ENVIRONMENTAL ARCHAEOLOGY IN NORTH-EASTERN HUNGARY

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Environmental Archaeology in North-Eastern Hungary

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Edited by

Erika Gál – Imola Juhász – Pál Sümegi

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Magdaléna Seleanu

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View of the Nyírjes peat bog at Sirok

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This volume is dedicated to

Gyula Kerékgyártó,

an amateur archaeologist in Jászberény,

who discovered many Palaeolithic,

Mesolithic and other archaeological sites

in the Jászság

CONTENTS

FOREWORD

Even though analytical and environmental studies linked to archaeological research and archaeological sites have been conducted for over one hundred years in Hungary, these were rarely intertwined until recently. Only in the case of the monographic publication of a particular site were the findings of archaeological research and various analytical results published together.

It is quite obvious that any area, which has been settled by ancient communities, bears an imprint of the one-time presence of these communities. The natural geomorphologic, climatic and ecologic dynamics of a particular region determined the environment with which ancient communities interacted. They adapted to the environment and, depending on their options and capabilities, they tried to manipulate natural processes and transform the environment to suit their needs. Holocene sedimentary sequences, river regulations, forest management and the finds reflecting various aspects of hunter-gatherer lifeways or crop cultivation and stockbreeding reveal at least as much about the subsistence strategies of ancient populations as about their environment.

Many communities were forced to migrate from their ancestral homeland in prehistoric and historic times; however, these groups took with them their culture and deep-rooted customs, which they preserved in their new homeland and passed on to their descendants. Neighbouring peoples first became acquainted with each others' raw materials and artefacts through the exchange of various commodities; later, they intermixed and learnt about each others' culture, blending the centuries or perhaps millennium long traditions.

A number of volumes presenting the newest findings of Hungarian and European archaeologists, palaeoenvironmentalists and geoarchaeologists have already been published as part of the research project aimed at reconstructing Hungary's Holocene environment. This volume presents the results of the palaeoenvironmental and archaeological studies conducted in north-eastern Hungary. The geoarchaeological borings conducted over the past few years have resulted in continuous sequences, which yielded invaluable data for reconstructing past environments and climates through the sedimentological, palaeobotanical and malacological analyses of these sequences. The series of radiocarbon dates obtained for these sequences provide a reliable chronological framework for the finds. The overview of the sites and archaeological finds from the study areas has been written by archaeologists, who have included new finds from the areas and have offered new interpretations of old ones. The discussion of the animal bone samples from the archaeological sites provides an insight into the species of a particular age and area, and also an idea of hunting and animal breeding strategies.

The increasing corpus of data, the results of new research projects and the analyses of their findings often result in controversial and, sometimes, conflicting conclusions, which reflect the kaleidoscopic nature of our knowledge in this field and the plurality of possible approaches. We have respected the diversity of opinions of the scholars contributing to this volume and have also included studies, which will hopefully provoke further debates. It is our hope that this volume will prove to be a useful and valuable companion to present and future generations of scholars studying ancient man and his environment.

Erika Gál

LIST OF CONTRIBUTORS

Gábor Bácsmegi
Kubinyi Ferenc Museum
3170 Szécsény, Ady E. u. 7, Hungary
e-mail: bacsmegi@freemail.hu

Eszter Bánffy
Archaeological Institute of the Hungarian Academy of Sciences
1014 Budapest, Úri u. 49, Hungary
e-mail: banffy@archeo.mta.hu

Elvira Bodor
Geological Institute of Hungary
1143 Budapest, Stefánia út 14, Hungary
e-mail: tnagy@axelero.hu

Mihály Braun
Department of Inorganic and Analytical Chemistry, University of Debrecen
4010 Debrecen, Egyetem tér 1, Hungary
e-mail: braun@tigris.klte.hu

Piroska Csengeri
Herman Ottó Museum
3528 Miskolc, Görgey út 28, Hungary
e-mail: csengerip@hermuz.hu

János Dani
Déri Museum
4026 Debrecen, Déri tér 1, Hungary
e-mail: dani@derimuz.hu

Szilvia Fábián
Archaeological Institute of the Hungarian Academy of Sciences
1014 Budapest, Úri u. 49, Hungary
e-mail: fabian@archeo.mta.hu

Erika Gál
Archaeological Institute of the Hungarian Academy of Sciences
1014 Budapest, Úri u. 49, Hungary
e-mail: gal@archeo.mta.hu

Adam Gardner
Ovid Technologies Ltd.
250 Waterloo Road, London, SE1 8RD, United Kingdom
e-mail: agardner@ovid.com

Magdolna B. Hellebrandt
Herman Ottó Museum
3528 Miskolc, Görgey út 28, Hungary
e-mail: safrany@hermuz.hu

Gusztáv Jakab
Department of Geology and Palaeontology, University of Szeged
6722 Szeged, Egyetem u. 2–6, Hungary
e-mail: cembra@freemail.hu

Imola Juhász
Archaeological Institute of the Hungarian Academy of Sciences
1014 Budapest, Úri u. 49, Hungary
e-mail: juhasz@archeo.mta.hu

Viktória Kiss
Archaeological Institute of the Hungarian Academy of Sciences
1014 Budapest, Úri u. 49, Hungary
e-mail: kissv@archeo.mta.hu

Tomasz Kalicki
Institute of Geography and Spatial Organisation, Polish Academy of Sciences
31018 Kraków, ul. Sw. Jana 22, Poland
e-mail: kalicki@zg.pan.krakow.pl

Janusz K. Kozłowski
Institute of Archaeology, Jagiellonian University
31007 Kraków, ul. Gołębia 11, Poland
e-mail: kozlowsk@argo.hist.uj.edu.pl

Gabriella Kulcsár
Archaeological Institute of the Hungarian Academy of Sciences
1014 Budapest, Úri u. 49, Hungary
e-mail: kulcsar@archeo.mta.hu

Péter Langó
Archaeological Institute of the Hungarian Academy of Sciences
1014 Budapest, Úri u. 49, Hungary
e-mail: lango@archeo.mta.hu

Zita Margitai
Department of Inorganic and Analytical Chemistry, University of Debrecen
4010 Debrecen, Egyetem tér 1, Hungary
e-mail: margitaiz@freemail.hu

Károly Mesterházy
Hungarian National Museum
1088 Budapest, Múzeum krt. 14–16, Hungary

Marek Nowak
Institute of Archaeology, Jagiellonian University
31007 Kraków, ul. Gołębia 11, Poland
e-mail: nowak@argo.hist.uj.edu.pl.

Róbert Patay
Árpád Museum
2300 Ráckeve, Kossuth Lajos u. 34, Hungay
e-mail: patayr@freemail.hu

Tamás Pusztai
Herman Ottó Museum
3528 Miskolc, Görgey út 28, Hungary
e-mail: pusztai@hermuz.hu

Andrea Somogyi
European Synchrotron Radiation Facility
38043 Grenoble, 6 rue Jules Horowitz, France
e-mail: somogyia@esrf.fr

Pál Sümegi
Department of Geology and Palaeontology, University of Szeged
6722 Szeged, Egyetem u. 2–6, Hungary
e-mail: sumegi@geo.u-szeged.hu

Imre Szalóki
Institute of Experimental Physics, University of Debrecen
4026 Debrecen, Bem tér 18, Hungary
e-mail: szaloki@tigris.klte.hu

Miklós Takács
Archaeological Institute of the Hungarian Academy of Sciences
1014 Budapest, Úri u. 49, Hungary
e-mail: takacs@archeo.mta.hu

Albert Tóth
Department of Applied Ecology, University of Debrecen
4010 Debrecen, Egyetem tér 1, Hungary
e-mail: a_toth@delfin.klte.hu

Tünde Törőcsik
Science and Information Centre, University of Szeged
6722 Szeged, Ady tér 10, Hungary

Andrea Vaday
Archaeological Institute of the Hungarian Academy of Sciences
1014 Budapest, Úri u. 49, Hungary
e-mail: vaday@archeo.mta.hu

Marián Vizdal
Philosophical Faculty, Prešov University
08001 Prešov, ul. 17. novembra 1, Slovakia
e-mail: tomasko@unipo.sk

Katherine Jane Willis
School of Geography and the Environment, University of Oxford
Mansfield Road, Oxford, OX1 3TB, United Kingdom
e-mail: kathy.willis@geog.ox.ac.uk

Csilla Zatykó
Archaeological Institute of the Hungarian Academy of Sciences
1014 Budapest, Úri u. 49, Hungary
e-mail: zatyko@archeo.mta.hu

PRE-NEOLITHIC DEVELOPMENT IN NORTH-EASTERN HUNGARY

Pál Sümegi

INTRODUCTION

Two major chronological units, namely an Early Mesolithic and a Late Mesolithic, have been recently distinguished in the Mesolithic of the Carpathian Basin on the basis of the latest findings from sites in the Jászság region and the re-evaluation of data from other, earlier investigated Mesolithic sites.[1] In addition to the Szekszárd–Palánk site,[2] the Sződliget site[3] too was dated to the Early Mesolithic.[4] The later phase of the Mesolithic was further subdivided into several phases by Róbert Kertész on the basis of typological investigations carried out at several Mesolithic sites in the Jászság region.[5] He distinguished an earlier phase (Jászberény), which he correlated with the Boreal, and a later phase (Jásztelek), dated to the Early Atlantic.[6] Róbert Kertész correlated Barca I,[7] Sered,[8] Mostová,[9] Tomášikovo, and the Czech and Austrian sites at Smolín,[10] Přibice[11] and Kamegg, Limberg–Mühlberg with his Jászberény phase,[12] while the Jásztelek I site was tentatively correlated with Tarpa–Márki tanya in the Tiszahát region,[13] Kaposhomok in Transdanubia,[14] Ciumeşti/Csomaköz II,[15] Kamenitsa I in the Sub-Carpathians[16] on the basis of their stone tools.[17]

This paper presents the results of a research project focusing on the environmental history of the Carpathian Basin during the Late Mesolithic. Before the advent of the Neolithic, several profound changes took place in the material culture of the Late Mesolithic groups of Europe, which had an intensive impact on the environment and which can be clearly traced both in the composition of the sediments and in the palaeontological record. The uniform transformation of stone tools has been regarded as an important element of pre-Neolithic development both in the Balkans and in Central Europe.[18] Consequently, we sought an answer to the question of whether there are any visible signs of pre-Neolithic human impacts in Hungarian Holocene profiles, an important source of data for environmental

1 *Kertész* (1993).
2 *L. Vértes:* Die Ausgrabungen in Szekszárd–Palánk und die archäologischen Funde. Swiatowit 24 (1962) 159–202.
3 *Gábori M.:* Mezolitikus leletek Sződligetről. ArchÉrt 83 (1956) 177–182; *M. Gábori:* Mesolithischer Zeltgrundriss in Sződliget. ActaArchHung 20 (1968) 33–36.
4 *Kertész* (1993); *Kertész* (1996a); *Kertész* (1996b).
5 *Kertész* (1993).
6 *Kertész* (1994a); *Kertész* (1994b).
7 *Prošek* (1959).
8 *J. Bárta:* Pleistocénne piesocné duny pri Seredi a ich paleolitické a mezolitické osídlenie. SlovArch 5 (1957) 5–72.
9 *Bárta* (1980).
10 *K. Valoch:* The Mesolithic Site of Smolín, South Moravia. *In:* The Mesolithic in Europe. Ed.: C. Bonsall. Edinburgh 1985, 461–470.
11 *K. Valoch:* Eine endpaläolithische Industrie von Pribice (Bez. Breclav) in Südmähren. Casopis Moravského Musea v Brne 60 (1975) 45–78.
12 *Kertész* (1993); *Kertész* (1996a); *Kertész* (1996b).
13 *T. Dobosi V.:* Tarpa. RégFüz I. 22. Budapest 1969, 22; *T. Dobosi V.:* Ásatás Tarpa–Márki tanyán. CommArchHung (1983) 5–18; *Szathmáry L.:* A Déri Múzeum mezolitikus leleteiről. Magyar Kurír 26 (1978) 3–6.
14 *Pusztai R.:* Mezolitikus leletek Somogyból. JPMÉ (1957) 96–104.
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16 *L. G. Matskevoi:* Mezolit Predkarpatya, zapadnogo Podolya i Zakarpatya. *In:* Arkheologiya Prikarpatya, Volyni i Zakarpatya (Kamennyi Vek). Kiev 1987, 75–89.
17 *Kertész* (1993); *Kertész* (1996a); *Kertész* (1996b).
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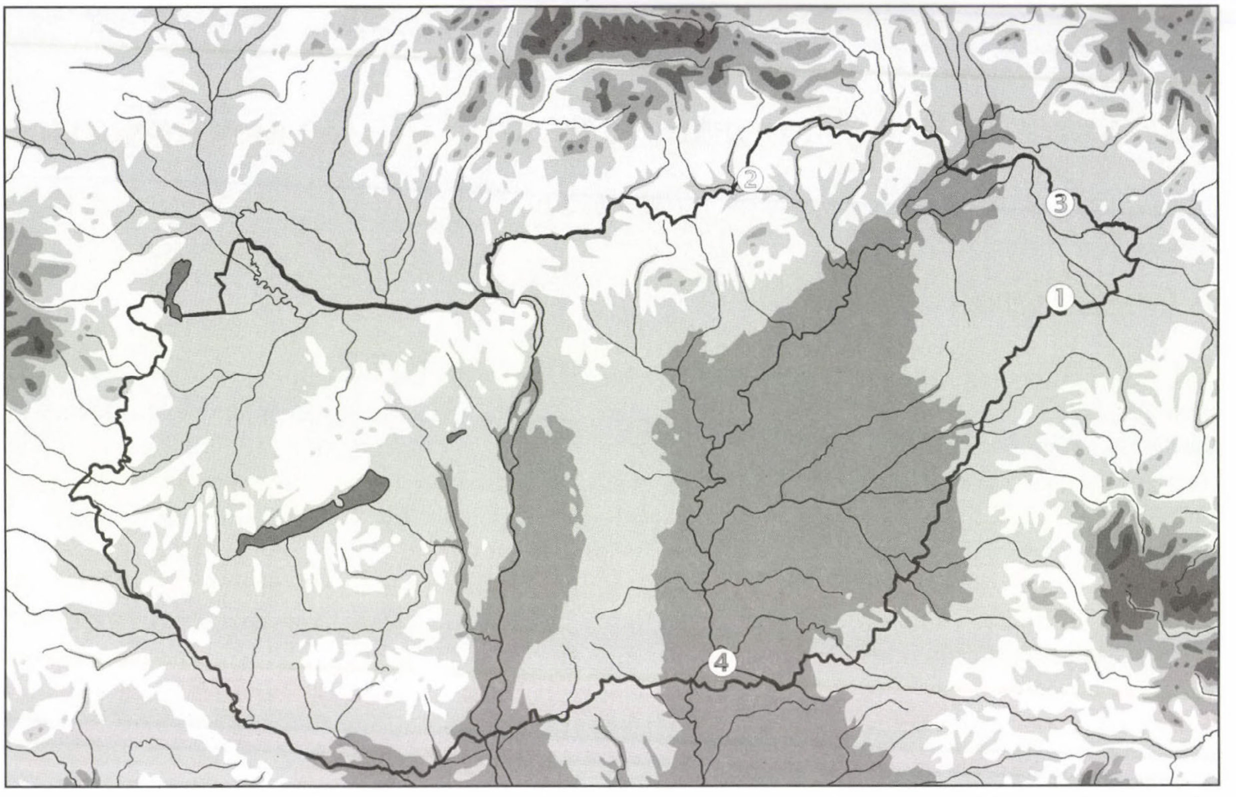

Fig. 1. Palaeoenvironmental sampling locations in Hungary
1. Bátorliget marshland, 2. Kelemér–Nagy-Mohos-tó and Kis-Mohos-tó, 3. Csaroda–Nyíres-tó, 4. Szeged–Gorzsa-Batida

history studies, and if so, in which areas they can be demonstrated. Parallel to these investigations, we also attempted to clarify the nature of pre-Neolithic human impact on the environment.[19]

THE STUDY AREAS

The present paper focuses on the analyses of the most recent and most important Hungarian Holocene profiles *(Fig. 1)*, chiefly the profiles from the Bátorliget marshland[20] and Nagy-Mohos at Kelemér;[21] contemporaneous horizons from other profiles have also been included in our investigation *(Figs 2–3)*.

