<sup>14</sup> The decoration of the Keszthely group exhibit general continuity with the last phase although there are some new elements. First, the complete decoration system of the Zseliz culture (fig. 6) and Keszthely group occasionally appear

<sup>6</sup> N. Kalicz – R. Kalicz-Schreiber: Die erste frühneolithische Fundstelle in Budapest. *Balkanica* 23 (1992) 49.

<sup>7</sup> J. Makkay: Excavation at Bicske. I. The early Linear Band Ceramic. *Alba Regia* 16 (1978) 10; J. Makkay – E. Starnini – M. Tulok: Excavations at Bicske–Galagonyás (Part III). The Notenkopf and Sopot–Bicske cultural phases. *Società per la Preistoria e Protostoria della Regione Friuli–Venezia Giulia. Quaderno* 6. Trieste 1996, 264.

<sup>8</sup> J. Pavúk: Ältere Linearkeramik in der Slowakei. *SIA* 28 (1980) 47.

<sup>9</sup> F. Horváth: Az Alföldi Vonaldíszes Kerámia első önálló települése a Tisza–Maros szögében: Hódmezővásárhely–Térfok (The first independent settlement of the Alföld Linear Pottery Culture in the Tisza–Maros region: Hódmezővásárhely–Térfok), in: G. Lőrinczi (ed.): *A kőkortól a középkorig (Von der Steinzeit bis zum Mittelalter)*. Szeged 1994, 104.

<sup>10</sup> M. Bondár – Sz. Honti – V. Kiss: A tervezett M7-es autópálya Somogy megyei szakaszának megelőző régészeti feltárása (1992–1999). *Előzetes jelentés I* (The preceding archaeological excavation of the planning M7 highway in County Somogy (1992–1999). Preliminary report I). *SMK* 14 (2000) 94–114.

<sup>11</sup> N. Kalicz: Die Keszthely-Gruppe der transdanubischen (mitteleuropäischen) Linienbandkeramik im Lichte der Ausgrabung in Kustánszeg (Westungarn). *CommArchHung* 1991, 7.

<sup>12</sup> N. Kalicz: Becsehely. Ausgrabungen. *MittArchInst* 7 (1977) 119.

<sup>13</sup> N. Kalicz: Funde der ältesten Phase der Linienbandkeramik in Südtransdanubien. *MittArchInst* 8/9 (1978–79[1980]) 30.

<sup>14</sup> J. Pavúk: Chronologie der Želiezovce-Gruppe. *SIA* 17/2 (1969) 271.





fig. 7. Fragment of a faced pot (pit 4018)

mixed within a single decorative motif. Second, it is possible to identify a higher frequency of red painting. Faced pots (*fig. 7*), human figurines and zoomorphic modeled forms are also represented. This chronological horizon seems to be contemporary with the Zseliz culture in Northern Transdanubia, but does not include the latest phase of the Zseliz culture.<sup>15</sup>

These hypothetical cultural phases were identified primarily through territorial separation. The earliest phase was detected in the northern part of the excavated area after which it is postulated that the settlement focus shifted to the south. Finally, the latest occupations are located in the western part of the plateau.

<sup>15</sup> J. Regenye: Chronological situation of the Sopot culture in Hungary. VMMK 22 (2002) 32.

## ANGABEN ZU DEN HAUSTYPEN DES MITTLEREN NEOLITHIKUMS IN UNGARN

Trotz der relativ hohen Zahl der Ausgrabungen ist es nicht zu sagen, dass die Siedlungen der europäischen Linienbandkeramik in Ungarn recht gut bekannt wären. Den Grund dazu sehe ich darin, dass die großen Häuser des mittleren Neolithikums an den kleinen Grabungen nicht beobachtet werden konnten, auch in den besten Fällen konnten die Ausgräber höchstens einige Pfostenlöcher registrieren. Ein vollständiges Gebäude, ein unregelmäßiges Grubenhaus legte J. Makkay in Bicske–Galagonyás aus der Zeit der älteren Bandkeramik frei.<sup>1</sup> Da es aber von der Standardform der in Europa in großer Zahl bekannt gewordenen Häuser vollständig abweicht, wollen wir uns damit in den Folgenden nicht befassen.

Die in dem letzten Jahrzehnt begonnenen großzügigen Bautätigkeiten ermöglichten in Ungarn die Beobachtung von größeren Flächen. So gelang es auf dem Fundort Mosonszentmiklós–Egyéni-földek<sup>2</sup> (Komitat Győr–Moson–Sopron) und Törökbálint–Dulácska<sup>3</sup> (Kom. Pest) Pfostenlochrerien zu registrieren, die die Umriss linienbandkeramischer Häuser konturierten. Beide Siedlungen kamen anlässlich der Autobahnbauten ans Tageslicht. Die bisherige größte neolithische Grabung wurde in Balatonszárszó–Kis-erdei-dűlő (Kom. Somogy) durchgeführt, wo eine riesige linienbandkeramische Siedlung neben einem mittelalterlichen Kirchenbau zum Vorschein kam. Die bis jetzt gefundenen mehr als 30 Hausgrundrisse deuten eine, der mitteleuropäischen Siedlungen ähnliche Größe an.<sup>4</sup>

An der nördlichen Trasse der Autobahn 2/a kam das im Frühling 1996 ausgegrabene Siedlungsdetail von Dunakeszi (Kom. Pest) vor. Das erste Haus stand am östlichen Rand der freigelegten Fläche. Die hausbegleitenden Objekte (Objekt 4, 3, 10, 11, 2, 29 und 6) konnten keine Fundamentgräben dieses Hauses sein (*Abb. 1*), da das Gebäude in diesem Fall mindestens 15 m breit gewesen sein sollte, und das eine unwahrscheinliche Breite bei einem neolithischen Haus wäre.<sup>5</sup> Das Gebäude selbst war N–S orientiert, mit einer kleinen Abweichung nach NO. Von den, die Stützpfeiler und Pfosten des Hauses bedeutenden Objekten gelang den Ausgräbern Anna Endrődi und Attila Horváth 17 kleinere und größere Gruben zu beobachten.<sup>6</sup> Das südliche Ende des Hauses, genauer gesagt die Objekte dieser Wand, blieben nicht erhalten. Die Distanz zwischen den noch sicher dem Haus zuordnenden Objekten ist 20 m (*Abb. 1; 2. 1*).

Das zweite Haus (*Abb. 1*) von Dunakeszi stand in der unmittelbaren Nähe des ersten, westlich davon (*Abb. 2. 1*). Zwischen den beiden Gebäuden gab es keinerlei Beziehung, die auf eine Superposition hätte hindeuten können. Davon könnten sie noch zeitgleich sein. Dieses Haus war von Osten und Westen von einer Reihe von Objekten begleitet. Die Grube 122 bringt einen Kontakt zwischen den zwei Häusern zustande, es handelt sich hier aber um eine spätere Störung. Die Distanz zwischen den hausbegleitenden Objekten betrug 12–12,5 m, und das Haus war knapp 30 m lang. Wie bei dem ersten Haus, besteht auch hier die

<sup>1</sup> J. Makkay: Excavations at Bicske. I. The early neolithic. The earliest Linear Band Ceramic. *Alba Regia* 16 (1978) 12–16.

<sup>2</sup> I. M. Egry: Mosonszentmiklós–Egyéni-földek. *RégFüz* Ser. I:48 (1997) 19.

<sup>3</sup> A. Endrődi: Törökbálint–Dulácska. *RégFüz* Ser. I:46 (1994) 28.

<sup>4</sup> T. Marton – K. Oross: Újkőkori falu Balatonszárszó határában [Neolithisches Dorf in der Gemarkung von Balatonszárszó]. Vortrag am 26.02.2002 an der Konferenz „A Régészeti Intézet ásatásai az M7 autópálya Somogy megyei szakaszán“ im Archäologischen Institut der Ungarischen Akademie der Wissenschaften in Budapest 2002;

K. Oross: Das neolithische Dorf von Balatonszárszó – Siedlungsstruktur und Architektur im Spiegel der bandkeramischen Siedlungen Mitteleuropas. Beitrag an der Roundtable „Exchange and cultural contacts in the Neolithic Carpathian Basin and around: Advances in the Research“ 30. 11. 2002 in Budapest.

<sup>5</sup> Die allgemeine Distanz der Längswände der linienbandkeramischen Häuser schwankte zwischen 5–7 m. Das Haus 11 von Stein, das 7,5 m breit war, nannte P. J. R. Modderman schon „außerordentlich breit“ (*Modderman* 1972, 78).

<sup>6</sup> Ich bin beiden für die Zulassung des Publikationsrechts für Dank verpflichtet.



Möglichkeit, dass auch dieses Gebäude, besonders in nördlicher Richtung, länger war, wie es hier bestimmt werden konnte. Im Inneren des Hauses blieben viele kleine Pfostenlöcher erhalten, die Bestandteile der Baustruktur gewesen sein konnten. Die Grube 54 – die in der Mitte des Hauses liegt – ist von großer Bedeutung, im Objekt konnten nämlich Feuerspuren konstatiert werden. Die Annahme einer innerhalb des Hauses existierenden Feuerstelle kann die zentrale Lage des Objektes unterstützen.

Um diese Gebäude richtig bewerten zu können, müssen wir das Bild über die Siedlungen und Häuser der europäischen Linienbandkeramik kurz skizzieren. Die Haustypen dieses Kulturkreises fassten P. J. R. Modderman, H. T. Waterbolk und J. Lüning in mehreren Arbeiten zusammen.<sup>7</sup> Der Größe und Baukonstruktion nach unterschieden sie drei Klassen, u. zw. den ‚Langbau‘, ‚Bau‘ und ‚Kleinbau‘.<sup>8</sup> Die Siedlungen der frühen Linienbandkeramik werden durch die Vielzahl solcher Gebäude charakterisiert, obwohl nicht alle gleichzeitig bewohnt waren. Sie wurden meistens N–S, mit einer leichten Abweichung nach NO orientiert. Die wichtigste, in Beziehung mit diesen Häusern an den langjährigen Grabungen in Elsloo, Sittard und Geleen gemachte Beobachtung war die dreifache Teilung des Hausinneren.<sup>9</sup> Aufgrund dessen nahm man funktionelle Unterschiede an. Diese Gebäude unterschieden sich auch nach der Größe voneinander, nach zwei Gesichtspunkten stimmten sie aber überein. Der erste war die Regelmäßigkeit des Grundrisses – die Pfostenlöcher standen in geregelten Reihen –, der andere die Anzahl der das Dach haltenden Pfostenreihen. Der für die Frühstufe der Linienbandkeramik charakteristische Zug ist die, im Inneren des Hauses zu beobachtende Y-Konfiguration, die P. J. R. Modderman für den wichtigsten Charakterzug der Häuser Geleen-Typs hielt.<sup>10</sup> Diesem schrieb die Forschung in typologischer Hinsicht eine besondere Wichtigkeit zu.

Untersuchen wir beide hier behandelte Häuser von Dunakeszi, wird ersichtlich, dass sie weder der Größe noch der Struktur nach dem europäischen Standard entsprechen. Der erste und vielleicht wichtigere Unterschied ist, dass die Zahl der die Dachkonstruktion haltenden Pfosten- und Pfeilerreihen weniger als fünf ist. Das kleinere Gebäude hatte eindeutig drei, das grössere vielleicht vier solche Konstruktionselemente. Den anderen, ebenfalls nicht unwichtigen Unterschied bildet die Konstruktion. Während die früher erwähnten, „klassischen“ Häuser aus der frühen und mittleren Jungsteinzeit ein regelmäßiges Hausinnere hatten, war es bei den zwei Gebäuden von Dunakeszi nicht zu beobachten. Die Pfostenreihen, bzw. Pfostengruben sind durcheinander und auch nicht immer in Reihen geordnet zu finden, manchmal fehlt auch je ein Pfosten.<sup>11</sup> Darauf aber, dass sie Bauten waren, weisen die Längsgruben hin, die unerlässliche Zubehöre der linienbandkeramischen Häuser waren.

Früher haben wir schon erwähnt, in welchen Zügen unsere Häuser von den bis dahin registrierten mittel- und westeuropäischen Gebäuden abwichen. Aber auch das ist festzustellen, dass dieser Haustyp in die bisherigen Einteilungen auch nicht aufgenommen wurde, diese Häuser wurden als ‚fehlerhaft‘, oder ‚beschädigt‘ erwähnt. Im folgenden versuche ich zu untersuchen, ob es richtig sei, oder ein, bis dahin nicht registrierter Haustyp in der europäischen Linienbandkeramik existiert.

Die erste Parallele unserer Häuser liegt sowohl räumlich als auch zeitlich weit von Dunakeszi. In Szentgyörgyvölgy–Pityerdomb (Kom. Zala) erschloss E. Bánffy in der zweiten Hälfte der 90er Jahre außer zahlreichen anderen neolithischen Objekten einige kettenartig angelegte kleine Gruben, die in N–S-Richtung lagen (*Abb. 2. 2*). In den Längsgruben fand sie kleine Pfostenspuren, aber auch im Zwischenraum der Gruben kamen ähnliche Objekte vor. Die Länge der sich so umrissenen Häuser schätzte die Ausgräberin auf 11,5–12,0 m. Das innerhalb des erwähnten Gebietes gefundene, Feuerspuren aufweisende Objekt konnte aller

<sup>7</sup> Waterbolk – Modderman 1958-59; Modderman 1958-59; Modderman 1970, 36; Modderman 1972, Abb. 49; Modderman 1985, Abb. 3; Lüning 1988, Abb. 47.

<sup>8</sup> Waterbolk – Modderman 1958-59; Modderman 1958-59; Modderman 1970, 36.

<sup>9</sup> Modderman 1958-59; Modderman 1972.

<sup>10</sup> Modderman 1972, 78.

<sup>11</sup> Bei diesen soll man aber auch mit der Möglichkeit rechnen, dass diese Objekte nicht tief genug waren und so durch die maschinelle Vertiefung der Flächen vernichtet wurden.



Wahrscheinlichkeit nach eine Feuerstelle sein.<sup>12</sup> Das erschlossene Hausdetail gehört zu einer sehr frühen Phase der Linienbandkeramik, in der die Reminiszenzen der Starčevo-Kultur noch zu beobachten sind.<sup>13</sup> Damit wurde das Gebäude von Szentgyörgyvölgy eine der besten Parallelen des kleineren Hauses von Dunakeszi.

Den Entsprechungen unserer Häuser folgend folgt räumlich die Fundstelle 2 von Brunn in Niederösterreich, wo das Fundmaterial der bisher frühesten Phase der Linienbandkeramik im Laufe einer riesigen Ausgrabung in den 90-er Jahren freigelegt wurde.<sup>14</sup> Die hier freigelegten zehn Gebäude können ihren allen Charakteristika nach – Dreipfostensetzung, unregelmäßiger Grundriss und die hausbegleitenden Längsgruben – mit den in Dunakeszi Beobachteten für gleich gehalten werden (*Abb. 2. 3*).

Zu unseren Häusern sind weitere Parallelen schon in Deutschland zu finden. Zuerst erwähnen wir die wichtigsten, die vielleicht im größten Maße unseren Gebäuden ähneln. In Altdorf (Bayern, Kreis Landshut) wurden die Grundrisse von zwei Pfostenhäusern an einer relativ kleinen Grabung entdeckt. Eines der Gebäude lag auf einer Fläche von 15 × 8 m, und es wurde am Südennde durch eine Dreipfostenreihe abgeschlossen. In der Publikation wird betont, dass die Mehrzahl der zum Haus gehörenden Funde in der Grube 162 zum Vorschein kam. Dabei ist die Anmerkung des Ausgräbers Kurt Reinecke sehr wichtig. Er hielt nämlich dieses Gebäude für einen neuen Haustyp, obwohl er es bis zum Vorkommen neuerer Objekte nur bedingt aussprach.<sup>15</sup> Mit demselben Haus beschäftigte sich auch W. Meier-Arendt. Er hielt es für die kleinere Variante der Häuser der älteren Linienbandkeramik und datierte es in die ältere Phase der Kultur.<sup>16</sup> Hier handelt es sich unzweifelhaft wieder um eine recht genaue Parallele (*Abb. 2. 4*).

Ein anderer, betreffs unseres Themas wichtiger Fundort ist Schwanfeld. Es liegt wieder in Bayern, im Landkreis Schweinfurt. Zwischen 1979 und 1983 legte man in drei Grabungssaisons neun frühlinienbandkeramische, sieben stichbandkeramische Häuser und ein, der deutschen Terminologie nach spätneolithisches Haus frei.<sup>17</sup> Unter ihnen gab es einen „erstaunlich kurzen bandkeramischen Bau“ (Haus 12), das wieder in allen Einzelheiten dem Haus 1 von Dunakeszi entsprach.<sup>18</sup> Die Ausgräber bemerkten in Verbindung mit diesem Haus, dass „schon in dieser frühen Zeit verschiedene Bautypen bestanden“.<sup>19</sup> Wir möchten auf das daneben stehende Haus 11 aufmerksam machen, das sowohl der Größe als auch der Struktur nach dem Haus 2 von Dunakeszi ähnelt, und auch das räumliche Verhältnis der nebeneinander stehenden Häuser fast gleich ist. So können die Häuser von Schwanfeld nicht nur einzeln, sondern auch zusammen als ausgezeichnete Parallelen bewertet werden (*Abb. 2. 5*).

Innerhalb einer linienbandkeramischen Siedlung wurden 26 Häuser in Rosdorf (Deutschland, Kr. Göttingen) freigelegt, von denen fünf unserem Haustyp formal gut entsprechen.<sup>20</sup> Von ihnen wird jetzt ein Objekt abgebildet (*Abb. 2. 6*).

Einen ähnlichen Grundriss wies das in Enkinnen (Landkreis Donau-Ries, Bayern, Schwaben) erschlossene neolithische Haus. Die innerhalb des Gebäudes gefundenen

<sup>12</sup> Bánffy 2000, 54, Abb. 4; E. Bánffy: Neue Daten zur Entstehung der Bandkeramik, in: St. Hiller – V. Nikolov (Hrsg.): Karanovo III. Beiträge zum Neolithikum in Südosteuropa. Wien, 2000, 376, Abb. 3.

<sup>13</sup> Bánffy 2000, 54.

<sup>14</sup> Stadler: [http://www.nhm-wien.ac.at/nhm/prehist/Stadler/Brunn/Brunn\\_Ceramics\\_g.html](http://www.nhm-wien.ac.at/nhm/prehist/Stadler/Brunn/Brunn_Ceramics_g.html). Abb. 5.

<sup>15</sup> K. Reinecke: Zwei Siedlungen der ältesten Linearkeramik aus dem Isartal. BVbl 48 (1983) 39–40.

<sup>16</sup> W. Meier-Arendt: Überlegungen zur Herkunft des linienbandkeramischen Langhauses, in: S. Bökönyi (ed): Neolithic in Southeastern Europe and its Near Eastern Connections. International Conference 1987. Szolnok-Szeged. VAH 2. Budapest 1989. 183–184.

<sup>17</sup> J. Lüning – P. J. R. Modderman: Hausgrundrisse der ältesten Bandkeramik aus Schwanfeld, Landkreis Schweinfurt, Unterfranken. AJB 1981, 66; Lüning 1983.

<sup>18</sup> Lüning 1983, Abb. 9; J. Lüning: Neue Forschungen zu den frühesten bäuerlichen Siedlungen in Mitteleuropa, in: Vorträge des 3. Niederbayerischen Archäologentages 1985, 10.

<sup>19</sup> Lüning 1983, 31.

<sup>20</sup> B. Schlüter: Die bandkeramische Siedlung auf dem Mühlengrund in Rosdorf, Ldkr. Göttingen, in: Frühe Bauernkulturen in Niedersachsen. Archäologische Mitteilungen aus Nordwestdeutschland. Beiheft 1. Oldenburg 1983, 45–90, Abb. 1, 9, 10–12.



Pfostenlöcher folgten einander unregelmäßig und lückenhaft, so, dass dieser Bau praktisch nur durch die Längsgruben gedeutet wurde (*Abb. 2. 7*). Dieses Haus könnte ein „Kleinbau“ der Einteilung von Moddermann nach gewesen sein.<sup>21</sup> Ein wichtiges Moment ist in diesem Fall die westlich vom Gebäude laufende Pfostenreihe, die vielleicht der Rest eines Zaunes gewesen sein könnte.

Obwohl die Beispiele noch lange erwähnt werden könnten, wegen Platzmangel wurden hier nur die wichtigsten Entsprechungen aufgezählt. Weitere Parallelen wurden schon in einem früheren Artikel behandelt.<sup>22</sup>

Die oben gesagten kurz zusammenfassend können wir vielleicht mit Recht feststellen, dass es hier von einem nur teils erkannten, aber bis dato nicht definierten Typ der früh- und mittelpaläolithischen Häuser handelt, der in mehreren Hinsichten von dem Standardtyp der mitteleuropäischen Linienbandkeramik abweicht.<sup>23</sup> Sie vertreten alle drei, der Größenordnung nach aufgestellten Typen (Kleinbau, Bau, Großbau). Diese Gebäude bestehen aber nur aus drei Pfostenreihen, während die hausbegleitenden Längsgruben manchmal Pfostenspuren erkennen lassen. Diese Pfosten konnten aber keinesfalls eine so große und schwere Konstruktion wie die Außenwände dieser Häuser tragen, sie waren eher einfache Dachstützen. Diese oftmals erkennbare schwächere Konstruktion läßt besonders bei den Kleinbauten eine andere Funktion – Speicher oder Ställe – vermuten.<sup>24</sup>

Wichtige Unterschiede zu den Standardgrundrissen sind ferner, dass auch der Fundamentgraben im NW-Teil des Hauses fehlt, und dass die Außenwände dieser Häuser als einfache Pfostenreihen rekonstruiert werden können. In dieser Hinsicht sind noch die Feuerspuren in den Häusern von Bedeutung, da noch keine Herde in den standardisierten Häusern der frühen Linienbandkeramik gefunden wurden.<sup>25</sup> Über die Lage dieser Gebäude innerhalb der Siedlungen konnte es festgestellt werden, dass sie in den meisten Fällen zwischen Häuserreihen klassischen Typs, am Rand der Ansiedlungen oder in deren Nähe standen. In Dunakeszi fällt es im ersten Augenblick auf, dass die Abfallgruben, die sich in anderen Ansiedlungen in der Umgebung der Häuser befanden, ein einziges Beispiel (Objekt 91) ausgenommen, fehlen.<sup>26</sup>

Diese Gebäude können nicht einem oder anderem Areal, bzw. einer oder anderer Unterperiode der Linienbandkeramik zugewiesen werden, weil sie in einem riesigen Gebiet von den Niederlanden bis zur mittleren Donau auftreten und von der frühesten Linienbandkeramik an (Brunn, Szentgyörgyvölgy) bis zur Flomborn–Notenkopfkeramik-Periode (Rosenburg) datieren, während ganz genaue Entsprechungen auch in gleich frühen Siedlungen (Altdorf, Schwanfeld) zu finden sind.

Wie gesehen, hatten diese Häuser also einen einfacheren Aufbau als der Standardtyp, und sie waren in einigen Fällen auch kleiner. Jedoch können wir diese „Abweichungen“

<sup>21</sup> J. Lüning: Ausgrabungen zur ältesten Bandkeramik im Nördlinger Ries. *AJB* 1987, 33, Abb. 4.

<sup>22</sup> Unter anderen: Landshut, Wang, Alteglofsheim und Straubing (Deutschland), Strögen und Rosenberg (Österreich) ferner Elsloo (Niederlande); L. A. Horváth: Neolithische Funde und Befunde in der Gemarkung von Dunakeszi. *ActaArchHung* 53 (2002) 26–27.

<sup>23</sup> J. Lüning: Forschungen zur bandkeramischen Besiedlung der Aldenhovener Platte im Rheinland, in: *Nitra* 1982, 125–156, Abb. 19; J. Lüning: Stand und Aufgaben der siedlungsarchäologischen Erforschung des Neolithikums im rheinischen Braunkohlenrevier, in: G. Bauchhenß (Hrsg.): *Archäologie in den Rheinischen Lössbörden. Beiträge zur Siedlungsgeschichte im Rheinland. Rheinische Ausgrabungen* 24. Köln 1983, 33–46, Abb. 3; Lüning 1988, Abb. 33; Chr. Strahm: Einführung: Prähistorische Siedlungsmuster in Europa, in: *Symposium Settlement Patterns*

between the Alps and the Black Sea 5<sup>th</sup> to 2<sup>nd</sup> millenium B.C. V. *Memorie del Museo Civico Storia Naturale di Verona. Sezione del Science dell'Uomo* 4. Verona – Lazise 1995, 17–34, Abb. 7; Boelcke 1982, Abb. 19; E. Lenneis: Zu den ersten festen Wohnhäusern und Siedlungen im Raume Österreichs. *MAGW* 121 (1991) 121–136, Abb. 3.

<sup>24</sup> Dagegen liegen auch Langhäuser von diesem Typ vor, die trotz ihrer schwächeren Konstruktion auch Wohnhäuser gewesen sein könnten.

<sup>25</sup> W. Meyer-Christian: Die Y-Pfostenstellung in Häusern der Älteren Linearbandkeramik. *BJ* 176 (1976) 2; E. Lenneis: Altneolithikum: Die Bandkeramik, in: E. Lenneis – Chr. Neugebauer-Maresch – E. Ruttkay: *Jungsteinzeit im Osten Österreichs. Mit Beiträgen von Christian Mayer, Johannes-Wolfgang Neugebauer und Peter Stadler.* St. Pölten – Wien 1995, 18, 30.

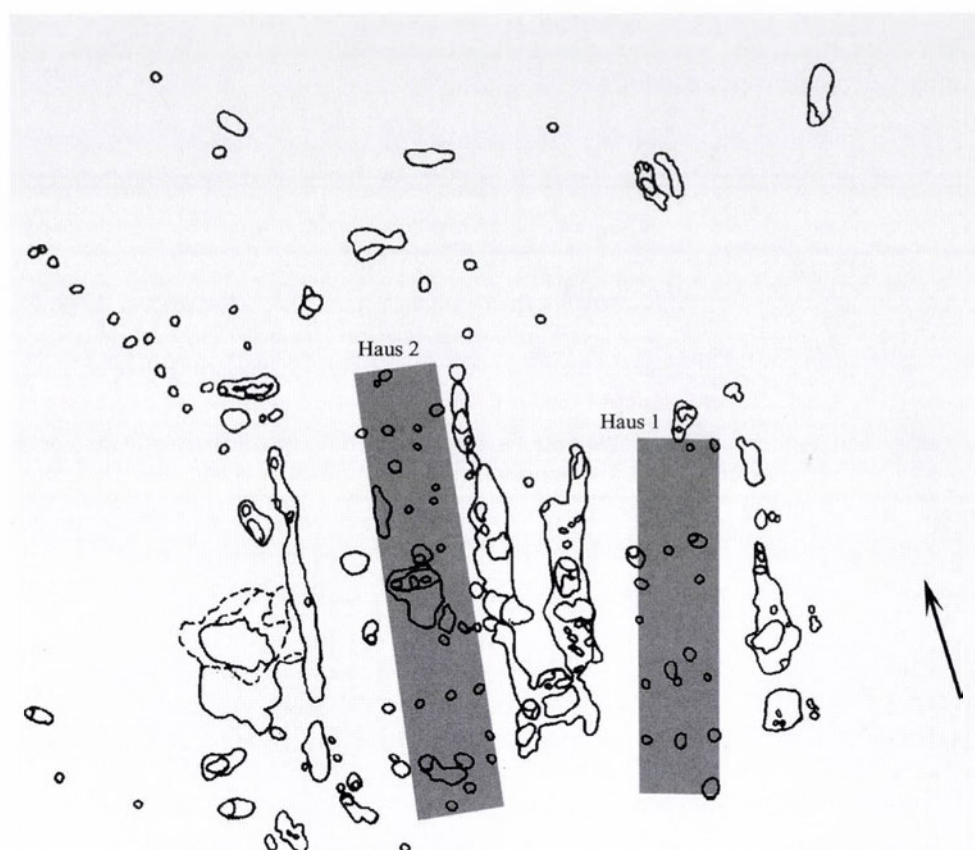
<sup>26</sup> Boelcke 1982, 18.

einfach nicht für einen bloßen Zufall halten. Hinsichtlich dessen, dass es auch zwischen den behandelten Gebäuden kleinere Unterschiede gibt, scheint es wahrscheinlich zu sein, dass diese Typologisierung der frühlinienbandkeramischen Häuser im Laufe späterer Analysen noch weiter verfeinert werden kann.

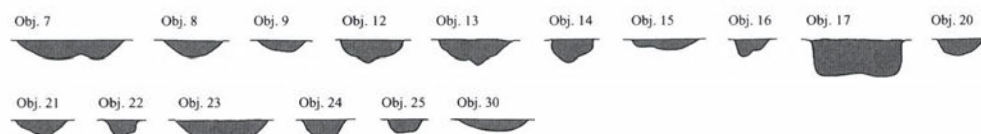
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### Haus 1



### Haus 2

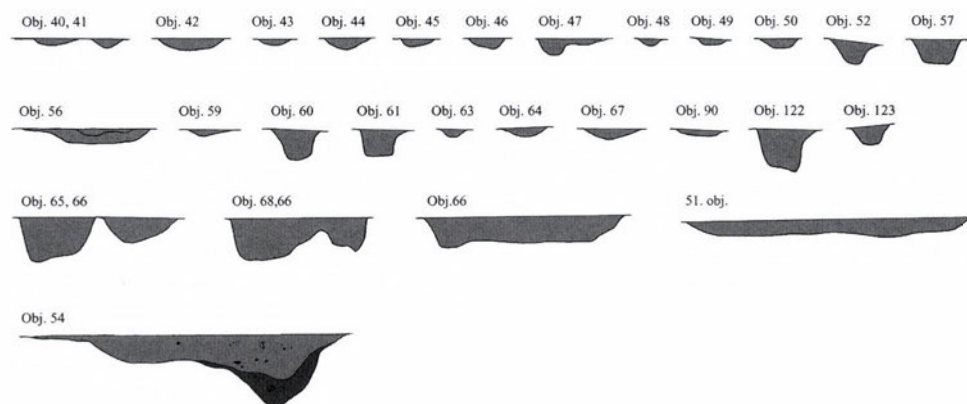


Abb. 1. Die neolithischen Häuser von Dunakeszi-Székesdűlő

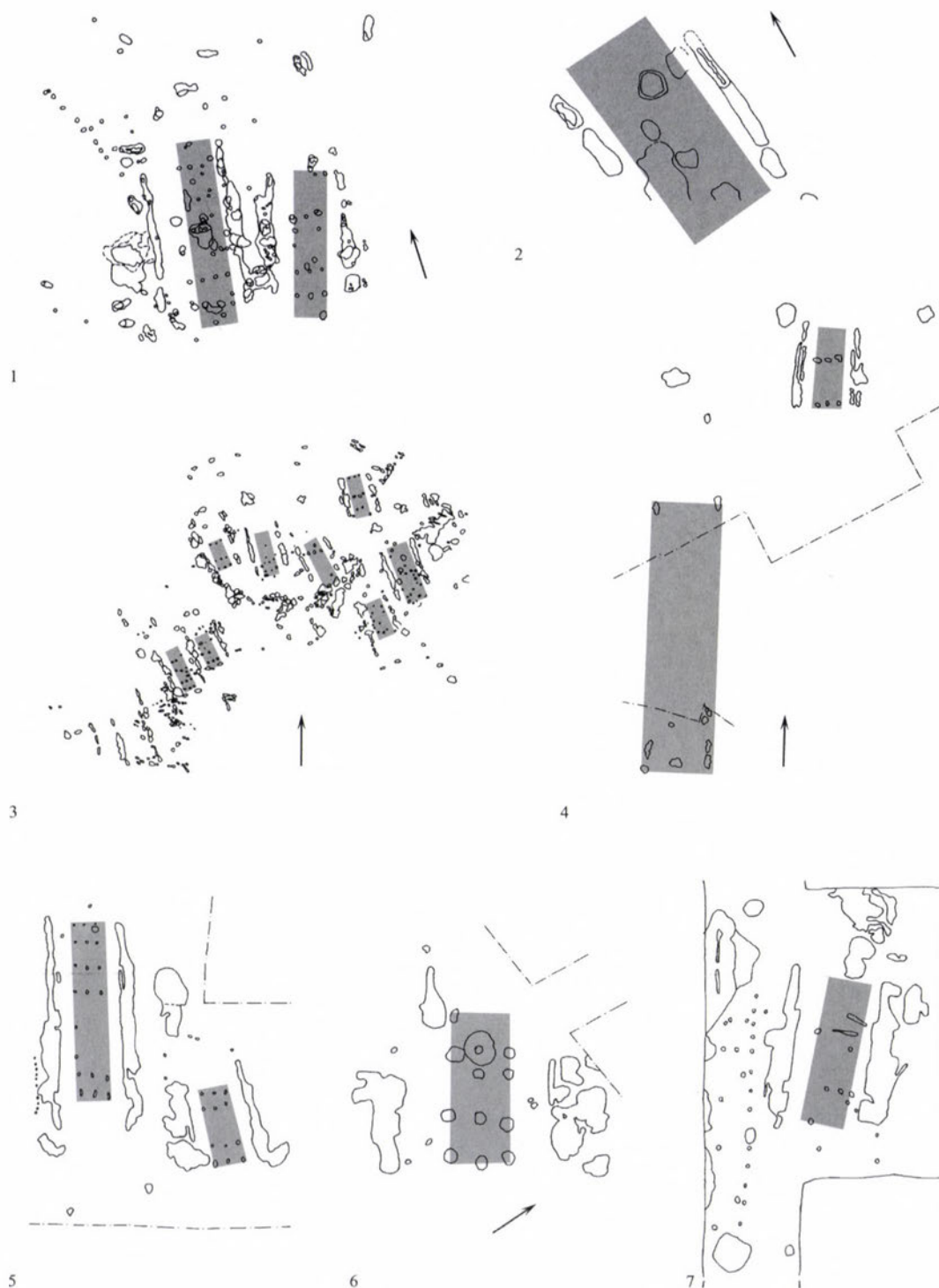


Abb. 2. 1. Die neolithischen Häuser von Dunakeszi-Székesdülő, 2. das Haus von Szentgyörgyvölgy-Pityerdomb, 3. die frühneolithischen Häuser von Brunn, 4. die frühneolithischen Häuser von Altdorf, 5. die neolithischen Häuser von Schwanfeld, 6. das neolithische Haus von Rosdorf, 7. das neolithische Haus von Enkinken





## PROVENANCING: METHODS, POSSIBILITIES, PROBLEMS

Provenance studies are fairly topical in modern archaeological research, being part of geoarchaeology, on the one hand<sup>1</sup> and general archaeometry on the other.<sup>2</sup> These studies can help us to follow the movement of goods and obviously the movements of the people transporting them. By coming to an understanding of how things moved special significance can also be recognised – both aesthetic and functional – in terms of quality and the effort involved in transporting objects over longer distances.

Most of the archaeological objects found on various types of sites – settlements, graves, depot finds etc – have been detached from their original contexts – bedrock, habitat etc. – to become “utensils” or “goods” used by these prehistoric ancestors and seen as “finds” by us. Provenancing deals with tracing back the route of the object found on the site to the source or some stations along this route: mines and workshops using scientific analysis. It is only a small portion of the finds that can unambiguously be traced from quarrying/processing/use to the archaeological site proper. However, the number of these items and the ratio of their contribution to general knowledge of prehistory is constantly growing.

Materials particularly suitable for provenancing include natural materials where their occurrence is in a restricted region like rocks, minerals and fossils, as well as animals/plants from restricted areas. These aspects clearly depend on the natural characteristics of the archaeological sites.

Artificial materials with some natural components and special production technology can also be traced back to source(s) and workshop(s), i.e. some distinct spatial/temporal location in the former life of the object when it underwent some important and specific activity – extraction, processing, firing, melting etc.

M. DeGrooth suggested a scheme for describing the “life” of the object from bedrock to discarded tool.<sup>3</sup> She elaborated the scheme for chipped stone tools: however, a similar – more general – outline can be drawn up for almost all of the human products (*fig. 1*).

The actual movement of goods can be observed, provided the conditions of preservation are favourable. Quite a large part of the objects actually traded have never come down to us. It is evident from ethnographical analogy that most of the goods traded and exchanged, even looted, comprise materials that leave few traces in the archaeological record like food, spices/narcotics and textiles. Even if the preservation is favourable, e.g. in the case of livestock which was often traded, there is little chance to demonstrate that the bones were not of local origin. Large-scale movements, however, can be deduced from isotope studies as great changes in the environment (altitude, food basis) all of which leave their signatures in the bone material.

In a number of cases, however, the non-local existence of the finds can be clearly demonstrated. Marine shells found in continental contexts or various rocks found in a flat alluvial plain are themselves clear signs of the movement of goods. For most such objects of alien origin, the source (region) can be identified with some certainty.

### *Provenancing techniques*

The identification of the source of objects can be based on various methods. There are, however, some necessary steps to be followed.

The first thing is to identify the problem, i.e. the material suitable for provenancing. We start this process of recognition by the macroscopic analysis of the finds, separating the

<sup>1</sup> Herz – Garrison 1998.

<sup>2</sup> Jerem – Biró 2002.

<sup>3</sup> DeGrooth 1988.



“special” and “curious” from among the mass of more general finds. In doing this we are certainly following the practice of the prehistoric people who also separated these materials from the surrounding world and preferentially selected them for their own purposes. We can say that our ancestors were very good field geologists and had a sound knowledge of different materials and their suitability for different activities.

After focusing on the specific raw material, it becomes possible to map known occurrences on archaeological sites – possibly also noting the temporal (stratigraphic) and functional dimensions as well. The more specific and unique the material we are tracing, the more can be expected from simple distribution studies, even without knowing the exact place of origin. Thus, distribution maps of, e.g. obsidian or specific pottery, such as Samian ware, yield meaningful results on trade and contacts long before the actual scientific characterisation of the sources/workshops takes place.

The distribution pattern of a given specific raw material in itself speaks clearly to the attractions and popularity of the stuff. Depending on the acquisition strategy, the core of the distribution area will be located around the source(s). In the case of interacting supply regions, distinguishing the individual sources and their production may be essayed by certain “fingerprinting” techniques. For this, knowledge of the source proper is not indispensable because the distinct “groups” can be distinguished based on certain qualities inherent to the archaeological evidence itself.

The more typical and perspective approach, however, begins with the identification of the potential sources in a region and their distinction by, hopefully, objective methodology and transferring experience to the archaeological evidence. Such a strategy – a collection and database approach – was adopted in “Lithotheca”, the comparative raw material collection of the Hungarian National Museum.<sup>4</sup> By surveying the sources and creating a systematic description of the material, most of the important raw materials, present in great quantities, can be identified and allocated to source regions with reasonably probability.

Normally, a raw material of inferior quality would be used only in the immediate vicinity of the sources. The better the quality, the larger will be the observed radius of distribution and the limits of the regular supply zones will be balanced between available raw material source regions. The problem starts again with the highest quality raw materials, which can “move” over hundreds of kilometres, across prehistoric cultural boundaries and supply regions. For the identification of distant raw materials, scientific (s.l.) characterisation is indispensable. The problem is that most of the procedures suitable for unambiguous (?) identification of the source are typically expensive and often destructive. The exact identification of raw materials is even more complicated because the level of knowledge on the sources will be very different and often inadequate. Therefore provenancing is a very time-consuming and difficult task where co-operation is most important, on the regional as well as the disciplinary scale.

Scientific methods suitable for provenancing include standard petrographical, physical and, chemical analytical techniques. For natural substances and composite materials made of unaltered, or not too greatly altered constituents, petrographical and mineralogical methods of analysis can be very revealing. The main drawback is that relatively large amounts of material are necessary and, consequently, this can cause serious damage to the object itself. The harmful effects can be minimised by using fragments for analysis and documenting the pieces investigated, in drawings and photos prior to and after analysis. To start a destructive analysis on an archaeological object, however, needs a well-defined purpose anyway. Using petrographical methods, the identity (name, origin) of the rock can be clarified and hypotheses on provenance (at least, region or regions to be considered) can be made.

Methods of minimal destruction such as Laser Ablation Mass Spectroscopy and various Ion Beam Analysis techniques (PIXE<sup>5</sup>, PIGE<sup>6</sup>) are easier on the object but since they are derived from a very small surface, may be less informative. Standard geochemical analyses

<sup>4</sup> Biró – Dobosi 1990; Biró et al. 2000.

<sup>5</sup> Particle Induced X-ray Emission Spectrometry

<sup>6</sup> Particle Induced Gamma-ray Emission Spectrometry

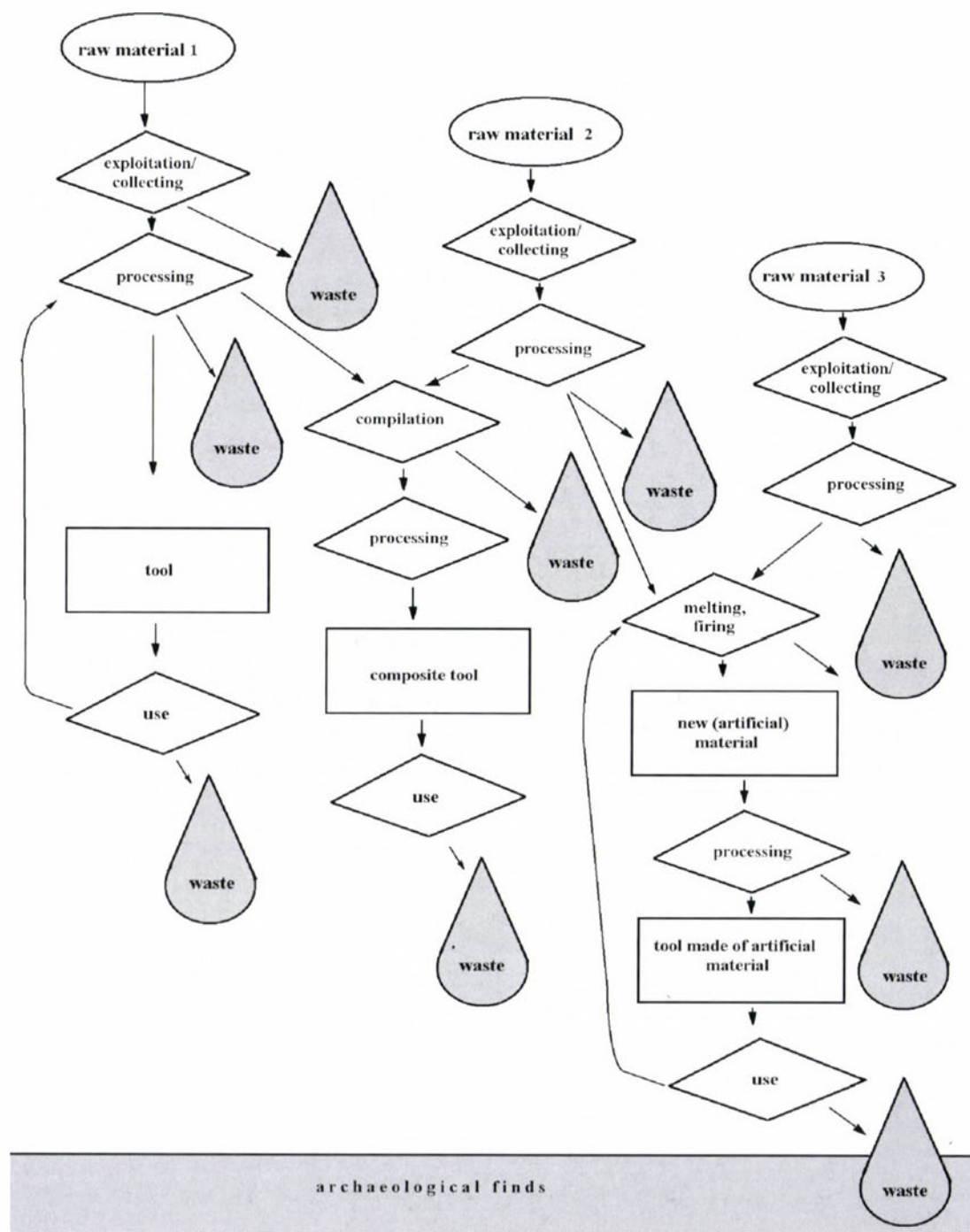


fig. 1. Flow chart on the “life” of archaeological finds from raw material acquisition till moment of discard



Raw material	Method used	References
chipped stone tool raw materials, general	distribution maps distribution maps petrography chemical analyses, summary	<i>Biró 1988.</i> <i>Biró 1998.</i> <i>Dobosi 1978.</i> <i>Biró et al. 2000.</i>
obsidian	distribution map distribution map distribution map OES <sup>45</sup> INAA <sup>46</sup> EDS <sup>47</sup> , XRF <sup>48</sup> PIXE <sup>49</sup> -PIGE <sup>50</sup> FTD <sup>51</sup>	<i>Rómer 1876.</i> <i>Roska 1934.</i> <i>Biró 1981.</i> <i>Cann–Renfrew 1964.</i> <i>Williams et al. 1984.</i> <i>Biró et al. 1986; Biró 1988.</i> <i>Elekes et al. 2000.</i> <i>Biró – Bigazzi – Oddone 2000.</i>
Szeletian felsitic porphyry	distribution map XRD <sup>52</sup> PGNAA <sup>53</sup>	<i>Simán 1986b</i> <i>Vértes – Tóth 1963.</i> <i>Markó et al. 2003.</i>
rock crystal	Fluid Inclusion Analysis	<i>Dobosi – Gatter 1996.</i>
radiolarite	distribution maps PIXE-PIGE	<i>Biró – Regenye 1991.</i> <i>Elekes et al. 2000a.</i>
hydrothermal and limnic silicites	distribution map petrography, OES XRD	<i>Biró – Szakáll – Simán 1984.</i> <i>Biró – Pálosi 1986.</i> <i>Viczián 1986.</i>
flint	distribution maps INAA PGNAA	<i>Simán 1989.</i> <i>Varga 1991.</i> <i>Kasztovszky et al. 2002a.</i>
polished stone tool raw materials, general	distribution map petrography	<i>Biró – Szakmány 2000.</i>
Green schist	petrography PGNAA	<i>Szakmány – Kasztovszky 2001.</i>
Blue schist	petrography	<i>Józsa et al. 2001.</i>
basalt	petrography PGNAA	<i>Schléder – Biró 1999.</i> <i>Füri 2003.</i>
phonolite	petrography	<i>Biró et al. 2001.</i>
andesite	petrography	<i>Judik et al. 2001.</i>
marble	Stable isotope analysis Cathodo-luminescence	<i>Demény et al. 1997.</i> <i>Zöldföldi et al. 2002.</i>
pottery	petrography INAA	<i>Szakmány 2001.</i> <i>Balla et al. 1988.</i>
bronze-casting moulds (stone and fired clay)	petrography	<i>Péterdi et al. 2002.</i>
glass	OES XRD	<i>Zimmer 1988.</i> <i>Fórizs et al. 2000.</i>
metal	OES REA (XRE) <sup>54</sup> PIXE-PIGE PGNAA electron microprobe	<i>Junghaus et al. 1960.</i> <i>Kis Varga – Költő 1985.</i> <i>Uzonyi et al. 2000.</i> <i>Kasztovszky et al. 2002b.</i> <i>Czajlik – Sólymos 2002.</i>
amber	distribution map IRS <sup>55</sup>	<i>Horváth 1999.</i> <i>Dobosi 1985.</i>
fossil molluscs	palaeontological (macroscopic) analysis	<i>Gábori 1969.</i> <i>Dobosi 1985.</i>
Spondylus	distribution map	<i>Kalicz – Szénászký 2001.</i>

Table 1. A selection of provenancing studies – methods and results – published from Hungary.

<sup>45</sup> Optical Emission Spectroscopy

<sup>46</sup> Instrumental Neutron Activation Analysis

<sup>47</sup> Electron Energy Dispersive Spectroscopy

<sup>48</sup> X-Ray Fluorescence Spectroscopy

<sup>49</sup> Particle Induced X-ray Emission Spectrometry

<sup>50</sup> Particle Induced Gamma-ray Emission Spectrometry

<sup>51</sup> Fission Track Dating

<sup>52</sup> X-Ray Diffraction Analysis

<sup>53</sup> Prompt Gamma Neutron Activation Analysis

<sup>54</sup> Röntgen emissziós analízis [X-Ray emission analysis]: abbreviations by the authors

<sup>55</sup> Infra-Red Spectroscopy

such as INAA<sup>7</sup> or ICP-MS<sup>8</sup> preferentially use a larger quantity of well-homogenised samples. Also, a relatively small amount of material is needed for isotope geochemical analysis, preferable for the identification of marble and investigation of organic materials, i.e. bone or tooth enamel.

Recently, we have tried to apply a new and non-destructive analytical technique (PGNAA<sup>9</sup> or PGAA<sup>10</sup>) for the analysis of bulk chemical composition of archaeological artefacts. Good results have been achieved on different lithic raw materials<sup>11</sup> and preliminary applications have begun on pottery and metals as well.<sup>12</sup>

Different dating techniques, used for the determination of the age of the rock can also help in the identification of the source: a good example is the application of FTD<sup>13</sup> on obsidian.<sup>14</sup> In a similar manner, FTD can be useful for identifying workshops producing glass.

The number of objects for which provenance analysis may be used is gradually growing and the results are more and more meaningful in an archaeological context. We are, however, quite far from using this methodology in a routine way on archaeological finds. A lot has to be done in basic research, documentation and integration of results into an archaeologically oriented interpretation.

Without aiming at full coverage, in *Table 1*, we have attempted to summarise some successful or promising provenancing studies made on archaeological (mainly prehistoric) materials.

### ***Provenance in the archaeological context***

#### **ARCHAEOLOGICAL SITES: SPATIAL, TEMPORAL DIMENSIONS**

Archaeological sites are traditionally interpreted in a chronological and geographical framework. Coeval sites with basically similar material cultures and spiritual worldview constitute the basic technical units for archaeology, ranked into “entities”, “cultures”, “groups” depending on the assumed coherence of proximity. These units, more or less, hopefully correspond to the formerly existing structure in prehistoric communities.

Movement of goods obviously did take place within the communities characterised by similar material culture. The resources are unevenly distributed with time and place for all activities within the group, however it actually functioned. The land use of prehistoric communities remains fairly unexplored, though certain patterns have already been established. Exploitation sites/mines are found typically outside the normal habitation zone, their location determined mainly by the geological conditions. The popularity of certain sources, however, compared to other sources of similar quality might depend on accessibility resulting from geographical as well as settlement historical factors.

Prehistoric mines are fairly well catalogued due to the initiatives of the Bochum Mining Museum.<sup>15</sup> The most recent complete catalogue with respect to “flint mines” was compiled on the occasion of the VIIth Flint Symposium<sup>16</sup> and for Hungary, in the recently published volume “Magyar régészet az ezredfordulón (Hungarian archaeology at the Millenium)”. New data on polished stone tool quarries were also added.<sup>17</sup>

The goods may simply move from quarry/place of origin to the habitation site or the place of utilisation, which is not necessarily the same. Different stages of workshop activity can intrude in-between or at the above loci. Some “industrial regions” with respect to certain prehistoric raw materials can be postulated in different periods and with respect to certain raw materials. Thus, in the past few years distinct workshop regions were recognised in the Bakony Hills for the exploitation of radiolarite and flint.<sup>18</sup> On some sites with favourable

<sup>7</sup> Instrumental Neutron Activation Analysis

<sup>8</sup> Inductively Coupled Plasma Spectroscopy – Mass Spectroscopy

<sup>9</sup> Prompt Gamma Neutron Activation Analysis

<sup>10</sup> Prompt Gamma Activation Analysis

<sup>11</sup> Szakmány – Kasztovszky, *in print*.

<sup>12</sup> Kasztovszky *et al*, *in print*.

<sup>13</sup> Fission Track Dating

<sup>14</sup> Biró – Bigazzi – Oddone 2000.

<sup>15</sup> Weisberger 1980.

<sup>16</sup> Lech 1995.

<sup>17</sup> Bácskay – Biró 2003, fig. 26 in: MRE 2003.

<sup>18</sup> Biró – Regenye 1995; Biró – Regenye 2003.



– probably very consciously selected – geological/geographical settings such as Aszód–Papi földek<sup>19</sup> or Zengővárkony,<sup>20</sup> various kinds of workshop activity took place, comprising several kinds of raw material (Aszód: bone and antler,<sup>21</sup> obsidian and limnic quartzite,<sup>22</sup> basaltic andesite;<sup>23</sup> Zengővárkony: Mecsek radiolarite<sup>24</sup> and phonolite).<sup>25</sup> The area around the Tokaj Hills has long been known to be rich in raw materials and, consequently so are settlements specialised in the exploitation of high quality raw materials and their processing to various degrees. The obsidian-workshops located by the best quality obsidian in Slovakia already operated in the Upper Palaeolithic period (Cejkov and Kašov).<sup>26</sup> In the Early Neolithic, expeditions were seemingly mounted to the source area by the people living on the lowlands (Kőtelek, Méhtelek, Mezőkövesd, Füzesabony<sup>27</sup>) resulting in a very high percentage of obsidian use on the sites and practically no known traces of habitation around the sources. A different strategy for raw material procurement and probably inter-tribal division of labour had developed by the Middle Neolithic. The heyday of workshop activities around the sources was probably during the time of the Tiszadob and Bükk cultures,<sup>28</sup> when these top-quality sources were heavily exploited. Lengyel culture obsidian processing workshops (Aszód, Csabdi, Kolary) are already located at considerable distances from the sources and work on much smaller nodules appear to have been grabbed in haste from already impoverished sources.

The structure of the hydro- and limnoquartzite supply seems to be entirely different. The workshops around sources like Hejce or Boldogkőváralja<sup>29</sup> realised a high level of elaboration on the material which was transported to regions poor in stone raw materials in the form of blades. This was necessary because the expertise necessary for working the very rigid post-volcanic siliceous rocks with numerous “faults” – traces of plants, inclusions, cavities – was not common knowledge and working on these materials resulted in a large amount of waste. A new workshop-site for processing Northern Tokaj limnic quartzite, has recently been excavated by Judit Koós.<sup>30</sup> The elaboration of the material is currently in progress.

Some degree of local working also took place on the regular habitation sites, however the overall quantity of tools and more typically that of production waste is much lower. Differences between a general (not “industrial” site) and a workshop site are mainly apparent in the relatively high ratio of (finished, used, broken etc.) tools compared to production waste, mainly in the initial phases of production.

The movement of special quality raw materials, such as obsidian, Szentgál radiolarite, greenschist etc. surpassed the boundaries of communities characterised by similar material cultures. High quality raw materials travelled in the form of typically finished tools or elaborate half-products (e.g. blade cores) across cultural/political boundaries.

#### RAW MATERIAL “SITES”: SPATIAL, TEMPORAL DIMENSIONS

Raw material utilised by prehistoric people embraced a large number of commodities. Quite a large proportion of these was available in their immediate surroundings and yield very few, if any, grounds for provenance analysis. Such items include organic matters – bone, antler, vegetal substances like wood or plant tissues for fabric and textile. Some of the utilised materials of organic origin, though may have a definable spatial dimension, e.g. the use of marine shells (*Spondylus*, cowry) or other substances undoubtedly of distant origin: coral, ivory etc. Organic materials and raw materials of organic origin were typically “recent” in the sense that they had been existing coeval to the group using them. There are, however, instances when fossil bone or fossil molluscan remains were utilised, such as Tertiary molluscan shells by Upper Palaeolithic hunters.<sup>31</sup> In the opinion of István Vörös, most of the mammoth bone objects from the Late Pleistocene were collected as sub-fossil elements, i.e. bones of an already

<sup>19</sup> Kalicz 1985.

<sup>20</sup> Dombay 1939; Dombay 1960.

<sup>21</sup> Antoni 1990.

<sup>22</sup> Biró 1998.

<sup>23</sup> Biró 1992; Judik et al. 2001.

<sup>24</sup> Biró 1989; Biró 1990.

<sup>25</sup> Biró et al. 2001; Biró et al. *in press*

<sup>26</sup> Bánesz 1967.

<sup>27</sup> Bácskay – Biró 1983; Starnini 1993; Biró 2001.

<sup>28</sup> Bánesz 1991; Biró 1998.

<sup>29</sup> Losits 1981; Vértés 1965.

<sup>30</sup> Hidasnémeti-Kőteles

<sup>31</sup> Gábori 1969; Dobosi 1985



practically extinct animal.<sup>32</sup> The spatial dimension of the contemporary distant elements agree with their habitats (e.g. *Spondylus*)<sup>33</sup> while fossils can be associated with known collecting spots already form a geological time scale.

Inorganic materials used, more or less, consciously certainly provide more information for provenance studies. Clay extracted from pits to be used for wattle walls and pottery was typically, though not necessarily, local. Tempering material used for the production of pottery could be also local (sand, chaff) but it seems that distant materials – metamorphic and igneous rock fragments – were also frequently used. These tempering materials of distant origin could also be “local” in the sense that small fragments grit from worn quern-stones, polishers, axes etc. could be used occasionally or with and with intention. There are also a lot of “household stone utensils” – hammer-stones, cooking stones, rocks used for fixing i.e. tent bases (*Dömös*)<sup>34</sup> which are basically local, originating from the immediate surroundings of the site. In most archaeological surveys till the very recent times these “blocks of stone” were not collected and only mentioned in the very best cases. On modern large surface excavations where all evidence from closed archaeological units are preserved, these stone tools may occur in very large quantities. For example, on the excavations of the motorway M7 in Zala county, close to the Mura river, came an incredible number of heavily utilised pebbles (mainly local quartzite). The large number of finds is obviously related to local characteristics, i.e. the wealth of handy and hard pebbles – a feature which had probably considerable impact on the life of the people along the Mura river.

Specialised tools, however, always needed better raw materials. Since the Early Palaeolithic we can observe very conscious use of optimal raw materials. In the Early and Middle Palaeolithic periods, accessibility of good raw material not very far from the habitation site was one of the factors influencing the spatial development of human settlement systems. Long distance movement of special quality raw materials emerged by the Middle Palaeolithic, though we do not know if these early instances of long distance transports can be assigned to trade, gifts or movement of the related communities e.g. occurrence of *Swieciechów* flint in *Sólyomkúti* (*Vidróczky*) rock shelter or obsidian in *Pilisszántó II* cave, both dated to Middle Palaeolithic.<sup>35</sup> A regional supply of preferred raw materials, far surpassing one-day-walking distance was already established by the Middle Palaeolithic, as is apparent from the results of a new field survey conducted by A. Markó and A. Péntek in the Cserhát Hills. The collected items of Middle Palaeolithic character were often made of *Szeletian felsitic porphyry*, a favourite raw material collected in the eastern parts of the Bükk Mountains. The identity of the rock was checked by instrumental analytical technique, i.e. Prompt Gamma Activation Analysis.<sup>36</sup>

The first exploitation sites clearly documented by traces of mining could be also dated to the Middle Palaeolithic, though dating a quarry site is always a difficult problem. First, because the traces of exploitation in themselves carry no chronological implication, second, because very few datable remains were left behind by the (temporary) users of the resources and, finally, because of the possible permanent/lasting use of the raw material sources over the different cultures. Quarry sites associated with the Middle Palaeolithic/Early Upper Palaeolithic in Hungary comprise *Budapest–Denevér street*,<sup>37</sup> *Miskolc–Avas*,<sup>38</sup> *Korlát*,<sup>39</sup> and *Erdőbénye–Sás stream*.<sup>40</sup>

By the Upper Palaeolithic, the chipped stone lithic inventory reached the height of its complexity. In spite of the long use of this technique in the production of tools, the wealth of forms was not enlarged essentially by (later) prehistoric stone knappers. Also, the complexity of the raw material distribution pattern seems to be fully functioning by this time. It is very difficult today to draw supply zones and reconstruct systems because due to the large time scale of the Palaeolithic we do not really know the existing coeval communities as well as

<sup>32</sup> *Vörös 2000.*

<sup>33</sup> *Kalicz – Szénászký 2001.*

<sup>34</sup> *Gábori 1964.*

<sup>35</sup> *Vértés 1960; Biró 1984.*

<sup>36</sup> *Markó et al. 2003.*

<sup>37</sup> *Gábori–Csánk 1989.*

<sup>38</sup> *Simán 1986a*

<sup>39</sup> *Simán 1995.*

<sup>40</sup> *Bácskay 1995.*



the units of controlled land. We cannot see the Upper Palaeolithic system of raw material circulation as a network yet although more importantly we can – and do – draw the so-called “action radius” of Upper Palaeolithic communities on the basis of the provenance of raw materials found on the sites. Long distance distribution of certain high quality raw materials (obsidian, Prut flint, rock crystal) can be demonstrated in quite a few instances over distances of several hundred kilometres.

By the beginning of the Neolithic period, habitation sites finally become detached from the environs of the raw material sources. It was more important to live on fertile arable land, which could be cultivated than live close to raw material sources. It seems that early farming communities typically solved their bulk raw material needs by expeditions to the sources, starting out from the agricultural settlements located from 30–100 km from the source. With the formation of the dense settlement system of the fully developed Neolithic communities, a certain division of labour appeared among the settlements. The sites lying relatively close to the raw material sources definitely specialised in exploiting/controlling the source and producing half-products for further transport to the “non-industrial” settlements. Such habitation sites with intensive workshop activity were, for example Kup (for Tevel flint) and Mencshely –Vöröstó (for Szentgál radiolarite). By the end of the Middle Neolithic, the success of the agricultural communities on the Great Hungarian Plain (Alföld) region probably provided a basis for clearly industrial settlements in the North–Hungarian Mid-mountain range (typically, Tokaj Hills) to exploit and work materials full-time for lowland communities.

#### PROVENANCING COMPOSITE/CHEMICALLY TRANSFORMED MATERIALS

Determining the source of something of distant origin is difficult enough for goods made from natural products, transformed by humans only in a physical way – cutting, chipping, polishing etc. It is evident that most of the archaeological materials found on prehistoric sites are not like this. From the Palaeolithic period onwards, the number/ratio of artificial materials which do not occur in nature increased continuously. These materials could be chemically transformed (heated, burnt, melt) and they could be mixtures of several components, each component coming from different – identifiable? – sources. The resulting new materials – e.g. ceramics and metals (alloys) – are not found naturally in the environment and provenancing may be directed to locating some of the components or the “birthplace” of the new quality, the place of production – the settlement, workshop. For example, in the study of pottery, temper can be more characteristic of the origin of the grit used for temper. This place of origin can be indirect: fragments of used-up stone utensils, broken pottery fragments (grog) are often used, materials which may have a complicated history in themselves. The bulk composition, especially in the case of very special pottery may have more to do with the place of production, i.e. recipes and technology characteristic of a particular workshop. Hence the success of the provenancing for Samian ware and certain types of glass.

The investigation of metal and alloys is even more complicated as by re-melting the objects several times, these substances can be used and the chemical composition changed accordingly. Therefore most successful metal provenancing studies were made on very early (not recirculated) metals and special, homogeneous raw materials like lead.

The investigation of the quarry sites (mines) is most important in the case of composite materials as well, though traces of prehistoric utilisation will be often over-printed by modern industrial activity, like the threatened danger to the Roşia Montana Roman gold mines by planned modern industrial operations. The ore coming from a certain mine region may contain characteristic trace elements or have a characteristic isotopic composition that permits identification of its origin even following the elaborate processes of ore-dressing, smelting and forging.

With the composite materials made through chemical transformation, however, it is more likely to get data on the place of production, typically on a wider scale. Recipes for producing a certain substance like glass may be widespread over a relatively large area but certainly typical of the particular cultural context.<sup>41</sup>

<sup>41</sup> *Fórizs et al. 2000.*



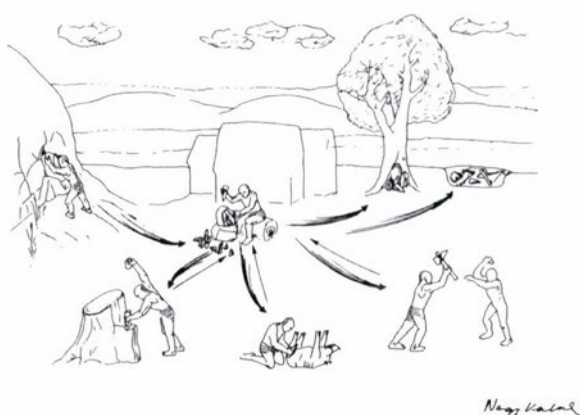


fig. 2. "Movement" of the raw material: Possible route covered with one "owner"

### Interpretation

It is clear that provenance studies on different levels can be of great help in understanding the past. At the same time, they raise new problems as to the actual mechanism of transport.

The simplest case would imply a self-sufficient approach. As the resources are unevenly distributed and everyday life takes place on a location different from the source of raw materials, it is necessary to collect/exploit the commodities used for the actual needs of the community. The production of the finished tool/vessel etc. would normally take place on the settlement (with tools and production waste). Their place of use may be confined to the settlement but more typically "moves" with the owner. The discarded pieces are typically found again in the context of the settlements because personal belongings would tend to be more concentrated here than in places where their use was uncertain. A special case is provided by grave goods and depot finds, stored for further use in this world or beyond earthly concerns (*fig. 2*).

The movement of material can be quite complicated even in this simple "autarchic" case. The typical situation, however, must have been even more complex. Probably different members of the community exploited the quarries, prepared the materials and used the various types of artefacts. The geological/geographical characteristics of a region and natural division of labour no doubt connected a given piece of artefact and made from a certain raw material, to a number of persons during its life-cycle from raw material to rejected piece of worn artefact, i.e. discarded junk. The same exploited block could serve widely different ends in the hands of several persons, simultaneously and over a longer time period as the artefact was transformed and reworked several times (*fig. 3*).

As we can see, one person could have carried the same (block of!) raw material to various places and have distributed it among several users without the need to hypothesise any sophisticated forms of social contact and exchange system. The finished artefact, however, did not necessarily remain in the possession/use of the community exploiting and processing the raw material. Typically, products from the "industrial region" were spread in the form of regular supply to other communities, which belonged to the same cultural/ethnic?/political? community (category?). The bulk distributions of regional raw materials seem to follow the territory of cultural units defined on the basis of other elements of the material culture. This process is clearly seen in the analysis of the main raw materials used for chipped stone artefacts in Hungary from the Neolithic till the Copper Age.<sup>42</sup> The regulation of access to the sources (if any), that is, the mechanism of actual distribution is not known to us. We can only form our conclusions from the traces and the quantity and ratio of half-products compared to finished/used artefacts on the individual sites. It is clear that the pattern changed depending

<sup>42</sup> Biró 1998, esp. Map series.



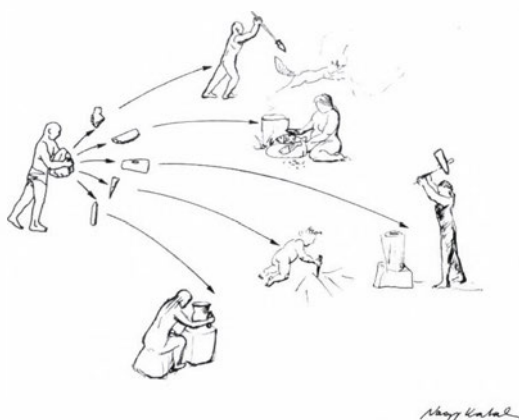


fig. 3. "Movement" of the raw material: Possible route covered within the "owner" community

on the raw material and chronological period. Raw materials which needed special expertise tended to be processed close to the sources and travel in a highly elaborate form as reflected by the blade-depot made of limnic quartzite (Boldogkőváralja).<sup>43</sup> On the other hand, easily worked valuable raw materials like obsidian can be processed from the stage of lumps and pre-cores quite far from the sources (e.g. Csabdi or Kolary). The strategy of raw material acquisition also changed through time as a function of the general settlement features and a seemingly more intensive protection of the source regions.<sup>44</sup>

Raw materials with special – aesthetic, functional – merits could also circulate beyond the "homeland". These "long-distance" raw materials travelled over very large distances and, sometimes crossed several, cultural boundaries. Their identification can be more difficult due to the extremely great distance from the source while the mechanisms by which they were transported is even more enigmatic. We can suppose the mediation of tradesmen, "diplomatic" gifts including kindred relations and also some form of warfare – as loot or goods abandoned in a far-away land by the intruders (*fig. 4*). These possibilities are not imaginary situations for prehistory; it is enough to mention Troy and its siege to see clearly that war and booty can work at least both ways. As time advanced it appears that materials and situations both become more complex and the range and intensity of contacts constantly increased.

Seen from the perspective of the sites, the extent of contacts documented by non-local materials present on the settlement, an "action radius" is hypothesised for prehistoric (mainly Palaeolithic) communities. The name in itself implies that the members – at least, some members – of the community actually covered these distances. In more recent prehistoric periods, however, the transport of the goods may have been restricted to a selected few persons (trades people) or, even more likely, the items physically moved by being passed from hand to hand. The most likely routes the objects actually covered seem to naturally agree with the modern road network, which is one of the reasons for the richness and variety of the prehistoric settlements along the new motorways. The geographical factors – proximity of mountains, waterways, passes and fords in rivers – governed the main roads of communication from the earliest times of human history till the present.

### **Conclusions and perspectives**

Provenancing is a most useful tool for the historical interpretation of archaeological evidence. It is, however, time-consuming and expensive due to the number of (preferably) non-destructive analytical techniques necessary for objective analysis. It is very easy to make mistakes for several reasons including not knowing all the sources used, interaction of

<sup>43</sup> Vértes 1965.

<sup>44</sup> Biró – Regenye 1991; Biró – Regenye 2003.

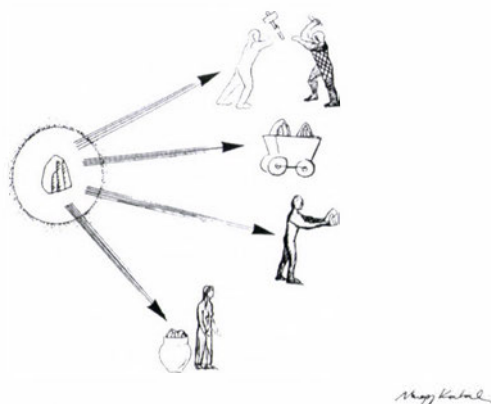


fig. 4. "Movement" of the raw material: Goods crossing beyond cultural boundaries

the physical/chemical properties of different sources studied by specific methods, problems of interpretation and so on.

Therefore, it is considered a good plan of action to share knowledge and responsibilities in multi-disciplinary and international co-operation programs using available fast channels for communication and sharing information. Such a project was currently realised within the framework of UNESCO, lead by D. Hovorka, entitled "Raw materials of the Neolithic/Aeneolithic polished stone artefacts: their migration paths in Europe" (IGCP-442, <http://www.ace.hu/igcp442>). A closing monograph of the project can be expected soon, reflecting our present state of knowledge in this matter.

For the same ends, we have just finished a National Science Foundation (OTKA 025086) project "Atlas of prehistoric non-metallic raw materials in the Carpathian Basin". We are trying to summarise existing data in a public, easily understandable form which can be also updated relatively fast ([www.ace.hu/atlas](http://www.ace.hu/atlas)). We have started to publish the data – and images! – of our comparative raw material collection in the same way ([www.ace.hu/litot](http://www.ace.hu/litot)).

The investigation of provenance is a complex task that needs the co-operation of analyst and archaeologist to achieve reliable and meaningful results. It is not easy to separate facts from hypotheses and hypotheses from dreams, not to speak about clearly mistaken views. Communication is also not easy but absolutely necessary. By the accumulation of data, availability of analytical facilities and regular scientific discussions we can better serve the historical interpretation of archaeological finds.



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## ROUND TABLE NOVEMBER 30, 2002, DISCUSSION (Compiled by Eszter Bánffy)

*E. Bánffy:*

Today's meeting focused on three, closely related archaeological phases within the Neolithic of the Carpathian Basin: the neolithisation process and the earliest neolithic period, both in the Alföld (Great Hungarian Plain) region and in Transdanubia, Western Hungary; the more developed LBK phases that followed the initial phase; and finally, the late neolithic formations that developed in the eastern region of the Carpathian Basin.

Similarly, discussing the problem of contacts has concentrated on three basic elements:

- the controllers and/or exploiters of resources;
- the others to whom the foreign material or ware arrived; and finally,
- the hypothetical mediators, who might have stood in-between groups living at great distances.

*F. Horváth:*

I should like to propose that the word "trade" not be used in societies with no monetary exchange. Let us restrict our terminology to the expression "exchange".

*P. Raczky:*

From the great conference volume edited by C. Lamberg-Karlovsky and C. Renfrew we know the precise definitions. Trade, therefore, is a meaning for actions of exchange in general. K. Polányi defined the notion of trade without money. Thus the terminology is fixed.

*E. Lenneis:*

According to the neolithisation process, Transdanubia is a possible region for the formulation of LBK. Some other areas, however, also come into question, especially when the origins of long houses are considered. Although the Pityerdomb houses are the earliest buildings in the South, it is not clear from the remains whether they belong to e.g. the Mohelnice type or to some other type.

*E. Bánffy:*

I do not want to vindicate myself the right to name *the* only region of the LBK formulation. I also think that each of the geographic regions where LBK developed with the contribution of Southern immigrants and local populations could be called a formation zone. On the basis of my investigations I only wanted to point out that Transdanubia is unique for one reason: it is the Northern periphery of the Starčevo culture distribution area and thus the only region where the earliest LBK could have formulated with a direct contribution by a greater influx of real immigrants from the Mid-Balkans. In addition to the components of this – to my mind complicated – process we can identify some elements. However, I think we must be brave enough to admit that there are still other elements that we do not know yet. Both statements are equally important for future research.

*P. Raczky:*

Both E. Bánffy and E. Lenneis spoke about the material facts among the elements of the transition. I think you are right, it is necessary to discuss these. But it is also a very important task for research to *see behind the screen*. We should, therefore, also discuss the human factor. What was the mechanism of adaptation? That is, this adaptation is not simple, because it happens on a totally new scale, and is a new way of life, a new psychological setting. It is thus something difficult to catch on the basis of material culture. Agriculture, for example, represents a totally new body of knowledge. What is the historical movement of this process? The new book by Leroi-Gourhan stresses this mechanism, which is a change within the mind. What was first? Adaptation followed by the change in mind, or a change in thinking that was followed by adaptation?



*E. Bánffy:*

It is also a possibility that these two actions took place in a continual interaction with each other, thus the answer is “both”.

*P. Raczky:*

I agree.

*A. Whittle:*

Considering the transition period and the participation of the Starčevo culture in it, Transdanubia is certainly an important region. There were times when the Körös culture was claimed to be the main participant in the process, but this was a time when there was no research in Transdanubia. Now it is investigated and the model constructed is more and more convincing, as far as the contact between local mesolithic groups and the Starčevo groups is concerned. But just one more reflection: we see, on the basis of the Balatonszárszó site, how big excavations can change the picture. From the M3 motorway excavations we also know quite early long houses. Nonetheless, it is not to exclude that similar settlements would be found somewhat southwards in the Alföld region, let us say, some fifty kms from the Northern limit of the Körös culture, which could give new information about the transition processes there. We might see that there was not only a Transdanubian front but also an Alföld front. I certainly do not want to influence where your next motorway should go, but I think until new information of the northern Körös culture my question remains a question.

*E. Bánffy:*

My problem concerns the observation that the two contact zones have fairly little in common in terms of the archaeological remains. The early Neolithic in Eastern Hungary as well as the earliest transitional materials to the LBK, look more to the East. It has evidently close connections with Transylvania, and both the Romanian and the Serbian Banat. However, as the large excavation material from Budapest–Aranyhegy suggests, there was little connection between the Szatmár II culture settlements and the earliest Transdanubian LBK.

*P. Raczky:*

I should like to separate the two regions totally: Transdanubia and the Great Hungarian Plain at the time of the transition. The Starčevo culture has altogether some dozen sites in Transdanubia; the Körös sites however reach the number of five thousand! Körös settlements can have sometimes more than one-meter high accumulation of layers, while the Starčevo sites in Transdanubia are small, single-layer settlements. In Serbia, Starčevo sites can be one and a half meter high! So this is a great difference. Statistically it has a dramatic meaning: it shows that the character and the development of the two cultures are totally different. Those who speak about the Körös-Starčevo culture in common blur these differences and are thus unable to solve the problems of different lines in development. Thus, first of all, we must define these differences, and only then will it be possible to study the different ways of development.

*F. Horváth:*

I should like to add something to this problem. The old excavation at Bicske, also the new excavation in Pityerdomb with its typological plates, and especially the new Balatonszárszó material, clearly show to me, what a strong Vinča A impact might have been in Transdanubia! I cannot explain how and why but it is clearly there. This concerns both ceramic technology (tempering etc.) and some pottery types. This contribution might be explained, at least in part, by a direct migration of Vinča people to Transdanubia.

*P. Raczky:*

This is one tendency. The other one is new concepts coming with new knowledge. We must not forget the first Bicske publication, in which there is an interpretation of a pit being a house. It is of importance that the new generation of archaeologists not only have new sites but also new concepts, new attitudes. To mention only one example: everyone knows the excavation Kisköre–Gát in the Alföld. Here the ditches were interpreted as houses, while the posthole structure in-between was thought to have been a waste disposal area.



*A. Whittle:*

Some questions to Krisztián Oross: how large is the plateau you have the settlement on? How long could the early phase last? How many generations can you calculate within the classical phase?

*K. Oross:*

The plateau is about 450 meters from the east to the west. The northern part of the plateau is empty. We have excavated a part of an early LBK site there, which extends into the unexcavated area. The classical site may stretch for another 200–300 m more towards the South, but to the East and West both the plateau and settlement end. To the other question: no houses intersect. As to the finds, we have just finished the excavation, so that more time is needed for the processing of finds. Therefore, I cannot answer your question concerning the number of generations now.

*E. Bánffy:*

I could add to the question of time depth a few 14C dates from Transdanubia: I have heard from Nándor Kalicz that the late Starčevo site of Vörs was dated to 5400 (!) BC, Pityerdomb began at 5480 and lasted for about 90–100 years. I am aware that there is a discrepancy with the early dating of Brunn II. near Vienna, which should start at 5620.

*E. Lenneis:*

The new results from Brunn are not published yet but I have heard that the laboratory in Switzerland might have measured the earliest dates too high, the improved and correct ones should be not earlier than 5500.

*L. A. Horváth:*

Ich hätte eine Frage an Alasdair Whittle. Zu welcher Phase der Körös-Kultur gehört das Material der Siedlung in Ecsefalva? Es scheint, dass westliche Kontakte zu dieser Zeit schon vorhanden waren. Deshalb wäre es interessant zu wissen, in welcher Phase der Kultur die Kontakte mit dem Alpengebiet begannen.

*A. Whittle:*

Wir warten noch auf mehrere Daten, die aber aus Ecsefalva schon jetzt bekannt sind. Diese sind 5800, 5700 BC. Es gibt auch ältere Datierungen aus Endröd, i. e. 6000 BC, und die späten Körös-Daten gehen bis 5500 BC. Wenn die Frage aber so gestellt ist, welcher Keramikstil dazu in Ecsefalva gehört, so kann Krisztián Oross eine genauere Antwort geben.

*K. Oross:*

Leider haben wir wegen der ausgedehnten Ausgrabungen in Szárszó nur wenig Zeit gehabt, uns mit der Keramik von Ecsefalva zu beschäftigen. Ca. 10–15 % der Keramik habe ich schon untersucht. Meist handelt es sich dabei um ein Starčevo IIb-Material, mehr kann aber jetzt noch nicht gesagt werden.

*L. A. Horváth:*

Es ist aber sehr interessant. Nämlich lebten noch Mesolithiker um 5800 im Alpengebiet. Es wäre wichtig zu wissen, ob – wie die Karte zeigte – die Träger der Körös-Kultur Kontakte tatsächlich mit diesen Mesolithikern hatten.

*E. Bánffy:*

I should like to pose a question to Florin Draşovean. Twenty years ago, when I participated in the excavation at Herpály, Nándor Kalicz showed me some shards, telling that they were imported pieces from the Petreşti culture. Therefore I tried to memorize them, as well as the relative chronological position of the two cultures to each other. From what you said today about the origins and contacts of the Petreşti culture, it appears to me as a part of a sort of new *melting pot* in the Banat, a region from where finally some new chronological and typological relations were emitted. How is that?

*F. Draşovean:*

First of all, I do not believe that all imported painted shards from Herpály belong to the Petreşti culture. I have not seen them, only some colour photos in the small volume “The Late Neolithic in the Tisza region”, but one of those in the picture surely belongs to the Foeni group. Secondly, at the present state of research in Banat only the Foeni pottery is painted. It



is clear that the Banat region had a stronger connection with the Alföld than to Transylvania during the Middle Neolithic. In the Late Neolithic, things change a little bit, because the Herpály and – what Professor Lazarovici calls – the Cluj–Cheile Turzii–Lumea Noua–Iclod complex all have painted pottery. It is not fair to discuss what exactly this formation means because Professor Lazarovici is not here. But in my opinion we can speak about extremely strong relations between Transylvania and the Eastern and Northern part of the Alföld region. These types of material as well as some imported shards published by János Makkay from Vésztő–Mágor belong to a hundred percent to the Foeni group.

*P. Raczky:*

It is always dangerous to think about a relative chronology only on the basis of some potshards. It is well known, that in the history of a tell settlement the ground was sometimes cleared in connection with destruction activities, so that pottery fragments might begin to “live their own lives” and move around. Therefore to make a chronology based only on potshards is difficult. Secondly, the Herpály painted styles are different. The first style is the black painting, and it transforms into the red, white and finally unpainted styles. With the help of 14C dating we established that this process took approximately 400 years. This is a long time as this change may mean very complex relations to the most different cultural formations within the polichrom groups to the East. Similarly, the Öcsöd site contained several areas from the vertical stratigraphy to the totally eroded and mixed layers. It is thus, once again, quite dangerous to build a chronology on the presence of some imported potshards at a site.

*F. Draşovean:*

Pál Raczky is right, because our interpretation depends to a hundred percent on the accuracy of the excavation. If it is carefully done, we can pay more attention to imported ware. Speaking about the imported shards from Vésztő–Mágor: according to the publication, they belong to the classical Tisza period. At Öcsöd, those sherds were published from both the Szakálhát and the Tisza layers. In my opinion, this is too early. As for the formation of the Tisza culture, we should need another round table of discussions. But in Herpály, all shards were published from the early phase of the tell settlement, which is to my mind correct. What is more, the imports occur at both sides! So I see no contradiction. In Transylvania, both painted and unpainted specimens of the Foeni group appear as imported pieces in the late Tordos settlements. This is, therefore, not a problem of some isolated sherds: these are units of cultural content in Transylvania, together with a comparative stratigraphy. Unfortunately, most of them remain still unpublished.

*P. Raczky:*

It was a great problem for us to precisely establish the real phasing of the pots found in the central part of the tell at Csőszhalom. Secondary re-deposition within the stratigraphy was so great that, for example, we encountered numerous black painted, Herpály type shards as well as white painted ones. Some of these fragments, however, were sunken into postholes. This created quite a difficult situation. To cite another example: at the excavation of László Domboróczki in Füzesabony, some grave spots were not visible, although burials were dug into the settlement from above. However, there was no sign of intruding features. Such phenomena can also bias the chronology.

*E. Bánffy:*

Instead of a proper summary, I only want to draw attention to one remarkable result of today's meeting. In the morning I began with a warning that we should urgently proceed with the analysis of contacts using purely archaeological methods; otherwise we shall be unable to co-operate with those colleagues investigating the same question but approaching it from other fields of science. It has become clear, however, that we have much to do in order to make each other's results comparable even within Neolithic archaeology! There are plenty of methods and research attitudes that have proven to be essential in contact analyses, as has also been shown during the session. Just to mention one: it is possible to establish provenance on the basis of the analysis of pottery motifs alone, certainly, not in the 19<sup>th</sup> century style. We have also seen that the occurrences of different types of objects, pottery, lithic raw materials etc.

can be plotted onto the same map. The circles that outline various distributions can thus be compared to each other, reflecting the mobility and contact areas of a given cultural group. This all shows that there is a great need for cooperation even amongst us. It is particularly important for us to compare our results at every phase, not only at the end, so that discussion helps us to change our mind during the course of our work as well. I think that exactly this took place today. Thus, I hope that all of you experienced as many new impressions and, like myself, were given courage for further research into contact analyses.





## ENVIRONMENTAL CHANGES UNDER THE NEOLITHIZATION PROCESS IN CENTRAL EUROPE: BEFORE AND AFTER (Keynotes lecture)

According to the archaeological, archaeobotanical and archaeozoological information available for us today the major centers of production must have developed in several places on Earth independently from one another.<sup>1</sup> It was the area of the Middle East and Anatolia where a new developmental trend could first emerge, justified by chronological data, leading to the appearance of Neolithic agricultural production; i.e. plant and animal farming. This Neolithization process in the Near-East must have taken place at the end of the Ice Age and the beginning of the Holocene sometime around the turn of the 10–11th millennia BC.

According to environmental historical data the global climate at the end of the Pleistocene preceding the emergence of neolithization was fundamentally different from its present day counterpart. Continental ice sheets reached their greatest expansion around 18 000 BP covering an area of approximately 50 million km<sup>2</sup>.<sup>2</sup> The extension and location of the climatic belts were totally different during this glacial period from the one observable today's interglacial. As a result of this fundamentally different vegetation and soils could have developed in the given regions with average July palaeotemperatures being 5–10 C° colder in the central and southern parts of Europe than today. The average January palaeotemperatures for the same area were 20–40 C° lower than today.<sup>3</sup>

Following the Last Glacial Maximum (LGM) a gradual warming started leading to the retraction of inland and montane ice sheets. This resulted in a gradual reorganization of the climatic and vegetation belts as well as the soils on our planet between the LGM and the beginning of the Holocene.<sup>4</sup> According to calibrated radiocarbon data global warming culminated in the areas of the present-day Mediterranean and subtropics around 11–12 000 BP, in the temperate warmer parts of Europe at 10–11 000 BP and in Northern Europe at 9–10 000 BP. All these data seem to justify the development of climatic, soil and vegetation conditions characteristic for the Holocene in the Near East preceding the neolithization process. In other words highly significant transformations occurred in the climate accompanied by alterations in the soils and the vegetation in the area before the emergence of the Neolithic.

There was such a great coincidence between the climatic changes occurring at the beginning of the Holocene and the process of neolithization that even the older so-called new archaeological models hypothesized in the 1960s<sup>5</sup> emphasized the importance of climate-change induced sea-level, vegetation and faunal changes in the process of Neolithization. The Neolithization process affected not the whole of the SW Asian region but only the areas with the most favourable natural endowments. This region is known as the Fertile Crescent in the literature.<sup>6</sup>

It was by no means accidental that this subtropical (Mediterranean) region can be regarded as the cradle of agricultural production and the productive societies. This area provided

<sup>1</sup> S. Bökönyi: *History of Domestic Mammals in Central and Eastern Europe*. Budapest 1974; Zohary – Hopf 1988.

<sup>2</sup> J. J. Lowe – M. J. C. Walker: *Reconstructing Quaternary Environments*. Hong Kong 1984.

<sup>3</sup> J. E. Kutzbach – J. Guetter: The influence of changing orbital parameters and surface boundary conditions on climate simulations for the past 18.000 years. *Journal of Atmospheric Sciences* 43 (1986) 1726–1759.

<sup>4</sup> N. Roberts: *The Holocene. An Environmental History*. Oxford 1998.

<sup>5</sup> S. R. Binford – L. R. Binford: *New perspectives in Archeology*. New York 1968.

<sup>6</sup> C.N. Anderson: *The Fertile Crescent: Travels in the Footsteps of Ancient Science*. Fort Lauderdale, Florida, U.S.A. 1968; J. Mellaart: *The Neolithic of the Near East*, London 1975.



shelter during the Ice Age for a part of the cereals (wheat, barley) and the wild animals later domesticated and farmed (sheep, goat, auroch, pig). The emergence of food production fundamentally transformed the interaction and relationship between man and environment, and man and the society. Humans successfully managed to alter their surrounding environment via several ways; i.e. the establishment of arable lands, pastures and showing preference for and intentionally spreading certain plants and animals while controlling and gradually restricting others (weeds, predators). Parallel with these events large numbers of people were crammed together in the newly developing permanent settlements, their ethos, social energies and interpersonal relations suffering radical changes. However the emergence of permanent settlements also enabled the large-scale, efficient, long-term accumulation of human knowledge and experiences from generation to generation.

In contrast to this several prerequisites for agricultural production and the development of productive societies were missing in Europe despite the presence of favorable climatic and soil conditions in Southern Europe. As a result of this mainly Mesolithic hunting-fishing-gathering groups inhabited the continent at this time. The remains of seasonal hunting camps of these Mesolithic groups refer to the presence of relatively smaller and highly mobile groups of people in the area. This Mesolithic population of the European continent started to get acquainted with the Neolithic type of production around 9000 BP as a result of the cultural and ethnical impulses reaching the area from the region of the Fertile Crescent during its northwest expansion.<sup>7</sup> The SE part of the European continent had a crucial and pioneer role in the process of neolithization of the Mesolithic Europe thanks to its favorable geographic location. The earliest traces of Neolithic technical (clay pottery, polishing and drilling of stones, spinning-weaving) and economic innovations originating from the area of the Fertile Crescent are restricted to this region.

The Carpathian-Balkan region is of crucial importance regarding the neolithization of the European continent as these areas acted as transit areas and mediators for the earliest food production cultures originating from the area of the Fertile Crescent to expand their areas of influence into the central and western parts of the continent. The area of Carpathian Basin can be regarded as one of the most important areas in the process of European neolithization as its central part forms the northern boundary of expansion of the Anatolian-Balkan agricultural civilization. There are two major models for the expansion of the Neolithic cultures bearing Mediterranean roots from the area of the Fertile Crescent to the southern parts of the Carpathian Basin and onwards to the European continent. According to the first hypothesis the continuous spreading and migration of humans must have enabled the expansion of Neolithic civilization from its birthplace.<sup>8</sup> The other theory accounts for the gradual adaptation of the Neolithic technical innovations and lifestyle.<sup>9</sup> Most likely both assumptions must have played a role in the process. However no matter which process do we account for a time-transgressive phenomenon emerged from the area of the Fertile Crescent resulting in the penetration of a new Neolithic civilization into the European continent, becoming dominant in the majority of the regions there between the 10th and 5th millennia BC.

<sup>7</sup> K. Behre: Some reflections on anthropogenic indicators in the record of prehistoric occupation phases in pollen diagrams from the Near East, in: Bottema et al. 1990, 219–237; S. Bottema – H. Woldring: Anthropogenic indicators in the pollen record of the eastern Mediterranean, in: Bottema et al. 1990, 231–265; W. van Zeist – H. Woldring – D. Stapert: Late Quaternary vegetation and climate of southwest Turkey. *Paleohistoria* 17 (1975) 53–143; J. R. A. Greig – J. Turner: Some pollen diagrams from Greece and their archaeological significance. *JAS* 1 (1974) 177–194; A. Huttunen – R. Huttunen – Y. Vaasari – H. Panovska – E. Basilova: Late-glacial and Holocene history of flora and vegetation

in the western Rodope mountains, Bulgaria. *Acta Botanica Fennica* 144 (1992) 63–80; A. Whittle: Europe in the Neolithic. Cambridge 1996; K. J. Willis – K. D. Bennett: The Neolithic transition – fact or fiction? *Palaeoecological evidence from the Balkans*. *Holocene* 4 (1994) 326–330.

<sup>8</sup> V. G. Childe: The dawn of European civilization. London 1957; A. Ammerman – L. L. Cavalli-Sforza: The Neolithic Transition and the Genetics of Populations in Europe. Princeton 1984; Zohary – Hopf 1988.

<sup>9</sup> R. Dennell: European Economic Prehistory, a New Approach. London 1983; G. Barker: Prehistoric Farming in Europe. Cambridge 1985.



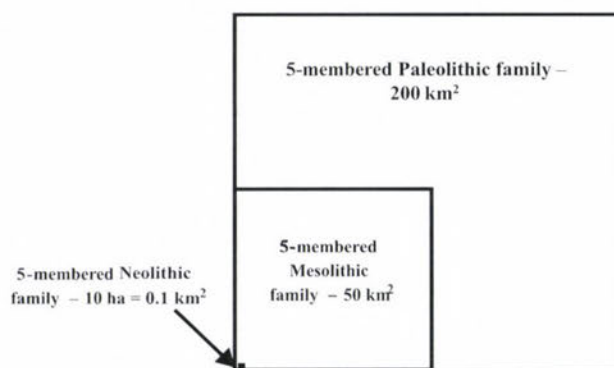


fig. 1. How many minimum are was needs for a 5-membered family?

The emergence and spreading or expansion of Neolithic cultures poses a large number of important and interesting archaeological and environmental historical questions. From these we would like to touch upon the most important ones, mainly those that are somehow related to the areas of the Carpathian Basin and Central Europe.

Question No.1: What triggers the expansion of Neolithic culture and the process of neolithization? Is there an environmental aspect of this process?

The interrelationship between man and environment can be grasped most accurately in a relatively simple way via the analysis of existing relations between the social, technical and environmental conditions or factors.<sup>10</sup> The engagement in a Neolithic lifestyle, sedentism and more reliable food resources might have led to significant population growths in contrast to the hunting cultures. The main reason for this is while for a hunting-fishing-gathering family a minimum area of 50–100 km<sup>2</sup> is sufficient to get by, it is only an area of 5–10 hectares that can efficiently provide for the needs of a Neolithic family due to the more intensive landscape utilization<sup>11</sup> (*fig. 1*) (large rectangles–Mesolithic and small rectangles–Neolithic). As a result of the steady population growth deriving from lifestyle differences the Mesolithic communities could have been easily overwhelmed by the Neolithic groups in a given area within the period of a couple of generations. However, the ability of the environment to provide for the needs of a larger population even among intensive landscape utilization is restricted controlling the possibilities for population growth (*fig. 2*). When the Neolithic communities reached the Neolithic limit of the environment to provide for their needs they had to face two alternatives to choose from: 1. the introduction of a more intensive landscape utilization and the development of a more advanced social system and order, 2. migration to new areas untouched by Neolithic groups. This latter option was relatively easier to implement at the time of birth of the Neolithic civilization. Thus the ability of the environment to provide for the needs of humans must have had a crucial role in the initiation of migrations out of the area of the Fertile Crescent for the Early Neolithic groups.

Naturally the Neolithic groups and the civilization itself during its course of expansion lasting several thousand years and embedding a number of generations were not preserved in their original form but must have suffered some alterations. On one hand numerous new technical innovations must have emerged during the course of neolithization. Furthermore several new cultural influences might have affected the migrating groups, which eventually might have led to a strong transformation of the original Neolithic cultural habits and traditions

<sup>10</sup> N. J. G. Pounds: *An Historical Geography of Europe*. Cambridge 1990.

<sup>11</sup> M. Füzes: A földművelés kezdeti szakaszának (neolitikum és rézkor) növényleletei Magyarországon. (Die Pflanzenfunde in Ungarn der anfänglichen Entwicklungsphase des Ackerbaues [Neolithikum und Kupferzeit]). *TapolcaVMK* 1 (1990) 139–238; M. Füzes: A Dunántúl korai növénytermesztése

és növényleletei. A Starčevo kultúra és a Tapolcai csoport. (Die frühe Pflanzenzucht und die Pflanzenfunde in Transdanubien. Die Starčevo and die Tapolca-Gruppe). *Bibliotheca Musei Tapolcensis* 1 (1991) 267–362; E. S. Deevey: The human population. *Scientific American* 203 (1960) 194–204.



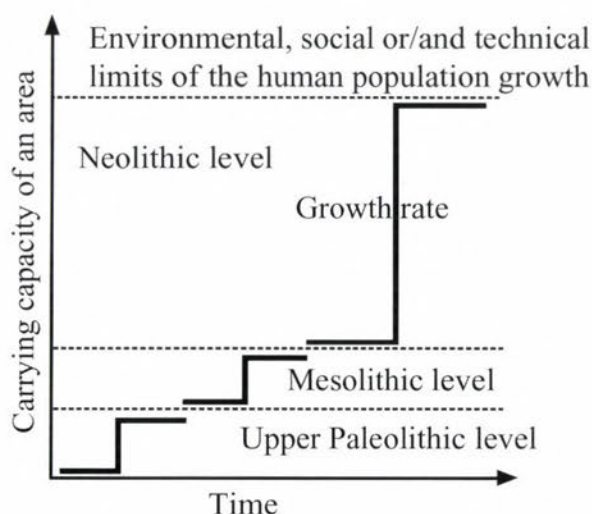


fig. 2. The Upper Paleolithic, Mesolithic, Neolithic levels of the environment to provide for the needs of human population

existing in the areas of Fertile Crescent. According to archaeological investigations Neolithic communities belonging to the Central Asian – Aegean – Balkan cultural groups managed to reach as far as the center of the Carpathian Basin. Traces of the Körös–Starčevo culture bearing cultural roots in the Balkans can be found in the NE parts of the Great Hungarian Plain (Alföld), its center and along the shores of Lake Balaton (*fig. 3*). According to radiocarbon measurements<sup>12</sup> the first appearance of Early Neolithic groups in this area can be dated between the closure of the 7<sup>th</sup> and opening of the 6<sup>th</sup> millennia BC. However according to the most recent palaeotemperature reconstructions based on the latest pollen analytical findings

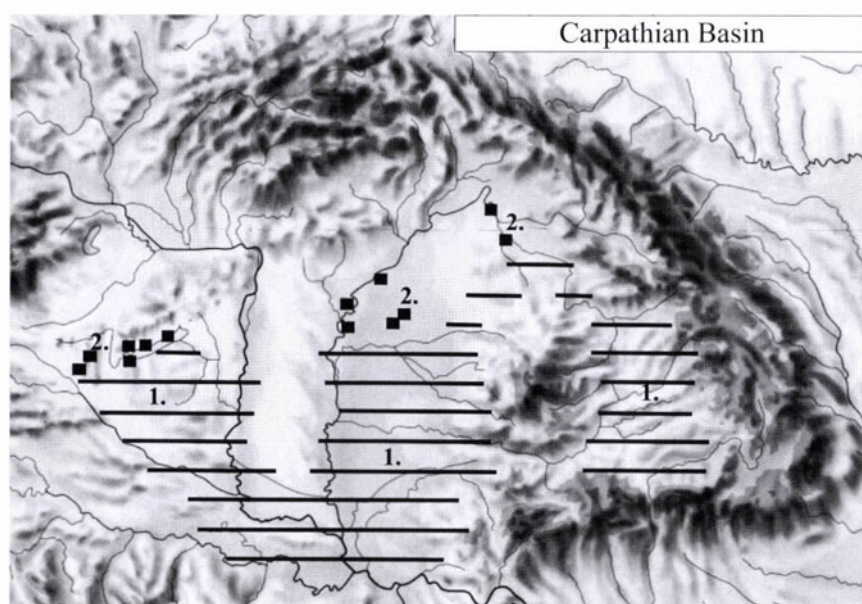


fig. 3. Sporadic Early Neolithic sites on the limit zone of the distribution  
1. Distribution of the Early Neolithic sites,  
2. Sporadic Early Neolithic sites on the limit zone of the distribution

<sup>12</sup> E. Hertelendi – N. Kalicz – P. Raczky – F. Horváth – É. Veres – I. Svingor – I. Futó – L. Bartosiewicz: Re-evolution of the Neolithic in eastern Hungary

based on calibrated radiocarbon dates. Radiocarbon 37 (1996) 239–241.

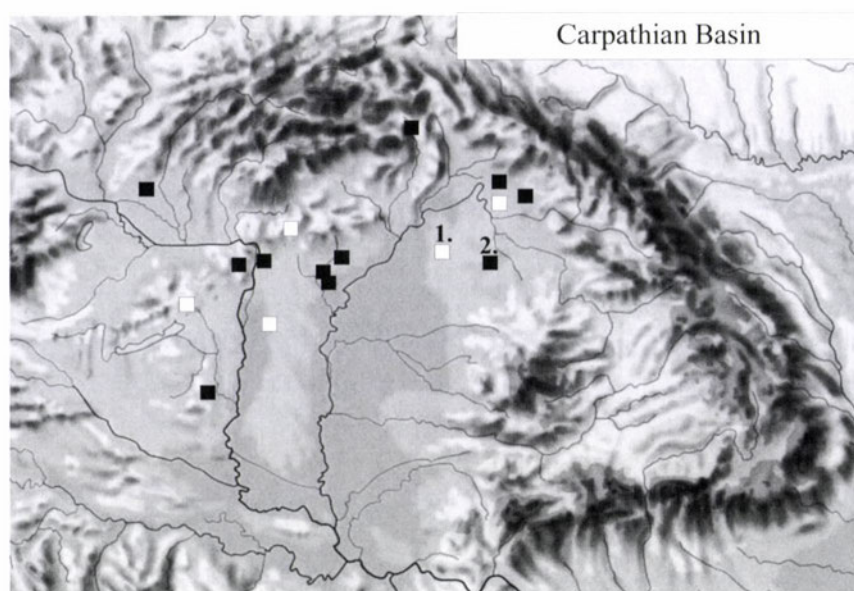


fig. 4. Mesolithic finds, tools and excavated sites of the Carpathian Basin

1. Mesolithic finds and tools, 2. Excavated Mesolithic sites

this time coincides with the development of the Holocene climatic optimum, thus this climate change must have had a significant role in the settlement of Balkan-type Neolithic groups into the area of the Carpathian Basin.<sup>13</sup>

But can we justify this above-mentioned theory based on a single Hungarian pollen profile? Or were there similar observable changes in other groups indicative of the palaeoenvironment for this period?

Nevertheless we are instantaneously faced with the question of why did this Neolithization process bearing Mediterranean roots halt in the Carpathian Basin? According to the pollen based palaeoclimate reconstructions this previously mentioned climatic optimum was replaced by a sudden worsening of the climate decelerating the process of neolithization. After this, according to this model, a following improvement in the climate enabled the reactivation of the process of Neolithization and the onward migration of Neolithic groups towards the northern parts of the Carpathian Basin and the western parts of the European continent.<sup>14</sup>

According to archaeological data however the expansion of Neolithization not only halted in the Carpathian Basin but there has been an important cultural and production transformation as well in the area preceding the onward expansion. According to our findings a very complex interaction must have evolved between the Neolithic and Mesolithic groups in the central areas of the Carpathian Basin, and their surrounding environments. Only a new complex geoarchaeological model was suitable to explain the presence of neolithization in the region, and the complex interactions of humans displayed in such factors as the level of socio-economic and technical development and cultural interaction and the environment.

This new model is based on the following archaeological and environmental evidences:<sup>15</sup>

1. The earliest Neolithic groups must have migrated to the southern parts of the Carpathian Basin from the Mediterranean. Representatives of this Early Neolithic culture were cultivating Mediterranean crops such as einkorn, emmer, spelt and barley and raised animals with a dominance of sheep and goat but cattle, pigs and dogs were also among the domesticated animals.

The Mesolithic groups (*fig. 4*) in the northern parts of the Carpathian Basin can be culturally linked to the regions of Western and Central Europe. These Mesolithic groups had a

<sup>13</sup> Magyari 2002, Sarlóhát.

<sup>14</sup> Magyari 2002.

<sup>15</sup> Sümei – Kertész 2001.



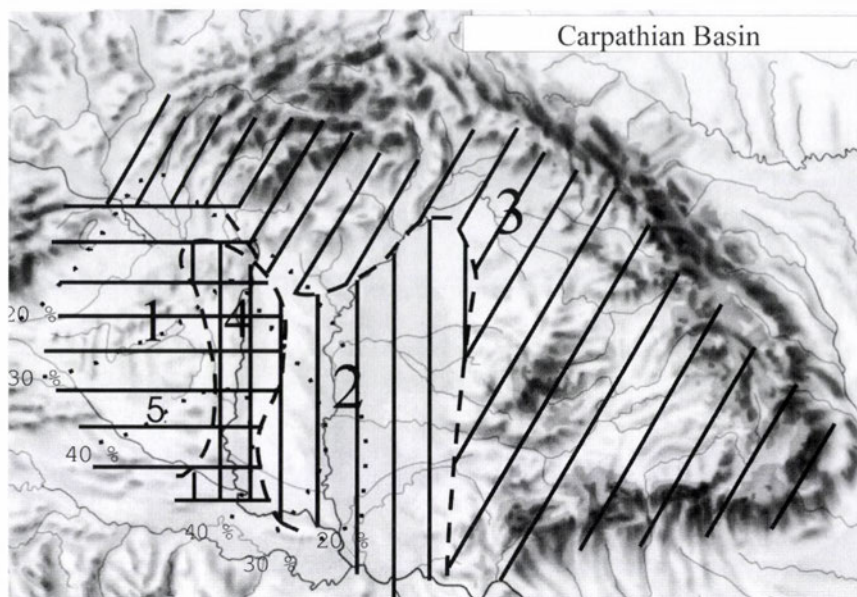


fig. 5. The climatic zones of the Carpathian Basin

1. Distribution of Cf Köppen zone, 2. Forest-steppe (BS) climatic zone of Köppen,
3. Subcarpathian and Carpathian (Df) climatic zone, 4. Transition zone,
5. Frequency of Submediterranean climatic effect

subsistence based exclusively on hunting and gathering, with a dominance of the former. Due to their mobile lifestyles, these smaller hunter groups established seasonal settlements, with summer and winter camps. The less expensive and thin occupation layers observed at these camps indicate a low population density and brief, seasonal occupation.

Every creature, including the plants and animals domesticated by the Early Neolithic groups, has certain habitat and environmental preferences. As such they can only be cultivated and bred till their tolerance limits. Environmental factors such as prehistoric temperatures, precipitation, solar radiation during the growth season, the length of the vegetation period, etc. had overall influence on the crops cultivated and the animals bred by the Earliest Neolithic communities, as well as the prey animals of the hunter-gatherer communities. This phenomenon is called the minimum limiting factor of Liebig.<sup>16</sup>

While utilizing the concept of the minimum limiting factor it were not only the environmental components that have been accounted for but also the possible production traditions and experiences of the Early Neolithic groups of the Carpathian Basin as well. With the help of these they might have fundamentally determine and influence the possibilities for production from the side of the society.

The area of the Carpathian Basin is characterized by large-scale mosaic-like complexity regarding its climate and natural endowments in all three, micro-, meso-, and macro-scales. The formation of a macro-scale mosaic patterning or complexity was due to the presence of an overlap in three major climatic zones (Cf, BS, Df) in the region (*fig. 5*). This situation is further complicated with a gently decreasing Continental effect from the east to the west complemented by an increase in the Oceanic effect in the same direction. Furthermore an increasing Sub Mediterranean influence from the north to the south and the presence of Sub Carpathian–Carpathian influence in the hilly areas and mountains can be observed.

One of the most striking characteristics of the growth season in the Carpathian Basin is its large-scale heterogeneity even in the seemingly homogenous area of the Great Hungarian Plain (Alföld) as well (*fig. 6*). Both the length of the growth season as well as the average temperatures, the accumulated quality of radiation along with the sunshine duration display a gradual decrease from the south towards the north. These components of the growth season

<sup>16</sup> Liebig 1840.



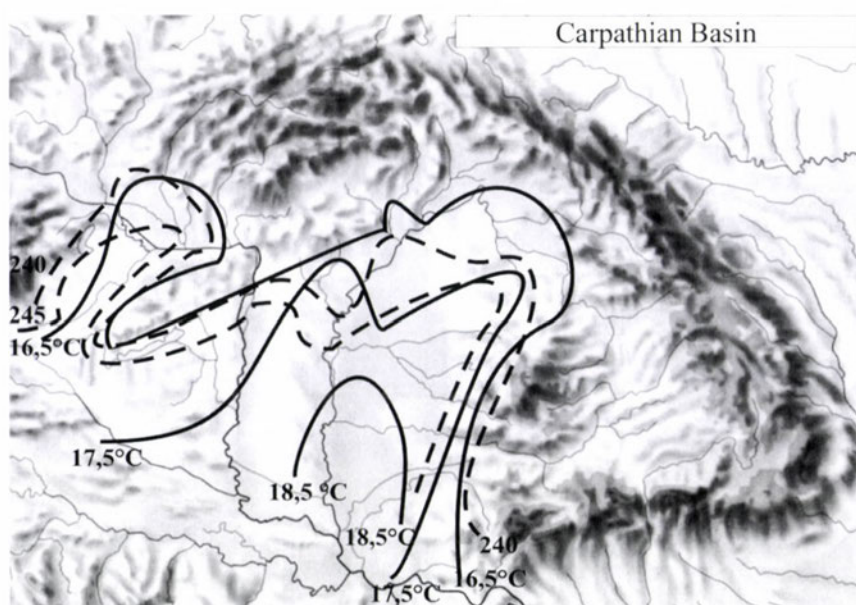


fig. 6. Temperature conditions of the growing season in the Carpathian Basin

—— Number of the growing season days,  
 - - - - Mid-Temperature of the growing season

influence not the limit or geographic boundary of production but rather the crop yields and the safe ripening of the produce. Thus the engagement in a Mediterranean type of agricultural production (growth of Mediterranean type of plants and animals) north of the central parts of the Carpathian Basin poses an increasing uncertainty regarding the possible crop yields and sometimes may lead to yield losses as well.

Nevertheless factors like soil, bedrock and hydrologic conditions are well known to affect fundamentally the possibilities for agricultural production. These latter components further enhanced the mosaic-like complexity of the climate and vegetation through their spatial variance.

Via the application of the minimum limiting factor concept of Liebig<sup>17</sup> a theoretical barrier line could have been reconstructed referred to as the *Central European–Balkan Agroecological Barrier* (abbreviated as CEB AEB), which fundamentally determined the northward distribution of Balkanic type neolithization during the Early Neolithic of the Carpathian Basin. However, a different type of minimum factor along each and every small segments of this line must have prevented the settlement of the Early Neolithic communities (fig. 7). For example despite the favourable strong Sub-Mediterranean climatic influence in the area of the Danube–Tisza Interfluvium (high rates of accumulated quantity of radiation and sunshine duration) soil and bedrock conditions (sandy soils) acted as some sort of limiting factors forming a barrier for agricultural production at the level of agro-technology of the period. This is a good example for the emergence of an agro-ecological barrier line. This theoretical line observable in the Early Neolithic was termed as the *Central European–Balkan Agro-ecological Barrier* (abbreviated as CEB AEB) in mutual agreement with my archaeologist colleague Róbert Kertész.

The CEB AEB had a decisive influence on the northward advance of the Early Neolithic culture and its production economy in the Carpathian Basin. The Early Neolithic communities with a Mediterranean cultural background found themselves in an ecological trap on the marginal areas under Balkanic-type climatic and environmental influences. As a result their advance in the Carpathian Basin first slowed down and eventually halted along the CEB AEB. What was the effect of this on the Mesolithic communities with gathering–fishing and hunting lifestyles living north of this barrier? In order to get an answer to this question two important things should be pointed out.

<sup>17</sup> Liebig 1840.



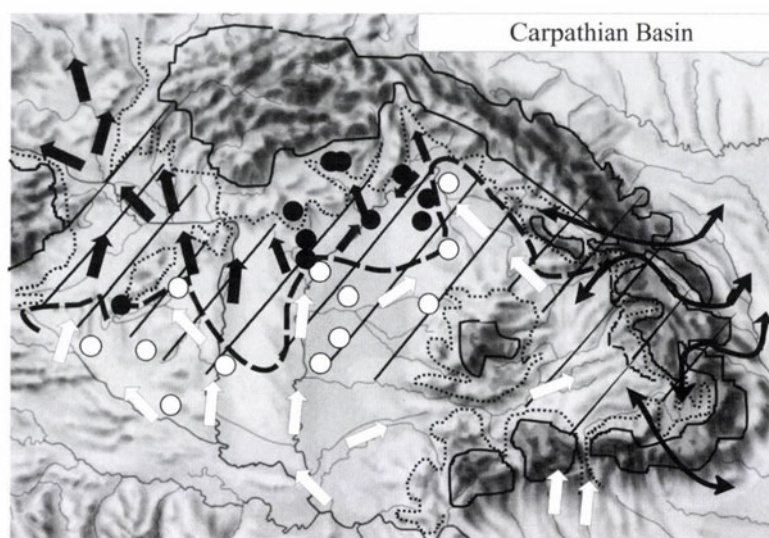


fig. 7. Central-European-Balcanic Agroecological Barrier

- [Hatched box] Adaption zone, [Thick black line] Central European–Balkan agroecological barrier,  
 [Dashed line] Carpathian and Alpien piedmont agroecological barrier,  
 [White arrow] Early Neolithic infiltration, [Black arrow] Middle Neolithic infiltration,  
 [Thick solid line] Carpathian Upland Agroecological barrier,  
 [Open circle] Early Neolithic human impact (soil erosion, vegetation change) before 6000 cal BC ,  
 [Solid black circle] Middle Neolithic human impact (soil erosion, vegetation change) 5500–5000 cal BC,  
 [Double-headed arrow] Early Neolithic migration without settlement before 6000 cal BC

On one hand the Mesolithic hunters could get really close to the Neolithic farmers in space. This enabled the transmission of the Neolithic culture from one community to the other. On the other hand it is important to emphasize that due to the lack of conditions necessary for the creation of Balkan type agricultural production north of the CEB AEB, the Early Neolithic communities were unable to settle onto these areas. This gave some time to the Mesolithic communities to adopt the Neolithic technical and production innovations without actually assimilating culturally, economically or demographically into the Balkanic Neolithic communities. However, Mesolithic communities south of the CEB AEB fully assimilated into the Neolithic communities undergoing the whole neolithization process except for those places where possibilities for isolation were present for a shorter or longer time (e.g. The Iron Gate). Thus the CEB AEB played a crucial role in the formation of a totally different new Neolithic culture fully adapted and assimilating to the local conditions north of the boundary: the Linienbandkeramik Culture.

Archaeological and palaeoanthropological observations seem to indicate the existence of a secondary neolithization zone, a so-called *adaptation zone* along the line of the CEB AEB in the central parts of the Carpathian Basin, where the local Late Mesolithic groups could have resided next to the newly arriving Neolithic groups coming from the Balkans.<sup>18</sup>

However it must be noted, and this factor was not mentioned in our previous paper with Róbert Kertész,<sup>19</sup> that this model explains the expansion of the Early Neolithic groups at a

<sup>18</sup> P. Sümegi: Preneolitizáció egy kárpát-medencei, késő-mezolitikum során bekövetkezett életmódbeli változás környezettörténeti rekonstrukciója. (Preneolithization: palaeoenvironmental reconstruction of change of life during the Late Mesolithic in the Carpathian Basin) Múmsz. II. Debrecen, 2004, 21–32.

<sup>19</sup> P. Sümegi – R. Kertész: A Kárpát-medence őskörnyezeti sajátosságai egy ökológiai csapda az

újkőkörban? (Palaeoenvironmental characteristics of Carpathian Basin, an ecological trap in the Neolithic). Jászokunság, 1998, 144–157; Sümegi – Kertész 2001; P. Sümegi – R. Kertész – Z. E. Rudner: Paleoenvironmental history of Hungary, in: Zs. Visy (ed.): Hungarian Archaeology at the Millenium. Budapest 2004, 51–56.



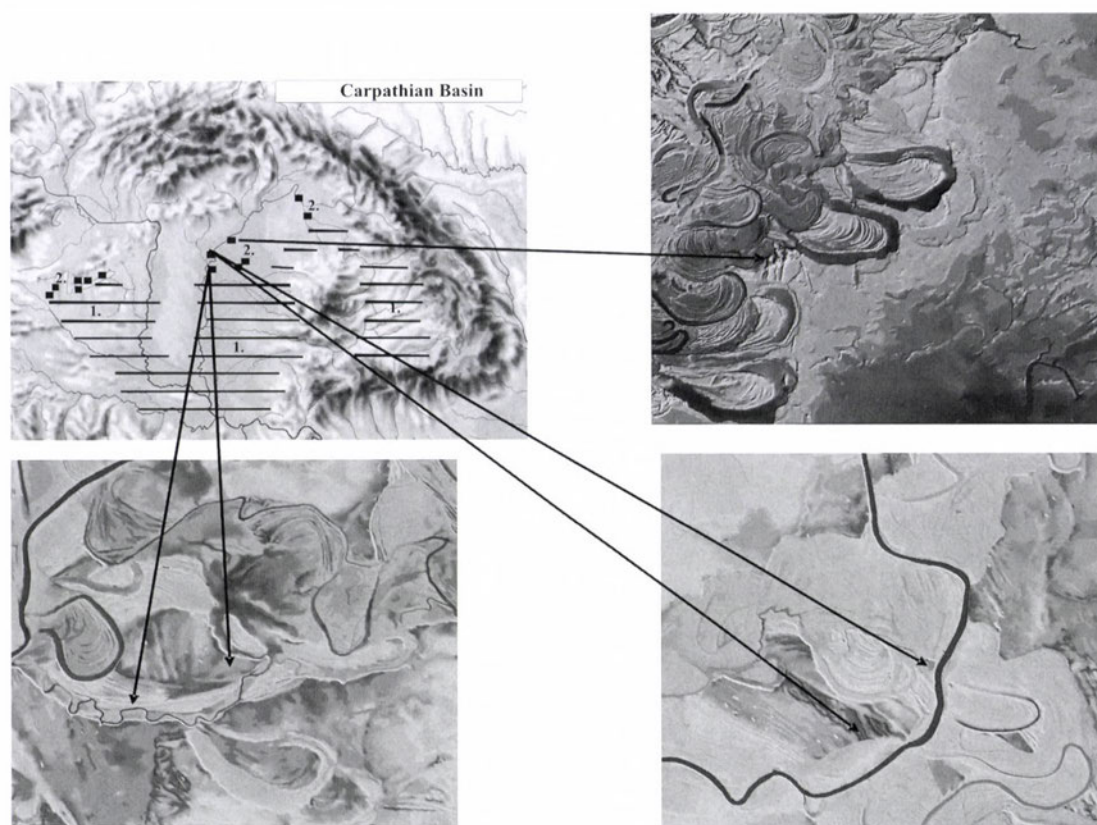


fig. 8. Early Neolithic sites in the northern boundary of the Balkan-Aegean culture

larger-scale embedding several thousand square kilometres, a scale of 1 : 1 000 000. Why is this important? Because it has been known ever since the discovery of the phenomenon of chaos that if the magnification or zoom is changed during the analysis of spatial distribution of a feature than we are faced with newer and newer principles and connections related to the different levels of reality. To justify this assumption let me present you a photograph of a piece of textile where you can get a good picture of the fabric from a considerable distance. However when we zoom into the picture only the thread pieces and later on the minor filaments of different colour can be deciphered at greater magnifications. At an even greater magnification we may be able to see the molecules building up the fibers. I think it's quite obvious now that we can see different interrelations at different scales or magnifications between the components of reality, thus the consideration of the scale in our maps for the analysis of the Early Neolithic or any other cultural groups is really important regarding the final outcome and theories of our studies.

The effect of this zooming and the importance of the scale are well observable in a study of the Agroecological Barrier and the spreading of Early Neolithic communities. However if we examine the distribution of Early Neolithic settlements at a greater magnification the previously seemingly unified picture falls apart and we are confronted with minor patches of island-like settlement clusters (fig. 8–9). At this scale the CEB AEB becomes discontinuous as well turning into a diffuse, complex zone of variable width. The same phenomenon can be observed in case of the line of *Carpathian Basin Neolithization Zone* situated north of the Agro-ecological Barrier. The spot-like distributions of the communities of the Körös and Starčevo cultures are clearly observable in the adaptation zone. In our view this zone enabled the formation of restricted local settlements alone due to the different environmental conditions. Such island or spot-like distribution points are the Starčevo sites of Tihany and Vörs or the Körös settlement sites of Tiszaszöllös, Kőtelek.<sup>20</sup> The loess-covered Pleistocene lag surfaces preserved in the

<sup>20</sup> P. Sümegei: Early Neolithic man and riparian environment in the Carpathian Basin, in: E.

Jerem – P. Raczky (eds): *Morgenrot der Kulturen*. Budapest 2003, 53–60.



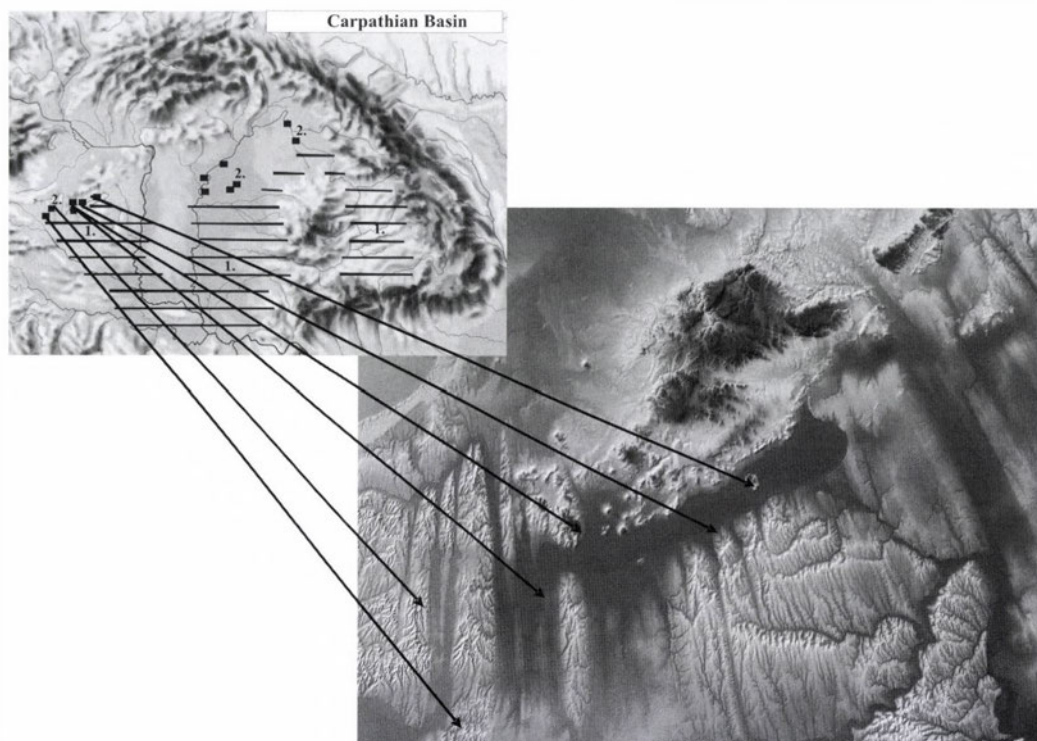


fig. 9. Sporadic Early Neolithic (Starcevo) sites on the loess-covered surfaces in the northern boundary of the Balkan-Aegean culture

neotectonic depressions and on the Holocene alluvia enabled the formation of such island-like settlements. In case of the site of Tihany we can speak about a real island-like settlement as due to the high lake level of Lake Balaton this peninsula used to form an actual island at the time. An exchange of information maybe groups of people as well might have emerged in the zone of adaptation between the two fundamentally different cultural groups. As a result of this the representatives of the local Mesolithic hunting-fishing-gathering communities by adopting the Neolithic technical innovations, settling permanently and engaging themselves in food production could have started a new cultural and economic wave preserving on one hand their own traditions and yet independent of the Mediterranean type of cultures and economies. The loess-covered Pleistocene lag surfaces, which can be regarded as islands ecologically speaking, must have had a crucial role in the enhancement of this process as they enabled the settlement of Neolithic groups in the green corridors accompanying the rivers and serving as summer hunting sites for the Mesolithic groups; i.e. *their zone of infiltration*. Thus the adaptation process must have taken place not in the whole of the zone but concentrated to the confined neighborhood of these loessy islands. The newly emerged Linienbandkeramik culture started its expansion from this zone of adaptation reaching further north in Central Europe and as far as the river Rhein, the northern parts of the German–Polish Lowlands and the river Dnester. However, the immigrant groups of the Starčevo, Körös and the Transylvanian Körös cultures underwent some sort of adaptation as well thanks to their different surrounding environment, as these cultural groups bearing Mediterranean cultural roots found themselves on the northern periphery of Balkanic and Sub-Mediterranean environmental influences in the Carpathian Basin and were forced to adapt to the local conditions in order to survive. Thus according to our findings the mosaic-like complexity of the environment in the Carpathian Basin played a fundamental role in the halting of the northern expansion of the culture with Mediterranean roots. Furthermore this highly complex mosaic-like environment must have enabled the development of an interaction between the Mesolithic and Neolithic groups and the adaptation of the technical innovations; i.e. the development of a new Neolithic culture within the Carpathian Basin independent of and totally different from the Mediterranean type.

Finally at the end of my presentation I would like to sum up the most important questions we touched upon and which have arisen in relation to the neolithization of the Carpathian Basin:

- 1) Did a former climatic change influence the emergence and spreading of the Neolithic civilization?
- 2) Why was the process of neolithization an expansional one? Could there be any environmental factors behind the expansion of the Neolithic culture?
- 3) Why did the advance of Neolithic cultures bearing Mediterranean roots halt in the Carpathian Basin? Are there any scientific results, which actually underlie the assumption that the Early Neolithic groups of the Carpathian Basin arrived from the Mediterranean, Balkan–Aegean regions? Can we justify from palaeoenvironmental data that the DVK (Transdanubian Linienbandkeramik) and AVK (Alföld Linienbandkeramik) sites located at the northern parts of the Carpathian Basin developed in a chronologically younger horizon than the Starčevo, Körös sites?
- 4) Can we identify a transformation in the production types and economy between the northern and southern parts of the Carpathian Basin, i.e. the Early and Middle Neolithic with the help of palaeoenvironmental tools?
- 5) Can we identify a mosaic-like complexity of the environment in a given area via the application of pedological, archaeobotanical and archaeozoological findings? Could the different climatic, soil, vegetation and hydrologic conditions act as limiting factors forming an ecological barrier in an area lacking any prominent geomorphological boundaries?
- 6) Must we really account for the scale or magnification of maps as factors influencing the final outcome of our interpretations during the course of investigations on the expansion of cultures and environmental factors?

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# THE IMPORTANCE OF PEDOLOGICAL INVESTIGATIONS IN HOLOCENE PALAEOECOLOGICAL RECONSTRUCTIONS. A CASE STUDY (HORTOBÁGY, HUNGARY)

Two different hypotheses exist about the steppe areas of the Hungarian Great Plain and about the generation of sodic soils occurring in these areas. According to the first scientific opinion, the plain territories — such as our sample area (*fig. 1*), Hortobágy — had become forested in the Holocene, and ancient loess steppe grassland patches occurring on the higher ridges were surrounded by closed forests, but sodic areas had not occurred yet.

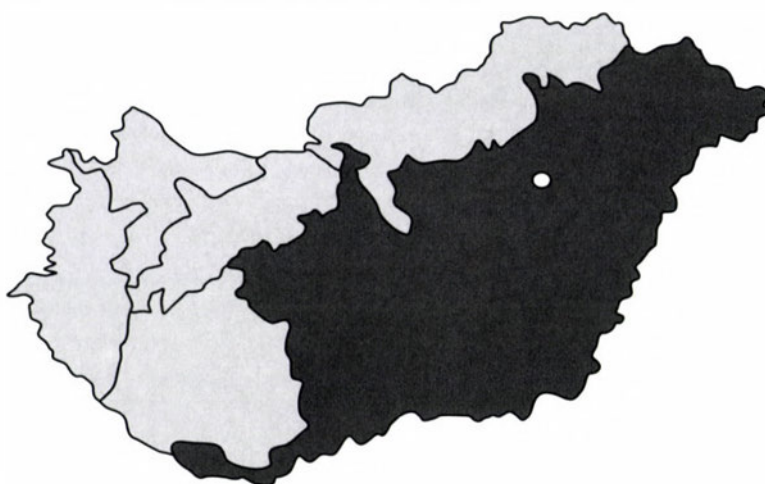


fig. 1. The location of the sampling area

The second hypothesis says that the Hortobágy could not have been covered by extended forests for longer times and salinization processes occurred since late Pleistocene, were continuous during the Holocene and pasturing cultures settling on the steppe and river control works of the 19<sup>th</sup> century have extended and stabilised sodic areas. According to the second hypothesis, salinization developed in the observed area as a consequence of connecting parent material, climatic and special geomorphological reasons.

As a representative of the first opinion, Székely<sup>1</sup> detected a mild and wet climatic character in the Carpathian basin 7000 years ago, as a consequence of which oak became dominant in the forests. This was followed by the blooming period of the forests of the plain, with beech becoming dominant and generation of oak, hornbeam–oak vegetation types. Soils transformed into Luvisol. Neolithic cultures are estimated to have appeared in this period, bringing a sharp extension of anthropogenic effects, which, together with decreasing forested areas, resulted in the development of former Luvisol towards Chernozem soils.

Surveys of Alexandrovskiy<sup>2</sup> in a sample area of the North Caucasus also proved that, due to climatic changes during the Holocene, soil generation had also changed. The sample area observed by them may have been a cold, dry steppe or forested steppe around the early

<sup>1</sup> Gy. Székely (ed.): Magyarország története. Előzmények és magyar történet 1242-ig (History of Hungary. Premises and Hungarian History until 1242). Budapest 1984, 49–68.

<sup>2</sup> A. L. Alexandrovskiy: Holocen development of soils in response to environmental changes: the Novosvobodnaya archaeological site, North Caucasus. Catena 41 (2000) 237–248.



Holocene. Due to climate change, forest has extended and Chernozem soil, that had generated below the former steppe, has changed into Luvisol. The author says that a similar change also characterized the Great Russian Plain and Central Europe. Based on palaeobotanical data, the steppe period continued until the first half of the Holocene.

In connection with the question of treeless areas, Borhidi<sup>3</sup> states that in the central parts of the Great Hungarian Plain climate in itself is not enough for maintaining forest vegetation. Historical documents suggest that, the rate of forested areas estimated from data from the 15<sup>th</sup> and 16<sup>th</sup> centuries could not exceed 30–40 percent. However, the author remarks that the Carpathian basin cannot be evaluated as one landscape unit and globally. He also states that the Great Plain is uniform neither climatically nor in a geological-pedological sense, its current mosaic type may be the mirror image of its postglacial diversity.

Contrary to these opinions, Bodrogközy<sup>4</sup> states that, with steppe vegetation appearing, mainly Chernozem soil generation took place during the Holocene on the Great Plain. He estimates the appearance of sodic areas in the early Holocene, but explains their expansion by river regulations.

Nyilas and Sümegi<sup>5</sup> took sedimentological and malacological surveys in a sample area of the Hortobágy. Based on these they state that the theory according to which the whole surface of the Great Plain – including Hortobágy – was covered by forests in the preboreal ages<sup>6</sup> could not be confirmed by malacological investigations.

Szöör, Sümegi and Balázs<sup>7</sup> took sedimentological and geochemical surveys on upper Pleistocene palaeosol samples collected in the area of Hajdúság. Their results defined a kind of a steppe, made diverse by sodic patches. They state that salinization began not in the Holocene, but sodic soils may also have been generated already during the warm and dry interglacial periods of the Pleistocene.

As we could see above, soil generation processes of Chernozem and/or Luvisol in the Hortobágy during the Holocene, causes for salinization and the development of the sodic steppe as well as the transformation of soils are still open questions.

Negotiating between the two different conceptions and further analyses are highly important, considering the appreciation of the soil generation in the Hortobágy, since in the first case the generation of sodic soils can be followed back only for a few centuries, while according to the second opinion, sodic soils have been characteristics of the Hortobágy and the Great Hungarian Plain for thousands of years. Proving the different opinions and confirming the presence of sodic soils in the Holocene pose an extraordinary scientific problem.

### ***The importance of soils in the reconstruction of the palaeoenvironment***

Examination of soils could be one of the most important methods to solve this problem. The statement of Dokuchayev that “Soil is the mirror of the landscape” stands for palaeosoils, too. What can we mean by this statement? Soils develop on soil forming factors, under soil generation processes (pair of processes). Soil forming factors – geological conditions, relief, hydrogeology, climatic conditions, biological factors, the period required for soil generation and human effects – form a great overlap with the landscape components. Aggregated operation of soil forming factors, acceleration of some of these effects and the way they

<sup>3</sup> A. Borhidi: Kerner és az Alföld növényföldrajza mai szemmel (Kerner and phytogeography of the Great Hungarian Plain with a current view). Kanitzia 6 (1998) 7–16.

<sup>4</sup> Gy. Bodrogközy: Szikes puszták és növénytakarójuk (Sodic steppes and their vegetation). BékésMK 6 (1980) 29–50.

<sup>5</sup> F. I. Nyilas – P. Sümegi: The Mollusc fauna of Hortobágy at the end of the Pleistocene (Würm 3) and in the Holocene. Proceedings of the 10th International Malacological Congress, Tübingen, 27<sup>th</sup> August – 2<sup>nd</sup> September 1989 (1991) 481–486.

<sup>6</sup> R. Soó: A magyar puszták fejlődéstörténetének problémája (Problems of generation history of the Hungarian steppes). FrK 59 (1931) 1–17.

<sup>7</sup> Gy. Szöör – P. Sümegi – É. Balázs: Sedimentological and geochemical analysis of Upper Pleistocene paleosoils of the Hajdúság region, Hungary, in: M. Pécsi – F. Schweitzer (eds.): Quaternary environment in Hungary. Studies in Geography in Hungary 26 (1991) 47–59.



interfere always characterize the landscape formation and environment in a certain period. Based on that, palaeosoils – in case we know their age – can be good bases in reconstructing the palaeoenvironment.

In solving the problem, orientation among time levels (periods) means a difficulty. Archaeological excavations provide us information concerning one or two generations, some descend not more than a few hundred years. Vegetation changes follow the changes of the environment at a same pace or a bit more slowly. Geological changes, however, need much more time than mentioned above, for some processes thousand years may appear as seconds. Soil changes can be placed somewhere between vegetational and geological periods. We do not have enough information about how much time is required for the appearance of a differentiated pedon that can be described with genetical soil horizons.<sup>8</sup>

According to the current knowledge, simple, quick soil processes (dissolution of salts, initial leaching processes, carbonate moving inside the profile) need only one or two hundred years, while some thousand years are required for the development of a mature soil.<sup>9</sup> It also means that short-range changes (climate changes, short time human actions etc.) cannot certainly be reconstructed in soil generation. Besides these, soil serves as a good indicator of long-lasting, constant changes.

A bigger problem is that – although some fixed, buried soils are known from the Pleistocene and earlier times – Holocene soil forms rarely get to the position when soil formation stabilizes and – for example by burying – previously generated soil characteristics engage. Recent soils have been continuously developing since the last loess formation periods and either climate, living beings or other soil forming factors change; soils are altering, continuously adapting to new conditions. According to the above-mentioned facts, one cannot confirm the date of salinization by observing current soils. Buried and intact Holocene soils are needed for deciding questions on soil history, such that have not developed after their generation and changed postgenetically as little as possible. Such buried soil strata can be found in the Hortobágy in the burial sites of Copper Age, kurgans.

Kurgans are also called “mounds of the Kumanian nation”, “mounds of the Tartars” and “mounds of the Turkish” in Hungarian. Kurgans are inestimable treasures of Hungary, are carriers of significant archaeological, landscape, botanical and pedological values.<sup>10</sup> Their pedological value means that information can be gained from their observation concerning soil generation processes that passed during the time since their creation, characteristics of buried soil strata, and the environment of soil generation.

Since palaeosoils are also suitable for the reconstruction of the ancient environment, an aim of our work was to present the environment of the buried soil of the kurgan called Csípő mound in Hortobágy with the help of pedological investigations and identify the soil generation processes that took place since the building of the kurgan, and that which soil type suits the original soil stratum. In addition to pedological research, the reconstruction of ancient environment has been completed by malacological investigations.

<sup>8</sup> P. Stefanovits: Mezőgazdasági Mémőktovábbképző Intézet talajvédelmi tanfolyama, Gödöllő, 1966; <http://www.sardc.net/imeresa/Programs/CEP/Pubs/CEPFS/CEPFS01.htm>; O. E. Hayes – N. Clark: Cropping systems that help control erosion. Bull. 452. Wisconsin Soil Conservation Comm., Soil Conservation Service, and the Univ. of Wisconsin Agricultural Exp. Station. Madison 1941.

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### **Methods, materials studied**

Coenological investigations<sup>11</sup> and soil mapping with a Pürckhauer sampler<sup>12</sup> were made on the kurgan selected called Csípő mound and its surroundings several times in 2000 and 2001. Due to the fact that kurgans are nature conservation areas in Hungary, in order to protect the kurgan and its valuable vegetation, samples were collected not from dug profiles, but we made network-mapping drills.<sup>13</sup> Borings were made at 5–6 meters depth into the body of the kurgan and at 2 meters depth in the surroundings. The aim of the drillings, started from the top third of the kurgan, was to observe the material of the kurgan and the soil buried by the kurgan. The boring started at the foothill region of the kurgan at the supposed accumulation zone, aimed at reconstructing the area that was destroyed during the building of the kurgan. And the borings at a farther area of the kurgan were supposed to explore the areas that had not been (or had only been slightly) disturbed during the building of the kurgan. Drilled samples were split based on their morphology in accordance with soil strata, then malacological and soil investigations were made. Among soil examinations, CaCO<sub>3</sub> %, total organic carbon (pyrolysis), humus % (Tyurin-method), pH (both H<sub>2</sub>O and KCl), salt % and mechanical analyses were carried out.<sup>14</sup>

### **Results, conclusions**

Chernozem, Vertisol and Solonetz mosaics were identified in the area surrounding the kurgan. Mosaic shapes were determined by groundwater and micromorphology characteristics. Specific stratification could be seen within the kurgan.

Calcic Chernozem soil was determined on the top of the mound. Below the recent Chernozem soil, a culture stratum showing differing thickness, but homogeneous colour was found and it was followed in the core by the buried soil and its parent material.

A and B horizons of recent Chernozem soil mean dry habitats and can be characterised by humus and lime dynamics typical for Chernozem soils. Based on the colour and humus content (*Table 1*) of the culture stratum it can be stated that the kurgan itself was built from the rich organic materials of its surroundings. The high salt content of this spot may refer to the sodic environment equal in age to the building time of the kurgan. Based upon its colour, organic material and lime dynamics, the buried soil below the culture stratum shows a drier environment and slightly sodic, Chernozem type soil generation.

Molluscs were found in the top layer (Chernozem A horizon) of the body of the mound, in the buried soil and its parent material, and in two spots of the surrounding area (C horizon of the ring surrounding the kurgan and A horizon of the surrounding soil). Dry steppe species (*Chondrula tridens*, *Cepaea vindobonensis*) were brought to the surface from the buried soil by the cores from the centre of the kurgan. At this point, the humus content (2,3%), slightly alkaline pH and CaCO<sub>3</sub> content (0,5%) of the soil reveals Chernozem soil formation. Species preferring slightly wet or alternating dry environments were found in the cores taken at the edges of the kurgan (*Vertigo pygmaea*, *Helicopsis striata*, *Chondrula tridens*, *Vallonia pulchella*, *Cepaea vindobonensis*). According to their characteristics, buried soils found here are similar to the previously presented ones, although, their pH was slightly higher (pH H<sub>2</sub>O 9,4; pH KCl 8,2). As for the morphology, carbonate and humus contents of this soil show Chernozem-like soil generation, the accumulation of salts and parallel appearance of high pH. These may result from the growth of groundwater level that saturated the fixed palaeosoil after the building of the mound.

<sup>11</sup> J. Braun-Blanquet: Pflanzensociologie II. Wien 1951.

<sup>12</sup> H. Finner (hrsg.): Bodenkundliche Kartieranleitung. Hannover 1994.

<sup>13</sup> H. J. B. Birks – H. H. Birks: Quaternary Palaeoecology. London 1980.

<sup>14</sup> I. Buzás (ed.): Talaj- és agrokémiai vizsgálati módszertankönyv (Methods for soil and agrochemistry analysis) 2. Budapest 1988.



horizon (cm)	pH (H <sub>2</sub> O)	pH (KCl)	salt %	CaCO <sub>3</sub> %	TOC %	humus %	Mechanical analysis		
							clay	dust	sand
A 0-20	7,72	7,06	0,07	2,29	7,19	3,43	38	39	23
B 20-110	7,8	7,4	0,2	2,31	6,33	2,63	39	35	26
k1 110-160	7,5	7,21	1,53	0,06	6,36	2,46	39	32	29
k2 160-320	7,25	6,81	1,35	0,07	6,18	2,82	38	40	22
k3 320-400	8,47	7,31	0,76	0,15	5,34	2,37	38	35	27
Ap 400-420	8,96	7,6	0,68	0,52	5,53	2,35	39	36	25
Bp 420-480	9,49	8,03	0,41	10,14	4,59	1,5	38	37	25
C 480-580	9,66	8,08	0,16	14,76	3,79	0,6	41	34	25

Table 1. Results of soil analysis from the core sample of the centre of Csípő mound.

A: recent soil A horizon; B: recent soil B horizon; k1, k2, k3: culture strata with anthropogenic origin; Ap: buried (palaeo) soil A horizon; Bp: buried (palaeo) soil B horizon; C: parent material of buried soil

In the parent material, lime content increases (13%) and humus content decreases. In the covering soil of the body of the kurgan, species indicating the driest environment were found (*Helicopsis striata*, *Chondrula tridens*, *Cepaea vindobonensis*). The examined soil horizon corresponds morphologically (animal burrows, lime dynamics etc.) to the B horizon of Chernozem soils, which fact is also confirmed by soil analysis.

Examinations of soil texture during research in recent years have analysed the relation between salinization and parent material<sup>15</sup>, which are proper indicators of certain soil generation processes (clay formation, lessivage etc.), too. Data of mechanical analysis in the material of the kurgan show a balanced loamy texture, that is, signs for clay formation, lessivage, strong leaching, acidification in pH, altogether forest soil (Luvisol) formation. Contrarily, an environment of steppe type, but mosaic, frequently effected by water and by salinization processes was reconstructed.

By determining the altitude (above sea level) of the drillings made on the body of the kurgan, the determination of the settlement of a loess type sediment, that serves as parent material of the buried soils, also became possible.

Parent material in the centre of the kurgan lays about 30–50 cm higher than in the drillings made at the edges (fig. 2). This supports the pedological and malacological results according to which the buried soil at the centre of the kurgan generated during drier conditions, and going towards the lower edges of the “hump” of the parent material, an area covered by water periodically or edged by wet habitats could generate. Therefore, the kurgan was originally built on a natural mound, not surprisingly, since it was the drier locations that served as proper burial sites in the environment often covered by water.

Species found farther from the kurgan (*Planorbis planorbis*, *Anisus spirorbis*, *Oxyloma elegans*, *Chondrula tridens*, *Cepaea vindobonensis*) refer to a water-edged, sodic and steppe type environment, thus mosaic area. Part of the soil samples taken from this area is Chernozem soil covering a slightly higher ridge, which emerges from the mosaic wet and sodic area as an island.

Pedological and malacological examinations can be well compared with botanical results.<sup>16</sup> The dry loess grasslands harmonise well with the Chernozem soils generated on the top of the kurgan and with the dry steppe mollusc species. However, going towards the foothill region of the kurgan, loess vegetation varies with the species of the sodic pastures along stripes. Those ridges around the kurgan which contain mollusc species preferring both steppe and wet environments are well indicated in the botanical record by the patches of

<sup>15</sup> L. Kuti – T. Tóth – B. Kerék – A. Zöld – I. Szentpétery: Fluctuation of the groundwater level, and its consequences in the soil-parent material-groundwater system of a sodic Grassland. Agrokémia és Talajtan 51 (2002) 253–262.

<sup>16</sup> K. Penksza – K. Joó: Kunhalmok botanikai és talajviszonyainak vizsgálata (Examinations on botanical and soil conditions of kurgans). Aktuális flóra- és vegetációkutatás a Kárpát-medencében V. Pécs 2002, 65.



*Salvia nemorosae-Festucetum rupicolae* Zólyomi ex Soó 1964 association and the protected *Phlomis tuberosa*. These ridges emerge only by 10–30 cm from the salt affected environment. A typical plant association of lower areas is *Artemisia santonici-Festucetum pseudovinae* Soó in Máthé 1933 corr. Borhidi 1996, a sodic pasture plant association.

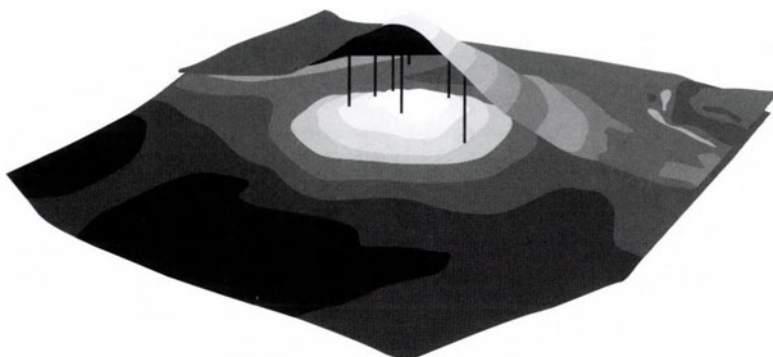


fig. 2. The position of the parent material on the basis of the drillings

Based on the pedological, malacological and botanical data gained from the Csípő mound and its surroundings we can state that the kurgan was built in the Copper Age onto an existing loess ridge, which emerged from a wet area under salinization processes. Processes referring to forest vegetation existing in the area and this way referring to forest type soil formation can not be reconstructed during thousands of years passed. Soil generation processes represent processes towards Chernozem types. Current vegetation on the kurgan and in its surroundings show similarity with the vegetation present at the time of the building of the kurgan.<sup>17</sup>

<sup>17</sup> The author thanks Pál Sümegi, Károly Penksza and Katalin Joó for their help during research

and making their results available. The research was supported by OTKA T 038272.

## SPACE AND GIS TECHNOLOGY IN PALAEOENVIRONMENTAL ANALYSIS (Old maps, satellite images and digital elevation models in archaeology)

The analysis of the environmental status and the original, natural relief of study areas (prior to the water regulation works) their cartographic reconstruction is a high priority in archaeology. Palaeohydrological studies may support archaeological fieldwork, mainly on flatland areas. The aim of mapping the palaeohydrological status is to determine and locate all factors that have been governing the water transport of the study area, and detecting differences in water supply.

The most important is the absolute elevation of parts in the study area and the local elevation differences. Other important factors are the type and the quality of soil, but this can be hardly investigated by classic geographic information system (GIS) methods: satellite image analysis provides valuable ancillary information on them. Signs of old water channels that were active before water regulation works can be detected even in areas covered now by large cultivated fields, because their water supply is different from that of their surroundings owing to the different soil types. It is for this reason that these channel traces are made visible by their different vegetation type and density. Therefore, the most important databases for our investigations are: the digital elevation models and the medium- and high-resolution satellite images. Besides, it is possible to have a look at the natural status of the study area prior to and at the time of the river regulations on old maps.

In the present study I show the key databases used in constructing a GIS-based analysis of a flatland zone the Great Hungarian Plain in order to reconstruct the palaeohydrology of the study area. The ancient water system is crucial for the settlement and economic system of the civilization investigated by archaeologists:<sup>1</sup> water supply, the possibility of such as inundation, the defence capabilities, the extents of possible agricultural lands are very important factors.<sup>2</sup> Almost all of them are determined by the elevation, and can be studied by the described data sources.

### *Old maps based on systematic cartography*

The reconstruction of palaeoenvironment often requires old maps that were surveyed before industrialization, the water regulation measures and other major landscape-transforming human activities. The main requirement to these maps is that they have to fit to modern topographic ones without significant error. The very old maps, drawn before the introduction of the field geodesy, seldom meet this requirement. In Europe the 18<sup>th</sup> century brought about improvement when Cassini started the survey of France. In Hungary some county maps were surveyed by Sámuel Mikoviny between 1730 and 1750 but these maps did not form a contiguous

<sup>1</sup> P. Sümegi – R. Kertész – G. Timár – K. Herbich: Palaeoenvironmental factors and Neolithization process of the Carpathian Basin: some aspects of a new geoarchaeological model, in: P. Cattelain (ed.): Acts of the XIVth Union Int. of Prehistoric and Protohistoric Sciences, Liège, Belgium, 2–8 September 2001., Section 1: Theory and methods. British Archaeological Reports, International Series 1145 (2003) 135–141.

<sup>2</sup> P. Sümegi: Early Neolithic man and riparian environment in the Carpathian Basin, in: E. Jerem

– P. Raczky (eds): Morgenrot der Kulturen. Budapest 2003, 53–60; P. Sümegi – E. Magyar – Zs. Szántó – S. Gulyás – K. Dobó: Part II. Man and environment in the Late Neolithic of the Carpathian Basin – a preliminary geoarchaeological report of Polgár – Csöszhalom, in: R. Aslan – S. Blum – G. Kastl – F. Schweizer – D. Thumm (eds): MauerSchau 2 (Festschrift für Manfred Korfmann) Remshalden-Grünbach 2002, 838–840.



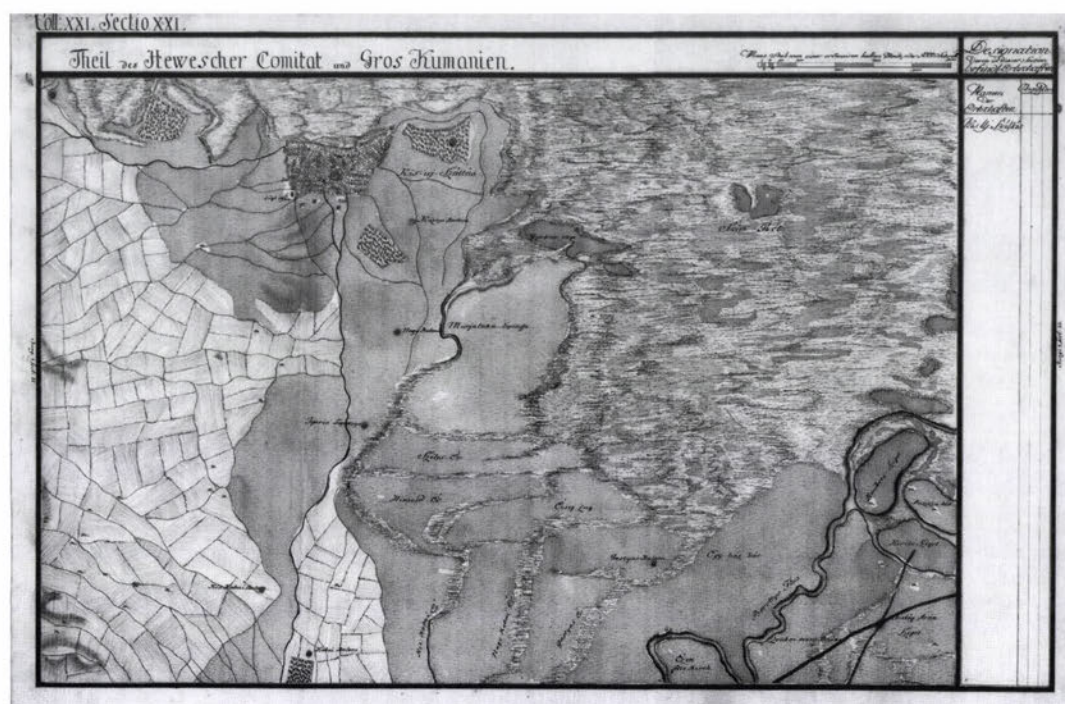


fig. 1. Map sheet of Kisújszállás (1784), the Great Hungarian Plain.  
First military survey of the Habsburg Empire

system.<sup>3</sup> Some detailed maps of different parts of the Great Hungarian Plain have been made by Antal Balla.<sup>4</sup> The first two large-scale map series resulted from the first and second military surveys of the Habsburg Empire, taken by the Institute of Military Geography of Vienna.

The first military survey of the Habsburg Empire was taken between 1783 and 1786, during the reign of Emperor Joseph II, and is often referred to as the 'Josephian survey' (*Josephinische Landesaufnahme*).<sup>5</sup> The survey has no real geodetic basis<sup>6</sup> albeit in that time a few triangulation campaigns were under way or completed.<sup>7</sup> The colour survey sheets have the scale of 1 : 28 800 and each of them covers a 18206 by 12137 meters area.<sup>8</sup> As the survey has been made for military purposes, the terrain cover signs mainly refer to the possibilities of the infantry and the cavalry; that's why the riparian forests are mostly signed as swamplands. Fitting the map sheets to the modern topographic maps and thus their GIS integration can be made using similar points (ground control points). The precisiton of this fitting varies within a wide range in Hungary: some sheets fits almost precisely (error is under 10 meters) while the neighbouring one may contain significant distortion and its fitting is burdened with an error of around one hundred meters.

The main advantage of this map system is that it is the first to be quasi-precisely fitted to modern maps and still shows the environmental conditions before the main water regulation measures in the Great Hungarian Plain and along the Danube. Regularly inundated areas are clearly marked along with ancient stream channels. This enables investigating the palaeohydrology of the Great Hungarian Plain even for Neolithic times (*fig. 1*).

<sup>3</sup> Á. Papp-Váry – P. Hrenkó: Magyarország régi térképeken. [Hungary on old maps] Budapest 1990, 90.

<sup>4</sup> *ibidem* 134.

<sup>5</sup> A. Borbély – J. Nagy: Magyarország I. katonai felvétele II. József korában. [The first military survey of Hungary issued in the age of Emperor Joseph II.] Térképészeti Közlöny 2 (1932).

<sup>6</sup> E. Bod: A magyar asztrogeodézia rövid története 1730-tól napjainkig I. rész, [A brief history of

the Hungarian astrogeodesy I. part] Geodézia és Kartográfia 34 (1982) 283–289.

<sup>7</sup> L. Homoródi: Régi háromszögelési hálózataink elhelyezése és tájékozása. [Placing and orientation of our old triangulation networks] Földmérési Közlemények 5 (1953) 1–18.

<sup>8</sup> T. Strenk: The structure of maps covering Hungary from the first military survey. AnnUnivSciBudapest 1–2 (1985) 360–372.







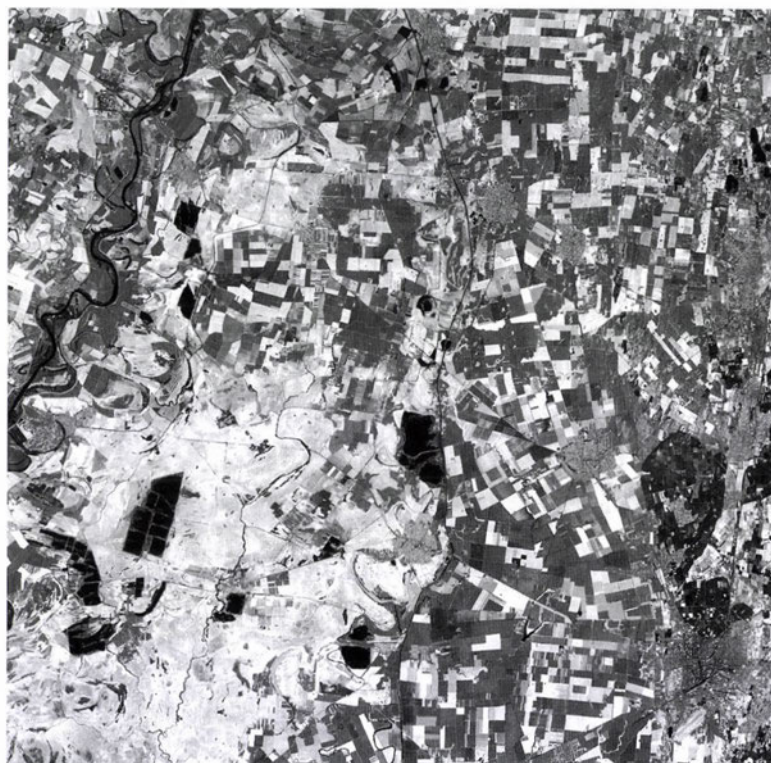


fig. 3. Landsat Thematic Mapper (30 meter resolution) satellite image of the Polgár–Hortobágy area

The use of aerial photographs in archaeology has a remarkable history.<sup>11</sup> The knowledge of the shadowing effects and the colour changes caused by different soils resulting from the remains of old settlements or different water supply, are well-known among archaeologists, and therefore are beyond the scope of this presentation. Here I only mention that aerial photographs are mostly used to identify possible research sites, rather than to reconstruct the palaeoenvironment.

Compared to aerial photographs, satellite images offer a wide-scale view (of an area) but a worse resolution. As they are in digital format, a computer-based image processing is available to improve some details with great importance to our study.<sup>12</sup> The most relevant palaeoenvironmental elements, well recognisable on satellite images, are the soil differences. Changes in vegetation cover usually refer to different soils, even in an intensive agricultural landscape. Abandoned river or stream channels can be easily mapped on those datasets (*figs 3–4*). In the following paragraphs, the Landsat Thematic Mapper, the SPOT XS/P and the Ikonos data are described.

NASA first launched a Landsat satellite with a Thematic Mapper (TM) instrument onboard in 1984.<sup>13</sup> The system surveys the Earth's surface from an altitude of 700 kilometres, the pixel (smallest image element) size on the surface is 30 meters. The instrument measures the surface reflectance in seven different channels (this means 7 independent colours). The size of a full image scene is about 6000 by 6000 pixels, or 180 by 180 kilometres. By now almost a full global coverage of original Landsat TM data, older than 10 years, is available without charge, so this data source is a very cheap method to gather information on the present environment, and

<sup>11</sup> *S. Neogrady*: A légifénykép és az archeológiai kutatások. [Aerial photography and archaeological research] *Térképészeti Közlöny* 7 (1950) 283–332; *Zs. Miklós*: A légi fotózás szerepe a templomkutatásban. Két Tolna megyei középkori templom felfedezése. [The role of aerial photography in the

church research. Discovery of two medieval churches in Tolna county.] *Műemlékvédelem* 46 (2002) 30–35.

<sup>12</sup> *P. Mather*: *Computer Processing of Remotely-sensed Images: An Introduction*. Chichester 1989.

<sup>13</sup> *T. M. Lillesand – R. W. Kiefer*: *Remote Sensing and Image Interpretation*. New York 2000.



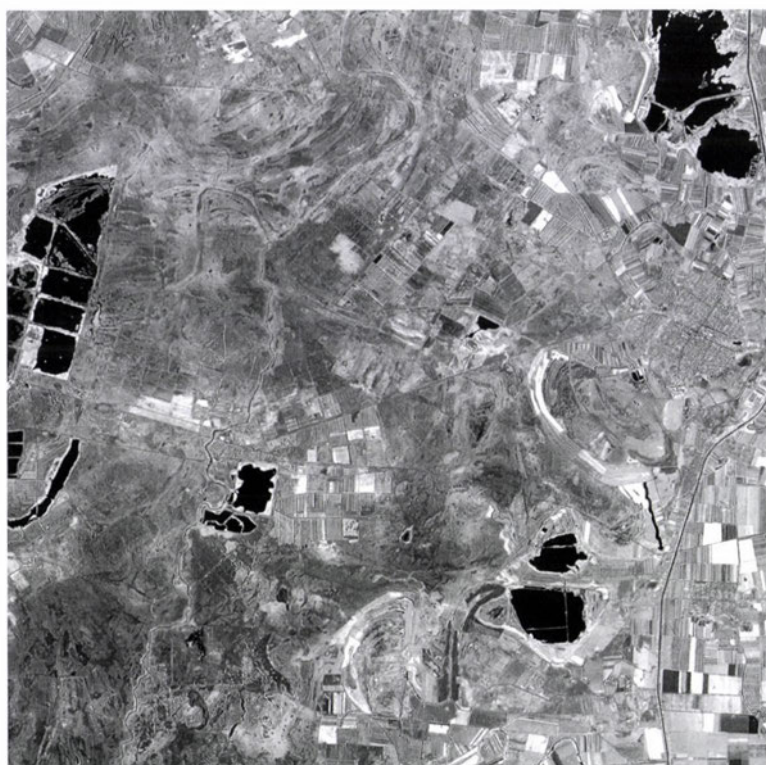


fig. 4. Spot XS (20 meter resolution) satellite image of the Hortobágy area, the Great Hungarian Plain

to study some elements of the palaeoenvironment, too (*fig. 3*). Compared to the following two data types, it provides information with worse horizontal and better spectral resolution.

The French SPOT satellite system started in 1988. Its multispectral receiver (XS system) provides surface reflectance data on three channels with 20 meters of horizontal resolution. The resolution of the one panchromatic (P) band is 10 meters. As its horizontal resolution is significantly better than that of the Landsat, it provides more effectiveness in searching palaeogeographical elements (*fig. 4*) but these data can be only purchased.

The Space Imaging Ikonos system has produced a new class in satellite imagery. Its resolution (and also its small area coverage) makes it similar to aerial photographs. The colour resolution of the Ikonos is 4 meters while the panchromatic one is 1 meter (*fig. 5*). The data are very expensive and usually it is a better choice to buy airplane-based ortophotos for the study area than ordering the Ikonos imagery.

Besides the satellite images, digital elevation models provide a very powerful tool for palaeoenvironmental studies. The digital elevation model (DEM) is a raster image that covers a part of the Earth's surface like a map, and its pixels contain the significant (usually the average) elevation of the covered part of the terrain. These models can be derived by numerous methods: using the original levelling data, digitizing the elevation contour lines of a map and use the digitized vertices as a model of the original levelling data or using spaceborne radars as the ones onboard of the ERS-1 and 2 satellites<sup>14</sup> and the Space Shuttle (SRTM; see below) or using stereopairs. In the practice the contour line digitalization is the most used but also the most labor-consuming method. Nowadays, as the SRTM dataset is released, it can be used for applications that don't need high accuracy. In the following these two methods are described.

<sup>14</sup> C. Prati – F. Rocca: DEM generation with ERS-1 interferometry. Assoc. of Geodesy Simposia. New York 114 (1994) 19–26.





fig. 5. Space Imaging IKONOS image (4 meter resolution) of the vicinity of Tiszacsege. The pre-regulation course of the Tisza River is indicated by parallel lines. Three oxbow lakes, cut off prior to water control works, are indicated by letters.

Digitizing the map contour lines, and using the digitized vertices as simple three-dimensional samples, and generating an elevation model after using an appropriate interpolation method is a well known and widely used method. The quality of the resulting DEM is characterized by the scale and the vertical contour interval of the original map, and their horizontal and vertical resolutions. Usually these map properties determine the effective resolution both in a horizontal and a vertical sense.

On a flatland area such as the Great Hungarian Plain, a very fine vertical interval is needed to compile a useful DEM. Even using a contour interval of half meter (this is the maximum available to date), extensive areas remained totally flat on the model. At the areas having just a few meters of internal relief difference, such high-resolution DEMs provide shocking images, telling a whole story of the old stream structure<sup>15</sup> (figs 6–7). Coupling these datasets with dating methods, e.g. radiocarbon and pollen analyses, even the age of the abandoned channels can be determined, thus reconstructing the palaeohydrology both in space and time.<sup>16</sup>

Contour-based DEMs are quite expensive and in Hungary it is forbidden to make them from official, state owned maps without permission. They are based upon the country of the study area, and it is a complicated task to fit together DEMs of different qualities from neighbouring countries, using different geodetic bases and national map projection systems.

<sup>15</sup> G. Timár: Az Alföld nagyfelbontású digitális domborzati modellje. (High resolution digital elevation model of the Great Hungarian Plain) *Geodézia és Kartográfia* 55 (2003) 19–23.

<sup>16</sup> G. Timár – P. Sümegei – J. Geiger – Zs. Szántó – E. Bodor: Story of an oxbow lake: an outlook

to the Holocene tectonics and climate of the Great Hungarian Plain, in: G. Bada (ed.): *Quantitative neotectonics and seismic hazard assessment: New integrated approaches for environmental management*. Abstract book of the 3<sup>rd</sup> EGS Stephan Mueller Topical Conference, 2001, 62.



fig. 6. Contour based elevation model of the Polgár – Tiszadob area. The width of the image is 18 km, the height is 24 km. The relief difference of the Tisza meander belt is below 10 meters. Darker hue indicates lower altitude.



fig. 7. Contour based elevation model of the Köröszug (the confluence of the Tisza and Körös Rivers). Size of the depicted terrain is  $24 \times 24$  km. The elevation difference in the floodplain is below 8 meters.





fig. 8. The central part of the Great Hungarian Plain on the Space-Shuttle-radar-based elevation model (SRTM). The areas of the previously presented elevation models are indicated by small rectangles. Note the abandoned channel system of the plain, even far from the present rivers.