From 9200 BP (8400 calBC), in the second half of the Mesolithic, linden (*Tilia*) gradually declined in the Bátorliget area, parallel to the advent of oak (*Quercus*). According to the pollen data, a closed oak woodland developed under the more balanced, milder, and wetter climatic conditions. The composition of the mollusc remains and the dominance of the species-rich forest dwelling fauna, as well as the emergence of an *Anisus spirorbis–Ruthenica filograna–Discus perspectivus* palaeoassociation point towards the formation of a closed forest vegetation. Similar changes have been observed at 9200 BP (8400 calBC) in the profile from Nyíres-tó at Csaroda[22] and the profile from Kis-Mohos at Kelemér.[23] According to our findings, the Mesolithic hunter-fisher-gatherer communities apparently populated the closed oak forests in the north-eastern parts of the Great Hungarian Plain and the Carpathian foreland,

19 Our research was generously funded by two grants: OTKA T-034 392 and NKFP 5/0063/2002.
20 *Sümegi* (1996).
21 *Magyari et alii* (2002).
22 *Sümegi* (1999).
23 *Willis et alii* (1998).

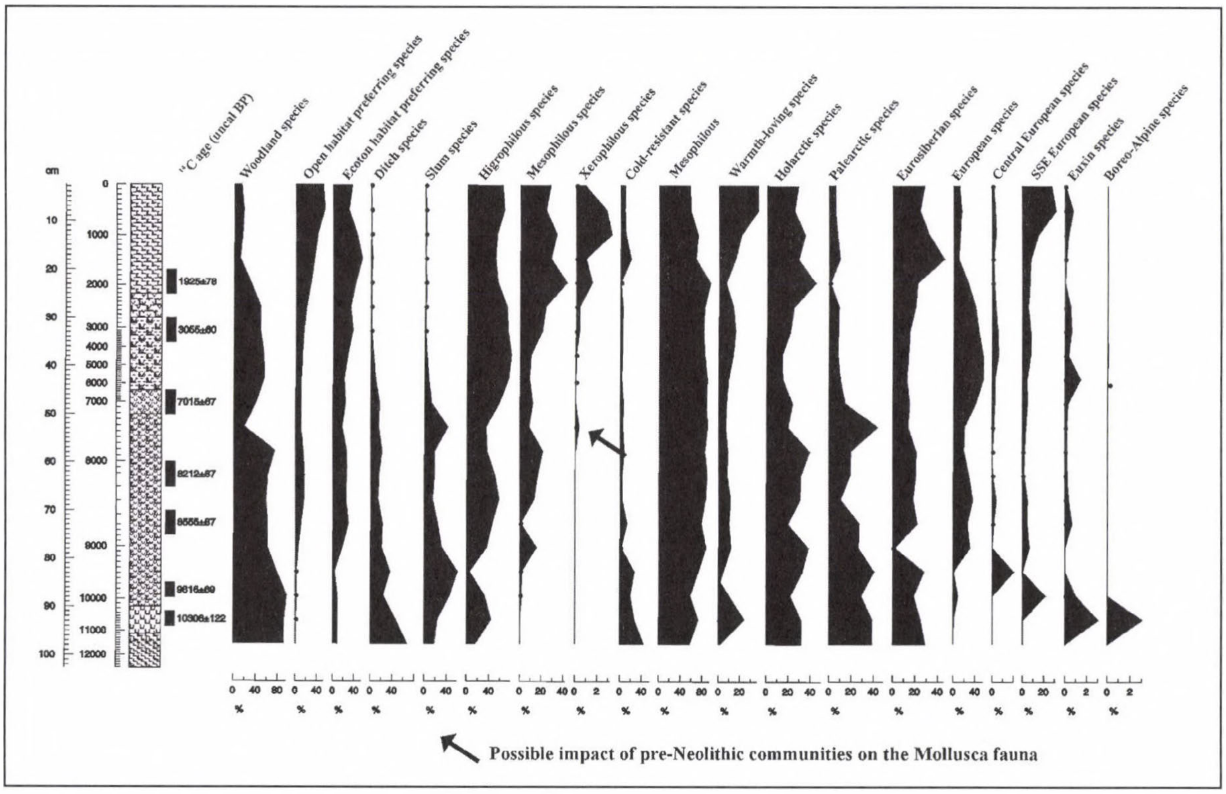

Fig. 2. Impact of pre-Neolithic communities on the environment as reflected by the changes in the Early Holocene Mollusca fauna from the Bátorliget marshland

which provided sufficient water supplies. The pollen profile[24] and the radiocarbon dates[25] of the deposits of an oxbow lake lying between Mesolithic settlement sites near Jászberény similarly indicated the development of a closed gallery forest dominated by oak at 9200 BP (8400 calBC).

The malacological data indicate that mean July palaeotemperatures were quite high (reaching 22 °C), exceeding even the current values.[26] The pollen composition of the cores taken from the central part of the Bátorliget marshland similarly suggested a mean July palaeotemperature of 20–21 °C for this period,[27] especially after accounting for the values of the warmest months using the method developed for recent pollen data.[28] These data imply a temperature peak of a warming phase, even though they differ significantly from the values gained for the entire area of the Great Hungarian Plain on the basis of earlier pollen data (a mean July palaeotemperature of 24–25 °C).[29]

The palaeoenvironmental changes at the Pleistocene/Holocene boundary reflected in the Bátorliget profile and other profiles from the northern part of the Great Hungarian Plain correlate well with the environmental transformation noted at the coastal settlement of a Mesolithic community at Franchthi Cave in Greece, indicated by the changes in the composition of the malacofauna, namely in the appearance

24 *Kertész et alii* (1994).

25 *Sümegi P.:* Jászsági adatok a magyarországi holocén rétegtani és őskörnyezettani vitás kérdéseihez. 5. Magyar Őslénytani Vándorgyűlés Kiadványa. Pásztó 2002.

26 *Sümegi et alii* (1996).

27 *K. J. Willis – P. Sümegi – M. Braun – A. Tóth:* The Late Quaternary environmental history of Bátorliget, N.E. Hungary. Palaeogeography, Palaeoclimatology, Palaeoecology 118 (1995) 25–47.

28 *B. A. Davis – S. Brewer – T. Stevenson – S. Juggings:* High resolution from low resolution: a new method for time-series pollen-climate reconstruction and its application in investigating abrupt Holocene climate change in Southern Europe/Mediterranean. *In:* PAGES–PEPIII Conference: Past Climate Variability through Europe and Africa, August 27–31, 2001. Abstract book. Aix-en-Provence 2001.

29 *Járainé-Komlódi M.:* Adatok az Alföld klíma- és vegetációtörténetéhez I. BotKözl 53 (1966) 191–201; *Járainé-Komlódi M.:* Adatok az Alföld klíma- és vegetációtörténetéhez II. BotKözl 56 (1969) 43–55.

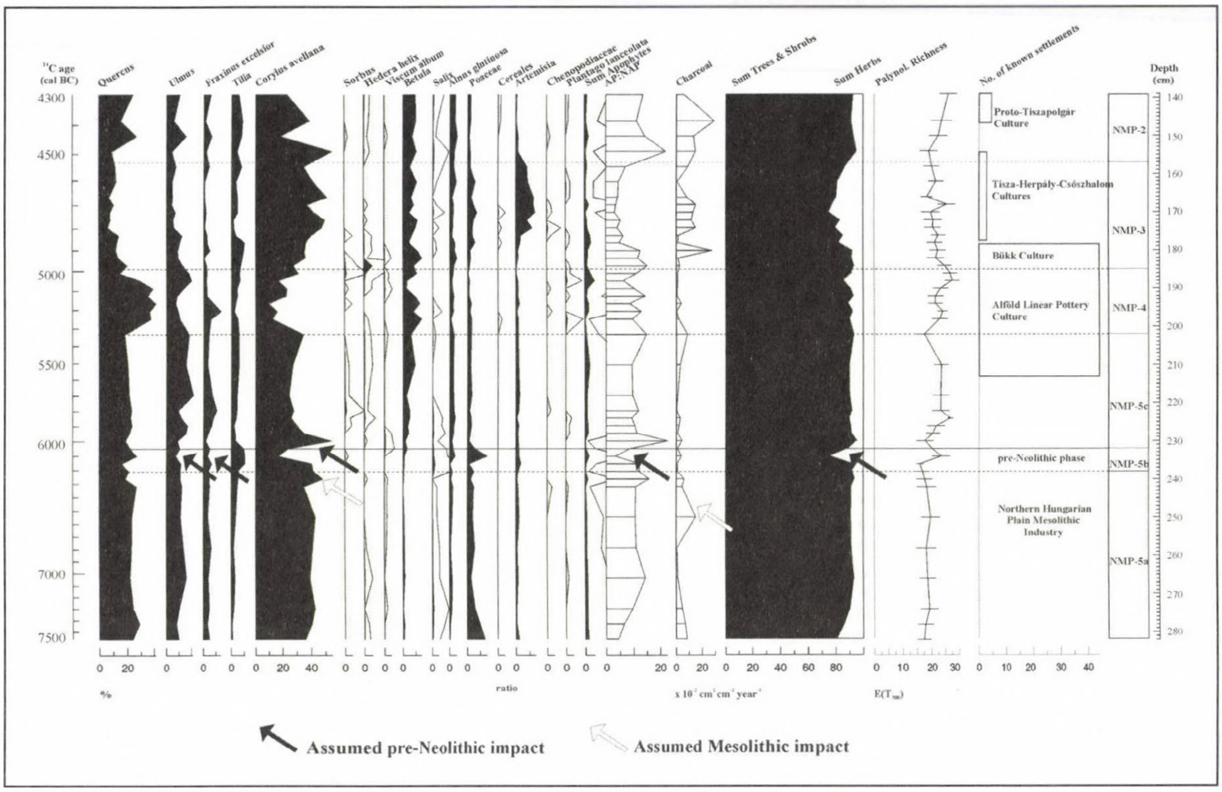

Fig. 3. Impact of Mesolithic and pre-Neolithic communities on the environment as reflected by the changes in the pollen samples from Kelemér–Nagy-Mohos-tó (after Magyari et al. [2001], with modifications)

of *Cyclope neritea*, a species preferring significant water cover, whose presence reflects the flooding of coastal areas[30] and the development of a maximum water level in the Eastern Mediterranean.[31] These changes were probably triggered by the more intensive melting of the gradually retreating continental ice-sheets and glaciers during this period, yielding an increased freshwater supply for the seas, which in turn led to the rise of global sea levels and the flooding of the shelves and river estuaries.[32]

Parallel to these environmental changes, a significant cultural transformation can be noted among the Natufian communities in the Ancient Near East, which had pursued an intensive hunter-gatherer lifestyle, resulting in the appearance of the first farming groups (pre-pottery Neolithic).[33] The relationship between the palaeoenvironmental and cultural changes was so striking that all scholars emphasised the role of environmental changes, even if focusing on different aspects of these changes, in the emergence of Neolithic civilisation in the Ancient Near East.[34]

The Early Holocene environmental changes during the 9th millennium BC can thus be seen to have triggered significant social and technological changes among both the pre-Neolithic communities of the Ancient Near East and the Central European Mesolithic population, leading to a parallel development

30 *J. C. Shackleton – T. H. van Andel:* Prehistoric shell assemblages from Franchthi cave and evolution of the adjacent coastal zone. Nature 288 (1980) 357–359; *T. H. van Andel – T. W. Jacobsen – J. B. Jolly – B. Lianos:* Late Quaternary history of the coastal zone near Franchthi cave, southern Argolid, Greece. Journal of Field Archeology 7 (1980) 389–402.

31 *D. F. Williams – R. C. Thunell – J. P. Kennett:* Periodic freshwater flooding and stagnation of the eastern Mediterranean Sea during the late Quaternary. Science 201 (1978) 252–254.

32 *D. A. Adamson – F. Gasse – F. A. Street – M. A. Williams:* Late Quaternary history of the Nile. Nature 287 (1980) 50–55.

33 *A. G. Sherratt:* Water, soil and seasonality in earlier cereal cultivation. World Archaeology 11 (1980) 313–330.

34 *S. R. Binford – L. R. Binford:* New perspectives in archeology. New York 1968; *G. Childe:* Man makes himself. London 1936.

among the Neolithic food-producing communities and the Mesolithic non-food-producing populations living in different regions.

The palaeoenvironmental data[35] and the changes noted in the Mesolithic industries of the Carpathian Basin[36] suggest that the 9th millennium BC was an important turning point for the subsequent development of the Mesolithic groups in the Great Hungarian Plain as well, since this period saw the appearance of a number of technocultural elements characterising the second half of the Mesolithic in the lithic inventories.[37] At the same time, none of the lithic types (such as trapezoidal blades) appeared, which can be associated with the latest Mesolithic horizon, marking the end of the Mesolithic. The analysis of samples taken from the level lacking trapezoidal blades of the Jászberény I site yielded radiocarbon dates of 8030±250 BP (7051 calBC),[38] indicating that these tools appeared at a later date, during the 7th millennium BC.

One important palaeoenvironmental fact regarding the archaeology of the Mesolithic communities in the Carpathian Basin is that the hinterland of the Mesolithic settlements established in the closed oak forests dotting the alluvial plains and fringing the marshlands in the northern part of the Great Hungarian Plain was a closed mixed pine-birch taiga vegetation in the sub-Carpathian and Sub-Alpine zones during the 9th millennium BC.[39] Several Mesolithic sites characterised by a lithic inventory based on raw materials taken from differing sources, yet closely linked to the Mesolithic industries in the northern part of the Great Hungarian Plain,[40] have been excavated in these hinterland areas (e.g. at Smolín, Kamegg, Sered I and Barca I).[41] The archaeological record indicates that the Mesolithic sites in the northern part of the Great Hungarian Plain and the Sub-Carpathian and Sub-Alpine regions lie north of the Balkanic Tardigravettien distribution and represent regional variants of local industries following Epigravettian traditions, in which western tool manufacturing techniques played a prominent role, together with Sauveterrian and Beuronian cultural elements.[42] The Mesolithic sites on the alluvial fans in the northern part of the Great Hungarian Plain were labelled Northern Hungarian Plain Mesolithic Industry,[43] while those in the Sub-Carpathian region were named Tisza Valley Mesolithic Industry.[44]

These two industries were interpreted as special local sub-groups of the Epigravettien, derived from the Gravettien and characterised by a mixed culture incorporating western manufacturing techniques too. In contrast to Róbert Kertész's palaeoenvironmental reconstructions,[45] these groups with a similar cultural background did not occupy the areas with a continental forest steppe, but preferred closed, mixed oak-pine woodlands during the 9th–8th millennia BC. Thus the flora, the fauna, and the soils in the distribution area of the two Mesolithic populations, whose tools were manufactured from raw materials taken from differing sources, differed fundamentally.[46]The differences in the natural resources undoubtedly played a role in the emergence of cultural differences on the group level during the Mesolithic.

At the turn of the 8th–7th millennia BC, the differences in the vegetation between the northern areas of the Great Hungarian Plain, and the Sub-Carpathian and Sub-Alpine regions disappeared, resulting in the emergence of a relatively uniform vegetation of species rich closed deciduous woodlands, characterised by a dominance of oak and hazel up to 600 m a.s.l., while the zone between 600 and 1000/1200 m was occupied by mixed deciduous woodlands dominated by linden, spruce and Scots

35 *Sümegi et alii* (2002).
36 *Kertész* (1996a); *Kertész et alii* (1994).
37 *Kertész* (1996b) 144.
38 *Kertész et alii* (1994).
39 *Willis et alii* (1997); *Sümegi* (1998); *Gardner* (1999); *Magyari et alii* (2001).
40 *Kertész* (1996a); *Kertész* (1996b).
41 *Bárta* (1980); *Bárta* (1981); *Prošek* (1959).
42 *Kertész* (1996a); *Kertész* (1996b).
43 *Kertész* (1994a); *Kertész* (1994b).
44 *Bárta* (1981).
45 *Kertész* (1996a); *Kertész* (1996b).
46 *Willis et alii* (1997); *Sümegi* (1998); *Gardner* (1999); *Magyari et alii* (2001).

pine,[47] reflecting the development of a zonal, montane vegetation during the Early Holocene in the Carpathian Basin. As a result of these changes, the vegetation of the mid-mountain ranges, the mountain forelands, the hills, and the lowland floodplains became relatively homogenous. However, a steppe and forest steppe vegetation survived in areas which had lower groundwater levels or alkaline soils from the end of the Pleistocene, indicating the emergence of a mosaic patterning in the vegetation both on a local and a regional level in the Carpathian Basin, even during periods characterised by the expansion of closed oak woodlands.[48]

Parallel to the homogenisation of the vegetation in the mid-mountain ranges and the northern part of the Great Hungarian Plain at the beginning of the 7th millennium BC, a pre-Neolithic development can be noted on Mesolithic sites. The technological innovations in the material culture of Late Mesolithic groups throughout Europe can be pinpointed to the period immediately preceding the emergence of the Neolithic and the arrival and settlement of Neolithic groups, whose cultural and economic roots lay in the Near East and the Aegean/Balkanic world.[49]

In addition to sharing numerous similarities, the stone industries of several sites in the northern part of the Great Hungarian Plain, such as Jásztelek I,[50] Tarpa–Márki tanya, Ciumeşti II and Kamenitsa I, reveal a pattern which can be fitted into the above mentioned process. The lithic inventory of these settlements includes conical cores, trapezes, retouched, truncated and notched tools; the use of the microburin technique can also be noted.[51] In terms of pre-Neolithic development and the shift to intensive gathering and stockbreeding, the discovery of a sickle insert with sickle gloss at the Jásztelek I is most noteworthy, even if its source values is limited since it was a surface find.[52]

Besides the absolute dominance of closed forest species, several xero-thermophilous, steppe and forest steppe molluscs (*Cepaea vindobonensis*, *Granaria frumentum*) have also been identified in the Bátorliget profile during the 7th millennium BC, probably corresponding to the latest Mesolithic horizon characterised by trapezoidal blades *(Fig. 2)*. The presence of these species indicates smaller steppe-like patches within the woodlands and reflects either a natural mosaic-like patterning in the environment or vegetation changes triggered by small-scale human activity around 8000–7500 BP (6900–6500 calBC). There is evidence for similar, local pre-Neolithic human impact on the environment elsewhere in the Carpathian Basin during the 7th millennium BC, before the arrival and settlement of food-producing communities, resulting in the creation of patches of open vegetation and the extension of marginal forest vegetation.[53] The appearance of a more open vegetation can perhaps be directly linked to the settlement of Mesolithic hunter groups and the creation of campsites during the active growth period in woodlands.

The initially perhaps spontaneous and, later, conscious manipulation of the environment to encourage the spread of light-loving plants such as hazel (which was intensively gathered[54]) in the marginal forest vegetation led to similar changes in the vegetation. The creation of "hunting trails" for the pursuit of forest game (aurochs, deer, wild boar, buffalo) or foliage feeding undoubtedly contributed to the

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47 *S. Farcaş – J. L. de Beaulieu – M. Reille – G. Coldea – B. Diaconeaşa – T. Goslar – T. Jull:* First ^{14}C datings of Late Glacial and Holocene pollen sequences from the Rumanian Carpathians. Comptes Rendues de l'Academie des Sciences de Paris, Science de la Vie 322. Paris 1999, 799–807; *Willis et alii* (1997); *Willis et alii* (1998); *Gardner* (1999); *E. Magyari – G. Jakab – E. Rudner – P. Sümegi:* Palynological and plant macrofossil data on Late Pleistocene short term climatic oscillations in North-east Hungary. Acta Palaeobotanica, Supplement (1999) 491–502; *Magyari E. – Jakab G. – Sümegi P. – Rudner E. – Molnár M.:* Paleoökológiai vizsgálatok a Keleméri Mohos tavakon. *In:* Tőzegmohás élőhelyek Magyarországon: kutatás, kezelés, védelem. Ed.: E. Szurdoki Miskolc 2000, 101–131; *Stieber J.:* A magyarországi felső-pleisztocén vegetációtörténete az anthrakotómiai eredmények (1957-ig) tükrében. FtKözl 97 (1967) 308–316.

48 *Sümegi P. – Krolopp E. – Hertelendi E.:* A Ságvár-Lascaux interstadiális őskörnyezeti rekonstrukciója. Acta Geographica, Geologica et Meteorologica Debrecina 34 (1998) 165–180; *Sümegi et alii* (2002).

49 *T. H. van Andel – C. N. Runnels:* The earliest farmers in Europe. Antiquity 69 (1995) 481–500.

50 *Kertész* (1993).

51 *Kertész* (1996a); *Kertész* (1996b).

52 *Kertész* (1993); *Kertész* (1996a); *Kertész* (1996b).

53 *Sümegi* (1998); *Sümegi* (1999); *Sümegi* (2001); *Sümegi – Kertész* (2000); *Sümegi et alii* (2002); *P. Sümegi – E. Magyari – Zs. Szántó – S. Gulyás – K. Dobó:* II. Man and environment in the Late Neolithic of the Carpathian Basin – a preliminary geoarcheological report of Polgár–Csőszhalom. *In:* MauerSchau 2. Festschrift für Manfred Korfmann. Hrsg.: R. Aslan – S. Blum – G. Kastl – F. Schweizer – D. Thumm. Remshalden–Grunbach 2002, 838–840.

54 *N. Kalicz – J. Makkay:* Frühneolithische Siedlung in Méhtelek–Nádas. MittArchInst 6 (1976) 13–24.

appearance and expansion of patches of steppe-like vegetation.[55] According to the radiocarbon dates for the Bátorliget profile, these malacological changes, reflecting pre-Neolithic human impact, took place immediately before the appearance of the first Early Neolithic groups in the Carpathian Basin, i.e. the arrival of Körös and Starčevo groups.[56]

The possibility of spontaneous forest fires was greatly reduced in the Northern Mountain Range after the decline of coniferous woodlands in the Early Holocene and the expansion of trees less susceptible to burning.[57] Even though their intensity was greatly reduced, forest fires did not cease completely during the 7th millennium BC, as evidenced by the appearance of both closed forest and thermo-xerophilous mollusc species in the Bátorliget profile. The maximums of smaller micro-charcoal peaks show a strong correlation with the decline of oak (*Quercus*) and the spread of hazel (*Corylus*) between 7000–6000 BC.[58] Similar changes have been observed on other sites in the northern areas of the Great Hungarian Plain and the Northern Mountain Range.[59]

Even though the palaeoenvironmental investigation of Hungarian Mesolithic sites is still in its infancy,[60] there are good analogies from America, Australia[61] and Western Europe[62] for the practice of forest burning among hunter-gatherer communities with the purpose of creating trails and clearings for herds of hunted species, the extension of marginal forest zones, and the establishment of campsites.[63]

The intentional human-induced expansion of the marginal forest zones and the creation of a mosaic patterning in the woodland environment at the close of the Mesolithic can be regarded as one of the most important human impacts on the environment, leading to the extensive spread of hazel.[64] Even though there in no archaeobotanical evidence for the gathering of hazelnuts from Mesolithic sites in Hungary, there seems to be a strong correlation between the increase of hazel in pollen profiles, anthropogenic forest fires and gathering strategies observed on several Western European Mesolithic sites.[65] Similar phenomena have been noted by Imola Juhász during her analysis of pollen profiles from western Transdanubia.[66]

The vegetation changes during the Late Mesolithic and conscious human activity aimed at the creation of a mosaic-like woodland environment, traces of which have been observed in the study areas discussed here, provides crucial evidence that the hunter-fisher-gatherer groups populating the Carpathian Basin reached the so-called "substitutional phase" in the second half of the Mesolithic.[67] In other words, the experiences gained from the conscious manipulation of the environment prepared them

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55 *Sümegi* (1998); *Sümegi* (1999); *Sümegi* (2001); *Sümegi – Kertész* (2000); *Sümegi et alii* (2002).

56 *E. Hertelendi – N. Kalicz – P. Raczky – F. Horváth – É. Veres – I. Svingor – I. Futó – L. Bartosiewicz:* Re-evaulation of the Neolithic in eastern Hungary based on calibrated radiocarbon dates. Radiocarbon 37 (1996) 239–241.

57 *Willis et alii* (1997).

58 Ibidem 745.

59 *Sümegi* (1998); *Sümegi* (1999); *Sümegi* (2000).

60 *Kertész et alii* (1994a); *Kertész et alii* (1994b); *Kertész R. – Sümegi P. – Kozák M. – Braun M. – Félegyházi E. – Hertelendi E.:* Ásatások Jászberény I. lelőhelyen. Előzetes jelentés az első azonosított alföldi mezolit telepen végzett kutatásokról. ArchÉrt 121–122 (1997) 3–26.

61 *P. Mellars:* Fire, ecology, animal populations and man: a study of some ecological relationship in prehistory. PPS 42 (1976) 15–45.

62 *J. G. Evans:* The Environment of Early Man in the British Isles. London 1975.

63 *K. D. Bennett – P. C. Tzedakis – K. J. Willis:* Quaternary refugia of North European trees. Journal of Biogeography 18 (1991) 103–115; *K. D. Bennett – S. Boreham – M. J. Sharp – V. R. Switsur:* Holocene history of environment, vegetation and human settlement on Catta Ness, Lunnansting, Shetland. Journal of Ecology 80 (1992) 241–273; *J. G. D. Clark:* Star Carr: a case study in bioarcheology. Reading 1972, Massachussetts; *G. D. Clark:* Practile motion and the theory of charcoal analysis, source area, transport, deposition and sampling. Quaternary Research 30 (1988) 67–80; *J. G. D. Clark – J. Merkt – H. Muller:* Post-glacial fire, vegetation and human history on the northern Alpine forelands, South Western Germany. Journal of Ecology 77 (1989) 897–925; *Smith* (1970).

64 *Smith* (1970); *K. E. Behre:* The role of man in European vegetation history. *In:* Vegetation History. Eds: B. Huntley – T. Webb III. Amsterdam 1988, 633–672.

65 *Smith* (1970).

66 *Juhász E. I.:* A Délnyugat Dunántúl negyedkori vegetációtörténetének palinológiai rekonstrukciója. PhD Thesis. Marseille–Pécs 2002.

67 *M. Zvelebi – P. Rowley-Conwy:* Foragers and farmers in Atlantic Europe. *In:* Hunters in Transition. Ed.: M. Zvelebil. Cambridge 1986, 67–93.

for the adoption of subsistence strategies based on food production.[68] The expansion of hazel between 7000–6000 BC following smaller or greater micro-charcoal peaks has been observed at various palaeoecological sampling locations near Mesolithic sites in the northern part of the Great Hungarian Plain and in the Northern Mountain Range as well, suggesting that the Mesolithic communities in the northern areas of the Carpathian Basin had probably reached this substitutional phase during this period.[69]

This assumption was verified by the results of the palynological analysis of the Mohos peat bogs at Kelemér,[70] where a cyclical decline of elm and ash values during the Late Mesolithic (at 5960 calBC; *Fig. 3*) suggests the selective gathering of their leaves for animal fodder.[71]

It would appear that the appearance of steppe plants and snail species preferring an open vegetation, the micro-charcoal peaks, the emergence of the mosaic patterning of the forest vegetation, the spread of hazel, and the selective gathering of leaves as animal fodder, as well as the new elements in the stone industry noted on the latest Mesolithic sites (such as trapezoidal blades and sickle gloss on some tools, reflecting intensive gathering) can be correlated. These changes suggest a pre-Neolithic phase characterised by more intensive gathering and hunting, the adoption of certain elements of stockbreeding and a more intensive manipulation of the environment and its vegetation during the 7th millennium BC, reflected by the marked presence of Mesolithic communities in the archaeological record from the broader environment of the Bátorliget marshland. Even though no pre-Neolithic sites have yet been excavated in the Carpathian Basin, the changes observed in the sedimentary basins at Bátorliget, Kelemér and Csaroda all point towards an independent pre-Neolithic phase, involving the gradual adoption of certain elements of a production economy, and the striking advances made by Late Mesolithic communities preceding the appearance of the first Early Neolithic groups.[72] The archaeological and palaeoenvironmental evidence indicates that the social changes leading to the more intensive exploitation of the environment had been triggered by the cultural impacts reaching the Mesolithic communities of the Carpathian Basin after the settlement of the Neolithic groups, whose origins can be traced to the Fertile Crescent of the Ancient Near East, whence they migrated to the Balkans and the Aegean.[73]

SUMMARY

The radiocarbon dated Holocene profiles indicate a series of small-scale human impacts leading to vegetation changes between 7000–6000 calBC. These changes can apparently be directly correlated with the intensive gathering of hazel, the utilisation of the shoots and foliage of ash and linden saplings for animal fodder, the creation of hunting trails and clearings for campsites, the appearance of more permanent settlements and the early adoption or imitation of certain elements of food production and the archeologically proven internal development of Mesolithic communities. The palaeoenvironmental record has confirmed earlier assumptions made by archaeologists, according to which there was an independent pre-Neolithic phase in the 7th millennium BC, directly preceding the appearance of Early Neolithic cultures in the Carpathian Basin. This phase survived in the Carpathian foreland even after the arrival and settlement of the Körös culture.

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68 *M. Zvelebil:* Mesolithic prelude and Neolithic revolution. *In:* Hunters in Transition. Ed.: M. Zvelebil. Cambridge 1986, 5–16.

69 *Sümegi* (1998); *Sümegi* (2000); *Sümegi et alii* (2002).

70 *Magyari et alii* (2002).

71 *H. M. Heybroek:* Diesases and lopping for fodder as possible causes of a prehistoric decline of Ulmus. Acta Botanica Neederlandica 12 (1963) 2–22; *Kertész R. – Sümegi P.:* Az Északi-középhegység negyedidőszak végi őstörténete. NMMÉ 23 (1999) 66–93.

72 *P. Sümegi – R. Kertész:* Palaeogeographic characteristic of the Carpathian Basin – an ecological trap durnig the Early Neolithic? *In:* From the Mesolithic to the Neolithic. Proceedings of the International Archaeological Conference held in the Damjanich Museum of Szolnok September 22–27, 1996. Eds: R. Kertész – J. Makkay. Budapest 2001, 405–416.

73 *A. J. Ammerman – L. L. Cavalli-Sforza:* Measuring the rate of spread of early farming in Europe. Man 6 (1971) 674–688.

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RECONSTRUCTION OF LONG-TERM ENVIRONMENTAL CHANGES AT KELEMÉR–KIS-MOHOS-TÓ

Mihály Braun – Pál Sümegi – Albert Tóth – Katherine Jane Willis – Imre Szalóki – Zita Margitai – Andrea Somogyi

INTRODUCTION

Chemical composition of lacustrine sediments is widely used for the reconstruction of past environmental events. Concentrations of biogenic elements and trace metals in sediment reflect changes in soil development in the catchment area or alternations in lake processes. Lake and bog sediments are a mixture of materials, which can be classified according to their origin. Components derived from outside the lake proper are termed allogenic, whereas those deposited directly from aquatic solution through biological uptake or chemical sorption and precipitation are designated authigenic. Authigenic components include biochemically precipitated carbonate minerals, Fe and Mn oxides, oxyhydroxides, sulphides, sulphates, phosphates, etc. In contrast, the allogenic fraction consists entirely of clastic mineral particles resulting from erosion of the catchment soils or from dust.[1]

The bulk element analysis is generally very important and useful in most palaeoenvironmental studies. The heavy metal content of sediment samples is considered to be a good indicator of historic pollutions. On the other hand, measuring only the total content of the elements may mask some valuable information. In many cases, important additional information can be derived from the analysis of the different chemical phases of the samples, revealing the causes of environmental processes which would remain undetected on determining only the total content of the elements in question.

Inductively coupled plasma optical emission spectrometry (ICP-OES) and energy dispersive X-ray fluorescence (EDXRF) analyses are widely used for the determination of the element composition of sediment samples. As these techniques are not capable of discriminating between different chemical forms of the elements, usually the total amounts of the elements present in the sample are investigated.[2] However, the allogenic part can be measured directly by EDXRF after removing the authigenic fraction by wet digestion, because the primary and secondary silicate minerals, which may hold trace metals within their crystal structure, are retained in the insoluble residue. Sequential extraction coupled with ICP-OES techniques allow to distinguish different element species within the authigenic fraction.[3]

In this study, we present a practical combination of EDXRF and ICP-OES methods[4] used to investigate the speciation of elements in sediment samples collected from Kis-Mohos, a smallish peat bog in north-eastern Hungary. On the basis of the speciation of the elements in the sediment samples, it was possible to elaborate a soil development model explaining the rapid change between 10,500 and 8800 BP in the vegetation (from coniferous to deciduous forest) and the soil (from podzol to a brown-earth soil) on the surrounding slopes of Kis-Mohos.[5]

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1 *Engstrom – Wright* (1984).

2 *R. Tertian – F. Claisse:* Principles of quantitative X-ray fluorescence analysis. London 1982.

3 *A. Somogyi – M. Braun – A. Tóth – K. J. Willis:* Speciation of elements in lake sediments investigated using X-ray fluorescence and inductively coupled plasma atomic emission spectrometry. X-ray Spectrometry 27 (1998) 283–287.

4 *I. Szalóki – A. Somogyi – M. Braun – A. Tóth:* Investigation of geochemical composition of lake sediments using EDXRF and ICP-AES techniques. X-ray Spectrometry 28 (1999) 399–405.

5 *Willis et alii* (1997).