The SRTM (Shuttle Radar Topography Mission) elevation dataset<sup>17</sup> offers a solution to this latter problem. This data source is the result of a joint mission of the NASA, USGS and the German and Italian space authorities.<sup>18</sup> The measuring campaign was carried out in February 2000, when a radar instrument onboard of the Space Shuttle Endeavour measured the majority of the Earth's surface during its 11-days mission.<sup>19</sup> The data processing took more than two years afterwards, and now the elevation of the area between the 60 degrees of northern and 57 degrees of southern parallels is to be published. The Eurasia data block was released in November 2003 providing a new level of global digital elevation data of the area of the Pannonian Basin, too.

The SRTM elevation dataset has three by three arc second horizontal resolution that equals a raster size of 90 meters. This improves the data quality of the SRTM by a factor of 10 compared to its predecessor, the GTOPO30 data.<sup>20</sup> The vertical resolution is one meter, but the accuracy is not so good: as a radar-based elevation dataset, its surface model contains the elevation of the forests and buildings, too. It should be also underlined that in the regions of high relief the radar beam response cannot be evaluated from low-lying areas

<sup>17</sup> T. G. Farr – M. Kobrick: Shuttle Radar Topography Mission produces a wealth of data. *Eos, Trans. American Geophys. Union* 81 (2000) 583–585.

<sup>18</sup> B. Rabus – M. Eineder – A. Roth – R. Bamler: The shuttle radar topography mission – a new class of digital elevation models acquired by spaceborne radar. *Photogrammetric Remote Sensing* 57 (2003) 241–262.

<sup>19</sup> M. Werner: Shuttle Radar Topography Mission (SRTM). Mission overview. *Journal of Telecommunication (Frequenz)* 55 (2001) 75–79.

<sup>20</sup> GLOBE Task Team et al.: The Global One-kilometer Base Elevation Model. Internet database, 1999.





fig. 9. Palaeohydrological map of the Polgár area: combination of a second military survey sheet with the contour-based elevation model, in a common projection system.

because of the shadowing effect.<sup>21</sup> Similarly, water surfaces produce non-valuable radar reflection signals, so they appear on the original SRTM images as zero rasters with no elevation. Fortunately, the elevations of water bodies are well known and the original images can be improved using these values.

This dataset covers the surface with homogeneous quality and methodology, not disturbed by national borders. Besides, these data are free and available on the Internet, which is a remarkable advantage compared to the contour-based models. On the flatlands, its resolution provides worse results, but even these images can be used for tracing palaeochannels of abandoned streams (*fig. 8*).

Summarizing the described methods, it should be underlined that satellite images and DEMs can be used together very effectively. Very flat areas (eg. the Hortobágy, the central zone of the Great Hungarian Plain) shows no internal differences on a DEM but its soil differences can be easily detected on a Landsat TM or SPOT image (*fig. 4*).

### **Combination of the datasets**

The aim of such a combination is to have all the data in the very same map projection system. In case of the satellite images and any data based on modern maps, georeferencing is an easy task. As was mentioned before, some of the old maps can be rectified by ground control points or by estimating the parameters of their projection and geodetic base (if there was any). Moreover, the

<sup>21</sup> G. Timár – T. Telbisz – B. Székely: Űrtechnológia a digitális domborzati modellezésben: az SRTM adatbázis. (Space technology in the digital elevation

modelling: the SRTM database) Geodézia és Kartográfia 55 (2003) 11–15.



knowledge of the used map signs and area coding is also necessary. After converting our data to a common system, it is possible to overlay these maps and satellite images, or even to make bird's-eye-views using e.g. the old maps. In the practice, coupling the second military survey map sheets with the high-resolution elevation models proved to be the most useful combination, resulting in a 'palaeoenvironmental map' (fig. 9).

### **Conclusions**

Although the environment has changed significantly during the very last centuries, some key elements can be found and analyzed in modern databases. The most important environmental factors are connected to the ancient water supply and local elevations: multispectral satellite images and high-resolution digital elevation models are capable to map them. In addition to these databases, the analysis of old maps brings us back some centuries closer to the unchanged 'palaeoenvironment'. Some of these data sources are now partially free and available on the Internet, providing an almost global cover, making the GIS support of palaeoenvironmental studies an extremely low-cost option.<sup>22</sup>

<sup>22</sup> The presented research activities are supported by the Hungarian Space Office and the Ministry of Informatics and Telecommunication (Project TP094). The author is extremely grateful to Pál Sümegi and Imola Juhász (University of Szeged and Archaeological Institute of HAS) for their patient

help to introduce him to the very basics of the archaeological analyses. The digital elevation models on *figs 6–7*. have been compiled based on topographic maps whose content is owned by the Institute of Geodesy, Topography and Remote Sensing (FÖMI) with its permission.

## THE LAST GLACIAL CLIMATE, ENVIRONMENT AND THE EVIDENCE OF PALAEOLITHIC OCCUPATION IN VOJVODINA PROVINCE, SERBIA: AN OVERVIEW

At the end of the last interglacial, over 100 ka ago, Earth's climate switched into a colder, glacial mode.<sup>1</sup> The last glacial was punctuated by a series of large and abrupt climatic changes.<sup>2</sup> During this, generally cold and climatically unstable period, humans finally occupied the whole European land.

The Vojvodina region is situated in SE part of Carpathian (Pannonian) Basin. This area is a low land of the Danube, the Tisa (Tisza) and the Sava rivers' interfluvium. The largest part of the Vojvodina region has been covered by various types of last glacial sediments. In spite of their large spreading and considerable diversity of last glacial deposits which represent different environmental conditions until now known evidence of human occupation is very poor and incomplete. This study summarizes recent advances in chronostratigraphical, palaeoclimatic and palaeoenvironmental interpretations as a time and palaeogeographical framework for archaeological evidence during the last glacial period in the Vojvodina region.

### *Chronostratigraphy*

Classical Pleistocene subdivisions are based on climatostratigraphic criteria. The basic climatostratigraphic units are glacials and interglacials.<sup>3</sup> High-resolution studies on deep-sea sediments and ice-cores indicate abrupt palaeoclimatic oscillations during the last glacial period. These abrupt climatic changes are interpreted to have affected the Northern Hemisphere as well, and more specifically Europe. Among the available terrestrial sequences likely to register such oscillations, loess sequences, corresponding to eolian deposition in periglacial environments, can provide easily accessible high-resolution records.<sup>4</sup> Signatures of the last glacial abrupt climatic fluctuations provided a reliable basis for a very detailed millennial chronostratigraphy.

During the last glacial period the SE part of Carpathian Basin is known as a periglacial area with intensive loess accumulation. Names of the loess-palaeosol units follow the Chinese loess stratigraphic system. The chronostratigraphy of the last glacial cycle loess-palaeosol sequences of the Vojvodina region based on Amino-acid racemization (AAR), luminescence and radiocarbon geochronology have been presented in several recent studies.<sup>5</sup> According to that chronostratigraphic model, the last interglacial–early glacial palaeosol S1

<sup>1</sup> G. J. Kukla – M. L. Bender – J. L. Beaulieu – G. Bond – W. S. Broecker – P. Cleveringa – J. E. Gavin – T. B. Herbert – J. Imbrie – J. Joyel – L.-D. Keigwin – K. L. Knudsen – J. F. McManus – J. Merkt – D. R. Muhs – H. Mueller – R. Z. Poore – S. C. Porter – G. Seret – N. J. Shackleton – C. Turner – P. C. Tzedakis – I. J. Winograd: Last Interglacial climates. *Quaternary Research* 58 (2002) 2–13.

<sup>2</sup> W. Broecker: Does the trigger for abrupt climate changes reside in the Ocean or in the Atmosphere? *Science* 300 (2003) 1519–1522.

<sup>3</sup> G. J. Kukla – V. Cilek: Plio-Pleistocene megacycles: record of climate and tectonics. *Palaeogeography, Palaeoclimatology, Palaeoecology* 120 (1996) 171–194.

<sup>4</sup> D. D. Rousseau – P. Antoine – C. Hatté – A. Lang – L. Zoeller – M. Fontugne – D. Ben Othman – J. M. Luck – O. Moine – M. Labonne – I. Bentlaeb – D. Jolly: Abrupt millennial climatic changes from Nussloch (Germany) Upper Weichselian eolian records during the Last Glaciation. *Quaternary Science Reviews* 21 (2002) 1577–1582.

<sup>5</sup> S. B. Marković – E. A. Oches – P. Sümegei – M. Jovanović – T. Gaudényi: An introduction to Middle and Upper Pleistocene loess-palaeosol sequences at Ruma brickyard (Vojvodina, Serbia). *Quaternary International* (in press); E. A. Oches – S. B. Marković – W. D. McCoy – T. Stevens – T. Gaudényi – M. Jovanović – R. Walther: Linking the loess – palaeosol record of Pleistocene climate



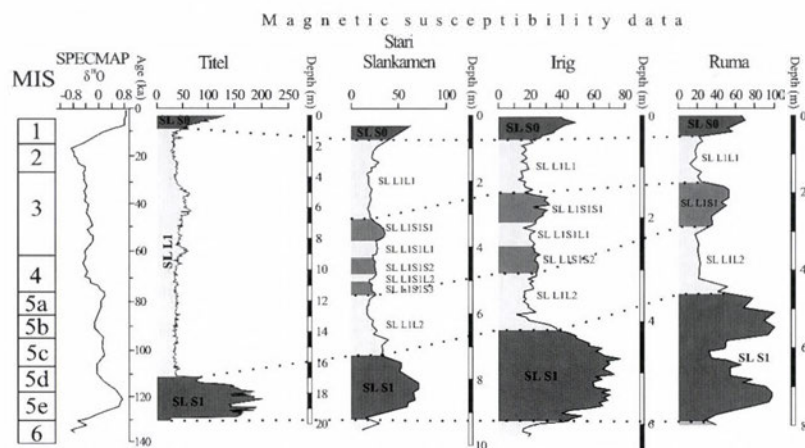


fig. 1. Correlation between the low field magnetic susceptibility records of Titel, Stari Slankamen, Irig and Ruma loess-palaeosol sequences and SPECMAP  $\delta^{18}\text{O}$  series

correlates with Marine isotope stage<sup>6</sup> (MIS) 5. This palaeosol is overlaying by composite loess horizon L1 correlating with MIS from 4 to 2. The structure of the last glacial loess L1 is differently exposed at loess sites in the Vojvodina region. The older loess sub horizon L1L2 is accumulated above palaeosol S1. The Middle Pleniglacial is represented in our region by a weakly developed chernozem soil L1S1, which appears either as a complete pedohorizon (Ruma and Neštin sites), or as a double (Irig, Petrovaradin, Batajnica) or triple pedocomplex (Stari Slankamen). However, palaeosol L1S1 in several exposures (Mošorin and Titel) is not exposed. The youngest loess layer L1L1 accumulated during the Upper Pleniglacial period. Detailed low magnetic susceptibility variations detected in Vojvodina's loess-palaeosol, support correlation with the delta oxygen variations of SPECMAP palaeoclimatic model (*fig. 1*). Grain size evidence revealed many episodes of cold-dry and warm-wet palaeoclimatic conditions, indicating a possible relationship with the Dansgaard-Oeschger cycles.

The generalized chronostratigraphic model of the last glacial cycle loess-palaeosol sequences in the Vojvodina region is shown at *fig. 2*.

The last glacial loess-palaeosol sequences are also stratigraphically related to the other dominant type of the last glacial deposits in the Vojvodina region, cyclic sediments of river terraces.

### ***Palaeoclimatic and palaeoenvironmental interpretation***

The reconstruction of palaeoclimatic and palaeoenvironmental conditions during the last glacial period in the Vojvodina region is interpreted on the basis of sedimentological, magnetic and malacological evidence from the following loess exposures: Mišeluk, Petrovaradin, Irig, Ruma, Stari Slankamen, Batajnica, Titel, Mošorin and Orlovat.

The Vojvodina loess-palaeosol sequences accumulated continuously and completely recorded climatic and environmental oscillations during the last glacial period. Generally, Vojvodina was the driest and the warmest part of the Carpathian Basin during the last glacial period. Palaeoenvironmental reconstruction suggests the dominance of a steppe vegetation, ranging from a relatively humid and thick grassland to dry cold steppe environments. A summarized reconstruction of palaeoenvironmental changes during the last about 110 ka is presented in *fig. 3*.

in Serbia with the expanding central European aminostratigraphy. 17. Congress of INQUA, Reno Nevada, USA, 23–30 July 2003 (2003); M. Bokhorst – S. B. Marković – P. Sümegei – M. A. Prins – J. F. Vadenberghe: Evidence for dominant wind directions in the Pannonian Basin during MIS 2. (in preparation).

<sup>6</sup> D. Martinson – M. G. Pisias – J. D. Hays – J. Imbrie – T. C. Moore – N. J. Shackleton: Age dating and the orbital theory of ice ages: development of a high-resolution 0 to 300,000-year chronostratigraphy. *Quaternary Research* 27 (1987) 1–30.

S0	S0	S0	S0
L1L1	L1L1	L1L1	L1L1
	L1S1	L1S1S1	L1S1S1
		L1S1L1	L1S1L1
		L1S1S2	L1S1S2
		L1S1S2	L1S1S3
	L1L2	L1L1	L1L1
S1	S1	S1	S1

fig. 2. Chronostratigraphic model of the last glacial cycle loess-palaeosol sequences in the Vojvodina region

The last interglacial–early glacial period of investigation area, characterized by continuous pedogenesis of palaeosol S1. Palaeopedological data derived from this palaeosol indicate moderate to warm steppe environment. An early glacial trend of cooling caused palaeoclimatic instability, detectable in five dust peaks correlated to events from C21 to C24 in the North Atlantic region.<sup>7</sup>

Intensive loess deposition began at about 75 ka and terminated during the late Pleistocene–Holocene transition, including two periods of enhanced accumulation at about 70–50 and 30–10 ka. Loess deposition was interrupted by the formation of a weakly developed steppe pedohorizon.

At a number of localities in the Vojvodina loess plateau, the boundary between palaeosol S1 and overlying loess unit L1 is sharp. The colour, granulometric composition, carbonate content and low field magnetic susceptibility change abruptly. The oldest of the last glacial loess layer L1L2 recorded late early glacial and lower Pleniglacial palaeoclimatic oscillations. Grain size distribution of loess L1L2 contains signatures of several periods with intensive air circulation, probably related to Heinrich events (HE) 5 and 6<sup>8</sup> as well as cold periods

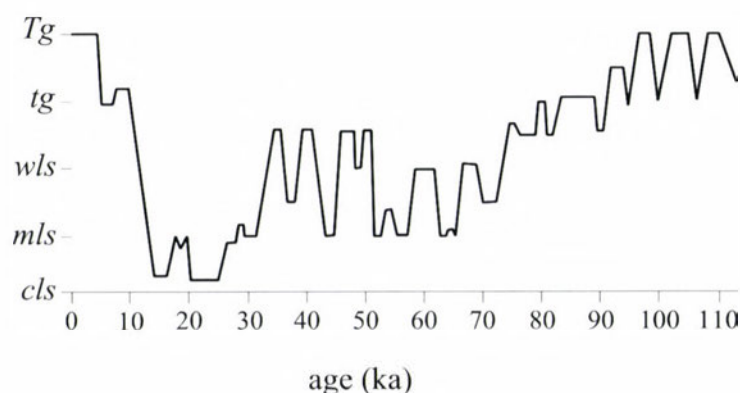


fig. 3. Curve of reconstructed environment during the last 110 ka showing (cls) cold loess steppe, (mls) mild loess steppe, (wls) warm loess steppe, (tg) temperate grassland and (Tg) thick grassland

<sup>7</sup> J. F. McManus – G. C. Bond – W. S. Broecker – S. Johnsen – L. Labeyrie – S. Higgins: High-resolution climate from the North Atlantic during the last interglacial. *Nature* 371 (1994) 326–329.

<sup>8</sup> G. Bond – W. Broecker – S. Johnsen – J. McManus – L. Labeyrie – J. Jouzel – G. Bonani: Correlations between climate records from North Atlantic sediments and Greenland ice. *Nature* 365 (1993) 143–147.



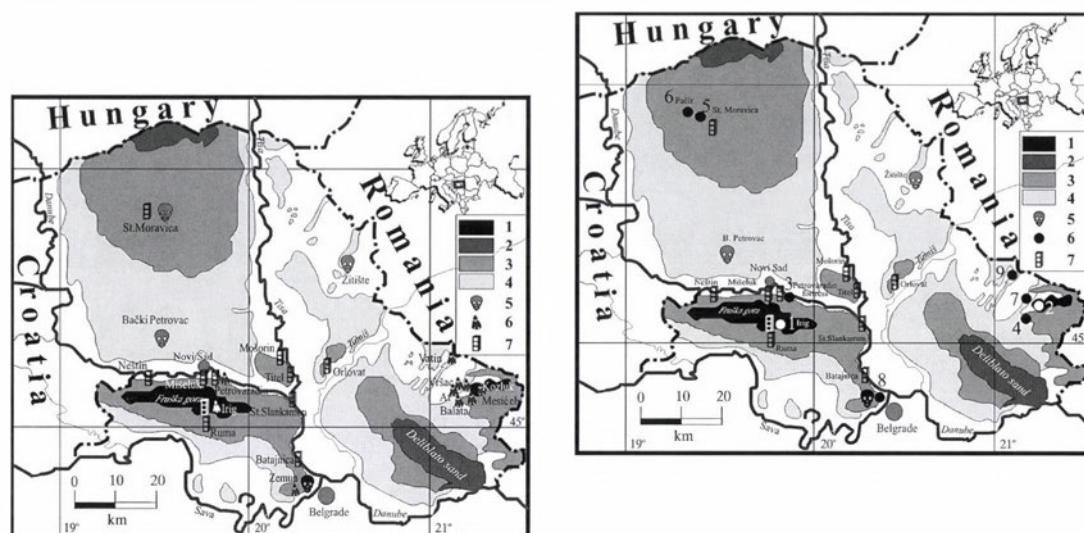


fig. 4. Morphological map of Vojvodina province with geographical position of Palaeolithic archaeological sites and main loess exposures

C18 and C20. Loess horizon L1L2 is mainly characterized by a dominance of aridity tolerant open vegetation and the temperate land snail species *Helicopsis striata*, *Pupilla muscorum*, *P. triplicata* and *Vallonia costata*. This is typical assemblage of “warm” loess steppe environment called *H. striata*.<sup>9</sup> Alternating presence of termophilous species (e.g. *Chondrula tridens*, *Granaria frumentum*) and cryophilous taxa such as *Vallonia tenuilabris* reflected short time palaeoclimatic oscillations. Findings of a woolly mammoth (*Mammuthus primigenius*) skeleton fragments at the base of loess layer L1L2 of Mišeluk and Ruma sites,<sup>10</sup> add to the palaeoecological picture of Vojvodina’s lower Pleniglacial environment.

The middle Pleniglacial temperate warm and relatively humid climate was detected in the increase of clay content and low magnetic susceptibility values. These palaeoclimatic changes have initiated the pedogenesis of a weakly developed steppe soil complex L1S1. Dependents of local conditions of Interpleniglacial palaeosol L1S1 have been developed as the continuous, double or triple pedocomplex. In the driest parts of the Vojvodina region this palaeosol is not exposed. Loess sub layers intercalated into the L1S1 pedohorizon preserved evidence of a sudden cooling related to HE 4 and 5.1. Land snails detected in weakly developed palaeosol L1S1S1, L1S1S2 and L1S1S3 provided presence of an equivalent of a *Chondrula tridens* fauna<sup>11</sup> with some euritermic elements as *Euomphalia strigella*, *Truncatellina cylindrilica* and *Cochlicopa lubrica*. Poor snail fauna of intercalated loess inter-layers L1S1L1 and L1S1L2 presents a dry and relatively cold environment indicated by the presence of the cold loving species *Vallonia tenuilabris*.

The uppermost loess stratum L1L1 contained detailed evidence of lower Pleniglacial palaeoclimatic fluctuations. Low values of magnetic field susceptibility and clay content as well as high values of carbonate content and a dominance of coarse grain size fractions demonstrated the coldest palaeoclimatic event of the last glacial period. The three episodes of prolonged accumulation of the coarsest grain size fractions could be associated with cold episodes related to HE 1, 2 and 3. Composite mollusc of loess unit L1L1 association large diversity of environment from open grassland to closed boreal forest ecotones. Presence of the frigidophilous species *Columella columella*, *Vertigo parcedenta*, *Vallonia tenuilabris* and *Aegopinella ressmanni* reflected the coldest palaeoclimatic conditions related to the last glacial maximum period.

<sup>9</sup> Ložek 1964.

<sup>11</sup> Ložek 1964.

<sup>10</sup> R. Milić: Novi nalazi *Elephas primigenius* Blum. u Sremu, Vojvodina. Priroda Vojvodine 4 (1978) 49–50.



Fossil mollusc assemblages also provided precise information about local palaeoenvironmental conditions. The land snail assemblage from the loess belt around of Fruška Gora mountain represents sharp environmental differences. The mollusc association from the north slopes of Fruška Gora mountain shows more humid and relatively colder environment than in other sites in Vojvodina region and indicated that the northern slopes of the Fruška Gora mountain played an important role during the late Pleistocene. It was a kind of refugial area; it is one of those rare places on the Southeast part of Carpathian Basin, where the Palaeopreillyrian snail assemblage survived (*Aegopinella ressmanni*, *Ena montana* and *Euophailia strigella*).<sup>12</sup> In the contrast of that composition of mollusc fauna suggest that investigated area, parts of the southern slope of the Fruška Gora mountain range, was a refugium for warm-loving and xerophilus mollusc taxa, where these elements could survive during the unfavourable climate periods of the Late Pleistocene. It is reflected in the continuous presence of *Granaria frumentum* specimens in the loess samples.

### ***The evidence of middle and upper palaeolithic occupation***

Human presence during the last glacial period in Vojvodina is evidenced by Middle and Upper Palaeolithic artefacts found in the several open sites. The Palaeolithic sites are grouped on the Bačka's and Srem loess plateaus as well as in Vrsac and its surroundings (fig. 3). Only two sites, Crvenka-At and the Petrovaradin fortress were archaeologically investigated. The Palaeolithic finds are also known from the following localities: Kozluk, Balata and Mesić channel<sup>13</sup> near Vrsac, Cigan near Irig<sup>14</sup> and the site on of river Danube bank under 20 m thick loess cliff near Zemun.<sup>15</sup> General archaeological data about Vojvodina's Palaeolithic sites are summarized in Tab. 1.

The Middle Palaeolithic of Vojvodina region has been reported only from the Kozluk and Cigan-Irig sites. This changed at the end of 2003 during the routine protection excavations at Petrovaradin fortress. The investigations included two Middle Palaeolithic layers.<sup>16</sup> About two hundred artefacts were collected at the upper, darker horizon of the initial pedogenesis, that contains mainly chipping products, which include: Levallois flakes, transversal scrapers, denticulated tools, retouched flakes and quartz tools. According to the preliminary stratigraphical interpretation this horizon could be related to the Middle Pleniglacial soil LIS1. In the lower loess stratum which probably is equivalent to loess unit L1L2 correlated with MIS 4 poor Middle Palaeolithic industry was identified with massive bifacial side-scraper and back resembling tools, related to the Micoquian of the Central Europe. However, it is too early to draw precise conclusions about the cultural belongings of these Middle Palaeolithic industries.

The most detailed information about Upper Palaeolithic in the SE part of the Carpathian Basin has been revealed after the excavations of the Crvenka-At site near Vršac. During the exploitation of the raw material at the local quarry more than two thousand Aurignacian finds were collected.<sup>17</sup> The stratigraphic position of these artefacts was confirmed after systematic excavations made by I. Radovanović in 1984.<sup>18</sup>

The Upper Palaeolithic artefacts from the Crvenka-At site could be related to the typical Aurignacian culture from the Krems Dufour site. This kind of Aurignacian industry is also well documented from sites in the Romanian part of the Banat region: Kosava, Tincova, Romanești Dumbravița).<sup>19</sup> The artefacts identified at Crvenka-At include: blades from massive single-

<sup>12</sup> P. Sümeği – E. Krolopp: Quaternary malacological analysis for modeling the Upper Weichselian palaeoenvironmental changes in the Carpathian Basin. *Quaternary International* 91 (2002) 53–63.

<sup>13</sup> S. Brodar: Palaeolitik v Vrsu in njegovi okolici. *AV* 6 (1955) 181–203; Radovanović 1984, 7–8; Brukner 1974.

<sup>14</sup> P. Medović: Cigan-Irig – palaeolitski nalaz. *AP* 12 (1970) 11–12.

<sup>15</sup> Šarić 1984.

<sup>16</sup> D. Mihailović: Spirituality and Cultural Identity in the Middle-Upper Palaeolithic Transition in the Balkans, in: M. Otte (ed.): *Spiritualité – Actes du Colloque de Liège*, 10–12 décembre 2003. (in press)

<sup>17</sup> Mihailović 1992.

<sup>18</sup> I. Radovanović: Vršac-At, palaeolitsko nalazište. *AP* 25 (1986) 11–12.

<sup>19</sup> F. Mogosanu: *Palaeoliticul din Banat*. București 1978.



Site Nr. and name	Description	Culture	Stratigraphic position	Environment
1. Cigan-Irig		Middle Palaeolithic	Unknown	Unknown
2. Kozluk		Middle Palaeolithic	Unknown	Unknown
3. Petrovaradin fortress	About 200 artefacts mainly chipping products: Levallois flakes, transversal scrapers, denticulated tools, retouched flakes and quartz tools from darker layer of initial pedogenesis. Massive bifacial side-scraper and back resembling tools from lower loess horizon	Micoquian	Probably lower part of palaeosol L1S1 and Loess layer L1L2	Loess steppe and temperate grassland
4. Crvenka-At	About 1500 artefacts: chipping technology tools, single platform cores, carinated and nosed end-scrapers and blades	Typical Aurignacien	Late Pleistocene fluvial sand loess layer depth.	
5. Stara Moravica 6. Pačir	Open air site, fireplace with charcoal remains of <i>Pinus montana</i> and <i>Picea excelsa</i> with bone tools	Gravettien and Epigravettien	In the base of the youngest loess layer L1L1 close to contact with interstadial palaeosol	Loess steppe
7. Mesić kanal	Several stone tools	Gravettien and Epigravettien	Unknown	Unknown
8. Zemun	Site on of river Danube bank under the 20 m thick loess cliff near Zemun. About ? artefacts: backed points and bladelets, shouldered points and numerous short, thumbnail and circular scrapers	Gravettien and Epigravettien	Unknown	Unknown
9. Vatin	Bone artefacts	Upper Palaeolithic	Unknown	Unknown

Table 1. Overview of Middle and Upper Palaeolithic sites of Vojvodina province

platform cores, carinated, nosed and core-like end-scrapers, blades and different types of burins.<sup>20</sup> Dufour bladelets and Krems type points were not found at this locality, but several cores for the production of bladelets were collected. Similar Aurignacian industry was also found at the Balata site, near Vršac.<sup>21</sup>

Evidence of Gravettian and Epigravettian cultures have been documented at the Mesić channel site near Vršac,<sup>22</sup> at loess exposures of the brickyards at Pačir and Stara Moravica with traces of fireplaces<sup>23</sup> and at the site on the bank of the Danube river under a 20 m thick loess cliff near Zemun with a large number of artefacts that included: backed points and bladelets, shouldered points and numerous short, thumbnail and circular scrapers.<sup>24</sup>

Human Palaeolithic remains have been discovered from Bački Petrovac, Žitište and in a loess exposure of unknown position in the vicinity of Belgrade. In Bački Petrovac and Žitište, the parts of two mineralized skulls, identified as *Homo sapiens fossilis*, have been discovered.<sup>25</sup> After recent investigations, a human mandibula was found in the loess exposure

<sup>20</sup> Mihailović 1992.

<sup>21</sup> D. Mihailović: Zbirka orinjasijenskih nalaza sa lokaliteta Balata kod Vršca. Glasnik Srpskog arheološkog društva 7 (1992) 92–98.

<sup>22</sup> Brukner 1974.; I. Radovanović 1984, 7–8.

<sup>23</sup> J. Marković-Marjanović: Prethodno saopštenje o novim palaeolitskim nalazima severne Bačke. Starinar 7–8 (1958) 213–226; D. Basler: Nalazišta palaeolitskog i mezolitskog doba u Srbiji, in: D.

Basler (ed.): Praistorija jugoslavenskih zemalja – tom I. Sarajevo 1979, 363–371.

<sup>24</sup> Šarić 1984.

<sup>25</sup> S. Živanović: O palaeolitskom čoveku Vojvodine. Zbornik Matice srpske za prirodne nauke 75 (1988) 127–132; Ž. Mikić: Antropološka struktura stanovništva Srbije. Etnoarheološki problemi, knjiga 4. Filozofski fakultet u Beogradu. Beograd 1988, 18.

in the vicinity of Belgrade identified as a *Homo sapiens* probably belonging to the Upper Palaeolithic European population.<sup>26</sup>

### General remarks

Sedimentological, pedological, magnetic and palaeontological evidence all suggest the appearance of gradual palaeoclimatic cooling trend during the last 100 ka in the Vojvodina region. This period has characterized by two temperate phases related to the Early Glacial and Middle Pleniglacial glacial as well as two cold stages correlated to the Lower and Upper Pleniglacial. Many of the detected short time climatic oscillations have not changed environmental conditions dramatically. The general palaeoclimatic overview of the last glacial period has demonstrated that Vojvodina was the driest and the warmest part of the Carpathian Basin.

Changes in the Molluscan assemblages refer to mosaic biotopes with a dominance of grass vegetation, ranging from relatively humid and warm to dry and temperate cold environments.

The poorly known Palaeolithic evidence of the SE part of the Carpathian Basin can be regarded as one of the missing links in the understanding of the last glacial human occupation of Europe. However, some initial results of archaeological investigations look very promising. Archaeological evidence from the Petrovaradin fortress and Crvenka-At sites indicates a cultural unity in the Carpathian Basin during the Middle and Upper Palaeolithic. The details of human occupation of the Vojvodina region before the Aurignacian, during the earlier Upper Palaeolithic Szeletian stadium and Middle Palaeolithic cultures related to Micoqian, Jankovichian or Babonyian, are still unsolved. The results of sedimentological and malacological investigations and the measurement of luminescence absolute ages of loess sequences of the Petrovaradin fortress locality will be provide more detailed information.

The late Middle Palaeolithic in the Vojvodina region is characterized by Levallois technology with the usage of local materials, same as in the northern parts of the Carpathian Basin.

Some areas, such as the slopes of Vršac's mountains, were intensively and continuously occupied during the whole Palaeolithic period, from Mousterian (Kozluk) and Aurignacian (Crvenka-At, Balata) to Gravetian (Mesić kanal) times.

The Danube corridor was the main transit route of modern human colonization of Central Europe.<sup>27</sup> The special position of the SE part of the Carpathian Basin, between the well-studied western and eastern European Middle and Upper Palaeolithic sites, establishes this region as an important link in the understanding of cultural and chronological relations between central European and Mediterranean intermediate Gravetian and Epigravetian backed tool industries, especially because the investigated area and the north Balkan are characterized by a small number of well studied Palaeolithic sites (Kadar in the north Bosnia, Šalitrena cave in Serbia, Climente I and II in Iron Gate, Temnata cave and Bacho Kiro in Bulgaria).<sup>28</sup> Because of that, the investigations of the last glacial archaeological sites in Vojvodina province will present a great challenge for scientists, providing significant possibilities in the reconstruction of human occupation in this region as an important fragment contributing to the Palaeolithic mosaic of Europe.

<sup>26</sup> M. Roksandić – V. Dimitrijević: A human mandible from the loess in the vicinity of Belgrade (Yugoslavia). *Human evolution* 16 (2001) 27–35. [http://www.erin.utoronto.ca/~mroksand/\\_private/Mandibulafin.doc](http://www.erin.utoronto.ca/~mroksand/_private/Mandibulafin.doc)

<sup>27</sup> N. J. Conard – M. Bolus: Radiocarbon dating the appearance of modern humans and timing of cultural innovations in Europe: new results and new challenges. *Journal of Human Evolution* 44 (2003) 331–371.

<sup>28</sup> A. Montet White – H. Laville – A.-M. Lezine: Le Paléolithique du Bosnie du Nord. *Chronologie,*

*environnement et préhistoire. L'Anthropologie* 90/1 (1986) 29–88; Ž. Jež – Z. Kaluderović: Šalitrena pećina. *Arheološki pregled* 26 (1985) 33; V. Boroneanț: The Mesolithic habitation complexes in the Balkans and Danube Basin. *Living Past* 1 (1999) URL: <http://www.cimec.ro/livingpast/mesolithic.htm>; S. Ivanova – S. Sirakova: Chronology and cultures of the Bulgarian Palaeolithic, in: D. W. Bailey – I. Panayotov (eds): *Prehistoric Bulgaria. Monographs in World Archaeology* No 22. Madison – Wisconsin 1995, 9–54.



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## CHANGES IN VEGETATION AND CLIMATE IN EASTERN AUSTRIA FROM THE MESOLITHIC TO THE BRONZE AGE: REASONS FOR THE MIGRATION OF NEOLITHIC POPULATION?

One of the most important steps in the history of man was the development from a hunting and gathering lifestyle to agriculture and stock-farming. This only formed the base of our economic system.

The question why people started to cultivate crops and to breed animals is hard to answer. The Greek poet Hesiod understood agriculture as a god's gift. The opinion of modern archaeologists, archaeobotanists and archaeozoologists is, that this process started with the climatic improvement at the end of the last glacial period in form of an evolution demanding several thousand years.<sup>1</sup> Many questions are still open concerning the reasons the ways of the expansion of Neolithic cultures, the relationship between the Mesolithic population and the migrating earliest Neolithic groups etc. The interdisciplinary symposium "Environmental Changes under the Neolithization Process in Central Europe: before and after" at Budapest tried to find some answers to these questions.

The first groups of the Older Linearbandkeramik (LBK) culture arrived in Eastern Austria not earlier than 5500 cal BC.<sup>2</sup> Are there any environmental factors causing the immigration of these groups to Eastern Austria? The interpretation of palynological data enables us to describe the environmental changes in time and to recognise the relationship between people and vegetation. This paper summarises the development of vegetation in Eastern Austria and tries to find an answer to the above mentioned question.

### *The distribution of the Mesolithic and the first agricultural cultures in Austria*

#### THE MESOLITHIC PERIOD<sup>3</sup>

Mesolithic finds are known from all Austrian provinces (*fig. 1*). They consist mainly of different numbers of silex; tools of bones and antler are rare. Remnants of Mesolithic sites have been found along the rivers Rhine, Salzach, Kamp and Danube. The summer camps lie in not forested sandy areas nearby the river banks (e.g. Bisamberg [Lower Austria] and Maxglan [Salzburg]). During the winter time the groups preferred places in some distance from the rivers, where they could find refuge in caves (Halbhöhlen) and below ledges (Felshöhlen, Balmen, Abri sous roche) like at Kobloch (Vorarlberg), Pass Lueg (Salzburg) and Griffen (Carinthia). The finds from Kamegg and Limberg (Kamp valley [Lower Austria]), Hirschbichl and the oldest grave (8000 cal BC) from Zigeunerhöhle near Elsbethen (both Salzburg) belong to the Early Mesolithic. The sites in Vorarlberg (Kummenbalme and Rheinbalme) are dated to the second half of the 6<sup>th</sup> and the beginning 5<sup>th</sup> millennium BC, the time when the first Neolithic groups immigrated into Eastern Austria. Mesolithic people have been also penetrating the high mountains. The sites here, however, are not as numerous as in the Southern Alps.<sup>4</sup> Nevertheless several sites are known between 1500 and 2300 m a. s. l. mainly in pass, saddle or shoulder locations: Hirschbichl in Defreggen (Eastern Tyrol), Ullafels in Fotscher valley and two sites in Rofen valley (both Tyrol) and finally sites in the Klein Walsertal.

<sup>1</sup> M. Höneisen: Vom Jäger zum Bauern: Die neolithische (R)Evolution. Die ersten Bauern. Schweizerisches Landesmuseum 2 (1990) 7–14.

<sup>2</sup> Lenneis – Stadler – Windl 1996.

<sup>3</sup> Urban 2000.

<sup>4</sup> P. Biagi – R. Nisbert – R. Scaife: Man and vegetation in the Southern Alps: the Valcamonica – Valsabbia watershed (Northern Italy), in: P. Biagi – J. Nandris (eds): Highland Zone Exploitation in Southern Europe. Monografie di Natura Bresciana 20 (1994) 133–152.



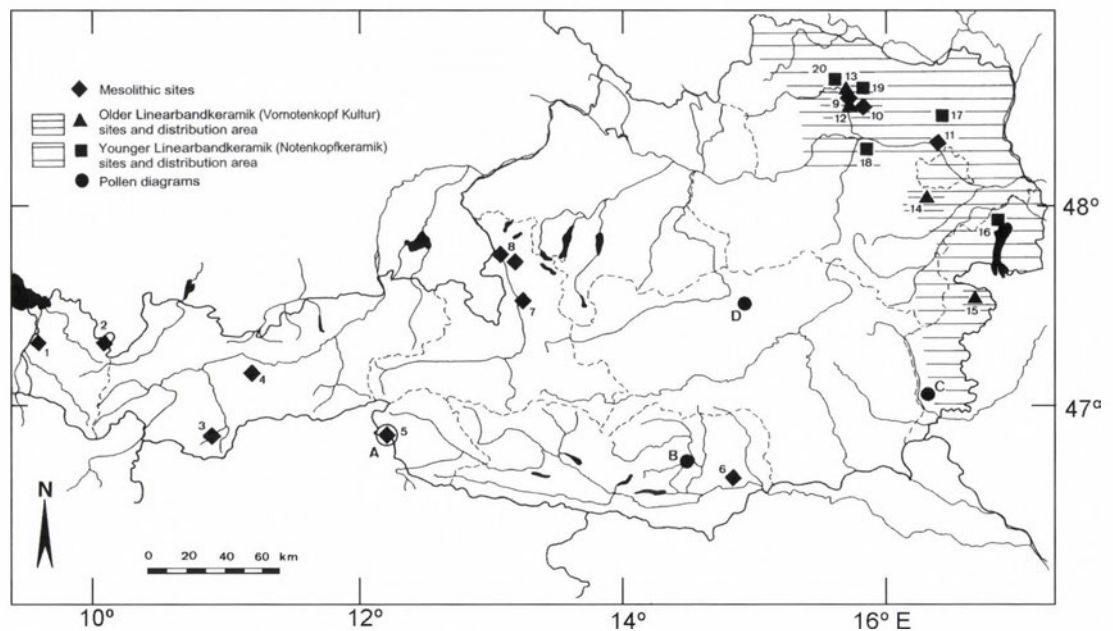


fig. 1. Distribution map of the Mesolithic and Early Neolithic sites and the pollen diagrams mentioned in the text.

*Mesolithic*: 1 Kobloch, Krinnenbalme, Rheinbalme; 2 Kleinwalsertal; 3 Vent and Rofental; 4 Ullafels in Fotscher valley; 5 Hirschbichl in Defreggen; 6 Griffen; 7 Pass Lueg; 8 Elsbethen and Maxglan; 9 Kamegg; 10 Limberg; 11 Bisamberg. *Older LBK*: 12 Rosenberg; 13 Strögen; 14 Brunn am Gebirge; 15 Neckenmarkt. *Younger LBK*: 16 Winden am See; 17 Aspern a. d. Zaya; 18 Gutenbrunn; 19 Pulkau; 20 Poigen. *Pollen diagrams*: A Hirschbichl in Defreggen; B Längsee; C Rohr–Heugraben; D Lake Leopoldstein.

#### NEOLITHIC PERIOD<sup>5</sup>

The earliest Neolithic groups immigrated from SE to Eastern Austria (*fig. 1*). The settlements are located mainly near rivers or lakes. The new population took care that water, fertile soils and appropriate timber for house construction and for tools were present. The distribution area of the older Linearbandkeramik (LBK, so-called Vornotenkopfkeramik, 5480–4920 cal BC) coincides with that of loess from the Burgenland to the Kamp valley in Lower Austria. The most important sites are Rosenberg and Strögen near Horn, Brunn am Gebirge near Mödling (all Lower Austria) and Neckenmarkt (Burgenland). During the younger LBK (Notenkopfkeramik, 5280–4520 cal BC) the settled area expanded to the S, N and NW. Beside further sites in Lower Austria (Aspern an der Zaya, Poigen and Gutenbrunn NE Herzogenburg), one site was found in Burgenland: Winden am See. In the second half of the 5<sup>th</sup> millennium, Neolithic culture expanded rapidly and reached the Drau–Save area in the S and Upper Austria, Salzburg and Bavaria in the N and NW.

#### THE LATE NEOLITHIC AND BRONZE AGE

With the beginning of the Late Neolithic period from 4200 cal BC onwards, the population penetrated the inner Alps and colonised the Inn valley up to 1800 m a. s. l., Western Styria and the Drau valley in Carinthia. The density of the population increased continuously and reached a first maximum during the Bronze Age (2000–800/750 BC),<sup>6</sup> when copper ore in the Grauwackenzone of the Central Alps became very important.

#### *Vegetation development (fig. 2–4)*

There are several palynologically investigated localities in Eastern Austria. Unfortunately, most of them are without any radiocarbon dates, do not contain the time window in discussion, are not investigated in detail, or they are located too far from the settled area. Moreover, the

<sup>5</sup> Lenneis – Stadler – Windl 1996; Urban 2000.

<sup>6</sup> Urban 2000.

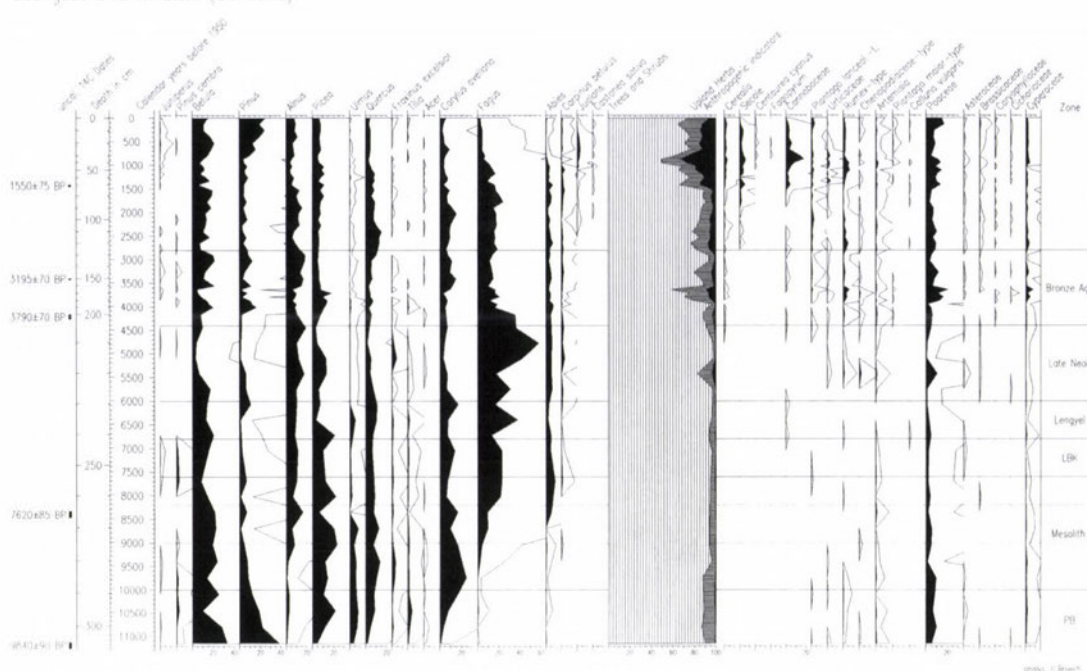


fig. 2. Reduced percentage pollen diagram of Längsee

area populated by Neolithic groups is located in the north-eastern and eastern lowlands, outside the previously glaciated area and is therefore poor in sites usually suitable for palaeoecological research.

Consequently only three pollen profiles are at our disposal (*fig. 1*):

- Längsee (548 m a. s. l.) is located in the Krapp–Feld, Carinthia. The lake is close to the Würmian pleniglacial ice margin and owes its origin to a dead ice block. The results of interdisciplinary investigations have been published by Schmidt et al.<sup>7</sup>
- The pollen profile Rohr–Heugraben (284 m a. s. l.) has been cored in a mire in the Zickenbach valley in Burgenland. The site is influenced by the small river Zickenbach, therefore the sediments are changing several times from clay to sedge peat and back. First results are published by Drescher-Schneider and Wick.<sup>8</sup>
- Lake Leopoldstein (680 m a. s. l.) is located between the Eisenerzer Alps and the Hochschwab massif on the southern border of the Northern Calcareous Alps. Investigations have been carried out in connection with the archaeological excavation of a copper mining place in the Eisenerzer Ramsau.<sup>9</sup> The lake sediments consist mainly of clay during the Late Glacial and of lake marl during the Holocene.

The time scale of the pollen diagrams is based on the  $^{14}\text{C}$ -dates published in the original literature and is indicated on the left side of the diagrams in *figs 2–4*. The consequence of the calibration<sup>10</sup> is in some cases a greater deviation than the  $^{14}\text{C}$ -measurement indicates. In the

<sup>7</sup> Schmidt et al. 1998.

<sup>8</sup> R. Drescher-Schneider – L. Wick: Neue Pollenanalysen in der Südoststeiermark und im Burgenland und ihre siedlungsgeschichtlichen Aussagen, in: A. Lippert (hrsg.): Die Drau-, Mur- und Raab-Region im 1. vorchristlichen Jahrtausend. Akten des Intern. und Interdisziplin. Symposiums vom 26. bis 29. April 2000 in Bad Radkersburg. UPA 78 (2001) 15–27.

<sup>9</sup> R. Drescher-Schneider: Die Vegetations- und Klimageschichte der Region Eisenerz auf der Basis pollenanalytischer Untersuchungen im

Leopoldsteiner See und in der Eisenerzer Ramsau, in: S. Klemm (hrsg.): *Montanarchäologie in den Eisenerzer Alpen. Archäologische und naturwissenschaftliche Untersuchungen zum prähistorischen Kupferbergbau in der Eisenerzer Ramsau*. MPK 50 (2003) 174–197.

10 M. Stuiver – P. J. Reimer – E. Bard – J. W. Beck – G. S. Burr – K. A. Hughen – B. Kromer – G. McCormac – J. van der Plicht – M. Spurk: Intcal98 Radiocarbon Age Calibration, 24,000–0 cal BP. Radiocarbon 40 (1998) 1041–1083.





Lake Leopoldstein 628 m a.s.l. (Styria)

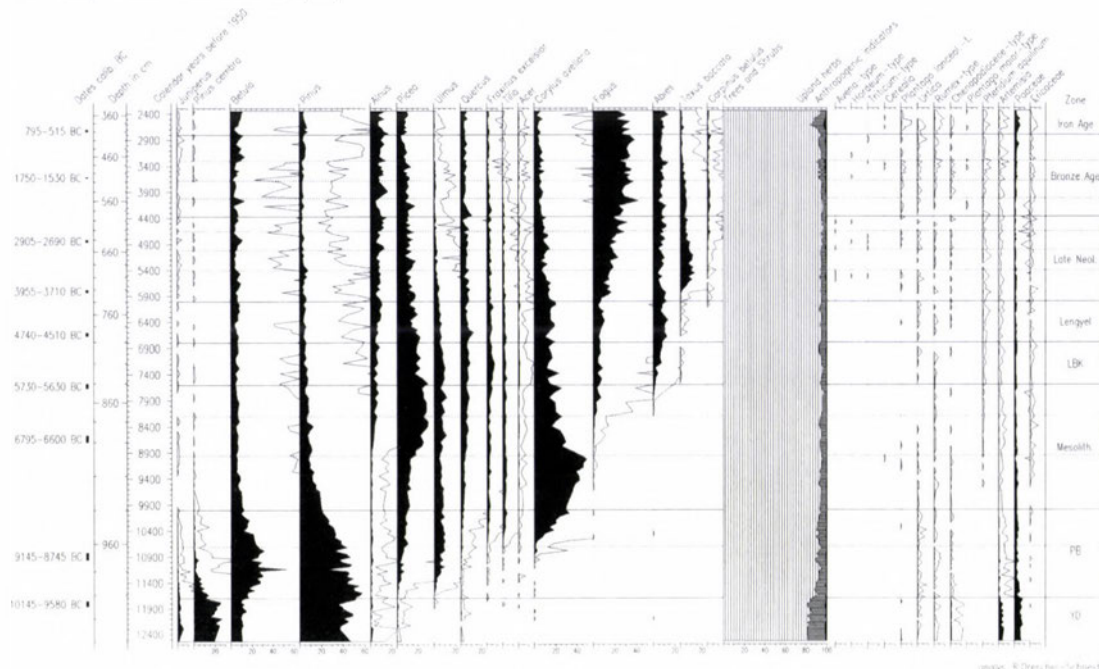


fig. 4. Reduced percentage pollen diagram of Lake Leopoldstein

case of more than one intercept age the time scale of the pollen diagrams, changes depend on the chosen intercept age. Consequently, the time scales presented here may differ from the date presented in the original literature.

#### LATE GLACIAL

For the period between the Last Glacial Maximum and the beginning of the Late Glacial there are no reliable data. In three pollen diagrams from Carinthia (Längsee,<sup>11</sup> Jeserzer See,<sup>12</sup> Stappitzer See<sup>13</sup>) some indications can be found that ameliorated climatic conditions between 17 000 and 15 000 uncal BP initiated a first expansion of shrubs and timber-line tree species such as pine, stone pine, larch and spruce.

Before the beginning of the Late Glacial Interstadial (12 600 cal BC) alpine meadows and scrubby vegetation with juniper, dwarf birch and willow were dominant. With the beginning of the climatic improvement, the vegetation changed for a few centuries into an open birch forest. At the lower altitudes of Eastern Austria the vegetation during the Late Glacial Interstadial ( $\pm 12\,500 - \pm 10\,700$  cal BC) was dominated mainly by pine forests. *Pinus cembra* – the subalpine stone pine was frequent. *Pinus mugo* probably was present too. The mean value of the AP (arboreal pollen) is around 85%, a sign of rather open forests.

The climatic deterioration during the Younger Dryas ( $\pm 10\,700 - \pm 9600$  cal BC) was not able to distort the forests, but the timberline was depressed and stands on good drained soils (e.g. sand) were strongly damaged mainly by aridity.

#### HOLOCENE

During the early Holocene (Preboreal,  $\pm 9600 - \pm 8000$  cal BC) the forests were still quite open in the whole area. The species composition of the woodland developed in different ways in the three regions:

<sup>11</sup> Schmidt et al. 1998.

<sup>12</sup> E. Schultze: Neue Erkenntnisse zur spät- und frühpostglazialen Vegetations- und Klimaentwicklung im Klagenfurter Becken. Carinthia II, 174/94 (1984) 261–266.

<sup>13</sup> A. Fritz – F. H. Ueik: Klimageschichte der Hohen Tauern. Spätwürmzeitliche und postglaziale

Klima- und Vegetationsentwicklung in den südlichen Hohen Tauern (Ostalpen, Kärnten). Ergebnisse der Bohrungen am Stappitzer See bei Mallnitz. Wissenschaftliche Mitteilungen aus dem Nationalpark Hohe Tauern, Sonderband 3 2001.



- In the lowlands of Carinthia spruce, hazelnut and elements of the Mixed Oak forests, mainly elm and oak, expanded very rapidly and dominated the forests already a few decades after the end of the Younger Dryas. Beech and fir started to immigrate before 8000 BC.
- In the lowlands of Burgenland, pine and birch were still dominating while spruce, elm, hazelnut immigrated and expanded slowly.
- At lower altitudes of the Northern Calcareous Alps, birch and pine were dominating, but spruce and elm already were frequent.

During the Older Mesolithic (Boreal,  $\pm 8000 - \pm 7000$  cal BC) the southern and southeastern lowlands were covered by spruce forests characterised by hazelnut as an integral component of the woody cover. Beech started to invade these forest types. In Eastern Tyrol (Hirschbichl, *fig. 1*), single larches and stone pines reached the high altitude of the Mesolithic site (2140 m a. s. l.) at around 8500 cal BC, but the vegetation cover was still dominated by subalpine grasslands and *Alnus viridis* and *Pinus mugo* scrubby woodland respectively.<sup>14</sup> At lower altitudes of the calcareous Alps, the pollen percentages of hazelnut dominate absolutely – as is known from large areas of Central Europe.

During the Younger Mesolithic ( $\pm 7000 - \pm 5600$  cal BC) the woodlands reached their maximum density.

- In the south-eastern lowlands, fir, yew-tree and hornbeam penetrated established mixed lime- or beech-forests.
- In higher altitudes of Eastern Tyrol, spruce-forest with stone pine and larch reached the area of the Mesolithic station at Hirschbichl.
- In the Northern Calcareous Alps, spruce dominated just as in the central Eastern Alps, but was accompanied by elm, lime and oak in the canopy.

The start of the Neolithization in eastern Austria coincides with the dominance of the lime-elm-oak-mixed woodland.

- In the south-eastern lowlands, yew is the characteristic associate of a second shade tolerant tier,
- whereas in the southern part of the Eastern Alps, mixed beech-fir-spruce-forests dominated the montane belt.
- In the Northern Calcareous Alps, spruce-fir-mixed woodlands with associated elm and maple in the canopy were widespread.

During the Early and Middle Neolithic period the diversity of woodlands was the highest during the entire Holocene and pollen diagrams give the impression of most favourable climatic conditions.

From about 3600 cal BC onwards during the Late Neolithic and Bronze Age in the submontane and montane altitudinal zone of the Eastern Alps beech was dominating or at least co-dominating the canopy,

- whereas in the valleys of the central Alps spruce is the dominant tree-species in the woodland.
- In the more continental lowlands of Burgenland and southeastern Styria, oak–hornbeam mixed woodland on deep soils was the dominant forest type, fir- and beech stands were restricted to N-exposed slopes.

### *Climatic development (Table 1)*

Beside the Late Glacial climatic changes, known for a long time, Zoller<sup>15</sup> described Holocene fluctuations in the Canton Tessin (Switzerland). Later on Patzelt and Bortenschlager<sup>16</sup> published the first summary of Holocene climatic oscillations by interpreting the advances

<sup>14</sup> K. Oeggel – N. Wahlmüller: Holozäne Vegetationsentwicklung an der Waldgrenze der Ostalpen: Die Plancklacke (2100 m) / Sankt Jakob im Defreggen, Osttirol. Dissertationes Botanica 234 (1994) 389–411.

<sup>15</sup> Zoller 1960.

<sup>16</sup> G. Patzelt – S. Bortenschlager: Postglaziale Gletscher- und Klimaschwankungen in der Venedigergruppe (Hohe Tauern, Ostalpen). Zeitschrift für Geomorphologie 16 (1973) 25–72.

Table 1. Survey of vegetation and climate development in Eastern Austria

<sup>14</sup> C years BP		Alpine Chrono-zones (Welten 1982)	Vegetation history in the Southern Lowlands (Längsee, Carinthia)	Human impact	Vegetation history in the Southeastern Lowlands (Rohr, Burgenland)	Human impact	Veget. history on the southern border of the Northern Calcareous Alps (Lake Leopoldstein Styria)	Human impact	Temperature	Precipitation	Climate	Climatic oscillations in the Eastern Alps	Years AD / BC cal	Culture periods in the Eastern Alps
1500	Holocene	Subatl.	<b>Fagus-Quercus-Abies</b> -forest with Carpinus and locally with Ostrya		<b>Pinus-Quercus-Picea</b> -forests		<b>Fagus-Abies</b> -forest with Picea and Acer		high but oscillating			Hst. 1.Jt. n.Chr.	600 AD	Middle Ages
2000					reforest. Bet. + Pinus								1 BC	Roman period
2500					total deforestation and humus erosion							Hst. 1. Jt. v. Chr.	410	Iron age
3000		Subboreal			<b>Quercus-Carpinus-Abies-Fagus</b> -forest		<b>Fagus-Abies-Taxus</b> -f. with Tilia, Quercus, (imm.+ exp. of Carpinus at lower altitudes)			high		Löbben	920	Bronze age
3500													1440	
4000													1940	Late Neolithic / Copper age
4500												Rotmoos II	2980	
5000		Atlantikum	<b>Fagus-Abies-Picea</b> -forest with QM and Corylus imm. + exp. of Carpinus		<b>Tilia-Ulmus-Quercus-Abies-Picea</b> -f. with Fagus, Carp., Taxus, Alnus along the river		<b>Picea-Abies-Fagus</b> -forest with QM, Corylus, imm. of Taxus			? lower ?	atlantic (warm and humid)	Rotmoos I	3590	Lengyel
5500													4430	
6000													4880	
6500												Frosnitz	5320	Linearbandkeramik
7000												?? Misox ??	5630	Mesolithic
7500													6000	
8000													6420	
8500													6900	
9000		BO	<b>Picea-Corylus-QM</b> -forests imm. of Fagus, Abies, exp. of Fagus		<b>Picea-Pinus</b> -f. + QM, imm. Fagus		<b>Corylus</b> dominant, imm. of Fagus		high but oscillating	increasing	warm, but still relatively dry	Venediger	7460	Palaeolithic
9500					<b>Pinus-Betula</b> -f. , imm. + exp. Picea, QM, Corylus		<b>Betula-Pinus-Picea-Ulmus</b> , exp.Cor.,Tilia,Frax, open <b>Bet.-Pin</b> -f imm. Ulmus, Picea, Cor.					Schlaten	7830	
10,000	Late Glacial	PB							rapidly increasing	low, but slowly increasing	continental with warm/hot summer		8250	
10,500													8800	
11,000		YD	open <b>P.cembra</b> -Pinus-f.		open <b>P.cembra</b> -Pinus-f.		open <b>P.cembra</b> -Betula-f.		low	low	subarctic ?	Younger Dryas	9600	
11,500													10,730	
12,000		Alleröd + Older Dryas	<b>Pinus</b> (cf. mugo)- <b>P.cembra</b> - <b>Betula</b> -forest		no records		<b>Pinus cembra</b> - <b>Pinus</b> (cf. mugo)- <b>Betula</b> -forest					Interstadial	11,300	Palaeolithic
12,500													11,850	
13,000		Bölling	Shrub veget. with Junip., Betula nana, Salix				open <b>Betula</b> - <b>Pinus</b> -f.					Full Glacial	12,600	
13,500							alpine meadows with Junip.							



and regressions of several different glaciers. Wick and Tinner<sup>17</sup> improved the knowledge of the climatic development by pollen and plant macro rest analyses at high altitudes. Using the  $\delta^{18}\text{O}$  method, it became possible to reconstruct some of these climatic fluctuations also in lowland lake sediments.

During the early and mid-Holocene three periods of climatic oscillations are known:

- The earliest one, the Preboreal-oscillation (the Schlaten-, Splügen-1-, Rion-1-oscillation)<sup>18</sup> between  $\pm 8800$  and  $8400$  cal BC, recognisable in the oxygen isotope record from Ammersee (SW Munich, Germany)<sup>19</sup> has also been found in some lowland pollen diagrams.<sup>20</sup> Because of the  $^{14}\text{C}$  plateau in the early Holocene,<sup>21</sup> it is not certain whether these events are synchronous or not. The sample resolution in Lake Leopoldstein is not detailed enough to decide if the oscillation at  $\pm 10\,700$  cal BP may be correlated with this Preboreal-oscillation.
- The prominent event in the  $\delta^{18}\text{O}$  record of Ammersee at  $\pm 7200$  cal BC may be synchronous with the Boreal-oscillation (Venediger-, Splügen-2-, Splügen-3-, Rion-2-, Bivio-oscillation) between  $7600$  and  $6900$  cal BC approximately. It is tripartite. The main vegetation response at high altitudes is reflected in peaks of the herbaceous pollen curves<sup>22</sup> and prominent decreases in the macrofossil concentration of larch and stone pine.<sup>23</sup> The influence of the decreased temperature on the already established lowland forests may have been rather low. Nevertheless, an increase of herbaceous pollen types (*Artemisia*, *Asteraceae*, *Chenopodiaceae* and *Urtica*) is visible in the diagram of Rohr; at Lake Leopoldstein beech immigration stops and the first pollen grain of *Plantago lanceolata* appears, while the continuous curve of *Pteridium aquilinum* starts at both localities. In all three pollen profiles, profound changes in the forest composition are remarkable: spread of alder (Lake Leopoldstein, Längsee, Rohr), decrease of hazelnut (Lake Leopoldstein, Längsee) and spruce (Rohr), spread of beech (Längsee) and immigration of fir (Rohr). On the other hand, human impact by Mesolithic hunters cannot be completely excluded, especially in the diagram of Rohr.
- The climate cooling at  $6200$  BC cal. is recorded in the oxygen isotope curve of European lake sediments such as samples from Ammersee.<sup>24</sup> The deterioration started at ca.  $6300$  BC and reached the maximum at  $6200$  BC. The period of recovery lasted about  $200$  years.<sup>25</sup> According the  $\delta^{18}\text{O}$  curve, we assume a temperature depression of  $1.7^\circ\text{C}$  in the mean annual air temperature in Central Europe.<sup>26</sup> In the Western Alps this cool and moist period is known as Misox-, Splügen-5- and Rion-3-oscillation.<sup>27</sup> In the pollen records of the Austrian Alps, there is no clear evidence for this oscillation. Only Vorren

<sup>17</sup> Wick – Tinner 1997.

<sup>18</sup> G. Patzelt: Der zeitliche Ablauf und das Ausmaß postglazialer Klimaschwankungen in den Alpen, in: B. Frenzel (hrsg.): Dendrochronologie und postglaziale Klimaschwankungen in Europa. Erdwissenschaftliche Forschung 13 (1977) 248–256; Wick – Tinner 1997.

<sup>19</sup> U. von Grafenstein – H. Erlenkeuser – A. Brauer – J. Jouzel – J. Johnsen: A Mid-European Decadal Isotope-Climat Record from  $15\,500$  to  $5000$  BP. Science 284 (1999) 1654–1657.

<sup>20</sup> K.-E. Behre: Die Klimaschwankungen im europäischen Präboreal. Petermanns Geographische Mitteilungen 2 (1978) 97–102; A. F. Lotter – U. Eicher – U. Siegenthaler – H. J. B. Birks: Late-glacial oscillations as recorded in Swiss lake sediments. JQS 7 (1992) 187–204; R. Schneider – K. Tobolski: Late-glacial and holocene environments of a lake in the Southern Alps, in: G. Lang (ed.): Swiss Lakes and Mire Environments during the last

$15\,000$  years. Dissertationes Botanicae 87 (1985) 229–272.

<sup>21</sup> B. Becker – B. Kromer: Extension of the Holocene dendrochronology by Preboreal pine series,  $8800$  to  $10\,000$  BP. Radiocarbon 28 (1986) 961–967.

<sup>22</sup> S. Bortenschlager: Beiträge zur Vegetationsgeschichte Tirols. I. Inneres Ötztal und unteres Inntal. Ber. Nat. Med. Ver. Innsbruck 71 (1984) 19–56.

<sup>23</sup> K. Oeggel – N. Wahlmüller: Vegetation and climate history of the high alpine mesolithic camp site in Eastern Alps. Preistoria Alpina – Museo Tridentino di Scienze Naturali 28 (1992/1994) 71–82; Wick – Tinner 1997.

<sup>24</sup> von Grafenstein et al. 1998.

<sup>25</sup> Tinner – Lotter 2001.

<sup>26</sup> von Grafenstein et al. 1998.

<sup>27</sup> Zoller 1960; Wick – Tinner 1997.



& Mørkved<sup>28</sup> recognise a “cool/moist?” period between 7500 and 7000 <sup>14</sup>C years BP (6200–5600 cal BC) in the pollen record of the Gurgler Alm (Ötztal, Tyrol). However, in the lowlands the vegetation response to this event mostly has gone unrecognised by pollen studies. Tinner and Lotter<sup>29</sup> conclude that increasing precipitation during this cooling favoured the growth of more drought-sensitive species allowing them to out-compete light-demanding species (mainly hazelnut) by forming denser forest canopies. Between 6200 and 5600 BC, no climatic deterioration is recognisable in the lowlands of eastern and south-eastern Austria. Nevertheless, some changes in the canopy are noticeable: beech dominates and fir spreads at Längsee, yew and hornbeam immigrate at Rohr, beech starts to develop and fir immigrates at Lake Leopoldstein. These differences are partly a question of the direction of migration, partly a consequence of probably further increasing precipitation or of a better-balanced distribution of precipitation over the year.

It is evident, that after the end of the Younger Dryas, mean annual temperature was rising rapidly. The limiting factor for immigration and expansion of the thermophilous flora in the early Holocene was not temperature but the periodical droughts (quite frequent till about 7000 BC), retarding at the same time soils formation and the expansion of dense forests. Our pollen records indicate increasing precipitation from 7000 to 5600 BC, without any strong decline in temperature. This interpretation is supported by the results of the investigations concerning glacier fluctuations at Pasterze and Gepatschferner (Eastern Alps). Nicolussi and Patzelt<sup>30</sup> show that between 8500 and 1700 BC, both glaciers have repeatedly retreated for long time periods behind their present day extension. Nevertheless, there is evidence of a number of advances, dated to – among others – around 6900, 6450 and 5700 BC, when the glaciers were as large or little larger than around ca. 1950 AD, but they never reached the extent attained during the 19<sup>th</sup> century. Increasing precipitation from 7000 BC onwards, is also postulated by preliminary investigations in the peat bog Capellarowiese (Mürzsteiger Alpen, Styria)<sup>31</sup> and by Roos-Barraclough et al.<sup>32</sup> for the Swiss Jura Mountains.

### *Are there any environmental factors causing the migration of the Neolithic groups to Eastern Austria?*

In Central and South-Eastern Europe, the limiting factor for the development of the vegetation in Early Holocene was the drought.<sup>33</sup> The modification of the precipitation regime occurred in two steps: the first around 7000 BC and the second around 6200 BC. On this occasion the regime could have changed in two ways: either the quantity of precipitation (mm/year) could have increased or the distribution pattern may have changed (with a major part of precipitation during the vegetation period or during winter, spring and autumn respectively) or both. Rossignol-Strick<sup>34</sup> mentions a “Holocene climatic optimum” in the Mediterranean – referring to the time from about 8000 BC (9000 uncal. BP) onwards – and hypothesises that the most clement climatic conditions (warmer than at present and with precipitation between 800 and 1300 mm, mainly occurring in spring and summer) at the onset of the Holocene account for the explosion of the Early Pre-pottery Neolithic culture and the human demographic expansion.<sup>35</sup> Together with the still high temperature, the increase of precipitation at around 7000 BC in

<sup>28</sup> K.-D. Vorren – B. Mørkved: Human impact on the Holocene forest line in the Central Alps. *Vegetation History and Archaeobotany* 2 (1993) 145–156.

<sup>29</sup> Tinner – Lotter 2001.

<sup>30</sup> K. Nicolussi – G. Patzelt: Untersuchungen zur holozänen Gletscherentwicklung von Pasterze und Gepatschferner (Ostalpen). *Zeitschrift für Gletscherkunde und Glazialgeologie* 36 (2000) 1–87.

<sup>31</sup> R. Drescher-Schneider – I. Draxler: Das Hochmoor Capellarowiese (Stmk., Österreich) – Erste Ergebnisse zur Genese des Hochmoores und zur Waldgeschichte der Umgebung. *Geologische*

Bundesanstalt Arbeitstagung 2001, Neuberg an der Mürz, Berichte (2001) 153–163.

<sup>32</sup> F. Roos-Barraclough – W. O. van der Knaap – J. F. N. van Leeuwen – W. Shotyk: A Late-glacial and Holocene record of climatic changes from a Swiss peat humification profile. *The Holocene* 14 (2004) 7–19.

<sup>33</sup> K. J. Willis – M. Braun – P. Sümegei – A. Tóth: Does soil change cause vegetation change or vice versa? A temporal perspective from Hungary. *Ecology* 78 (1997) 740–750.

<sup>34</sup> Rossignol-Strick 1999.

<sup>35</sup> Rossignol-Strick 1999, 528.



Central Europe is the start of the period generally known as the climatic optimum. As there are indications of favorable climatic conditions from 7000 BC on also in Hungary<sup>36</sup> and in Romania,<sup>37</sup> we assume that these climatic improvements could be jointly responsible for the migration of the Early Neolithic people to the Balkan Peninsula.

The Neolithization of Eastern Austria was probably indirectly influenced by the second moist period between 6200 – 6000/5900 BC. The climatic deterioration occurred at the same time or shortly after the arrival of the first Early Neolithic groups in SE Hungary (Alföld) and along the shores of Lake Balaton (between the end of the 7<sup>th</sup> and beginning of the 6<sup>th</sup> millennium BC)<sup>38</sup> and some hundred years before the expansion of the Linearbandkeramik (5600/5500 BC) to the area North of Hungary.

In what way the climatic deterioration did go on? Two developments go together: on the one hand, a decrease in temperature that means most probably cooler summer, reduced sunshine duration and resulted in a shorter growing season. On the other hand, there was an increase in precipitation. For the vegetation development the following consequences are probable: areas, tending to suffer periodic droughts, changed to well-balanced hydrological regions, suitable for agriculture. More sustainable resources for food-production might have led to a population increase.

Increasing, more frequent and heavy precipitation causes intense floods and the danger of devastation of the cultivated river plains by the deposition of gravel, sand and mud.

Beside flood disasters, higher precipitation could lead to a rise in the ground water table and consequently to a wetting and partly oversalinating of the arable soil, as far as to deprive people of the base of living and to compel them to emigrate.<sup>39</sup>

High precipitation has the tendency to wash out the nutrients from soils. Because manuring did not exist, the fields had to be lain out in shorter time because of depletion.

All these facts may have forced parts of the population to look for new favourable areas.

Beside all these direct climatic impacts, changes in the techno-economic and psychosociological background are to be expected.

### **Conclusions and summary**

Neolithization was a very complex process. Climatic deteriorations at around 7000 BC and 6200 BC could have initiated development and probably migration of the Early Neolithic population (first in the southern Balkan Peninsula, later in the Carpathian Basin), although the climatic changes were certainly not the single reason. In order to assess the response of the Neolithization process to climatic changes, we need further information concerning soil development, river dynamics, hydrology etc. and their connections with the history of the settlements, in addition to additional radiocarbon dates.

The climate oscillation at 6200 BC seems to have no direct influence on Neolithization in Eastern Austria. But it could have been one of the reasons for the development in the Carpathian Basin and could have prepared the preconditions (*Voraussetzungen*) for the extremely rapid expansion of the Linearbandkeramik culture from Eastern Austria to Poland. The wide distribution area and – in spite of some regional differences – the quite uniform appearance of the LBK, can only be explained by intensive contacts between different regions.<sup>40</sup>

<sup>36</sup> Magyari 2002, cit. in Sümegi this volume.

<sup>37</sup> I. Tantou – M. Reille – J.-L. de Beaulieu – S. Farcas – T. Goslar – M. Paterne: Vegetation history in the Eastern Romanian Carpathians: pollen analysis of two sequences from Mohoš crater. *Vegetation History and Archaeobotany* 12 (2003) 113–125.

<sup>38</sup> Sümegi this volume

<sup>39</sup> W. Haarnagel: Die Grabung Feddersen Wierde. Methode, Hausbau, Siedlungs- und Wirtschafts-

formen sowie Sozialstrukturen. Band II, Wiesbaden 1994; K. E. Behre – D. Kučan: Die Geschichte der Kulturlandschaft und des Ackerbaus in der Siedlungskammer Flögeln, Niedersachsen, seit der Jungsteinzeit. *Probleme der Küstenforschung im südlichen Nordseegebiet* 21 (1979) 226.

<sup>40</sup> Urban 2000.

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## THE EFFECT OF NEOLITHIC SHIFTING CULTIVATION ON VEGETATION DEVELOPMENT: “*LANDNAM*” AND SECONDARY SUCCESSION

Pál Sümegi proposes that there is a major boundary between Southeast and Central Europe running across the Carpathian Basin. Southeast and Northwest of this boundary different Neolithic cultures existed, ancient Balkanic cultures to the South and East, and the Linearbandkeramik culture to the Northwest. Sümegi thinks, that differences in the climate contributed a lot to the formation of this boundary.<sup>1</sup> This may be the case, but climatic differences also caused the formation of the south-eastern boundary of Central European woodlands in exactly the same area. Different densities of woodland contributed to the differences in cultures as can be seen in the structure of ancient houses: Southeast of the boundary Neolithic houses were mainly constructed by clay bricks, whereas timber was the most important construction material Northwest of this boundary.<sup>2</sup> In both cases, landscape transformations were necessary to establish agriculture. In treeless or not densely wooded areas on the one hand, and in densely wooded areas on the other, these transformations were certainly very different processes. Dense woodlands had to be cleared before agriculture could be started. This process took place during a so-called *landnam*-phase.<sup>3</sup> However, timber and wood were not simply waste, that had to be destroyed and removed before agriculture could start. They were really sought-after resources; in the areas Northwest of the boundary mentioned above, timber was much more important in constructing houses than farther to the Southeast, and more wood was needed to heat the houses during cold seasons.<sup>4</sup> Woodlands were, therefore, very important resources for Neolithic people. In the centre of Europe and other places farther to the West and North they could only live at places where timber and wood were available.

But men had to learn how to deal with woodlands, and therefore it is understandable that non-wooded and wooded areas had not been cultivated at the same period of time. There was a delay in the expansion of the Neolithic culture; its expansion was stopped at the limit of the woodlands for some centuries. After that, Neolithic settlements could only be founded at sites, where tall and evenly grown oak trees were available. Even and tall trunks were necessary to timber the characteristic long houses, which are about 30 m long. This is the same length as the dimension of the trunks of large oak trees.

Neolithic culture was not a civilisation. Neolithic farmers were not organized into states and complex economic structures. Therefore, regular trade in important resources, such as food and timber, would have been unlikely to occur between settlements. By trading these goods, it would have been possible to fight against shortages of resources. If the one or the other resource was no more available at a site, it was delivered by trade. Inside civilisations a transport of crops and timber guarantees for the fact that human communities can survive at a site when some resource is not or no more available, e.g. when the crop harvest was too poor, or when the woodlands were destroyed.

Both archaeologists and pollen analysts can demonstrate that Neolithic settlements were not complex civilisations. Archaeologists know that not only Neolithic, but all prehistoric settlements were not as stable as later settlements, which existed inside civilisations and

<sup>1</sup> P. Sümegi this volume.

<sup>2</sup> S. Piggott: Vorgeschichte Europas. Vom Nomadentum zur Hochkultur. Munich 1974, 99; G. Albrecht – P. Wollkopf: Rentierjäger und frühe Bauern. Steinzeitliche Besiedlung zwischen dem Bodensee und der Schwäbischen Alb. Städtische

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<sup>3</sup> J. Iversen: Landnam i Denmarks Stenalder. Danmarks Geologiske Undersøgelse II, København 66 (1941).

<sup>4</sup> Küster 2003.



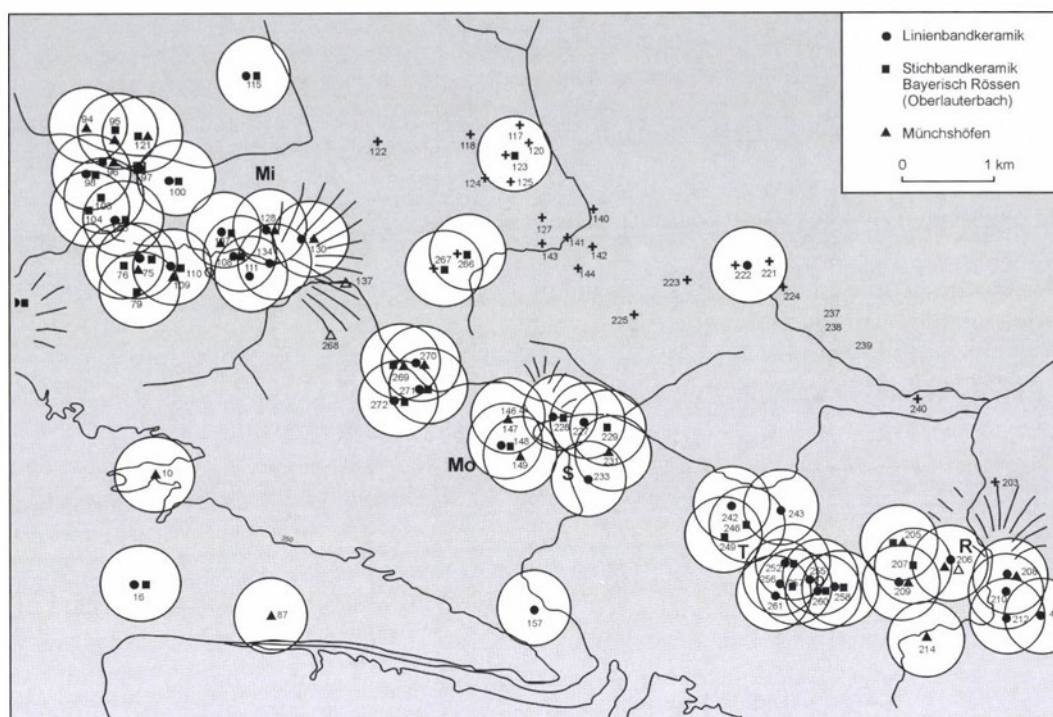


fig. 1. Map of the loess landscape SE of Regensburg, Germany  
(after Küster 1998, Schier 1985).

The village names are: Mi - Mintraching, Mo - Moosham, R - Rickofen, S - Sengkofen, T - Taimering. The white areas are located around a Linearbandkeramik or Middle Neolithic settlement, and the size of the areas is about 35 hectares. Possibly such an area might have been cleared around a Neolithic settlement. Please note, that the settlements did not exist during the same period of time. On the white areas, not only a *landnam* phase took place, when the settlement was founded, but also a secondary succession of woodland, after the settlement had been abandoned.

therefore were included into trade systems. Hvass excavated some settlements in Denmark and developed a model in which he stated that all these settlements existed one after another.<sup>5</sup> Possibly only the settlements were shifted and not the fields, but it is also possible that not only the settlements but also the fields have been shifting from one place to another. Connected with shifting, new parts of the woodland were cleared so that new settlements could be constructed and new fields could be designed. The old sites and fields were abandoned. It is possible that the major reason for the shifting of settlements was the lack of timber and firewood after the settlement existed for more than some decades. Perhaps it was easier to rebuild the settlement at another site than to transport timber from the growing place of the tree to the site where the timber was needed.<sup>6</sup>

On fig. 1, a map is presented which shows the locations of Linearbandkeramik and Middle Neolithic settlements in Niederbayern.<sup>7</sup> This is the region Southeast of Regensburg in Bavaria, one of the centres of early Neolithic distribution in SE Germany. Not only the localities of the settlements are marked in this map. The sites are surrounded by schematic clearances. They have a size of about 35 hectares which was possibly the area needed for farming activities to produce enough crops for a population of about 70 to 100 people in a Neolithic settlement.<sup>8</sup> Not all settlements existed at the same time; they were founded during a period of more than

<sup>5</sup> Hvass 1982.

<sup>6</sup> Küster 2003.

<sup>7</sup> Schier 1985.

<sup>8</sup> C.C. Bakels: Four Linearbandkeramik settlements and their environment: a palaeoecological study of

Sittard, Stein, Elsloo and Hienheim. Diss. Leiden 1978.

## GÖRBEIMOOS

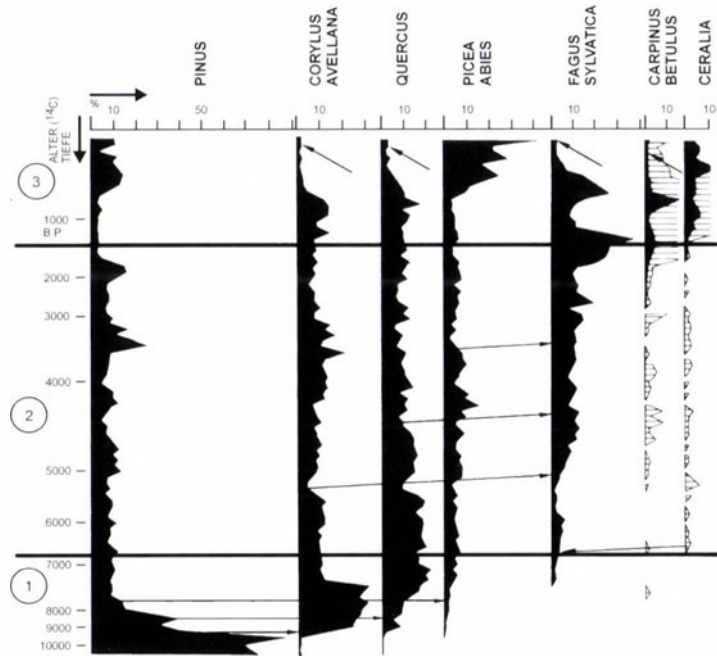


fig. 2. Selected pollen percentage curves from Görbelmoos, Southwest of Munich, Germany (after Küster 1998; details of the pollen analysis: Küster 1995).

Pollen curves are hatched if a  $10 \times$  exaggeration is shown. The arrows show developments in the woodland succession and human influences. During phase 1, no influence of farming on the vegetation is traceable. *Fagus* is not present. Phase 2 is the period of prehistoric agriculture, in which not only the *landnam* processes but also secondary successions of woodlands took place.

*Fagus* expanded. Phase 3 is the period of historic land use and stable settlements. Secondary successions of woodlands did not take place. *Fagus* became rarer.

1000 years. At all sites, woodlands have been cleared at some point of time; and all the sites have been abandoned after a few decades.<sup>9</sup>

From an ecological point of view, this means that again, woodlands could develop on the abandoned sites. The development of shrubs, birch and other trees thereafter was not disturbed any longer by humans after a site was abandoned. After such a so-called secondary succession of woodland, the same tree species could develop again that grew in the woodland before. But it is also possible that different tree species could immigrate more easily during secondary successions. They might have immigrated as well, when secondary successions did not take place. But it is obvious that the immigration of a “new” tree species has been easier, when it had only to compete with young trees of another species; the immigration to a dense woodland with well-developed tall trunks was certainly much more complicated.

Pollen diagrams from many parts of Germany and adjacent areas show, that obviously, there was a special effect on woodland development which was caused by Neolithic and later prehistoric clearances and the following secondary successions (fig. 2). Pollen diagrams from this region can normally be divided into three phases. In the first phase of the pollen diagram, cereal pollen is not recorded. In the second phase, some scattered cereal pollen grains are traced. And in a third phase, a lot of cereal pollen grains can be found. Regarding the radiocarbon dates, it becomes clear that phase 1 is the period when only hunters and gatherers lived in the area. Phase 2, more or less, equals the prehistoric phase, when there were only some scattered and not totally stable agrarian settlements, that shifted some decades after their foundation.

<sup>9</sup> Küster 1998.



Phase 3 is the historic phase, in which more intensive land-use started; settlements and fields existed permanently, and trade structures functioned to deliver important consumable goods to places where they were lacking.<sup>10</sup>

It is very striking, that there is one tree species which did not occur during phase 1, but was expanding during phase 2, and diminished during phase 3; this is beech, *Fagus sylvatica*. Beech was not present at most sites in Germany and adjacent areas when the first farmers cleared woodlands. But during the phase when settlements and fields were not only founded but also abandoned after some decades, beech could expand at very many sites. It is likely that the expansion of beech was favoured by the fact that secondary successions took place.<sup>11</sup> Perhaps it was more complicated to the tree to expand in dense oak woodlands, where all trees were already developed but not the immigrating species. The opinion that the beech expansion was favoured by the prehistoric way of founding and abandoning settlements and fields is supported by the fact that the beech expansion took place during a very long period, that lasted for several millennia. Beech was obviously not able to spread very rapidly at many sites in this area.

Looking at other well-dated pollen diagrams from several other sites the same phenomenon is very often visible. Beech immigration did not begin before agrarian settlements were present in the regions. In some cases, the first settlements and the immigration of beech took place at about the same period of time. In other cases, there was a delay between the first agrarian activities and the beginning of beech expansion. But it must be stressed that the connection between beech expansion and agrarian activities was not a general phenomenon. Beech was not furthered by human activities during its expansion to some elevated areas in hills and high mountains such as the Black Forest and the Vosges.<sup>12</sup> It was also stated, that this connection is not obvious in areas farther to the Southeast.<sup>13</sup>

Somewhat apart from the excavated prehistoric settlements, Hvass located the medieval settlement.<sup>14</sup> In contrast to its predecessors, it was absolutely stable since the time it was founded. A stable settlement could only survive through centuries if it was included into a civilisation, which means that it was situated inside a state. This fact guaranteed economic stability. Only inside a civilisation trade could be established, that supported the settlements with goods, which were lacking at special points of time. For instance, when a house or a part of the settlement burnt down, timber could be delivered by transport on stable roads. If the harvest turned out to be poor, crops could be brought to the settlements from elsewhere as well. Christian authorities contributed to the stability of settlements by asking people to give money or goods to poor people.

In the pollen diagrams, an increase of cereal pollen deposition is indicated in the same period when settlements became stable (phase 3 in *fig. 2*). The intensity of land-use was increasing in total. Not only agriculture was intensified, but also the exploitation of woodlands. Timber cutting and firewood collecting intensified because towns and monasteries had to be supported. Especially in towns, a lot of timber and firewood were in demand, as much more stable houses were constructed there as well as cathedrals and mills; greater rooms were heated by greater ovens. Coppices and similarly exploited woodlands expanded a lot. The more intensively a woodland is exploited, the less beech trees can survive in it. Therefore it is rather reasonable that the pollen percentages of beech in medieval and early modern layers of the pollen diagrams indicate a dramatic decline of this tree in the woodlands. Secondary successions of woodlands did not take place any more, and the expansion of beech came to an end. At the beginning of the Middle Ages, beech had reached its greatest range and the greatest frequency in Europe. Since then, the pollen percentages of beech have been reduced very rapidly.

<sup>10</sup> Küster 1998, 33; Küster 1995.

<sup>11</sup> Küster 1996; H. Küster: The role of farming in the postglacial expansion of beech and hornbeam in the oak woodlands of central Europe. *The Holocene* 7 (1997) 239–242.

<sup>12</sup> Küster 1996.

<sup>13</sup> A.R. Gardner – K. J. Willis: Prehistoric farming and the postglacial expansion of beech and hornbeam: a comment on Küster. *The Holocene* 9 (1999) 119–122.

<sup>14</sup> Hvass 1982.

In conclusion, it perhaps can be said, that the expansion of beech was favoured by secondary successions in relatively low-lying areas in some parts of Central Europe. But different ecological processes possibly took place in the hills and mountains, where the stability of woodlands was not as high as in the lowlands. Also, different processes took place in areas where beech was already occurring before agriculture expanded, e.g. in many places of SE Europe.

Pollen diagrams excellently show, how ecosystems change in time. It is very well indicated how humans influenced the development of woodlands. It is very striking that possibly a tree species which is regarded as "natural" or "indigenous" in many parts of Europe, expanded to these areas with the indirect support of man. On the other hand, this component of forest ecosystems diminished when economic pressure on woodlands became more intensive.

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## POLLEN EVIDENCE FOR HUMAN ACTIVITY IN THE SURROUNDINGS OF EARLY NEOLITHIC SETTLEMENTS IN THE KUJAWY REGION (CENTRAL POLAND) BASED ON POLLEN ANALYSIS

Between 7000 and 5000 years ago, farming villages were established in Poland and other parts of Central Europe. The understanding of the earliest European farmers is important since they represent the first use of domesticated plants and animals outside their native region and south of the Carpathians and the Alps.

The Kujawy region of Central Poland has been studied archaeologically since the 1930's.<sup>1</sup>

During the last two decades of the 20<sup>th</sup> century archaeological research has led to the discovery of significant early Neolithic settlements in southern Kujawy.<sup>2</sup> Wide-area excavations took place at two sites, Brześć Kujawski and Osłonki lying ca. 10 km apart (*fig. 1*). These sites are located at the northern frontier of the initial agricultural colonization of Europe.<sup>3</sup> Archaeological excavations conducted in Brześć Kujawski revealed two main periods of early Neolithic occupation: the first by people of the Linear Pottery culture, and the second, when the site was settled by people of the Lengyel culture. Archaeological excavations conducted in Osłonki have revealed a large settlement of the Lengyel culture with well-preserved archaeological remains, the most important of which are dozens of trapezoidal longhouses and circa hundred graves, as well as traces of settlement fortification. Of particular note are graves with extraordinary amounts of copper, including one with a copper diadem.<sup>4</sup> The settlers in Osłonki made heavy demands on the local environment and probably changed it significantly by land clearance, timber cutting for construction and firewood, crop cultivation, and grazing of livestock. Since Osłonki was occupied at the same time as the nearby settlement at Brześć Kujawski, paths were cut through the forest. Thus, the early farmers transformed the primeval forest into cultural landscape.<sup>5</sup>



fig. 1. Location of the Osłonki and Brześć Kujawski sites in the Kujawy region.

<sup>1</sup> K. Jażdżewski: Cmentarzyska kultury ceramiki wstęgowej I związane z nimi ślady osadnictwa w Brześciu Kujawskim (Gräberfelder der bandkeramischer Kultur und die mit ihnen verbunden Siedlungsspuren in Brześć Kujawski). *WiA* 15 (1938) 1–105.

<sup>2</sup> P. Bogucki – R. Grygiel: Early farmers of the North European Plain. *Scientific American* 248 (1983)

104–112; R. Grygiel: The household cluster as a fundamental social unit of the Lengyel Culture in the Polish Lowlands. *PMMAE* 31 (1984) 41–334. *Bogucki 1996a; Grygiel – Bogucki 1997.*

<sup>3</sup> P. Bogucki: The spread of early farming in Europe. *American Scientist* 84 (1996) 242–253.

<sup>4</sup> *Bogucki 1996a; Grygiel – Bogucki 1997.*

<sup>5</sup> *Grygiel – Bogucki 1997.*



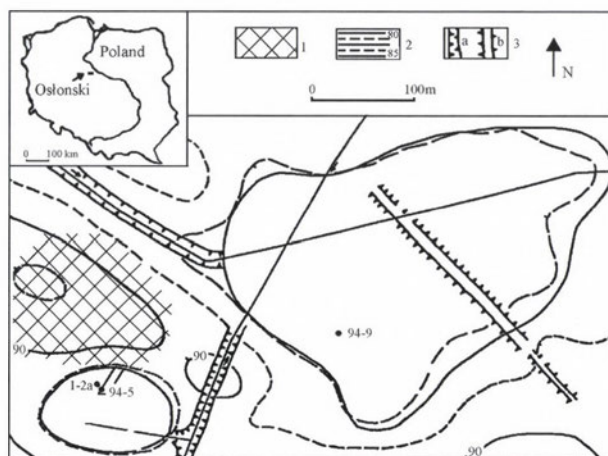


fig. 2. Location of the examined palynological profiles at Oslonki.  
1. archaeological site, 2. contour lines, 3. ditches

The Kujawy region was generally covered by black earths. This area is almost lacking of biogenic sediment. In that part of Poland only a few sites were recognized, which were filled by organic material. These sediments were palynologically dated to the Bronze Age.<sup>6</sup> Nowadays this area has been completely changed by human activity.

A palaeoenvironmental study was initiated in 1982 at Brześć Kujawski, but there were no organic sediments carrying plant remains.

In 1994, biogenic sediments were discovered near the Lengyel archaeological settlement at Oslonki. An environmental research project that included pollen and plant macrofossil analyses, as well as archaeozoological (cladocerans and molluscs) and geomorphological investigations was immediately undertaken. The aim of the research was to reconstruct the natural environment during the occupation of the Oslonki region and to investigate its subsequent changes under human impact.

### **Palynological investigations**

The Lengyel settlement at Oslonki was situated between a depression of a melt water channel on the west and a kettle hole on the south.<sup>7</sup>

Biogenic sediments in each basin have yielded material for pollen analysis. Three profiles excavated from these areas have been palynologically studied in detail. Two profiles (coring Os 1-2a and outcrop Os 94-5) were obtained from the biogenic sediments of the kettle hole; one profile (coring Os 94-9) was excavated from the biogenic sediments from the depression of melt water channel (fig. 2).

All pollen diagrams (figs. 3–5) have been prepared in POLPAL program.<sup>8</sup>

The biostratigraphy of the investigated material is subdivided into local pollen assemblage zones.<sup>9</sup> Local pollen assemblage zones (LPAZ) permitted the correlation of all pollen diagrams (fig. 6). These units are correlated with subdivisions established in Poland<sup>10</sup> and correlated

<sup>6</sup> K. Milecka: Paleobotanical research on the archaeological site Rybiny (in Polish with English summary). Ser. A – Geografia Fizyczna 49 (1998) 147–162.

<sup>7</sup> B. Nowaczyk – D. Nalepka – I. Okuniewska-Nowaczyk: The role of prehistoric man in the formation of forms and deposits on selected areas of the Wielkopolska-Kujawy Lowlands (in Polish with English summary). Geographia. Studia et Dissertationes 25 (2002) 34–60.

<sup>8</sup> A. Walanus – D. Nalepka: POLPAL. Program for counting pollen grains, diagrams plotting and numerical analysis. Acta Palaeobotanica Suppl. 2

(1999) 659–661; D. Nalepka – A. Walanus: Data processing in pollen analysis. Acta Palaeobotanica 43 (2003) 125–134.

<sup>9</sup> J. H. B. Birks: Numerical zonation, comparison and correlation of Quaternary pollen-stratigraphical data, in: Handbook of Holocene palaeoecology and palaeohydrology. Chichester – New York 1986.

<sup>10</sup> M. Ralska-Jasiewiczowa – M. Latalowa: Poland, in: Palaeoecological events during the last 15 000 years: Regional Synthesis of Palaeoecological Studies of Lakes and Mires in Europe. Chichester – New York – Brisbane – Toronto – Singapore 1996, 403–472.

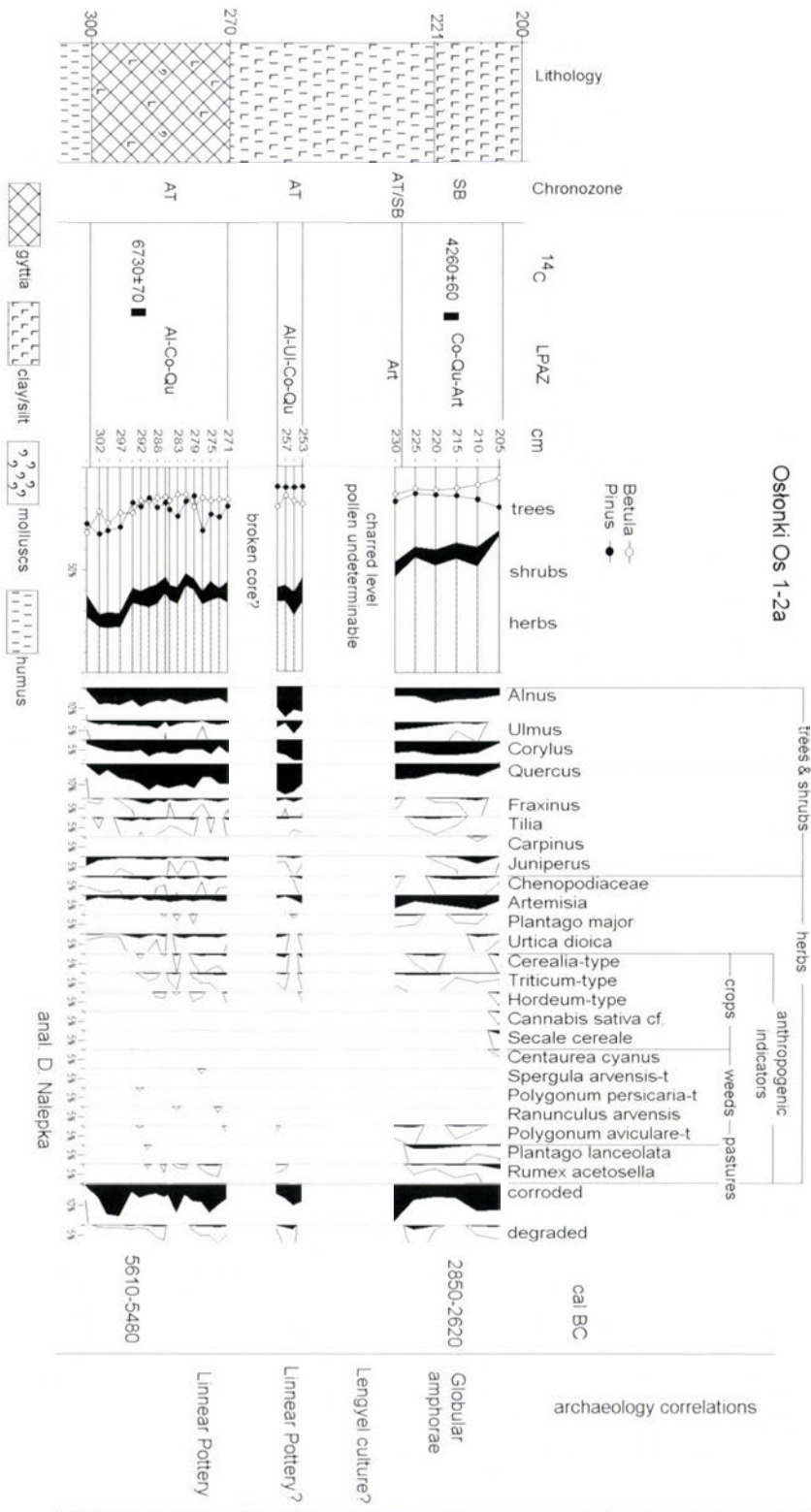


fig. 3. Simplified percentage pollen diagram from Ostlonki Os 1-2a



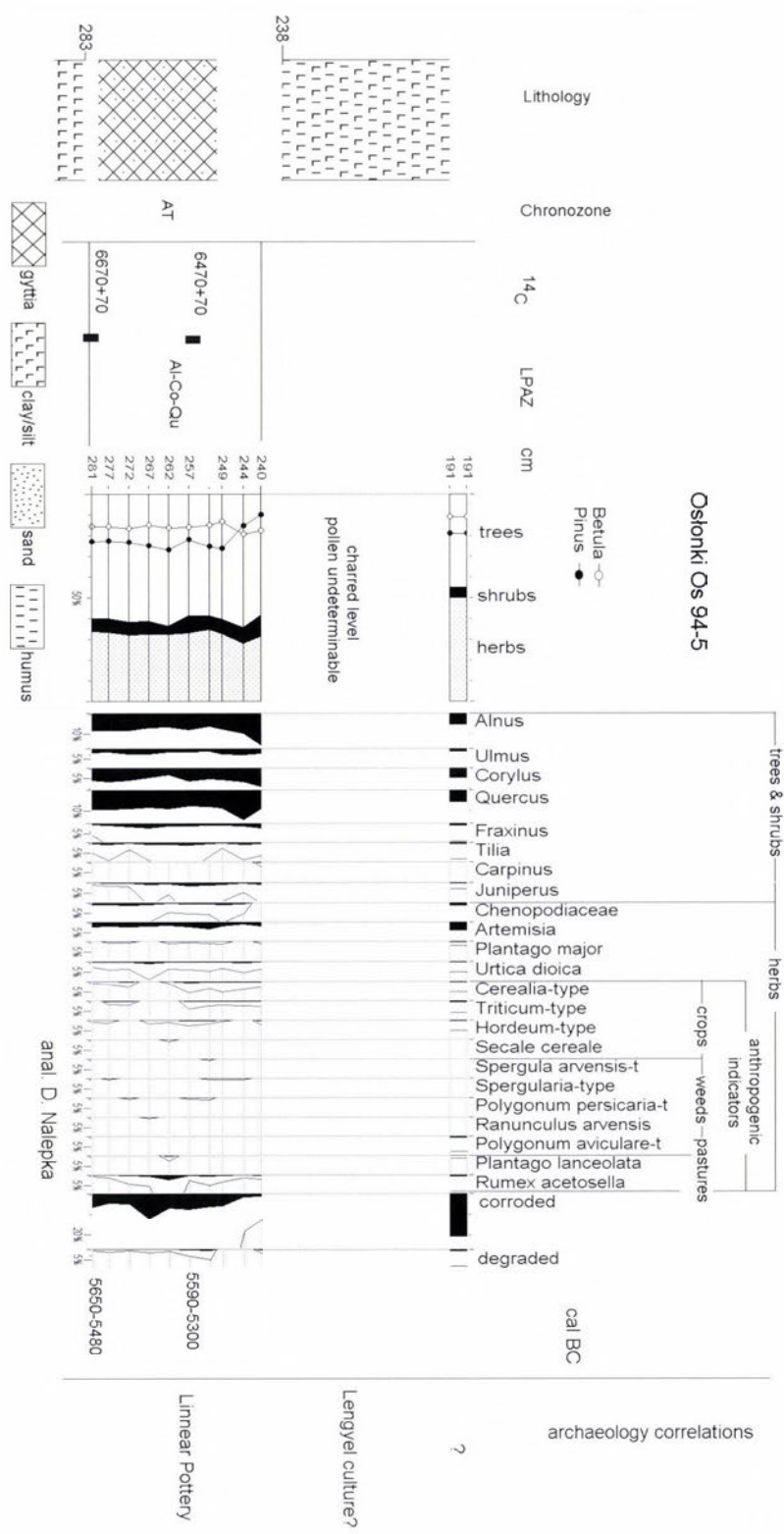


fig. 4. Simplified percentage pollen diagram from Oślonki Os 94-5

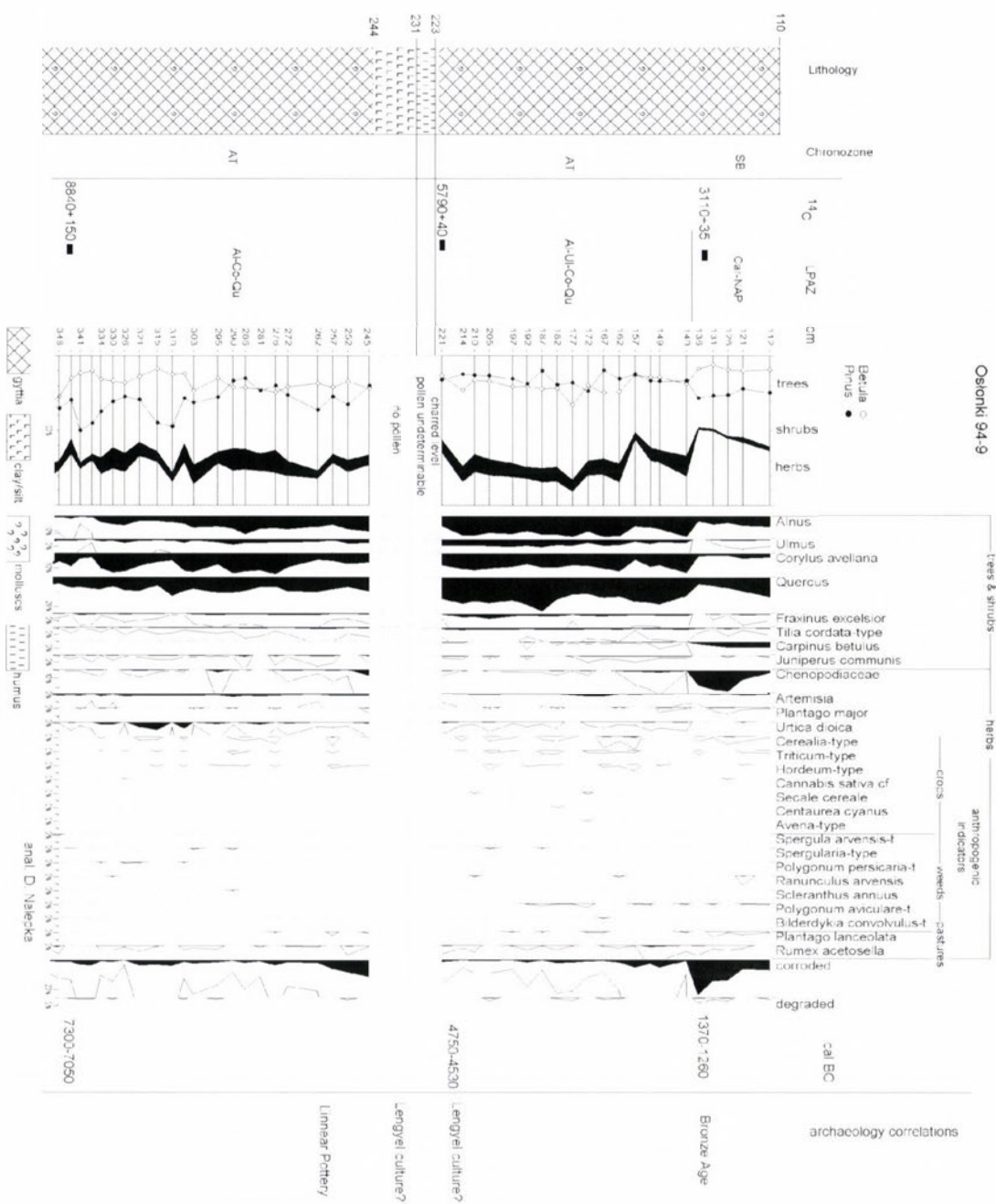


fig. 5. Simplified percentage pollen diagram from Osłonki Os 94-9



with a general chronostratigraphic subdivision acc. to Mangerud et al.<sup>11</sup> Reconstruction of the vegetation near the village was described within these units.<sup>12</sup>

The synchronicity of anthropogenic processes was established using radiocarbon dates. Radiocarbon dates made it possible to compare all palynological results. Radiocarbon determinations available from profiles Os 1-2a and Os 94-5 have been made by the Radiochemical Laboratory of the Museum of Archaeology and Ethnography in Łódź, using conventional techniques. Radiocarbon determinations obtained from the profile Os 94-9 have been made by the Poznań Radiocarbon Laboratory, using the AMS technique.

Profile	cm	<sup>14</sup> C BP	Nr	cal BC
Os 1-2a	212–217	4260 ± 60	Lodz-1179	2850–2620
Os 1-2a	291–295	6730 ± 70	Lodz-1181	5610–5480
Os 94-5	256–260	6470 ± 70	Lodz-1176	5590–5300
Os 94-5	279–283	6670 ± 70	Lodz-1177	5650–5480
Os 94-9	135	3110 ± 35	Poz-840	1370–1260
Os 94-9	221	5790 ± 40	Poz-839	4750–4530
Os 94-9	344	8440 ± 150	Poz-836	7300–7050

Tab. 1. Radiocarbon data from the Osłonki profiles

The palynological reconstruction considers the Late Glacial, older and middle part of the Holocene, up to the Subboreal period.<sup>13</sup> In the uppermost parts of all analyzed diagrams there were only scattered and discontinuous palynological records. They cannot be correlated with any precisely dated archaeological artefacts collected during excavations. Among the analyzed levels hiatuses were recognised. Some of them were visible in the lithology, but a few were discovered during pollen analysis. Without radiocarbon data (conventional and the AMS) it would be almost impossible to interpret pollen diagrams in detail.

The article presented is only focused on the diagram sections including indicators of anthropogenic changes (figs. 3–6), which are considered as the late Atlantic and part of the Subboreal periods. These sections, extracted from 3 diagrams, are combined according to their mutual correlations (fig. 6). Hiatuses, that existed in the source diagrams are included in them.

Local vegetation on the basis of LPAZ

Bottom parts of the Os 1-2a, Os 94-5 & Os 94-9 (figs. 3–5) diagrams (Al-Co-Qu LPAZ) correspond to the late Atlantic period. The relatively high presence of pollen indicators of forested areas (*Corylus*, *Ulmus*, *Quercus*, *Tilia*, *Fraxinus*), proved that the area was covered by mixed deciduous forests on fertile soils. On poorer sandy soils, *Pinus* woods were developed. Some open areas with heliophilous herbs (NAP summary curve) must also have existed nearby, but it cannot be determined whether they were caused naturally or anthropogenically.

The appearance of the first cereal pollen grains (*Cerealia*, *Hordeum*, *Triticum*), segetal weeds (*Spergula*, *Polygonum*, *Ranunculus arvensis*), single grains of pastures (*Plantago lanceolata*, *Rumex acetosella*) and continuous but low presence of ruderals (*Artemisia*, *Urtica*) reflect a very weak farming system in a forested environment.

The younger sections of two (figs. 3, 5) diagrams (Al-Ul-Co-Qu LPAZ) are characterized by similar to the lower LPAZ level in composition of pollen taxa, although their quantities differs in small amount. Deciduous forests still dominate. Herbaceous communities,

<sup>11</sup> J. Mangerud – S. T. Andersen – B. E. Berglund – J. Donner: Quaternary stratigraphy of Norden, a proposal for terminology and classification. *Boreas* 3 (1974) 109–126.

<sup>12</sup> Nalepka et al. 1998.

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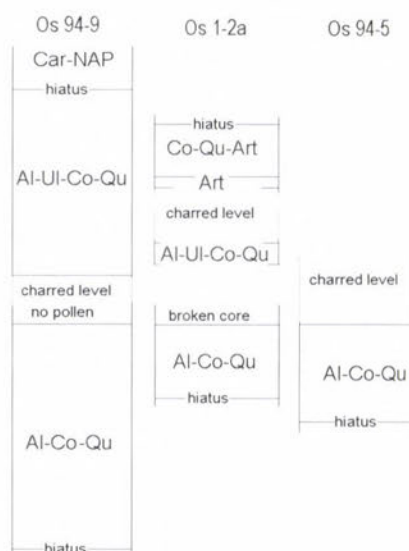


fig. 6. The setting up of three pollen diagrams acc. to distinguished local pollen assemblage zones (LPAZ)

including plants of fields, meadows, fallow lands, and pastures suggest not much stronger agricultural activity than before.

The upper section of the Os 1-2a (fig. 3) diagram (Art & Co-Qu-Art LPAZ), where the quantity of tree pollen diminished and herbaceous increased, reflects reduction in forested area and stronger agricultural, mainly pasture, activity (*Rumex acetosella* & *Plantago lanceolata*).

In the upper section of the Os 94-9 diagram (fig. 5, Car-NAP LPAZ), where the quantity of tree pollen diminished and herbaceous pollen increased, *Carpinus* pollen grains have been appeared as continuous curve.

### Human correlations

The palaeoecological interpretation of pollen diagrams carries a lot of difficulties particularly in that it is almost impossible to interpret any events in a human context. The palynologically identified activities of Neolithic farmers could be referred to individual cultures only on the basis of radiocarbon dates and detailed correlation with the results of archaeological studies in the Oslonki region.

**AL-Co-Qu LPAZ.** Only a few pollen grains of farming indicators (*Triticum*, *Hordeum*) and field weeds (*Spergula*, *Polygonum*, *Ranunculus acris*) as well as single grains of pasture plants (*Rumex acetosella* and *Plantago lanceolata*) indicated agriculture and cattle keeping. Those indicators, in such small quantity, could be correlated here with the Linear Pottery culture. According to archaeological knowledge, Linear Pottery settlements in this region are generally scarcely represented. In a sense, they represent pioneer food-producing communities that carried out the initial forest-breaking and the identification of promising settlement locations. Their settlements appear to have been relatively short-lived.<sup>14</sup>

Upper level contains strongly destroyed pollen and charred organic particles in the examined sediment. This damage of the sediment was caused probably by the Lengyel settlers, which used larger areas for farming and exposed soils to strong erosion, bringing about the increased input of mineral matter to the basin. Pollen grains were thus destroyed because of the poor conditions of preservation. It can be suggested that the hiatus previous to the Al-UI-Co-Qu was caused by low ground water levels during the Lengyel culture. Some confirmation for this suggestion can be the high percentage of *Stipa pennata* remnants found in archaeobotanical

<sup>14</sup> Bogucki 1996a.



materials from that region.<sup>15</sup> The custom of making wells by the Lengyel settlers at the nearby Lengyel site of Konary<sup>16</sup> could be postulated as additional evidence supporting this theory.

Until now, the detailed botanical interpretation of that period has been based on plant macrofossils collected directly from the archaeological sites.<sup>17</sup> The level in Os 94–9 diagram, which is covered by Al-Ul-Co-Qu LPAZ, (fig. 5) may include pollen remnants from the Lengyel Culture. This statement is based on the <sup>14</sup>C data only. But on the basis of pollen indicators, the vegetation is almost the same as the older section, recognized as correlated with the Linear Pottery culture. This level has been under more detailed analysis.

In the younger level, Co-Qu-Art LPAZ (fig. 3), the traces of agricultural activity include pollen grains, which indicate that animal breeding becomes more important than during the previous periods. According to <sup>14</sup>C and archaeological data they may be correlated with the late Neolithic, which probably means the Globular Amphorae culture here.

In the upper level of the Car-NAP LPAZ of Os 94–9 diagram (fig. 5), the presence of percentage amounts of *Carpinus* pollen and <sup>14</sup>C data suggest connection with the Bronze Age.

### Conclusions

The vegetation history in the Osłonki region could not be characterized on the basis of pollen data as continuum of processes but only as episodes interrupted at times when the sediments were destroyed during the Holocene. This destruction was caused firstly by the early Neolithic settlers, and in the later periods by the late Neolithic groups. Before the development of the early Neolithic occupation, primeval mixed deciduous forests with *Quercus*, *Tilia*, *Ulmus*, *Fraxinus* and *Corylus* covered the landscape in the vicinity of Osłonki. Only small, open areas with heliophilous herbs were present. The first farmers appeared in a forested environment. Cereals along with segetal weeds and ruderals reflected the spread of agriculture. *Triticum* and *Hordeum* were cultivated. The inhabitants of Osłonki exploited wild vegetal resources, which were available in the neighbourhood.<sup>18</sup> They used wood, first of all oak and pine, but also of other trees and shrubs such as birch, poplar, and hazel, although probably in smaller quantity. Fruits and seeds of a few wild plants (e.g. hazel nuts, and *Vaccinium vitis-idaea* fruits) may have been collected for food.<sup>19</sup>

The landscape around the Lengyel settlement must have been exploited quite heavily; in the immediate vicinity of the houses and beyond, timber requirements of the longhouse construction would have resulted in substantial timber cutting, to which the constant requirements for fuel, tool use, and house repair could be added. In all, there is a picture of a very intensive local landscape use.

Using archaeological and palynological information, we still could not say that there was a sharp boundary between foragers and farmers across this area, suggesting that small “islands”

<sup>15</sup> A. Bieniek: Archaeobotanical analysis of some early Neolithic settlements in the Kujawy region, central Poland, with potential plant gathering activities emphasised. *Vegetation History and Archaeobotany* 11(2002) 33–40.

<sup>16</sup> R. Grygiel: A well of the Stroke-Ornamented Ware culture from Konary near Brześć Kujawski (Poland). *AR* 54 (2002) 106–113.

<sup>17</sup> A. Bieniek: Plant husbandry of the Danubian Neolithic cultures in Poland on the basis of analysis of plant macroremains coming from several archaeological sites in the Kujawy region (in Polish). PhD manuscript.

<sup>18</sup> D. Nalepka: Natural environment and agricultural activity of the Lengyel culture settlement in Osłonki (Kujawy Lake District) (in Polish with English summary) *Polish Botanical Studies, Guidebook Series* 23 (1999) 79–87; D. Nalepka – A. Bieniek:

The exploitation of plant resources by the first Neolithic farmers in Osłonki region (Central Poland) based on pollen and macrofossil analyses, in: *The Ecological Setting of Europe – from the Past to the Future. European Agriculture on its Way from the Past to the Modern Time*. Höör, Sweden, 16–21. IX. 2000; Nalepka et al. 1998.

<sup>19</sup> A. Bieniek: Bread wheat (*Triticum aestivum* s.l.) and feather grass (*Stipa* sp.) in the early Neolithic in the Kujawy region (in Polish with English summary). *Polish Botanical Studies, Guidebook Series* 23 (1999) 89–106; A. Bieniek: The early Neolithic plant husbandry in the Kujawy region, central Poland, in: S. Colledge – J. Conolly – S. Shennan: *New Perspectives on the Origins and Spread of Farming in Southwest Asia and Europe*. Institute of Archaeology, University College London in print.

of agricultural settlement existed among the forager groups. We only know that finally the foragers of the North European Plain adopted agriculture shortly after ca. 4000 BC.

After the end of the Lengyel settlements at Osłonki, then at Brześć Kujawski, the settlements of the late Neolithic (Globular Amphorae and Funnel Beaker culture) of this area are found.<sup>20</sup> But they are located on different soil types, often some distance back from the stream channels. The Late Neolithic pattern in this region represents a completely different system of land use from that developed by the Lengyel culture.<sup>21</sup>

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<sup>20</sup> *Grygiel – Bogucki 1997*.

<sup>21</sup> Palynological investigations have been funded or supported by the W. Szafer Institute of Botany Polish Academy of Sciences, State Committee for Scientific Research (Project No 6PO4F 07921),

Museum of Archaeology and Ethnography in Łódź, the Wenner-Gren Foundation for Anthropological Research, Inc., the American Institute of Polish Culture in Miami and the W. Szafer Foundation for Polish Botany.





## A NEW QUANTITATIVE METHOD FOR THE PALAEOBOTANICAL DESCRIPTION OF LATE QUATERNARY ORGANIC SEDIMENTS

(Mire-development pathways and palaeoclimatic records from Southern Hungary)

Before quantitative pollen analysis was invented by von Post<sup>1</sup> in 1916 peat stratigraphy was the main source of evidence of palaeoenvironmental investigations. Layers of scarcely humified *Sphagnum* peat were taken as indicators as fast peat growth and therefore of wet climatic conditions. Layers of humified peat with wood fragments were taken to indicate a dryer mire surface and so an arid and warmer climate.<sup>2</sup>

Lakes, fens and bogs have different vegetation depending upon the water level and nutrient status, and produce characteristic sediments in these different environments. The Troels – Smith sediment description system<sup>3</sup> is designed for a quick, logical and simple description of such sediments in the field, which accurately reflects their composition. This sediment description method is commonly used in Quaternary palaeoecology. Fig. 1. presents the different Troels – Smith sediment types deposited under oligotrophic and eutrophic conditions.<sup>4</sup> The problem is that in some cases the same sediment type accumulated under different environmental conditions and vegetation type, hence a detailed plant macrofossil description is recommended.

The pioneer palaeobotanical studies on Quaternary sediments in the 19<sup>th</sup> century were the plant macrofossil analyses. But this method later was overshadowed by quantitative pollen analysis. At this time the plant macrofossil record emerged only in association with pollen diagrams. The methodical developments of the eighties (Birks, Janssens, Rybniček, Grosse – Brauckmann, Wasylikowa etc.) made this method essential in Quaternary palaeoecology.<sup>5</sup>

The invention of QLCMA technique (semi-quantitative quadrat and leaf-count macrofossil analysis technique) in Southampton opened the door to detailed quantitative data processing.<sup>6</sup>

Why is the macrofossil analysis so important? Plant macrofossils provide at last tree types of important information in palaeoecological investigations: (1) identification may be more detailed than for some pollen taxa because of the distinctive morphology, which provide good ecological interpretation (e.g. *Gramineae*, *Cyperaceae*, *Bryophytes*); (2) taxa not found or rarely found as pollen may produce good macrofossils; (3) for the assessment of local presence or absence the heavier macrofossils give a better clue than the easily transported pollen.<sup>7</sup> A further advantage is the use of plant macrofossil analysis in the reconstruction of past mire vegetation.<sup>8</sup> So that macrofossil analysis helps to refine and amend palaeoenvironmental interpretations made from pollen analysis alone.<sup>9</sup>

<sup>1</sup> L. von Post: Forest tree pollen in south Swedish peat bog deposits [translated: M. B. Davis – K. Faegri (1967)]. Pollen et Spores 9 (1916) 375–401.

<sup>2</sup> Birks – Birks 1980.

<sup>3</sup> Troels – Smith 1955.

<sup>4</sup> Birks – Birks 1980.

<sup>5</sup> Birks – Birks 2000.

<sup>6</sup> Barber et al. 1994.

<sup>7</sup> H. H. Birks: Plant macrofossils in Quaternary lake sediments. Arch. Hydrobiol. Beih. Ergebn. Limnol. 15 (1980) 1–60; K. Wasylikowa: Analysis of fossil fruits and seeds, in: Berglund 1986, 571–590; G. Grosse-Brauckmann: Analysis of vegetative plant macrofossils, in: Berglund 1986, 591–618.

<sup>8</sup> Rybniček 1973; K. Rybniček – E. Rybničková: The History of Flora and Vegetation on the Bláto mire in Southeastern Bohemia, Czechoslovakia (Palaeoecological Study). Folia Geobot. Phytotax. 3 (1968) 117–142; N. G. Slack: Can one tell the mire type from the bryophytes alone? J. Hattori Bot. Lab. 75 (1994) 149–159; G. Jakab – E. Magyar: Új távlatok a magyar lápkutatásban: szukcesszió kutatás paleobryológiai és pollenanalitikai módszerekkel (New progress in the Hungarian mire succession studies: the use of palaeobryological and palynological techniques in the reconstruction of hydroseries). Kitaibelia 5 (2000) 17–36.

<sup>9</sup> Birks – Birks 2000.



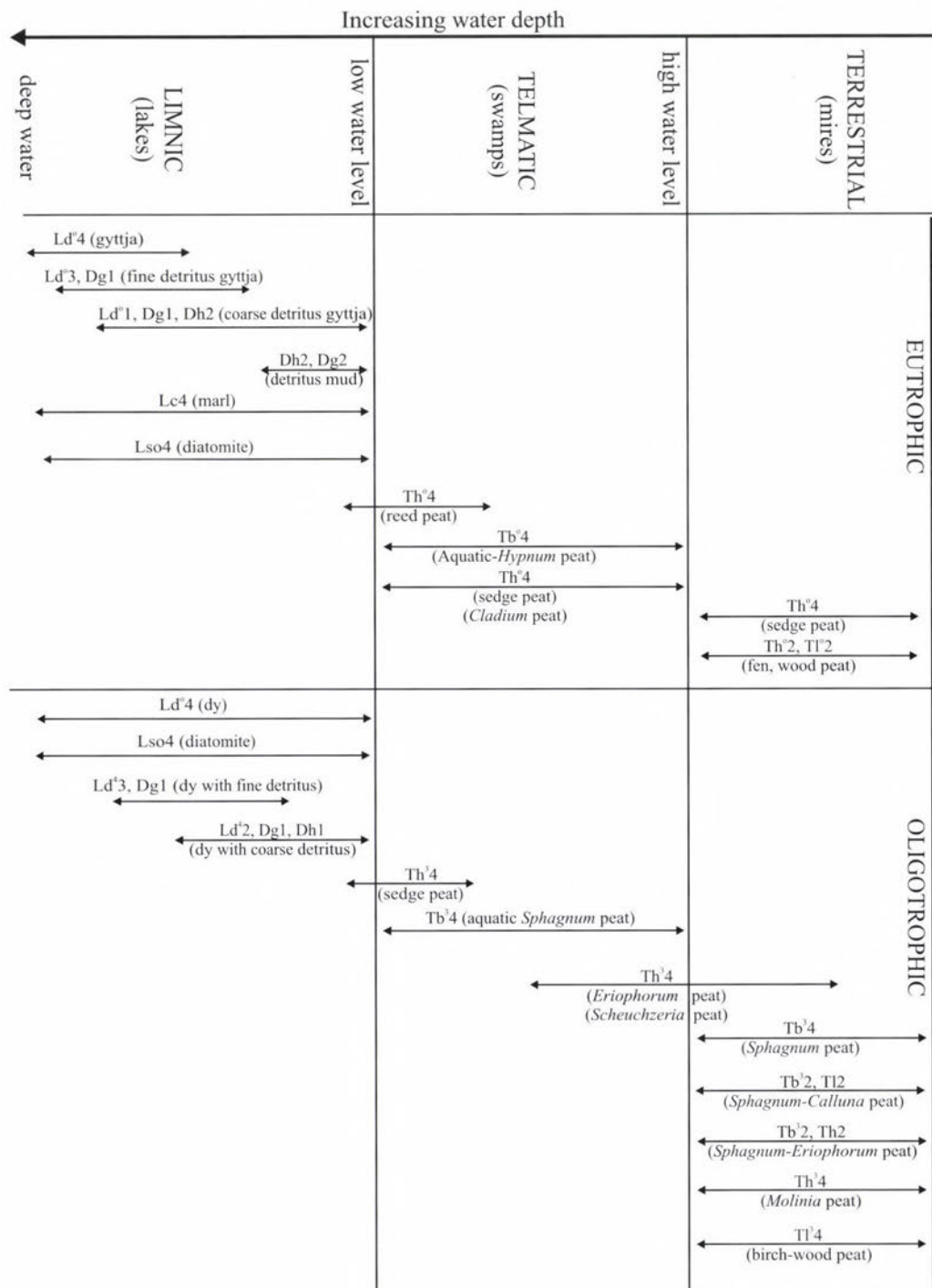


fig. 1. Sediment types deposited with increasing water depth under oligotrophic and eutrophic conditions (Birks – Birks 1980)

By comparison recent plant associations and fossil plant assemblages we can reconstruct past plant associations. Plant associations (units of vegetation) under some strong ecological influence (e.g. salty soil, water) possess uniformity in geographical space and permanency in geological time. Rybníček<sup>10</sup> proved the permanency of mire vegetation during the Holocene in Central Europe. So we can reconstruct the vegetation of former (drained and destroyed) peatbogs, or the local succession (hydroseres). We can detect climatical and hydrological changes as well. By this way, we can establish the nature conservation plans with the determination of optimal water level and quality. With the use of modern vegetation science,

<sup>10</sup> Rybníček 1973.

plant macrofossil analysis could provide the most detailed description of local environment in Quaternary palaeoecology.

There are some considerable problems with this method. Normally there are only relatively few macroremains in 1–5 cm<sup>3</sup> sediment (e.g. seeds), therefore large samples are needed (50 – 100 cm<sup>3</sup>) for detailed analysis. Some sediment, like oligotrophic lake sediments are poor in macroremains.

On the other hand, the most common remains, the vegetative plant tissues, are not identified commonly. The identification of rizodermal tissues is not popular in Quaternary research, because the lack of detailed manuals and keys.

Most palaeobotanical studies do not deal with the description of moderately humified, unidentifiable material even though these can provide important palaeoenvironmental information.

Plant macrofossil analysis is particularly used in oligotrophic, acid *Sphagnum* peats (oligotrophic environment), but in Central Europe sedge peats and lake sediments (eutrophic environment) are much more common and important.

To resolve the above detailed problems, we describe in this paper a new quantitative method for the palaeobotanical description of organic sediments. We present the so called Peat Component System for the holistic description of organic remains, and the modified QLCMA technique for the quantification of these components. In second part of this article the use of these methods are illustrated with an example.

## Methods

### Plant macrofossil analysis

#### THE PEAT COMPONENT SYSTEM

The term “peat component” is used by us to describe the macroscopic organic matter of the sediment that retain on a 300 µm sieve. Peat components occur in peat, but of course in smaller quantities in lake sediments as well.

Peat components cause the characteristic physical features of peat. One physical feature is elasticity. This means that the sediment has an ability to regain its shape after deformation. Another feature is the ability to absorb large volume of water.

The peat components can be divided into two main groups (Table 1). In the specific peat component group identification can be made on species level. The three main components of this group are the seeds, mosses and rizodermal tissues. We can use many manuals and keys for the identification of seeds and mosses.<sup>11</sup> The number of manuals dealing with the determination of rizodermal tissues is limited.<sup>12</sup> Most of these keys use macroscopic features, so that large samples are needed. The most useful manual was recently published by Jakab and Sümegi.<sup>13</sup> The keys and descriptions are based on the microscopic features of tissues. The use of this manual is essential in the method described below.

<sup>11</sup> W. Beijerinck: Zadenatlas der Nederlandsche Flora. Wageningen 1947; G. Berggren: Atlas of Seeds. 2. Cyperaceae. Stockholm 1968; S. Jávorka – V. Csapody: Iconographia florum partis austro-orientalis Europae centralis. Budapest 1991; N. J. Katz – S. V. Katz – M. G. Kipiani: Atlas and Keys of Fruits and Seeds Occurring in Quaternary Deposits of the USSR. Moscow 1965; Sz. Schermann: Magismeret I–II. [Seed studies I–II]. Budapest 1967; W. H. Schoch – B. Pawlik – F. H. Schweingruber: Botanical Macro-Remains. Bern – Stuttgart 1988; A. J. E. Smith: The moss flora of Britain and Ireland. Cambridge 1978; L. Hedenäs: Field and microscope keys to the Fennoscandian species of the Calliergon-

Scorpidium-Drepanocladus complex, including some related or similar species. Biodetector AB, Märsta 1993, etc.

<sup>12</sup> G. Grosse-Brauckmann: Über pflanzliche Makrofossilien mitteleuropäischer Torfe. I: Gewebereste krautiger Pflanzen und ihre Merkmale. Telma 2 (1972) 19–55. A. П. Пидопличка: Определитель остатков травянистых растений и зеленых мхов (Bryales) в торфе. Минск 1936.

<sup>13</sup> G. Jakab – P. Sümegi: A lágyszárú növények tőzegben található maradványainak határozója mikroszkópikus bélyegek alapján [Identifying of herbaceous plant remains from peat on the basis of microscopic features]. Kitaibelia 8 (2003) (in press).



<b>Specific peat components:</b> (identification possible on species level)	seeds, fruits bryophytes rizodermal tissues (e.g. <i>Carex</i> spp.) epidermal tissues other tissues and organs (pine needles, hairs, tracheids, sporogons etc.) Insect remains
<b>Non-specific peat components:</b> (identification not possible on species level with this method)	Monocot. Undiff. – unidentifiable monocotyledons U. O. M. – unidentifiable organic matter U. L. F. – unidentifiable leaf fragment U. B. F. – unidentifiable bryophyte fragment <i>Sphagna</i> undiff. ( <i>Sphagnum</i> stem) charcoal wood Mollusc shell fragments

Table 1. The main categories of peat components

The second group is the non-specific peat components. In this group identification is not possible on species level with this method. The main non-specific peat components are as follows.

*Unidentifiable monocotyledons* (Monocot. Undiff.): Mostly translucent tube-like rootlets or epidermis fragments with elongated cells. The young rootlets of *Phragmites* with hardly differentiated cells often got into this category.<sup>14</sup>

*Unidentifiable leaf fragments* (U. L. F.): Moderately humified deciduous tree leaf fragments. They are easily recognisable by the remains of weblike veins.

*Unidentifiable organic matter* (U. O. M.): Strongly humified fragments with irregular shape. They are insufficient for any further identification.<sup>15</sup>

*Unidentifiable bryophyte fragment* (U. B. F.): In humified peat, only the stem remains of bryophytes can be found that are insufficient for further identification. They are easily recognisable by their tube-like form and brown colour. The nerve of the leaf frequently remains on the stem.

*Unidentifiable Sphagna* (*Sphagnum* stem): In less humified peats the stems of *Sphagna* occur in high quantity. These do not have any characteristic features that would allow specific identification.

*Charcoal*: Charred wood fragments larger than 300 µm (mostly between 1–3 mm). The origin of charcoal of this size is presumably terrestrial (allochton), so it makes possible to correlate multiple corings in a location.

*Wood*: Uncharred wood fragments larger than 300 µm. Presumably terrestrial elements (allochton) in lakes and smaller peatbogs.

*Mollusc shell fragments*: It is not possible to identify Mollusc with this method, because most of them break into pieces during the extraction, but we can detect the volume of shell fragments.

The specific peat components help us to reconstruct past plant associations, but the non-specific peat components also contribute to the reconstruction of environmental and hydrological changes.

The nomenclature of bryophytes follows Düll,<sup>16</sup> vascular plants Tutin et al.<sup>17</sup> and syntaxons Borhidi.<sup>18</sup>

#### QUANTIFICATION OF PEAT COMPONENTS

For the quantification of peat components we modified the QLCMA method (semi-quantitative quadrat and leaf-count macrofossil analysis technique) developed by Barber et al.<sup>19</sup> With this

<sup>14</sup> Barber et al. 1994 used this category in a similar context.

<sup>15</sup> Barber et al. 1994 used this category in a similar context.

<sup>16</sup> R. Düll: Distribution of the European and Macaronesian Mosses (Bryophytina). Part I. – Bryol. Beitr. Duisburg 4 (1984) 1–107; R. Düll:

Distribution of the European and Macaronesian Mosses (Bryophytina). Part II. – Bryol. Beitr. Duisburg 5 (1985) 110–232.

<sup>17</sup> T. G. Tutin et al. (eds.): Flora Europaea I., II., III., IV., V. – Cambridge 1964, 1968, 1972, 1976, 1980.

<sup>18</sup> Borhidi 2003.

<sup>19</sup> Barber et al. 1994.

method we can determine macrofossil concentrations from small samples (1–3 cm<sup>3</sup>) with the use of poppy seeds as marker grains (0.5 g = 959 ± 52) under dissecting microscope. Barber et al.<sup>20</sup> determined the volume of *Sphagnum* leaves with this method, and then identified *Sphagnum* under biological microscope.

In our version we took 3 cm<sup>3</sup> samples and strained them on a 300 µm screen. The retained material was stored in water. Wet residues were then transferred to jars for storage, and covered by water. We also added a few drops of glycerol : ethanol : formaldehyde mixture to discourage bacterial and fungal growth.

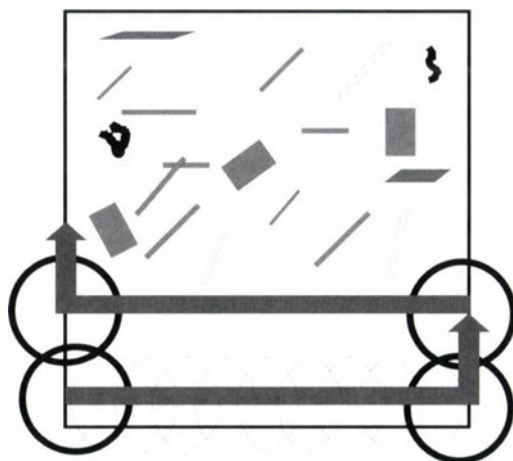


fig. 2. The identification and quantification of Monocotyledons with scanning under biological microscope

Subsequently we placed the residues under dissecting microscope and removed all seeds. In the diagrams the total number of seeds were marked in 3 cm<sup>3</sup>.

After that we mixed the poppy seeds (it must be soaked before) and the residue. When the poppy seeds were spread evenly, we counted all the peat components and the poppy seeds in a 1 cm<sup>2</sup> large quadrat (10 × 10 mm) in ten different parts of the material. It is not possible to identify the rhizoms and bryophytes under dissecting microscope, so that we counted them as Bryophytes and Monocotyledons.

Hereafter, we took randomly 100 moss leaves and 100 tissue remains, and mounted them water on microscope slides. We identified the mosses and the tissues under biological microscope (fig. 2). The tissues are often quite long, so it is hard to determine the exact number of remains. We decided to scan the whole slide and count as much as is seen. In this way we got the species composition of these peat components.

The next equation shows the calculation of macrofossil concentrations.

$$\text{macrofossil concentration} = \frac{\text{counted macrofossil (average)} \times 960 \text{ (total poppy seed)}}{\text{counted poppy seed (average)} \times \text{volume (cm}^3\text{)}}$$

fig. 3. Quantification of peat components

The macrofossil diagrams were prepared using PSIMPOLL Ver. 2.25.<sup>21</sup> Principal components analysis (PCA) was used to highlight the ecological characteristics of peat components in some core. PCA were carried out using SYNTAX 2000.<sup>22</sup>

<sup>20</sup> Barber et al. 1994.

<sup>21</sup> Bennett 1992.

<sup>22</sup> J. Podani: SYN-TAX 5.0: Computer programs for multivariate data analysis in ecology and systematics. Abstracta Botanica 17 (1993) 289–302.



### Pollen analysis

Samples for pollen analysis were collected using a 1 cm<sup>3</sup> volumetric subsampler at 4 cm intervals. Pollen samples were prepared following the method described by Berglund – Ralska-Jasiewiczowa<sup>23</sup> with *Lycopodium* spore<sup>24</sup> added to each sample in order to determine the pollen concentration. Pollen samples from peat were prepared with the same method, but prior to the acetolysis, samples were treated with 2% NaOCl in waterbath for 2 minutes.

Pollen and spores were identified with the aid of keys.<sup>25</sup> Minimum 300 terrestrial pollen grains were counted in each sample. Since the aim of our investigation was the reconstruction of the mire forming vegetation and its relation to changes in the terrestrial vegetation, pollen percentages were calculated in two different ways. For the description of changes in the terrestrial vegetation the percentage calculation is based on the sum of all terrestrial taxa. The other pollen diagram depicts the curves of the peat-forming and water plants. The percentage calculation is based on their sum plus the terrestrial pollen sum and includes Pteridophyta spores.

The pollen diagrams were prepared using PSIMPOLL Ver. 2.25.<sup>26</sup> Zonation of both the terrestrial and aquatic diagram was performed using statistical procedures, from among the results of optimal splitting by information content<sup>27</sup> were used to guide decisions as to the number and position of the pollen assemblage zone (LPAZ) boundaries.

### Mollusc analysis

Only the corings CSTII and HP11 contain sufficient mollusc shell for further studies. The cores were cut into 10 cm long pieces, and strained on an 800 µm sieve. The cores were analysed in 20 cm long sections because the amount of mollusc specimens did not exceed the sufficient number (100 specimens) in the 10 cm samples.

The species have been assigned to different palaeoecological groups:<sup>28</sup>

1. Species living in oxygen-rich living water: *Valvata piscinalis*, *Viviparus contectus*, *Lithoglyphus naticoides*, *Lymnaea stagnalis*, *Planorbis* cf. *carinatus*, *Unio* cf. *crassus*, *Pisidium amnicum*.

2. Species living in living or stagnant but permanent water: *Valvata cristata*, *V. pulchella*, *Bythinia leachi*, *B. tentaculata*, *Lymnaea palustris*, *L. peregra*, *Planorbis planorbis*, *Planorbarius corneus*, *Anisus vorticulus*, *A. vortex*, *Gyraulus albus*, *Armiger crista*, *Bathyomphalus contortus*, *Acroloxus lacustris*, *Segmentina nitida*, *Hippeutis complanatus*.

3. Species tolerate periodic water: *Lymnaea truncatula*, *Anisus spirorbis*, *Pisidium obtusale*, *P. casertanum*.

4. Hygrophilous, mostly marshland and terrestrial species: *Carychium minimum*, *Succinea oblonga*, *S. elegans*, *V. antivertigo*, *V. angustior*, *Vallonia enniensis*, *Zonitoides nitidus*, *Perforatella rubiginosa*.

5. Mesophilous and xerophilous terrestrial species: *Pupilla muscorum*, *Vallonia costata*, *Limacidae*, *Euconulus fulvus*, *Helicopsis striata*.

In addition the species have been assigned to palaeoclimatical groups: cold resistant (*Valvata pulchella*, *Bythinia leachi*, *Succinea oblonga*, *Oxyloma elegans*), thermophilic

<sup>23</sup> B. E. Berglund – M. Ralska-Jasiewiczowa: Pollen analysis and pollen diagrams, in: Berglund 1986, 455–479.

<sup>24</sup> J. Stockmarr: Tablets with spores used in absolute pollen analysis. Pollen et Spores 13 (1971) 614–621.

<sup>25</sup> P. D. Moore – J. A. Webb – M. E. Collinson: Pollen Analysis. Oxford 1991; M. Reille: Pollen et spore D'Europe et D'Afrique du Nord. Laboratoire de Botanique Historique et Palynologie Marseille 1992; Supplement 1. Marseille 1995; Supplement 2. Marseille 1997.

<sup>26</sup> Bennett 1992.

<sup>27</sup> H. J. B. Birks – A. D. Gordon: Numerical Methods in Quaternary Pollen Analysis. London 1985.

<sup>28</sup> Ložek 1964; Meijer 1985; J. Fényes: A Duna-Tisza közti tőzeges tavak fejlődéstörténete Mollusc-fauna vizsgálatok alapján [Development history of peat lakes in Danube-Tisza Interfluvium on the basis of Mollusc fauna investigations]. Alföldi Tanulmányok 8 (1983) 7–30; E. Krolopp: Biostratigraphic division of Hungarian Pleistocene Formations according to their Mollusc fauna. Acta Geologica Hungarica, 26 (1983) 62–89; Sümegi – Krolopp 1995; P. Sümegi: Az ÉK-magyarországi löszterületek összehasonlító ökönyvezeti és sztratiográfiai értékelése [Comparative palaeoecological and stratigraphic valuation of the NE Hungarian loess areas]. Kandidátusi (PhD) Thesis, Budapest 1996.



(*Bithynia tentaculata*, *Lithoglyphus naticoides*, *Anisus vorticulus*, *Vertigo antivertigo*, *Vallonia emniensis*, *Helicopsis striata*) and eurytherm (the others).

We arrange the species on the bases of habitat requirements.<sup>29</sup> Although the Mollusc species not sufficient for the reconstruction of past plant associations,<sup>30</sup> some recent investigations show<sup>31</sup> the possibility of reconstructing general vegetation units (e.g. woodland, ecotone, steppe).<sup>32</sup>

The aquatic species has special habitat requirements as well.<sup>33</sup> The samples dominated by aquatic species, therefore the analysis has been focused on the changes of aquatic environment (e.g. oligotrophy, vegetation density).

### Chronology

From the Holocene layers four bulk samples were submitted for radiocarbon dating at the Nuclear Research Centre of Hungarian Academy of Sciences, Debrecen, Hungary.<sup>34</sup> All samples were unfiltered peat. The radiocarbon dates of Hajós–Kaszálók presented in fig. 2. The radiocarbon dates from Császártöltés (CSTII core) were published later by Cserny.<sup>35</sup>

Sample ID	Depth below peat surface (cm)	$\delta^{13}\text{C(PDB)}$ [‰]	$^{14}\text{C}$ age years BP	Calibrated range years BC/AD (2 $\sigma$ )
Hajós-5	95–100	-28,17±0,02	1650±80	320–500 AD
Hajós-6	160–65	-28,73±0,01	1770±80	180–350 AD
Hajós-7	215–220	-26,84±0,04	3960±70	2560–2360 BC
Hajós-8	265–270	-27,58±0,07	7310±80	6230–6090 BC
Hajós-9	291–296	-28,03±0,02	9130±130	8510–8230 BC

Table 2. Radiocarbon dates from the Holocene sediments of Hajós–Kaszálók

### Site description

The Great Hungarian Plain, called “Alföld” in Hungarian, is the biggest sedimentary basin in Europe, filled with Neogene sediment of great thickness. The geological evolution of the Pannonian basin started in the Miocene, thus in this basin 2000–3000 m thick marine and 1000–2000 m thick lake sediment deposited during Late Tertiary.<sup>36</sup>

Fluvial sedimentation started at about the beginning of Quaternary. As a result of fluvial activity, 200–300 m, maximum 700 m thick Quaternary sedimentary series accumulated in the deepest parts of the Great Hungarian Plain. Rivers entering the Great Hungarian Plain built extensive alluvial fans in the Quaternary Age<sup>37</sup> and behind these alluvial fans some lowland within subsidences intersected on the surface by innumerable rivers and brooks. The analysed lowland, Solt–Baja alluvial Plain consists of two Late Quaternary neotectonic catchment subbasins.<sup>38</sup> From the point of view of evolution, the western part of the Great Hungarian Plain is one of the most specific regions in Hungary. The relief conditions and network of rivers suffered the most dramatic transformation during the Late Pleistocene. All the watercourses

<sup>29</sup> Ložek 1964; Meijer 1985.

<sup>30</sup> J. G. Evans: Land Snails in Archaeology. London – New York 1972.

<sup>31</sup> T. Deli – P. Sümegei: Biogeographical characterization of Szatmár-Bereg plain based on the mollusc fauna, in: J. Hamar – A. Sárkány-Kiss (eds.): The Upper Tisza Valley. Tiscia Monograph Series. Szeged 1999, 471–477; P. Sólmos: Ecological and biogeographical investigation of the recent mollusc fauna of Szársomlyó (S Hungary), southern side. Malakológiai Tájékoztató 15 (1996) 61–67; P. Sólmos – A. Nagy: The recent mollusc fauna of the Szársomlyó (S Hungary): spatial pattern and microclimate. Malakológiai Tájékoztató 16 (1997) 35–42.

<sup>32</sup> Sümegei – Krolopp 1995; Sümegei – Krolopp 2001.

<sup>33</sup> J. Ökland: Lakes and Snails. Environment and Gastropoda in 1500 Norwegian Lakes, Ponds and Rivers. Oegstgeest 1990; Meijer 1985.

<sup>34</sup> E. Hertelendi – É. Csongor – L. Záborszky – I. Molnár – I. Gál – M. Györfy – S. Nagy: Counting system for high precision  $^{14}\text{C}$  dating. Radiocarbon 31 (1989) 399–408.

<sup>35</sup> T. Cserny: A balatoni negyedidőszakú üledékek kutatási eredményei [Results in the research of Quarter sediments of Lake Balaton]. FTK 132 (2000) 193–213.

<sup>36</sup> Rónai 1985.

<sup>37</sup> Sümegei 1944.

<sup>38</sup> Jaskó – Krolopp 1991; Scheuer et al. 1992.



coming from the northern part of Carpathians and Alps had a role in the evolution of the alluvial fan plain whose name is Kiskunság. The Danube River with its tributaries used to flow across the Kiskunság alluvial fan during the first phase of Quaternary then during the Weichselian glacial time a subsidence, more intense than ever before, started in the Solt–Baja Plain. As a consequence of the subsidence, a completely new network of watercourses developed, which in the course of their erosion and deposition, transformed the sinking area into floodplain. This subsidence was, for a time, counterbalanced by the aggradational work of the river. Thus, changes of the riverbeds were frequent in this plain.<sup>39</sup>

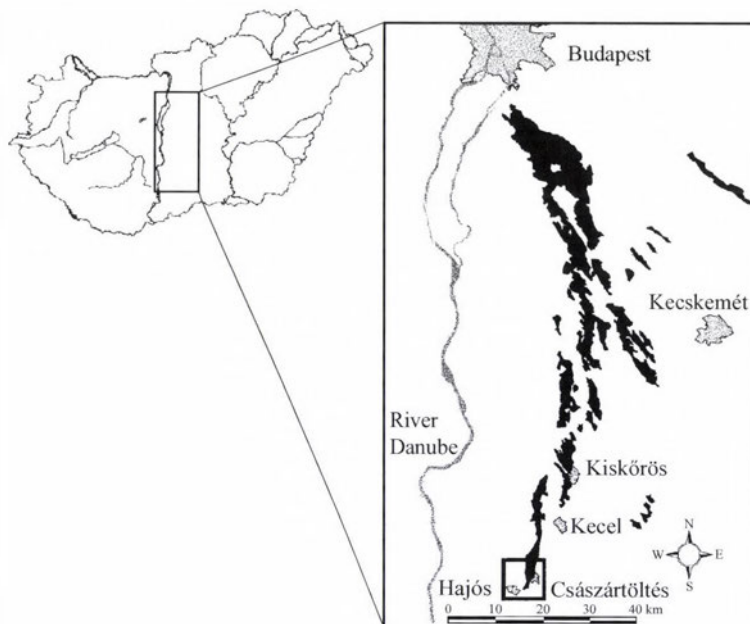


fig. 4. The position of Hajós (Hajós–Kaszálók Mire) and Császártöltés (Vörös-mocsár Mire) in Hungary

The Vörös-mocsár Mire and the Hajós–Kaszálók Mire (46°23'40" N, 19°09'30" E) are the southern unit of the mire system of the Danube–Tisza Interfluve ("Turján, őrtég, Vörös-mocsár") running south in the former watercourse of the river Danube (fig. 4). The mires situated at the border of two significantly different regions on an area. The Solti Plain belonging to the Danube floodplain is covered with the network of abandoned watercourses of the river Danube. The watercourses are in different step of infilling. The Solti Plain and the adjoining Sand Dunes of the Danube–Tisza Interfluve are separated by an approximately 10 meters high, steep loesswall. Groundwater springs rise from the base of the loesswall. The Sand Dunes of the Danube–Tisza Interfluve are actually underlain by loess that in places.<sup>40</sup>

The Danube–Tisza Interfluve lies in the warm temperate zone. It is characterised by January mean temperatures higher than –2°C and the duration of the winter is only three month. The climate of the region is semiarid, and dominated by submediterranean rather than cool continental climate influence. The region is poor in precipitation. The total annual precipitation varies between 500 and 600 mm most over the region.<sup>41</sup>

The natural vegetation of the Sand Dunes was *Junipero–Populetum* scrub and sandy grasslands, formed by *Bromus squarrosus*, *Secale sylvestre*, *Stipa borystenica* and *Festuca vaginata*. Well-drained areas were occupied by oak forests (*Iridi variegatae–Quercetum*

<sup>39</sup> M. Pécsi: A magyarországi Duna-völgy kialakulása és felszínalakulása [Development and geomorphology of Hungarian Danube-valley]. Budapest 1959.

<sup>40</sup> Marosi – Somogyi 1990.

<sup>41</sup> A. Borhidi: Klimadiagramme und klimazonale karte Ungarns. Annales Univ. Sci. Budapest 4 (1961) 21–

50; A. Borhidi: Characteristics of the climate of the Danube–Tisza Mid-Region, in: J. Szujkó-Lacza – M. Rajczy (eds.): The Flora of the Kiskunság National Park I. Magyar Természettudományi Múzeum, Budapest 1993, 9–20.

*roboris*, *Polygonato latifolii*–*Quercetum roboris*). Recently most of the area is cultural landscape with ploughlands and vineyards and some patches of natural vegetation. The Solti Plain was a widespread peatland with patches of *Fraxino pannonicae*–*Alnetum* forests.<sup>42</sup>

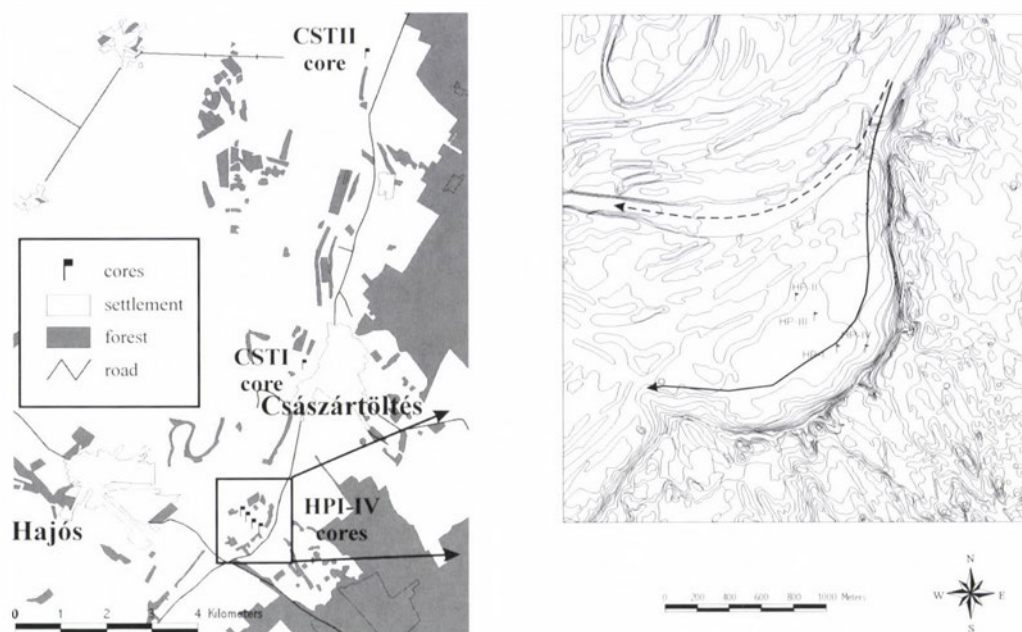


fig. 5. Map of Vörös-mocsár and Hajós–Kaszálók Mire and the approximate position of sampling sites for peat cores CSTI–II and HPI–IV

Water regulations started in 1873 destroyed the original vegetation of this peatland. The artificial Danube Basin Channel (“*Abzugskanal*”), finished in 1929, drained the mires. Only some patches of the natural vegetation survived.<sup>43</sup> After the water regulations peat-cutting altered the former landscape. Most areas (and sediments) of the Vörös-mocsár destroyed by peat-cutting. One exception is that, Hajós–Kaszálók Mire remained intact. There is only a little information about the original vegetation of these areas. Menyhárth<sup>44</sup> in 1877 reported widespread *Carex elata* stands (“Zsombék-formation”-hummock) from the mire, and mentioned the occurrence of *Stratiotes aloides*, *Ranunculus lingua*, *Caltha palustris*, *Nuphar lutea*, *Dianthus superbus*, *Hippuris vulgaris*, *Galium palustre*, *Menyanthes trifoliata*, *Nymphoides peltata* etc. Nowadays the peatlands are covered with secondary vegetation: meadows, reedswamps and sedgeswamps. The most important problems of nature conservation are the lack of water and the invasion of *Solidago gigantea*.

### Field sampling

Peat cores were retrieved using a 5 cm diameter Russian corer.<sup>45</sup> The position of the boreholes is shown on fig. 5. In the Hajós–Kaszálók Mire the boreholes were placed along a transect. Borehole HPI was gained from the deepest part of the basin and was used for pollen analytical

<sup>42</sup> Borhidi 2003; K. Tóth: Nemzeti park a Kiskunságban [National Park of the Kiskunság]. Budapest 1979; K. Tóth (ed.): 20 éves a Kiskunsági Nemzeti Park 1975–1995. Kecskemét 1996; T. Pócs: Növényföldrajz [Fytogeography], in: T. Hortobágyi – T. Simon (eds): Növényföldrajz, társulástan és ökológia. Budapest 1991, 27–166; Z. Rakonczay (ed.): A Kiskunságtól Bácsalmásig. A Kiskunság természeti értékei [From Kiskunság to Bácsalmás. Natural values of the Kiskunság]. Budapest 2001; J. Szujkó-Lacza: Flowering plants of the Kiskunság National Park and the other region between the

Danube and Tisza Rivers, in: J. Szujkó-Lacza – M. Rajczy (eds): The Flora of the Kiskunság National Park I. Budapest 1993, 43–467.

<sup>43</sup> Á. Boros: A Duna-Tisza köze köriserdői és zsombékosai [Ash forests and hummock-formations in Danube-Tisza Interfluvium]. Botanikai Közlemények 32 (1936) 84–97; Molnár – Biró 2001.

<sup>44</sup> L. Menyhárth: Kalocsa környékének növénytenyésztete [Cultivation of plants in the environs of Kalocsa]. Budapest 1877.

<sup>45</sup> Aaby – Digerfeldt 1986.



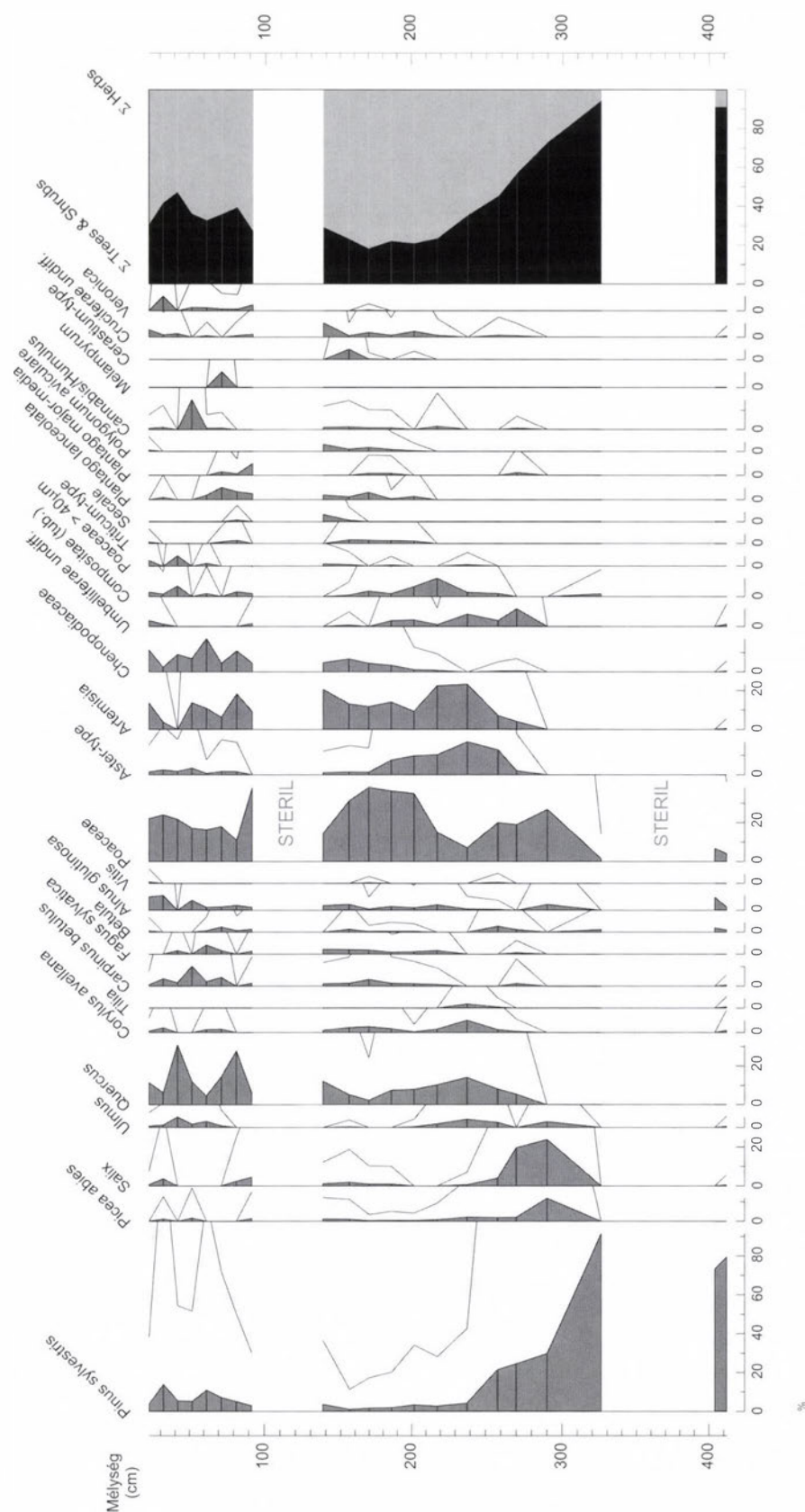


fig. 6/1. Percentage pollen diagram of HPI core (LPAZ: local pollen analytical zones)

and radiocarbon analysis. All other cores were used for plant macrofossil analysis. Only cores CSTII and HPII contained mollusc shells. Mollusc analysis was made only on these sequences.

Detailed description of the peat cores follow the system described by Troels – Smith.<sup>46</sup>

Local pollen zone		Zone description
HPIP-7.	20–92 cm	The principal tree species in this zone are <i>Quercus</i> , <i>Carpinus betulus</i> and <i>Alnus cf. glutinosa</i> . Total arbor pollen accounts for 35–40%. Mixed oak and oak-hornbeam forests are typical. Strong anthropogenic signal and extensive forest-steppe area was detected in this zone. <i>Cyperaceae</i> pollen grains are frequent.
HPIP-6.	92–138 cm	Devoid of pollen.
HPIP-5.	138–210 cm	Oak-hornbeam and hoarnbeam-beach forests characterise this zone, but steppe area increased to 75–80%. Presumably beach forests increased on the floodplain of the River Danube, and steppe area and ploughland replaced the mixed forest-steppe on the Sand Dunes of the Danube–Tisza Interfluvium. <i>Tilia</i> and <i>Ulmus</i> disappeared and <i>Quercus</i> decreased. Large number of weed species indicate strong anthropogenic influence, like <i>Polygonum aviculare</i> , <i>Cerastium sp.</i> , <i>Plantago lanceolata</i> , <i>Spergula sp.</i> <i>Triticum</i> -type cereal pollen is present in each sample.
HPIP-4.	210–270 cm	Principal tree species of the mixed forest-steppe dominate this zone: <i>Quercus</i> , <i>Ulmus</i> , <i>Corylus avellana</i> , <i>Tilia platyphyllos</i> and <i>Tilia cordata</i> . Up to 258 cm <i>Pinus sylvestris</i> is an important species of the terrestrial vegetation together with <i>Salix</i> and <i>Betula</i> . The most dominant herbaceous remains are the pollen of <i>Artemisia</i> , <i>Aster</i> -type, Poaceae and Umbelliferae. Other important herbaceous species are <i>Plantago major/media</i> , <i>Filipendula vulgaris</i> , <i>Pimpinella sp.</i> The first anthropogenic signal was detected at 238 cm.
HPIP-3.	270–326 cm	The first sample (326 cm) of the local pollen assemblage zone HPIP-3 shows similar pollen composition to the HPIP-1. zone with high representation of <i>Pinus sylvestris</i> and very few other pollen types (e.g. <i>Betula</i> , Poaceae, <i>Dipsacus</i> -type, <i>Galium</i> ). Above 290 cm (c. 9500 cal. yr BP) total land pollen concentrations increase and attain the highest values throughout the core (max. 1.01 million grains/cm <sup>3</sup> ). Arboreal pollen frequencies decrease gradually from 50 to 37%. Declining values of schotch pine are counterbalanced by increases in <i>Salix</i> , <i>Picea abies</i> and <i>Ulmus</i> . <i>Vitis</i> pollen appears and there is a steady increase in Poaceae. From these data we can infer the development of a gallery forest around the study site made up of willow and abundant liana. Well-drained areas in the vicinity of the meander must have supported mixed stands of spruce ( <i>Picea abies</i> ) and elm ( <i>Ulmus</i> ); however, we can also surmise a spread in grassland dominated by Poaceae, Umbelliferae and <i>Aster</i> species.
HPIP-2.	326–402 cm	Devoid of pollen.
HPIP-1.	402–412 cm	The principal tree species in this zone is <i>Pinus sylvestris</i> . Small quantities of <i>Pinus cembra</i> , <i>Pinus mugo</i> , <i>Larix decidua</i> , <i>Betula nana</i> , <i>Hyppophae rhamnoides</i> , <i>Alnus cf. glutinosa</i> and <i>Selaginella selaginoides</i> were also found. The small quantity of herbaceous pollen (particularly <i>Artemisia</i> and <i>Chenopodiaceae</i> ) is a strange phenomenon. The pollen concentration in this zone is extremely low that suggests selective fossilisation, and probably extensive bare surfaces with patches of tundra vegetation.

Table 3. Summary of the pollen stratigraphy of core Hajós–Pincék I.

## Results

### The pollen record

The reconstruction of the terrestrial vegetation development is based on the pollen analytical study of core HPI. The results of the pollen study are presented in *fig. 6*.

In the samples between 92–138 cm and 326–402 cm the pollen concentration was insufficient for further study with this treatment. The pollen concentration between 156–250 cm was however optimal.

Between 326–402 cm the pollen concentration is extremely low (6000–29000 pollen/cm<sup>3</sup>), only the pollen grains of *Pinus sylvestris* were encountered in the samples that suggests selective fossilisation.

The sediment between 92–138 cm contained large number of organic particles smaller than 250 µm. The use of the NaOCl treatment proved insufficient to dissolve these particles. Initially we supposed that the large amount of organic particles is responsible for the low pollen concentration. However, the sufficient number of *Lycopodium* spores found on each slide suggests pollen sterility rather than imperfect pollen preparation.

The pollen stratigraphy is summarized in *Table 3*.

<sup>46</sup> Troels – Smith 1955.



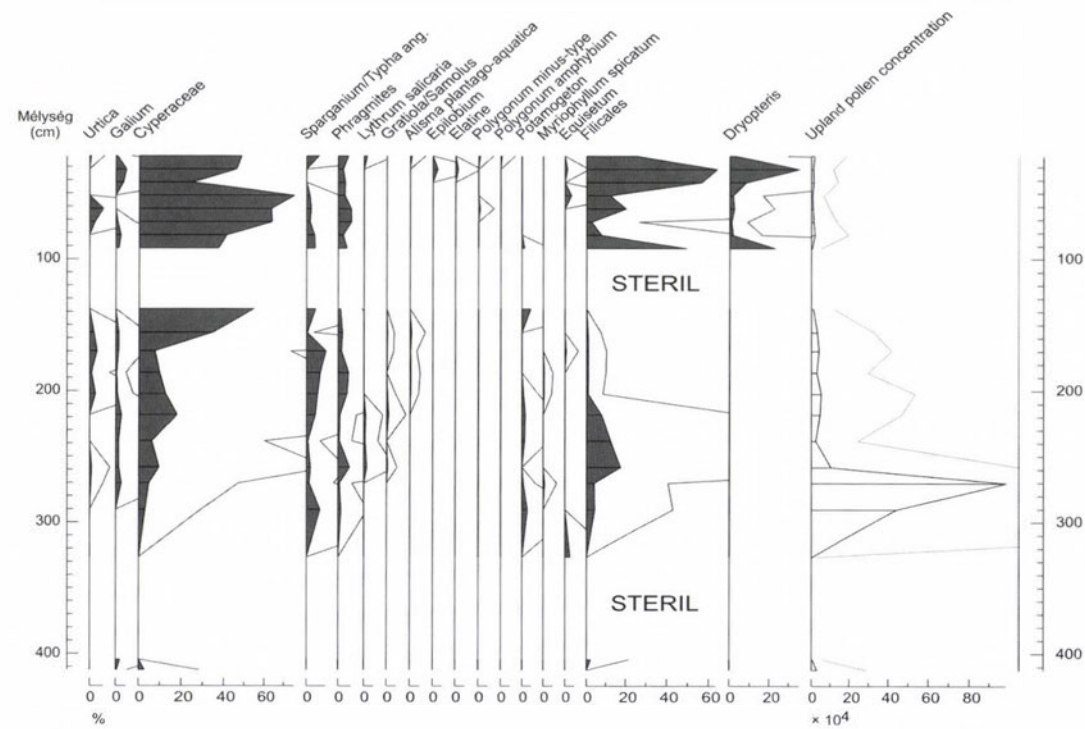


fig. 6/2. Percentage pollen diagram of HPI core (LPAZ: local pollen analytical zones)

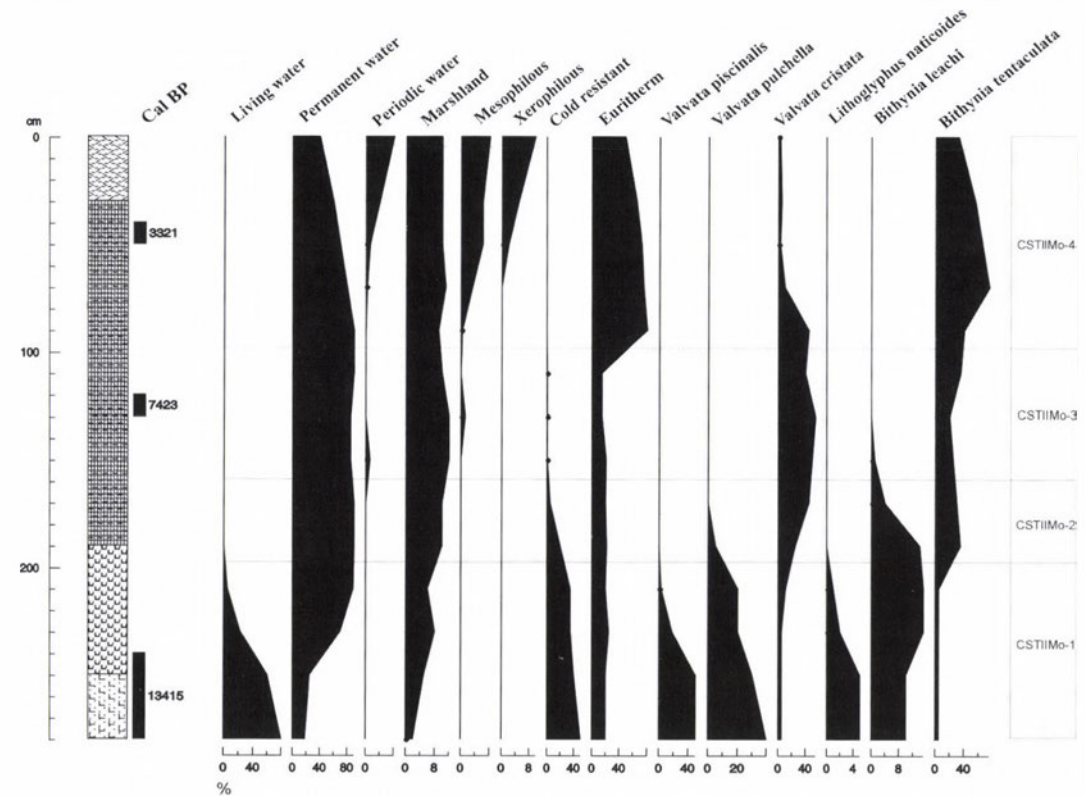


fig. 7. Mollusc diagram of CSTII core

### The malacological record

Only the corings CSTII and HPII contain sufficient mollusc shell for further studies. The results of the malacological study are presented in *fig. 7*. The number of Mollusc in HPII core was insufficient to draw histograms. The Mollusc stratigraphy is summarized in *Table 4–5*.

Mollusc zone		Zone description
	0–95 cm	No Mollusc remains
HPIIMo-3.	105–95 cm	<i>Valvata cristata</i> shells are frequent (more than 70%). The frequency of aquatic ( <i>Pisidium</i> spp., <i>Armiger crista</i> ), amphibious ( <i>Succinea oblonga</i> , <i>Oxyloma elegans</i> ) elements is the highest in this zone.
HPIIMo-2.	130–105 cm	Some stagnant water environment favourable Mollusc ( <i>Planorbis cornutus</i> , <i>Lymnaea palustris</i> , <i>Segmentina nitida</i> ) appeared in this layer. This palaeoassociation suggest that a shallow lake developed in the analysed palaeochannel during this phase with emerged and submerged vegetation.
	200–130 cm	No Mollusc remains
HPIIMo-1.	200–220 cm	Some rheophilous Mollusc elements ( <i>Valvata piscinalis</i> , <i>Lithoglyphus naticoides</i> , <i>Lymnaea stagnalis</i> ), but only their few specimens can be found in this layer. This poor malacofauna is similar to malacofauna from CSTIMo-1. level and it indicates fluvial phase in the analysed palaeochannel.

Table 4. Summary of the mollusc stratigraphy of core Hajós–Pincék II.

Mollusc zone		Zone description
CSTIIMo-4.	40–100 cm	The aquatic malacofauna changed. <i>Valvata cristata</i> declines, and the frequency of <i>Bithynia tentaculata</i> increased, indicating the eutrophication of water. The xerophilous and mesophilous elements ( <i>Pupilla muscorum</i> , <i>Vallonia costata</i> , <i>Helicopsis striata</i> ) emerge among the terrestrial species.
CSTIIMo-3.	100–160 cm	The <i>Valvata cristata</i> shells are frequent (more than 50%). The frequency of aquatic ( <i>Lymnaea palustris</i> , <i>Pisidium</i> spp., <i>Segmentina nitida</i> ), amphibious ( <i>Succinea oblonga</i> , <i>Oxyloma elegans</i> , <i>Carychium minimum</i> ) and strongly hygrophilous terrestrial elements ( <i>Vertigo antivertigo</i> , <i>Vallonia emmisiensis</i> ) is the highest in this zone. On the basis of radiocarbon dating the first agricultural human populations occupy the territory at this time. Presumably the high quantity of sediment and terrestrial mollusc shell got into the channel derived from the shore, because of human impact.
CSTIIMo-2.	160–200 cm	The rheophilous elements decline and disappear. The first terrestrial elements ( <i>Succinea</i> spp., <i>Vallonia</i> spp., <i>Vertigo</i> spp.) emerge in this zone. The <i>Valvata cristata</i> – <i>Bithynia leachi</i> – <i>Bithynia tentaculata</i> paleoassociation developed in this zone. Elements with different ecological requirements (deep/shallow water, open/dense aquatic vegetation) emerge in the same quantity. This phenomenon is explicable with the periodic flood of River Danube.
CSTIIMo-1.	200–280 cm	The number of rheophilous elements ( <i>Valvata piscinalis</i> , <i>Lithoglyphus naticoides</i> , <i>Lymnaea stagnalis</i> , <i>Planorbis</i> cf. <i>carinatus</i> , <i>Unio</i> cf. <i>crassus</i> , <i>Pisidium amnicum</i> ) is very high. This was the so called <i>Valvata piscinalis</i> – <i>Lithoglyphus naticoides</i> palaeoassociation (Sümegi, 1996; Sümegi – Krolópp, 2001) include cold resistant (widespread in the Pleistocene) (eg. <i>Valvata pulchella</i> , <i>Bithynia leachi</i> ) and thermophilic (widespread in the Holocene) (eg. <i>Lithoglyphus naticoides</i> , <i>Bithynia tentaculata</i> ) elements as well. The palaeochannel could have been a spillstream of River Danube.

Table 5. Summary of the mollusc stratigraphy of core Császártöltés–Vörös-mocsár II.

### The macrofossil record

The results of macrofossil analyses are shown in *figs 9–14*. Within the macrofossil diagrams unlinked histograms present only lower values. Local macrofossil assemblage zones have been labelled using the following system: HP (Hajós–Pincék: Hajós–Kaszálók) or CST (Császártöltés–Vörös-mocsár), I–IV (number of core), M (local macrofossil zone), -zone number.

The macrofossil stratigraphy is summarized in *Table 6–7*.

The small charred wood fragments (larger than 300 µm, but mostly between 1–3 mm) are presumably terrestrial (allochton) elements in the macrofossil records. By comparing the charcoal histograms of the multiple corings with each other (*fig. 8*) the next statements can be made.

The concentration of charcoal decreases from east to west (from the sand dunes towards the river Danube). This phenomenon can be easily explained by the geographical features. The arid sand dunes could be burned down much more easily than the humid floodplain with its marshes and watercourses. So the winds blow the charcoal (scale) from the arid Sand Dunes of Danube–Tisza Interfluvium towards the floodplain. The sudden decrease of charcoal



Site	Zone description	Detected plant community
Hajós– Pincék I.	HPIM-6 (20–115cm). <i>Carex elata</i> is the major and nearly the only peat component, with in combination of <i>Phragmites australis</i> . Water tables somewhat higher.	<i>Caricetum elatae</i>
	HPIM-5 (115–140cm). Water tables decline in this zone. Zone contains high amount of charcoal and wood fragments. Hollow and <i>Cyperus fuscus</i> communities disappear in this zone.	<i>Caricetum elatae</i> <i>Calamagrostio-Salicetum cinereae</i>
	HPIM-4 (140–215cm). <i>Carex elata</i> become a permanent peat component. The presence of <i>Cyperus fuscus</i> , <i>Chara</i> and <i>Amblystegiaceae</i> mosses indicates a well developed hummock-hollow structure and higher mire water levels. <i>Schoenoplectus tabernaemontani</i> appears in high quantity.	<i>Caricetum elatae</i> <i>Cypero-Juncetum bufonii</i>
	HPIM-3 (215–275cm). <i>Phragmites</i> is the major peat component, with in combination of <i>Typha</i> and <i>Thelypteris palustris</i> .	<i>Thelypteridi-Phragmitetum</i> <i>Thelypteridi-Typhetum</i>
	HPIM-2 (275–300cm). Macrofossil density is higher. Peat accumulation starts. <i>Carex elata</i> appear in this zone. The high amount of unidentified organic matter signs the increased humification. <i>Menyanthes trifoliata</i> characterise this zone.	<i>Phragmitetum communis</i> <i>Menyanthetum</i>
	HPIM-1 (300–420 cm). Macrofossil density is very low in this zone. <i>Phragmites</i> and <i>Equisetum cf. fluitans</i> are the main components. The sediment description suggests an open water habitat.	<i>Phragmitetum communis</i> <i>Equisetetum fluitantis</i> open water
Hajós– Pincék II.	HPIIM-5 (25–95 cm). <i>Carex elata</i> is the major and nearly the only peat component, with in combination of <i>Phragmites australis</i> . <i>Cyperus fuscus</i> communities disappear in this zone, but <i>Menyanthes trifoliata</i> occur.	<i>Caricetum elatae</i>
	HPIIM-4 (95–105 cm). <i>Carex elata</i> become the dominant peat component. Water tables somewhat higher in this zone. The presence of <i>Cyperus fuscus</i> , <i>Chara</i> and <i>Amblystegiaceae</i> mosses indicates a well developed hummock-hollow structure and higher mire water levels.	<i>Caricetum elatae</i> <i>Cypero-Juncetum bufonii</i> <i>Nymphaetum albo-luteae</i>
	HPIIM-3 (105–130 cm). <i>Phragmites</i> is the major peat component, with in combination of <i>Typha</i> and <i>Thelypteris palustris</i> .	<i>Thelypteridi-Phragmitetum</i> <i>Thelypteridi-Typhetum</i>
	HPIIM-2 (130–180 cm). Macrofossil density is higher. Peat accumulation starts. <i>Carex elata</i> appear in this zone. <i>Phragmites australis</i> and <i>Equisetum cf. fluitans</i> are the main peat components. The high amount of mollusc remains is a characteristic feature of this zone.	<i>Phragmitetum communis</i> <i>Equisetetum fluitantis</i> stagnant and well oxygenised open water living water
	HPIIM-1 (180–220 cm). Macrofossil density is very low in this zone. <i>Phragmites</i> and <i>Equisetum cf. fluitans</i> are the only components. The sediment description suggests a living water habitat.	<i>Equisetetum fluitantis</i>
	HPIIIM-6 (25–70 cm). <i>Carex elata</i> is the major and nearly the only peat component, with in combination of <i>Phragmites australis</i> . Decreased <i>Carex elata</i> rootlets and the presence of <i>Calamagrostis</i> suggest a drier mire surface at the top of the sequence.	<i>Caricetum elatae</i>
	HPIIIM-5 (70–105 cm). <i>Carex elata</i> is the major and nearly the only peat component, with in combination of <i>Phragmites australis</i> . The large amount of wood fragments suggest the spread of <i>Salix cinerea</i> swamp.	<i>Calamagrostio-Salicetum cinereae</i>
Hajós– Pincék III.	HPIIIM-4 (105–130 cm). <i>Carex elata</i> become the dominant peat component. Water tables somewhat lower in this zone. <i>Cyperus fuscus</i> communities disappear in this zone.	<i>Caricetum elatae</i> <i>Caricetum elatae</i>
	HPIIIM-3 (130–170 cm). <i>Carex elata</i> appear in this zone. The presence of <i>Cyperus fuscus</i> and <i>Amblystegiaceae</i> mosses indicates a well developed hummock-hollow structure and higher mire water levels.	<i>Caricetum elatae</i> <i>Cypero-Juncetum bufonii</i>
	HPIIIM-2 (170–190 cm). Macrofossil density is higher. Peat accumulation starts. <i>Phragmites</i> is the major peat component, with in combination of <i>Typha</i> and <i>Thelypteris palustris</i> .	<i>Thelypteridi-Phragmitetum</i> <i>Thelypteridi-Typhetum</i>
	HPIIIM-1 (190–300 cm). Macrofossil density is very low in this zone. <i>Phragmites</i> and <i>Equisetum cf. fluitans</i> are the only components.	<i>Phragmitetum communis</i> <i>Equisetetum fluitantis</i> stagnant water
	HPIVM-6. (35–85 cm). <i>Carex elata</i> is the major peat component, with in combination of <i>Phragmites australis</i> and <i>Equisetum fluitans</i> . The presence of <i>Cyperus fuscus</i> and <i>Amblystegiaceae</i> mosses indicates a well developed hummock-hollow structure and higher mire water levels.	<i>Caricetum elatae</i> <i>Equisetetum fluitantis</i> <i>Cypero-Juncetum bufonii</i>
	HPIVM-5. (120–85 cm). <i>Carex elata</i> is the major and nearly the only peat component, with in combination of <i>Phragmites australis</i> . The lack of <i>Cyperus fuscus</i> indicate a poorly developed hummock-hollow structure and lower mire water levels.	<i>Caricetum elatae</i>
	HPIVM-4. (120–170 cm). <i>Carex elata</i> is the major and nearly the only peat component, with in combination of <i>Phragmites australis</i> . The presence of <i>Cyperus fuscus</i> , <i>Nuphar lutea</i> and <i>Amblystegiaceae</i> mosses indicates a well developed hummock-hollow structure and higher mire water levels.	<i>Caricetum elatae</i> <i>Nymphaetum albo-luteae</i> <i>Cypero-Juncetum bufonii</i>
Hajós– Pincék IV.	HPIVM-3. (170–225 cm). Macrofossil density is higher. Peat accumulation starts. <i>Phragmites</i> is the major peat component, with in combination of <i>Typha</i> and <i>Thelypteris palustris</i> .	<i>Thelypteridi-Phragmitetum</i> <i>Thelypteridi-Typhetum</i>
	HPIVM-2. (225–285 cm). <i>Menyanthes trifoliata</i> is the major and nearly the only peat component, with in combination of <i>Amblystegiaceae</i> mosses. This is a so called “brown moss community”.	<i>Menyanthetum</i> “brown moss carpet”
	HPIVM-1. (285–300 cm). Macrofossil density is very low in this zone. The seeds of <i>Hippuris</i> and <i>Myriophyllum</i> indicate an open water habitat.	<i>Hippuridetum vulgaris</i> <i>Myriophylletum verticillati</i> stagnant water

Table 6. Summary of the zonations for Hajós–Pincék I–IV.

Site	Zone description	Detected plant community
Császár-töltés I.	CSTIM-7 (30–70 cm). <i>Carex elata</i> and <i>Phragmites australis</i> are the major peat components. Water table is somewhat lower.	<i>Caricetum elatae</i>
	CSTIM-6 (70–100 cm). Macrofossil concentration is higher. <i>Phragmites</i> is the major peat component, with in combination of <i>Carex elata</i> and <i>Equisetum</i> remains. Remains of pioneer mud vegetation detected in this zone. Water table is higher and fluctuating.	<i>Phragmitetum</i> <i>Cypero-Juncetum bufonii</i>
	CSTIM-5 (100–170 cm). <i>Phragmites</i> is the major and nearly the only peat component.	<i>Phragmitetum</i>
	CSTIM-4 (170–210 cm). Macrofossil concentration is higher. <i>Typha</i> , <i>Phragmites</i> are the major peat components, with in combination of <i>Carex elata</i> remains. Remains of water-lily communities detected in this zone. Water table is higher.	<i>Phragmitetum</i> <i>Nymphaeetum albo-luteae</i>
	CSTIM-3 (210–290 cm). Macrofossil density is low in this zone. <i>Phragmites</i> is the only component.	
	CSTIM-2 (290–308 cm). Macrofossil concentration is higher. Peat accumulation starts. <i>Phragmites</i> is the major peat component, with in combination of <i>Amblystegiaceae</i> mosses, <i>Comarum palustre</i> , <i>Menyanthes trifoliata</i> , <i>Sparganium minimum</i> etc.	<i>Phragmitetum</i> <i>Menyanthetum</i> <i>Sparganio minimi</i>
	CSTIM-1 (308–420 cm). Macrofossil concentration is low in this zone. <i>Phragmites</i> and <i>Equisetum</i> are the major peat components.	– <i>Utricularietum</i> “brown moss carpet”
		<i>Equisetetum fluitantis</i> living water
		<i>Phragmitetum</i>
		<i>Ranunculetum aquatilis</i> <i>Cypero-Juncetum bufonii</i>
Császár-töltés II.	CSTIIM-4 (80–135 cm). Macrofossil concentration is lower. <i>Typha</i> , <i>Phragmites</i> are the major peat components. Pioneer mud vegetation and water-crowfoot communities important in this zone. Water table is somewhat lower and fluctuating.	<i>Phragmitetum</i> <i>Nymphaeetum albo-luteae</i> <i>Cypero-Juncetum bufonii</i>
	CSTIIM-3 (135–200 cm). <i>Typha</i> , <i>Phragmites</i> are the major peat components, with combination of <i>Carex elata</i> remains. Remains of water-lily and pioneer mud communities detected in this zone. Water table is higher.	<i>Phragmitetum</i> <i>Nymphaeetum albo-luteae</i> <i>Cypero-Juncetum bufonii</i>
	CSTIIM-2 (200–245 cm). Macrofossil concentration is higher. <i>Typha</i> , <i>Phragmites</i> are the major peat components, with combination of <i>Glyceria</i> remains. <i>Mollusc</i> and <i>Ostracoda</i> remains became frequent.	<i>Phragmitetum</i> <i>Glycerietum</i>
	CSTIIM-1 (245–275 cm). Macrofossil concentration is low in this zone. <i>Typha</i> , <i>Phragmites</i> and <i>Equisetum</i> are the major peat components.	stagnant water
		living water
		<i>Equisetetum fluitantis</i>

Table 7. Summary of the zonations for Császártöltés – Vörös-mocsár I–II.

concentration suggests short range transport of this size of charcoal. The distance could be some hundreds of meters.

The amplitude of the same charcoal peaks is different in the distant sites. For example the first peak is higher in the HPIV and CSTI cores than in the CSTII core. But the second peak is higher in the CSTII core than in the HPIV and CSTI cores. This phenomenon can be explained with the short range dispersal as well. Probably the intensity and spread of fire was different in the different parts of the sand dunes.

The position of charcoal peaks together with the radiocarbon data suggest that all important vegetation changes have taken place at the same time in the whole channel (fig. 8), but local environmental factors and the geomorphological position modified the main trend of hydrosere succession. In the following the main trend of succession has been discussed. The hydrosere succession of Hajós–Kaszálók Mire is presented with vegetation maps and drawings as well (fig. 15).

### Mire vegetation development

#### RIPARIAN PHASE

The radiocarbon and palaeoecological data suggest that the analysed filled up palaeochannel cut down from active river system of Danube under one of the neotectonic subsidence processes thus a long, uncommon oxbow lake developed at the transition phase of Pleistocene/Holocene boundary. This long canal-like oxbow lake fragmented under the filling process of Holocene. The 47 km long peatland is fragmented by small alluvial fans.<sup>47</sup>

<sup>47</sup> J. Dömsödi: A magyarországi Duna-völgy déli szakaszának lápi eredetű szervesanyag tartalékai [Organic material reserve on southern section of the

Danube-valley in Hungary]. *Agrokémia és Talajtan* 21(1972) 337–354.



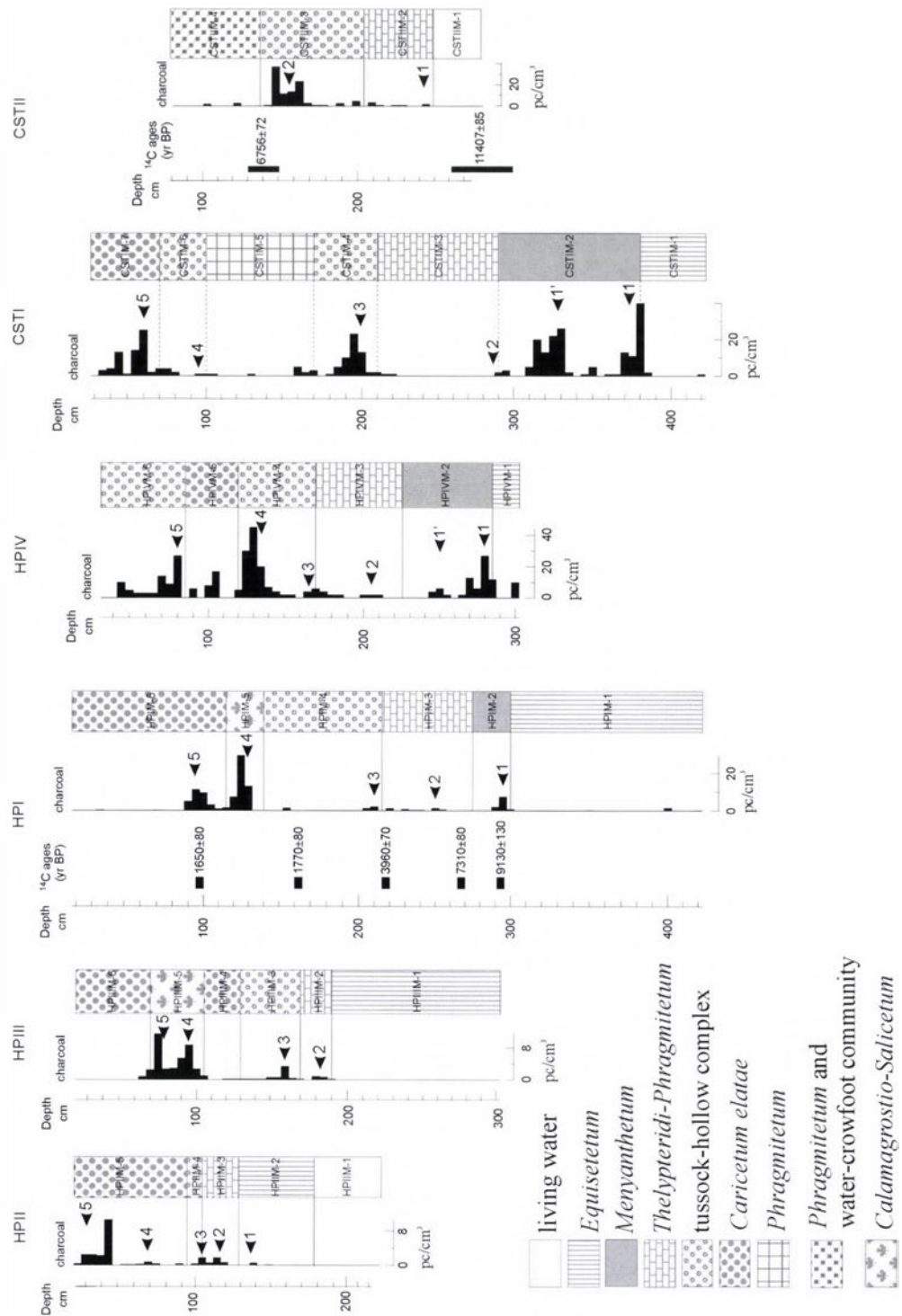


fig. 8. Correlation of macrofossil diagrams

Jaskó – Krolopp<sup>48</sup> and Scheuer et al.<sup>49</sup> proved intensive neotectonic subsidence processes from the near Paks–Sárköz Depression. They proved that the river Danube appeared in the area only at the Early-Holocene ( $10\,800 \pm 150$   $^{14}\text{C}$  age years BP). The neotectonic subsidence processes continued in the Holocene.

<sup>48</sup> Jaskó – Krolopp 1991.

<sup>49</sup> Gy. Scheuer – F. Schweitzer – E. Hertelendi – Gy. Szöör: Megsüllyedt és eltemetett vörösiszapok és löszösszetek lito és geokémiai fácieselemzése és rétegtani értékelése [Lito- and geochemical facies

analysis and stratigraphic assessment of subsided and buried redclays and loess-sequences], in: Gy. Szöör (ed.): Fáciesanalitikai, paleobiogeokémiai és paleoökológiai kutatások. Debrecen 1992, 65–80.

The bottom sediment of the cores was fine sand rich in muscovite and small gravels. After the deposition of the coarse grained sandy riverbed, the palaeochannel (spillstream) separated from the river Danube, and parts of it filled in differently. Different vegetation types developed because of the introduced terrestrial sediment, the different geomorphological position and the springs of the loess wall that had different chemical composition.

Therefore different palaeoassociations and different sediments developed in the palaeochannel from the Late-Pleistocene and Early-Holocene. Wide range of hydrophyte vegetation and habitat emerged in the channel from the living water to the rich fen communities depending on the water supply and geomorphological position.

The first phase of mire succession took up to 7310 year BP, when living water communities and riparian habitats dominated the channel. Even though the influence of surface waters decreased gradually, because of intensive neotectonic subsidence processes, the importance is certain up to 7310 year BP. According to the radiocarbon dating the first part of this phase can be assigned to the Late Glacial, and the second to the Early-Holocene (after 9130 year BP). The first charcoal peak at  $9130 \pm 130$   $^{14}\text{C}$  age years BP in the macrofossil record marks the beginning of Holocene (fig. 8). It coincides with a sharp decline in *Pinus sylvestris* pollen, and so most likely indicates that the loose pine forest burnt down around the palaeochannel belt, most probably as a consequence of relatively dry winters and springs followed by warm summers. The water level of the palaeochannel was high, with living and stagnant water.

The living water was without macrophytes, well oxygenised and relatively nutrient rich. This is indicated by the number of rheophilous molluscs (*Valvata piscinalis*, *Lithoglyphus naticoides*, *Lymnaea stagnalis*, *Planorbis cf. carinatus*, *Unio cf. crassus*, *Pisidium amnicum*).

The living water was fringed with horsetail marsh (*Equisetum fluitantis*) palaeoassociation. This association emerged in almost every cores (HPIM-1, HPIIM-2, HPIIIM-1, CSTIM-1 and CSTIIM-1 zones).

In the embayments of the palaeochannel poorly oxygenised oxbow lakes developed without macrophyte vegetation and mollusc associations.

On the margins of these lakes rich macrophyte vegetation emerged. Floating and submerged aquatic vegetation with *Hippuridetum vulgaris* and *Myriophylletum verticillati* associations. This association emerged in the HPIV core (HPIV-1 zone).

Peat formation started in the near-shore zone of these lakes, with rich fen associations (*Menyanthetum*, *Sparganio minimi* – *Utricularietum*). The most important vascular plants were *Menyanthes trifoliata*, *Comarum palustre*, *Sparganium minimum*, *Phragmites australis* and *Carex vesicaria*. This community was very rich in bryophytes. The most important bryophytes were the *Calliergon richardsonii*, *Warnstorfia sarmentosa*, *Calliergon giganteum*, *Drepanocladus aduncus*, *Pseudephemerum nitidum* and *Hamatocaulis vernicosus*. This is the so called “brown moss carpet”, that is frequently reported from Pleistocene sediments in Hungary,<sup>50</sup> but has not been reported from the Early Holocene till now. This community is very similar to the Late Pleistocene moss assemblage of Nagy-Mohos Peat Bog in NE Hungary.<sup>51</sup> This associations emerged in the HPI, HPII and CSTI cores (in HPIM-2, HPIVM-1 and CSTIM-2 zones).

The pollen concentration in the first part of this phase (402–412 cm) is extremely low that suggests selective fossilisation. The principal tree species in this zone was *Pinus sylvestris*.

<sup>50</sup> Á. Boros: Pleisztocén mohák Magyarországon [Pleistocene moss in Hungary]. Földtani Közlemény 82 (1952) 294–301.

<sup>51</sup> E. Magyarai – G. Jakab – E. Rudner – P. Sümegei: Palynological and plant macrofossil data on the Late Pleistocene short-term climatic oscillations in North-Eastern Hungary. Proceedings 5<sup>th</sup> EPPC, Acta Paleobot. Suppl. 2 (1999) 491–502; E. Magyarai – G. Jakab – P. Sümegei – E. Rudner – M. Molnár: Paleobotanikai vizsgálatok a keleméri Mohos-

tavakon [Palaeobotanical examinations of Mohos peat bog in Kelemér], in: E. Szurdoki (ed.) Tőzegmohás élőhelyek Magyarországon: kutatás, kezelés, védelem. CEEWEB Munkacsoport, Miskolc 2000, 101–131; I. Juhász – P. Sümegei – G. Jakab – Zs. Szántó – M. Molnár: Jégkorszaki reliktum Sphagnum láp Magyarországon [Ice Age relict Sphagnum bog in Hungary], in: M. Dombos – G. Lakner (eds): 6. Magyar Őkológus Kongresszus. Előadások és posztterek összefoglalói, Gödöllő 2003.



Small quantities of *Pinus cembra*, *Pinus mugo*, *Larix decidua*, *Betula nana*, *Hyppophæ rhamnoides*, *Alnus cf. glutinosa* and *Selaginella selaginoides* were also found. Probably extensive bare surfaces with patches of tundra vegetation and boreal woodlands dominated the terrestrial vegetation.

The second part of this phase (326–402 cm) is devoid of pollen. The lack of sufficient pollen can be explained with erosion. In the macrofossil diagram of HPIV and CSTI cores (HPIV 215 cm, CSTI 285 cm) there is a conspicuous decrease in the macrofossil concentrations (U.O.M. and Monocot. Undiff. histograms) that suggests the peat degradation, probably as a consequence of the low water table. The HPIV and CSTI cores are on the margin of the marsh, so the lack of water affected mostly this part of the channel and the peat decomposed.

In the third part (HPIP-3 zone) of this phase the pollen data suggest development of a gallery forest around the study site made up of willow and abundant liana. Well-drained areas in the vicinity of the meander must have supported mixed stands of spruce (*Picea abies*) and elm (*Ulmus*); however, we can also surmise a spread in grassland dominated by *Poaceae*, *Umbelliferae* and *Aster* species.

Although the pollen sterile sediment layer (between 402 and 326 cm) has not yet been dated by absolute techniques, judging from the radiocarbon data above it (291–296 cm: 10460–10180 cal. BC), it certainly represents the final stadial of the Late Glacial, that is the Younger Dryas (YD: ~ 12 680–11 590 cal. BP). Pollen evidence from this period is rather scanty in the southern part of the Danube–Tisza Interfluvium. The only sequence with well preserved YD pollen assemblages is Ócsa.<sup>52</sup> Here the stadial pollen spectra are characterised by the dominance of Gramineae and *Artemisia*, arboreal pollen declines sharply with *Pinus* and *Betula* effected on the first place. Járαι-Komlódi argued that cold continental *Artemisia* steppe with parkland boreal forest characterised the landscape in the area of Ócsa. Temperate deciduous tree taxa (*Quercus*, *Ulmus* and *Corylus avellana*) that were presented in the preceding Allerød interstadial did also survive the YD, but their frequency decreased. The palaeochannel at Ócsa is situated in extensive wetland area that is a former floodplain of the Danube. Sand dunes and sand formation are in a distance from floodplain, whereas Hajós is located on the fringe of the sand dunes of the Danube–Tisza Interfluvium, therefore the YD vegetation must have differed remarkably. Lake Kolon and Bócsa are located in the heart of the blown sand area. Their palaeoenvironmental records<sup>53</sup> go back to the YD. In both lakes the sediment contains large quantity of wind blown sand in this phase hinting at the intensification of sand movements. The pollen preservation is poor in these levels, therefore we have no information on the terrestrial vegetation. However pollen assemblages from the Allerød interstadial abound in Gramineae, *Artemisia* and *Chenopodiaceae*; NAP frequencies attain 70–75% suggesting that the area was predominantly treeless, cold continental steppe. Similarly to Bócsa, pockets of warm temperate deciduous trees occurred,<sup>54</sup> however, the vegetation must have been predominantly treeless as opposed to Ócsa. On the basis of the YD blown sand movements<sup>55</sup> we can assume that during this phase large areas lost their vegetation cover became barren in the vicinity of Hajós as well.

#### REED SWAMP PHASE

The sediment composition and the fossil assemblage changed at about 7300 year BP. Peat accumulation started in every part of the channel. The 2<sup>nd</sup> charcoal peak marks the beginning of this phase in the macrofossil record.

The onset of the reedswamp development coincides with a dramatic change in the terrestrial vegetation. The thick *Salix* scrub fringing the wetland in the vicinity of HP-I in

<sup>52</sup> Járαι-Komlódi 1996; M. Járαι-Komlódi: Adatok az Alföld negyedkori klíma és vegetációtörténetéhez. I. [Data to Quarternary climate and vegetation history of the Great Hungarian Plain. I.]. Botanikai Közlemények 53 (1996) 191–201; M. Járαι-Komlódi: The late glacial and holocene flora of the Great Hungarian Plain. Annales Univ. Sci. Budapest (Sectio Biologica) 9–10 (1968) 199–225.

<sup>53</sup> Borsy et al. 1991; Lóki et al. 1995.

<sup>54</sup> Lóki et al. 1995.

<sup>55</sup> Gy. Gábris – E. Horváth – Á. Novothny – K. Ujházy: Environmental changes during the last- late-, and post-glacial in Hungary, in: Á. Kertész – F. Schweitzer (eds): Physico-geographical Research in Hungary Studies in Geography in Hungary 32 (2000) 47–62; Borsy et al. 1991.



the Early Holocene disappears; *Quercus*, *Corylus*, *Ulmus* and *Tilia* expands, whereas *Pinus sylvestris* and *Picea abies* withdraws from the area. This change to a predominantly deciduous canopy is accompanied by the occurrence and immediate increase of Aster-type and *Artemisia* pollen. Both taxa attain frequencies near 20%; their increase takes place in the expense of *Gramineae* species suggesting a major change in the steppe vegetation. Instead of the elsewhere characteristic afforestation or forest expansion (e.g. Báb-tava,<sup>56</sup> Ócsa,<sup>57</sup> Tiszagyulaháza,<sup>58</sup> Pocsaj<sup>59</sup>), in the area of Hajós we witness the expansion of warm continental loess and sand 'pusztas' rich in *Artemisia*, *Compositae* and *Umbelliferae* species. The increase of these taxa suggests increasing aridity in this area around 8000 cal. BP (fig. 6) that is the end of the Boreal chronozone. *Artemisia* and Aster-type pollen retains high values throughout the Atlantic chronozone and arboreal pollen frequencies decline gradually. If we assume that sedimentation was continuous throughout the Atlantic phase in HP-I, then we can conclude that the sand area to the east of Hajós must have remained open throughout the mid Holocene with only pockets of mixed-oak forests.

The mollusc palaeoassociation (*Planorbarius corneus*, *Lymnaea palustris*, *Segmentina nitida* in HPIIMo-2 zone) suggests that a shallow lake developed in the analysed palaeochannel during this phase with emerged and submerged vegetation.

The vegetation of the channel became uniform. Reed swamp covered the entire basin. The occurrence of *Thelypteris palustris* remains suggest the presence of floating reed swamps (*Thelypteridi-Phragmitetum*, *Thelypteridi-Typhetum*) in the deeper part of the basin. This fossil plant association is very poor in species. The macrofossil record not suggests submerged vegetation in this phase.

This sedimentary phase can be traced everywhere in the basin with different thickness, 20 cm at HPIII, but 80 cm at CSTI. The later (CSTIM-3 zone) contains large quantity of inorganic material (aleurit) washed into the basin by the near stream come from the Sand Dunes. The increased erosion activity can be explained with the continuing neotectonic subsidence processes. The changing relief caused increased sediment infilling through the loess-canyons. The large amount of terrestrial material infilled some parts of the channel and separated the embayments near the loess wall. The result of erosion activity of this period can be seen in fig. 5. The infilled northern part of the Hajós-Kaszálók Mire is shown as an important, and nearly the only crossing point across the peatland in the medieval military maps.<sup>60</sup>

The Hajós-Kaszálók Mire separated from the inundations of the river Danube. After this event, this part of the palaeochannel could have been supplied with poorly oxygenated underground water. The connection with the river Danube must have remained continuous at the northern part of the Vörös-mocsár (CSTII), where reedswamp, water-crowfoot and water-lily communities dominate the whole sequence, with in combination with different mollusc communities.

#### INITIATION OF "ZSOMBÉK"-FORMATION

After 3900 year BP the climate became much more favourable. The 3<sup>rd</sup> charcoal peak signs the beginning of this phase in the macrofossil record. Oak-hornbeam and hornbeam-beach forests emerged, but steppe area increased to 75–80% as well. Presumably, beach forests increased on the floodplain of the river Danube, and grazed meadows, crop-fields and hay meadows replaced the mixed forest-steppe on the Sand Dunes. Although the climate must have become more humid in this phase, the strong anthropogenic signal suppresses the arboreal vegetation change.

Mollusc remains were found only in HPII (HPIIMo-3 zone). *Valvata cristata* shells are frequent (more than 70%), and the frequency of aquatic (*Pisidium* spp. *Armiger crista*) and amphibious (*Succinea oblonga*, *Oxyloma elegans*) elements are the highest in this zone. Due

<sup>56</sup> Magyari 2002.

<sup>57</sup> Járati-Komlódi 1996.

<sup>58</sup> Magyari 2002.

<sup>59</sup> E. Félégyházi: Adalékok a Tisza és a Szamos folyóhálózatának alakulásához a felső-pleniglaciális

időszakban [Contribution to the development of river network of Tisza and Szamos in Upper Pleniglacial times]. Acta Geographica Debrecina 34 (1998) 203–218.

<sup>60</sup> Molnár – Biró 2001.



to the wetland vegetation succession that entailed a decrease in pH, mollusc shells are missing in the upper part of the sediment in Hajós–Kaszálók Mire.

The water table become higher and diverse mire vegetation developed in the channel of the Hajós–Kaszálók Mire. The tussock-hollow formation ('*zsombék-semlyék*') becomes the dominant vegetation type. Large tussocks of *Carex elata* standing in shallow, fluctuating water (the '*zsombék*'-formation of Tuzson<sup>61</sup>) is a typical mire vegetation type (*Caricetum elatae* plant association) of the Hungarian Lowlands. This association frequently form complex with hollow associations (pioneer mud and floating aquatic associations) and very rich in species. The joint occurrence of pioneer mud (*Cypero–Juncetum bufonii*) and floating aquatic (*Nymphaeetum albo-luteae*) associations suggest high, but fluctuating water table. High water table was in spring and early summer, but low water table and bare mud surfaces likely prevailed in late summer.

This association emerged in almost every cores (HPIM-4, HPIIM-4, HPIIIM-3 and HPIVM-4 zones).

PCA was used to highlight the ecological characteristics of the different taxa in the HPI, HPII and HPIV cores. The principal component biplots (figs 16–18) provided a sharp ecological gradient from eutrophy on the left to oligotrophy on the right. The changing position of *Equisetum fluitans* in the PCA biplots can be explained with the changing water supply, living water in HPI and HPII cores (Early Holocene) but ground water in HPIV core (Late Holocene).

#### BREAKING DOWN OF "ZSOMBÉK"-FORMATION

In the first part of this phase, between about 1700 and 1650 years BP (92–138 cm) high amplitude charcoal peaks in the macrofossil record suggest intensive burning in the area. Pollen preservation in this part of the sediment was poor that is most likely related to the high charcoal content. Since the pollen record below 138 cm points at intense human disturbance of the natural vegetation (crop production, grazing, trampling, hay cutting), it is conceivable that the charcoal peak represent fires of human origin, but its natural origin can not be excluded.

The first part of this phase is between the 4<sup>th</sup> and the 5<sup>th</sup> charcoal peaks. The increase of wood in the macrofossil record (emerging willow swamp) suggests low water table. According to historic data<sup>62</sup> and some pollen diagrams that have high resolution pollen spectra representing the 1<sup>st</sup> millennium AD,<sup>63</sup> there was a period between ca. AD 700 and 1100 when the climate of the Carpathian Basin became more arid. This is indicated by a gap in sedimentation in the Tapolca basin that was accompanied by high *Pinus* pollen frequencies and poor pollen. Similar changes were found in the pollen record of the Sarló-hát sedimentary sequence in the NE part of the Great Hungarian Plain.<sup>64</sup> According to the radiocarbon data this period occurred in this area between ca. AD 200 and 500.

The water table in the channel became lower. The diverse tussock-hollow vegetation complex degraded. *Caricetum elatae* became the dominant plant association. Pioneer mud and floating aquatic (hollow) associations disappeared. Willow swamp (*Calamagrostio–Salicetum cinereae*) emerged in the deeper part of the channel (HPIM-5 and HPIIIM-5 zone). This way of hyrosal succession is common in recent mires under anthropogenic influences (water regulations).<sup>65</sup> The structure of the hummock-hollow complex become much more dense, and the bare mud surfaces disappear. This association emerged in almost every cores (HPIM-6, HPIIM-5, HPIIIM-4, HPIIIM-6 and HPIVM-5 zones).

In the second part of this phase, after 1650 year BP (20–92 cm) the climate became favourable, warm and moderately arid. Mixed oak and oak-hornbeam forests emerged. Strong anthropogenic signal and extensive forest-steppe area was detected in this zone. The hollow associations and

<sup>61</sup> J. Tuzson: A Magyar Alföld növényformációi [Vegetation formations of Great Hungarian Plain]. Botanikai Közlemények 3 (1914) 1–7.

<sup>62</sup> Gy. Györffy: Hová lettek az avarok? [What has happened to avars?] História 17 (1995) 3–9.

<sup>63</sup> Gy. Györffy – B. Zólyomi: A Kárpát-medence és Etelköz képe egy évezred előtt [The images of

Carpathian Basin and Etelköz a millenium ago].

Magyar Tudomány 8 (1996) 899–918; Magyarai 2002.

<sup>64</sup> Magyarai 2002.

<sup>65</sup> I. Szodfridt – P. Tallós: A Felsőnyirádi-erdő láp- és ligeterdei [Marshes and groves of Felsőnyirádi forest]. VMMK 7 (1968) 193–201.



*Equisetum fluitans* return in the HPIV core (HPIVM-6 zone) that suggests the importance of periodic springs at the bottom of the near loess-wall. This springs were fed the marshes with ground water in humid periods. One of this springs is very close to the HPIV borehole.

#### ALTERNATIVE PATHWAY IN THE VÖRÖS-MOCSÁR MIRE

The connection with the river Danube remained continuous at the northern part of the Vörös-mocsár and the inundations reached the area. The largest flood reported in 1873, but smaller in 1941, 1945 and 1956 as well.

The oxigene, nutrient and carbonate rich waters altered the main direction of hydrosere succession. *Phragmites* dominated plant associations emerged in the whole sequence. For example at 3960 year BP (3<sup>rd</sup> charcoal peak) when the shift of *Caricetum elatae* community was remarkable in the Hajós–Kaszálók Mire, the humid climate results the shift of *Phragmitetum* associations in the CSTI core. In this core the shift of *Carex elata* was only a periodic event (CSTIM-4 zone). At last *Carex elata* presents remarkable quantity only in CSTIM-7 zone after 1700 year BP.

It is highly important to remark, that there is a hiatus in the upper part of CSTII core. The absence of younger charcoal peaks (3<sup>rd</sup>–5<sup>th</sup> peaks) in this core and the radiocarbon data suggest this hiatus. This can be easily explained with the water regulations and peatcut in this part of the peatland.

#### Conclusions

A new quantitative palaeobotanical method for the description of organic sediments (lake sediments and peat) is presented by the authors. The Peat Component System with the palaeobotanical description of macroscopic organic material allowed us to reconstruct the hydrosere succession and hydrological changes. The modified “semi-quantitative quadrat and leaf-count macrofossil analysis technique” (QLCMA of Barber et al.<sup>66</sup>) was used to quantify the peat components. The specific peat components help us to reconstruct past plant associations, but the non-specific peat components also contribute to the reconstruction of environmental and hydrological changes (water level changes). The small charred wood fragments (larger than 300 µm) are mostly allochthon elements in the macrofossil records. By comparing the charcoal histograms and radiocarbon data of the multiple corings with each other it is possible to describe the hydrosere succession in space and time (figs 8, 15).

This quantitative plant macrofossil technique together with pollen, molluscs, and radiocarbon analyses have been used to reconstruct the postglacial mire development of an eutrophic peat bog in S Hungary. The analysis of the Holocene peat sequence was used to reconstruct the development of a filling up spillstream of River Danube. The reconstructed palaeohydrological and hydrosere changes were compared with the coincident terrestrial vegetation alterations.

The Vörös-mocsár Mire got well oxygenised, nutrient and carbonate rich surface water since the sediment accumulation have started. *Phragmites* dominated plant associations emerged in the whole sequence. The rise of *Carex elata* was only a periodic event. At last *Carex elata* emerged only after 1700 year BP. The Hajós–Kaszálók Mire isolated from the flood waters of the Danube and got only underground water since the Early Holocene, when the increased erosion activity, caused by the Holocene neotectonic subsidence of the Solti Plain, got large amount of inorganic sediment to the channel. *Phragmites* dominated plant associations emerged only in the Early Holocene. Tussock-hollow forming *Caricetum elatae* plant association emerged in the fragmented channel, because of the increasing oligotrophy and improving climate after 3900 year BP.<sup>67</sup>

<sup>66</sup> Barber et al. 1994.

<sup>67</sup> This research was supported by the Hungarian Science Foundation (OTKA) under Grant No. T 034392 and T 45947. We thank Kiskunság National Park Directorate for granting permission to core

the study site and for funding this research. We also thank Csaba Bíró, Zoltán Vajda and Zoltán Sebestyén for providing maps and data of the site, Róbert Vidéki and Zsolt Molnár for recent botanical data.



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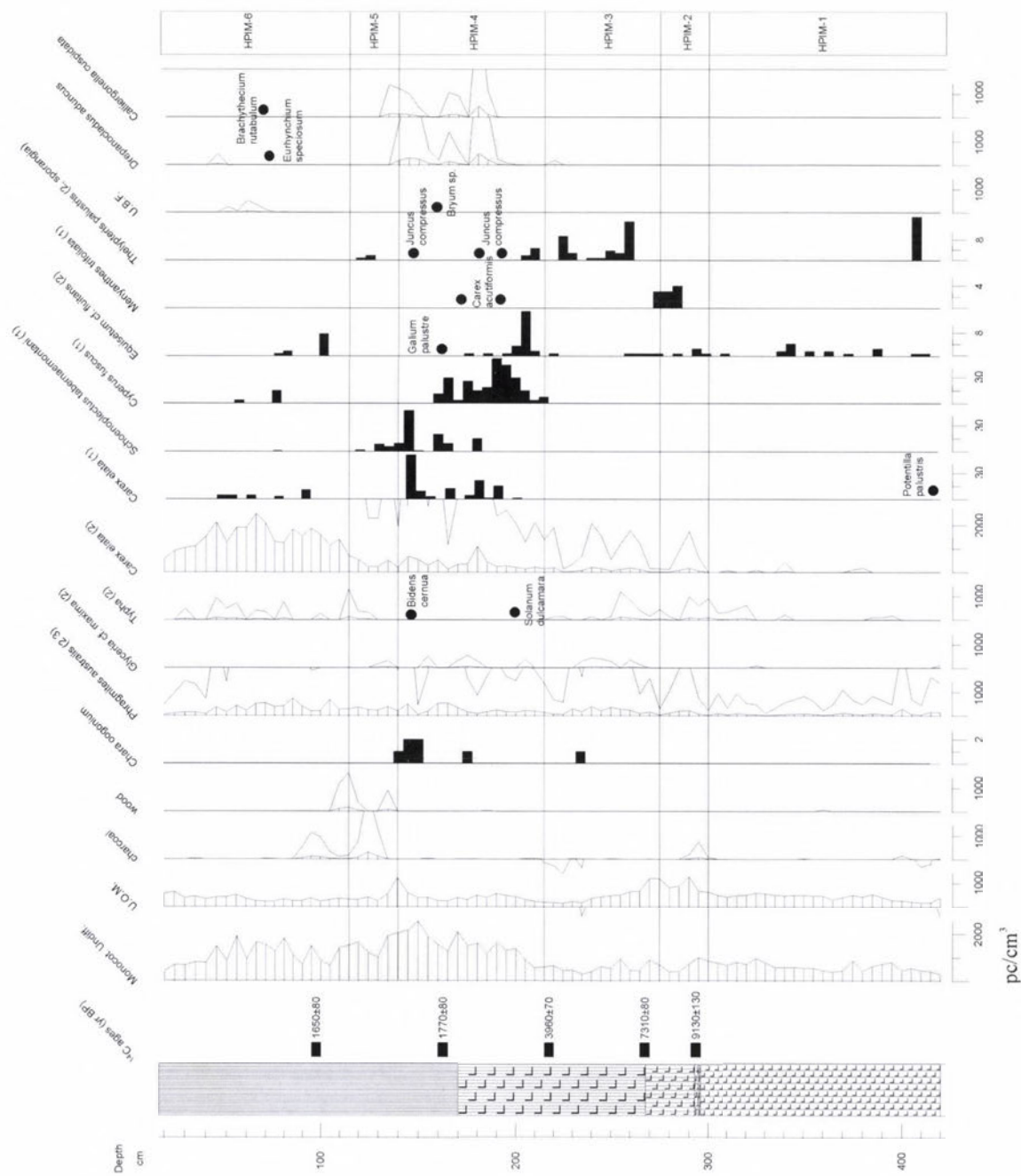


fig. 9. Macrofossil diagram of HPI core (1: seed, 2: rizodermal tissue, 3: epidermal tissue)

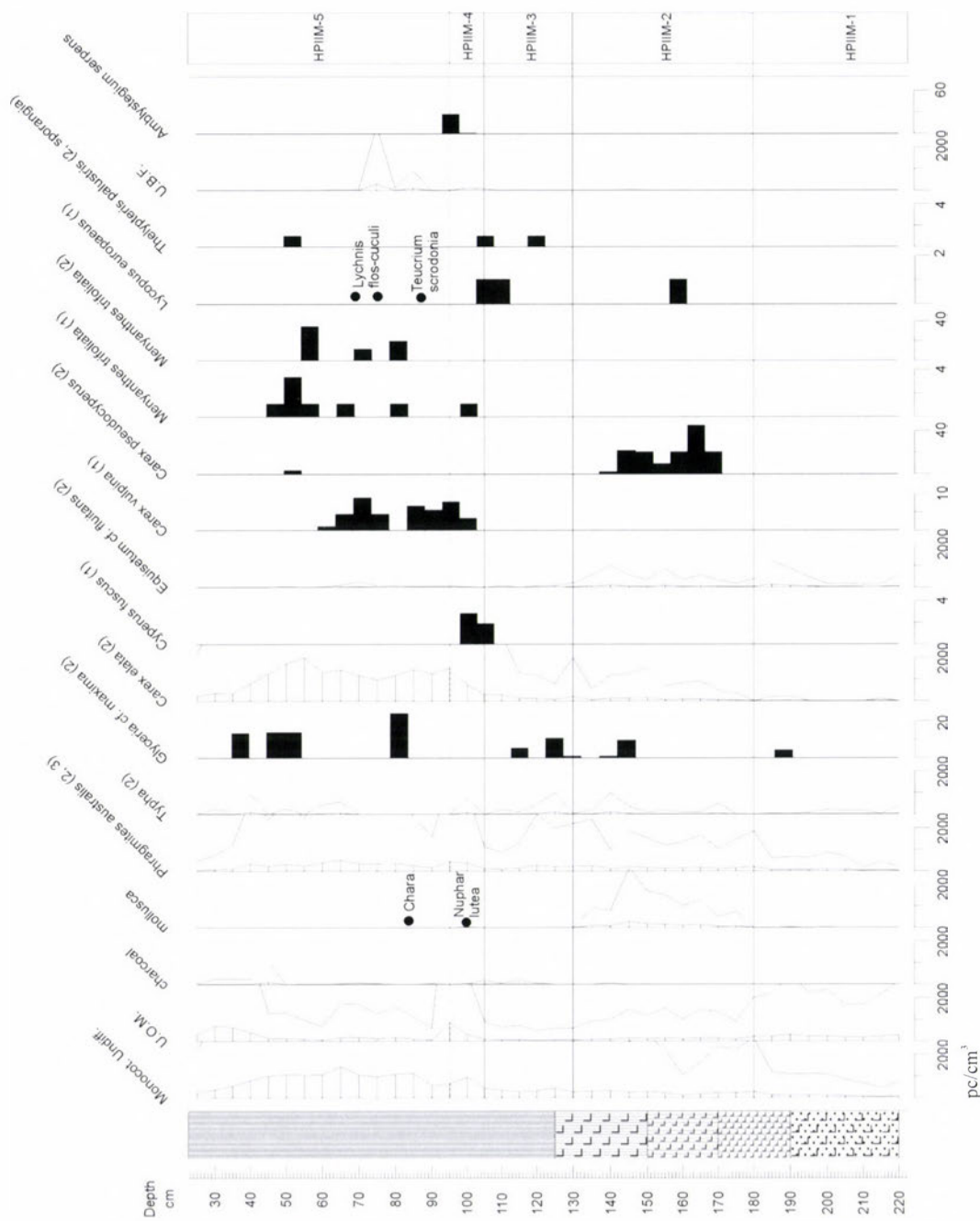


fig. 10. Macrofossil diagram of HPII core (1: seed, 2: rizodermal tissue, 3: epidermal tissue)



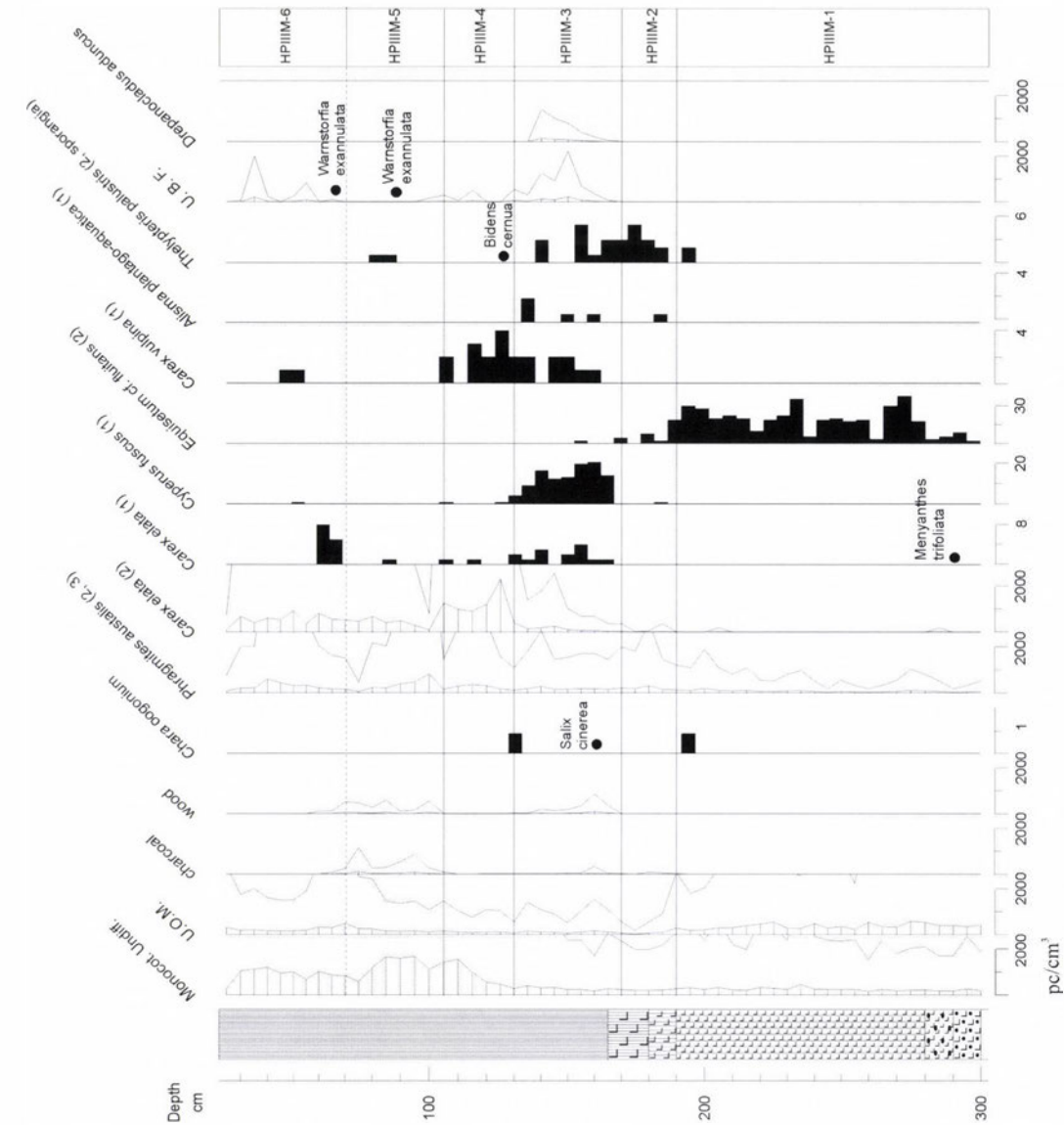


fig. 11. Macrofossil diagram of HPIII core (1: seed, 2: rizodermal tissue, 3: epidermal tissue)

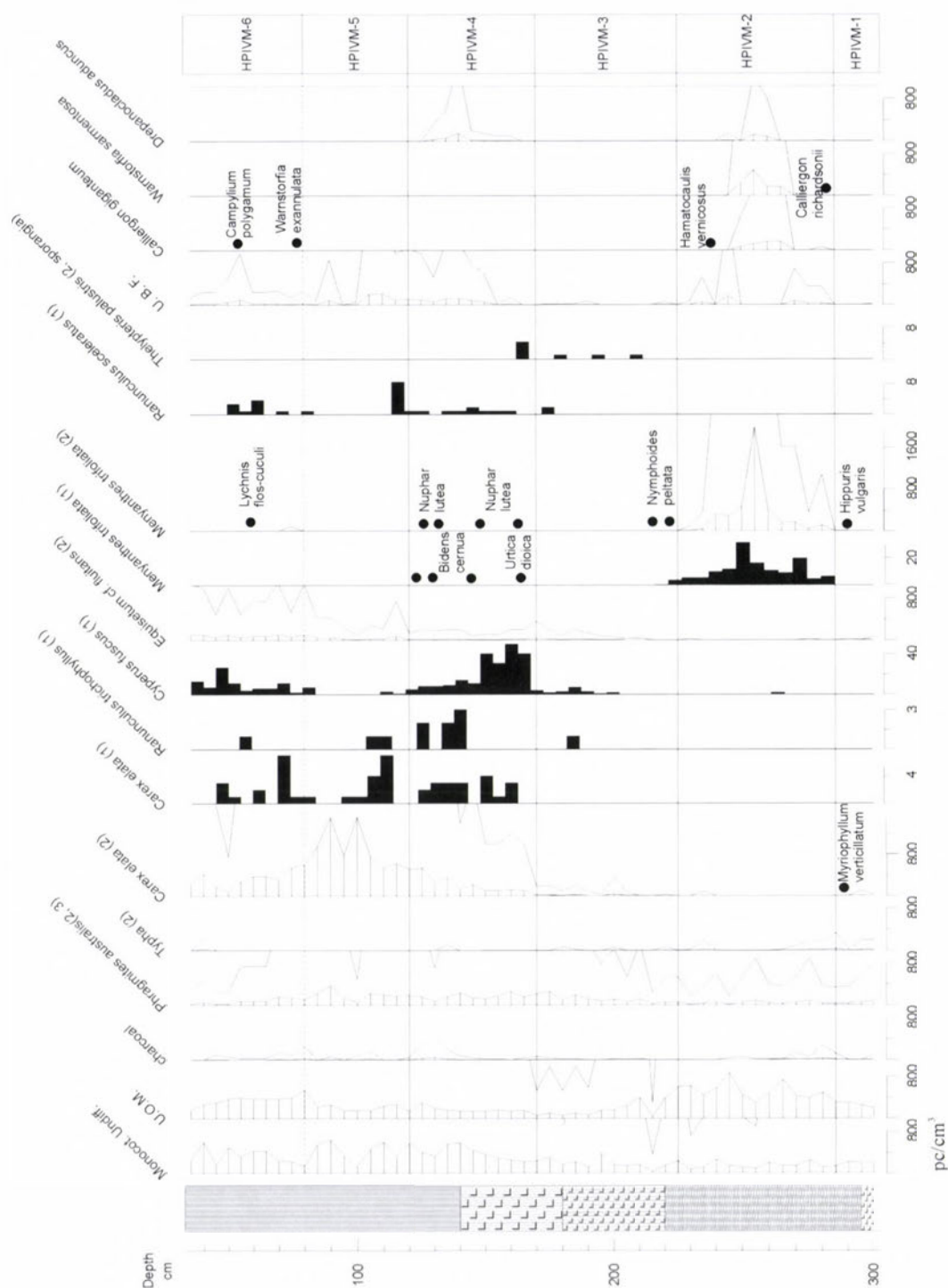


fig. 12. Macrofossil diagram of HPIV core (1: seed, 2: rizodermal tissue, 3: epidermal tissue)



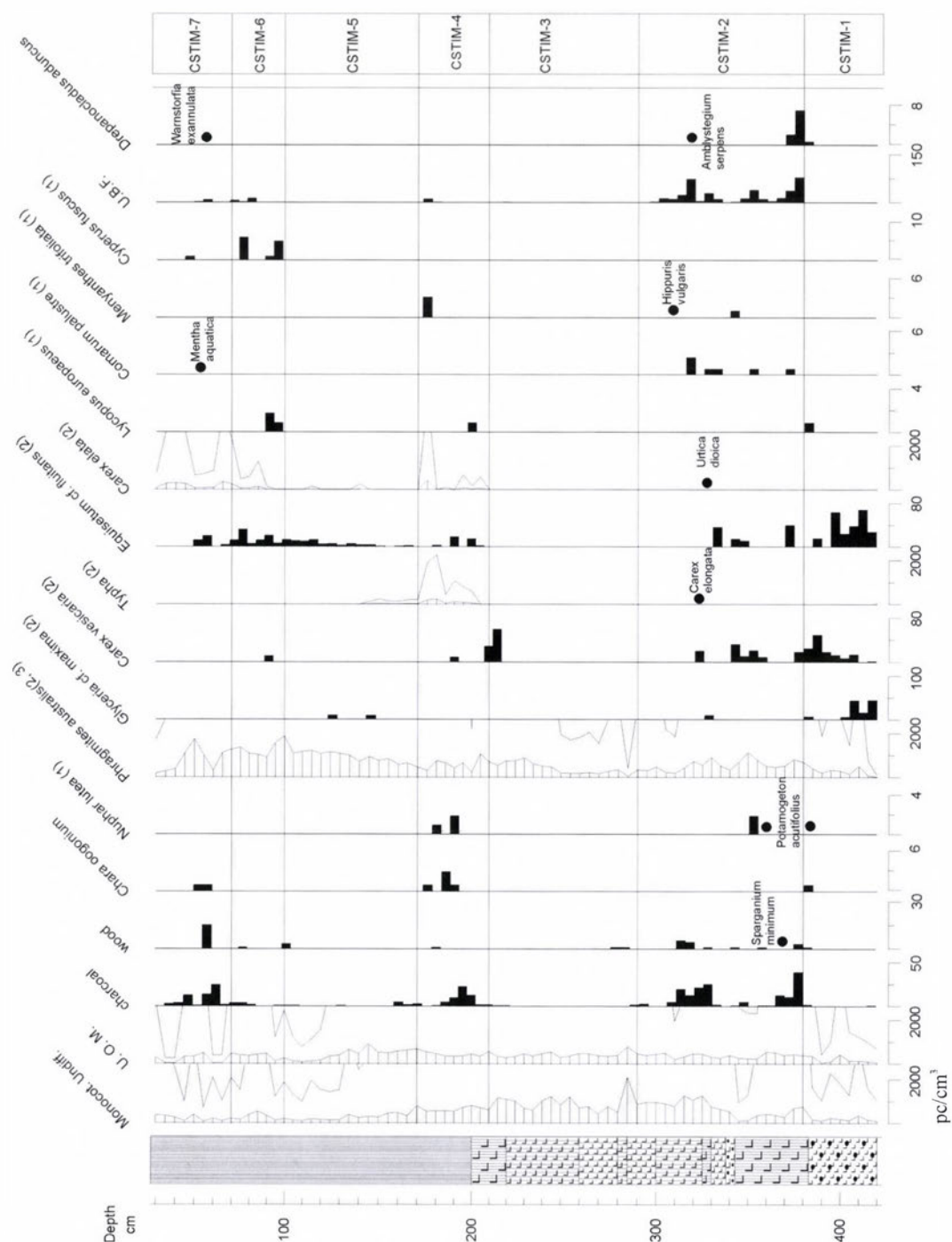
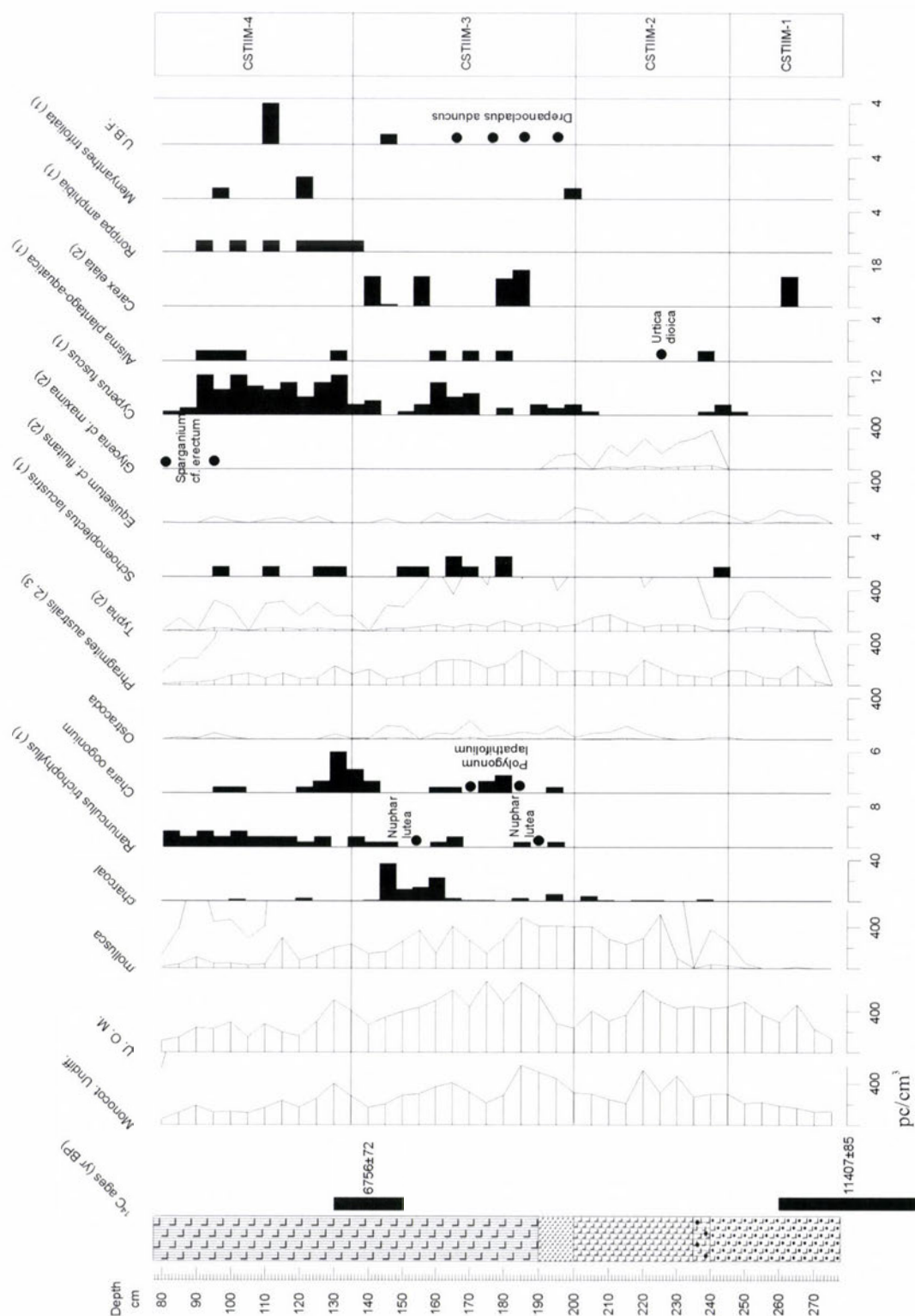


fig. 13. Macrofossil diagram of CSTI core (1: seed, 2: rizodermal tissue, 3: epidermal tissue)





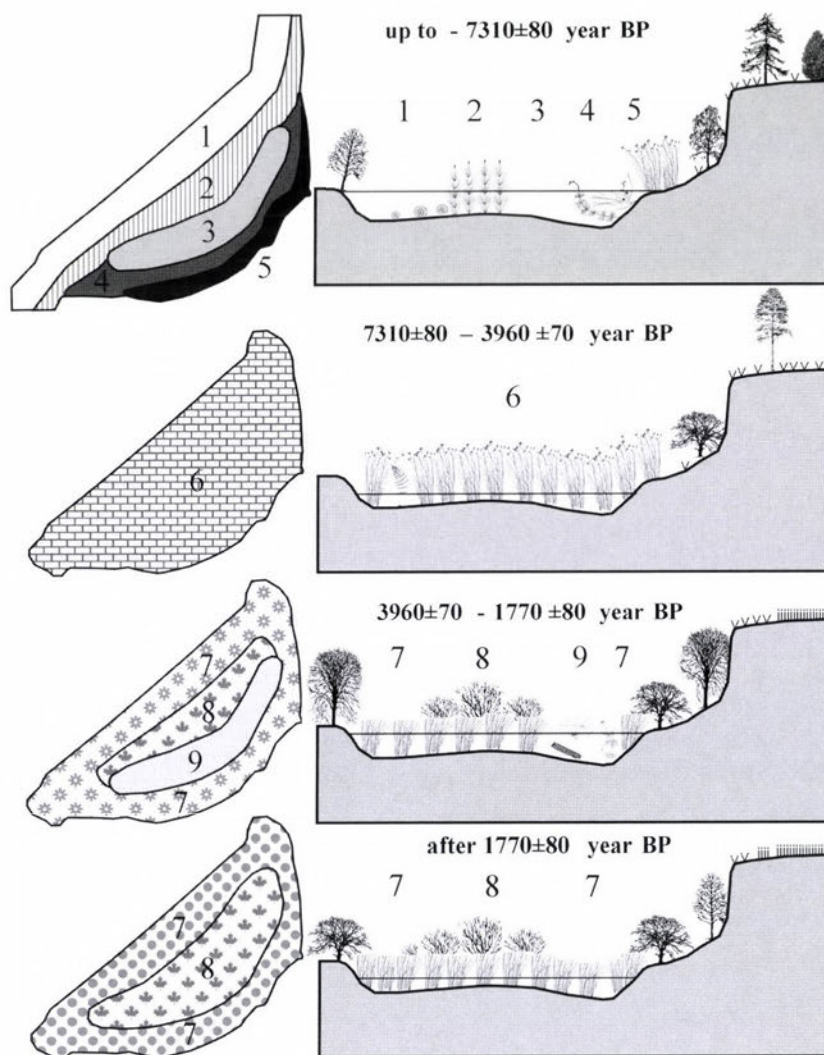


fig. 15. Hydroseral succession of Hajós-Kaszálók Mire. Wetland plant communities:  
 1. living water, 2. *Equisetetum*, 3. stagnant water, 4. *Myriophylletum*, 5. *Menyanthetum*,  
 6. *Thelypteridi-Phragmitetum*, 7. *Caricetum elatae*, 8. *Calamagrostio-Salicetum cinereae*,  
 9. *Nymphaeetum* and *Cypero-Juncetum*

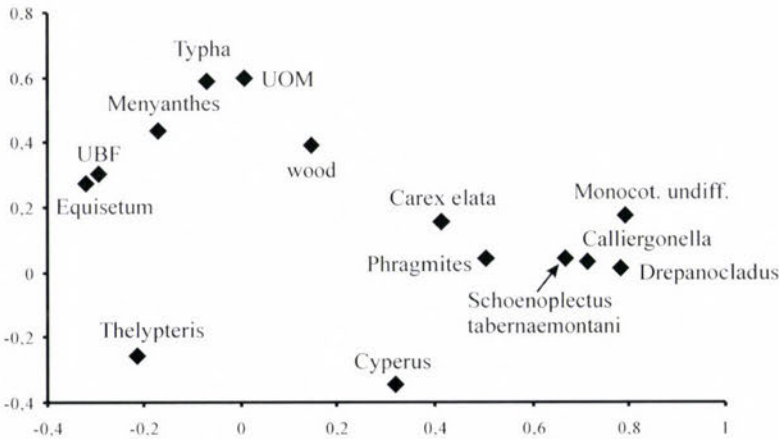


fig. 16. Principal component biplots of selected macrofossil spectra of HPI core

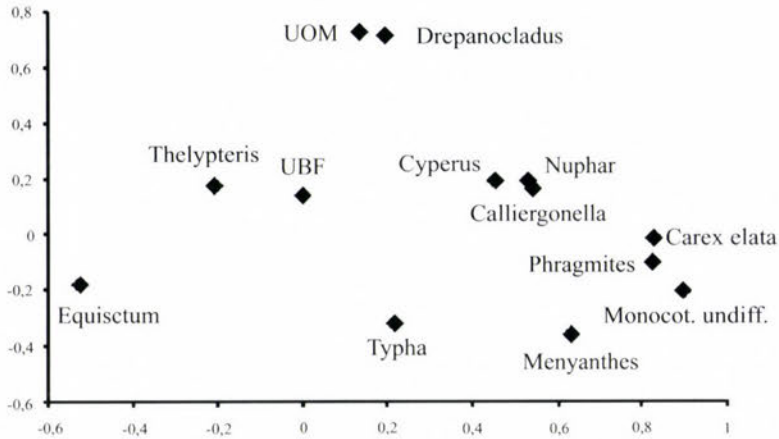


fig. 17. Principal component biplots of selected macrofossil spectra of HP II core

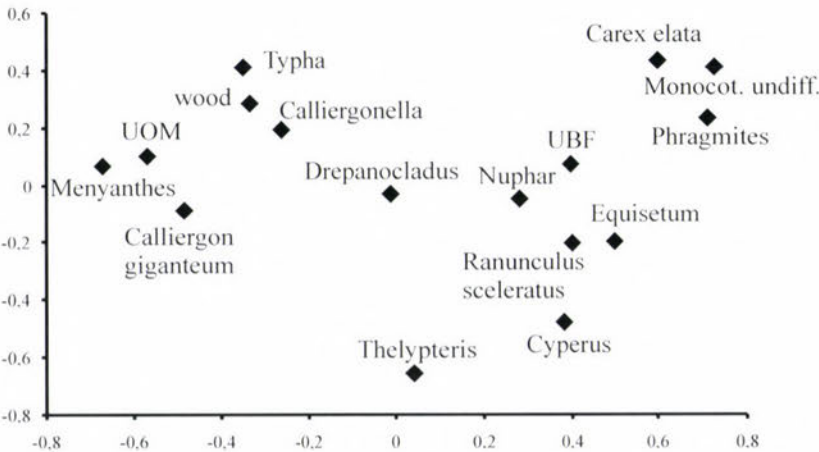


fig. 18. Principal component biplots of selected macrofossil spectra of HPIV core





## PALYNOLOGICAL EVIDENCE OF PRENEOLITHIZATION IN SOUTH–WESTERN TRANSDANUBIA

Before the beginning of the Neolithic, several radical changes took place in the life of Late Mesolithic groups of Europe. As a result of these, Mesolithic communities left behind much more signs of their activities, which are more easily distinct than sediments and palaeontological finds. Archaeologists have previously regarded the uniform transformation of stone tools during the Late Mesolithic as an unambiguous sign of a process determined as *preneolithization*. Preneolithization forms an important component of the process through which cultivation and the productive economies emerged.

With the help of my research I was trying to elucidate something about the effects of the Preneolithization process in a base profile of the Holocene age bearing a high importance for future environmental historical reconstruction and studies. The other thing I was seeking an answer for: what was the exact timing of this process – if present at all – in the profile? Furthermore, I wanted to clarify what can exactly be regarded as the outcome of this phenomenon from an environmental historical point of view.



fig. 1. The location of the site



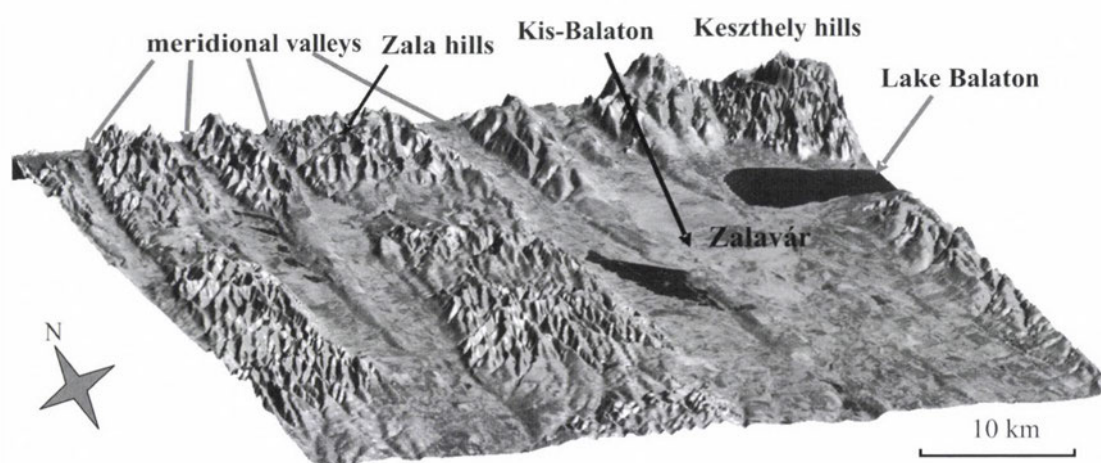


fig. 2. The digital landscape model of south-western Transdanubia based on a satellite image from 1990 (after Timár 2003)

### ***The study area***

The site of Zalavár is located west of Lake Balaton (fig. 1), in the proximity the Kis-Balaton Natural Conservancy Area. The Kis-Balaton (Little Balaton) is a continuous swampy area, which has been artificially drained several times during history. The major interventions took place during the 1950's when the area was totally drained out and used for agricultural purposes. Reinundation started at the beginning of 1990's when serious environmental problems emerged concerning the water quality of Lake Balaton and the importance of this swampy area in filtering the water going to Lake Balaton was recognized.

In fig. 2. the digital landscape model of the surrounding area is shown. The western part of this region is characterized by the so-called meridional valleys of the Zala-hills. One of these valleys is the Hahót-basin, from where I have also studied several pollen profiles.<sup>1</sup> This basin is surrounded by the ridges of the rolling hills of Zala which run north to south with their characteristic streams: the Szévíz and the Principális-channel (constructed by the Romans), whose valleys run in a meridional direction from a joint basin. This Digital Landscape Model (prepared by Gábor Timár) is based on a satellite image from 1990, when the Kis-Balaton was not yet inundated. Nowadays, the entire area west of Lake Balaton is covered with water.

To help in the understanding of the archaeological history of the area west of Lake Balaton I would like to present a drawing (fig. 3) from Sándor Jaskó.<sup>2</sup> That figure presents the cross-section of the north of Kis-Balaton area with a typical terrestrial island: Island Páhok. The archaeological site of Zalavár together with those of the Hahót-basin and the archaeological site of Vörs-Mária asszony-sziget are situated also in such a terrestrial island, some meters above the present day water level (104,5 m) around 110–115 m a. s. l. protected from inundation.

### ***The vegetation around Kis-Balaton***

In the meridional valleys one can find the typical flora of the *Preillyricum* between the *Illyricum* phytogeographical province of the Western Balkans and the Pannonia region of most of modern day Hungary. The vegetation is characterised by a mixture of beech and pine forest. The typical tree species are the following: *Fagus sylvatica* L., *Pinus sylvestris* L., *Carpinus betulus* L. and *Quercus petraea* L.

There are also numerous *Illyric*, *Mediterranean* and *Alpine* flora elements which inhabit the undergrowth of oak forests. One can find large stands of alder trees (*Alnus glutinosa* L.) which grow in wet meadows whose water table is constantly high. In the more open parts, close

<sup>1</sup> Juhász 2001; Juhász 2002; Juhász 2003; Juhász 2004.

<sup>2</sup> Jaskó 1947.

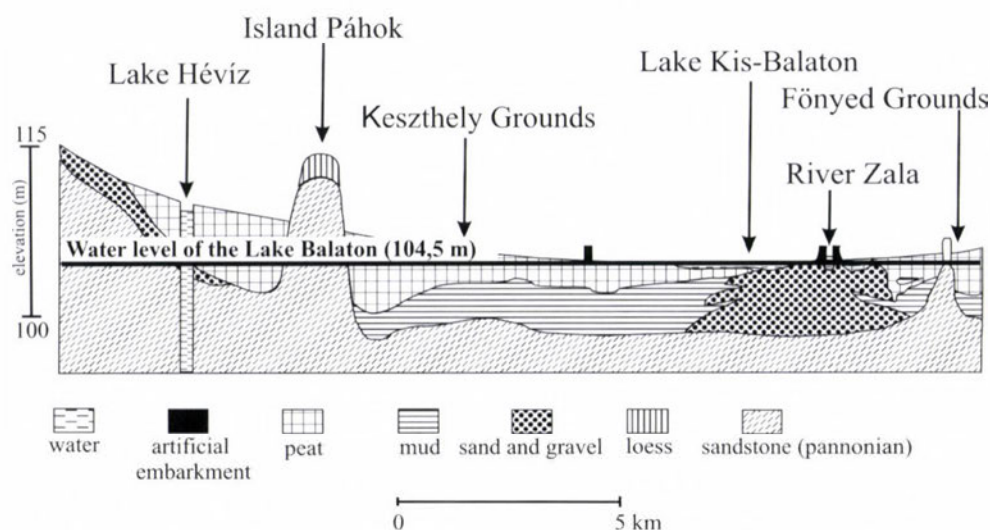


fig. 3. Example for the special terrestrial island of the Kis-Balaton region  
(after Jaskó 1947, modified)

to the Kis-Balaton, around the mires are farmlands, cultivated areas can be found. Nowadays, most of the surroundings of the coring point are uncultivated; the level of the underground water is high with tall sedge vegetation. In the surroundings of the coring point typical aquatic vegetation is found.<sup>3</sup>

#### **Coring, treatments and age determinations**

The mire was explored by the National Peat Cadastral Survey. The coring point was pointed out by Hervé Richard and his colleagues of the Laboratoire de Chrono-écologie of Besançon during a field trip in 1992, based on a 1 : 2880 scale map and on the advice by Miklós Szabó and Zoltán Czajlik that was put at my disposal in 1998. The palynological analyses were made in the Laboratory of IMEP, in Marseille during my PhD studies. The borehole was deepened using a so-called Russian peat sampler, which excludes younger pollen contamination and guarantees the acquisition of an intact sediment core.

During the chemical treatments I followed the standard laboratory method of Erdtman<sup>4</sup> completed by the dense media separation method using Cd-I<sub>2</sub> (Thoulet).<sup>5</sup> If it was necessary I used an additional step of sieving on the organic material to remove the additional coarse debris to facilitate the pollen counting.

Four samples from the 4 m long sediment core were sent for AMS dating to Gif-sur-Yvette with the cooperation of Martine Pattern. Unfortunately, one of these data is in inversion and the base date was considered to be also too young compared to the results of the palynological analyses and both were rejected. Later new samples were sent for bulk sample dating. The results of this second dating justify our previous hypothesis and seem to be in good correspondence with each other, with the previous, accepted ones (fig. 4).

In fig. 5. there are the accepted dates concerning the lower section of the sequence (380–205 cm). All of the dates are drawn on a calibrated calendar year (cal. BC) scale which shows the existence of an almost linear sedimentation rate.

#### **Results of the palynological analyses**

The results of the pollen analyses (fig. 6) show a continuous sequence from the end of Late Pleistocene/the very beginning of the Holocene until approximately 700 year BP. In

<sup>3</sup> Hortobágyi – Simon 1981.

<sup>4</sup> G. Erdtman: New methods in pollen analysis. Svensk Botanisk Tidskrift 30 (1936) 154–164.

<sup>5</sup> T. Nakagawa – E. Bruggliapalia – G. Digerfeld – M. Reille – J.-L. de Beaulieu – Y. Jasuda: Dense media

separation as a more efficient pollen extraction method for use with organic sediment/deposit samples: comparison with the conventional method. Boreas 27 (1998) 15–24.



Depth (cm)	Lab. number	Year uncal. B.P.	Year cal. B.C.	Probability	Acceptance
ZV-207	Ly-11223	7260±40 BP	6220 BC-6020 BC	95.4%	yes
ZV-245	Gif-100245	7530±110 BP	6600 BC-6160 BC	92.7%	yes
ZV-322	Ly-11222	8950±60 BP	8280 BC-7940 BC	95.4%	yes
ZV-353	Ly-11221	9550±60 BP	9250 BC- 8650 BC	95.4%	yes

fig. 4. The radiocarbon dates concerning the beginning of Holocene, the Mesolithic–Neolithic transition (using atmospheric data from *Stuiver et al. 1998*; drawn by OxCal v. 3.5, *Bronk Ramsey 2000*)

this paper I only would like to discuss the results of the analysis of the first 4 local pollen zones, from ZV-a to ZV-d, covering the period from 10 000 BP to 7000 BP, the Palaeolithic, Mezolithic and Neolithic.

#### ZV-a (380–345 cm)

The dominant taxon is Scots pine (*Pinus sylvestris*) with frequencies around 60% of the total pollen sums which shows that the vegetation in the beginning of the Holocene was dominated by pine forests. The pioneer taxa: birch (*Betula*) and hazel (*Corylus*) can be found at the marginal sides of the forest. One can only find very low percentages of the thermophilous tree taxa. The forest is surrounded by a dry steppe-like environment with mugwort (*Artemisia*) and a great variety of taxa. This type of environment is typical for the very beginning of the Holocene which is supported by the radiocarbon date: 9550±60 BP. The presence of other herbaceous taxa such as *Filipendula*, *Lamiaceae* and *Ranunculaceae* shows a relatively humid environment. The members of the local vegetation, *Cyperaceae*, *Typha/Sparganium* are abundant and the aquatic taxa (*Alisma–plantago aquatica*, *Myriophyllum spicatum*, *Nuphar lutea*, etc.) show low, but constant water levels on the site and the proximity of Lake Balaton.

#### ZV-b (345–325 cm)

The most important alteration is the sudden augmentation of Scots pine frequencies until a maximum of 90% while birch has an important decline. Other mesophyle forest taxa such as *Quercus* (oak) and *Ulmus* (elm) have their regular occurrences.

Other coniferous species such as spruce (*Picea*) and fir (*Abies*) rise and have their transitory maxima.

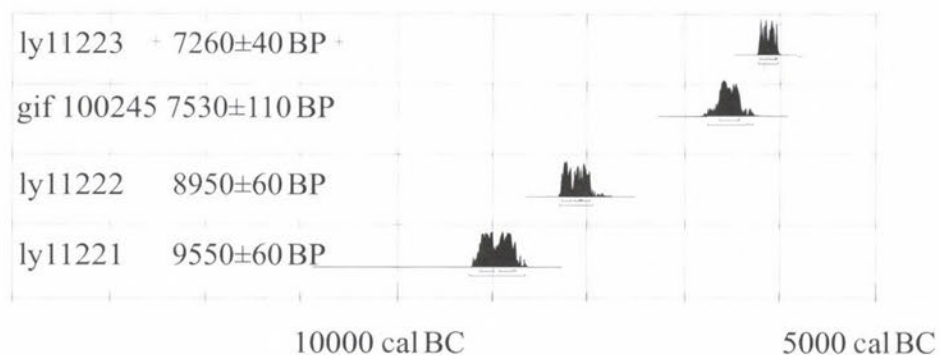


fig. 5. The accepted radiocarbon dates on a calibrated BC scale

The herbaceous vegetation is dominated by *Artemisia*, such high percentages of this taxon have never been found in any other pollen sequence in this region. The other steppe elements, such as goosefeet and the grasses (*Chenopodiaceae*, *Poaceae*) are also well represented. The steppe-like environment is persisting but the typical elements of the wet-mesophile prairies are also spreading (*Apiaceae*, *Filipendula*, *Rubiaceae* and *Ranunculaceae*). The palynological richness is very high in this local pollen zone.

#### ZV-c (325–255 cm)

Because of two periods of different sedimentation during which the pollen grains are very poor preserved, we have to distinguish during this zone 4 sub-zones. The palynological richness is very variable during two of the sub-zones having taphonomic problems, the richness is decreasing, but the elevation of the frequency values during this period is evident.

#### ZV-c1 (325–305 cm)

At the beginning the rate of *Pinus* is lower and is parallel to the high value of *Betula* (birch). The continuous curve of the trees of the mixed oak forest is observable, oak (*Quercus*), lime (*Tilia*) and elm (*Ulmus*) are very abundant. *Corylus* (hazel) is the second dominant taxon after *Pinus*. There is the beginning of the elevation of *Picea* and *Abies* curves. Among the herbaceous taxa, *Poaceae* are well presented, the steppe species, as well as the wet-meadow species are very sporadic. *Alnus* (alder) is regularly present, the *Pteridophytes* are at their highest level, *Typha* and *Cyperaceae* are continuously at a high level.

#### ZV-c2 (305–290 cm)

The sediment is filamentous peat. *Pinus* pollen reaches the highest level and dominates the pollen assemblage; *Abies* and *Picea* are also preserved due to their highly resistant pollen grains. The values of mesophyle taxa have a sudden drop contemporaneous to the presence of the filamentous peat sediment.

#### ZV-c3 (290–270 cm)

Like during the first sub-zone, the percentage of pine is less elevated. The birch is almost missing. The members of the oak forest (*Quercus*, *Tilia*, *Ulmus*) are present again with high values. *Corylus* is raising and remain the co-dominant taxon. Among the herbaceous species, *Poaceae* increase and steppe species are very sporadic, *Artemisia* has totally disappeared. The wet-meadow species are rare, but present.

#### ZV-c4 (270–255 cm)

The second filamentous peat section is presented in the sediment. Similarly to the first sub-zone grown poor in pollen, *Pinus* has a maximum and dominates the pollen assemblage, *Abies* and *Picea* are also preserved. The values of the mesophyle taxa have again a sudden drop contemporary to the presence of the filamentous peat sediment, except to some grains of *Ulmus* and *Corylus*. The curve of grasses (*Poaceae*) raises.

This is the appearing/initiating period of the thermophylous oak forest; the very beginning of the zone is dated to 8950±60 BP. There are two trenches of that zone in which the pollen preservation is erroneous. The taphonomic problem is attached to the presence of filamentous peat. The pollen spectra associated with this sub-zone are very poor in *Corylus*, it can not be ruled out that this reduction is attached to a problem of different pollen conservation.

#### ZV-d (255–200 cm)

This part of the sequence is the most important from the viewpoint of neolithization. During this period a strong forest cover with a species rich mixed oak forest is present dominated by hazel. One can notice two or three distinguishable peaks of *Corylus* pollen. The first peak is dated to before 7530 ± 110 BP (6380 cal. BC) at 245 cm; the second right after this date and the third at 7260 ± 40 BP (6120 cal. BC) at 205 cm depth. These sudden raises in the pollen percentage (from 10% to 20%, from 10% to 30% and latter from 20% to 50%) are referring to the collection of hazelnut (*Corylus avellana*). There seems to be a strong correlation between the increase of hazel pollen grains and the strategies applied during gathering.

Almost all taxa of the oak wood are present with high frequencies. A coniferous forest of *Picea* and *Abies* also appears not far from the site either indicating a mosaic like environment following the exposures, or a real mixture of the different taxa that one can find currently



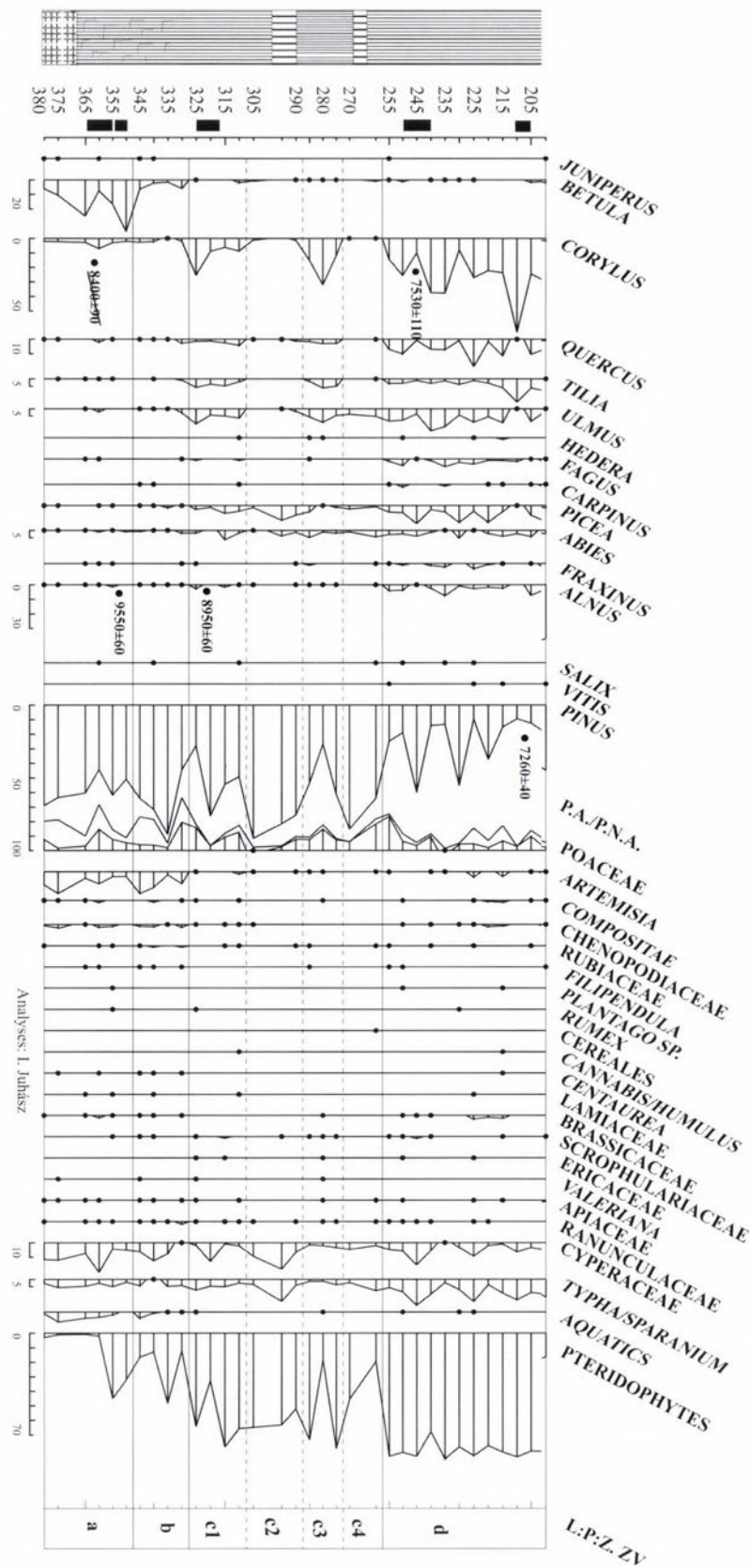


fig. 6. Pollen diagram with the most important taxa

in the region.<sup>6</sup> Although *Fagus* (beech) is already regionally present with sporadic pollen occurrences in the sequence as early as the beginning of the previous zone, it settles down definitively in the forest during this phase, associated with the Atlantic period. The continuous presence and periodic rise of *Fraxinus* (ash) and less clearly detectable rise of *Tilia* (lime) may show the utilization of the shoots and foliage of younger ashes (*Fraxinus*) and lime (*Tilia*) for animal feeding.

In the humid zones we can remark a modest progression of *Alnus*, which is probably associated to the gallery forest (*ripisylvae*) on the margin of mire, dominated by *Pteridophytes*. Among the herbaceous taxa *Poacea* is dominant but the presence of some anthropogenic plant species is also remarkable. The rise of those taxa is focused around the depth when the hazel peaks are also present. The third elevation of the different arboraceous and herbaceous species is the most important around 7260 ± 40 BP (6120 cal. BC) when the Neolithic population is already settling down in the region.

### ***The neolithization process in Central Europe***

The central part of the Carpathian Basin seems to be one of the most important areas in the process of European neolithization. This area forms the northern boundary of expansion of the Körös–Starčevo cultures.<sup>7</sup> Sümegi and Kertész<sup>8</sup> proposed a new agroecological model for the whole of the Carpathian Basin based on palaeoecological, climatological and pedological research as well as the results of the latest archaeological data.<sup>9</sup> Previous models treated the environmental and social factors, which influenced the expansion of the Early Neolithic communities bearing their cultural roots, agricultural production experience in the Balkans and Mediterranean areas.<sup>10</sup> In the new model – in contrast to the previously offered theories – a fundamentally different approach is present, offering an explanation on the past relationships between man and the environment, the spreading of neolithization at a macro-scale (at thousands of square kilometres).<sup>11</sup>

The palynological sequence of Zalavár gives signs of the effects of the palaeoenvironment during the neolithization process on a local scale (*fig. 6*).

### ***The role of loess covered terrestrial islands on flood-plains in the Central European neolithization***

The appearance and settlement of the new cultures originating from the Balkans and Asia during the Early Neolithic, had a highly important role in the evolution of the environment of the Carpathian Basin. This is the time when such an anthropogenic impact started that finally led to the transformation of the original natural conditions of the Great Hungarian Plain.<sup>12</sup> In *fig. 7*, the distribution of the archaeological sites with Mesolithic finds and tools marked with black and the excavated Mesolithic archaeological sites marked with white can be seen. Before the beginning of the Neolithic, several radical changes took place in the life of the Late Mesolithic groups of Europe. As a result of these, Mesolithic communities left behind many more signs of their activities which are more easily distinguishable in the composition of the sediments and the palaeontological finds.<sup>13</sup> The uniform transformation of stone tools during the Late Mesolithic have been previously regarded by archaeologists as an unambiguous sign of a process identified as preneolithization. Preneolithization forms an important component of the process through which cultivation and the productive economies have been developed.<sup>14</sup>

<sup>6</sup> Hortobágyi – Simon 1981.

<sup>7</sup> I. Kutzian: The Körös Culture. DissPann II. No. 23. Budapest 1947; Kalicz 1977; Kalicz – Makkay 1977; Kalicz et al. 1998.

<sup>8</sup> Sümegi – Kertész 2001.

<sup>9</sup> Kertész et al. 1994; Sümegi et al. 1998.

<sup>10</sup> A. J. Ammerman – L. L. Cavalli-Sforza: Measuring the rate of spread of early farming in Europe. *Man* 6 (1971) 674–680.

<sup>11</sup> Sümegi et al. 2003.

<sup>12</sup> Sümegi 2003.

<sup>13</sup> Kertész et al. 1994; Sümegi et al. 1998; Sümegi 2000.

<sup>14</sup> Sümegi 2004.



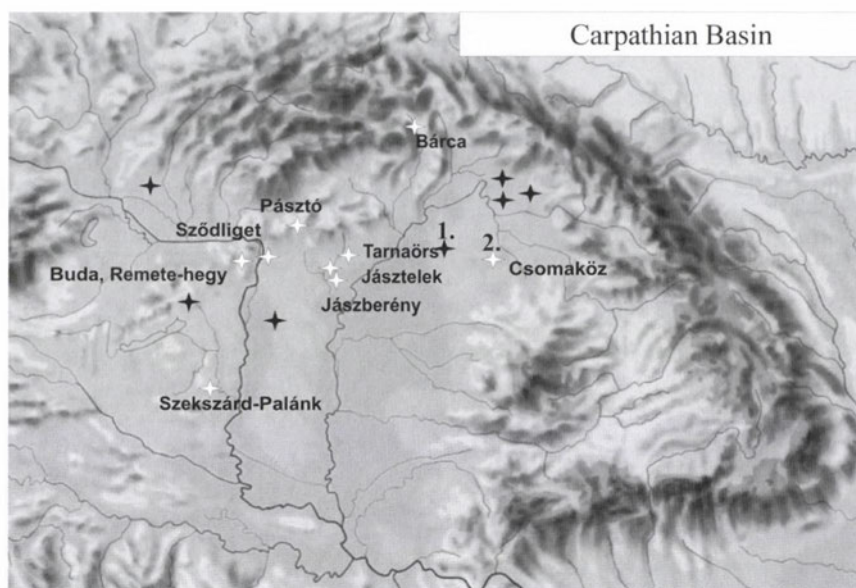


fig. 7. Mesolithic finds and tools and excavated Mesolithic sites in the Carpathian Basin  
(after Sümeği 2000)

✦ Mesolithic finds and tools, ✧ Excavated Mesolithic sites

During the Early Neolithic settlements of the Körös culture were clearly connected to alluvial plains of the rivers (fig. 8).<sup>15</sup> According to several authors,<sup>16</sup> hydromorph soils of the alluvial plains must have had an important role in the economies of the Körös culture. Sümeği<sup>17</sup> examined this process at a local and regional scale and found no signs of homogenous geomorphologic conditions neither around the area of the Körös culture (in the river valleys), nor in the territory of the Starčevo culture (in the lake and brook systems). He found very different subsoil water level, base-rock, soil and vegetation conditions around the Early Neolithic settlements and distinguished two settlement types – on an environmental basis – within the Körös culture.

We can find such settlements in the Körös and in the Tisza valley. In the Körös valley the Holocene along with the Pleistocene alluvial surfaces, loess covered rest-surfaces with backswamps, levees and river channels can be clearly separated. In the Tisza valley<sup>18</sup> loess covered terrestrial island- and peninsula-like Pleistocene relict-surfaces developed on the alluvia during the Holocene riparian process. Several differences in settlement strategy caused by the regional and micro-scale mosaicism can be clearly seen.

Two different types of economies seem to have been established on the two major surfaces with different geological histories and different landscape as well as hydrological conditions. These differences in settlement properties raise a very important question for consideration. During the Early Neolithic, groups living in the Carpathian Basin on the northern periphery of their expansion had to undergo an adaptation process earlier. During this adaptation process their landscape use and settlement strategies had to be changed as they moved from a predominantly alluvial area towards elevated loess covered surfaces.<sup>19</sup> This

<sup>15</sup> Kalicz – Makkay 1972; Kalicz – Makkay 1977; Sherratt 1982; A. Sherratt: The development of Neolithic and Copper Age settlement in the Great Hungarian Plain. Part 2: Site surveys and settlement dynamics. *Oxford Journal of Archaeology* 2 (1983) 13–41; A. Whittle: Europe in the Neolithic. Cambridge 1996.

<sup>16</sup> K. Kosse: Settlement Ecology of the Early and Middle Neolithic Körös and Linear Pottery Cultures in Hungary. *BAR IntSer* 64 (1979); Sherratt 1982; N. Roberts: The Holocene. An Environmental History. Oxford 1998.

<sup>17</sup> Sümeği 2000.

<sup>18</sup> P. Raczky: Raczky Pál: A korai neolitikumból a középső neolitikumba való átmenet kérdései a Közép- és Felső-Tisza vidéken (Questions of transition between the Early and Middle Neolithic in the Middle and Upper Tisza Region). *ArchÉrt* 110 (1983) 161–194.

<sup>19</sup> E. Bánffy: The 6<sup>th</sup> Millennium BC Boundary in Western Transdanubia and its Role in the Central European Neolithic Transition. *VAH* 15, Budapest 2004.

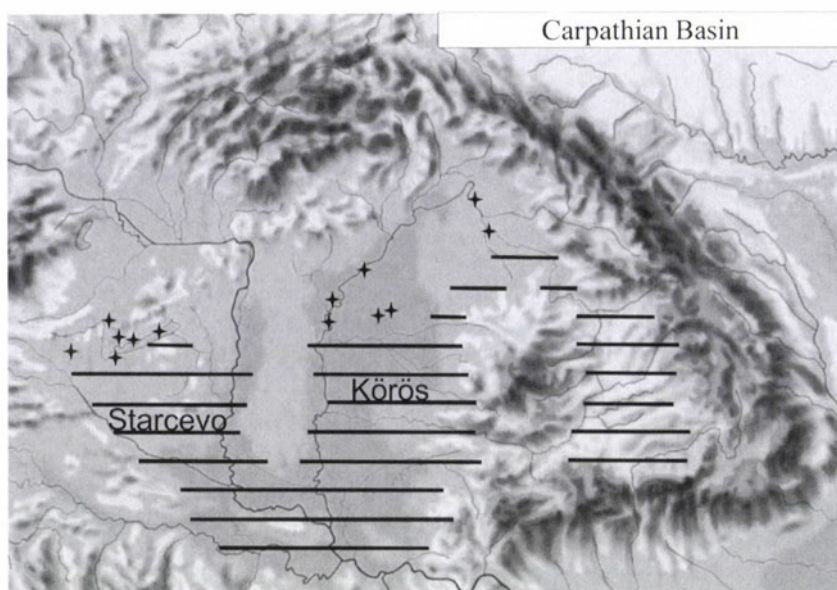


fig. 8. Distribution of Early Neolithic sites and sporadic Early Neolithic sites on the limit zone of distribution (after Sümeği 2000)

— Distribution of the Early Neolithic sites,  
+ Sporadic Early Neolithic sites on the border zone of distribution

provided an excellent opportunity for the extension of the previously acquired productive economies to the loess-covered “heights”. These micro-mosaics of the river alluvia and the loess covered relict surfaces probably had an important role in the neolithization process of the Carpathian Basin. It seems that these loessy alluvial island-like surfaces were primarily chosen by the Neolithic communities for settling.<sup>20</sup>

In the central parts of the Carpathian Basin, Mesolithic communities lived and migrated on the alluvia which was covered with closed forest.<sup>21</sup> It means that the Mesolithic hunters lived in the proximity Early Neolithic farmers even although they lived on and used different habitats in the riparian environment.

### *The importance of south-western Transdanubia in the neolithization process*

Very similar geological conditions developed in the neotectonic basins of Lake Balaton where several of the Starčevo communities<sup>22</sup> chose the small loess covered islands (fig. 3)<sup>23</sup> or loess covered meridional hills for their sites of settlement during the Early Holocene. The Early Neolithic sites around and west of Lake Balaton (fig. 9) are the following: Becsehely, Szentgyörgyvölgy, Zánka and Tihany.<sup>24</sup>

We have traces of the activities of local productive communities from as early as 7000 BC in the Carpathian Basin, which can be interpreted as “preneolithic human influence” resulting in the emergence of open vegetational areas and the extension of marginal vegetation in several localities.<sup>25</sup> The emergence of more open vegetation might show direct links to the

<sup>20</sup> Sümeği 2000.

<sup>21</sup> Kertész et al. 1994.

<sup>22</sup> Kalicz et al. 1998; Bánffy 2000; E. Bánffy: Neue Daten zur Entstehung der Bandkeramik, in: St. Hiller – V. Nikolov (hrsg.): Karanovo III: Beiträge zum Neolithikum in Südosteuropa. Wien 2000, 375–382; E. Bánffy: Starčevo und/oder LBK? in: H.-J. Beier (hrsg.): Varia Neolithica I. Beiträge zur Ur- und Frühgeschichte Mitteleuropas 22. Weissbach 2000, 47–60.

<sup>23</sup> Jaskó 1947.

<sup>24</sup> Kalicz 1977; Bánffy 2000; Kalicz et al. 1998; K. Sági – Z. Törőcsik: A Dunántúli Vonaldiszes Kerámia “Tapolcai csoportja” (The “Tapolca group” of the Transdanubian Linear Pottery culture). TapolcaVMK 1 (1989) 29–72; K. Sági – Z. Törőcsik: A Dunántúli Vonaldiszes kerámia kultúrája “Tapolcai csoportjának” Balaton környéki lelőhelyei (Fundorte der zur Kultur der Transdanubischen Linienbandkeramik gehörenden “Tapolca-Gruppe” in der Balatongegend). Bibliotheca Musei Tapalcensis 1 (1991);

<sup>25</sup> Sümeği 1998; Sümeği – Kertész 2001.



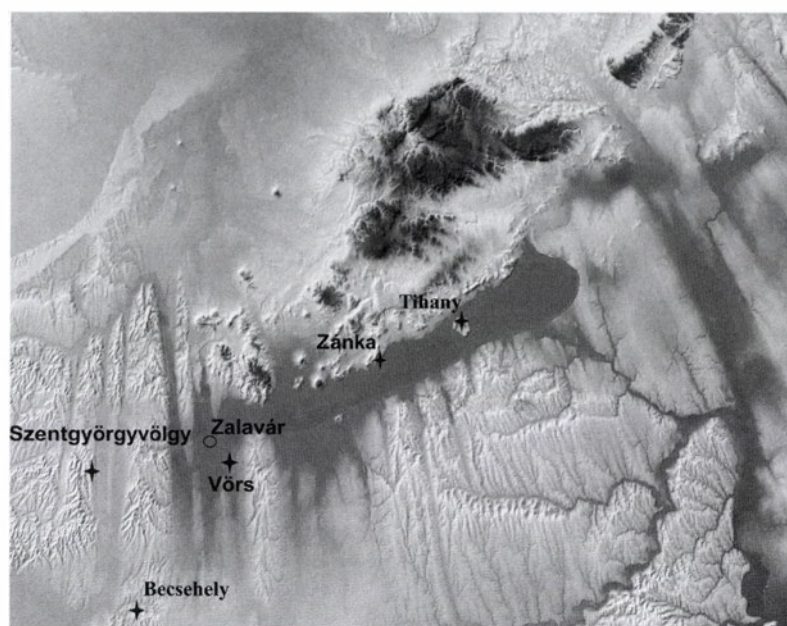


fig. 9. Distribution of Early Neolithic sites around Lake Balaton

settlement of Mesolithic hunting cultures and the development of Mesolithic camps during the active growth period in a woodland setting.

Although no archaeobotanical signs referring to the collection of hazelnut (*Corylus*) have come to light from Hungarian Mesolithic sites so far, there seems to be a strong correlation between the increase of hazel pollen grains and human induced forest burnings as well as strategies applied during gathering clearly observable in case of the Western European Mesolithic sites.<sup>26</sup> A similar process resulting in the expansion of hazel following a forest fire can be observed in several pollen profiles of Western Transdanubia and the area adjacent to the Kis-Balaton region and the Hahót-valley.<sup>27</sup>

As the results of palynological research on different Holocene radiocarbon dated profiles (fig. 10) indicate several, small and less important, anthropogenic changes in the vegetation took place between 6000–7000 cal. BC. These alterations seem to display direct connections (fig. 11) with a more massive gathering of hazel-nut, the utilization of the shoots and foliage of younger ashes (*Fraxinus*) and linden (*Tilia*) for animal feeding, the formation of hunting trails and camp sites, on the whole a more permanent settling and possibly the early adaptation or imitation of certain techniques and methods of production and the archaeologically proven inner developments of Mesolithic communities. Data gained through the application of natural sciences seem to further justify the previous assumptions of archaeologists, according to which right before the appearance of Early Neolithic cultures in the Carpathian Basin, an independent preneolithic phase must have developed around 7000 BC. This phase survived in the foothill areas of the Carpathians during the settling of the Körös culture.

### Summary

During recent years it has been made clear that the central part of the Carpathian Basin represents a very important transitional region between the environments of the Balkan Peninsula and the western part of Europe. These two for-mentioned regions are significantly different from each other, even at the macro-scale. These environmental differences were most probably already present during the Holocene and determined the life of Mesolithic and Neolithic groups. The Central European–Balkan Agro-Ecological Barrier–CEB AEB, determined the settlement and

<sup>26</sup> A.G. Smith: The influence of Mesolithic and Neolithic man on British vegetation, in: D. Walker – R.G. West (eds): Studies in the Vegetational History of the British Isles. Cambridge 1970, 81–96.

<sup>27</sup> Juhász 2002; Juhász 2003; Juhász 2004.

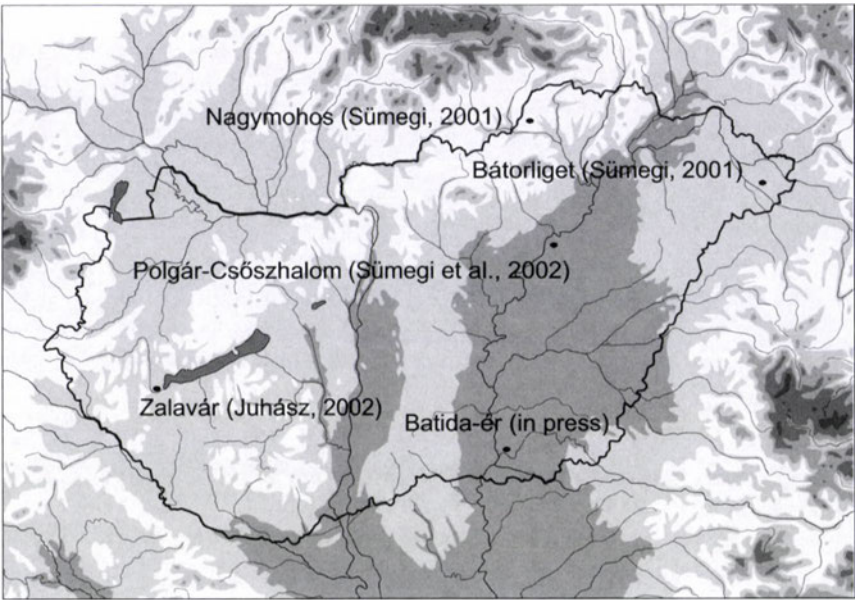


fig. 10. Other palynological sequences with signals of preneolithic human impact in Hungary

expansion possibilities of the Early Neolithic Körös culture in the Early Neolithic and probably also had an essential part in the neolithization process of Late Mesolithic communities in the Carpathian Basin, and in the establishment of the Neolithic groups which are already independent of their cultural roots, and in the development of the Linear Pottery complex. A so-called infiltration zone along the main river valleys played an important role, because the Late Mesolithic and Early Neolithic communities had their contact with each other. In these transitional areas – from the aspects of morphology, climate, vegetation and soil conditions – we have to consider an environmental shift because of the effects of a micro-scale mosaicity. These different micro-environmental resources must have significantly altered and modified the settlement strategies of the Körös culture in the Neolithic and led to the establishment of settlements which are bearing alternating functions. The palynological sequence of Zalavár gives signs of the effects of the palaeoenvironment during the neolithization process on a local scale and seems to further justify the fore-mentioned processes.

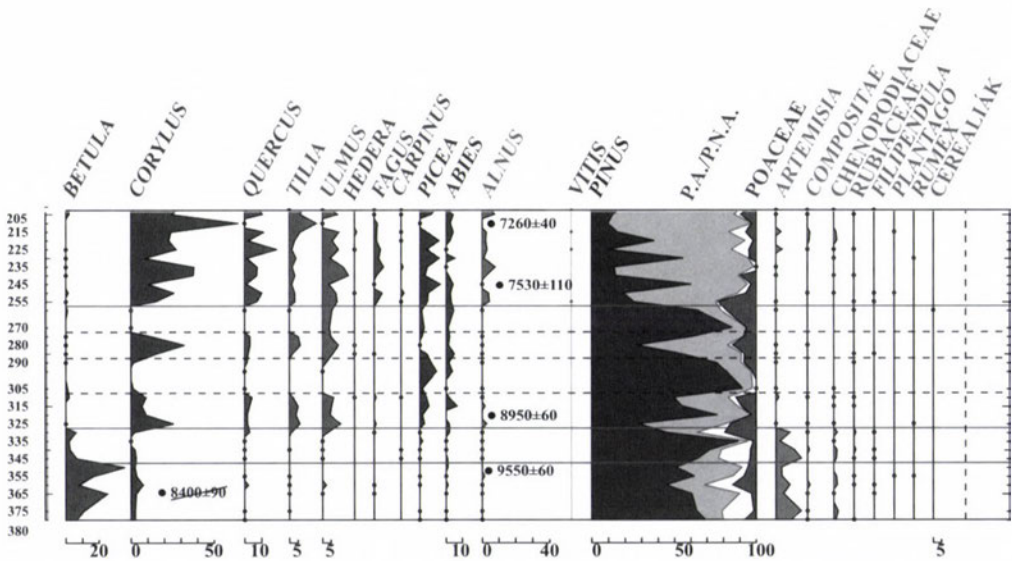


fig. 11. The simplified pollen diagram with signs of preneolithization



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## THE HUMAN PRESENCE IN POLLEN DIAGRAMS FROM ROMANIAN CARPATHIANS

Evidence for the influence of human activity in Romanian Carpathians was identified for very early times, the area constituting an important centre of civilization and culture.

The available regional archaeological information indicates the Neolithic communities belonging to Gura Baciului, Ocna Sibiului, Starčevo–Criș III–IV Cultures, estimated at 5900–5400 years BP<sup>1</sup>, as first proofs for human presence in Transylvania. More recent dating at Gura Baciului<sup>2</sup> indicates even an older value as presumed before, of 6400 ± 90 years BP (7300 cal. years BP).

Archaeological data confirming the palynological ones have been also found in some other sites from Transylvania. Remnants of Boian Culture (Middle Neolithic), dated to 5500–6000 years BP have been found at Brăduț (690m altitude) and Turia.<sup>3</sup> Four <sup>14</sup>C datings were obtained at Malnaș-Băi (5349 ± 40 BP; 5407 ± 20 BP; 5497 ± 100 BP; 5663 ± 42 BP) for the Cucuteni ceramic.<sup>4</sup> Albiș, Peteni and Zoltan settlements were attributed to the Bronze Age (3500–4000 BP).<sup>5</sup>

The study of the pollinic diagrams in 7 sites from Romanian Carpathians, dated by using <sup>14</sup>C, shows the presence of taxa representing anthropogenic indicators (*Table 1*). Most of these indicators are present in all the diagrams, at different times. Sites from Western Carpathians (Apuseni Mts.), Southern Carpathians (Retezat Mts.) and from Eastern Carpathians (Harghita, Căliman, and Gutâi Mts. respectively) are presented (*fig. 1*). These results can be considered only orientative, further studies being needed in the future for the occurrences in areas with low and moderate altitude.

### *The Atlantic*

Recent palynological investigations in the Apuseni Mountains<sup>6</sup> demonstrated that evidence of human impact appeared during the 7800–7425 cal. years BP period, and for the first cultivations at ca. 6820 cal. years BP. Two sequences from **Ic Ponor** karst area, in the peat

<sup>1</sup> G. Lazarovici: Les Carpates Méridionales et la Transylvanie. in: Atlas du Néolithique européen. L'Europe orientale. E.R.A.U.L., 1993, 243–284; J. P. Demoule: La Néolithisation de l'Europe sud-orientale, in: Rapports du Groupe de travail sur la Néolithisation. Mémoires de la Société Préhistorique Française 26 Suppl. (1999) Revue d'Archéométrie, Actes Congrès International C-14 Archéologie, 6 avril 1998, 453–454; C-M. Mantu: The Absolute Chronology of the Romanian Neolithic and Aeneolithic / Chalcolithic Periods. The State of Research, in: Rapports du Groupe de travail sur la Néolithisation. Mémoires de la Société Préhistorique Française, 26, Suppl. (1999) Revue d'Archéométrie, Actes Congrès International C-14 Archéologie, 6 avril 1998, 225–231.

<sup>2</sup> Z. Maxim: Concluzii privind evoluția și Cronologia Neo-Eneoliticului din Transilvania, in: Neo-Eneoliticul din Transilvania – date arheologice și matematico-statistice. Biblioteca Musei Napocensis 19 (1999) 129–133.

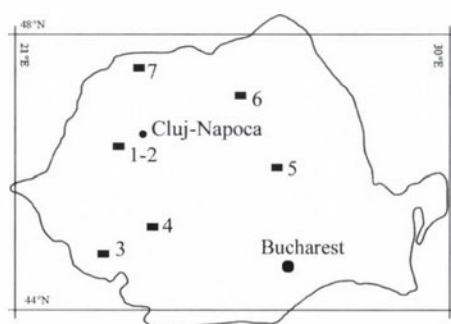
<sup>3</sup> Z. Székely: Bradut, Covasna County. In the Chronicle of Archaeological Researches – the 1997 Campaign, Calarasi, 20–24 May 1998, 9–10.

<sup>4</sup> A. László: Malnas Bai. Cronica cercetarilor arheologice 1983–1992 (The Chronicle of Archaeological Researches 1983–1992). The National Commission for Archaeology, Bucharest 1997, 52–53.

<sup>5</sup> Z. Székely: Considerații arheologice privind așezarea din epoca bronzului de la Peteni, jud. Covasna. Materiale și Cercetări Arheologice (1980) 129–134.

<sup>6</sup> A. Bodnariuc: Histoire holocène de la végétation des Monts Apuseni (Carpates Occidentales, Roumanie) – étude palynologique. Teză doctorat, Univ. Paul Sabatier Toulouse III, Lab. d'Ecologie Terrestre 2000, 68; A. Bodnariuc – A. Bouchette – J. J. Dedoubat – T. Otto – M. Fontugne – G. Jalut: Holocene vegetational history of the Apuseni mountains, central Romania. *Quaternary Science Reviews* 21 (2002) 1465–1488; G. Jalut – A. Bodnariuc – A. Bouchette – J. J. Dedoubat – T. Otto – M. Fontugne: Holocene vegetation and human impact in the Apuseni Mountains, Central Romania, in: S. Tonkov (ed.): Aspects of Palynology and Palaeoecology. Festschrift in honour of Elissaveta Bozilova. Pensoft, Sofia – Moscow 2003, 137–170.





- 1 - Ic Ponor (Apuseni Mts.); 2 - Capatana (Apuseni Mts.)  
 3 - Semenic Mts.; 4 - Taul Zanogutii (Retezat Mts.)  
 5 - Mohos (Hargita Mts.); 6 - Iezerul Caliman (Caliman Mts.)  
 7 - Steregoiu (Gutai Mts.)

fig. 1. Location map of cited  $^{14}\text{C}$  sites

bog with the same name (1040 m altitude) evidenced the first signs of extremely early human impact. Pollen zone 1, on the basis of sequence was dated by  $^{14}\text{C}$  in its basal part (sequence 1). The age determined was  $8990 \pm 80$  years BP and corresponding to Boreal.

Based on  $^{14}\text{C}$  data on sequence 2, the following pollen zone was dated as starting at  $8770 \pm 90$  years B.P. (Boreal) and ending about 7000 years ago ( $6870 \pm 90$  years BP in sequence 1, and  $6980 \pm 90$  years B.P. in sequence 2 respectively), thus in early Atlantic. The increase of the participation of *Poaceae* and the synchronous presence of some grains of *Rumex*, in both analyzed sequences, are considered by the author as representing the first human indicators in the region. At that time, *Chenopodiaceae* and *Asteroidae* became also more frequent.

Based on  $^{14}\text{C}$  data ( $6980 \pm 90$  years BP, and  $6400 \pm 110$  years BP respectively) on sequence 2, next zones belong to middle Atlantic. It is better represented and on a higher thickness in sequence 1. The end of this stage is marked by the presence of *Chenopodiaceae*, *Asteroidae*, *Urticaceae*, *Rumex*, and *Plantago*. As in the case of the first isolated walnut tree (*Juglans*) grains (sequence 2), they are an argument for the neighbouring human communities.

Zone 5: the upper part of sequence 1 is dated at  $6190 \pm 90$  years BP. Relative increase of *Poaceae*, *Artemisia* (in both sequences), *Ranunculaceae* (sequence 1), and *Plantago lanceolata* (sequence 2) pollen was noticed. Towards the end of this zone, the relative decrease of the spruce fir (*Picea*) values and the synchronous increase of hazel should be interpreted as the consequence of clearances.

Zones 6–8: in sequence 1 they are delimited by two  $^{14}\text{C}$  data, of  $6190 \pm 90$  years BP, and  $5680 \pm 110$  years BP respectively, thus belonging to late Atlantic. Towards the middle part of sequence 1, and the end of sequence 2 respectively, the same trend as mentioned in zone 6 was recorded. It consists in the steep decline of the spruce fir (*Picea*) curve, synchronous with the hazel (*Corylus*) peak, as a possible consequence of previously mentioned causes. Concerning grasses, the *Poaceae* pollen shows a slight increasing trend, and sequence 1 records an isolated occurrence of the cereals (*Cerealia*) pollen.

In both sequences from **Ic Ponor** a coal layer was identified, as a proof of previous fires.

**Căpățâna complex (Apuseni Mountains)** consists of two oligotrophic peat bogs (located at 1220 m altitude) covering a small area protected by law. First palynological and geochemical study was performed by Mitroescu et al.<sup>7</sup> More recently, a new sequence was probed (Fărcaș et al., unpublished), and 7 samples were dated by  $^{14}\text{C}$ . The age determinations were used for separating local pollen zones. The dynamics of pollen taxa was also of interest. The  $^{14}\text{C}$  data document a stage of the vegetation history in the Apuseni Mts. It begins with Atlantic, as suggested by the presence of the hazel (*Corylus*) pollen that is about 50% in zone 1.

<sup>7</sup> S. Mitroescu – M. Vădan – D. Anton: Studiul palinologic și geochemic al tinoavelor de la

Căpățâna – Munții Apuseni. *Contribuții Botanice* (1989) 149–165.



The indicators of human impact in the 6 first pollen zones are scarce, and they do not seem to change the pollen spectra of trees. A relatively constant presence of the *Poaceae*, *Chenopodiaceae*, *Apiaceae*, *Ranunculaceae*, *Asteraceae*, *Fabaceae*, *Brassicaceae*, *Urticaceae*, *Rumex* and *Plantago* pollen can be attributed to modest human activities in the area. This is supported by their relatively constant low values also in the upper pollen spectra.

Rösch and Fischer (2000)<sup>8</sup> obtained by drilling a peat sequence of 1,6 m from **Semenic Mountains**, in a site of 1400 m altitude, on which they performed complex studies (pollen and macrofossils). The results obtained show the unexpected old age of the sequence (Preboreal), due to the high degree of compression of the sediment. Based on <sup>14</sup>C data and the results obtained, the authors divided the pollen diagram in 9 local pollen zones, each corresponding to a certain time interval of the Holocene.

First evidence on human impact was attributed to the pollen zone 5a. If we compare this diagram with the others <sup>14</sup>C dated diagrams from Romanian Carpathians, we consider that this evidence is older in **Semenic Mountains** (zone 2), and we can argue this opinion.

Zone 2 (b, c): marks the middle and the late Atlantic and it was dated by using <sup>14</sup>C at 6780 ±60 years BP. The diagram shows as a major event the decrease of the pine (*Pinus*) curve until almost his disappearance, correlated with the hazel (*Corylus*) curve increase. Concerning the human impact evidence, a great number of indicator families and taxa are present in the pollen diagram of this zone: *Chenopodiaceae*, *Artemisia*, *Urticaceae* (nitrophile taxa showing human habitats), *Plantago lanceolata*, *P. major*, *Poaceae*, *Rumex*, *Centaurea*, *Apiaceae*, *Asteraceae*, *Brassicaceae*, *Cichorioideae*, *Ranunculaceae*. All these indicate the first farming cultures, like forest grazing, the rotation followed by fallow, the clearance, the ruderalization etc.

The palynological study on the peat bog from **Mohoş** (1050 m altitude, **Harghita Mountains**) by Tanţău et al. 2003<sup>9</sup> based on the comparison of two sequences marked as M1 and M2 lead to the separation of 19 local pollen zones. Sequence M1 starts in the Late Glacial with three pollen zones showing no equivalency in sequence M2. Evidence of the anthropogenic impact in the region is present in the pollen diagrams starting with zone 11.

Zone 11: a decrease of the relative amount of hazel (*Corylus*) is compensated mainly by the relative increase of spruce fir (*Picea*) (M2h). In sequence M1 the presence of cereal pollen indicates that the human activity in the crater zone directly affected the broad-leaved trees formations, by favouring the development of spruce fir (*Picea*). This event took place 6230 ±240 years BP ago, thus during Atlantic.

The recent complex studies of the ancient crater from **Ştereş** (800 m altitude, **Gutâiului Mountains**) performed by Feurdean et al.,<sup>10</sup> Björkman et al.,<sup>11</sup> evidenced aspects of the local history of vegetation starting with Late Glacial till nowadays. Based on <sup>14</sup>C data, 19 pollinic zones were established. Human evidence in the region was noticed within zones 14–19.

Zone 14: started about 6600 years ago (near the base of zone we have a <sup>14</sup>C data at 6425 ±75 years BP) and 7500 cal. years BP, respectively. Some peaks of *Poaceae*, *Cyperaceae*, *Artemisia* and *Chenopodiaceae*, probably caused by a human influence, characterize it. The pollinic diagram is dominated by hazel (*Corylus*) and spruce fir (*Picea*), and it was noted as belonging to middle Atlantic. The previous zone marked a decrease of the ratio A.P./T., in the favour of grasses, which was present in this zone too.

<sup>8</sup> M. Rösch – E. Fischer: A radiocarbon dated Holocene pollen profile from the Banat mountains (South-western Carpathians, Romania). *Flora* 195 (2000) 277–286.

<sup>9</sup> I. Tanţău – M. Reille – J. L. de Beaulieu – S. Fărcaş – T. Goslar – M. Paterne: Vegetation history in the Eastern Romanian Carpathes: pollen analysis of two sequences from the Mohoş crater. *Vegetation History and Archaeobotany* 12 (2003) 113–125.

<sup>10</sup> A. Feurdean – L. Björkman – B. Wohlfarth: A paleoecological reconstruction of the Late Glacial

and Holocene based on multidisciplinary studies at Ştereş site (Gutâi Mts., NW Romania). *SUBB Geologia* 46 (2001) 125–140.

<sup>11</sup> S. Björkman – A. Feurdean – B. Wohlfarth: Late-Glacial and Holocene forest dynamics at Ştereş in the Gutâiului Mountains, Northwest Romania. *Review of Palaeobotany and Palynology* 124 (2003) 79–111.



### The Subboreal

In zones 3, 4 and 5 in **Căpățâna**, the *Fabaceae* pollen appears in the spectra, while *Artemisia* pollen disappears. Singular presence of the walnut tree (*Juglans*) pollen is worth to mention. Concerning the arboreal taxa, *Picea* registers some abrupt oscillations. *Carpinus* shows an increasing trend, while *Corylus* a decreasing one.

In **Semenic 1**, zones 3, 4 and 5 (a, b) represent the Subboreal age (early, middle and late Subboreal). Zone 4 has a  $^{14}\text{C}$  data at  $3880 \pm 60$  years BP. The forest dynamics marks significant changes, induced by climate and other factors, possible anthropogenic. First evidence of the carrot (*Daucus carota*) and of the hemp (*Cannabis type*) pollen appears in zone 3, while the walnut tree (*Juglans*), cereal crops (*Cerealia*), wheat (*Triticum*), barley (*Hordeum*), *Polygonum aviculare* and *Conium* pollen appears in zone 5. All these show the presence of different farming types and of the culture weeds. The other herbaceous families and taxa which were pointed out in the previous zone were maintained in zone 5, too.

**Tăul Zănoğlu** (1840 m altitude, **Retezatului Mountains**) represents a reference site for palynological studies in Romania. It was first investigated by Pop et al.<sup>12</sup> Recently, Fărcaș et al.<sup>13</sup> who obtained new data supported by accurate  $^{14}\text{C}$  ages. Based on the 11 age measurements and on pollen spectra, the authors separated 9 pollen zones. Due to the high altitude in the sub-alpine level, as well as to the specific mountain landscape, the anthropogenic indicators are not very evident and abundant in the diagram. They are present only in the three uppermost zones.

Zone 7: Its base was dated at  $6645 \pm 65$  years B.P. (uncalibrated age). The first signs of human impact can hardly be noticed within the  $5730 \pm 60$  years B.P. and  $5275 \pm 55$  years B.P. interval, after the debut of the hornbeam (*Carpinus*) expansion, that was typical for Subboreal. Several peaks of various grass taxa such as *Poaceae*, *Artemisia*, *Asteroidae*, *Rumex* and *Apiaceae* can be noticed in the pollen diagrams.

Some cereal taxa were noticed in the spectra from **Mohoș**, starting with the optimum stage for hornbeam (*Carpinus*) and during the whole beech (*Fagus*) phase. Their pollen is usually accompanied by *Plantago* pollen, *lanceolata* type (local zones 17, 18, and 19), which is another anthropogenic indicator taxon.

**Iezerul Căliman** (1650 m altitude) is the most representative palynological case study in **Căliman Mountains** (Fărcaș et al.<sup>14</sup>). Its location is significant for the postglacial dynamics of trees, their occurrence and expansion, as well as for the interpretation of their migration from the glacial refuges. The diagram from **Iezerul Căliman** was separated into 8 pollinic zones, based on the curves of the main taxa and on the  $^{14}\text{C}$  data. As in the case of other investigated sites, the human impact becomes visible starting with pollinic zone 4, attributed by using  $^{14}\text{C}$  ( $4200 \pm 100$  to  $4010 \pm 90$  years BP, uncalibrated age) to Subboreal.

Zone 4: the first anthropogenic proofs occur at this level, being represented by the sporadic presence of the walnut tree (*Juglans*) pollen, by the *Poaceae* pollen that registers a modest peak, as well as by a more significant evidence of the *Rumex* pollen.

At **Șteregoiu**, zone 15 has an uncalibrated radiometric age of  $3680 \pm 70$  years BP (4000–4,500 cal. years BP), indicating the middle Subboreal age. Some sparse grains of *Plantago lanceolata* begin to appear in this zone.

### The Subatlantic

In **Apuseni Mountains (Ic Ponor)**, in the rest of pollen zones (9 towards the surface), an increase in amount of pine (*Pinus*) and birch (*Betula*), pioneer species that follow the massive clearances of spruce fir (*Picea*) forests, can be noticed. Hornbeam (*Carpinus*) and beech

<sup>12</sup> E. Pop – V. Lupșa – N. Boșcainu: Diagrama sporopolinică de la Tăul Zănoğlu (Munții Retezat), în: Progrese în palinologia românească. București 1971, 219–225.

<sup>13</sup> S.Fărcaș – J.-L. de Beaulieu – M. Reille – Gh. Coldea – B. Diaconeasa – C. Goewry – Th. Goslar –

T. Jull: First  $^{14}\text{C}$  datings of Late Glacial and Holocene pollen sequences from Romanian Carpathes. Comptes Rendus Acad. Sci. Paris, Sciences de la vie 322 (1999) 799–807.

<sup>14</sup> Ibidem 803.



(*Fagus*) register in this area their absolute maxima within the analyzed sequences, while towards the surface their curves decrease. In the pollen diagram of sequence 1 the first grains of walnut tree (*Juglans*) pollen are also present. The end of this zone registers the strong decrease of the A.P./T. ratio in the favour of grasses. The relative regression of trees reflects the anthropogenic destruction of forests at all the altitudes.

The *Poaceae* and *Chenopodiaceae* pollen registers an increasing trend in both sequences. The pollen of *Artemisia*, *Centaurea cyanus*, *Rumex*, *Cannabis* sp., *Urticaceae*, *Plantago lanceolata* (very characteristic in sequence 1), and *P. coronopus*, as well as some cereal grains (*Cerealia*) and one single, isolated occurrence of rye (*Secale*) are present in sequence 1. It is worth to mention the sudden occurrence and the peak of *Onobrychis* pollen, a fodder leguminous plant.

In Căpățâna, zone 7 has an uncalibrated radiometric age of  $2080 \pm 90$  years BP, indicating the early Subatlantic period. Single occurrences of the walnut tree (*Juglans*) and cereals pollen are compensated by constant values of pollen belonging to various herbal families with anthropogenic significance. As an exception, the *Poaceae* pollen registers a slight increase.

The base of zone 8 indicated a  $^{14}\text{C}$  age of  $2180 \pm 200$  years BP, which is doubtful in our opinion. The dynamics of competition between arboreal taxa is characterized by coupled evolutions of spruce fir (*Picea*) and fir tree (*Abies*), in opposition with beech (*Fagus*). The presence of the walnut tree (*Juglans*) pollen becomes more noticeable, while cereal pollen is totally absent in this local pollen area.

In zone 9, the decline of the fir tree (*Abies*) and beech (*Fagus*) curves, correlated to the increase of pine (*Pinus*) and birch (*Betula*) ones suggest more intense anthropogenic processes connected to forest grazing and clearance. The increasing trend of the *Poaceae*, *Cyperaceae* and *Ranunculaceae* curves plead for the same factor.

Zone 10 was dated at  $290 \pm 120$  years BP in its base (Late Subatlantic). The reversed ratio between the decline of the spruce fir (*Picea*) curve – due to economic activities, and the increase of the birch (*Betula*), pine (*Pinus*) and alder (*Alnus*) curves – due to human impact is clearly visible in the pollen spectra. In the surface horizon the revival of spruce fir (*Picea*), favoured by anthropogenic plantation is worth to mention. In the same area, the pollen of cereals becomes more significant, as a result of agricultural activities, but also of the presence of the *Rumex* and *Plantago lanceolata* pollen.

In **Semenic 1**, zone 6 (a, b, c, d) covers the early and middle Subatlantic, based on  $^{14}\text{C}$  data at  $2560 \pm 110$  years B.P. and  $1260 \pm 20$  years BP. Families and taxa of grasses and herbs remain the same as in the previous zone.

Zones 7 (a, b, c), 8 (a, b) and 9 (a, b) belong to the late Subatlantic age. In zone 7 the carrot (*Daucus carota*) pollen disappears completely; the rye (*Secale*) pollen shows its first evidence; the *Poaceae* curve increases almost until the end of this sub-zone.

In zone 8 the pine (*Pinus*) curve shows a slight increase that will continue in the next zone, too; the beech (*Fagus*) pollen reaches a new maximum; *Plantago lanceolata* curve marks a slight increase, while the *Poaceae* curve shows its maximum in the pollen diagram of this zone.

A strong human influence on the arboreal taxa appears in the pollen spectra of zone 9. The pine (*Pinus*) and hazel (*Corylus*) curves intensely increase, as compared to the previous zones. The mixed oak (*Quercetum mixtum*) and spruce fir (*Picea*) curves show a slight increase. All these increases are correlated with the regression of the beech (*Fagus*) and fir tree (*Abies*) curves in the latest sub-period (9 b).

Concerning the herbal taxa, some of them gradually disappear in the pollen diagram of zone 9 (e.g. some cereal crops, *Urticaceae*, *Rumex*, *Plantago major*, *Apiaceae*, *Brassicaceae* etc.). On the contrary, other taxa mark their maximum percentages (e.g. *Plantago lanceolata* and *Cichorioideae*), while the *Poaceae* pollen maintains its high values.

In **Tăul Zănoaguții**, the base of zone 8 is marked by the increase of the beech (*Fagus*) curve. The rapid changes suggest the presence of a hiatus, confirmed by the ages for the 150–155 cm level. A lack of sedimentation for about 2000 years made dating of regional



spreading of beech (*Fagus*) impossible. Here it is associated with a low but continuous curve of fir tree (*Abies*). Concerning anthropogenic indicators, they continue pollen zone 7 with the previously mentioned taxa. In addition, a slow but continuous increase of the pine (*Pinus*) curve, that will register a significant peak in the basal part of next zone, can be interpreted as a human contribution.

Zone 9: The radiometric age ( $315 \pm 50$  years BP) corresponds to the late Subatlantic, and it marks the beginning of the decline of the beech (*Fagus*) curve in the pollen diagram. This corresponds to a peak of spruce fir (*Picea*). The pine (*Pinus*) revival is noticeable till the surface levels, where a slight birch (*Betula*) maximum can be also recorded. Hornbeam (*Carpinus*) progressively decreases towards the surface. This dynamics of arboreal taxa is clearly determined by anthropogenic factors, as a consequence of broad-leaved trees clearance for economic purposes, and their replacement with spruce fir (*Picea*) and pine (*Pinus*). In the same time, birch (*Betula*) can be considered as a pioneer species on the areas submitted to clearance. Additionally, human impact is documented in the region by the presence of walnut tree (*Juglans*), and chestnut tree (*Castanea*) pollen; even if isolated and relatively scarce, it indicates the presence of plantations at significantly lower altitudes.

Among grasses, *Rumex*, as well as *Asteroidae*, *Apiaceae* and especially *Poaceae* families show a pronounced development in this local pollen zone. Constant amounts of *Artemisia* and *Chenopodiaceae* were also recorded.

In **Mohoș** in zone 17, the absolute domination of beech (*Fagus*), exceptionally decreasing below 50% can be mentioned. The beech (*Fagus*) optimum lasted at least 20 centuries, between around  $2910 \pm 90$  years BP, till at least  $900 \pm 150$  BP. As in other parts of Europe, human activities caused the successful evolution and the propagation of beech (*Fagus*). Grasses are less abundant in this pollinic zone, but the local agricultural impact is proved in M1m by the regular occurrence of cereal pollen (mainly *Secale*) and *Plantago lanceolata* type.

Zone 18: The age of the base of this zone (M1n) was estimated at  $540 \pm 160$  years BP, synchronous with the first records of the walnut tree (*Juglans*) pollen. After that, the regional perturbations became evident, proved by the sharp relative decrease of the beech (*Fagus*) percentages in zone M2o (or by fluctuating relative amounts in zone M1n), accompanied by the sensitive increase of the pine (*Pinus*) percentages. Beech (*Fagus*) decline starts to be noticed at the end of this zone. The modest increase of the pine (*Pinus*) curves is a consequence of the anthropogenic clearances, which favour the occurrence of this opportunistic pioneer taxon at a regional scale. The walnut tree (*Juglans*) and cereals pollen is regularly present.

Zone 19: signs of agricultural optimum mark this modern zone. The corn (*Zea*) pollen is present in all the spectra of M1o zone, as well as the walnut tree (*Juglans*), various cereals, and *Secale* pollen. The proportion of beech (*Fagus*) brutally decreases sometimes below 20%, that of birch (*Betula*) and spruce fir (*Picea*) showing a slight increase. It is the only zone where the relative amount of A.P. (arboreal pollen) is always below 80%.

In **Iezerul Căliman**, in zone 5, dated between  $3240 \pm 100$  and  $2780 \pm 200$  years BP, the decrease of the hornbeam (*Carpinus*) curve is correlated to the increase of the beech (*Fagus*) curve and to the decrease of the spruce fir (*Picea*) curve. The correlation between the hornbeam (*Carpinus*), and spruce fir (*Picea*) sharp decline with the steep increase of pine (*Pinus*) and the relatively moderate one of birch (*Betula*) towards the end of this zone can be interpreted as a result of human impact due to forest grazing and clearance. Another argument is also the A.P./T. ratio, which shows an increase of N.A.P. values. However, the whole zone is characterized by the increase of the *Poaceae*, *Asteroidae* and *Rumex* curves.

The last three zones, 6, 7 and 8 belong to Subatlantic, as proved also by the age of  $2780 \pm 200$  year BP measured in the base of local pollen zone 6. The main feature of zone 6 is the increase of the pine (*Pinus*) curve, with the corresponding change of the A.P./T. ratio in the favour of A.P. The cause is probably the development of *Pinus mugo*, favoured by the clearance of the spruce fir (*Picea*) forest in the view of pastoral usage. Not only the spruce fir curve, but also those of beech (*Fagus*) and hornbeam (*Carpinus*), and that of *Poaceae* seem to be affected by the *Pinus mugo* peak.



Zone 7: is differentiated from the previous one by a pronounced decline of *Pinus mugo*, correlated to the relative increase of other arboreal taxa (beech, hornbeam, spruce fir, and alder), and that of the grasses, represented by *Poaceae*, *Asteroidae* and *Cyperaceae* families. It may be that the intended destruction of *Pinus mugo* (probably by firing) took place for extending the subalpine pastures; a similar process happened in **Căliman Mountains** also close to nowadays, this time for the medical-pharmaceutical usage of *Pinus mugo* by extraction of its etheric oils. The relative decrease of *Pinus mugo* curve allows a better distinction of the participation of other trees, located at lower altitudes (mountain and hill stages).

Zone 8: the transition between zones 7 and 8 was dated by using  $^{14}\text{C}$  at  $1710 \pm 240$  years BP. The pollinic trends are similar to those in zone 6, the *Pinus mugo* curve showing a sharp increase up to about 50%, correlated to a relative decline of all the other arboreal taxa. Towards the surface (at 40 cm depth) in the last analyzed horizon, a new regression of *Pinus mugo* is accompanied by the relative increase of spruce fir (*Picea*) and fir tree (*Abies*) – the latest recording here its maximum, even if represented by low values (about 5%). Walnut tree (*Juglans*) sporadically shows low values starting with zone 4.

The A.P./T. ratio changes according to the evolution of the *Pinus mugo* curve, from a decrease in the transitional zone to an increase towards the surface. This involves also a slight increase of the curves of *Poaceae* family and the restoration of the *Artemisia* and *Chenopodiaceae* pollen, with syncopated curves even in these last local pollen zones. However, the landscape suggested by the pollen diagram of the last analyzed horizon (40 cm depth) matches the present-day image in the surroundings of **Iezerul Căliman**, where among clusters of *Pinus mugo*, flocks of sheep accompanied by shepherds can be frequently seen.

In **Șteregoiu** zone 16 was delimited on the base of two  $^{14}\text{C}$  data ( $3130 \pm 75$  years BP and  $2100 \pm 75$  years BP), which reveal the Subboreal – Subatlantic transition. The strong decrease in the spruce fir (*Picea*) and hazel (*Corylus*) curves is accompanied by an increase of the beech (*Fagus*) and hornbeam (*Carpinus*) curves. Single pollen grains of *Plantago lanceolata*, *Rumex acetosa/R. acetosella* and *Urtica* can be interpreted as signs of local human influence on the vegetation.

Zone 17: was dated towards its ending at  $1180 \pm 75$  years BP (1270–950 cal. years BP), corresponding to middle Subatlantic. The beech (*Fagus*) curve reveals an increasing trend, while the hornbeam (*Carpinus*) one decreases. Human influence in this zone becomes strongly evident by the *Poaceae* peak, as well as by the first evidence of the rye (*Secale*) pollen.

Zone 18: marks the maximum value of the beech (*Fagus*) pollen. As pioneers of deforested lands, birch (*Betula*) and hazel (*Corylus*) manifest a slight increase, anthropically induced. *Secale*, *Plantago lanceolata* and *Artemisia* become more frequent in this zone.

Zone 19: started about 200 years ago, as indicated by the  $^{14}\text{C}$  data of  $90 \pm 75$  years BP and 280–170 cal. years BP, respectively. A dense forest developed, dominated by beech (*Fagus*) with more than 75% participation. Some changes are noticeable in the structure of the forest in this zone. Hornbeam (*Carpinus*) becomes less common, hazel (*Corylus*) shows a slight increasing trend, being probably favoured by the human influence. This represents the first stage when the pollinic spectra from Șteregoiu reflect a more significant anthropogenic impact.

The first proofs of cultivated cereal crops (*Hordeum* and *Secale*) are relatively minor, but the diagram contains other typical anthropogenic indicators pleading for the presence of various cultivated lands, pastures and fallow lands (*Juglans*-type, *Poaceae* >40 $\mu\text{m}$ , *Plantago lanceolata*, *Chenopodiaceae*, *Rumex acetosa/acetosella*, *Artemisia*, *Cannabis*-type, *Urtica*).

As shown by the authors, some of these pollen types were present also in earlier stages in the pollen diagram from Șteregoiu but in minor amounts, while in the latter one, they show an increasing trend. Thus, the relative increase of the *Poaceae* <40 $\mu\text{m}$  and *Artemisia* pollen may signify an open vegetation in expansion, used for grazing. Even nowadays, as mentioned by the authors, this open vegetation – including forest is used for this purpose, while the vegetation of mires dominated by *Poaceae* provides the hay used as food for animals.



The authors conclude that around 1000 cal. years BP the forest grazing practice was introduced, as suggested by the regular presence of *Plantago lanceolata*, while around 300 cal. years BP evidence for arable lands at lower altitudes can be found.

### Conclusions

Even man was present in the studied regions since the beginning of the Atlantic period, his influence on the environment in this period was quite weak and hard to identify by pollen analyses.

As mentioned in Table 1, the earliest signs of human impact on the studied sites can be dated at about 7000 years BP (Ic Ponor). Chronologically, these palynological data are consistent with the numerous archaeological data for the 8000–6000 years BP interval in the Balkans<sup>15</sup>, as well as with the oldest <sup>14</sup>C data for the Neolithic age in northern Balkans (7500–7000 years BP).<sup>16</sup>

During Subboreal, the human intervention multiplied without an amplification.

In Romania, as in many other regions in Europe, human activity was one of the factors that favoured the beech expansion and propagation during Subatlantic.<sup>17</sup> The last part of the Subatlantic is the optimum period for agriculture and grazing.

<sup>15</sup> K. J. Willis: The vegetational history of the Balkans. Quaternary Science Reviews 13 (1994) 769–788.

<sup>16</sup> K. J. Edwards – P. Halstead: The Neolithic transition in the Balkans – archaeological perspectives and palaeoecological evidence:

a comment on Willis and Bennett. The Holocene 6 (1996) 120–122.

<sup>17</sup> H. Küster: The role of farming in the Postglacial expansion of beech and hornbeam in oak woodlands of central Europe. The Holocene 7 (1997) 239–242.

## FOSSIL INSECTS AND THE NEOLITHIC: METHODS AND POTENCIAL

The *Insecta*, or *Hexapoda* (= 6 legs), belong to the phylum *Arthropoda*, characterised by having an external skeleton composed at least in part of chitin, a complex polysaccharide,<sup>1</sup> which can be remarkably resistant to decay. They are found in all habitats from the edge of the sea to snow patches on the highest peaks, often in profusion. It is therefore not surprising that they are the most frequent fossils of multicellular animals found in terrestrial and fresh to brackish water deposits belonging to the last two million years, the Quaternary.<sup>2</sup> Their multifarious forms mean that the fossils often show a wide range of diagnostic attributes, which allow identification, often down to the species level. Such would not be important but for the facts that many individual species have unique habitat requirements and that there is little evidence for evolutionary change, both morphological and physiological, during the Quaternary.<sup>3</sup> Faced with the stresses of changing climate and environment, species have shifted their distributions, unless trapped in the isolation of mountain top or oceanic island, where change or extinction was the only option. The identifiable parts of insects, found fossil, range from the head capsules of larval midges (*Diptera*, *Chironomidae*),<sup>4</sup> through individual mandibles of the larvae of the alder fly (*Sialis* sp.), the puparia of flies (*Diptera*) to the robust exoskeletal units of the true bugs (*Homoptera*) and beetles (*Coleoptera*). Because of the accumulated knowledge of morphology, habitat and distribution, it is the latter group which has been most exploited in archaeological interpretation, although the *Diptera* have recently been shown to have considerable potential, particularly in the archaeological context.<sup>5</sup>

Any anaerobic context is likely to preserve insect remains and preservation can be equally good within high latitude and high altitude frozen ground<sup>6</sup> as within the thoroughly desiccating conditions of deserts and the desert fringe.<sup>7</sup> In temperate Europe, however, faunas have mostly been recovered from peats<sup>8</sup> and other natural organic sediments, from alluvial silts<sup>9</sup> to lacustrine deposits,<sup>10</sup> or from waterlogged archaeological contexts, either wells<sup>11</sup> or pits.<sup>12</sup> The one neolithic well so far examined for its insect fauna, at Kolhorn in the Netherlands, has produced a rather restricted fauna.<sup>13</sup> Occasionally charring, as the

<sup>1</sup> A. D. Imms: Insect natural history. London 1971.

<sup>2</sup> Elias 1994.

<sup>3</sup> G. R. Coope: Insect faunas in ice age environments: why so little extinction? in: J. H. Lawton – R. M. May: Extinction Rates. Oxford 1995, 55–74.

<sup>4</sup> W. Hofmann: Chironomid analysis, in: B. E. Berglund: Handbook of Holocene Palaeoecology and Palaeohydrology. Chichester 1986, 715–727; W. Hofmann: Late-Glacial/Holocene succession of the chironomid and cladoceran fauna of the Soppensee (Central Switzerland). Journal of Paleolimnology 25 (2001) 411–420.

<sup>5</sup> Panagiotakopulu, in press

<sup>6</sup> P. C. Buckland – P. I. Buckland – P. Skidmore: Insect remains from GUS: an interim report, in: J. Arneborg – H. C. Gulløv: Man, Culture and Environment in Ancient Greenland. Copenhagen 1999, 74–79.

<sup>7</sup> Panagiotakopulu 2001a.

<sup>8</sup> e.g. N. Whitehouse: Mire ontogeny, environmental and climatic change inferred from fossil beetle

successions from Hatfield Moors, eastern England. The Holocene 14 (2004) 79–93.

<sup>9</sup> D. N. Smith – A. J. Howard: Identifying changing fluvial conditions in low gradient alluvial archaeological landscapes: can Coleoptera provide insights into changing discharge rates and floodplain evolution? Journal of Archaeological Science 31 (2004) 109–120.

<sup>10</sup> S. J. Brooks – H. J. B. Birks: Chironomid-inferred air temperatures from Lateglacial and Holocene sites in north-west Europe: progress and problems. Journal of Quaternary Science 20 (2000) 1723–1741.

<sup>11</sup> Osborne 1969.

<sup>12</sup> M. Hellqvist: Insect assemblages from Iron Age wells in Central Sweden. Norwegian Archaeological Review 32 (1999) 1–18.

<sup>13</sup> T. Hakbijl – J. P. Pals – C. D. Troostheide: Plant and insect remains from the Late Neolithic well at Kolhorn. Palaeohistoria 31 (1989) 157–163.



assemblages from beneath the tephra of Santorini (Thera) in the Aegean<sup>14</sup> or in the disposal of stored product residues<sup>15</sup> may lead to preservation of insect remains, and in situations of high free phosphate content, as in cesspits specimens may be ‘calcified’.<sup>16</sup> Casts within voids in deposits may also occur.<sup>17</sup> Research upon insects from natural Quaternary and archaeological deposits has largely been developed in England, and it is inevitable that this discussion will focus upon work carried out there.

### *Recovery of insect remains*

Until the development of an efficient paraffin (kerosene) flotation technique by Coope and Osborne,<sup>18</sup> insect remains were recovered either by splitting sediment along bedding planes and searching surfaces for identifiable sclerites or by complete disaggregation of samples and sorting under a low power binocular microscope in either water or alcohol. Splitting inevitably leads to bias in favour of the larger and/or more colourful individuals, and sorting of entire samples, even if disaggregated beforehand, can be particularly time consuming. Coope and Osborne’s technique, sometimes with slight variations<sup>19</sup> has become standard for the recovery of insects from waterlogged samples, although it has the disadvantage that sclerites become disassociated, increasing the difficulties in identification. In the field, samples of at least 5 litres are recovered from each suitable stratigraphic context into polythene bags and labelled and sealed. Sample size may vary as to the nature of the deposits, and a single kilogram of deposit from a well may be sufficient to produce an extensive fauna. Stratigraphic successions with little apparent change are usually sampled in 50 or 100 mm slices, depending upon the degree of resolution required. Well sealed samples will survive in storage for several years in a cold, dark room, but storage at +3°C in a cold store is recommended, since materials slowly dry out and algal growth occurs in daylight. Processing has the advantage of being cheap in terms of materials, if sometimes slow. Samples are disaggregated in hot water and washed out over a 300 µm mesh sieve. The more indurated sediments may need breaking down with a suitable deflocculant, usually washing soda (sodium carbonate) or calgon (sodium hexametaphosphate), although occasionally hot caustic soda (sodium hydroxide) solution may be employed for the most intransigent materials. Insect remains, however, may be corroded by strong alkalis, and their use must be carefully monitored. There is often a trade-off between care in initial sample processing and ease of identification of the recovered remains: the more fragmented through rough handling the more difficult the identification. Having thoroughly desegregated the material and picked out large items from stone and pottery to twigs and hazelnuts, the material on the sieve is drained of surplus water, returned to the bowl or bucket in which the sample was first broken down, and ordinary commercial paraffin (kerosene) added, sufficient being employed to wet thoroughly the material. The light oil adsorbs onto the surface of the insect cuticle, and when cold water is added and the mix vigorously stirred, a flotant is formed, which is rich in insect remains. The float is then poured off into the sieve, washed with liquid detergent and alcohol, and stored in alcohol. The process of flotation

<sup>14</sup> E. Panagiotakopulu – P. C. Buckland: Insect pests of stored products from Late Bronze Age Santorini, Greece. *Journal of stored Product Research* 27 (1991) 179–184.

<sup>15</sup> cf. P. J. Osborne: Stored product beetles from a Roman site at Droitwich, England. *Journal of stored Product Research* 13 (1977) 203–204.

<sup>16</sup> *Girling 1979*; see also M. A. Robinson: Insects as palaeoenvironmental indicators, in: D. R. Brothwell – A. M. Pollard: *Handbook of archaeological sciences*. Chichester 2001, 121–133.

<sup>17</sup> cf. E. Panagiotakopulu – P. C. Buckland – P. Day – C. Doumas – A. Sarpaki – P. Skidmore: A lepidopterous cocoon from Thera and evidence for silk in the Aegean Bronze Age. *Antiquity* 71 (1997) 420–429.

<sup>18</sup> G. R. Coope – P. J. Osborne: Report on the Coleopterous Fauna of the Roman Well at Barnsley Park, Gloucestershire. *Transactions of the Bristol and Gloucestershire Archaeological Society* 86 (1968) 84–87.

<sup>19</sup> e.g. G. R. Coope: (1986). *Coleoptera analysis*, in: B. E. Berglund: *Handbook of Holocene Palaeoecology and Palaeohydrology*. Chichester 1986, 703–713; Elias 1994; H. K. Kenward – A. R. Hall – A. K. G. Jones: A tested set of techniques for the extraction of plant and animal macrofossils from waterlogged and archaeological deposits. *Science and Archaeology* 22 (1980) 3–15.



is usually repeated three times, although if the final float still has significant numbers of identifiable fragments, it may be necessary to repeat the additions of water until no further insects are recovered. Unfortunately floats are rarely purely of insect sclerites, and it usually necessary to sort the fragments out from a mass of plant remains. Occasionally, this has the advantage that a reasonable, if unquantifiable sample of identifiable plant macrofossils, largely seeds, is also obtained. Long term storage in alcohol is usually acceptable, but corrosion of sclerites has been noted where methanol has been used, and the material added to industrial alcohol to make it unpalatable can also result in erosion of chitin. Drying, however, often results in specimens curling up or breaking along lines of thinner chitin, although freeze-drying may alleviate these problems.

Insects either preserved by desiccation or by charring, do not respond well to wetting, and will fragment. This means that such samples cannot be treated by the paraffin flotation method. Both require sorting of the entire sample, and storage in dry conditions. This material has the advantage that individual sclerites may remain articulate, easing some of the problems of identification.

Whilst there are good keys for the identification of European *Coleoptera*,<sup>20</sup> and *Diptera*, these normally require complete specimens, often utilising elements such as variations in antennal or tarsal segment length to differentiate species. In addition, many species, particularly of the smaller taxa, such as the commonly occurring *aleocharine staphylinids* amongst the *Coleoptera*, require careful examination of the genital armature (*aedeagus*) to secure identification. Fossil material is usually identified by direct comparison with modern reference material, and this requires access to full collections for the region involved, although it should also be noted that even on the historical timescale species may have substantially changed their distribution. The development of the BUGS database provides habitat and distribution data on much of the European *coleopterous* fauna, as well as listing the Quaternary fossil record for each species.<sup>21</sup> It has made the processes of site interpretation somewhat easier, but the work is still time consuming and, in comparison with palynology and plant macrofossil studies, there are few practitioners. The combination of these techniques with the study of the contemporary insect fauna makes them much more powerful tools.

### *Insects and climate*

The first modern studies of fossil insects from Quaternary sediments were carried out by Russell Coope and F. W. Shotton of the University of Birmingham, England. They had noticed well preserved beetle remains on the bedding planes of a thin layer of peat within mid-Weichselian (Würm) sands and gravels at Upton Warren in Worcestershire, and Shotton had immediately seized upon these as a possible means of zoning the Pleistocene. His reasoning was that most entomologists believed that insects belonged to a rapidly evolving group and would show rapid morphological variation through time. Coope was more circumspect and doggedly matched the material with existing species,<sup>22</sup> a process which he repeated at the Early Weichselian site of Chelford in Cheshire.<sup>23</sup> One species defied identification, a dung beetle, *Aphodius* sp. A, which was later recovered from several mid-Weichselian sites over then years later was matched with a species, *A. holdereri*, found on the high Tibetan plateau.<sup>24</sup> The Upton Warren faunas defined a temperate interlude in the middle of the last glaciation, and the contrast between a relatively thermophilous beetle fauna and an open landscape as

<sup>20</sup> e.g. H. Freude – K. W. Harde – G. A. Lohse: Die Käfer Mitteleuropas. Krefeld 1963–1989.

<sup>21</sup> P. I. Buckland – P. C. Buckland: How can a database full of Bugs help reconstruct the climate? in: G. Burenhult – J. Arvidsson: Archaeological informatics: pushing the envelope. CAA 2001. Computer applications and quantitative methods in archaeology. Proceedings of the 29<sup>th</sup> conference, Gotland, April 2001. BAR IntSer 1016 (2002) 453–462; [www.bugs2000.org](http://www.bugs2000.org)

<sup>22</sup> G. R. Coope – F. W. Shotton – I. Strachan: A Late Pleistocene fauna and flora from Upton Warren, Worcestershire. Philosophical Transactions of the Royal Society of London B244 (1961) 379–421.

<sup>23</sup> G. R. Coope: A Late Pleistocene insect fauna from Chelford, Cheshire. Proceedings of the Royal Society of London B151 (1959) 70–86.

<sup>24</sup> G. R. Coope: Tibetan Species of Dung Beetle from Late Pleistocene Deposits in England. Nature 245 (1973) 335–336.