MATERIAL AND METHODS

Study area

The study area lies in the Kelemér region of north-eastern Hungary. The landscape is one of undulating hills and valleys formed in alluvial sands and gravels deposited during the Tertiary. Within one of these valleys (310 m a.s.l.) there is a small *Sphagnum* peat bog (~60 m diameter), Kis-Mohos-tó (20°24'30" E, 48°24'40" N), from which an 8.86 m sedimentary sequence was collected. The peat bog Kis-Mohos-tó *(Fig. 1)* has no inflowing or outflowing streams and is probably hydrologically maintained by the continental climate of the region, which provides relatively high amounts of precipitation (650–700 mm/yr) with a maximum in June and a minimum in February and a mean annual temperature of 9.58 °C.[6] Slopes surrounding the bog are covered with an acidic nonpodzol brown forest soil, upon which is situated a mixed deciduous woodland dominated by *Quercus cerris* and *Carpinus betulus*.

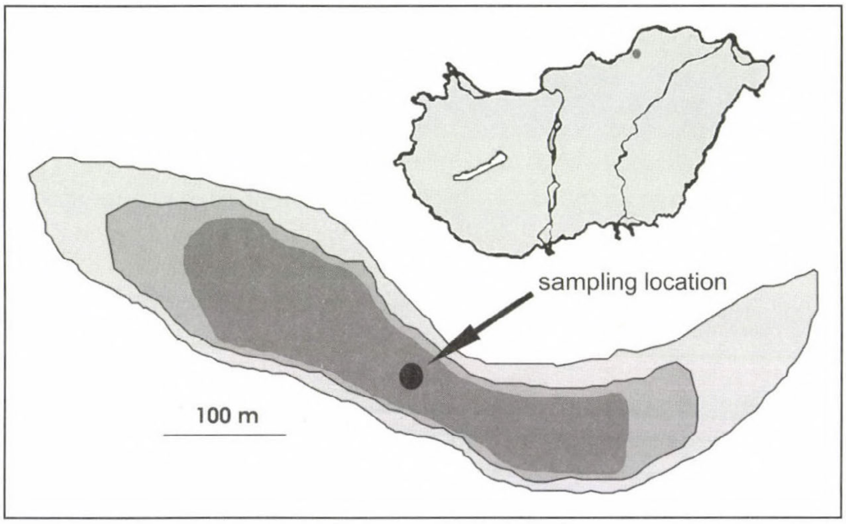

Fig. 1. Sampling site at Kelemér–Kis-Mohos-tó in north-eastern Hungary

Sediment sampling

Two continuous, undisturbed sedimentary sequences were obtained from the Kis-Mohos-tó basin using a 5 cm diameter modified Livingstone piston corer.[7] One sequence was used for pollen analysis, the other for the chemical analyses. The main lithostratigraphic features of the sedimentary sequence were identified through macroscopic investigation and the measurement of percentage of inorganic and organic material at 4 cm intervals throughout the core by loss-on-ignition.[8] Analyses of the surface textures of the quartz sand grains in the section of the profile between 730 and 686 cm was carried out using scanning electron microscopy following the technique of Krinsley and Doornkamp.[9]

Chemical analysis

The geochemical elements in the sediment were measured in 4-cm sections throughout the core using a modified technique of the bulk sediment digestion of Bengtsson and Enell.[10] Acid-soluble concentrations of Al, K, Mg, Li, Cr, Sr, Ba, Fe, Mn, P, and Ca were determined using ICP-OES.

The sediment section between 708 and 672 cm was subsampled at 1 cm intervals, making 37 samples overall. The element content representing the authigenic part was investigated by ICP-OES after

6 *Kakas J.:* Magyarország éghajlati atlasza. Budapest 1960.
7 *H. E. Wright:* A square rod piston sampler for lake sediments. Journal of Sedimentary Petrology 37 (1967) 975–976.
8 *B. Aaby:* Palaeoecological studies of mires. *In:* Handbook of Holocene Palaeoecology and Palaeohydrology. Ed.: B. E. Berglund. New York 1986, 111–126.
9 *D. H. Krinsley – J. C. Doomkamp:* Atlas of quartz and grain surface textures. Cambridge 1973.
10 *L. Bengtsson – M. Enell:* Chemical analysis. *In:* Handbook of Holocene Palaeoecology and Palaeohydrology. Ed.: B. E. Berglund. New York 1986, 423–455; *Braun M.:* Tavak, lápok és a környezet múltbeli állapotváltozásainak történeti rekonstrukciója az üledék elemösszetétele alapján. PhD Thesis. Debrecen 1998.

acid digestion. ICP-OES measurements were carried out with a Spectroflame instrument (Spectro Analytical Instruments, Cleve, Germany) in the simultaneous multielement and sequential operation mode. Excitation was performed with a 27.12 MHz R.F. generator at 1.05 kW energy, and nebulisation with a cross-flow nebuliser using argone at 0.6 l min/1 as nebulising gas, at 15 l min/1 as cooling gas and at 4.0 l min/1 as plasma gas. Both the line and the background intensities were integrated for 25 s. Two-sided background correction was applied.

Sequential extraction and analysis

The procedure described below was based on procedures as desrcibed by Tessier and his colleagues,[11] with the modifications suggested later by other scholars.[12]

(1) Easily mobilised fraction

0.3 g of air-dry sediment samples were let stand with 10 cm^3 1 mol/dm^3 NH_4NO_3 solution (pH=7) at room temperature for 24 h. Since centrifuging failed to separate the aqueous phase and the low density solid part rich in plant fibres, the sample solution (8 cm^3) between the top and bottom layers of organic debris was removed by using plastic syringes lengthened with teflon tubes.

(2) Organic colloid and carbonate bound fraction

After the NH_4NO_3 treatment, the suspension was subjected to extraction with 8 cm^3 1 mol/dm^3 ammonium-acetate solution at room temp for 24 h. The liquid phase was removed by the syringe technique described above.

(3) Manganese oxides bound fraction

After the ammonium acetate treatment, 8 cm^3 0.1 mol/dm^3 hydroxylamine hydrochloride solution containing 25% acetic acid was added to the sample residues. The 8 cm^3 units of sample solution were removed after 24 h extraction.

(4) Iron oxydes bound fraction

The sample residues were treated with 8 cm^3 extractant containing 0.2 mol/dm^3 ammonium acetate and 0.1 mol/dm^3 ascorbic acid. 8 cm^3 sample solutions were again removed after 24 h of leaching.

(5) Non-mobile, organic matter plus sulphide bound fraction

After the ascorbic acid treatment, the sample residues were transferred to beakers and digested with 20 cm^3 65% (m/m) nitric acid at 100 °C. 2 cm^3 30% (m/m) hydrogen peroxide was added to each sample to enhance the oxidisation of organic matter. After digestion the samples were brought to dryness and resuspended with 10 m^3 of 1:10 HNO_3, then filtered into volumetric flasks and diluted to 25 cm^3 with deionised water.

(6) Silicate bound fraction

The acid-insoluble residue, representing the allogenic part, was analysed by EDXRF after homogenisation in an agate mortar. Pressed pellets of 10 cm diameter and 50-150 mg/cm^2 weight were prepared for the X-ray measurements. An Si(Li) detector (made at the Nuclear Research Centre of the Hungarian Academy of Sciences, Debrecen, Hungary) with 200 eV FWHM at the Mn Kα line and an IBM AT compatible computer with an S100 MCA card (Canberra) were used for the EDXRF measurements. Characteristic X-rays were excited by an annular ^{125}I radioisotope source. Life time was >95%. Net

11 *A. Tessier – P. G. C. Campbell – M. Bisson:* Sequential extraction procedure for the speciation of particulate trace metals. Analytical Chemistry 51 (1979) 844–851.

12 *A. M. Ure – P. Quevauviller – H. Muntau – B. Griepink:* Speciation of heavy metals in soils and sediments, an account of the improvement and harmonization of extraction techniques undertaken under the auspices of the BCR of the Commission of the European communities. International Journal of Environmental Analytical Chemistry 51 (1993) 135–151; *Engstrom – Wright* (1984).

peak intensities were determined with AXIL software.[13] The elemental sensitivity (AXIL) and the emission transmission methods were used for the calculation of concentrations. Element concentrations were expressed on a sediment dry matter basis.

Pollen analysis

Samples for analysis of the pollen contained within the sediment were collected using a 1-cm^3 volumetric subsampler. The sampling interval was 8 cm throughout the core with a finer interval of 2 cm for the section between 686 and 710 cm. Samples were processed for pollen[14] with exotic pollen added to each sample in order to determine the concentration of pollen.[15] A minimum count of 300 grains (all pollen plus spores) per sample was made in order to ensure a statistically significant sample size[16] and charcoal abundance was determined using Clark's point count method.[17]

Radiocarbon dating

Radiocarbon dating of the sequence was obtained by both bulk and AMS (Accelerator Mass Spectrometry) analyses. Nine bulk samples of sediment were analyzed for radiocarbon ages at the Nuclear Research Centre of the Hungarian Academy of Sciences, Debrecen, Hungary and four samples of plant macrofossils were analyzed for AMS dates at the NERC (National Environment Research Council) radiocarbon dating facility in East Kilbride, Glasgow. In order to allow comparison with the COHMAP (Co-operative Holocene Mapping Project) computer-simulated climatic data,[18] the dates were calibrated using the calibration program CALIB and are labelled calBP.[19]

RESULTS AND DISCUSSION

Temporal representation

Results from the 13 radiocarbon dates (four AMS and nine bulk dates) *(Table 1, Fig. 2)* indicate an almost linear relationship of sediment deposition with time. The basal sediments extend back to 14,640 calBP and linear interpolation suggests that 1 cm of sediment was deposited in the basin during 20 years. Although it was not possible to obtain dates for the period between 14,600 and 9000 calBP, which includes the Late glacial/Postglacial transition when a change in sedimentation rate might have occurred, the available dates suggest that the accumulation rate has been uniform *(Fig. 2)*.

13 *J. P. van Espen – K. Janssens:* Spectrum evaluation. *In:* Handbook of X-ray spectrometry. Eds: R. E. van Grieken – A. A. Markowicz. Practical Spectroscopy A Series, Vol. 14. New York 1993, 181–293.

14 *B. E. Berglund – M. Ralska-Jasiewiczowa:* Pollen analysis and pollen diagrams. *In:* Handbook of Holocene Palaeoecology and Palaeohydrology. Ed.: B. E. Berglund. New York 1986, 455–479.

15 *J. Stockmarr:* Tablets with spores used in absolute pollen analysis. Pollen et Spores 13 (1971) 615–621.

16 *L. J. Maher:* Nomograms for computing 95% limits of pollen data. Review of Palaeobotany and Palynology 13 (1972) 85–93.

17 *R. I. Clark:* Pollen count estimation of charcoal in pollen preparations and thin sections of sediments. Pollen et Spores 24 (1982) 523–535.

18 *J. E. Kutzbach – P. J. Guetter:* The influence of changing orbital parameters and surface boundary conditions on climate simulations for the past 18,000 years. Journal of Atmospheric Science 43 (1986) 1726–1759; *J. E. Kutzbach – P. J. Guetter – P. J. Behling – R. Sehling:* Simulated climate changes: results of the COHMAP climate-model experiments. *In:* Global climates since the last Glacial Maximum. Eds: *H. E. J. Wright – J. E. Kutzbach – T. Webb III. – W. F. Ruddimann – E. A. Street-Perrott – P. J. Bartlein.* Minneapolis 1993, 136–169; P. Behling's personal communication, 1994.

19 *Stuiver – Reimer* (1993).

Spatial representation

In this study there are two spatial perspectives to consider: the spatial representation of the pollen and that of the chemical elements. Previous work has demonstrated that small lakes (<5 ha) contain pollen predominantly from a local source area.[20] The small size (<1 ha) of the Kis-Mohos-tó basin, which was an open water pond from 14,600 to 2000 calBP, suggests that the majority of the pollen rain entering this basin will be from a local and extralocal source and that the pollen record will represent changes that were occurring in the vegetation on the slopes surrounding the basin and immediate vicinity (up to 1000 m).

Chemical elements in the lake sediments are derived from a number of different sources but represent two main components: elements from the atmosphere and surrounding soils carried into the basin by overland flow, throughflow, and precipitation, and elements formed as a result of chemical processes within the lake sediment. With the exception of the component entering the lake from the atmosphere (which is thought to be low in comparison to the other elements), the spatial representation of the chemical data is therefore local and restricted to the watershed.[21]

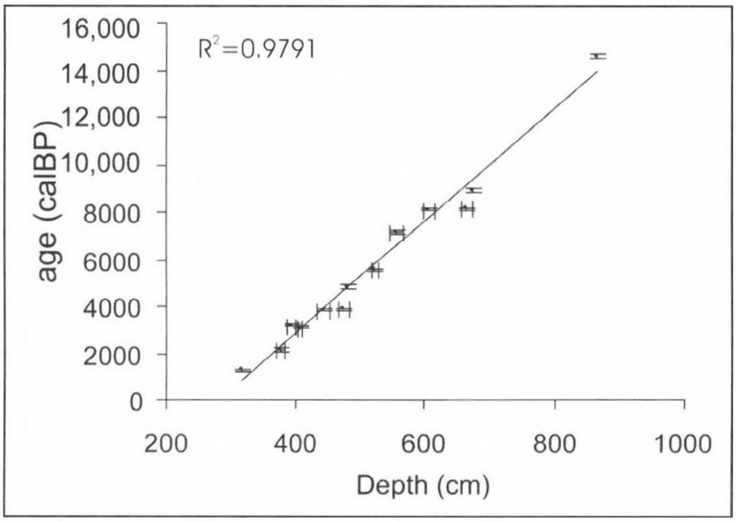

Fig. 2. Calibrated radiocarbon dates plotted against depth. The dates are fitted with a linear regression

Code number	Depth (cm)	Age (^{14}C yr BP)	Age (^{14}C cal.yr BP)
AA-11984	316	1345+50	1281
deb-3338	372–384	2148+57	2130
deb-3298	388–400	2994+55	3190
deb-3329	410–417	2945+53	3080
deb-3339	437–457	3574+45	3849
deb-3347	470–486	3598+49	3883
AA-12993	484	4270+75	4840
deb-3301	520–530	4751+62	5540
deb-3300	550–570	6250+73	7170
deb-3296	600–616	7379+82	8130
deb-3324	658–674	7685+51	8140
AA-11986	675	8020+100	8950
AA-11987	868	12495+95	14640

Table 1. Radiocarbon age determination for the sediment sequence. Calibrated ages were calculated using the calibration program CALIB (Stuiver – Reimer [1993])

Principal Components Analysis (PCA) ordination results

PCA on sediment geochemical data revealed 4 factors explaining 78.6% of the original variance *(Table 2)*. By performing Cluster Analysis (CA) on principal component scores the sediment sequences was divided into 8 zones. The classification results were confirmed via Discriminant Analysis (DA) where the segregation of the zones was highly significant

20 *C. R. Janssen:* Recent pollen spectra from the deciduous and coniferous-deciduous forests of northeast Minessota: a study in pollen dispersal. Ecology 47 (1966) 804–825; *G. L. Jacobson – R. H. W. Bradshaw:* The selection of sites for paleovegetational studies. Quaternary Research 16 (1981) 80–96; *S. T. Jackson:* Pollen source area and representation in small lakes of the northeastern United States. Review of Palaeobotany and Palynology 63 (1990) 53–76.

21 *Mackereth* (1966); *F. H. Bormann – G. E. Likens:* Pattern and processes in a forested ecosystem. Berlin 1979; *D. R. Engstrom – B. C. S. Hansen:* Postglacial vegetation change and soil development in southeastern Labrador as inferred from pollen and chemical stratigraphy. Canadian Journal of Botany 63 (1984) 543–561; *Engstrom – Wright* (1984); *D. R. Engstrom – E. B. Swain:* The chemistry of lake sediments in time and space. Hydrobiologia 143 (1986) 37–44.