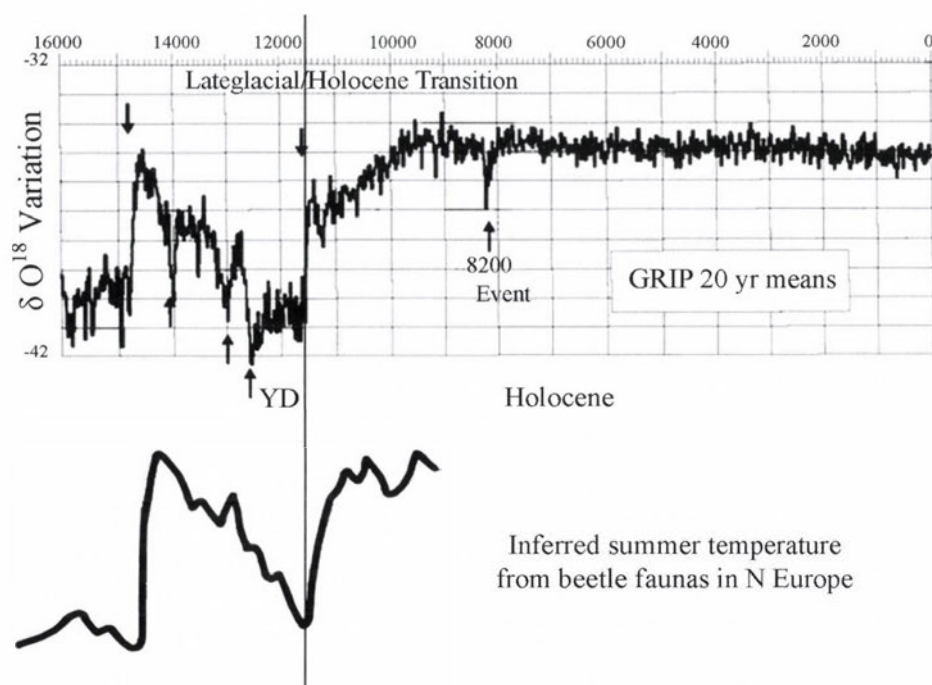


fig. 1. Climate curve as derived from the GRIP Ice Core in Greenland, compared with the Lateglacial to Early Holocene North European Coleopteran curve

indicated by the pollen provoked some discussion. The controversy was further fuelled when beetle evidence from sites at Red Moss, Lancashire,<sup>25</sup> Rodbaston, Staffordshire,<sup>26</sup> Church Stretton, Shropshire<sup>27</sup> in England and Glanllynau, Gwynedd, in Wales<sup>28</sup> all indicated that the climatic transitions during the Lateglacial and into the Early Holocene were not gradual processes of warming over hundreds if not thousands of years, but were abrupt changes from high arctic to warmer than present day at *ca.* 13 500 BP. It had been cooling to subarctic and then arctic conditions, followed by precipitate warming at *ca.* 10 000 BP to at least as warm as present day at the opening of the Holocene. Osborne's<sup>29</sup> well dated and closely sampled succession at West Bromwich, near Birmingham, indicated that the last abrupt change into the present interglacial took less than the standard deviation of a radiocarbon date, and in less time than sample resolution would allow, probably less than forty years. This pattern has been repeated at several sites, not only in the British Isles but also in Scandinavia.<sup>30</sup> Initially greeted with much scepticism, to the extent that one leading palynologist, who would perhaps now wish to remain nameless, talked about having to differentiate between 'pollen' and 'beetle' interstadials, the evidence from the Greenland ice cores, resolved to at least an annual record, firmly placed the interpretation on the side of the Quaternary entomologists (*fig. 1*).<sup>31</sup> The evidence from Stage 3, the period before the maximum expansion of ice sheets during the last glacial, is particularly striking. With its frequent swings from cold to temperate in the ice core record matched closely by the beetle evidence,<sup>32</sup> it should be a cause for concern

<sup>25</sup> A. C. Ashworth: A Late-glacial Insect Fauna from Red Moss, Lancashire, England. *Entomologica Scandinavica* 3 (1972) 211–224.

<sup>26</sup> A. C. Ashworth: The Climatic Significance of a Late Quaternary Insect Fauna from Rodbaston Hall, Staffordshire, England. *Entomologica Scandinavica* 4 (1973) 191–205.

<sup>27</sup> Osborne 1972.

<sup>28</sup> G. R. Coope – J. A. Brophy: Late Glacial environmental changes indicated by a coleopteran succession from North Wales. *Boreas* 1 (1972) 97–142.

<sup>29</sup> P. J. Osborne: The Late Devensian Flandrian transition depicted by serial insect faunas from West Bromwich, England. *Boreas* 9 (1980) 139–147.

<sup>30</sup> G. R. Coope – G. Lemdahl – J. J. Lowe – A. Walkling: Temperature gradients in northern Europe during the last glacial-Holocene transition (14–9 14C kyr BP) interpreted from coleopteran assemblages. *Journal of Quaternary Science* 13 (1998) 419–434.

<sup>31</sup> R. B. Alley – D. A. Meese *et al.*: Abrupt increase in the Greenland snow accumulation at the end of the Younger Dryas event. *Nature* 362 (1993) 527–529.

<sup>32</sup> Coope 2001.



for the complacency of the oil lobby and right wing governments everywhere. The Holocene interglacial has been remarkably stable since its last, short cold event at *ca.* 8200 BP,<sup>33</sup> but there is no guarantee that it will continue under increased anthropogenic pressure.

More recently the closer sample resolution available from study of the remains of the aquatic larvae of chironomids, non-biting midges from lake sediments has further refined the evidence for the precipitate nature of climate change.<sup>34</sup> This is well illustrated in the multidisciplinary study of the Lateglacial succession from the lake on Kråkenes in southwest Norway,<sup>35</sup> although sample size from cores somewhat limits the utility of the beetle evidence.

Although the ice core evidence indicates a relatively stable climate for the present interglacial between *ca.* 8200 BP and the onset of the post-medieval Little Ice Age, this does not mean that oscillations between regimes dominated by westerly and a more continental circulation pattern did not have impact. Annual average temperatures do not indicate seasonality, distribution of rainfall and storminess, all of which can have significant impact upon both insect and human communities. The record of Holocene climate available from the proxy of insect fossils has been discussed by Osborne,<sup>36</sup> Wagner<sup>37</sup> and Buckland and Wagner,<sup>38</sup> often with differing conclusions. Wagner<sup>39</sup> felt that the scale of human interference in the Late Holocene landscape was such that it was virtually impossible to dissect any climate signal from the insect record. Whilst Osborne<sup>40</sup> saw a swing towards more oceanic conditions in the Late Holocene, perhaps at the sub-Boreal sub-Atlantic transition *ca.* 850 BC, where van Geel and others<sup>41</sup> have indicated a worldwide climatic event, although its synchronicity can be doubted.<sup>42</sup> The overall patterns of extinction from the British insect fauna, with a south-eastward retreat of most species, do suggest that conditions at least as late as the Middle Bronze Age, *ca.* 3000 BP, were significantly more continental than the present day, and this applies as much to open ground assemblages, like that from Wilsford in Wiltshire<sup>43</sup> as still forested localities like Thorne Moors in south Yorkshire.<sup>44</sup> The Wilsford shaft, inevitably a ritual feature to archaeologists, but with the ritual bucket and remains of the rope for hauling up buckets of water in the bottom and an extensive dung fauna from the animals being watered at the top,<sup>45</sup> has a remarkably thermophilous coprophagous assemblage with large numbers of *Onthophagus* spp. and *Aphodius quadriguttatus*. The latter now extinct in Britain and most species of the former very rare.<sup>46</sup> A hide beetle, dermestid, from the site, *Dermestes lanarius*, which presently has an east European and Russian steppe core distribution,<sup>47</sup> is either a survivor in gaps in the mid-Holocene forest from the even more continental climate of the Early Holocene, when low sea level engendered continentality, or an

<sup>33</sup> D. Klitgaard-Kristensen – H.-P. Sejrup – H. Haflidason – S. Johnsen – M. Spurk: A regional 8200 cal yr cooling event in northwest Europe, induced by final stages of the Laurentide ice-sheet deglaciation? *Journal of Quaternary Science* 13 (1998) 165–169; W. Tinner – A. F. Lotter: Central European vegetation response to abrupt climate change at 8.2 ka. *Geology* 29 (2001) 551–554.

<sup>34</sup> S. J. Brooks: The response of Chironomidae (Insects: Diptera) assemblages to Late-Glacial climatic change in Kråkenes Lake, Western Norway. *Quaternary Proceedings* 5 (1997) 49–58.

<sup>35</sup> H. H. Birks – R. W. Battarbee – H. J. B. Birks – E. G. Bradshaw – S. J. Brooks – C. A. Duigan – V. J. Jones – G. Lemdahl – S. M. Peglar – S. M. Solem – T. Solhøy – M. K. Stalsberg: The development of the aquatic ecosystem at Kråkenes lake, western Norway, during the Late-glacial and early-Holocene – a synthesis. *Journal of Paleolimnology* 23 (2000) 91–114.

<sup>36</sup> P. J. Osborne: Some British later prehistoric insect faunas and their climatic implications, in: A. Harding: *Climatic Change in Later Prehistory*. Edinburgh 1982, 68–74; Osborne 1997.

<sup>37</sup> Wagner 1997.

<sup>38</sup> P. C. Buckland – P. Wagner: Is there an insect signal for the Little Ice Age? *Climate Change* 48 (2001) 137–149.

<sup>39</sup> Wagner 1997.

<sup>40</sup> Osborne 1997.

<sup>41</sup> B. van Geel – J. Buurman – H. T. Waterbolk: Archaeological and palaeoecological indications of an abrupt climate change in the Netherlands and evidence for climatological teleconnections around 2650 BP. *Journal of Quaternary Science* 11 (1996) 451–460.

<sup>42</sup> cf. C. van den Bogaard – W. Dörfler – R. Glos – M.-J. Nadeau – P. M. Grootes – H. Erlenkeuser: Two tephra layers bracketing Late Holocene palaeoecological changes in Northern Germany. *Quaternary Research* 57 (2002) 314–324.

<sup>43</sup> Osborne 1969.

<sup>44</sup> Buckland 1979.

<sup>45</sup> Bell *et al.* 1989.

<sup>46</sup> Osborne 1969.

<sup>47</sup> V. A. Minoranskiy: Some data on the ecology of the hide beetle *Dermestes lanarius* Illiger (Coleoptera Dermestidae). *Entomological Review* 48 (1969) 477–478.



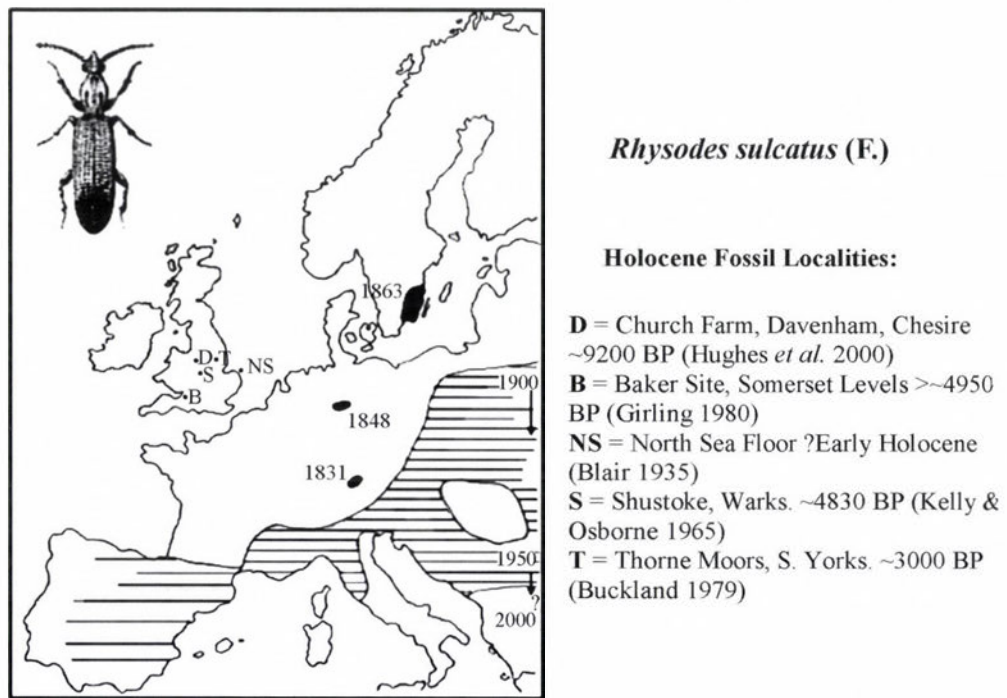


fig. 2. The declining distribution of the Urwaldrelikt *Rhysodes sulcatus* (revised from Speight 1989). Climate change, destruction of old growth forests (*Urwald*) or both?

accidental import. Even in the latter case, the site lies sufficiently far inland to suggest that the species was able to establish viable populations in the climate of Bronze Age southern England. Fossil evidence shows that over thirty species of beetle have disappeared from Britain during the Holocene.<sup>48</sup> Most of these are associated with declining woodland habitats (fig. 2), but the list is sufficiently varied to implicate climate change.

The Elm Decline, an almost synchronous event across much of northern and western Europe, marks the boundary between pollen zones VIIa and VIIb in Britain. Its origin has perhaps occasioned more discussion than any other aspect of the Holocene, largely because it is co-incident with the first clear evidence for settled agriculture in the British Isles at about 5200 BP (= ca. 3900 cal BC). Interpretation, recently reviewed by Parker and others,<sup>49</sup> has vacillated between climate change, disease and human impact. At West Heath Spa, London, the finds of the bark beetle, scolytid, *Scolytus scolytus*, the chief vector in the spread of the fungus responsible for Dutch Elm Disease, which has devastated elms across Europe over the past few decades, in deposits across the VIIa/b boundary has occasioned much discussion<sup>50</sup> and helped to revive interest in the disease hypothesis. Rowley-Conwy<sup>51</sup> had, however, already dispelled the simple model of human collection of fodder for animals by calculating the necessary population densities of humans and domestic stock for the scale of impact on the elms of mid-Holocene Denmark. Recently Bonsall and others<sup>52</sup> have

<sup>48</sup> Buckland, *in press*

<sup>49</sup> A. G. Parker – A. S. Goudie – D. E. Anderson – M. A. Robinson – C. Bonsall: A review of the mid-Holocene elm decline in the British Isles. *Progress in Physical Geography* 26 (2002) 1–45.

<sup>50</sup> M. A. Girling – J. R. A. Greig: A first fossil record for *Scolytus scolytus* (F.) (Elm Bark Beetle): its occurrence in Elm Decline deposits from London and the implications for Neolithic Elm Disease. *Journal of Archaeological Science* 12 (1985) 347–352; P. D. Moore: Hampstead Heath clue to historical decline of elms (Find of Dutch elm

disease beetle in pre-elm decline level). *Nature* 312 (1984) 103.

<sup>51</sup> P. Rowley-Conwy: Forest grazing and clearance in temperate Europe with special reference to Denmark: an archaeological view, in: M. Bell – S. Limbrey: Archaeological aspects of woodland ecology. *BAR IntSer* 146 (1982) 199–215.

<sup>52</sup> C. Bonsall – M. G. Macklin – D. E. Anderson *et al.*: Climate change and the adoption of agriculture in northwest Europe. *European Journal of Archaeology* 5 (2002) 9–23.



resurrected the climate change model as explanation for final phase of neolithic expansion which took agriculture north-westwards to the most remote islands of Scotland, after an 800 – 1300 year falter at the English Channel. Using evidence largely drawn from around Oban on the west coast of Scotland, they have suggested that a short phase of drier conditions around 4000 cal BC facilitated expansion onto soils previously too wet for cereal cultivation. Such a model is likely to be appropriate on the local scale, but it ignores the fact that much of lowland Britain has well drained soils, often based on well drained loess,<sup>53</sup> similar to those across the Channel in France and the Low Countries, and unlikely to be adversely affected by waterlogging. In addition, the insect evidence from the Somerset Levels, which they adduce to support their case,<sup>54</sup> can only be used to show that a more continental climate existed at least until the time of their deposition, and not only at that period. In fact, similar elements in the biota are still present much later. Of the two freshwater littoral ground beetles, which provide the best evidence, *Oodes gracilis* is still present in the Iron Age at Goldcliff across the Severn Estuary,<sup>55</sup> and *Chlaenius sulcicollis* occurs in the deposits around the Bronze Age Meare Heath trackway.<sup>56</sup> The implication of this and other fossil insect evidence is that the climate of the Holocene was more continental until some yet to be determined event, at the sub-Boreal sub-Atlantic transition, if not as late as the beginning of the Little Ice Age. This does not mean, however, that minor oscillations, insufficient to cause major extirpations from the beetle fauna, did not have effects upon agricultural productivity, leading to fluctuations in the degree, nature and density of human settlement. It is a truism of the farming community that what affects them is weather and not climate. In the subsistence economy, long term change can be adjusted for, the one disastrous poor summer leading to insufficient fodder for overwintering core stock and poor grain and other crop yields cannot, and starvation may be inevitable.

The Elm Decline remains enigmatic. The presence of the relevant vector is no guarantee of the presence of a sufficiently virulent strain of the disease to cause a widespread decline, and as Clark<sup>57</sup> has shown in north east Scotland, like other scolytids, *S. scolytus* is one of the many bark beetles, which form part of the natural forest assemblage through the mid-Holocene; it was not an accidental neolithic introduction to north west Europe. One point, however, is particularly relevant in that scolytid attack is not a random process and the adult beetles actively search out trees under stress, those damaged by wind throw drought or bark stripping by herbivores. Increase the level of stress, either by climate change, increased grazing pressure or other opening up of closed forest cover, and the numbers of bark beetles will increase exponentially and apparently healthy trees overwhelmed. Which species will be given the selective advantage may be purely stochastic, but its impact may be dramatic. In North America, in the absence of evidence for a significant human presence in the forests, hemlock, *Tsuga* sp, shows a precipitate decline in the mid-Holocene, apparently the result of insect attack.<sup>58</sup> In Europe, we still do not know who held the gun. Did drought open up the forest to human expansion, or did human expansion put the forest under stress leading to catastrophic insect attack? Perhaps before this question can be answered, the nature of the pre-neolithic forests themselves needs to be examined in more detail.

<sup>53</sup> J. Catt: The contribution of loess to soils in lowland Britain, in: S. Limbrey – J. G. Evans: The effect of man on the landscape: the Lowland Zone. London, Council for British Archaeology Research Report 21 (1978) 12–20.

<sup>54</sup> Girling 1979; M. A. Girling: Investigations of a second insect assemblage from the Sweet Track. Somerset Levels Papers 10 (1984) 79–91.

<sup>55</sup> D. N. Smith – P. J. Osborne – J. Barrett: Preliminary palaeo-entomological research at the Iron Age sites at Goldcliff, Gwent, Wales, 1991–1993. Quaternary Proceedings 5 (1997) 255–268.

<sup>56</sup> Girling 1982.

<sup>57</sup> S. H. E. Clark: Holocene environmental change in Northeast Scotland: a palaeoentomological approach. Unpubl. PhD, University of Sheffield 2002.

<sup>58</sup> N. Bhiry – L. Filion: Mid-Holocene hemlock decline in eastern North America linked with phytophagous insect activity. Quaternary Research 45 (1996) 312–320.



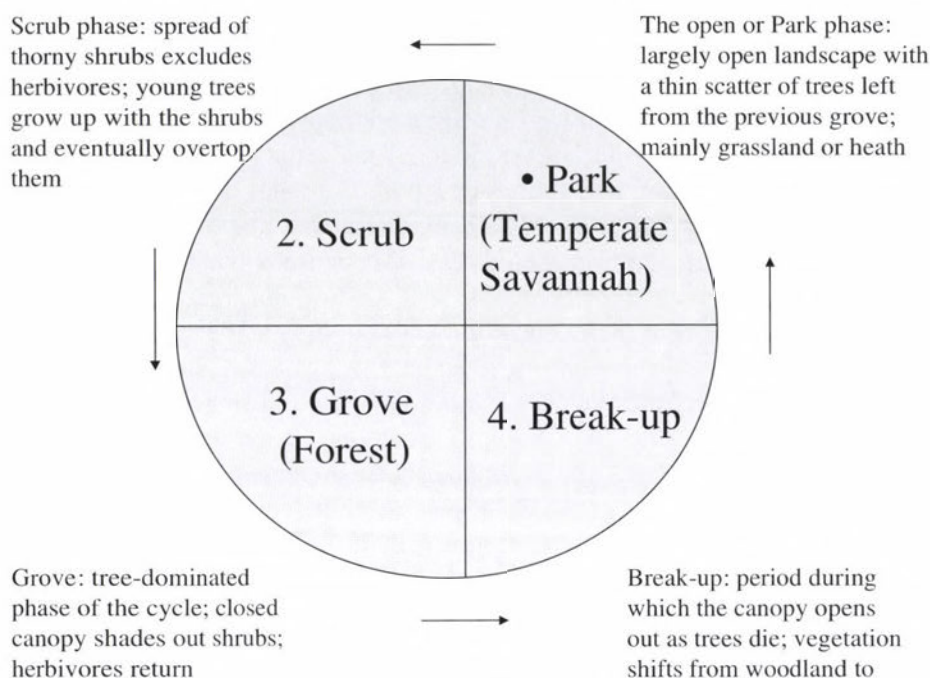


fig. 3. The Vera Model of forest succession driven by large herbivores, as modified by Kirby 2003.

### *The nature of the Urwald*

The natural 'climax' vegetation of Europe, outside the aridity of the Mediterranean zone and Steppe and below the cold of the high mountains and Arctic, is forest. Whilst there is no doubt that an overall regional picture of the composition of the vegetation is best obtained from pollen,<sup>59</sup> insects in particular provide levels of resolution not available from palynology. Osborne,<sup>60</sup> for example, had pointed out the relative frequency of the lime bark beetle, *Ernoporus caucasicus* in mid-Holocene deposits before Greig,<sup>61</sup> also working at the University of Birmingham, had re-evaluated the pollen and plant macrofossil record and suggested that much of the primary lowland woodland of western Europe had been dominated by *Tilia* rather than *Quercus*. Recent work by Frans Vera<sup>62</sup> has raised doubts over another aspect of the primary forest, the *Urwald*. His model essentially puts large herbivores back into the landscape and has implications for conservation as much as for interpreting the past. He sees a cycle in which grazing pressure leads to semi-permanent natural clearings in the woodland and a succession of pasture woodland through to mature forest with regeneration largely taking place in the margins protected from animals by the development of thorn scrub (fig. 3). It has much to commend it over the mechanistic model of progressive tree immigration from Lateglacial refugia once favoured by many palynologists,<sup>63</sup> and more recent work has re-opened the debate over just where the refuges from glacial cold and ice lay.<sup>64</sup> The idea that herbivores had a significant role in the

<sup>59</sup> Moore et al. 1991.

<sup>60</sup> M. R. Kelly – P. J. Osborne: Two faunas and floras from the alluvium at Shustoke, Warwickshire. Proceedings of the Linnean Society of London 176 (1965) 37–65.

<sup>61</sup> J. R. A. Greig: Past and present lime woods of Europe, in: M. Bell – S. Limbrey: Archaeological Aspects of Woodland Ecology. BAR IntSer 146 (1982) 23–56.

<sup>62</sup> Vera 2000.

<sup>63</sup> H. Godwin: History of the British flora: a factual basis for phytogeography. Cambridge, 1975.

<sup>64</sup> e.g. K. J. Willis: Where did all the flowers go? The fate of temperate European flora during glacial periods. Endeavour 20 (1996) 110–114; J. R. Stewart – A. M. Lister: Cryptic northern refugia and the origins of the modern biota. Trends in Ecology and Evolution 16 (2001) 608–613.

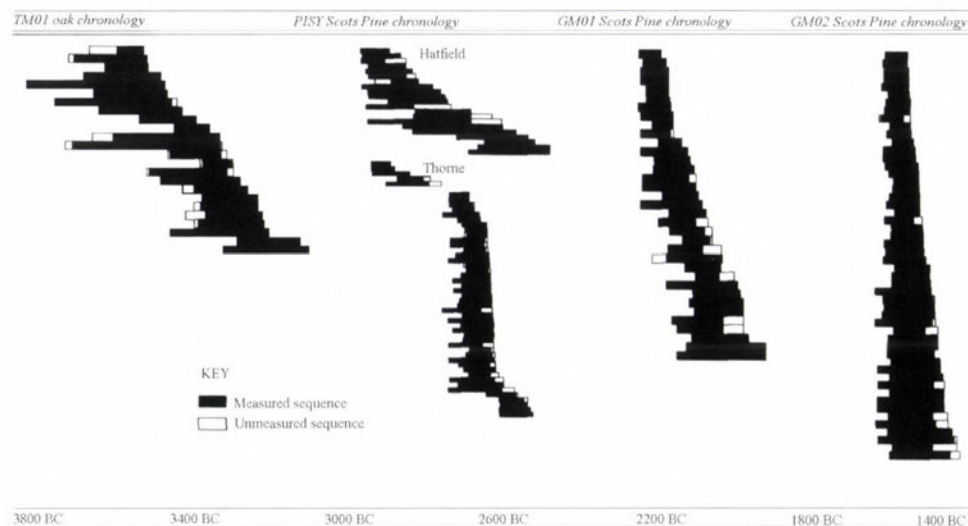


fig. 4. Dendrochronological sequence from Thorne and Hatfield Moors, S. Yorks.

The gaps in the sequence reflect phases in which peat growth expands across the pine forested bog after extensive fire (from *G. Boswijk: The buried forests of Thorne Moors. Thorne and Hatfield Moors Papers 6* [2003])

maintenance of mid-Holocene forest diversity has provoked an often hostile response,<sup>65</sup> although there have been some attempts at compromise.<sup>66</sup> The fossil insect record provides an independent check upon models derived from other palaeoecological evidence. Not only can individual species be *monophagous*, restricted, like *E. caucasicus*, to a single host plant, but also a succession of species tracks the death and decay of trees. Whilst these elements in the fauna may not be host specific, they chart the progress from death of terminal twigs to incorporation in the forest litter layer. Much of this fauna has suffered extensively at the hands not only of forest clearance but also of tidy forestry, in which dead wood was not suffered to remain on the forest floor. Species, like *Rhysodes sulcatus* (fig. 2), which lives in damp, decaying wood on the forest floor, were common in the mid-Holocene but are now approaching extinction, not regionally but totally.<sup>67</sup> Pre-neolithic forests were perhaps different from anything that survives today and both Peterken<sup>68</sup> and Vera,<sup>69</sup> for different reasons, have stressed that even those few places, like the Bielowski Forest on the Polish-Byelorussia border, held up as examples of pristine forest habitats, have not escaped some impact, be it virtual elimination of predators on the large herbivores or selective logging. Yet, viewed with the perspective of the Quaternary, the Holocene is from the beginning an atypical interglacial. The old forest fauna, having evolved in a landscape of fairly contiguous woodland in the mid-Tertiary, is broken up and re-assembled at the end and beginning of each glacial interglacial cycle. Mid-Holocene faunas, before significant neolithic impact contain the same Urwald elements as previous interglacials, be they Marine Isotope Stage 5e (= Eemian, Riss/Würm), 7, 9 (= Hosteinian, Mindel/Riss), 11 or older,<sup>70</sup> but there are differences in other elements of the faunas, which cannot be simply ascribed to biogeographic accident or climate. As Rackham<sup>71</sup> has remarked, the last interglacial (Riss/Würm) at sites like Trafalgar Square in London<sup>72</sup> and Deeping St.

<sup>65</sup> Rackham 2003.

<sup>66</sup> e.g. R. H. W. Bradshaw – G. E. Hannon – A. M. Lister: A long-term perspective on ungulate-vegetation interactions. *Forest Ecology and Management* 181 (2003) 267–280; J. C. Svenning: A review of natural vegetation openness in north-western Europe. *Biological Conservation* 7 (2002) 290–296.

<sup>67</sup> Speight 1989.

<sup>68</sup> G. F. Peterken: *Natural forests*. Cambridge 1996.

<sup>69</sup> Vera 2000.

<sup>70</sup> Buckland, *in press*

<sup>71</sup> O. Rackham: *Savannah in Europe*, in: K. J. Kirby – C. Watkins: *The ecological history of European forests*. Wallingford, CABI 1998, 1–24.

<sup>72</sup> Coope 2001.



James in Lincolnshire<sup>73</sup> look like temperate savannah rather than forest. It is probably 3 °C warmer<sup>74</sup> and with increased summer aridity, the London site perhaps did approximate to that of its host institution – it lay beneath Uganda House. The last interglacial in Britain also had other similarities with East Africa. The fauna included elephant, rhinoceros, hippopotamus, buffalo, hyena and lion, none of which returned to Central or Western Europe after the last glacial maximum.<sup>75</sup> This fauna is reflected in the extensive dung beetle faunas of Stage 5e, which not only include the alleged Sicilian endemic *Onthophagus massai*, but also an unidentified species of *Heptalaucus* of north African affinities and a *Drepanocerus*, a genus widespread in sub-Saharan Africa, but whose closest match to the fossils comes from the lowland valleys of Nepal.<sup>76</sup> The last interglacial was clearly a very different world, and such an assemblage of large game would have a major impact upon vegetation cover, not least upon floodplains. By the time neolithic farmers came to make inroads into the forests of Central Europe, earlier human impact had already had a profound impact upon its vegetation.<sup>77</sup> If the floodplain forests were as dense as both the pollen and insect evidence would seem to indicate,<sup>78</sup> it was because a very significant proportion of the large grazers and their predators had already been eradicated. The question posed by Vera's<sup>79</sup> reassessment of the nature of the Holocene forest cycle. Whether their place was taken by increased numbers of the resident large to medium sized herbivores, of aurochs, horse, elk, red deer, roe deer, wild boar and beaver, and whether these were the creators and maintainers of clearings in the forest, which the first neolithic colonists were able to move into. In Skåne, southern Sweden, Lemdahl<sup>80</sup> has already pointed to the diverse nature of the Holocene forest and assessment of the British evidence suggests a similar picture.<sup>81</sup> However there are serious spatial problems with the sampling – most samples come from the structurally complex closed forests of floodplain and lowland fen, and only Osborne's<sup>82</sup> study of the Church Stretton valley in the Welsh Borders, on the edge of the uplands of the Longmynd, indicates an essentially open, grazed pre-neolithic landscape. Part of the problem is also taphonomic, if pollen from wetland hollows in forest provides a clear view of the immediate closed woodland,<sup>83</sup> the attenuated nature of these successions leads to poor insect preservation. In addition, insect dispersal of those taxa, which do not form part of the aerial plankton,<sup>84</sup> is not random. A point made emphatically by the failure of insect samples from the heart of raised mires at Thorne and Hatfield Moors in south Yorkshire to register the processes leading to complete forest clearance on the surrounding higher ground evident in pollen and aerial archaeological evidence.<sup>85</sup> It is evident, however, from the limited amount of insect data available that neolithic penetration was probably not along the floodplains of the major rivers, which look to have been particularly densely vegetated,

<sup>73</sup> D. H. Keen – M. D. Bateman – G. R. Coope – M. H. Field – H. E. Langford – J. S. Merry – T. M. Mighall: Sedimentology, palaeoecology and geochronology of Last Interglacial deposits from Deeping St James, Lincolnshire, England. *Journal of Quaternary Science* 14 (1999) 411–436.

<sup>74</sup> G. R. Coope – A. R. Beesley: How warm was the Ipswichian interglacial: evidence from insect assemblages. *International Union for Quaternary Research XII international Congress: Program with Abstracts*, Ottawa 1987.

<sup>75</sup> A. J. Stuart: Mammalian extinctions in the Late Pleistocene of northern Eurasia and North America. *Biological Reviews* 49 (1991) 225–266.

<sup>76</sup> C. Gao – D. H. Keen – S. Boreham – G. R. Coope – M. E. Pettit – A. J. Stuart – P. L. Gibbard: Last Interglacial and Devensian deposits of the River Great Ouse at Woolpack Farm, Fenstanton, Cambridgeshire, UK. *Quaternary Science Reviews* 19 (2000) 787–810.

<sup>77</sup> cf. C. Turner: Der Einfluß großer Mammalier auf die interglaziale Vegetation. *Quartärpaläontologie* 1 (1975) 13–19.

<sup>78</sup> e.g. Buckland 1979; Girling 1982.

<sup>79</sup> Vera 2000.

<sup>80</sup> G. Lemdahl: Holocene forest environments in southern Sweden and wood living insects. *Geological Society of America Annual Meeting, Colorado 2002, Program with Abstracts*, 46–11.

<sup>81</sup> Buckland, *in press*

<sup>82</sup> Osborne 1972.

<sup>83</sup> R. H. W. Bradshaw: Spatially precise studies of forest dynamics. B. Huntley and T. Webb III: *Vegetation History*. Dordrecht 1988, 725–751.

<sup>84</sup> sensu R. A. Crowson: *The biology of the Coleoptera*. London 1981.

<sup>85</sup> Buckland 1979; D. N. Riley: *Early Landscape from the Air*. Sheffield, 1980; B. M. Smith: *A palaeoecological study of raised mires in the Humberhead Levels*. BAR BS 336 (2002).



if occasionally and locally broken up by flooding. As Bogucki<sup>86</sup> has remarked on other evidence, may be Gradmann's<sup>87</sup> hypothesis was not all bad, although the mechanisms for maintaining openness were perhaps large herbivores, particularly herds of aurochs, rather than drought.

Despite their opposing views, neither Rackham<sup>88</sup> nor Vera<sup>89</sup> seems prepared to include fire as part of the natural sequence in lowland forest. In the uplands, beginning with Simmons,<sup>90</sup> fire, if largely (if not entirely) anthropogenic, has been seen as a natural element in Holocene vegetation succession, and even in the lowlands, charred trees are a familiar feature of the stratigraphy of most bogs.<sup>91</sup> At Thorne, Boswijk<sup>92</sup> was able to show a return period of about 400 years for serious fires across many square kilometres of pine forested raised mire, and the basal wet, deciduous forest, largely of oak, was similarly fire-scarred, although the return period could not be calculated. Microscopic charcoal, either from domestic or forest fires is a consistent feature of Lateglacial and Holocene sediment profiles.<sup>93</sup> There are elements in the European insect fauna which show that fire has been an integral part of forest history long before there were any significant human impacts, although there can be no doubt that human activities, both deliberate and accidental, have significantly pushed up fire frequency. The classic example of a pyrophilic species is provided by the jewel beetle, buprestid, *Melanophila acuminata*. This is able to locate fires from at least one kilometre away and oviposits in burnt birch or conifers whilst the wood is still in excess of 40 °C.<sup>94</sup> In Britain it has declined to the edge of extinction, surviving only on the Surrey heaths, west of London.<sup>95</sup> Elsewhere in Europe it is restricted to those areas where fire suppression by foresters is less than complete. Several ground beetles, carabids,<sup>96</sup> are also attracted to burnt ground, and Whitehouse and Eversham (2002) have used the presence of *Pterostichus angustatus*, previously regarded as a recent immigrant to Britain,<sup>97</sup> in samples from Hatfield Moors to argue for continuity of fire generated habitats. Two species of *Agonum* show similar attractions. *A. quadripunctatum*, also increasingly restricted to lowland heaths in England,<sup>98</sup> is known from Middle Pleistocene deposits at Waverley Wood in Warwickshire,<sup>99</sup> and *A. bogemanni* appears to have been associated with slash and burn cultivation in Scandinavia,<sup>100</sup> although its primary habitat must have been on naturally burnt ground. Whether these and several other pyrophilic species show a similar if temporary rise in frequency during neolithic landnam remains to be seen.

<sup>86</sup> P. I. Bogucki: Forest farmers and stockherders. Early agriculture and its consequences in North-Central Europe. Cambridge 1988.

<sup>87</sup> R. Gradmann: Die Steppenheide-Theorie. Geographische Zeitschrift 39 (1933) 265–278.

<sup>88</sup> Rackham 2003.

<sup>89</sup> Vera 2000.

<sup>90</sup> Simmons 1969; most recently Simmons 2002.

<sup>91</sup> F. M. Chambers – J. G. Lageard – G. Boswijk – P. A. Thomas – K. J. Edwards – J. Hillam: Dating prehistoric bog fires in northern England to calendar years by long distance cross-matching of pine chronologies. Journal of Quaternary Science 12 (1997) 253–256.

<sup>92</sup> G. Boswijk: A dendrochronological study of oak and pine from the raised mires of the Humberhead Levels, eastern England. Sheffield 1998.

<sup>93</sup> e.g. K. J. Edwards – G. W. Whittington: Multiple charcoal profiles from a Scottish lake: taphonomy, fire ecology, human impact and inference. Palaeogeography, Palaeoclimatology, Palaeoecology 164 (2000) 67–86; K. J. Edwards – G. Whittington – R. M. Tipping: The incidence of microscopic charcoal in lateglacial deposits. Palaeogeography, Palaeoclimatology, Palaeoecology 164 (2000) 247–262.

<sup>94</sup> H. V. Danks – R. G. Foottit: Insects of the boreal zone of Canada. Canadian Entomologist 121(1989) 625–690.

<sup>95</sup> K. N. A. Alexander: The invertebrates of living and decaying timber in Britain & Ireland. A provisional annotated checklist. Peterborough, 2002.

<sup>96</sup> L.-O. Wikars: Effects of forest-fire and the ecology of fire-adapted insects. Uppsala 1997.

<sup>97</sup> P. S. Hyman: Review of the scarce and threatened Coleoptera of Great Britain. Part 1. Peterborough, 1992.

<sup>98</sup> M. L. Luff: Provisional atlas of the ground beetles (Coleoptera, Carabidae) of Britain. Monks Wood, Centre for Ecology and Hydrology 1998.

<sup>99</sup> F. W. Shotton – D. H. Keen – G. R. Coope – A. P. Currant – P. L. Gibbard – M. Aalto – S. M. Peglar – P. Skidmore: Dipterological perspective on the Holocene history of the North Atlantic area. University of Sheffield 1996.

<sup>100</sup> C. H. Lindroth: Changes in the Fennoscandian Ground-beetle fauna (Coleoptera, Carabidae) during the twentieth century. Annales Zoologici Fennici 9 (1972) 49–64.



### Insect communities and reaction to some human events

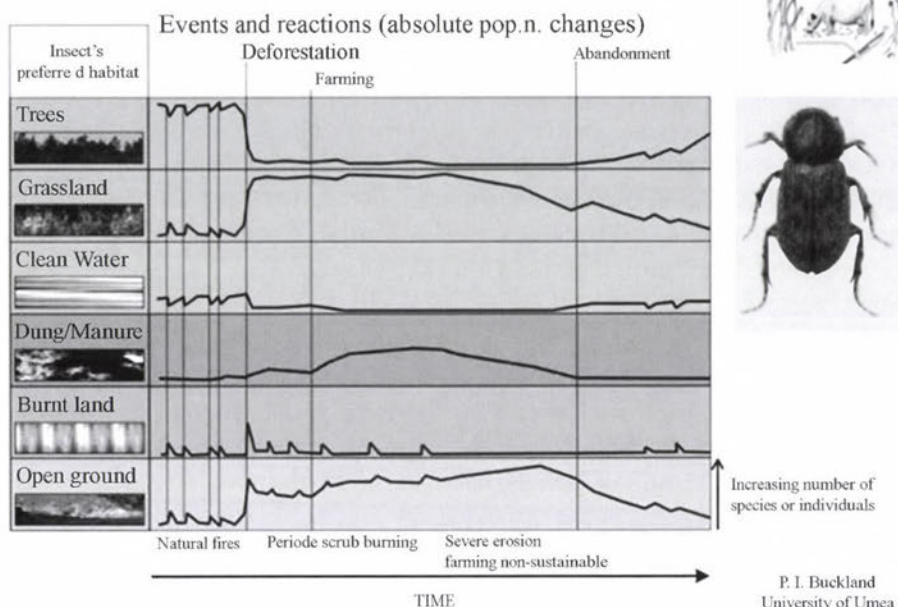


fig. 5. A theoretical model of the impact on the composition of insect faunas occasioned by a 'small temporary clearance'

Fig. 5. attempts to summarise some of the impacts upon elements of the insect fauna created by an episode of clearance and partial regeneration in a forested landscape, a small temporary clearance, perhaps prolonged by natural or domestic animal grazing.<sup>101</sup> Open ground may have been extended by ring barking of large trees, rather than felling, and this could have led to a peak in dead wood species before a decline in forest elements. Robinson<sup>102</sup> has suggested that the presence of the large chafer *Valgus hemipterus* at the South Stanwick long barrow in Northamptonshire reflects suitable breeding habitats in the decaying tree stumps of recently cleared land.

#### *Insects in immediate human landscapes*

Not only are insects sensitive indicators of climate and environmental change, their food requirements may be such that they are confined to one species or a group of species not separable in the pollen diagram. The example in Table 1 summarises the plant hosts of the fauna identified by Robinson<sup>103</sup> from the sealed old ground surface and structural turves beneath Silbury Hill, a large neolithic mound on Salisbury Plain in southern England. Radiocarbon dates on the turves indicate construction around 4500 BP. The beetle fauna shows no trace of woodland, and includes many species now characteristic of old established unimproved grassland, including the elaterids *Agrypnus murina*, *Agriotes* spp. *Athous haemorrhoidalis*, whose larvae encompass the familiar wireworms of pasture, *Dascillus cervinus* and the garden chafer *Phyllopertha horticola*. This picture of pasture is further reinforced by the suite of dung beetles of the genera *Onthophagus* and *Aphodius*, which would have lived in the droppings of domestic animals. The table also shows the level to which the pollen would have allowed identification. In this particular example, it is the character of the landscape which is better indicated by the *Coleoptera*, but there are many

<sup>101</sup> cf. P. C. Buckland – K. J. Edwards: The longevity of pastoral episodes of clearance activity in pollen diagrams: the role of post-occupation grazing. *Journal of Biogeography* 11 (1984) 243–249.

<sup>102</sup> M. Robinson: Coleopteran evidence for the Elm Decline, Neolithic activity in woodland, clearance and the use of the landscape, in: A. S. Fairburn: *Plants in Neolithic Britain and beyond*. Neolithic

studies group seminar papers 5. Oxford 2000, 27–36.

<sup>103</sup> M. Robinson: The insects, in: A. Whittle: *Sacred mound holy rings. Silbury Hill and the West Kennet palisade enclosures: a Later Neolithic complex in north Wiltshire*. Oxbow Monographs 74. Oxford 1997, 36–46.

situations, where the plants, particularly those utilised by man for either their leaves or stems, for example flax, *Linum*, and nettles, *Urtica*, are more likely to be recorded by the presence of their *phytophages* amongst the insects than by their pollen spectra. Nettles, for example, have a particularly broad suite of insect feeders,<sup>104</sup> and may be harvested either as food, before flowering, or as a source of fibres. Similarly the leaves of docks and sorrel, *Rumex* spp, can form an important source of essential vitamin C, and like crop plants in the *Chenopodiaceae*, are harvested before coming into flower; both may be represented only by their phytophages. In the Silbury Hill list, the most likely species of *Rhinoncus* are those which live on terrestrial species of *Rumex* and *Polygonum*, *R. pericarpus* and *R. bruchoides* and *R. castor*.

Taxon	Host	Pollen
<i>Chrysolina haemoptera</i> (L.)	<i>Plantago</i> spp.	<i>Plantago</i> (to species)
<i>Hydrothassa glabra</i> (Hbst.)	Ranunculaceae	Ranunculaceae (some genera)
<i>Galeruca tanacetii</i> (L.)	Asteraceae	Asteraceae (subfamily)
<i>Neocrepidodera ferruginea</i> (Scop.)	Poaceae	Poaceae (some genera)
<i>Mantura matthewsi</i> (Curt.)	<i>Helianthemum nummularium</i>	<i>Helianthemum</i> sp.
<i>Sphaeroderma rubidum</i> (Graells)	<i>Carduus</i> & <i>Cirsium</i> spp.	<i>Carduus</i> & <i>Cirsium</i> spp.
<i>Bruchus/Bruchidius</i> sp.	Leguminosae	Leguminosae
<i>Sitona sulcifrons</i> (Thun.)	Leguminosae, esp. <i>Trifolium pratense</i>	Leguminosae
<i>S. lepidus</i> Gyll.	<i>Trifolium</i> spp.	Leguminosae
<i>Cleonis pigra</i> (Scop.)	<i>Carduus</i> & <i>Cirsium</i> spp.	<i>Carduus</i> & <i>Cirsium</i> spp.
<i>Liparus coronatus</i> (Goez.)	Umbelliferae	Umbelliferae
<i>Hypera punctata</i> (F.)	<i>Trifolium</i> spp.	Leguminosae
<i>Rhinoncus</i> spp.	Polygonaceae	Polygonaceae (to some species)
<i>Mecinus pyraister</i> (Hbst.)	<i>Plantago</i> spp.	<i>Plantago</i> (to species)

Table 1. The plant hosts of the fauna identified by *Robinson 1997*.

One of the characters of Western society is the apparent dominance of meat and cereal products in the diet, and this is often transferred onto cultures in the past, which may have found it wholly alien, having evolved a more balanced diet, away from the Big Mac. In part the plant macrofossil record inevitably reinforces this position, largely because the chances of preservation of cereals by charring, either during processing<sup>105</sup> or by burning of residues in hearths, are so much the greater than most other crops. Pulses therefore tend to be under-represented, unless unusual circumstances lead to their preservation. The material figured (fig. 6) was charred by the Late Bronze Age eruption of Santorini in the Aegean, and shows evidence of infestation by the field pest *Bruchus rufipes*. Archaeologists put great effort into sieving large amounts of sediment to recover a few charred grains of wheat or barley, often of doubtful stratigraphic integrity; the degree to which rodents and invertebrates have bioturbated sediments is rarely assessed. Not only are seed crops more likely to appear in the archaeological record, but they also have the advantage over leaf crops for human consumption in that they can be stored from one season to another, providing subsistence at times when plant and animal productivity is low. Survival, however, also relies upon being able to overwinter sufficient livestock to maintain breeding populations and in most climates of Europe this requires collection of additional fodder, either in the form of grass

<sup>104</sup> B. N. K. Davis: Insects on nettles. Cambridge, 1983.

Mercer: Farming Practice in British Prehistory. Edinburgh 1981, 123–162.

<sup>105</sup> G. Hillman: Reconstructing crop husbandry practices from charred remains of crops, in: R.





fig. 6. Charred pulses from Late Bronze Age Akrotiri, Santorini, Greece.  
Note the frequent exit holes of the bean weevil, bruchid, *Bruchus rufipes*

hay or leaf fodder. The role of elm in this has been much discussed since Troels-Smith's<sup>106</sup> original paper, but other trees have been widely exploited as fodder sources,<sup>107</sup> and there is direct evidence from Weier in Switzerland for neolithic winter stalling of animals and use of leaf fodder.<sup>108</sup> The site also provides one of the few examples of study of an insect fauna from a neolithic settlement rather than landscape context.<sup>109</sup> The assemblage is dominated by puparia of the flies *Musca domestica* and *Thoracochaeta zosterae*, both of which are associated with the warm of fermenting accumulations of herbivore dung. The former, the common house fly, is essentially a warm temperate species and it has been suggested that it probably first became closely associated with Man in Egypt.<sup>110</sup> If this is the case, it represents one of his first fellow travellers, able to exploit the artificially cushioned habitats, which he created, and extending its distribution during the neolithic at least as far as central Sweden<sup>111</sup> where similar evidence for stalled animals has been adduced. *T. zosterae* at the present day in Britain is restricted to coastal wrack beds, whilst as a fossil it can be very common in archaeological assemblages from cess pits and similar foul accumulations.<sup>112</sup> Although it was possible that seaweed was being transported inland for industrial or other use, it seems more likely that its current habitat restriction reflects improved hygiene, a point later proved by biochemical analysis of puparia;<sup>113</sup> in Germany, old records of this so-called seaweed fly occur from byre residues.<sup>114</sup> The insect evidences from both Weier in Switzerland and Alvastra in Sweden provide convincing evidence of stalling at least of cattle during the neolithic. In the Netherlands, Schelvis<sup>115</sup> has shown that another group, the mites can be similarly employed in the detection of dung, some appearing specific to the source animal. In this context, however, ectoparasites can be more useful and may provide evidence beyond the simple species present.

<sup>106</sup> J. Troels-Smith: Ivy, mistletoe and elm. Climate indicators – fodder plants. Danmarks geologiske Undersøgelse IV/4 (1960) 1–32.

<sup>107</sup> e.g. beech, J. N. Haas – S. Karg – P. Rasmussen: Beech leaves and twigs used as winter fodder: examples from historic and prehistoric times. Environmental Archaeology 1 (1998) 81–86; holly, J. Radley: Holly as winter feed. Agricultural History Review 9 (1961) 89–92.

<sup>108</sup> P. Rasmussen: Leaf-foddering of livestock in the Neolithic: archaeobotanical evidence from Weier, Switzerland. Journal of Danish Archaeology 8 (1989) 51–71.

<sup>109</sup> Nielsen et al. 2000.

<sup>110</sup> Panagiotakopulu, in press

<sup>111</sup> Skidmore in: H. Göransson: Alvastra pile dwelling – a 5000-year-old byre? K. Viklund: Nordic

Archaeobotany – NAG 2000 in Umeå. Umeå, University of Umeå Environmental Archaeology Laboratory, Dept. of Archaeology & Sami Studies 15 (2002) 67–84.

<sup>112</sup> Skidmore 1998.

<sup>113</sup> S. C. Webb – R. E. M. Hedges – M. Robinson: The seaweed fly *Thoracochaeta zosterae* (Hal.) (Diptera: Sphaerocidae) in inland archaeological contexts: 13C and 15N solves the puzzle. JAS 25 (1998) 1253–1257.

<sup>114</sup> F. Köhlhorn: Über die Dipterenfauna des Stallbiotops. Beiträge zur Entomologie 14 (1964) 85–118.

<sup>115</sup> J. Schelvis: Predatory mites (Acari: Gamasida) in excrements of five domestic animal species. Pedobiologia 38 (1994) 72–80.



fig. 7. An almost complete human flea, *Pulex irritans*, from the Norse farm at Gården under Sandet, in the Western Settlement, Greenland

The cattle louse, *Damalinia bovis*, occurs at Weier in the byre,<sup>116</sup> but Buckland and Perry<sup>117</sup> have argued that the presence of large numbers of sheep lice, *D. ovis*, and the wingless parasitic fly, *Melophagus ovinus*, the ked, is more likely to indicate wool processing than simply the presence of their host. Insect remains may offer an original contribution to the debate concerning the timing of the secondary products revolution.<sup>118</sup>

Ectoparasite remains can also be used to define other activities, of which delousing provides an example. Humans have three lice, one bug (*Hemiptera*) and one flea.<sup>119</sup> The flea, *Pulex irritans*, is probably a primary parasite in the nests of an early South American domesticate, the Guinea pig, *Cavia* sp. It found human blood to its liking and by the Late Neolithic had travelled up the Americas and crossed Eurasia to reach remote Orkney off the northern tip of Scotland,<sup>120</sup> probably utilising small steps in the gift exchange of furs as a transport mechanism. It appears in large numbers everywhere from New Kingdom Amarna in Egypt (fig. 7) to Norse Greenland.<sup>121</sup> The origins of the bed bug, *Cimex lectularius*, have been explored by Panagiotakopulu and Buckland;<sup>122</sup> it is present at Bronze Age Amarna, but is unlikely to have found suitably warm habitats in Central and Northern Europe until the advent of heated stone housing in the Graeco-Roman period. Lice have probably been with, and co-evolved with, Man since his departure from Africa. The earliest records of the crab or pubic louse are from Roman Carlisle in northern England,<sup>123</sup> but, closely related to a species on gorillas, it was perhaps more widespread on the human body when ancestors were more hairy. This point is also relevant to the head and body lice of the genus *Pediculus*, *P. humanus capitis* and *P. h. corporis*, which are sometimes accorded specific rank. As the body louse breeds in the clothing of its host, has it diverged from the head louse since humans began to wear clothes? The head louse is recorded from the Pre-Pottery Neolithic in Palestine<sup>124</sup> and again is a common find in suitable desiccated, frozen or anaerobic deposits from Egypt to Greenland and Peru.<sup>125</sup> On the post-medieval farm at Reykholt in western

<sup>116</sup> Nielsen et al. 2000.

<sup>117</sup> P. C. Buckland – D. Perry: Ectoparasites of sheep from Stóraborg, Iceland and their interpretation. Piss, parasites and people, a palaeoecological perspective. *hikuin* 15 (1989) 37–46.

<sup>118</sup> A. G. Sherratt: The secondary exploitation of animals in the Old World. *World Archaeology* 15 (1983) 90–104.

<sup>119</sup> J. R. Busvine: *Insects, hygiene and history*. London 1976.

<sup>120</sup> P. C. Buckland – J. P. Sadler: A biogeography of the human flea, *Pulex irritans* L. (Siphonaptera: Pulicidae). *Journal of Biogeography* 16 (1989) 115–120; P. C. Buckland – J. P. Sadler: *Insects,*

*in*: K. J. Edwards – I. B. M. Ralston: *Scotland: environment and archaeology 8000 BC-AD 1000*. Chichester 1997, 105–108.

<sup>121</sup> Panagiotakopulu 2001a; Panagiotakopulu 2001b.

<sup>122</sup> E. Panagiotakopulu – P. C. Buckland: The bed bug, *Cimex lectularius* L. from Pharaonic Egypt. *Antiquity* 73 (1999) 908–911.

<sup>123</sup> H. K. Kenward: Pubic lice (*Phthirus pubis*) were present in Roman and medieval Britain. *Antiquity* 73 (1999) 911–915.

<sup>124</sup> J. Zias – Y. Mumcuoglu: Pre-Pottery Neolithic B head lice from Nahal Hemar Cave. *Atiqot* 20 (1991) 167–168.

<sup>125</sup> Panagiotakopulu 2001a.



Iceland, concentration of lice in one room sample has been interpreted as the result of de-lousing,<sup>126</sup> on the fossil evidence a very necessary activity.

Stored hay, particularly grass and sedge hay, has a distinctive beetle fauna in storage, including species of the *cryptophagid* genera *Cryptophagus* and *Atomaria*, the *lathridiid*, *Lathridius minutus* (grp.), the *endomycid* *Mycetaea hirta* and the *mycetophagid* *Typhaea stercorea*. Their presence in large numbers in structures normally indicates fodder storage.<sup>127</sup> However elements of this part of the synanthropic fauna would also be able to exploit other habitats in farms, including floors on which hay was spread to provide a working surface, and interpretation requires the careful evaluation of other lines of evidence as well as the coleopteran. This allows many of the problems raised by Kenward<sup>128</sup> and often repeated, to be minimised, although what constitutes an indoor or outdoor assemblage may still be problematic.<sup>129</sup> Fig. 8, based upon work in the Norse North Atlantic region<sup>130</sup> summarises possible routes by which insect remains could come to be incorporated in rural archaeological sediments.

### The grain fauna

Although the insect fauna associated with fodder may occur in other habitats, one particular assemblage that found in stored grain is unlikely to be found outside that habitat. Both the silvanid *Oryzaephilus surinamensis* – the name is perhaps unfortunate as the saw-toothed grain beetle is first recorded in charred grain from the late neolithic site at Mandalo in Macedonia<sup>131</sup> – and cucujid *Cryptolestes ferrugineus* are occasionally recorded from under bark.<sup>132</sup> This is probably their natural habitat, but the grain weevil, *Sitophilus granarius*, is not known from the wild. This flightless weevil is probably a primary occupant of large grass seeds in the nests of wild rodents, and its usual pabulum with humans, in granaries and grain stores, is merely an extension of the same. The insect's original distribution probably coincided with that of the wild progenitors of wheat and barley in the Near and Middle East, and the fossil record suggests that it probably travelled westwards with early agriculturists.<sup>133</sup> Although able to maintain breeding populations in the Mediterranean zone, to the North it needs the artificial warmth of large stocks of grain to survive. It is therefore not surprising that the grain fauna first reaches northwest Europe in the baggage train of the Roman army, appearing in the Rhineland and England shortly after the conquest in the first century AD.<sup>134</sup> There are, however, two earlier records, both from Linienbandkeramik (LBK) sites in Germany, one near Göttingen<sup>135</sup> and the other at Erkelenz-

<sup>126</sup> P. C. Buckland – J. P. Sadler – G. Sveinbjarnardóttir: Palaeoecological investigations at Reykholt, western Iceland, in: C. Morris – J. Rackham: Norse and Later Settlement and Subsistence in the North Atlantic. Glasgow 1992, 149–168.

<sup>127</sup> T. Amorosi – P. C. Buckland – K. J. Edwards – I. Mainland – T. H. McGovern – J. P. Sadler – P. Skidmore: They did not live by grass alone: the politics and palaeoecology of fodder on the North Atlantic islands. *Environmental Archaeology* 1 (1998) 41–54.

<sup>128</sup> H. K. Kenward: Pitfalls in the environmental interpretation of insect death assemblages. *Journal of Archaeological Science* 2 (1975) 85–94.

<sup>129</sup> cf. A. R. Hall – H. K. Kenward: Disentangling dung: pathways to stable manure. *Environmental Archaeology* 1 (1998) 123–126.

<sup>130</sup> P. C. Buckland – J. P. Sadler – D. N. Smith: An insect's eye view of the Norse farm, in: C. Batey – J. Jesch – C. D. Morris: The Viking Age in Caithness, Orkney and the North Atlantic. Proceedings of the 11<sup>th</sup> Viking Congress, Kirkwall. Edinburgh 1993, 506–527.

<sup>131</sup> S. M. Valamoti – P. C. Buckland: An early find of *Oryzaephilus surinamensis* from final Neolithic Mandalo, Macedonia, Greece. *Journal of stored Product Research* 31 (1995) 307–309.

<sup>132</sup> A. Horion: Faunistik der Mitteleuropäischen Käfer, 7. Clavicornia, Sphaeritidae – Phalacridae. Überlingen-Bodensee 1960; K. Koch: Ökologie. Die Käfer Mitteleuropas. Krefeld, 1989.

<sup>133</sup> P. C. Buckland: Granaries, stores and insects. The archaeology of insect synanthropy, in: D. Fournier – F. Sigaut: La préparation alimentaire des cereales. PACT 1991, 69–81.

<sup>134</sup> K. Koch: Zur Untersuchung subfossiler Käferreste aus römerzeitlichen und mittelalterlichen Ausgrabungen im Rheinland. *Rheinische Ausgrabungen* 10 (1971) 378–448; H. K. Kenward – D. Williams: Biological Evidence from the Roman Warehouses in Coney Street. *Archaeology of York* 14/2. London 1979.

<sup>135</sup> S. Büchner – G. Wolf: Der Kornkäfer – *Sitophilus granarius* (Linné) – aus einer bandkeramischen Grube bei Göttingen. *AKorr* 27 (1997) 211–220.

### Insect Evidence in a Norse Farm

Arrows indicate movement of deposits containing insect remains

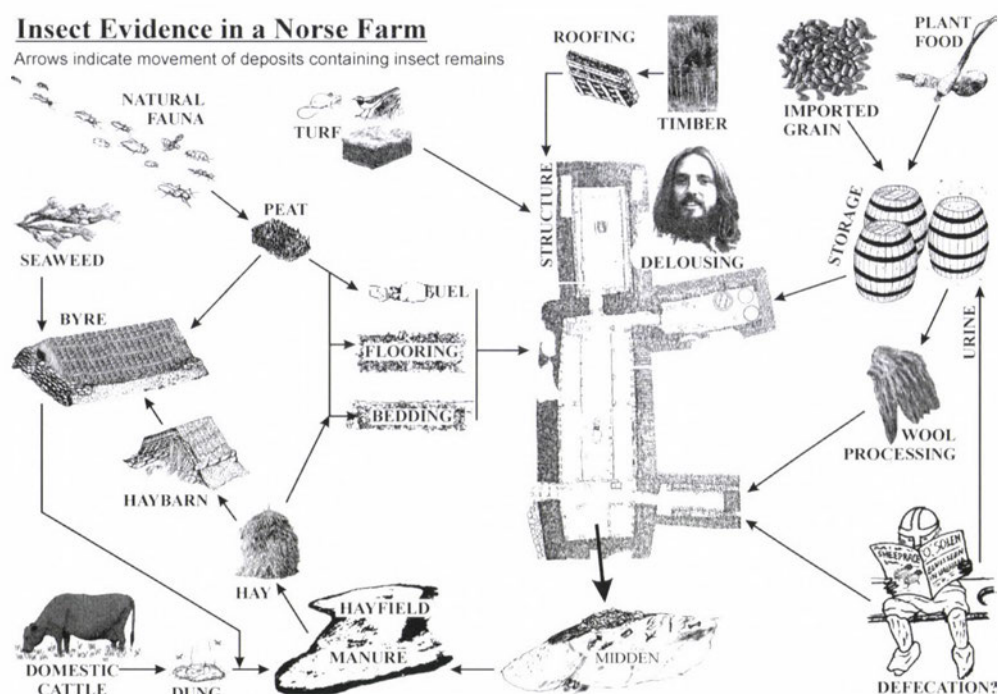


fig. 8. Pathways for fossil insect assemblages on a farm site

Kückhoven, in East Rhine province.<sup>136</sup> The implications of these finds are considerable. They imply not only that this neolithic group practiced large scale storage and transport of grain, but extracting a tithe by destroying part of the crop in storage, they present a factor which requires building into any palaeoeconomic models of the remarkable episode of LBK expansion.

### Conclusion

Insects offer considerable potential for refining the interpretation of archaeological contexts at both the regional and immediate level. The few neolithic sites, which have been examined, provide evidence of the nature of the pre-settlement landscape and of the manner in which the cleared landscape was exploited. They also provide palaeoeconomic evidence, which is not available from other palaeoecological sources.

<sup>136</sup> E. Schmidt: Der Kornkäfer *Sitophilus granarius* Schön. (Curculionidae) aus der Schuttschicht des bandkeramischen Brunnens von Erkelenz-Kückhoven, in: Brunnen der Jungsteinzeit.

Internat. Symposium Erkelenz 27–20 Okt. 1997. Materialien zur Bodendenkmalpflege 11 (1998) 261–269.



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## PREHISTORIC FISHING ALONG THE DANUBE

Considering the significant body of knowledge concerning the archaeozoology of the central Carpathian Basin (present-day Hungary) and the Iron Gates Gorge of the Danube (where the river forms the border between Romania and Serbia), largely publicized in the works of the late Sándor Bökönyi, relatively little is known about fish exploitation, an important source of animal protein in ancient times. This may be explained, to a great extent, with the lack of water-sieved or even dry screened find assemblages from archaeological sites from either of these two regions. In this situation, the remains of small animals, such as most fish in the Danube, are almost certainly lost.<sup>1</sup> The first review of sporadically found fish remains recorded at archaeological sites in Hungary was presented fifteen years ago.<sup>2</sup> Since then, new excavations as well as the occasional use of water-sieving have yielded new information. The aim of this work is to review the current state fish bone studies in the Carpathian Basin and the Iron Gates section of the Danube river.

Overexploitation, habitat loss and pollution have severely hit fish stocks worldwide. While the destruction of marine habitats has received great publicity (partly because of its international implications), dwindling stocks of fresh water fish attracted attention only in the case of major catastrophes induced by industrial activity, such as the mass poisoning of alluvial biotopes in the Rhine near Basel (Switzerland) in November 1986 or all along the Tisza river (Hungary) in 1999, when 650 t fish were poisoned by cyanide.<sup>3</sup> From a zoological point of view, only a relatively few endangered or extinct species have been monitored. A remarkable exception is sturgeons, the largest fish in the Danube, which were relatively common until dams were built in the Iron Gates. The dams effectively cut off the migration route of endangered beluga sturgeon and other anadromous fish. Further upstream, sturgeon shoals thinned out as the river was regulated and walled off from the floodplain.<sup>4</sup> Large-scale commercial navigation along the Danube also had a negative impact as it became necessary to keep the riverbed clean of sand and gravel deposits. By the mid-20<sup>th</sup> century, beluga sturgeon seldom swam upstream beyond the Iron Gates. The same human interference with river systems has also affected the entire aquatic ecosystem, including smaller bodied, less spectacular fish species. Diachronic changes in the composition of fish fauna are, therefore of interest in understanding the relationship between natural habitats and human subsistence activity. Prehistoric fishing represents the earliest point in such studies. Although fishing was presumably important during the Mesolithic and even earlier periods, to date only a few such settlement remains have been known from the Carpathian, with no convincing evidence of large-scale fish exploitation. Sporadically occurring fish bones may be observed more consistently from the early Neolithic onwards, as people apparently exploited the alluvial habitats in which they increasingly settled practicing agricultural production.

The reconstruction of prehistoric fishing is a multidisciplinary task. Chapters in this summary article, therefore were drafted with regard to the following aspects relevant to the subject:

1. Ichthyoarchaeological properties explain *which species* were exploited and how reliable is their representation (*Chapter 3*).

<sup>1</sup> L. Bartosiewicz: A régészeti feltárás finomításának lehetőségei (Possibilities in the refinement of archaeological recovery). *RégFüz* 2 (1983) 37–54.

<sup>2</sup> I. Takács – L. Bartosiewicz: Data to the history of fish exploitation in Hungary. Paper delivered at the

4<sup>th</sup> Conference of the ICAZ Fish Remains Working Group, 1987, York, England.

<sup>3</sup> [www.transnationale.org](http://www.transnationale.org)

<sup>4</sup> C. Woodard: Singing the Danube blues. *Christian Science Monitor*, May 11, 2000.



2. The palaeohydrological reconstruction of alluvial habitats helps in identifying locations where fishing may have taken place (*Chapter 4*).
3. Familiarity with fish behavior points to *seasons* when various fish could be most easily targeted (*Chapter 5*).
4. Ethnohistoric records of artisanal fisheries reveal basic *attitudes* towards fish exploitation (*Chapter 6*).

This outline is intended to provide an interpretive framework, showing the complex interactions between nature and society as reflected in the prehistory of fishing. The review of each of the four topics was based on the inclusion of additional data from natural and social sciences respectively, since the disciplinary boundaries between these areas of research often overlap.

### **Material and method**

This summary is based on an analysis of data available in the literature, as well as unpublished data (especially from water-sieved assemblages) by the author. Most of the published fish bone materials originate from excavations where finds were collected only by hand and the naked eye due to both real limitations (especially time, labor and money) and the conservative attitude by some archaeologists. The advantage of hand-collected fish bone assemblages is that being inevitably selected by size, they are directly comparable to similar materials published in the literature. Thus a general framework may be outlined within which more detailed but less numerous analyses of water-sieved materials from recent excavations can be interpreted.

Due to the general character of this paper, its chronological scope ranges within the Mesolithic to the Bronze Age. Water-sieved assemblages, as well as radiocarbon dates are available only for a few settlements. These included Schela Cladovei<sup>5</sup> (Iron Gates Gorge, Danube river) with Mesolithic and early Neolithic (Criş/Starčevo culture) occupations, Ecsegfalva 23<sup>6</sup> (Tisza/Berettyó river) an early Neolithic (Körös culture) settlement, Győr-Szabadrét-domb<sup>7</sup> (Danube/Rába river) a largely Copper Age (Boleráz group) site and Tiszaug-Kéménymet<sup>8</sup> (Tisza river) a Middle Bronze Age (Nagyrév culture) tell.

The geographical distribution of sites included in this study is rather heterogeneous. In contrast with the title, some assemblages from the tributaries of the Danube, especially the Tisza river, have also been included, as alluvial habitats typical of the same overall landscape in most of the Carpathian Basin, especially the plains. These sites are characteristic of Neolithic subsistence,<sup>9</sup> and as such deserve particular attention. The two major areas available for study, the sections of the Danube in Hungary and in the Iron Gates, are shown in *fig. 1*.

A few sites reviewed here represent the prehistory of a lower section of the Danube in the aforementioned Iron Gates region between Romania and Serbia. On the other hand, the upper reaches of the river, located in very different environmental and cultural settings in Austria and Germany, were beyond the focus of the present study.

A relatively small set of assemblages was recovered using water-sieving. These collections offer better sight of taxonomic richness, however, are not directly comparable to previous, hand-collected assemblages from Hungary without a significant risk of inter-site interpretational bias. A target-oriented experiment has shown that, bone fragments measuring less than 19 mm, tend to be lost with great probability when finds are collected exclusively by hand.<sup>10</sup> Unfortunately, as is clearly shown by water-sieved bone assemblages,

<sup>5</sup> Bonsall et al. 2001, 16.

<sup>6</sup> A. Whittle – L. Bartosiewicz – D. Borić – P. Pettitt – M. Richards: In the beginning: new radiocarbon dates for the Early Neolithic in northern Serbia and south-east Hungary. *Antaeus* 25 (2002) 114–117.

<sup>7</sup> Bartosiewicz et al. 1994.

<sup>8</sup> A. M. Choyke – L. Bartosiewicz: Bronze Age animal exploitation in the Central Great Hungarian Plain. *ActaArchHung* 51 (1999–2000) 43–70.

<sup>9</sup> I. Takács: Fish remains from the early Neolithic site of Endrőd 119, in: S. Bökönyi (ed.): *Cultural and Landscape Changes in South-East Hungary I*. Budapest 1992, 301–311.

<sup>10</sup> L. Bartosiewicz: Water-sieving experiment at Örménykút, Site 54, in: *Járó – Költő* 1988, 267–274.



fig. 1. The location of study areas along the Danube

the overwhelming majority of fish remains from prehistoric sites in Hungary would fall way below this size criterion.

Given the multitude of taphonomic factors that distort even the consumption refuse from archaeological sites, the reliable reconstruction of prehistoric aquatic habitats, ancient fishing and cultural attitudes to fish stocks is a near impossible task. In order to create a frame of reference within which these more complex phenomena may be interpreted, data on 32 present-day traditional fishing communities were integrated within this study. This set of data was hoped to provide an interpretative/contextual framework within which prehistoric relationships between humans and aquatic animals may be translated into sociocultural meanings.<sup>11</sup> Ethnoarchaeology uses analogy as an interpretative tool and for developing appropriate research strategies in archaeology.<sup>12</sup> It explores relationships between behavior and material culture often disregarded by ethnologists, and to attempts to establish how features of known behavior may be recognized in archaeological remains.<sup>13</sup> Archaeologists often rely on analogical reasoning<sup>14</sup> in testing hypotheses of non-observable ancient behavior by seeking modern parallels.<sup>15</sup> Of the two different types of analogy used in archaeology, formal and relational, recently the first has been successfully used in the interpretation of archaeoichthyological assemblages from the north-western coast of Scotland.<sup>16</sup> *Formal analogy* is based on the assumption that if two phenomena have two or more attributes in common, they probably share other attributes as well. Formal analogy is useful when no historical documents are available. A typical example is the reconstruction of prehistoric processes based on their material correlates in modern populations.<sup>17</sup>

<sup>11</sup> L. R. Binford: Smudge pits and hide smoking: the use of analogy in archaeological reasoning. *American Antiquity* 32 (1967) 1–12.

<sup>12</sup> W. R. Belcher: Butchery practices and the ethnoarchaeology of South Asian Fisherfolk, in: W. Van Neer (ed.): *Fish exploitation in the past*. Tervuren, Koninklijk Museum voor Midden-Afrika, *Annalen, Zoologische Wetenschappen* 274 (1994) 169–176.

<sup>13</sup> C. Kramer: Introduction, in: C. Kramer (ed.): *Ethnoarchaeology*. New York 1979, 4–7.

<sup>14</sup> Wylie 1985.

<sup>15</sup> R. Ascher: Analogy in archaeology. *Southwestern Journal of Anthropology* 17 (1961) 317–325.

<sup>16</sup> Cerón-Carrasco 2002.

<sup>17</sup> Wylie 1985.



Most of the fishing communities used in analogous reasoning in this study were documented in Oceania<sup>18</sup> along the Pacific Coast of Asia.<sup>19</sup> The next largest group of ethnohistoric observations represents Atlantic Europe<sup>20</sup> and North America,<sup>21</sup> (including two Pacific communities). Fewer ethnographic data are available from Latin America,<sup>22</sup> while Africa<sup>23</sup> was represented only by two studies. The geographical distribution of these ethnographic data, is shown in *Table 1*.

<sup>18</sup> *T. Akimichi*: Perception and function: traditional resource management in three Pacific Islands. *Resource Management and Optimization* 4/36 (1981) 1–378; *T. Akimichi – K. Ruddle*: The historical development of territorial rights and fishery regulations in Okinawan Inshore Waters, in: *Ruddle – Akimichi 1984*, 37–88; *G. B. K. Baines*: Traditional resource management in the Melanesian South Pacific: a development dilemma, in: *Berkes 1989*, 273–296; *J. Carrier*: Marine tenure in Papua New Guinea, in: *McCay – Acheson 1987*, 142–167; *K. B. Foster – J. J. Poggie Jr.*: Customary marine tenure and mariculture management in outlying communities of Pohnpei State, Federated States of Micronesia. *Ocean and Coastal Management* 20 (1993) 1–22; *R. E. Johannes*: Traditional marine conservation methods in Oceania and their demise, in: *R. Johnson (ed.)*: *Annual Review of Ecology and Systematics*, 9. Palo Alto, Annual Reviews 1978, 349–364; *R. E. Johannes*: Worlds of the Lagoon: Fishing and Marine Life in Palau District of Micronesia. Berkeley 1981; *J. J. Kalland*: Sea tenure in Tokugawa Japan: the case of the Fukuoka Domain, in: *Ruddle – Akimichi 1984*, 11–36; *M. P. Sissenwine – P. Mace*: ITQ's in New Zealand: the era of fixed quotas in perpetuity. *Fishery Bulletin* 90 (1991) 147–160; *L. Zann*: Traditional management and conservation of fisheries in Kiribati and Tuvalu atolls, in: *Ruddle – Johannes 1985*, 53–78.

<sup>19</sup> *P. Alexander*: Sea tenure in Southern Sri Lanka, in: *A. Spoehr (ed.)*: *Maritime Adaptations: Essays on Contemporary Fishing Communities*. Pittsburgh 1980, 91–112; *W. Belcher* personal communication quoted, in: *Acheson – Wilson 1996*, 583; *F. Berkes*: Marine inshore fishery management in Turkey, in: *Proceedings of the Conference on Common Property Resource Management*. National Research Council. Washington DC 1986, 63–83; *M. Gadgil*: Social restraints on resource utilization: the Indian experience, in: *J. A. McNeecey – D. Pitt (eds)*: *Culture and Conservation: The Human Dimension in Environmental Planning*. Dublin 1985, 135–154; *S.-B. Han*: *Socio-economic Organization and Change in Korean Fishing Villages: A Comparative Study of Three Fishing Communities*. PhD Dissertation, Michigan State University. Ann Arbor, University Microfilms 1972; *B. Nietschmann*: Torres Strait Islander Sea resource management and sea rights, in: *Ruddle – Johannes 1985*, 127–154; *K. Ruddle*: Solving the Common Property Dilemma: Village Fisheries Rights in Japanese Coastal Waters, in: *Berkes 1989*, 168–184; *P. Vondal*: The common swamplands of Southeastern Borneo, in: *McCay – Acheson 1987*, 231–249.

<sup>20</sup> *K. O. Martin*: Play by the rules or don't play at all, in: *R. Andersen (ed.)*: *North Atlantic Maritime Cultures*. The Hague 1979, 277–298; *P. Dürrenberger – G. Pålsson* personal communication in: *Acheson – Wilson 1996*, 579–594; *S. Jentoft – T. Kristoffersen*: Fishermen's co-management: the case of the Lofoten fishery. *Human Organization* 48 (1989) 355–365; *R. Van Ginkel*: Plunderers into planters: Zealand oystermen and the enclosure of the marine commons, in: *J. Boissevain – J. Verrips (eds)*: *Dutch Dilemmas: Anthropologists Look at the Netherlands*. Assen 1989, 89–105.

<sup>21</sup> *J. M. Acheson*: Government regulation and exploitative capacity: the case of the New England ground fishery. *Human Organization* 43 (1984) 319–329; *J. M. Acheson*: The lobster gangs of Maine. Hanover 1988; *F. Berkes*: Common property resource management and cree Indian fisheries in Subarctic Canada, in: *McCay – Acheson 1987*, 66–91; *H. P. Bishop*: The emergence of hunting territories among the Northern Ojibwa. *Ethnology* 9/1 (1970) 1–15; *R. Brightman*: Conservation and resource depletion: the case of the Boreal Forest Algonquins, in: *McCay – Acheson 1987*, 121–141; *M. Dewar*: *Industry in Trouble: The Federal Government and the New England Fisheries*. Philadelphia 1983; *R. K. Nelson*: A conservation ethic and environment: the Koyukon of Alaska, in: *Williams 1982*, 211–228; *W. F. Royce*: Managing Alaska's Saknon fisheries for a prosperous future. *Fisheries* 14/2 (1989) 8–13; *N. M. Williams*: A boundary to cross: observations on Yolgnu boundaries and permission, in: *Williams 1982*, 131–153.

<sup>22</sup> *D. P. Leveil – B. Orlove*: Local control of aquatic resources: community and ecology in lake Titicaca, Peru. *American Anthropologist* 92 (1990) 362–382; *J. R. McGoodwin*: Mexico's conflictual inshore Pacific fisheries: problem analysis and policy recommendations. *Human Organization* 46 (1987) 221–231; *D. Miller*: The evolution of Mexico's spiny lobster fishery, in: *Berkes 1989*, 185–198; *C. G. M. Robben*: Conflicting discourses of economy and society in Coastal Brazil. *Man* 29 (1994) 875–900; *M. Southon*: Competition and conflict in an Ecuadorian Beach seine fishery. *Human Organization* 48 (1989) 365–369; *D. K. Sutherland*: Economic Success in a Belizean Fishing Village. Boulder, Westview 1986.

<sup>23</sup> *J. Rowntree et al.*: Fishery management in the Northern Nile Delta Lakes of Egypt: the case of Hosha. Food and agriculture organization of the United Nations, Studies and Reviews 61 (1984) 542–555; *Thomas 1996*, 287–314.

Continent	Number of fisheries
Asia	8
Oceania	9
Europe	4
North America	5
Central/South America	4
Africa	2
<b>Total</b>	32

Table 1. The geographical distribution of artisanal fisheries used in the ethnographic analogy

Data describing attitudes to present-day fish stocks data were synthesized using a factor analysis (Varimax rotation, latent roots  $\geq 1$ ). The purpose of this calculation was to establish basic relationships between various aspects of artisanal fish management. In the absence of written sources, such trends, hypothetically, would enhance our understanding of the prehistoric archaeoichthyological record.

### *Archaeoichthyological finds*

The archaeozoological study of fish remains has several aspects. These include the representativity of samples, as well as the biological features of various fish species which have a bearing on both bone preservation and the culture-historical interpretation of ichthyoarchaeological finds.

#### THE FREQUENCY OF FISH REMAINS IN ARCHAEOZOOLOGICAL ASSEMBLAGES

Most archaeozoological collections in Hungary contain an amazingly small portion of fish bones, largely attributable to the fact that, with a few recent exceptions, animal remains have always been collected exclusively by hand. The lack of dry screening of water-sieving may have a detrimental effect on the representation of entire classes of vertebrates, not to speak of even smaller animals such as land snails or arthropods.<sup>24</sup>

In addition, depending on the scope and nature of excavations, the number of animal bones recovered from sites also tends to vary broadly. Given these great differences in assemblage sizes, the stochastic relationship between the decimal logarithms of the number of all identifiable specimens ( $\lg \text{Non-fish NISP} = x$ , including mammalian and bird remains) and the number of fish bones represented in an assemblage ( $\lg \text{Fish NISP} = y$ ) is best expressed by

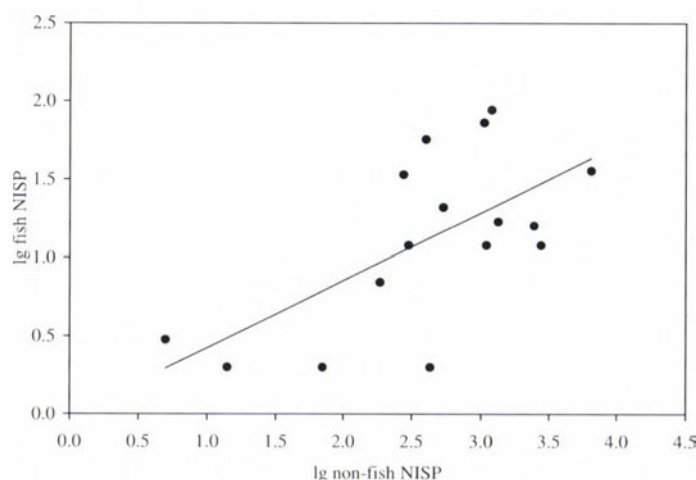


fig. 2. The occurrence of fish bones in hand-collected faunal assemblages

<sup>24</sup> I. Takács: Collecting biological finds from the well of a medieval village, in: *Járó – Költő* 1988, 275–282.



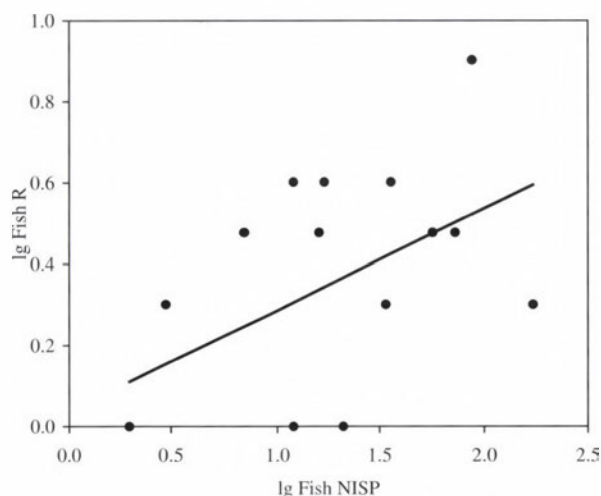


fig. 3. Relationship between taxonomic richness and assemblage size

the linear regression between these two variables for the 16 prehistoric fish bone assemblages plotted in (fig. 2). Assemblages containing only a single, non-identifiable fish bone were not included in this calculation. Decimal logarithms improve the linearity of this equation by reducing the heteroscedasticity of data. The trend shown in fig. 2. may be described using the following equation:

$$\lg \text{Fish NISP} = 0.431(\lg \text{Non-fish NISP}) - 0.007$$

$$(r = 0.641)$$

The significant but low correlation ( $P \leq 0.010$ ) as well as the low regression coefficient indicate that the recovery of additional bones from fish follows a clearly regressive trend for hand-collected fish bone assemblages. This means that (as would be the case with mammalian remains as well), increasing sample sizes yield ever more fish bones: the probability of encountering new specimens is not in a linear proportion with assemblage size. Statistical parameters of the overall picture, however, are somewhat distorted by the occurrence of single fish bones in numerous assemblages aligned at the bottom of the graph. This phenomenon points to the tremendous difference in the probability by which fish vs. larger mammalian bones are found when no form of fine recovery is practiced.

#### TAXONOMIC RICHNESS

Along similar principles, the so-called taxonomic richness ( $\lg \text{Fish R}$ , the number of taxa identified) of fish bone assemblages may be appraised as a function of fish bone sample size ( $\lg \text{Fish NISP}$ ; fig. 3). Although, given the small number of fish bones to begin with, the representation of various species would be difficult to compare in numerical terms, the few major hand collected assemblages show at least trends in the presence of fish remains as a function of assemblage size.

$$\lg \text{Fish R} = 0.251(\lg \text{Fish NISP}) - 0.035$$

$$(r = 0.512)$$

Archaeoichthyological remains originating from a greater variety of fish species originate from settlements represented by large assemblages. Increasing the size of archaeoichthyological assemblages, however, yields only a declining number of new taxa, and this trend is statistically significant ( $P \leq 0.050$ ). This is expressed by the low regression coefficient. To some extent, therefore, the inventory of fish remains, thus, would be more characteristic of sample size than the differential richness of the studied samples: in random samples the least frequent fish species would be the least likely to occur.<sup>25</sup>

<sup>25</sup> D. K. Grayson: Quantitative Zooarchaeology. Studies in Archaeological Science, New York 1984.

## TAPHONOMY AND INTERSPECIFIC DIFFERENCES IN OSTEOLOGY

This review is built around the osteological evidence for fish, predominantly from the Danube and its tributaries in Hungary. These remains, recovered from archaeological sites, must also be discussed in terms of taphonomic bias and taxonomic identifiability.

The taphonomic process incorporates the entire sequence of *post mortem* changes that define the character and composition of zoological assemblages. Owing to its roots in aquatic ecology<sup>26</sup> and palaeontology,<sup>27</sup> taphonomic research has had an appeal to archaeozoologists, since in reality, the manifestation of ancient cultural phenomena in archaeoichthyological remains is distorted by these *post mortem* changes in the original fish skeleton. Taphonomic loss is related to ancient human activity, a host of natural effects and, last but not least, the archaeologists themselves. The simplified sequence of the taphonomic process is summarized in *Table 2*.

Source of data	Selective process	Interpretation
<i>Biocoenosis</i>	not relevant	= living fish community, "ichthyofauna"
↓	biostratonomy	= primary human action (fishing, processing, consumption, disposal) and pre-depositional natural effects (scavengers, weathering)
<i>Thanatocoenosis</i>		= dead "community"
↓	fossil diagenesis	= post-depositional natural effects
	survey and excavation	
<i>Archaeological assemblage</i>	storage, curation	= secondary, modern human action
↓	documentation, analysis	
<i>Publication</i>		

Table 2. Overview of the taphonomic process effecting fish remains

Ancient, "primary" human effects themselves, of the utmost interest to the archaeologist, form part of biostratonomy. They are a source of bias from the viewpoint of faunal history, but offer perspectives on important culture historical questions:

1. *mode of procurement* (selective fishing defined by human preference of technical limitations may distort the picture of the early exploitation of alluvial resources)
2. *age and size criteria* (these may have an influence on which fish were targeted within the populations available)
3. *differential deposition* (very large fish, such as sturgeon, were dismembered and parts transported, again selectively)
4. *carcass processing* (loss due to anatomically differential bone structure and degrees of butchering)
5. *mode of deposition* (well defined, protected features vs. scattered surface finds, scavengers' access to the remaining evidence: dogs, pigs and rodents may transport/gnaw fish bones)

Post depositional natural effects on the thus deposited bone are described by the generic term fossil diagenesis. They include the effects of:

1. *mechanical damage* (changing surface conditions, soil pressure, mechanical erosion may all damage delicate fish bone)
2. *soil pH and possibly autolysis* by decaying fish fats (acidic soils and in some cases, fatty acids<sup>28</sup> tend to dissolve bone, while basic soils preserve them)

<sup>26</sup> E. Wasmund: Biocoenose und Thanatocoenose. Biosozologische Studie über Lebensgemeinschaften und Totengesellschaften. Archiv für Hydrobiologie 17 (1926) 1–116.

<sup>28</sup> M. Mézes – L. Bartosiewicz: Fish bone preservation and fat content. Offa 51 (1994) 361–364.

<sup>27</sup> I. A. Efremov: Taphonomy: a new branch of paleontology. Pan-American Geologist 74 (1940) 81–93.



3. *exposure to and transport by water* (alternating exposures of fish bone, especially at coastal sites, may cause additional loss)
  4. *heat fluctuations - crioturbation* (extreme heat and cold are most damaging near the surface)
  5. *activity by living organisms – bioturbation* (burrowing animals, plant roots)
- Excavator's decisions act as the last set of filters on this body of information:
1. *research policy* (preferential funding, contract archaeology)
  2. *choice of excavated area* (partial excavation, rescue work etc.)
  3. *spatial aspects of sampling* (contiguous surfaces, trenches, test pits)
  4. *recovery techniques* (hand-collection, screening, flotation/water-sieving)
  5. *data management and evaluation* (documentation, storage and publication)

Depending on size and anatomical features, this multitude of taphonomic factors has a differential effect on various fish. Interspecific comparisons between different species are made difficult by the different skeletal characteristics fish. The remains of very small species fall victim not only to primary effects such as digestion by humans and animals,<sup>29</sup> but are at a disadvantage during most of the taphonomic process. They are particularly sensitive to the precision of recovery. At the other extreme, it is chiefly large and compact dermal scutes of sturgeon which show up even in hand-collected assemblages, which otherwise contain few fish remains. They are arranged in dorsal, lateral and ventral rows along the body of the fish and differ both in size and shape by anatomical location.<sup>30</sup> Similarly to the great number of vertebrae, dorsal fin rays and other serial features of the fish skeleton, these remains are extremely difficult to interpret in quantitative terms, not to speak of the insurmountable bias inherent to the reconstruction of the Minimum Number of Individuals (MNI).

#### ARCHAEOICHTHYOLOGICAL CHARACTERISTICS

When only hand-collected assemblages are available for study, mostly the remains of various sturgeons (*Acipenser* sp.), large carp (*Cyprinus carpio* L. 1758), catfish (*Silurus glanis* L. 1758), pike (*Esox lucius* L. 1758), and sometimes pikeperch (*Stizostedion lucioperca* L. 1758) may be identified. Small bone fragments are not only rare, but they may also originate from bones of these same species.

Fishing potentially yielded an abundant supply of animal protein in prehistoric subsistence economies in the Carpathian Basin, but the species available for consumption were defined by the composition of the local "ichthyofauna" of various alluvial habitats as discussed below. In spite of wet sieving, mostly the remains of these characteristically large fish species could be identified at the recently excavated Körös culture settlement of Ecsegfalva 23. A major difference was, however, that the presence of young individuals from large fish such as pike could also be established<sup>31</sup>. The rest of that material (as was often the case with other, carefully excavated sites) was made up by small-size species and/or specimens of the carp family (*Cyprinidae*). These two groups of fish small-sized remains, however, clearly illustrate the importance of sieving in obtaining archaeoichthyological assemblages that offer a sound and reliable basis for interpretation even from a taphonomic point of view.

Familiarity with the range of fish ages/sizes represented by the archaeoichthyological remains at a site helps fine-tuning the reconstruction of roles various species played in the diet. The mass measurement of bones may be used in reconstructing the dietary role of fish.<sup>32</sup> On the basis of standardized osteological measurements, sometimes the length of fish can be directly estimated (using coefficients or regression equations), as is the case with Beluga sturgeon,<sup>33</sup>

<sup>29</sup> A. K. G. Jones: Fish bone survival in the digestive systems of pig, dog and man: some experiments, in: D. C. Brinkhuizen – A. T. Clason (eds): *Fish and Archaeology*. BAR IntSer 294 (1986) 53–61.

<sup>30</sup> R. W. Casteel: *Fish remains in archaeology*. London – New York – San Francisco 1976.

<sup>31</sup> Bartosiewicz, unpublished data.

<sup>32</sup> L. Bartosiewicz – R. Cerón-Carrasco – F. Gyulai: Számítógépes méretbecslések őskori halmaradványok alapján (Computerized size estimations using prehistoric fish remains). *Halászatfejlesztés* 19 (1996) 212–220.

<sup>33</sup> Bartosiewicz – Takács 1997.

pike<sup>34</sup> and catfish.<sup>35</sup> Although similar comparative growth curves for wild carp have not been available, patterning in the size distributions of modern record specimens representing the feral form offer some insight in the sizes those animals reached during prehistory, especially in large, open waters, such as the Danube near Schela Cladovei,<sup>36</sup> on the basis of other species whose skeletal remains could be studied in detail.<sup>37</sup>

The more generalized, additional use of biometric size reconstruction in estimating the dietary roles of various fish is severely hampered by the difficulty of reliably counting the minimum number of individuals in fish bone assemblages. In this situation, familiarity with the size ranges of live fish could be of help in interpreting the list of species at least in an impressionistic/descriptive manner. The main dimensions of species relevant to this study are summarized in *Table 3*.

	Species	Total length, m	Live weight, kg
Beluga sturgeon	<i>Huso huso</i> Linné 1758	2–3 (max. 10)	80.00–100.00 (max. 1000.00)
Russian sturgeon	<i>Acipenser gueldenstaedti</i> Brandt 1833	2.00–2.50	80.00–100.00
Ship sturgeon	<i>Acipenser nudiiventris</i> Lovetzky 1828	2.00	40.00–50.00
Stellate sturgeon	<i>Acipenser stellatus</i> Pallas 1771	1.50–2.00	30.00–50.00
Sterlet	<i>Acipenser ruthenus</i> Linné 1758	1.00–1.20	15.00–16.00 (max.)
Carp	<i>Cyprinus carpio</i> L. 1758	max. 1.00	30.00
Bream	<i>Abramis brama</i> L. 1758	0.15–0.40	0.20–0.40
Barbel	<i>Barbus barbus</i> L. 1758	0.70–0.80	4.00–5.00
White bream	<i>Blicca bjoerkna</i> L. 1758	0.25–0.35	max. 1.00
Crucian carp	<i>Carassius carassius</i> L. 1758	0.20–0.50	3.00–5.00
Undermouth	<i>Chondostroma nasus</i> L. 1758	0.20–0.40	0.20–1.00
Orfe	<i>Leuciscus idus</i> L. 1758	0.35–0.70	0.50–1.50
Knife	<i>Pelecus cultratus</i> L. 1758	0.25–0.50	0.30–1.00
Roach	<i>Rutilus rutilus</i> L. 1758	0.10–0.35	0.05–0.20
Rudd	<i>Scardinius erythrophthalmus</i> L. 1758	0.20–0.35	0.20–0.40
Tench	<i>Tinca tinca</i> L. 1758	0.25–0.60	0.30–2.50
Vimba	<i>Vimba vimba</i> L. 1758	0.25–0.30	0.20–0.40
Catfish	<i>Silurus glanis</i> L. 1758	2.00–2.50	150.00–200.00
Pike	<i>Esox lucius</i> L. 1758	0.50–1.50	5.00–25.00
Pikeperch	<i>Stizostedion lucioperca</i> L. 1758	1.00–1.50	15.00–20.00

Table 3. Characteristic dimensions of fish species known from archaeological assemblages<sup>38</sup>

Naturally, it is possible, that a massive and steady supply of small fish provided more animal protein than the odd, large specimen. Prolific small Cyprinids must have been much more easily available than formidable beasts, often heavier than humans. Large catfish or majestic Beluga sturgeon must have had a cognitive significance to the inhabitants of prehistoric settlements along the Danube. With all the fish species of large size under discussion here, the frequency and actual size of the largest specimens landed depends on the reproductive capacity and growth characteristics of the respective fish stocks.<sup>39</sup> Since 1800, for example, the estimated 1.84 kg average annual decrease in record sturgeon body weights was found to be statistically significant.<sup>40</sup> The large, 181 kg specimen caught at Paks (Hungary) in 1987

<sup>34</sup> L. Bartosiewicz: Osteometrical studies on the skeleton of pike (*Esox lucius* L. 1758). *Aquacultura Hungarica* 6, Szarvas 1990, 25–34.

<sup>35</sup> I. Takács: Segédlet szubfosszilis harsák testmagyságának kiszámításához a fő vázalkotók méretei alapján (Hilfe zur Berechnung der Körpergrösse von subfossilen Welsen aufgrund der Abmessungen der Hauptgerippekomponenten). *MMMK* 1986–1987, 105–126.

<sup>36</sup> L. Bartosiewicz – I. Takács – I. Székelyhidy: Problems of size determination in common carp (*Cyprinus carpio*), in: W. Van Neer (ed.): *Fish exploitation in the past*. Tervuren, Koninklijk

Museum voor Midden-Afrika, *Annalen, Zoologische Wetenschappen* 274 (1994) 55–60.

<sup>37</sup> I. Székelyhidy – I. Takács – L. Bartosiewicz: Ecological and diachronic variability in large-sized catfish (*Silurus glanis* L. 1758) and pike (*Esox lucius* L. 1758) in Hungary. *Offa* 51 (1994) 352–356.

<sup>38</sup> Berinkey 1966.

<sup>39</sup> L. E. Miranda – M. W. M. Wingo – R. J. Muncy – T. D. Bates: Bias in growth estimates derived from fish collected by anglers, in: R. C. Summerfelt – G. E. Hall (eds): *Age and growth of fish*. Ames 1987, 211–219.

<sup>40</sup> Bartosiewicz – Takács 1997.



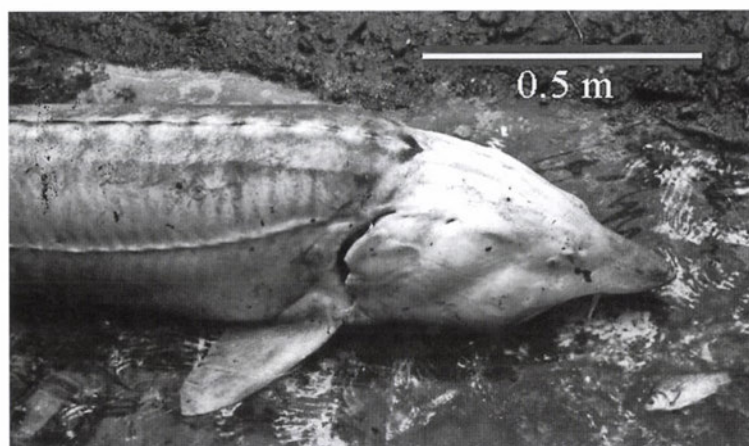


fig. 4. Sturgeon, weighing 181 kg, caught at Paks (Hungary) in 1987

(fig. 4), nearly two decades after the closure of the Iron Gates 1 dam,<sup>41</sup> may have attained this respectable size after having been trapped upstream, behind the hydroelectric installation.

On the other hand, a size increase in carp is the natural consequence of large domestic carp going feral and cross-breeding with wild stock, leading to its genetic extinction. Wild carp is gone now in Europe (fig. 5), although the bones of extremely large prehistoric wild carp are known, for example, from prehistoric site of Schela Cladovei.

### *Habitat reconstruction*

As opposed to terrestrial animals, fish are directly and inseparably bound to their respective aquatic habitats. It is the quality of water that directly regulates food supplies (depending on the place of each species within the complex aquatic food chain), and has a major impact on both the timing and success of reproduction for every kind of fish. The properties of water are influenced by climatic, topographic and hydrographic conditions, which act together in determining the suitability of habitats for the variety of fresh water species that live in various branches of rivers and their respective floodplains in the Carpathian Basin.

### WATER PROPERTIES

Climate and topography influence aquatic life through the quantity of oxygen dissolved in water ( $y$ , mg/l). This is a function of current speed ( $x_1$ , m/s) and water temperature ( $x_2$ , °C).

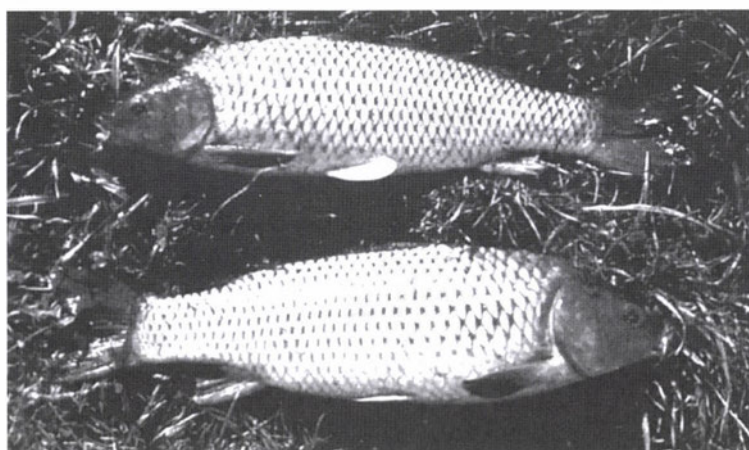


fig. 5. Wild carp photographed by E. K. Balon in the Slovakian section of the Danube in 1955\*

<sup>41</sup> K. Pintér: Magyarország halai (The fish of Hungary). Budapest 1989, 24.

\* E. K. Balon: The common carp, *Cyprinus carpio*: its wild origin, domestication in aquaculture, and

selection as colored nishikigoi. Guelph Ichthyology Reviews 3 (1995) 1–55.

According to empirical data,<sup>42</sup> this relationship may be expressed by the following regression equations:

$$\begin{array}{lll} X_1 = \text{speed of current:} & y = 1.953x + 1.984 & r = 0.943 \\ X_2 = \text{temperature:} & y = -0.221x + 13.669 & r = -0.979 \end{array}$$

The regression coefficients of “x” values express the phenomenon that every additional 1 m/s in water velocity increases dissolved oxygen content by almost 2 mg/l in rivers, while a 1 °C rise in temperature would result in a 0.2 mg/l loss. Such habitat differences not only influence fish behavior: they may directly determine which species are available for fishing.

#### TOPOGRAPHY AND CHANGES IN WATER QUALITY

As the speed of the river is greater towards its source (and its temperature tends to decrease with increasing altitudes), the further upstream fish move, the better the circumstances for spawning. Aeration parameters in various sections of a river are summarized after Harka<sup>43</sup> in *Table 4*.

River section	Water velocity, m/s	Summer temperature, °C	Dissolved oxygen, mg/l
Spring (krenon)	>1.5		>5.5
Mountain (ritron)	1.5–2	13	4.5–5.5
Lower mountain (hiporitmo)	1–1.5	16	4.0–4.5
Foothill region	0.7–1	20	3.5–4.0
Lower foothill (epipotamon)	0.5–0.7	20	3.0–3.5
Plain (metapotamon)	<0.5	25	2.5–3.0
River mouth (hipopotamon)		>25	<2.5

Table 4. General changes in water parameters along a river’s course<sup>44</sup>

Alluvial habitats, defined by the parameters of water as listed above also differ in at least the percentual composition of various species in their fish fauna. To what extent this is reflected in an archaeoichthyological assemblage, is also a matter of differential fishing, preservation and recovery, the aforementioned three strongest selective processes in taphonomy. Short-range migrations of fish shoals also connect different sections of the same river, which reduces the environmental indicator value of these species.

Such finer details are unlikely to be directly manifested in the archaeoichthyological record, unless fine recovery techniques are applied. These sites represent different, lower foothill (epipotamon), plain (metapotamon) and, to some extent, river mouth (hipopotamon) habitats. As mentioned before, fish bone assemblages from the upper reaches of the Danube in Austria and Germany were not studied.

Owing to the immense difficulty of precisely quantifying fish remains (not least due to complex taphonomic situations such as the aforementioned natural deposition, selective preservation and partial recovery), emphasis in this was laid on the presence/absence evaluation of species and the environmental interpretation of those identified. The species composition of fish remains from 5 water-sieved assemblages can be compared to each other in *Table 5*.

<sup>42</sup> Péntes – Tölg 1977, 327, Table 4; Harka 1993.

<sup>43</sup> Harka 1993.

<sup>44</sup> Harka 1993.



	Species	Győr–	Tiszaug–	Ecsegfalva	Schela	Schela
		Szabadrét-domb	Kéménýtető	23	Cladovei	Cladovei
		Copper Age	Bronze Age	Neolithic	Mesolithic	Neolithic
Tench	<i>Tinca tinca</i> L. 1758	+	+	+		
Crucian carp	<i>Carassius carassius</i> L. 1758	+	+			
Pikeperch	<i>Stizostedion lucioperca</i> L. 1758	+		+		
Knife	<i>Pelecus cultratus</i> L. 1758	+				
Rudd	<i>Scardinius erythrophthalmus</i> L. 1758	+				
Pike	<i>Esox lucius</i> L. 1758	+	+	+	+	+
Catfish	<i>Silurus glanis</i> L. 1758	+	+	+	+	+
Carp	<i>Cyprinus carpio</i> L. 1758	+	+	+	+	+
Roach	<i>Rutilus rutilus</i> L. 1758	+	+	+		+
Bream	<i>Abramis brama</i> L. 1758	+		+	+	+
Barbel	<i>Barbus barbus</i> L. 1758	+		+	+	+
White bream	<i>Blicca björkna</i> L. 1758		+			
Orfe	<i>Leuciscus idus</i> L. 1758			+	+	
Vimba	<i>Vimba vimba</i> L. 1758			+		
Undermouth	<i>Chondostroma nasus</i> L. 1758				+	
Sturgeon sp.	<i>Acipenseridae</i>				+	+
Sterlet	<i>Acipenser ruthenus</i> L. 1758				+	+
<b>Total NISP</b>		<b>1685</b>	<b>2472</b>	<b>2195</b>	<b>1196</b>	<b>1961</b>

Table 5. The presence of various species identified in five water-sieved samples

Species identified in all five assemblages are marked by shading. Remarkably, these ubiquitous species include the fish (the “trinity” of pike, carp and catfish) whose large specimens are also known in almost all hand-picked fishbone collections. All three occupy a central position in this list. The diagonal pattern displayed by the various fish species begins with tench in the upper left corner and ends with sterlet in the lower right corner. The minimum requirements of dissolved oxygen by these characteristic freshwater fish species (as well as that of pikeperch) are as follows<sup>45</sup>:

Tench ( <i>Tinca tinca</i> Linné 1758)	0.7 mg/l
Pikeperch ( <i>Stizostedion lucioperca</i> Linné 1758)	2.0–3.0 mg/l
Sterlet ( <i>Acipenser ruthenus</i> Linné 1758)	3.0–3.5 mg/l

The high value of (non-anadromous) sterlet indicates, why other oxygen-loving and anadromous species of sturgeons seek rapid rivers during the spring for spawning, and why water temperature is of decisive importance in the timing of their migration, as much as in the reproduction of even more sedentary fresh water fish species. Tench, on the other hand, located at the bottom of the list, is a small Cyprinid that well tolerates warm, stationary waters owing to its low requirement of dissolved oxygen.

Of the settlements examined in this table two sites, located in different parts of Hungary (Tiszaug–Kéménýtető and Ecsegfalva 23), each represent a metapotamon type habitat. Tiszaug is located almost directly on the river, while the other Ecsegfalva 23 lay off the main stream of nearby tributaries. While Győr–Szabadrét-domb also falls in the metapotamon category, it is located near the largest inland delta in Europe, the Szigetköz region, that was a wetland area richly supplied by a web of various branches of the Danube. It may be looked upon therefore as a transitional habitat between the metapotamon and hipopotamon categories. It is important to note, however, that at this point, the Danube returns to itself,

<sup>45</sup> Péntes – Tölgy 1977, 327.

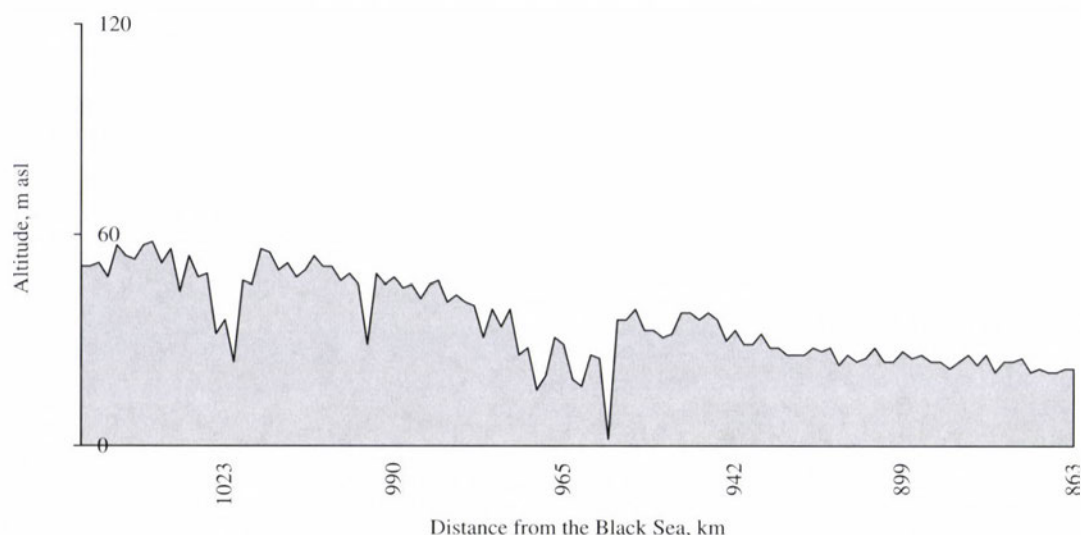


fig. 6. Pre-regulation longitudinal section of the lower Iron Gates  
(based on 1872 data by Rinaldo)

rather than opening into the sea. An important feature, brackish waters, therefore is missing. It is the speed of the water that is most reminiscent of a “real” river delta. Owing to their special location downstream from the Iron Gates, the two chronologically distinct units originating from Schela Cladovei represent an entirely different habitat, most similar to a lower foothill (epipotamon) situation. Of all the identified fish species, the presence of undermouth would be most indicative of this habitat.

#### RIVERBED GRADIENTS AND THE INTENSITY OF DISCHARGE

As has been pointed out, aside from climate, the speed of water defines alluvial habitats through the quantity of oxygen dissolved. The velocity of water is directly related to topography. Even within the relatively even area of the Great Hungarian Plain, the evolution of a mosaic-like environment seems primarily related to local vertical variations in the landscape, i. e. the relative height of the water table. This important parameter defines aquatic habitats, soil formation, flora and fauna alike.

In the case of large rivers, such as the Danube, the effect of topography is even more dramatic. The *ca* 2300 m<sup>3</sup>/s average discharge of the Danube at Budapest more than doubles to over 5600 m<sup>3</sup>/s in the Iron Gates gorges. Before the construction of the Iron Gates 1 dam, this latter, *ca* 130 km long section of the Danube displayed extremely dynamic changes in water levels. Minimum discharge was 1400 m<sup>3</sup>/s, while 16 000 m<sup>3</sup>/s values were also measured.<sup>46</sup> Prior to dam closure, the riverine environment of the Iron Gates gorges was characterized by strong currents, hard substrates, and was rich in nutrients, aquatic plants, insects and invertebrates that sustained rich and varied fish resources.

The Danube was confined to a width of only 170 m in the Khazan gorge. As shown in *fig. 6*, depths at this section varied between 0.5 and 50 m before the river exited to the plain. In the lower part of the Iron Gates gorges, near Turnu-Severin in Romania, the riverbed has a very steep gradient, falling 8 m in only 20 km. By contrast, over the 935 km between Schela Cladovei and the Black Sea, the riverbed declines overall by only 34 m.<sup>47</sup> Thus the net gradient is three orders of magnitude different (40% vs 0.037%) not to mention the considerable differences in topography and relief between these two sections of the Danube Valley.

Prehistoric findspots suggest that understanding habitat preferences of sturgeon may point to locations where certain types of fish could be caught most efficiently – information whose intimate knowledge must have been essential to prehistoric fisher folk. Lake sturgeon in Canada

<sup>46</sup> Bancila et al. 1972, 9.

<sup>47</sup> C. C. Giurescu: Istoria pescuitului si a pisciculturii în Romania (The History of Fishing and Pisciculture in Romania). București 1964.



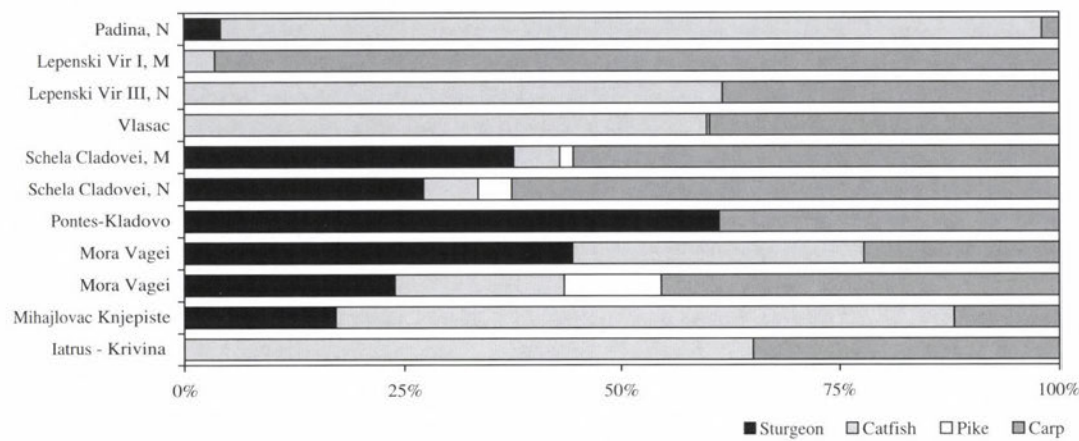


fig. 7. The relative frequency of sturgeon bones in hand-collected fish assemblages along the Iron Gates section of the Danube

spawn in rivers at depths of *ca* 0.5–5 m, in areas of swift water or rapids at the foot of low falls that slow down further migration.<sup>48</sup> Given the mass movement during the spawn run, such places must have been packed with sturgeons of all sorts in the Iron Gates gorges as well, making them increasingly vulnerable to human predation. This hypothesis seems to be supported by the differential proportion of from large fish in hand-collected archaeozoological assemblages at different locations within the Iron Gates. When appraising data in *Table 6*, it should be born in mind that fish bone finds indicate catch (i.e. consumption), rather than entire fish populations.

Sites (proceeding downstream)	Acipenserid	Catfish	Pike	Carp	Varia
Padina, Neolithic <sup>49</sup>	64	1502		32	1053
Lepenski Vir I, Mesolithic <sup>50</sup>		3		86	154
Lepenski Vir II, Mesolithic <sup>51</sup>		5		1	47
Lepenski Vir III, Neolithic <sup>52</sup>		22		14	364
Vlasac, Mesolithic <sup>53</sup>		2283	11	1552	5241
Schela Cladovei, Mesolithic <sup>54</sup>	315	46	13	466	817
Schela Cladovei, Neolithic <sup>55</sup>	131	30	19	303	251
Pontes-Kladovo, Early Medieval <sup>56</sup>	34			22	
Mora Vagei, Neolithic <sup>57</sup>	8	6		4	
Mora Vagei, Roman Period <sup>58</sup>	11	9	5	21	
Mihajlovac Knjepiste, Neolithic <sup>59</sup>	10	41		7	183
Iatrus – Krivina (Roman) <sup>60</sup>		11		6	17

Table 6. The number of bones representing large fish species in hand-collected assemblages from the Iron Gates

<sup>48</sup> *S. Needs-Howarth*: Lake sturgeon fishing at Prehistoric Iroquoian sites near Lake Simcoe, Ontario. *Archaeofauna* 5 (1996) 147–154.

<sup>49</sup> *A. T. Clason*: Padina and Starčevo: Game, fish and cattle. *Palaeohistoria* 22 (1980) 142–173.

<sup>50</sup> *Bökönyi* 1969.

<sup>51</sup> *Bökönyi* 1969.

<sup>52</sup> *Bökönyi* 1969.

<sup>53</sup> *Bökönyi* 1978.

<sup>54</sup> *Bartosiewicz et al.* 2001.

<sup>55</sup> *Bartosiewicz et al.* 2001.

<sup>56</sup> *Bartosiewicz* 1996.

<sup>57</sup> *Bartosiewicz*, unpublished.

<sup>58</sup> *Bartosiewicz*, unpublished.

<sup>59</sup> *S. Bökönyi*: Animal remains of Mihajlovac–Knjepište, an early neolithic settlement of the Iron Gate Gorge. *Balkanica (Hommage a Nikola Tasić a l’occasion des ses soixante ans)* 23 (1992) 77–87.

<sup>60</sup> *L. Bartosiewicz – A. M. Choyke*: Animal remains from the 1970-1972 excavations of Iatrus (Krivina), Bulgaria. *ActaArchHung* 43 (1991) 181–209.

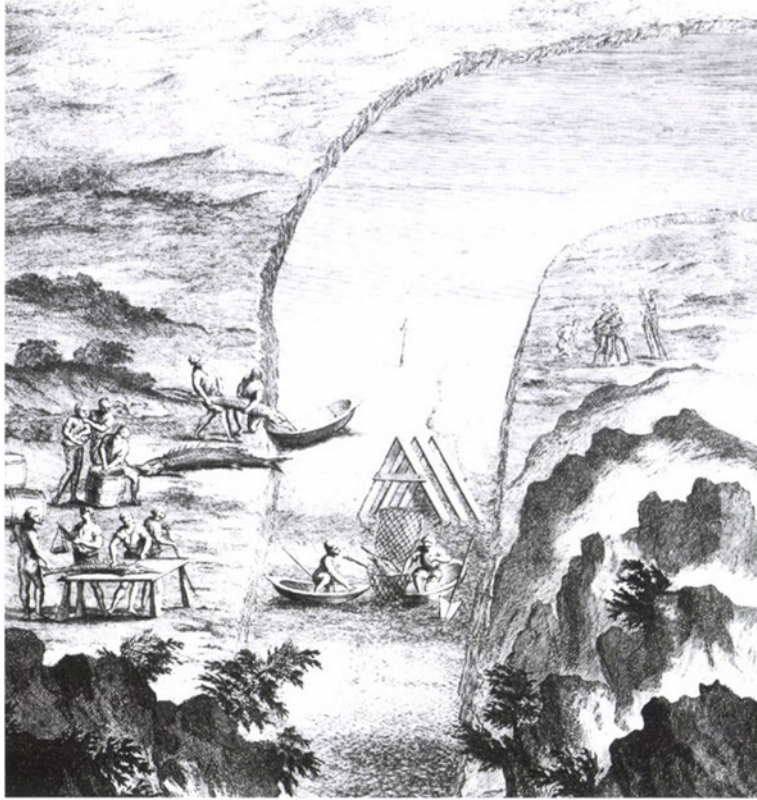


fig. 8. Sturgeon fishing at the exit of from the Iron Gates gorges in Marsigli's 1726 book.  
Note the landscape changes downstream, toward the top of the picture

The trend suggested by this table is even more clearly expressed in percentual terms, summarized in *fig. 7*.<sup>61</sup> The historical landscape relevant to this situation may be appraised in an excellent early 18<sup>th</sup> century picture published by Marsigli,<sup>62</sup> an Italian military engineer and polyhistor, who travelled along the Danube (*fig. 8*).

### Seasonality

Seasonality in fish and, in fact, all animals may be most precisely appraised on the basis of stable<sup>63</sup> incremental structures (e.g. otoliths, mussel shell).<sup>64</sup> The open vs. closed state of growth rings in fish vertebrae makes distinction between summer/winter catch, to some extent, possible, but is a poor indicator of age itself, owing to the possibility of bone remodelling that may result in the resorption of growth rings. In the absence of the serial laboratory study of these features, inferences concerning seasonality were drawn from the presence and absence of certain fish in the find material.

Interspecific differences in spawning temperatures, as well as the presence of off-season stragglers meant that all fish species known from archaeological assemblages in the Danubian region, even anadromous sturgeons, were available year round. The use of their bones as seasonal indicators in archaeological assemblages, therefore, is limited to probabilistic interpretations. Evidently, all fish could be most successfully targeted during the spawning season, and their indicator value may be critically evaluated on the basis of this empirical observation.<sup>65</sup> Most species seek shallow waters near riverbanks as well as residual waters for spawning, where they become more visible and easily fall victim to human predation. This may have been especially important in prehistoric times, when the success of fisher folk was

<sup>61</sup> Bartosiewicz 1996, Bartosiewicz 1997.

<sup>62</sup> L. F. Marsigli: *Danubius Pannonico-Mysicus*, vol. VI. Amsterdam – The Hague 1726.

<sup>63</sup> The perpetual re-modeling through life makes bones ill-suited for this purpose.

<sup>64</sup> A. Wheeler – A. K. G. Jones: *Fishes*. Cambridge Manuals in Archaeology, Cambridge 1989.

<sup>65</sup> Bartosiewicz *et al.* 1994, 110.



at least as dependent on the intimate knowledge of animal behavior as on the technology by which hunting and fishing equipment were produced.

In short, the sheer presence, rather than the age or size represented by the archaeological remains of various fish species, thus may be assigned with greater probability to their respective season of spawning. Regardless of the actual season, for example, groups of migrating sturgeon, tended to include individuals of different ages and sizes.<sup>66</sup> The present-day spawning schedules of fish identified at prehistoric sites in Hungary are listed in *Table 7*.

Species		Spawning time	Water temperature
Beluga sturgeon	<i>Huso huso</i> Linné 1758	March–May	9 °C
Russian sturgeon	<i>Acipenser gueldenstaedti</i> Brandt 1833	April–May	8–18 °C
Stellate sturgeon	<i>Acipenser stellatus</i> Pallas 1771	April–May	10–17 °C
Ship sturgeon	<i>Acipenser nudiiventris</i> Lovetzky 1828	April–June	10–17 °C
Starlet	<i>Acipenser ruthenus</i> Linné 1758	April–June	12–17 °C
Carp	<i>Cyprinus carpio</i> L. 1758	April–May	18–20 °C
Bream	<i>Abramis brama</i> L. 1758	April–June	12–13 °C
Barbell	<i>Barbus barbus</i> L. 1758	May–June	17–19 °C
White bream	<i>Blicca björkna</i> L. 1758	April–June	16–17 °C
Crucian carp	<i>Carassius carassius</i> L. 1758	May–June	17–18 °C
Undermouth	<i>Chondostoma nasus</i> L. 1758	April–May	–
Orfe	<i>Leuciscus idus</i> L. 1758	May–June	–
Knife	<i>Pelecus cultratus</i> L. 1758	April–May	–
Roach	<i>Rutilus rutilus</i> L. 1758	April–May	10–15 °C
Rudd	<i>Scardinius erythrophthalmus</i> L. 1758	April–May	15–18 °C
Tench	<i>Tinca tinca</i> L. 1758	May–June	22–25 °C
Vimba	<i>Vimba vimba</i> L. 1758	April–May	–
Catfish	<i>Silurus glanis</i> L. 1758	May–June	18–19 °C
Pike	<i>Esox lucius</i> L. 1758	February–March	7–10 °C
Pikeperch	<i>Stizostedion lucioperca</i> L. 1758	April–May	12–14 °C
Tench	<i>Tinca tinca</i> L. 1758	May–June	22–25 °C

Table 7. Spawning parameters of various large fish species identified at archaeological sites<sup>67</sup>

Beluga, Russian and Stellate sturgeon swim upstream to the Iron Gates between January to June as well as October to December. These two periods also coincide with seasons of high discharge in this region (*fig. 9*),<sup>68</sup> when low water temperatures and high water velocity favour spawning. Sturgeon fishing between June and September only took place opportunistically in the Iron Gates when water temperatures were high and discharge low. Mátyás Bél, an 18<sup>th</sup> century Hungarian naturalist, documented the same two seasons in Hungary: spring fishing began in March and continued uninterrupted until June. The fall season for sturgeon lasted from August until December.<sup>69</sup> Temperatures within the same month may vary between different aquatic habitats. Regional variations between aquatic environments across Europe introduce additional noise into this system.<sup>70</sup>

### *Historical and ethnographic aspects of fish exploitation*

While large Acipenserid bones commonly occur in some Mesolithic and Neolithic archaeological assemblages, they seem to become rare by the late Middle Ages. In part, this may be explained by a shift in the focus of archaeological research: catch sites were more likely to coincide with the sites of consumption during prehistory.

<sup>66</sup> G. Roussow: Some considerations concerning sturgeon spawning periodicity. *Journal of the Fisheries Research Board of Canada* 14 (1957) 553–572.

<sup>67</sup> Berinkey 1967.

<sup>68</sup> Bancila et al. 1972, 19.

<sup>69</sup> Bél 1764.

<sup>70</sup> P. S. Maitland – K. Linsell: *Europas sötvattenfiskar*. Stockholm 1978; K. Curry-Lindahl: *Våra fiskar. Havs- och sötvattenfiskar i Norden och övriga Europa*. Stockholm 1985.

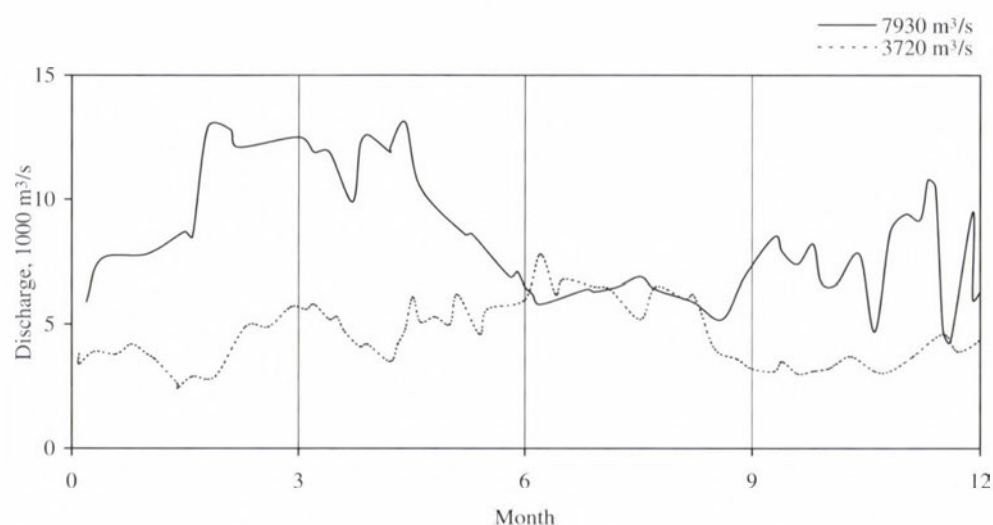


fig. 9. Seasonal fluctuations in the quantity of water at high and low mean annual discharge in the Iron Gates gorge

Catching large fish, such as sturgeon or catfish, in the mainstream of the Danube evidently required specialized techniques in comparison to simple forms of fish “gathering” (e.g. potting) that could be practiced anywhere in its floodplains of the Great Plain. The landing of such large individuals must have also required cooperative fishing techniques. Aside from the cultural difference to the apparently more opportunistic form of fishing practiced in the Great Plain, the presence of sturgeon in classical Starčevo assemblages from within the Iron Gates is also explained by the statistical fact that anadromous sturgeons are caught with greater probability in the lower sections of rivers. It must be mentioned within this context that, historically, sturgeons were known to have migrated upstream way beyond the Carpathian Basin into sections of the Danube located in present-day Austria and Bavaria.<sup>71</sup>

The extensive floodplains of the slowly meandering rivers and wetlands in the Great Plain offered completely different opportunities for fishing. After early summer floods receded, millions of fish of all sizes were trapped in pools where they could be simply gathered. Mátyás Bél, a 18<sup>th</sup> scholar, mentioned the unbearable smell of dead fish, left behind after major flood of the Tisza river.<sup>72</sup> While it remains a question what the culturally determined reaction of prehistoric people would have been to this development in the environment,<sup>73</sup> it is quite conceivable that fish was a lot more common in the diet of most prehistoric sites would be suggested by the insignificant numbers of fish bones recovered from hand-collected settlement assemblages.

Sporadic occurrences of prehistoric fishing gear (e.g. fish hooks,<sup>74</sup> net remains<sup>75</sup>) from prehistoric sites in Hungary also indicate that, while opportunistic forms of fishing must have been important, some fishermen also possessed special skills and they possibly worked in an organized, cooperative manner.

According to a kind personal communication by Eszter Bánffy, a Mesolithic find from the Lake Balaton region may possibly be interpreted as the remains of a coracle.<sup>76</sup> Other boats

<sup>71</sup> A. Khin: *A magyar vizák története* (The history of Hungarian sturgeons). Budapest, Mezőgazdasági Múzeum Füzetek 2, 1957.

<sup>72</sup> Bél 1764.

<sup>73</sup> L. Bartosiewicz: “There is something rotten in the state...” Bad smells in Antiquity. *Journal of European Archaeology* 6 (2003) 171–191.

<sup>74</sup> I. Zalai-Gaál: A Mórágý-tüzközdombi horog. A neolitikus “aktív” halászat kérdései a Kárpát-medencében (Die Angel von Mórágý-Tüzközdomb. Die Fragen der Neolithischen “aktiven” Fischerei im Karpatenbecken). *ArchÉrt* 110 (1983) 231–242; A. M. Choyke – L. Bartosiewicz: Angling with bone,

in: W. Van Neer (ed.): *Fish exploitation in the past*. Tervuren, Koninklijk Museum voor Midden-Afrika, *Annalen, Zoologische Wetenschappen* Vol. 274 (1994) 177–182.

<sup>75</sup> J. Makkay: Textile impressions and related finds of the Early Neolithic Körös culture in Hungary. Budapest 2001, 64–65.

<sup>76</sup> K. Bakay – K. Sági – N. Kalicz: *Magyarország Régészeti topográfiája, I. Veszprém megye, keszthelyi járás* (Archaeological Topography of Hungary, vol. I. Veszprém County, Keszthely District) Budapest 1966, 76. Keszthely, Site 1. Reference provided by E. Bánffy.



are also known both from the Mesolithic and the Starčevo culture in the Pannonian region.<sup>77</sup> In addition to general transport, such boats may have been used in fishing.

In the absence of written sources, however, social and cognitive aspects of prehistoric fishing can be studied at best using ethnographic analogies. It is at this point, that the prestigious body of literary data concerning ethnohistoric records on artisanal fishing, compiled by Acheson and Wilson,<sup>78</sup> was worth analyzing. The 11 dichotomic variables (presence/absence) recorded in these traditional fishing communities, represent attitudes to the aquatic resources and their exploitation by indigenous communities around the world. Factor loadings of the two major factors (latent roots  $\geq 1$ ) obtained by their analysis are indicative of two fundamental dimensions that characterize artisanal fishing (Table 8).

Management attitudes	Factor 1 “traditional”	Factor 2 “commercial”
protection of breeding stock	<b>0.791</b>	-0.154
protection of young	<b>0.614</b>	0.357
conservation ethic	<b>0.593</b>	-0.334
size limits	<b>0.560</b>	<b>0.500</b>
seasonal limits	0.288	0.306
areas of fishing territory	0.123	0.302
fishing quotas	0.019	<b>0.762</b>
industrial fishing	-0.071	<b>0.781</b>
technology	-0.153	0.244
limited access	-0.294	0.402
protect from overcrowding	-0.457	-0.202
<b>Latent root</b>	2.092	2.151
<b>% of total variance</b>	19.0	19.6

Table 8. Latent roots expressing the relationship between attitudes to aquatic resources

As is shown by the greatest values on the first, bipolar factor<sup>79</sup> (encompassing 19.0% of the total variance), protection of the breeding stock and of young fish, conservation ethic and size limits form a closely related group. These are values shared by many indigenous groups in the developing world. By regulating how people fish, these communities have developed strategies best adapted to the chaotic population patterns that fish stocks tend to exhibit. Spawning, growth and mortality figures may have varied unpredictably even in prehistoric times (e.g. according to drought/flooding), which probably effected early subsistence economies more directly. This factor thus, represents “*traditional*” attitudes to fish management.

Factor loadings exceeding 0.5 on Factor 2 (19.6% of the total variance) also include size limits, associated with historical examples of industrial fishing (especially in the United States and Atlantic Europe) in which the protection of breeding stock was a low priority in the absence of a traditional conservation ethic. Size limits and fishing quotas characteristic of this attitude regulate stocks by the output, rather than the entire system of fish exploitation. This may be characterized as a “*commercial*” attitude.

In archaeoichthyological studies, our ability to transfer the abundant ethnographic information from its original framework to archaeology is of critical concern.<sup>80</sup> Archaeoichthyological assemblages, especially from prehistoric, are probably a product of traditional values that determined fish exploitation in ancient times. Paradoxically, however, fish remains from archaeological sites by definition represent output, i. e. fish that were

<sup>77</sup> M. Eric: Nova datiranja deblakovja colnov. Arheo 16 (1994) 74–78. Reference provided by E. Bánffy.

<sup>78</sup> Acheson – Wilson 1996, 582–583.

<sup>79</sup> H. H. Harman: Modern Factor Analysis. Chicago and London 1967, 100.

<sup>80</sup> R. Cerón-Carrasco: Of Men and Fish: Some aspects of the utilization of marine resources as recovered from selected Hebridean archaeological sites. PhD. Thesis, University of Edinburgh, 2002.

“not protected”. This is what makes the reconstruction of prehistoric attitudes to fisheries management difficult. Most interestingly, however, two variables, seasonal limitations and the areal definition of fishing territories played no direct role in determining these two basic types of attitudes. These seem to be equally independent from the two basic forms of fisheries management.

### Conclusions

While it cannot be demonstrated that fishing played a key role in the lives of all prehistoric peoples living along the Danube, the potential significance of exploiting aquatic resources should not be neglected at sites where fish bones have been recovered.

Owing to their generally small size and concomitant poor resistance to a host of taphonomic factors, fish remains tend to be dramatically underrepresented at sites where the material is collected without screening or water-sieving. Therefore, due to the hand-collection of finds that still dominates in Hungarian archaeology, the majority of bones available to specialists overwhelmingly represent large-size fish, which leads to the selective representation for mature individuals of carp (*Cyprinus carpio* L. 1758), pike (*Esox lucius* L. 1758) and catfish (*Silurus glanis* L. 1758). It is noteworthy, however, that the remains of these important species also occur most systematically in water-sieved assemblages from a number of sites. They may thus be considered ubiquitous in appropriately large surfaces of water on the basis of their consistent presence in archaeoichthyological assemblages from Hungary.

In this sense, their dominance in almost all major hand-collected samples has been reconfirmed by refined methods of recovery. Water sieved samples often yield bones from the younger and therefore smaller individuals of these large species. This is a very clear trend in the case of pike, while (with the exception of a few diagnostic skeletal elements, such as pharyngeal teeth) the thus recovered bones of younger carp are extremely difficult to distinguish from those of small Cyprinid species, which provide the bulk of finds from the sieved residue of prehistoric settlement deposits.

As a result of the natural geography of the Carpathian Basin, a region covered by marshland throughout its past, new assemblages obtained using more refined methods turn out to contain a great variety of bones from small species belonging to the carp family (*Cyprinidae*). Sturgeons (*Acipenseridae*) in the Danube form another better known group, whose prehistoric remains occurred most typically at settlements in the Iron Gates gorge, characterized by a radically different, dynamic aquatic habitat.

Although species-level identification in many fish families (*Acipenseridae*, *Cyprinidae*) is limited to special elements, small fish from the Danube must have played comparable roles in most cultures. Their known differing habitat preferences, however, may be used in illustrating variability in their respective aquatic habitats.

Ethnographic examples were used in an attempt to distinguish between traditional and commercial attitudes to fishing. While the two factors represent only 40% of total variance, they indicate that, cognitive aspects of traditional fishing may be distinguished from the modern, market-oriented exploitation of aquatic fauna. The idea of “managing” environmental resources is unlikely to have existed in its contemporary sense during prehistory. Traditional fishing cultures show, however, that both ideological and technical limitations were placed on the input i.e. reproductive aspect of fish stocks, as opposed to commercial fishing more determined by criteria defined the output. Prehistoric fishing in Hungary must have been closer to the first type.<sup>81</sup>

<sup>81</sup> I am grateful to Eszter Bánffy for having provided guidance in the archaeological literature pertinent to the subject of navigation. Figures from Marsigli's original work were kindly provided by Andrea Kreutzer of the Military Museum in Budapest.

Thanks are due to Alice M. Choyke for useful comments on the text as well as Erika Gál and László Daróczi-Szabó who translated articles written in Romanian.



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## THE NEOLITHIC AVIFAUNA OF HUNGARY WITHIN THE CONTEXT OF THE CARPATHIAN BASIN

Archaeo-ornithology is a special field within archaeo-zoology. It offers information both on the composition of the avian assemblages and fauna of the settlements. Various aspects of archaeo-ornithology also contribute to the environmental reconstruction and seasonality of the inhabited sites.<sup>1</sup> An interesting subject within this special field is the study of worked bird bones that provides information concerning the use of bird bones as raw materials for different instruments (e.g. flutes and pipes) and objects (tools, amulets, etc.).<sup>2</sup>

In the past, some archaeologists did not pay much attention to small bones in the excavated materials, thus contributing to the loss of fish-, bird and herpetological remains. This attitude fortunately has changed and recently in many excavations the bones are collected not only using hand-collected methods but using flotation, and wet as well as dry sieving. The identification of avian remains requires at least a basic comparative bird bone collection, specialization in bird osteology, taphonomy and taxonomy, and a certain skill in biology. Therefore many bird bone materials still lay in deposits of different museums and institutions being labelled only as “Aves indeterminated”.

Data concerning the Neolithic bird remains found in archaeological contexts in Hungary and former Yugoslavia were summarized by Sándor Bökönyi, Dénes Jánosy and Anneke T. Clason.<sup>3</sup> Other publications also listed bird bone materials and species beside the mammalian assemblages.<sup>4</sup> A few Neolithic bird remains were noted by István Vörös<sup>5</sup> as well. The subfossil avifaunas in Romania were studied and published by Tiberiu Jurcsák, Eugen Kessler and Erika Gál.<sup>6</sup> Some recently found remains have been identified, while others needed revision. The aim of this paper is to give a general overview about the Neolithic avifauna of the Carpathian Basin including the latest and yet unpublished results.

### Results

Twenty four Neolithic deposits of 21 localities furnished bird bones in Hungary (*fig. 1*). The assemblages richest in bird remains and in recognized species were found at Körös culture settlements (*Table 1*). Although the greatest number of bird bones (607) was found at site Endrőd 119, only 10% of the material was identifiable.<sup>7</sup> The recently excavated site Ecsefalva 23 yielded an outstandingly well preserved bird bone material by 276 remains

<sup>1</sup> A. Morales Muñiz: Ornithoarchaeology: the various aspects of the classification of bird remains from archaeological sites. *Archaeofauna* 2 (1993) 1–13; A. Eastham: The potential of bird remains for environmental reconstruction. *International Journal of Osteoarchaeology* 7 (1997) 422–429;

D. Serjeantson: Birds: a seasonal resource. *Environmental Archaeology* 3 (1998) 23–33.

<sup>2</sup> L. H. van Wijngaarden-Bakker: The selection of bird bones for artefact production at Dutch Neolithic sites. *International Journal of Osteoarchaeology* 7 (1997) 339–345; E. Gál: New data to the bird bone artefacts from Hungary and Romania, in: H. Luik – A. Choyke – C. Batey – L. Lõugas (eds): *From hooves to horns, from mollusc to mammoth: manufacture and use of bone artefacts from Prehistoric times to present. Research into ancient times no. 15. Muinasaja teadus, Tallin* (in press).

<sup>3</sup> Bökönyi – Jánosy 1965; Bökönyi 1974, 337–436; Jánosy 1985; Clason 1980.

<sup>4</sup> S. Bökönyi: Die frühalluviale Wirbeltierfauna Ungarns (Vom Neolithikum bis zur La Tène Zeit). *ActaArchHung* 11 (1959) 39–102; Bökönyi 1992, 198.

<sup>5</sup> I. Vörös: Animal husbandry and hunting in the Middle Neolithic settlement at Tiszavasvári-Deákalmi dűlő (Upper Tisza region). *JAMÉ* 36 (1994) 167–184; *Idem*: Dévaványa – Barcái Kishalom kora neolitikus állatsontleletei. [Early neolithic animal bones from Dévaványa – Barcái Kishalom] *CommArchHung* (1997) 31–37.

<sup>6</sup> T. Jurcsák – E. Kessler: Evoluția avifaunei pe teritoriul României (I). *Crisia* 16 (1986) 577–615; E. Kessler: Prezența Galinaceelor (Ord. Galliformes, Cl. Aves) printre resturile scheletice colectate din situri arheologice de pe teritoriul României. *ActaMN* 26–30 (1989–1993) 205–220; Kessler – Gál 1997; Kessler – Gál 1998.

<sup>7</sup> Bökönyi 1992, 198.



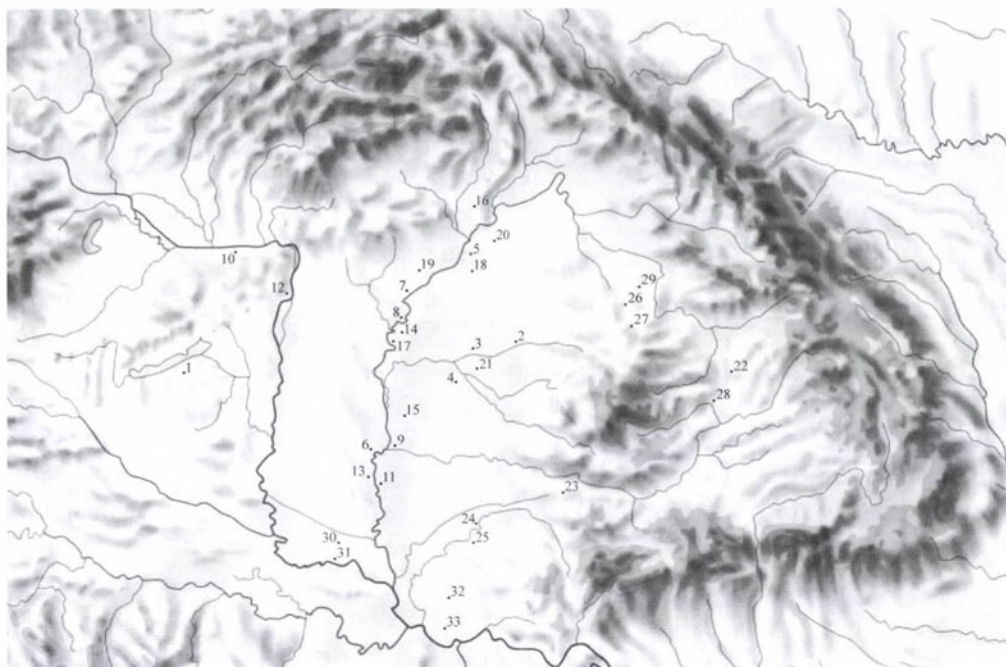


fig. 1. Neolithic localities and cultures yielding bird bone remains in the Carpathian Basin

1. Balatonszemes-Bagódomb (H), DLPC; 2. Berettyóújfalu-Herpály (H), He; 3. Ecsegfalva 23 (H), K;
  4. Endrőd 6 (H), ALPC; Endrőd 39 (H), K; Endrőd 119 (H), K; 5. Folyás-Szilme (H), ALPC;
  6. Gyálarét (H), K; 7. Kisköre-Gát (H), T; 8. Kötelek-Huszársarok (H), K; ALPC; 9. Maroslele-Pana (H), K;
  10. Neszmély-Tekeres patak (H); MZs; 11. Ószentiván (Tiszasziget) (H), V; 12. Pomáz-Zravlyák (H), MZs;
  13. Rőszke-Lúdvár (H), K; 14. Szajol-Felsőföld (H), K; 15. Szegvár-Tűzköves (H), T; 16. Szerencs-Taktaföldvár (H), T; 17. Szolnok-Szanda (H), K; 18. Tiszapolgár-Csőszhalom (H), CsH; 19. Tiszavalk-Négyesi határ (H), ALPC; 20. Tiszavasvári-Deákalmi dűlő (H), ALPC; Tiszavasvári-Keresztfal (H), ALPC; 21. Déványa-Barcói Kishalom (H), KP; 22. Ungureasca Cave (R), P; 23. Cladova (R), N; 24. Foeni (R), MN; 25. Parța (R), V;
  26. Salca (R), N; 27. Suplacu de Barcău (R), N; 28. Tureni-Săndulești (R), N; 29. Zăuan (R), N; 30. Ludas-Budzsák (S), K; 31. Nosza-Gyöngypart (S), K; 32. Padina (S), SC; 33. Starčevo (S), SC. Sínrai
- Abbreviations. H: Hungary, R: Romania, S: Serbia; DLPC: Dunántúli Linear Pottery Culture, H: Herpály culture, K: Körös culture, ALPC: Alföldi Linear Pottery Culture, T: Tisza culture, MZs: Musíc note – Zseliz culture, V: Vinča culture, CsH: Csőszhalom – Herpály culture, P: Petrești culture; N: Neolithic, MN: Middle Neolithic, SC: Starčevo – Criș

related to 65 individuals and 43 identifiable species.<sup>8</sup> The Alföldi Linear Pottery Culture (ALPC) Endrőd 6 furnished the best represented assemblage among the 15 Middle- and Late Neolithic sites (Table 4).

Fewer Neolithic settlements with bird bone assemblages are known in Serbia and in Romania (fig. 1). The Starčevo – Criș site Starčevo<sup>9</sup> and the Körös culture Ludas-Budzsák<sup>10</sup> yielded considerable avian materials in Serbia. Among the Transylvanian localities, Vinča culture Parța<sup>11</sup> and the Petrești – Linear Band Culture Ungureasca Cave<sup>12</sup> provided significant assemblages (Table 2).

The richest Neolithic avifaunas are known from the 23 Hungarian settlements by 76 bird taxa, 61 of which were recognized to species level. The total number of bird bone remains is 1109. The Körös culture settlements yielded 1053 bones of which 74 taxa were identified, while the Middle- and Late Neolithic sites furnished only 56 bird remains and 25 taxa. The four Serbian sites yielded 113 remains in all, and 28 bird taxa with 22 species were recognized. In Romania, 9 settlements yielded 81 bird bone remains and 31 taxa, 27 of them being identified to species level (Table 2).

<sup>8</sup> Gál in prep. b.

<sup>9</sup> Classon 1980.

<sup>10</sup> Bökönyi 1974, 436.

<sup>11</sup> Kessler – Gál 1997, 142.

<sup>12</sup> Kessler – Gál 1998.



All the species mentioned in this article are included in a separate table that also summarizes their ecological characteristics and seasonality<sup>13</sup> (Table 3).

### Discussion

Archaeornithological studies have accelerated in the last four decades. While in 1965 only 17 species were known in the Neolithic of Hungary,<sup>14</sup> 20 years later this number grew to 38.<sup>15</sup> Recently the number of bird identified taxa is 76.

The distribution of bird bone assemblages is different both within the Carpathian Basin and within the periods of the Neolithic. Some settlements yielded a remarkable number of avian remains and taxa while others furnished only a few bones and species. From a chronological point of view Early Neolithic sites provided the most abundant bird bone accumulations and the richest fauna.

In Neolithic avian assemblages mainly the remains of middle to large sized birds dominate. This phenomenon may have at least three basic reasons: taphonomic explanations, excavation methods and economic interest of the ancient peoples. Smaller bones rather fall prey to taphonomic loss caused by predators and other pre-depositional factors. Larger bones are usually more easily noted during the excavations with hand collecting methods. Finally, time and energy invested in (bird) hunting would target bigger prey animals. Other reasons, such as the frequency of and access to certain species in nesting or feeding place, seasonal fowling, etc. would also determine taxonomic composition.

From a taxonomical point of view, large and middle sized wading birds (Ciconiiformes and Charadriiformes), waterfowls (Anseriformes), terrestrial birds (Galliformes and Gruiformes) and perching birds (Passeriformes) are numerous in Neolithic avifaunas. Many more diurnal birds of prey (Accipitriformes and Falconiformes) than owls (Strigiformes) were reported among the predators. Pigeon, e.g. Woodpigeon (*Columba palumbus*), Roller (*Coracias garrulus*) or woodpeckers, e.g. Great Spotted Woodpecker (*Dendrocopos major*) have rarely been found.

Water fowl (swans, geese and ducks) are outstandingly well presented within the fauna. Different dabbling ducks (*Anas*) and diving ducks (*Aythya*) were hunted. Swans (*Cygnus*) and geese (*Anser*) were also present at many localities. Remains of Greylag Goose (*Anser anser*) were found at 13 sites. Coot (*Fulica atra*) and Mallard (*Anas platyrhynchos*) were the most hunted aquatic birds; they have been reported from 10 and 9 settlements, respectively. This latter species yielded the most abundant accumulation (33 remains of 6 individuals) at Ecsegfalva 23. Among wading birds large herons such as Grey Heron (*Ardea cinerea*) and Spoonbill (*Platalea leucorodia*) were often hunted at 7 and 6 sites, respectively. Within the large group of terrestrial birds White-tailed Eagle (*Haliaeetus albicilla*) was found at 7 sites. Vultures were reported only from Serbia and Romania.<sup>16</sup> Black Grouse (*Tetrao tetrix*) was found in 9 sites. This species – as already pointed out by Jánosy<sup>17</sup> – was living in plains from the Neolithic to Bronze Age.<sup>18</sup> Black Grouse seems to be especially frequent at Endrőd 119 and Ludas-Budzsák. A marshland species Crane (*Grus grus*) was reported from the greatest number of settlements (14), and warm steppe species Great Bustard (*Otis tarda*) also was hunted in 10 sites (Tables 1–2, 4).

Among passerines, especially corvids and larger songbirds such as Golden Oriole (*Oriolus oriolus*), different thrushes (*Turdus*) and Starling (*Sturnus vulgaris*) were found. The remains of small birds were abundant in the deposits of Ecsegfalva 23 and Ungureasca Cave (Romania) (Table 1–2). In the case of the recently excavated site Ecsegfalva 23 we know that beside of the hand collecting methods flotation, and dry and wet sieving of the material were also performed. This kind of separation of the remains from the sediment and other finds

<sup>13</sup> Peterson et al. 1977; Cramp (ed.) 1998.

<sup>14</sup> Bökönyi – Jánosy 1965, 92.

<sup>15</sup> Jánosy 1985, 96–97.

<sup>16</sup> Clason 1980; Kessler – Gál 1998.

<sup>17</sup> Jánosy 1965, 96.

<sup>18</sup> E. Gál – E. Kessler: Eneolithic bird remains from the tell site of Borduşani Popina (in press); E. Gál: Bronze Age bird remains from the Carpathian Basin (in prep.).



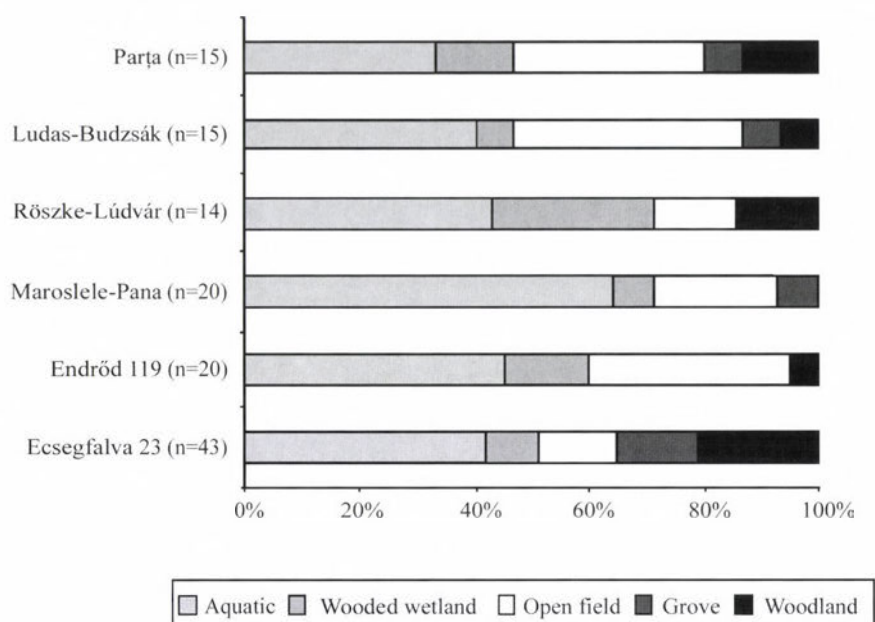


fig. 2. Proportion of bird species representing different ecotypes at the most represented settlements (n=number of species recognized)

always results in a higher proportion of small bones. The Petrești culture level of Ungureasca Cave yielded large bird species (e.g. Greylag Goose, Crane and Great Bustard) suggesting human interest in the economic value of the prey, but also some birds of prey and passerines. Concerning the settlement type, the faunal composition and the habitat of the recognized birds we may assume that different predators also may have contributed to the subfossil accumulation of this cave.<sup>19</sup>

The great number of wild fowl, aquatic- and wading birds must be in relation with the habitats around the Neolithic settlements. Majority of the sites are close to large rivers (e.g. Danube and Tisza) and their branches. The ecological significance of bird species indicate at least periodically flooded areas surrounded by swamps, reed beds and humid meadows. Many of the recognized species live in or close to waters, and make their nests on floating vegetal remains or in the reed bed.<sup>20</sup> Wooded wetlands such as gallery forests, where large wading birds and other arboreal species nest, also had to be around many localities. Although the number of identified species and thus the share of the different ecotypes are not always proportional in the studied settlements, one can notice the bigger ratio of aquatic species at site Maroslele-Pana, and the abundance of the arboreal species in wetland at Röszke-Lúdvár (fig. 2). Open field birds attached either to humid meadows or steppe and crops are generally well presented, in some localities (e.g. Röszke-Lúdvár and Ecsefalva 23), however, are recognized in smaller numbers by 20–30%. Forest species living in or at the edge of woodlands were found at Parța (Romania) and Ecsefalva 23 in greater number (fig. 2).

Studying the seasonality of the best represented Neolithic sites on the basis of bird species, one may notice that the seasonal presence of birds varies at in different sites. Resident species that are common all year round and summer visitors that come in the breeding season usually predominate. The only exception is site Maroslele-Pana where facultative over wintering species were in the biggest proportion (fig. 3). This group of birds includes migratory species that may stay during the cold season if the winter is mild and food is available.

Certain passage species also may remain during the winters. Black-throated Diver (*Gavia arctica*) identified from Kőtelek-Huszársarok<sup>21</sup> was observed in Hungary between October and April.<sup>22</sup> Bean Goose (*Anser fabalis*) known from Endrőd 119,<sup>23</sup> Szolnok-Szanda<sup>24</sup> and

<sup>19</sup> Kessler – Gál 1998.

<sup>20</sup> Peterson et al. 1977; Cramp (ed.) 1998.

<sup>21</sup> Jánossy 1985, 71.

<sup>22</sup> Peterson et al. 1977, 30.

<sup>23</sup> Bökönyi 1992, 198.

<sup>24</sup> Jánossy 1985, 73.

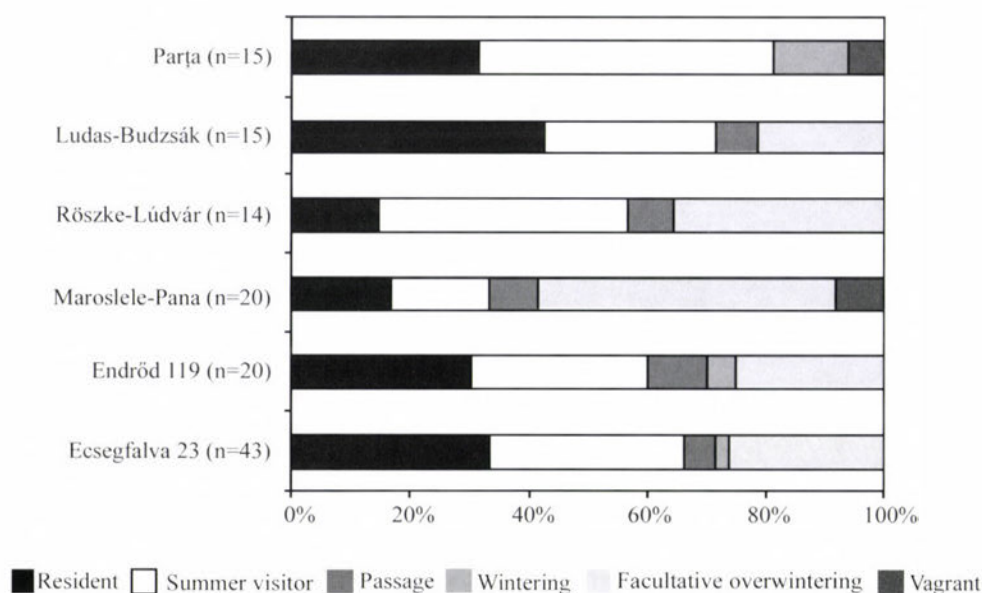


fig. 3. Seasonal presence of different bird species at the most represented settlements (n=number of species recognized)

Padina (Serbia),<sup>25</sup> and White-fronted Goose (*A. albifrons*) from Endrőd 119, Maroslele-Pana, Ószentiván<sup>26</sup> and Foeni (Romania) pass through Hungary in large numbers but often over winter between October–November and March–April.<sup>27</sup> Tufted Duck (*Aythya fuligula*) recognized from Ecsegfalva 23,<sup>28</sup> Röske-Lúdvár<sup>29</sup> and Ludas-Budzsák<sup>30</sup> also may over winter in November–April.<sup>31</sup> Vagrant species Shelduck (*Tadorna tadorna*) identified from Padina and Parța,<sup>32</sup> and Herring Gull (*Larus argentatus*) known from Maroslele-Pana may occur in late autumn–early winter.<sup>33</sup> Common spring- and autumn passage species (mainly ducks) and vagrants generally were found in small numbers in the Neolithic avifaunas (fig. 3). Winter visitors were identified in small number from Neolithic settlements. Ecsegfalva 23 yielded Goosander (*Mergus merganser*), Parța furnished *Branta sp. indet.* and Goosander, while Endrőd 119 provided Slavonian Grebe (*Podiceps auritus*).

We have to mention that the study of birds' seasonality is based both on palaeontological data and recent ornithological evidence. In the case of this latter, one has to take into consideration the changes in bird migrations due to the recently alternating ecological and climatic conditions, and birds' adaptation to human environments.<sup>34</sup> Although swans lately are seen only during the winter in Hungary, according to ornithological evidence they used to breed in this region until the 20<sup>th</sup> century. Crane recently is considered a passage species but it also used to breed in Hungary.<sup>35</sup>

### Conclusions

Körös culture and generally Neolithic settlements are rich in avian remains and taxa both in Hungary and in the Carpathian Basin. The representation of sites with bird bones and taxa in the earlier and later periods is significantly weaker (fig. 4). Although a generally decreasing tendency in hunting can be observed after the Neolithic, we can not attribute the gap in fowling to a sudden disinterest of people in bird hunting. It is very likely that different excavation

<sup>25</sup> Classon 1980.

<sup>26</sup> Jánosy 1985, 71.

<sup>27</sup> Peterson et al. 1977, 55–57.

<sup>28</sup> Gál (in prep.)

<sup>29</sup> Jánosy 1985, 72.

<sup>30</sup> Bökönyi 1974, 436.

<sup>31</sup> Peterson et al. 1977, 67.

<sup>32</sup> E. Kessler – E. Gál 1997, 142.

<sup>33</sup> Peterson et al. 1977, 60; 145.

<sup>34</sup> E. Gál: Adaptation of different bird species to human environments, in: J. Laszlovszky – P. Szabó (eds): People and Nature in historical perspective. Budapest 2003, 120–138.

<sup>35</sup> Peterson et al. 1977, 107.



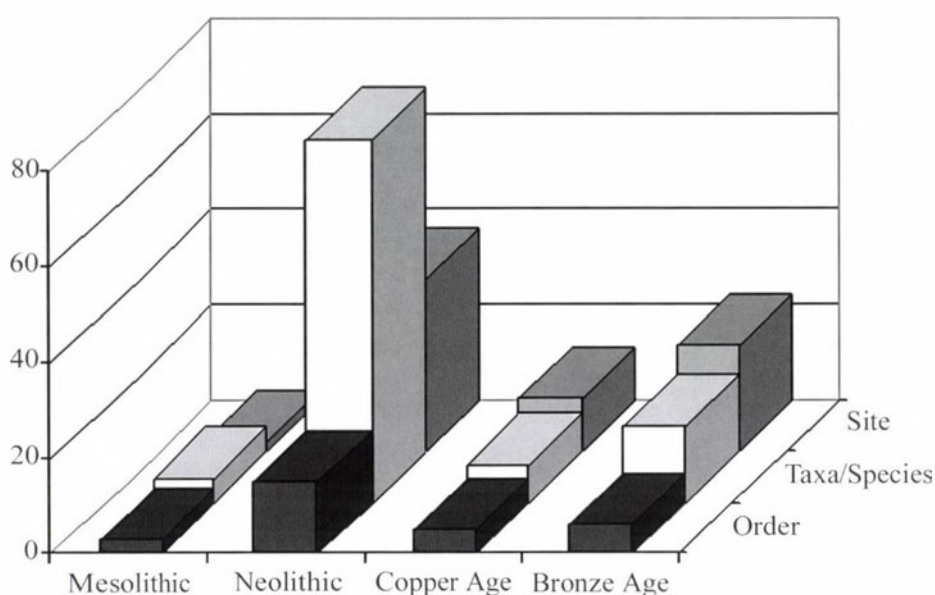


fig. 4. Bird bone representation in the different archaeological periods within the Carpathian Basin

methods, bird bone separation and selective identification of the remains gave rise to such an uneven distribution of results.

The numerous aquatic and wetland birds recognized from the settlements reflect the characteristic environment around Neolithic sites. The inhabitants lived near wetlands but also close to grazing grounds and scarce forests where exploitation of water- and woodland resources, as well as animal keeping was possible. The mosaic-like environment that must have had a specific role in the adaptation of Neolithic people in the Carpathian Basin<sup>36</sup> can be evidenced on the basis of bird faunas as well.

Birds were usually hunted in the breeding season when the diversity of avifauna is the greatest and both the adult birds and eggs were easily exploited. Some winter visitor species and the large number of resident- and possible overwintering birds do not exclude all year habitation at certain sites. On the other hand, the diverse avifaunas poor in remains and individuals do not indicate long-lasting settlements.

The bird bone assemblages usually do not indicate any system in fowling, this probably being an opportunistic and mainly seasonal occupation like fishing and shellfish-collecting. Although certain species (e.g. Mallard, White-tailed Eagle, Crane or Great Bustard) were often hunted in the Neolithic, we may state that bird hunting had an opportunistic character, and people did not focus to any species in particular. On the other hand, the abundance of wing bones in the particularly rich assemblage from Ecsegfalva 23 suggests a kind of interest in some species.<sup>37</sup> Thus we may assume that the captured or hunted birds must have had a well defined – usually economic or trophy – value.<sup>38</sup>

<sup>36</sup> P. Sümegi this volume

<sup>37</sup> E. Gál (in prep.)

<sup>38</sup> I am grateful to the next colleagues who invited me to work on the bird bone remains from the excavations having lead: Ms. Diana Bindea (Ungureasca Cave and Zăuan), Dr. Georgeta El Susi (Foeni and Parța), Dr. Viktória Kiss (Balatonszemes – Bagódomb), Dr. Zoia Maxim (Sincrai, Tureni

– Săndulești) and Prof. A. Whittle (Ecsegfalva 23). Dr. László Bartosiewicz provided the avian remains from site Endrőd 6 being excavated by Dr. Dénes Jankovich. I thank Mr. M. Gasparik for the access to the recent bird bone collection of the Hungarian Natural History Museum. Erika Gál currently is being employed by the Hungarian project NRDG 248/2002.

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[illegible]

Species	Ecsegfalva 23	Endröd 39	Endröd 119	Déaványa-Barcái	Gyálarét	Kötelek-Huszársarok	Maroslele-Pana	Röszke-Lúdvár	Szajol-Felsőföld	Szolnok-Szanda
<i>Circus sp. indet.</i>	1/1									
<i>Accipiter gentilis</i>	1/1									
<i>Buteo buteo</i>	1/1									
<i>Hieraaetus pennatus</i>	1/1									
<i>Tetrao tetrix</i>	2/1	1/1	?/7							
<i>Perdix perdix</i>	1/1		?/1							
<i>Porzana porzana</i>	1/1									
<i>Gallinula chloropus</i>	1/1									
<i>Fulica atra</i>	14/2	2/?	?/1				2/?	1/1		
<i>Grus grus</i>	1/1	3/?	?/6			2/?	1/1	1/1		2/?
<i>Tetrax tetrax</i>			?/2							
<i>Otis tarda</i>	1/1	14/?	?/8						1/1	2/?
<i>Scolopax rusticola</i>	1/1									
<i>Limosa limosa</i>	1/1									
<i>Larus cf. argentatus</i>							2/?			
<i>Columba palumbus</i>	24/4							1/1		
<i>Strix aluco</i>	1/1		?/1							
<i>Coracias garrulus</i>	1/1									
<i>Dendrocopus major</i>	1/1									
<i>Alauda arvensis</i>	1/1									
<i>Turdus merula</i>	1/1									
<i>Turdus viscivorus</i>	1/1									
<i>Turdus sp.</i>	2/?									
<i>Acrocephalus sp.</i>	1/1									
<i>Garrulus glandarius</i>	1/1									
<i>Pica pica</i>	1/1									
<i>Corvus cf. frugilegus</i>		2/?								
<i>Corvus cf. corone</i>										1/1
<i>Corvus frugilegus/C. corone</i>	2/1									
<i>Corvus sp.</i>							1/1			
<i>Sturnus vulgaris</i>	6/2									
<i>Passer domesticus</i>	2/2									
<i>Emberizidae indet.</i>	2/?									
<i>Passeriformes indet.</i>	3/?									
<i>Aves indet.</i>	56/?		545/?	2/?	30/17					
Total:	276/64	45/?	607/62	2/?	30/17	4/?	27/?	38/?	5/?	19/?

Table 1. List of identified bird taxa from the Körös culture settlements in Hungary



[illegible]

Species	Starčevo-Criș		Körös		Vinča	Petrești - LBC	Middle Neolithic		Neolithic				
	Padina (S)	Starčevo (S)	Ludas-Budzsák (S)	Nosza-Gyöngypart (S)	Parța (R)	Ungureasca Cave (R)	Foeni (R)	Cladova (R)	Salca (R)	Sincrai (R)	Suplacu de Barcău (R)	Tureni – Săndulești (R)	Zăuan (R)
<i>Accipiter gentilis</i>											1/1		
<i>Tetrao tetrix</i>			19/?			3/1	2/1			1/1		3/2	
<i>Perdix perdix</i>			?										
<i>Galliformes indet.</i>					2/?			1/1					
<i>Fulica atra</i>			1/1				2/1						
<i>Grus grus</i>		2/?	8/?		1/1	1/1							1/1
<i>Otis tarda</i>		6/?	32/?	2/?	1/1	1/1			1/1				
<i>Numenius arquatus</i>		1/1											
<i>Columba palumbus</i>					1/1								
<i>Bubo bubo</i>			1/1										
<i>Strix aluco</i>					1/1								
<i>Asio flammeus</i>					1/1			1/1					
<i>Turdus pilaris</i>						1/1							
<i>Turdus philomelos</i>						1/1							
<i>Pica pica</i>			2/?					2/1					
<i>Corvus cf. frugilegus</i>	1/1												
<i>Corvus cf. corone</i>	1/1					2/1							
<i>Corvus monedula</i>						2/1		2/1					
<i>Passeriformes indet.</i>						1/1							
<i>Aves indet.</i>	1/1					7/?	3/?	1/1					
Total	7/7	22/?	82/?	2/?	30/?	20/?	18/?	7/5	1/1	1/1	1/1	3/2	1/1

Table 2. List of identified bird taxa from Neolithic sites in Serbia and in Transylvania (abbreviations: S=Serbia, R=Romania)



Species	English Name	Ecotype	Seasonality	Months	Food
<i>Gavia arctica</i>	Black-throated Diver	Aquatic	Passage/Winter visitor	X-IV	Carnivorous
<i>Tachybaptus ruficollis</i>	Little Grebe	Aquatic	Summer visitor/Occasional winter visitor	III-X	Carnivorous
<i>Podiceps cristatus</i>	Great Crested Grebe	Aquatic	Summer visitor/Occasional winter visitor	II-XI	Carnivorous
<i>Podiceps griseigena</i>	Red-necked Grebe	Aquatic	Summer visitor	III-X	Carnivorous
<i>Podiceps cf. auritus</i>	Slavonian Grebe	Aquatic	Winter visitor	?	Carnivorous
<i>Phalacrocorax carbo</i>	Cormorant	Wooded wetland	Summer visitor	III-X	Carnivorous
<i>Pelecanus onocrotalus</i>	White Pelican	Aquatic	Summer visitor	?	Carnivorous
<i>Botaurus stellaris</i>	Bittern	Aquatic	Summer visitor/Occasional winter visitor	II-X	Carnivorous
<i>Nycticorax nycticorax</i>	Night Heron	Wooded wetland	Summer visitor	IV-X	Carnivorous
<i>Egretta garzetta</i>	Little Egret	Wooded wetland	Summer visitor	IV-X	Carnivorous
<i>Egretta alba</i>	Great White Egret	Aquatic	Summer visitor/Occasional winter visitor	III-X	Carnivorous
<i>Ardea cinerea</i>	Grey Heron	Wooded wetland	Summer visitor/Occasional winter visitor	II-XI	Carnivorous
<i>Ardea purpurea</i>	Purple Heron	Aquatic	Summer visitor	III-X	Carnivorous
<i>Ciconia cf. nigra</i>	Black Stork	Wooded wetland	Summer visitor	IV-IX	Carnivorous
<i>Ciconia cf. ciconia</i>	White Stork	Wet meadow	Summer visitor	III-VIII	Carnivorous
<i>Platalea leucorodia</i>	Spoonbill	Aquatic	Summer visitor	IV-IX	Carnivorous
<i>Cygnus cygnus</i>	Whooper Swan	Aquatic	Winter visitor	X-III	Carnivorous
<i>Cygnus olor</i>	Mute Swan	Aquatic	Winter visitor	?	Herbivorous
<i>Anser fabalis</i>	Bean Goose	Wet meadow	Passage/Occasional winter visitor	IX-IV	Herbivorous
<i>Anser albifrons</i>	White-fronted Goose	Wet meadow	Passage/Occasional winter visitor	X-III	Herbivorous
<i>Anser anser</i>	Greylag Goose	Wet meadow	Summer visitor	II-XI	Herbivorous
<i>Branta sp. indet.</i>	goose	Wet meadow	Winter visitor		Herbivorous
<i>Tadorna tadorna</i>	Shelduck	Open land	Vagrant/Occasional winter visitor	kb. XI	Herbivorous
<i>Anas cf. penelope</i>	Wigeon	Aquatic	Passage	III-IV, IX-X	Omnivorous
<i>Anas cf. strepera</i>	Gadwall	Aquatic	Summer visitor/Passage	III-XI	Omnivorous
<i>Anas crecca</i>	Teal	Aquatic	Passage	III, IX-X	Omnivorous
<i>Anas platyrhynchos</i>	Mallard	Aquatic	Resident/Passage	II-III, IX-X	Omnivorous
<i>Anas aff. acuta</i>	Pintail	Aquatic	Summer visitor/Passage	II-XI	Omnivorous
<i>Anas querquedula</i>	Garganey	Aquatic	Summer visitor/Passage	III-X	Omnivorous
<i>Anas cf. clypeata</i>	Shoveler	Aquatic	Summer visitor/Passage	II-XI	Omnivorous
<i>Aythya ferina</i>	Pochard	Aquatic	Summer visitor/Occasional winter visitor	II-XI	Omnivorous
<i>Aythya nyroca</i>	Ferruginous Duck	Aquatic	Summer visitor/Occasional winter visitor	III-XI	Omnivorous
<i>Aythya fuligula</i>	Tufted Duck	Aquatic	Passage/Winter visitor	IX-IV	Omnivorous
<i>Mergus cf. merganser</i>	Goosander	Aquatic	Winter visitor	XI-III	Carnivorous
<i>Milvus sp.</i>	unidentified kite	?	Summer visitor	III-IX	Carnivorous/Scavenger
<i>Haliaeetus albicilla</i>	White-tailed Eagle	Wooded wetland	Resident		Diurnal bird of prey
<i>Gyps fulvus</i>	Griffon Vulture	Open rocky land	Resident		Diurnal bird of prey

Species	English Name	Ecotype	Seasonality	Months	Food
<i>Gypaetus/Agypius/Gyps</i>	Vulture species	Rocky land	Resident		Carnivorous/Scavenger
<i>Circus gallicus</i>	Short-toed Eagle	Woodland	Summer visitor	IV-XI	Diurnal bird of prey
<i>Circus aeruginosus</i>	Marsh Harrier	Aquatic	Summer visitor/Occasional winter visitor	III-X	Diurnal bird of prey
<i>Accipiter gentilis</i>	Goshawk	Woodland	Resident		Diurnal bird of prey
<i>Buteo buteo</i>	Buzzard	Grove	Resident		Diurnal bird of prey
<i>Aquila chrysaetos</i>	Golden Eagle	Wooded rocky place	Resident		Carnivorous
<i>Hieraaetus pennatus</i>	Booted Eagle	Woodland	Summer visitor	IV-IX	Diurnal bird of prey
<i>Tetrao tetrix</i>	Black Grouse	Wet meadow	Resident		Herbivorous
<i>Perdix perdix</i>	Partridge	Open land	Resident		Herbivorous/Insectivorous
<i>Porzana porzana</i>	Spotted Crake	Aquatic	Summer visitor/Occasional winter visitor	III-XI	Carnivorous
<i>Gallinula chloropus</i>	Moorhen	Wooded wetland	Summer visitor	III-XI	Carnivorous
<i>Fulica atra</i>	Coot	Aquatic	Summer visitor/Occasional winter visitor	II-XI	Carnivorous
<i>Grus grus</i>	Crane	Wet meadow	Passage/Summer visitor	II-V, VII-XI	Carnivorous
<i>Tetrax tetrax</i>	Little Bustard	Open land	Resident		Carnivorous
<i>Otis tarda</i>	Great Bustard	Open land	Resident		Carnivorous
<i>Scolopax rusticola</i>	Woodcock	Woodland	Passage/Summer visitor	III-X	Carnivorous
<i>Limosa limosa</i>	Black-tailed Godwit	Wet meadow	Summer visitor/Passage	III-IX	Carnivorous
<i>Numenius arquatus</i>	Curlew	Aquatic	Passage	II-XII	Carnivorous
<i>Larus cf. argentatus</i>	Herring Gull	Aquatic	Vagrant	IX	Carnivorous
<i>Columba palumbus</i>	Woodpigeon	Woodland	Summer visitor/Occasional winter visitor	II-XI	Herbivorous
<i>Bubo bubo</i>	Eagle Owl	Sz+E	Resident		Nocturnal bird of prey
<i>Strix aluco</i>	Tawny Owl	Woodland	Resident		Nocturnal bird of prey
<i>Asio flammeus</i>	Short-eared Owl	Wet meadow	Resident/winter visitor		Diurnal bird of prey
<i>Coracias garrulus</i>	Roller	Grove	Summer visitor	IV-IX	Carnivorous
<i>Dendrocopus major</i>	Great Spotted Woodpecker	Woodland	Resident		Insectivorous
<i>Alauda arvensis</i>	Skylark	Open land	Summer visitor/Occasional winter visitor	II-XI	Insectivorous
<i>Turdus merula</i>	Blackbird	Woodland	Resident		Omnivorous
<i>Turdus viscivorus</i>	Mistle Thrush	Woodland	Resident/winter visitor	X-IV	Omnivorous
<i>Acrocephalus sp.</i>	unidentified warbler	Aquatic	?	?	Insectivorous
<i>Garrulus glandarius</i>	Jay	Woodland	Resident		Omnivorous
<i>Pica pica</i>	Magpie	Grove	Resident		Omnivorous
<i>Corvus corax</i>	Raven	Sz+E	Resident		Omnivorous/Scavenger
<i>Corvus cf. frugilegus</i>	Rook	Ny+E	Resident		Omnivorous
<i>Corvus cf. corone</i>	Carion Crow	Ny+E	Resident		Omnivorous
<i>Corvus sp.</i>	unidentified crow	Ny+E	Resident		Omnivorous
<i>Sturnus vulgaris</i>	Starling	E+Ny	Summer visitor/Occasional winter visitor	III-X	Omnivorous
<i>Passer domesticus</i>	House Sparrow	E+Ny	Resident		Omnivorous

Table 3. General table including the ecological and seasonal characteristics of bird species



Species	Vinča	DLPC	ALPC					Szilmeg group	Music note-Zseliz		Tisza			Csőszhalom-Herpály	
	Ószentiván (Tiszasziget)	Balatonszemes-Bagódomb	Endrőd 6	Kőtelek-Huszársarok	Tiszavalk-Négyesi határ	Tiszavasvári Deákhalmi dűlő	Tiszavasvári Keresztfal	Folyás-Szilmeg	Neszmély-Tekeres patak	Pomáz-Zravlyák	Kisköre-Gát	Szegvár-Tűzköves	Szerencs-Taktaföldvár	Tiszapolgár-Csőszhalom	Berettyóújfalú-Herpály
<i>Podiceps cristatus</i>			1/1			?									
<i>Phalacrocorax carbo</i>			4/1												
<i>Pelecanus sp.</i>												1/1			
<i>Egretta alba</i>	1/1														
<i>Ardea cinerea</i>			1/1												
<i>Ardea purpurea</i>														1/1	
<i>Ciconia cf. nigra</i>											2/?				
<i>Ciconia sp.</i>			2/2												
<i>Platalea leucorodea</i>							1/1								
<i>Cygnus cf. olor</i>			3/1												
<i>Anser albifrons</i>	1/1														
<i>Anser cf. anser</i>		1/1	5/1										3/?		
<i>Anser sp.</i>									1/1			1/1			
<i>Anas crecca</i>			1/1												
<i>Anas cf. platyrhynchos</i>			4/1												
<i>Anas sp.</i>			1/1							1/1					
<i>Aythya ferina</i>			1/1												
<i>Anatidae indet.</i>			2/1												
<i>Haliaeetus albicilla</i>												1/1	1/1	*	2/?
<i>Tetrao tetrix</i>		1/1													
<i>Fulica atra</i>	2/?		1/1		1/1										
<i>Grus grus</i>				2/?				1/1							
<i>Bubo bubo</i>														1/1	
<i>Aves indet.</i>			2/?						1/1					1/1	
Total NISP/MNI	4/?	2/2	28/13	2/?	1/1	?	1/1	1/1	2/2	1/1	2/?	3/3	4/?	3/3	2/?

Table 4. List of identified bird taxa from the Middle- and Late Neolithic sites in Hungary

# AGRICULTURE, STOCK FARMING AND ENVIRONMENT: ADAPTATION AND CHANGE DURING THE NEOLITHIC LAKESHORE PERIOD (4300–2400 BC CAL) IN SWITZERLAND<sup>1</sup>

Lakeshore settlements are especially interesting to researchers dealing with questions of environmental change and human-environment interactions due to their very good preservation of organic material such as plant remains (wood, seeds and fruit remains, leaves, twigs), animal bones, antler, textiles, etc. Owing to the good preservation of wood, it is possible to date the life spans of these villages precisely with the help of dendrochronology.

In Switzerland, lakeshore settlements can be found from the Neolithic Period (between 4300 and 2400 BC cal) and again during the Bronze Age (between 1900 to 1500 and 1050–850 BC cal). The Neolithic Period is divided into three phases:

- upper (younger) Neolithic (4300 to 3500 BC cal, Pfyn and Cortaillod cultures),
- later Neolithic (3300 to 2750 BC cal, Horgen culture) and
- final Neolithic (2750 to 2400 BC cal, Corded Ware culture and Bell Beaker culture<sup>2</sup>).

There is a high correlation between the fluctuations of atmospheric <sup>14</sup>C as a proxy-indicator for climatic changes and the presence or absence of lakeshore settlements<sup>3</sup> in the studied region.

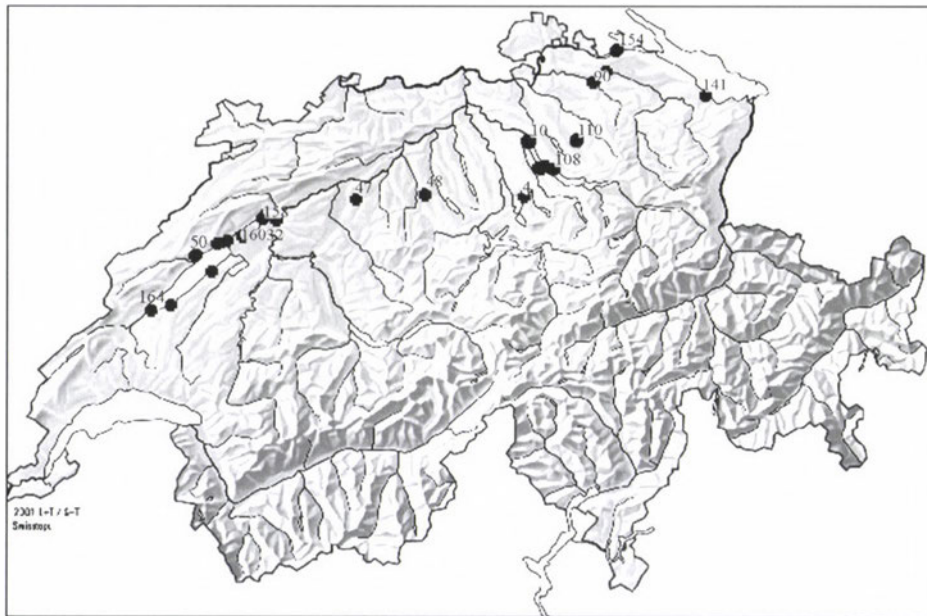


fig. 1. Geographical distribution of the Neolithic lake shore sites in the northern Alpine foreland which supplied archaeozoological assemblages (after Schibler *et al.* 1997, 554, fig. 1)

<sup>1</sup> Most of the data and their interpretation included in this brief review have already been published, some even in English. Therefore a short summary of the lecture given at the conference might be sufficient for orientation. For further reading see bibliographical data in the footnotes to this paper.

<sup>2</sup> A. Hafner – P. J. Suter: Das Neolithikum in der Schweiz. Paper in: [www.jungsteinSITE.de](http://www.jungsteinSITE.de), 27. 11.

2003, 75 pages. With English abstract; W. E. Stöckli – U. Niffeler – E. Gross-Klee (eds): Die Schweiz vom Paläolithikum bis zum frühen Mittelalter II: Neolithikum. Basel 1995.

<sup>3</sup> E. Gross-Klee – C. Maise: Sonne, Vulkane und Seeufersiedlungen. JSGU 80 (1997) 85–94.



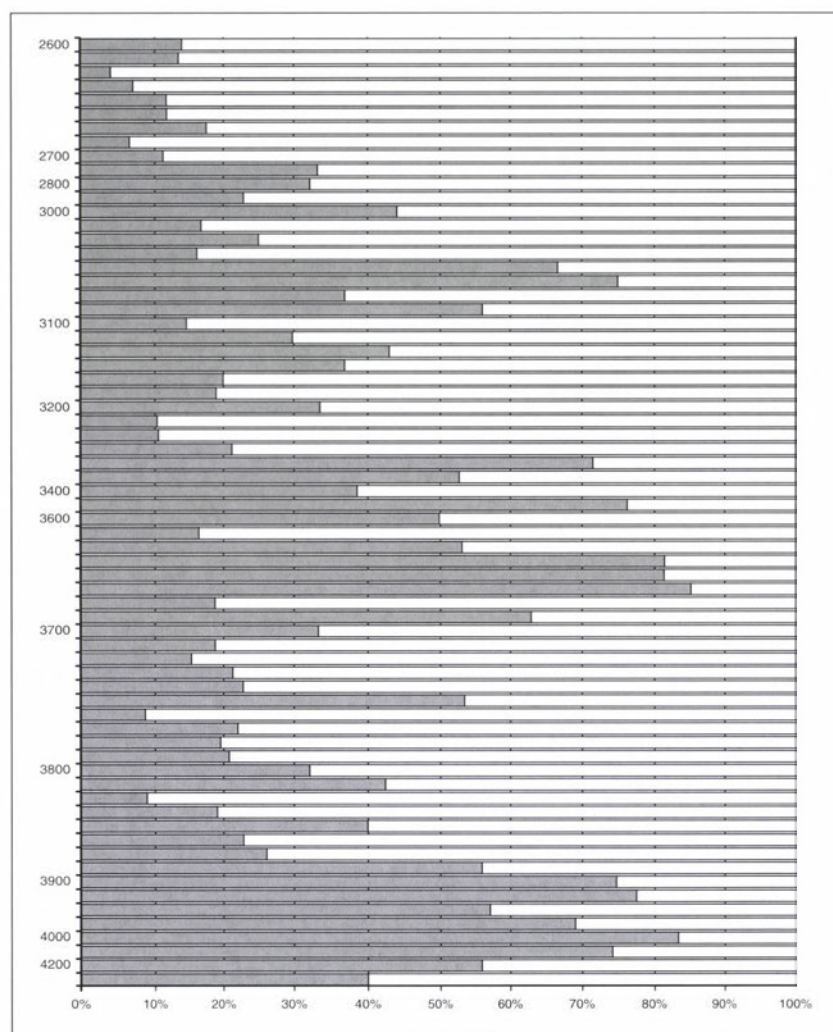


fig. 2. Frequencies of wild (black) and domestic (white) animal bones in lake shore settlements of central and eastern Switzerland between the 43rd and the 25th century cal BC

The database discussed in this paper includes archaeozoological results from 138 settlement layers and archaeobotanical results of 38 settlement layers<sup>4</sup>. The sites are distributed evenly over the Swiss midlands and 112 of the settlements are dated precisely with the help of dendrochronology (*fig. 1*).

The relationship between the bones of wild and domestic animals shows the overall tendency of decreasing importance for hunting during the Neolithic (*fig. 2*). However, during the upper Neolithic there are great fluctuations in the importance of wild animals, their bones varying between less than 20% and more than 80% of all identifiable bone specimens. These fluctuations are caused by an apparent increase in hunting, while the importance of domestic animal bones remains stable through time (*fig. 3–4*). This means that more meat was available in the daily diet. A period with a very great importance of hunting is the 37<sup>th</sup> century BC (*fig. 5*). The importance of wild animals is very high in all the villages of that time, regardless of archaeological culture or geographical location. Indicators of various origins (atmospheric <sup>14</sup>C, glaciation, timberline etc.) show a short-term climatic deterioration for the time around 3650 BC cal labelled “Piora 2” or “Rotmoos 2” cold phase. It is very likely that neolithic farmers tried to compensate losses in cereal yields with an intensification of hunting and gathering.

<sup>4</sup> S. Jacomet – J. Schibler: Les données archéologiques reflètent-elles l’exploitation de la traction animale sur les sites néolithiques au Nord des Alpes? in: R.-M. Arbogast – P. Pétrequin – S. van

Willigen – M. Bailly (eds): Premiers chariots, Premiers araires. La traction animale en Europe au IV<sup>e</sup> millénaire avant notre ère. Colloque Frasnais (in press).

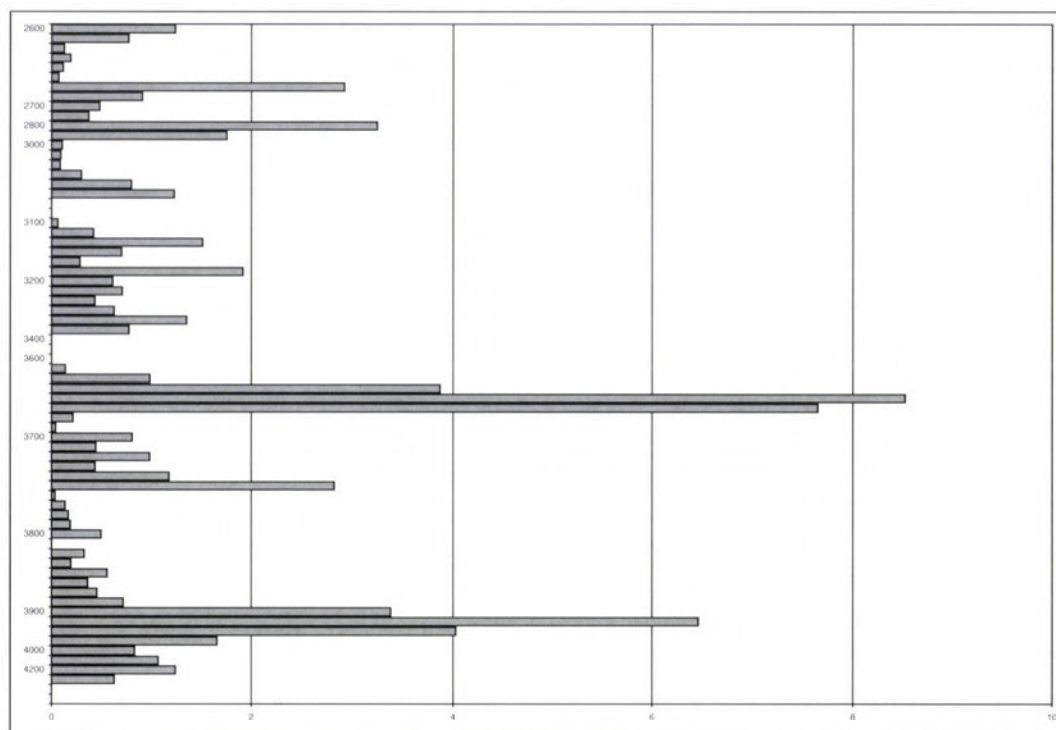


fig. 3. Importance of wild animal bones in lake shore settlements of central and eastern Switzerland between the 43rd century and the 25th century cal BC. The values represent numbers of animal bone fragments per square meter and cultural layer / settlement phase

Low densities of cereal grains and threshing remains as well as high areal densities of collected wild plant remains make this interpretation even more probable<sup>5</sup>.

During the later and final Neolithic Period, the fluctuations between wild and domestic animal bones have much smaller amplitude, despite the fact that short-term climatic deteriorations still took place. Either food shortages did not appear in such a way as during the upper Neolithic or people were able to compensate for them in another way. Both possibilities might be true: on the one hand, climatic fluctuations seem to have been less extreme than before. On the other hand, the landscape had changed a lot compared to the upper Neolithic and the people had adopted their agricultural strategies and stock farming. Archaeozoological and archaeobotanical results are indicative of the following changes between the upper Neolithic Period (4300–3500 cal BC) and the later/final Neolithic Periods (3300–2400 cal BC)<sup>6</sup>:

<sup>5</sup> J. Schibler – S. Jacomet – H. Hüster-Plogmann – C. Brombacher: Economic crash in the 37<sup>th</sup> and 36<sup>th</sup> century BCcal in Neolithic Lakeshore Sites in Switzerland. *Anthropozoologica* 25–26 (1997) 553–570; H. Hüster-Plogmann – J. Schibler – K. Steppan: The relationship between wild animal exploitation, climatic fluctuations and economic adaptations. A transdisciplinary study on Neolithic sites from the Lake Zurich region, Southwest Germany and Bavaria, in: H. Manhart – J. Peters – J. Schibler (eds): *Historia animalium ex ossibus*. Internationale Archäologie. Rahden, *Studia honoraria* (Festschrift für Angela von den Driesch) 8 (1999) 189–200; B. Huntley – M. Baillie – J. M. Grove – C. U. Hammer – S. P. Harrison – S. Jacomet – E. Jansen – W. Karlen – N. Koc – J. Luterbacher – J. Negendank – J. Schibler: Holocene Paleoenvironmental Changes in North-West Europe: Climatic Implications and the Human Dimension, in: G. Wefer – W. H. Berger – K.-E. Behre – E. Jansen (eds): *Climate Development*

and History of the North Atlantic Realm. Berlin – Heidelberg – New York, *Hanse Conference on Climate History* 2002, 259–298.

<sup>6</sup> J. Schibler – S. Jacomet – H. Hüster-Plogmann – C. Brombacher – E. Gross-Klee – A. Rast-Eicher (eds): *Ökonomie und Ökologie neolithischer und bronzezeitlicher Seeufersiedlungen am Zürichsee*. Zürich und Egg, *Monografien der Kantonsarchäologie Zürich* 20, 1997. With extensive English summary; B. Huntley – M. Baillie – J. M. Grove – C. U. Hammer – S. P. Harrison – S. Jacomet – E. Jansen – W. Karlen – N. Koc – J. Luterbacher – J. Negendank – J. Schibler: Holocene Paleoenvironmental Changes in North-West Europe: Climatic Implications and the Human Dimension, in: G. Wefer – W. H. Berger – K.-E. Behre – E. Jansen (eds): *Climate Development and History of the North Atlantic Realm*. Berlin – Heidelberg – New York, *Hanse Conference on Climate History* 2002, 259–298; E. Marti-Grädel – B. Stopp: Late



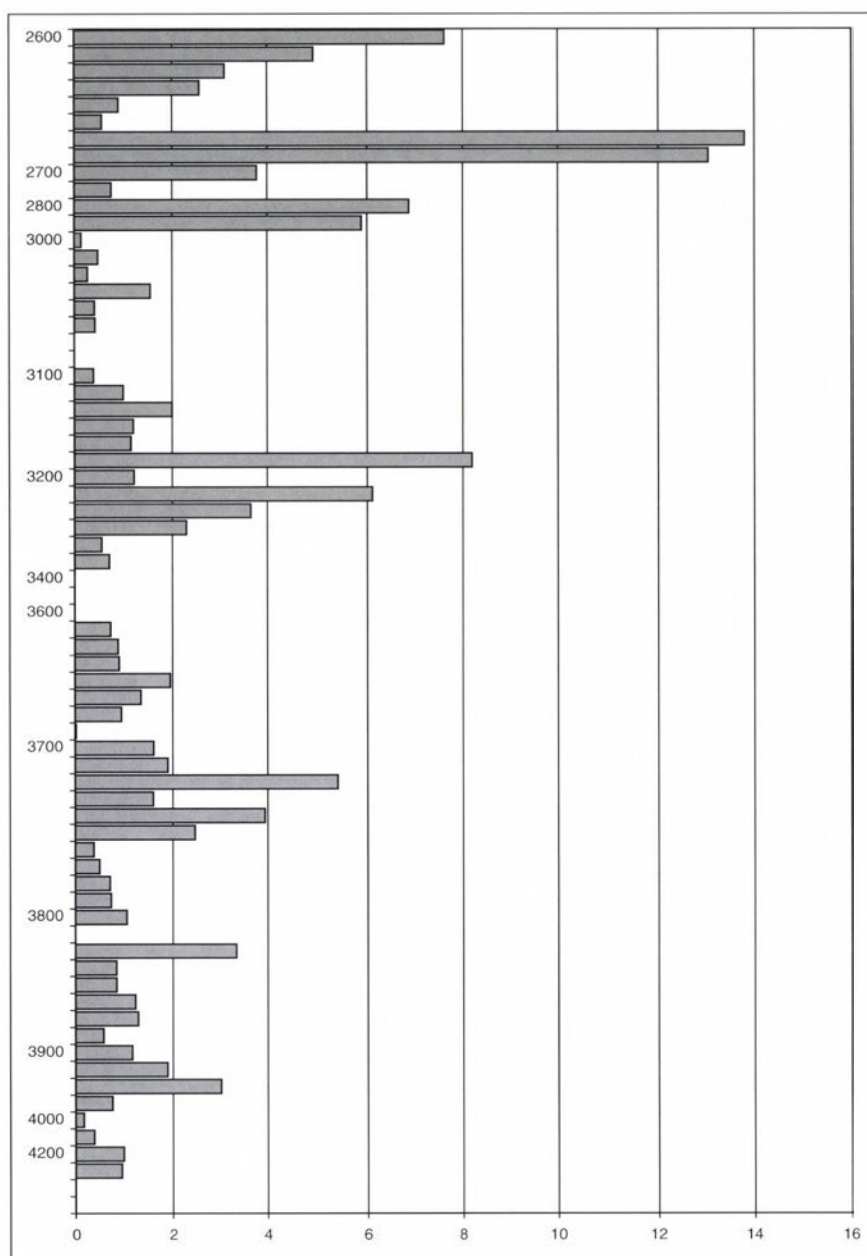


fig. 4. Importance of domestic animal bones in lake shore settlements of central and eastern Switzerland between the 43rd century and the 25th century cal BC. The values represent numbers of animal bone fragments per square meter and cultural layer / settlement phase

Neolithic economy at lakeside settlements in Western Switzerland. Proceedings of the 7<sup>th</sup> ICAZ Conference, Konstanz. *Anthropozoologica* 25–26 (1997) 495–504; J. Schibler – S. Jacomet: Archaeozoological and archaeobotanical evidence of human impact on Neolithic environments in Switzerland, in: Benecke, N. (ed.): *The Holocene history of the European vertebrate fauna. Modern Aspects of Research*. Rahden, *Archäologie in Eurasien* 6 (1999) 339–354; J. Schibler – K. Steppan: Human impact on the habitat of large herbivores in Eastern Switzerland and Southwest Germany in the Neolithic. *Archaeofauna* 8 (1999) 87–99; H. Hüster-Plogmann – J. Schibler – S. Jacomet: The significance of aurochs as hunted

animal in the Swiss Neolithic, in: G.-C. Weniger (ed.): *Archäologie und Biologie des Aurochs*. Wissenschaftliche Schriften des Neanderthal-Museums 1 (1999) 151–160; R. Ebersbach: Modeling Neolithic agriculture and stock farming at Swiss Lakeshore Settlements – Evidence from historical and ethnographical data. *Archaeofauna* 8 (1999) 115–122; R. Ebersbach: *Von Bauern und Rindern. Eine Ökosystemanalyse zur Bedeutung der Rinderhaltung in bäuerlichen Gesellschaften als Grundlage zur Modellbildung im Neolithikum*. Basel, *Basler Beiträge zur Ur- und Frühgeschichte* 15, 2002. With extensive English summary.

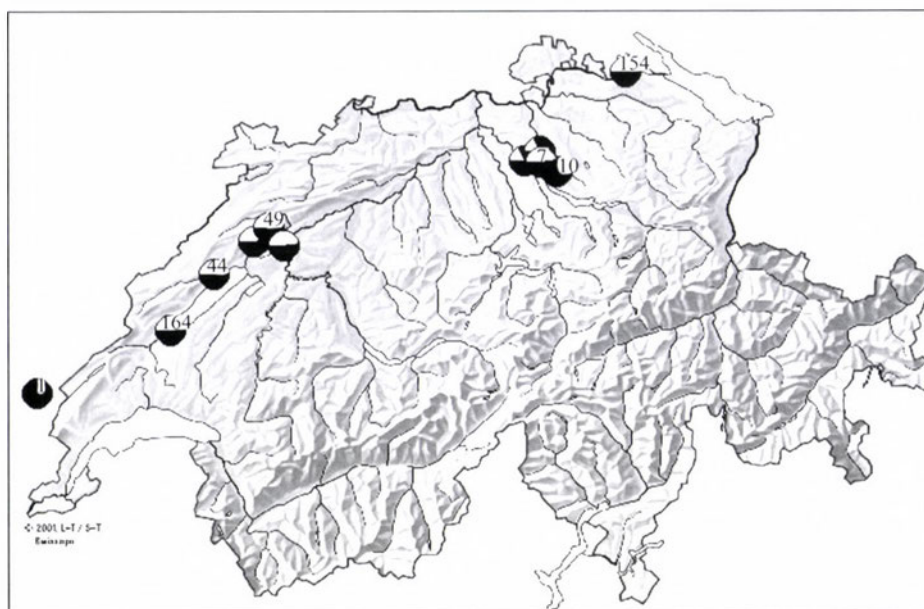


fig. 5. Frequencies of wild animal bones (black) and domestic animal bones (white) in settlements from the second half of the 37th century and the 36th centuries cal. BC in the Alpine foreland (after Schibler et al. 1997, 566, fig. 12). 1. Clairvaux Motte aux Magnins, 7. Zürich Seefeld, 10. Zürich Mozartstrasse, 44. Auvernier Port, 49. Twann Bahnhof, 154. Steckborn Schanz, 164. Yverdon Garage Martin

- Gradual opening of the landscape (lower percentages of forest species among seed and weed remains and fewer woodland bird species; higher densities of mammals typical for open landscapes, such as hare and roe deer)
- First indications of grazing the open land since the late Horgen and especially Corded Ware cultures (seeds and fruit remains from tread-resistant vegetation)
- Higher densities of domestic animal species (Horgen culture: intensification of pig husbandry; Corded Ware culture: more cattle and more sheep/goat herding)
- Diversification of stock keeping (first oxen in the Corded Ware culture, perhaps even in the Horgen culture; woolly sheep since the Corded Ware culture)
- Use of traction power evidenced by finds of wheels and possible ploughs since the Corded Ware culture, perhaps even since the Horgen culture, i. e. 34<sup>th</sup> century BC<sup>7</sup>
- Better techniques of animal keeping, probably better strategies for overwintering (sudden increase in stature and frame of cattle and sheep/goat during the Corded Ware culture)
- Intensification of summer crops such as poppy and flax since the Horgen culture allows a better distribution of labour over the year
- Intensified cultivation of less demanding crops, such as barley and spelt wheat, cultivation on less favourable soils than before
- Larger villages with longer duration of occupation
- Euthropic lakeshores with the first spread of reed belts

The typical field system of the late and final periods of the Neolithic may have been an alternating system of crop cultivation and grazed short fallows.

Human and animal activity, such as cultivation and grazing, led to a gradual opening of the landscape and mineralization of the lakes. Different types of open land developed, which led to an increasing diversity of ecosystems. The transformation of the natural environment

<sup>7</sup> J. Schibler: Haus- und Wildtiernutzung in den jungsteinzeitlichen Feuchtbodensiedlungen des Kantons Thurgau. *Archäologie der Schweiz* 20–21 (1997) 57–61; H. Hüster-Plogmann: Früheste archäozoologische Hinweise zur Nutzung von

Rindern als Zugtiere in neolithischen Siedlungen der Schweiz. Schleife, Schlitten, Rad und Wagen. Zur Frage früher Transportmittel nördlich der Alpen, in: J. Köninger et al. (eds): *Hemmenhofener Skripte* 3 (2002) 103–108.



into a cultural landscape started during the Neolithic Period. Neolithic farmers adapted to the new, transformed environment by developing new agricultural techniques and herding strategies (cf. more open land > higher densities of cattle). New techniques and perhaps even new forms of domestic animals and plants have been introduced at the beginning of a new archaeological culture (cf. Corded Ware culture: woolly sheep), but they have also developed within one cultural sequence, as is shown by the example of the Horgen culture. Whilst the pottery style of the Horgen culture may not look very sophisticated, its agriculture and stock keeping strategies were all the more innovative and adaptable.

## PLEISTOCENE SURVIVORS IN THE IRON GATES MESOLITHIC/NEOLITHIC ARCHAEOFAUNAS

Early Holocene archaeological sites in the Iron Gates region (*fig. 1*), related to the Lepenski Vir culture, due to their early and long occupation as well as their socio-economic complexity, are of crucial importance for understanding the Mesolithic/Neolithic transition in Southeast Europe and beyond. Changes in subsistence strategies, domestication of plants and animals, as well as an overall change in man-animal relationships are among those characteristic aspects of this transition that are considered to pave the path to the sedentary way of life. Yet, all these changes played out in a very specific way in the Iron Gates. The practices of hunting were largely important in all prehistoric societies, yet in the Iron Gates hunting and fishing most likely dominated the economy even once sedentary habits might have been accepted, such as building houses and developing monumental art.

Detailed reviews of archaeological sites, research history, stratigraphy and chronology of the region are presented by Radovanović<sup>1</sup> and Borić.<sup>2</sup> One should only mention that several sites in the Iron Gates provided sequences dated to the early phases of the Holocene, around or before 9000 cal BC. Recent radiometric dates associated with trapezoidal buildings at the key-site, Lepenski Vir, indicate that the occupation of these structures covers a time span from c. 6200 to 5500 cal BC. However, the unquestionable evidence of Mesolithic occupation at Lepenski Vir is enabled by new AMS dates that indicate deposits dated to around 8200–7600 cal BC.<sup>3</sup>

Environmental changes at the beginning of Holocene did not have the same rhythm in every region. The environment of the Iron Gates is peculiar in this respect, and it is known as an environmental refugium that preserved many Tertiary plant and animal relics. It is also possible, and even expectable, that changes in the faunal composition, including large mammals related to the end of the Pleistocene and the beginning of the Holocene were restrained in the Iron Gates, and that Pleistocene faunal elements survived in the Iron Gates while they were already extinct in the surrounding regions. If one could find the evidence for this assumption, it would be also possible to suggest that this environmental “delay” in the Pleistocene/Holocene faunal changes could have influenced the Mesolithic/Neolithic transition in the Iron Gates with regard to many archaeological differences between this and the surrounding areas.

The expression “Mesolithic/Neolithic” from the title relates to the fact that the paper deals with both periods, but, at the same time, it is a deliberate reminder concerning dilemmas of associating the Lepenski Vir culture to one or the other realm,<sup>4</sup> and to the general fact that classification of human societies does not stand our rigid categories.

On the basis of the archaeozoological material that has been examined so far, primarily from the sites of Padina and Lepenski Vir, I would like to emphasize that domestication did not play an important role in the Iron Gates Mesolithic/Neolithic transition. Hunting and fishing were the basis of subsistence in both periods, while catching anadromous fish was the main reason for the selection of settlement locations, and the most important socio-economic

<sup>1</sup> Radovanović 1996.

<sup>2</sup> D. Borić: Seasons, life cycles and memory in the Danube Gorges, c. 10 000–5500 BC. Unpublished Ph.D. Dissertation, University of Cambridge. Cambridge 2002.

<sup>3</sup> A. Whittle – L. Bartosiewicz – D. Borić – P. Pettitt – M. Richards: In the beginning: new radiocarbon dates for the Early Neolithic in northern Serbia and south-east Hungary. *Antaeus* 25 (2002) 63–117.

<sup>4</sup> D. Srejović: Lepenski Vir, Nova praistorijska kultura u Podunavlju. Srpska književna zadruga. Beograd 1969, 1–328; B. Jovanović: Chronological frames of the Iron Gate Group of the Early Neolithic Period. *AI* 10 (1969) 23–38; Radovanović 1996; D. Borić: The Lepenski Vir conundrum: reinterpretation of the Mesolithic and Neolithic sequences in the Danube Gorges. *Antiquity* 76 (2002) 1026–1039.



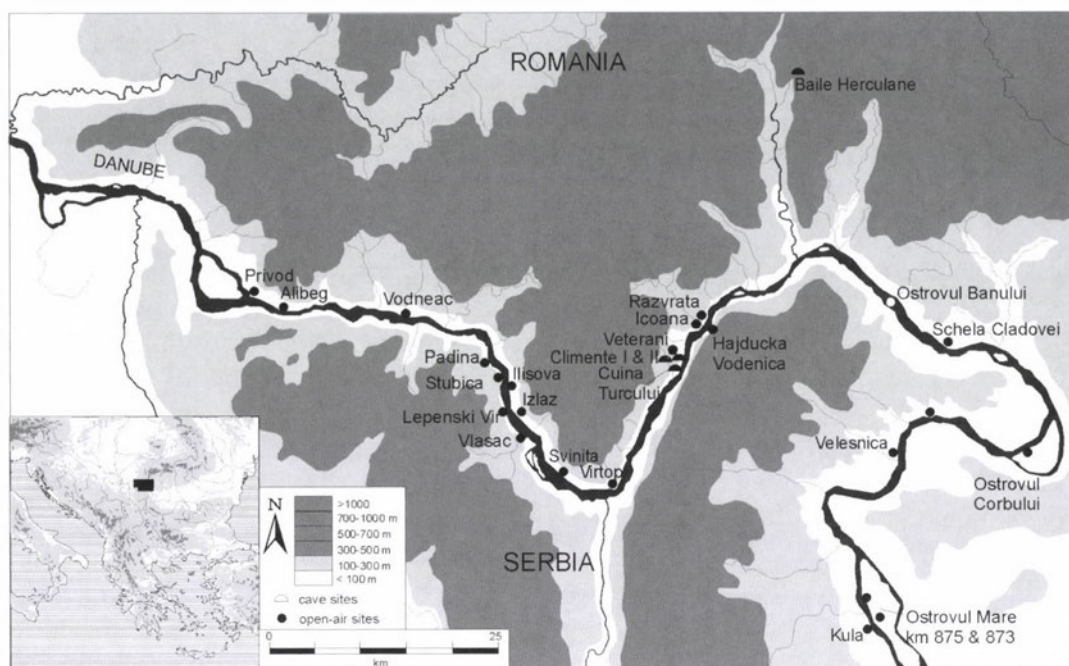


fig. 1. Map showing principal sites with the Early Holocene sequences in the Iron Gates (Borić, 2002)

activity that directed the life rhythm of these groups. This way of life might have been chosen due to the environment of the Gorges, and here one finds an example where the transition from the Mesolithic into the Neolithic is not accomplished by accepting the influence of presumably more advanced societies, but through the adherence to logical choices in the given environment.

Archaeozoological research presented in the first reports soon after the rescue excavations in the Iron Gates in the 1960s,<sup>5</sup> more recently have seen a new impetus through the analyses of material from renewed excavations,<sup>6</sup> analyses of previously unpublished material from old excavations,<sup>7</sup> and reanalyses of the previously published material.<sup>8</sup> This new work facilitated reinterpretations of the faunal data, and has also played an important role in the reinterpretations of the archaeological data in general.

The following discussion about a fragmented lion tooth in the reanalysed material from Padina is thus one element of the zooarchaeological potential that this renewed work made possible.

#### *A lion tooth fragment from Padina*

A lion tooth fragment discovered at the site of Padina has fragmented parts of crown and root (fig. 2, a, c). The preserved part of the crown is its central portion, with the incision between the main cusps and part of a carnassial's blade. The protoconid is broken below its tip, and its blade, stretching from the incision toward the tip, with the preserved length of approximately 8 mm, is worn in such a way that a narrow dentin band is exposed. The paraconid is broken immediately in front of the incision. On the buccal side of the crown an islet of enamel is exposing the line of the base of the crown, although the enamel is missing at the swelling that marks the transition between the crown and the root. Lingually, the base of the crown is

<sup>5</sup> Bökönyi 1969; S. Bökönyi: The vertebrate fauna of Vlasac, in: D. Srejović – Z. Letica (eds): Vlasac, Vol. II. 35–65, Beograd 1978; Clason 1980.

<sup>6</sup> L. Bartosiewicz – C. Bonsall – V. Boroneanț – S. Stallibrass: Schela Cladovei: a preliminary review of the prehistoric fauna. Mesolithic Miscellany 16 (1995) 2–19.

<sup>7</sup> Dimitrijević 2000; V. Dimitrijević: Lepenski Vir animal bones: what was left in the houses? Proceeding of the Conference "The Iron Gates in Prehistory: New Perspectives", Edinburgh, 30 March – 2 April 2000 (in press).

<sup>8</sup> Dimitrijević – Borić (forthcoming).

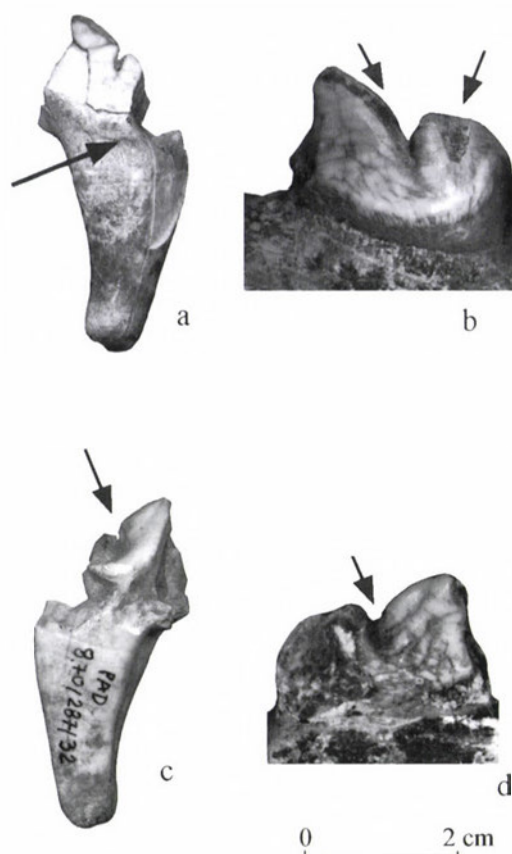


fig. 2. Lion lower carnassials comparison

a. M1 dext., Padina, buccal aspect, the arrow shows base of the enamel, b. M1 sin., Risovača, buccal aspect, arrows show wear traces, c. M1 dext., Padina, lingual aspect, the arrow shows an incision between protoconid and paraconid, d. M1 sin., Risovača, lingual aspect, the arrow shows the same incision. For easier comparison the Risovača specimen is shown in mirror view.

damaged. Only the anterior process of the root is preserved, and in its full length, while its anterior portion below the base of the crown is damaged.

The tooth was broken along its narrowest, and thus the weakest part, along the line dividing the anterior and posterior fang of the root and corresponding parts of the crown. In addition to this major break, the tooth is further damaged orally and lingually at the level of the crown base, and this damage is not from a simple mechanical break, but looks like it was made by several strokes. It is most probably of biogenic origin, i.e. made by a human or an animal. All these damages are old, most probably made prior to deposition. Missing flake of the enamel on the buccal side of the crown, and the one at the anterior portion of the root are recent, as the result of excavation or post-excavation damages.

The carnassial blade shows that it is a carnivorous carnassial tooth. The position of the incision dividing the protoconid and paraconid in relation to the root branching point shows that it is a lower carnassial, and its size indicated that it comes from a large cat of the genus *Panthera*, the species that in size corresponds to present-day lions.

The tooth is compared with the first molar of the lower jaw of a cave lion identified in the Upper Pleistocene fauna of the Risovača Cave in central Serbia (fig. 2).<sup>9</sup> The wear of the Risovača specimen is somewhat more advanced, as the exposed enamel band on the protoconid blade is broader. The details of the morphology, which can be observed on the preserved part of the crown of the Padina specimen, are similar to those of the comparative specimen from Risovača: the buccal side of the crown is convex, the base of the crown is

<sup>9</sup> Dimitrijević 1997.



swollen, and the crown is deeply excavated lingually at the level of incision. The position of the divergence point between the processes of the root is the same. The size comparison is made difficult by the fragmentary nature of the specimen from Padina and the Risovača specimen's imbeddedness in the jawbone. On the Padina specimen, it is only possible to take the measurement of the buccal height of the incision (*Table 1*), which is slightly smaller than on the Risovača specimen. The visual comparison of the two specimens' sizes indicates a smaller size for the specimen from Padina.

	PAD	RIS	Slatina ( <i>Ninov 1999</i> )
length (1)		29.4	26.3
protoconid length (2)		16.8	
paraconid length (4)		14.7	
breadth (7)		15.7	
protoconid height (9)		16.0	
lingual incision height (16)		12.7	
buccal incision height	9.9	10.2	

Table 1. *Panthera* M1 inf. (mm)<sup>10</sup>

However, this comparison with the Pleistocene cave lion is not intended to identify the Padina specimen to this species but rather demonstrate that both specimens belong to the same genus. Moreover, there are no clear morphological differences in the lower carnassial between the species of this genus.<sup>11</sup> The size difference is important, although again not very conclusive. Generally, cave lions are larger than present-day species, but specimens of different sizes are known from the European Pleistocene, some of them overlapping with those of modern comparative specimens of the species belonging to this genus.<sup>12</sup> Differences in size can also be due to sexual dimorphism within the same species. If we assume that the Pleistocene lion survived into the Postglacial, one should expect a reduction in size, according to Bergman's rule and adaptation to presumably less suitable environments.

The tooth was found in the layer of intensive black soil above the rocky base of Sector II (Trench 2, Block 3a) at Padina. The tooth's colour and structure are similar to many fragments of animal bones that are found in the same layer.

It is reasonable to assume that the remains of lions will rarely comprise a palaeontological or archaeozoological assemblage. These animals are on the top of the nutrition chain; normally they are rarely hunted, and, only occasionally are found in the bone accumulations of predators. Although lions are hunters, they do not accumulate bones as hyaenids and some other felid species. Although some examples from south-east European prehistory concerning the presence of lions are quoted below, their rarity in faunal assemblages come from the fact that humans rarely opposed but rather avoided this beast.

*Upper Pleistocene cave lions and Holocene European lions*

The lion, variously assigned to the same species as the recent animal, *Panthera leo* (Linnaeus), or separate subspecies, *Panthera leo spelaea* (Goldfuss), or separate species, *Panthera spelaea* (Goldfuss), inhabited a vast region from Western Europe to eastern Asia in the Pleistocene<sup>13</sup>. The taxonomic is at least partly due to the fact that morphological distinctions between the Pleistocene cave lion, on one hand, and the Holocene and the recent species, on the other, are present but not very accentuated,<sup>14</sup> while the chronological separation is often taken for granted.

<sup>10</sup> The numbers in brackets are the numbers of measurements from *Schmidt 1940*, Plate I.  
<sup>11</sup> *Schmidt 1940; Argant 1991*.  
<sup>12</sup> *Argant 1991*, 246–247.

<sup>13</sup> *R. Musil*: Paleobiogeography of terrestrial communities in Europe during the Last Glacial. SbNM 41B (1985) 29.  
<sup>14</sup> *Argant 1991*.

Remains of the Upper Pleistocene cave lion are found in many caves in the Balkans and in the surrounding regions.<sup>15</sup> In Serbia, they are found in the following caves: Risovača, Prekonoška, Pećina u crvenim stenama, Lazareva and Jerinina. The size of these specimens is larger when compared to recent animals belonging to this species.<sup>16</sup>

In the European Holocene lion remains are rare. The westernmost Holocene find is a single canine from the Late Neolithic cemetery of Zengővárkony in the Carpathian Basin. Other finds in this area come from three sites of Eneolithic age. Together, these finds cover the time span of approximately one thousand years (3500–2500 BC).<sup>17</sup> A pelvis fragment was found at Tiszaföldvár-Téglagyár, an upper jaw fragment with incisors and premolars at Gyöngyöshalász-Encspuszt, and, both teeth and skeletal remains (two canines, fragments of scapulae, radius, two ulnae, two metatarsals and one phalanx), at Tiszaluc-Sarkad. Cut marks and damages on some of the bones led Vörös to conclude that “lion was hunted, its flesh eaten, teeth and bones used as bone implements”.<sup>18</sup>

“How did the lion get into the Carpathian Basin?” as Vörös<sup>19</sup> named one of subtitles in his paper, was explained by migration from Asia via Eastern Europe at the “Late Neolithic-Copper age faunal wave”. Vörös presumed that the warming and aridity at the end of the Atlantic opened new migration routes for the animals, e.g. across the dried out marshes of the Lower Danube.

This scenario cannot be accepted for the find from Padina, since its age predates the climatic optimum. Moreover, its presence in the Danube valley, which connects the Pannonian and Dacian Basins, offers another explanation for the occurrence of these finds both at Hungarian sites in the Pannonian Plains and at Bulgarian sites in the Dacian Basin. This latter region might have been the area from where the spread of lions was possible in the course of the Atlantic and Subboreal, even if its distribution was possibly restricted to the Danube Gorges in the Early Holocene, Preboreal and Boreal.

With regard to the Padina find in particular, it is more probable that the lion survived in this area as a Pleistocene relict than that it migrated into the region through already populated areas of Eastern Europe and the Danube Gorges during the Mesolithic and Early Neolithic periods.

One could hope that future finds will fill the gaps in the record, since in addition to the first find at Goljamo Delčevo,<sup>20</sup> only in the last two decades several new reports of lion remains come from Bulgaria. Together they cover the time span from the Neolithic (Karanovo) to the Late Bronze Age (Durankulak). A tooth fragment is found in the Neolithic levels of Karanovo, while there are many more finds in the Eneolithic: a single atlas in Goljamo Delčevo, a proximal part of ulna at Slatino, a juvenile tibia and a first phalanx at Sozopol, a humerus fragment at Devetaška Cave, and the most numerous remains come from Durankulak: two mandibles, one scapula, three humeri, four radii, one tibia and one rib from the Eneolithic and one mandible from the Late Bronze Age strata.<sup>21</sup>

Ninov<sup>22</sup> provided some important observations with regard to the broad ecological tolerance of the Holocene lion from Bulgaria, as its remains are found at sites located both in lowland and mountainous regions, and both by major rivers and in karstic regions. Consequently, lions could inhabit wooded, wooded-steppe, or open-steppe environments. Probably the most important limiting factor was the availability of prey, and, according to Ninov,<sup>23</sup> this condition is met in the richness of ungulates at Eneolithic sites in Bulgaria. I would add that concerning the survival of several important Pleistocene ungulate species, such as *Bos primigenius* Bojanus and *E. hydruntinus* Regalia, even the composition of herding ungulates did not drastically change since the Pleistocene, although this large predator could possibly shift from one species of prey to another, as long as a sufficiently large prey mass was available.

<sup>15</sup> Rakovec 1961; Malez 1963; Ninov 1999; E. Terzea: *Panthera spelaea* (Goldf.) in pleistocenul superior din Romania. *Lucr. Inst. de speol. “Emil Racovita”* 4 (1965) 251–283.

<sup>16</sup> Dimitrijević 1997, 257–259.

<sup>17</sup> Vörös 1983.

<sup>18</sup> Vörös 1983.

<sup>19</sup> Vörös 1983.

<sup>20</sup> Ivanov – Vasilev 1975 after Ninov 1999.

<sup>21</sup> Ninov 1999.

<sup>22</sup> Ninov 1999.

<sup>23</sup> Ninov 1999.



The southern Balkans lion finds in Greece, and those from the Ukraine are more important for filling another gap in the record, between the archaeozoological finds and written historical sources. In the Ukraine, lion bones have been found at seven sites: Chalcolithic Mayaki, Bolgrad and Molukhov Bugor, and Early Iron Age Ol'biya, Berezan', Chernomorka II and Chernovaty. The latest finds indicate the presence of lion at the Black Sea coast even in the last centuries of the first millennium BC.<sup>24</sup>

The most southern find is from Tiryns at Peloponnesus, while the most numerous remains come from Kastanas, a Bronze and Iron Age settlement from Macedonia in Greece, where twelve skeletal parts were found. They originate from different layers covering the span of several hundred years at the beginning of Iron Age (1200–800 BC).<sup>25</sup>

The finds of actual bones, combined with ancient written sources and the artistic representations of lions, reaffirm that lions were present in Greece well into the historic period.<sup>26</sup> Besides notions on Greek lion mythology and iconography, Babić<sup>27</sup> presented a review of the most interesting descriptions of lion in ancient written sources. The important remark is found in the citation of Aristotle, who mentioned “two species of lions, the plump, curly-maned, and the long bodied, straight maned”.<sup>28</sup> This observation is interestingly commented by Babić as a possibility of an existence of both surviving cave lion and Asiatic migratory specimens.

### *Other Pleistocene “survivors”*

Generally, Holocene and Pleistocene faunal compositions differs considerably, and most remarkable differences occur in the composition of the large mammalian fauna. There are a number of shared species, such as red deer, roe deer and wild swine, although the relative frequency of particular species differs. While some large mammalian species disappeared, the extinction of others was postponed. This process is best documented for aurochs *Bos primigenius* and *Equus hydruntinus*. Aurochs is present in the Iron Gates archaeofaunas, as it is in archaeofaunas of the surrounding areas – the Carpathians, the Pannonian Plains, and the central Balkans. It is characterized by a decreased size in comparison to the Pleistocene species, which makes it difficult to distinguish it from domestic forms. Contrary to the conclusions of earlier researchers,<sup>29</sup> we<sup>30</sup> do not find domestic specimens of cattle at Padina and Lepenski Vir during the occupation of these settlements.

Life conditions in the Upper Gorge in this region were not so favorable for *Equus hydruntinus* Regalia, a zebroid horse species, sometimes wrongly referred to as “European ass” (but different from the true asses and hemiones in tooth morphology).<sup>31</sup> Its presence is reported for Lepenski Vir.<sup>32</sup> A single find of a horse from Padina is not identified to the species level.<sup>33</sup> At the same time, this animal is frequent, and even abundant at some sites of the Early Neolithic Starčevo–Körös culture groups,<sup>34</sup> and became finally extinct in the Late Neolithic/Eneolithic. The Holocene appearance of this small equid in the Carpathian Basin, Vörös<sup>35</sup> explains as the consequence of their migration from the East, within the same “faunal wave” that brought lion and other species,<sup>36</sup> although admitting that oddly enough there are no *E. hydruntinus* remains in Eastern Europe and Southern Eurasian steppes during the Mesolithic and Neolithic periods, and that their expansion toward the west during the warming and rising humidity of the climate contradicts the supposed ecological demand of the species, i.e. arid steppes.

<sup>24</sup> T. Krakhmalnaya: Carnivore remains from Late Pleistocene and Holocene deposits in the Ukraine, in: Benecke 1999, 223–235.

<sup>25</sup> C. Becker: Kastanas: Ausgrabungen in einem Siedlungshügel der Bronze- und Eisenzeit Makedoniens 1975–1979, Die Tierknochenfunde. Prähistorische Archäologie in Südosteuropa 5 (1986) 186.

<sup>26</sup> Babić 2001.

<sup>27</sup> Babić 2001.

<sup>28</sup> Aristotle, Historia Animalium XI. 44, from Babić 2001.

<sup>29</sup> Bökönyi 1969; Clason 1980.

<sup>30</sup> Dimitrijević (in press); Dimitrijević – Borić (forthcoming).

<sup>31</sup> as explained by A. Forsten: Old World “Asses”. Quartärpalaontologie 8 (1990) 71–78.

<sup>32</sup> Bökönyi 1969.

<sup>33</sup> Clason 1980.

<sup>34</sup> Vörös 1981.

<sup>35</sup> Vörös 1981.

<sup>36</sup> Vörös 1983.

Wild horse, *Equus ferus* Boddaert, and interestingly enough, elk, *Alces alces* Linnaeus were recorded at two cave sites on the left banks of the Danube in the Iron Gates region—Cuina Turcului and Climente.<sup>37</sup> Wild horse remains are known from the wider region, but Postglacial elk remains are very rare, although also known from Hungary.<sup>38</sup>

A fragmented scapula found under the floor of one building at Lepenski Vir gives an indication about the presence of a large stature deer, comparable to elk or giant deer.<sup>39</sup>

All of the above mentioned species might have been possible preys for large predators, such as lion. Another carnivorous predator not previously recorded in the Iron Gates, although of much smaller size, was found at Padina. A felid distal humerus of a medio-lateral breadth of 26.6 mm was found, and can be compared to lynx, *Felis (Lynx) lynx* Linnaeus (fig. 3). It is of similar morphology but distinctly smaller stature. At the same time, this specimen is larger than the same bone of wild cat, *Felis silvestris* Schreber. On the basis of its size, it could fit pardine lynx, *Felis (Lynx) pardina* Temminck.



fig. 3. Lynx humeri from Padina comparison.

1. *Felis (Lynx) pardina*, humerus dextralis, a. cranial view, b. caudal view;
2. *Felis (Lynx) lynx*, humerus sinistralis, a. caudal view, b. cranial view

<sup>37</sup> A. Bolomey: An outline of the Late Epipalaeolithic economy at the Iron Gates: the evidence on bones. *Dacia* 17 (1973) 41–52; *Al. Păunescu*: Cercetările arheologice de la Cuina Turcului–Dubova (jud. Mehedinți), in: *Tibiscu Istorie*, volum Închinat Celei de-a 60 aniversari a unirii (1970) 11–56.

<sup>38</sup> Vörös 1983; L. Bartosiewicz: The emergence of holocene faunas in the Carpathian Basin: A review, in: *Benecke* 1999, 73–90.

<sup>39</sup> Dimitrijević 2000.



The bio/geo/chronological distribution of pardine lynx is somewhat dubious. Its recent distribution is restricted to the Iberian Peninsula, according to Hemmer,<sup>40</sup> while the idea of its presence in northern Greece, southern Albania and southern parts of former Yugoslavia<sup>41</sup> has been rejected. It has also been shown that recent and sub-recent lynx populations in the Balkans belong to a subspecies of northern lynx, *Lynx lynx martinoi* Mirić, characterized by a smaller size in comparison with the Carpathian and Scandinavian lynxes, but still within the range of the species variability, and different from pardine lynx.<sup>42</sup>

In the Upper Pleistocene of south-western Europe, there are finds ascribed to pardine lynx<sup>43</sup> that show its previous, wider distribution. It is especially significant that this species is also found in the Postglacial and Upper Pleistocene of southern Europe and the Balkans.<sup>44</sup> In Veternica Cave in Croatia, remains of at least four animals identified as pardine lynx were found, originating from three different layers, Layer "d" of Postglacial age and Layers "i" and "h" of the Last glacial age. In Layer "i", a distal humerus is found with the medio-lateral breadth of the distal end measuring 27.0 mm.<sup>45</sup> A single find, a complete tibia, originates from Upper Pleistocene deposits of Vrelska Cave, Serbia.<sup>46</sup>

The peculiarity of the Padina find is not only the occurrence of pardine lynx, but even more its co-presence with undoubtedly confirmed northern lynx, *Felis (Lynx) lynx*. Werdelin<sup>47</sup> suggests the coexistence of these two species, assuming that the competition with larger species, more precisely northern lynx, in the course of the Upper Pleistocene influenced the size reduction of pardine lynx.

### **Conclusions: Immigrants from Asia or Pleistocene survivors?**

Climatic changes at the end of the Last Glacial are marked by drastic changes in the distribution and composition of fauna in Europe. Apart from large-scale migrations, many large mammalian species became extinct. Whether this process was sudden and catastrophic or more gradual is the question that has occupied the attention of palaeontologist for decades. Although these extinctions can be seen as sudden in the sense of geological time, and catastrophic with regard to changes in the faunal composition, continuing palaeozoological research, particularly with the help of absolute dates, has indicated that the process might have lasted for several thousand years.<sup>48</sup>

Several large mammalian species were spared from extinction during climatic changes only to be "finished off" in the course of the Holocene. Some of these species, such as aurochs, and *Equus hydruntinus*, were still abundant at the beginning of the Holocene, and their presence in this period is well established. Others are much rarer and their existence in the Holocene is hardly recognizable. These are largely species that became mostly extinct in their previous habitats, but survived for a long time as isolated populations in certain areas. An illustrative example is the survival of dwarf mammoths on Wrangel Island well into 3700 BP, the species discovered only in the last decade of the last century.<sup>49</sup> Giant deer, *Megaloceros giganteus* (Blumenbach), survived into the Early Holocene in the Middle Urals, as well as woolly rhinoceros, *Coelodonta antiquitatis* (Blumenbach).<sup>50</sup>

<sup>40</sup> H. Hemmer: *Felis (Lynx) lynx* Linnaeus, 1758 – Luchs, Nordluchs, in: J. Niethammer and F. Krapp (ed.): *Handbuch der Säugetiere Europas Band V. Raubsäuger – Carnivora (Fissipedia)*. Wiesbaden 1993, 1119–1167.

<sup>41</sup> like in F. Van den Brink: *Die Säugetiere Europas westlich des 30. Längengrades 2., neubearbeitete Auflage*, Hamburg/Berlin 1968, 217.

<sup>42</sup> Dj. Mirić: *Balkanske populacije risa (Lynx lynx martinoi* Mirić, 1978), SANU posebna izdanja, knj. 539, Odelj.prir.mat.nauka knj. 55 Beograd 1981, 1–154.

<sup>43</sup> Werdelin 1981.

<sup>44</sup> Rakovec 1961; Malez 1963; Dimitrijević, 1997.

<sup>45</sup> Malez 1963, 97, Plate XIII fig. 6 a-c.

<sup>46</sup> Dimitrijević 1997.

<sup>47</sup> Werdelin 1981.

<sup>48</sup> A review on data and theories on Quaternary megafaunal extinction is given by S. Davis: *The Archaeology of Animals*. Batsford, London. 1987; see also A. Lister - P. Bahn: *Mammoths*. London 1995, 119–139.

<sup>49</sup> Lister - Bahn 1995, 137.

<sup>50</sup> P. Kosintcev: Formation and evolution of the Holocene fauna of megamammals in the Urals and West Siberia, in: Benecke 1999, 133–139.

Although it is possible that migrations took place and that some animal species came in this way from Asia, or any other given region, into Europe, I suggest that it is unlikely that a lion, a predator that needs large undisturbed hunting territory, would have migrated into the already populated land of south Europe, i.e. into environments that were already in the course of the Neolithic altered due to human impact. It is more likely that this species survived the end of the Last Glacial in restricted areas of Southern Europe, from where it might have spread in several episodes during the Holocene. The lack of more abundant finds of this species in the Pleistocene/Holocene archaeofaunas could be the consequence of human reluctance to hunt it. The presence of another carnivorous species mentioned above, pardine lynx, is even more difficult to explain by an assumed Postglacial migration, since the distribution of this species shrinks towards the Iberian Peninsula in the Holocene. At the same time, importantly, large herds of herbivores survived the end of the Last Glacial, providing large carnivores with adequate prey as one of the main conditions for the survival of these large predators.<sup>51</sup>

<sup>51</sup> I thank Borislav Jovanović for his kind permission to reanalyse archaeozoological material from Padina, Dušan Borić for sharing effort and pleasure

while working on it, as well as for the valuable comments on this paper, and Staša Babić for an interesting discussion on Greek and “Serbian” lions.



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## DENDROCHRONOLOGY AND NEOLITHIC RESEARCH IN HUNGARY

Dendrochronology, i.e. archaeological dating based on the annual-rings of trees has become an integral part of archaeological research. In Hungary, systematic investigations started relatively late at the end of the 1980s. Nevertheless, the main questions could be clarified by now and the construction of a dendrochronological sequence has begun.<sup>1</sup>

The current status of research does not yet permit the absolute dating of neolithic sites, but relative dating, i.e. internal chronologies of archaeological features and sites can be established. However, several features were observed on more recent material, which raise serious questions that need to be answered by prehistorians as well.

The most important question formulated during the analysis of annual-rings is whether and to what extent the current dendrochronological status of the Carpathian Basin directly available for research, can be projected onto the past?

Unfortunately, experts in none of the scientific fields concerned (dendrochronology, biology, forestry) have paid attention to this question. The problem is even more relevant since dendrochronological research considers the “dendrochronological zones” as stable all over Europe. However, dendrochronological investigations in Hungary during the last 15 years revealed some phenomena that do not correspond to this *topos* and that have to be evaluated in future research.

The analysis of modern materials has shown that samples originating from the Northern Hill region and its geological continuation, the Pilis–Buda Hills are comparable. Similarity could also be established with samples from the Great Hungarian Plain. Thus, these series present the “central Hungarian basic oak chronology”. Data from other regions did not consistently correlate either with this data set or with each other.

The reason for this data fragmentation is probably the fact that the Carpathian Basin and present-day Hungary within it, lay at a crossing point of different climatic, meteorological and therefore diverse vegetation zones. Thus, only the central part of the country and the basin display homogeneous features, while in other regions the different influences interfere to different and rapidly changing extents, giving a strong local character to the growth of the trees. Unfortunately, the climate and vegetation historical background of the phenomenon is not well understood. In addition more work needs to be carried out on a comparison of subsoil water levels and changes in water level in dendrochronological zones.

According to the analysis of the archaeological material it seems that this kind of “mosaic” is not only a recent characteristic, but also existed in historical times, too. It seems likely that similar features characterised prehistoric times as well although this remains to be demonstrated through future research.

None of the chronologies of the Carpathian Basin could be compared to those of the neighbouring regions. The Pannonian oak chronology based on numerous samples originating from Roman period sites (it now covers two periods: 454–207 BC, 170 BC – 99 AD, respectively) produced positive results in comparison to the South German oak chronology. This means that contrary to the recent, modern and medieval data series, the oak chronology of Roman Pannonia seems to be comparable (!) to the south German data. If this observation is correct, it means that in this period at least the edge of the region covered by the “German”

<sup>1</sup> The latest publication in English: A. Grynaeus: Dendrochronology and Environmental History, in: J. Laszlovszky – P. Szabó (eds): *People and Nature*. Budapest 2003, 175–193; in Hungarian: A. Grynaeus: A magyarországi dendrokronológiai

kutatás eredményei és új kérdései, in: B. F. Romhányi – A. Grynaeus – K. Magyar – A. Végh (eds): *“Es tu scholaris”*. Ünnepi tanulmányok Kubinyi András 75. születésnapjára. Budapest 2004, 87–102.



chronology lay much more to the east than today, extending even into Roman Pannonia. However, this leads us to the supposition that the dendrochronological zones of Hungary and the Carpathian Basin must have changed at least once in the last 2500 years! Up to now, the reason for this change remains obscure. It certainly occurred, however, which should alert scientists to the fact that similar, basic transformations must have taken place in other, earlier epochs, too.

For year-exact dating, counting the number of the annual-rings in the sapwood of the different tree species is a prerequisite for the dendrochronologist. The image based on research into recent material (17<sup>th</sup>/<sub>s</sub> annual-rings) corresponds to the statements of European research<sup>2</sup>, according to which the number of annual-rings in the sapwood decreases step by step eastwards (The investigation into the reasons for this feature remains the task of future work). At the same time, scholars commonly suggest that this number was constant through the centuries, too, i.e. the same factors characterised the given region centuries earlier, as well. The analysis of the Hungarian archaeological material led once again to considerations that may inspire new investigations. During the construction works of the M3 motorway, an 18<sup>th</sup> century well was found at the site of Szihalom-Pamlényi field. Altogether 38 dendrochronological oak samples could be collected.<sup>3</sup> Most of the samples contained the sapwood as well, in 23 cases even completely, i.e. till the bark. This allowed us to make statistics concerning the average annual-rings in this group of samples. It has turned out that the obtained number differs considerably (by a factor of 2.3) from the number observed on recent material. Since the data series of annual-ring thickness of the Szihalom well largely correspond to each other, the number of sapwood annual-rings has to be considered as representative for the given material. It will be the task of future research to see whether the discrepancy in the number of sapwood annual-ring is characteristic only for the trees used for the construction of the well, or whether it can be observed over a larger region, too, and thus we have found a phenomenon that changes through time.<sup>4</sup>

Unfortunately there is no reference material from other sites, which would contain such a large number of samples with complete sapwood and bark. Nevertheless, we could frequently observe an extremely low number of sapwood annual-rings on samples from the Roman period. This fact too, indicates that the number of sapwood annual-rings has to be investigated systematically and we cannot accept as an axiom the stability of this factor through the centuries. A great help in finding the answer would be if the biologists and the foresters could tell us what influences the number of sapwood annual-rings in a given tree species.

Besides the classical dendrochronological problems, research on archaeological sites also allows observations concerning the forest exploitation of the population. One of these observations is that the data series of the samples of a given site is often comparable to each other, but the number of covered annual-rings is not very high. This allows the conclusion that the trees exploited did not grow in each other's proximity, i.e. the material of a given object (e.g. a well's lining) was collected and brought to the site from a very large region. Two different reasons can be given for this phenomenon: it either refers to a selection system that means that suitable trees were chosen and timbered within the forest, or there was appropriate wood was left in the settlement's environment, therefore the suitable material had to be bought on the market. This latter possibility seems to be probable, especially in those cases when the structure was not built from choice, "nice" wood. In both cases, however, one may acquire new, thought-provoking information.

While analysing the samples we could sub-divide them into two groups by the manner of dressing: some of them are "segments", sawn tangentially from the stemwood which do

<sup>2</sup> Recently e.g. *K. Christensen*: Sapwood in oak trees from Schleswig to Trondheim. Lecture on the conference "Advances in European Dendrochronology" (Travemünde, 14–18<sup>th</sup> September 1994).

<sup>3</sup> Rescue work of A. Várady whom I'm grateful for her help and cooperation.

<sup>4</sup> About the subject in details see: *A. Grynaeus*: Sapwood analysis on archaeological remains in Hungary, in: *Dendrochronology and Environmental trends*. Kaunas 1998, 18–21.

not contain the pith, others are “planks” sawn approximately radially or cut longitudinally. This difference indicates different times and different practices of dressing, too. If the trees representing the two types of dressing are contemporaneous, we must find another explanation, e.g. different function.

Future tasks of dendrochronological research in Hungary lead in two different directions, which are nevertheless interrelated. On the one hand, “floating” chronologies can be lengthened and sooner or later these series of relative chronologies will be anchored to one or several absolute dates. As part of this work a long relative chronological sequence can be produced probably first for the Avar Period which will remain disconnected for a while, but will allow us to make an internal periodisation of the given time period, as well as the comparison of these data to archaeological dating, answering a number of questions (as well as raising some new ones). A part of this work research started in Transylvania in 2003. These works are led by the Hungarian Dendrochronological Laboratory.

The other field of research goes beyond simple dendrochronological dating, and needs the adoption of methods from dendroclimatology, climatic-history, geology, and landscape-history. In other words comprehensive, interdisciplinary research would be needed. The first step in this direction was the foundation of the Budapest Tree-Ring Laboratory in the Department of Paleontology of the Eötvös Loránd University in Budapest, together with Miklós Kázmér, assistant professor at that department. The results of this research will provide a basis for the scientific analysis of climatic, meteorological and vegetation-historical questions in historical periods. The results of this comprehensive research will benefit not only researchers of historical periods, but also “fans” of the Neolithic.





## FINDINGS OF GEOARCHAEOLOGICAL AND ENVIRONMENTAL HISTORICAL INVESTIGATIONS AT THE KÖRÖS SITE OF TISZAPÜSPÖKI – KARANCSPART HÁROMÁG

There has been an intensification of research related to the distribution of the Körös culture and its northern boundary during the past few years and numerous interpretations have been advocated explaining the possible reasons for the emergence of this borderline. All these processes have been univocally triggered by archaeological excavations implemented at the Mesolithic sites of the Jászság, which had been discovered by an amateur archaeologist Gyula Kerékgyártó of Jászberény, under the supervision of Róbert Kertész.<sup>1</sup> Two highly distinct conceptions have been put forward for the area of the Middle Tisza region.

Makkay applied an approach of language history while formulating his concept of the “Jászság boundary”, saying that it was historical-cultural factors that have finally led to the emergence of this borderline, plus the fact that the Mesolithic groups frequently encountered the Neolithic groups of the Körös culture.<sup>2</sup> According to his views, the line running along the meeting points of communities bearing different technical and cultural traditions and belonging to distinct language families should mark the trajectory of this boundary. Discussing the critics of this concept is not the subject of this paper however, it must be mentioned that the emergence of a cultural interface stretching for several hundred kilometers seems to be quite unlikely within the Carpathian Basin<sup>3</sup> with data on population densities of hunting – fishing – gathering communities at hand,<sup>4</sup> due to the low population numbers of the foraging Mesolithic groups inhabiting the area.

The second concept of a geoarchaeological model draws upon the fact that the Carpathian Basin has been characterized by a large-scale versatility during the past 10 000 years. As a result, a large-scale mosaic-like segmentation or complexity emerged, observable both at the macro-, meso- and micro-scale within the basin from as early as the Ice Age.<sup>5</sup> The emergence of a macro-scale mosaicity or complexity is due to the overlap of four major climatic zones in the region.<sup>6</sup> Thanks to the cumulative interaction of these climatic zones, a mosaic-like vegetation developed in the Carpathian Basin as early as the end of the Pleistocene, and this mosaic-like complexity is observable in the composition and distribution of the modern vegetation of the basin as well.<sup>7</sup>

The effects of the extensive overlapping climatic zones are further intensified and influenced by the regional and local morphological and hydrological conditions.<sup>8</sup> The strongest climate-modifying influences emerged within the river valleys, as well as on the northern and southern slopes of the hills and mountains.<sup>9</sup> Thus the interface of the different climatic zones does not form a clearcut uniform boundary at the macro level, but appears as rather segmented minor puzzle pieces, restricted to adjacent smaller areas, creating a mosaic-like pattern. Furthermore, all these climatic influences followed a cyclically fluctuating trend,

<sup>1</sup> Kertész et al. 1994a,b, 1997.

<sup>2</sup> J. Makkay: Theories about the origin, the distribution and the end of the Körös Culture, in: L. Tóth (ed.): At the Fringe of three worlds. Szolnok 1996. 35–49.

<sup>3</sup> Kertész – Sümegi 1999a,b, 2003; Kertész 2003.

<sup>4</sup> E. S. Deevey: The Human Population. Scientific American 203 (1960) 195–204.

<sup>5</sup> Sümegi 1996, 2003a; Sümegi – Krolópp 1995, 2002, Sümegi et al. 1998, 1999; Sümegi – Kertész 1998.

<sup>6</sup> Sümegi 1995, 1996, 2001, 2003a,b,c; Sümegi et al. 1998, 1999; Sümegi – Krolópp 1995, 2002; Sümegi – Kertész 1998.

<sup>7</sup> Sümegi 1996, 2001, 2003a,b,c; Sümegi et al. 1998;

Sümegi – Kertész, 1998.

<sup>8</sup> Sümegi 1996, 1998, 1999, 2003a,b.

<sup>9</sup> T. Deli – P. Sümegi: Biogeographical characterisation of Szatmár–Bereg plain based on the mollusc fauna, in: J. Hamar – A. Sárkány-Kiss (eds): The Upper Tisza Valley. Szeged 1999, 417–477; Sümegi – Hertelendi 1998.



appearing with given frequencies throughout the course of history,<sup>10</sup> rendering some sort of plasticity to the boundary of the likewise periodically expanding – contracting climatic and environmental puzzle pieces.<sup>11</sup> The mosaic-like segmentation reached such a large-degree, that the actual borderline or interface of the individual climatic and environmental units is practically resolved.<sup>12</sup>

This complexity or mosaicity of the climatic, faunal, floral and soil endowments developing during the Quarternary and cyclically fluctuating in space and time had a major deterministic role on the immigrating and settling human communities. Simply because it practically prevented the expansion or spreading of the gathered, hunted or even produced plants and animals giving the economic foundations of these societies to the whole of the Carpathian Basin at a given moment of time.<sup>13</sup> Therefore, the immigrant groups of people from various climatic-environmental areas could occupy only certain parts of the basin at a time. Those parts, which corresponded to their economic experience acquired up to that time, and which provided for their hunted, bred, foraged or cultivated animals and plants.<sup>14</sup>

This new geoarchaeological model, conceptualized earlier, was developed for the whole of the Carpathian Basin by taking into account all the environmental and social factors, which were influencing and could have determined the spreading of the Neolithic communities bearing Balkanic–Mediterranean cultural roots and production experiences.<sup>15</sup> Based on the model, the authors hypothesized the emergence of a Central European–Balkan Agroecological Barrier (CEB AEB) within the central parts of the Carpathian Basin, which in essence determined the possibilities of spreading of the productive societies within the whole basin during the Early Neolithic.

The ecological needs of the cultivated plants and the farmed animals of the Körös – Starčevo culture, as the earliest group engaged in agricultural production, the preservation of a dual subsistence made up of productive and non-productive phases, the emergence of a sedentary lifestyle, as well as the level of technical development and production experiences gave the basis of this new agroecological model.<sup>16</sup> While formulating the new hypothesis of the CEB AEB, the authors on the one hand systematically disproved the theories advancing the presence of the “Proto-Tisza” boundary. On the other hand they have also emphasized the important role of the river valleys acting as rendezvous points and infiltration zones for the Mesolithic and Neolithic groups in the whole process of neolithization within the Carpathian Basin.<sup>17</sup>

A part of the archaeologists working on the Neolithic accepted this new model right away without showing any doubts,<sup>18</sup> while others simply rejected it without bringing up any acceptable counter-arguments.<sup>19</sup> However, it must be borne in mind that above-mentioned, new agroecological model works at a scale of several 1000 km<sup>2</sup> (macro level) for the explanation of the process of neolithization within the Carpathian Basin.<sup>20</sup> Although some initial steps have been taken for the conceptualization of a model working at a regional scale<sup>21</sup> by taking into account the regional differences observable within the basin,<sup>22</sup> no final version has come to light so far. Conversely, when we have a look at the settling process of the Körös communities at the macro level, it becomes quite obvious that the sites of settlement were purely restricted to the floodplains

<sup>10</sup> Sümegi et al. 2000; Sümegi – Krolopp 2002.

<sup>11</sup> Sümegi 2003a.

<sup>12</sup> Sümegi 2003a.

<sup>13</sup> Sümegi 2003a.

<sup>14</sup> Sümegi – Kertész 1998.

<sup>15</sup> Sümegi – Kertész 1998, 2001; Sümegi 2003a,b,c, 2004.

<sup>16</sup> Sümegi – Kertész 1998.

<sup>17</sup> Kertész – Sümegi 1998.

<sup>18</sup> N. Kalicz – Zs. M. Virágh – K. T. Bíró: The northern periphery of the early neolithic Starčevo Culture in south-western Hungary: a case study an excavation at Lake Balaton. *DocPraehist* 25 (1998) 151–181.

<sup>19</sup> Domboróczky 2003; J. Chapman: From Franchthi to the Tiszazug: two Early Neolithic worlds, in: E. Jerem – P. Raczky (eds): *Morgenrot der Kulturen*. Budapest 2003, 89–108.

<sup>20</sup> Sümegi – Kertész 1998, 2001; Sümegi – Hertelendi 1998; Sümegi et al. 2002, 2003a,b,c,d.

<sup>21</sup> Sümegi 2000, 2003; Sümegi et al. 2003a,b,c, 2004.

<sup>22</sup> K. J. Willis – P. Sümegi – M. Braun – K. D. Bennett – A. Tóth: Prehistoric land degradation in Hungary: who, how and why? *Antiquity* 72 (1998) 101–113; Sümegi 1998, 1999, 2004.

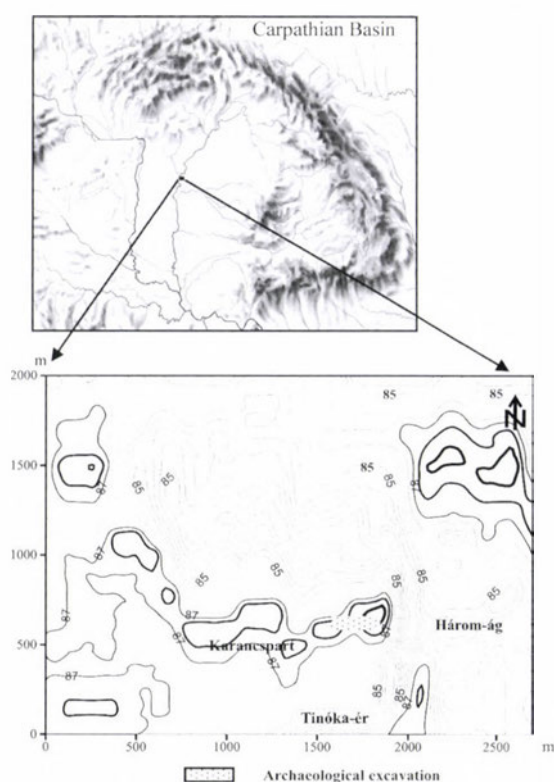


fig. 1. The analysed Körös sites in the Carpathian Basin

and alluvial areas of the rivers.<sup>23</sup> Based on this outcome derived from an observation made at the macro level, several authors have arrived at the conclusion that the hydromorphic soils of the floodplain must have had a significant role in the subsistence of the Körös culture groups.<sup>24</sup>

It is essential to consider the importance of the presently lacking local and regional investigations corresponding to analyses implemented at the micro and macro levels, and the fact that the first local investigations yielded contradictory results<sup>25</sup> to those of previous archaeological researches. The following parts of the present paper are discussing the findings of a complex geoarchaeological investigation implemented at the micro level at an Early Neolithic site, located at the northern boundary of the Körös culture belonging to the zone of the CEB AEB, in the vicinity of Tiszapüspöki.

Archaeologists of the János Damjanich Museum of Szolnok implemented detailed archaeological excavations at the site, enjoying public funding, preceding the construction of the No. 4 highway, under the supervision of Dr. Marietta Csányi, who was the head of the Department of Archaeology, Board of Trustees of the Museums of Szolnok County at the time. It was the Board that asked us to carry out our investigations at the site and we are all grateful for their kind support.

### Materials and methods

Based on finds collected by field walking,<sup>26</sup> a Körös site belonging to the village of Tiszapüspöki and registered to the prefecture of Törökszentmiklós was excavated during the summer of 1999 (fig. 1). From the site Karancspart-Háromág, several objects are dated to the Körös culture,

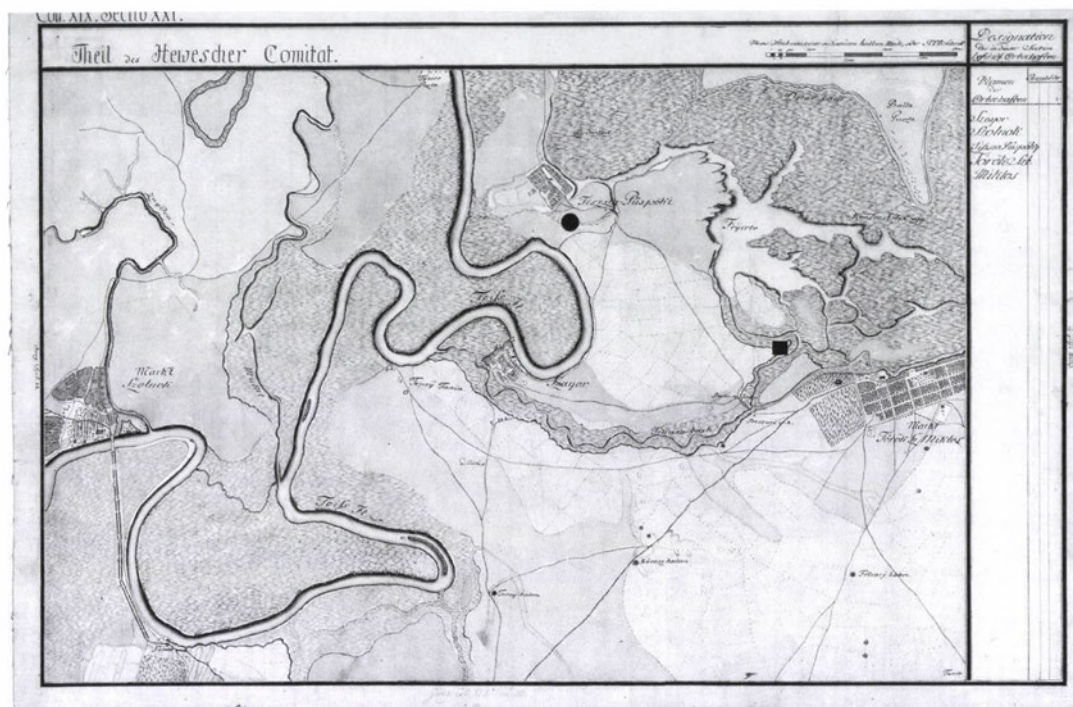
<sup>23</sup> Kalicz – Makkay 1977; Makkay 1982; Sherratt 1980, 1982; A. Sherratt: The development of Neolithic and Copper Age settlement in the Great Hungarian Plain. Part 2: Site surveys and settlements dynamics. *Oxford Journal of Archaeology* 2 (1983) 13–41; A. Whittle: *Europe in the Neolithic*. Cambridge 1996; Raczkó 1989.

<sup>24</sup> Kosse 1979; Sherratt 1982; C. Bonsall – M. Macklin – R. W. Payton – A. Boroneant: Climate, floods and river gods: environmental change and the Meso-Neolithic transition in southeast Europe. *Before farming* 3 (2002) 1–15.

<sup>25</sup> Sümegi 2000, 2003a,b,c; Sümegi et al. 2002, 2003a,b,c.

<sup>26</sup> Raczkó 1989.





1. ● 2. ■

fig. 2. Körös site and active, inactive river channels on the First Military Map (“Josephian”) (1782) of the Karancspart at Tiszapüspöki (Sümegi 2000)  
1. Pollen-site (Kartsú-ér) 2. Körös-site (Karancspart)

burial places and refuse pits have come to light besides the settling points of various other cultures.<sup>27</sup> Parallel with traditional archaeological investigations, detailed geoarchaeological studies have been carried out as well at the site.<sup>28</sup> These included the analysis of the following aspects, in accordance with the required steps of a palaeoecological study implemented with an archaeological perspective:<sup>29</sup>

1. Detailed morphological studies of the area (with the help of aerial photos, historical and modern maps of the area, personal field mapping and the construction of a digital elevation model).<sup>30</sup>

In order to capture the regional geomorphological conditions of the site the following maps have been utilized: the historical maps of the First Military Survey, the so-called “Josephian” maps (1782), the map series of Sándor Lietzner (1787–1790) and Sámuel Lányi (1845) depicting conditions preceding the 19<sup>th</sup> century river regulations, the map of the Third Military Survey prepared after the river regulations (1863), the soil map of Kreybig (1937), the geological map of Sümeghy (1941) (figs 2–3), and the modern digital maps prepared by Gábor Timár (figs 4–5).<sup>31</sup>

After the evaluation of the map data, the gained results were complemented with our personal morphological (fig. 6) and field work observations in 3D (fig. 7). The use of the historical maps in our work was highly important, as the river regulations of the 19<sup>th</sup> century significantly altered the original hydrological system of the Great Hungarian Plain. Thus the original environmental conditions of the site could be captured only via the combined use of these historical maps and data retrieved from various palaeoenvironmental sites. Aerial photographs were taken personally from an elevation of 60–100 meters above the site.<sup>32</sup>

<sup>27</sup> Marietta Csányi’s personal communication.

<sup>28</sup> Sümegi 2001b.

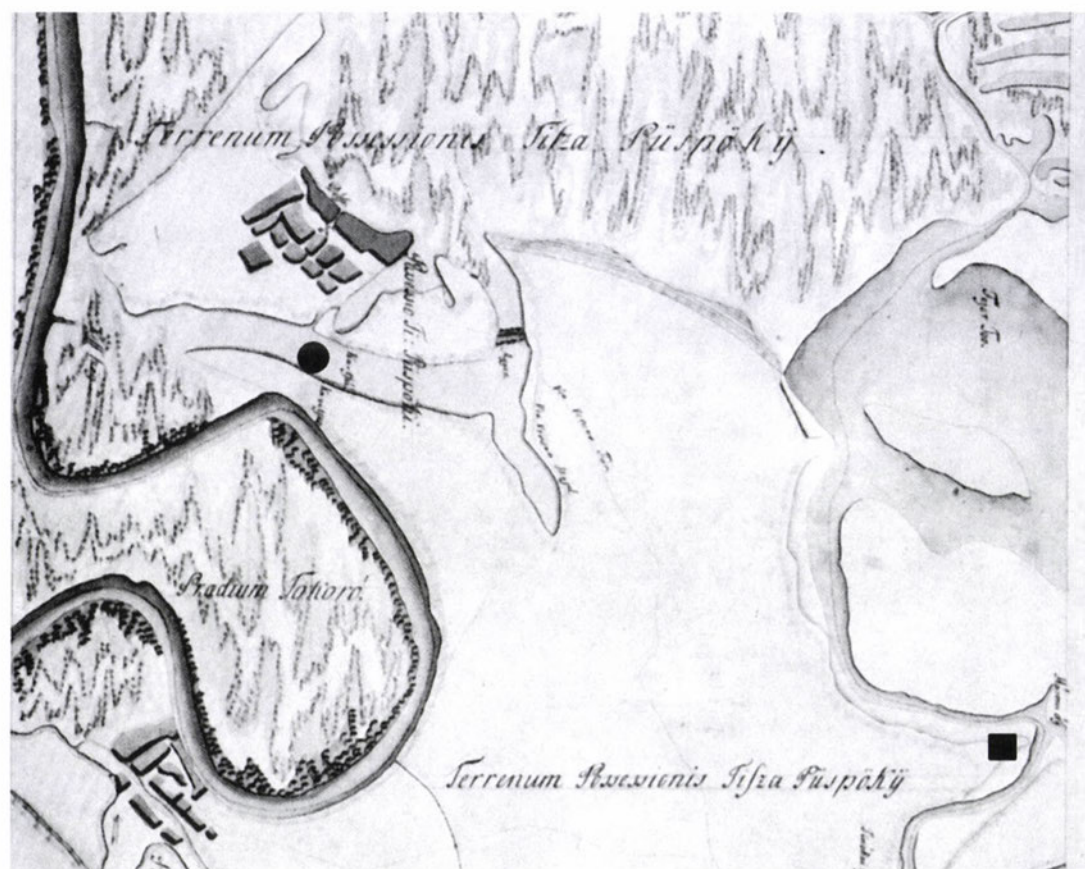
<sup>29</sup> Birks – Birks 1980.

<sup>30</sup> DEM: Timár – Rácz, 2001, 2002; Timár 2003a,b.

<sup>31</sup> Timár – Rácz 2001, 2002; Timár 2003a,b.

<sup>32</sup> Kertész – Sümegi 2003.





1. ● 2. ■

fig. 3. Körös site (Tiszapüspöki, Karancspart) and active, inactive river channels on the historical (1790) map (Sümegei 2000)

1. Pollen-site, 2. Körös-site (Karancspart)

2. In order to determine the spatial distribution of soils and reveal the underlying geology of the area high-resolution coring was carried out at 5, 10, and 20 m intervals with the help of an auger retrieving samples at 5 cm intervals in three sections (figs 8–10).

3. Open geological profiles were dug at the site for detailed litostratigraphical, palaeopedological, fine stratigraphical and sedimentological studies (fig. 11). Grain-size distribution of the samples taken at 10 cm intervals were determined via traditional hydrometry,<sup>33</sup> while the carbonate and organic content was determined by the method of Dean-type<sup>34</sup> loss on ignition. The palaeopedological investigations embedded the analysis of micromorphology,<sup>35</sup> grain-size distribution, carbonate and organic content of the soils,<sup>36</sup> as well as the measurement of the pH, and potentiometric pH measurements on water-based solutions in order to determine the former bioactivity and the genetic type of the soils, embedding the Early Neolithic artifacts.

4. Undisturbed samples for pollen studies were taken not from the adjacent Tinóka creek and the area of the Háromág, due to the presence of about 3 m-deep drainage channels, but at a more distant site of the Kartsú creek located at the edge of the village of Tiszapüspöki which must have been an active channel of the river Tisza during the Holocene, but now completely

<sup>33</sup> Molnár 1980.

<sup>34</sup> Dean 1974.

<sup>35</sup> G. Szendrei: Talaj-mikromorfológia (Soil micromorphology). Budapest 2000;

M. A. Courty – P. Goldberg – R. Macphail (eds): Soil Micromorphology in Archaeology. Cambridge 1989.

<sup>36</sup> Dean 1974.





fig. 4. Körös site and active, inactive river channels on the digital field map around Karancspart at Tiszapüspöki (Sümege 2000)  
1. Pollen-site, 2. Körös-site (Karancspart)

silted up.<sup>37</sup> Pollen extraction was carried out after the generally used method of Zólyomi – Erdtman with  $\text{ZnCl}_2$ .<sup>38</sup> During the evaluation, the quantitative and qualitative changes of the vegetation induced by the climate,<sup>39</sup> the climate indicator species,<sup>40</sup> as well as the ecological needs of the various plant species were considered<sup>41</sup> along with the anthropogenic influences on the environment.<sup>42</sup> The sudden drops in case of the arboreal pollens were taken to correspond to human influences, while the gradual changes were interpreted to represent climatic events. The most important and frequent taxa were depicted in temporal and appearance order on pollen diagrams prepared by the software Psimpoll. The number of AP (arboreal pollens) and NAP (non-arboreal pollens) were evaluated together. The corroded,

<sup>37</sup> Sümege – Bodor 2000.

<sup>38</sup> B. Zólyomi: Magyarország növénytakarójának fejlődéstörténete az utolsó jégkorszaktól (Development of the Hungarian vegetation from the last glacial). MTA Biológiai Osztályának Közleményei 1 (1952) 491–544.

<sup>39</sup> L. Kordos – M. Járainé-Komlódi: Az elmúlt tízezer év klímaváltozásai Magyarországon [Climatic

changes in Hungary in the last ten-thousand years]. Hungarian Meteorological Survey 92 (1988) 96–100.

<sup>40</sup> J. Iversen: Viscum, Hedera, and Ilex as climate indicators. A contribution to the study of the post-glacial temperature climate. Geologiska Föreningens i Stockholm Förhandlingar 66 (1944) 463–483.

<sup>41</sup> Behre 1988; Horváth et al. 1995; Simon 1994.

<sup>42</sup> Behre 1988; Diegerfeldt 1972; Sümege 1998.

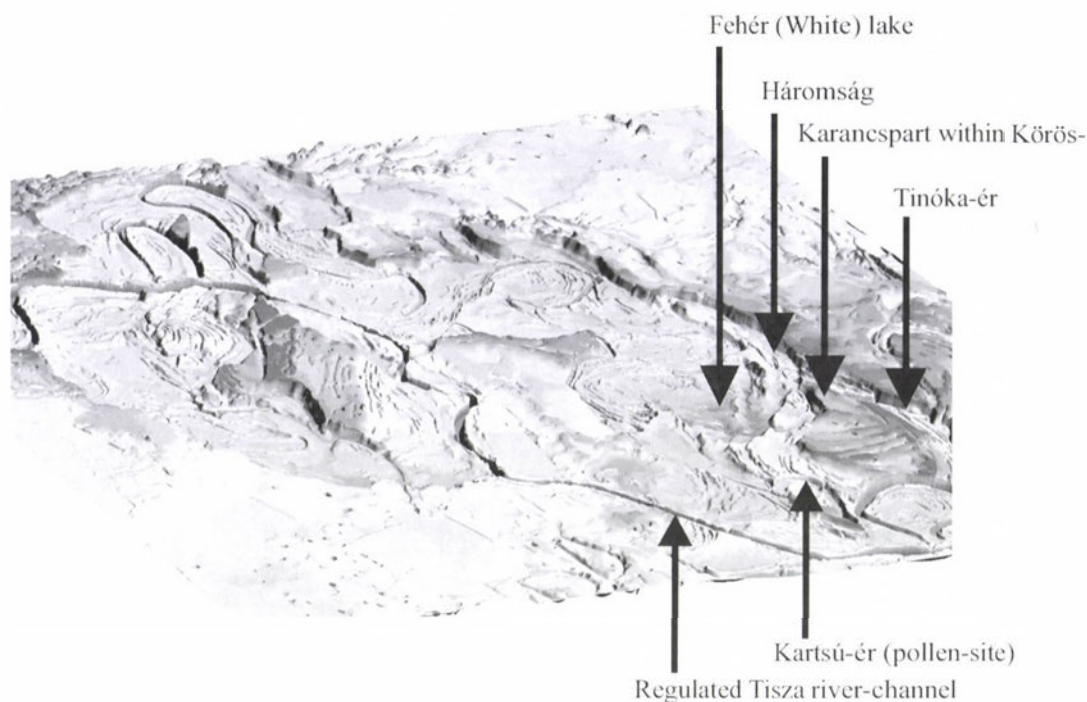


fig. 5. Middle Tisza region within Karancspart Körös site on the digital 3D field map

redeposited as well as the folded pollen grains unsuitable for determination were also counted for AP and NAP. The aquatic vegetation was evaluated separately.

5. In order to determine the horizon corresponding to the time of the Körös culture within the pollen profiles, and to reconstruct the temporal changes of the vegetation during the Holocene, some samples were radiocarbon dated in the Light Isotope Laboratory of the Nuclear Research Center of the Hungarian Academy of Sciences in Debrecen (*Table 1*).

6. The soil horizon embedding the Körös artifacts as well as the deposits of pits of the Körös objects, and those located further away from the Körös objects were wet sieved (several hundred kg) using a mesh of 0.5 mm, in order to retrieve the mollusc shells for malacological analysis. The rates of abundance, dominance as well as the Haarlow index were calculated ( $\text{height} \times \text{width} \times \text{dominance}$ ) in order to eliminate the taphonomic and preservation bias during the evaluation of the mollusc fauna as well as the determination of the dominant form.<sup>43</sup> The mollusc material has been used for the reconstruction of the once-prevailing local environmental conditions of the site at the time of the Körös culture.

All these detailed natural scientific studies were aimed at preparing a complex environmental reconstruction of the site on the one hand, and to establish a system of intercontrolled palaeoenvironmental analyses on the other hand.<sup>44</sup> The final results of the palaeoecological and geoarchaeological investigations implemented at the site and its surroundings, and conceptualized in the next parts will reveal the interrelations of the Early Neolithic human communities and their surrounding environment at a local level. The principles and concepts put forth are valid only at a local scale and can not be extended regionally to other Körös site or sites due to the presence of the three-level mosaic-like complexity present in the Carpathian Basin as mentioned previously.<sup>45</sup>

<sup>43</sup> Sümegei 2003a; Sümegei – Deli 2004.

<sup>44</sup> Sümegei 2003a.

<sup>45</sup> Sümegei 1996; Sümegei et al. 1998; Sümegei – Kertész 1998.



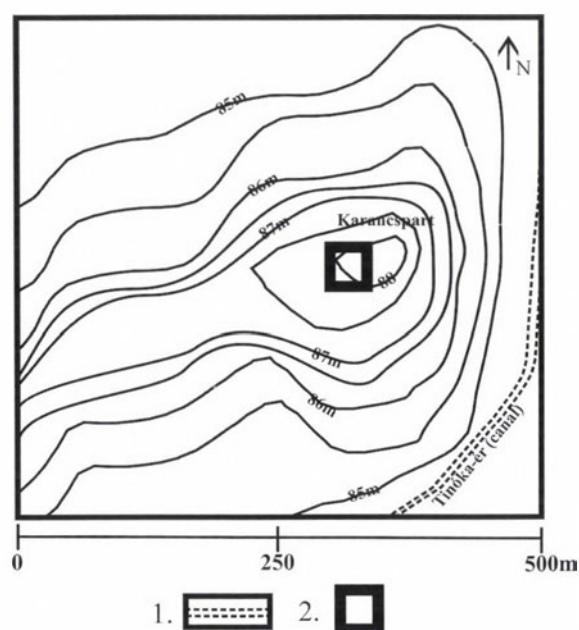


fig. 6. Local morphologic situation of Karancspart, Háromág Körös site at Tiszapüspöki (Sümegei 2000)

1. Canalised Pleistocene river channel, 2. Körös-site

## Results

### *The findings of geomorphological and historical studies*

The evaluation of the historical maps unambiguously revealed that although the representatives of the Körös culture chose an alluvial plain as the site of their settlement, this plain is by no means homogenous, neither with regards to the morphology nor landscape evolution, in contrast to the former environmental archaeological assumptions.<sup>46</sup> In other words, the alluvial plain, when examined at a macro level, seems to be a homogenous landscape with ideal hydrological and hydromorphological conditions and soils. However, it turns into a heterogeneous system in reality composed of individual island-like Pleistocene lag surfaces.<sup>47</sup>

These Pleistocene lag surfaces tend to represent traces of an earlier fluvial system of channels and floodplains which got into an elevated position due to the neotectonic movements commencing at the end of the Pleistocene, beginning of the Holocene and the displacement of the active channels and the horizon of fluvial erosion, creating a system of elevated island-like surfaces above the Holocene floodplains.<sup>48</sup> Hydrogeologically speaking, these floodplain islands and elevated abandoned levees comprise a system free of annual floods and suitable for long-term settlement and agricultural production.

The Körös site of the Karancspart, Háromág at Tiszapüspöki and its surroundings is given by an extensive, elevated, island-like lag surface of Pleistocene age (figs 1–7). In other words, as justified by the findings of detailed evaluations of historical maps and digital elevation models of the area, the communities of the Körös culture chose the floodplain as the site of their settlement, however not the direct bank areas of the former channel of the Tisza river, but the more distant elevated Pleistocene lag surfaces and the bank areas of the silting-up abandoned channels acting as secondary or tertiary drainage channels in the area at the time. Naturally, these alluvial lag surfaces were by no means totally flat, uniform and homogenous areas, but were comprised of a complex, versatile system of abandoned, channels, riverbacks and backwater areas. These fluvio-morphological units of the Pleistocene alluvia are clearly observable in the studied region as well, the Tinóka creek located south of the site (figs 1–7)

<sup>46</sup> Nandris 1972; Kosse 1979; Makkay, 1982.

<sup>47</sup> Sümegei 2000, 2003a,b; Sümegei et al. 2002.

<sup>48</sup> Sümegei 2000, 2003b,c; Sümegei et al. 2002.

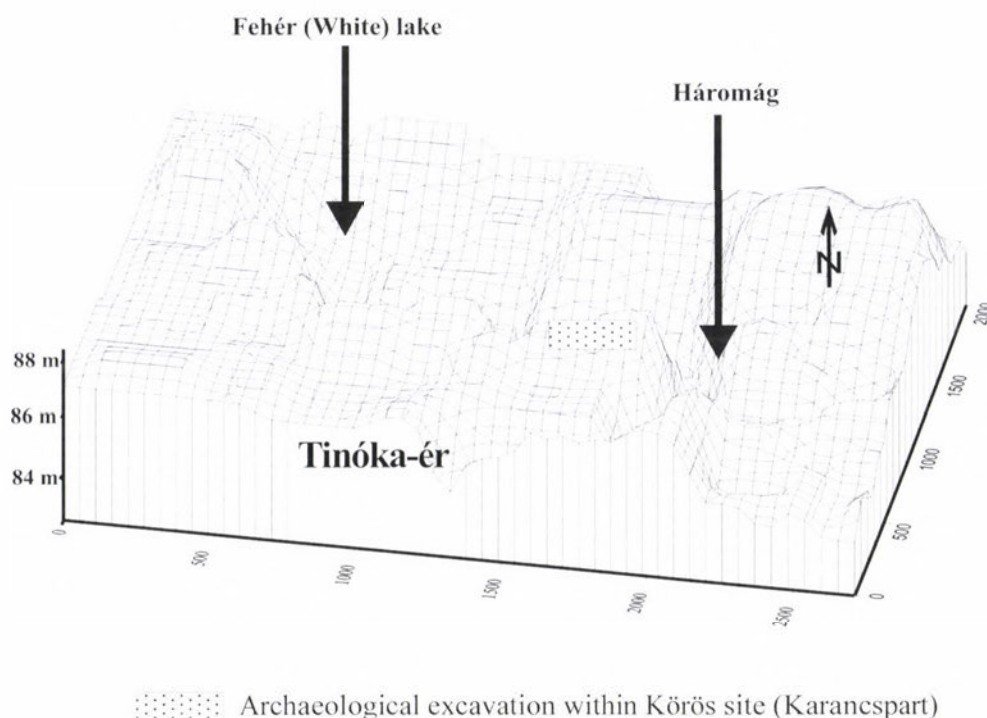


fig. 7. 3D morphological situation of Karancspart, Háromág Körös site at Tiszapüspöki (Sümegei 2000)

being a remnant abandoned channel of Upper Pleistocene age located on a lag surface elevated above the present-day alluvial plain of Holocene age. Furthermore, the area of the Karancspart is composed of an elevated backswamp with infusional loess deposits and a loess-covered, sandy abandoned natural levee (figs 3–4). This highly variegated lag surface is made up of smaller units of different elevations. The deepest, lowermost parts are occupied by silted-up abandoned channels (83–84 m), while the highest areas are composed of loess-covered abandoned natural levees or riverbacks (88–89 m).

With these topographical data at hand we can state the following: the formerly active but presently abandoned channels could have become flooded during the floods of the river Tisza in times preceding the river regulations, when the extension of the flooded areas and floodplains exceeded 30 000 km<sup>2</sup> but the water levels were not as high as recorded today, turning these abandoned riverbeds into secondary and tertiary drainage channels. However, the highest elevated areas managed to remain free of floodwaters.

Consequently, the communities of the Körös culture occupying the elevated areas of the Karancspart site were in fact dwelling in an aquatic habitat close to the river, but not on the banks of the active riverbed, but on the flood-free banks of the Pleistocene abandoned channels acting as drainage channels during the times of floods. This typical type of settling method is linked to well-definable morphological units thanks to the special landscape development of the Great Hungarian Plain, namely the Pleistocene lag surfaces.<sup>49</sup> What does it exactly mean? These channels had been active riverbeds during the Würmian and at the end of the Pleistocene, which got into an elevated position as a result of the end-Pleistocene tectonic movements and turned into inactive canal-like channels via minor subsidence. The canal-like, longitudinal abandoned channels are one of the most characteristic geomorphological features of the Great Hungarian Plain observable almost in every part.<sup>50</sup> These canals must have been fully flooded during floods harbouring huge amounts of floodwater and becoming secondary and tertiary drainage channels during the Holocene.

<sup>49</sup> Sümegei 2000.

<sup>50</sup> Sümegei et al. 1999, 2000, 2002a, 2003a,b,c.



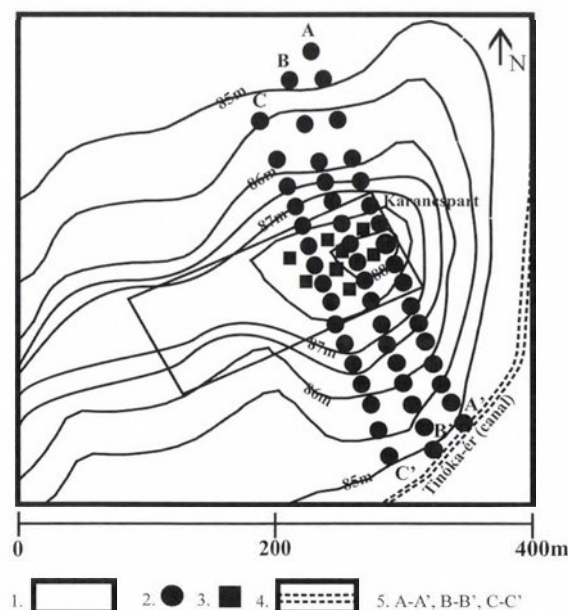


fig. 8. The position of the geoarchaeological bore-holes, archaeological excavation, Körös objects (pits, burial, house) and morphological situation of Karancspart, Háromág Körös site at Tiszapüspöki (Sümegei 2000)

1. Area of the archaeological excavation, 2. Geoarchaeological bore-holes, 3. Körös objects (pits, burial, house), 4. Canalised Pleistocene river channel, 5. Geological cross section

Several such drainage channels could have been identified at the site of Karancspart, Háromág of Tiszapüspöki, which could have carried floodwaters into the vicinity of the settlement during the Holocene. These are for example the channels of the Tinóka creek, the abandoned riverbeds under the name Háromág (Three branches), and finally the Kartsú creek (after the map of Leitzner 1790) at the edge of the village of Tiszapüspöki, which was an active channel of the Tisza River during the beginning of the Holocene. Floodwaters managed to reach the lowermost parts of the area during the flooding of the Tisza, turning the backswamp areas of the Pleistocene lag surfaces into a pond during the Holocene (fig. 2: Fejér Pond, named after the map of Leitzner and the First Military Survey). According to the morphological data available for the studied area, the channels and depressions surrounding the elevated, loess-covered, abandoned levee of the Karancspart were covered with water during and after the floods, turning the settlement site of the Körös culture into an approximately 5 ha peninsula, which was a part of an extensive alluvial island stretching from Töröszentmiklós, to Tiszapüspöki and Szajol, covering an area of about 8–10 km<sup>2</sup> (figs 2–5). Several such Neolithic sites, occupying similar alluvial islands could have been identified from other areas of the Great Hungarian Plain so far.<sup>51</sup>

#### **Results of sedimentological and faciesanalytical investigations of the cores**

Geological maps (fig. 9) and cross-sections (fig. 10) were prepared for the area via the analysis of boreholes deepened at 5, 10 and 20 m intervals. According to the findings of these analyses, different morphogenetical units reflecting the morphology, Pleistocene water coverage, and fluvial sedimentation characteristic of a former floodplain could have been identified. Aolian loess was deposited on the elevated heights of the levees, while its aquatic counterpart, infusional loess accumulated on the floodplains behind the levees and the backswamp areas along with other floodplain loess-like sediments.<sup>52</sup> These differences in the lithology, and the

<sup>51</sup> Sümegei 2000, 2003b,c, 2004; Sümegei et al. 2002a,b, 2003b,c.

<sup>52</sup> Pécsi 1993; Földvári 1957.

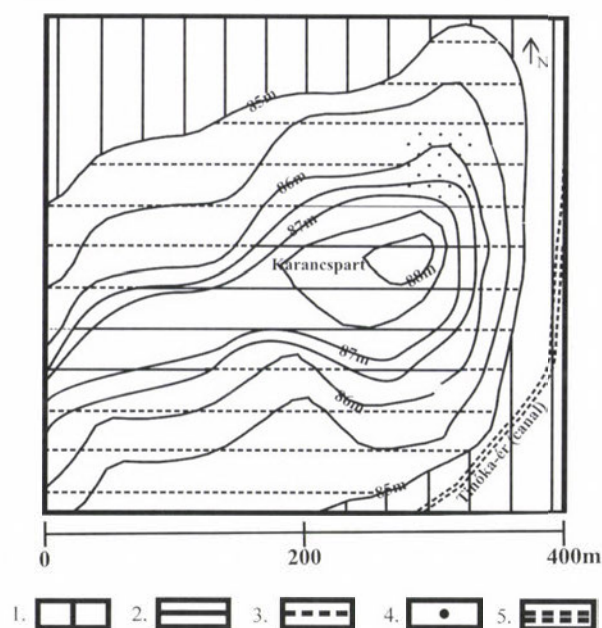


fig. 9. Geological map of Karancspart, Háromág Körös site at Tiszapüspöki (Sümegei 1999)

1. Holocene flood plain sediments, 2. Loess, 3. Infusion loess, 4. Wind-blown sand,
5. Canalised Pleistocene river channel

two major loess types were clearly identifiable on the borehole profiles with the help of grain-size, carbonate and organic content data (figs 11–12).

Three major horizons or layers could have been identified within the boreholes deepened at the highest points of the Karancspart between 87 and 88 m at the settling points of the Körös culture. The bedrock is made up of sandy deposits, more precisely grayish-yellow, well-sorted, very fine-fine sands, which are either carbonate-free or contain minimal carbonate. This layer is overlain by a yellowish-brown layer of fine silty-coarse silt with significant carbonate content, a typical aeolian loess deposited among dry conditions (fig. 11). On this loess layer an organic-rich, blackish brown soil developed with calcareous coating in its B and B/C horizons, embedding the artifacts of the Körös culture. No signs of fluctuations in the groundwater table (iron spots or precipitates) could have been identified in the elevated areas.

Sedimentary structures like iron precipitates and reddish-brown spots indicating groundwater fluctuations are observable in the layers below 86 m ASL, accompanied by an alteration of the sedimentary facies as well. Here we could have identified coarse-silty fine silts of brownish-green hue with iron and carbonate precipitates and significant clay content, or infusional loess genetically speaking (fig. 12). The bedrock here is also very fine-fine sand, and a black soil horizon developed on top of the infusional loess deposits with higher clay content than that on the aeolian loess layer (figs 10–12). According to the facies distribution analysis of the boreholes, the infusional loess layers are inter-fingered with the type aeolian loess layers comprising most likely a heterotypical facies, which emerged at the same time during the end of the Pleistocene in different environments and topographic position. According to the findings of sedimentological and malacological investigations,<sup>53</sup> the most important differences between these two loessy facies were those of the height of the ground water table, and the humidity as well as the vegetation cover of the area serving as the site for dust accumulation. In case of the infusional loess deposits, the accumulation of the dust particles took place in an environment, which was under water cover at least in a part of the year, while the type aeolian dust particles, lacking any signs of groundwater influences, must have accumulated among dry steppe-forest steppe conditions. All these data seem to imply that in the area of the Great Hungarian Plain the evolution of a loessy hydrosere from

<sup>53</sup> Földvári 1957; Pécsi 1993; Sümegei 1989, Sümegei et al. 1992; Sümegei – Krolópp 1995.



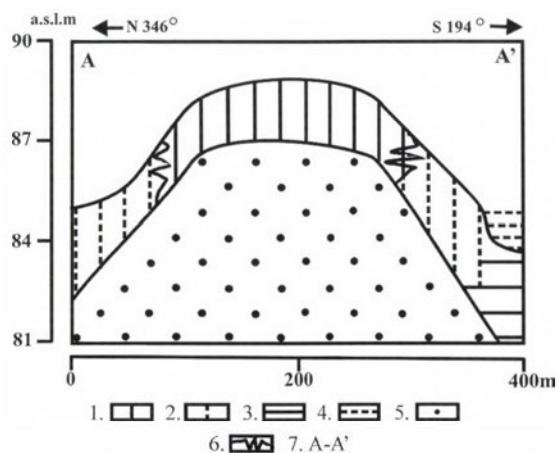


fig. 10. A–A' geological cross-section of Karancspart, Háromág Körös site at Tiszapüspöki (Sümegei 2000)

1. Loess, 2. Infusion loess, 3. Floodplain sediment, 4. Holocene eutrophic lake sediment,
5. Sand, 6. Lithological border zone, 7. Geological cross-section

the lowermost part of the floodplain to the topmost part of the levees was highly dependent on the geomorphological endowments, the elevation and the actual level of the groundwater. As a result, a dust accumulation surface with frequently fluctuating water coverage emerged on these areas, determining the process of dust accumulation on the one hand, and the structure and composition of the yielding loessy deposits via the diagenesis on the other hand.

When the findings of the former geological and geomorphological surveys of the Great Hungarian Plain are considered,<sup>54</sup> which were implemented at a higher resolution, it might seem surprising that in areas with relatively small differences in their relief significant variation can be observed in the sedimentary facies even within a relatively small distance. However, after the complex, palaeoecological analysis of the site of Szeged-Óthalom<sup>55</sup> it became rather apparent that the area of the Great Hungarian Plain is made up of relatively smaller, well-traceable, topomorphological sedimentary units which extend over a couple hundred metres, characterized by distinct sedimentological parameters influencing both the vegetation and soil conditions, as well as the possibilities of human settlement, as it has been shown by the most recent geoarchaeological studies. These sedimentary units managed to preserve signs of their original morphological, topographical and sedimentary conditions as well as the groundwater levels prevailing during the time of their formation.<sup>56</sup>

### **Results of the palaeopedological studies**

The extensive archaeological excavations and the geoarchaeological coring involving an area of several ha enabled the detailed study of the prevailing soils at the site, as well as the extrapolation of the horizontal alterations of the bedrock and the overlying soil horizons to larger areas (fig. 13). Thus the horizontal tracing of the settlement horizons of the individual cultures was also feasible (fig. 14). According to the findings of soil analyses, the evolution of soils in the area was determined by the composition of the bedrock, and the topographical and morphological conditions of the site. The topmost horizon is covered by chernozem, the surrounding areas of these by meadow black earth soils, while hydromorphic meadow soils developed in the lowermost areas.

Pedological and archaeostratigraphical correlation of the individual horizons was also feasible with the help of a geoarchaeological profile dug at the site (fig. 14). The tools and artifacts of the Körös culture are univocally linked to the lowermost part of horizon A of the

<sup>54</sup> Rónai 1985.

<sup>55</sup> Krollopp et al. 1995.

<sup>56</sup> Sümegei 2000.

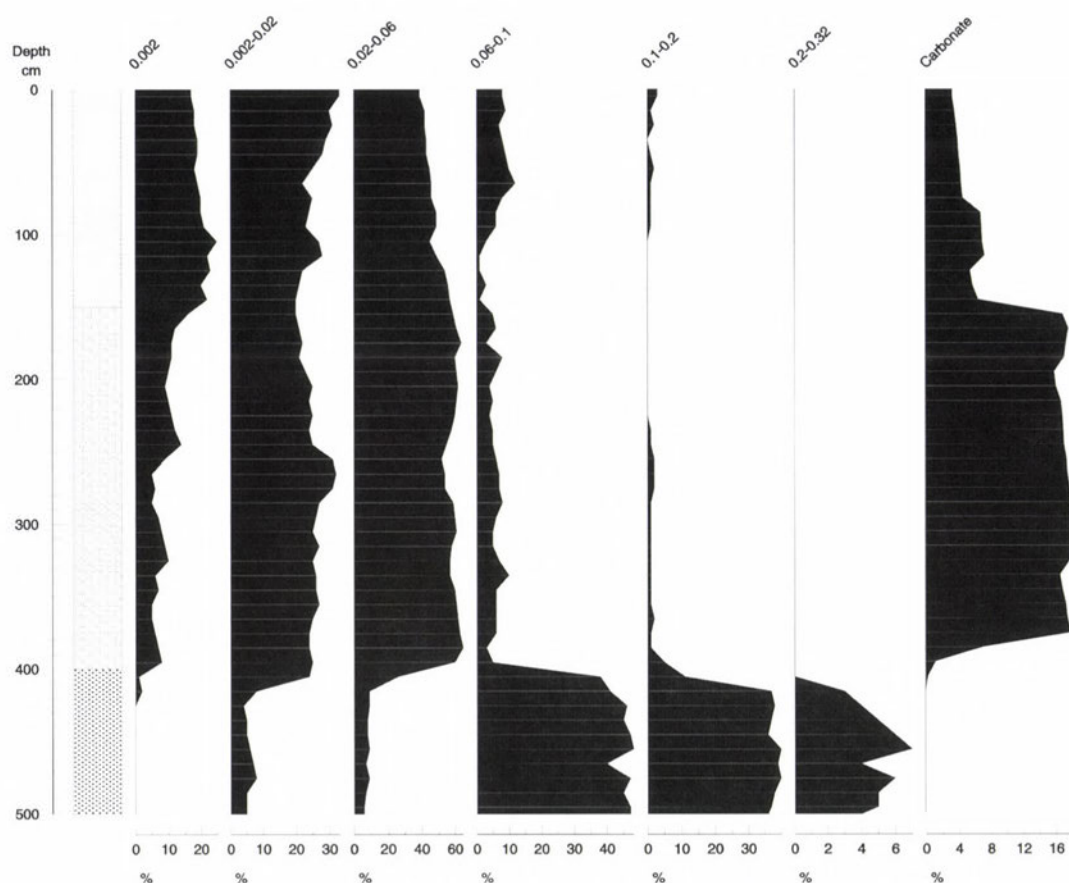


fig. 11. Sedimentological results of a bore-hole sequence on the topmost part of Karancspart, Körös site at Tiszapüspöki (*Sümegei 2000*)

blackish-brown organic-rich soil, well-below the plow-zone in undisturbed conditions and the borderzone of the A, B horizons.

Chernozem soils, with clearly distinguishable horizons developed in the topmost part of the studied area (*fig. 15*). Below the 30 cm deep plow zone, a highly disturbed, slightly calcareous, neutral, friable A horizon with 4–5% organic content and a blackish-brown hue could have been identified with a thickness of 50–60 cm. The pits of the Körös culture were filled in with soils of the same parameters in great thickness, sometimes reaching 100 cm as well. Below this A horizon, a calcareous, friable B horizon developed with sporadic carbonate veins and coatings, numerous crotoivines and a dark brown hue with a thickness of approximately 30–50 cm. Significant amounts of calcareous coatings, concretions and crotoivines are observable at the border of the B and C horizons. According to these parameters, calcareous chernozem soils developed on the aeolian loess covering the topmost parts of the site. However, it is still ambiguous whether the formation of chernozem soils observable in the modern soil horizon was present during the Early Neolithic as well, when the representatives of the Körös culture settled in the area.

According to the findings of sedimentological and micromorphological investigations, aeolian loess sediments accumulated on top of the sandy deposits of the Pleistocene abandoned levee. The soils, which developed on this loess layer, are characteristic of open vegetation areas and are observable both in the pits assigned to the Körös culture and embed the artifacts of the same cultural group.

However, no signs of root holes or biogalleries, characteristic of arboreal vegetation, have been observable neither in the profile nor the thin-sections of the micromorphological studies. Conversely, significant amounts of crotoivines, though unknown age, have been encountered in the soils embedding the Körös artifacts.<sup>57</sup> A part of these crotoivines made by gophers and

<sup>57</sup> Marietta Csányi's personal communication.



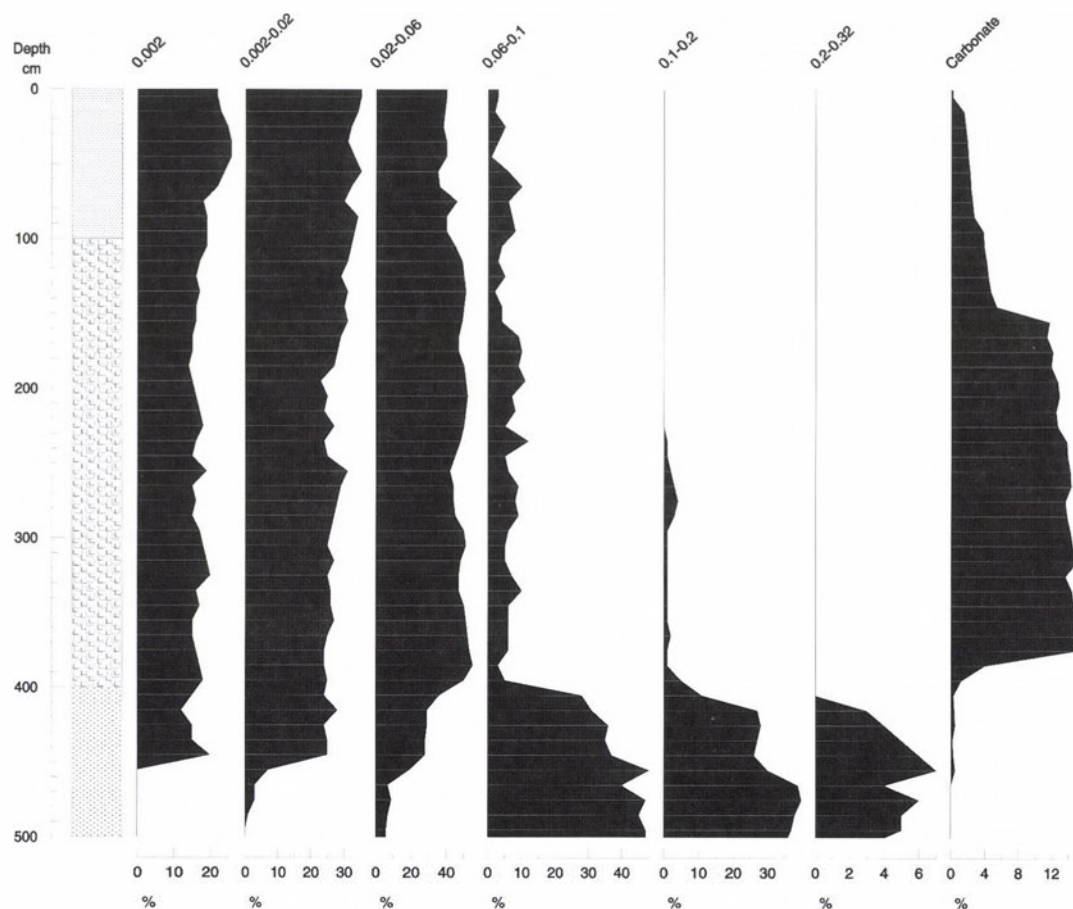


fig. 12. Sedimentological results of a bore-hole sequence on the deepest part of Karancspart, Körös site at Tiszapüspöki (Sümegei 2000)

hamsters starts out from the settlement horizon of the Neolithic. Thus they can be regarded to be coeval with the Early Neolithic artifacts.

No signs of clay movement or groundwater influences could have been observed in the thin-sections. Conversely, significant amounts of smaller-size biogalleries and filling in carbonates were identified.

The carbonate-rich horizon primarily appeared in the soil horizons rich in organic matter, but significant amounts of carbonates could have been observed in the underlying horizons as well.

On the basis of these observations, we can say that the representatives of the Körös culture settled onto a Holocene steppe-forest steppe area with chernozem-like soils, which had developed on aolian loess bedrock. In our view, the concept of chernozem soil is not a historical but a genetical term. Thus in order to be utilizable in palaeoenvironmental studies for the identification of fossil soils of this type, the main observable parameters of this fossil soil should be clearly set first.

Another source of uncertainty comes from the fact that pedogenesis was prevalent during the Neolithic in the area as well, and this might have led to an alteration of the former Early Neolithic soils, bringing about the formation of polygenetic soils in the end.

There is a significant change in the character of soils in the levels below 86 m at Karancspart with a sudden change in the carbonate content (fig. 16), a significant increase in the clay content of the A horizon giving it a darker hue, and the appearance of iron and limonite spots in the B horizon. The A horizon is brownish-black, alkaline with a minimal carbonate content, reduced friability, and a greasy lustre. The B horizon is characterized by a suddenly rising carbonate content, alkaline pH and a significant decrease in the organic

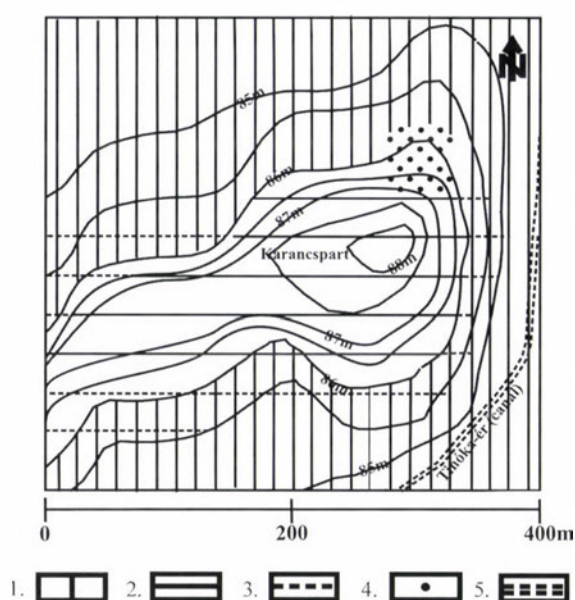


fig. 13. Soil-map of Karancspart, Háromág Körös site at Tiszapüspöki (Sümegei 2000)

1. Hidromorphic soil, 2. Black earth, 3. Black earth with hidromorphic stamps,  
4. Wind-blown sand, 5. Canalised Pleistocene river channel

content (fig. 16). Iron spots and limonite spots, implying the influences of a fluctuating water table are observable in the borderzone of B and C horizons. The bedrock of the soil is primarily infusional loess.

Another change in the genetics of soils is observable in the areas with an elevation around 84 m ASL. Although the hue is still blackish-brown, the organic content is a lot lower, yielding a polihedric, carbonate-free, slightly acidic A horizon with reddish-brown iron and limonite spots. There is no sharp boundary between the A and B horizons, the B horizon is being of significant clay content and a grayish-brown hue located below the A horizon. Iron and manganese spots as well as pea structures could have been identified here with an increasing trend towards the bedrock. Several, cm-thick standing biogalleries could have been observed in this horizon, filled in with secondary iron or carbonate, which can be linked to the presence of a former arboreal vegetation. The appearance of arboreal vegetation is presumable in the lower lying areas of the Karancspart, enjoying better hydrological conditions and water supply. The bedrock or the hydromorphic meadow soil here is given by clayey, silty floodplain deposits.

The alterations of the soils in accordance with the local morphological endowments and the emergence of a soil series at the site (calcareous chernozem, meadow chernozem, meadow soils) all seem to imply that the fossil groundwater table, morphology, elevation and the relief conditions must have been important not only during the formation of the Pleistocene hydroseries, but in the Early Holocene pedogeny as well.

#### ***Results of the sedimentological and palaeobotanical analysis of cores, the reconstruction of the former vegetation in the area***

In the channel of the Kartsú creek, located at the edge of the village of Tiszapüspöki at the end of the football field, a minor drainage channel was dug suitable for retrieving samples for sedimentary, palynological and radiocarbon analyses, to capture the initial phase of channel development and the evolution of the Holocene vegetation in the surroundings of our Körös site, the closest as possible to the area of the Karancspart.

Deposits on the surface of the Kartsú creek bed were only slightly disturbed, thus we could retrieve undisturbed core samples to a depth about 7 m, starting off from the surface. The collapse of the borehole in the deepest sandy horizons prevented detailed sampling from



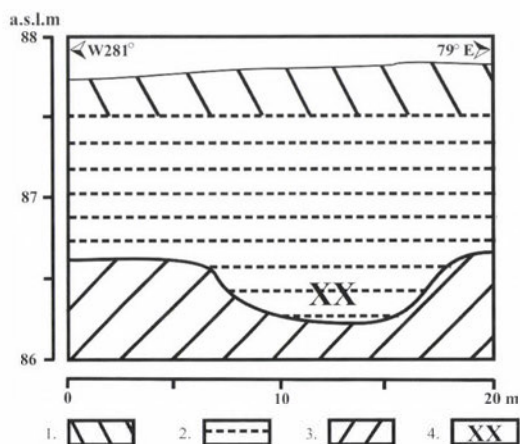


fig. 14. Soil horizons within Neolithic finds on the Karancspart at Tiszapüspöki  
1. Soil (ploughed), 2. Soil A horizon, 3. Soil B horizon, 4. Körös finds

and below this level. However, knowing the morphological parameters of the riverbed we may assume that the actual floor of the channel is situated well below this depth.

The bottom of the borehole (bw. 7.0–6.4 m) yielded very fine sandy fine sands with a significant fraction of medium-grained sands implying a deposition from high-energy fluvial waters. These sediments correspond to the active channel deposits of a former river. No pollen grains suitable for evaluation has come to light from this horizon, but some shell fragments of the mussel *Unio* cf. *crassus*, preferring moving water habitats corroborated our first conception of the prevailing palaeoenvironmental conditions. According to the radiocarbon analysis of charcoal remains retrieved from a depth of 7 m, the active channel phase was present in the area even at the opening of the Holocene as well dated between 9000–9100 BP (Table 1, fig. 17).

The deposition of very fine-fine sands continued in the section between the depths of 6.4–5.6 m with the intercalation of minor silty seams and layers providing some pollen grains suitable for evaluation. The differential deposition of the sedimentary layers containing alternatively more sand or silt in the active riverbed must have been linked to the fluctuations of the water level in the channel. This systematically alternating composition of the sediments retrieved from the borehole clearly implies that we have managed to core not the central but the marginal sedimentary sequences of the former riverbed. Sampling via coring from the center of the former riverbed along the main channel line was hampered by the presence of a 1.5–2 m deep drainage channel, which had been created during the 19<sup>th</sup> century river regulations.

Code	Metre	$\delta^{13}\text{C(PDB)} [\text{‰}]$	Radiocarbon age (BP)	Radiocarbon age cal BC 1 $\sigma$
deb-7885	3,0 – 3,2	-27,12 $\pm$ 0,06	3210 $\pm$ 60	1520 – 1420
deb-7918	5,6 – 5,8	+0,95 $\pm$ 0,18	7180 $\pm$ 70	6130 – 6120 6100 – 5980
deb-7948	6,8 – 7,0	-27,57 $\pm$ 0,03	9050 $\pm$ 110	8410 – 8380 8330 – 8180 8110 – 7992

Table 1. Radiocarbon data from Kartsú-creek core profile

There is a significant change in the composition and character of the sediments between the depths of 5.6–5.4 m, yielding organic-rich deposits of dark brown hue and a significant silt fraction. This has been interpreted as remnants of a pack of drift-wood deposited in the channel around 7000–7100 BP as shown by radiocarbon dates. If the material of this horizon is not the outcome of the secondary redeposition of earlier deposited fossil wood remains of Holocene

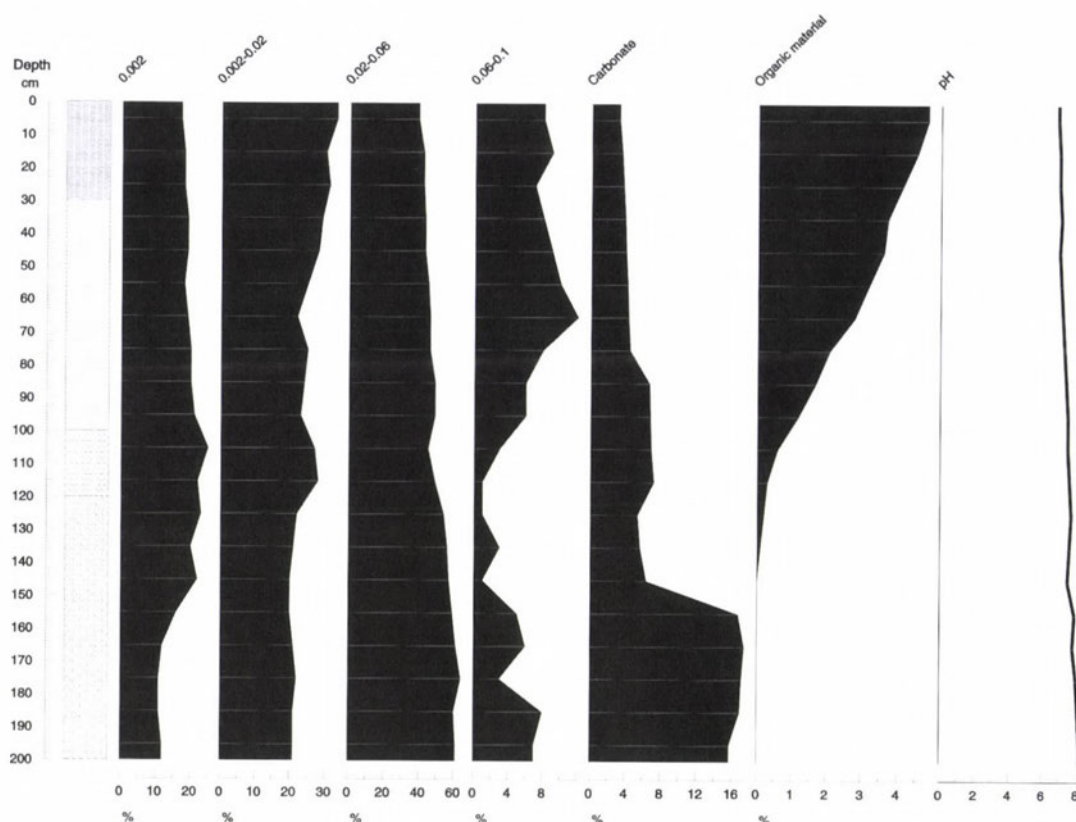


fig. 15. The results of the soil analysis on the black earth soil profile on the topmost part of Karancspart, Körös site at Tiszapüspöki (Sümegei 2000)

age, referred to as the “black oak” phenomenon by Starkel<sup>58</sup> taphonomically speaking, then this sedimentary layer must have accumulated at the beginning of the Atlantic Phase based on the chronological classification applied for the Holocene.<sup>59</sup>

There is a gradual decrease in the sand fraction within the deposits upward from this layer with cyclic reappearance of sand grains coarser than very fine sand. The fraction of very fine sands was reduced to 50% of its original amount (fig. 17). Coarse silty fine silts with a significant clay, organic and carbonate content were deposited between 5.4–4.0 m. During this period, corresponding to the second half of the Holocene, the channel of the Kartsú creek located on the floodplain received waters during certain periods of the year only, becoming part of the active channel system of the river at times of flooding.

There is a sudden increase in the sand fraction between 4.0–3.8 m, implying that the studied channel turned into an active river branch again during this period. According to the sedimentological and facies analyses of the sedimentary sequence of the channel, this period was the last of an active channel in its evolution followed by a slow, gradual silting-up in what was turned into a cut-off channel. According to the calculated rate of sedimentation based on radiocarbon dates, this change in the hydrological conditions must have happened around 4400 BP, marking the final cut off of the channel from the active riverbed and the emergence of an oxbow lake (fig. 18).

<sup>58</sup> L. Starkel: Hydrological and palaeogeographical changes within the Vistula catchment against the background of Central Europe, in: L. Starkel (ed.): Geographical Studies, Special Issue 5 (1990) 189–198.

<sup>59</sup> J. Mangerud – S. T. Anderson – B. E. Berglund – J. J. Donner: Quaternary stratigraphy of Norden, a proposal for terminology and classification. *Boreas* 3 (1974) 109–127; H. J. Mangerud – H. J. B. Birks – D. Jäger: Chronostratigraphical subdivision of the Holocene. *Striae* 16 (1982) 80–83.



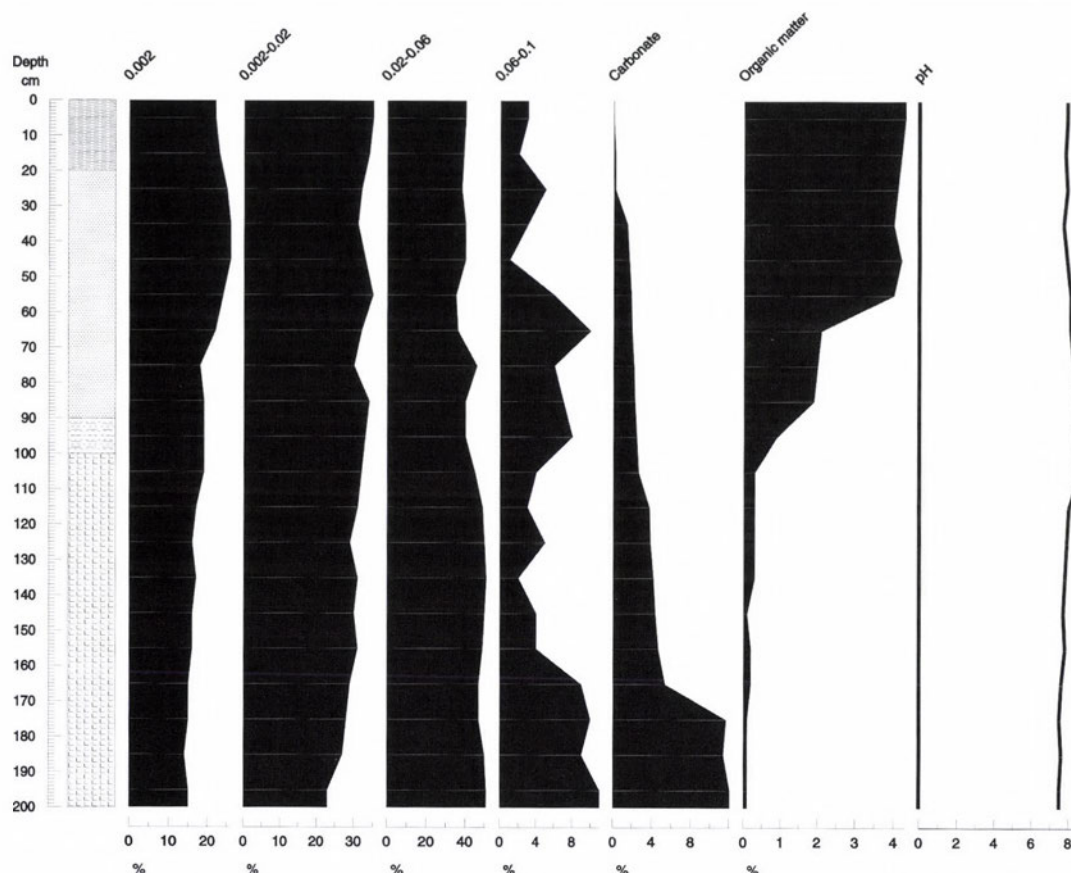


fig. 16. The results of the soil analysis on the hydromorphic black earth soil profile of Karancspart, Körös site at Tiszapüspöki (Sümeği 2000)

There is a sudden increase in the silt and organic content of the deposits lying upward from the depth of 3.8 m, accompanied by a significant drop in the coarse fraction (fig. 17). All these changes seem to imply that the water in the cut-off channel must have experienced a rapid eutrophization consummating at a depth of 3 m with the deposition of blackish-brown, clayey silts corresponding to eutrophic lacustrine deposits. Samples taken above 3 m were unsuitable for evaluation due to disturbance by human activities (creation of drainages).

According to the sedimentary data, sandy deposits deriving from larger distances of the wider watershed area of the ancient river Tisza must have been deposited in the studied channel between the depths of 7 and 4 m. However, this grain-size composition poses the problem of the origin of the retrieved pollen grains and whether or not they are suitable for the reconstruction of the local vegetation.<sup>60</sup> Palaeoecological studies generally do not consider oxbow lakes as ideal sites of sampling for pollen analysis,<sup>61</sup> because the recurring temporal overflows may result in the transportation and accumulation of pollen grains deriving from larger distances into the basin of the lake on the one hand. Furthermore, the currents may stir up the deposits on surface of the lake's bottom resulting in a mixing of both sediments and pollen grains preserved in them as well, hampering the adequate sedimentological, geochemical and palaeontological interpretations and evaluations. Several taphonomic investigations have been implemented on silting-up oxbow lakes of the North American continent in the past few years.<sup>62</sup> Due to problems surrounding the evaluations, the final outcome of these studies is highly ambiguous and subject to frequent

<sup>60</sup> Sümeği et al. 1999; Sümeği – Bodor 2000.

<sup>61</sup> Birks – Birks 1980.

<sup>62</sup> Fall 1987.

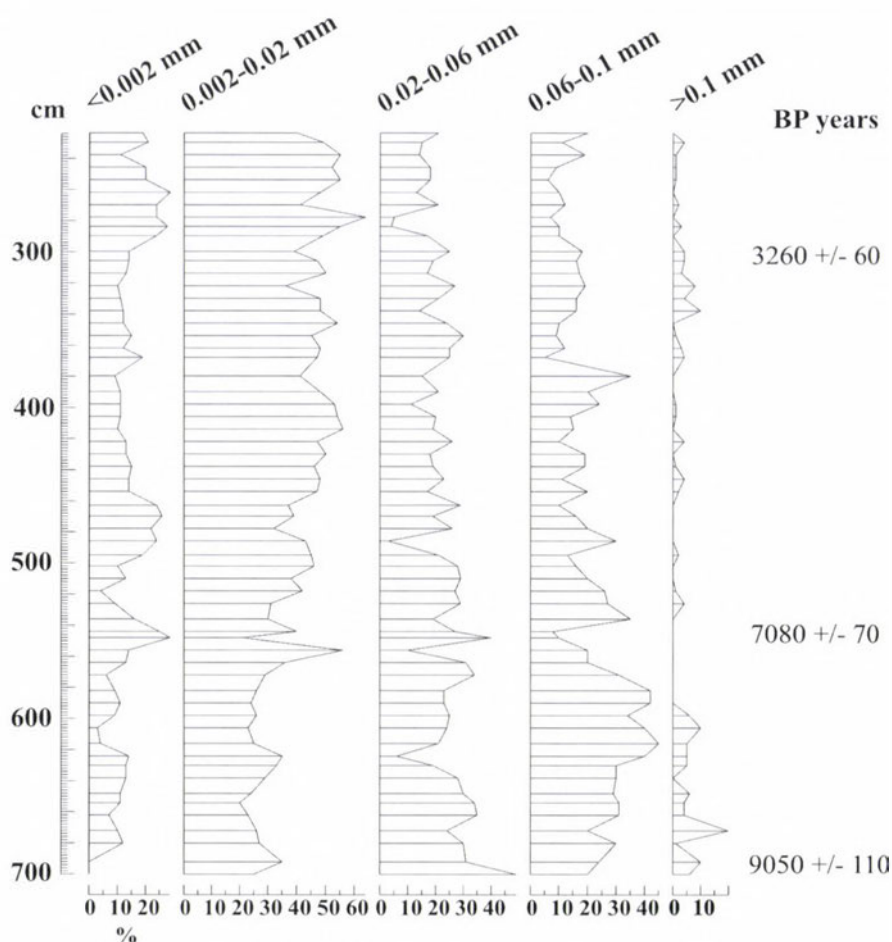


fig. 17. Results of the sedimentological analysis on the core sequence of Kartsú-ér at Tiszapüspöki

debates.<sup>63</sup> Conversely, according to the findings of similar recent studies on Hungarian oxbow lakes,<sup>64</sup> two major lake types can be distinguished regarding pollen accumulation and preservation. The first one is the group of the classical horseshoe-shaped oxbow lakes, where the majority of the accumulated pollens are of local and extralocal origin, meaning that similarly to other small sedimentary basins pollen grains deriving primarily from the littoral aquatic and terrestrial vegetation tend to accumulate and be preserved in their basins. On the other hand, we cannot say this about the longitudinal channel-like oxbow lakes, giving the second group, which are cyclically flooded and connected to the main channel system of the rivers during floods. An enrichment in the floating pollen grains carried into the channel by floodwaters in the silt fraction, and the ash particles and heavier pollen grains in the sand fraction can be observed and even in this lake system the final pollen composition may be a factor of the composition of the deposited sediments.<sup>65</sup> Thus in other words the pollen composition tends to reflect not the local vegetation but that of a larger region.

Besides the problems of pollen taphonomy, another significant hardship in the analysis of pollen grains deriving from the Kartsú creek arises from the fact that the coring site is located some 10 kms away from the actual Körös site of the Karancspart in a totally different geomorphological position, the floodplain of the Holocene Tisza river. This way we could capture the vegetation of not the actual settlement site, but only its wider background area, the floodplain of the active river Tisza in our palynological analysis.

<sup>63</sup> S. A. Hall: Pollen analysis and paleoecology of alluvium. *Quaternary Research* 31 (1989) 435–438.

<sup>65</sup> Fall 1987.

<sup>64</sup> Sümegei et al. 1999, 2004; Sümegei – Bodor 2000; Magyari 2002.



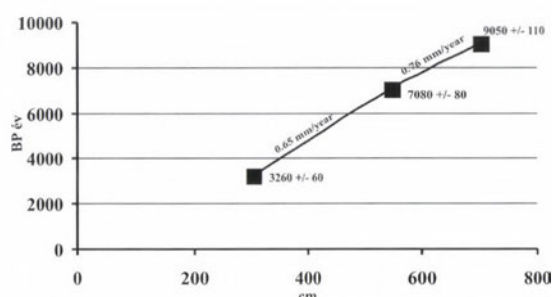


fig. 18. The sedimentological rate in the pollen core sequence based on radiocarbon data

Unfortunately, human disturbances related to the 19<sup>th</sup> century river regulations in the area via the construction of a network of extensive drainage channels and other regulatory objects hampered the possibility of sampling in the direct vicinity of the site.

Samples suitable for evaluation turn up from a depth of 6.7 m and upwards in the borehole, the first pollen zone located between 6.7 and 5.7 m characterized by an extremely low number of pollen grains.

The dominating APs belong to the taxa of common oak (*Quercus robur*), and Norway pine capable of getting to larger distances because of its airbag supported floating grains (*Pinus silvestris*). An indicator taxon of slightly acidic soils is firmly present in this horizon though in small percentages, birch (*Betula pendula*).<sup>66</sup> At the end of this zone, representatives of the marginal terrestrial taxon *Alnus viridis*, avoiding calcareous soils and those of hazelnut (*Corylus*) appear in small numbers. The small quantity of *Corylus* pollen grains, and the exuberance of *Quercus* put this horizon into the Atlantic Phase.<sup>67</sup> The large quantity of redeposited marine Lower Miocene pollen grains in the whole zone, and folded pollen grains towards the end of the period are highly characteristic of this horizon. All these findings seem to point to the significance of extralocal pollen grains originating from larger distances and washed into the basin at the beginning of the Holocene.

According to the pollen composition, the presence of a gallery forest, with the dominance of oak and enjoying ideal hydrological conditions could have been inferred for the floodplain of the river Tisza at the beginning of the Holocene around 8000 and 5000 cal BC (*Table 1*). The undergrowth must have been rather scant made up of the representatives of the *Artemisia-Chenopodium* association primarily. According to Berglund,<sup>68</sup> this stage in the development of the undergrowth is characteristic even during the Atlantic Phase as well on the European continent. The taxa of *Artemisia* are not the same as those on a cold continental steppe however,<sup>69</sup> but their firm presence in the pollen material may imply the temporary emergence of minor clearances within the reconstructed oak dominated gallery forest covering the floodplain. The presence of the taxon gentian (*Gentiana*) as an indicator of fresh, drying-out marshland meadows is highly significant here, though must be regarded as local in origin and distribution.<sup>70</sup> Some representatives of shield-fern, *Dryopteris* and *Polygonum* must have been present in the wet areas as well. The taxa *Xanthium* and *Hypericum* appear at the end of the first phase. The presence of *Xanthium* as a floodplain weed member tends to indicate human influences in the area (*fig. 19*). The first plants indicating human disturbance and influences appear in the horizon dated between 5800–5900 cal BC in the form of cultured Gramineae pollen grains, followed by those of cereals at 5700–5800 cal BC, according to the radiocarbon dates and the calculated sedimentation rates in the basin (*fig. 19*).

In the second pollen zone (5.7–4.7 m) an advent of beech (*Fagus*) could have been observed, besides the remaining prevalence of *Quercus robur*, reaching its maximal distribution towards the end of the phase. This large-scale occurrence of the taxa *Fagus* in the area of the

<sup>66</sup> Ellenberg 1974; Simon 1994.

<sup>67</sup> Berglund 1985; Iversen 1973

<sup>68</sup> Berglund 1985.

<sup>69</sup> Járαι-Komlódi 1966.

<sup>70</sup> Tamboer et al. 1976.

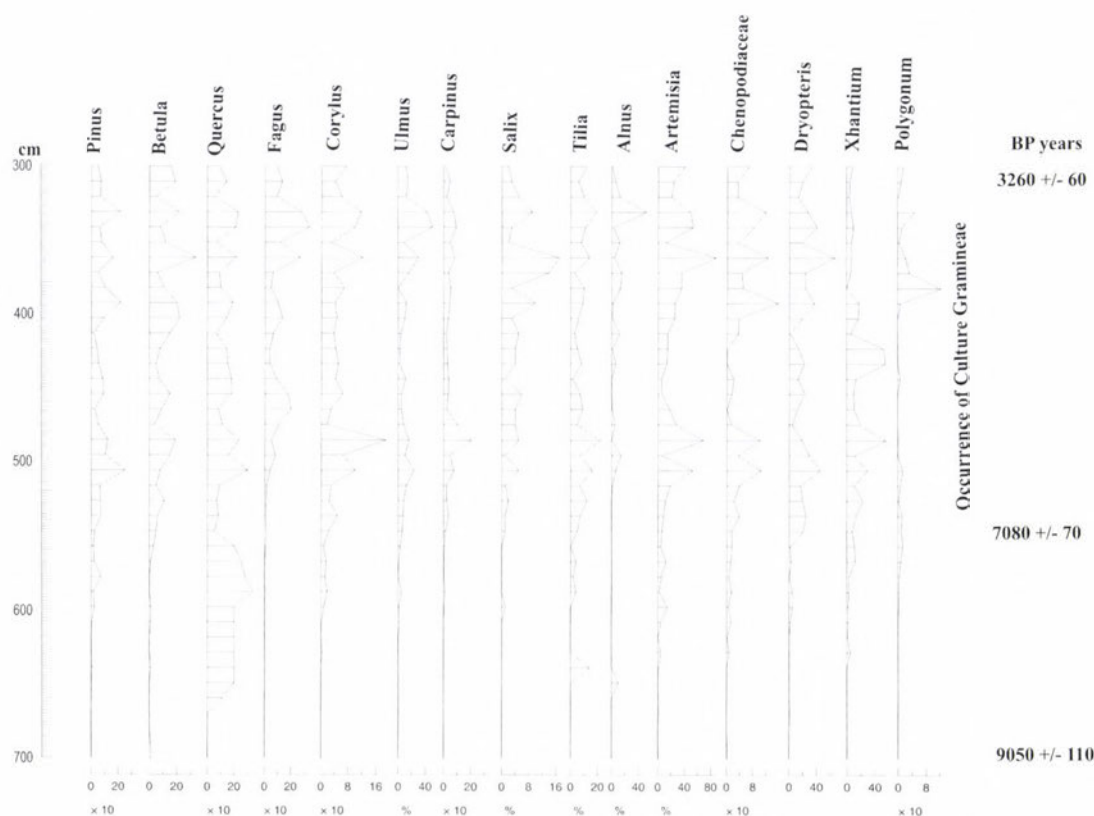


fig. 19. The results of the pollen analyses (selected pollen taxa)

Great Hungarian Plain is rather unusual and calls for an explanation. The rapid increase in the dominance of *Quercus*, *Fagus* and *Carpinus* brings about an irreversible change in the woodland vegetation.<sup>71</sup> When climatic conditions are beneficial, *Fagus* can easily spread in the lower-lying areas as well, partially because of the decline of *Tilia*. The presence of *Quercus* and *Tilia* in the vegetation hampers the free spreading of *Fagus*.<sup>72</sup> The contrasting trends in the amount of *Quercus* and *Fagus* are clearly observable on our diagram as well (fig. 19). The taxa *Fagus* and *Tilia* have similar edaphic needs. Thus the decline in *Tilia* may lead to the expanse of *Fagus* in the deserted areas, as humans tended to show a preference for more fertile, drier soils for settling.

Human influences might have had a role in the expansion of the latter taxon as well.<sup>73</sup> Logging was mainly restricted to the wood of *Quercus* and *Tilia* ideal for construction at this time, bringing about a decline of these woodland members and opening up new spaces for the spreading of *Fagus*.<sup>74</sup> The massive spreading of *Fagus* in low-lying areas and some valleys of the Massif Central was attributed to human influences as well.<sup>75</sup> On the other hand climatic influences and the decline in the fertility of soils might have played a significant role,<sup>76</sup> as *Fagus* does not generally tolerate cold winters,<sup>77</sup> but displays high tolerance to soil differences.

<sup>71</sup> Behre 1988

<sup>72</sup> Iversen 1973; G. H. Godwin: The History of the British Flora. Cambridge 1975<sup>2</sup>.

<sup>73</sup> K. J. Willis – P. Sümegei – M. Braun – A. Tóth: Does soil change cause vegetation change or vice-versa? A temporal perspective from Hungary. Ecology 78 (1997) 740–750.

<sup>74</sup> B. Frenzel: Climatic Fluctuations of the Ice Age. Cleveland 1973.

<sup>75</sup> M. Reille – L. Beaulieu: Pollen analysis of a long upper Pleistocene continental sequence in a Velay-maar (Massif Central, France). Palaeogeography, Palaeoclimatology, Palaeoecology 80 (1990) 35–48.

<sup>76</sup> S. T. Andersen: The differential pollen productivity of trees and its significance for the interpretation of pollen diagram from a forested region, in: H. J. B. Birks – R. G. West (eds): Quaternary Plant Ecology. Oxford 1973.

<sup>77</sup> Janssen – Janssen-Kettlitz 1972.



According to Berglund,<sup>78</sup> all these factors must have been important in the spreading of beech acting commonly.

Several different views have arisen in connection with the phenomenon of the spreading of *Fagus*. In Norway for example due to the climatic conditions and its low presence (0.7–2.6%), its pollen grains are regarded to be of extralocal origin transported from larger distances into the area.<sup>79</sup>

According to Tauber,<sup>80</sup> as the pollen grain of *Fagus* is relatively heavy, it is more likely to reach the ground on site without being filtered by the leaves of the trees, which commonly happens to lighter pollen grains. Rainfall largely enhances accumulation and deposition on site and as such, the pollen grains of *Fagus* are regarded to be locally deposited by that. Transportation from larger distances is more likely in the vicinity of mountains, being heavy grains as has been postulated by Hafsten<sup>81</sup> as well. This effect must be less influential in a lowland area.

However, we cannot fully exclude the possibility of these grains having been transported into the area of the Great Hungarian Plain and deposited in the basin of the Kartsú channel from the more distant mid-mountains. The expansion of the more lush *Fagus* vegetation in the area of the Great Hungarian Plain must be attributed to edaphic factors and climatic effects, a milder winter and more balanced precipitation rates at the end of the Atlantic Phase.

According to Birks,<sup>82</sup> the mean July palaeotemperatures were 5 °C higher in Central Europe than today during the Atlantic. A similar climate has been inferred for this period by Járainé-Komlódi earlier<sup>83</sup> as well. No signs of such a large-scale warming could have been identified neither in the alluvial nor the non-alluvial Hungarian palaeoenvironmental sites.<sup>84</sup> When the precipitation rates inferred from the pollen composition<sup>85</sup> are projected to our pollen composition at the studied site, then the large-scale expansion of *Fagus* would clearly justify an annual rainfall of 700–1000 mm for the end of the Atlantic, which is 200–500 mm (!) higher than the average present-day value (500–550 mm) recorded for one of the driest areas in the country, the Middle Tisza region.

When the formerly reconstructed mean July palaeotemperatures of 25–26 °C<sup>86</sup> are also considered, then we must reconstruct almost subtropical conditions prevailing in the Tisza-valley around 5000 BP, which is a nuisance. All this seems to point to an important aspect of palaeoenvironmental reconstructions, namely that the climatic parameters inferred from the pollen data must be taken with caution on the one hand. Secondly, the unique pollen accumulation and taphonomical conditions, which could have developed on the floodplain or alluvium of the river Tisza and in the long, channel-like oxbow lakes (reworking and redeposition, regional pollen traps, accumulation after significant transportation) must have yielded a lighter correlation between the former local vegetation and the pollen composition of the oxbow lake's deposits.

A rapid decline is observable in the proportions of *Ulmus*, *Tilia*, *Betula* pollen grains in the third pollen zone (between 4.7–4.0 m). These changes may refer to either an intensified deforestation or the use of foliage as fodder, as the ratio of cereal pollen grains becomes significant only from the middle part of the zone. The sudden drop in the ratio of *Fagus* is coeval with the appearance of cereals in this pollen phase. After a significant increase in the frequency of cereal pollen grains, sudden drops can be observed even in case of the wood and

<sup>78</sup> Berglund 1985.

<sup>79</sup> Haften 1956, Danielsen 1969.

<sup>80</sup> H. Tauber: Differential pollen dispersion and the interpretation of pollen diagrams. With a contribution to the interpretation of the elm fall. Copenhagen 1965.

<sup>81</sup> U. Hafsten: Pollen-analytic investigation on the late Quaternary development in the inner Oslofjord area. UBA 1956 Nat. R. 8.

<sup>82</sup> H. J. B. Birks: Changes in vegetation and climate during the Holocene of Europe – Landscape-

Ecological Impact of Climatic Change. Amsterdam – Washington – Tokyo 1990, 133–150.

<sup>83</sup> Járainé-Komlódi 1966.

<sup>84</sup> Sümegi 1996.

<sup>85</sup> Z. Borsy – E. Félegyházi – É. Csongor: A Bodrogek kialakulása és vízhálózatának változásai (Formation and changes of hidrological system of Bodrogek region) Alföldi Tanulmányok 13. Békéscsaba 1989, 65–81; Magyarai 2002.

<sup>86</sup> Járainé-Komlódi 1966.



bush taxa utilized for fodder, construction or heating (e.g. *Corylus*) as well. There is a large peak in the number of *Pteridinium*, the spreading of which is generally linked to deforestation, even though it does not directly indicate land cultivation.<sup>87</sup> The proliferation of *Pteridinium* may refer to the human-induced nature of the sudden drops in the ratio of the previously mentioned tree and bush taxa. It may also indicate that larger areas were deforested than what was actually needed for instant cultivation.<sup>88</sup>

A significant fluctuation in *Pinus*, *Picea*, *Quercus*, *Fagus* and *Corylus* is observable among the APs. The runoff of the *Pinus*–*Picea*–*Fagus* ratios in the first group is quite similar to one another just like that of *Quercus*–*Corylus* in the second group. The two groups display a strong negative correlation. The former group must have been characteristic for the more humid and milder periods, while the latter must have prevailed during the drier and warmer periods. There is an outstanding drop in the number of folded pollen grains and those, having been reworked from the Miocene within this pollen phase. A drastic fall in the sand fraction of the deposits was coeval with these changes marking the final isolation of the cut-off channel from the main channel system and the initiating eutrophization of the pond.