Variable	PC-1	PC-2	PC-3	PC-4	Communality
ODM	-0.910	0.186	0.056	0.157	0.891
Ca	-0.821	0.322	0.096	-0.135	0.806
Silicates	0.945	-0.033	0.113	-0.087	0.914
Al	0.876	0.355	0.169	0.000	0.923
Mg	0.905	-0.081	-0.039	-0.176	0.858
K	0.894	0.224	0.141	-0.294	0.955
Li	0.962	0.076	0.063	-0.074	0.941
Rb	0.792	0.042	0.045	0.005	0.630
Cr	0.925	0.248	0.149	0.076	0.945
V	0.814	0.301	0.174	0.334	0.896
Pb	0.705	0.069	0.217	-0.037	0.550
Cu	0.649	0.288	-0.277	0.309	0.676
Ba	0.201	0.877	0.028	0.052	0.814
Sr	-0.007	0.874	-0.019	0.018	0.764
P	0.376	0.090	0.797	-0.158	0.810
Mn	-0.591	-0.004	0.697	-0.235	0.889
Fe	0.589	-0.302	0.623	0.174	0.856
Zn	0.119	0.298	0.549	0.227	0.455
S	-0.190	0.036	-0.089	0.926	0.903
Na	-0.002	0.369	0.261	-0.216	0.251
Eigenvalue	9.91	2.43	2.08	1.30	
% of Variance	49.5	12.2	10.4	6.5	

Table 2. Results of principal component analysis

($p<0.001$). The distribution (concentrations) of the elements along the profile and the suggested zonation are shown in *Fig. 3a, 3b*.

PC1 included Ca and ODM (positively correlated), having negative correlation with Al, Mg, K, Li, Rb, Cr, V, Pb and Cu. Peat accumulation was coupled with considerable accumulation of Ca. The parent rocks on surrounding slopes are rather poor in carbonates they are unlikely to be a source of calcium. However, the leaf litter produced by deciduous trees is known to be rich in calcium which is easily washed out and likely to enter the bog. Owing to the acidic pH of sedimentation environment, Ca accumulation was controlled by humic substances (organic bound fraction) rather than as carbonates typical of the fen systems.

The elements weighed in PC1 upon their strong positive correlation structure are considered to be erosion indicators. Concentrations of Pb, Cu and Cr were shown to be positively correlated with those of Al, Mg and K which therefore cannot be interpreted as heavy metal contamination. The concentration peaks of these elements appear in the sediment geochemical zones KMC-1 and KMC-8, but also increased considerably along the sequence whenever soil erosion from slopes towards the basin was more intense.

In PC2 Ba and Sr was found to be strongly correlated with maximum concentrations in the zone KMC-2. Element analysis for Ba and Sr is normally carried out for marine sediments, and no published data have been found concerning their indicator roles in freshwater systems. The fallout of nuclear explosions contains high concentration of radioactive Sr thus it is the Sr and Br content of soils that has been more extensively studied.[22] Our results suggest that these two elements cannot derive from the parent rock for their concentrations were seen to be independent of the ash content of the sediment.

22 *A. Wild:* Soils and the environment. Cambridge 1993.

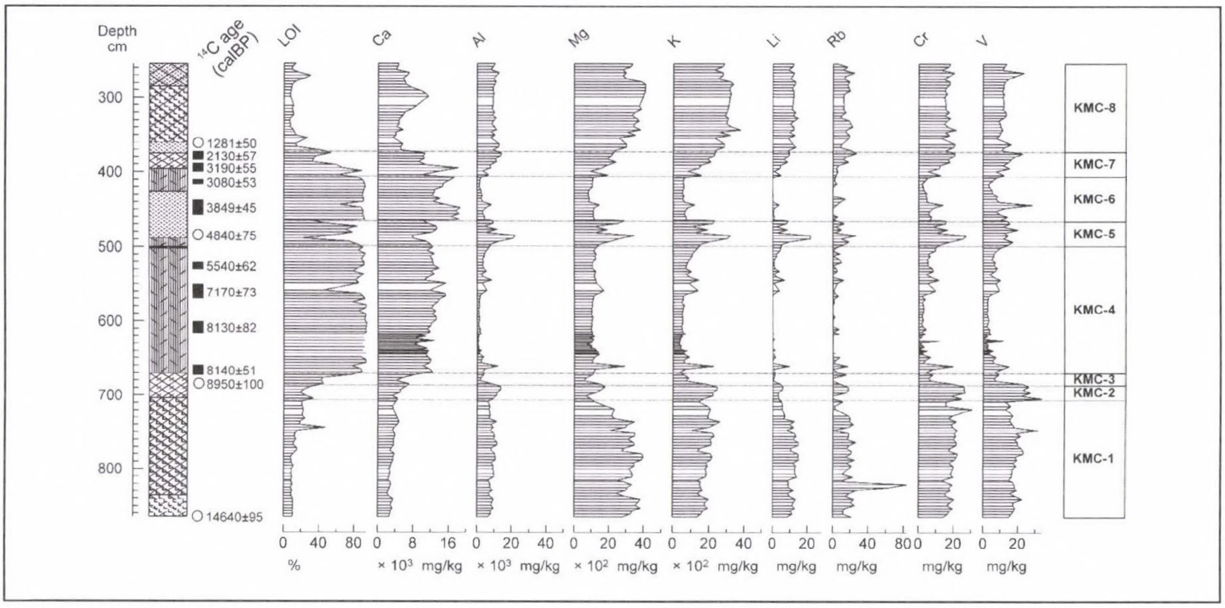

Fig. 3a. Elemental concentrations from the Kis-Mohos sediment plotted against depth and the zones determined by the multivariate analysis of geochemical data

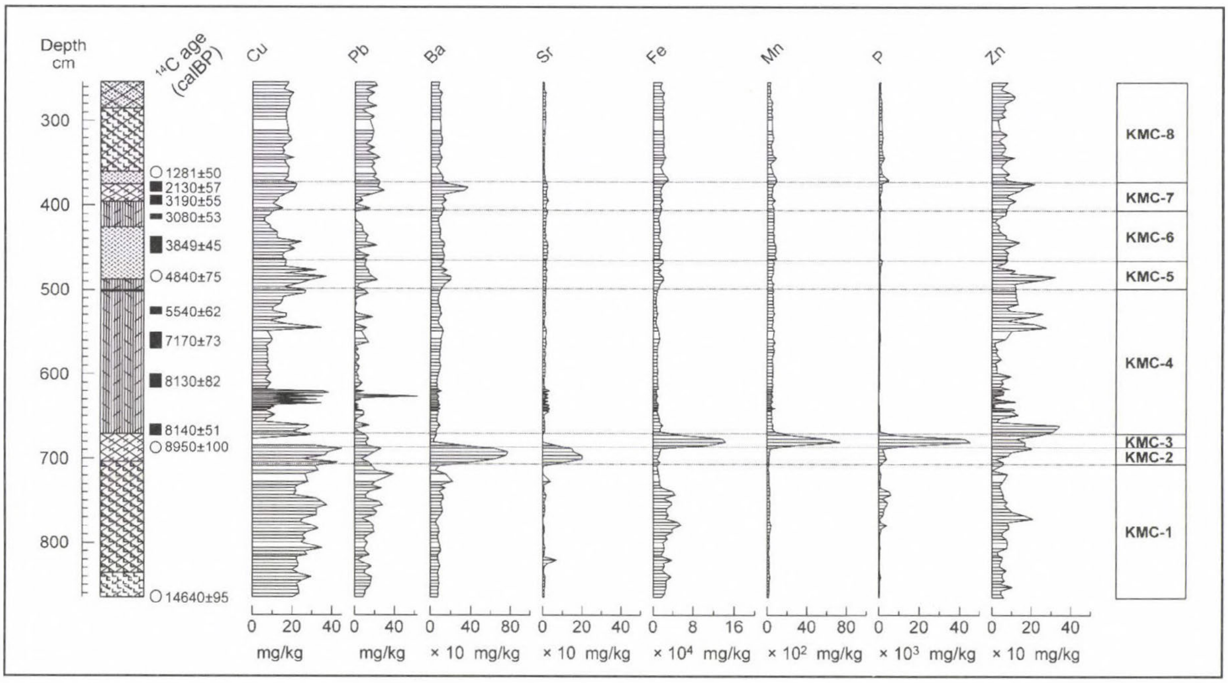

Fig. 3b. Elemental concentrations from the Kis-Mohos sediment plotted against depth and the zones determined by the multivariate analysis of geochemical data

PC3 included Fe, Mn and P with maximum concentrations in the zone KMC-3. Zinc was also weighed in this factor yet did not fit well in the factor structure. Its concentration had peaks in several zones along the sequence.

If the parent rocks have high levels of Fe, Mn and P, physical weathering (the disintegration of rocks into smaller pieces) coupled with erosion may convey particles to the lake in which these elements also show high concentrations. Via chemical weathering, the Fe and Mn content of the parent rock will be transformed to oxides and oxihydrates and accumulate in the soil of the watershed. In situations of poor drainage, reducing environments in waterlogged soils may enhance the mobilisation all three elements.[23] In anoxic conditions, microbes can use Mn^{4+} and Fe^{3+} as terminal electron acceptors.[24] In soils developing under coniferous vegetation, low pH and the accumulation of humic acids increase the mobility of Fe and Mn.[25] The reduced, mobile forms of these elements may be transferred to the lake by surface runoff or subsurface flow.

In many cases, soil phosphorus pools are dominated by inorganic phosphates including Fe- and Mn-phosphates, and phosphate may also be bound to Fe and Mn oxides and oxihydrates by sorption forces.[26] Hence factors enhancing the mobility of Fe and Mn in soils have a direct or indirect influence on the mobility of phosphorus as well.

Analysis of the sediment sequence from Kis-Mohos showed that concentration maxima of Fe, Mn and P were independent of peaks detected for erosion indicators (Al, K, ash, etc.), which suggests that their transport from the watershed may have taken place in water-dissolved (or, perhaps, in complex / colloid) form.

Weighed in PC4, sulphur displayed high concentrations in zones KMC-1 and KMC-6 having no significant correlation with ODM. Low communality computed for Na indicates that this element fit poorly in the factor structure, with concentrations fairly unvaried along the sequence.

Bog development and soil erosion

In the late- and postglacial periods slopes became unstable for several reasons. Frequent rainstorms triggered by climate change resulted in extensive landslides. Vegetation change may have affected the pressure of soil pore water which, if increased, may have weakened the soil's resistance against gravitational downslope forces. In many cases, vegetation change was brought about by anthropogenic effects (grazing, deforestation). Soil development on the slopes may change cohesion, friction, and hydrologic conditions which in turn may increase the probability of landslides.[27]

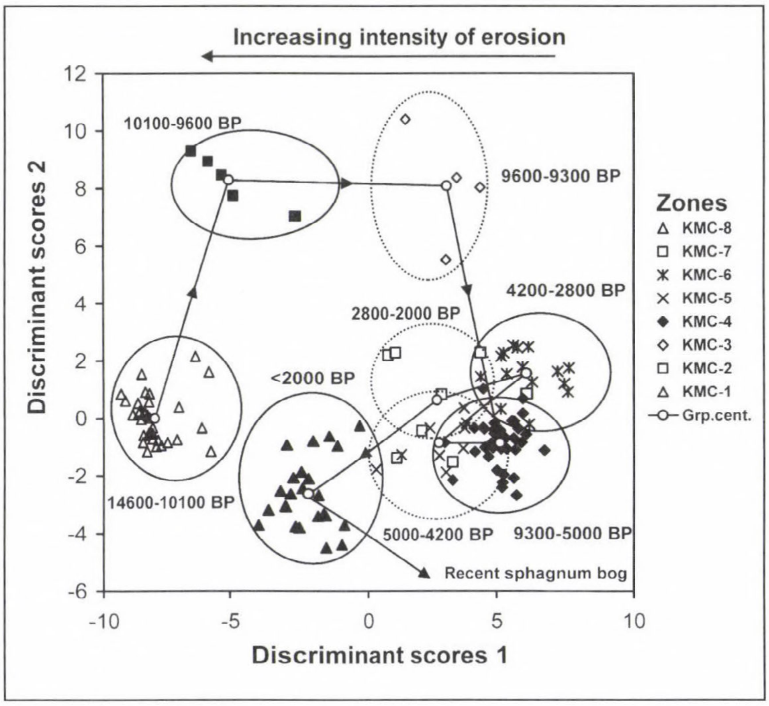

Fig. 4. Results of discriminant analysis

Surrounded by steep slopes, Kis-Mohos is suggested to have been strongly influenced by changes of the watershed, reflected by sensitive reactions in sediment accumulation and bog development. The elemental composition of lake or bog water is normally different from those reaching the basin via surface (direct) runoff or subsurface flow. If transported materials are trapped in the sediment under the control of physical,

23 *Engstrom – Wright* (1984); *Mackereth* (1966).

24 *K. Kilham:* Soil ecology. Cambridge 1994.

25 *J. W. Muir – J. Logan – C. J. Brown:* Mobilization of iron by aqueous extracts of plants 2. Capacities of amino-acid and organic-acid fractions of pine-needle extract to maintain iron in solution. Journal of Soil Science 15 (1964) 226–237; *J. W. Muir – R. I. Morrison – C. J. Bown – J. Logan:* Mobilization of iron by aqueous extracts of plants 1. Composition of amino-acids and organic-acid fractions of aqueous extract of pine needles. Journal of Soil Science 15 (1964) 220–225.

26 *Engstrom – Wright* (1984).

27 *S. M. Brooks – M. G. Anderson – K. Crabtree:* The significance of fragipans to early-holocene slope failure – application of physically based modeling. The Holocene 5 (1995) 293–303.

chemical and biological processes, sediment analyses allow the reconstruction of past changes in the vegetation and soils of the watershed.

Alterations in sediment composition related to erosion were identified and evaluated by discriminant analysis (DA). The first two discriminant functions, representing 78.6% of the original variance, quantify the two most important factors, erosion and filling up via peat accumulation *(Fig. 4)*. On the basis of the first discriminant function (DA-1) three such phases were identified. Negative values indicated unstable watershed and intense erosion, while low positive values a decreasing erosion intensity. At high positive values the surrounding slopes became stabilised with consequent minimum erosion.

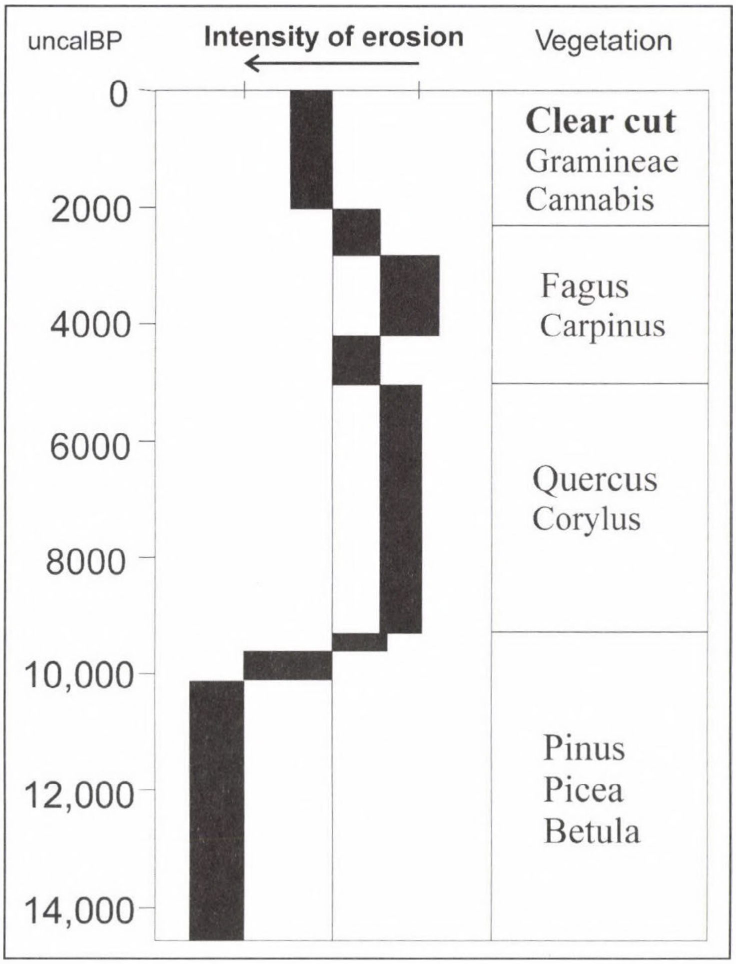

Fig. 5. Relation of vegetation and soil erosion indicated by the first discriminant function and pollen results

Climate and vegetation of the watershed was shown to have a strong impact on the composition of the sediment accumulated in Kis-Mohos *(Fig. 5)*. During the Late Glacial period, the area was characterised by intense erosion. The slopes were covered by coniferous woodland and the cold climate was unfavourable for soil formation and development.[28] Authigenic sedimentation associated with the lake's biological production was negligible relative to the deposition of allogenic material arriving from the watershed, leading to the accumulation of minerogenic sediments which reflects the composition of the parent rocks.

In the early Postglacial period, the vegetation of the watershed shifted from coniferous woodland to deciduous forest dominated by oaks and hazel. Milder climate was favourable for soil formation and the slopes became stabilised. The lake system was transformed to become a peat bog, the contribution of allogenic material from the watershed to the overall sediment deposition was low. Bog development associated with peat accumulation was interrupted by two distinct events of soil inwash, both triggered by vegetation change. When the oak became replaced by beech and hornbeam forest, soil was laid over the accumulating peat.