There are some representatives of the taxa *Dryopteris* and *Xanthium* in this zone, with the latter heliophyl, stenohaline species appearing on soils rich in N.<sup>89</sup> The decrease in the number of *Dryopteris* is clearly accompanied by an increase in the number of *Fagus* as shown on our diagram.<sup>90</sup> The regional value of *Dryopteris* is a lot lower than that of *Fagus*, because fern stands usually densely cover the near-surface areas of the ground. Thus their spores are a lot less likely to become airborne.<sup>91</sup> The common appearance of the taxa *Secalae* and *Triticum* is observable in the middle of the zone. Representatives of the taxa *Scabiosa*, *Centaurea* also appear from here along with those of *Chenopodium botrys*, which strictly avoids haline habitats and also *Geranium*, an accessory plant of oak woodlands. *Polygonum* and *Centaurea cyanus* tend to be the accessory weeds of “intensified prehistoric agricultural activities”,<sup>92</sup> indicating extensive land cultivation and crop production. After an increase *Secalae* pollen grains become coherent in the profile from the end of the zone most likely marking the peak of land cultivation here. The pollen grains of *Triticum* are not as significant and numerous as those of *Secalae* in this zone. However, this can be attributed to the better spreading capacities of the former with large pollen production. While, the latter tends to remain on site right next to the cultivated lands.<sup>93</sup> The appearance of the taxon *Plantago major* towards the end of the zone refers to treading, construction of roads and trails as well as pastoralism.<sup>94</sup> A common undergrowth plant of clearances, appearing after deforestations *Rubus* turns up towards the end of the phase. Nitrophilous weeds like *Polygonum bistorta*, and the heliophyl, stenohaline *Bidens*, which prefers soils rich in N also appear towards the end of the zone.

From the aquatic phytoplanktons the representatives of *Botryococcus braunii* were dominant. The occurrence of *Mougeotia*, *Zygnemataceae* indicates the presence of an open-water system in the oxbow lake in a mesotrophic state.<sup>95</sup> The firm presence of *Sphagnum* and *Spirogyra* refers to either slightly acidic or alkalescent (pH 5–7) waters.<sup>96</sup> The pH optimal for the proliferation of the planktonic forms present in this horizon (*Mougeotia*, *Zygnemataceae*, *Spirogyra*) is also between 5–6.

Open-water pondweeds (*Myriophyllum verticillatum*) are continuously present with an increase in *Potamogeton natans* from the middle part of the profile. All this refers to a deepening of the water in the lake, corresponding to the previously mentioned increase of *Geranium* and *Alnus* reaching their peak values by the end of the phase. The proliferation of *Potamogeton natans* indicates rapidly warming mesotrophic waters.<sup>97</sup> There is another rise

<sup>87</sup> Van Geel 1978.

<sup>88</sup> Brogers 1972.

<sup>89</sup> Horváth et al. 1995.

<sup>90</sup> Janssen – Janssen-Kettlitz 1972.

<sup>91</sup> Tamboer et al. 1976.

<sup>92</sup> Danielsen 1969.

<sup>93</sup> Behre 1981.

<sup>94</sup> Behre 1981.

<sup>95</sup> Van Geel 1978.

<sup>96</sup> J. Simons – A. P. Beem: *Spirogyra* species and accompanying algae from polls and ditches in the Netherlands. AQUAT Bot. 37 (1990) 247–269.

<sup>97</sup> Cruise 1990.



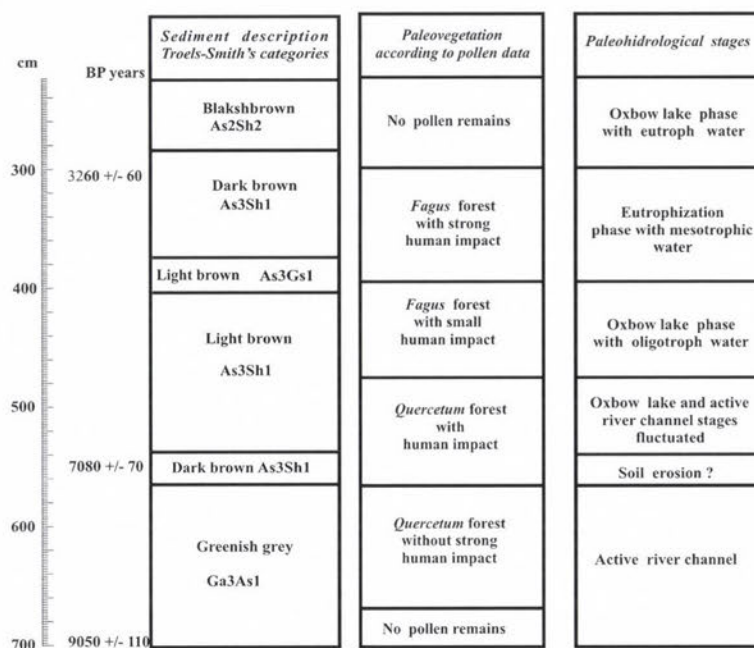


fig. 20. Lithological, pollen analytical and palaeoecological stages on the core sequence of Kartsú-ér at Tiszapüspöki

in the ratio of *Riccia* pollen grains at the end of this phase. This is inferred as a sign of rise in the water level by several researchers.<sup>98</sup> The firm presence of *Trapa natans* refers to water temperatures above 20 °C throughout most of the growth season. The low ratio of the littoral *Phragmites*, *Typha* and *Glyceria*, indicating increased trophicity, seem to corroborate the reconstructed mesotrophic state of the oxbow lake.<sup>99</sup>

There are cyclic fluctuations in the amount of *Quercus robur* and *Fagus* pollen grains, occupying near-water areas from the depth of 4 m up to 2.8 m. The quantity of *Ulmus* remains low. Parallel with this, a drastic clearance is observable in the undergrowth (*Geranium*) of the hornbeam-oak woodlands as depicted in the NAP diagram. NAPs inhabiting the other wet habitats also experience a decrease like *Artemisia*, *Polygonum sp.*, *Chenopodium rubrum*. From the genus *Polygonum* the taxon *Polygonum avicularae* is the most important. The representatives of *Centaurea cyanus* also disappear here. Dry-resistant forms become more characteristic in the section with the prominence of *Amaranthus*<sup>100</sup> appearing in the drier habitats along the roads and arable lands. The taxon *Festuca sp.* also turns up along with *Plantago major*, a characteristic form of treaded weed associations and mesophytic, fresh habitats.<sup>101</sup> There is a sudden increase in the ratio of the heliophyl, stenohaline and stenocalc thyme (*Thymus*) preferring drier habitats with nitrogen poor soils in the middle of this zone. According to Digerfeldt,<sup>102</sup> there is an increase in the frequency of NAP, especially that of the taxa of *Gramineae* during the second half of the Holocene represented by the taxon *Festuca* in our case with its very first appearance throughout the whole profile. Berhe<sup>103</sup> also considered the late part of the Holocene to be the peak time of *Gramineae*. Thanks to the lower fertility of the soils, crop cultivation must have been subsidiary with a dominance of animal husbandry during this period. The lack of cereal pollen grains in our

<sup>98</sup> B. Van Geel – D. P. Hallewas – J. P. Pals: A late Holocene deposit under the Estfrieze Zeedijk dear Enkhuizen (Prov. of Noord-Holland, the Netherlands): palaeoecological and archaeological aspests. Review of Palaeobotany and Palynology 38 (1982/83) 269–335.

<sup>99</sup> Ellenberg 1978.

<sup>100</sup> Horváth et al. 1995.

<sup>101</sup> Simon 1994.

<sup>102</sup> G. Digerfeldt: The Post-Glacial development of Lake Trummen, Regional vegetation history, water level changes and palaeolimnology. Folia Limnological Scandinavica 16 (1972) 1–96.

<sup>103</sup> Berhe 1988.



pollen diagram might also be linked to the prevalence of animal husbandry, corroborated by a clear proliferation of plants tolerating drier climates and treading.

There is a rise in the number of the aquatic *Botryococcus* at the beginning of this zone, followed by the appearance of *Oenanthe*, *Sparganium* sp. and the increase of *Nymphaeaceae* towards the end of the zone signifying a marked change and the emergence of shallow, still water conditions in the basin of the lake. The dominant forms of open-water pondweeds are *Myriophyllum verticillatum*, and *M. spicatum* the taxa *Potamogeton natans* becoming subordinate. As implied by the pollen composition there must have been a drop in the lake level, accompanied by an increase in the trophic rate of trophicity. However the mesotrophic stage could have been preserved at the beginning of the period followed by a gradually increasing eutrophization. Minor patches of *Phragmites*, *Rorippa*, *Polygonum amphibium*, and *Circuta virosa* could have occupied the littoral zone and floodplain areas. Conversely at the end of the zone the taxon *Chenopodium rubrum* returns, occupying fresh habitats of stenohaline weed associations with soils rich in nitrogen and carbonates. The marked sudden increase of *Sanguisorba officinalis* in the central part of the local pollen zone is a clear sign of temperature drop just like that of firm presence of *Thalictrum flavum* with similar ecological needs.

There could have been a minor expansion of *Sparganium ercetum* and *Rorippa* in the littoral zone in the second part of this pollen zone with *Phragmites* occurring only sporadically. All these alterations seem to indicate a probable increase in the trophic state of the water, and a reduction in water depth. The appearances of marshland plants tolerant to and characteristic of waters of higher trophic stage (*Stratiotes aloides*, *Lemna*, *Sparganium erectum*), and the complete disappearance of *Botrychium* further corroborate this assumption. However, the firm presence of *Mougeotia* and *Potamogeton natans* points to the successful preservation of the mesotrophic state. A decrease in the water level might have induced the successful expansion of marshland plants.<sup>104</sup> The poor preservation of the pollen grains up from 2.8 m within the profile hampered the successful evaluation of the retrieved samples.

As it has been shown by the gained sedimentological and pollen data, the oxbow lake of the Kartsú creek located in the vicinity of the village of Tiszapüspöki must have been an open-water system since its very birth (fig. 20). The lake itself must have been in a mesotrophic stage regarding water quality. Minor changes like eutrophization were traceable in the upper part of the profile only. The constant presence of acidophilous algae (*Mougeotia*, *Zygnemataceae*, *Sphagnum*), and the taxon *Spirogyra* refers to slightly acidiferous conditions with pH around 6. Open-water pondweeds, rooted in deeper waters (*Myriophyllum spicatum*, *Potamogeton natans*) appeared even in the earliest stage of the lake's evolution. Water temperatures must have been around or slightly above 20 °C during the hottest months of the growth season. There was no extensive reed vegetation surrounding the lake in the littoral zone, rather it was substituted by taxa like *Sparganium* and *Rorippa*. The coast must have been occupied by a narrow line of gallery forest of *Salix*, *Alnus* and *Betula*. Extensive, lush, deciduous woodland could have emerged a little farther away from the beach. The elevated parts of the alluvium were covered by typical Atlantic *Quercus* woodlands from about 8000 BP with the appearance and gradual expansion of *Fagus* from the closure of the period, though due to the special regional nature of the pollen trap sampled the site of origin (local or distant) of the *Fagus* pollen grains can not be univocally determined.

A large-scale variance was observable in the undergrowth of the gallery forest represented by plant associations preferring, fresh, humid woodland habitats or swamp meadows. The prevalent taxon was *Chenopodium* occupying more humid substrates. The taxa tolerating drier conditions like *Thymus*, *Amaranthus* and *Gramineae* appear only towards the end of the Atlantic in smaller proportions. The sudden and drastic drop in the AP from about 5700–5500 cal BC must be attributed to human influences, namely intensive deforestation. The presence of the pollen grains of cereals and a wide-scale of weeds seems to justify this assumption. In the light of this information derived from the pollen data, humans must have followed a

<sup>104</sup> M. Kabaliene: On climatic changes and evolution of the lakes of Lithuania during the Lateglacial

and Holocene. Quaternary Studies in Poland 1990, 65–69.



sedentary lifestyle for a longer time and was engaged in intensive land cultivation at some distance away from the woodland areas. Changes in the pollen composition indicating the use of foliage as fodder in animal husbandry are dated around 5500–6000 cal BC while those indicating land cultivation and constructions turn up from about 5500 cal BC. From about 4400 cal BC, vegetation indicating an intensifying extensive animal husbandry could have been inferred. Weeds and cereals indicating the reappearance of crop cultivation are traceable only at a later stage, between 1500–1800 cal BC.

The studied channel must have emerged as early as the final phase of the Würmian at the end of the Pleistocene or during the Late Glacial around 10–20 000 BP years. However, the collapse of the fluvial sandy bedrock material in the foot of the borehole enabled the capturing of the final phase of this early evolutionary stage of the active channel only, which extends into the Holocene. This development stage yielded no pollens suitable for evaluation.

According to the radiocarbon dates measured on the inwashed charcoal material, the riverbed was an active channel at the beginning of the Holocene and was completely cut off around only 7000 BP leading to the emergence of a dynamic oxbow lake. According to the pollen data, the lake was surrounded by hardwood woodland with a dominance of oak (*Quercetum*) showing no signs of human disturbances or activities.

As the sedimentological data implies, the terrigenous material initiated to inwash into the lacustrine basin around 7000–6000 BP. These changes though are coeval with the transformation of the active channel into an oxbow lake, might have come emerged as a result of human activities as well, because plants indicating animal husbandry and crop cultivation tend to show up here in the pollen material besides the remaining dominance of the hardwood oak woodlands (cereals, weeds inhabiting treaded habitats or those subjected to grazing).

According to the calibrated radiocarbon dates (cc. 5600–5700 cal BC), this transformation was coeval with the settlement of the first human groups, the representatives of the Early Neolithic Körös culture in the area. Several objects of this culture have been discovered in the studied area of the Karancspart of Tiszapüspöki (graves, pits, houses).<sup>105</sup> However, this settlement site is located about 10 km away from the channel of the Kartsú creek, subjected to pollen sampling. Thus the identified human influences dated to the Early Neolithic in that profile must be attributed a different, separate group of the same culture, which must have settled closer to the actual channel.

Unfortunately, detailed archaeotopographical surveys are lacking in the studied region leaving us with the question of whether or not there were other Körös settlement sites or settlement points on the investigated floodplain area of the Tisza. However, several previous archaeological investigations proved to be successful in identifying several settlement points of this Early Neolithic culture in the studied region.<sup>106</sup>

Initially, the newborn oxbow lake, which had developed between 7000–4000 BP, enjoyed temporal water supply during floods leading to the emergence of clear, well-lit waters in an oligo-mesotrophic state turning into eutrophic from the closure of the Bronze Age as a result of gradual silting-up and increasing human influences (deforestation, grazing, increasing soil erosion). A woodland with beech as the dominant form must have surrounded the lake at this time. The accumulation of beech pollen grains, or the transportation of these onto the studied area must have started around 5000–5100 BP, becoming a dominant element in the vegetation only from 4500 BP. Human influences reached the peak of their intensities during the Late Bronze Age, as was indicated by the pollen composition of the profile suitable for evaluation. From this time onwards the retrieved pollen material was unsuitable for evaluation due to secondary dehydration (river regulations) and decay. The increase in the clay content within the deposits of the channel implies intensified soil erosion and the acceleration of the silting-up

<sup>105</sup> Marietta Csányi's personal communication.

<sup>106</sup> P. Raczky: A Tisza-vidék kulturális és kronológiai kapcsolatai a Balkánnal és az Égeikummal a neolitikum, rézkor időszakában – Újabb kutatási eredmények és problémák (Cultural and

chronological contacts between Tisza Region and Balkan Peninsula and Aegean region during Neolithic and Copper Age – New results and problems). Szolnok – Budapest 1988.



of the lake leading to eutrophization. The further evolutionary history of the channel can not be elucidated (medieval, modern etc.) because of the significant soil erosion, and disturbance and mixing of the individual layers attributed to human activities.

### *The results of malacological analysis*

Approximately 50 kg of sediments retrieved from the excavation site of the 1999 fall and deriving from the chernozem horizon stratigraphically corresponding to the one embedding the Körös artifacts, but sampled at a distance from the actual Körös objects, was subjected to wet sieving to retrieve and determine the mollusc remains (Table 2). This site of sampling located farther away from the actual settlement point was chosen deliberately, in order to gain data on the background environmental conditions of the actual human settlement, because treading, gardening and the construction of houses at the settlement points might have easily led to the transformation of the original natural endowments calling for an adaptation of the vegetation and the mollusc fauna as well.<sup>107</sup>

Species	Abundance	Dominance	Haarlow-index (height × weight × dominance)
<i>Granaria frumentum</i> (Draparnaud 1801)	17	3.51	69.8
<i>Vallonia costata</i> (Müller 1774)	201	41.53	246.7
<i>Chondrula tridens</i> (Müller 1774)	97	20.04	947.9
<i>Helicopsis striata</i> (Müller 1774)	152	31.41	1099.4
<i>Cepaea vindobonensis</i> (Férussac 1821)	17	3.51	1533.9
<b>TOTAL</b>	<b>484</b>	<b>100.00</b>	-

Table 2. The Mollusc fauna from the Neolithic soil horizon of the archaeological excavation, Karancspart at Tiszapüspöki.

Only mesophylic and xerophylic species could have been identified in the mollusc fauna poor in species.<sup>108</sup> These elements tend to dwell in open-vegetation areas like steppes-forest-steppes today,<sup>109</sup> thus there is every reason to believe that they must have occupied similar habitats during the Early Holocene as well. As shown by these malacological data, the communities of the Körös culture chose an open-vegetation area of steppe-forest steppe experiencing dry conditions in a part of the growth season as the site of their settlement. According to the composition of the malacofauna and the calculated values of the malacothermometer method<sup>110</sup> the mean July temperatures must have exceeded 20 °C with values fluctuating between 20–22 °C. In other words, the conditions of the growth season were much like what we have today in the region. This picture drawn on the basis of the composition of the malacofauna regarding the palaeoenvironmental conditions is utmost different from the former one reconstructed via the pure utilization of geomorphological data.<sup>111</sup> The composition

<sup>107</sup> Evans 1972.

<sup>108</sup> Evans 1972; V. Ložek: Quartermollusken der Tschechoslowakei. Rozprawy Ústavu ústředníku geologického (Praha) 31 (1964); E. Krollop – P. Sümege: A magyarországi löszök képződésének paleoökológiai rekonstrukciója Mollusc-fauna alapján [Palaeoecological reconstruction of Hungarian loess development based on Mollusc fauna], in: Gy. Szőör (ed.): Fáciesanalitikai, paleobiogeokémiai és paleoökológiai kutatások. (Faciesanalytical, paleobiogeochemical and

paleoecological investigations) Debrecen 1992, 247–263.

<sup>109</sup> M. P. Kerney – R. A. D. Cameron – J. H. Jungbluth: Die Landschnecken Nord- und Mitteleuropas. Hamburg – Berlin 1983; P. Sóllymos – A. Nagy: The recent mollusc fauna of the Szársomlyó (S Hungary) spatial pattern and microclimate. Malakológiai Tájékoztató 16 (1997) 35–42.

<sup>110</sup> Sümege 1989, 1996.

<sup>111</sup> Nandris 1972; Kosse 1979; Sherratt 1980, 1982.



of the mollusc fauna, reflecting the local environment is in good agreement with the other major environment indicator, the chernozem-like soil reflecting the presence of a steppe-forest steppe vegetation at the site of the Karancspart during the Early Neolithic. According to the values of the calculated Haarlow index, a dominant form of this environment was a taxon, which is still a character species of the modern forest steppes of the Great Hungarian Plain, *Cepaea vindobonensis*.<sup>112</sup>

Species name	Abundance (i)	Dominance (%)
<i>Viviparus acerosus</i> (Bourguignat, 1862)	7	1.32
<i>Lithoglyphus naticoides</i> (Pfeiffer, 1828)	1	0.19
<i>Lymnaea stagnalis</i> (Linnaeus, 1758)	1	0.19
<i>Planorbis planorbis</i> (Linnaeus, 1758)	1	0.19
<i>Chondrula tridens</i> (Müller, 1774)	1	0.19
<i>Cepaea vindobonensis</i> (Férussac, 1820)	3	0.56
<i>Unio pictorum</i> (Linnaeus, 1758)	487	91.71
<i>Unio tumidus</i> (Retzius, 1788)	16	3.01
<i>Unio crassus</i> (Retzius, 1788)	11	2.07
<i>Anodonta</i> sp.	3	0.56
<b>TOTAL</b>	<b>531</b>	<b>99.99</b>

Table 3. The mollusc fauna of the Körös pits at Tiszapüspöki-Karancspart, archaeological excavation.

The 1999 excavations at the site have led to the discovery and excavation of several minor pits yielding Körös pottery remains, burnt daub fragments, charcoal, bones and a remarkable shellfish as well as fish material.<sup>113</sup> Thus to fulfill the requests of archaeologists approximately 268 kg of dirt was wet sieved using a mesh of 0.8 mm to retrieve the embedded mollusc remains (Table 3). All shellfish shells were measured individually, yielding a total of 6.17 kg shellfish material belonging to the taxa *Unionidae*. However, only a minor portion of the fauna was suitable for determination (Table 3). The composition of the mollusc fauna was almost the same at every single site, characterized by a dominance of *Unio pictorum* and a couple of accessory elements making the fauna more colourful, which were also of the same taxa in each and every pit. So the whole mollusc fauna of the pits could have been treated as one during the evaluation.

531 specimens of 10 different species (4 aquatic, 2 terrestrial gastropods, 4 bivalves) have come to light (Table 3). The proportion of aquatic faunal elements exceeded 99%, with about 92% given by the representatives of the taxon wide-spread in mesotrophic lakes and cut-off channels, *Unio pictorum*. Conversely, several specimens of species preferring moving water habitats have been retrieved from the pits as well like the gastropods *Viviparus acerosus*, *Lithoglyphus naticoides* or the mussel *Unio crassus*. None of these elements have come to light from the terrestrial deposits of the site, and they could not have come from the floodwaters either, as the area of the Karancspart was an elevated levee located high above the areas affected by floodwaters preceding the river regulations, as shown by sedimentological findings of the profile established there.

The significant proportions of an aquatic mollusc fauna and the rheophylic species present in the culture layers require some sort of an explanation. They must have ended up in the culture layers as a result of some sort of a human activity. The numerous shell medals and necklaces retrieved from several Hungarian Neolithic sites along the river Tisza<sup>114</sup>

<sup>112</sup> Férussac 1821.

<sup>113</sup> Marietta Csányi's personal communication.

<sup>114</sup> N. Kalicz – P. Raczky: Berettyóújfalu–Herpály. A settlement of the Herpály culture, in: P. Raczky (ed.): The Late Neolithic of the Tisza region. Budapest – Szolnok 1987, 105–125; P. Raczky – A. Anders – E. Nagy – K. Kurucz – Zs. Hajdú –

W. Meier-Arendt: Polgár–Csőszhalom, in: P. Raczky – T. Kovács – A. Anders (eds): Utak a múltban (Paths in the past). Budapest 1997, 34–43; F. Horváth: A Gorzsai halom késő neolitik rétege [The Late Neolithic layer of the kurgan of Gorzsa]. ArchÉrt 109 (1982) 201–220.

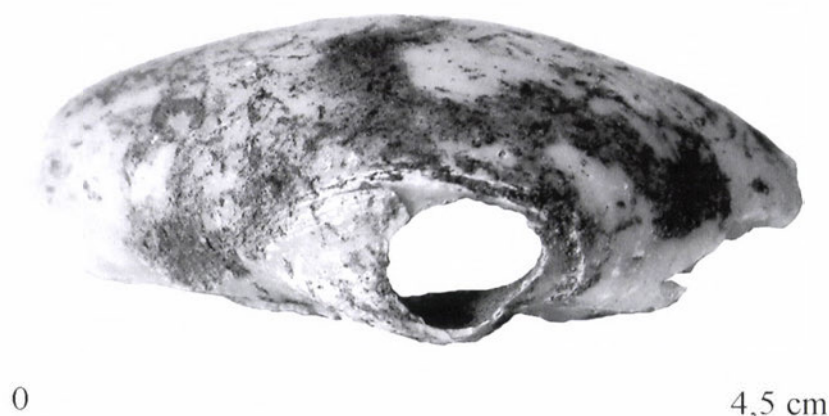


Photo 1. Tiszapüspöki-Karancspart obj. 55, S-93

clearly indicate that the shells of the gastropod *Lithoglyphus naticoides* and mussels *Unio* was frequently utilized for making jewellery.<sup>115</sup> Signs of such activities could have been identified on a single specimen from our studied site (Photo 1).

There are several explanations for the presence of shell material at these sites and the possible role of shellfishing. In our view the meat of these mussels must have primarily served as a food resource during the Early Neolithic, and the shells of other minor molluscs, the meat of which had not been consumed must have gotten into the refused shell material accidentally, as part of the shellfishing or fishing activities.

Several interesting questions, arose in connection with the surrounding environment of the Karancspart and the retrieved mollusc fauna. These questions were posed by the fact that the channels and ditches surrounding the Karancspart, and experiencing silting-up during the Holocene (Tinóka creek, Háromág, Fehér Pond) had been subjected to such large-scale transformations as a result of the river regulations (dredging, drainage, plowing) hampering their use in palaeoenvironmental reconstructions. Thus we can not univocally determine whether the shellfish material came from the Kartsú creek being an active channel at the time located about 10 km away from the Körös site on the floodplain of the river Tisza, or the nearby Tinóka creek.

According to the findings of the archaeozoological studies of the shellfish material retrieved from other archaeological sites (Ecsefalva, Gorzsa, Nagykörű, Polgár, Tiszaszöllös), shell mounds in the vicinity of active riverbeds were dominated by moving-water species like *Unio crassus* and we have come across some specimens of the gastropod *Valvata piscinalis* as well in each and every case. These forms are however, completely missing here. Conversely, several specimens of the rheophylic *Lithoglyphus naticoides*, *Viviparus acerosus* have been retrieved from the Körös site of the Karancspart indicating that the gathered material or at least a part of it must have come from moving waters. In order to interpret the dominance of *Unio pictorum* in the harvested shellfish material, one needs to get a clear view of the importance of the elevated cut-off channels, which had been active during the Pleistocene (Tinóka creek, Háromág), in the life of the Körös settlement.

According to the prevailing modern geomorphology in the study area, the objects belonging to the Körös site of the Karancspart must have occupied a position between 86 and 88 m ASL, with the silted-up channel of the Tinóka creek located lower at around 83m ASL during the Neolithic. The channel of the Kartsú creek, being an active branch of the Tisza at the time was located 82 m ASL. The highest modern floods in the studied area exceed 10 metres. However, the floodwaters restricted to a relatively small floodplain of about 3000 km<sup>2</sup> today must have affected a much larger area of about 30 000 km<sup>2</sup> preceding

<sup>115</sup> Sümegi 1999a,b.



river regulations. All this seems to imply that the waters producing extremely high floods today could have been dispersed on a floodplain of a size about 10 times of its modern counterpart during the Neolithic, meaning that floods could have been only a couple metres high at that time. These waters, though could not have flooded the Körös site of the Karancspart, they could have easily invaded the areas of the Tinóka, Háromág creeks and the backwater areas of the Fehér Pond flowing through the Kartsú creek. In other words the Tinóka creek located some hundred metres away from the actual Körös site must have functioned as a drainage channel for floodwaters during the Neolithic, enjoying water coverage of 2–3 m during floods.

The interaction between the unregulated river and the surrounding floodplain must have been completely different in the Neolithic from that of their modern counterparts.<sup>116</sup> The movement of floodwaters onto the floodplain and back into the active channel must have been less rapid enabling the emergence of habitats with slowly moving-water conditions within the channels connecting the active riverbed with the floodplain, at least in a part of the growth season. In other words, this resulted in the cyclic fluctuations of slowly moving and still water conditions in the channel of the Tinóka creek. This temporary supply of fresh moving water during the floods must have been beneficial for the proliferation of the still-water habitat preferring *Unio pictorum*, and the rheophylic species.

Archaeological excavations implemented at the Körös site of the Karancspart yielded an outstanding mollusc fauna retrieved from the soil layers embedding the cultural artifacts. The majority of these forms (bivalves, aquatic elements) is not natural to the terrestrial facies, and must have ended up in the culture layers as a result of human activities, partly via intentional shellfishing for food<sup>117</sup> and as accessories of the shellfishing or fishing activities.

### Summary

The following palaeoenvironmental picture could have been drawn in connection with the settlement site of the Körös culture at Karancspart based on the findings of detailed geomorphological, sedimentological, palaeobotanical, malacological and radiocarbon analyses: The Körös group of the site of Karancspart must have chosen a peninsula-like extension of a loess-covered Pleistocene lag surface, covering about 10 km<sup>2</sup> as the site of their settlement.

This lag surface formed an island-like structure on the Holocene floodplain of the Tisza due to the presence of numerous drainage channels, which had emerged even during the Pleistocene. The highest parts of the lag surface and the direct neighbourhood of the Körös settlement site were covered by calcareous chernozem soils harboring a dry steppe-forest steppe and characterized by mean July temperatures of 20–22 °C.

A hydromorphic counterpart of this chernozem must have encircled these highest areas. Hydromorphic meadow soils with typical floodplain vegetation, including arboreal species occupied the lower-lying areas and the banks reflecting the evolution of a loessy hydroseries from the lowermost part of the floodplain to the topmost part of the levees highly dependent on the geomorphological endowments, the elevation and the actual level of the groundwater. This must have been especially true for the floodplain areas located west of the lag surface of Karancspart, having been covered by an extensive gallery forest of large-scale species diversity and the dominance of oak (*Quercus*) during the opening of the Neolithic.

This complex environment composed of gallery forest-covered floodplains, Pleistocene riverbeds and backswamps, contributing to a mosaic-like diversity regarding habitats, soils, bedrock conditions at the micro level must have offered ideal conditions for leading both a productive and nonproductive lifestyle during the Early Neolithic. In our view the direct neighbourhood of the site of Karancspart was suitable for crop cultivation and animal husbandry at the Neolithic state of development. While the surrounding floodwater influenced drainage channels, and floodplain areas could have been havens of an nonproductive lifeway of hunting–fishing–gathering. Thus

<sup>116</sup> T. Bellon: A Tisza néprajza [Ethnography of the Tisza]. Budapest 2003.

<sup>117</sup> Sümegi 2003.



the Körös community of the Karancspart had the possibility of being in parallel engaged in a dual lifestyle ensuring ideal and stable food resources throughout their lives.

In our view these island-like Pleistocene lag surfaces situated on Holocene alluvia in the northern borderzone of the expansion of Neolithic cultural groups bearing Balkanic and Aegean cultural roots, offering special conditions for settlement, must have been of crucial importance in the migration and settlement of the Körös cultural groups within the Carpathian Basin and the whole process of neolithization. The observed temporary summer settlements of Mesolithic groups<sup>118</sup> on the alluvia covered by gallery forests surrounding lag surfaces suitable for agricultural production in Hungary as well as the temporary boosts of the population reconstructed at these sites<sup>119</sup> further corroborates this presumption. Thus these floodplain areas or alluvial areas, primarily around the river Tisza must have been the sites of first contact and interaction between the Neolithic groups dwelling on the nearby lag surfaces and the Mesolithic groups inhabiting temporarily the floodplains. Consequently, these were of crucial importance in the spreading of Neolithic culture within the Carpathian Basin<sup>120</sup> and the emergence of the Linear Pottery Complex.

On the other hand the settling of the Körös cultural groups to the site of Karancspart corroborates the findings of previous studies,<sup>121</sup> according to which the settlement of these groups onto the loessy areas with chernozem soils could have commenced even during the Early Neolithic and this adaptation process is by no means connected to the groups of the Middle Neolithic Linear Pottery Complex as it had been advocated earlier.<sup>122</sup> This adaptation process observable at the northern margin of the Körös culture bearing Balkanic and Aegean cultural roots seems to point to an important factor. Namely that this group had a much more flexible and wide-scale adaptation activity and capacity regarding environmental conditions than what had previously been assumed.<sup>123</sup> Thus the sporadic sites identified north of the formerly drawn borderline of this culture may actually be satellite sites of the same group. It is also probable, that the Körös communities adapted to the conditions of these loess covered areas had a much more important role in the shaping of the spiritual and economic life of the Linear Pottery Complex than it had been previously assumed. The most important question is how far this adaptation process of the Körös culture could get in the Tisza valley on the one hand? And what was the role of this environmental adaptation process in the neolithization of the Alluvial Fan Complex of the Northern Great Hungarian Plain?

The northern boundary of distribution of the Körös culture seems to form a continuous line only at a regional scale of several hundred kilometres, and displays large-scale discontinuities deriving from the mosaic-like distribution of these groups inhabiting the island-like lag surfaces along the river Tisza and its tributaries when examined at a local scale of a resolution of some kilometres and beyond. The same can be said about the environmental conditions, which developed in the central parts of the Carpathian Basin, the Pannonicum during the last 30 000 years.<sup>124</sup> Thus the mosaic- or puzzle-like local environmental segments are acting as fractals unifying into larger units at a regional-scale only. Once one manages to acknowledge this mosaic-like patterning of the Carpathian Basin observable at the micro-, meso- and macro levels, along with the whole underlying dynamic mechanism acting during the Holocene, the adaptation and settling strategies exercised by the Körös groups will become more apparent as well. Furthermore, we can also understand the latest version of the Central European Balkanic Agroecological Barrier,<sup>125</sup> which is based on the fact that this scattered, island-like settlement pattern observable at the local level turns into a boundary surface when examined at a regional scale. And the role of surfaces enhancing settlement in the river valleys can not be interpreted at a regional level, but only at the local level.<sup>126</sup> In the light of these latest findings, the previous opponents of the CEB AEB may be able to reconsider their former doubts and counter-arguments considering the preceding conceptions of this model as well.

<sup>118</sup> Sümegi – Kertész 1998, 2001.

<sup>119</sup> Kertész et al. 1994.

<sup>120</sup> Kalicz – Makkay 1977.

<sup>121</sup> Sümegi 2000, 2003, 2004.

<sup>122</sup> Kosse 1979.

<sup>123</sup> Kertész – Sümegi 1999a,b.

<sup>124</sup> Sümegi 1995, 1996, 1998, 2000, 2003a,b,c, 2004.

<sup>125</sup> Sümegi 2003a,b,c, 2004.

<sup>126</sup> Sümegi 2003a,b,c, 2004.



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## RÖMISCHE BODENSTÄNDIGE KERAMIK

Folgender theoretischer Überblick ist eine Zusammenfassung der Beobachtungen der spätkeltischen – frührömischen handgeformten Keramik<sup>1</sup> aus der Umgebung von Esztergom, dem Ausgrabungsmaterial des Vicus von Albertfalva<sup>2</sup> und Almásfüzitő,<sup>3</sup> bzw. einer Grube der einheimischen Siedlung von Szakály-Réti földek,<sup>4</sup> weiters vom Fundplatz Budapest-Meggyfa Str.-Kerek Str.<sup>5</sup>

*Einführung*

Die römischen handgeformten Gefäße besitzen im Gegensatz zum auf der Töpferscheibe hergestellten provincialen Material, welches einen uniformen überregionalen Charakter hat, eigenständige lokale Charakteristika und bilden verschiedenen keramischen Kreisen zusprechbare Gruppen. Um die ethnoarchäologische Definition zu gebrauchen, stehen wir regional abweichenden technologischen Dialekten,<sup>6</sup> sog. Keramikprovinzen<sup>7</sup> gegenüber, worunter jene technologische Tradition zu verstehen ist, die durch ein abweichendes Formspektrum und Formgebung, und in der Tendenz der angewendeten Verzierungsarten, weiterhin in der Magerung und der Methode des Brennverfahrens zum Ausdruck kommt. Die handgeformten Gefäße in der Römerzeit sind, im Gegensatz zur früheren Auffassung, nicht zu den niedrigeren Sozialschichten der Bevölkerung zuzuschreiben oder ausnahmslos an eine bestimmte ethnische Gruppe gebunden zu werden. Sie sind keine qualitativ geringe Ware, sondern, da sie zur alltäglichen Küchennutzung bestimmt waren, in Form und in technologischer Verarbeitung ihrer Funktion angepasst.<sup>8</sup> Bezieht man die obige Gesichtspunkte ein, ergeben sich räumliche Überdeckungen zwischen den lokalen Gruppen. Für ein allgemein gültiges Ordnungsprinzip kann man aber keinen einzigen Gesichtspunkt hervorheben, es ist vielmehr eine umfassende Analyse notwendig. Wird aber in bestimmten Gebieten und bestimmten Zeitabschnitten nur ein einziger technologischer Gesichtspunkt verfolgt, können sich regionale Abweichungen abzeichnen.<sup>9</sup>

Die für den einfachen Alltagsgebrauch bestimmte Keramik kann, durch die an den zur Verfügung stehenden Ton angepasste Verarbeitungstechniken sowie der überbrachten, auf Erfahrungen basierenden Normen wichtige Hinweise für das Abgrenzen einzelner kultureller- und Handelsgebiete liefern. Weiterhin spielt diese Keramik bei der Frage der Fortführung oder Änderung einer für ein bestimmtes Gebiet charakteristischen kulturellen Tradition eine bedeutende Rolle, sowie spiegelt die gegenseitigen Einflussnahmen mit den benachbarten Gebieten wider.<sup>10</sup>

<sup>1</sup> Horváth 1997 Manuskript in der Bibliothek des Archäologischen Institutes der Ungarischen Akademie der Wissenschaften (MTA Régészeti Intézet) einsehbar. Horváth 1998, 65–81.

<sup>2</sup> Horváth 1999a, 367–379.

<sup>3</sup> F. Horváth: Die römerzeitliche Siedlungskeramik im Vicus von Almásfüzitő (Odiavum/Azaum) am Beispiel einer frühkaiserzeitlichen Grube, in: B. Liesen – U. Brandl (hrsg.): Römische Keramik. Herstellung und Handel (Kolloquium Xanten, 15–17. 6. 2000). Xantener Berichte 13 (2003) 205–240.

<sup>4</sup> Gabler – Horváth 1996, 146–147, 158–159.

<sup>5</sup> Grabungsmaterial von István Welner. Für die Bearbeitung der Stücke habe ich Klára Szabó zu danken.

<sup>6</sup> Vossen 1971, 109; R. Vossen: Reisen zu Marokkos Töpfern: Forschungsreisen 1980 und 1987. Hamburg 1990, 19–26.

<sup>7</sup> K. Kritsotakis: Mineralogische und geochemische Untersuchungen zu Charakterisierung Rheinzauberer Terra Sigillata und rauhwandiger Keramik Mayener Art. JRGZM 33 (1986) 753.

<sup>8</sup> Ebner 1997, 59.

<sup>9</sup> G. Wieland zieht zur Bestimmung der Lokalgruppen der spätkeltischen Fundkomplexe des Gebietes zwischen Schwarzwald und Nördlinger Ries die Form- und Verzierungselemente heran und nicht das von W. E. Stöckli anhand des Manching Materials erarbeitete Verfahren, nach welchem die Magerung ein Zuordnungsprinzip darstellt, Wieland 1996, 131–163; W. E. Stöckli: Die Grob- und Importkeramik von Manching. Manching 8. Wiesbaden 1979, 8–17.

<sup>10</sup> Vossen 1971, 108; Leckebusch 1998, 417–418.



Um die Eigenheiten voneinander abweichender technologischen Kreisen und ihre Ausbreitung zu bestimmen, ist die systematische Fundaufnahme eines grossen Gebietes nötig, wofür die Bearbeitung des Materials aus der Gegend um Esztergom einen möglichen Ausgangspunkt liefern könnte.

### **Definition und Schwierigkeiten**

Bezüglich der Bezeichnung der „handgeformten“ bzw. der „Grobkeramik“ bestehen in der Forschung von Zeit zu Zeit Bedenken. Erstere schiebt ausschließlich das technologische Merkmal vor, wogegen letztere eines der äußeren Erscheinungskriterien hervorhebt. In letzter Zeit findet bei der Charakterisierung dieser Materialgruppe eher der neutrale, den Kern dieser Keramik besser zugreifende Begriff „der einheimischen oder bodenständigen Keramik“<sup>11</sup> Eingang in die Fachliteratur.

### **Forschungsgeschichte**

Im Allgemeinbewusstsein wurde die handgeformte römische Keramik lange der spätrömischen Phase, als materielle Nachlassenschaft der in dieser Zeit in der Provinz sesshaft werdenden barbarischen Bevölkerungsgruppen zugeschrieben oder einfach als urgeschichtlich angesprochen. Der Beginn der Betrachtung dieses Problems setzt mit Publikationen über die frühkaiserzeitlichen (Ende 1. Jh. – Anfang 2. Jh. n.Chr.) Tumuli (Hügelgräber), Töpfersiedlungen und einheimische Siedlungen bzw. mit der Bearbeitung der Vicusbefunde ein. So gut wie in jedem Fall ist neben der Keramik nach römischem Vorbild auch die Grobkeramik vorhanden, welche entweder als oberflächliche Drehscheibenarbeit oder als handgeformte Keramik bezeichnet wurde. Ihr Vorkommen wurde in den Bearbeitungen als Beweis für die Existenz fremder Bevölkerung auf betrachtetem Gebiet herangezogen.

Das durch N. Fettich 1928–1929 in den Tumuli von Ivánc freigelegte Material publizierte 1957 É. Bónis.<sup>12</sup> In diesem Fall, insbesondere da der Fundplatz dicht am Leitha-Gebiet liegt, wo in der Tat frühgermanischer Nachlass gefunden wurde, schien folgerichtig, die Wurzeln dieses Materials in der germanischen Keramik zu suchen.

Anhand einiger Stücke aus dem Vallum und den umliegenden Wohngruben des Lagers Adony verweisen die Verfasser (L. Barkóczi – É. Bónis) darauf,<sup>13</sup> dass der Ursprung der formalen und technologischen Elemente dieser Materialgruppe bei den den Römern vorangegangenen Bevölkerungen (Kelten, Illyrer, Germanen) zu suchen ist. Weiterhin stellten sie fest, dass die Nachfrage nach der bodenständigen Keramik nach den Markomannenkriegen auch nicht abnahm, vielmehr ist diese Materialgruppe in den Siedlungen entlang der Donau, so z.B. auch im Fundmaterial vom Ende des 2. Jh. n.Chr. in Albertfalva zu finden.

Dem gegenüber verwarf L. Barkóczi<sup>14</sup> anhand der Form- und Verzierungsmerkmale der sog. Pátkaer-Ware<sup>15</sup> aus dem in Bicsérd freigelegten Töpferofen aus dem 2. Jh. n.Chr. die Möglichkeit eines lokalen Ursprungs. An Stelle dessen hält er einen südwestlich-pannonischen, keltisch-germanischen Einfluss für möglich, welcher mittels einer von dort übergesiedelten Bevölkerungsgruppe in der Keramik seinen Niederschlag fand.

Diesen Faden nimmt auch É. Koczur auf, die das Erscheinen der handgeformten Keramik in Tác-Margittelep an ein konkretes historisches Ereignis, nämlich an die den Markomannenkriegen vorangegangenen Rüstungen knüpft. Dann sei an dieser zentral gelegenen Stelle eine südwestliche-westliche pannon-norische Bevölkerungsgruppe erschienen. Daraus ergibt sich in Hinsicht der behandelten Materialgruppe eine spätere – Ende des 2. – Mitte des

<sup>11</sup> Zanier 1992, 144; Lenz – Schuler 1998, 595; Ebner 1997, 59.

<sup>12</sup> Bónis 1957, 72–73, Abb. 14. 7; Palágyi – Nagy 2000, 110.

<sup>13</sup> Barkóczi – Bónis 1954, 150.

<sup>14</sup> L. Barkóczi: Császárkori kelta edényégető telep Bicsérden (Celtic Pottery Kilns from the Times of the Roman Empire at Bicsérd). *FolArch* 8 (1956) 72, 74.

<sup>15</sup> Die Bezeichnung des Pátkaer-Typs geht auf die im Hügel von Pátka gefundene Grobkeramik zurück, *F. Römer: Compte-rendu de la huitième session, II. Budapest 1876. Résultats généraux du mouvement archéologique en Hongrie avant la VIIIe session du Congrès International d'Anthropologie et d'Archéologie préhistorique à Budapest 1876. Budapest 1878, Abb. 76; Bónis 1975, Bild 2/1.*



3. Jh. n.Chr. – Datierung als sonst im Falle der anderen Siedlungen.<sup>16</sup> Deutlich erkennbar überträgt die Verfasserin die von L. Barkóczi aufgestellte Theorie auf ihre eigenen Befunde.

Mit der Frage nach dem Ursprung der Gefässe von Pátka hält S. Palágyi bei Zugrundelegung neuerer Ausgrabungsergebnisse die Interpretierung als germanische Hinterlassenschaft für unrichtig. Die handgeformten Gefässe werden nämlich in solch grosser Zahl und auch in solcher Weitentfernung von germanischer Bevölkerung beobachtet, dass die Zuschreibung zu einer einzigen Bevölkerungsgruppe oder einer einzigen Werkstatt unbedingt falsch ist. Weiter ist ihre Beobachtung im Zusammenhang mit den Befunden der Ville von Baláca, wonach auch die über italische Verbindungen verfügenden Villeneigentümer diese „billigere“ Küchenkeramik benutzten, sehr bedeutend. Ihr Gebrauch ist also nicht als Folge einer niedrigeren Romanisierungsstufe zu interpretieren.<sup>17</sup>

Das Erkennen des behandelten Materials ist vor allem den Archäologen M. Kelemen und I. Torma anlässlich der topografischen Geländebegehungen um Esztergom zu verdanken.<sup>18</sup> Sie erkannten, dass diese Materialgruppe nicht den urgeschichtlichen Kulturen zuzusprechen ist, und sich gleichzeitig auch vom völkerwanderungszeitlichen Material unterscheidet und sie somit den Begleitfunden entsprechend unter die spätkeltischen–frühhömischen Funde aufnehmen. Diesem Umstand ist auch zu verdanken, dass die Umgebung um Esztergom durch die Forschungen von M. Kelemen bezüglich der handgeformten spätkeltischen – frühhömischen Keramik zu den am besten bearbeiteten Gebieten zählt.

Bei der Veröffentlichung der einheimischen Siedlungen von Tokod erwähnt M. Kelemen<sup>19</sup> bei der Beschreibung der einzelnen Objekte stets die ohne Töpferscheibe gefertigten mit Muscheln gemagerten Gefässe, und stellt diese auch im Foto dar. Die Verfasserin rechnet auf diesem Gebiet mit einer Besiedlung seit der La Tène-Zeit, da die Funde auch mangels der kontemporären Befunde auf die Existenz einer spätkeltischen Siedlung weisen. Sie stellt fest, dass sich das Leben in der ursprünglichen Siedlung durch die seit der 2. Hälfte des 1. Jh. n.Chr. ansiedelnden römischen Soldaten bzw. die zivile Bevölkerung grundlegend nicht veränderte. Die handgefertigte Keramik tritt in der Siedlung überall im Kontext mit dem übrigen frühhömischen Fundmaterial auf. Es kann allerdings auch mit dem Fortbestehen einiger Objekte bis in die spätrömische Zeit gerechnet werden. Es lässt sich aber das Material vom 1.–3. Jh. n.Chr. bzw. 4.–5. Jh. n.Chr. gut voneinander unterscheiden. Mit Hilfe der Terra sigillata ist erkennbar, dass die handgeformte Keramik bis Ende des 2. – Anfang des 3. Jh. n.Chr. durchgehend in Gebrauch war. Sie kamen nämlich häufig gemeinsam mit Terra Sigillata Stücken aus Mittelgallien, Rheinzabern und sogar Westerndorf vor.

Jene Bruchstücke, die aus dem Töpferofen des Esztergomer Dózsa György-Platzes stammen und von M. Kelemen publiziert wurden, sind LT D–frühhömisch.<sup>20</sup> Die Benutzungszeit des Töpferofens ist anhand der Funde ans Ende des 1. Jh. n.Chr. zu setzen. Im Laufe der Analyse gelangt sie zu der Schlussfolgerung, dass das Vorkommen keltischer Formen in der Römerzeit in erster Linie auf solchen Gebieten zu beobachten ist, in denen die keltische Bevölkerung in größerer Zahl weiterlebte. Es ist in diesen Gebieten nicht vom Neuaufleben, sondern viel mehr vom Weiterleben der keltischen Traditionen zu rechnen.

Das Material des Ofens von Balatonfüzfő wurde ebenfalls von obiger Verfasserin publiziert.<sup>21</sup> Die Grobkeramik unterteilt sie in zwei Gruppen: die LT D-Gruppe, also die Keramik der Siedlung vor der römischen Besetzung und die Funde, die mit dem Material der Tumuli und der Siedlungen des 1.–2. Jh. n.Chr. eine Ähnlichkeit aufweisen. Sie weist darauf hin, dass in zahllosen Fällen versucht wurde, diesen Keramiktyp einer einzigen Bevölkerungsgruppe zuzuordnen. Diesen Versuchen widerspricht jedoch das weit verbreitete Vorkommen dieser Keramikgruppe. Ihrer

<sup>16</sup> É. Kocztur: Ausgrabungen im südlichen Stadtviertel von Gorsium (Tác-Margittelep). Alba Regia 13 (1972 [1974]) 124.

<sup>17</sup> S. Palágyi: Egyéb kerámia (Die sonstige Keramik), in: K. Bíró-Sey et al.: A balácai pincegazdaság főépületének pincéje (Der Keller der Hauptgebäude der Villenanlage von Baláca) Balácai Közlemények 2 (1992) 52; Palágyi – Nagy 2000, 110.

<sup>18</sup> MRT 5.

<sup>19</sup> M. H. Kelemen: Funde und Grabungen in Tokod, in: A. Mócsy (Hrsg.): Die spätrömische Festung und das Gräberfeld von Tokod. Budapest 1981, 13–36.

<sup>20</sup> Kelemen 1988, 167–175, Abb. 6. 1, 3.

<sup>21</sup> Kelemen 1980, 58–59, Abb. 6. 7–9.



Meinung nach wurde diese Ware nicht in zentralen, großen Töpfersiedlungen hergestellt, sondern in kleineren Werkstätten, wo lokale Bedürfnisse befriedigend und dem jeweiligen Geschmack entsprechend, auch Gefässe auf der Töpferscheibe hergestellt wurden.<sup>22</sup>

Im Zuge Autobahngrabungen wurde in Ménfőcsanak auf der Gemarkung Szeles eine einheimische Siedlung mit bisher für Pannonien grösstem Ausmass freigelegt. Die Befunde umfassen das 1.–2. Jh. n.Chr. Das gesamte Material konnte in der Kürze der Zeit noch nicht bearbeitet werden, aber die bisher erschienenen zwei, vorläufigen Berichten von E. T. Szőnyi<sup>23</sup> liefern aus unserer Hinsicht wichtige Informationen. Zumal kommt in der gesamten Siedlung LT D-Keramik in grosser Menge vor, und es scheint, als hätte ihre Bevölkerung auch nach der römischen Besetzung ihre ursprüngliche Lebensweise beibehalten. Die Verfasserin zufolge weist die Keramik auf keltische oder quadische Traditionen.

Es besteht also kein Zweifel, dass die bodenständige Keramik, die den lokalen Charakter lange bewahrt, entlang der Donau allgemein gebräuchlich war.

Gleichfalls bei Autobahngrabungen wurden in Herceghalom zwei bzw. in Páty ein solcher Fundplatz freigelegt, in denen die besprochene Keramik ebenfalls in großer Zahl vertreten ist. Die Bearbeiterin des Materials, K. Ottományi,<sup>24</sup> folgt jener Richtung in der Forschung, wonach die handgeformte Keramik nicht an ein einzelnes Ethnikum zu binden ist. Sie hält die im keltischen Fundzusammenhang gefundenen Stücke für ursprünglich dakisch, aber die Fragmente im Kontext mit dem Material der 1.–2. Jh. n.Chr. sollten ihrer Meinung nach von bodenständiger eraviskischen Bevölkerung bzw. einer ursprünglich aus dem Noricum stammenden Volksgruppe getragen werden.

Zsuzsa Bánki,<sup>25</sup> die das Material des keltisch-eraviskischen Gräberfeldes von Sárbogárd bearbeitete, teilte die da gefundene Keramik in zwei Gruppen. Neben den auf der Töpferscheibe gefertigten keltisch-römischen Formen erschienen auch handgeformte Ware. Hinter der Form- und Ziersprache der Grabgefässe meint sie ein dakisch-sarmatisches Charakteristikum festzustellen. Hersteller dieser Keramik ist, die mit den Kelten vermischte illyrisch-pannonische Urbevölkerung. Nachdenklich macht allerdings die Feststellung, wonach das Gräberfeld ein doppeltes Gesicht besass; zum einen das Gräberfeld der stark romanisierten Stammesaristokratie (Wagenbeigaben, Säulenbruchstücke), zum anderen die Eravisker, die den Romanisierungseinflüssen gegenüber zurückhaltend waren und die Traditionen bewahrten. Die handgeformten Gefässe können den Letzteren zugesprochen werden.

Obige Ansichten sind nicht nur für die pannonische Forschung bezeichnend, sondern spiegeln auch den vorherrschenden Standpunkt bezüglich der ethnischen, sozialen und chronologischen Feststellungen<sup>26</sup> der provinzialrömischen Forschung wider. Die im Gebiet des Noricum vorkommende römische Grobkeramik erhielt die Bezeichnung „aus norischem Ton gefertigte Ware“<sup>27</sup> oder „norische Ware“.<sup>28</sup> Die handgeformte Ware wird als evidenter Begleitfund der römischen Fundverbände betrachtet, was den Schein erweckt, als wäre im Gebiet des Noricum von einer technologisch einheitlichen Ware die Rede. A. Kaltenberger verwies erstmals darauf, dass diese Ware „bezüglich Form und Materialqualität eigene regionale Merkmale aufzeigt“.<sup>29</sup>

<sup>22</sup> *Stroh 1934*, 98–108. Veröffentlicht einen Töpferofen aus Hailfingen vom Ende des 2. Jh. n.Chr., welcher ausschließlich handgeformte Keramik enthielt. Aus dem pannonischen Gebiet ist bislang kein Ofen bekannt, welcher allein zum Brand handgeformter Ware verwendet worden wäre.

<sup>23</sup> *Szőnyi 1995* bzw. *Szőnyi 1996*.

<sup>24</sup> *Ottományi – Gabler 1985*, 213–214.

<sup>25</sup> *Zs. Bánki*: Kelten- und Eraviskengräber in Sárbogárd. *CommArchHung* (1998) 94–95.

<sup>26</sup> Die Zusammenfassung früherer Gesichtspunkte bezüglich des germanischen und rätischen handgeformten Materials, *Zainer 1992*, 143.

<sup>27</sup> Nach der Definition von R. Miglbauer sind die aus diesem Material gefertigten Gefässe „stark

gemagert, schwarz gebrannt und weist eine fettige Oberfläche auf.“ „Kennzeichnend ist ... glimmerhältige Ton. Er ist oft stark mit Quarzkörnchen und Kalksteinchen gemagert“, *Miglbauer 1990*, 38, 51.

<sup>28</sup> Nach R. Miglbauer ist die norische Ware neben der jeweiligen Verarbeitung des Tons durch die bodenständigen Formmerkmale zu definieren, *Miglbauer 1990*, 51; Einen Überblick zu diesem Fragenkomplex s. *Tober 2001*, 113–117.

<sup>29</sup> *Kaltenberger 1995*, 9; *Tober 2001*, 116 leitet die Aufmerksamkeit auf die Unrichtigkeit der Bezeichnung der als einheitlich behandelten „Norische Ware“.



Die rumänische Forschung widmete in letzter Zeit der Analyse der behandelten Fundgruppe große Aufmerksamkeit. Bezüglich der Bezeichnung dieser Gruppe wird aus der reichen Auswahl die von V. Rusu-Bolindeț, V. Voişian und S. Cociș als „Keramik der La Tène-Tradition“ angesprochene, bevorzugt.<sup>30</sup> In diese reihen sie aber außer der handgeformten Ware auch dakische scheibengedrehte<sup>31</sup> und keltische, auf der langsam rotierenden Scheibe gefertigte Gefässe, welche nach der Eroberung Dakiens, der aus Pannonien und Noricum einsiedelnden Bevölkerungsgruppe zugeschrieben ist. Die handgeformte Ware wird als „römisch-dakische Keramik“ beschrieben, ergänzt dadurch, dass auch die ursprünglich gesondert betrachtete keltische Ware in Bezug auf ihre Form- und Technologiemerkmale in diese Kategorie gereiht wurde.<sup>32</sup> Bei der Analyse der Funde von Napoca gelangten sie zur Schlussfolgerung, dass die bodenständige dakische Bevölkerung über drei Generationen hinweg die Tradition der Herstellung des Kochgeschirrs bewahrte. Die Bedeutung dieser Tradition wurde im Laufe der Zeit in den Hintergrund gedrängt und verliert etwa um die 2. Hälfte des 2. Jh. n. Chr. zugunsten der römischen Provinzware seine Dominanz.<sup>33</sup> Auch die Verfasser selbst betonen an mehreren Stellen den Lokalcharakter der Warengruppe.<sup>34</sup>

### **Grundbegriffe bei der Beschreibung der Keramik**

Der *Ton* ist ein in der Natur vorkommendes Gemenge der Minerale, der mit Wasser vermischt leicht formbar wird, und nach dem Brand seine Form beibehält, standfestig wird, seine Formbarkeit verliert und nicht durchlässt.<sup>35</sup>

Man unterscheidet *fetten Ton*, mit hohem Feinheitsgrad der Tonminerale und hoher Bildsamkeit, vom *mageren Ton*, mit feinkörnigen Tonmineralen in geringerer Menge, von mittlerer bis geringer Bildsamkeit. Die *Bildsamkeit* ist jene besondere Eigenschaft des Tons, welche bei Wasserzufuhr den festen Ton in eine formbare Masse verwandelt, die gleichzeitig fest und bildsam ist.<sup>36</sup> Die von den Archäologen häufig verwendete Bezeichnung „gut geschlämmt“ weist auf die Aufbereitungsphase, bei dem, um feinere und grobe Verunreinigungen auszusondern, das kochtrockene Rohstoffmaterial durchweicht wird.

Beim Formen der Gefässe mussten die damaligen Töpfer mit der während des Trocknens entstehenden *Trockenschwindung* rechnen, da das zugefügte Anmachwasser durch die Trocknung das Gefäss schwinden lässt. Ist die Trockenschwindung beendet, ist das Gefäss lederhart. Besonders bei dickwandigen Gefässen musste darauf geachtet werden, dass die Oberfläche gemessen am Scherbenkern nicht wesentlich schneller trocknete, da die so entstehenden Spannungen dem Gefäss Risse zugefügt hätten. Der magere Ton beansprucht durch die in ihm in geringer Menge enthaltenen Tonmineralen weniger Wasser um formbar zu werden und zeigt beim Trocknen im Verhältnis zur Wasserverdampfung eine kleinere Volumenveränderung.<sup>37</sup> Der fette Ton dagegen braucht zur Bearbeitung mehr Wasser, und sein Volumen sinkt beim Trocknen und im Brand im Verhältnis dazu. Je grösser der Volumenveränderung, um so grösser ist die Gefahr, dass sich das Gefäss verwirft oder reisst.<sup>38</sup> Die nicht plastischen Komponenten des mageren Tons haben hier eine mechanische Wirkung, aber bei höheren Temperaturen setzt sich auch eine chemische Wirkung zu, wodurch die Brandbeständigkeit des Tons sinkt oder erhöht.<sup>39</sup>

<sup>30</sup> Zusammenfassung der Standpunkte der dakischen Forschung s. Rusu-Bolindeț – Voişian – Cociș 2000, 141–145.

<sup>31</sup> Rusu-Bolindeț – Voişian – Cociș 2000, 163. Sie selbst machten darauf aufmerksam, dass diese schwer von der provinzialrömischen Ware zu unterscheiden ist, wenn es überhaupt nötig ist. Lediglich die auf den scheibengefertigten römischen Waren verwendeten Leiste ist der einzige Grund, nach dem diese als eigene Gruppe isoliert wurde.

<sup>32</sup> Rusu-Bolindeț – Voişian – Cociș 2000, 146–163, 167.

<sup>33</sup> Rusu-Bolindeț – Voişian – Cociș 2000, 146–163, 167.

<sup>33</sup> Rusu-Bolindeț – Voişian – Cociș 2000, 176.

<sup>34</sup> Rusu-Bolindeț – Voişian – Cociș 2000, 174.

Eine Materialuntersuchung ergab, dass die Materialzusammensetzung der sog. „auf der langsam rotierenden Scheibe hergestellten keltischen Ware“ einigermaßen von der handgeformten Ware abweicht, was auf eine andere Tonlagestätte weist.

<sup>35</sup> Petrik 1913, 46.

<sup>36</sup> Albert 1967, 48.

<sup>37</sup> Petrik 1913, 53, 55.

<sup>38</sup> Petrik 1913, 83.

<sup>39</sup> Petrik 1913, 84.



Das Maß der Neigung zum Rissen und Deformieren während der Trockenschwindung wird in der Keramikindustrie als *Trocknungssensibilität* bezeichnet.<sup>40</sup> Je geringer die Trocknungsschwindung des Tones und größer die Porosität des Scherbens ist, um so kleiner ist die Trocknungssensibilität. Das bedeutet, dass bei fetten aber mergeligen bzw. mageren Tönen können solche Fehler besser abgeholfen werden. Die Trocknungssensibilität hängt auch bei mageren Tönen im grossen Maße vom Mengenverhältnis der bildsamen Tonminerale und der Magerungskomponenten ab.<sup>41</sup> Die *Brandschwindung und Festigkeit* hängt von der Zusammensetzung der Tonminerale und der Körnigkeit ab. Die Brandschwindung, ebenso wie die Trockenschwindung, und die Dichte sind beim mageren, grobkörnigen Ton geringer, als bei fettem, feinkörnigem Ton.<sup>42</sup>

Die in der Natur vorkommenden Tone sind nicht rein, sondern eine Mischung aus formbarem reinem Ton und nichtplastischen Mineralienanteilen, die die Bildsamkeit des Tons herabsetzen, und deshalb diese als *Magerungsmittel* bezeichnet werden.<sup>43</sup> Sie spielen eine Rolle bei der Verminderung der Trocknungssensibilität, bei der Erhöhung der Feuchtigkeitsleitungsfähigkeit und bei der Senkung der Trockenschwindung.<sup>44</sup> Ob der Magerungsmittelinhalt im Falle einer Töpferprodukt als ursprünglicher Bestandteil des Tons ist oder aber es nachträglich dem Material zugesetzt wurde, lässt sich vielfach nicht mehr feststellen. Aber bei grobkörnigen Zusätzen können wir von einer gewollten Beimischung ausgehen. In der Fachliteratur der Töpferkunst erscheinen Quarz, Kalkstein, Mergel, Kiese und Pirit als im Ton auftretende schädliche Einschlüsse.<sup>45</sup>

Vor der Übersicht der Auswirkung, der in der archäologischen Literatur bei der Beschreibung der Scherben oft als Magerungsmittel bezeichneten, nichtplastischen Bestandteile des Tons, darf die Tatsache nicht außer acht gelassen werden, dass die chemischen Reaktionen im Scherben um so intensiver sind, je geringer die Korngrösse ist.<sup>46</sup>

Der Quarzkiese ist mehr oder weniger Siliciumdioxid. Quarz und Glimmer sind seit Anfang an ursprüngliche Komponente des Tons.<sup>47</sup> Quarz schwillt im Feuer, wodurch die Schwindung des Scherbens wesentlich herabgesetzt wird. Der grobere, körnige Sand hat auf die Feuerfestigkeit von Kochgeschirr eine positive Wirkung,<sup>48</sup> erhöht die Porosität (=Wasser-aufnahmevermögen), wodurch das Gefäss der Erhitzung und schneller Temperaturschwankungen besser standhält.<sup>49</sup> J. Albert zufolge kann der Magerungseffekt von Quarzsand bei einer Korngrösse von 0,2–0,5 mm vorteilhaft sein, größere Körner als 2–3 mm den Scherben beim Brennen jedoch zerspringen lassen. In archäologischen Keramikfunden sind häufig größere Kieskörner zu beobachten, die von der Töpferliteratur eindeutig als Verunreinigungen definiert werden, von denen der Rohton unter allen Umständen zu reinigen ist.

Die Schamotte (poröse Keramik) gehört in die Gruppe jener Magerungsmittel, dessen tatsächliches Erkennen im ausgebrannten Scherben beinahe unmöglich ist. Durch Versuche konnte jedoch bewiesen werden, dass es bei stark mit grobkörnigen Zusätzen

<sup>40</sup> Albert 1967, 68.

<sup>41</sup> Albert 1967, 71.

<sup>42</sup> Albert 1967, 75.

<sup>43</sup> Petrik 1913, 51–52; allgemein können Magerungsmittel etwa zwischen 10–50% dem Ton beigesetzt werden, Kardos o.J. 13.

<sup>44</sup> Albert 1967, 71.

<sup>45</sup> Albert 1967, 109; Petrik 1913, 92, 159–160.

<sup>46</sup> Gebauer 1980, 23.

<sup>47</sup> Die sog. sekundären Tone sind jene, die nicht an der Stelle des ursprünglichen Gesteins verblieben waren, und sich deshalb aus verschiedenen Tonbestandteilen zusammensetzten. Charakteristisch für diese ist, dass sie viel Eisen, Quarz, Glimmer und andere Verunreinigungen enthalten, Kardos o.J. 7.

<sup>48</sup> Grofsik 1940, 356.

<sup>49</sup> Petrik 1913, 61; Kardos o.J. 39. „Die Töpfer auf der ganzen Welt, die mit primitiver Technologie arbeiten und poröse Gefässe herstellen, kennen verschiedene

Verfahren, mit deren Hilfe sie ihre Gefässe mehr oder weniger wasserundurchlässig machten...

Die Töpfer der Fiji-Inseln verschmieren ihre Gefässe äusserlich mit Teer.“ Bei der Beschreibung der norischen Ware wird oft der Begriff der „wachsglänzenden Oberfläche“ benutzt, welche aller Wahrscheinlichkeit nach durch ein Eintauchen in Wachs zustande kam, s. Tober 2001, 115; Bei den Auerbergtöpfen wurde eine Wachsimprägnation schon von G. Pohl im Jahre 1959 registriert, G. Pohl: Wachsgetränkte einheimische Keramik frühromischer Zeit aus Raetien. Germania 37 (1959) 244–246; E. Schindler-Kaudelka und Ch. Flügel beobachteten, dass diese Wachsbehandlung in der Periode nach Claudius nicht zu verfolgen ist, obwohl dieser Wachsbezug die Wärmeleitungs- und Wärmebestandfähigkeit positiv beeinflusst. Diese Mischung besteht aus „Bienenwachs, Steatit und Talg“, Flügel–Schindler-Kaudelka 1995, 78.



gemagerten Gefäßen die Rissbildung wesentlich sinken lässt.<sup>50</sup> Glimmer widersteht den Wärmeeinwirkungen gut.<sup>51</sup>

Die Wirkung von Kalziumkarbonat (Kalkkörner, Muschelbruch und Schnecken, Mergelknollen), ob in der Tonmasse fein verteilt oder körnig, ist sehr unterschiedlich. Der fein verteilten Kalk enthaltende Ton, die sog. Schalentonerde,<sup>52</sup> die gut auf der Töpferscheibe zu verarbeiten ist und ein glattwandiges Gefäß entstehen lässt, widersteht den schnellen Temperaturschwankungen aber nicht. Die Töpferliteratur macht darauf aufmerksam, dass die Kalkkörner im Scherben im Feuer in gebrannten Kalk (Kalziumoxid) umgewandelt werden und beim Zusammentreffen mit Wasser in Reaktion treten. Die Kalziumhydroxidbildung (gelöschter Kalk) wird von einem ca. anderthalbfachen Volumenzuwachs begleitet, in dessen Folge auf der Gefäßoberfläche kegelförmige Abplatzungen und Risse zu beobachten sind.<sup>53</sup> Auf der Oberfläche des gebrannten Gefäßes kann diese Reaktion nachträglich erfolgen, allein das Wassergehalt der Luft ist schon ausreichend für die Bildung von Kratern. Das archäologische Material widerspricht diesen Feststellungen nicht, allerdings hat man diese Erscheinungen bei der Keramikherstellung nicht als Fehler betrachtet, sondern absichtlich angewandt. Die organischen und kalziumkarbonathaltigen Substanzen verbrennen während des Brandes, bilden häufig Abplatzungen, wodurch ein löchriger poröser (Kraterporen, lime bowling) Scherben entsteht, welche über eine erhöhte Wärmeleitungsfähigkeit und Bruchfestigkeit verfügt.<sup>54</sup> Durch Untersuchungen konnte bewiesen werden, dass die Oberfläche des über 800 °C erhitzten Gefäßes ausbricht und die organischen und kalkigen Komponenten gegebenenfalls ausfallen. Es ist damit zu erklären, dass das körnige Kalziumkarbonat im Ton ebenso umgewandelt wird wie beim Kalkbrennen. Beim Verbrennen von Kalziumkarbonat bei 650–900 °C entsteht Kohlendioxid und Kalziumoxid (gebrannter Kalk), woraus durch Absorption Kalziumhydroxid (gelöschter Kalk) gebildet wird. Dadurch vergrößert sich das Volumen so, dass die Scherbenoberfläche abspringt und sich Kalkkrater bilden. Vielfach sind in diesen Kratern die Reste der Magerungssubstanzen gut ihre Definierung erleichternd zu erkennen.

Im Gegensatz hält E. Schindler-Kaudelka<sup>55</sup> das Entstehen der löchrigen, porösen Oberfläche für eine sekundäre Erscheinungsauswirkung, da der säurehaltige Boden nämlich die kalkhaltigen Magerungspartikeln<sup>56</sup> ausschwemmt. Die löchrige Oberfläche ist allerdings in jedem Fall nicht ausschließlich als Folge der sekundären Bodeneinwirkungen anzusehen, oft passen in unterschiedlichem Maße löcherige Scherben zusammen.

In dem Fall, wenn sich ein Gefäß aus porösen und weniger porösen Scherben zusammenstellen lässt, muss man auch mit dem Fakt rechnen, dass die Poren am unteren Teil des Gefäßes durch das Kochen zuzementiert<sup>57</sup> worden sein konnten.

Selten kommt körniger Feldspatsand als Verunreinigung im Ton vor.

Eisenpirit<sup>58</sup> zerfällt beim oxydierenden Brand in Eisendioxid und Sulfidendioxid, was in ausgebrannter Scherbe in Form von rotbraunen Körnchen erscheint.

Die *Farbe des Gefäßes* hängt neben dem *Brandmethode* (Ofengase) wesentlich von der Zusammensetzung des Tones ab (Eisenoxid – in erster Linie Eisen-, Mangan- und Titanoxid),<sup>59</sup> der Farbton wird auch von der Höhe der Brandtemperatur beeinflusst.

a) *gelb-rot-rötlich braun*: Während des oxydierenden Brandes erhält der eisenoxidhaltige Ton diese Farben. Die Farbschattierungen hängen von der Temperaturhöhe beim Brand ab.

<sup>50</sup> Durch die Versuche von J. Weiss konnte das Mass der durch den Brand entstehenden Fehler durch die dem Ton beigemengte pulvierte, schon ausgebrannte Scherben von 50% auf 5% gesenkt werden Weiss 1994, 116.

<sup>51</sup> Kardos o.J. 13.

<sup>52</sup> Petrik 1913, 166. neben der Schalentonerde unterscheidet er den sog. Kochtopfton, der aus der Sicht des Töpferhandwerks ohne Kalkbeimengung nur fein verteilten Sand beinhaltet; Furger – Deschler Erb bezeichnen den archäologischen Beobachtungen nach den Kochtopfton aber gerade als stark gemagert, Furger – Deschler Erb 1992, 89.

<sup>53</sup> Albert 1967, 109; Gebauer 1980, 26.

<sup>54</sup> Flügel – Joachimski – Flügel 1997, 278–279, mit Literaturhinweis.

<sup>55</sup> Schindler-Kaudelka 1997, 117.

<sup>56</sup> Schneider 1989, 20; Gastgeb 1995, 212; Tober 2001, Anm. 706.

<sup>57</sup> Magetti – Kahr 1981, 2; Es ist aber auch „die Abdichtung“ der Scherbe durch Mehlsuppe oder Fett archäologisch nachzuweisen, die die Unebenheiten ausgleicht und die Poren zuschließt, Furger – Deschler Erb 1992, 448.

<sup>58</sup> Sog. „Narrengold“, Kardos o.J. 10.

<sup>59</sup> Gebauer 1980, 19.



b) *grau-braun-schwarz*: Der eisenoxidhaltige Ton erlangt bei reduzierenden Einflüssen die obigen Farbschattierungen.

c) *rot-hellgelb*: Der Ton mit fein verteilten Kalkanteilen verhält sich unterschiedlich. Bei höheren Temperaturen wird der Ton hellgelb. Diese Schattierung kommt aber bei handgeformter Keramik nicht vor, da diese Tonart für die Herstellung sog. Tafelgeschirrs geeignet war, nicht aber für die Erfordernisse die an Kochgeschirr zu stellen waren.

Wir unterscheiden *reduzierenden* und *oxydierenden Brand*. Die Reduktion ist nach L. Petrik jener chemische Prozess, beim ein Metalloxid mit Kohlenstoff oder allgemein mit einem solchen Stoff erhitzt wird, der sich mit Sauerstoff leichter verbindet als mit Metall. Befindet sich im Brennofen keine überflüssige Luft, so kann der Kohlenstoff in der Flamme nicht verbrennen, die Flamme wird russig und qualmig. Dies reduziert auch das im Ton enthaltene Eisenoxid, und eine rötlich-gelbe Scherbe wird grau.<sup>60</sup> Beschickt man den Brennofen mit viel Brennmaterial und lässt gleichzeitig weniger Luft ein, als zur Verbrennung nötig, so wird das Brennmaterial nicht vollständig ausgenutzt, da ein Teil nur zu Kohlenmonoxid verbrennt. Hierbei kann aber eine höhere Brenntemperatur erreicht werden, da sich die entwickelte Wärme auf ein kleineres Gasvolumen verteilt.<sup>61</sup>

Wird relativ wenig Brennmaterial in den Brennofen gegeben und überflüssige Luft zugeführt, verbrennt das Brennmaterial vollständig zu Kohlendioxid und Wasser. Die Flamme hat *oxidierende Wirkung*, allerdings können so nur geringere Temperaturen erreicht werden, da die entstehende Wärme auf ein grösseres Gasvolumen entfällt.<sup>62</sup>

Die Farbe des Gefässes, ob grau-schwarze oder rot-braune Schattierungen aufweist, lässt bis zu einem gewissen Grad Schlüsse auf die Brandmethode zu. Es darf aber nicht ausschließlich nur die Oberfläche des Scherbens betrachtet werden. Besonders bei handgeformter Keramik weicht das Innere der Scherben von der Farbe der Oberfläche ab, und beide zusammen betrachtet lassen bessere Aussagen über die Methode des Brandes zu.<sup>63</sup>

Beim reduzierenden Brennen ist der Scherbenkern dunkler, sein Mantel hellgrau. Dagegen ist beim Oxydationsbrand der Scherbenmantel rot-braun, wogegen der Scherbenkern oft grau bleibt, was in der Keramikliteratur als „partielle Oxydation“ (Bezeichnung nach *Shephard 1956*, 213) beschrieben wird.<sup>64</sup> Der Farbumschlag kann auch während beim Abkühlen durch Reoxydationsprozess entstehen.<sup>65</sup> Die häufig an den Gefässen beobachteten Farbflecken können während der Reoxydationsvorgänge infolge einer sekundären Hitzeeinwirkung hervorgerufen worden sein, was indirekt auch auf die funktionale Anwendung weist, d.h. diese Gefässe kamen direkt mit dem Feuer in Berührung, wurden als Kochgeschirr benutzt.

Während des Kochens beim steigenden Temperatur erhöht sich die *Wärmeleitungsfähigkeit* bei den Gefässen mit über 1 mm Porengrösse in größerem Maße, was in diesem Falle wesentlich dem in den Poren die Luft ablösenden Wasser zuschreiben ist.<sup>66</sup> Nach den römischen Alltagskeramik scheinen diese Kenntnisse als Erfahrungen beim Herstellen des Kochgeschirrs bekannt zu sein.

Im Folgenden soll die handgeformte Keramik vom Vicus Albertfalva,<sup>67</sup> von Tokod-Altáró-Erzsébetakna und aus der Gemarkung Úny-Baráthegy,<sup>68</sup> weiter aus der einheimischen Siedlung von Szakály-Réti földek,<sup>69</sup> nach den oben besprochenen Gesichtspunkten verglichen werden. Auf jedem dieser Fundplätze kommen spätkeltische Keramikformen vor, jedoch ist die römische Besiedlungsphase bedeutender. Diese Fundplätze sind ihrem Charakter nach ähnlich und datieren etwa in die gleiche Zeit. In Tokod und Szakály bleibt, im Gegensatz zu den anderen zwei Fundplätzen, die handgeformte Keramik jedoch längere Zeit, auch an der Wende vom 2. zum 3. Jh. n.Chr., in der Phase als sich die Sigillaten von Rheinzabern nach

<sup>60</sup> Petrik 1913, 9–10.

<sup>61</sup> Petrik 1913, 151.

<sup>62</sup> Petrik 1913, 151.

<sup>63</sup> Schneider 1989, 11. Stellt fest, dass die Archäologie bei der Analyse technischer Gesichtspunkte zu viel Gewicht auf die Oberflächenfarbe des Scherbens legt und die Betrachtung des Scherbenbruchs oft außer Acht gelassen wird.

<sup>64</sup> Vossen 1971, 114.

<sup>65</sup> Magetti – Kahr 1981, 4–5; Diese Erscheinung wurde bei den Gefässen aus dem 2. Ofen von Solothurn registriert, Furrer 1996, 20.

<sup>66</sup> Albert 1967, 123–126.

<sup>67</sup> Horváth 1999a, 367–379.

<sup>68</sup> Horváth 1997, Kat.-Nr. 537–792; 793–859.

<sup>69</sup> Gabler – Horváth 1996, 158–159.



Pannonien ausbreiten, in Gebrauch. Die Stücke von Albertfalva sind im allgemeinen ins 1.–2. Jh. n.Chr. zu datieren.

### 1. Form, Funktion und typologische Einordnung

Bei der Keramik sind die *Form* und die *primäre Funktion*<sup>70</sup> voneinander untrennbare Begriffe. Handgeformte Gefäßscherben aus geschlossenen Objekten kamen nie alleine, sondern gemeinsam mit Import- und provinzialrömischer Ware vor. Einem jeweiligen Gebrauchsgegenstand (einfache Alltagskeramik,<sup>71</sup> Kochgeschirr) lässt sich eine bestimmte Art der Verarbeitung und Form zuordnen (Gebrauchstöpferei). Hält man sich die funktionale Trennung der Gefäße vor Augen, lassen sich zwei grundlegende Aussagen treffen: in allen fünf Fundplätzen bilden Kochgeschirr, Töpfe (und Dreifussschalen)<sup>72</sup> sowie Deckel die größte Fundgruppe (*Abb. 1–3*). Die Keramikformen betrachtend, weist die Siedlung von Albertfalva die größte Streuung auf: als Unikat im Formspektrum ist eine Backtasse anzusehen. Tellerformen kennen wir auch aus Tokod und Szakály, bei denen eine Funktion als Backteller auch in Frage zu kommen ist. Schüsseln wurden in ein oder zwei Exemplaren, mit Ausnahme des Szakályer Materials, überall gefunden. Dagegen fehlen im Vicus von Albertfalva im bislang bekannten Keramikspektrum die Tassen, wenn nicht ein Henkelbruchstück hierher gerechnet wird. Im bearbeiteten Material befindet sich kein einziges Tafelgeschirr.

In Albertfalva differenziert der Raddurchmesser der Töpfe stark (zwischen 12 und 26 cm); die meisten Gefäße sind aber mit kleineren Maßangaben (12–16 cm) zu bezeichnen, was völlig mit den Werten der Deckel korrespondiert. In Tokod und Úny ist diese Abweichung noch gravierender (8–32 cm), aber die Mehrzahl stimmt auch hier mit den Werten der Deckel, die zwischen 12 und 21 cm liegen, überein. Das erhärtet die Funktion der Töpfe als Kochgeschirr. So muss bei den kleineren und größeren Gefäßen auch eine andere Gebrauchsfunktion erwogen werden. Die größeren konnten auch als Vorratsgefäße dienen. Ihre Volumengröße lässt sich aber an Hand des fragmentierten Materials nicht ermitteln.

Die Zusammenstellung der Typentafel ist für die jeweilige Forschung immer die größte Schwierigkeit, was teilweise dem fragmentarischen Zustand des Materials und der Wechselhaftigkeit der Formen als Folge der Formgebung durch die Hand zuzuschreiben ist. Bei diesem Überblick möchte ich von der Analyse einzelner Formen absehen, dies kann der Materialpublikation detailliert entnommen werden.<sup>73</sup> Im Zusammenhang mit den archäologischen Typen der handgeformten Keramik machten auch mehrere Autoren<sup>74</sup> darauf aufmerksam, dass typochronologisch abtrennbare Charakteristika hinter den abweichenden Randausbildungen nicht in jedem Fall zu suchen sind, wie auch ähnlich geformte Randstücke aus weit von einander entfernten Gebieten nicht zwangsläufig sicher auf ein kontinuierliches Weiterleben der Töpfertradition einer Volksgruppe weisen. Der Definition Ch. Flügels nach<sup>75</sup> ist der Typ jenes Ensemble von Gefäßen, welches als eine Gruppe über bestimmte gemeinsame Charakteristika verfügt, jedoch die einzelnen Stücke selbst nicht in jedem Fall jedes einzelne Charakteristikum tragen.

Bei den Esztergomer Gefäßen ist die Formähnlichkeit einiger Typen der handgeformten Gefäße und der auf der Töpferscheibe hergestellten Varianten unbestreitbar.<sup>76</sup>

<sup>70</sup> Leckebusch 1998, 380 und 396. Das Kochgeschirr ist der Form nach so ein Topf, in dem sekundär Speisereste, bzw. an der Oberfläche Farbveränderungen durch die Berührung mit dem offenen Feuer zu beobachten sind.

<sup>71</sup> Hofmann 1988, 296.

<sup>72</sup> Es ist ein Koch- und Speisegefäß nach römischem Vorbild und keine bodenständige Form.

<sup>73</sup> Horváth 1998, 68–69, Taf. 1–4; Horváth 1999a, 372–374.

<sup>74</sup> Rieckhoff 1995, 30; Wieland 1996, 131–132; Flügel 1996, 345.

<sup>75</sup> Flügel 1996, 345.

<sup>76</sup> Zu ähnlichem Schluss kommt die Arbeit über die römische Keramik der Schweiz von Schucany et al. 1999, 70, bzw. Zanier auf Grundlage des Materials vom Lager Ellingen, Zanier 1992, 143; dagegen meint Struck den Ursprung der Formcharakteristika bei der handgeformten Keramik in der vorrömischen Phase gefunden zu haben, M. Struck: Römische Grabfunde und Siedlungen im Isartal bei Ergolding, Landkreis Landshut. MBV Reihe A 71. München 1996, 79. Gleichen Standpunkt vertreten die Autoren im Zusammenhang mit der früh-römischen Siedlung von Bornheim-Sechtem, Lenz – Schuler 1998, 598.



## 2. Verzierungsarten

Die meisten Verzierungsarten kommen für gewöhnlich auf je einem Wandfragment vor, so dass wir nur verzerrte Informationen über den möglichen Zusammenhang zwischen Form und Verzierung erhalten. Deshalb behandeln wir den Charakter der Verzierungsarten und der Gefäßformen getrennt. Bei einigen Formen ist jedoch eine charakteristische Verzierung zu beobachten, wohinter eventuell sogar ethnochronologische Merkmale auszumachen sind.

Die bislang vorgekommenen Verzierungsarten bei der handgeformten Keramik lassen sich grundlegend in drei Gruppen gliedern<sup>77</sup>: 1. die plastischen Verzierungen (ungegliederte einfache Knubben und Wülste), 2. die eingetieften Verzierungen (Fingereindrücken, durch Fingereindrücke und schräge Einstiche gegliederte Ränder und Sohlenpartie, Einschnitten, eingetiefte Wellenlinie usw.), 3. Kombination von plastischer und eingetiefter Verzierungsarten (mit Fingereindruck gegliederte einfache Knubbe, durch Fingereindrücke gegliederte Leisten, Doppelknubben und Leisten mit Fingereindrücken, mit Fingereindrücken und schrägen Einschnitten gegliederte Leisten und Kammstrichdekor usw.)

Die Anzahl der verzierten Stücke ist in Albertfalva relativ höher (36,8%), als in Tokod (26,5%) oder Úny (26,8%).<sup>78</sup> Im Grubenbefund von Szakály waren von 12 Bruchstücken drei verziert.<sup>79</sup> Diese Abweichungen sind prägnanter in der Verteilung der jeweils verwendeten Verzierungsarten. Im römischen Material kommen die plastische Verzierungen an sich nicht vor, sie erscheinen eher auf der latènezeitlichen Keramik. Die Kombination mit eingetieften Verzierungen ist jedoch viel häufiger und wurde dadurch ein dekorativer Charakter den einfachen Knubben bzw. Leisten entlehnt.<sup>80</sup> Die durch Fingereindrücke gegliederten Leisten auf den Stücken von Albertfalva ähneln denen von Tokod und Úny und befinden sich auf dem Bauch der muschelgemagerten Töpfe. Auch zwei von drei Stücken aus Szakály tragen mit Fingereindrücken gegliederte Leiste bzw. Knubben, wogegen die Qualität des Scherbens grundlegend anders ist.

Das Übergewicht der eingetieften Verzierungen ist gleicherweise für die Fundplätze von Tokod, Úny, Albertfalva und auch Budapest–Medve-Str. charakteristisch.<sup>81</sup> Das Fundmaterial von Albertfalva und Medve-Str. unterscheidet sich allerdings grundlegend von dem der anderen zwei Fundplätze, da hier nur der Kammstich angewandt wurde. Im publizierten Material von Szakály wurde nur auf einem einzigen Stück eine mit Holz eingekerbte Linienverzierung beobachtet.<sup>82</sup>

Der *Spatel-* bzw. *Kammstich* ist die am häufigsten vorkommende Verzierungsart, welche in den noch weichen Ton mit einem zinkenartigen Gerät eingegraben wurde. Dem Charakter nach diente der Spatel- bzw. Kammstich in den meisten Fällen gleichzeitig der Oberflächenbehandlung wie auch der Verzierung. Mit unterschiedlich dichten Kämmen wurden in erster Linie Seitenwände und Schultern von Töpfen und Deckeln außen, oder Hals und Rand innen, oder eventuell der Schulterteil mit Linienbündeln versehen, oftmals wurden aber auch beide Seiten des Gefäßes in gleicher Art verziert. Beim Spatel- bzw. Kammstich stellt sich die Frage, ob dieser reine ästhetische Funktion besaß, oder nicht auch aus praktischen Erwägungen verwandt wurde.<sup>83</sup> Es muss festgestellt werden, dass er häufig nur am Schulterteil oder in den oberen Regionen des Gefäßinneren vorkommt, was für eine reine Zierfunktion spricht. So ist jener Gefäßteil mit Spatel- bzw. Kammstich verziert, der vom Gefäßinneren noch zu sehen

<sup>77</sup> In seinem Werk über die ungarischen Töpferei reiht M. Kresz diese Verzierungsarten einer gemeinsamen Gruppe zu, bei der die Abwandlung der Oberfläche vom positiven Charakter ist: reliefartige Verzierung oder aber vom negativen Charakter ist: eingetiefte, eingeritzte Verzierungsarten, *Kardos o.J.* 32.

<sup>78</sup> Horváth 1999a, 374, 79.

<sup>79</sup> Gabler – Horváth 1996, Kat.-Nr. 89, 91, 97.

<sup>80</sup> Im Zusammenhang mit dem Kochgeschirr von Magdalensberg weist E. Schindler-Kaudelka jedoch darauf hin, dass in diesem Gebiet die kombinierte Verzierungsart nicht vorkommt, dagegen die

eingetieften Verzierungen auf der Schulter häufig auftreten, *Schindler-Kaudelka* 1997, 120.

<sup>81</sup> Horváth 1999a, 374.

<sup>82</sup> Gabler–Horváth 1996, 18, Abb. 12.

<sup>83</sup> Wieland 1996, 152. Sieht die Verwendung deshalb als gezielt, da die Oberfläche des Gefäßes durch den Kammstich grober und dadurch leichter anzufassen war. Weiter gibt er den dickeren und tieferen Rillen auch jene Aufgabe, dass die derart vergrößerte Oberfläche, mit Wasser durchtränkt, zur Aufbewahrung frischer Lebensmittel geeigneter war (sog. Verdunstungs-Kühleffekt).



ist, und das leichtere Handhaben kann hier keine Rolle spielen. Solche Behandlung der inneren Oberfläche kommt im Fundmaterial von Úny nicht vor. In Tokod jedoch ist diese Verzierung auf Topfrändern und -deckeln (im Verhältnis 6:2) zu beobachten, wie auch in Albertfalva auf vier Rändern und Schultern sowie auf zwei Deckeln.

In spätkeltischen Fundkomplexen kommen senkrechte Kammstrichverzierungen insgesamt nur bei den handgeformten Nachahmungen der Graphittonkeramik vor. Für die römischen Stücke sind neben waagerechten Linienbündeln auf Schulter und Bauch auch Kammstrichverzierungen aus unregelmässigen, sich kreuzenden kurzen Linienbündeln charakteristisch. Die Forschung stimmt darin überein, dass es sich um die Nachlassenschaft der keltischen Keramikunst handelt, deren Anfänge bis in die ältere La Tène-Zeit reichen und in der LT C-Periode schon weit verbreitet waren.<sup>84</sup> In der Römerzeit ist bis zu den Markomannenkriegen weit bekannt, und auf bestimmten Gefässen (Urnen, Tafelgeschirr, Töpfe, Deckel)<sup>85</sup> Anfang des 3. Jh. auch noch vereinzelt anzutreffen. Der Spatel- bzw. Kammstrich kommt häufig zusammen mit anderen Motiven vor, wie z.B. mit den eingeritzten Wellenlinien, welche ebenfalls nur für den keltischen Kulturkreis charakteristisch sind. Dem Material vom dakischen Charakter ist wiederum jener Topf zuzurechnen, auf dessen Schulter neben den geschwungenen Kammstrichlinienbündeln vier ungegliederte Knubben zu finden sind,<sup>86</sup> und weiters die Scherbe, auf deren Hals Wellenlinienbündel in Kammstrich mit darunter befindlichen einfachen Knubben angebracht sind.<sup>87</sup>

Die Verzierung mit eingetieften Wellenlinien bzw. Wellenlinienbündeln des Halses der Gefässe mit ausladendem Rand ist in klassischen dakischen Gebieten sehr häufig. Sowohl aus dem keltischen als gleichermaßen aus dakischem Milieu können jene Töpfe stammen, die neben dem Kammstrich mit Fingereindrücken auch mit eingeritzten schrägen Linien gegliederten Leisten verziert sind. Im dakischen Kulturkreis sind plastische Verzierungsarten wesentlich verbreiteter.

Für das Alb-Gebirge und das Obere Donaugebiet sind Kammeindrücke charakteristisch, welche auch infolge der römischen Besetzung weit verbreitet blieben. Dies trifft für unser Gebiet nicht zu; ein ähnliches Motiv wurde lediglich auf einem spätkeltischen Bruchstück aus Tokod-Szorosok beobachtet.<sup>88</sup> Die Behandlung der Gefässoberfläche mit sog. Spatelstich ist selten, gemessen an der vorherigen Verzierungsart, bei der die Kammzinken regelmässig aufgebracht wurden und gleichmässig tief in die Oberfläche des Gefässes eingetieft wurden, verleiht dagegen die Verarbeitung mit einem unregelmässig endenden Holz- oder Knochenstäbchen dem Gefäss einen groben Charakter.

Die *vertiefte Wellenlinie* kommt gleichfalls als Abschluss der Kammstrichverzierung vor, kann aber auch ein selbständiges Verzierungselement bilden. Es handelt sich um die in der Bronzezeit auftretenden dann in der Hallstatt- bzw. La Tène-Zeit in den Hintergrund gedrängte Verzierung, welche schließlich zwischen Ende des 1. Jh. v.Chr. und Anfang 1. Jh. n.Chr. wieder auf den scheibengedrehten und handgeformten Gefässen erscheint.<sup>89</sup> Dabei handelt es sich um eine bzw. mehrere parallel zueinander verlaufende Wellenlinie(n), welche mit einem einheitlich schmalen oder breiteren Gerät oder einem nicht gleichmässig endenden Hölzchen eingetieft wurde(n). Meistens befindet sie sich waagrecht auf der Schulter bzw. dem Bauch,

<sup>84</sup> Wieland 1996, 152; Zur Abgrenzung der in keltischer Tradition stehenden Keramik von Napoca wird als alleiniges Argument die Kammstrich- bzw. besenstrichartige Verzierung angeführt. Bemerkenswert wird allerdings, dass sich die Formen der Gefässe von der römischen Ware nicht unterscheiden, *Rusu-Bolindeț – Voișian – Cociș* 2000, 167.

<sup>85</sup> Bónis 1942, 10–11; Palágyi 1995, 139; Kelemen 1997, 108.

<sup>86</sup> Eine ähnliche Verzierung ist auf einem Topf von Gellérthegy mit ausladendem Rand zu finden, Bónis 1969, Abb. 25. 15.

<sup>87</sup> Schörgendorfer 1942, 112; Kelemen 1997, 108. Die mit Kammstrich kombinierte Verzierungsart

der handgeformten Keramik Südwest- und Ost-Pannoniens betrachtet sie als in der Tradition der Urbevölkerung stehend. Ähnlich verzierte Keramik ist aus dem Banat aus den Fundplätzen von Kovačica (Antalfalva), Orešac (Homokdiód), Dubovac (Dunadombó) bekannt, s. Rašajski 1961, Karte 1; das Exemplar in Šimanovci Brukner 1995, T. XX, 205 weicht insofern von unserem Stück ab, als zwischen den am Hals befindlichen Wellenlinienbündeln in Kammstrichverzierung ein waagrechtes Linienbündel verläuft, weiters in Capilna (Sebeskápolna): Glodariu – Moga 1989, Abb. 41, 1–2.

<sup>88</sup> Horváth 1997, Kat.-Nr. 535.

<sup>89</sup> Schörgendorfer 1942, 113.



kann aber auch vom Hals herab senkrecht verlaufen. In spätkeltischen Fundkomplexen ist diese Verzierungsart nicht sehr häufig. Es sind auf einem fassförmigen Topf aus Esztergom-Szentgyörgymező bzw. auf einer handgeformten Variante eines Graphittontopfes aus Esztergom-Várhegy bekannt.<sup>90</sup> Wellenlinien sind auch auf römischen Scherben zu finden und kann in der Kombination mit anderen Verzierungs-elementen auftreten.

Aus Úny ist ein Deckel bekannt, der mit Holz *eingetiefes*, X-förmiges Zeichen trug.<sup>91</sup> In Szakály ist eine Wandscherbe mit eingetieftem Tannenzweigmotiv bekannt.<sup>92</sup>

In besonders großer Menge kommen unter den handgeformten Gefäßen Deckel bzw. Tassen vor,<sup>93</sup> deren Rand durch *Fingereindrücken* bzw. *Einstichen* gegliedert ist. Diese Verzierung an Rändern ist schon in spätbronzezeitlichen und hallstattzeitlichen Fundkomplexen<sup>94</sup> zu beobachten, findet man aber auch auf den spätkeltischen Gefäßen in großer Zahl.<sup>95</sup> In spätrömischer Zeit erscheint es bei der markomann-quadische Keramik als Besonderheit.<sup>96</sup>

Betrachtet man die Funktions- und Formmerkmale, es zeigt sich, dass die *Fingereindrücken* und *Einstichen* nicht nur auf Töpfen, sondern auch auf Tassen vorkommen. In unzähligen Fällen ist schwer zu entscheiden, ob die eingetiefte Verzierung mit der Hand oder aber mit einem abgerundten Holz- oder Knochenstäbchen erreicht wurde, meist können nur die Stellen der Fingerabdrücke Aufschluss geben.<sup>97</sup> Zu den einklemmungsartigen Verzierungen können jene Stücke gerechnet werden, auf denen die rippenartige Verzierung nicht getrennt herausgeformt und nachträglich auf die Gefäßoberfläche aufgebracht wurde, sondern direkt aus dem Gefäß selbst herausgeformt wurde und deshalb zu der Gruppe der eingetieften Verzierungen zu rechnen ist. Es handelt sich hier um eine archaische Verzierungsart. Das Muster der eingetieften Reihenverzierung kann dreieckig,<sup>98</sup> oval-linsenförmig,<sup>99</sup> rund-blattförmig oder langgezogen-S-förmig sein und kommt gleichfalls auf spätkeltischen und römischen Gefäßen vor.

Sowohl auf spätkeltischen<sup>100</sup> als auch frühromischen Gefäßen sind schmale, mit einem spitzen Werkzeug auf den noch nicht gebrannten Scherben aufgebrachte *schräg* bzw. *senkrecht verlaufende kurze eingetiefte Linien* zu beobachten.

<sup>90</sup> Horváth 1997, Kat.-Nr. 164, 320; In der Form übereinstimmende und gleichfalls mit Wellenlinien verzierte Keramik kam in Gomolova vor Szekeeres 1961, Taf. 3. 32 und Kuzmin: Brukner 1995, Taf. X. 101.

<sup>91</sup> Horváth 1997, Kat.-Nr. 853.

<sup>92</sup> Gabler – Horváth 1996, Kat.-Nr. 91.

<sup>93</sup> Römische Deckel mit ähnlichem Rand kennen wir aus Gorsium (Tác), Fitz et al. 1978, Taf. XX. 525; Auch auf den spätkeltischen-römischen handgeformten Gefäßen der südost-bayrischen Gruppe ist diese Verzierung recht häufig vorgekommen: Regensburg, Paring, Landshut, Straubing, Rieckhoff 1995, 46, Taf. 10.

<sup>94</sup> Ilon 1996, 138, Taf. III. 6. Némethbánya; Jerem 1981, Abb. 9. 2. Sopron–Krautacker.

<sup>95</sup> Jovanović 1971, Taf. V. 4. eine Tasse mit eingedrückter Verzierung am Rand; Jovanović 1978, Taf. II. 3. am Rand einer Tasse mit Einschnitten und Jovanović – Jovanović 1988, Taf. XXXI. 6. von Gomolava; Todorović 1962, Abb. 3. eine dakische Tasse von Židovar (Zsidóvár), bei der nicht nur der Rand und Sohlenrand, sondern auch der Henkel mit Einschnitten verziert ist. Popilian 1976, Taf. LXXIV. 941. dakische Tasse von Oltenia, deren Rand gleichfalls mit Fingereindrücken gegliedert ist. Preda 1986, Taf. XV. 4, XVI. 3, 5, XVII. 3. dakische Tassen von Oltenia Inferior. Popilian 1980, Taf. XXIII. M. 155/1, M. 162/2, Taf. XLV. 3, 6–7. dakische Tassen bzw. Töpfe aus dem Fundort von

Locusteni; Crişan 1978, Taf. 1. 3, 5, 2. 1, 8, 3. 5. Töpfe von Ziridava (Pécska, Pecica). Ottományi–Gabler 1985, Taf. XXIX. 10. eine Tasse von Páty – Herceghalom, die am Sohlenrand mit Eindrücken gegliedert ist, stammt aus dem Fundkomplex der 1.–2. Jh. n.Chr.

<sup>96</sup> Ács-Vaspuszta: Ottományi 1989, Abb. 116. 34, 123. 8/a; Pilismarót-Malompaták: Ottományi 1996, Abb. 7. 8.

<sup>97</sup> Ähnliche Verzierung vgl. Gellérthegey-Tabán: Bónis 1969, Abb. 10. 11, 34. 21; Szentendre-Cementgyár: Visy 1970, Taf. IV. 13; Gorsium: Fitz et al. 1976, Taf. XVIII. 1; Balatonfüzfő: Kelemen 1980, 59, Abb. VI. 6.

<sup>98</sup> Gellérthegey-Tabán: Bónis 1969, Abb. 22. 3; Gomolava: Rašajski 1954, Taf. VI. 8; Kuzmin, Brukner 1995, Taf. VII. 62; und Wieliczka: Pieta 1986, Abb. 7. 5, aus frühromischen Fundzusammenhängen.

<sup>99</sup> Bónis 1969, Abb. 25. 14, 38. 17, 58. 25, 104. 9.

<sup>98</sup> Gellérthegey-Tabán: Bónis 1969, Abb. 22. 3; Gomolava: Rašajski 1954, Taf. VI. 8; Kuzmin: Brukner 1995, Taf. VII. 62; Wieliczka: Pieta 1986, Abb. 7. 5, frühromisch.

<sup>99</sup> Bónis 1969, Abb. 25. 14, 38. 17, 58. 25, 104. 9.

<sup>100</sup> Gellérthegey-Tabán: Bónis 1969, Abb. 13. 16, 15. 19, 62. 33; Plavna (Plávna): Jovanović 1989, Taf. IV. 5, 13; Bare: Brukner 1995, Taf. I. 7; Tilisca (Tilicske): Lupu 1989, Taf. 9. 4; Wieliczka: Pieta 1986, Abb. 7. 2.



*Ungegliederte Knubben*<sup>101</sup> sind aus mehreren spätkeltischen Fundplätzen bekannt. Häufig ist auf der Gefäßinnenseite an der Stelle der Knubbe eine Bauchung festzustellen, welche beim Aufdrücken der Knubbe auf die Gefäßwand entstanden sein kann. Aus einem Seitenbruchstück fiel die aufgeklebte Knubbe heraus und macht erkennbar, wie in die für die Knubbe vorgesehene Stelle ein Grübchen getieft wurde.<sup>102</sup> Selten unterteilte man die Knubben durch senkrechte Einschnitte.<sup>103</sup> Häufiger dagegen ist eine Verzierung in der Knubbenmitte durch Fingereindrücke, wofür Beispiele verschiedener Varianten in spätkeltischen Fundkomplexen bekannt sind.<sup>104</sup> Meistens stehen die Knubben separat (4-5 Stück) rund um die Schulter herum, wovon bei der Kombination mit dem Kammstrich schon die Rede war.

Die *Doppelknubbeauflage*<sup>105</sup> kann auch separat stehen, in spätkeltischen Fundzusammenhängen ist aber die *Kombination mit schräg eingeschnittenen Linien- und mit Fingereindrücken* häufiger.<sup>106</sup>

Nach Kammstrich sind die *ungegliederten oder durch Fingereindrücke oder schräge Einschnitte gegliederten Leisten* das am häufigsten vorkommende Zierelement im vorliegenden Material. Sie ist eine archaische Dekorweise. Relativ selten brachte man ungegliederte Rippen auf die Gefäßwand.<sup>107</sup> Die durch schräge Einschnitten gegliederte Leiste ist etwas häufiger vertreten.<sup>108</sup>

Die durch Fingereindrücken gegliederte (vielleicht mit abgerundetem Knochen- oder Holzstäbchen) Leisten sind einerseits charakteristisch für die fassförmigen spätkeltischen Töpfe mit sich leicht verbreiterndem Rand,<sup>109</sup> andererseits für die frührömischen muscheligemagerten Gefäße<sup>110</sup> und befinden sich bei letzteren meistens auf dem Gefäßbauch. Die Scherben aus

<sup>101</sup> Schörgendorfer 1942, 117; Crișan 1968, Abb. 70–71; Gellérthegey-Tabán: *Bónis* 1969, Abb. 10, 1–3, 10, 12, 19, 34, 32, 36, 1, 66, 19, hier sind in erster Linie nicht die runden, sondern die waagrecht gestreckten Knubben charakteristisch. Zemplin (Zemplén): *Benadik* 1965, Abb. 12; Gomolava: *Jovanović – Jovanović* 1988, Taf. XXXIII, 1, XVII, 3; Ziridava (Pécska, Pecica): *Crișan* 1978, Taf. 78, 82; Oltenia Inferior: *Preda* 1986, Taf. XIV; aus den römischen Fundkomplexen ist diese Verzierungsart auch bekannt, Inota: *Palágyi* 1982, Taf. V, 7, 1. Hügel.

<sup>102</sup> Esztergom-Szentgyörgymező: *Horváth* 1997, Kat.-Nr. 266; Ähnliche Technologie beobachtete G. Ilon im späthügelgräberzeitlichen-frühurnenfelderzeitlichen Gräberfeld von Nemetbánya, *Ilon* 1996, 140.

<sup>103</sup> Esztergom-Löwy u.: *Horváth* 1997, Kat.-Nr. 86; spätkeltisch; Páty-Herceghalom: *Ottományi – Gabler* 1985, Taf. XXIX, 6, 8; 1.–2. Jh. n.Chr.

<sup>104</sup> Gellérthegey-Tabán: *Bónis* 1969, Abb. 7, 3, 10, 6, 33, 27, 40, 25, 63, 31, auf dem Gellértberg ist eigenständig aber sonst mit Fingereindrücken gegliederten, girlandenartig angebrachten Leisten zusammen vorkommend häufig, dagegen erscheint die runde durch drei Fingereindrücke geteilte Knubbe im Fundmaterial aus der Umgebung von Esztergom nicht. Szentendre-Zementfabrik (Cementgyár): *Vísy* 1970, Taf. IV, 14; Ziridava (Pécska, Pecica): *Crișan* 1978, Taf. 78, 10; Inota: *Palágyi* 1982, Taf. XXI, 3; 2. Hügel, welcher in das 2. Jh. n.Chr. datiert ist.

<sup>105</sup> Gellérthegey-Tabán: *Bónis* 1969, Abb. 19, 26, 22, 1, 22, 5; Szentendre-Zementfabrik (Cementgyár): *Vísy* 1970, Taf. IV, 16, 18, V, 1; Ziridava (Pécska, Pecica): *Crișan* 1978, Taf. 77, 10, 51, 1.

<sup>106</sup> Es ist eine bis in die Bronzezeit zurückreichende Verzierungsart. Die Verwendung der einfachen oder Doppelknubben ist auch bis in die Hallstatt-

bzw. La Tène-Zeit zurückverfolgen, s. Jerem 1981, Abb. 17, 9 und 12; Gellérthegey-Tabán: *Bónis* 1969, Abb. 6, 2, 57, 28; Ziridava (Pécska, Pecica): *Crișan* 1978, Taf. 70, 2.

<sup>107</sup> Dorog, Esztergom-Szentgyörgymező, *Horváth* 1997, Kat.-Nr. 50, 189, 216.

<sup>108</sup> Gellérthegey-Tabán: *Bónis* 1969, Abb. 93, 17–19, 104, 1–2; Szentendre-Zementfabrik (Cementgyár): *Vísy* 1970, Taf. IV, 1–2; Bare: *Brukner* 1995, Taf. I, 9; Gomolava: *Jovanović – Jovanović* 1988, Taf. XIX, 12; Ziridava (Pécska, Pecica): *Crișan* 1978, Taf. 84, 10, 15; Esztergom-Szentgyörgymező bzw. Széchenyi Platz, Pilisecsév-Od szántova, Tokod-Erzsébetakna, *Horváth* 1997, Kat.-Nr. 121, 227, 290, 511, 671–673, 675, 679, 688.

<sup>109</sup> Sie war in der Hallstatt-Zeit weitverbreitet, *Jerem* 1981, Abb. 9, 9, 10, 8, 12, 4, 16, 1; den Stücken von Esztergom stehen auch die Gefäße von Gellérthegey-Tabán in Form und Verzierung nahe, *Bónis* 1969, Abb. 12, 24, 19, 22, 93, 26, 104, 11; Gomolava: *Jovanović* 1971, Beilage 4; *Brukner* 1992, Taf. 20, 134; Ménfőcsanak: *Szőnyi* 1995, Abb. 2, 1; Keramik aus den Fundplätzen Kovin (Kevevára), Dubovac (Dunadombó) bzw. Banatska Palanka (Ó-Palánka) im Banat bekannt, s. *Rašajski* 1960, Karte 1; Plavna (Plávna): *Jovanović* 1989, Taf. VI, 10; Ziridava (Pécska, Pecica): *Crișan* 1978, Taf. 84, 11, 17; Oltenia Inferior: *Preda* 1986, Taf. LXII, 2, LXVI, 6; Tilișca (Tilicske): *Lupu* 1989, Taf. 6, 8; Esztergom-Szentgyörgymező: *Horváth* 1997, 44.

<sup>110</sup> *Bónis* 1957, 72–73: den im Tumulus Ivánc vorgekommenen handgeformten Topf aus dem 2. Jh. n.Chr., der mit Leisten verziert war, spricht sie als germanisch an, s. im Gegensatz dazu *Palágyi* 1995, 140; Balatonfüzfő: *Kelemen* 1980, 59, Abb. VI, 9; ihre Verbreitung im spätkeltischen bzw. römischen Material bringt sie einerseits mit den



Tokod gehören zu den muschelgemagerten frührömischen Stücken, wozu auch ein einziges aus Albertfalva zu zählen ist,<sup>111</sup> wogegen sich das Fragment aus Szakály qualitätsmäßig von den vorherigen abhebt.<sup>112</sup>

### 3. Magerungsarten

Bei der Analyse der Keramikformen habe ich schon darauf verwiesen, dass alle Stücke als Kochgeschirr einzuordnen sind. Unter den Magerungskomponenten aller Fundplätze ist der Anteil der in gebrannter Scherbe im Form von weißen Körnern vorkommenden kalciumkarbonathaltigen Kalkstein- oder Mergelknollen oder Muschelschalen sehr hoch und annähernd gleich. Das Verhältnis zwischen den zwei kalciumkarbonathaltigen Magerungssubstanzen betrachtend, unterscheidet sich Albertfalva vom Tokod und Úny, da hier eher Kalkstein (Mergel?, Kreide?) benutzt wurde als Muscheln.<sup>113</sup> Im Fundplatz der Medve-Str. ist der Gebrauch von Muscheln vollkommen verdrängt. Szakály bildet eine eigenständige Gruppe; nur bei der Hälfte der Stücke lässt sich kalkhaltiges Magerungsmaterial beobachten (kleinere und größere Kalkkörnerchen). Viel auffälliger ist dagegen, dass fast in jedem Fragment unverarbeitete Tonkörnerchen vorkommen.<sup>114</sup>

Auf dem Gebiet von Pannonien treffen wir vielerorts muschelgemagerte Gefäße (Ménfőcsanak,<sup>115</sup> Inota,<sup>116</sup> Gorsium,<sup>117</sup> Szakály-Réti földek,<sup>118</sup> Umgebung von Esztergom,<sup>119</sup> Neszmély-Kalinhegy, Almásfüzitő).<sup>120</sup> Von diesen Fundorten bildet das Siedlungsgebiet der Azaler einen geschlossenen Raum. Im gesamten Territorium in den LT D2 und römischen Fundplätzen kommen die muschelgemagerte Gefäße in unterschiedlicher Menge vor. Es ist keine ausschließlich pannonische Erscheinung im römischen Reich, ähnlich gemagerte Gefäße kennen wir aus Rätien,<sup>121</sup> Britannien<sup>122</sup> ebenfalls. Diese Magerungstechnologie kann nicht allein als Eigenart der spätkeltischen-römischen Phase betrachtet werden, so z.B. beobachtete G. Ilon<sup>123</sup> im spätbronzezeitlichen Material von Némethánya ähnliche (muschel- und schneckengemagerte) Stücke.

### 4. Brandmethoden

Bezüglich des Brandes zeigt jeder der erwähnten Fundplätze ein gemischtes Bild. In Budapest-Medve Str., Albertfalva, Tokod und Úny sind Spuren, die auf eine oxydierende Brandmethode weisen in den Hintergrund gedrängt (ein Drittel der untersuchten Stücke).<sup>124</sup> Die auf der Töpferscheibe gefertigten Kochgefäße sind fast ohne Ausnahme im Reduktionsbrand hergestellt, und auch die handgeformten Gefäße gehören in diese Kategorie.<sup>125</sup> Für die Stücke

Dakern, andererseits mit den Sarmaten in Zusammenhang. Die Verzierung ist auch auf einem kleinen bauchigen Gefäß mit ausladendem Rand aus Ménfőcsanak zu finden, *Szőnyi 1995*, Abb. 2. 2, 4; Bajna, Bajót, Esztergom-Várhegy, Kesztlőc, Máriahalom, Mogyorósbánya, Nagysáp, Pilismarót, Sárísáp, Tokod-Erzsébetakna, Úny, *Horváth 1997*, 44.

<sup>111</sup> *Horváth 1999a*, Kat.-Nr. 14, 2, Abb. 6–7.

<sup>112</sup> *Gabler – Horváth 1996*, Kat.-Nr. 97.

<sup>113</sup> *Horváth 1999a*, Kat.-Nr. 97.

<sup>114</sup> *Gabler – Horváth 1996*, 146–147, 158.

<sup>115</sup> Für die Informationen im Zusammenhang mit den muschelgemagerten Gefäßen von Ménfőcsanak und Neszmély-Kalinhegy habe ich Andrea Vaday zu danken.

<sup>116</sup> *Palágyi 1995*, Abb. 1.

<sup>117</sup> Auf dem Foto erscheinen die Gefäße als ob sie muschelgemagert wären, *Fitz et al. 1976*, Taf. XVIII: 1=243.

<sup>118</sup> *Gabler – Horváth 1996*, 159. Im Gegensatz zum Material der anderen Fundplätze sind die

muschelgemagerten Stücke von Szakály auf der Töpferscheibe hergestellt. Die Muschelschale wurde, gründlich zerkleinert und dem Ton beigegeben. Ihre Oberfläche ist dicht mit kleinen Löchern übersät. Sie haben eine braungraue-ockerrote Färbung. Die Außenseite der Gefäße war häufig mit einer Tonschicht überzogen.

<sup>119</sup> *Horváth 1997*, Abb. 16–18; *Horváth 1998*, Abb. 3.

<sup>120</sup> S. Anm. 3.

<sup>121</sup> *Währen 1992*, 449; *Währen – Schneider 1994*, 39–59.

<sup>122</sup> Eine Literaturhinweise s. *Flügel – Joachimski – Flügel 1997*, 278.

<sup>123</sup> *Ilon 1996*, 137, Taf. XIX. 1–2, 3–5.

<sup>124</sup> Ähnliche Beobachtungen beim Kochgeschirr machte auch *Leckebusch 1998*, 382; *Schucany et al. 1999*, 70.

<sup>125</sup> *Chur: Hochuli-Gysel et al. 1986*, 108; *Augst: Furger – Deschler Erb 1992*, 89; *Bregenz: Leckebusch 1998*, 382; *Teurnia und Hemmaberg: Gastgeb 1995*, 247; *Schucany et al. 1999*, 70.



von Szakály ist die fleckige Farbe bzw. Farbumschlag charakteristisch, wobei im Gegensatz zu den rot-braunen Tönungen die Anteilnahme der grauen Exemplaren verschwindend ist.<sup>126</sup>

Die Ermittlung der Brenntemperatur ist eine Zielsetzung der naturwissenschaftlichen Untersuchungen. Während des Brandes gehen im Scherben chemische Prozesse vor, bei denen einzelne Rohstoffe umgewandelt werden, in deren Phasenbestand wir durch röntgen-diffraktometrische Untersuchungen Einblick erhalten. Diese lassen dann Rückschlüsse auf die Brenntemperatur zu. Dieser Wert wird bei den handgeformten Gefäßen von Napoca auf über 850–950 °C geschätzt.<sup>127</sup> Dagegen zeigte die röntgendiffraktometrische Untersuchung an den Gefäßen von Bad Kreuznach, dass ihre Brenntemperatur nicht zu hoch gewesen sein kann, 500 °C sicher erreichte, aber 700 °C<sup>128</sup> nicht überschritt. J. Weiss kommt durch Versuche zu der Schlussfolgerung, dass die Brenntemperatur 550 °C erreichen musste, da sonst der Scherben bei Berührung mit Wasser erneut durchnässt wäre, aber 800 °C nicht überschritten hat.<sup>129</sup>

Es gibt auch Überschlagsberechnungen, wie lange der Brennvorgang gedauert haben könnte. Nach M. Kardos „ist ein ca. 15 cm hohes Gefäß nach einer Stunde ausgebrannt. Stücke von 30–38 cm benötigten etwa zweimal so viel Zeit. Zwei Stunden waren sicher für den Brand jedes Gefäßes ausreichend, dessen Durchmesser 90 cm nicht überschritt.“<sup>130</sup>

### **Sekundäre Spuren**

Betrachtet man den Ursprung sekundärer Spuren, so lassen sie sich in zwei Gruppen teilen. In die eine gehören die Spuren, die sich aus der Funktion ergeben, die anderen entstehen durch die jahrhundertelangen Bodeneinwirkungen.<sup>131</sup> Zur ersten Gruppe gehören die sekundären Brandspuren<sup>132</sup>, Speisereste, die Herausbildung unterschiedlichen Porenverteilung, weiter die Flickstellen an zerbrochenen Gefäßen. Die löcherige Oberfläche kann, wie oben schon erwähnt wurde als Folge der Bodeneinwirkungen entstanden sein, die mit der Änderung der chemischen Zusammensetzung einhergehen. Es ist aber auch zu untersuchen, was für eine Wirkung das Kochen und sekundärer Brand auf die chemische Zusammensetzung ausüben konnten.

Die sekundären Spuren, die sich aus der Benutzung ergeben, geben neben der Wandstärke der Gefäße Aufschluss über die Funktion und unterstützen ihre Verwendung als Kochgeschirr. Wo diese Spuren fehlen muss eine Verwendung als Vorratsgefäß erwogen werden.

### **Frage der Herstellungswerkstatt**

Die Mehrzahl der handgeformten Gefäße kennen wir aus Siedlungsobjekten, weshalb schwer zu beantworten ist, ob ihre Herstellung von der auf der Töpferscheibe gefertigten Ware getrennt vorgenommen wurde. Es stellt sich die Frage, ob diese innerhalb der Haushalte hergestellt wurden, denn sie erforderte kein größeres Fachwissen bezüglich des Töpferofens. In der Veröffentlichung der Befunde der Öfen von Balatonfüzfő setzt M. Kelemen<sup>133</sup> die Arbeit solcher kleinerer Werkstätten voraus, die die lokale Nachfrage befriedigten und gleichfalls auch scheibengedrehte Gefäße herstellen konnten.

A. Furger deutet darauf hin, dass in den Befunden der rätischen Töpferöfen sehr selten handgeformte Gefäße vorkommen und schlussfolgert, dass diese vielleicht in extra dafür gebauten Öfen hergestellt wurden.<sup>134</sup> Ch. Flügel sieht im Zusammenhang mit den Auerbergtöpfen das Fehlen handgeformter Keramik in den Töpferofenbefunden darin, dass obwohl der Grundrohstoff vor Ort zu finden war, dieser doch aus anderer Tonlagerstätte

<sup>126</sup> Gabler – Horváth 1996, 146–147; Ähnliches wurde im Falle der handgeformten Material von Napoca beobachtet, wo die Zahl der mit oxydierendem Brand gebrannten Stücke bei 71% liegt, wogegen die den keltischen und dakischen scheibengeformten Stücken zugerechnete Gefäße in größerem Umfang mit reduzierendem Brand hergestellt wurden, *Rusu-Bolindeț – Voişian – Cociș 2000*, 172, 175.

<sup>127</sup> *Rusu-Bolindeț – Voişian – Cociș 2000*, 173.

<sup>128</sup> Hofmann 1988, 297.

<sup>129</sup> Weiss 1994, 119.

<sup>130</sup> Kardos o.J. 44.

<sup>131</sup> Magetti – Kahr 1981, 2.

<sup>132</sup> An der handgeformten Keramik von Napoca ist es bei 80% zu beobachten, *Rusu-Bolindeț – Voişian – Cociș 2000*, 173.

<sup>133</sup> Kelemen 1980, 58–59, Abb. 6. 7–8.

<sup>134</sup> Furger 1991, 262.



stammt.<sup>135</sup> Aus Hailfingen veröffentlicht A. Stroh<sup>136</sup> einen Töpferofen vom Ende des 2. Jh. n.Chr., der ausschließlich handgeformte Keramik enthielt. Nahe Analogien zu diesen Stücken werden aus den 8 km entfernt liegenden Fundplätzen von Rottenburg und Holzmaden erwähnt, wo sie aber gemeinsam mit auf der Töpferscheibe gefertigten Stücken benutzt waren. Aus Pannonien kennen wir bislang keinen solchen Ofen, der ausschließlich zum Brennen von handgeformter Keramik gedient hätte.

### **Zusammenfassung**

Das besprochene Material ist hinsichtlich der Technologie handgeformt, stark gemagert, grob in der Verarbeitung, seiner Funktion nach Kochgeschirr und vom lokalen Charakter.<sup>137</sup> Mittels obiger Fundplätze kommen wir zur Schlussfolgerung, dass sich der Lokalcharakter in individueller Anwendung der Magerungskomponenten (in Bezug auf Qualität und Quantität) am spezifischsten durchsetzt und der Unterschied zwischen den funktionengebundenen Formmerkmalen und den verwendeten Zierarten in den Hintergrund rückt. Die erwähnten Fundplätzen lassen sich in drei Gruppen teilen: 1. Tokod-Erzsébetakna, Úny-Baráthegeyidűlő (und auch Almásfüzitő), als Teil der Gruppe des Esztergomer Gebietes, 2. Das Material von Albertfalva und Budapest-Medve Str. steht sich tendenziell ebenfalls nahe, 3. Die handgeformte Keramik von Szakály-Réti földék unterscheidet sich grundlegend von den oberen zwei Gruppen. Die Funde von Albertfalva stimmen in einem gewissen Maße mit der Gruppe des Esztergomer Gebietes überein.<sup>138</sup>

<sup>135</sup> Flügel 1999, 109; wie es schon oben erwähnt wurde, wurden bezüglich der Zusammensetzung des Rohtons der scheibengefertigten und handgeformten Gefäße ähnliche Beobachtungen anhand des Materials von Napoca gemacht, Rusu-Bolindeț – Voişian – Cociș 2000, 174.

<sup>136</sup> Stroh 1934, 98–102.

<sup>137</sup> Schucany et al. 1999, 70.

<sup>138</sup> Im Gegensatz dazu zieht Leckebusch markante Grenzen zwischen den einzelnen Regionen, Leckebusch 1998, 417; Aber die geochemischen Untersuchungen von G. Hofmann bezeugen, dass im Fall der Fundplätze um Bad Kreuznach auch mit Warenaustausch gerechnet werden kann, Hofmann 1988, 297. Diese Untersuchung wurde von der OTKA-Stiftung FO19537 unterstützt.

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


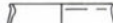











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


















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	Typ	Untertyp
I. Handgeformte Nachahmungen der Graphittonware mit der Rille unter dem Rand		a) 
		b) 
		c) 
		d) 
II. Tonnenförmige Gefäße mit eingezogenem, verdicktem Rand		a) 
		b) 
III. Bauchige Töpfe mit eingezogenem nicht profiliertem Rand	1. Tonnenförmig 	a) 
		b) 
		c) 
	2. Situlenförmig 	a) 
		b) 
		c) 
IV. Tonnenförmige Töpfe ohne deutliche Randlippenbildung		a) 
		b) 
		c) 
V. Bauchige Töpfe mit steil aufgebogener bzw. leicht schräg ausgezogener Randlippe		a) 
		b) 
		c) 
VI. Bauchige Töpfe mit kurz ausgebogenem Rand	1. Tonnenförmig	a) 
	2. Bauchig	a) 
		b) 
		c) 

☐ LT D    ☐ frührömisch, 1. Jh. n. Chr.





















Abb. 1. Formspektrum der bodenständigen Keramik aus der Umgebung von Esztergom (Typen I–VI)



	Typ	Untertyp
VII. Bauchige Töpfe mit langem, kräftig ausgebogenem Rand		a) 
		b) 
VIII. Bauchige Töpfe mit steil aufgebogener Randlippe		a) 
		b) 
IX. Bauchige Töpfe mit steil aufgebogener Randlippe		a) 
		b) 
X. Töpfe mit kurzem, schräg ausgezogenem Rand		a) 
		b) 
		c) 
		d) 
XI. Töpfe mit hohem, schräg ausgezogenem Rand		a) 
		b) 
XII. Töpfe mit kurzem, ausgebogenem Rand		a) 
		b) 
		c) 
XIII. Ovoiden Töpfe von S- Profilierung		a) 
		b) 
		c) 
XIV. Bauchige Töpfe mit langem, kräftig ausgebogenem Rand		a) 
		b) 

☐ LT D   ☐ römisch, 2.–3. Jh. n. Chr.   ☒ spätrömisch, 4. Jh. n. Chr.

Abb. 2. Formspektrum der bodenständigen Keramik aus der Umgebung von Esztergom (Typen VII–XIV)

	Typ	Untertyp
XV. Blumentopfförmige, weitmundige Töpfe		a) 
		b) 
XVI. Konische Tassen		a) 
		b) 
		c) 
		d) 
		e) 
		f) 
XVII. Konische Tassen		a) 
		b) 
		c) 
XVIII. Siebtasse		
XIX. Teller		
XX. Dreifußschale	ohne Abb.	
XXI. Schüssel		a) 
		b) 
		c) 
XXII. Deckel		a) 
		b) 
		c) 
		d) 

☐ LT D ☐ römisch, 2.–3. Jh. n. Chr.

### 3. Formspektrum der bodenständigen Keramik aus der Umgebung von Esztergom (Typen XV–XXII)





## RECONSTRUCTION OF THE SETTLEMENT STRUCTURE OF THE MEDIEVAL NAGYSZAKÁCSI (SOMOGY COUNTY)<sup>1</sup>

Landscape archaeology, which developed in Western Europe in the 50's and 60's and has become more and more accepted since then, has opened a new field in settlement studies.<sup>2</sup> The methodology of the new approach was developed by the archaeological research of Great Britain, where it could be based on ample sources and a landscape that affords the recognition of medieval settlements features. The sources and some elements of the method, however, could also successfully be applied in territories where the conditions were less favourable. In the present study we try to analyse and reconstruct the medieval structure of the modern Nagyszakácsi (Somogy county) using non-archaeological sources, which were already used in Hungary on the occasion of certain excavations (charters, early maps, aerial photos, toponyms), and with the help of archaeological field walkings.

Since the sources and the landscape conditions in Hungary usually prove barely sufficient for applying the above methods, the success of the study greatly depended on the choice of a suitable settlement. A significant factor was that it should have enough document reference and also that the sources should be of diverse types to afford the testing the method within a range of source environment. It also had to be considered that the settlement should be chosen in a territory where the geographical setting offers a greater opportunity to identify the topographic elements that existed in the Middle Ages (hills, valleys, streams etc). Finally, the sources and methods we intended to use needed that the settlement should be a still existing and inhabited village.

Nagyszakácsi can be found in Somogy county. It has excellent documentation in a Hungarian respect, although it has a different character. We have about one hundred charters from between 1359 and 1521 informing about the donation and the exchange of smaller holdings and the texts of perambulates of bounds encompassing larger territories. Some of the inhabitants of the medieval settlement were raised to the nobility rank from the legal status of servicing people, others came from a villein status.

With the analysis of the structure of the village and the landholding system, we try to find an answer to the question if the special legal status of the inhabitants of Szakácsi influenced the structure of the settlement. The problem of the connection between the populations of diverse legal conditions and the settlement structure has already been raised in archaeological research on the occasion of farmstead-like settlements and small castles of the Árpáadian Era and late medieval castles. The archaeological study of the scattered settlement pattern, which rarely appears in historical sources, early feudal private castles connected to *praedii*, and *curiae*, which are related to the lesser nobility, has demonstrated that the recognition of the various groups of the medieval society is facilitated by the complex use of various source groups and methods. Lesser nobility, the lowermost layer of nobility, which often differed from villains only in the social legal status, can be grouped in this category.

The study includes the structure of the inner territory of the village and its changes, the landholding pattern on the outskirts of the village and the varieties and changes of the land usage systems. We shall also discuss the problems of settlement typology and questions concerning the relationship between the inner territories and the outskirts. The sources and the

<sup>1</sup> The study was prepared with the support of the National Scientific Research Found (OTKA F 19227).

<sup>2</sup> On the methods and sources of landscape archaeology see: *W. G. Hoskins: The Making of the*

*English Landscape*. London 1955; *M. Aston – T. Rowley: Landscape Archaeology. An introduction to fieldwork techniques in Post-Roman landscapes*. London, 1974; *M. Aston: Interpreting the Landscape*. London 1985.



methods we intend to use afford a more complex analysis of the settlement yet do not provide new information concerning certain problems (e.g. house types, material culture etc). Beside the analysis of the medieval settlement structure we also intend to determine the possibilities and limitations of the method in the case of a settlement that has been inhabited since the Middle Ages, and that cannot fully be studied with archaeological methods. For this purpose the sources must be used together and, at the same time, in a complementary analytical way, a method that has not fully been applied in Hungarian research. It is important to analyse the descriptions of the landscape and lands in the historical sources, the elaboration of the data of the early maps and the surviving toponyms, to use the attainable aerial photos and to apply archaeological methods others than excavations.

The analysis of the structure of a village of the lesser nobility can also offer an insight into the settlement pattern of the lesser nobility that rose from the rank of the villeins, which can complete the picture drawn from the study of the upper and middle layers of aristocracy.

### *Sources and methods*

Before starting the discussion of the problems listed in the introduction, we find it important to introduce the source groups used in the study and the main trends and methods of former research in this field. The sources of the present study were the written documents referring to the settlement, the results of archaeological field walkings, the manuscript maps and the existing aerial photos.

The primary sources of the present paper were the descriptions of landscapes and landed properties in various documents, extents, perambulates of bounds and records about the donation, exchange and alienation of lands and data referring to the inner territory of the village.

Historians and archaeologists have already called attention to the possibilities of reconstructions after medieval written sources<sup>3</sup> yet the idea of the systematic analysis of the reconstruction of the settlement structure of certain villages came from historical geography. Jenő Major demonstrated that the use of the topographic descriptions of various sources can offer a new possibility for the research of settlements that have continuously existed in the same place. After the clarification of the spatial interrelation of the cartographic elements described in perambulates of bounds and charters on the division of landed properties, the medieval borders and certain details of the early ground plan can be reconstructed.<sup>4</sup> He concluded that sometimes relatively exact and complex ground plans can be drawn depending on how detailed the sources are. Although the sources we have afford the cartographic true-to-scale elaboration he suggested only in the case of the perambulates of bounds, he thought that the same method could be used for the reconstructions of the inner territories as well. In this case, the measurements of certain ground plan elements, as tofts and streets, can be calculated and sketched.

Ferenc Maksay applied the method suggested by Jenő Major at the reconstruction of medieval village types after perambulates of bounds and deeds of land divisions. He grouped the reconstructed village forms after Tibor Mendöl's typology<sup>5</sup>, which followed the German school. He differentiated two main types of villages: street village and agglomeration, and he found the former one characteristic in the 14<sup>th</sup>–16<sup>th</sup> centuries.<sup>6</sup> Similarly to Mendöl, who beside the typological grouping characterised the various categories according to the functional role they occupied within the settlement structure, Maksay also often regarded the natural conditions, and compared them to cultivation methods (rotation system, forest clearing– street village) or to the social status of the population (lesser nobility – cluster village, agglomeration). He also discovered that the types can be connected to various field systems and several types can be represented within a single settlement. István Szabó studied the medieval roots of modern typology and also differentiated two main types from the descriptions of documents on land divisions in the inner territory. Most of the settlements were regular street villages, the other type was the agglomeration of an irregular arrangement.<sup>7</sup> He studied in details the

<sup>3</sup> Szabó 1937; László 1943; Györfy 1956.

<sup>4</sup> Major 1961.

<sup>5</sup> Mendöl 1963.

<sup>6</sup> Maksay 1971, 91–110.

<sup>7</sup> Szabó 1969.



relevant terms of the sources and sketched the outlines of villages, the lines of the streets and the directions of the plots. Although he did not prepare a detailed reconstruction containing all the plots, he called attention to the fact that, in a lucky case, even the sketchy ground plan of a village can be reconstructed. Looking for the connections between the shape of a village and the landholding and cultivation systems he found a certain correlation (forest-clearing – single street shape<sup>8</sup>, rotation system – less regular pattern), yet, just like Maksay, he called attention to typological mixtures that can appear within the individual settlements.

The first attempt to reconstruct the medieval natural environment was carried out by the ethnogenetic school of the 30's and 40's,<sup>9</sup> and several researchers have since suggested and illustrated the reconstruction possibilities of medieval street and borderline systems based on the comparison of perambulates of bounds and the modern topographical setting.<sup>10</sup> István Szabó applied the method first on the occasion of his studies in Ugoesa county, where he collected the medieval geographical names from the documents of the individual settlements and compared them with cartographic data and sometimes identified them with modern place names. He determined the borders of the individual settlements from the analysis of written documents, reconstructed the medieval road system and marked the names of hills and water courses he had found in the sources. Later he also called attention to the fact that the analysis of perambulates of bounds from various periods can demonstrate the shrinking of the village township parallelly to the establishment of new settlements.<sup>11</sup> István Györffy has published the most complete collection of the historical sources on the natural environment and topographic setting of the Árpadian Era in his excellent work.<sup>12</sup>

Historical research usually uses the topographic descriptions of settlements in the documents for the reconstruction of the inner territories of villages, yet sometimes similar analyses were made regarding arable lands as well. Ferenc Maksay suggested already in 1962 that similarly to the historical, topographic analyses of arable lands applied abroad, the comparative analysis of early cartographic, archaeological and written sources can lead to the recognition of new elements of the usage of arable lands in historical times. He stressed, however, that due to the low number of early maps and the scarcity of the surviving traces of arable lands in Hungary, the agrarian references of the medieval sources deserve special attention.<sup>13</sup> He reconstructed in a few cases the places of the individual arable lands and clearings after the data recorded in the documents and the place names. Discussing Maksay's field reconstructions, we have to mention the problem of medieval land and length measures, which was already raised by Jenő Major with regard to the inner territories.<sup>14</sup> In his maps, Maksay indicated the lines of the streets, the directions of the plots, their order and the position of the fields as given in the documents, their direction and number, but the sources were not sufficient to make a true-to-scale reconstruction. He owed it, beside the deficiency of the descriptions in the sources, to the difficulty of determining the various land measures, since the size of many of them had already been forgotten. In the case of land measures, it is the unit given not in the royal (*regale*), but the customary (*usuale*) or local *iugerum* that causes the greatest problem. Bogdán, unlike Maksay, differentiated local and customary *iugerum*, determining the latter as a not royal unit of measure, which was nevertheless commonly used in the entire country. The uncertainties of the three data used in the exact determination of its size and the great divergences of the calculated values cannot provide an ultimate solution to the problem of the size of the customary *iugerum* (*hold*) and its common usage in the country.<sup>15</sup>

Beside the reconstruction of the structures of individual settlements, the data of the documents afford the analysis of the general characteristics of the appurtenant lands. The studies have demonstrated that the size of the appurtenant arable lands and meadows, the

<sup>8</sup> Szabó used here first of all records about infield ("tanor") since he could only suppose the existence of assart settlements in the Middle Ages from the sources.

<sup>9</sup> Szabó 1937; Jakó 1940.

<sup>10</sup> A few examples: Györffy 1956; Major 1960; Maksay 1971; Laszlovszky 1986/a; Vályi 1986.

<sup>11</sup> Szabó 1966, 86–87.

<sup>12</sup> Györffy 1963.

<sup>13</sup> Maksay 1962.

<sup>14</sup> Major 1960, 41; Major 1961, 6.

<sup>15</sup> Bogdán 1978, 177–179.



forms of the lands and the relationship between the surface of the arable lands and all the lands of the village show such a variety that complex analyses of smaller territorial units can bring more exact results.

Documents dealing with the circulation of the landed property and possessory actions were the sources for Márta Belényesy's studies as well. She, however concentrated on the interpretation of agrarian terms found in the sources to determine the cultivation techniques and landholding system of peasant farms.<sup>16</sup> The description of the various field systems, their distribution and their occurrence in the territory of a village led to conclusions about the structure of the entire territory. She defined four groups concerning the cultivation type of the lands in the 15<sup>th</sup> century: 1. freshly broken lands, 2. regularly fallowed lands, 3. lands in permanent one field system (so-called tanor lands), 4. lands in two- or three field system.<sup>17</sup>

The sources of the study also contain the results of field walkings. The role of archaeological research is increased partly by the relatively low number of documents in Hungary and the casualty of their survival, and partly by the fact that the observations made during field walkings help the interpretation of the data obtained from documents. Excavations play an eminent role in the study of the inner territories of villages, although excavations are usually restricted to the territories of perished villages. In the case of active villages, in the development of which no break led to ultimate devastation, it is usually methods other than excavations that can bring results. At the same time, the present study also deals with the structure of the lands, the investigation of which cannot be solved with excavations due to the extent of the territory and the character of the analysed phenomena. Although we will discuss the perished settlements on the outskirts of the villages and the Pauline monastery, mainly their location, age and character seem to be important from the respect of our analysis. Accordingly, the present study aims at the interpretation of the data of the written sources and finding their place in the modern landscape through comparing these data to the results of the field walkings and vice versa.

Works summing up the methodology, terminology and possibilities of archaeological field walking can be found both in Hungary and abroad.<sup>18</sup> Without repeating their statements, they basically differentiate three field walking methods according to the purpose and the depth. Targeted field walking is used for the localisation of a feature (settlement, castle, monastery etc.) known from other sources, while extensive field walking intends to register all the archaeological sites of a given territory and to sketch the spatially and chronologically most complete settlement pattern of a region. Intensive field walking concentrates on a smaller territory or a site and the systematic surface collection is completed with sedimentological examinations, geophysical and geomorphological analyses. An intensive surface analysis would in certain cases be justified for our study, but the application of the method lies beyond our goal and possibilities. So targeted and extensive field walkings are used in the present study as they seemed best fit to the possibilities provided by the sources and the demands they raised.

The study that marked the start of modern archaeological village investigation was written by István Méri. Similarly to Jenő Major,<sup>19</sup> he called attention to the possibilities hiding in the written sources (perambulates of bounds, maps, depictions) on the one hand, and the fact, on the other, that medieval features, which bear information on certain characteristics of the settlement structure, can be observed during field walkings (hollow roads, medieval road system, places of churches and/or cemeteries, traces of perished houses) and they can be correlated with the data of documents.<sup>20</sup> Thus he differentiated the settlement pattern of the Árpáadian Era showing an irregular scattered picture from the elongated, more closed arrangement of the late Middle Ages based on his observations made during field walkings.<sup>21</sup>

<sup>16</sup> Belényesy 1954–55; Belényesy 1964.

<sup>17</sup> Belényesy 1964, 232.

<sup>18</sup> Jankovich-Bésán 1985, 1992 discusses both the Hungarian and the international research history and methods.

<sup>19</sup> Major 1961.

<sup>20</sup> Méri 1954, 151.

<sup>21</sup> Méri 1953, 58.



Studies based on extensive field walkings present a complex settlement picture within an area.<sup>22</sup> The settlement history and structure of a region are drawn, the one-time villages and roads are identified and the medieval landscape is illustrated from the archaeological data (excavation and stray finds, field walkings, local surveys) and also from the written sources, early maps and toponyms. In Hungary, the most complete representation of the method can be found in the published volumes of the *Magyarország Régészeti Topográfiája* [Archaeological Topography of Hungary] series. István Éri suggested, after his experiences in Veszprém county, that the settlement network, the road system and the one-time hydrological situation can be reconstructed from topographic works and the analysis of documents.<sup>23</sup> László Blazovich used the results of archaeological topography together with the rich document material for the examination of the geographical setting and the settlement structure in his study on the settlement history of the southern part of the Hungarian Plain.<sup>24</sup> Extensive field walkings proved successful in solving certain problems concerning the settlement structure, first of all in the discovery of the farmstead-like settlements of the Árpadian Era, in the differentiation of the scattered and closed settlement types, while researchers repeatedly called attention to the limitations of the method. One should be cautious with affiliating the sites of various sizes and structures to periods. Sherds from the Árpadian Era also occur in the large closed sites even though the settlements were first mentioned only in late medieval documents.<sup>25</sup> The phenomenon, which was observed at repeatedly surveyed sites, that the cultivation brings materials of different periods to the surface after each ploughing can also cause difficulties in dating. Observations concerning the extent and the exact place of the sites must also be taken into account since they can "migrate", occasionally they shift to 5–25 m in consequence of ploughing.<sup>26</sup> Yet both the foreign archaeological literature and the Hungarian experiences show that extensive field walkings can help to a relatively exact picture of the sites in a region, which provide general information on the settlement structure and hierarchy, and, completed with the data of documents, some settlements can even be identified.<sup>27</sup>

Regarding the early maps, we used first of all the First Ordinance Survey from the time of Joseph II and the Second Ordinance Survey from the 19<sup>th</sup> century. In some cases the fief maps of the settlements and surveys made with economic purposes provided useful pieces of information. Ferenc Maksay demonstrated the limitations and possibilities of ordinance surveys from the end of the 18<sup>th</sup> century and the beginning of the 19<sup>th</sup> century, regarding their source value for the study of medieval settlement history and settlement structure. Maksay compared the reconstructions of the inner territories made after documents with the early maps from the 18<sup>th</sup>–19<sup>th</sup> centuries supposing, in most of the cases, a formal continuity, and stressed that the occasional changes that had happened between the two periods could not be detected with this method. Similarly to the inner territories, he compared the arable lands with the data of the maps from the 18<sup>th</sup> century and although he doubted that there existed a continuity without any break, the manuscript maps often proved to be valuable sources regarding the distribution of the cultivation types and the shapes of the fields.

We did not have the opportunity to prepare aerial photos during our investigations. We could only use the aerial photos kept in the FÖMI and the ones made for cartographic purposes by the Institute of Military History.

### *The history of the village and its sources*

Nagyszakácsi can be found about 40 km south-west of Marcali in the western part of Somogy county. In the Middle Ages it was known as Szakácsi, Nagyszakácsi, Külsőszakácsi, Felsőszakácsi and Kisszakácsi. The name of the settlement appeared already in the list of the Pauline monasteries in 1263, where the Saint Dominic monastery of Szakácsi was

<sup>22</sup> Kovalovszki 1955; Kovalovszki 1965; Mesterházy 1974; Mesterházy 1980; Valter 1974; Müller 1971; Benkő 1992.

<sup>23</sup> Éri 1969.

<sup>24</sup> Blazovich 1985.

<sup>25</sup> Galántha – Vályi 1984.

<sup>26</sup> Jankovich 1992, 148.

<sup>27</sup> The activities of the Hungarian archaeological topography have proved that late medieval settlements mentioned in the documents can nearly always be correlated with the archaeological sites. MRT 8, 32; MRT 9, 14; MRT 10, 723–724.



mentioned.<sup>28</sup> The village itself first appeared in a document in 1331.<sup>29</sup> The priest of Szakácsi was mentioned in 1359,<sup>30</sup> while in 1396 we can read about the cooks of Szakácsi.<sup>31</sup> The early establishment of the village is suggested by the fact that Gusztáv Heckenast included the village in the category of place names denoting professions. He demonstrated that these settlements were founded on princely lands in the early period of the organisation of the state.<sup>32</sup> Gyula Kristó, beside warning for caution regarding the source value of place names referring to the servicing population,<sup>33</sup> affiliated the development of the royal *praedium* of Segesd, which included Szakácsi as well, with the organisation of royal private estate in the 12<sup>th</sup> century or around 1200.<sup>34</sup> We cannot determine the circumstance and the exact date of the foundation of Szakácsi, yet it seems certain that it belonged among the villages of the servicing population that can be connected with the royal estate organisation. It was populated sometime in the 11<sup>th</sup>–12<sup>th</sup> centuries. The start of urbanisation, the development of the uniform layer of villeins, the donation of royal and castle estates in the 13<sup>th</sup> century led to the disintegration of servicing system. The special services given by the settlements working for the royal household usually turned into agricultural service and from a legal aspect the inhabitants got dissolved in the layer of villeins. The servicing people often aspired to gain the privileges of the nobility to strengthen their position.<sup>35</sup> The forefathers of the cooks of Szakácsi appearing in the documents from the 14<sup>th</sup> century were also raised to the rank of nobility from the legal status of servicing people. This process can be followed in the series of letters patent of nobility preserved in the so-called Tolvaj's formulary.<sup>36</sup> So transforming the former obligations into privileges, some of the inhabitants of Szakácsi<sup>37</sup> became royal cooks in the status of the layer of lesser nobility, who fulfilled their task in the royal court in a rotation system. This can be read from the royal account books from the end of the 15<sup>th</sup> century<sup>38</sup> where the names of the members of the lesser nobility of Szakácsi, the ones known from charters, are listed. At that time, they were already paid for the service. A document from 1471 referred to the price of the salt due to the master cooks.<sup>39</sup> A record from 1462 reveals that during wars they fulfilled their task following the ruler in the retinue. The lawsuits of György Veres of Nagyszakácsi and Péter Orros of Kisszakácsi, both master cooks of the royal court, was postponed that year by half a year since they took part in the campaign against the Turks in the retinue of the king.<sup>40</sup> A donation deed from 1466 hints at the significance of the settlement in the 15<sup>th</sup> century referring to it as a market town.<sup>41</sup>

So Szakácsi was an early settlement the population of which was composed of villeins giving agricultural services and manorial nobility, probably living a farming way of life, who gained the privileges of the nobility for royal service done in a part of the year.

Zsuzsanna Bándi published a very precious group of sources in 1986 under the title "A szakácsi pálos kolostor középkori oklevelei" [Medieval documents of the Pauline monastery of Szakácsi].<sup>42</sup> The study contains nearly one hundred documents issued between 1359 and 1521, which contain valuable data not only on the Pauline monastery on the outskirts of the village but also on the topography and economy of the medieval Szakácsi. The majority of

<sup>28</sup> "... Zakach Sancti Dominici ..." G. Gyöngyösi: Vitae Fratris Ordinis Heremitarum Sancti Pauli Primi Heremita cap. X. ELTE Egyetemi Könyvtár Ab. 151.

<sup>29</sup> *Anjou-kori Okmánytár II.* 560.

<sup>30</sup> MOL DI 4867, Bándi 1986, 28–29.

<sup>31</sup> "... coci de Zakachy ..." MOL DI 8135, Bándi 1986, 32.

<sup>32</sup> Heckenast 1970, 87.

<sup>33</sup> Kristó 1995, 263.

<sup>34</sup> Kristó 1988, 255–259.

<sup>35</sup> The servicing people of Águsterdő were raised to the rank of noble *serviens* in 1283: Heckenast 1970, 87; the royal door-keepers of Oroszi also aspired to gain the rank of nobility: Kubinyi 1995.

<sup>36</sup> *F. Tolvaj: Collectio stylorum saeculo XV in Foris Hungariae usu receptorum.* OSZK Fol. Lat. 1818. 110–129. In the followings: *Tolvaj's formulary.*

<sup>37</sup> Kubinyi 1995 Kubinyi has demonstrated that 55 nobles and 30 commoners lived in Szakácsi beside 6 priests in 1505.

<sup>38</sup> Engel 1797, 18–181.

<sup>39</sup> MOL DI. 17238, Bándi 1986, 53.

<sup>40</sup> MOL DI. 15750, Bándi 1986, 49.

<sup>41</sup> MOL DI. 16445, Bándi 1986, 51.

<sup>42</sup> Bándi 1986, 27–65.



the documents tell about land donations and exchanges that happened between the Pauline monastery and the lesser nobility living in Szakácsi and the neighbouring villages. At the indication of the exact place of the very small, 1–2 *iugerum* large lands the name of the area, the nearby road or spring and the cultivation type and owners of the neighbouring territories are mentioned. These minor data, which can often be connected to one-another, afford to draw, at least partially, the field structure of the medieval Szakácsi. Beside the published collection of documents, valuable information is contained in the documents dealing with the lesser nobility of Szakácsi and their landed properties, the copies of which can be found in the so-called Tolvaj's formulary.<sup>43</sup> The document of the perambulation of the bounds of the Trepk family of the neighbouring Monyorókerék and the Szakácsi family in Szakácsi edited in 1371<sup>44</sup> and the source from 1470 on the exchange of the forest called *Magaskerthwel* (Magaskörtvély)<sup>45</sup> offer the greatest help in the examination of certain details of the medieval Szakácsi. A document from 1382, which describes the boundaries of the lands of the Pauline order and the nobles of Szakácsi is somewhat more detailed.<sup>46</sup>

Since the pieces of information contained in the documents are scattered in space and time and as the medieval Szakácsi probably consisted of more than one settlement unit, we carried out an extensive field walking in the entire area of the village. The field walking was accomplished between October 1996 and November 1999 according to the method applied for the preparation of the volumes of the Archaeological Topography of Hungary, that is we inspected every territory that could be reached within the territory of the modern village and marked the sites in a map of a scale of 1:10 000.

Regarding the manuscript maps, we used the map of the First Ordinance Survey from the time of Joseph II, the Second Ordinance Survey from the 19<sup>th</sup> century<sup>47</sup>, and we found valuable data in the cadastre map of the village from between 1850 and 1855,<sup>48</sup> the survey of the village from the middle of the 19<sup>th</sup> century<sup>49</sup> and the forest map of Szöcsényi puszta from 1864.<sup>50</sup>

Aerial photos of the territory can be found in the Map Collection of the Institute of Military History and in the Map Collection of the FÖMI. Both series were made with cartographic purposes. The photos of the Institute of Military History were regrettably taken in the height of 3–4000 metres, which is less suitable for archaeological aerial photographic purposes, and they date from March 1961, so only the occasional discolourations of the soil can help. The photos of the FÖMI are more recent (October 12, 1981 and August 12, 1982) and were made from a lower altitude in a scale of 1:13 000. The date of the flight and the photos were not optimal for observing archaeological features, yet the height can afford the recognition of soil discolourations in the ploughed fields, while the traces appearing as relief formations can be identified in the meadows and grasslands.

### *The inner territory*

Due to the limitations of the sources, namely that they inform only about individual plots, we have barely any insight into the structure of the plots. It is clear that we cannot prepare the exact reconstruction of the inner territory. Nevertheless, the existence of several settlement units is suggested by the fact that the documents mark the settlement of Nagyszakácsi by the names Szakácsi, Nagy-, Kis-, Külső- and Felsőszakácsi.

Felsőszakácsi was only once mentioned in the documents in 1462.<sup>51</sup> Kozma's son Bálint sold that year a 3-*iugerum*-large arable land between *Megesharazth* (Megyeharaszt) and *Hathaserdew* (Hátaserdő) within the borders of the Felsőszakácsi estate to Antal

<sup>43</sup> Tolvaj's formulary 110–129.

<sup>44</sup> Tolvaj's formulary 128–129.

<sup>45</sup> Tolvaj's formulary 112–113.

<sup>46</sup> *Fejér Cod. Dipl.* IX/5 617–621; *Bándi* 1986, 29–30.

<sup>47</sup> First Ordinance Survey: Collo VII. Sectio 22; Second Ordinance Survey: Collo XXV. Sectio 59–60.

<sup>48</sup> SML Map collection K 353: Cadastral overall view of Nagyszakácsi, without date. (1850–55).

<sup>49</sup> SML Map collection U423: Map of the fields of Szakácsi (middle of the 19<sup>th</sup> century).

<sup>50</sup> SML Map collection T529: Economic map of Szöcsényi puszta. 1864

<sup>51</sup> MOL Dl. 15723, *Bándi* 1986, 48, App. 1: 22.



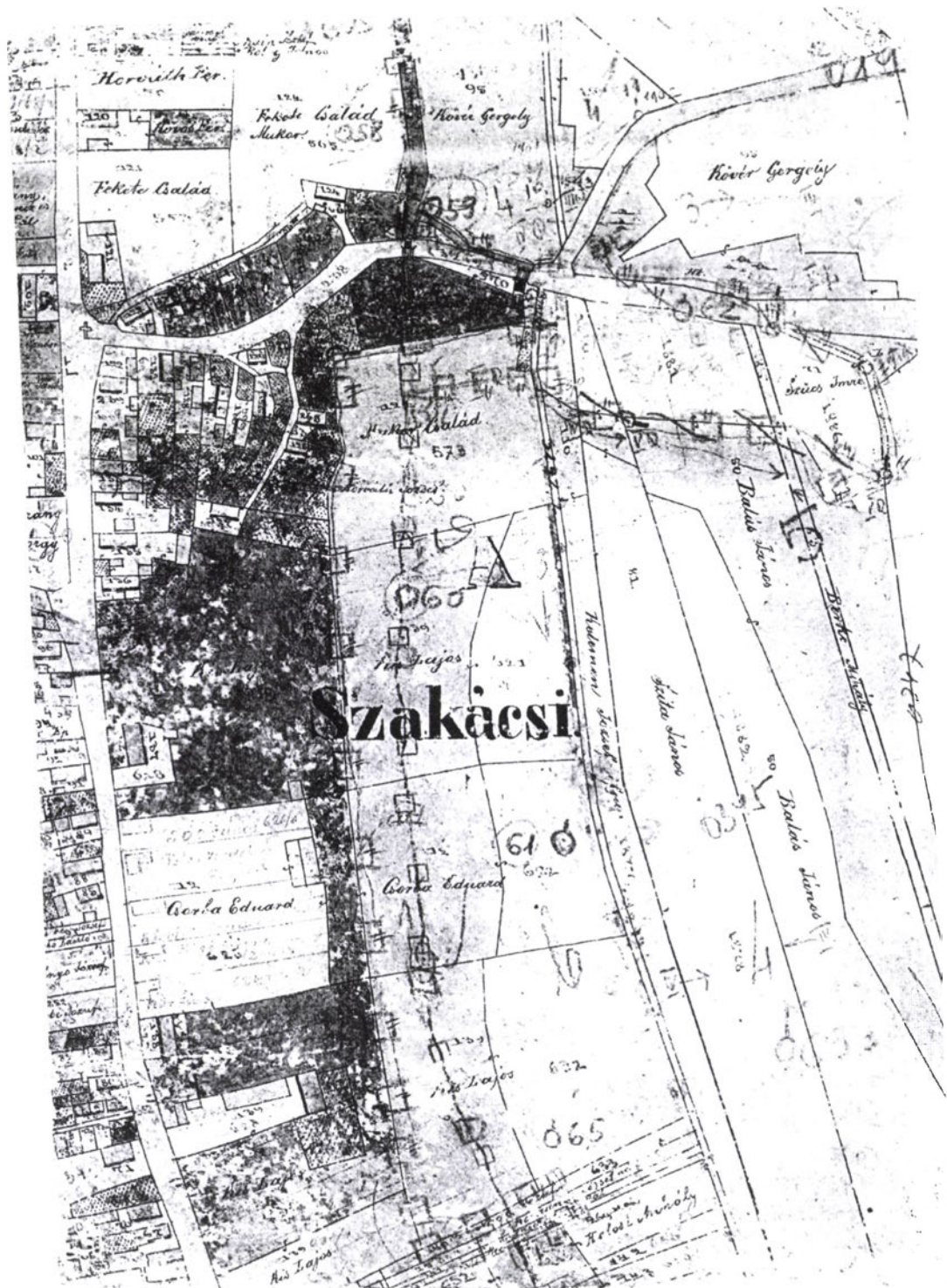


fig. 1. Inner territory of Nagyszakácsi in the middle of the 19<sup>th</sup> century  
(SML Map collection U 432)



Ivánka's son György of Külsőszakácsi. The versatility of the names of the settlement units is evidenced by the fact that *Megeharazth* (Megyeharaszth) was called a part of Külsőszakácsi in 1454,<sup>52</sup> while *Hatoserde* (Hátaserdő) was a place name in Nagyszakácsi in 1455.<sup>53</sup>

Kisszakácsi mostly appeared as a prefix before persons' names. Examining these personal names, however, we find that the same person used both the prefix of Kisszakácsi and Külsőszakácsi. Antal of Kisszakácsi's son György from 1454<sup>54</sup> can be found with the prefix Külsőszakácsi in 1455,<sup>55</sup> while in 1461 we learn that he lives in his estate at Külsőszakácsi.<sup>56</sup> Jakab Orros's son Peter uses the prefix Külsőszakácsi in 1463,<sup>57</sup> then Kisszakácsi in 1472.<sup>58</sup> The deeds of the alienation of a toft and a garden also prove the identity of Kis- and Külsőszakácsi. György Tolvaj sold a garden south of the Saint John Church in Külsőszakácsi to Jakab Orros's sons in 1452.<sup>59</sup> The same place is mentioned again in 1472, when we learn that Jakab's son Péter Orros sold a quarter of a villein's plot to György Veres south of the Saint John the Baptist Church at Kisszakácsi.<sup>60</sup>



fig. 2. Szakácsi on the First Ordinance Survey (Collo VII. Sectio 22)

Szakácsi and Nagyszakácsi often occur both as persons' names and place names. János Gondos of Külsőszakácsi, György Palfy of Szakácsi and Ferenc Thamassa of Nagyszakácsi are mentioned together among the nobility who held witness in a duress case in 1491, which implies the parallel existence of three settlement units.<sup>61</sup> Two settlements containing the word Szakácsi in their names are suggested by the fact that the transfer of a land between the parish and Antal Kisszakácsi's son György in 1454 was witnessed on behalf of the inhabitants of both Szakácsi's.<sup>62</sup> The data in the following chart warn us, nevertheless, that the question cannot as yet be closed. In a table we arranged the place names in the fields that are mentioned in the documents with reference to the name of the settlement.<sup>63</sup>

<sup>52</sup> MOL DI. 14820, Bándi 1986, 44, App. 1: 24

<sup>53</sup> MOL DI. 14913, Bándi 1986, 44, App. 1: 21.

<sup>54</sup> MOL DI. 14820, Bándi 1986, 44.

<sup>55</sup> MOL DI. 14913, Bándi 1986, 44.

<sup>56</sup> MOL DI. 15582, Bándi 1986, 48.

<sup>57</sup> MOL DI. 15826, Bándi 1986, 49–50.

<sup>58</sup> MOL DI. 17285, Bándi 1986, 54.

<sup>59</sup> MOL DI. 14546, Bándi 1986, 43.

<sup>60</sup> MOL DI. 17285, Bándi 1986, 54.

<sup>61</sup> Borsa 1979, 129.

<sup>62</sup> MOL DI. 14820, Bándi 1986, 44.

<sup>63</sup> The toponyms are listed in the chart in a uniform transcription for the sake of an easier comparison.



Place name	Külsőszakácsi	Nagyszakácsi	Szakácsi
Kilencdiófaszéle	1451, 1452, 1463, 1463		
Kútő	1444, 1444, 1453, 1453		
Hársberek	1463		
Nagyréti	1451		
Kerekerdő	1428, 1428, 1444, 1451, 1463, 1463		
Megyecharaszt	1454		
Kiseresztvényhegy	1451		
Szél	1451, 1463, 1463		
Nyíres	1444, 1471		
Szekérhid	1451, 1463		
Csipánharaszt	1451, 1463		
Csakan	1453		
Csolyanustó	1453		
Demeerdő	1452		
János Petes's forest	1444		
Vékonyerdő	1452		
Borsohely	1463		
Magaskörtvély	1455		
Hátaserdő		1455	
Szénégetőharaszt		1480	
Szölőharaszt		1466, 1471	
Roketas (beside the border of Szöcsény)		1471	
Csohosréti		1471	
Tolvaj-völgy		1471	
Kerekő		1471	
Alexandorbyky		1385	
Bereknyeszél		1471	1461
Halmosföld		1480, 1480	1453
Papharaszt			1453, 1453, 1453, 1453
Horohalja river			1402
Horohszél			1453
Horhas,Szél, Vízmosásszél			1453
Felsőcsér			1495
Újhegy			1453
Vezeitó			1453
Szénréti			1495
Haraszterdő			1475
Hosszúerdő			1459
Márk's forest			1507
Utaslaboserdő			1507
Givthugyepé			1453
Fővény, Kerekréti			1495
Barkolcászél			1425

Table 1. Place names of Szakácsi with the indication of the settlement unit

The table shows three well distinguished groups, that is settlements, which probably suggests that they were independent settlement units. At the same time, overlapping appears at two places in the case of Szakácsi and Nagyszakácsi, at *Bereknyezeel* (Bereknyeszél) and *Halmosföld*, that is they are mentioned at both places. The identity of the territory is further supported by the fact that *Roketas*, which belonged to Nagyszakácsi, can be found beside Szöcsény, and the modern toponym Cserhát tells that *Felsewcher* (Felsőcsér) of Szakácsi was also situated somewhere there.

The sources mention the parish church dedicated to All Saints from 1378.<sup>64</sup> They also report about the donation and alienation of several plots of the nobility and the villeins. The scattered data<sup>65</sup> afforded the reconstruction of certain plot groups, which suggest the existence of an east-west and another north-south directed row of plots. They also reveal that the plots of the nobility were often wedged into the row of villeins' plots in the plot row of the village. The phenomenon that the manors of the lesser nobility, who did not have a castle or a larger *allodium*, were inserted into the plot system of the village, was not unusual in the Middle

<sup>64</sup> MOL DL. 6515 Bándi 1986, 29.

<sup>65</sup> The documents mention altogether 11 plots of the nobility, 9 plots of the villeins, 1 deserted plot and a land suitable for a plot.

Age.<sup>66</sup> Nevertheless, within this system, they can often be found in more favourable places as around the church or slightly separately at the edge of the settlement.<sup>67</sup> Imre Holl observed a similar phenomenon at Sarvaly. The houses of the lesser nobility population of the village, which yielded a rich find material, were found near the street row of a fairly regular plot pattern, yet they were somewhat detached and stood at larger distances from one another.<sup>68</sup> Sometimes, the difference between the villeins' plots and the manors of the nobility appeared only in the size. The size or the value of the plots of the nobility was usually identified with those of three or four villein's plots.<sup>69</sup>

We do not know the exact place of the Szakácsi plots mentioned in the documents. The sources often list the manors of the nobility side by side, so one of them probably lay at the edge of the settlement, since an area suitable for a plot is mentioned beside it.<sup>70</sup> Casting a glance at the map of the inner territory of the village in the middle of the 19<sup>th</sup> century,<sup>71</sup> one cannot help noticing the differences in the sizes of the plots (*fig. 1*). We can find nearly only narrow strips of plots in the western row of the village, while in the eastern row, especially on the northern side, larger plots are inserted between the narrow tofts. It can also be observed that it is not the name of the owner the map indicates as the possessor of these larger plots but that of a family (Fekete family, Mukor family). It is not excluded, either, that Egyed Fekete of Külsőszakácsi mentioned repeatedly in medieval documents was an ancestor of the Fekete family from the 19<sup>th</sup> century. The sources do not afford the identification of the medieval manors of the lesser nobility with the large plots of the 19<sup>th</sup> century, it cannot be excluded, however, that in certain cases the shapes of the medieval manors were preserved.

The picture of the inner territory became even more colourful when in some cases the nobles of Szakácsi donated tofts or manors to the Pauline order,<sup>72</sup> which latter certainly did not use them as residences. It could happen similarly as in Botond village in Heves county where the Pauline monastery operated a farm between the tofts.<sup>73</sup>

The sources often mention gardens behind the tofts. We can hear about the garden of a toft when Pál Végh of Szakácsi sold half a plot with the half of the garden that belonged to the plot in 1467.<sup>74</sup> A duress case in 1475 also suggests that the garden was situated at the back of the plot since János Pap of Szakácsi annexed a part of György Veres and György Korothnai's garden to his plot held in villeinage at Szakácsi.<sup>75</sup> Certainly the same garden is mentioned in György Veres's will, where we can read about György Veres's garden part in *Tarroskerth* in Szakácsi.<sup>76</sup>

The archaeological field walkings recorded two larger sites near the inner territory of the modern Nagyszakácsi where sherds both from the Árpadian Era and the late Middle Ages were found (*fig. 12*). Site no. 29 in the central-southern part of modern Nagyszakácsi yielded only late medieval pottery, while we could collect sherds from the Árpadian Era in the approximately 50 cm × 50 cm large spot marked by x in the map. Sherds from the Árpadian Era were also collected in the entire territory of sites nos 21 and 28 south of site no. 29.

The location of Külsőszakácsi can be deduced from a document from 1470 included in Tolvaj's formulary.<sup>77</sup> At that time, Peter's son László bought from János Bogdán a part of the *Magaskerthwel* (Magaskörtvély) forest in Külsőszakácsi, which was situated north of his estate in Külsőszakácsi. The forest called *Magaskerthuel* (Magaskörtvély) is mentioned elsewhere as well,<sup>78</sup> it could be found north-east of Szakácsi. Accordingly, we have to look for Külsőszakácsi north-east, east of the modern village.

<sup>66</sup> Szabó 1969, 19.

<sup>67</sup> Maksay 1971, 124–125.

<sup>68</sup> Holl–Parádi 1982, 130–131. Holl 1985, 246.

<sup>69</sup> Maksay 1971, 123, 209.

<sup>70</sup> 1431: MOL DI. 12415, Bándi 1986 41.

<sup>71</sup> SML Map collection U432: Map of the Szakácsi fields (middle of the 19<sup>th</sup> century).

<sup>72</sup> The Pauline order got a whole toft in 1456: MOL DI. 15038, Bándi 1986 45–46; György Veres donated two manors in Nagyszakácsi: 1471: MOL

DI. 17203, Bándi 1986 52–53; the Pauline order was enlisted as the new owner of another manor in Szakácsi in 1491: MOL DI. 20578, Bándi 1986, 60.

<sup>73</sup> Maksay 1971, 124.

<sup>74</sup> MOL DI. 16514, Bándi 1986, 52.

<sup>75</sup> MOL DI. 17688, Bándi 1986, 55.

<sup>76</sup> 1453: MOL DI. 17462, Bándi 1986, 43.

<sup>77</sup> Tolvaj's formulary 128–129.

<sup>78</sup> 1455: MOL DI. 14913, Bándi 1986, 44, App. 1: 21.





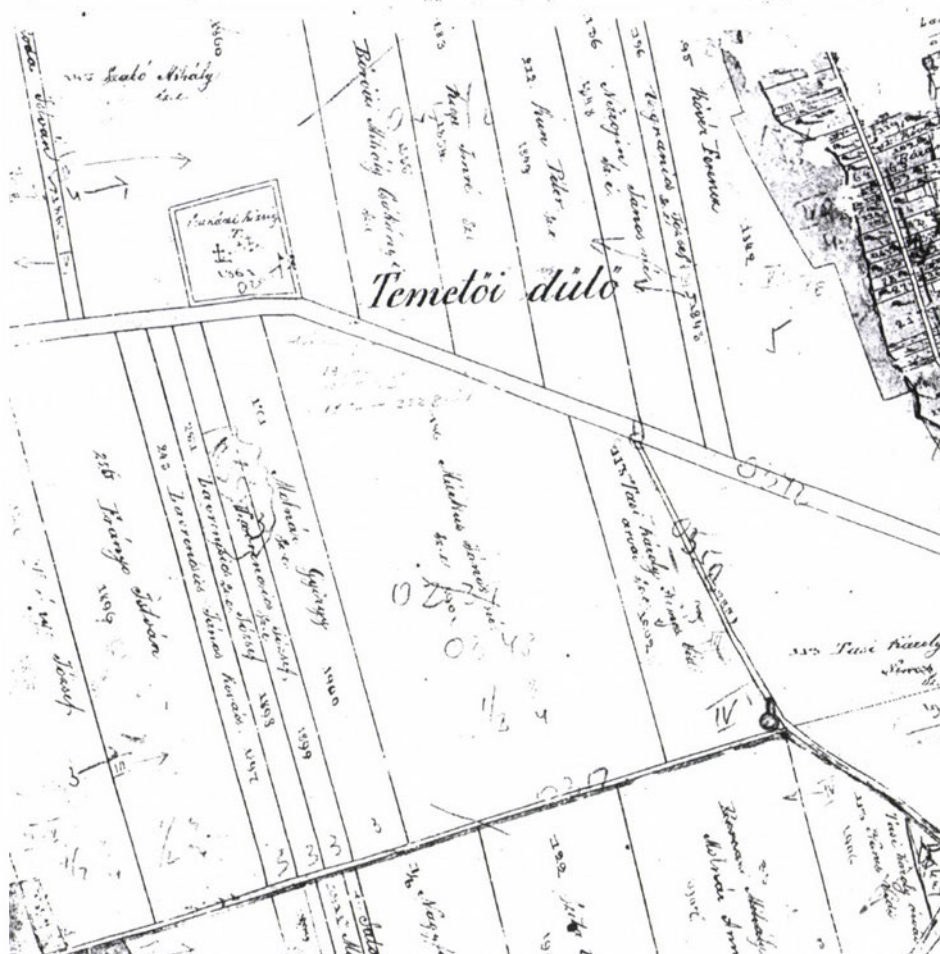


fig. 4. Temetői-dűlő on the map from the middle of the 19th century.  
(SML Map collection U 432)

Kis-Gáti-dűlő beside Nagyszakácsi is called Karikós-dűlő (XLVIII), while the name of the present Temető-dűlő [Cemetery field], where our site can be found, is Külső-Karikós-dűlő (XXXIV)<sup>79</sup> (fig. 5). It seems highly probable that the later place name preserved the distinctive attributive hidden in the name of the one-time settlement.

Probably the church dedicated to Saint John the Baptist mentioned in the sources stood in the territory of the modern Old cemetery. The documents report only about an entire plot of a nobleman,<sup>80</sup> a half plot<sup>81</sup> and a quarter of a villein's plot and a garden south of the church.<sup>82</sup> Since they make only a fraction of the settlement and we do not even know their relation to one another, we cannot tell more about the settlement structure of Külsőszakácsi from the sources.

Comparing the site with the aerial photos made of the territory, a discolouration of the soil can be observed in a north-west – south-east oriented zone (fig. 6). The line appearing as a light stripe in the aerial photo made by the FÖMI<sup>83</sup> and as a dark one in the one of the Institute of Military History<sup>84</sup> indicates the edge of the site as well. It can mark a one-time water course on which the village settled. A quadrangular 150 × 150 m large stripe appeared on the eastern side in a lighter colour than the surrounding ploughed area, while in some photos two light spots can be detected. We cannot be certain that they can be dated from the Middle Ages although the structural coincidences do not exclude that they belonged to Külsőszakácsi.

<sup>79</sup> SML Map collection K352. General cadastre sketch of Nagyszakácsi (1850–55).

<sup>80</sup> 1461: MOL DI. 15582, Bándi 1986, 48.

<sup>81</sup> 1453: MOL DI. 17462, Bándi 1986, 43.

<sup>82</sup> 1452: MOL DI. 14546, Bándi 1986, 43.

<sup>83</sup> FÖMI Map collection 1982: No. 1408/96.

<sup>84</sup> Military historical map collection of the Institute and Museum of Military History 1961: No. 42076.





uncovery of connections within the source, their interpretations and completion with other data in the case of perambulates of bounds, and finding out the relationship between the individual records in the case of data concerning smaller, sometimes only 1–2 *iugerum* large estates, we had to choose diverse methods at their analyses. At the same time, it also turned out that, in the case of the fields of Szakácsi, the reconstruction can be made only in smaller territorial units.

At the analysis of alienation deeds and donations, each unit of the estates is handled as a single record, and the first step of the study is the clarification of their position with relation to one another. Owing to the types of the sources and since they contain data scattered in time as well as in space, the data had to be fed into a computer with the indication of the various connections. The database of 153 records indicates the quantity and cultivation type of the individual estate parts, the place names given in the sources or the modern ones if they survived, their topographic position within these places, the old and the new owners, data hinting at the characteristics of land usage (direction of the field or arable land, etc.), the date of the document and the ordinary number of the records that seem to be connected from one respect or another (*Appendix 1*).

#### THE MAPPING OF THE DATA OF THE DOCUMENTS

First we reconstructed the outlines of the coherent territories described in the perambulates of bounds, which could be completed with related information from other documents.

The more detailed document from 1382 describes the lands of the Pauline monastery and the estates of the village.<sup>87</sup> At that time, the nobles in Szakácsi affirmed the donation their forefathers had done to the benefit of the monastery and they intended to fix it by the way of a perambulate of bounds. It started in the east at the boundary mark of Léta and Szakácsi. Then it proceeded southwards, westwards and then northwards and finished at one of the boundary marks of Szakácsi and Monyorókerék. On the route it passed by estates of the lesser nobility, roads, forests, coppices and a stream (*fig. 8*).

The document about the perambulation of the bounds of the estates of the Trepk family of Monyorókerék and the Szakácsi family of Szakácsi from 1371 – which at the same time describes a section of the boundary of the two villages – can be found in Tolvaj's formulary preserved in the National Széchenyi Library (*Appendix 2*).<sup>88</sup> The perambulate of bounds in 1382 mentions the village of Monyorókerék as the western or north-western neighbour of Szakácsi. The name of Monyorókerék in Somogy county cannot be found either in place names or in the ordinance surveys. Only the documents report about its existence and approximate location. Accordingly, Monyorókerék was the north-western neighbour of Szakácsi. A road led from the village to the monastery,<sup>89</sup> and it belonged to the parish of Szöcsény village.<sup>90</sup>

In 1371 the perambulate of bounds started from a river called Haas and proceeded from the west to the east. It crossed a road, the *Sichwa* (Zsitfa) river, which ran across a land called *Cheer* (Cser), then crossed the Monyorókerék road. Then they reached first a coppice, then a large protected or prohibited forest (*silva custodialis*) and a road. The perambulate of bounds was finished at a stream, where the dam of the mill of the monastery could be seen. The document also tells that the place called *Chereseuleu* (Cserszölő) can be found south of the route of the perambulate of bounds (*fig. 7*).

After having made a sketch from the data of the perambulates of bounds, we collected those records from the database that could be connected to any of the items listed in the perambulate of bounds. We made drawings after these records based on the relevant spatial information, then connected them to one another and to the data of perambulates of bounds (*figs. 9/a–c; 10/a–c; 11/a–b*).

In 1382 the perambulate of bounds started from the north-eastern fields of the village and proceeded southwards, where the forest of the priest of Szakácsi lay east of them, and the coppice of the Pauline monastery stretched in the west. In 1375, a document<sup>91</sup> mentioned

<sup>87</sup> MOL DI. 6903, *Bándi 1986*, 29–30.

<sup>88</sup> *Tolvaj's formulary* 128–129.

<sup>89</sup> 1382; MOL DI. 6903, *Bándi 1986*, 30, App. 1: 149.

<sup>90</sup> 1474; MOL DI. 17556, *Bándi 1986*, 55. Szöcsény village, to date Szöcsénypusztá north of Nagyszakácsi.

<sup>91</sup> MOL DI. 6264, *Bándi 1986*, 29, App. 1: 66.



an arable land of ten *iugerum* south of the forest of the All Saints parish Church, while in 1414<sup>92</sup> a thicket is mentioned between the forests of the Pauline monastery and the parish, on the northern side of an arable land donated to the Pauline monastery. A certain place called *Paperdey*, *Papharazthya* (Priestforest) is repeatedly mentioned in the documents within the borders of Szakácsi, Nagyszakácsi. In 1453<sup>93</sup> we learn that it lay in an area close to Gadány. Based on the name and the reference to the eastern fields of the village it seems probable that Paperdő was the name of the forest owned by the actual priest. The data tell that the forest was interrupted here and also in the neighbouring territories by arable lands, coppices and vineyards. For example, the coppice called *Zenegethewharazthya* (Szénégetőharasztja), bordered by a vineyard, can be found in Paperdő (fig. 9/a–c).<sup>94</sup>

Later, the perambulate of bounds reports about the coppice of the nobility of Szakácsi (*virgultum ... remanent ipsis scilicet Nobilibus de Szakács*), mentioning a path leading from Szakácsi to Léta west of it. We only mention but did not indicate in the map the uncertain record that the sons of Keres of Nagyszakácsi donated the vineyard they themselves had founded beside the road to Léta and the coppice of the village (*virgultum communitatis*) to the Pauline monastery in 1385.<sup>95</sup> The sources also tell that beside the above-mentioned path, a main road led from Szakácsi to Léta, so the question is which road they met in 1385. The place of the coppice could help but the coppice of the village and that of the nobility of Szakácsi cannot be identical since the first one refers to the forest that was used by the community of the village or some of the inhabitants, while the latter one was the coppice owned by certain members of the nobility in Szakácsi.

As the perambulate of bounds moved westwards, it arrived to a long prickly thicket called *Mege* (Megye). The Pauline monastery was given a part of an arable land east of the thicket called Megye in 1411, and the half of another arable land was exchanged in 1454 at a place called *Megeharazth* (Megyeharaszt), on the eastern side of which a public road (*via publica*) was mentioned.<sup>96</sup> This must be the path to Léta mentioned already in 1382. Further records tell that *Hatoserde* (Hátaserdő) lay beside *Megeharazth* (Megyeharaszt), and a forest called *Magaskerthuel* (Magaskörtvély) could be found east of it.<sup>97</sup> We know from the record from 1470 discussed at the inner territory that Külsőszakácsi lay south of Magaskörtvély. It should be added that Megyeharaszt, Hátaserdő and Magaskörtvély are mentioned in the sources, apart from one, within the borders of Külsőszakácsi or Felsőszakácsi, which means that this stretch of the perambulate of bounds in 1382 could not be far from the above-mentioned settlement (fig. 10/a–c).

Westwards, the perambulate of bounds arrived to the road that led to the monastery. They followed it for a short time, then turned west on the same road. We can also read about the road leading to the monastery and an arable land east of it in 1411.<sup>98</sup> Although we have no more references regarding at which stretch of the road the arable land lay, this record must be mentioned here since at that time Mihály Szakácsi's son Balázs donated the 1 *iugerum* large land to the Pauline monastery so it could probably be found near the Pauline estate.

The perambulate of bounds turned here to the north passing between Egyed's son János's and Demeter Soldus's arable lands and the forest of the Pauline monastery. The document states in an appendix that the road leading to Léta ran beside Egyed's son János's arable lands, where the Pauline monastery owned a field of 2 *iugerum* beside Egyed's son János's land. It was probably here that the Pauline monastery was donated a four *iugerum* large arable land, which was bordered by Egyed's son János's arable land in the south, Demeter's son János Soldus's arable land in the north and the west and a road in the east<sup>99</sup> (fig. 11/a–b).

The road to Léta is the joint element between the perambulates of bounds in 1382 and 1371. The road mentioned in 1371 west of the *Sichwa* (Zsitfa) river can be identified with the

<sup>92</sup> MOL DI. 10192, *Bándi 1986*, 38, App. 1: 67.

<sup>93</sup> MOL DI. 17462, *Bándi 1986*, 43, App. 1: 34.

<sup>94</sup> 1480: MOL DI. 18312, *Bándi 1986*, 57, App. 1: 31.

<sup>95</sup> MOL DI. 7139, *Bándi 1986*, 31, App. 1: 90.

<sup>96</sup> 1411: MOL DI. 9778, *Bándi 1986*, 36, App. 1: 112.;

1454: MOL DI. 14820, *Bándi 1986*, 44, App. 1: 23.

<sup>97</sup> 1455: MOL DI. 14913, *Bándi 1986*, 44, App. 1: 21.;

1462: MOL DI. 15723, *Bándi 1986*, 48, App. 1: 22.

<sup>98</sup> MOL DI. 9778, *Bándi 1986*, 36, App. 1: 92.

<sup>99</sup> MOL DI. 9778, *Bándi 1986*, 36, App. 1: 38.



road to Léta based to the data to be discussed later in the chapter on roads. The documents registered a place called *Cheer* (Cser), *Chereseuleu* (Cserszölő) beside it, south of the route of the perambulate of bounds, where even to date the part of the village called Cserhát is situated. The comparison of the routes of the perambulates of bounds reveals that the Cser part was probably met in 1382 as well. Cser probably lay on the border of the estate of the Pauline monastery, which is corroborated by the data referring to it in the documents. Mihály Kigyó donated 4 arable land parts (altogether 20 *iugerum*) and a meadow of two scythes (*falcastrum*) to the Pauline monastery in 1428.<sup>100</sup> The documents remark in the case of nearly every piece of land that they lie between the arable lands of the Pauline monastery, and once we can read that the Pauline monks sowed the donated arable land of 2 *iugerum*. In 1495, the monastery got an arable land measuring 4 and a half *iugerum* in an area called *Felsewcher* (Felsőcser), north and south of which lay the arable lands of the Pauline monastery.<sup>101</sup> The next donation was reported in 1500, when Máté Pauline prior gave Antal the officer of the Saint Benedict altar one and a half *iugerum* of arable land in Nagycser between the arable lands of the Pauline monastery, János Bodak's forest (*Bodakhianoserdeje*) and Péter Törpe's forest (*Echterpepetererdeje*).<sup>102</sup> The last donation came from András Tolvaj in 1539. He gave 12 *iugerum* arable land to the Pauline monastery in an area called Kiscseri.<sup>103</sup> It is important to note that, apart from a single case,<sup>104</sup> the documents do not mention lands of the nobility between the lands of the monastery. With all these in mind it is perhaps not farfetched to suggest that the mentioned donations can be found at the north-western end of the perambulate of bounds of 1382, between the arable lands of the Pauline monastery south of the Monyorókerék territory. So the joint elements help in the definition of the courses of the two perambulates of bounds in relation to one another.

To place the still schematic drawing on a map we needed points that could be located in the landscape, as the place of the monastery, the roads, the streams, the still existing place names and the settlements mentioned in the sources.

#### THE MONASTERY

The Pauline monastery dedicated to Saint Dominic and its place play an important role from the respect of the medieval topography of the village. The estate of the monastery partly originated from the territory of Szakácsi by means of donations, which, at least in space, were organically connected to the territory of the village. At the same time, the monastery, which was frequently mentioned in the sources, often served as a point of orientation at the description of the various areas. It should also be remembered that since the majority of the sources tell about land affairs between the nobility of Szakácsi and the Pauline monastery, the donations are probably related first of all to the territory closer to the monastery and here we have a greater opportunity for reconstruction.

There are no data about the exact date of the foundation of the monastery. The Saint Dominic monastery of Szakácsi was already mentioned in the registry made in 1263. The Pauline monastery had a relatively large estate in 1382, and ever new donations had enriched the monastery until in 1550 the monks, since they could no longer live there, leased the lands of the monastery for 12 years to István Gondos and Gergely and Mátyás Pálffy.<sup>105</sup>

In the literature, we can find general statements<sup>106</sup> and the adaptation<sup>107</sup> of the ground plan published by Tamás Guzsik<sup>108</sup> regarding the exact place of the monastery. Tamás Guzsik

<sup>100</sup> MOL DL. 11981, *Bándi* 1986, 40, App. 1: 48.

<sup>101</sup> MOL DL. 20358, *Bándi* 1986, 59, App. 1: 54.

<sup>102</sup> MOL DL. 20950, *Bándi* 1986, 62, App. 1: 49.

<sup>103</sup> Acta Conv. P. 1, no. 64. *Rupp* 1876, 293.

<sup>104</sup> It is mentioned as an addition to the perambulate of bounds in 1382 that the Pauline monastery has 2 *iugerum* of arable land and a meadow of two scythes beside Poka's son János's meadows. The above mentioned lands also lie next to the estates of the Pauline monastery.

<sup>105</sup> *Tolvaj's formulary* 129.

<sup>106</sup> *Csánki* 1909, 119. "A field is called Barátoki dűlő, because a monastery of the Pauline order stood here"; *Kocztur* 1964, 119. "The ruins of the Pauline monastery stood in the Barátok dűlő"; *Molnár* 1975, 228. Based on the data of the sources: "The noblemen of the village founded the monastery in a valley called Baráti szentegyház near Nagh Zakach."

<sup>107</sup> *Gál* 1992, 219.

<sup>108</sup> *Guzsik* 1986.



determined the place of the monastery after a field survey, relying mainly on the local traditions told by the villagers. He described that according to the traditions the monastery was near a by now abandoned farm called Barátok 2 km north-east of the village, although the inhabitants of the village could not point to the exact place. The author walked along the spring regions of the side-branches of the stream that flows here but could not find any trace of a medieval building on the surface. He marked the place of the monastery at the stream, about 1 km north of the Barátoki bridge on the sketch of the area drawn out of scale (as the published sketch is out of scale, the distance was deduced from the proportions of the map). I think that although the data in the study contain important information regarding the place of the monastery, the adaptation of the sketch without any remark would prompt an ultimate solution and thus it would be misleading.

We started the localisation of the monastery with the analysis of the sources. Most of them tell only that the monastery stood near the Szakácsi village, on its edge<sup>109</sup> or within its boundaries.<sup>110</sup>

The register from 1740 tells about the place or rather the ruins of the Pauline monastery. Accordingly, “some of the stone walls of the old Puszta Church are still standing in the valley, on the western side..” of the Baráti puszta next to Szakácsi, west of Gadány.<sup>111</sup> In the area we can find more than one place with the Baráti name or prefix. The Barátok-hill lies north-east of the village within the borders of Nagyszakácsi. The Barátok-hegyi stream runs across it toward south. A part of the forest on the eastern fringe of Somogyzsitfa is called Baráti forest, while the field called Baráti-puszta can be found in the southern part of the village toward Nagyszakácsi.

Although the ruins of the Saint Dominic monastery were still certainly standing in the middle of the 18<sup>th</sup> century, they were not indicated either in the First Ordinance Survey from 1783 or the second one from the beginning of the 19<sup>th</sup> century.<sup>112</sup> It is interesting to note, however, that in the second military map three roads meet along the Barátok-völgyi stream about 500 m north of the spot where the local tradition located the former building of the monastery (*fig. 3*).

The tradition holds that the Pauline monastery stood east of the Barátok-völgyi stream, about 100 m south of the northern border of Nagyszakácsi, in a lately uninhabited territory called Barátok or Barátok farm. The inhabitants of the farm started to settle over into the village in 1963 when the local agricultural co-operative was founded. The inhabitants have told that the traces of the monastery were found during the construction of the one-time barn.<sup>113</sup> The aerial photos made in 1961 still show houses in this place. Later it got depopulated and the forest invaded the territory.

During the field walkings, we could not find any trace of a building in the Barátok-puszta area or its vicinity within the territory of Somogyzsitva. The field walkings proved similarly unsuccessful on the Barátok-hill and in its environment. It must be added, however, that the area to which the local tradition refers is unsuitable for field walking because the surface is partly covered by a dense thicket and also because the farms have strongly disturbed the surface.

The comparison of the documents supports the supposition that the building could stand here. As it has already been mentioned, the monastery was always mentioned within the borders of Szakácsi. The perambulate of bounds in 1371 followed the northern border of Szakácsi, and based on later discussed data, this borderline approximately coincided with the northern border of the modern village. The eastern terminal of the perambulate of bounds was a landmark raised in the north beside the mill of the Pauline monastery. The monastery standing within the border of Szakácsi must have been somewhat to the south from this spot. In 1382, the perambulate of bounds followed the border of the estates of the Pauline monastery, and the monastery must have stood north of this line.

<sup>109</sup> 1456: MOL DI. 15022, *Bándi* 1986, 45.

<sup>110</sup> 1507: MOL DI. 21758, *Bándi* 1986, 64.

<sup>111</sup> *Gál* 1992, 219.

<sup>112</sup> Collo VII. Sectio 22.; Colonne XXV. Sectio 59.

<sup>113</sup> István Nagy's (Nagyszakácsi, 79, Kossuth L. street) oral communication. He also moved from the farm to the village in 1963.



All the above suggest that the monastery stood at the northern end of the Barátok hill near the Barátok-hegyi stream. To prove it, further archaeological studies are necessary. Although we could not identify the exact place of the monastery, it could approximately be located and the possible territory of the Saint Dominic monastery was accordingly conditionally marked in the map (*fig. 12, 13*).

#### THE ROADS

To locate the roads, we compared the data of the early maps, the results of field surveys, the place names and the information gained from the documents (*fig. 13*). The sources mention roads in altogether 19 cases. For the sake of a better orientation, we grouped them into three categories: 1. Main roads indicated as *via magna* (5), 2. minor roads (*via, semita*), of which at least one terminal is given in the document (7), 3. minor roads (*via, via publica*) the terminals of which are unknown, only some stretches are mentioned in the sources (7). In the table we printed in italics the destinations of the roads that are not mentioned in the texts but can logically be deduced. We have also marked the date of the source and the ordinal number of the given record in *Appendix 1*.

1.	2.	3.
<i>Szakácsi - Léta</i> , 1382 (150)	<i>Szakácsi</i> - monastery, 1382 (148)	road 1, 1371
Szőcsény - Léta, 1456 (153)	<i>Szakácsi</i> - Léta: path, 1382 (146)	road 2, 1371
<i>Szakácsi</i> - Gadány, 1471 (84)	<i>Szakácsi</i> - Léta, 1385 (90)	- Pauline vineyard, 1411 (89)
<i>Szakácsi</i> - Mésztegyő, 1480 (27, 28)	Léta - monastery, 1382 (145)	small road along the stream, 1382 (147)
<i>via magna</i> , 1411 (87)	<i>Szakácsi</i> - Monyorókerék, 1382 (144)	public road : <i>via publica</i> , 1454 (23)
	Road to Monyorókerék, 1371	footpath, 1451 (25)
	monastery - Monyorókerék, 1382 (149)	priest's road, 1466 (46)

Table 2. The roads in Szakácsi mentioned in the documents

The main road from Szakácsi to Léta seems to be the most significant road. The route of the perambulate of bounds in 1382 did not cross it, yet the document mentioned it in the appendix beside Egyed's son János's arable lands at the eastern stretch of the perambulate of bounds. Léta was first mentioned in the sources as *terra* in 1268.<sup>114</sup> The priest of Léta was mentioned in 1515.<sup>115</sup> Later the village perished and was not repopulated. The perambulate of bounds revealed that Léta neighboured Szakácsi in the north-east, its place is probably indicated by the Léta-majori dűlő in the fields of Marcali about 5 km north-east of Szakácsi. Regrettably, a larger part of the territory, which is surrounded by forest, is covered by weeds and bushes, and was unsuitable for field walkings. In the ploughed north-eastern part of the field we could not find any trace of a settlement. In the map of the First Ordinance Survey from the time of Joseph II, the territory is covered by forest, in the map of the Second Ordinance Survey from the 19<sup>th</sup> century, a clearing can be seen in the area of the modern Léta-majori dűlő, in the southern side of which the map indicates the Léta farm (*fig. 13*). The map also indicates the road stretch, which can still be seen as a hollow road in the forest, and which connects the Léta-majori dűlő with the road that runs to Szőcsénypusztá north of Szakácsi, then turns toward north-east and runs through the Léta forest toward Marcali. The record from 1456, which mentioned the magna via from Szőcsény to Léta indicates the stretch between Szőcsénypusztá and Marcali.<sup>116</sup> Lajos Glaser identified this road with a stretch of the road from Marcali to Zákány in 1929.<sup>117</sup> Judged from its position, the road running west of the Zsitfa river mentioned in the document from 1371, the modern national road, is identical with the *via magna* of Léta. Probably the via magna mentioned in 1411, on the southern side of which a thicket could be found, also meant the Léta road. The road to the vineyard of the Pauline monastery ran south of it.<sup>118</sup>

<sup>114</sup> ÁUO 188–189.

<sup>115</sup> MOL DI. 22664, Bándi 1986, 65.

<sup>116</sup> MOL DI. 15022, Bándi 1986, 45.

<sup>117</sup> Glaser 1929, 277.

<sup>118</sup> MOL DI. 9778, Bándi 1986, 36.



A document from 1471 mentioned the main road to Gadány beside *Kerektho* (Kerektó),<sup>119</sup> while from 1480 we are informed about the via magna to Mesztegnyő east of the field called Halmosföld.<sup>120</sup> As no more record refer to these two places, we can only propose that the above-mentioned roads are identical with the roads indicated in the ordinance surveys and the modern ones leading to Gadány and Mesztegnyő. This road starts eastwards in the northern part of the modern Szakácsi, then turns somewhat southwards and leads across the former Külsőszakácsi. From here it runs in the basin of a stream, goes round the vine-hill and leads toward Gadány turning in a north-westerly direction.

The localisation of the road to the monastery mentioned in the perambulate of bounds in 1382 is facilitated by the fact that we know both ends of the road, and that a stretch of the road can be found in the map from 1783 and the entire track in the map from the beginning of the 19<sup>th</sup> century (figs 2–3). The hollow road, which survived at some places in a depth of 2–3 metres, is still used by the villagers as the road to the Batrátok farm.

The east-west directed small road along the stream crosses the road to the monastery. The mentioned stretch could run along the Barátok-hegyi stream, which crossed the road to the monastery.

The path leading from Szakácsi to Léta, mentioned near the thicket called *Mege* in 1382, can be identified with the public road east of the place called *Megeharazth* (Megyeharaszt) mentioned in 1454 as a via publica<sup>121</sup> and with the road to Léta about which it is written in 1385 that the coppice of the village is east of it.<sup>122</sup> A road can be seen in the map of the Second Ordinance Survey that reaches Léta along the basin of the Barátok-hegyi stream. The perambulate of bounds suggests, however, that the path ran more to the south-west. It is also possible that the road from Léta to the monastery described in the perambulate of bounds in 1382 meant a more northerly stretch of the same road.

A stretch of the road from Szakácsi to Monyorókerék was at the eastern end of the perambulate of bounds in 1382, while the north-south directed stretch running more to the west was mentioned east of the Zsitfa river in the source from 1371.

In 1371 the perambulate of bounds followed the track of an east-west running road in the northern part of the modern Cserhát, at the eastern end of the which the mill of the Pauline monastery and the road that leads there are mentioned. The stream that fed the mill was certainly the modern Barátok-völgyi stream, and the mill and the road could be near the northern border of the modern Nagyszakácsi.

A donation to the Pauline monastery in 1466 reported about the priest's road, a public road to the forest, west and north of which coppices could be found.<sup>123</sup> At the same time, the perambulate of bounds in 1382 started on the road between the forests of the parish and the Pauline monastery. All these suggest that the perambulate of bounds started in 1382 on the priest's road.

The two ends of the road leading from the monastery to Monyorókerék can only approximately be determined. We have no data about the footpath mentioned in Külsőszakácsi in 1451.

#### RIVERS AND STREAMS

The Haas river, which was the terminal of perambulate of bounds in 1371, can be found in the text of a perambulate of bounds from 1331, when Tamás Transylvanian voivod was initiated, among others, to his estates in Tapsony.<sup>124</sup> The river is described as a river running from the north to the south east of Tapsony. After these data we can identify the *Haas* river with the modern Marót-völgyi canal.

Sichwa river (Zsitfa) is also mentioned in the document from 1371. It runs near the part called Cser east of a road. Cserhát is a still existing geographical name, this is how the northern settlement unit of the village and its environment is called. Zsitfa, accordingly, is

<sup>119</sup> MOL DI. 17203, Bándi 1986, 52.

<sup>120</sup> MOL DI. 18312, Bándi 1986, 57.

<sup>121</sup> MOL DI. 14820, Bándi 1986, 44.

<sup>122</sup> MOL DI. 7139, Bándi 1986, 31.

<sup>123</sup> MOL DI. 16445, Bándi 1986, 51.

<sup>124</sup> *Anjoukori Okmánytár II.* 558–560.



the medieval name of the Nagyszakácsi stream. The river (*Sythwa*), which flows northwards toward Somogyzsitfa, was also mentioned within the borders of Zsitfa in 1477.<sup>125</sup>

The stream that ran beside the Pauline mill at the eastern terminal of the perambulate of bounds in 1371 is the northern stretch of the modern Barátok-hegyi stream. The small road mentioned in the document in 1382 followed a more southerly stretch of this stream.

The next step was putting the above listed spots (monastery, roads, settlements, the field called Cser etc.) on a map and delineating the possible route of the perambulate of bounds with the indication of the rest of the data that could be identified. The medieval names are printed in italics in the map (*fig. 13*). We omitted the cartographic indication of the arable lands indicated in the drawing along the route of the perambulate of bounds since we do not have information about their sizes and often even about their exact location. Consequently, marking them in the map could be misleading.

### **Land measures used in Szakácsi**

A diverse use of square measures can be observed in Szakácsi. The most common measure was that of the arable land measured in *iugerum*, although in 1451 the size of the lands was given in customary *iugerum*. It happened that no unit of measure was mentioned or only a piece of arable land was donated,<sup>126</sup> and in 1463 we can even read about pieces of land measuring the width of a cart.<sup>127</sup> The sources repeatedly mentioned a surface measure of a day's ploughing. In 1453 we can read about "*habeo mediam dietam wlgo zantho feld ... comparavi secundum dimidium dietam wlgo zanthofeld*", that is a land that can be ploughed in half-a-day,<sup>128</sup> while in 1480 a piece of land described as "... *terrarum arabilum ad duarum dierum aratra ...*" is referred to at two separate places.<sup>129</sup> István Bogdán identified the size of the territory that could be ploughed in a day with the size of a customary *iugerum* especially because of the *vulgo* arable land and other data of the documents.<sup>130</sup> A donation deed to the Pauline monastery, however, contained the followings in 1471: "... *terram Berekynezel ad aratra decem et medii dierum simul cum rubetis ibidem habitis ac tria iugera terre Rokethas ...*", that is Berekynezel land of ten and a half days' ploughing with the adjacent coppices, three *iugerum* of a land called Rokethas.<sup>131</sup> Here the source clearly differentiated the land of a day's ploughing and the square measure *iugerum*, so the identification of the two units of measurement should be accepted with reservations, at least in the case of Szakácsi. The record from 1453 rather suggests that arable land used as a unit of land measure, which is really often used in the sources without the indication of any unit of superficial measure, can be identified with an arable land of half-a-day's ploughing. In my opinion, the use of arable land in the sense of a *iugerum* cannot be proved from the listed data, although they do not refute it either. The connection of the medieval land and the capacity of the plough was demonstrated early in the historical studies.<sup>132</sup> Márta Belényesy discussed it in details that the territory counted by the plough, a land for a plough, is the size of the territory that can be ploughed with a single plough in a year, which gives the average of a day's work with the plough in a *iugerum*. *Iugerum*, accordingly, was originally a land that could be ploughed in a day.<sup>133</sup> Jenő Szűcs, similarly to Belényesy, explained the divergences of the size of the land for a plough and the measurement of *iugerum* in different territories and in various periods with changes of the cultivation technology. He convincingly demonstrated that the territorial capacity of the moulded plough that appeared in the 13<sup>th</sup> century and turned the land more thoroughly was smaller than that of the former scratch plough. At the same time, the ploughing of the narrow strips of lands was more economic with the new plough type. In consequence, with the shortening of the royal *iugerum*, which had probably developed in a royal land structure, the smaller customary *iugerum* became regularly used. According to his calculations from the

<sup>125</sup> MOL DI. 17914, Bándi 1986, 56.

<sup>126</sup> 1453: MOL DI. 17462., Bándi 1986, 43, App. 1: 119

<sup>127</sup> MOL DI. 15903, Bándi 1986, 50, App. 1: 78.

<sup>128</sup> MOL DI. 17462, Bándi 1986, 43.

<sup>129</sup> MOL DI. 18312., Bándi 1986, 57.

<sup>130</sup> Bogdán 1978, 219. and 237.

<sup>131</sup> MOL DI. 17203., Bándi 1986, 52., App. 1: 20.

<sup>132</sup> Wenzel 1887, 170.

<sup>133</sup> Belényesy 1955, 84–85.



use of customary *iugerum* in the documents, with the longitudinal division of a royal *iugerum*, measuring the width of 12 royal fathoms (*ulna*), a *iugerum* measure of a width of 7–8 royal fathoms can be supposed. So the former 1:6 width-length proportion changed to 1:9–10. Jenő Szűcs also called attention to the fact that the process he sketched could best be observed in counties Somogy and Zala where the moulded plough appeared in the 13<sup>th</sup> century.<sup>134</sup>

Based on the above, the contradiction between the sizes of a land a day's ploughing and a *iugerum* observed in Szakácsi can be resolved supposing that *dieta* originally really meant a territory of a *iugerum*, probably a territory closely related to a royal *iugerum*.<sup>135</sup> In connection with the above process, it seems probable that, parallelly to the decrease of the size of a *iugerum*, *dieta* preserved its original size and later fixed in this form. If we accept this and that a *vulgo* arable land is identical, as Bogdán holds, with the size of a *iugerum*, the customary *hold* that became accepted in Szakácsi can be equalled to the half of a royal *iugerum*.

It should be added that Zsuzsana Bándi uses the territorial unit of a *dieta* in his source publication in the sense of a land for a plough. In the sense of the above, I find this solution awkward since a land for a plough as a unit of land measure hints at the cultivation capacity of a plough in a year, which is around 100–150 *iugerum*.

### *Forms of landholding and cultivation*

The sources contain several records that refer to certain spots, which are difficult to place within the boundary of the modern village. One of the reasons is, beside the incomplete data gained from the sources, that only a few of the medieval place names have been preserved to our times. The exceptions are the above mentioned *Cheer* (Cser), *Chereseuleu* (Cserszölő) – Cserhát; *Kylenchdyofazele* (Kilencdiófaszéle) – Diós-dűlő; *Niresalya* (Nyíresalja), *Niresalath* (Nyíresalatt) – Nyíresi. In some cases it turned out that the identical or nearly identical names mentioned in the documents and observed among the modern names do not mark the same place.<sup>136</sup>

Due to the scarcity of data and the difficulties in locating the medieval place names, the smaller fields, which cannot be marked in the map, can also call attention to certain characteristics of the fields on the outskirts. It should be stressed, nevertheless, that the sources nearly always tell about the lands of the nobility, and since many of them were donations to the Pauline monastery, they probably lay at the northern part of the outskirts, near the lands of the monastery.

Examining the landholding forms of the lands on the outskirts, the double feature of communal and private landholding forms can be observed in the case of the lands of the nobility. The terminology and the formal traits of the communal land regulation, as it was first described in Hungary by Károly Tagányi<sup>137</sup> and as it has ever since been discussed in the literature, can be found at the description of the individual parts of the estates. The essence of the economy based on the periodical redistribution of the land, which partly originated from the pasturing economy called nomadic land community by Tagányi, was that the territory was divided into fields according to the quality of the soil, and, until the next distribution, the members of the village tilled each a parcel in the individual fields. In result, the small strips of land of the various owners were distributed side by side in the various fields following a certain pattern. This type of landholding can equally be associated with rotation and fallowing cultivation systems from the respect of the cultivation type. The existence of this form of landholding in Szakácsi is suggested by the fact that the individual arable lands were certainly arranged in fields. The sources mention fields (*diverticulum*) in the territory called Kilencdiófa (*in diverticulo novem arborum nucum*)<sup>138</sup> and in a place called *Halmas*,<sup>139</sup>

<sup>134</sup> Szűcs 1993, 177–181.

<sup>135</sup> Since Szakácsi was the settlement of servicing population included in the royal land organisation, we have every reason to suppose that royal *hold*, which had developed in the royal estates, was used in the early period.

<sup>136</sup> *Nagreth* (Nagyvér) belonged to Külsőszakácsi, while the modern Nagyvér can be found near the inner territory of Nagyszakácsi. 1451: MOL DI. 14498, Bándi 1986, 42; Végh 1974, 314.

<sup>137</sup> Tagányi 1950.

<sup>138</sup> 1452: MOL DI. 14546, Bándi 1986, 43, App. 1: 2.

<sup>139</sup> 1453: MOL DI. 14546, Bándi 1986, 43, App. 1: 29.



and the same is suggested by the names *Bereknyezeel* (Bereknyeszéle)<sup>140</sup> and *Weresgevgzele* (Veresgyörgyszéle).<sup>141</sup> György Veres's will from 1453 also hints at a certain arrangement of arable lands when he mentions an arable land that lies *in ordinato vaginatum vulgo zalagon* beside a place called *Papharaztya* (Papharasztya).<sup>142</sup> Probably the traces of this structure can be detected in the regularities revealed in the adjacency of some lands of the nobility. György Kis Antal Iwanka of Külsőszakácsi's son bought some 1–2 *iugerum* large arable lands from Mihály Tolvaj in 1451. At the description of the lands distributed in nine different areas, the neighbouring landholder is mentioned in four cases. The arable lands can be found beside Péter Bor's land in the territories called *Zel* (Szél) and *KysErethwenhegh* (Kiseresztvényhegy), while at *Zekerhyd* (Szekérhíd), the buyer Antal's son György himself is the neighbour.<sup>143</sup> In György Veres's above mentioned will from 1453 we can find an arable land that he had bought from Tamás Szabó's daughter Klára, the neighbours of which were György Bíró in the west and he himself in the east. He had certainly bought the vineyard in the *Hwyhegh* (Újhegy) also from Tamás Szabó's daughter Klára. Here the eastern neighbour was György Bíró, while he himself (*solusmeth*) was the neighbour in the east.<sup>144</sup>

It was not unusual in the Middle Ages that the lands of the nobility were inserted into the communal land structure. The appurtenant lands on the outskirts of the nobility living in the community of villeins did not usually differ from those of the villeins,<sup>145</sup> although there are examples indicating that two strips of land were allotted to the manor of a nobleman.<sup>146</sup> Land divisions and donations in the 14<sup>th</sup>–15<sup>th</sup> centuries often meant the division or donation of only the plots of the nobility, while the lands on the outskirts were left for communal use.<sup>147</sup> Putting the lands of the nobility in Paty, Vas county, in 1334 on a map shows that the arable lands measuring 1–2 *iugerum* lay in distant parts of the outskirts of the village.<sup>148</sup>

In the course of the periodic redistribution, the lands were distributed at different places, that is the size characterised the appurtenant land of a plot and not its place on the outskirts. In the case of Szakácsi, however, we can see that, on the one hand, the nobles could freely dispose of their lands, and, on the other, the arable lands of the nobility are described at fixed geographical spots, which supposes a permanent ownership. The phenomenon can have several explanations. It is possible that the nobility of Szakácsi used the system of free occupation,<sup>149</sup> although the scattered character of the arable lands into strips of 1–2 *iugerum* and the fact that free occupation was characteristic of the early period when free land was abundant and when the nobility of Szakácsi stood close to villeins in a legal status make it improbable that the system could generally be sustained in the case of the lands of the nobility. The data rather suggest that the strips of the former division system became permanently owned holdings at the place of the last distribution. Since there are no data concerning the lands tilled by villeins, it cannot be decided if the appurtenant lands of the villeins' plots and the lands of the nobility wedged between them got fixed at the same time in the given position or we can see the traces of the process when the distributed lands of the nobility kept their places, while legally they were slowly withdrawn from the communal lands of the village.<sup>150</sup>

Beside the traces indicating integration in the former communal landholding system, some data suggest the existence of the permanent estates of the nobility. The frequency of place names containing personal names is conspicuous in the documents: *Petesiamuserdee*,<sup>151</sup>

<sup>140</sup> 1471: MOL DI. 17203, *Bándi 1986*, 52, App. 1: 20.

<sup>141</sup> 1503: MOL DI. 21187, *Bándi 1986*, 63, App. 1: 106.

<sup>142</sup> 1453: MOL DI. 14546, *Bándi 1986*, 43, App. 1: 35.

<sup>143</sup> 1451: MOL DI. 14498, *Bándi 1986*, 42, App. 1: 26., 44., 58.

<sup>144</sup> 1453: MOL DI. 17462, *Bándi 1986*, 43, App. 1: 35. and 60.

<sup>145</sup> *Maksay 1971*, 209; *Szabó 1969*, 19.

<sup>146</sup> *Tagányi 1950*, 58.

<sup>147</sup> *Tagányi 1950*, 57; *Maksay 1971*, 210.

<sup>148</sup> *Maksay 1971*, 211.

<sup>149</sup> In free occupation system the members of the community distributed a chosen meadow on the outskirts and used it until the soil got exhausted. As the free territories diminished the lands slowly turned into parts of a distribution system or were transformed into permanent holdings. *Tagányi 1950*, 24–25; *Szabó 1969*, 68.

<sup>150</sup> We can find examples how the lands the nobility allotted in the distribution system became permanently owned holdings: 1575: Derzsa, 1620: Bodrogolaszi *Tagányi 1950*, 59.

<sup>151</sup> 1444: MOL DI. 13763, *Bándi 1986*, 42, App. 1: 98.



*Markerdeye*<sup>152</sup>, *Bodakhianoserdeje*, *Echterpepetererdeje*<sup>153</sup>, *Weresgeurgzele*<sup>154</sup>, *Alexandorbyky*<sup>155</sup>, *Giwthusgeype*<sup>156</sup>, *Barkolchazele*<sup>157</sup>, *Tholway valley*<sup>158</sup>, *Bakathorgeep*.<sup>159</sup> Half of these place names contain the personal names of the nobles known from the documents (János Petes, János Bodak, Péter Törpe, György Veres, Mihály Tolvaj, László Bakator's son Benedek). These names with personal names imply that first of all the forests and also the cultivated lands were private properties. One of the reasons can be the above-mentioned landholding form of the appurtenant lands of the nobility as suggested by the place name *Weresgeurgzele* (Veresgyörgyszéle), which name hints at the arrangement of lands into fields and the presence of private property as well. At the same time, some sources interpret the suffix *széle* (*zele*) of certain place names as a field (*diverticulum*)<sup>160</sup>, while in the case of *Barkolchazele* it was completed with the expression *laneus*. The use of *laneus* as a unit of arable land was observed by Márta Belényesy in Pozsony, Szepes and Trencsén counties, especially in territories inhabited by German populations, where they indicated the permanent, privately owned appurtenant lands of tofts on the outskirts from the end of the 13<sup>th</sup> century.<sup>161</sup> The *laneus*-type arable lands were private properties from the very start. The reason in the mentioned counties was that a long deforestation process had to precede the tilling of the land. *Laneus* as an appurtenant arable land could mean scattered arable land parts, and also lands around the toft. Regarding the origin of the land marked by the expression *laneus* in Szakácsi, it certainly cannot be identified with the arable lands created with clearing in the northern counties, although a similarity can be supposed from a legal respect and regarding their spatial consolidation. The place names containing personal names, at the same time, can also mean individually cleared lands, where the law of first occupation was valid, that is the person who first broke the soil, be it a villein or a noble, could use the land as his private property.<sup>162</sup> It is possible that such a private occupation of a once uncultivated land hides behind the names *Giwthusgeype* and *Bakathorgeep*.<sup>163</sup> In the latter one we can suppose the property of László Bakator's son Benedek, who was compelled to pay 25 denar marks for the maiming of a monk's hand in 1413<sup>164</sup>, or a member of his family. This land was already mentioned as Demeter Hegedűs's property in 1494, and was situated in the neighbourhood of a nobleman's plot in Nagyszakácsi and not on the fringes of the outskirts.

At the same time, the data regarding the alienation and exchange of the lands of the nobility reveal the intention of the lesser nobility of Nagyszakácsi to have their lands close to one another and not scattered. The result of the process that Ferenc Maksay called early consolidation of the land was that the appurtenant lands of the nobility were distributed in twos and threes in a field.<sup>165</sup> This is evidenced by the data that tell about persons who bought or exchanged lands in a given field. Antal Iwanka of Külsőszakácsi's son György bought 1 *iugerum* arable land from Mihály Tolvaj in 1451, which lay in Külsőszakácsi, toward Imre's son Peter's garden<sup>166</sup> In 1463, he purchased half a *iugerum* of arable land, which also lay toward Imre and Péter's garden.<sup>167</sup> Antal's son György purchased half a *iugerum* of arable land in *Kerekerdealath* (under the Kerekerdő) in 1444, then each 1 *iugerum* of arable land at the same place in 1451 and 1463.<sup>168</sup> The same person bought one and a half *iugerum* of arable land at the *Hataserde* (Hátaserdő) in 1455, and 3 *iugerum* of arable land between *Hathaserdew* (Hátaserdő) and *Megesharazth* (Megyeharaszt) in 1462 from Kozma of Nagyszakácsi's sons Imre and Bálint.<sup>169</sup> He also bought half a *iugerum* of arable land from the parish in 1454 at a place called *Megeharazth* (Megyeharaszt) beside the Hátaserdő,

<sup>152</sup> 1507: MOL DI. 21669, *Bándi* 1986, 64, App. 1: 101.

<sup>153</sup> 1500: MOL DI. 20950, *Bándi* 1986, 62, App. 1: 49.

<sup>154</sup> 1503: MOL DI. 21187, *Bándi* 1986, 63, App. 1: 106.

<sup>155</sup> 1385: MOL DI. 7139, *Bándi* 1986, 31, App. 1: 90.

<sup>156</sup> 1453: MOL DI. 17462, *Bándi* 1986, 43, App. 1: 108.

<sup>157</sup> 1425: MOL DI. 11681, *Bándi* 1986, 39, App. 1: 110.

<sup>158</sup> 1471: MOL DI. 17203, *Bándi* 1986, 52, App. 1: 76.

<sup>159</sup> 1494: MOL DI. 20347, *Bándi* 1986, 58.

<sup>160</sup> The place *Kylenchdyofazele* mentioned in 1451 and 1463, was marked by the expression "*in diverticulo novem arborum nucum*" in 1452.

<sup>161</sup> Belényesy 1955, 72–76.

<sup>162</sup> Tagányi 1950, 27–28; Maksay 1971, 186–187.

<sup>163</sup> Gyep was the name of the uncultivated, wild territory in the Middle Ages: 1257: "... *terra inculta que gep vocatur* ..." *Szücs* 1993, 182.

<sup>164</sup> MOL DI. 10129, *Bándi* 1986, 38.

<sup>165</sup> Maksay 1971, 210, 214.

<sup>166</sup> MOL DI. 14498, *Bándi* 1986, 42, App. 1: 115.

<sup>167</sup> MOL DI. 15826, *Bándi* 1986, 50, App. 1: 116.

<sup>168</sup> 1444: MOL DI. 13763, *Bándi* 1986, 42, App. 1: 13.;

1451: MOL DI. 14498, *Bándi* 1986, 42, App. 1: 17.;

1463: MOL DI. 15826., *Bándi* 1986, 50, App. 1: 16.

<sup>169</sup> 1455: MOL DI. 14923, *Bándi* 1986, 44, App. 1: 21.;

1462: MOL DI. 15723, *Bándi* 1986, 48, App. 1: 22.



which lay next to his own lands.<sup>170</sup> Another example of the intent to obtain a neighbouring land is when Benedek Kaczó of Szakácsi's son Miklós gave twice 1 *iugerum* of arable land to the Pauline monastery in exchange for 2 *iugerum* of arable land beside his own land.<sup>171</sup> In 1411, Mihály of Szakácsi's son Balázs donated 1 *iugerum* of arable land to the Pauline monastery on the western side of his land, north and west of which János Poka's lands lay.<sup>172</sup> The results of the early consolidation of land is also manifested in the fact that Mihály Kígyó could give the Pauline monastery altogether 18 *iugerum* of arable land at a place called *Cher* (Cser) in exchange for the plot and the vineyard that his sister had bequeathed to the monastery,<sup>173</sup> then in 1495 he donated yet 4.5 *iugerum* of arable land to the monastery together with Márton Vidi and Péter Orros's widow at *Felsewcher* (Felsőcsér).<sup>174</sup> Lands similarly collected in a field could be seen in 1382, when the perambulate of bounds passed beside Poka's son János's sons' lands, Egyed's son János's arable lands and Demeter Soldus's arable lands. It is not only the consolidation intent of the lesser nobility that can be surmised in the background of lands occupying a larger territory, they can also be lands obtained by private occupation or they can be lands of free occupation, which often existed together with distributional communal landholding. The relevant data are from the fringes of the outskirts of the village. Mihály Kígyó, Egyed's son János and Demeter Soldus had arable lands in Cserhát or near it, while Poka's son János's sons had lands in the north-eastern corner of the outskirts of the village. It frequently occurred in the Middle Ages that in the territories closer to the village the distribution system was applied, while at most distant parts lands occupied by private clearing and originally freely occupied lands can be found<sup>175</sup> that later could be included in the distribution system or become permanent holdings.<sup>176</sup>

The landholding forms of forests also show the coexistence of the private and communal forms in Szakácsi. In 1385, on the occasion of a vineyard donation to the Pauline monastery, the coppice of the village (*virgultum communitatis*)<sup>177</sup> is mentioned beside György Bechy's coppice. György Székely mentions this record as an example to the communal forests of farming communities.<sup>178</sup> The coppice of the nobility of Szakácsi (*virgultum ... remanent ipsis scilicet Nobilibus de Szakács*)<sup>179</sup> and forests marked as private properties, like Pető's son János's and Egyed's son János's forests were mentioned in the perambulate of bounds three years before. Communal forests, accordingly, did not afford an unconditional use of the forest for the entire community of the village. Later data, the alienation and donation of forest parts and the mentioning of forests bearing persons' names support the theory that the former communal holding of the forests got disrupted, some remained under communal regulation, probably by the villeins, while others became incorporated in the estates of the nobility.

Regarding the landholding forms, the analysis of documents has demonstrated that the lands of the nobility of Szakácsi show characteristics both of the communal regulation of the lands and private holding. Although there are no data concerning the form the villeins owned their lands except for the existence of a communal forest, the mentioned double feature of the lands of the nobility suggests that the elements of the former servicing population that were gradually raised from the villein rank to the rank of the nobility acquired lands on the basis of the landholding rights of the nobility, then aspired to unite their parcels through separating, even territorially, their lands from the communal fields. Yet it seems there existed lands on the fringes of the outskirts that were cultivated according to the rules of the first occupation and/or arable lands that after some time became permanent estates of the nobility.

Some data refer to the cultivation technique. The expansion of arable lands, meadows and vineyards by clearing is indicated by the cultivated areas that can be found in territories marked by names referring to forests. An arable land<sup>180</sup> and a vineyard<sup>181</sup> could be found west

<sup>170</sup> MOL DI. 14820, *Bándi* 1986, 44, App. 1: 23.

<sup>171</sup> MOL DI. 15357, *Bándi* 1986, 46, App. 1: 96.

<sup>172</sup> MOL DI. 9778, *Bándi* 1986, 36, App. 1: 113.

<sup>173</sup> MOL DI. 9778, *Bándi* 1986, 36, App. 1: 113.

<sup>174</sup> MOL DI. 20358, *Bándi* 1986, 59, App. 1: 54.

<sup>175</sup> *Tagányi* 1950, 20–21, 26; *Szabó* 1969, 63.

<sup>176</sup> *Szabó* 1969, 68.

<sup>177</sup> MOL DI. 7139, *Bándi* 1986, 31, App. 1: 90.

<sup>178</sup> *Székely* 1953, 93.

<sup>179</sup> *Fejér Cod. Dipl.* IX/5. 617–621.

<sup>180</sup> 1444: MOL DI. 13763, *Bándi* 1986, 42, App. 1: 13;

1451: MOL DI. 14498, *Bándi* 1986, 42, App. 1: 17;

1463: MOL DI. 15826, *Bándi* 1986, 50, App. 1: 16.

<sup>181</sup> 1428: MOL DI. 11981, *Bándi* 1986, 40, App.

1: 14–15.



of the Kerekerdő within the boundary of Külsőszakácsi, while east of it, partly at *Borsohel* (Borsohely), further arable lands<sup>182</sup> were situated. An arable land and a coppice<sup>183</sup> are known at a place called *Borsohel* (Borsohely), a vineyard<sup>184</sup> and a coppice<sup>185</sup> at *Zewlewharazth* (Szőlőharaszt), a meadow and a forest<sup>186</sup> at *Niresalath* (Nyíresalatt) and the documents mention arable lands at *Hatoserdew* (Hátaserdő)<sup>187</sup>, *KysErethwenhegh* (Kiseresztvény hill)<sup>188</sup>, *Papharazthya* (Papharasztja)<sup>189</sup> and *Chypanharazthya* (Csipánharaszt).<sup>190</sup> The name of the *Kylenchdyofazele* (Kilencdiófászéle) field in Külsőszakácsi, which is probably identical with the modern Diós-dűlő, also attests to an arable land cut out from a forest.<sup>191</sup> Smaller arable lands<sup>192</sup> were exchanged near a spring called *Kwthfe* (Kútő) at *Hasberky* (Hársberek) also in Külsőszakácsi, and the sources mention a forest, a meadow and an arable land at Hársberek.<sup>193</sup> East of it can be found the meadow called *Naghreth* (Nagyret),<sup>194</sup> which is bordered by a forest in the east. The perambulates of bounds also inform us that the arable lands often alternated with thickets and coppices, which can indicate not only the regular land occupation with clearing but can refer to such a regulated rotation cultivation where the arable lands were sometimes abandoned, left to rest and the former pastures were cultivated instead. Examining the expressions *terra fimata*, *terra arabilis*, *terra campestris* appearing in the sources from the 14<sup>th</sup> century, Márta Belényesy has demonstrated the basic traits of the fallowing cultivation system.<sup>195</sup> The essence of the cultivation based on the alternation of arable lands and pastures is that beside the cultivated lands, there were territories on the outskirts, usually next to them, that had been ploughed and left temporarily rest. These fallow lands were used for pasturing, or the forest recaptured them and became thickets or coppices. Such a functional relationship between the arable lands and the fallow lands is suggested by the fact that György Veres donated an arable land of ten-and-half-a-day's ploughing together with the coppices beside it to the Pauline monastery in 1471.<sup>196</sup> Regarding the regulation system of land usage, Belényesy indicated the lowlands of Somogy, Zala and Veszprém counties as a characteristic territory of the fallowing system combined with communal land usage.<sup>197</sup> The above described communal landholding forms suggesting a former distribution system imply regulated land usage. The large number of coppices and thickets and their position between the arable lands suggest that in Szakácsi the fallowing cultivation system seems to have been more common than the rotation system, which demanded the treatment of the land left to rest.<sup>198</sup>

### *The results of the archaeological field walkings*

The information the documents contain about the village of Szakácsi are scattered both in space and time. They describe the geographical position of the individual plots, arable lands, meadows and forests, or refer to landholding forms or cultivation types. The archaeological field walking made in the settlement reveals the structure and the hierarchy of the settlements inhabited during the Middle Ages with regard to the entire territory. The different nature of the two source groups afford us to raise questions, while the historical and archaeological data can complete one another owing to the interrelations between the answers.

The data of the field walkings can help in the interpretation of the data and the location of the information in the real landscape. The typical cases are, for example, the identification

<sup>182</sup> 1463: MOL DI. 15826, *Bándi 1986*, 50, App. 1: 18., 129.

<sup>183</sup> 1461: MOL DI. 15611, *Bándi 1986*, 47, App. 1: 19; 1471: MOL DI. 17203, *Bándi 1986*, 52, App. 1: 20.

<sup>184</sup> 1471: MOL DI. 17203, *Bándi 1986*, 52, App. 1: 47.

<sup>185</sup> 1466: MOL DI. 16445, *Bándi 1986*, 51, App. 1: 46.

<sup>186</sup> 1444: MOL DI. 13763, *Bándi 1986*, 42, App. 1: 57;

1471: MOL DI. 17224, *Bándi 1986*, 53, App. 1: 55.

<sup>187</sup> 1455: MOL DI. 14913, *Bándi 1986*, 44, App. 1: 21.

<sup>188</sup> 1451: MOL DI. 14498, *Bándi 1986*, 42, App. 1: 26.

<sup>189</sup> 1453: MOL DI. 17462, *Bándi 1986*, 43, App. 1: 33.

<sup>190</sup> 1451: MOL DI. 14498, *Bándi 1986*, 43, App. 1: 64;

1463: MOL DI. 15826, *Bándi 1986*, 50, App. 1: 65.

<sup>191</sup> 1451: MOL DI. 14498, *Bándi 1986*, 42, App. 1: 1;

1452: MOL DI. 14546, *Bándi 1986*, 43, App. 1: 2;

1463: MOL DI. 15826, *Bándi 1986*, 49–50, App.

1: 3–4.

<sup>192</sup> 1444: MOL DI. 13763, *Bándi 1986*, 42, App. 1: 6.,

8.; 1453: MOL DI. 17462, *Bándi 1986*, 43, App. 1:

5, 7.

<sup>193</sup> 1452: MOL DI. 14546, *Bándi 1986*, 43, App. 1: 11;

1463: MOL DI. 15826, *Bándi 1986*, 50, App. 1: 9–10.

<sup>194</sup> 1451: MOL DI. 14498, *Bándi 1986*, 42, App. 1: 12.

<sup>195</sup> *Belényesy 1954–1955*.

<sup>196</sup> MOL DI. 17203, *Bándi 1986*, 52, App. 1: 20.

<sup>197</sup> *Belényesy 1964*, 323–324.

<sup>198</sup> *Belényesy 1960*, 92–93.



of the perished settlements mentioned in the documents with archaeological sites. At the same time, they offer an insight into the settlement system of territories that are not mentioned in the documents. The question is if the phenomena sketched from the data of the documents can be correlated with the results of the archaeological field walkings and what surplus information they can provide regarding the medieval settlement.

The field walking in the territory of the modern Nagyszakácsi<sup>199</sup> resulted 58 sites (P/15 sites, P-RP/1 site, P-RP-ÁE/1 site, P-RP-MA/1 site, P-ÁE/1 site, P-MA/4 sites, Rp/1 site, RP-ÁE/1 site, MP(Avar)/1 site, ÁE/4 sites, ÁE-MA/14 sites, MA/14 sites).<sup>200</sup> Most of the sites (40) contain finds from the Árpadian Era and/or the late Middle Ages, several medieval sites can be found in those parts of the village that are not mentioned in the documents.

Examining the distribution of the sites we find that the sites of the Árpadian Era and the Late Middle Ages cluster in three territories (*fig. 12*): west, south-west of the inner territory of the modern Nagyszakácsi, in the southern part of the Cserhát and in the territory and the environment of the former Külsőszakácsi. The lack of sites was conspicuous in the north-western part of the outskirts, while the repeated field walkings located prehistoric sites<sup>201</sup> in the north-eastern part of Szakácsi.

The largest sites of the Árpadian Era and/or the late Middle Ages (1, 3, 28, 29) covered the territories of the former Szakácsi, Nagyszakácsi and Külsőszakácsi, while very small, separate sites dominated in the Cserhát and west of the inner territory.

The quantity and the quality of the collected find material rarely afford the determination of a finer chronology. We could only differentiate with certainty the finds from the Árpadian Era and the Late Middle Ages. Each of the four sites found in the Sámsoni-sűrű-dűlő near the Cserhát (51–54) contains late medieval pottery. Sites nos 1–5 in the Diós-dűlő, Temetői-dűlő and Kis-gáti-dűlő east of the village yielded mostly late medieval pottery and a few finds from the Árpadian Era. West, south-west of the inner territory of modern Nagyszakácsi the finds of the Árpadian Era were found mainly in the southerly territories, while the northern area contained first of all late medieval sherds, similarly to sites nos 28 and 29 indicating the former Szakácsi, Nagyszakácsi, where the sherds of the Árpadian Era clustered in the southerly territories.

Accordingly, the results of the field walkings show that three larger and several smaller settlement units clustered in certain areas of the outskirts existed in the Middle Ages. The two sites in the territory of the modern Nagyszakácsi are separated in space and time as well. The southern settlement unit is characterised by a find material from the Árpadian Era, while the northern one mostly contained late medieval finds. In the case of village reduplications, the individual settlement parts can be called by names based on popular parlance in different periods. The original name of the settlement is often completed by the prefix Nagy (Large), which, in the meaning “old” refers to its earlier foundation.<sup>202</sup> So it cannot be excluded that the Nagyszakácsi mentioned in the documents is identical with site no. 28 in the south-western part of the modern village, while Szakácsi is identical with site no. 29 north of it.

The other large settlement unit east of the village is composed of sites nos 1 and 3, which can be identified with Külsőszakácsi mentioned in the sources. Here the two sites are only separated by a stream, they certainly belong together. Finds from the Árpadian Era, however, could be found in site no. 1 and in the northern part of site no. 3, which indicates, on the one hand, that the settlement that appeared in the sources only in the 15<sup>th</sup> century or its antecedents were inhabited already in the Árpadian Era, and implies, at the same time, that the first settlers inhabited the northern part of the settlement. The observation made in the field and the data of the early maps reveal that the church dedicated to Saint John the Baptist stood on the northern side of the dirt road crossing the middle of site no. 3.

<sup>199</sup> The archaeological field walking was carried out within the administrative borders of the modern Nagyszakácsi, which, of course, is not identical with the boundaries of the medieval village. Thus the results of the analysis can refer only to Szakácsi and its environment.

<sup>200</sup> P: Prehistoric, RP: Roman Period, MP: Migration Period, ÁE: Árpadian Era, MA: Middle Age.

<sup>201</sup> The exception is site no. 13, and even here only 3 sherds were collected from the Árpadian Era.

<sup>202</sup> Szabó 1966, 123.



Several small sites could be documented along a ridge running in a north-south direction west of the modern village and the large sites that can be identified with the medieval Szakácsi. They are separated by find-free zones and most of them contained late medieval pottery. A similar site concentration can be observed in the western side of the settlement part known to date as Cserhát in the northern side of the village. They are distributed at a distance of 100–200 metres from one another along a ridge, and nearly all are very small, occupying a territory of 50–100 × 50–200 m. Very few, mostly uncharacteristic pottery could be collected in these spots. Their distribution and size are very similar to those of the small settlements of the Árpáadian Era, which was noted by the research already in the 50's.<sup>203</sup> In a larger number they were documented by the topographic works in Pest and Békés counties.<sup>204</sup> In Nagyszakácsi, however, every site, except for site no 35, contained late medieval pottery, while no sherds were found from the Árpáadian Era at most of the sites. Similar small sites with late medieval pottery were also found in Pest county. They are regarded to be the last representatives of the earlier scattered settlement structure or, after their geographical position, to be small manors, the dwellings of animal keepers.<sup>205</sup> The field walkings carried out for the archaeological topography of Békés district also found late medieval farmstead-like settlements characterised by few sherds. Historical records and the fact that they were situated in the small islands of marshlands imply that they were temporary settlements used as refuges.<sup>206</sup>

Regarding the south-eastern territory of the village, the sources do not provide information, while the place called Cser (modern Cserhát) is repeatedly mentioned. Although the sources do not refer to dwellings in the Cserhát, a record published by Dezső Csánki shows that smaller estates, used also as housing sites, could exist on the outskirts in the Middle Ages. The Eresztvény estate was mentioned in the territory of Szakácsi in 1479: "*Possessio Erezthewen in territorio possessionis Nagzakachy*"<sup>207</sup> The estate is first met in Gede of Eresztvény (*Ereztheweni*)'s son Ferenc's name in 1428.<sup>208</sup> Sometime in the middle of the century, Lőrinc Gede exchanged 2 arable lands with his brother-in-law<sup>209</sup> György Veres at *Horozelegh*,<sup>210</sup> and a deed mentions Gede's sons' plots in 1467.<sup>211</sup> On the occasion of a duress case in 1471 we learn that Pál Szegedi's armed men attacked the Kisszakácsi, Gede and Nagyszakácsi settlements (*possessio*) in Somogy county, and they set on fire the houses of Gede (dicti) Simon and Lőrinc in Gede.<sup>212</sup> It means that the Gede family had a manor (*possessio*) at a place called Eresztvény at the beginning of the 15<sup>th</sup> century, and the fact that the place name was added to the name of the family indicates that the territory was a habitation site already at that time. They also had smaller lands in other parts of the outskirts of the village, and other members of the family (perhaps Ferenc Gede's sons) lived on smaller tofts in Szakácsi. Yet another interesting record refers to the feature of the Eresztvény manor. In 1498, the Pauline monastery and János Gondos had a lawsuit over Mihály Törpe's goods, who had died without inheritors and had bequeathed his property to the monastery, since János Gondos, who was charged with the transfer, did not pass the property to the monks. The next year we learn that János Gondos had King Ulászló II grant the above-mentioned lands to him. At that time he was already mentioned as János Gondos of Gedeháza. We cannot tell if the property of the former Gede family was obtained by the Törpe family and this is how it got in János Gondos's possession (this is suggested by the adoption of the place name) or he himself had obtained it earlier.<sup>213</sup> What is important for us is that the name of the former owner has been preserved in the name of the territory completed with the suffix *háza*.

<sup>203</sup> Szőke 1955; Kovalovszki 1965; Valter 1974.

<sup>204</sup> MRT 9, 15; MRT 8, 31.

<sup>205</sup> MRT 9, 15.

<sup>206</sup> MRT 10, 27.

<sup>207</sup> Csánki 1909, 579.

<sup>208</sup> MOL DI. 11981, Bándi 1986, 40.

<sup>209</sup> 1463: MOL DI. 15826, Bándi 1986, 49.

<sup>210</sup> 1453: MOL DI. 17462, Bándi 1986, 43.

<sup>211</sup> MOL DI. 16514, Bándi 1986, 52.

<sup>212</sup> MOL DI. 17268, Bándi 1986, 54.

<sup>213</sup> János Gondos got Péter Törpe's holdings in Szakácsi already earlier and also János Gondos and Gergely and Mihály Pálffy leased all the lands of the Pauline monastery in 1550. Consequently he had the intent and the possibility to obtain lands.



Hungarian historical and ethnographic research, which was launched with the analysis of the development of plots,<sup>214</sup> regards the settlements hiding behind place names ending with *laka*, *háza*, *telke*, *ülése*, *földje* as a form of plots on the outskirts, farmstead-like settlements characteristic of the Árpadian Era. Their development is due partly to the dispersion caused by the natural population increase and the advance of cultivation technique and partly to the division of family estates. They got widespread in the 13<sup>th</sup> and the 13<sup>th</sup>–14<sup>th</sup> centuries.<sup>215</sup> Most of the settlements with limited outskirts got depopulated in the course of the devastation process in the 14<sup>th</sup> century, and 80% of the place names ending in *laka*, *háza* and *telke* disappeared from the sources. The surviving settlement were often preserved as settlements of the lesser nobility, and the *terra*, which can be identified with the names ending in *földje* in the sources, appear as *possessio* on the outskirts of the villages from the last decades of the 13<sup>th</sup> century.<sup>216</sup> According to István Szabó, the occupancy of the *terra-possessio* type settlements has not been proved, in our case, however, the documents imply that Eresztvény *possessio* indicated an inhabited settlement. Along with the generally observable devastation process of villages in the 14<sup>th</sup> century, the division of lands, which often led to the birth of small settlements on the outskirts of villages, was carried on until the 15<sup>th</sup> century in the villages of the lesser nobility that had been raised from the rank of castle serfdom. In consequence, the appearance of settlements bearing the suffix *háza* in their name was frequent on the outskirts of larger villages in these territories even in the 14<sup>th</sup> – 15<sup>th</sup> centuries.<sup>217</sup>

The feature of the small sites observed in Szakácsi and the data of the documents suggest that this is another phenomenon connected to the landholding system of the lesser nobility. In result of field walkings in the region of the ‘szeg’ villages in Göcsej, Róbert Müller delineated the characteristic settlement pattern of the local population that was raised to the rank of lesser nobility from the castle serfdom status.<sup>218</sup> He observed usually small settlements, although some stretched to several hundred metres, near larger villages with churches, which were inhabited from the Árpadian Era to the Turkish period. He found that the inhabitants of the settlements the names of which contain the expression *szer* or *szeg* and a personal name were members of the lesser nobility, who in order to keep their lands left the larger villages before the end of the Árpadian Era and moved to their lands on the outskirts. We do not intend to interpret the settlements of the Árpadian Era and the late Middle Ages found in similar positions in Szakácsi after the examples of the *szer* settlements, yet it seems possible that these sites are the results of a similar movement from Szakácsi to the lands on the outskirts of the families of the lesser nobility.

The comparison of the sketch made after the documents and the results of the field walking calls attention to yet another interesting coincidence. Despite the repeated field walkings, we did not find late medieval sites in the north-eastern part of the village. The data of the documents suggest that this territory was in the possession of the Pauline monastery, which explains the lack of sites (*fig. 12*).

We could use documents for the analysis of Szakácsi that tell about the land circulation of the lesser nobility who owed services to the king even in the 16<sup>th</sup> century, so we could get a glimpse into certain details of the outskirts of the village from data referring to a special social group. First we tried to locate the roads, streams and the place of the monastery mentioned in the sources to learn about the general structure of the lands, and to get spatial points for a later reconstruction. We could not at all use the modern place names in the identification of medieval fields, which caused difficulties. The followings can be told about the lands on the outskirts after the systematisation and analysis of the data of the documents about territories on the outskirts of the village and the areas that could not be located, the manuscript maps and the results of the archaeological field walkings. The 1–2 *iugerum* large scattered arable lands, sometimes arranged in fields, which are repeatedly mentioned in the sources, imply a distribution system of communal regulation. This form can be connected with the rotation or

<sup>214</sup> The summary of the research history see e.g. in: Laszlovszky 1986b.

<sup>215</sup> Kubinyi 1986, 161.

<sup>216</sup> Szabó 1969, 145.

<sup>217</sup> Szabó 1969, 96–98; Illa 1976; Maksay 1940.

<sup>218</sup> Müller 1971.



the following cultivation type. At the same time, we could follow the process and the result of the process in the course of which the spatial organisation of the distribution system was slightly broken by the intent of the lesser nobility to gather their lands in a single unit. With regard to the spatial distribution of the lands gathered in larger units and the parcels arranged in fields, the sources indicate lands created with the unification of two or three parcels, permanent estates gained by clearing and smaller manors as well.

### Summary

The sources about Szakácsi did not afford the preparation of a relatively exact reconstruction encompassing a large part of the settlement, although the characteristic features of the village structure could be sketched.

The data of the documents already intimated the segmentation of the inner territory, while the field walkings have demonstrated, on the one hand, that it was not an inner segmentation but, using István Szabó's term, a real reduplication of the village, and located, on the other hand, the three settlement units. It is characteristic of the inner structure of all the three village parts that the plots were arranged in rows, the manors of the nobility were wedged between the plots of the villeins. No records refer to the size of the plots, but we know that there were gardens behind the houses. Both the documents and the maps and also the results of the field walkings suggest that beside the larger settlements with churches there were smaller settlements, inhabited manors on the outskirts. Probably Külsőszakácsi was such an estate of a noble family with a couple of buildings at the start. Later as the population increased, a church was built,<sup>219</sup> and it became an independent settlement unit.

The observed reduplication of the village and the inhabited manors on the outskirts also raise the problem of the definition of the inner territory. Szakácsi, Nagyszakácsi and Külsőszakácsi are certainly villages regarding the number of the plots, the size of the sites and the existence of churches, either as independent settlements or as a polyfocal settlement. The inhabited places on the outskirts can also be accepted as independent small settlements (see the *szér* settlement structure), but regarding their origin, they were certainly the scattered elements of Szakácsi or Nagyszakácsi. The agreement reached in archaeological practice in the course of the field walkings says that usually 5 sherds are enough to indicate a site, that is a settlement. In historical research, these farmstead-like settlements, appearing in a similar form during field walkings, also appear in the description of scattered villages. The clarification of the problem goes beyond the frames of this study. We found it important to make this remark because our case provided a characteristic example to this terminological problem.

The methods that could be used at the examination of the lands and the results we could reach were strongly influenced by the possibilities offered by the source types. We could not deduce consequences concerning the entire settlement, the fragmentary data on the lands of the nobility carried information concerning certain characteristics of the lands of the village through the description of the lands of a special social group. We could differentiate two basically different landholding forms, which existed side by side in the village. One was the system of small parcels arranged in fields, which supposes a communal regulation, the other comprised private landed properties, which were often gathered in units. This double feature is excellently characterised by the position of the forests. Some of them were used by the community of the village, some were the estates of the lesser nobility. It seems evident that the observed double feature of the lands on the outskirts should be explained by the double feature of the legal status of the inhabitants of the village. Since nearly all the sources tell only about the lesser nobility layer of the village, the only thing we can tell with certainty is that some of the inhabitants of the village who had been raised to the rank of nobility used the possibilities offered by the landholding rights of the nobility and made efforts to have lands less scattered. Two forms could be differentiated among the lands of the lesser nobility gathered in units. Some were adjusted to the row of smaller arable lands within the field system and they

<sup>219</sup> Róbert Müller observed that the building of a church meant the first step toward the development

of an independent settlement in the case of the *szér* settlements as well. Müller 1971, 83.



probably followed the cultivation pattern of the village, while another part of the lands were also spatially differentiated from the lands of the village cultivated in a rotation system, houses were built on them and they functioned as the manors of the lesser nobility. The field surveys suggested that they clustered in two groups on the small ridge rising above the environment. The dwelling places were probably not all contemporary, so it is difficult to estimate how far they were from one another, although the territory they could use shows that a manor of this type must have been surrounded by a land of a couple of *iugerum*.

The other purpose of the study mentioned in the introduction was to determine the possibilities and limitations of the application of the sources and the methods. Here, naturally, we can only sum up the conclusions drawn from the analysis of Nagyszakácsi. It is evident that another settlement can raise other problems.

The possibilities are largely determined by the fact that we had the descriptions of spatially dispersed small lands both in the inner territory and on the outskirts from approximately one hundred years. What is more, the sources discussed only a special group of the inhabitants of the settlement: the royal cooks who had gradually emerged from the once uniform servicing people to the rank of manorial nobility, who, however, still owed service to the king. In this case the analysis of the records seemed indispensable in order to reveal the connections between the minor details so that the possible connections and the resulting conclusions could be found.

Owing to the nearly total lack of surviving place names, the medieval fields and the places mentioned in the sources could be put on a map only when the cross-references of the fragmentary data in the sources delineated a certain territory. The determination of the relative position of the lands on the outskirts, which always belonged to the lesser nobility, also seemed problematic since they were probably scattered among the parcels of the villeins, which are not mentioned in the sources. In some parts of the outskirts, the position of the estates of the nobility could be reconstructed yet due to the above difficulties of the identification of the fields, they could not be put on a map. Nevertheless, we had the documents of two perambulates of bounds that describe relatively coherent territories. The course of the perambulates of bounds can be followed in the earlier mentioned manuscript maps, or it could be put on a map with the help of mediaeval roads that survived as hollow roads, water courses and the identification of the single surviving place name (Cserhát). The other related data were marked in a sketch because of the above mentioned problems. Since there was no possibility to make a reconstruction of the larger part of the outskirts of the settlements, yet the records scattered in time offered a possibility to demonstrate certain tendencies, we intended to make conclusions regarding some characteristics from the distribution pattern and changes of the lands of the lesser nobility on the outskirts.

We think the case of Szakácsi is a good illustration of how the analysis of the documents and the data of archaeological field walkings can, in some cases, interpret and complete one another. The archaeological results concerning the inner territories made it certain that the segmented inner territory appearing in the sources was actually a real village reduplication. Archaeological finds marked the place, the extensions and the inner chronology of the medieval villages of Szakácsi, Nagyszakácsi and also Külsőszakácsi. The characteristics of the plot system could be deduced from the data of the documents and the manuscript maps. The distribution of the hamlet-like settlements on the outskirts, their location and age are known from archaeological data, the circumstances of their foundation and the social status of the inhabitants were implied by the data of the written documents. At the same time, we expected the location of the Pauline monastery from the archaeological field walkings, yet the characteristics of the surface formations and the probably strong disturbance of the building of the monastery proved the method of field walking insufficient. So in this respect we could only rely on the records, the data of the manuscript maps and the observations made by the inhabitants of the village.

Since the various groups of sources influence the results of the study to different degrees and in different ways, for the sake of getting positive results in similar analyses, a conscious choice must precede the analysis that examines the targeted settlement from various aspects and considers the type of the village as well.



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## ABBREVIATIONS

FÖMI	Földmérési és Távérzékelési Intézet (Institute of Ordinance Survey and Remote Sensation)
MOL DL	Magyar Országos Levéltár, Diplomatikai Levéltár (Diplomatic Archives of the National Archives of Hungary)
OMF	Országos Műemléki Felügyelőség (National Inspectorate of Monuments)
SML	Somogy megyei Levéltár (Archives of Somogy county)



### Appendix 1.

#### Database of documentary evidences referring to Szakácsi

SERIAL NUMBER 001	PRECISE POSITION on the south
CULTIVATION arable land	NEW POSSESSOR Antal Iwanka's son György
QUANTITY 2 usu.	of Külsőszakácsi and his daughter
PLACE NAME Kylenechdyofazele	FIELD-SYSTEM field
UNIFIED PLACE NAME Kilencdiófaszéle	DATE 1463
MODERN PLACE NAME 59 Diós, 66 Diósi forest <sup>220</sup>	SETTLEMENT Külsőszakácsi
SOUTH Antal's son Pál	RELATIONS 001–003 (Kilencdiófaszéle)
PREVIOUS POSSESSOR Mihály Tolvaj	SERIAL NUMBER 005
NEW POSSESSOR Antal Iwanka's son György	CULTIVATION arable land
of Külsőszakácsi	QUANTITY 0,5
DATE 1451	PLACE NAME Kuthfey
SETTLEMENT Külsőszakácsi	UNIFIED PLACE NAME Kútfő
RELATIONS 002–004 (Kilencdiófaszéle)	PREVIOUS POSSESSOR will of György Veres
SERIAL NUMBER 002	FIELD-SYSTEM secundum dimidium dietam
CULTIVATION arable land	vulgo zanthofeld
QUANTITY 1 iugerum	DATE 1453
PLACE NAME Kilencdiófa dűlő	SETTLEMENT Külsőszakácsi
UNIFIED PLACE NAME Kilencdiófaszéle	RELATIONS 006–008 (Kútfő)
MODERN PLACE NAME 59 Diós, 66 Diósi forest	SERIAL NUMBER 006
PREVIOUS POSSESSOR György Tolvaj's son Mihály	CULTIVATION arable land
NEW POSSESSOR sons of Jakab Orros of Külsőszakácsi	QUANTITY 1,5 iugerum
FIELD-SYSTEM in diverticulo, field	PLACE NAME Kwthfe
DATE 1452	UNIFIED PLACE NAME Kútfő
SETTLEMENT Külsőszakácsi	PRECISE POSITION beside on the east
RELATIONS 001, 003–004 (Kilencdiófaszéle)	PREVIOUS POSSESSOR Borbála, widow of István Jank of Külsőszakácsi
SERIAL NUMBER 003	NEW POSSESSOR Péter Szakácsi's son Egyed
CULTIVATION arable land	DATE 1444
QUANTITY 1 iugerum	SETTLEMENT Külsőszakácsi
PLACE NAME Kylenechdyofazele	RELATIONS 005, 007–008 (Kútfő)
UNIFIED PLACE NAME Kilencdiófaszéle	SERIAL NUMBER 007
MODERN PLACE NAME 59 Diós, 66 Diósi forest	CULTIVATION arable land
PRECISE POSITION on the east	PLACE NAME Kuthfeey
NEW POSSESSOR György Veres, Orros Jakab, Miklós Orros	UNIFIED PLACE NAME Kútfő
FIELD-SYSTEM field	PREVIOUS POSSESSOR will of György Veres
DATE 1463	DATE 1453
SETTLEMENT Külsőszakácsi	SETTLEMENT Külsőszakácsi
RELATIONS 001–002, 004 (Kilencdiófaszéle)	RELATIONS 005–006, 008 (Kútfő)
SERIAL NUMBER 004	SERIAL NUMBER 008
CULTIVATION arable land	CULTIVATION arable land
QUANTITY 1 iugerum	QUANTITY 1 iugerum
PLACE NAME Kylenechdyofazele	PLACE NAME Kwthfealath
UNIFIED PLACE NAME Kilencdiófaszéle	UNIFIED PLACE NAME Kútfő
MODERN PLACE NAME 59 Diós, 66 Diósi forest	BESIDE Hársberek
	PREVIOUS POSSESSOR widow of István Jank of Külsőszakácsi
	NEW POSSESSOR Péter Szakácsi's son Egyed
	DATE 1444
	SETTLEMENT Külsőszakácsi

<sup>220</sup> The numbers are referring the serial numbers of place names in Nagyszakácsi in the volume *Végh* 1974.

RELATIONS 005–007 (Kútfő); 009–012, 121 (Hársberek)

SERIAL NUMBER 009

CULTIVATION forest

PLACE NAME Hasberek

UNIFIED PLACE NAME Hársberek

MODERN PLACE NAME 73, 85, 86, 99 Berek

NEW POSSESSOR György Veres, Péter Orros, Miklós Orros

DATE 1463

SETTLEMENT Külsőszakácsi

RELATIONS 008, 010–012, 121 (Hársberek)

SERIAL NUMBER 010

CULTIVATION meadow

QUANTITY 2 scythes (falcastrum)

PLACE NAME Hasberek

UNIFIED PLACE NAME Hársberek

MODERN PLACE NAME 73, 85, 86, 99 Berek

PRECISE POSITION beside

NEW POSSESSOR György Veres, Péter Orros, Miklós Orros

FIELD-SYSTEM grove

DATE 1463

RELATIONS 009, 011–012, 121 (Hársberek)

SERIAL NUMBER 011

CULTIVATION arable land

QUANTITY 1 iugerum

PLACE NAME Hasalath

UNIFIED PLACE NAME Hársberek

MODERN PLACE NAME 99 Berek alatti

PREVIOUS POSSESSOR György Tolvaj's son Mihály

NEW POSSESSOR sons of Jakab Orros

DATE 1452

RELATIONS 009–010, 012, 121 (Hársberek)

SERIAL NUMBER 012

CULTIVATION meadow

PLACE NAME Naghreth

UNIFIED PLACE NAME Nagyrét

MODERN PLACE NAME 4 Nagyrét

EAST Hársberek

PREVIOUS POSSESSOR Mihály Tolvaj

NEW POSSESSOR Antal Iwanka's son György of Külsőszakácsi

DATE 1451

SETTLEMENT Külsőszakácsi

RELATIONS 121 (Nagyrét); 009–011, 121 (Hársberek)

SERIAL NUMBER 013

CULTIVATION arable land

QUANTITY 0,5 iugerum

PLACE NAME Kerekerdealath

UNIFIED PLACE NAME Kerekerdő

PRECISE POSITION on the west

PREVIOUS POSSESSOR Borbála, widow of István Jank of Külsőszakácsi

NEW POSSESSOR Péter Szakácsi's son Egyed

DATE 1444

SETTLEMENT Külsőszakácsi

RELATIONS 014–018, 129 (Kerekerdő)

SERIAL NUMBER 014

CULTIVATION szőlő

QUANTITY 1

PLACE NAME Kerekerdew

UNIFIED PLACE NAME Kerekerdő

PRECISE POSITION BESIDE

PREVIOUS POSSESSOR Mihály Kígyó nővére Klára

NEW POSSESSOR Pauline monastery

DATE 1428

SETTLEMENT Külsőszakácsi

RELATIONS 013,015–018,129 (Kerekerdő)

SERIAL NUMBER 015

CULTIVATION vine

QUANTITY 1

PLACE NAME Kerekerdew

UNIFIED PLACE NAME Kerekerdő

PREVIOUS POSSESSOR Mihály Kígyó

NEW POSSESSOR Pauline monastery

DATE 1428

SETTLEMENT Külsőszakácsi

RELATIONS 013–014, 016–018, 129 (Kerekerdő)

SERIAL NUMBER 016

CULTIVATION arable land

QUANTITY 1 iugerum

PLACE NAME Kerekerdew

UNIFIED PLACE NAME Kerekerdő

PRECISE POSITION below, on the west

NEW POSSESSOR Antal Iwanka's son György of Külsőszakácsi and his daughters

DATE 1463

SETTLEMENT Külsőszakácsi

RELATIONS 013–015, 017–018, 129 (Kerekerdő)

SERIAL NUMBER 017

CULTIVATION arable land

QUANTITY 1 usu.

PLACE NAME Kerekerde

UNIFIED PLACE NAME Kerekerdő

PRECISE POSITION on the west

PREVIOUS POSSESSOR Mihály Tolvaj

NEW POSSESSOR Antal Iwanka's son György of Külsőszakácsi

DATE 1451

SETTLEMENT Külsőszakácsi

RELATIONS 013–016, 018, 129 (Kerekerdő)



SERIAL NUMBER 018  
 CULTIVATION arable land  
 QUANTITY 1 iugerum  
 PLACE NAME Kerekerdew  
 UNIFIED PLACE NAME Kerekerdő  
 PRECISE POSITION on the east, partly in  
 Borsohely  
 EAST Borsohely  
 NEW POSSESSOR György Veres, Péter Orros ,  
 Miklós Orros  
 DATE 1463  
 SETTLEMENT Külsőszakácsi  
 RELATIONS 013–017, 129 (Kerekerdő); 129  
 (Borsohely)

SERIAL NUMBER 019  
 CULTIVATION arable land  
 QUANTITY 5 iugerum  
 PLACE NAME Bereknyezele  
 UNIFIED PLACE NAME Bereknyeszéle  
 MODERN PLACE NAME 73 Berek, 99 Berek  
 alatti  
 PRECISE POSITION towards east and west  
 NORTH arable lands of Péter Veres's son  
 György  
 SOUTH arable lands of György Iwanka Kis  
 PREVIOUS POSSESSOR Péter Kígyó  
 NEW POSSESSOR György Veres  
 DATE 1461  
 SETTLEMENT Szakácsi  
 RELATIONS 020 (Bereknyeszéle); 035, 060,  
 123–125 (György Veres)

SERIAL NUMBER 020  
 CULTIVATION arable land, coppice  
 QUANTITY 10,5 dieta  
 PLACE NAME Bereknyezeel  
 UNIFIED PLACE NAME Bereknyeszéle  
 MODERN PLACE NAME 73 Berök, 99 Berek  
 alatti  
 PREVIOUS POSSESSOR György Veres  
 NEW POSSESSOR Pauline monastery  
 FIELD-SYSTEM dieta  
 DATE 1471  
 SETTLEMENT Nagyszakácsi  
 RELATIONS 019 (Bereknyeszéle); 019 (György  
 Veres)

SERIAL NUMBER 021  
 CULTIVATION arable land  
 QUANTITY 1,5 iugerum  
 PLACE NAME Hatoserdew  
 UNIFIED PLACE NAME Hátaserdő  
 PRECISE POSITION towards south and east  
 NORTH Péter (Gedő?)  
 SOUTH Péter (Gedő?)  
 EAST Magaskörtvély forest  
 PREVIOUS POSSESSOR Kozma's son Imre of  
 Nagyszakácsi

NEW POSSESSOR Antal Iwanka's son György  
 of Külsőszakácsi  
 FIELD-SYSTEM arable lands towards south and  
 east  
 DATE 1455  
 SETTLEMENT Nagyszakácsi  
 RELATIONS 022, 140 (Hátaserdő); 140  
 (Magaskörtvély); 023 (Péter Gedő?)

SERIAL NUMBER 022  
 CULTIVATION arable land  
 QUANTITY 3 iugerum  
 PLACE NAME Hathaserdew  
 UNIFIED PLACE NAME Hátaserdő  
 PRECISE POSITION beside  
 BESIDE Megyeharasztt  
 PREVIOUS POSSESSOR Kozma's son Bálint  
 of Nagyszakácsi  
 NEW POSSESSOR Antal Iwanka's son György  
 of Külsőszakácsi  
 FIELD-SYSTEM towards east and west  
 DATE 1462  
 SETTLEMENT Felsőszakácsi  
 RELATIONS 021, 140 (Hátaserdő); 023, 024  
 (Megyeharasztt); 111, 112 (Megye);

SERIAL NUMBER 023  
 CULTIVATION arable land  
 QUANTITY 0,5 iugerum  
 PLACE NAME Megeharazth  
 UNIFIED PLACE NAME Megeharasztt  
 NORTH Péter Gedő  
 SOUTH Antal's son György  
 EAST road (via publica)  
 PREVIOUS POSSESSOR parish church  
 NEW POSSESSOR Antal Iwanka's son György  
 of Külsőszakácsi  
 DATE 1454  
 SETTLEMENT Külsőszakácsi  
 RELATIONS 022, 024 (Megeharasztt); 111, 112  
 (Megye); 058 (Antal's son György)

SERIAL NUMBER 024  
 CULTIVATION road  
 PLACE NAME via publica  
 UNIFIED PLACE NAME public road  
 WEST Megeharasztt  
 DATE 1454  
 SETTLEMENT Külsőszakácsi  
 RELATIONS 022–023 (Megeharasztt); 111–112  
 (Megye); 091, 146 (road to Léta)

SERIAL NUMBER 025  
 CULTIVATION arable land  
 QUANTITY 1 usu.  
 PLACE NAME gyaloghwth  
 UNIFIED PLACE NAME foot path  
 BESIDE a foot path leads on it  
 PREVIOUS POSSESSOR Mihály Tolvaj

NEW POSSESSOR György Iwanka of Külsőszakácsi DATE 1451 SETTLEMENT Külsőszakácsi RELATIONS 122 (foot path)	SETTLEMENT Szakácsi RELATIONS 027, 028 (Halmos)
SERIAL NUMBER 026 CULTIVATION arable land QUANTITY 0,5 usu. PLACE NAME KysErethwenhegh UNIFIED PLACE NAME Kiseresztvényhegy PRECISE POSITION on the south BESIDE Péter Bor PREVIOUS POSSESSOR Mihály Tolvaj NEW POSSESSOR Antal Iwanka's son György of Külsőszakácsi DATE 1451 SETTLEMENT Külsőszakácsi RELATIONS 044 (Péter Bor)	SERIAL NUMBER 030 CULTIVATION vine PLACE NAME Mestegnehegh UNIFIED PLACE NAME Mesztegnyőhegy MODERN PLACE NAME Mesztegnyő PREVIOUS POSSESSOR will of cook Péter Szakácsi NEW POSSESSOR cook Péter Szakácsi's sister Anna DATE 1503
SERIAL NUMBER 027 CULTIVATION arable land QUANTITY 1 dieta PLACE NAME Halmosföld UNIFIED PLACE NAME Halmos EAST main road (via magna) to Mesztegnyő PREVIOUS POSSESSOR György Veres NEW POSSESSOR István of Nagyszakácsi's son János FIELD-SYSTEM dieta DATE 1480 SETTLEMENT Nagyszakácsi RELATIONS 028–029 (Halmos); 028, 151 (road to Mesztegnyő)	SERIAL NUMBER 031 CULTIVATION coppice QUANTITY 1 piece PLACE NAME Zenegethewharazthya UNIFIED PLACE NAME Szénégetőharaszt WEST vine of Gál Kaczó, Paperdő EAST Paperdő, (Papharaszt) PREVIOUS POSSESSOR István of Nagyszakácsi's son János NEW POSSESSOR György Veres DATE 1480 SETTLEMENT Nagyszakácsi RELATIONS 032–036 (Papharaszt)
SERIAL NUMBER 028 CULTIVATION arable land QUANTITY 1 dieta PLACE NAME Halmos föld UNIFIED PLACE NAME Halmos PRECISE POSITION towards east and south WEST György Vidi (sponsus of Ferenc Kakas) BESIDE main road to Mesztegnyő PREVIOUS POSSESSOR György Veres NEW POSSESSOR István of Nagyszakácsi's son János FIELD-SYSTEM dieta DATE 1480 SETTLEMENT Nagyszakácsi RELATIONS 027, 029 (Halmos); 151 (György Vidi); 027, 151 (road to Mesztegnyő)	SERIAL NUMBER 032 CULTIVATION arable land QUANTITY 1,5 iugerum PLACE NAME Banchazafew UNIFIED PLACE NAME Bancházafő BESIDE between arable lands of János's son Péter and Paperdő (Papharaszt) PREVIOUS POSSESSOR Demeter Soldos's daughter Zsuzsanna NEW POSSESSOR János Szakácsi's son Péter DATE 1429 RELATIONS 031, 033–036 (Papharaszt); 110, 111 (János's son Péter)
SERIAL NUMBER 029 CULTIVATION arable land PLACE NAME Halmas UNIFIED PLACE NAME Halmos PREVIOUS POSSESSOR Will of György Veres FIELD-SYSTEM in three fields DATE 1453	SERIAL NUMBER 033 CULTIVATION arable land QUANTITY 0,5 PLACE NAME Papharazthya UNIFIED PLACE NAME Papharaszt PRECISE POSITION beside on the east PREVIOUS POSSESSOR Will of György Veres DATE 1453 SETTLEMENT Szakácsi RELATIONS 031, 032, 034–036 (Papharaszt)
	SERIAL NUMBER 034 CULTIVATION arable land QUANTITY 0,5 PLACE NAME Papharazthya UNIFIED PLACE NAME Papharaszt PRECISE POSITION beside, towards Gadány



PREVIOUS POSSESSOR Will of György Veres  
DATE 1453  
SETTLEMENT Szakácsi  
RELATIONS 031–033, 035, 036 (Papharaszt);  
084–086 (Gadány)

SERIAL NUMBER 035  
CULTIVATION arable land  
QUANTITY 1 funiculus  
PLACE NAME Papharazthya  
UNIFIED PLACE NAME Papharaszt  
PRECISE POSITION beside, in ordinato  
WEST György Veres  
EAST György Bíró  
PREVIOUS POSSESSOR Will of György Veres  
FIELD-SYSTEM in ordinato vaginatum vulgo  
zalagon  
DATE 1453  
SETTLEMENT Szakácsi  
RELATIONS 031–034, 036 (Papharaszt); 019,  
060, 123–125 (György Veres); 060 (György  
Bíró)

SERIAL NUMBER 036  
CULTIVATION arable land  
QUANTITY 0,5  
PLACE NAME Papharastya  
UNIFIED PLACE NAME Papharaszt  
PREVIOUS POSSESSOR Will of György Veres  
DATE 1453  
SETTLEMENT Szakácsi  
RELATIONS 031–035 (Papharaszt)

SERIAL NUMBER 037  
CULTIVATION arable land  
QUANTITY 2 iugerum  
PLACE NAME Horohalya river  
UNIFIED PLACE NAME Horohalja  
PRECISE POSITION on the place where the  
millrace is being built  
BESIDE place of mill on the land of János's son  
Egyed  
PREVIOUS POSSESSOR János's son Egyed,  
Miklós Szakácsi's son János, Mihály's son  
Balázs  
NEW POSSESSOR Pauline monastery  
DATE 1402  
SETTLEMENT Szakácsi  
RELATIONS 040, 136 (Horohalja); 107  
(Horohszéle); 039–040, 080, 082, 130 (mills);  
087, 088, 089, 092, 136 (János's son Egyed)

SERIAL NUMBER 038  
CULTIVATION arable land  
QUANTITY 4 iugerum  
NORTH arable land of János Soldus  
WEST Demeter's son  
SOUTH arable land of Egyed's son János  
EAST road

PREVIOUS POSSESSOR Szakácsi Pál's son  
Ferenc  
NEW POSSESSOR Pauline monastery  
DATE 1411  
RELATIONS 150 (Egyed's son János, road to  
Léta); 096, 117 (Egyed's son Bálint)

SERIAL NUMBER 039  
CULTIVATION arable land  
QUANTITY 1 iugerum  
PLACE NAME ditch  
UNIFIED PLACE NAME ditch  
PRECISE POSITION beside, towards north  
BESIDE mill-river, ditch  
PREVIOUS POSSESSOR Pauline monastery  
(exchange)  
NEW POSSESSOR Benedek Kaczo's son  
Miklós  
DATE 1459  
SETTLEMENT Szakácsi  
RELATIONS 047, 078, 126 (ditch); 037, 040,  
080, 082, 130 (mills); 097, 117 (Miklós Kaczo)

SERIAL NUMBER 040  
CULTIVATION mill  
PLACE NAME Horohalya river  
UNIFIED PLACE NAME Horohalja  
PRECISE POSITION on the place of the  
prospective millrace  
BESIDE 2 iugerum arable land  
DATE 1402  
SETTLEMENT Szakácsi  
RELATIONS 037, 136 (Horohalja); 107  
(Horohszéle); 037, 039, 080, 082, 130 (mills)

SERIAL NUMBER 041  
CULTIVATION arable land  
QUANTITY 1  
PLACE NAME Horhas, Zeel, Vizmosaszél  
UNIFIED PLACE NAME Szél  
PREVIOUS POSSESSOR Will of György Veres  
NEW POSSESSOR György Veres, Péter Orros,  
Miklós Orros  
DATE 1453  
SETTLEMENT Szakácsi  
RELATIONS 042–044 (Szél); 045 (Folyószéle)

SERIAL NUMBER 042  
CULTIVATION arable land  
QUANTITY 1 iugerum  
PLACE NAME Zel  
UNIFIED PLACE NAME Szél  
PRECISE POSITION on the west  
DATE 1463  
SETTLEMENT Külsőszakácsi  
RELATIONS 041, 043, 044 (Szél); 045  
(Folyószéle)

SERIAL NUMBER 043  
 CULTIVATION arable land  
 QUANTITY 1 iugerum  
 PLACE NAME Zel  
 UNIFIED PLACE NAME Szél  
 PRECISE POSITION on the east  
 NEW POSSESSOR Antal Iwanka's son György  
 of Külsőszakácsi  
 DATE 1463  
 SETTLEMENT Külsőszakácsi  
 RELATIONS 041, 042, 044 (Szél); 045  
 (Folyószéle)

SERIAL NUMBER 044  
 CULTIVATION arable land  
 QUANTITY 2 usu.  
 PLACE NAME Zel  
 UNIFIED PLACE NAME Szél  
 NORTH Péter Bor  
 PREVIOUS POSSESSOR Mihály Tolvaj  
 NEW POSSESSOR Antal Iwanka's son György  
 of Külsőszakácsi  
 DATE 1451  
 SETTLEMENT Külsőszakácsi  
 RELATIONS 041–043 (Szél), 045 (Folyószéle);  
 026 (Péter Bor)

SERIAL NUMBER 045  
 CULTIVATION arable land  
 PLACE NAME Folioscele  
 UNIFIED PLACE NAME Folyószéle  
 BESIDE Gergely Gondos  
 PREVIOUS POSSESSOR will of Péter Szakácsi  
 the cook  
 DATE 1503  
 RELATIONS 041–044 (Szél); 120 (Vidi  
 Gondos)

SERIAL NUMBER 046  
 CULTIVATION coppice  
 QUANTITY piece  
 PLACE NAME Zewlewharazth  
 UNIFIED PLACE NAME Szőlőharaszt  
 NORTH vine of the monastery  
 WEST river  
 SOUTH public road to the forest  
 EAST priest's road, public road to the forest  
 PREVIOUS POSSESSOR György Veres  
 NEW POSSESSOR Pauline monastery  
 DATE 1466  
 SETTLEMENT Nagyszakácsi  
 RELATIONS 047, 123–125, 143 (Szőlőharaszt);  
 087, 089 (vine of the monastery); 124, 125  
 (road); stream-1382?

SERIAL NUMBER 047  
 CULTIVATION vine, coppice  
 QUANTITY 1,5  
 PLACE NAME Zeleharazthya

UNIFIED PLACE NAME Szőlőharaszt  
 WEST drain, land of Péter Therpe  
 SOUTH drain  
 PREVIOUS POSSESSOR György Veres  
 NEW POSSESSOR Pauline monastery  
 DATE 1471  
 SETTLEMENT Nagyszakácsi  
 RELATIONS 046, 123–125, 143 (Szőlőharaszt);  
 039, 078, 126 (ditch or drain); 049 (forest of  
 Péter Therpe)

SERIAL NUMBER 048  
 CULTIVATION arable land  
 QUANTITY 2 iugerum  
 PLACE NAME Cher  
 UNIFIED PLACE NAME Cser  
 MODERN PLACE NAME 47 Cserhát  
 PRECISE POSITION between arable lands of  
 the Pauline monastery  
 BESIDE near the monastery  
 PREVIOUS POSSESSOR Mihály Kígyó  
 NEW POSSESSOR Pauline monastery  
 DATE 1428  
 RELATIONS 049–054 (Cser); 049–051, 054,  
 104–105 (arable lands of Pauline monastery);  
 052, 104 (near the monastery)

SERIAL NUMBER 049  
 CULTIVATION arable land  
 QUANTITY 1,5 iugerum  
 PLACE NAME Nagcheer  
 UNIFIED PLACE NAME Cser  
 MODERN PLACE NAME 47 Cserhát  
 PRECISE POSITION between arable lands of  
 the Pauline monastery  
 BESIDE Bodakhianoserdeje,  
 Echterpepetererdeje  
 PREVIOUS POSSESSOR Máté the pauline  
 prior  
 NEW POSSESSOR Antal the officer of Saint  
 Benedict altar  
 DATE 1500  
 RELATIONS 048, 050–054 (Cser); 048, 050–  
 051, 054, 104–105 (arable lands of the Pauline  
 monastery); 118 (arable land of János Bodak);  
 047 (land of Péter Therpe); 061 (Saint Benedict  
 altar)

SERIAL NUMBER 050  
 CULTIVATION arable land  
 QUANTITY 12 iugerum  
 PLACE NAME Cher  
 UNIFIED PLACE NAME Cser  
 MODERN PLACE NAME 47 Cserhát  
 PRECISE POSITION between arable lands of  
 the Pauline monastery, towards east and west  
 BESIDE land of Mihály Vas's son  
 PREVIOUS POSSESSOR Mihály Kígyó  
 NEW POSSESSOR Pauline monastery



## DATE 1428

RELATIONS 048, 049, 051, 054 (Cser); 048, 049, 051, 054, 104, 105 (arable lands of the Pauline monastery) 057 (Jakab Vas)

## SERIAL NUMBER 051

CULTIVATION arable land

QUANTITY 2 iugerum

PLACE NAME Cher

UNIFIED PLACE NAME Cser

MODERN PLACE NAME 47 Cserhát

PRECISE POSITION between arable lands of the Pauline monastery, towards east and west

FIELD-SYSTEM sowed by pauline monks

PREVIOUS POSSESSOR Mihály Kígyó

NEW POSSESSOR Pauline monastery

DATE 1428

RELATIONS 048–050, 052–054 (Cser); 048–050, 054, 104, 105 (arable lands of the Pauline monastery)

## SERIAL NUMBER 052

CULTIVATION arable land

QUANTITY 4 iugerum

PLACE NAME Cher

UNIFIED PLACE NAME Cser

MODERN PLACE NAME 47 Cserhát

BESIDE near the monastery

PREVIOUS POSSESSOR Mihály Kígyó

NEW POSSESSOR Pauline monastery

DATE 1428

RELATIONS 048–051, 053, 054 (Cser); 048, 104 (monastery)

## SERIAL NUMBER 053

CULTIVATION meadow

QUANTITY 2 scythes (falcastrum)

PLACE NAME Cher meadow

UNIFIED PLACE NAME Cser

MODERN PLACE NAME 47 Cserhát

DATE 1428

RELATIONS 048–052, 054 (Cser)

## SERIAL NUMBER 054

CULTIVATION arable land

QUANTITY 4,5 iugerum

PLACE NAME Felsewcher

UNIFIED PLACE NAME Cser

MODERN PLACE NAME 47 Cserhát

NORTH arable lands of the Pauline monastery

SOUTH arable lands of the Pauline monastery

PREVIOUS POSSESSOR Mihály Kígyó,

Márton Vidi, Péter Orros's widow

NEW POSSESSOR Pauline monastery

DATE 1495

SETTLEMENT Szakácsi

RELATIONS 048–053 (Cser); 048–051, 104, 105 (arable lands of the Pauline monastery)

## SERIAL NUMBER 055

CULTIVATION meadow

PLACE NAME Nyresalya reeth

UNIFIED PLACE NAME Nyíres

MODERN PLACE NAME 72 Nyíresi

NORTH meadow of Bálint Tolvaj's sons

SOUTH meadow of Bálint Tolvaj's sons

PREVIOUS POSSESSOR Egyed Fekete of

Külsőszakácsi

NEW POSSESSOR György Veres

DATE 1471

SETTLEMENT Külsőszakácsi

RELATIONS 056, 057 (Nyíres)

## SERIAL NUMBER 056

CULTIVATION arable land

QUANTITY 1 iugerum

PLACE NAME Nyrkus

UNIFIED PLACE NAME Nyíres

MODERN PLACE NAME 72 Nyíresi

PREVIOUS POSSESSOR György Tolvaj's son

Mihály

NEW POSSESSOR Jakab Orros's sons

DATE 1452

RELATIONS 055, 057 (Nyíres)

## SERIAL NUMBER 057

CULTIVATION meadow, forest

PLACE NAME Niresalath

UNIFIED PLACE NAME Nyíres

MODERN PLACE NAME 72 Nyíresi

SOUTH László (?Vas)

EAST Jakab Vas

NEW POSSESSOR Szakácsi Péter's son Egyed

DATE 1444

SETTLEMENT Külsőszakácsi

RELATIONS 055, 056 (Nyíres); 050 (Mihály Vas)

## SERIAL NUMBER 058

CULTIVATION arable land

QUANTITY 0,5 iugerum

PLACE NAME Zekerhyd

UNIFIED PLACE NAME Szekérhid

WEST Antal's son György

PREVIOUS POSSESSOR Mihály Tolvaj

NEW POSSESSOR Antal Iwanka's son György of Külsőszakácsi

DATE 1451

SETTLEMENT Külsőszakácsi

RELATIONS 059 (Szekérhid); 023 (Antal's son György)

## SERIAL NUMBER 059

CULTIVATION arable land

QUANTITY 0,5 iugerum

PLACE NAME Zekerhyd

UNIFIED PLACE NAME Szekérhid

NEW POSSESSOR Antal Iwanka's son György  
of Külsőszakácsi  
DATE 1463  
SETTLEMENT Külsőszakácsi  
RELATIONS 058 (Szekérhid)

SERIAL NUMBER 060  
CULTIVATION vine  
QUANTITY piece  
PLACE NAME Hwyyhegh  
UNIFIED PLACE NAME Újhegy  
WEST György Veres  
EAST György Bíró  
NEW POSSESSOR György Veres  
DATE 1453  
SETTLEMENT Szakácsi  
RELATIONS 061 (Újhegy); 019, 035, 123–125  
(György Veres); 035 (György Bíró)

SERIAL NUMBER 061  
CULTIVATION arable land  
QUANTITY 1,5 iugerum  
PLACE NAME Vyhegh  
UNIFIED PLACE NAME Újhegy  
PRECISE POSITION towards east and west  
NORTH vine of Saint Benedict altar  
PREVIOUS POSSESSOR Máté the pauline  
prior  
NEW POSSESSOR Antal the officer of the Saint  
Benedict altar  
DATE 1500  
RELATIONS 060 (Újhegy); 049 (Saint Benedict  
altar)

SERIAL NUMBER 062  
CULTIVATION arable land  
QUANTITY 1 iugerum  
PLACE NAME Thwyssessark  
UNIFIED PLACE NAME Tövisessark  
MODERN PLACE NAME 74 Tüskési dűlő  
NEW POSSESSOR György Veres, Péter Orros,  
Miklós Orros  
DATE 1463

SERIAL NUMBER 063  
CULTIVATION arable land  
QUANTITY 3 iugerum  
PLACE NAME Rokethas  
UNIFIED PLACE NAME Rokétás  
BESIDE border of Szécsény  
PREVIOUS POSSESSOR György Veres  
NEW POSSESSOR Pauline monastery  
DATE 1471  
SETTLEMENT Nagyszakácsi

SERIAL NUMBER 064  
CULTIVATION arable land  
QUANTITY 1 usu.  
PLACE NAME Chypanharazthya

UNIFIED PLACE NAME Csipánharaszt  
PRECISE POSITION beside, on the east  
PREVIOUS POSSESSOR Mihály Tolvaj  
NEW POSSESSOR Antal Iwanka's son György  
of Külsőszakácsi  
DATE 1451  
SETTLEMENT Külsőszakácsi  
RELATIONS 065 (Csipánharaszt)

SERIAL NUMBER 065  
CULTIVATION arable land  
QUANTITY 0,5 iugerum  
PLACE NAME Chypanharazthya  
UNIFIED PLACE NAME Csipánharaszt  
PRECISE POSITION beside, on the east  
NEW POSSESSOR Antal Iwanka's son György  
of Külsőszakácsi  
DATE 1463  
SETTLEMENT Külsőszakácsi  
RELATIONS 064 (Csipánharaszt)

SERIAL NUMBER 066  
CULTIVATION arable land  
QUANTITY 10 iugerum  
NORTH forest of the Parish Church of All Saints  
PREVIOUS POSSESSOR Péter Szakácsi's son  
Benedek  
NEW POSSESSOR Tamás Szakácsi's sons  
Jakab and György  
FIELD-SYSTEM with its all appurtenances and  
use  
DATE 1375  
RELATIONS 067, 068, 144 (forest of the parish  
church)

SERIAL NUMBER 067  
CULTIVATION arable land  
QUANTITY 1 iugerum  
NORTH coppice between the forest of the  
Pauline monastery and the forest of the parish  
church  
PREVIOUS POSSESSOR László Bakator's son  
Benedek  
NEW POSSESSOR Pauline monastery  
DATE 1414  
SETTLEMENT Szakácsi  
RELATIONS 066, 068, 144 (forest of the parish  
church); 068, 087, 089, 111, 112, 149 (coppice);  
089 (Bakator)

SERIAL NUMBER 068  
CULTIVATION coppice  
PRECISE POSITION between the forest of the  
Pauline monastery and the forest of the parish  
church  
SOUTH 1 iugerum arable land (B. Bakator -  
Pauline monastery)  
PREVIOUS POSSESSOR László Bakator's son  
Benedek



NEW POSSESSOR Pauline monastery  
DATE 1414  
SETTLEMENT Szakácsi  
RELATIONS 066, 067, 144 (forest of the parish church); 067, 087–089, 111, 112, 149 (coppice); 089 (Bakator)

SERIAL NUMBER 069  
CULTIVATION meadow  
PLACE NAME Chakan  
UNIFIED PLACE NAME Csakan  
BESIDE Csolyanustó  
PREVIOUS POSSESSOR Will of György Veres  
DATE 1453  
SETTLEMENT Külsőszakácsi  
RELATIONS 070 (Csolyanustó)

SERIAL NUMBER 070  
CULTIVATION lake  
PLACE NAME Cholyanustho  
UNIFIED PLACE NAME Csolyanustó  
BESIDE in Csakan  
PREVIOUS POSSESSOR Will of György Veres  
DATE 1453  
SETTLEMENT Külsőszakácsi  
RELATIONS 069 (Csakan); 071, 073, 085 (lake)

SERIAL NUMBER 071  
CULTIVATION lake  
PLACE NAME fish pond in Chohosreth  
UNIFIED PLACE NAME Csohosrét  
PREVIOUS POSSESSOR György Veres  
NEW POSSESSOR Pauline monastery  
DATE 1471  
SETTLEMENT Nagyszakácsi  
RELATIONS 070, 073, 085 (lake)

SERIAL NUMBER 072  
CULTIVATION arable land  
QUANTITY 2  
PLACE NAME Vezeyto  
UNIFIED PLACE NAME Vezejtó  
PREVIOUS POSSESSOR Will of György Veres  
DATE 1453  
SETTLEMENT Szakácsi  
RELATIONS 073 (Vezeytó)

SERIAL NUMBER 073  
CULTIVATION lake  
PLACE NAME Vezeyto  
UNIFIED PLACE NAME Vezejtó  
PREVIOUS POSSESSOR Will of György Veres  
DATE 1453  
SETTLEMENT Szakácsi  
RELATIONS 072 (Vezeytó); 070, 071, 085 (lake)

SERIAL NUMBER 074  
CULTIVATION meadow  
EAST spring  
PREVIOUS POSSESSOR Mihály Hagyó of Monyorókerék (exchange)  
NEW POSSESSOR Pauline monastery  
DATE 1460  
RELATIONS 006, 075 (spring)

SERIAL NUMBER 075  
CULTIVATION spring  
WEST meadow of Mihály Hagyó of Monyorókerék  
DATE 1460  
RELATIONS 006, 074 (spring)

SERIAL NUMBER 076  
CULTIVATION meadow  
QUANTITY 2 scythes (falcastrum)  
PLACE NAME Tholwaj valley  
UNIFIED PLACE NAME Tolvaj valley  
PREVIOUS POSSESSOR György Veres  
NEW POSSESSOR Pauline monastery  
DATE 1471  
SETTLEMENT Nagyszakácsi  
RELATIONS 055 (Tolvaj meadow)

SERIAL NUMBER 077  
CULTIVATION meadow  
PLACE NAME Zenrethe  
UNIFIED PLACE NAME Szénrét  
PREVIOUS POSSESSOR Mihály Kígyó, Márton Vidi, Péter Orros's widow  
NEW POSSESSOR Pauline monastery  
DATE 1495  
SETTLEMENT Szakácsi

SERIAL NUMBER 078  
CULTIVATION arable land  
QUANTITY piece  
PLACE NAME Seregelfogo forest  
UNIFIED PLACE NAME Seregélyfogó  
PRECISE POSITION piece of land measuring the width of a cart  
BESIDE along the drain to the mill of the Pauline monastery  
PREVIOUS POSSESSOR Bálint Kozma's son Péter of Nagyszakácsi  
NEW POSSESSOR Pauline monastery  
FIELD-SYSTEM piece of land measuring the width of a cart  
DATE 1463  
RELATIONS 039, 047, 126 (ditch or drain)

SERIAL NUMBER 079  
CULTIVATION meadow  
BESIDE mill of Mihály Szabó  
PREVIOUS POSSESSOR will of Péter Szakácsi the cook

DATE 1503	RELATIONS 085 (Kerektó); 085, 086, 151 (road to Gadány-Mesztegnő)
RELATIONS 080 (mill of Mihály Szabó)	SERIAL NUMBER 085
037, 039, 040, 082, 130 (mills)	CULTIVATION lake
SERIAL NUMBER 080	PLACE NAME Kerektho
CULTIVATION mill	UNIFIED PLACE NAME Kerektó
PLACE NAME mill of Mihály Szabó	BESIDE road to Gadány
UNIFIED PLACE NAME mill of Mihály Szabó	DATE 1471
BESIDE meadow of Péter Szakácsi the cook	SETTLEMENT Nagyszakácsi
PREVIOUS POSSESSOR Mihály Szabó	RELATIONS 084 (Kerektó); 084, 086, 151 (road to Gadány-Mesztegnő)
DATE 1503	
RELATIONS 079 (mill of Mihály Szabó); 037, 039, 040, 082, 130 (mills)	SERIAL NUMBER 086
	CULTIVATION road
SERIAL NUMBER 081	PLACE NAME main road (via magna) to Gadány
CULTIVATION meadow	UNIFIED PLACE NAME main road (via magna) to Gadány
SOUTH mill of Mihály Hagyo of Monyorókerék	MODERN PLACE NAME road to Gadány
PREVIOUS POSSESSOR Pauline monastery	BESIDE Kerektó
NEW POSSESSOR Mihály Hagyo of Monyorókerék	DATE 1471
DATE 1460	SETTLEMENT Nagyszakácsi
RELATIONS 082 (mill of Mihály Hagyo)	RELATIONS 084, 085 (Kerektó); 084, 085, 151 (road to Gadány-Mesztegnő)
SERIAL NUMBER 082	
CULTIVATION mill	SERIAL NUMBER 087
PLACE NAME Mihály Hagyo of Monyorókerék	CULTIVATION coppice
UNIFIED PLACE NAME mill of Mihály Hagyo of Monyorókerék	NORTH via magna
NORTH meadow of the Pauline monastery	SOUTH road to the vine of the Pauline monastery
PREVIOUS POSSESSOR Mihály Hagyo of Monyorókerék	PREVIOUS POSSESSOR János Szakácsi's son Egyed
DATE 1460	NEW POSSESSOR Pauline monastery
RELATIONS 081 (mill of Mihály Hagyo); 037, 039, 040, 080, 130 (mills)	DATE 1411
	RELATIONS 090, 091, 146, 150 (via magna)
SERIAL NUMBER 083	
CULTIVATION meadow	SERIAL NUMBER 088
BESIDE below of the mill of Gergely Szakácsi's son Miklós	CULTIVATION road
PREVIOUS POSSESSOR Gergely Kelenizi's wife Zsuzsanna	PLACE NAME via magna
NEW POSSESSOR János Szakácsi's son Péter	UNIFIED PLACE NAME main road
DATE 1431	SOUTH coppice, (vine of János Szakácsi's son Egyed)
SETTLEMENT Szakácsi	DATE 1411
RELATIONS 130 (mill of Gergely Szakácsi's son Miklós)	RELATIONS 087, 090, 091, 146, 150 (via magna); 037, 089, 092 (János's son Egyed)
SERIAL NUMBER 084	SERIAL NUMBER 089
CULTIVATION arable land	CULTIVATION road
QUANTITY 3 iugerum	PLACE NAME road to the vine of the Pauline monastery
PLACE NAME Kerektho	UNIFIED PLACE NAME road to the vine of the Pauline monastery
UNIFIED PLACE NAME Kerektó	NORTH coppice and arable land of János's son Egyed
PRECISE POSITION beside	SOUTH Bakator
BESIDE main road to Gadány	DATE 1411
PREVIOUS POSSESSOR György Veres	RELATIONS 087 (road to the vine of the Pauline monastery); 046 (vine of the Pauline
NEW POSSESSOR Pauline monastery	
DATE 1471	
SETTLEMENT Nagyszakácsi	



monastery); 037, 088, 092 (János's son Egyed); 067, 068 (Bakator)

SERIAL NUMBER 090

CULTIVATION vine

PLACE NAME Alexandorbyky

UNIFIED PLACE NAME Alexandorbyky

NORTH trunk of an oak-tree

WEST coppice of György Bechy

SOUTH road to Léta

EAST coppice of the village

PREVIOUS POSSESSOR Keres of

Nagyszakácsi's sons Bekes and Mihály

NEW POSSESSOR Pauline monastery

DATE 1385

SETTLEMENT Nagyszakácsi

RELATIONS 146 (coppice of nobles); 087, 088, 091, 146, 150 (road to Léta)

SERIAL NUMBER 091

CULTIVATION road

PLACE NAME road to Léta

UNIFIED PLACE NAME road to Léta

NORTH vine of Keres of Nagyszakácsi

DATE 1385

SETTLEMENT Nagyszakácsi

RELATIONS 087, 088, 090, 146, 150 (road to Léta); 090 (Keres)

SERIAL NUMBER 092

CULTIVATION arable land

QUANTITY 1 iugerum

NORTH arable land of Kereztus's son Kozma

WEST road to the monastery

SOUTH arable land of Kereztus's son Kozma

EAST arable land of János of Szakácsi's son

Egyed

PREVIOUS POSSESSOR Mihály Szakácsi's son Balázs

NEW POSSESSOR Pauline monastery

DATE 1411

RELATIONS 021, 022, 078 (Kozma); 093, 147, 148 (road); 037, 088, 089 (János's son Egyed)

SERIAL NUMBER 093

CULTIVATION road

PLACE NAME road to the monastery

UNIFIED PLACE NAME road to the monastery

PRECISE POSITION towards the north and the south

EAST arable land of Mihály Szakácsi's son

Balázs

DATE 1411

RELATIONS 092, 147, 148 (road); 113 (Mihály Szabó's son Balázs)

SERIAL NUMBER 094

CULTIVATION forest

PLACE NAME Demeerdew

UNIFIED PLACE NAME Demeerdő

DATE 1452

SETTLEMENT Külsőszakácsi

SERIAL NUMBER 095

CULTIVATION forest

PLACE NAME Haraztherdew

UNIFIED PLACE NAME Haraszterdő

PREVIOUS POSSESSOR György Veres

(György Korotnai)

DATE 1475

SETTLEMENT Szakácsi

SERIAL NUMBER 096

CULTIVATION arable land

QUANTITY 1 iugerum

NORTH land of György Gekes's widow

WEST land of Egyed's son Bálint

SOUTH land of Miklós Kaczo

EAST Hosszú forest

PREVIOUS POSSESSOR Miklós Kaczo

NEW POSSESSOR Pauline monastery

DATE 1459

SETTLEMENT Szakácsi

RELATIONS 117 (Egyed's son Bálint); 038, 150 (Egyed's son János); 097 (Hosszú forest)

SERIAL NUMBER 097

CULTIVATION forest

PLACE NAME Hwzyw forest

UNIFIED PLACE NAME Hosszú forest

WEST 2 iugerum arable land of Miklós Kaczo

DATE 1459

SETTLEMENT Szakácsi

RELATIONS 096 (Hosszú forest); 039, 117 (Miklós Kaczo)

SERIAL NUMBER 098

CULTIVATION arable land

QUANTITY 1 iugerum

PLACE NAME Petesianuserdeemelleth

UNIFIED PLACE NAME forest of János Petes

PRECISE POSITION on the south

PREVIOUS POSSESSOR István Jank of

Külsőszakácsi's widow Borbála

NEW POSSESSOR Péter Szakácsi's Egyed

DATE 1444

SETTLEMENT Külsőszakácsi

RELATIONS (forest of János Petes - 1382)

SERIAL NUMBER 099

CULTIVATION forest

PLACE NAME Petesianuserdee

UNIFIED PLACE NAME forest of János Petes

DATE 1444

SETTLEMENT Külsőszakácsi

RELATIONS (forest of János Petes - 1382)

SERIAL NUMBER 100

CULTIVATION forest

PLACE NAME Vekonerdew	RELATIONS 048–051, 054 (arable lands of the Pauline monastery); 082 (meadow of the Pauline monastery)
UNIFIED PLACE NAME Vékony forest	
DATE 1452	
SETTLEMENT Külsőszakácsi	
SERIAL NUMBER 101	SERIAL NUMBER 106
CULTIVATION arable land	CULTIVATION arable land
QUANTITY 1 iugerum	QUANTITY 3 iugerum
PLACE NAME Markerdeye	PLACE NAME Weresgervghzele
UNIFIED PLACE NAME forest of Márk	UNIFIED PLACE NAME Veresgyörgyszéle
NORTH Utaslabos forest	PREVIOUS POSSESSOR Péter Szakácsi the cook
SOUTH forest of Márk	NEW POSSESSOR Péter Szakácsi's sister Anna and her sons, parish church
PREVIOUS POSSESSOR Benedek Tolvaj's son András, Tamás Szakácsi	DATE 1503
NEW POSSESSOR Péter Tóth	
FIELD-SYSTEM towards the east and the west	SERIAL NUMBER 107
DATE 1507	CULTIVATION arable land
SETTLEMENT Szakácsi	QUANTITY 2 iugerum
	PLACE NAME Horozeleg
SERIAL NUMBER 102	UNIFIED PLACE NAME Horohszéle
CULTIVATION forest	PREVIOUS POSSESSOR will of György Veres
PLACE NAME Wthaslaboserdew	DATE 1453
UNIFIED PLACE NAME Utaslaboserdő	SETTLEMENT Szakácsi
SOUTH Péter Tóth	RELATIONS 037, 040, 136 (Horohalja)
DATE 1507	
SETTLEMENT Szakácsi	SERIAL NUMBER 108
	CULTIVATION arable land
SERIAL NUMBER 103	QUANTITY 0,5 iugerum
CULTIVATION forest	PLACE NAME Giwthusgeype
PLACE NAME Markerdeye	UNIFIED PLACE NAME Giwthusgyepe
UNIFIED PLACE NAME forest of Márk	PREVIOUS POSSESSOR will of György Veres
NORTH Utaslaboserdő	DATE 1453
DATE 1507	SETTLEMENT Szakácsi
SETTLEMENT Szakácsi	
	SERIAL NUMBER 109
SERIAL NUMBER 104	CULTIVATION meadow
CULTIVATION arable land	QUANTITY 2
QUANTITY 3 iugerum	PLACE NAME Fewen, Kerekreth
PRECISE POSITION between the lands of the Pauline monastery	UNIFIED PLACE NAME Föveny, Kerekreth
BESIDE monastery, forest of D. Szécsényi's son László	PRECISE POSITION Kerekreth
PREVIOUS POSSESSOR Mihály Kígyó	PREVIOUS POSSESSOR Mihály Kígyó, Márton Vidi, Péter Orros
NEW POSSESSOR Pauline monastery	NEW POSSESSOR Pauline monastery
DATE 1428	DATE 1495
RELATIONS 048–051, 054, (arable lands of the Pauline monastery); 082 (meadow of the Pauline monastery); 048, 052 (monastery)	SETTLEMENT Szakácsi
	SERIAL NUMBER 110
SERIAL NUMBER 105	CULTIVATION arable land
CULTIVATION forest	QUANTITY 2 iugerum
PLACE NAME forest of D. Szécsényi's son László	PLACE NAME Barkolczazele
UNIFIED PLACE NAME forest of D. Szécsényi's son László	UNIFIED PLACE NAME Barkolcaszéle
BESIDE lands of the Pauline monastery, arable land of Mihály Kígyó	PRECISE POSITION on the east
DATE 1428	NORTH land of János Szakácsi's son Péter
	PREVIOUS POSSESSOR János Poka of Szakácsi
	NEW POSSESSOR János Szakácsi's son Péter
	FIELD-SYSTEM laneus
	DATE 1425
	SETTLEMENT Szakácsi



RELATIONS 032, 111 (János's son Péter); 111, 113, 144 (János Poka)

SERIAL NUMBER 111

CULTIVATION arable land

QUANTITY 1 iugerum

NORTH arable land of László's son János's son Péter

WEST coppice called Megye

SOUTH son of János

EAST arable land of János Poka

PREVIOUS POSSESSOR Lőrinc Szakácsi's son Domokos

NEW POSSESSOR Pauline monastery

DATE 1411

RELATIONS 032, 110 (János's son Péter); 110, 113, 144 (János Poka)

SERIAL NUMBER 112

CULTIVATION coppice

PLACE NAME Megye

UNIFIED PLACE NAME Megye

EAST arable land of Lőrinc Szakácsi's son Domokos

DATE 1411

RELATIONS 067, 068, 087–089, 149 (coppice)

SERIAL NUMBER 113

CULTIVATION arable land

QUANTITY 1 iugerum

NORTH land of János Poka of Szakácsi

WEST land of János Poka of Szakácsi

EAST arable land of Mihály Szakácsi's son Balázs

PREVIOUS POSSESSOR Mihály Szakácsi's son Balázs

NEW POSSESSOR Pauline monastery

DATE 1411

RELATIONS 110, 111, 144 (János Poka); 092 (Mihály's son Balázs)

SERIAL NUMBER 114

CULTIVATION arable land

QUANTITY 1 iugerum

WEST land of Jakab Veres

EAST land of Pál Pokocz

PREVIOUS POSSESSOR János Szakácsi's son Péter

NEW POSSESSOR Pál Pokocz of Szakácsi

DATE 1436

SETTLEMENT Szakácsi

SERIAL NUMBER 115

CULTIVATION arable land

QUANTITY 1 usu.

PRECISE POSITION towards the garden of Imre's son Péter

BESIDE Külsőszakácsi

PREVIOUS POSSESSOR Mihály Tolvaj

NEW POSSESSOR Antal Iwanka's son György of Külsőszakácsi

DATE 1451

SETTLEMENT Külsőszakácsi

RELATIONS 116 (garden of Imre's son Péter)

SERIAL NUMBER 116

CULTIVATION arable land

QUANTITY 0,5

PRECISE POSITION towards the garden of Péter and Imre

NEW POSSESSOR Antal Iwanka's son György of Külsőszakácsi and his daughters

DATE 1463

SETTLEMENT Külsőszakácsi

RELATIONS 115 (garden of Imre's son Péter)

SERIAL NUMBER 117

CULTIVATION arable land

QUANTITY 1 iugerum

NORTH land of László Szakácsi's son György's widow

SOUTH Egyed Szakácsi's son Bálint

PREVIOUS POSSESSOR Pauline monastery

NEW POSSESSOR Benedek Kaczo's son

Miklós

DATE 1459

SETTLEMENT Szakácsi

RELATIONS 096 (Egyed's son Bálint); 038, 150 (Egyed's son János); 039, 097 (Miklós Kaczo)

SERIAL NUMBER 118

CULTIVATION arable land

QUANTITY 1 iugerum

WEST land of János Bodak

EAST arable land of Márton's son Tamás

PREVIOUS POSSESSOR Gergely Kelenizi's wife and Demeter Soldos's daughter Zsuzsanna

NEW POSSESSOR János Szakácsi's son Péter

DATE 1429

SERIAL NUMBER 119

CULTIVATION arable land

QUANTITY piece

BESIDE (arable land of) László Zereger

PREVIOUS POSSESSOR will of György Veres

DATE 1453

SETTLEMENT Szakácsi

RELATIONS 134 (László Zereger)

SERIAL NUMBER 120

CULTIVATION arable land

QUANTITY 8,5 iugerum

PREVIOUS POSSESSOR Mihály Tolvaj (Warazloi)

NEW POSSESSOR Antal's son ..., Simon Finta ..., Vidi Gondos

DATE 1461

SETTLEMENT Külsőszakácsi

SERIAL NUMBER 121  
 CULTIVATION forest  
 PLACE NAME Hasberky  
 UNIFIED PLACE NAME Hársberek  
 MODERN PLACE NAME 73, 99 Berök  
 WEST Nagyrét  
 PREVIOUS POSSESSOR Mihály Tolvaj  
 NEW POSSESSOR Antal Iwanka's son György  
 of Külsőszakácsi  
 DATE 1451  
 RELATIONS 009–011 (Hársberek); 012  
 (Nagyrét)

SERIAL NUMBER 122  
 CULTIVATION road  
 PLACE NAME gyalogwth  
 UNIFIED PLACE NAME foot path  
 BESIDE it leads across 1 iugerum arable land  
 PREVIOUS POSSESSOR Mihály Tolvaj  
 NEW POSSESSOR Antal Iwanka's son György  
 of Külsőszakácsi  
 DATE 1451  
 RELATIONS 025 (foot path)

SERIAL NUMBER 123  
 CULTIVATION river  
 EAST coppice called Szőlőharaszt of György  
 Veres  
 DATE 1466  
 SETTLEMENT Nagyszakácsi  
 RELATIONS 046, 047, 124–126 (Szőlőharaszt);  
 019, 035, 123, 124 (György Veres)

SERIAL NUMBER 124  
 CULTIVATION road  
 PLACE NAME plebanoswth  
 UNIFIED PLACE NAME priest's road  
 PRECISE POSITION leading to forest  
 WEST coppice called Szőlőharaszt of György  
 Veres  
 DATE 1466  
 SETTLEMENT Nagyszakácsi  
 RELATIONS 046, 125 (road); 046, 047, 123,  
 125, 126 (Szőlőharaszt); 019, 035, 123, 125  
 (György Veres)

SERIAL NUMBER 125  
 CULTIVATION road  
 PLACE NAME via publica  
 UNIFIED PLACE NAME public road  
 PRECISE POSITION leading to forest  
 NORTH coppice called Szőlőharaszt of György  
 Veres  
 DATE 1466  
 SETTLEMENT Nagyszakácsi  
 RELATIONS 046, 124 (road); 046, 047, 123,  
 124, 126 (Szőlőharaszt); 019, 035, 123, 124  
 (György Veres)

SERIAL NUMBER 126  
 CULTIVATION drain  
 PLACE NAME esővízelvezető árok  
 UNIFIED PLACE NAME drain  
 NORTH vineyard called Szőlőharaszt  
 EAST vineyard called Szőlőharaszt  
 DATE 1471  
 SETTLEMENT Nagyszakácsi  
 RELATIONS 046, 047, 123–125 (Szőlőharaszt)

SERIAL NUMBER 128  
 CULTIVATION road  
 UNIFIED PLACE NAME road  
 WEST arable land of Pál Szakácsi's son Ferenc  
 DATE 1411

SERIAL NUMBER 129  
 CULTIVATION arable land  
 QUANTITY part of 1 iugerum  
 PLACE NAME Borsohel  
 UNIFIED PLACE NAME Borsohely  
 PRECISE POSITION on the east  
 WEST Kerekerdő  
 NEW POSSESSOR György Veres, Péter Orros,  
 Miklós Orros  
 DATE 1463  
 SETTLEMENT Külsőszakácsi  
 RELATIONS 018 (Borsohely); 013–018  
 (Kerekerdő)

SERIAL NUMBER 130  
 CULTIVATION mill  
 PLACE NAME mill of Gergely Szakácsi's son  
 Miklós  
 UNIFIED PLACE NAME mill of Gergely  
 Szakácsi's son Miklós  
 BESIDE meadow of Gergely Kelenizi's wife  
 PREVIOUS POSSESSOR Gergely Szakácsi's  
 son Miklós  
 DATE 1431  
 SETTLEMENT Szakácsi  
 RELATIONS 037, 039, 040, 080, 082 (mills)

SERIAL NUMBER 131  
 CULTIVATION forest  
 PREVIOUS POSSESSOR will of Péter Szakácsi  
 the cook  
 DATE 1503

SERIAL NUMBER 132  
 CULTIVATION meadow  
 PREVIOUS POSSESSOR will of György Veres  
 DATE 1453  
 SETTLEMENT Külsőszakácsi

SERIAL NUMBER 133  
 CULTIVATION meadow  
 PREVIOUS POSSESSOR will of György Veres  
 (Egyed Fekete)



- DATE 1453  
SETTLEMENT Külsőszakácsi
- SERIAL NUMBER 134  
CULTIVATION arable land  
PREVIOUS POSSESSOR will of György Veres (László Zereger)  
DATE 1453
- SERIAL NUMBER 135  
CULTIVATION arable land  
QUANTITY 1 iugerum  
PREVIOUS POSSESSOR will of Péter Szakácsi the cook  
DATE 1503
- SERIAL NUMBER 136  
CULTIVATION meadow  
PLACE NAME Horohalya  
UNIFIED PLACE NAME Horohalja  
PREVIOUS POSSESSOR Miklós Szakácsi's son János, János Szakácsi's son Egyed, Mihály's son Balázs  
NEW POSSESSOR Pauline monastery  
DATE 1402  
SETTLEMENT Szakácsi  
RELATIONS 037, 040 (Horohalja); 107 (Horohszéle)
- SERIAL NUMBER 137  
CULTIVATION arable land  
QUANTITY 1,5 iugerum  
BESIDE at the edge of the village Szakácsi  
PREVIOUS POSSESSOR Gergely Kelenizi's wife and Demeter Soldos's daughter Zsuzsanna  
NEW POSSESSOR János Szakácsi's son Péter  
DATE 1429  
SETTLEMENT Szakácsi
- SERIAL NUMBER 138  
CULTIVATION forest  
QUANTITY piece  
PREVIOUS POSSESSOR will of György Veres  
DATE 1453  
SETTLEMENT Külsőszakácsi
- SERIAL NUMBER 139  
CULTIVATION vine  
PREVIOUS POSSESSOR György Veres  
DATE 1453  
SETTLEMENT Külsőszakácsi
- SERIAL NUMBER 140  
CULTIVATION forest  
PLACE NAME Magaskerthuel  
UNIFIED PLACE NAME Magaskörtvély  
BESIDE Hátaserdő  
PREVIOUS POSSESSOR Mihály Tolvaj (Warazloi)
- NEW POSSESSOR daughters of Antal Iwanka's son György of Külsőszakácsi  
DATE 1455  
SETTLEMENT Külsőszakácsi  
RELATIONS 021 (Hátaserdő, Magaskörtvély)
- SERIAL NUMBER 141  
CULTIVATION meadow  
QUANTITY 1 scythe (falcastrum)  
DATE 1461  
SETTLEMENT Külsőszakácsi
- SERIAL NUMBER 142  
CULTIVATION vine  
QUANTITY 0,5  
PLACE NAME Therpechegye  
UNIFIED PLACE NAME Terpecshegye  
WEST Egyed Fekete  
EAST Péter Orros  
NEW POSSESSOR Péter Orros, Miklós Orros  
DATE 1463  
RELATIONS 133 (Egyed Fekete)
- SERIAL NUMBER 143  
CULTIVATION vine, coppice  
QUANTITY 0,5  
PLACE NAME Zeleharazthya  
UNIFIED PLACE NAME Szőlőharaszt  
PREVIOUS POSSESSOR György Veres  
NEW POSSESSOR Pauline monastery  
DATE 1471  
SETTLEMENT Nagyszakácsi  
RELATIONS 046, 047, 123–125 (Szőlőharaszt)
- SERIAL NUMBER 144  
CULTIVATION road  
PLACE NAME road to Monyorókerék  
UNIFIED PLACE NAME road to Monyorókerék  
PRECISE POSITION on the east, near Léta  
WEST forest of the parish priest of Szakácsi  
BESIDE land of Poka of Szakácsi's son János, coppice  
DATE 1382  
SETTLEMENT Szakácsi  
RELATIONS 149 (road to Monyorókerék); 066–068 (forest of the parish church); 110, 111, 113 (János Poka)
- SERIAL NUMBER 145  
CULTIVATION road  
PLACE NAME road from Léta to the monastery  
UNIFIED PLACE NAME road from Léta to the monastery  
PRECISE POSITION on the east  
BESIDE linden-tree marked by a cross, coppice  
DATE 1382  
SETTLEMENT Szakácsi

SERIAL NUMBER 146	SETTLEMENT Nagyszakácsi
CULTIVATION road	RELATIONS 086 (road to Gadány)
PLACE NAME path to Léta	
UNIFIED PLACE NAME path to Léta	SERIAL NUMBER 152
WEST coppice and arable lands of the monastery	CULTIVATION forest
EAST coppice of the nobles of Szakácsi	PLACE NAME Magaskörtvély
DATE 1382	SOUTH curia of Péter's son László in
RELATIONS 024, 090, 091 (road)	Külsőszakácsi
	PREVIOUS POSSESSOR János Bogdán
SERIAL NUMBER 147	NEW POSSESSOR Péter's son László
CULTIVATION road	DATE 1470
PLACE NAME small road along the stream	SETTLEMENT Külsőszakácsi
UNIFIED PLACE NAME small road along the stream	RELATIONS 021, 140 (Magaskörtvély)
PRECISE POSITION towards the east and the west	
BESIDE forest of the Pauline monastery	SERIAL NUMBER 153
DATE 1382	CULTIVATION vine
RELATIONS 092, 093, 148 (road)	NORTH vine of Kelemen Seres of Szöcsény
	WEST main road (via magna) from Szöcsény to Léta
SERIAL NUMBER 148	SOUTH main road (via magna) from Szöcsény to Léta
CULTIVATION road	EAST vine of Márk Zsitvai's son Lukács
PLACE NAME road to the monastery	PREVIOUS POSSESSOR László Szöcsényi
UNIFIED PLACE NAME road to the monastery	NEW POSSESSOR Pauline monastery
BESIDE forest of Pető Szakácsi's son János, near a stream	DATE 1456
DATE 1382	SETTLEMENT Szöcsény
RELATIONS 092, 093, 147 (road)	
SERIAL NUMBER 149	
CULTIVATION road	
PLACE NAME road from the monastery to Monyorókerék	
UNIFIED PLACE NAME road from the monastery to Monyorókerék	
PRECISE POSITION towards the east and the west	
BESIDE coppice	
DATE 1382	
RELATIONS 144 (road to Monyorókerék)	
SERIAL NUMBER 150	
CULTIVATION road	
PLACE NAME road to Léta	
UNIFIED PLACE NAME road to Léta	
BESIDE land of Egyed's son János	
DATE 1382	
RELATIONS 087, 088, 090, 091, 146 (road); 038 (Egyed's son János)	
SERIAL NUMBER 151	
CULTIVATION road	
PLACE NAME via magna to Mesztegnyő	
UNIFIED PLACE NAME main road to Mesztegnyő	
WEST arable land for a plough on Halmos	
BESIDE Ferenc Kakas's sponsus György Vidi	
DATE 1480	



## Appendix 2.

## Perambulation of the bounds of the estate of the Trepk family of Monyorókerék and the Szakácsi family of Szakácsi from 1371.

Tolvaj's formulary OSzK Fol. Lat. 1818. 128–129. p.

Collectio styolorum saeculo XV in Foris Hungariae usu receptorum. Ex dono Illustrissimi Domini Comititis Francisci Tolvaj

Nos Conventus monasterii Sancti Aegidii de Simigio memorie commendamus quod cum iuxta continentiam litterarum comitis Capelle Regie arbitratoriarum quatuor *probi* et nobiles viri ..... nostro testimonio inter partes infrascriptos, videlicet Nicolaum filium Joannis, Bekus filium Kezes (?), Joannem filium Egidii, Demetrium filium Elek, Petrum filium Joannis, et Petrum filium Nicolai de Zakachy actores ab una, item magistros Dominicum, Joannem, Isyp (?) et Leukus filios Stephani filii Trepk, in causam attractos parte ab altera, super facto metarum inter possessiones Zakach predictam ipsorum actorum et Moniorokerek dictorum in *C(omatturum)* distinguendum. In octavis festi Nativitatis Beate Virginis proxime preteritis (szept. 15.) arbitrarie et ipsas partes componere debuissent. Nosque secundum earundem litterarum tenorem ad ipsum arbitrium audiendum et dictam compositionem videndam, unum ex nobis virum religiosum, fratrem Jacobum Sacerdotem pro nostro testimonio duximus destinandum. Tandem idem homo noster una cum predictis Nicolao filio Joannis Bekus et Petro filio Nicolai, qui pro se personaliter et pro predictis aliis eorum proximis *omis eorum* in se assumentes, item annotatis magistris Dominico, Joanne et Isyp, qui similiter pro se personaliter et pro dicto Leukus fratre ipsorum, *omis eiusdem, si in* infrascripta compositione persistere vellet, super se accipiendo (?), coram nobis adherebant, et in nullo infrascripte compositioni contradicebant, sed eandem suo modo afirmabant, ad nos redeundo retulit eo modo: quod ipse partes secundum ordinationem et dispositionem arbitriariam proborum et nobilium virorum per ipsos adductorum taliter concordassent super metis inter predictas possessiones earum distinguendis: Quod ipse partes presente ipso nostro testimonio in predictis ..... Ad facies dictarum possessionum ipsarum accedendo metas in se invicem easdem possessiones perpetuo separantes taliter reambulassent et ipsas possessiones per has metas ab invicem distinxissent, **quod primo incepissent** a fluvio Haas vocato et penes eundem fluvium unam metam terream erexissent, et ab hinc versus orientem per vi..... et valde prope agrediendo, duas antiquas metas terreas, unam videlicet in ..... Ilicis, et aliam in arbore similiter Ilicis reperissent, penes quas tertiam novam erexissent, deindeque versus eandem plagam orientalem ..... eundo pervenissent ad unam metam antiquam ad radicem cuiusdam arboris Ilicis cumulatam, iuxta quam novam metam terream elevassent. Ab hinc vero similiter ad eandem partem vadendo, pervenissent ad unam magnam arborem Ilicis, meta terrea circumfusam in *arboris* que existentem, et penes ipsam novam metam terream cumulassent, et ab hinc p..... eundo similiter unam arborem Ilicis, meta terrea circumfusam reperissent, iuxta quam novam erexissent, modicumque ab inde semper ad eandem partem transeundo, similiter unam arborem Ilicis in radice metam terream habentem inveniebant, quam renovassent, et deinde per bonum spacium ad eandem plagam orientis eundo pervenissent ad unam viam (Oeseguso) transitum prebentem, ex utraque parte metam terream habentem, penes quas tertiam metam terream erexissent, deinde directe ad fluvium Sichwa (?) nuncupatum detendendo ipsumque fluvium ad *terram* Cheer vocatam saliendo ac semper ad dictam plagam procedendo et ad unam viam de Moniorokerek distinguentes, penes quas novas elevassent, transeuntes pervenissent ad quandam arborem Ilicis meta terrea circumdatam, quam renovassent, indeque ad angulum ipsius *virgulti* parciū declinando ad quandam ..... Ilicis vocatam novam metam terream erexissent, et inde prope eundo in medio cuiusdem terre arabilis, unam metam terream cumulassent, et de hinc ad angulum unius silve magne custodialis prope eundo, penes unam viam novam metam terream elevassent et abinde semper penes latus ipsius silve per *quam* plures continuas metas terreas de novo erectas euntes pervenissent ad quandam rivulum, iuxta quem supra clausuram molendini Heremitarum Ecclesie Sancti Dominici unam metam terream de novo cumulassent. Ibiq; mete partium predictam ipsam terram Cheresculeu ac terras ipsius possessiones Moniorokerek separantes terminarentur.

“Quemquidam omnes mete a principio usque ad finem semper ad partem meridiāalem ipsi possessioni Zakach et ad partem septentrionalem ad Zakach transitum prebentem perveniendo ipsamque viam transiliendo, penes eandem in rubetis sub quodam arbore Piri sylvestriunam metam terream reperissent, iuxta quam novam erexissent et in eisdem novam erexissent, et in eisdem rubetis seu virgultis, ulterius modicu transeundo unam metam terream invenissent antiquam, penes quam novam cumulassent et ab inde in eodem virgulte semper ad predictam partem per continuas tres metas terreas antiquas ipsam terreā Cheer ac terris dicte possessionis Moniorokerek distinguentes

... trionalem dicte possessioni Moniorokerek separarent et distinguerent. Hoc etiam declaranto quod super ... habite

*Anno domini millesimo trecentesimo septuagesimo primo. 1371*



fig. 6. Site of Külsőszakácsi on aerial photos



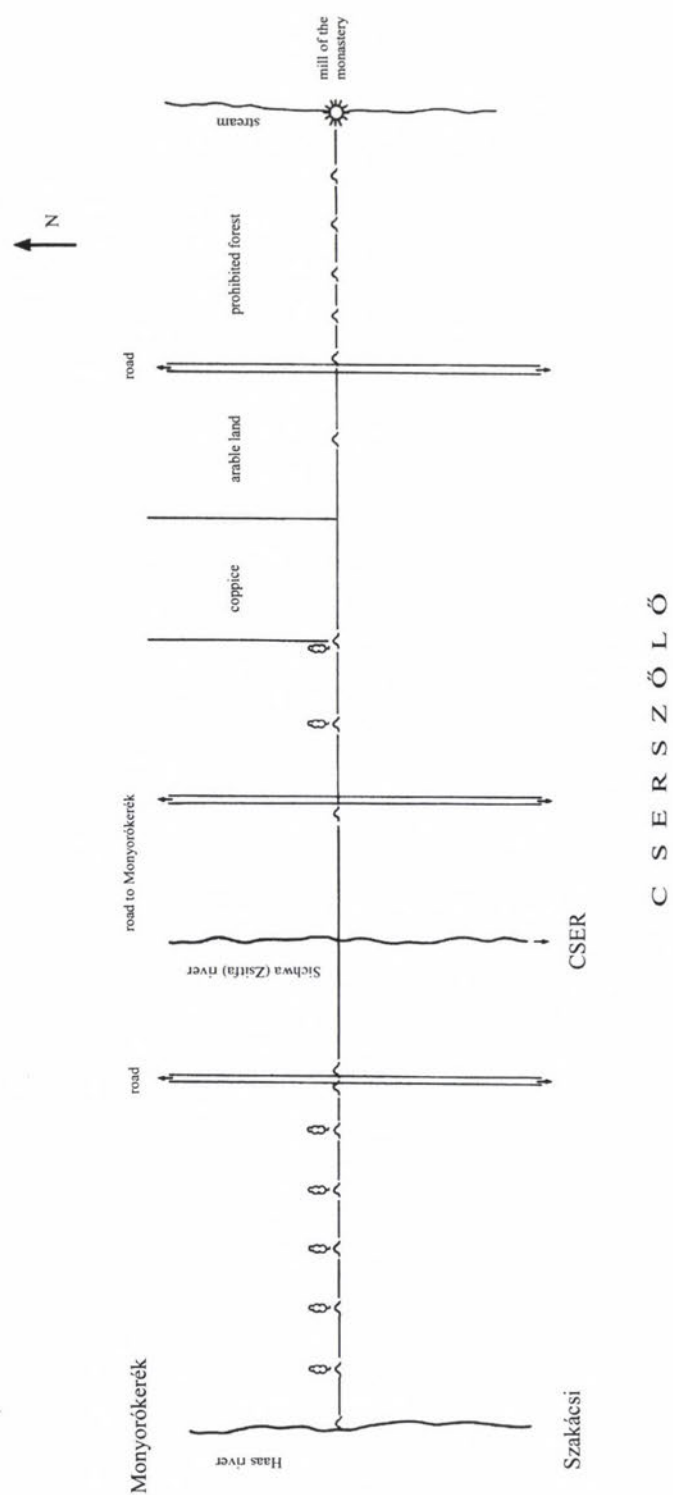


fig. 7. Sketch of the perambulation of the Trepk family of Monyorókerék and the Szakácsi family in Szakácsi issued in 1371

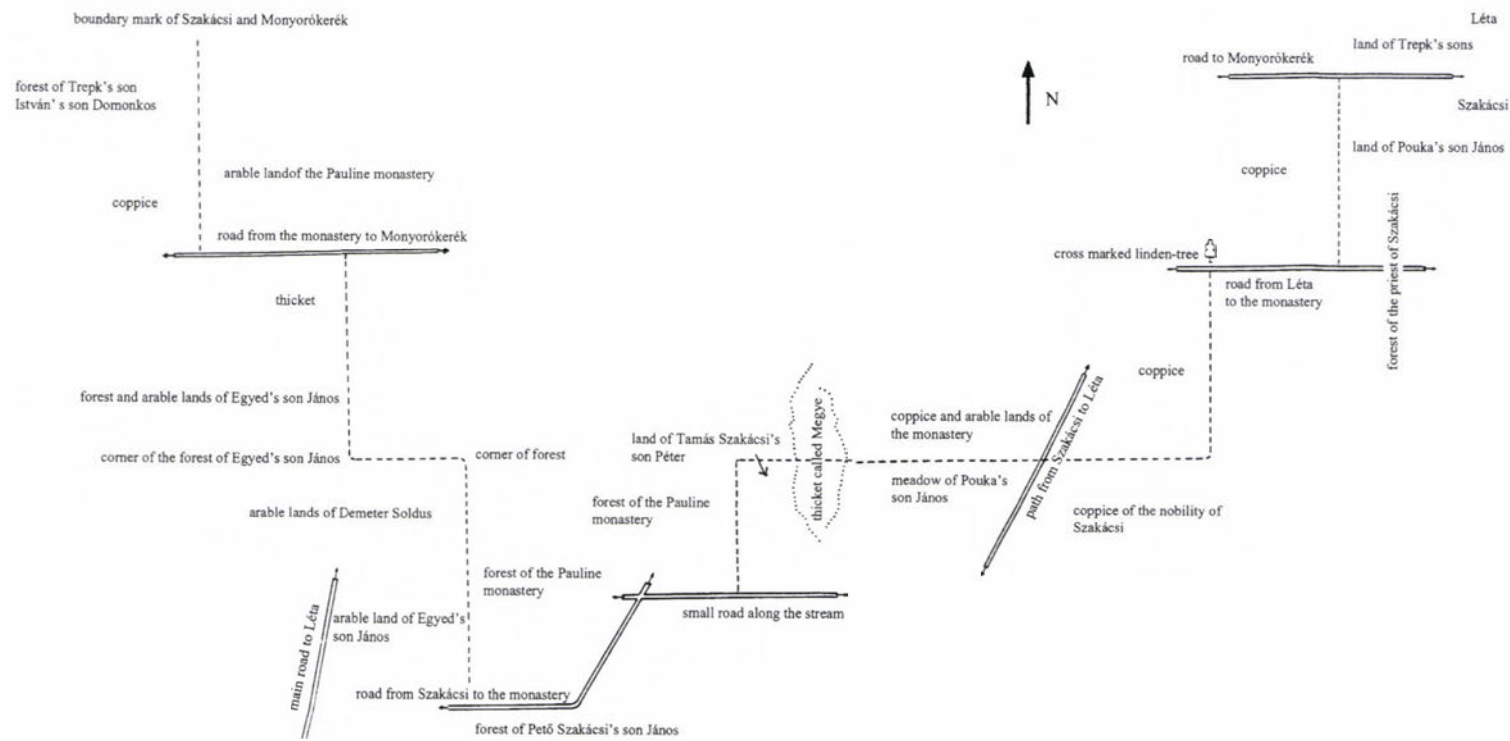


fig. 8. Sketch of the perambulation of the lands of the Pauline monastery issued in 1382



9/a

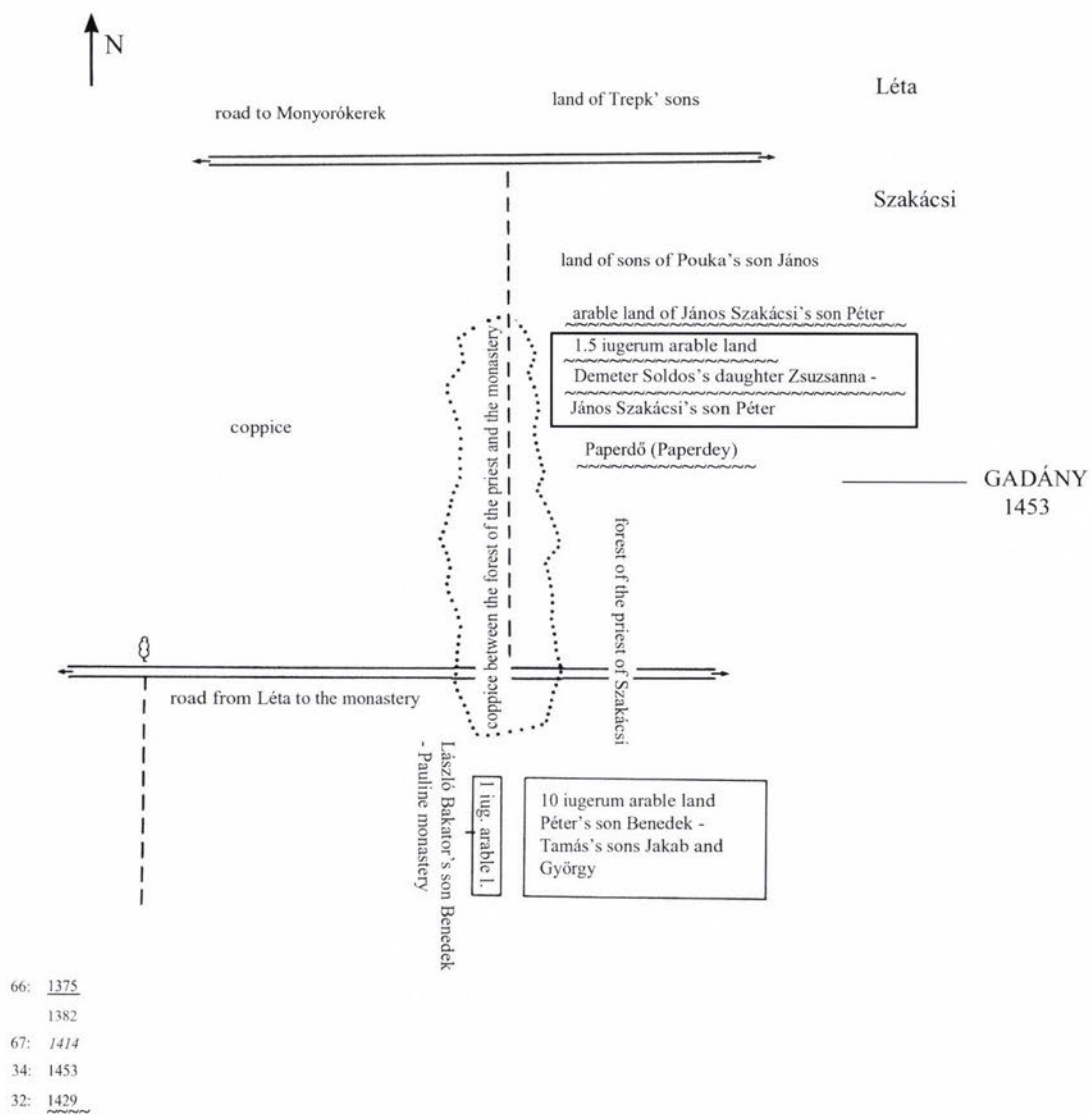


fig. 9/a–c. First section of the perambulation from 1382 with other available documentary data

fig. 9/b.

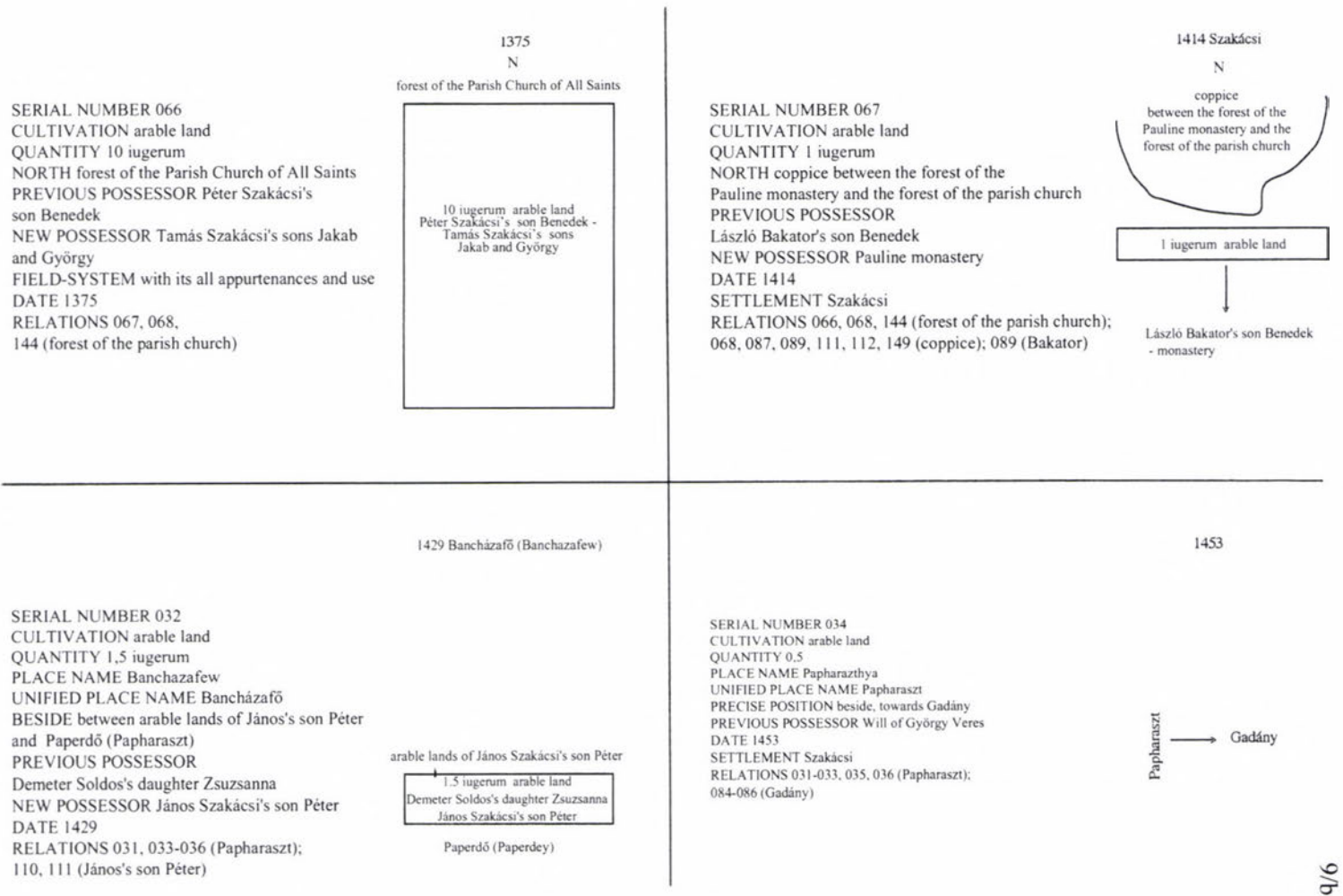




fig. 9/c.