After the forest cover of the watershed had stabilised, peat accumulation was carried on. Signs of human activity were detected at the first (minor) soil inwash from 5000 BP, and around the second major one as well.[29] The anthropogenic impact was demonstrated by characteristic changes in the pollen spectrum and the high concentration of hemp (*Cannabis*) pollen. Soil erosion was followed by a landslide covering the peat with an almost 1 m thick layer of clayey loam and interrupting bog development for a longer period. The present-day peat bog is a fairly recent formation having existed since *ca.* 1000 BP.

28 *Willis et alii* (1997).

29 *K. J. Willis – P. Sümegi – M. Braun – K. D. Bennett – A. Tóth:* Prehistroric land degradation in Hungary: Who, how and why? Antiquity 72 (1998) 101–113.

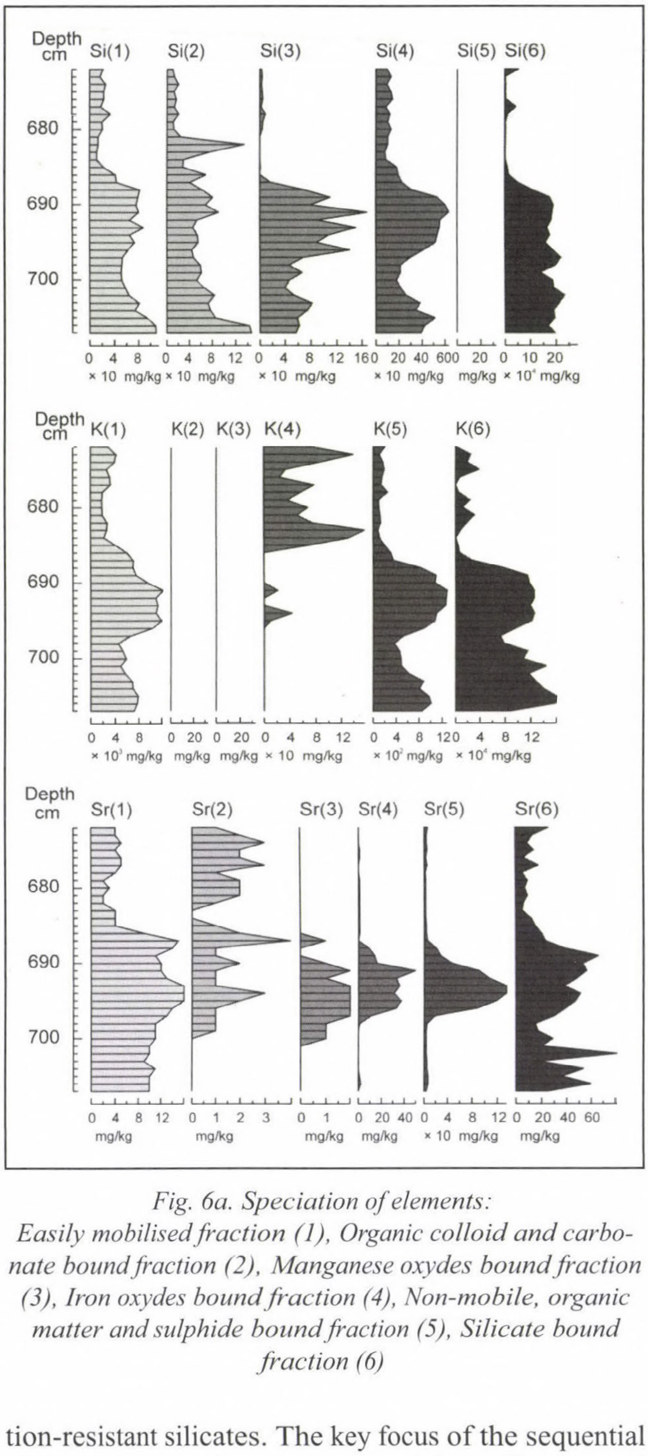

Fig. 6a. Speciation of elements:
Easily mobilised fraction (1), Organic colloid and carbonate bound fraction (2), Manganese oxydes bound fraction (3), Iron oxydes bound fraction (4), Non-mobile, organic matter and sulphide bound fraction (5), Silicate bound fraction (6)

Speciation analysis and environmental reconstruction

Chemical composition of the sediment in Kis-Mohos-tó was found to be a sensitive indicator of the environmental events and processes in the watershed. Sediment accumulation was shown to be steady and continuous for a longer reach of time. This particular situation enabled us to reconstruct the major stages of soil and vegetation development in the watershed for the period 14,600–8000 BP by analyzing the elemental composition and pollen spectrum of the sediment.

Pollen analysis results suggest that between 14,600–9200 BP, the watershed of Kis-Mohos was covered by coniferous woodland.[30] It is assumed that podzolic soil, characteristic of this forest type, was formed. Increased amounts of charcoal and a shift in the pollen spectrum show that vegetation change began at 9200–9000 BP. Between 9000–8000, the coniferous forest was replaced by a deciduous type (dominated by oaks and hornbeam). It is very likely that the podzol was transformed to an acidic brown forest soil.

Soil formation processes may have affected the sediment accumulation in the lake basin. Analysis of the sediment sequence by a sequential extraction protocol allows the quantification of element species transported in different ways (e.g. solution, rock particle, organic matter bound) and hence a detailed reconstruction of environmental events.

Sediment analysis was developed and performed to discriminate between 6 fractions: (1) mobile, (2) easily mobilised organic colloid bound, (3) manganese-oxides bound, (4) iron-oxides bound, (5) organic matter bound, (6) residue, including mostly the digestion-resistant silicates. The key focus of the sequential extraction was to distinguish between the authigenic and allogenic components of the sediment. Authigenic materials are mostly oxides, hydroxides, sulphates and carbonates, or metals associated with organic matter, therefore can be solubilised fairly easily. Allogenic materials are components of silicates highly resistant to digestion, thus forming a residue after sequential extraction. According to the stepwise extraction procedure described above, fractions (1–5) are considered to be authigenic and (6) allogenic *(Fig. 6a, 6b).*

30 *Willis et alii* (1997).

Reconstruction of soil formation processes

At present day podzol is the characteristic soil type of coniferous forests at higher latitudes (boreal zone) of the northern temperate zone. In the late glacial period the major part of Central Europe was unglaciated yet very cold. Climatic modelling results suggest that the mean temperature in January was below –20°C. Owing to the continental climate, this part of Central Europe including the Carpathian Basin may have been periglacial with extensive permafrost. Acidic parent rocks and low soil temperatures ensured the formation of podzol in this region. Although it is hard to assess the depth of the permafrost, it is likely that the lower B and C horizons of the podzol profile were seasonally, or permanently frozen. Owing to the low soil temperature, microbial activity could have been reduced to minimum, and the resulting soil was probably shallow and erodable.

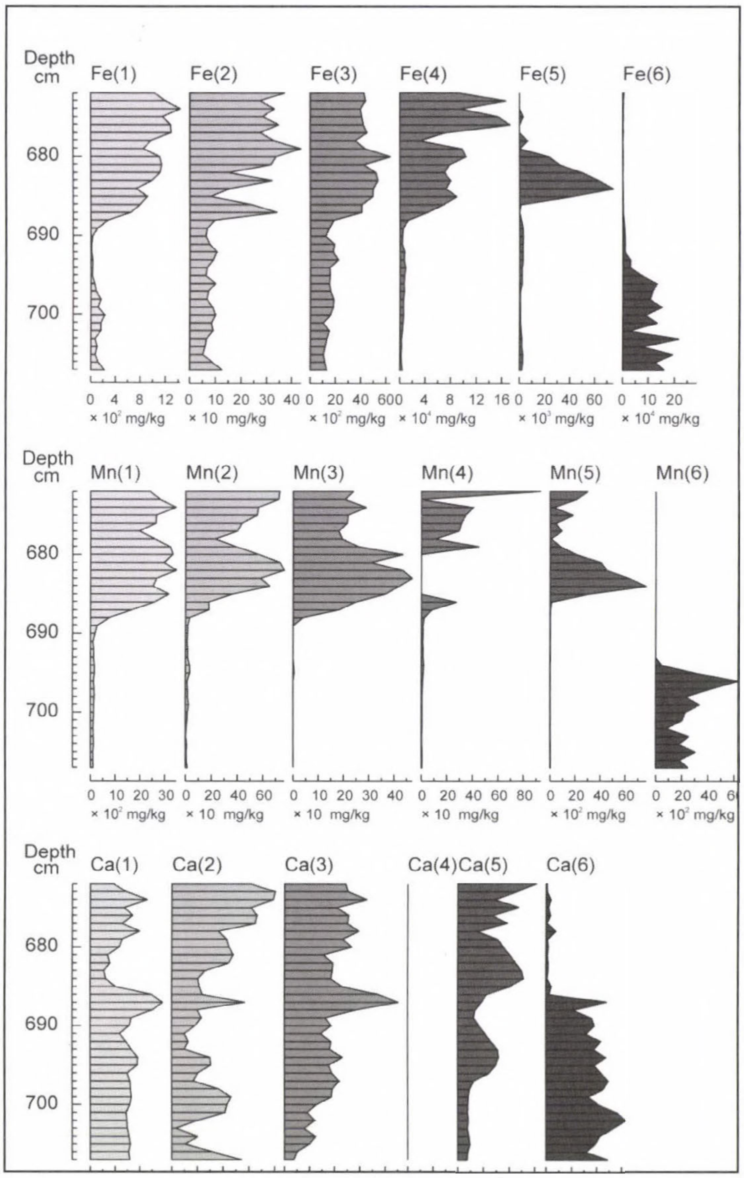

Fig. 6b. Speciation of elements:
Easily mobilised fraction (1), Organic colloid and carbonate bound fraction (2), Manganese oxydes bound fraction (3), Iron oxydes bound fraction (4), Non-mobile, organic matter and sulphide bound fraction (5), Silicate bound fraction (6)

Under such circumstances, the dominating process in the topsoil could have been physical weathering with a subordinate role of chemical weathering. The results of EDXRF analysis show that in silicate particles (solubilisation residue) deposited in the sediment through this period, concentrations of Fe, Mn, Ca, Sr, Y, Zr were high yet those of mobile forms were very low. The concentrations of inwashed yet dissolved forms (thus appearing as authigenic) of K, Si, Sr and Ca were an order of magnitude lower than those of the residue. This suggests that chemical disintegration of the parent rocks had begun but did not become a dominant process.

Owing to the cold climate, litter decomposition was inhibited and in time (like in North European boreal forests) leaf litter may have accumulated to form a thick carpet on the soil surface. Leaf litter is characterised by low density and poor heat conductance and thus behaves as a thermic isolator for the underlying soil. It maintains the low soil temperature and preserves the permafrost. Such an environment may actually enhance the subsistence of permafrost since temperature increase alone would not be enough for the thawing of the icy soil.

Firstly, the litter cover of the soil surface must be thinned and lost. This process can also be reconstructed from the chemical composition of the sediment from Kis-Mohos. At 9800–9200 BP, large amounts of Sr and Ba were transported to the lake. These peaks are suggested to indicate the intensified

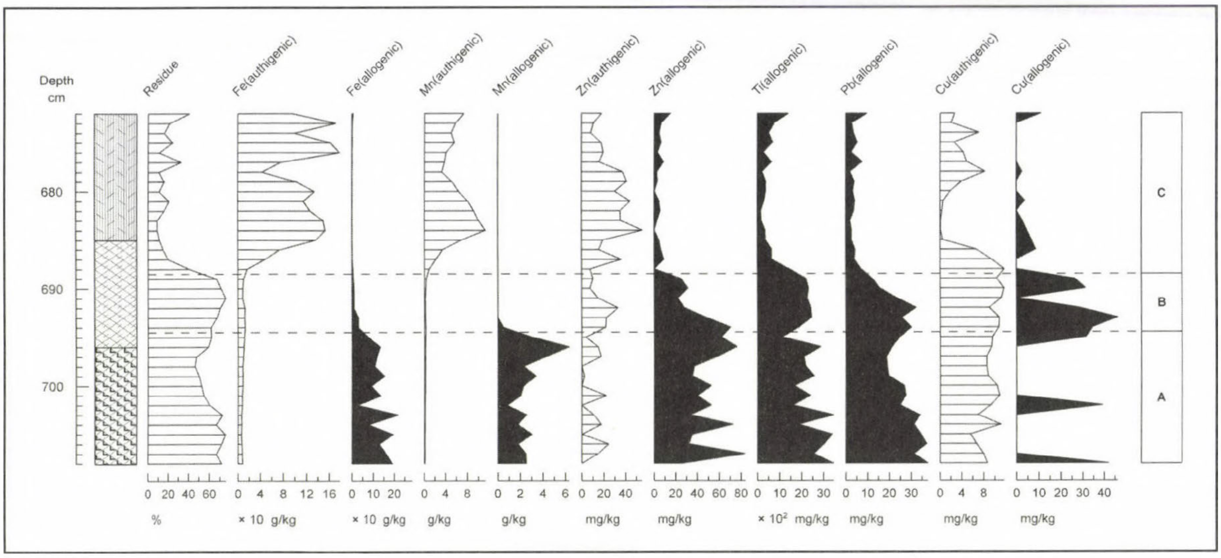

Fig. 7a. Physical characteristics and elemental compositions from the Kis-Mohos sediment plotted against depth. The allogenic fraction (filled) was determined using XRF and the authigenic fraction (open) using ICP-AES as a sum of the 1-5 fractions

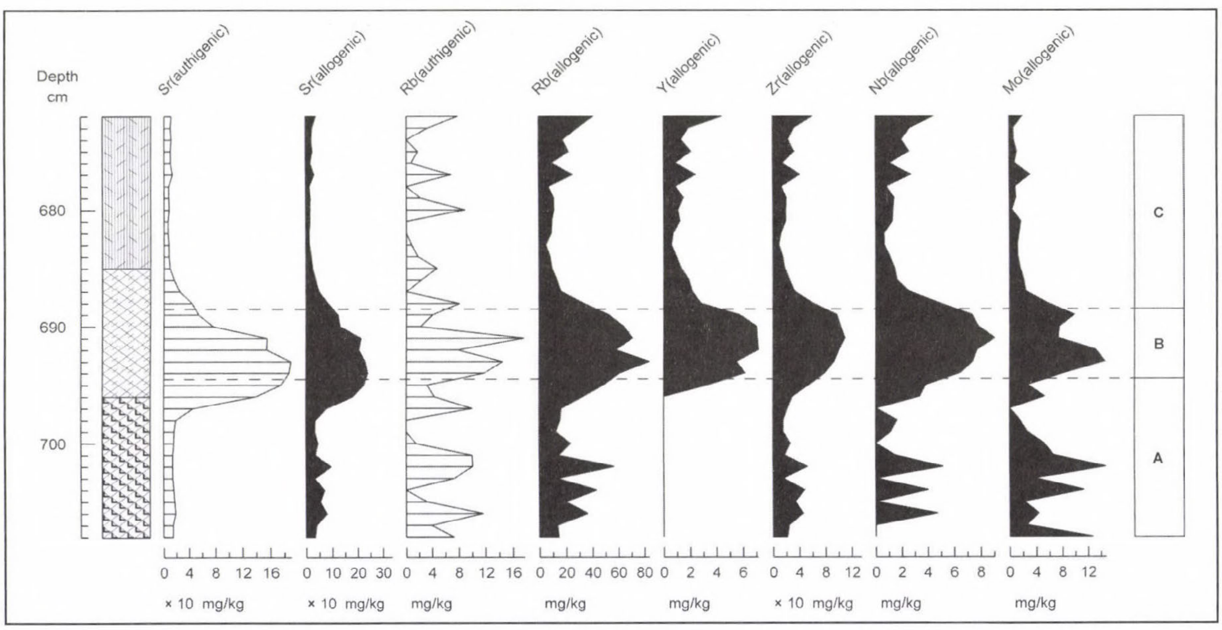

Fig. 7b. Physical characteristics and elemental compositions from the Kis-Mohos sediment plotted against depth. The allogenic fraction (filled) was determined using XRF and the authigenic fraction (open) using ICP-AES as a sum of the 1-5 fractions

decomposition of the litter layer since needles of spruce (*Picea*) contain high concentrations of both elements. Although leaching might have occurred during the late glacial, it was probably rather low because of reduced microbial decomposition activity. The first sign of environmental change was the breakdown of the litter layer by which the accumulated foliar Sr and Ba became mobilised and transported to the lake. In the sediment section dated right to this period, most of the Sr appeared in fraction (5). This seems to suggest that following a forest fire event Sr associated with wood ash and microscopic charcoal particles was washed into the lake.

The second step of environmental change may have been the thawing of permafrost. As the litter layer became thinned, larger and larger areas of soil surface went exposed to solar radiation which enhanced thawing.[31] It is not easy to assess the depth to which thawing proceeded. It is likely that the bottom horizons (lower B and C) of the podzol failed to thaw until 9200–9000 BP. Studies on the recent aspects of podzol soils demonstrate that the maximum of Fe accumulation is normally found in the lower B horizon whilst that of Mn is in the C horizon.[32] Iron and manganese peaks along the sediment sequences suggest that it was the soil pool of these elements that became washed into the lake. The preceding period (14,600–9200 BP) was characterised by high iron and manganese content in the sediment insoluble residue (6). By this stage, however, the authigenic forms (1–5) became dominant, indicating that the chemical weathering of the parent rocks became intensified. Organic acids released during litter decay may have enhanced the mobilisation of iron and manganese. Owing to the thawing of frozen topsoils soil, pores became saturated by water and in the anaerobic, reducing conditions iron and manganese may have been transformed to water soluble forms. Mobile iron and manganese species conveyed to the lake by soil water and overland flow reacted with the dissolved oxygen of the lake water, precipitated and entered the sediment. In podzols the concentration of organic acids and organic bound complexes has been known to decline abruptly with depth. At 20 cm below the soil surface most of the iron and manganese is immobile.[33] Waterlogged situations develop frequently during permafrost thaw since after the melting of the surface ice the underlying frozen layer inhibits the infiltration of water, leading to the dominance of anaerobic processes.[34]

The third, final stage of soil transformation is indicated by increasing calcium concentrations in the sediment. The calcium content of the insoluble residue (6) indicates that at first the parent rocks of the watershed were rich in calcium. After the transition of coniferous to mixed deciduous woodland, high amounts of Ca were released from the soil and entered the sediment pool as an authigenic component (1–5). The surrounding slopes became stabilised, the volume of materials transported to the lake via erosion turned very low. Calcium may have been leached directly from the soil, or rather, a characteristic feature of deciduous stand-forming tree species is that they accumulate high levels of calcium in their leaves, which is fairly easily leached from the litter. The increasing calcium content of the sediment, indicating the development of brown forest soil became dominant since ca. 8800 BP.

The three stages characterising the transformation of podzol to brown earth took place within ca. 1000 years. The time span of the first stage, i.e. the decay of coniferous litter was around 800 years, that of the second stage, i.e. the thawing of permafrost and the remobilisation of soil Fe and Mn ca. 200 years. The third stage became dominant at around 8800 BP and has been until present day. Vegetation change was much faster than the transformation of the soil. Coniferous woodland (dominated by *Pinus, Larix* and *Betula*) was replaced by a deciduous type (*Quercus, Corylus, Tilia, Fraxinus, Ulmus, Carpinus* and *Alnus*) in ca. 100 years (9500–9400 BP).

31 *G. B. Bonan:* Soil temperature as an ecologycal factor in boreal forests. *In:* A system analysis of the global boreal forest. Eds: H. H. Shugart – R. Leemans – G. B. Bonan. Cambridge 1992, 123–139.

32 *J. Jersak – R. Amundson – J. G. Brimhall:* A mass-balance analysis of podzolization – examples from the northeastern United States. Geoderma 66 (1995) 15–42.

33 *U. S. Lundström:* The role of organic acids in the soil solution chemistry of a podzolized soil. Journal of Soil Science 44 (1993) 121–133.

34 *L. A. Viereck – C. T. Dyrness – K. van Cleve – M. J. Foote:* Vegetation, soils and forest productivity in selected forest types in interior Alaska. Canadian Journal of Forest Research 13 (1983) 703–720.

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Willis et alii (1997) — *K. J. Willis – M. Braun – P. Sümegi – A. Tóth:* Does soil change cause vegetation change or vice versa? A temporal perspective from Hungary. Ecology 78 (1997) 740–750.

AN OVERVIEW OF THE PALAEOBOTANICAL DATA FROM KELEMÉR–KIS-MOHOS-TÓ

Imola Juhász

INTRODUCTION

Kis-Mohos-tó (20°24'30" E, 48°24'40" N) lies near Kelemér in north-eastern Hungary *(Fig. 1)*. The Pleistocene/Early Holocene vegetation history of Kelemér–Kis-Mohos-tó was published by Kathy Willis and her colleagues,[1] who presented an outline of the long term-relationship between major climatic changes, vegetation change and soil development. A model for the process by which podzol was transformed into brown earth was presented, together with a discussion of possible triggering mechanisms, as well as the different phases of the major vegetation changes from 14,600 to 8000 calBP.

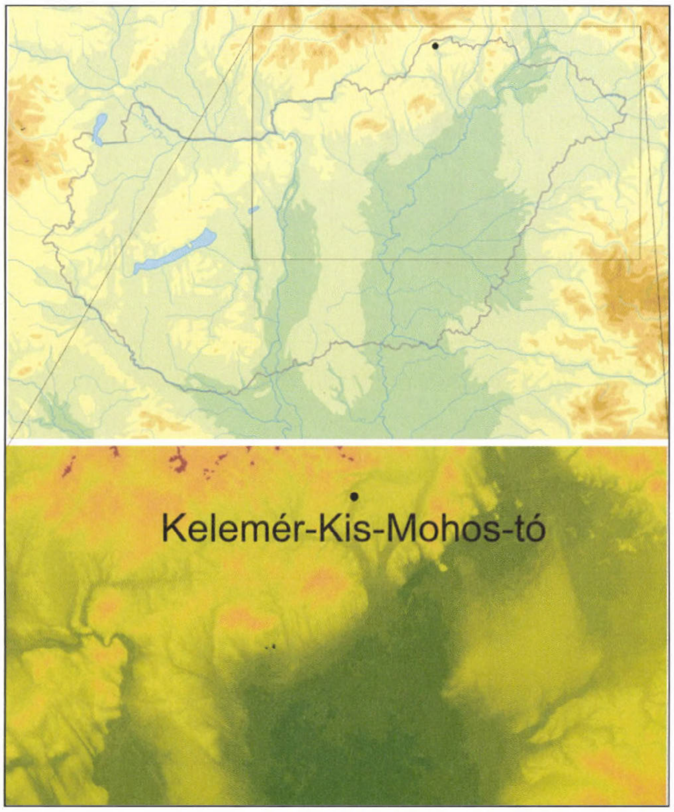

Fig. 1. The location of Kelemér–Kis-Mohos-tó in north-eastern Hungary

Another overview of the Holocene vegetation history and the evidence for prehistoric land degradation at Kelemér–Kis-Mohos-tó was later published by Kathy Willis and her colleagues.[2] The geochemical elements preserved in the lake sediment provided a record both of soil erosion within the basin and also of mining activity in the wider region. Analysis of the pollen contained in lake sediments helped identify changes in the vegetation composition around the lake, including forest clearance, arboriculture and crop cultivation.

In the lack of new data from the site, this paper can at the most present an overview of the already published data *(Fig. 2)*. The results of various palaeoecological analyses (pollen, charcoal, geochemistry) and a detailed overview of regional archaeological data and radiocarbon dates are presented in summarizing tables *(Tables 1 and 2)*, showing the vegetation history of Kis-Mohos-tó during the last 14,600 calBP years.

The description of the study area, the methodology used for the analyses of the sediment core from Kis-Mohos-tó, as well as the detailed results of the geochemical and sedimentological analyses concerning the Late Glacial and early Postglacial period are presented by elsewhere in this volume.[3]

1 *Willis et alii* (1997).

2 *Willis et alii* (1998).

3 Cp. *Mihály Braun et alii* in this volume (pp. 25–38).

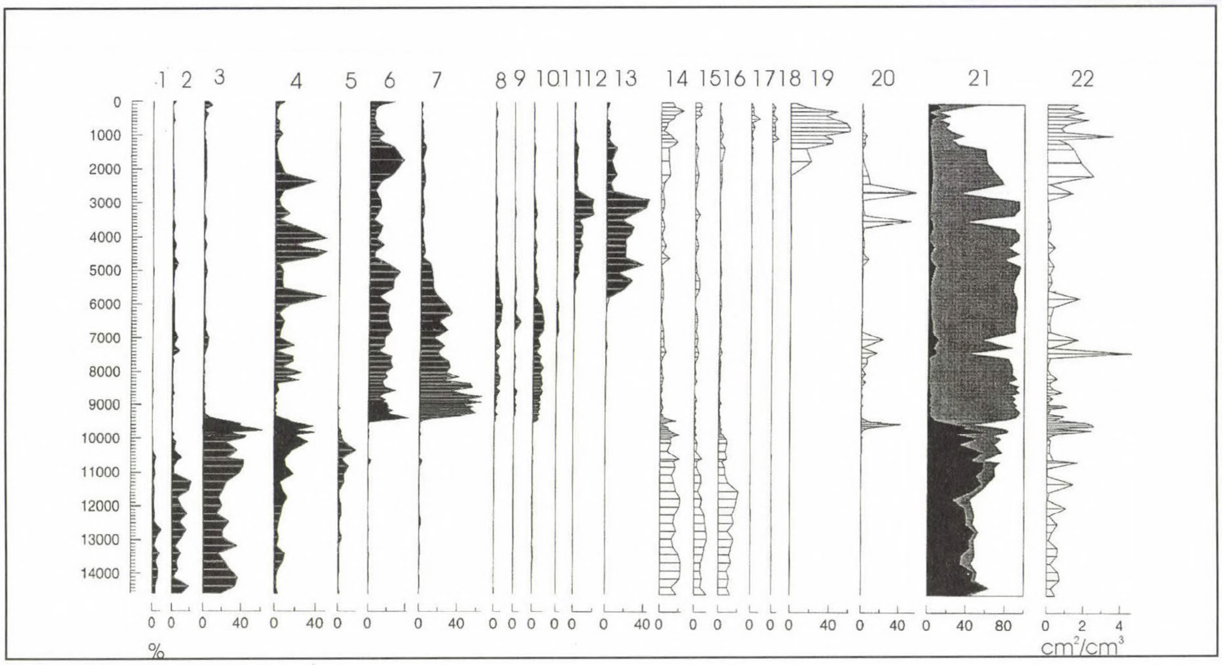

Fig. 2. The percentage pollen diagram of selected taxa from Kelemér–Kis-Mohos-tó (after Willis et alii [1997]) 1. Juniperus, 2. Picea, 3. Pinus, 4. Betula, 5. Larix, 6. Quercus, 7. Corylus, 8. Tilia, 9. Fraxinus excelsior, 10. Ulmus, 11. Acer, 12. Carpinus betulus, 13. Fagus, 14. Poaceae, 15. Cyperaceae, 16. Artemisia, 17. Cerealia, 18. Plantago lanceolata, 19. Cannabis, 20. Filicales, 21. AP/NAP (coniferous, broad-leaved, herbs), 22. charcoal concentration

THE HYDROSERAL DEVELOPMENT OF KELEMÉR–KIS-MOHOS-TÓ

The hydroseral development of Kis-Mohos-tó has not yet been fully established. Based on the sediment lithostatigraphy,[4] only major units of wetland development were distinguished. Between 14.600–13,200 calBP, the basin was occupied by an oligothrophic lake. Between 13,200 and 10,200 calBP, the basin was gradually enriched in macrophytes, suggesting that the water became more mesothrophic. From 10,200 to 9200 calBP, a typical charcoal rich layer indicates a major change in the mesotrophic lake environment. These changes led to the shallowing of the lake by 9000 calBP. A transitional peat bog *(Fig.3)* developed around *ca.* 8200 calBP (6200 calBC), which coincides with the same change at Nagy-Mohos-tó.[5] The development of the transitional peat bog may have stopped around *ca.* 2300 calBP (300 BC). The local vegetation suggests the development of a shallow lake phase at this time. The clay rich silty sediment with high charcoal content and the gravel content indicates soil erosion. The lithostratigraphical and pollen data indicate that the water level of the mire had probably been artificially raised during the Celtic period. The re-establishment of the *Sphagnum* carpet could have only restarted in the later 20th century.[6]

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4 *Sümegi* (1998).

5 *Juhász I. E.:* Délnyugat Dunántúl negyedkori vegetációtörténetének palinológiai rekonstrukciója. PhD Thesis. Pécs–Marseille 2002; *Magyari E. – Jakab G. – Sümegi P. – Rudner E. – Molnár M.:* Paleoökológiai vizsgálatok a Keleméri Mohos tavakon. *In:* Tőzegmohás élőhelyek Magyarországon: kutatás, kezelés, védelem. Ed.: E. Szurdoki. Miskolc 2000, 101–131; *Magyari E.:* Climatic versus human modification of the Late-Quaternary vegetation in Eastern Hungary. PhD Thesis. Debrecen 2002.

6 *Sümegi* (1998).

RESULTS

An almost linear relationship between sediment deposition and time can be noted. The sediment began to accumulate in the basin from *ca.* 14,600 calBP (13,600 BC), a process which continued to the present day. The geochemical analyses indicated three distinct stages in the transformation of podzol to brown earth during the Late Glacial and early Postglacial period, within a period of *ca.* 1000 years (between 9000–8000 calBP). Vegetation change was much faster than the transformation of the soil, and coniferous woodland was replaced by deciduous woodland in the *ca.* 100 years between 9500–9400 calBP.[7]

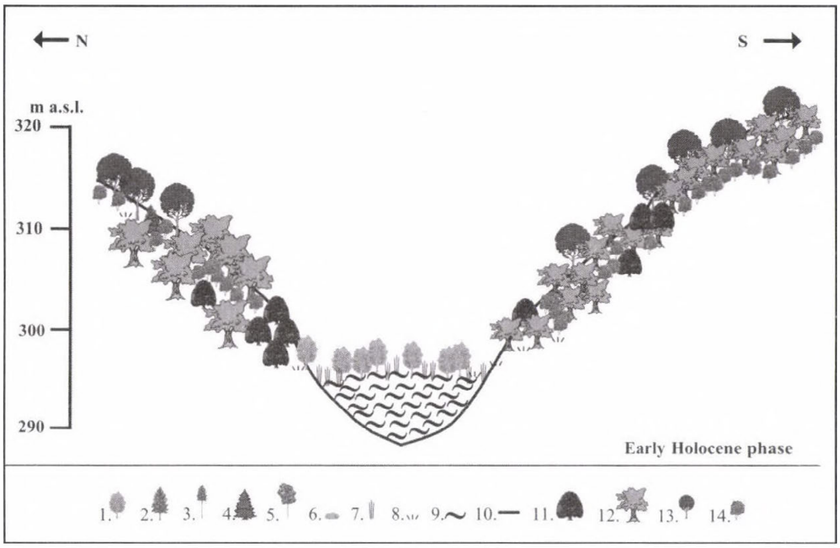

Fig. 3. The cross-section of the site and the Early Holocene vegetation at Kelemér–Kis-Mohos-tó (after Sümegi)
1. Birch (Betula), 2. spruce (Picea), 3. larch (Larix), 4. Scots pine (Pinus sylvestris), 5. Stone pine (Pinus cembra), 6. cushion-like vegetation, 7. reed (Phragmites), 8. sedge (Carex), 9. Sphagnum and brown mosses, 10. shoreline, 11. elm (Ulmus), 12. oak (Quercus), 13. linden (Tilia), 14. hazel (Corylus)

The geochemical analyses of the upper part of the sediment core indicate that ten periods of land degradation have occurred in this region since the Middle Neolithic (Impacts I–X). The anthropogenic impact was almost continuous and can be demonstrated by characteristic changes in the pollen spectrum. Pál Sümegi suggested that a human impact can be assumed from as early as the Mesolithic.[8] With the exception of the last two periods of degradation, the chemistry of the sediment returned to background levels following the period of disturbance. From 2600 calBP (600 BC) onwards, the degradation became continuous and there was no return to the background levels seen in previous periods. The formation of the present-day peat bog is a fairly recent.

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Willis et alii (1997) — *K. J. Willis – P. Sümegi – M. Braun – A. Tóth:* Does soil change cause vegetation change or vica versa? A temporal perspective from Hungary. Ecology 78 (1997) 740–750.

Willis et alii (1998) — *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.

7 *Willis et alii* (1997).
8 *Sümegi* (1998).