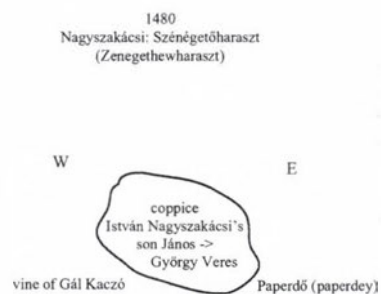
SERIAL NUMBER 035  
 CULTIVATION arable land  
 QUANTITY 1 funiculus  
 PLACE NAME Papharazthya  
 UNIFIED PLACE NAME Papharaszt  
 PRECISE POSITION beside, in ordinato  
 WEST György Veres  
 EAST György Bíró  
 PREVIOUS POSSESSOR Will of György Veres  
 FIELD-SYSTEM in ordinato vaginatum vulgo zalagon  
 DATE 1453  
 SETTLEMENT Szakácsi  
 RELATIONS 031-034, 036 (Papharaszt);  
 019, 060, 123-125 (György Veres); 060 (György Bíró)

\*vaginatum vulgo zalagon in ordinato\*

SERIAL NUMBER 033  
 CULTIVATION arable land  
 QUANTITY 0,5  
 PLACE NAME Papharazthya  
 UNIFIED PLACE NAME Papharaszt  
 PRECISE POSITION beside on the east  
 PREVIOUS POSSESSOR Will of György Veres  
 DATE 1453  
 SETTLEMENT Szakácsi  
 RELATIONS 031, 032, 034-036 (Papharaszt)

SERIAL NUMBER 036  
 CULTIVATION arable land  
 QUANTITY 0,5  
 PLACE NAME Papharastya  
 UNIFIED PLACE NAME Papharaszt  
 PREVIOUS POSSESSOR Will of György Veres  
 DATE 1453  
 SETTLEMENT Szakácsi  
 RELATIONS 031-035 (Papharaszt)

SERIAL NUMBER 031  
 CULTIVATION coppice  
 QUANTITY 1 piece  
 PLACE NAME Zenegethewharazthya  
 UNIFIED PLACE NAME Szénégetőharaszt  
 WEST vine of Gál Kaczó, Paperdő  
 EAST Paperdő, (Papharaszt)  
 PREVIOUS POSSESSOR  
 István of Nagyszakácsi's son János  
 NEW POSSESSOR György Veres  
 DATE 1480  
 SETTLEMENT Nagyszakácsi  
 RELATIONS 032-036 (Papharaszt)



9/c

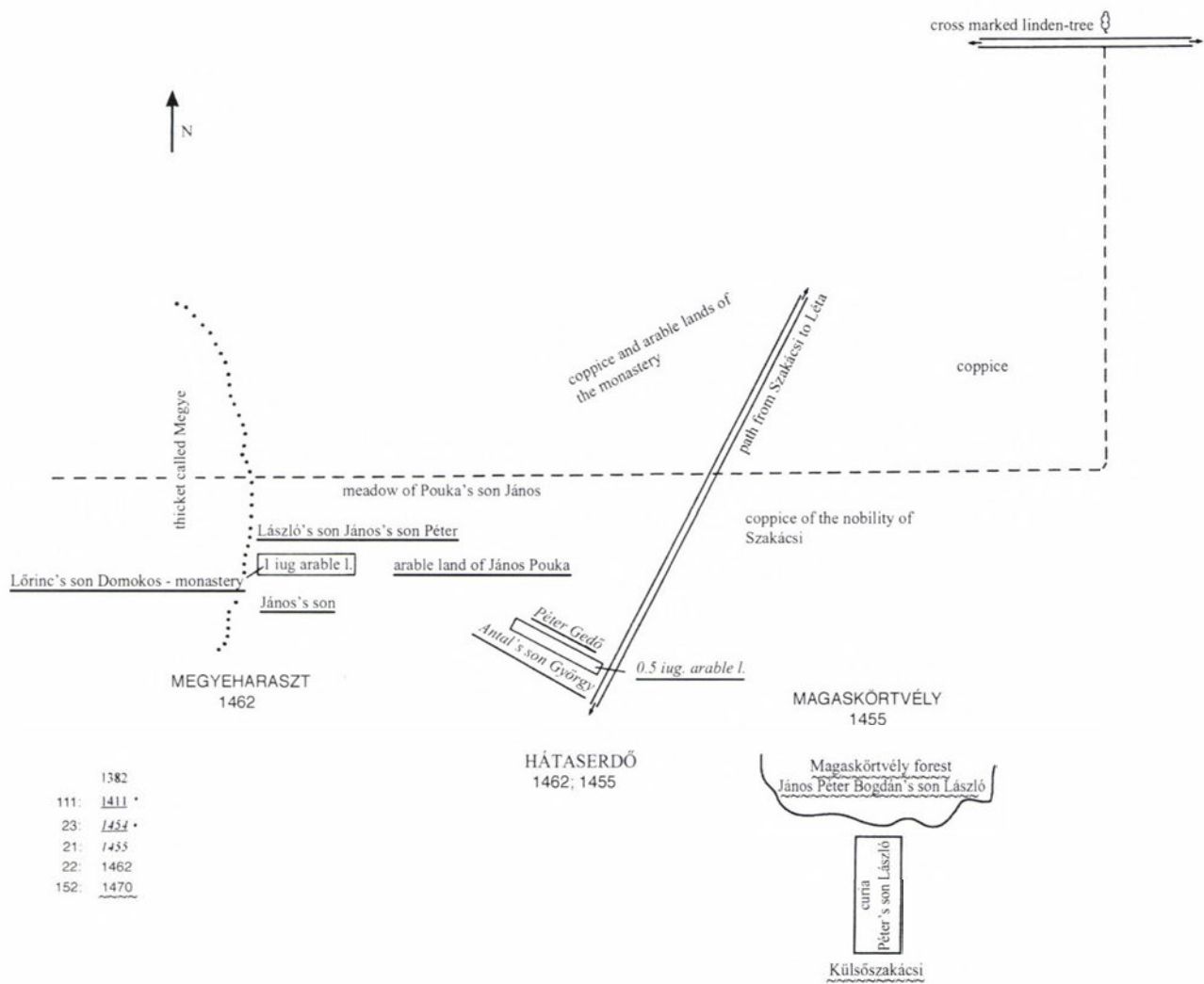




fig. 10/b.

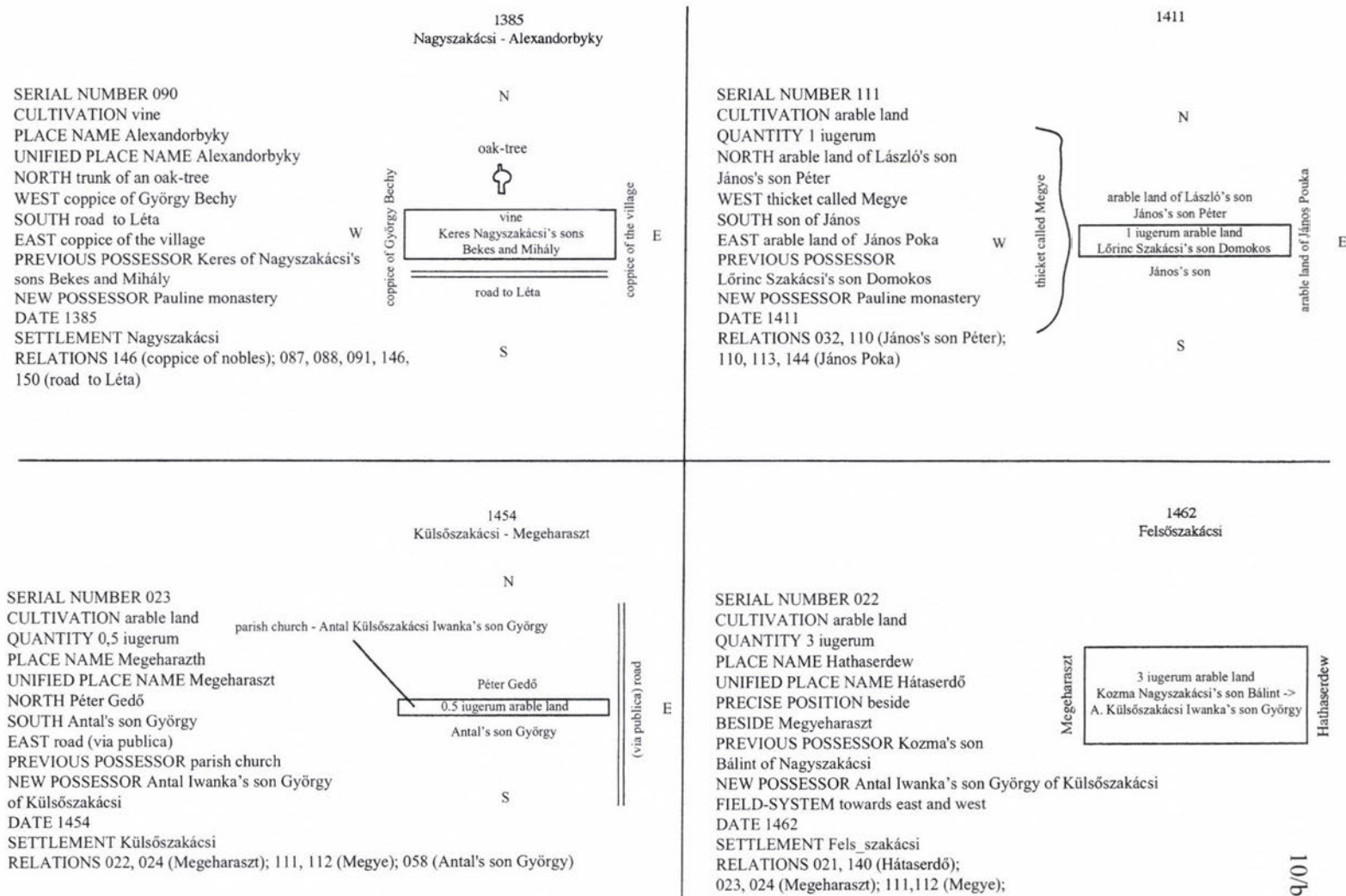
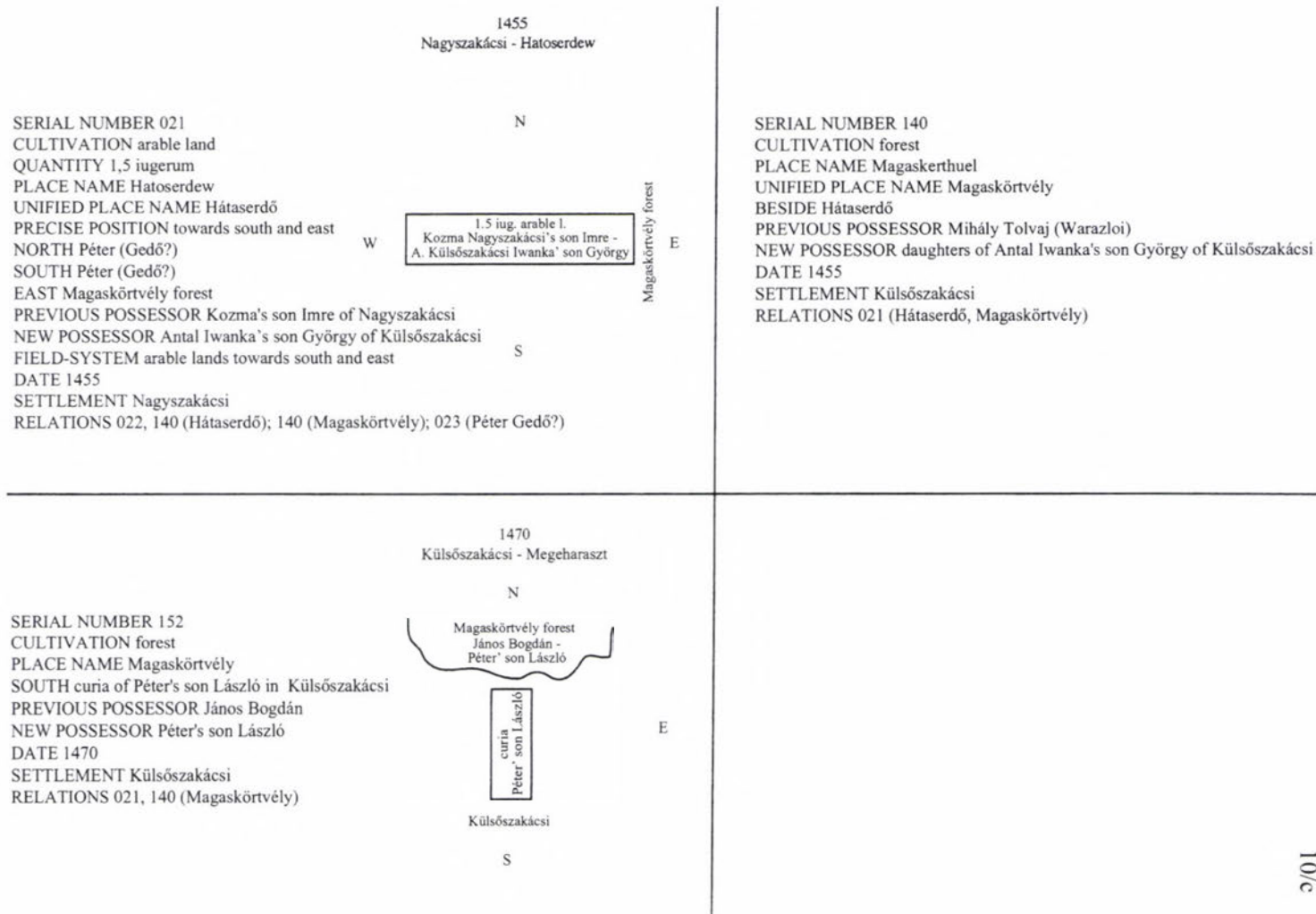


fig. 10/c.



10/c



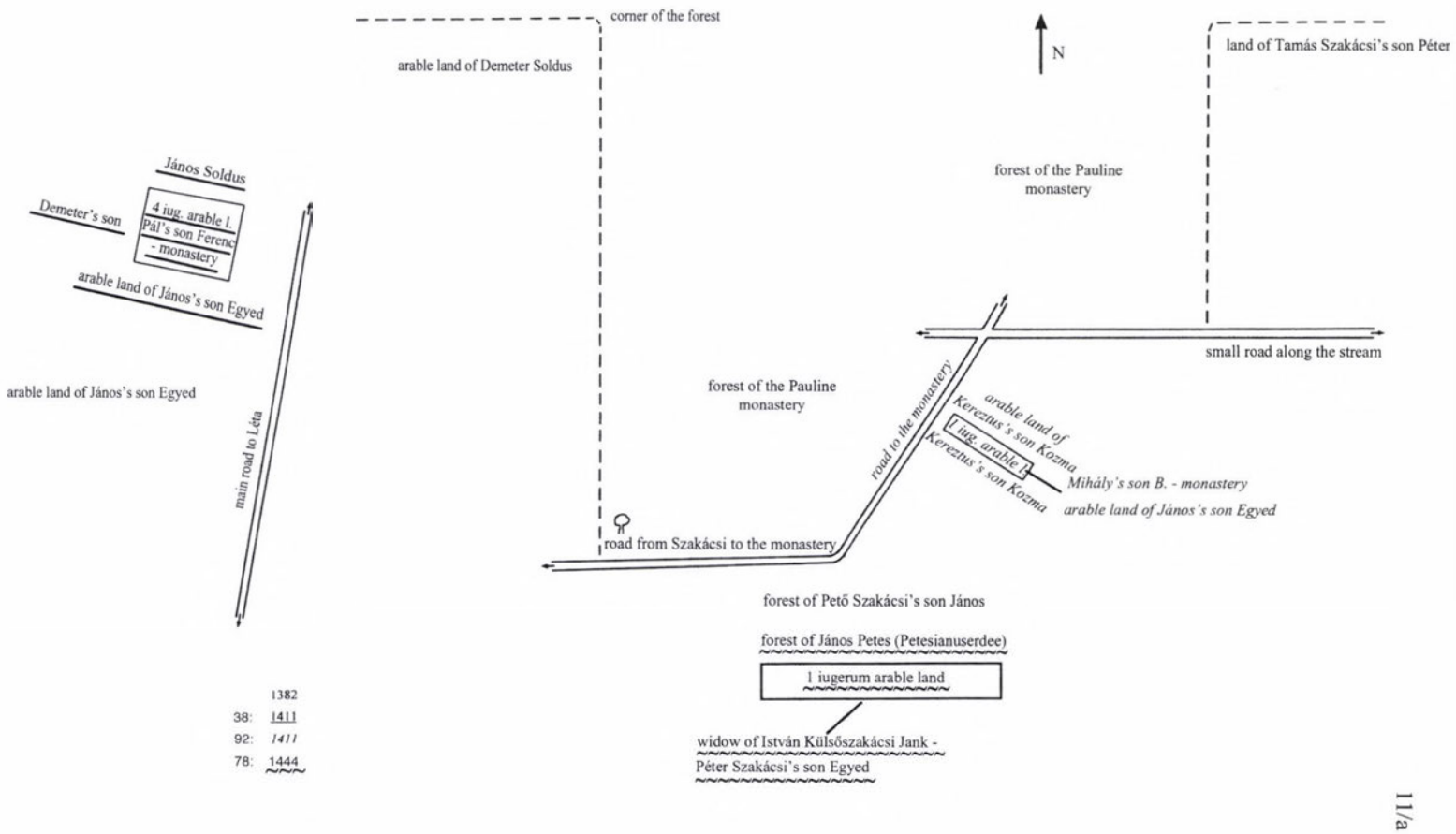
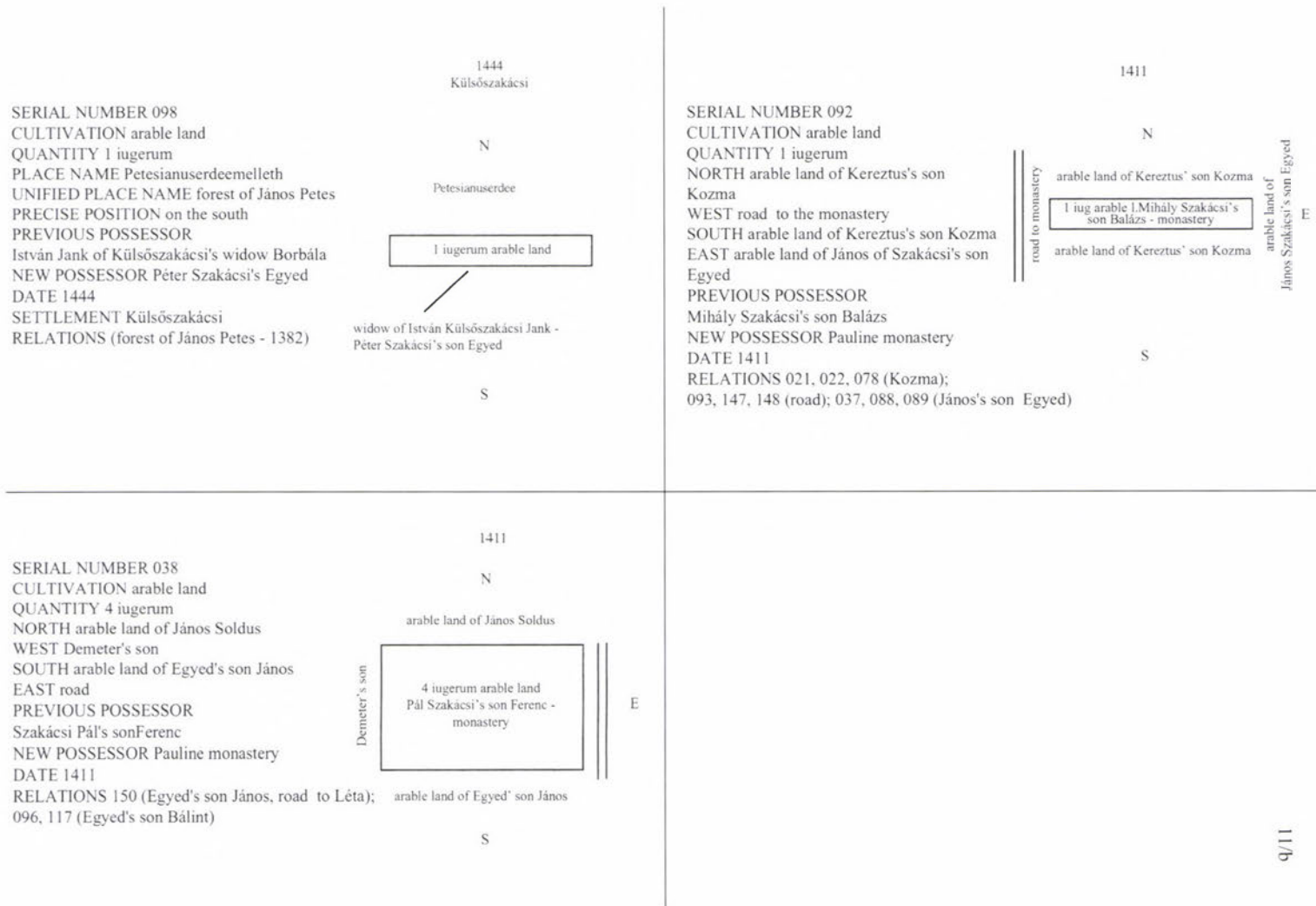


fig. 11/a-b. The third section of the perambulation from 1382 with other available documentary data

fig. 11/b.





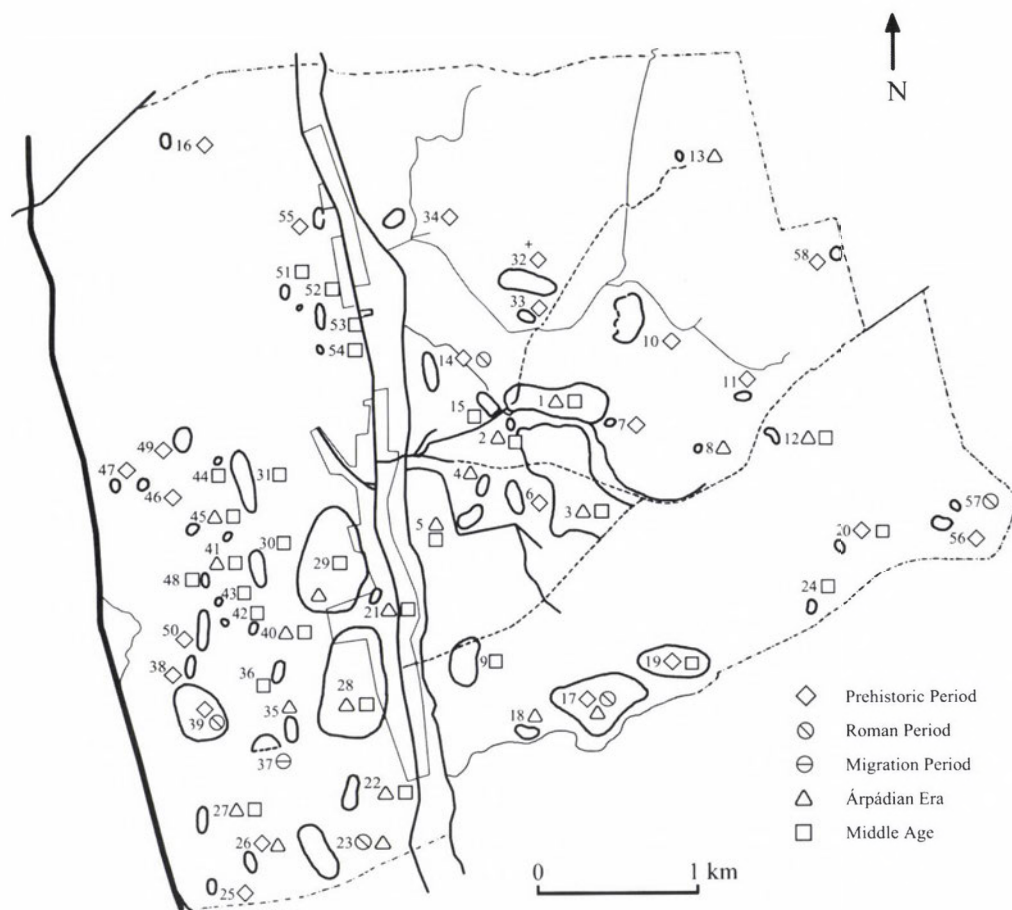


fig. 12. Archaeological sites from Nagyszakácsi



fig. 13. Medieval roads, place names and the possible route of the perambulation in 1382





## OPPONENT'S REMARKS ON ISTVÁN GAÁL'S DOCTORAL THESIS

*Nándor Kalicz*

István Gaál's name is well known in the research of the Central European Neolithic. In a number of large-scale studies, he discussed the problems of cemeteries, cultic phenomena, cultic objects and diverse articles of use of the Middle and Late Neolithic and even the Early Copper Age, in a Hungarian sense, and sketched the solutions he could derive from his own investigations. He has really laid the foundations for such a work. He spent, all in all, about 4 years in foreign institutions (Austria, Bulgaria, Germany), from which we can mention the Humbolt grant in Germany as the one that offered an excellent opportunity to do research work in major institutions and to learn the latest theoretical analytical methods.

After finishing his university studies, the candidate acquired a university doctoral degree. He chose the Transdanubian Lengyel culture for the topic of his thesis with a special stress on the problems of diffusion and chronology. He had more experience when he prepared his candidate thesis, in which he analysed all the known Neolithic cemeteries of Central Europe, a larger geographical unit, within certain social archaeological frames. In this dissertation, we could already meet the elements of his later perfected analytical method.

The academic doctoral dissertation he has handed in for this discussion encompasses a more restricted territory, he returns to the Lengyel culture. He himself conducted a series of smaller and larger excavations and rescue excavations, the most significant of which was the excavation of the Mórág settlement and cemetery of the Lengyel culture. It is understandable that the settlement and the cemetery uncovered within authentic circumstances, and especially the latter one, offered an excellent opportunity for a deeper analysis and the application of modern methods. The work, which he has perfected for years, reflects the candidate's knowledge of statistics and seriation. This knowledge has created a new foundation in the analytical methods of excavation results, first of all of cemeteries and appears to be a pioneering work in Hungary. It should be emphasised that before him, nobody carried out the analysis of the burials of the Lengyel culture in Hungary in such details. The dissertation discusses only those find units that are considered the most authentic in archaeology, the burials, and he extended his investigations to all the burials uncovered in Southern Transdanubia from the same period. From these sites we can mention the Zengővárkony site as the best known cemetery, which contains the largest number of graves. He mentions as the basic principle of the monumental work, which he prepared with exemplary diligence and energy: "...from the respect of the history of science, burials represent the oldest and most important sources for the recognition of human history, although only a complex analysis including the results of settlement and environmental archaeological investigations can form a really true picture of the contemporary conditions." We wholly agree with this idea and hope that he extends his method

<sup>1</sup> The Hungarian proceeding in conferring the degree of Doctor of the Hungarian Academy of Sciences is different than the practices in most of the European countries. During the procedure three opponents – specialists of the given subject – explain in writing their opinion on the thesis, whereupon

the candidate has the opportunity to reply. Here, the opponents' remarks on István Zalai-Gaál's thesis defended in 2003, titled "*The history of the Late Neolithic in Southern Transdanubia. Typology – Chronology – Socialarchaeology*" and the candidate's answer, are published.



to the settlements that form a coherent unit with the burials and the cemeteries. His results were born from a new, multi-aspectual cemetery analysis method, which is based on attribute analysis, a method that makes the most complex use of statistics. The very complicated method is based on absolute data and their comparison with each other in the most diverse correlations and groupings. This method can bring two important results. It can help the determination of the relative chronology of the examined graves, grave groups and cemeteries (?) and to establish the hierarchy presumed in the analytical units, which, at the same time, can mirror the status of the buried persons within the community from the quantitative and qualitative interrelations of the grave finds. As the sizes of the examined units are highly different, it is uncertain to what degree the presumed position, especially within the cemetery, and the hierarchy suggested from the combination of the finds appears in the entirety of the settlements linked with these units.

Here I would like to mention two things. The Várna cemetery is unique (also from the respect of its geographical location) not only in Bulgaria but also in the whole of Europe. Its extreme richness and ritual specifics set it apart from every contemporary cemetery. It also represents a younger phase than the analysed Southern Transdanubian burials. A similar tendency to richness seems to have appeared perhaps only in the contemporary Tiszapolgár – Bodrogkeresztúr phase. At the same time, the complex publication of the cemetery is not yet known, which would be indispensable for an analysis. The very high level of hierarchy is really obvious in this cemetery, which, however, rooted in different geographical, economical and social conditions than the ones presumed in the Lengyel culture. A great difference is also reflected in the circumstance that at Várna the graves can be found in a huge cemetery unit, while the burials in the eastern territory of the Lengyel culture were uncovered in groups of diverse sizes both in the north and in the south. Perhaps the existence of hierarchy itself and its grades, which the multi-aspectual analyses of the author also demonstrated in the Lengyel culture, can provide a base for certain comparisons, although in the latter case they naturally appear on a very low level.

Another, less significant problem roots in the classification of burials. When can we speak of independent cemeteries or only of groups of graves and how can we evaluate the settlement burials? The population of the western (Central European) Linear Pottery culture already established large uniform cemeteries in its vast occupation zone, as it can be read in the dissertation. The candidate mentions that such cemeteries are not known or barely known in the territory of the later Lengyel culture. Nevertheless, the Nitra cemetery with 76 unearched graves does not really seem unique in the light of the 96 graves at Vedrovice in Moravia, the 24 graves of Rutzing in Austria, the more than 60 graves rescued from the coherent cemetery of Kleinhadersdorf and the rest of the smaller grave groups. Thus it seems highly probable that we can expect grave groups and cemeteries of the Linear Pottery culture in Transdanubia as well beside the already known settlement burials. The question is, which I myself cannot as yet answer, if all the grave groups that are differentiated within a larger unit can be treated as independent cemeteries or they are the constituents of a larger cemetery. We can certainly agree with the candidate in that the grave groups formed some kind of an independent unit within the larger structural units formed by the inhabitants of the settlements. Accordingly, their separate analysis seems reasonable and the name is not crucial.

Before the detailed analysis, the author shortly describes, together with the history of the research, the actual state of the relative chronology in the occupation zone and the ideas connected with this issue. Some elements of this sketch may be debated like, for example, the role of the early Lengyel expansion, from which the territory of Southern Transdanubia was left out even though the importance of this territory appears more and more emphatically in the evolution and further development of the Lengyel culture. I am also uncertain in the question of the extension of the role of white painting to the Sopot culture, since vessel painting is not evidenced in this culture in Croatia apart from the younger Brezovljani phase and the imported Lengyel wares. It is true, at the same time, that this is not only the phase of the disintegration into groups but also the period of a second major expansion, which can be detected first of all



in Karinthia and Slovenia. The only Croatian site is known from the Slovenian border zone. The Drava–Sava Interfluve does not belong to the border zone.

The subsequent large chapters contain the most thoroughly elaborated, most important part of the dissertation. Analyses that use the basic elements of the metric and quantitative data already appeared in István Gaál's early works. Formerly, typological evaluations, which reflected the personal subjective approach of the researcher, provided the base for archaeological research, and they often led to contradictory results. The exact, measurable and mathematically controllable data mirror the real situation and conditions, which can be learned from the various correlations of these data. The candidate carries out the necessary analyses from a great variety of approaches concerning the burial rite, the cemeteries themselves, the graves, the buried persons and their place in the grave, the finds put into the graves etc. He differentiated no less than 16 versions only of the body positions. The kinship links of the buried persons were determined with serologic analyses applied in the 70's and 80's. This time, however, he himself emphasises that DNA analyses must be used in archaeology to meet the modern demands.

The classification and analysis of grave furniture offering customs and the grave furniture itself like ceramics, tool and jewellery finds, and the establishment of the broadest correlations, combinations and multidirectional chains of the individual find types of finds are first discussed regarding the find materials. The candidate applies everything that the specialists of modern archaeology have developed, especially in Germany, in respect of this method based on natural sciences and mathematics, and sometimes he himself modifies and completes it to fit it to the Hungarian conditions. Perhaps he divides the type groups of the finds to be analysed into too many elements. It is questionable if it is always justified to suggest the hierarchy of the buried persons from the quantitative and qualitative differences of the individual combinations, especially in simple cases. This question also emerges when seemingly evident traces of certain divergences appear repeatedly within the "cemeteries", which may indicate the existence of a hierarchy. One of the (published) grave groups from Aszód offers an interesting example to prove this presumption. Here the richest grave no. 2 furnished with prestige goods is situated in the centre encircled by numerous children, a number of women and a few men. The grave group, which occupies a long stretch beside it, differs not only in its shape, but also in the fact that men with pairs of boar tusks and women with Spondylus beads alternate without a person placed in the centre. In the case of Aszód, the position (shape) of the two grave groups and their finds reflect two different types of community conditions within the same settlement. It should also be added that the Aszód cemetery and the similar northern burials have yielded much less grave furniture than the ones in Southern Transdanubia and they are more similar to the ones in Eastern Hungary. This means that a great diversity can be experienced in the burial rites and the grave furniture, just as the candidate described it, not only in larger units as the eastern group of the Lengyel culture but also in the Southern Transdanubian cemeteries. I find it doubtful that the number of vessels within a burial can be counted among the categories indicating hierarchy, since settlement finds imply that anybody could get vessels. In this case, the number of the vessels and their combination seem to have a secondary, complementary role. Their role in the burial rite is diverse in Southern Transdanubia as well, the candidate observed no less than 29 combinations of only the vessel types. From the grave furniture groups he differentiates persons of a special status, who were buried in the centre or at the edge of the grave group, sometimes in smaller clusters. Such meticulous and manifold analyses often point to details that the traditional analyses usually fail to notice. The evolution of the grave groups ("cemeteries") is an interesting problem just like the questions if the central burials were the first ones in these groups or the deceased had a predetermined place and if the burials of eminent statuses were at the edge of the group why was it so?

In the typological categorisation of the finds, ceramics are discussed at the greatest length. The author grouped the vessels into two classes, and differentiated each 3 vessel-types within these classes. The types are further divided into series and then in the next phase established morphological groups and versions. The examination of the hollow-footed



vessels is instructive from this respect. He divided the vessel type of the first class into four groups, and determined the typological units of the hollow-based vessels, that is the series and morphological groups, by certain attributes, the number of which is about 70. I feel, however, that although the distinguishing features manifested in these categories are recognisable, they are so minimal in the ultimate phase of the categorisation that they do not express the intention of the producers of the hollow-based vessels nor the divergences rooting in their function. A classification to such a depth seems superfluous since I think the necessary information can be reached already in the earlier phases of the analysis. The question is if the determination of the relative chronological order demands such a detailed classification.

The “Butmir type” vessels described among the 6 main vessel types need mentioning. The candidate’s opinion is that the tradition of the “bomb-shaped” vessels of the Linear Pottery culture survived in them. Nevertheless, not the bomb shape but a strongly segmented pot shape is characteristic of the earliest representatives of this specific type, which appeared in the Protolengyel horizon without an antecedent, and which became characteristic in the early Lengyel period. The candidate’s analysis made it clear how the shape of the vessel, which was probably prepared to fulfil the same function, changed in the younger phases and started to remind of the bomb-shaped vessels of the Linear Pottery period, the production of which ceased after the Protolengyel and the early Lengyel periods.

It is remarkable that with the applied method he convincingly demonstrated the modifications of the individual vessel types in time. The author dedicates a significant chapter to the attribute analysis of the Southern Transdanubian cemeteries, where he deals with the problem of group evolution and “order of rank” based on the combinations of the burial custom groups and the find groups. He set up 11 find ranges from the “richness”, the divergences deduced from the combinations of 85 find groups determined by the analysis of 285 graves. These find ranges help orientation in hierarchy and, comparing them with their distribution in the cemetery, a new social archaeological factor can be determined. The combination analysis of the shapes and ornaments of the vessels, the definition of the find horizons occupy again discussed at a length in this chapter, which contribute to the determination of the relative chronology. Accordingly, he separates 5 phases of the Southern Transdanubian cemeteries from the early to the late ones (early, early-transitional, transitional and transitional-late). We can agree with the results of the analyses, which reveal that the Southern Transdanubian cemeteries were first opened in the earliest Lengyel phase, which matches the early phase (1a1–2) represented by the Lower Austrian Fribritz and Wilhelmsdorf sites. The combination analysis also pointed out that the transitional phase was the organic continuation of the early phase, although already significant changes appeared (1b). The changes were so significant in the transitional-late phase that the author found the definition of a new phase justified (2a). The candidate found it partly contemporary to Pečenad. He regarded the latest horizon of the cemeteries (2b) to have been the fulfilment of the preceding late phase. He identified it with the “copper horizon” and found it contemporary to the Moravány phase. According to him, this period survived until the traditionally determined phase III. This phase is, however, still missing in Southern Transdanubia. István Gaál’s relative chronology, as opposed to the earlier approximate determinations, is based on the above described analyses, which reach deeper than ever before, and this can be accepted as a basis for the analysis of similar burials and even the settlement features of other territories as well (e.g. Aszód).

The last but one chapter deals with the relationship between the Lengyel culture and the neighbouring cultures, which means the Vinča, the Sopot, the Tisza and the Herpály cultures. He discusses this question with the traditional method and gives a short recapitulation of the results of the last decade. He focuses first of all on the problems of relative chronology, and his conclusions, apart from the dubious suggestion concerning a few less important details, match the results he reached in the previous chapters of his dissertation. The importance of absolute chronology seems to have evaded his attention in this energy-intensive working process. Data of this type are only mentioned in a few short notes and even there the conventional and the calibrated data are mixed (because of this e.g. Aszód and Svodin would be hundreds of years



younger than Zalaszentbalázs of the latest phase, and the same is repeated in the case of the Sopot culture as well). Since this aspect is not among the aims of the dissertation, I accept them as minor inaccuracies. I judge his remark concerning the Sopot culture the same way, which doubts that the Sopot culture could be the antecedent of the Lengyel culture since it was parallel to it south of the Drava. This is true just like the fact that it started much earlier and expanded to Transdanubia in a certain early period. Naturally it is not known why the Lengyel culture evolved only north of the Drava. Perhaps the fact that one of the antecedents of the Lengyel culture was the Central European Linear Pottery culture, the southern border of the occupation zone of which was the Drava may have played some role in it. Only a specific local variant of the Linear Pottery culture the Malo Korenovo evolved in Croatia. Its characteristic finds appeared north of the Mura together with the younger so-called Brezovljani phase of the Sopot culture. Its problem, together with ceramic painting, will perhaps be solved by the results of recent excavations conducted on large surfaces, where the transition of the two cultures is clearly reflected.

The author discusses the problems of the Tisza culture in details. He describes most of the published or mentioned burials but does not go beyond the earlier published data (Banner, Bognár-Kutzián, Korek etc.). From the respect of the contacts between the Lengyel and the Tisza cultures, he owes a larger significance to two sites beside Aszód. One is Bicske, the finds of which, affiliated to the Tisza culture, cannot sufficiently be estimated from an inner chronological aspect because of their fragmented condition and common ornamental motives. The other site is Mórág, where the candidate collected and published the earlier unknown fragments that represent the Tisza culture, which had been found in the settlement partly as stray finds. Regrettably, we do not know in what a ceramic context they lay. A few fragments were found above graves dated from phase 1b. It is suggestive that the best analogues are known from Gorzsa, according to which the candidate propounds that, the Lengyel 1b–2a, that is the copper horizon, and the oldest D–C phases of Gorzsa were contemporary. It means that this is the proof of an E–W contact system in the north, manifested through Aszód and in the south in the region of Mórág, which can get sufficient emphasis in a historical evaluation in the future.

The extremely detailed analyses and their correlations, which are built on each other in a logical order and which complete each other, provide a safer and more detailed base to the determination of the relative chronology, which is an essential condition in the description of historical processes. The significant novelty is, among others, that the mistakes of the former typological analyses, which came from the subjective visual judgement of the researchers and thus led nearly each scientist to diverse conclusions, are eliminated and this hopefully exact method places the analyses on a realistic foundation. This offers the opportunity to the candidate to make a detailed chronological differentiation and draw conclusions that are different from the traditional ones or modify our ideas about the subsequence of historical processes. I think that the candidate's method can generally be applied on other geographical territories and at the finds of other periods as well.

A part of the last chapter contains the recapitulation of the substantial conclusions of the dissertation. In the other part, the candidate tries to give a sketch of the social archaeological conditions of the population of Southern Transdanubia. István Gaál examines the contacts that can be demonstrated with the cemeteries of the Lengyel culture unearthed in other territories from the above aspects and dedicates long pages to the analysis of the community conditions of the Southern Transdanubian Late Neolithic population from the family the smallest unit to larger organisational units. Especially the explicit stratification of the cemetery of Varna in Bulgaria provides analogues for him to prove the existence of an initial social hierarchy from the simpler find circumstances of the Lengyel culture.

I cited only a few examples from the rich content of the dissertation, which demanded much energy to accomplish. The greatest merit of the work is the new method based on mathematics-statistics-seriation, which will hopefully help to reach the accuracy we missed until now and to provide a safe base for the new results deduced with the help of a



comprehensive analysis. These results are partly different from the earlier ones, partly modify or shade them. We can definitely rely on these conclusions and use his method and results in our works of a similar character. We emphasise that István Gaál has already published details of the problems discussed in the dissertation in a number of progress reports. The latest one was the elaboration of the Mórágý cemetery on the same basis, which appeared in the form of a book just a few days ago. The work is supported by about 1000 items in the reference list, and I would especially like to call attention to the exemplary construction of the rich illustration, which gives a stress to the theme. Even if we do not estimate the significant and important work István Gaál accomplished until this dissertation, which is amply illustrated in the reference list, the objectives of the dissertation and the new and convincing results obtained with the consequent application of a new method are enough to match the demands of the academic doctoral degree and render the dissertation in itself suitable to be submitted to discussion, which I propose to the Committee.

### *Tibor Kemenczei*

The thesis contains partly more and partly less than the title suggests. To begin with the latter one, the data obtained exclusively from the cemetery analyses cannot alone reflect the history of the Late Neolithic in Southern Transdanubia since the concept of “history” covers more than the fragmentary picture of a community, which the thesis sketched. We can add that the morphological assortment of the handicraft products of the characteristic Late Neolithic culture of Southern Transdanubia, the chronological position of the individual phases, the connections of the culture and its settlement structure are all discussed in the study. These special topics, however, could not yet be integrated into a unified history at the present state of research.

The description of the social structures of the Southern Transdanubian Lengyel culture and their changes from the analysis of the cemetery finds, which was the ultimate aim of the thesis, was evidently successfully accomplished. The base is provided by not really many graves: 658 burials in 628 graves at 12 sites. Most of them were uncovered at three sites, Zengővárkony, Lengyel-sánc and Mórágý. Only the last site was unearthed with modern methods where the author recorded all the details of the excavation. The thesis very meticulously analyses the relatively small source material, regarding both the phenomena that evidence the burial customs and the objects that were placed in the graves. His methods meet the requirements of our days. He used computer programs to affiliate the individual data of the discussed source material into attribute groups, which afforded chronological differentiation between the individual parts of the cemetery. This provided a base to the demonstration of the social structures reflected in the burial customs of the community that used the cemetery.

The literary citations at the start of the work intend to prove that onetime social conditions, ethnicity and ideology can be deduced from the analysis of burials. The burial rite, the features and numbers of the objects in the graves can really offer clues to the social status of the dead, but it is never more than a dim reflection of the reality. The same is implied in the thesis when the author declares that the data of the settlement and environment archaeological investigations need to be integrated to be able to draw a more complex social picture. It can also be pointed out that in certain periods and cultures the social status of the dead was marked in a way that was not manifested in the objects that were preserved to our days. Anyhow, the Lengyel culture is not one of them. The grave finds of this culture offered a really favourable condition to the application of any form of cemetery analyses.

We have to be careful with the cited opinions of researchers who think that prehistoric grave furniture marked ethnicity and who identify prehistoric cultures with ethnic groups. The thesis seems to agree with these researches, at least this is what the following sentence suggests: “Ethnic groups that consider themselves as members of the same ethnicity can be found behind different archaeological cultures and this can be supposed in the case of the cultures of the Lengyel complex.” The series of doubts starts with the question if prehistoric communities had ethnic consciousness and what the concept of ethnicity was in the prehistory. To carry on the train of thought, the next question that emerges is what elements of the preserved material and



spiritual cultures characterise only a specific ethnicity. The thesis mentioned the specific traits of the ceramics as such an element. Some researchers really consider it an important criterion in the separation of cultures, cultural groups yet we can cite a number of examples when the potters modified the shapes and the ornamental motives of their products in a period when there was certainly no population exchange in the territory. Prehistoric burial rites do not offer unanimous proofs on ethnicity either. It is enough to remind of the fact that a population of a specific culture can practise diverse burial rites or modify them in the course of time. Thus it could have been another subject what reasons stood behind the application of diverse burial rites within a cultural entity, like the practice of cremation in the Lengyel culture. The number of the studies that discuss this problem could fill a library, and the thesis did not produce new arguments in this respect. We could not learn what kind of a unit the communities of the Lengyel culture formed in Southern Transdanubia, in what features their material and spiritual culture differed from those of other units of the Lengyel entity and what the reasons of these divergences were. So the discussions on the general problems of archaeological culture, ethnicity and burial rites cannot be ranked among the accomplishments of the thesis.

The thesis chose the Copper Age cemetery of Varna to illustrate the social differences that existed in the communities that used the Late Neolithic cemeteries of Southern Transdanubia. Nevertheless, the similar and different social conditions evolved independent of each other at the communities living in distant regions depending on the local economic, cultural and natural conditions. Thus the social classification in the Southern Transdanubian communities of the Lengyel culture evolved without the influence of the Varna population. The Varna example based on the really bulky technical literature published in this topic cannot replace the missing description of the natural and economic conditions and communication system in consequence of which the Lengyel culture evolved, flourished and its social differentiation developed.

The thesis analyses and compares all the details and specifics of the burial rites to learn more about the social and economic conditions of the Lengyel culture. Regarding the description of the rites of prehistoric population groups composed from the archaeological literature we have to point out, however, that the survived relics of the burial cult of prehistoric populations are not always suitable to draw conclusions concerning the social differentiation. From the comparison, for example, of the number of Bronze Age graves that contained weapons or implements of tool production with the ones without such objects we could conclude that the populations, which had an evidently more differentiated society, had less pronounced leader and handicraft layers.

The description of the history of the research of the Lengyel entity from the western part of the Carpathian Basin to Moravia, which was composed from the archaeological literature, defines the chronological and geographical place of the remains of the Southern Transdanubian late Neolithic, and profitably contributes to the accomplishment of the objectives of the thesis.

Beside the general description of the burial rites, the customs, the grave shafts, the sepulchral structures and the depths of the graves, the work discusses in details all the similar phenomena observed in the cemeteries of the Lengyel culture. The analysis of the objects placed in the graves and the classification of their characteristic features proved to be a method that provided a firm base for the observation of the chronological differences between the individual grave groups and changes in the grave furniture.

In the cemeteries of the Lengyel culture, the type and the number of the objects placed in the graves matched the social status of the buried persons. The elements of the grave furniture compose a separate group, objects that bear symbolic meaning like ceramics, anthropomorphic or zoomorphic clay idols, food offerings, dog skeletons, pig jaws, querns. The second group is constituted of the objects used or worn in life, like stone tools, bone and antler tools, copper jewellery, marine bivalve shell beads, tusk lamella pendants. The number of the different types in the individual burials, and their composition led to the differentiation of grave furniture groups. The proportionate difference of these objects reflects the higher or lower status of the individual within the community. The final results of the analysis, however, are similar



to those deduced from the cemetery finds and burial rites of other prehistoric communities that were not analysed with this method, namely that the individuals buried with more or unique grave furniture occupied an eminent role in the community and certain elements of the grave furniture could have symbolic meanings. One of the problems that can be raised here is the spiritual background hiding behind the position of querns in the graves. Other prehistoric communities also practised this custom, like e.g. the population that lived in the Great Hungarian Plain in the Early Iron Age. Even if we accept János Makkay's interpretation that the querns were offerings, we have to ask to what layer of the community the people whose grave contained querns belonged in the cultivating and animal breeding populations that lived in the mountains and in the plain. Another question that demands an answer is what exactly the "privileged position" of an individual buried with idols and specific burial vessels of the fertility rite meant within the community. It is certainly not sufficient to say that this status could be connected with the contemporary beliefs and cult. Although a few sentences refer to the supposed spiritual background of the idols, a complex religious historical analysis all over Europe would reveal more about the ideology of the Late Neolithic communities.

According to the data of the thesis, 6.5% of the graves had special grave furniture. This datum, however, refers to the entire duration of the cemetery and it cannot be told how the ratio changed in the individual phases of the Lengyel culture. Without this the changes of the society cannot be followed, if ever it changed. Thus the only thing we can learn from the analysis of the grave furniture groups is that there were rich and poor people and individuals of special, undetermined statuses in the communities that used the cemeteries.

The finds were classified according to typology, one of the basic methods of archaeology, where the analysis of the ceramic material stood in the focus. This naturally comes from the source material in which clay vessels are represented with the largest number and variety. After the general description of the vessel types and production technology from the literature, which does not contain any novelty, we can find a detailed description of the types of funeral ceramics separated by the profiles, that is morphologically. The thesis further separated them into 4–3 genres within the two classes that were metrically determined in a hierarchical poligenetic system borrowed from biology and then morphological groups and versions were differentiated within these genres. It means the author succeeded in grouping the not really many vessel kinds (hollow-based vessels, glasses, cups, jugs, vessels of inverted mouths, mugs) found in the graves of the Lengyel culture into seven types. In the followings, the typological attributes helped the determination of the clay vessels and the ornamental motives prepared during the individual periods of the Lengyel culture.

The description of the function of the other significant group of objects found in the graves, which contains polished stone axes, maces, adzes, chisels and flaked stone tools, and their comparison with other objects convincingly support the theory that these objects also reflect the social status of the buried individuals. It can be added in this respect that stone maces preserved this function until the Early Iron Age, while the polished trapezoid stone chisels can be found in graves even in the Late Bronze Age and the Hallstatt period. Thus we think that more data is needed to prove the conclusion that the stone weapons and tools placed in the graves evidence social division of labour.

The attribute analysis of the cemeteries of the Lengyel culture demanded a really substantial evaluation work. The differentiation of the burial custom groups including diverse object types, the find groups of tools, jewellery and articles of wear and their combination tables led to the demonstration of grave groups in the individual cemeteries and the establishment of the proportion of graves furnished with a richer grave furniture than the rest, from which we can draw conclusions concerning the social differentiation in the community that used the cemetery.

The definition of the periods of the cemeteries of the Lengyel culture and the object types that characterise these periods is a significant conclusion of the thesis. The combined occurrence of certain vessel types and the distribution of the ceramic groups determined with this method in the map of the cemetery convincingly support these results. The changes that



led to the differentiation of a new period in the evolution of the Lengyel culture appeared in the morphological variety of the ceramics of the early phase in the transitional–early phase. Nevertheless, the question in what other constituents of the culture this so-called development manifested itself beside the changes demonstrated in ceramics has not been answered.

Research usually divides prehistoric cultures into early, classical and late phases. The morphological and motive assortments of the objects produced by the handicrafts, among them the potters, changed during these phases. Nevertheless, the individual object types were usually longer used than the phases of the cultures, so it is impossible to affiliate the handicraft products, including potteries, into sharply distinguished horizons characterised with drastically new morphological and motive assortments. The thesis differentiated the various periods by the profiles of the vessels, that are by the combinations of the shapes, determining the clay vessels characteristic of these periods in percentage ratios. The description of the vessel shapes and their versions could be even more suggestive if they were illustrated in type tables. Owing to the analysis of the ceramics, which needed a really serious analytical work, the periods of the individual cemeteries could be determined.

The separation of periods in the Lengyel culture is supported by data cited from other territories and cultures. The summary based on the archaeological literature illustrates a similar picture regarding the burials of the Late Neolithic cultures around Southern Transdanubia (Vinča, Sopot, Lužianky) as the one drawn from the analysis of the grave finds of the Lengyel culture. The proportions of the graves with rich and poor grave furniture are nearly identical. The discussion of the finds showing links with the late Neolithic cultures of the Great Hungarian Plain (Tisza, Herpály, Csőszhalom cultures) covers first of all the definition of the chronologically corresponding periods.

More space could have been dedicated to the discussion of the economic, technical historical, geographical and perhaps ethnic components that resulted in the evolution of the corresponding features of the social conditions, the burial customs, the cult and the handicrafts in the mentioned cultures. The character of the direct contacts, which are more than simply analogous phenomena rooting in the similar economic and social conditions, and their possible influence on the development of the culture could also have deserved more attention. We are sufficiently informed about the finds of the Tisza culture from Mórág, which enabled the verification of the synchronicity with the younger phases of the Lengyel culture. The results are not significantly different from the chronological comparison of the different periods of the Lengyel culture from Southern Germany to the Tisza region published by Juraj Pavúk in 2000.

The sketch of the contacts of the Lengyel culture is in fact a recapitulation of research history. In consequence of the actual state of research and the scarcity of data owing to the lack of source material, the part on the Late Neolithic cultures of the neighbouring territories do not contain significant new elements. It is also true, however, that this aspect is not among the objectives of the thesis.

The summary of the conclusions drawn from the analysis of the source material offered an occasion to sketch the social archaeological conditions of the Neolithic population although social archaeology is a field of research in the present and not a condition in the past. In the description of the social conditions results reach by other scientists dominate like explanations on the kinship relationships, lineage's, endogamy and exogamy, the role of biological ages and organisation, which were borrowed from the literature. One of the conclusions in this topic is the supposition that matrilineal lineage and marriage dominated in the communities of the Lengyel culture. The ultimate conclusion is, however, which we can perfectly accept, that no prehistoric analysis can reveal the prehistoric kinship ties.

The general statements on the tribes and clans did not get us closer to the recognition of the organisation of the communities of the Lengyel culture. The graves of men buried with especially rich grave furniture do not indicate more than the initial phase of social differentiation. The supposition that the tools really reflect the job the deceased did in life, that



is that the tools reflect the division of labour within the community, is another question that needs further examination.

According to the results of the cemetery analyses, the society of the Lengyel culture was hierarchical and not only persons but also families could have a higher status. The evolution of the social differentiation was the result of the development of technology, the new methods of cultivation and the growing importance of commerce. Besides, the impact from the Tisza and the Vinča cultures could encourage the changes.

The data of the cemetery analyses convincingly proved the cited conclusions concerning the social structure. The archaeological literature has already revealed the character of the general changes that happened in the Late Neolithic. So the detailed description of the specific local factors that dominated in Southern Transdanubia and the deep analysis of the way the contacts with the Hungarian Plain and the influences arriving from the Balkans became manifest would certainly have been justified.

In contrast to the analysis of the social structure, the evaluation of the morphological and motive assortments characteristic of the handicraft products of the Lengyel culture in Southern Transdanubia has enriched the research with new information. Owing to the detailed analysis, we can follow the process of the modifications of certain object types in the subsequent phases of the culture. The comparison with the various periods of the Late Neolithic cultures around the discussed territory resulted a reliable chronology. The deep analysis of the causes of the evolution and the cessation of the discussed culture and the effects that influenced these processes could be the central topic of a historical study. The many citations, which were not linked with the topic, were not organic constituents of the work just like the descriptions of old research results, the explanations of the concepts and the numerous foreign terms.

The thesis excels in the Hungarian prehistoric research especially with the computerised analysis of the ceramic finds and the burial rites. The meticulousness of the analysis, the fact that it includes all the significant and less significant details demanded an enormous effort. Yet it did not bring results that would surpass the level of an evaluation reached with the traditional comparative method. Nor could we learn the actual history of the Southern Transdanubian communities of the Lengyel culture from the data of the detailed analyses, or their complex social history. It is true that the source material we have at present does not afford it as yet. Nevertheless, the huge database that supports the detailed results could only be obtained with a computer. Thus the applied methods indicated a way for research that can lead more laboriously but safer to the ultimate goal.

István Gaál's work meets the demands set to an academic doctorate thesis both in its form and its content, thus I definitely propose it to be subjected to an open discussion. As the method of the analysis of the source material is modern and it certainly corresponds to the goal of the work, the social historical results are supported by objective data obtained from the analyses, I propose that the Committee grant the degree to the candidate.

### *Pál Raczky*

The opponent, whose task was to evaluate the archaeological activity of the candidate, is in an easy situation since he is personally acquainted with István Gaál's academic career. He is a person of whom one can say that his work has developed in systematically developed scholarly arc, in which the next logical step would be the title of Doctor of the Hungarian Academy of Sciences.

The rigorous treatment of the factual information, in a positive sense, of his working practice was fully developed during the time he spent at the University of Saarbrücken within the framework of a Humboldt grant as well as under the influence of Jan Lichardus, his professor, who played a major role in shaping the candidate's career. István Gaál actually started his long-term archaeological analyses and the foundation of the method applied during this period. He became interested in the complex problem of cemetery analyses at the end of the 1980's. His own archaeological investigations in Southern Transdanubia offered, among other things, a first rate material basis, especially the Late Neolithic burial units uncovered at Mórágý-Tűzkődomb. In the 1980's, he succeeded in widening his investigations based



on quantitative analyses with his studies of correlations between a number of unearthed cemeteries of the European Neolithic. His treatment of the topic was deeply permeated by the "Saarbrücken school" and the statistical method that Jan Lichardus used in his cemetery analyses of the Rössen culture. The candidate's dissertation entitled "Social Archaeological Analyses of the Central-European Neolithic cemeteries" crowned this work and it appeared in the form of a book in 1988. All these studies focused on the complex general archaeological-historical problem of describing the relationships between the settlements and cemeteries, the possibilities for which differ from period to period.

István Gaál's academic doctoral dissertation carries on the examination of the same methodological problem, on the mind of nearly all Neolithic archaeologists, with respect to the relationships between the settlements and the graves of the Lengyel culture in Southern Transdanubia. At the same time, this new "case study" offers a basic source for better understanding the Late Neolithic history of this major geographical unit and so the choice of the subject can certainly be approved. Prehistoric studies need, from time to time, syntheses that also try to integrate the ever growing quantity of new data into a qualitatively up-to-date model. This process naturally generates new questions and inspires new approaches in archaeological research.

István Gaál's review involved the analysis of archaeological features related to 658 persons buried in 628 graves in 12 sites in Southern Transdanubia. We are faced with the initial axiom, which raises certain doubts, in his description of the theoretical background to the study right at the beginning. The candidate writes "...both the small and large grave groups and the individual graves found in a number of places are discussed as separate cemeteries based on methodological considerations. Thus, we have counted 35 cemeteries in the analyses." This is how 21 cemeteries are described at the Zengővárkony settlement and 3 cemeteries at Mórág. This "a priori" methodological statement would require a more detailed explanation. The statement is all the more astonishing since there is only a single grave in the so-called cemetery no. 7 at Zengővárkony (pp. 61–62). Thus, whether we respect Ch. Peschel's or O. Höckmann's cited criteria on the number of the graves required to define a cemetery (12 or 10 graves, p. 60), the independent existence of cemeteries no. 7 as well as of cemetery no. 8 at Zengővárkony, which have only 1 and 2 graves apiece, is very questionable. All these questions naturally raise further cognitive-philosophical problems. Namely, if the accepted rate of an archaeological examination approaches the groups of graves pre-determined within a system of such tiny "elementary units", how can the coherence of the macro structures, units of larger numbers of graves representing a higher level of integration be determined? To make this dilemma more apparent let us take an example: The Aszód site of the Lengyel culture is well known from preliminary reports. Here, 3 large groups of graves can be distinguished, all definitely separated in space (Kalicz 1985, 30–33). Our question is whether this would represent 3 groups of graves from a single cemetery, as Nándor Kalicz, the excavator of the site himself interpreted them, or three independent cemeteries?

In our view, an archaeological analysis should proceed in the reverse direction. It would be more appropriate to start from a given random set of burials and let the inner quantitative analysis of this set lead to a stage where certain subsets (groups of graves) can be identified and determined within the set followed by the archaeological explanation comprised of the definition and an explanation of the chronological and spatial correlation of the graves. Only then can we speak of independent graves, grave groups, cemeteries, perhaps a regional system of cemeteries and the relationship of these units with diverse levels of the settlement units. In this approach, a "cemetery" is not a predetermined fact but a structure representing a certain hierarchical level, which appears as the result of a comparative analysis. This discussion strategy should follow the accepted method for the analyses of various settlement phenomena and units of increasing scales, since in itself the clarification of the correlations between the settlements and the cemeteries seems to demand this logical process.

In connection with any discussion of the aforementioned broader, systems theory approach, another similarly important problem should be raised, apparently neglected by István Gaál in his dissertation. We refer to the very important basic factual data used in the



general demographic and representative sampling methods. These contribute to the essential foundations of a social reconstruction. It is not an accident that this subject has also been discussed by N. Nieszery in his reconstruction of the actual population size in the synthesis of burials of the Bavarian Linear Pottery culture (*Nieszery 1995*, 13–18). The question is, how the 658 dead individuals discussed by István Gaál can be compared with the total population of contemporary settlements of the Lengyel culture in Southern Transdanubia, and what proportion of the prehistoric population they represent. The representative value of the 658 burials also needs to be determined. Nieszery, for example, arrived at the conclusion, which has larger regional implications, that the cemeteries of the Central European Linear Pottery culture represent the remains of only 20% of the population. His final question paints a rather pessimistic picture: “Was also ist mit knapp 80% der verstorbenen Bandkeramiker geschehen?” The situation is perhaps even worse owing to the fact that the dead found in the cemeteries were not chosen by random sampling which might have been more representative of proportions within the original population in a given smaller sample. Accordingly, the statistical analysis of cemeteries cannot provide an authentic picture of the entire Neolithic population. As P. van de Velde wrote in his study on the burial rites of the Linear Pottery culture: “And here lies a problem, for I do not believe that the selection of the people to be buried in the Bandkeramik cemetery was random in any statistical sense. When sociological, ethnographical or demographic research questions are to be answered from a graveyard, it should first be established that the relevant funerals have occurred randomly, as regards precisely these dimensions” (*Van de Velde 1997*, 85–86). Thus, we are left with a feeling that something is missing with regard to the estimated entire population of the Lengyel culture in Southern Transdanubia, the chosen scene for the analysis. Nor can we tell to what degree the relevance of the statistical data from these 628 graves can be extended to a larger territory.

It should also be discussed in greater detail the chronological interval the graves used in this analysis represent in an absolute sense, since chapter 2 on the chronological problems attempts only a relative chronological sequence. Perhaps the  $^{14}\text{C}$  data cited in connection with Lower Austria on page 53 can be accepted as a directive regarding the Lengyel culture (4900–4300 BC). This identifies the complex chronological span of the phases of the culture, characterized by painted ceramics, as lasting 600 years. It seems likely that the Lengyel graves studied in Southern Transdanubia fall approximately within these boundaries.

János Makkay made estimations of this type in relation to the Tisza culture on the Great Hungarian Plain in 1982, regarding the calculated number of the population based on the sizes of the settlements and the houses and the capacity of the arable lands (*Makkay 1982*, 124–163). Lately, Nándor Kalicz has summed up the settlement data of the Late Neolithic in Hungary and their connection with the size of pertinent populations (*Kalicz 2001*). Among other things, he estimated a population of 45 000–50 000 individuals and a population density of 0.5 persons/km<sup>2</sup> in any given period of the Late Neolithic for the Lengyel–Tisza–Herpály–Csőszhalom culture complex. These data constitute basic values that allow evaluating the number of unearthed graves in a settlement in a relative sense as well. An absolute factual example is offered by Zengővárkony, where in the case of the estimated total number of graves from the entire duration of the cemetery (cemeteries in István Gaál’s opinion; about 400 years) containing 4000–6000 objects (*Kalicz 2001*, 160), the unearthed 658 burials would have represented from 6 to 9% of the population. Given a population estimate of 20 000–25 000 individuals in a generation as proposed for the Lengyel culture based on the settlement historical data, a population of 6000–8000 individuals can be supposed in Southern Transdanubia. Extrapolating this value to 24 generations in 600 years, we get a complex population number of 144 000–192 000 individuals. Examining the 658 burials discussed in the dissertation from this point of view, we get a representative value of 0.4–0.3%, which does not do credit to the relevance of statistical analyses.

To continue in this line of thinking, we should call attention to another important point. The social, demographic and other specifics of the Lengyel culture in Southern Transdanubia and, in general in the eastern region, derived from grave analyses cannot automatically be



applied to the western regions of Transdanubia. There is hardly any information on burials from this region, or more exactly, none of the known cemeteries are linked with settlements, meaning that a basically different set of regulations determined the burials as a whole. Thus, we cannot set up "universal laws" even within the Lengyel complex regarding the cult of the dead.

Starting from the same methodological concept, we can question another conceptual unit of the dissertation, which deals with the early Copper Age cemeteries of north-eastern Bulgaria (pp. 18–22). What connection in reality can this "case study" have with regard to the given region of the late Lengyel culture apart from the fact that both are burials? The majority of the cited cemeteries, especially the Varna cemetery, are chronologically linked with the early Copper age of the Carpathian Basin. Colin Renfrew already suggested in 1978, that the Varna cemetery contained the burials of the elite stratum from a number of communities over a large region. This can explain the unusually high number of extremely rich graves. So it cannot be accepted as a typical demographic and social representant for a single settlement. It also means that the Varna cemetery was exceptional not only in Bulgaria but in the entire territory of south-eastern Europe and any comparison with this cemetery needs a contextual explanation. István Gaál is at fault for not providing an explanation of this archaeological correlation, although it is clear that he suspects the existence of similar social stratification processes in north-eastern Bulgaria and in Transdanubia in the 5th millennium BC. All these problems result, however, in a mechanical conflation of an available research result and a working hypothesis before the analysis of the Lengyel graves at the beginning of the dissertation. It is true that the author shortly returns to the problem of the social conditions of the Varna cemetery in the final summary of his work, and tries to underpin justification of this conflation by finding a correspondence within the find associations of the examined Lengyel cemeteries (pp. 485–487). We think that the combined discussion of all aspects of such a distant cultural review should have been better grounded in this final evaluative part. In addition, the remarks cited from Jan Lichardus in note 135 and the ones regarding A. Häusler are relevant as well to this thematic unit, that is, the north-eastern Bulgarian Copper Age cemeteries.

A substantial part of István Gaál's dissertation is grounded in the theory that the personal jewellery and articles of wear and use by the buried persons can be differentiated from the objects, the grave furniture, that the members of the community placed in the graves. From this starting point, he reviews the graves of the Lengyel culture in Southern Transdanubia in thematic units of three basic find categories. As every specialist must know all too well, the attribution of such finds into these categories can sometimes prove very difficult although such a simplification of the situation seems necessary from the viewpoint of an analysis. Further targets of the analyses are the grave as a unit in and of itself (grave constructions and the shafts) and the specifics of the positioning of the dead (e.g. the orientation, the position, the body posture). As a summary of the aforementioned criteria, the thesis defines 16 bodily posture groups, 14 groups of grave furniture offerings, 19 groups of tool offerings and finally 14 types of jewellery wearing customs. These variables can be interpreted with respect to the burials as the co-ordinates of a multivariate function. Comparison of the graves, therefore, actually requires a multidimensional functional comparison.

István Gaál uses statistical methods to analyse all the elements in the previously described variables, which he calls "groups of burial customs". In essence, the preparation of the combined tables of the grave furniture, the tools and the articles of wear constitute the basis of the cemetery analysis. In this work, only those graves could be included that contained more than one find type and only when the same combination of finds occurred more than once. Altogether 101 custom groups are identified and statistically analysed, including the evaluation of their correlations. Table 5/1 sums up the distribution of the 8 find group categories according to the occurrence of the categorised objects of the graves in cemeteries in Southern Transdanubia. By analyzing the custom groups of grave furniture, offerings, tools and jewellery wearing, István Gaál is able to group the burials in 13 combination units, which, according to him, each defined a group in the prehistoric society in question. The



seriation analysis of the grave furniture, the tool and jewellery finds by graves resulted in 85 “find group combinations”, of which the limits of 11 “find ranges” are outlined by the demonstrated similarities. In the next step, the analysis of the position of these find ranges within the individual cemeteries is described. This is best illustrated in the distribution shown in table 5/2. The Mórág-B1 cemetery is especially interesting, since here the relationships between kinship groups from I to XII determined and 8 find group ranges could be examined by seriation analyses. The outcome seems to be somewhat negative, since the biologically determined groups cannot be unambiguously identified with certain of the find range groups. At the same time, larger find group ranges match the horizontally clearly differentiated grave groups in the cemetery. To us, this suggests that, in the case of the Mórág B1 cemetery different associations of objects were used within the kinship groups of the coeval population to express social differences. If this can be established in the case of a single cemetery, it is even more true for the more dispersed cemetery system in a broader geographical region.

An immense practical work and the computerised treatment of a huge mass of data lies behind the logical train of thought and hierarchical analytical method of the dissertation. At the same time, the so-called attribute analysis, the system of burial custom groups, find groups, find group combinations and find ranges provide frameworks for a systematically worked-out method.

The bulk of the archaeological “small work”, which demands a lot of energy, is best illustrated by the chapters on ceramics. It is a pity that the analysis of this thematic entity is divided into two distant chapters (“Classification of the grave finds – Ceramics” pp. 207–280, and “Combination analysis of the ceramics” pp. 348–414). Nevertheless, it is obvious that from the point of view of Late Neolithic cemetery analyses, vessels contain the most information about relative chronology despite the fact that even they follow the dynamics of the contemporary social processes with a considerable delay. The deep analysis of the ceramic shapes and the groups of ornamental motives and their interrelations revealed chronologically meaningful correlations (Table 5/11). Table 5/12 offers an impressive representation of the results of seriation analyses carried out on 64 vessel types from 94 burials with the introduction of the most probable relative chronological series. The typo-chronological evolution of the vessel types outlines those ceramic groups, that represent theoretical development phases within the complex unit of the cemeteries of the Lengyel culture in Southern Transdanubia. Thus, with regard to the vessel combinations that characterize relative chronology, the probable sequence of cemeteries in Southern Transdanubia could also be set up (Table 5/14).

Following this step, it seemed logical to match the theoretically implied “ceramic horizons” with the general chronological system developed for the whole of the Lengyel culture (5/15). We feel that in this chronological table, which integrates the development in the territories of Slovakia, Austria as well as Hungary, the phase system of the former also includes settlement historical data, while István Gaál’s chronological system is based on the results of cemetery analyses in Southern Transdanubia. It should be sufficient to mention that only the vessels that occur in the graves more than once can be used for chronological analyses, while the settlement materials contain a much more modest “vessel type range”. This way, certain immanent asymmetries are integrated into this morphological i. e. typo-chronological comparison although it clearly reflects a particular working hypothesis. An ideal working program for the future would be one that could identify the find correlations of the settlements that belong to the Southern Transdanubian cemeteries of the Lengyel culture and especially ones that could determine their ceramic horizons and how they can be compared to the chronology of cemeteries. To date, accordingly, the analysis of cemetery finds, a local group of sources, provides the basis for the scheme set up to describe the development of the Lengyel culture. It certainly seems provocative to further remark that even so an evolutionary model would be reliable only in Southern Transdanubia, and could not be extended to the whole of Hungary. Finding a solution to this complex problem is definitely not István Gaál’s sole task, yet perhaps it outlines the dimensions of the overall program that Hungarian prehistoric research must develop.



Chapter 6 paints a meticulous and very convincing picture of the surrounding cultures linked with the Lengyel culture and their general relative chronology. I mention here, as a small detail, that I miss a more emphatic use of S. Dimitrijević's system concerning the chronology of the Vinča culture, since he differentiated phases D1-D2-D3 and he dealt with this problem in a much more detailed manner than B. Bruckner. We would find it equally important to integrate W. Schier's recent publications, since he was the last author who reviewed all the former detailed debates on Vinča chronology and who set up the most comprehensive relative chronological table. He deserves more than a footnote (p. 419, note 11).

The relative chronology of the Late Neolithic of the Hungarian Plain clearly shows the main points of debate, especially the role of the correlation between finds from Bicske and Öszöd in the comparison between Eastern and Western Hungary. The chronological evaluation of the Tisza-Herpály-Csőszhalom complex in relation to the Neolithic cultures of Transylvania and the Banat region, especially the Vinča culture, would perhaps be perfect if Gh. Lazarovici's and even more importantly F. Drasoveanu's arguments would be presented since these contradict ideas shared by Hungarian archaeologists. The essence of those theories is that the beginning of the Late Neolithic in the Carpathian Basin can only be linked with the Vinča C period, so a correspondence with the B2 phase, as has been suggested, is out of the question.

The chapter entitled "The social archaeological conditions of the Southern Transdanubian Late Neolithic population" was intended to sum up the conclusions drawn from the immense analytical work carried out by István Gaál. In effect, we feel this thematic unit to be fairly modest after the impressive extent of previous analyses. Only 13 pages close the very intensive studies described over 400 pages, and even this historical social synthesis remains on the level of generalisations. The reference list should also be updated with the integration of the theoretical results from the most recent volumes (e.g.: *M. P. Pearson: The Archaeology of Death and Burial*. Phoenix Mill 1999; *F. McHugh: Theoretical and Quantitative Approaches to the Study of Mortuary Practice*. BAR IntSer 785, Oxford 1999; *P. K. Wason: The Archaeology of Rank*. Cambridge 1994; *U. D. Price – G. M. Feinman (eds): Foundations of Social Inequality*. New York-London 1995; *J. E. Arnold (ed.): Emergent Complexity*. Ann Arbor 1996). An increasing number of theoretical debates have lately concerned tribal and clan type organisation, which really reach beyond the framework of the present work. Thus, the problems of tribes and political unity could only superficially be mentioned in relation to Late Neolithic communities.

The dissertation is complemented with sections including the "Catalogue", "Illustrations", "Plates", "Typological tables" and "Cemetery maps" organised within an independent volume. These help in understanding the results of the statistical analyses and to follow the logical line of the thematic units. This work in itself is enough to illustrate the extent of István Gaál's work, which has created a quantitative basis for a discussion of the social questions surrounding the Late Neolithic in Hungary and, at the same time, presents us with an example of the genre of such complex synopses.

Nothing can better illustrate the significance of István Gaál's scientific work than the archaeological literature that the author used in the dissertation under discussion here. It is certainly the result of a long collection, something evident from the candidate's curriculum vitae as well.

In addition to the merits of the dissertation, one must also stress the role the candidate plays in Hungarian and international scientific life. This role was defined by the opportunities offered by the Humboldt grant and the system of European contacts he developed from this base. The working conditions provided in the Archaeological Institute of the Hungarian Academy of Sciences, and the outstanding scholarly weight of this research centre, secured a potent scientific background.

Summing up all these points, that is, recognising the merits of the dissertation and putting stress on the role the candidate plays in international scientific life we state securely that István Gaál is qualified to receive the title of Doctor of the Hungarian Academy of Sciences. Accordingly, we suggest that the Examination Committee appointed by the Doctoral Council of the Hungarian Academy of Sciences supported the candidate in the appropriate administrative process.





## POSSIBILITIES OF THE SOCIAL-ARCHAEOLOGICAL STUDIES OF THE NEOLITHIC

I handed in my dissertation for the academic doctoral degree titled “*The history of the Late Neolithic in Southern Transdanubia. Typological-chronological-social archaeology*” to the Hungarian Academy of Sciences in 1991, and defended it in 2003. I analysed the cemeteries of the Lengyel culture with the so-called feature analysis (Merkmalanalyse), discussing the relationship of the living and the dead in the Neolithic, the bases of the analyses of Neolithic cemeteries, their possibilities and limitations. The case study was the results of the analysis of an early Copper Age cemetery in NE Bulgaria. I sketched the purpose and methods of the work, summed up the earlier and recent research history, the chronological problems and settlement patterns of the Lengyel culture in Hungary, Slovakia, Moravia and Austria.

I started the analysis of the cemeteries of the Lengyel culture in Southern Transdanubia with the determination of the burial rites (metric features, special grave features, grave shafts and grave constructions, depth of the graves, anthropological and biochemical analytical results, burial customs), the practice of providing grave furniture and the grouping of these practices, and groups of tools, jewellery and costumes. The next step was the classification of the grave finds, which included the analysis of the ceramics and the typological grouping of the polished stone tools. In the course of the feature analysis of the cemeteries I could determine the combinations of the groups of burial customs, the problems of group evolution and “ranking”, the combinations of find groups and the ranges of finds.

The combinatory analysis of the grave ceramics with the determination of the correlation between the vessel shapes and ornaments played an especially great role in the relative chronological analyses. The results produced by my analytical method helped to determine the relationship of the Lengyel culture with the surrounding cultures, especially the Vinča culture, the Sopot culture and the Protolengyel horizon, just like the Late Neolithic cultures of the Hungarian Plain. At the same time, it afforded to prepare a summary of the information we have gathered about the burial rites of these cultures.

In the recapitulation, we could follow the development of the Lengyel culture as it is reflected in the archaeological feature groups, looking for answers concerning the social archaeological conditions and organisation of this Late Neolithic population.

Nándor Kalicz, Tibor Kemenczei and Pál Raczky evaluated my dissertation, and in the followings I will try to answer the questions and problems they raised in their examiner’s reports.

Tibor Kemenczei stated that my study contained partly more and partly less than it could be expected after the title. We can agree that the history of a prehistoric period or culture cannot be described only from the data of cemetery analyses. We also mentioned that a really authentic picture can be drawn only from the combined analysis of the find materials of cemeteries and settlements, but we do not have settlements or settlement fragments unearthed to a considerable extent from the Southern Transdanubian sites of the Lengyel culture. We know contemporary Neolithic cemeteries and settlements only from the large tell excavations in the Great Hungarian Plain (Alföld) and from Aszód and Svodín (Szögyén), which have not yet been published. From the occupation territory of the Lengyel culture, the Brześć-Kujawski site should be mentioned, where an entire system of trapezoid houses and grave groups was unearthed and analysed on a high standard.<sup>1</sup> The results were taken into consideration at the discussion of the social archaeological issues.

<sup>1</sup> R. Grygiel: The household cluster as a fundamental social unit of the Brześć-Kujawski Group of the Lengyel Culture in the Polish Lowlands. *Prace i Materiały Muzeum Archeologicznego i*

*Etnograficznego w Łodzi*, seria archeologiczna 31 (1986) 43–335; R. Grygiel: Brześć Kujawski. Beispiel einer natürlich befestigten Siedlung der Lengyel-Kultur in Kujawy. *Jahresschrift für mitteldeutsche*



P. van de Velde analysed the social structure of the western Linear Pottery culture preceding the Lengyel culture on the highest standard so far,<sup>2</sup> although the settlement features from Elsloo and Heinheim investigated by P. J. R. Modderman were given only a secondary role beside the analysis of the Elsloo cemetery.<sup>3</sup> Yet, in the western Linear Pottery culture, the Elsloo site is the only one where the relationship between the settlement and the associated cemetery can be examined even though the period of the use of the cemetery does not entirely overlap that of the settlement.

658 burials unearthed in 628 graves at 12 sites in Southern Transdanubia is really not a large sum, it is, however, sufficient to analyse the problems on an appropriate level from a historical aspect as well. A really modern excavation, where all the details of the excavation were recorded was conducted only at Mórágý-Tűzködomb.<sup>4</sup> A new feature of the analysis of the Mórágý site was that beside the anthropological examination of the skeletons executed by Zsuzsanna K. Zoffmann, Imre Lengyel made biological (sero-genetic) analyses as well, so the sex of the infant skeletons of diverse age categories could also be determined.

The analysis of the grave groups unearthed by Mór Wosinsky on the Lengyel rampart<sup>5</sup> caused the greatest problems, since neither the drawings of the graves nor a cemetery map, not even the skeletons were preserved, and the majority of the preserved finds could not be identified by graves. János Dombay prepared a relatively exact documentation of his excavation observations,<sup>6</sup> but already Zsuzsanna K. Zoffmann called attention to the contradictions between the published descriptions of the graves and the data of the cemetery maps.<sup>7</sup> It should also be mentioned that only about fifty skeletons were preserved from the 368 graves of the Zengővárkony cemetery. Most of them can be affiliated to certain grave groups, so the data of the anthropological and biological analyses offer a good opportunity to deduce significant conclusions.

The quantitative and qualitative components of phenomena and objects linked with the burial customs can furnish information on the position of the buried persons within the community yet it is just a vague reflection of the one-time reality. We also hinted at it and we have to mention, from this respect, the obvious difference that appears, for example, between the glacier mummy from Tirol and the Neolithic-Copper Age skeletons uncovered during the excavations.<sup>8</sup> Tibor Kemenczei agrees that the grave finds of the Lengyel culture offered favourable conditions for the application of any kind of cemetery analysis. Yet he has doubts concerning the opinions I cited from authors who thought that the prehistoric grave furniture

Vorgeschichte 73 (1990) 261–266; R. Grygiel: Untersuchungen zur Gesellschaftsorganisation des früh- und Mittelneolithikums in Mitteleuropa. Brno – Łódź 1994, 43–77.

<sup>2</sup> P. van de Velde: The Social Anthropology of a Neolithic Cemetery in the Netherlands. *Curr. Anthropol.* 20 (1979) 37–58; P. van de Velde: On Bandkeramik Social Structure. An Analysis of Pot Decoration and Hut Distribution from the Central European Neolithic Communities of Elsloo and Hienheim. *Analecta Praehistorica Leidensia* 12. Leiden 1979; P. van de Velde: Bandkeramik Social Inequality – A Case Study. *Germania* 68 (1990) 19–38; Velde 1993.

<sup>3</sup> Modderman 1970; P. J. R. Modderman: Die Bandkeramik in Graetheidegebiet, *Niederländisch-Limburg. BRGK* 66 (1985) 25–121.

<sup>4</sup> I. Zalai-Gaál: Die Gräbergruppe-B2 von Mórágý-Tűzködomb und der frühere Abschnitt der Lengyel-Kultur. *ActaArchHung* 52 (2001) 1–48; Zalai-Gaál 2002.

<sup>5</sup> M. Wosinsky: Leletek a lengyeli őskori telepről [Finds of prehistoric settlement from Lengyel]. I–II. Budapest 1885–1890; M. Wosinsky: A lengyeli praehistoricus sáncz- és lakóiról [Prehistoric causeway and its inhabitant from Lengyel], in: *Az Országos Régészeti és Embertani Társulat Évkönyve 1879–1885*.

Budapest 1886, 104–114; M. Wosinsky: Funde und Bestattungsweise in Lengyel. *MAGW* 19 (1889) 153–156; M. Wosinsky: A hasogatott köeszközök néhány ritkább fajtája [Some rare types of ground stone implements]. *ArchÉrt* 10 (1890) 139–146; M. Wosinsky: Das prähistorische Schanzwerk von Lengyel. Seine Erbauer und Bewohner. I–III. Budapest 1888–1891; M. Wosinsky: Tolnavármegye az őskortól a honfoglalásig [Tolna county from the Prehistoric times to the Hungarian Conquest]. I. Budapest 1896.

<sup>6</sup> J. Dombay: A zengővárkonyi őskori telep és temető [Prehistoric settlement and cemetery from Zengővárkony]. *ArchHung* 23 (1939); J. Dombay: Körézkori és kora-vaskori település nyomai a pécsvárad-i Aranyhegyen [Traces of a Chalcolithic and early Iron Age settlement on Pécsvárad-Aranyhegy]. *JPMÉ* 3 (1958) 53–102; J. Dombay: Próbaásatás a villánykövesdi körézkori lakótelepen [Trial excavation on a Chalcolithic settlement in Villánykövesd]. *JPMÉ* (1959) [1960] 55–71; J. Dombay: Die Siedlung und das Gräberfeld in Zengővárkony. *ArchHung* 37 (1960).

<sup>7</sup> Zs. K. Zoffmann: Die unveröffentlichten Pläne des neolithisch Gräberfeldes von Zengővárkony. *JPMÉ* 17–18 (1972–1973) 47–60.

<sup>8</sup> Angeli 1997, 31.



marks ethnicity or who identify certain prehistoric cultures with ethnic groups and try to find the evidences in the ceramics. He is of the opinion that not even the prehistoric burial rites can be used as evident data for an ethnic affiliation, pointing out that a population having a specific culture could use diverse burial customs, and the rites could change by time.

The science of prehistory has supposed behind the individual prehistoric cultures an ethnicity of a mutual origin and the community of related population groups. G. Kossina's statement that the "cultural provinces" are identical with certain peoples or tribes of peoples triggered a debate that lasted for decades,<sup>9</sup> which has not been closed even to date. Initially, the anthropological and the ethnological arguments had a great role in the debate on the concept of culture. The find-centred notion of culture was born in the 50's, and a decisive role was lent to the features of the archaeological objects as well.<sup>10</sup> The most important results of this activity can be found in U. Fischer's works. He supposed that the characteristic features of the burial customs are conform with certain "ceramic types" and identical ethnic units can be supposed behind identical archaeological feature groups.<sup>11</sup>

In this respect, I would like to mention the followings. The use of the term "culture" is ambiguous in prehistoric science, it means nothing but the classification of the finds in a systematic scheme, which is usually associated with the ethnic, economic, ideological or political groups of the people who produced and used them. Nevertheless, the material culture is often different even at groups living in the same geographical environment within identical economic conditions. A "culture" can show a uniform picture even independent of the ethnic barriers. Prehistoric peoples and tribes cannot be determined the same way as e.g. minerals.<sup>12</sup> The evolution of a people or a tribe does not always follow the same pattern. Nevertheless, the "culture" construed from the statistics of finds, already indicates, even with its limitations, the defeat of the forced social economic trend of the past decades in Eastern Europe. The concept of culture, however, should encompass all the living conditions available. The greatest problem for an archaeologist of prehistoric periods is that he cannot see everything. The group formation derived from the finds, at the same time, is not based singly on the subjective opinion of the archaeologist, it has objective bases as well. The meaning of culture determined from the archaeological find material, especially the ceramics, often changed depending on the comprehension of the individual researchers and the given research conditions. We can find good illustrations among others in the study of the Furchenstich culture,<sup>13</sup> or the Walternienburg–Bernburg culture.<sup>14</sup> In these cases, the barriers of the cultures depended solely on the current opinions of the individual researchers. This is why a critical approach to the sources is so important. It is basically the social economic conditions we examine in their complex interrelationships. In the reasonable use of the prehistoric archaeological material, model building can be regarded as an important method. The use of models, however, can lead to overoptimistic conclusions.<sup>15</sup> First of all the experiences of other fields of science, mainly the natural sciences, are borrowed in an unchanged form at the

<sup>9</sup> G. Kossina: Die Herkunft der Germanen. Zur Methode der Siedlungsarchäologie. Würzburg 1911; G. Kossina: Ursprung und Verbreitung der Germanen in vor- und frühgeschichtlicher Zeit. Berlin 1926.

<sup>10</sup> A. L. Kroeber – C. Kluckhohn: Culture. A critical review of concepts and definitions. Cambridge (Mass.) 1952; M. K. H. Eggert: Prähistorische Archäologie und Ethnologie: Studien zur amerikanischen New Archaeology. PZ 53 (1978) 6–164; B.G. Trigger 1978: Time and traditions. Essays in archaeological interpretation. Edinburgh 1978; R. Hachmann (hrsg.): Studien zum Kulturbegriff in der Vor- und Frühgeschichtsforschung. Saarbrücker Beiträge zur Altertumskunde 48. Bonn 1987; S. Wolfram: Zur Theoriediskussion in der prähistorischen Archäologie Großbritanniens. Ein forschungsgeschichtlicher Überblick über die Jahre 1968–1982. Oxford 1986.

<sup>11</sup> Fischer 1956.

<sup>12</sup> Angeli 2002, 156.

<sup>13</sup> A. Točík: Die Furchenstichkeramik in der Südwestslowakei. PA 52 (1961) 343; S. Dimitrijević: Zur Frage der Retz–Gajary-Kultur in Nordjugoslawien und ihre Stellung im pannonischen Raum. BRGK 61 (1980) 21, 28; E. Ruttkay: Zur Problematik der Furchenstichkeramik des östlichen Alpenvorlandes. Beitrag zum Scheibenhenkelhorizont. SIA 36 (1988) 234; N. Kalicz: Beiträge zur Kenntnis der Kupferzeit im ungarischen Transdanubien, in: Kupferzeit 1991, 362; Angeli 2002, 161.

<sup>14</sup> Fischer 1956, 86; H. Behrens: Die Jungsteinzeit im Mittelbe–Saale-Gebiet. Berlin 1973, 114; H. Behrens: Der Walternienburger und der Bernburger Keramikstil und die Walternienburg–Bernburger-Kultur. Jahresschrift für mitteldeutsche Vorgeschichte 63 (1981) 11, 15.

<sup>15</sup> Angeli 2002, 168.



use of prehistoric archaeological models. One of the most important system models based on archaeological data evolved from the trends of the relationship between the agrarian economy and the number of the population. It says that the innovations introduced in food production resulted in the increase of production, in consequence of which the number of the population grew. Specialisation appeared in production and it increased the significance of exchange. Finally, all these led to the evolution of a layer of a higher status. The change of the social structure had a positive effect on the productive sphere, which, once again, led to an increase in the population.<sup>16</sup> The results of the analysis of the Lengyel cemeteries supported the likelihood of this model.

J. Lüning differentiates the concepts of deductive and inductive culture. The first one is deduced not from the prehistoric source material but from other branches of science, as e.g. U. Fischer associated the Corded Ware people with the Indo-Germans both linguistically and culturally. The inductive concept of culture is based on the prehistoric find material itself. It is a selective method, since the find material represents only a segment of the “one-time reality”, the culture of the people who lived in the prehistoric times. Another selection is also made when the scientific question is raised and the data are classified and grouped, so the inductive concept of culture constantly changes as the investigations develop.<sup>17</sup> In the Neolithic, the concept of culture serves first of all the classification of the archaeological phenomena and marks a higher level of the classification system, which is suitable, at the same time, for the accomplishment of certain tasks and reaching aims.

I myself always use the concept of “social structure” in a sociological or ethnological sense, in agreement with P. van de Velde.<sup>18</sup> This means the division of the communities within a culture according to groups, family relations and kinship relations.

Various burial customs can be observed within the large occupation territory of the Lengyel culture. It is enough to think of the cremation and inhumation burials occurring in the Aszód and Györe cemeteries.<sup>19</sup> The same can be observed at the chronologically earlier western Linear Pottery culture as well, where there are cemeteries with only inhumation or only cremation burials and ones with mixed rites.<sup>20</sup> In the Tiszapolgár-Basatanya cemetery of the Copper Age, research supposed different ethnic groups from the burial rites and especially from the body positions.<sup>21</sup> In the case of the Linear Pottery culture, research dedicated special attention to this problem in the recent years supposing the existence of alien groups that settled over or conquered the autochthonous populations, although the differences are also explained by diverse social layers.<sup>22</sup> The question can be decided in the future with the help of anthropological, or even more probably DNA analyses. It can be observed in the Lengyel culture that the grave group of cremation burials, composing a closed territorial unit in the Györe cemetery, represents the early, initial phase of the culture.<sup>23</sup> Cremation burials are also mentioned from the Lužianky (Sarlókajsz) cemetery of the preceding Protolengyel horizon.<sup>24</sup> The presumption that the communities of the same ethnic group buried their dead in the southern Transdanubian cemeteries of the Lengyel culture, in addition to the fact that the burial rite and the material culture, including the character of the ceramics and the cultic objects, are uniform within the eastern occupation zone of the culture, can be supported first of all by the results of natural scientific analyses. Imre Lengyel's serogenetic analyses underlined the possibility that a certain kinship relation existed between the inhabitants of the Zengővárkony and Mórág settlements.<sup>25</sup> Zsuzsanna K. Zoffmann supposes

<sup>16</sup> *ibidem*

<sup>17</sup> J. Lüning: Zum Kulturbegriff im Neolithikum. *PZ* 47 (1972) 145–173.

<sup>18</sup> Velde 1993.

<sup>19</sup> Kalicz 1985; I. Zalai-Gaál: Die Brandbestattung im Spätneolithikum Transdanubiens, in: J. Regénye (ed.): Sites and Stones. Lengyel Culture in Western Hungary and Beyond. A Review of the Current Research. Lengyel'99 and IGCP-442 Conference Veszprém, 1999. Veszprém 2001, 37–45; E. Hoffmann: Zur Problematik der bandkeramischen Brandbestattungen in Mitteleuropa. *Jahresschrift für*

*mitteleuropäische Vorgeschichte* 57 (1973) 71–103; Peschel 1992; B. Hahnel: Frühneolithische Gräber in Österreich. *FÖ* 32 (1993) 107–128.

<sup>20</sup> Bognár-Kutzián 1963, 403–406.

<sup>22</sup> Peschel 1992, 192.

<sup>23</sup> J. Ódor – I. Zalai-Gaál: Bericht über die Rettungsgrabungen in Györe, Südtransdanubien. (in press)

<sup>24</sup> B. Novotný: Lužianska skupina a počiatky mal'ovanej keramiky na Slovensku. Bratislava 1962, 221.

<sup>25</sup> Imre Lengyel's report from November 26, 1985.



from Penrose identities that the population of the Mórágý group could be autochthonous, and this group could not be effected by alien influences (migration or infiltration) in Transdanubia during the Neolithic, at least it could not be demonstrated by the Penrose analysis.<sup>26</sup>

Nándor Kalicz mentions that my work embraces a more limited area as it returns to the Lengyeli culture. In the 70's, I analysed the cemeteries of the Central and Western European Linear Pottery culture as well,<sup>27</sup> but without the application of computerised and modern analytical methods and database. In the present study I elaborated a cemetery analysis method which does not only afford the examination of the burial customs and the find material of the Lengyel culture but it also helps the evaluation of the burial customs of the Tisza and Herpály cultures after a recapitulative elaboration. It can be based on the publications of the burials unearthed at the Gorzsa, Csőszhalom and Herpály sites completed with the addition of the burial features of a similar age found in the eastern and southern parts of the Carpathian Basin in a database and their statistic and seriation evaluations. The Late Neolithic sites unearthed recently in the Hungarian Plain with the most up-to-date methods offer an advantage we lacked in the case of the Lengyel culture in Transdanubia: the system of settlements and burials can be examined in their complexity, mostly within the frames of the chronological relationships determined from the stratigraphical positions.

Regarding the finds, we first focused on the customs concerning the grave furniture, the classification and analysis of the grave furniture, the tools and the jewellery finds, and the determination of the combinations of the relationships. Nándor Kalicz writes: "whatever has been elaborated from this method, based on natural science and mathematics, first of all in Germany, the candidate uses and sometimes even modifies it to comply with the Hungarian conditions..." In this regard I would only like to mention that this analytical method is varied according to various schools in Germany and in Austria, and it constantly changes, as I could experience it during my study trips to Germany. I myself did not go beyond the method of ceramics analysis that I had started to learn in 1987, and which I used for the analysis of the grave vessels of the Mórágý cemetery.<sup>28</sup> The typological system of Mórágý has significantly been changed since then as the entire bulk of the southern Transdanubian grave pottery material has been analysed, masses of new typological units has come to existence and the typological-chronological course of the development of the ceramics could be delineated from the earliest Lengyel period of Southern Transdanubia to the latest known period. The analysis of the B1 grave group at Mórágý did not afford such determinations since the cemetery was not used at the early phase of the development. It was opened only in the transitional (Lengyel Ib) horizon, and the majority of the burials dated from the late and the latest development phases.

Another question that arose is that perhaps I separated the type groups of the examined finds into too many elements. When I recorded the ceramics into the database and analysed them, I mainly relied on the results published by M. Dohrn-Ihmig,<sup>29</sup> J. E. Doran and F. R. Hodson,<sup>30</sup> P. Stehli and A. Zimmermann,<sup>31</sup> M. Lichardus-Itten,<sup>32</sup> R. Vossen,<sup>33</sup> R. Gläser,<sup>34</sup> G. Schneider,<sup>35</sup> R. Heiner,<sup>36</sup> M. Meisenheimer,<sup>37</sup> J. Rulf<sup>38</sup> and M. Strobel.<sup>39</sup> The first aspect I had

<sup>26</sup> K. Zoffmann 1999.

<sup>27</sup> I. Zalai-Gaál: Sozialarchäologische Untersuchungen des mitteleuropäischen Neolithikums aufgrund der Gräberfeldanalyse. BÁMÉ 14 (1988) 38–55.

<sup>28</sup> Zalai-Gaál 2002

<sup>29</sup> Dohrn-Ihmig 1983.

<sup>30</sup> Doran – Hodson 1975.

<sup>31</sup> Stehli – Zimmermann 1980.

<sup>32</sup> Lichardus-Itten 1980.

<sup>33</sup> R. Vossen: Probleme der Keramikklassifikation: Analyse von Material und Techniken. Archäographie 2 (1971) 107–122.

<sup>34</sup> R. Gläser: Die Linienbandkeramik in Transdanubien. I–III. Beiträge zu ihrer Chronologie und Entstehung. Inauguraldissertation zur Erlangung der Doktorwürde. Manuskript. Heidelberg 1993.

<sup>35</sup> G. Schneider: Naturwissenschaftliche Kriterien und Verfahren zur Beschreibung von Keramik. APA 21 (1989) 7–39.

<sup>36</sup> R. Heiner: Eine Merkmalanalyse von Siedlungskeramik mit Hilfe faktoren- und clusteranalytischer Verfahren. APA 21 (1989) 41–51.

<sup>37</sup> Meisenheimer 1989.

<sup>38</sup> J. Rulf: Neolithische Keramik als archäologische Quelle. Eine Elbeprovinz der Kultur mit Linearbandkeramik, in: Saarbrücker Studien und Materialien zur Altertumskunde 6–7, 1997–1998. Bonn 1998, 91–131.

<sup>39</sup> M. Strobel: Ein Beitrag zur Gliederung der östlichen Linearbandkeramik. Versuch einer Merkmalsanalyse. SASTUMA 4–5 (1995–1996) 9–98.



to consider was that the Neolithic pottery was hand thrown, so naturally there are no two vessels that are identical in every features, only ones where a number of features are similar. It depends on the find material itself and the information we have how we divide the ceramic material into its elements. As we could see, the stylistic features have a much greater importance in the ceramic analysis with a typological and chronological purpose than the technical features.<sup>40</sup> It should be added that the chosen features and the archaeological interpretation dimensions (technology, function, spatial and chronological distribution) are linked, yet the majority of the researchers carry out the typological and chronological analyses from the vessel shapes. The measurement and grouping of the technological features is a complicated task, which often cannot be executed in its complexity in the case of grave ceramics. The technological features often do not depend on the culture in a relative chronological sense, they are rather determined by the raw material people could find around the settlement. The technological features do not afford the setting up of a similarly fine chronological system as the other features do.

The vessel shapes can be analysed from various aspects. Only those chosen features can be taken into account that are relevant from the respect of the question we raise and that can serve the elaboration of the so-called artificial and natural classes.<sup>41</sup> In the case of artificial classes, the morphological features of the ceramics were analysed according to a uniform scale of values (functional units).

According to Nándor Kalicz, the features manifested in the individual grades of the typological system can be recognised yet they are so minimal in the final stage of the classification that the necessary information can be attained already in the previous phases of the analysis and it is not certain that the determination of the relative chronological order needs such a detailed classification. The grading comes from the hierarchical classification system of a polygenetic structure used in natural science. At the same time, a code system is necessary to be able to enter the large number of finds, first of all the ceramic material, into the database, and seriation analyses also need this solution. The grading is a simple process. The two classes of ceramics are composed of “high” and “broad” vessels (“Klasse I and II”). Within these two classes we can find the vessel genres (“Gattungen”), which contain the series (“Serien”), which are also metrically determined from the relationship between the individual vessel parts. The morphological groups (“Formengruppen”) were determined within the series metrically and from the profiles. Within these groups, the variants (“Varianten”) and sub-variants (“Untervarianten”) are differentiated only by the similarities and the diversities of the profiles. This classification system has mathematical and also “atavistic” elements in that the typological units of former investigations, that is hollow-pedestalled bowls, tumblers, the so-called Butmir-vessels were the determinant elements in the differentiation of the vessel types. The primary aim of the classification, the perhaps too detailed division of the finds was to get typological units that can be checked by simple measurements. They can be examined in seriation context and the typological features of the finds can be compared not only with the finds of the Lengyel culture recovered from other territories but with the objects of the late Neolithic cultures of the region as well. The hierarchical typological method I used can be further developed on a higher mathematical level. My intention was to reach a level where the relative chronological connections and the typological units that are indispensable for the examination of the development can be separated. It should also be mentioned from the respect of the German method that classification has recently been entirely placed on mathematical bases, e.g. each vessel can be placed within a circle and the analysis is carried out in relation to the circle and the individual vessel regions.<sup>42</sup>

<sup>40</sup> J. Lichardus – M. Lichardus-Itten: Ein Beitrag zu den kulturellen Beziehungen während der frühen Kupferzeit in Deutschland, in: Kulturen zwischen Ost- und West. Berlin 1993, 76; J. Lichardus – M. Lichardus-Itten: Nordpontische Beziehungen während der frühen Vorgeschichte Bulgariens. Thracia 11 (1995) 36.

<sup>41</sup> Doran – Hodson 1975; Stehli – Zimmermann 1980, 151.

<sup>42</sup> In the development of my ceramics typological method I got significant help from Prof. Jan Lichardus when I pursued studies in the Saarbrücken University by the grant of the Alexander von Humbolt Foundation.



I also agree with Nándor Kalicz in that the necessary information (on the relative chronology) can often be attained already in the previous analytical phase. It is true that the relative chronological order can successfully be determined in a previous analytical phase as well. The method I use is necessary first of all because of the exact description and definition of the typological units, which is the prerequisite of an analytical publication in the German and also the Anglo-Saxon research beside a detailed descriptive catalogue. During the years spent with the analyses, the greatest difficulty we had to face was the determination within the hierarchy of the typological system of the level the units of which would be used for the seriation evaluation and of the level the units of which could represent the traditional "type". However, seriation was made on the level of the morphological groups, versions and also sub-versions. I established that the evaluation on the level of morphological groups (136 graves/47 morphological groups) illustrated the connections between the graves and the ceramic typological units in a too wide plane, while on the level of subversions (76 graves/63 subversion) in a too narrow plane. Seriation in itself cannot solve the chronological problems of prehistoric archaeology. The order of the graves and typological units appearing in the seriation tables has to be compared with the plates illustrating the pottery found in the closed archaeological complexes, that is in the individual graves. It means that the seriation results have to be completed with the results of the traditional-archaeological comparative method, and the result has to be analysed in relation to the cemetery maps. This complex analysis revealed that, in our case, the seriation made on the level of versions provided the most reliable results in the correlation of 122 graves and 75 typological units. Naturally, the results of the analyses made on the other above-mentioned levels can also be evaluated. As it has been mentioned, the chronological system is composed of two grades (I, II), three phases (Ia, Ib and IIa) and five periods (Ia1, Ia2, Ib, IIa1, IIa2). With the help of seriation made from the versions, these chronological units can clearly be distinguished, while the results reached on the levels of series and morphological groups do not answer the question in what proportion the individual vessel types are represented in the larger stages (grades and phases) of the development of the Lengyel culture.

So it can be seen that prehistoric typology is based on chosen features that help the differentiation of objects. The identity and similarity of these features suppose a connection. The starting point of the typological method was the organisation of the types of object groups into a series based on smaller or larger similarities. These series are usually interpreted as development series, which are evaluated according to chronological aspects. Two things, however, need to be emphasised from this respect. 1. The setting up of the typological series is not chronologically relevant in itself; it can gain a chronological significance only in consequence of the interpretation. 2. It should not be forgotten that we deal with the products of human activities, the evaluation of which can define the direction of typological analyses. One of the greatest difficulties of former ceramics analyses was that the typological systems were treated as static formations. Yet they constantly change, so instead of being static, they are dynamic formations,<sup>43</sup> which is corroborated by the results of our analyses. This holds true for the complexity of social archaeological conditions just as well as for the vessel shapes and ornaments.

Nándor Kalicz examines my typological-chronological system in details and mentions the sites in Upper-Northern Hungary that served as analogues to the individual periods of the system. In the systems made by Slovakian researchers, the finds uncovered at Pečenady,<sup>44</sup> Moravany<sup>45</sup> and Santovka<sup>46</sup> had a great role. In these cases, however, find units of small item numbers, consisting of 20–60 sherds, are used, which do not have a representative value from

<sup>43</sup> K. J. Narr: Typologie und Seriation. BJ 178 (1978) 22; Angeli 1997, 23.

<sup>44</sup> J. Pavúk: Nové nálezy lengyelskej kultúry za Slovenska. SIA 13 (1965) 27–50; J. Pavúk: Sučasný stav štúdia lengyelskej kultúry na Slovensku. PA 72 (1981) 255–299.

<sup>45</sup> J. Pavúk: Postavenie fázy Moravany vo vývoji lengyelskej kultúry, in: Otázky neolitu a eneolitu našich zemi – 2000. Plzeň 2000, 151–160, with references.

<sup>46</sup> J. Pavúk: Santovka eine bedeutende Fundstelle der Lengyel-Kultur in der Slowakei. AKorr 24 (1994) 167–177.



the respect of chronological analyses. One of the neuralgic points of the Lengyel periodisations has been J. Lichardus and J. Pavúk's debates carried on for decades on the division of the stages of the Lengyel culture with painted vessels. Not even the analysis of the cemeteries of the Lengyel culture in Southern Transdanubia could decide this debate. A turning point can be expected from the analysis of the 161 graves V. Němejcová-Pavúková unearthed recently at Svodín (Szőgyén) and the 220 graves uncovered by Nándor Kalicz at Aszód, and the evaluation of the finds they contained.

According to Nándor Kalicz, it is questionable to what degree the hierarchy supposed mainly from the distribution of the graves in the cemetery and the finds can manifest itself in the entirety of the associated settlements, regarding the great differences in the size of the examined units. To prove the hierarchy supposed from the quantitative and qualitative features of the finds buried with the dead, he mentions one of the published grave groups from Aszód. The richest grave no. 2 furnished with prestige goods is located in the centre of the group surrounded by numerous graves of infants and women and a few men. It means that "the position (form) of the two grave groups and their finds reflect diverse community conditions within the same settlement" at the Aszód site as well.

Nándor Kalicz doubts that the number of the vessels in the individual graves within the burials can suggest rank order. We certainly agree with his opinion that the number and the combination of vessels have, in this case, only a secondary, complementary role. It can be observed, at the same time, that 19.6% of the burials furnished with vessels contained one vessel, 21.0% contained 2 vessels, and 14.5% had three vessels. Burials with four (10.7%), five (10.0%) and six vessels (5.6%) were less frequent, and only a very low proportion of the burials contained more than 6 vessels (6 vessels: 5.6%; 7 vessels: 2.9%; 8 vessels: 0.7%; 9 vessels: 1.4%). More vessels occur only sporadically in the Lengyel graves in the Southern Transdanubia: 10 vessels were given to an adult male in grave no. 108 at Zengővárkony and a boy in grave no. 109 at Mórág. Eleven and twelve vessels were found, respectively, in the cremation graves nos. 12 and 13 at Györe, while the largest number of vessels, 21 items, were found in grave no. 114 of an adult at Zengővárkony. So it can be observed that the number of people buried with larger and larger numbers of vessels gradually decreases (*diagram 1*).

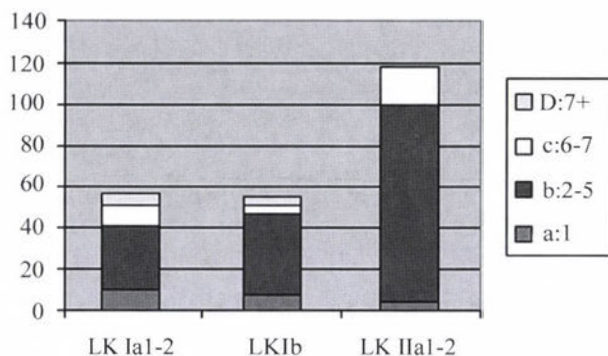


diagram 1. Vessel number per graves in the individual horizons

All the three opponents mention the problems raised by the cemetery of Varna, first of all that I compared the hierarchy supposed in the communities that used the Late Neolithic cemeteries in Southern Transdanubia with the conclusions of the Copper Age cemetery of Varna, which I used as a model. I agree with Tibor Kemenczei that the similar or diverse social conditions developed independently at communities living far from each other depending on the local economical, cultural and natural conditions. Consequently, the social differentiation that existed in the communities of the Lengyel culture in Southern Transdanubia developed without the impact of the Varna population. Both Nándor Kalicz and Pál Raczky think that the Varna cemetery is unique because of its specific character (and geographical conditions) not only in Bulgaria but in Europe as well. Its extreme richness and specific rites differentiate it from



every other cemetery of the same period. It also represents a younger phase than the burials of the Lengyel culture. Besides the entire cemetery has not yet been published, which would be indispensable for the analysis. In the catalogue and the volume of the Saarbrücken conference of 1988, only the finds of the grave units, among them the central grave group, that were considered the most important from the respect of the analyses were completely published,<sup>47</sup> which really does not compensate for the publication of the entire material. The elaboration of the social archaeological model of the Karanovo VI–Gumelnița–Kodžaderma culture was carried out not only from the Varna cemetery. The smaller, so-called “rural cemeteries” of the territory consisting of 30–60 graves (Goljamo Delčevo, Devnja, Vinica, Radingrad, Liljak, Targovište, Kubrat, Ruse, Durankulak, Balbunar, Varaști, Dridu) are completely published, and the results of the observations made in the Varna cemetery were evaluated in relation to these sites. These cemeteries are located within the same geographically enclosed region and represent stages A2–B1 of the mentioned cultural entity. J. Lichardus differentiated 5 groups within the communities buried in the cemeteries by the grave furniture (Ausstattungskategorien).<sup>48</sup> The analysis of the structure of the Varna and the rural cemeteries has demonstrated social differences in regard of both sexes and the children and it could be recognised for the first time that social differentiation is linked not with the individuals but with the families.<sup>49</sup> So it can be told that the social system of the Karanovo VI–Gumelnița–Kodžaderman cultural entity was differentiated. Certain layers can be demonstrated among men as well as women and children. Metal trading was concentrated in the hands of the leading personalities. The complexity of the new technique supposes not only a great skill but also the inheritance of the knowledge. It is probable that the development of metallurgy (copper and gold) contributed to the basic changes that happened in the social structure, beside exterior influences. Certain elements of the burial rites of the Karanovo VI–Gumelnița–Kodžaderman cultural entity survived from the preceding Neolithic Boian-Marica entity, continuity can be demonstrated in many features, while significant differences appear suggesting discontinuity. It is important to note that innovations could be demonstrated not only in burial rites but also in religion, economy and society (e.g. copper, cart, horse, plough, trade, temple-like buildings etc.). A hierarchically built social organisation evolved in consequence of the changes, which was headed by the families of a local and an “over-regional” upper layer, as it is proved by insignia and symbols of power. The group or layer of persons of special functions (handicrafts, miners, and traders) evolved. Certain elements of the burial rites differ in the case of men and women and cultic places appear separated from the dwellings.<sup>50</sup> These changes can only be explained by exterior impacts, their origin can be found outside the territory of the cultural entity. This is the reorganisation that can be demonstrated in the Early Copper Age of Bulgaria especially in the burial rite. It proceeded on the cultural base of an agrarian population, so the traditions certainly did not disappear; yet a new and very specific social structure came to life. This process cannot be understood in the Balkan and the Central European region through only typological analytical methods. First of all the examination of the structures and the analysis of their interrelations is needed for the investigation of the phenomenon within the safest possible chronological frames.<sup>51</sup> At the analysis of the Lengyel cemeteries, we placed the emphasis not especially on the individual phenomena but on the demonstration of the correlation of structures. We examined the analogues of the social archaeological phenomena that appeared during the investigation of the cemeteries in North-Eastern Bulgaria in an earlier phase, in the Late Neolithic of Southern Transdanubia. For me, these results and possibilities meant

<sup>47</sup> I. Ivanov: Das Gräberfeld von Varna – Katalog, in: *Macht, Herrschaft und Gold*, 183–208; I. Ivanov: Der Bestattungsritus in der chalkolithischen Nekropole von Varna (mit einem Katalog der wichtigsten Gräber), in: *Kupferzeit 1991*, 131–149.

<sup>48</sup> J. Lichardus: Handwerker und Handwerkerstand in der frühen Kupferzeit, am Beispiel des Karanovo VI–Gumelnița-Kulturverbandes, in: J. G. P. Best – N. M. W. de Wries (eds): *Interaction and*

*Acculturation in the Mediterranean*. Amsterdam 1982, 197–221; Lichardus 1984; J. Lichardus: Der westpontische Raum und die Anfänge der kupferzeitlichen Zivilisation, in: *Macht, Herrschaft und Gold 1988*, 79–129; Lichardus 1991.

<sup>49</sup> Lichardus 1991, 186.

<sup>50</sup> Lichardus 1984, 142; 1989, 18.

<sup>51</sup> Lichardus 1989, 22.



the actuality of the "Varna model" in the analysis of the social archaeological problems of the Lengyel culture. At the same time, I did not suppose the existence of similar social stratification processes in North-Eastern Bulgaria and Transdanubia in the 5<sup>th</sup> millennium BC.

The burial rites of the Neolithic development, the Linear Pottery culture and the even earlier SE European Early Neolithic cultures were discussed in a number of recapitulative papers in the recent years.<sup>52</sup> Ida Bognár-Kutzián evaluated the cemeteries and the graves of the Tiszapolgár culture, which followed the Lengyel culture, and published them still applying the comparative archaeological method.<sup>53</sup> The most up-to-date analytical methods were used on Copper Age cemeteries in the case of the above-mentioned NE Bulgarian cemeteries, so it is only here that we had data and results that could give an answer to the above listed questions, the stratification and the hierarchy of the population group that lived in the period following the Lengyel culture. The Lengyel culture lived in its occupation zone between the two mentioned chronological horizons, so it was evident to analyse the social archaeological problems of the Lengyel population with regard to the well investigated earlier western Linear Pottery culture and the appropriately analysed later Copper Age cemeteries. The main emphasis was placed on the question *what was new as compared to the earlier phenomena, what differences and divergences could be observed in relation to the social archaeological conditions of the later Copper Age population who lived already in developed tribal communities*. I would like to add that the burial rite of the Tiszapolgár culture, which followed the Lengyel culture in the Hungarian Plain, was recently analysed in a number of papers,<sup>54</sup> yet none of these studies included all the known Tiszapolgár burials. I have already started the recording of the data of these burials in a database, which will afford social archaeological analyses with the same method I used at the investigation of the cemeteries of the Lengyel culture.

Pál Racky was not convinced of the starting axiom that "the smaller and larger grave groups and the individual, scattered graves are discussed separately for methodological reasons, so we can count with 35 cemeteries during the analyses." Nándor Kalicz also poses the question: when can we speak of independent cemeteries or only groups of graves? The question is if we can consider all the grave groups that can be distinguished within a larger unit as independent cemeteries or they are parts of a larger cemetery. Ch. Peschel discussed those cemeteries in his study on the burial rites of the western Linear Pottery culture in which at least 12 graves were unearthed and they offer sufficient information for the analysis.<sup>55</sup> According to O. Höckmann's definition we can speak of a cemetery when a burial group contains more than ten graves.<sup>56</sup> Larger numbers of graves can be observed in a few grave groups at Zengővárkony, Lengyel and Mórág. The exact number of the graves in a cemetery is often difficult to determine since the original extent of a cemetery can only approximately be determined and erosion and later disturbances have destroyed many graves. Another question is how many people could live on a certain territory or area at a time, since this aspect is very important in the study of every historical period. The majority of the data on prehistoric periods are not realistic, the data on the size of prehistoric populations are only approximate ones.<sup>57</sup>

<sup>52</sup> Storch 1984–1985; Peschel 1992; Nieszery 1995; H. Peter-Röcher: Bestattungssitten oder Opferbrauch? Anmerkungen zu menschlichen Skelettresten des älteren Neolithikums, in: Beiträge zur prähistorischen Archäologie zwischen Nord- und Südosteuropa (Festschrift für Bernhard Hänsel). Espelkamp 1997, 59–66.

<sup>53</sup> Bognár-Kutzián 1963; I. Bognár-Kutzián: The Early Copper Age Tiszapolgár Culture in the Carpathian Basin. ArchHung 48 (1972)

<sup>54</sup> S. N. Skomal: The social organisation of the Tiszapolgár Group at Basatanya–Carpathian Basin Copper Age. Journal of Indo-European Studies 8 (1980) 75–92; Meisenheimer 1989;

J. Sofaer Derevenski: Age and gender at the site of Tiszapolgár-Basatanya, Hungary. Antiquity 71 (1997) 873–889; J. Chapman: Tensions at funerals. Micro-Tradition Analysis in Later Hungarian Prehistory. Budapest 2000.

<sup>55</sup> Peschel 1992.

<sup>56</sup> O. Höckmann: Zur Verteilung von Männer- und Frauengräbern auf Gräberfeldern des Frühneolithikums und des älteren Mittelneolithikums. JRGZM 29 (1982) 13–74.

<sup>57</sup> G. Smolla: Prähistorische Populationsgrößen, in: Actes du VIII<sup>e</sup> Congrès International des Sciences Préhistoriques et Protohistoriques Beograd 9–15 Septembre 1971. Beograd 1973, 68–70.



Some researchers estimate the number of the population from the settlements and the settlement features (houses). The analyses based on the size and the structure of the houses can give realistic results only within an identical climatic zone and at populations that carry on identical economic activities, as it has been demonstrated by P. J. R. Modderman's studies.<sup>58</sup> It was investigated at the settlements of the Linear Pottery culture if the house communities reflect the social units. Three different models were analysed. Accordingly, a small or an enlarged small family or one or more small families or a large family could live in a long house. J. Lüning thinks that not large families but autonomic, cultivating small families lived in the long houses since the palaeodemographic-data prove that at least 50% of the new-born infants died and a very low average age can be expected at persons who lived until their 18<sup>th</sup> birthday. Apart from the parents, the small families included two-three "surviving" children and also the grandparents and unmarried girls. Thus a family of the Linear Pottery culture counted 5–7 persons according to Lüning's calculations.<sup>59</sup> U. Veit thinks, at the same time, that no realistic data can be deduced about the number of the people only from the size of the houses: The comparison with the data of other territories and periods also lead to larger numbers than the 5–7 persons per house supposed by Lüning.<sup>60</sup> In the case of the Lengyel group of Southern Transdanubia, this question cannot be discussed from settlement data, it were mainly Imre Lengyel's serogenetic results from the Mórágý cemetery that we could use (*Table 1*):

Find groups	Kinship groups (family units)		
	$\alpha$	$\beta$	$\gamma$
<b>A1</b> (graves rich in fancy goods, tools and jewellery/articles of wear)	-	-	46. Inf. II girl
<b>A2</b> (tools, ceramics, <i>Canis familiaris</i> )	-	10. male	-
<b>B</b> (tools, jewellery/articles of wear, ceramics)	-	38. Inf. I girl	47. Inf. II/Juvenis boy, 48. female
<b>C</b> (tools with ceramics)	17. boy, 18. Juvenis, 27. Inf. II girl, 26. Juvenis boy, 6. adult, 25. female, 28. female	14. male, 9. Inf II girl, 7. female, 84. adult, 8. Neonatus boy	50. adult, 16. female, 15. adult
<b>D</b> ( jewellery/articles of wear with ceramics)	-	49. male	63. Inf II. girl, 51. female, 52. Inf I boy
<b>E</b> (only tools)	24. female, 21. female	13. Inf. I girl, 12. Inf. I-II girl	-
<b>F</b> (only ceramics)	19. female, 30. Inf. I girl	41. Neonatus boy	36. female
<b>G</b> ("without grave-goods")	31. female	-	54. Inf. I. boy
	<b>12 individuals</b>	<b>11 individuals</b>	<b>11 individuals</b>

Table 1. Correlation of anthropological categories and find groups at Mórágý

Pál Racky also thinks that the biological (kinship) groups demonstrated in grave group B1 at Mórágý cannot on the whole be matched with certain find range groups. The picture will be different, however, if we examine the relationships in the wider, also kinship groups, in the family units illustrated in *Table 1*. Pál Racky also states that the larger find range groups match the horizontally well-differentiated grave groups in the territory of the cemetery.

It is much more difficult to tell how large the extended families ("erweiterte Familie") consisting of 2–3 nuclear families ("Kernfamilien") could be. Similarly to Modderman and Velde, B. Soudský and I. Pavlů also supposed the existence of these extended families after the analysis of the Middle Neolithic houses unearthed at Postoloprty in Bohemia.<sup>61</sup>

<sup>58</sup> Modderman 1970.

<sup>59</sup> J. Lüning: Wohin mit der Bandkeramik? – Programmatische Bemerkungen zu einem allgemeinen Problem am Beispiel Hessens, in: Beiträge zur prähistorischen Archäologie zwischen Nord- und Südosteuropa (Festschrift für Bernhard Hänsel). Espelkamp 1997, 23–57.

<sup>60</sup> Veit 1996.

<sup>61</sup> Soudský 1955; B. Soudský: Bylany – osada nejstarsich zemedelcu z mladsi doby kamenné. Praha 1966; Soudský 1969; B. Soudský – I. Pavlů: The Linear Pottery Culture settlement patterns of central Europe, in: P. Ucko – R. Tringham – G. Dimbleby (eds): Man, settlement and urbanism. London 1972, 317–328.



The size of the Neolithic populations can the best be estimated from cemeteries using the early formula published by G. Smolla.<sup>62</sup> These calculations can answer the question of the chronological interval raised by P. Racky. Accordingly, 328 persons could live at a time in the 12 Late Neolithic settlements in Southern Transdanubia, from where the burials of 628 individuals are known, who were buried in a period of about six hundred years. This can mean an average population of 27 individuals in a village. Thus the number of the family units (houses) could be 3–5 in a village depending on the estimated number of the living members of a family. Another question that can be raised is if there were just as many houses in the large, central settlements like Zengővárkony, Lengyel and Mórág as in the smaller ones where the cemeteries contained fewer graves. The number of the known sites of the Lengyel culture has increased to about 130 since the recent field walkings. From these sites we can calculate that 3500 people could live at a time, in average, in the investigated region, which means 2 (2.3) individuals on the 8133 square kilometres of the region. Taking into consideration, however, that only about one third of the sites of the Lengyel culture are known, the size of the population living at the same time could be around 10 000 (10 530) individuals, which equals with 0.7 persons per square kilometres. This number is close to the 0.5/km<sup>2</sup> calculated by Nándor Kalicz for the entire Lengyel–Tisza–Herpály–Csőszhalom complex.<sup>63</sup>

The scientific analyses also furnished data on the demographic conditions. According to Imre Lengyel's calculations, the serogenetic balance reflected in the significance of the divergence between the uncovered and calculated samples of AB item number proves that the Zengővárkony population counted at least 550–620 individuals.<sup>64</sup> This result was reached from the analysis of 58 bone samples from Zengővárkony (the number of the skeletons that were preserved after the excavations). Examining the 658 individuals registered in the database in relation to Imre Lengyel's data, we can expect a population of about 7000 individuals only in Zengővárkony during the development of the Lengyel culture in Southern Transdanubia, and this number of the population should be projected to the above-mentioned period of six hundred years. Accordingly, about 1000 persons lived in average in 100 years, that is roughly in three generations. Nándor Kalicz calculated with at least ten thousand burials at the entire Aszód site after the comparison of the size of the unearched area and the number of the graves found there with the entire extent of the site.<sup>65</sup> Zsuzsanna K. Zoffmann supposed a total population number of 120 individuals and 4–5 small families of seven members, in total 32–36 individuals at a time during the analysis of the grave group B1 at Mórág. She concluded that the rows or concentric circles of the graves imply that the population that used the cemetery consisted of 4 usque 6 families, on the condition that the cemetery was used during at least four generations.<sup>66</sup> The grave group B1 at Mórág, however, was used only in the transitional and late horizons of the Lengyel culture and at least four or five larger grave groups can be expected at the site after the surface observations. So not even the scientific analyses can unambiguously determine the size of the populations and the number of the generations that used the cemeteries.

As we could see, the question how representative the graves are poses one of the gravest methodological problems in the prehistoric cemetery analyses since the number of the known graves is too low as compared to the estimated data. The results of the "large regional" and "small regional" analyses should also be mentioned in this respect. According to calculations

<sup>62</sup> G. Smolla: Paläodemographische und paläopathologische Grundlagen, in: B. Wolfram (hrsg.): *Bevölkerungsbiologie – Beiträge zur Struktur und Dynamik menschlicher Populationen aus anthropologischer Sicht*. Stuttgart 1974, 333–341; Veit 1996, 34: A mortality rate of 4 is recommended in the case of the occurrence of infant skeletons.

<sup>63</sup> N. Kalicz: Zusammenhänge zwischen dem Siedlungswesen und der Bevölkerungszahl während

des Spätneolithikums in Ungarn, in: A. Lippert – M. Schultz – S. Shennan – M. Teschler-Nikola (hrsg.): *Mensch und Umwelt während des Neolithikums und der Frühbronzezeit in Mitteleuropa*. Rahden/Westf. 2001, 160.

<sup>64</sup> Imre Lengyel's report on November 24 and 26, 1985.

<sup>65</sup> Kalicz 1985.

<sup>66</sup> K. Zoffmann 1999.



made from the settlement data in the territory of Aldenhovener Platte, 5000–10 000 people could live at the time of the Linear Pottery culture yet only a single cemetery of 112 graves (Niedermerz 3) is known there.<sup>67</sup> A ten times larger population is supposed in the territory of Graetheide, Holland as well, while here, too, only a single cemetery of 113 graves (Elsloo) is known.<sup>68</sup> One hundred graves of a population of 10 000 individuals have been unearthed, that is the proportion of the graves is only 1% (an intensive archaeological topographic activity was pursued in both territories so it seems possible that the population of the Linear Pottery culture used only a single cemetery). According to the principles of population statistics, a sample of one hundred items is sufficient for statistic analyses independent of the size of the basic population. It is not the relative proportion of the sample but the absolute size that is important. Analysing sociological, anthropological or demographic issues in a cemetery, we have to accept that the examined burials were randomly chosen. The situation, however, is different in the case of the Lengyel cemeteries. Here every recorded grave and relatively many cemeteries or grave groups are included in the analysis. Some colleagues suppose from the above discussed arguments that more than 1000 individuals could live in the Niedermerz region during more than six generations, from whom only 102 inhumation and 10 cremation burials have been preserved. The rest could be burnt, buried in a small depth, the graves could be destroyed by the plough or erosion.<sup>69</sup> In the case of the inhumation burials, a minority is supposed, the role of which within the total population is not yet clarified.<sup>70</sup>

The problem of the representativeness of prehistoric graves appears in a new light when they are first examined within small regions. If the Elsloo cemetery belongs to a single nearby settlement where 8–10 houses accommodated 5–6 persons, the coexistence of 40–60 people can be supposed in the settlement. Thus the approximately three generations that used the cemetery could bury here 120–180 dead persons, only a little more than the unearthed 113 graves.<sup>71</sup> Niedermerz is more complicated from this respect. The cemetery is about 500 m from the nearest three settlements, and some more hamlet-like settlement remains were found at a distance of 700–800 m. Relying on the Elsloo data, the population of a single settlement used this cemetery as well. If only the settlement Langweiler 8 is regarded, the 7–11 contemporary houses could bury 250–300 dead during six generations.<sup>72</sup> In this case, however, the dead buried in Niedermerz represent not a minority but a significant proportion of the total population.<sup>73</sup> Naturally the results of both analytical methods are uncertain, the boundaries cannot be definitely drawn between speculation, hypothesis and proof.<sup>74</sup>

As it has already been mentioned, all the known and sufficiently documented graves of the Lengyel culture from Southern Transdanubia are analysed in the study. Most of them were uncovered in larger cemeteries, grave groups and clusters, although many sites yielded only a single or a few burials. The recapitulative evaluation discusses the consequences that can be drawn from these latter occurrences. The smaller and larger grave groups unearthed at Zengővárkony, on the Lengyel rampart and on the Tűzködb at Mórág and the single graves uncovered at various sites are discussed as cemeteries only because of methodological reasons. The expression “cemetery” was used as a technical term supposing that the graves composing the totality of the territorially linked burials at a site, distributed in groups and, within the groups, in clusters, contain the bodies of persons of the same kinship. The quantitative and qualitative analyses were carried out in typological, chronological and social archaeological

<sup>67</sup> Dohrn-Ihmig 1983.

<sup>68</sup> Modderman 1970.

<sup>69</sup> Dohrn-Ihmig 1983; Lüning – Stehli 1989.

<sup>70</sup> Lüning – Stehli 1989.

<sup>71</sup> Velde 1993.

<sup>72</sup> P. Stehli: Merzbachtal – Umwelt und Geschichte einer bandkeramischen Siedlungskammer. Germania 67 (1989) 1–60.

<sup>73</sup> Velde 1993.

<sup>74</sup> J. Lüning counts with 26 800 inhabitants in the territory of Merzbachtal. From this he calculated

360 000 persons for the territory of (the former) Western Germany, which means 1.5 persons/km<sup>2</sup>. If only the loess region is regarded, 17 members of the Linear Pottery culture lived in a square kilometre (J. Lüning: Frühe Bauern in Mitteleuropa im 6. und 5. Jahrtausend v. Chr. JRGZM 35 (1988) 87). We think that neither our nor other authors' manipulative calculations can yield realistic data in this respect.



contexts not only in respect of the individual burials and grave clusters but also in relation to all the burial features unearthed at a site. Thus the occurrence of every phenomenon and manifestation is examined from the respect of the relationships, divergences and similarities between the Zengővárkony, Mórág and Villánykövesd cemeteries. In the book I am preparing from my study, however, respecting the extremely useful pieces of advice from my opponents, I write about the Mórág, the Zengővárkony and the Lengyel cemeteries, discussing the grave groups and clusters in separate territorial units. Nándor Kalicz agrees with me that the grave groups composed an independent unit within the larger organisational units of the populations of the settlements, so their independent analysis is justified. The discussion strategy of the Lengyel cemeteries in Southern Transdanubia, however, did not afford the application of the known method of the increasingly intensive analysis of the various settlement phenomena and units, which Pál Racky misses from my study. He expected to see the sketch of the dimensions of the archaeological program to be accomplished by the prehistoric research of Southern Transdanubia. The analysis of the settlement features and finds will be the second stage of my study on the Late Neolithic of Southern Transdanubia. Up to now, the ceramics from Zengővárkony and Mórág have been entered into the database and the associated photos have been made. The drawings of the profiles, which are indispensable for a typological-chronological analyses are continuously prepared. The evaluation of the drawings of the cuttings illustrating the position and place of the settlement features (pits) at Zengővárkony, published by János Dombay, and at Mórág prepared by us will also be made. Only then can we determine the relationship between the graves and the settlement features under or above them, which seems to be especially difficult at Zengővárkony since the settlement material unearthed at the site was strongly selected and the layers were not respected at the excavations. DNA analyses should be included in the archaeological project, which can be made in the Archaeological Institute of the MTA in the future and the settlements should also be excavated.

Nándor Kalicz also raises the question of the evaluation of settlement burials. The population of the western Linear Pottery culture established uniform, huge cemeteries as well in its occupation zone, which were not at all or only sporadically known in the territory of the later Lengyel culture at the time of the Linear Pottery culture. Taking into consideration the 96 graves from Vedrovice, Moravia,<sup>75</sup> the 24 graves from Rutzing, Austria,<sup>76</sup> and the more than 60 graves unearthed at Kleinhadersdorf,<sup>77</sup> “the Nitra cemetery with the 76 unearthed graves does not really seem unique. So we can probable expect the existence of grave groups and cemeteries of the Linear Pottery culture in Transdanubia as well beside the known settlement burials.” The recently unearthed Linear Pottery graves from Balatonszárszó do not compose a closed, uniform cemetery, according to the publications, like the ones known e.g. from Nitra<sup>78</sup> or the Rhine region.<sup>79</sup> István Torma could not find any trace indicating such a cemetery during his systematic field walkings in Tolna county.<sup>80</sup> The reasons of the diverse burial forms and customs in the western and eastern geographical groups of the Lengyel cultures are not simply due to the actual state of investigations. A noteworthy phenomenon can reinforce it. During the

<sup>75</sup> V. Ondruš: Detské pohrby na neolitickom sídlíste ve Vedrovicích. ČMM 57 (1972) 27–36; V. Podborský a kol.: Dvě pohřebiště neolitického lidu s lineární keramikou ve Vedrovicích na Moravě (Zwei Gräberfelder des neolithischen Volkes mit Linearbandkeramik in Vedrovice in Mähren). Brno 2002.

<sup>76</sup> A. Kloiber – J. Kneidinger: Die neolithische Siedlung und die neolithischen Gräberfundplätze von Rutzing und Haid, Ortsgemeinde Hörsching, politischer Bezirk Linz-Land, III. Teil. JOÖMV 113 (1968) 25–32; A. Kloiber – J. Kneidinger: Die neolithische Siedlung und die neolithischen Gräberfundplätze von Rutzing und Haid, Ortsgemeinde Hörsching, politischer Bezirk Linz-Land, II. Teil. JOÖMV 114 (1969) 19–28.

<sup>77</sup> V. Lebzelter – G. Zimmermann: Neolithische Gräber aus Klein-Hadersdorf bei Poysdorf in Niederösterreich. MÖAG 66 (1936) 1–16; J. – W. Neugebauer – Ch. Neugebauer-Maresch: Kleinhadersdorf. FÖ 26 (1987) 194; 27 (1988) 265; 28 (1989) 167; 29 (1990) 182; 30 (1991) 237.

<sup>78</sup> J. Pavúk: Neolithisches Gräberfeld in Nitra. SIA 20 (1972) 5–105.

<sup>79</sup> Nieszery 1995. (with references)

<sup>80</sup> I. Torma: A Kapos- és Koppány-völgy őskori települései [Prehistoric settlements of the Kapos- and Koppány-valley]. Egyetemi szakdolgozat. Budapest 1963.



intensive field walkings conducted in the northern part of Zala county in the recent years, 124 new sites of the Lengyel culture were discovered yet no trace of cemeteries or grave groups could be demonstrated.<sup>81</sup> This cannot be ascribed simply to the soil conditions, which are unfavourable for the preservation of bones, especially if we take into account that the burials could be documented at Elsloo and also in Niedermerz only from the imprints of the skeletons ("Leichenschatten"). The state of investigations is, however, really responsible to a certain degree for the lack of the cemeteries of the Linear Pottery culture.

H.-P. Storch was the first to call attention to the evident disproportion of the Neolithic settlements and cemeteries during the analysis of the Linear Pottery sites of the southern Upper Rhine region.<sup>82</sup> In the case of extensively studied settlement areas of the Linear Pottery culture, N. Nieszery compared the population number estimated from the houses with the number of the graves that could be associated with them or were unearthed in their vicinity. He arrived to the conclusion that the few burials of the Linear Pottery culture made only 20% of all the buried people.<sup>83</sup> This is explained, among others, by the fact that the main burial rite was cremation and the depth of the graves with scattered ashes is modest and they were furnished with less grave furniture than the inhumation burials. This raised the question what had happened to the 80% of the deceased population. The same problem holds true for the Late Neolithic, Early Copper Age period as well even though similar demographic analyses cannot yet be made in the case of the Lengyel culture at the present state of investigations. First it should be clarified if only a certain part of the population was buried in the cemeteries of the Linear Pottery culture and the Lengyel culture. Some researches think it evident that all the members of a community are buried in the same cemetery. This is nothing but the mechanic adaptation of ethnographic analogues to prehistoric situations. According to G. Kurth, a prehistoric anthropological series is representative only when the proportion of not adults (infans 1 and 2 and juvenile individuals) is higher than 60%.<sup>84</sup> K. Randsborg thinks that it cannot be expected that both sexes can be found in a cemetery in equal proportions from every social group.<sup>85</sup> A number of cultures and cemeteries are known from the Neolithic where probably not the entire population is present. For example, the dominance of males or females, the lack of children can be due to defective anthropological identifications, or that the researchers concentrated first of all on the more robust male skeletons, as it could be observed in the case of the Zengővárkony excavations. These problems were raised with regard to the development of the Central European Lengyel culture as well.

Nándor Kalicz finds the extension of the role of white painting to the Sopot culture questionable since vessel painting is missing from this culture in the territory of Croatia except for the younger, that is Brezovljani phase and the imported Lengyel vessels. We agree that this period is not only the period of disintegration into groups but also the time when a second significant expansion took place, which can be observed first of all in Carinthia and Slovenia. The Drava-Sava Interfluvium, however, does not belong to the border zone. Ceramics of pastose painting occurs in numerous, geographically strongly connected cultures in the territory from the Aegean to Moravia. Its chronological importance is that it appears not as an isolated phenomenon but within a large, closed region, and the Vinča-Pločnik culture played an important role in its distribution. The "prestige goods" of pastose painting, however, did not have a practical function, since the very thick chalk-like matter, applied on the surface after baking, readily peels off from the vessel. The real pastose white painting applied after baking first appeared at the beginning of the Neolithic. It is true for the Tisza, Herpály and the Lengyel culture alike, although it cannot be decided as yet where this characteristic ornamental technique came from. It more likely arrived from the south than from the north.

<sup>81</sup> L. A. Horváth: Siedlungsgeschichtliche Probleme im Karpatenbecken an der Wende des mittleren und späten Neolithikums, in: *The Late Neolithic of the Middle Danube Region. International Symposium on the Problems of the Transition from Middle to Late Neolithic in the Middle Danube Region 1997*, Timișoara. Bibliotheca Historica et Archaeologica Banatica 14 (1998) 129.

<sup>82</sup> Storch 1984–1985.

<sup>83</sup> Nieszery 1995, 16 and 19.

<sup>84</sup> G. Kurth: Paläodemographische Kriterien zur Beurteilung des Aussagewertes vor- und frühgeschichtlicher Skelettserien. *Homo* 27 (1976) 128–131.

<sup>85</sup> K. Randsborg: Social stratification in Early Bronze Age Denmark. *PZ* 49 (1974) 38–61.



The finds unearthed in the Györe cemetery, which are unique in the Central European Neolithic, especially the typological characteristic of the vessel with a band-handle unearthed in the cremation grave no. 12, yielded further data to the study of the southern, south-eastern contacts of the Lengyel culture.<sup>86</sup> The “Knopfhenkel” vessels appeared in the SE European region together with the black burnished ceramics. The first black burnished ware appeared in the Struma valley (Kováčevo) in the Balkan at the end of the Early Neolithic (Karanovo II) and it became a characteristic element of the Middle Neolithic development characterised by the ceramic material of Sitagroi I and II and Dikili Tash.<sup>87</sup> They are such super-cultural processes that led to the evolution of the Vinča culture and the Dimini-Tsangli, Karanovo III, Dudeşti, Usoe, Sopot, Kakanj and Danilo cultures in Southeastern and Central Europe.<sup>88</sup> The transition from the early to the middle Neolithic in the Balkan ran in parallel to the transition from the middle to the late Neolithic cultures in the Aegean.

At the same time, basic changes took pace in the Central European Neolithic as well, which are usually associated with influences and impacts arriving from the region of the Vinča culture. Recently, research reduced these impacts to the Sopot culture, the evolution of which could be determined by changes in the Vinča culture, and which only mediated the impacts. The south-eastern European influences manifested themselves the strongest in the western part of the Carpathian Basin at the time of the development of the Sopot II culture (Proto-Lengyel horizon).

It should be mentioned with regard to the chronological position of the above mentioned grave no. 12 from Györe that horn-shaped applications appeared already in stage IA of the Sopot culture beside the knob ornaments. The basic ornamental motives were the “Tiefstich” and the “Kerbschnitt”, techniques that had been unknown in the area until then.<sup>89</sup> S-profiles also appeared in the ceramics of the Sopot II culture on a few strongly Vinča-featured vessel types, and the earliest tumbler types of the Lengyel culture had similar profiles. This stage of the Sopot culture is the most “Vinčoid”, and the various types of the “Knopf- and Ansatzhenkel” are characteristic first of all of the find material of the Vinča culture. As it is known, the effect of the Vinča culture in the evolution of the Sopot culture appeared mainly in the radical change of pottery technology. Thus the horizon of the black burnished ceramics in the Slavonian–Sirmium region and in Transdanubia started with the Sopot culture, in parallel to the Vinča B2 and C1 stages.<sup>90</sup> It cannot be accidental that the direct antecedents of the band-handled vessel from grave no. 12 of Györe can be found in the ceramics of the Sopot II culture unearthed at Bicske-Galagonyás.<sup>91</sup> The vessel handle found at the Pepelane site (“Pepelane Typ der Sopot-Kultur”)<sup>92</sup> seems to be contemporary to the Györe find, and the item from Obre II also came from the Late Neolithic.<sup>93</sup>

<sup>86</sup> I. Zalai-Gaál: Geschlechterrollen im Spätneolithikum Südtransdanubiens. I. Die Kinder. *ActaArchHung* 54 (2003) Abb. 2 a–c, Abb. 3. 1.

<sup>87</sup> J. Lichardus – M. Lichardus-Itten: Probleme der griechischen Kupferzeit, in: *Marburger Studien zur Vor- und Frühgeschichte* 16 (Festschrift für Otto-Herman Frey zum 65. Geburtstag). Hitzeroth 1994, 377.

<sup>88</sup> M. Garašanin: Vinča i vinčanska kultura u neolitu jugoistočne Evrope. (Vinča und die Vinča-Kultur im Neolithikum Südosteuropas), in: *Vinča u praistoriji i srednjem veku*. Katalog Galerije SANU 50. Beograd 1984, 57–65, 207–211, 62; P. Raczky: A Tisza-vidék kulturális és kronológiai kapcsolatai a Balkánnal és az Égeikummal a neolitikum, rézkor időszakában [Cultural and chronological connections between the Tisza region and the Aegean–Balkan culture in the Neolithic and the Copper Age]. Szolnok 1988, 32; N. Kalicz – R. Kalicz-Schreiber: Die erste frühneolithische Fundstelle in Budapest. *Balcanica* 23 (1992) 59; N. Kalicz: The early phases of the neolithic in western Hungary (Transdanubia). *Poročilo* 21 (1993) 92; N. Kalicz: A dunántúli (közép-európai)

vonaldíszes kerámia legidősebb leletei és a korai Vinča kultúra (The oldest finds of the Transdanubian (Central European) Linear Pottery and the early Vinča culture), in: *A kökortól a középkorig*. Szeged 1994, 72.

<sup>89</sup> S. Dimitrijević: Sopotsko-lendelska kultura. *Monogr. Arch.* 1. Zagreb 1968, 28, Abb. 4. 2; Dimitrijević 1969, T. 111. 3.

<sup>90</sup> Dimitrijević 1969, 92.

<sup>91</sup> J. Makkay: Die neolithischen Funde von Bicske. *ŠZ* 17 (1969) 261, Abb. 6. 5, 7.

<sup>92</sup> K. Minichreiter: Prvi rezultati arheoloških istraživanja u Pepelanama godine 1985. *Izdanja Hrvatskog Arheološkog Društva* 14 (1990) Abb. 14. 11; Z. Marković: Sjeverna Hrvatska od neolita do bronzanog doba. Problem kontinuiteta stanovništva i kultura sjeverne Hrvatske od ranog neolita do početkabronzanog doba. *Koprivnica* 1994, 252, Taf. 3 a, 9.

<sup>93</sup> A. Benac: Obre II. Neolitsko naselje Butmirska grupe na Gornjem Polja. *Glasnik Sarajevo N.S.* 26. Sarajevo 1971, Abb. 112. 16; L. Streud – A.-K. Streud: A quantitative analyses of the material remains. *WMBHL IVA* (1974) fig. 21. 5 a–b.



According to the actual results of investigations, the southern, south-eastern influences could arrive in Southern Transdanubia along the Sió and the Sárköz, from which respect the region of Nagytétény could also be important.<sup>94</sup> Recently research supposed a third route as well at the end of the evolution of the Vinča culture, the stages of which are marked by the Vinča, Obrež-Beletinci, Gomolava, Babska, Sopot, Seče and Balatonmagyaród-Hídvégpuszta sites.<sup>95</sup>

At the examination of the Late Neolithic burials in the Hungarian Plain, I really did not go beyond the earlier known data, in this case I only intended to demonstrate similarities with the burials of the Lengyel culture. The burial customs of the two territories and cultural entities can be compared only when the Neolithic burials of the Hungarian Plain will be evaluated with the same method as the ones of the Lengyel culture. The contacts between the Lengyel and the Tisza culture can be studied at the present state of research at Aszód and Bicske, although Nándor Kalicz does not owe a special chronological importance to the Tisza finds uncovered here being too fragmentary and since the ornamental motives are not really characteristic. Only a few Tisza sherds are known from Mórág-Tűzködomb as well, a few of which were found above the graves of the Lengyel Ib phase, while the rest were stray finds.<sup>96</sup> Nándor Kalicz agrees with me that the best analogues are known from Gorzsa. Based on these finds the Lengyel Ib–2a, that is the “copper horizon” seems to be contemporary to the oldest D–C phases of Gorzsa. He thinks to find proofs of a southern contact beside the northern, E–W oriented contact system, which can be demonstrated at Aszód.

Tibor Kemenczei also accepts the theory cited by many specialists that the individuals buried with unique or numerous grave goods had a prominent role in the community and that certain grave-goods had a symbolic role. He raises the question what spiritual background can lie behind placing querns in the graves. János Makkay,<sup>97</sup> M. Lichardus-Itten<sup>98</sup> and M. Dohrn-Ihmig<sup>99</sup> discussed the phenomenon in details. Entire querns are known only from three graves of the Lengyel culture in Southern Transdanubia. In many other graves we found fragments called rubbing or polishing stone. Idols, grave vessels of unusual types and animal grave-goods (first of all *Canis familiaris*), which can be linked with fertility cult, also raise problems, which I have already published, classified and discussed a few studies.<sup>100</sup> I also intend to prepare a book on the religious historical evaluation with a complex, European review. It should be mentioned concerning the archaeological interpretations of the fertility cults, which are treated as evidences (“fertility goddess”, “Great Mother Goddess”, “Mother Earth”, etc.), that their religious historical background can be led back to studies by J. Mannhardt,<sup>101</sup> G. Frazer<sup>102</sup> and M. Malinowski,<sup>103</sup> which were based on even older concepts from the 19<sup>th</sup> century. There are very few object that support the theory of a “fertility paradigm”. The archaeological finds we have only afford to find the place of the items of figural art in space and time and in the relevant social and economic systems.

From the discussed Southern Transdanubian Lengyel burials, 6.5% represents the group of uncommon grave furniture. Tibor Kemenczei mentions that this means the total period of the use

<sup>94</sup> J. Makkay: A kőkor és rézkor Fejér megyében [Palaeolithic and Copper Age in Fejér County]. Székesfehérvár 1970, 31; Kalicz 1985, 81.

<sup>95</sup> E. Bánffy: Vinča impacts on late neolithic/early chalcolithic Transdanubia, in: The Vinča culture, its role and cultural connections. Timișoara 1996, 328.

<sup>96</sup> I. Zalai-Gaál: Theiß-Importe aus Mórág-Tűzködomb. *Antaeus* 25 (2002) Abb. 1. 1–6, Abb. 2. 1–3.

<sup>97</sup> J. Makkay: Mahlstein und rituales Malen in den prähistorischen Opferzeremonien. *ActaArchHung* 30 (1978) 13–36.

<sup>98</sup> Lichardus-Itten 1980.

<sup>99</sup> Dohrn-Ihmig 1983.

<sup>100</sup> I. Zalai-Gaál: Ein Bothros und die neolithische anthropomorphe Idolplastik von Mórág-Tűzködomb. *WMME* 18 (1993) 3–46; I. Zalai-

Gaál: Betrachtungen über die kultische Bedeutung des Hundes im mitteleuropäischen Neolithikum. *ActaArchHung* 46 (1994) 33–57; I. Zalai-Gaál: Neufunde der neolithischen anthropomorphen Idolplastik im südlichen Transdanubien. *WMME* 19 (1996) 57–87; I. Zalai-Gaál: Die applizierte Tierplastik der Lengyel-Kultur. *ActaArchHung* 50 (1998) 43–90; I. Zalai-Gaál: A győrei neolitikus antropomorf edény (Neolithic anthropomorphic vessel from Györe). *WMME* 22 (2000) 7–38; I. Zalai-Gaál: Eine besondere Art spätneolithischer Grabbeigaben: die Tiergefäße der Lengyel-Kultur. *MAGW* 132 (2002) 175–193.

<sup>101</sup> J. Mannhardt 1963.

<sup>102</sup> J. G. Frazer: *Az aranyág* (The golden bough. A study in magic and religion). Budapest 1965.

<sup>103</sup> B. Malinowski: *Baloma*. Budapest 1972.



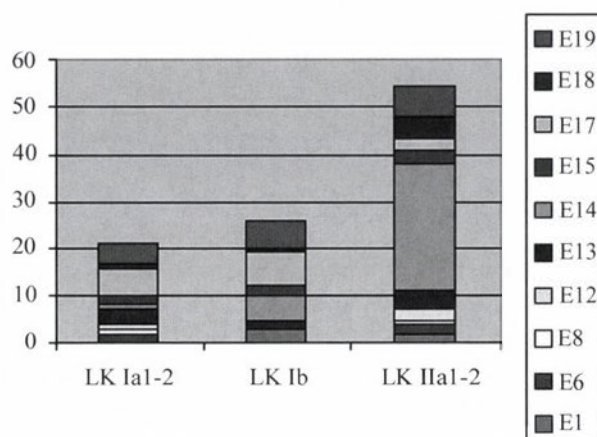


diagram 2. Distribution of tool custom groups by horizons

of the cemetery so it cannot be told how the proportion changed in the individual periods of the Lengyel culture and thus we cannot follow the changes of the social structure. The small item number did not always afford us to trace the changes in the periods or horizons in the case of uncommon burials. Only 1.0% (6) of the graves with grave furniture contained anthropomorphic or zoomorphic objects in Southern Transdanubia. They usually occur in only a single grave in a cemetery except grave group B1 at Mórág, where animal-shaped ceramics characterised the burials of two young women. In the Zengővárkony graves we do not know the sex of the buried persons, yet the finding circumstances of burial no. 214 imply that the zoomorphic (bear-shaped) vessel was placed beside a male. The remains of *Canis familiaris* were found in only 0.5% (3) of the graves with grave furniture in Southern Transdanubia. An entire dog was placed beside the dead in burial no. 10 at Mórág and no. 128 at Zengővárkony, while grave no. 119 at Zengővárkony contained the skull of a dog. In all the three graves the skeletons were strongly crouched, and placed in a specific position, different from the rest of the skeletons. The grave furniture was unusually rich from the respect of both the quantity and the composition. Placing a pig jaw in the graves also appeared in the Carpathian Basin in the Late Neolithic. In Southern Transdanubia, however, only 1.0% (6) of the burials contained this type of grave furniture, and all of them were discovered on the southern side of grave group no. 9 at Zengővárkony. In five graves even the skull was missing. As it has already been mentioned, only 3 graves (0.5%) contained querns in the Southern Transdanubian cemeteries of the Lengyel culture. Only a single grave contained such a find at Zengővárkony, where the skull was missing. The quern was placed under the skull of a girl of inf. 2 age in grave no. 46 of the Mórág cemetery. It showed the remains of red paint on the surface, which is an important contribution to the determination of the function of these objects. The symbolic meaning of the rubbing stones placed beside

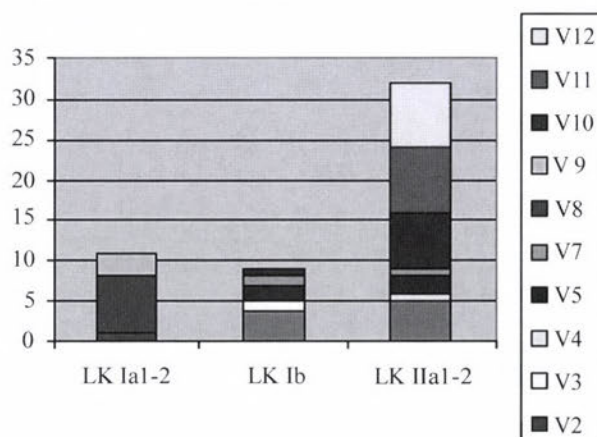


diagram 3. Distribution of jewellery custom groups by horizons

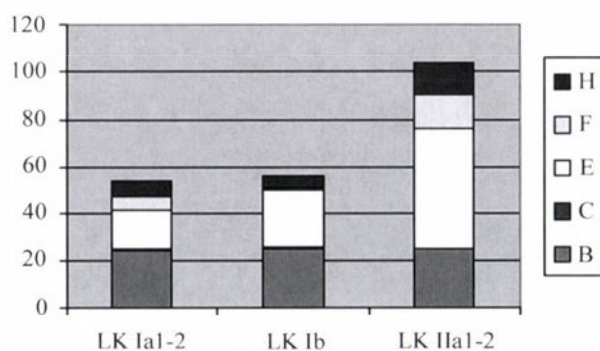


diagram 4. Distribution of find groups by horizons

the dead (in 4.1% of the graves, 24) is also proved by the fact that the skulls were missing in 11 graves of this character. The frequency of the occurrence of querns and rubbing stones in the individual cemeteries is connected not only with the contemporary social archaeological conditions but also with the relative chronological position of the burials.

The correlations and the structural changes were analysed in chapter 5 of my study. Here I only wish to hint at the results indicating the changes by cemetery horizons in the diagrams. At the analysis of the feature groups, 14 units of grave furniture, 19 tool and 12 jewellery/articles of wearunits were separated and they were determined as custom groups (*diagrams 2–3*):

From a methodologically point of view, the choice of the criteria after which the certain analytical units were distinguished was the crucial point. After the analysis of the correlation of custom groups, the find group categories were analysed by cemeteries, and finally the combinatory statistical analysis of the graves and the find groups was carried out with the definition of the combination groups and the examination of the group formation of the burials. The distribution of the find groups by horizons is illustrated in *diagram 4* (A: burials without grave furniture, B: only grave furniture, C: only tool finds, D: only jewellery/articles of ware finds, E: grave furniture and tool finds, F: grave furniture and jewellery finds, G: tool and jewellery finds, H: grave furniture, tool and jewellery finds):

The seriation analysis of the correlation between grave furniture, tool and jewellery groups by graves yielded further data on the social archaeological conditions of the Lengyel population in Southern Transdanubia. Here we examined the custom groups that occurred in more than two graves, and we examined only those 285 graves where more than one custom group could be distinguished. In these burials, the custom groups of grave furniture, tool and jewellery form 85 find group combinations. To enable a more detailed analysis of group formation and order between burials, the burials that represent the above 85 grave find group combinations were separated into 11 find ranges after the differences ("richness") we could observe between them (with the find group combinations in brackets). Their distribution by horizons is illustrated in *diagram 5*.

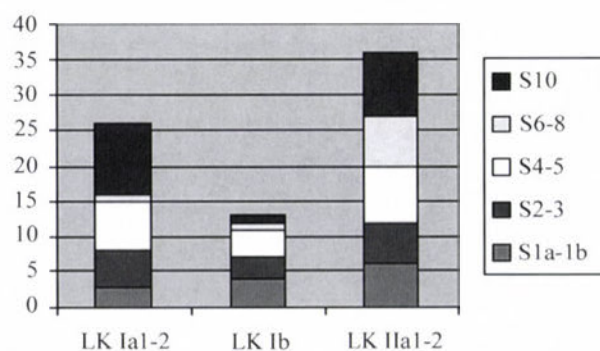


diagram 5. Distribution of find range groups by horizons



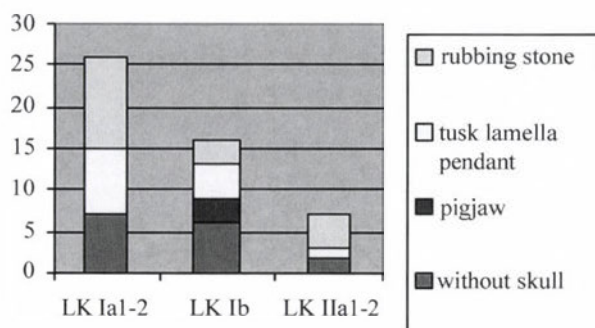


diagram 6. Distribution of uncommon burials by horizons

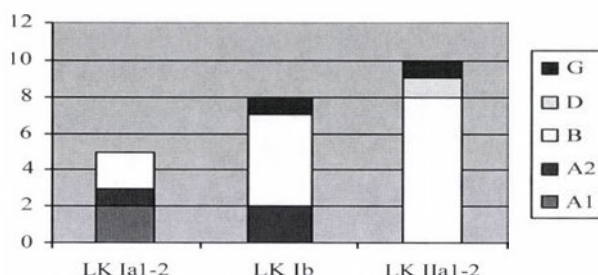


diagram 7: Distribution of burials with various stone axe types by periods

The proportional divergences, differences and changes between the individual horizons are conspicuous in the case of the above-mentioned uncommon burials as well (*diagram 6*):

The same method was used for the analysis of the number of the vessels (*diagram 1*), the stone axe types (*diagram 7*) and the silex tools (*diagram 8*) by graves and the distribution of the various tool types (*diagram 9*) and the imported wares (*diagram 10*) by horizons. Significant conclusions could be drawn regarding the development of the economic conditions and their changes in time. Tibor Kemenczei concluded that the burial custom groups including various object types, the differentiation of the finds groups of tools, jewellery and articles of ware and the tables of their combinations afforded the determination of grave groups within the individual cemeteries and established the ratio of graves with richer grave goods than the rest, from which we can draw conclusions concerning the social differentiation of the community that used the cemetery. Another question that could be answered was in what other elements of the culture this so-called development appeared beside the changes that could be demonstrated in ceramics.

The analysis of the custom groups uncovered not only that there were rich and poor people and people of a special, undetermined status in the Lengyel communities. Within the supposed community, I could also analyse the stratification on several levels.

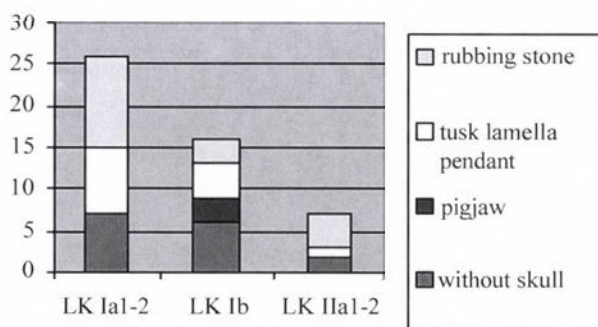


diagram 8: Number of silex tools in the individual graves by horizons

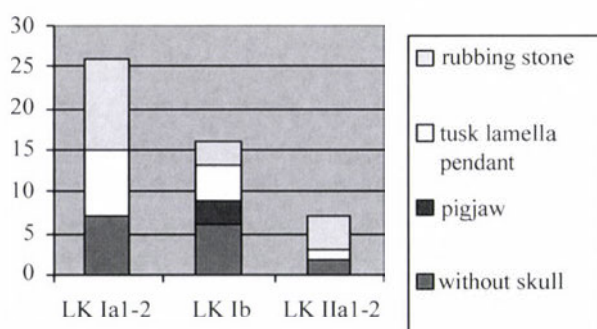


diagram 9: Distribution of burials with stone axes, stone adzes, silex and bone tools by horizons

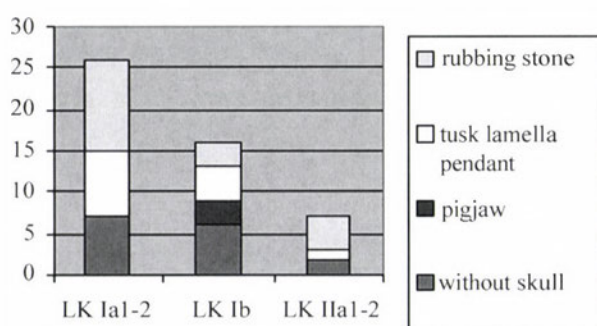


diagram 10: Distribution of burials with imported wares by horizons

According to Tibor Kemenczei, more space could have been dedicated to the economic, technical historical and natural geographic factors that contributed to the evolution of the identities and similar features of the social conditions, burial customs, cults and handicrafts in the Lengyel, Tisza, Vinča and Sopot cultures. The population groups of these cultures mostly lived at the same time in neighbouring territories within similar geographical and climatic conditions, and influenced one another. Judged from the tool finds, their way of life and activities must have been similar and a significant identity can be discovered in their burial customs, which can indicate similar social organisations. Most of the common traits appear in a cultic-religious field. Idols, anthropomorphic and zoomorphic vessels of identical shapes occur in the eastern group of the Lengyel culture from Svodín (Szögyén) through Aszód to Mórág, that is from the north to the south. Pál Racky published the fragments of the "Svodín type" anthropomorphic vessels of the Lengyel culture from Polgár-Csőszhalom,<sup>104</sup> and we can find cultic objects of similar features although of different shapes in the Tisza and Herpály cultures. In these cases, research supposes common roots, impacts arriving from the south, southeast. The technical changes of tools and weapons can clearly be followed in the finds of the Lengyel culture.<sup>105</sup> The same will be possible at the Late Neolithic cultures of the Hungarian Plain after the publication of the large excavation materials of the last decades.

In the description of the outlined social conditions, we included the explanations about the kinship systems, the lineage, the concept of endogamy and exogamy, the role of ages

<sup>104</sup> P. Racky: Evidence of contacts between the Lengyel and Tisza-Herpály Cultures at the late neolithic of Polgár-Csőszhalom. *BudRég* 36 (2002) Fig. 1. 1 a-c, 2 a-c, 3.

<sup>105</sup> I. Zalai-Gaál: Die chronologische und soziale Bedeutung der Mitgabe von Steinäxten in den spätneolithischen Gräbern Südtransdanubiens, in: *Kupferzeit* 1991, 389-399; I. Zalai-Gaál: Typologie und Chronologie des geschliffenen

Steingerätbestandes der Lengyel-Kultur im südlichen Transdanubien, in: J. Regénye (ed.): *Sites and Stones. Lengyel-Culture in Western Hungary and Beyond. A Review if the Current Research.* Lengyel '99 and IGCP-442 Conference Veszprém, 1999. Veszprém 2001, 81-85; I. Zalai-Gaál: Der spätneolithische geschliffene Steingerätbestand in Südtransdanubien. I. Die analytische Bearbeitung des Fundmaterials. *WMMÉ* 24 (2002) 7-79.



and organisation collected from the technical literature. They are the results of ethnologic investigations made on living populations, which I tried to use as analogues to the communities of the Lengyel culture. One of the greatest hindrances of the analyses of the prehistoric community conditions is the hardly surmountable attitude that we use the concepts of our own age and society to interpret the phenomena. Another characteristic of the investigation of prehistoric conditions is the generalised approach to archaic societies, which is characteristic even to date.<sup>106</sup> The anthropological models we can use are too general, and the varieties in the archaeological records are difficult to categorise for comparative studies.<sup>107</sup> Regional differences and features appear in every site, so it cannot be expected that they perfectly fit into the typological systems set up in anthropological theories. As we could see, the archaeological data on burials offer an excellent opportunity for the analysis of the organisational forms since a cemetery is the result of the chronologically long-term activity of a certain closed human group, which is cohered by a network of kinship relationships, common ideological ideas and economic interests. Thus we found the study of kinship relationships indispensable on the condition that, beside historical peoples and ethnologic communities, the Neolithic populations also lived in kinship systems and took record of the lineage. As we could see the analysis of kinship is the most difficult part of social anthropology not only in the case of prehistoric societies but also in ethnologic communities. Taking into consideration, however, the table in which Murdock illustrates, in a sample of 250 societies, 193 unilateral organisations of the types of kinship groups and their attitude to exogamy,<sup>108</sup> we can understand that no prehistoric analysis in itself can solve the issues related to kinship systems, and the only help we can expect in the future is DNA test. In connection to Imre Lengyel's serogenetic studies we have already discussed the problems of endogamy and exogamy since the examined population fragment can be regarded endogamous after its serological features. The degree of endogamy, however, is not known.

As I have already mentioned, I intend to publish the two main parts of the thesis, the results of the typological-chronological analyses of the ceramics and the social archaeological research in a significantly enlarged form in two separate volumes. In these studies I will use the pieces of advice of my opponents, the latest social archaeological materials published in the technical literature, which have not evaded my attention but I will need more time to study them in order to answer the emerged questions and problems.

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## CORRIGENDA

in: *István Zalai-Gaál: Possibilities of the social-archaeological studies of the Neolithic, 468-469.*

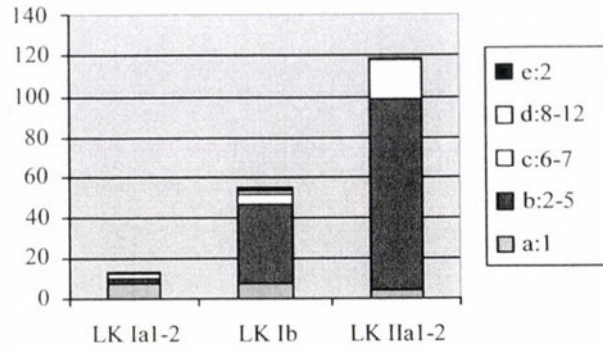


diagram 8: Number of silex tools in the individual graves by horizons

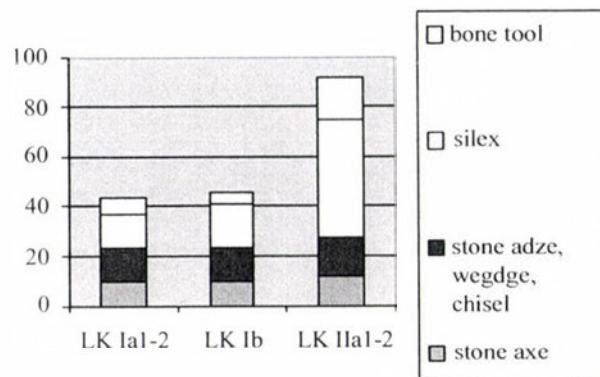


diagram 9: Distribution of burials with stone axes, stone adzes, silex and bone tools by horizons

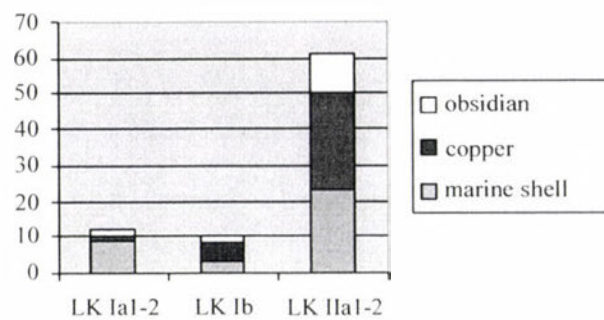


diagram 10: Distribution of burials with imported wares by horizons









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