Sediment zones	Description of changes in the sediment	Pollen zones	Radiocarbon age	Description of changes in the vegetation	Nature of the vegetation changes
14,600–9800 calBP	podzol	14,600–11,000 calBP	12,495±100 uncalBP (14,640 calBP)	A coniferous forest steppe of *Pinus, Picea, Larix* and *Betula* with steppe elements, such as grasses, Chenopodiacea, Cyperaceae and *Artemisia.*	Open coniferous forest with patches of steppe-like communities.
14,600–9800 calBP	podzol	11,000–10,000 calBP		The dominance of *Larix* and *Betula* increased with the decline in *Picea* and the steppe elements. *Larix* was the significant component of the early Postglacial forest.	A more closed forest canopy.
9800–9200 calBP	podzol	9600–9500 calBP		Rapid decline in all the dominant components of the early Postglacial forest and an increase in mixed deciduous woodland. This woodland was composed of *Quercus, Corylus, Tilia, Fraxinus ornus, F. excelsior, Ulmus, Alnus, Carpinus,* with over 90% of the total pollen concentration. Increase in charcoal concentration suggests that burning was occurring, associated with an increase of the Filicales type.	A dramatic change in the forest. Transition between a closed coniferous forest to a species rich deciduous woodland which lasted *ca.* 100 years.
9200–9000 calBP and ~8,800 calBP	podzolic brown earth later changing to brown earth	9500–8000 calBP	8020 ±100 uncalBP (8950 calBP)	Mixed deciduous woodland survived around Kis-Mohos until anthropogenic activity affected the woodland at 8000 calBP.	Mixed deciduous woodland.

Table 1. The different phases of the Pleistocene vegetation history of Kelemér–Kis-Mohos-tó (after Willis et alii [1997])

Sediment layer zones	Description of changes in the sediment	Pollen zones	Radiocarbon age	Description of changes in the vegetation	Archaeological cultures	Number of sites within 50 km
8500 BC–100 AD	Fine organic mud with some terrestrial and detrital material	5330–4400 BC	6250±73 uncalBP at 560 cm (5220 BC)	Impacts I–II No signs of widespread clearance or cereal cultivation; a reduction in the established woodland species of oak and hazel, followed by the expansion of maple, ash and ferns. Presence of charcoal caused by burning. Shifting agriculture and small-scale animal husbandry. Collection of wood for stoking kilns for the manufacture of pottery. Impact III Once the clearance ceased, the soil recovered and the environment became stable again.	Middle Neolithic Alföld Linear Pottery culture (5330–4940 BC) and Bükk culture (5260–4800 BC) Late Neolithic Proto-Tiszapolgár culture	 25 sites 19 sites none
	Lack of evidence for soil erosion. Either these activities were not occurring in the hydrological catchment of the basin or anthropogenic activities did not cause soil degradation.	4000–3200 BC	4751±62 uncalBP at 525 cm (3950 BC)	Rise in copper. Change from mixed oak, hazel and elm woodland with lime, ash and maple to one dominated by birch and then beech (similar to woodlands in the Balkans) between 5000–3000 BC. Possible explanations for this change: climatic change, soil change, anthropogenic influence. Expansion of beech, used for the production of charcoal (together with hornbeam), an extremely valuable resource used for metal smelting. Beech also coppices well and thrives on disturbed and burnt soil. It is more likely an indirect result of anthropogenic activity, involving arboriculture with burning and clearance (removal of oak and hazel) for gaining construction material.	Early and Middle Copper Age cultures Tiszapolgár culture (4410–3760 BC) and Bodrogkeresztúr and Ludanice cultures (3900–3500 BC)	 2 sites 4 sites

Table 2. The different phases of the Holocene vegetation history of Kelemér–Kis-Mohos (after Willis et alii [1998])

Sediment layer zones	Description of changes in the sediment	Pollen zones	Radiocarbon age	Description of changes in the vegetation	Archaeological cultures	Number of sites within 50 km
	Increase in soil erosion, further rise of copper.	3200–2400 BC 2800–2300 BC	4270±75 uncalBP at 484 cm (2890 BC)	Impact IV There is no widespread forest clearance for arboriculture; the changes in the woodland composition were natural, marked by the opening up of the forest canopy, a decrease in beech and an increase in hornbeam. *Carpinus* saplings need light in the canopy, which suggests some form of human impact. Geochemical data suggest that wood was an important commodity in the region, as hornbeam coppices extremely well. Impacts V–VI Two periods of vegetation change can be noted. First, a dramatic decline of oak and hazel, replaced by beech and hornbeam. Later, beech and hornbeam decline to be replaced by birch. An opening up of the forest and the appearance of open-ground herbaceous vegetation (grasses and ferns). Copper working calls for metal smelting, the landscape gradually becomes depleted of trees. Even though archaeologically this period marks the advent of horse-breeding, there is no evidence for large-scale animal husbandry.	Late Copper Age Baden culture (3500–2800 BC) Early Bronze Age Nyírség and Hatvan cultures (2800–2000 BC)	15 sites 11 sites
		2000–1800 BC	3598±49 uncalBP at 478 cm (1933 BC) and 3574±45 uncalBP at 447 cm (1899 BC)	Impact VII Another large increase in birch occurs, followed by an increase in ferns, suggesting further clearance of the predominantly beech and hornbeam woodland.	Middle Bronze Age Füzesabony and late Hatvan cultures (2000–1500 BC)	6 sites
		1200–800 BC	2945±53 uncalBP at 409 cm (1130 BC) and 2994±55 uncalBP at 394 cm (1240 BC)	Impact VIII Large-scale depletion of beech and hornbeam in the woodland. The Kyjatice culture built a chain of hillforts along the boundary between the Bükk Mountains and the Great Hungarian Plain. Possible indiscriminate selection of trees for the construction of the hillforts during this period.	Late Bronze Age Piliny culture (1450 BC) Late Bronze Age/ Early Iron Age Kyjatice culture (1250–900 BC)	38 sites 71 sites

Table 2 (cont'd)

Sediment layer zones	Description of changes in the sediment	Pollen zones	Radiocarbon age	Description of changes in the vegetation	Archaeological cultures	Number of sites within 50 km
100 AD	A dramatic transition into grey clay. An irreversible threshold was crossed and soil erosion was thereafter continuous.	800 BC–100 AD		Impact IX A new period of deforestation, whose impact on the landscape appears to have been much more dramatic. The forest was greatly reduced, with the final depletion of beech and hornbeam. Presence of a birch woodland with an understorey of grasses and ferns.	Middle Iron Age Pre-Scythian (900–600 BC), Scythians (600–300 BC) and Celtic groups (300–0 BC)	3 sites 2 sites 6 sites
1600 AD	The growth of a *Sphagnum* mat. Transition from lake sediment to valley-bottom peat bog. Irreversible changes in soil stability.	100–1600 AD	2148±57 uncalBP at 378 cm (180 AD) and 1345±50 uncalBP at 361 cm (669 AD)	Impact X High increase in the use of hemp (*Cannabis*) indicates that the lake was used for rope production (retting the hemp in order to rot away the fleshy part of the plant to reveal the fibres). Further forest burning for clearance of land for cultivation. The oak forest re-establishes itself. The ancient Hungarians began cereal cultivation.	Roman Age (0–375 AD) Migration period (375–895 AD) Hungarian Conquest period and Middle Ages (895–955–1526 AD)	24 sites 14 sites 10 and 191 sites

Table 2 (cont'd)

COMPARISON AND CORRELATION OF THE POLLEN SEQUENCES CONCERNING THE HOLOCENE ENVIRONMENTAL HISTORY OF THE MOHOS LAKES AT KELEMÉR

Imola Juhász

INTRODUCTION

Several already published pollen sequences are available from the Mohos lakes at Kelemér. The results of the first investigations of the Mohos lakes were published in one of Bálint Zólyomi's early papers,[1] in which he suggested that the development of Nagy-Mohos-tó began about 10,000 years ago, while that of Kis-Mohos-tó about 5000 years ago. Later, two new sediment cores were taken from Nagy-Mohos-tó: the NM I–II pollen sequence analysed by Enikő Magyari[2] and the NM 2b sequence analysed by the present author.[3]

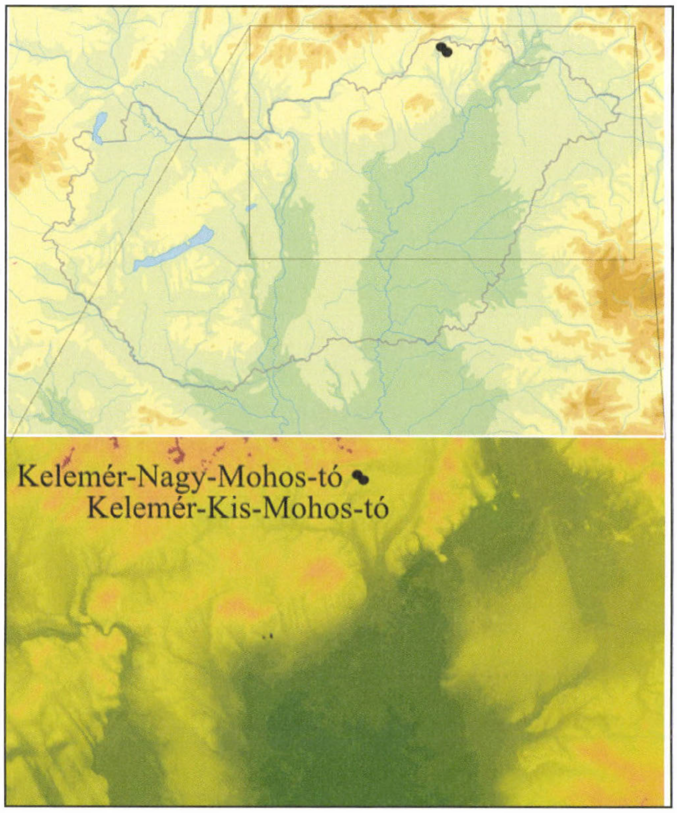

Fig. 1. The location of the Mohos lakes (Kis-Mohos-tó and Nagy-Mohos-tó) at Kelemér in northern Hungary

The NM I–II pollen sequence of a 430 cm deep sediment core was divided into eight pollen zones. The first four local pollen assemblage zones (LPAZ) were labelled NMP-1 to NMP-4; they were assigned to the Pleistocene. The last four LPAZs, from NMP-5 to NMP-8, provided data only about the Early and Middle Holocene. There is a hiatus in the sediment accumulation around 6300 calBP (5515±45 uncalBP at 143 cm), resulting from prehistoric peat cutting, which prevents a vegetation reconstruction for the southern basin of Nagy-Mohos-tó for later periods. Two hiatuses can be noted in the upper 143 cm (NMP-9): the first shows a difference of *ca.* 1700 calBP years between successive sub-samples, while the second a difference of *ca.* 950 calBP years between 119 and 115 cm. This can perhaps be interpreted as an indication that the lake was used for rope production in the Migration period, while the second probably represents an unsuccessful attempt to drain the bog.[4] The sample at 110 cm was dated to 235±45 uncalBP (1659 AD).

The 560 cm deep NM 2b pollen sequence[5] was divided into fourteen LPAZs: five of these (NM 2b-a to NM 2b-e) date to the Pleistocene, while the remaining nine (NM 2b-f to NM 2b-n) represent the

1 *Zólyomi B.:* A Bükkhegység környékének Sphagnum-lápjai. BotKözl 28:5 (1931) 89–121.
2 *Magyari E. – Jakab G. – Sümegi P. – Rudner E. – Molnár M.:* Paleoökológiai vizsgálatok a Keleméri Mohos tavakon. *In*: Tőzegmohás élőhelyek Magyarországon: kutatás, kezelés, védelem. Ed.: E. Szurdoki. Miskolc 2000, 101–131; *Magyari et alii* (2001); *Magyari* (2002).
3 *Juhász* (2002); *Juhász* (2005).
4 *Magyari* (2002) 24.
5 *Juhász* (2002); *Juhász* (2005).

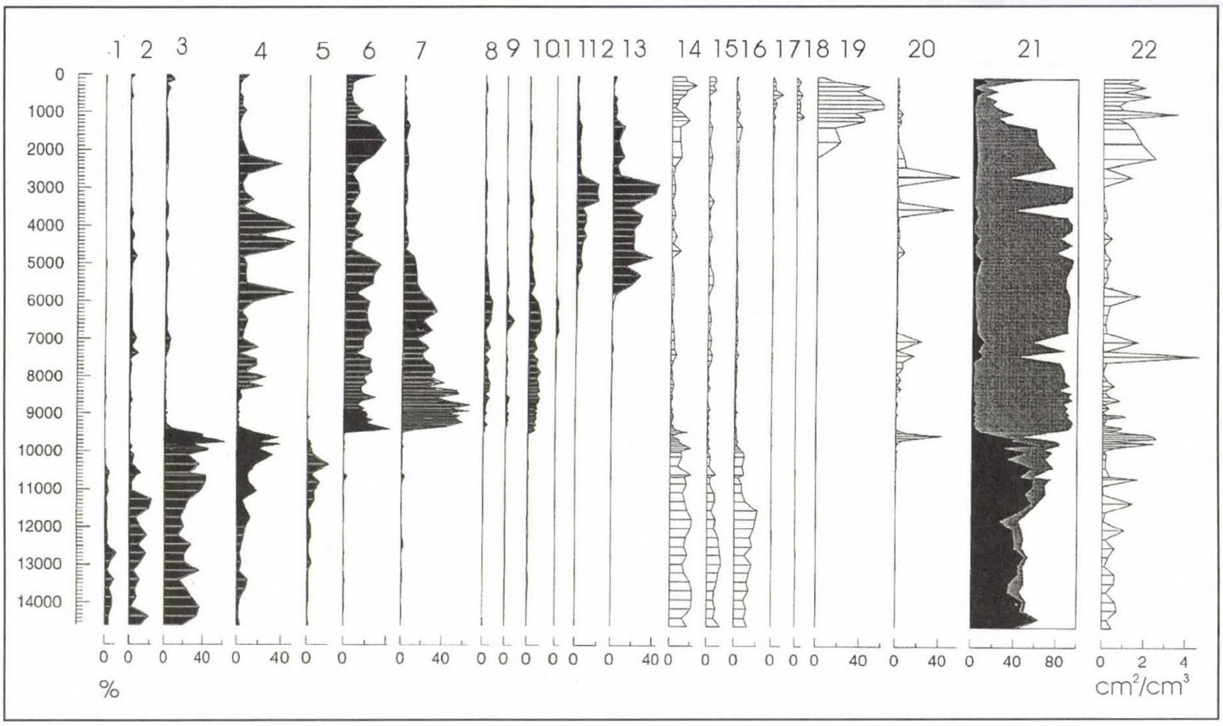

Fig. 2. The percentage pollen diagram of selected taxa from Kelemér–Kis-Mohos-tó (after Willis et alii [1997]) 1. Juniperus, 2. Picea, 3. Pinus, 4. Betula, 5. Larix, 6. Quercus, 7. Corylus, 8. Tilia, 9. Fraxinus excelsior, 10. Ulmus, 11. Acer, 12. Carpinus betulus, 13. Fagus, 14. Poaceae, 15. Cyperaceae, 16. Artemisia, 17. Cerealia, 18. Plantago lanceolata, 19. Cannabis, 20. Filicales, 21. AP/NAP (coniferous, broad-leaved, herbs), 22. charcoal concentration

Holocene vegetation history of Nagy-Mohos-tó. The presence of several hiatuses can be noted in this pollen sequence too. A part of the Holocene, between *ca.* 5800 uncalBP and *ca.* 4800 uncalBP (4800±45 uncalBP, 3400 BC, between 166–172 cm in the NM 2b sequence), as well as the period from 2500 to 1345 uncalBP, is missing. The correlation and the comparison of the Nagy-Mohos-tó sequences were based on the continuous Kis-Mohos-tó pollen sequence,[6] taken from a location lying at a distance of 400 m *(Fig. 1).*

DESCRIPTION AND EVALUATION OF THE POLLEN SEQUENCES OF THE MOHOS LAKES AT THE END OF THE LATE GLACIAL AND THE BEGINNING OF THE HOLOCENE

A coniferous forest steppe of Scots pine, spruce, larch and birch (*Pinus, Picea, Larix* and *Betula*) can be reconstructed for Kis-Mohos-tó between 14,600 and 9500 calBP, with several steppe elements, such as the grasses, Chenopodiacea and *Artemisia (Fig. 2).* The growing dominance of *Larix* and *Betula* and the decline of *Picea* and steppe elements can be noted from 11,000 calBP, while *Larix* becomes the dominant component of the early Postglacial forest. This is followed by a rapid decline (lasting about 100 years) of the coniferous forest and the increase of deciduous trees, chiefly oak, hazel, linden and ash (*Quercus, Corylus, Tilia* and *Fraxinus*) from as late as 9600 calBP.[7] Unfortunately, this transitional period has not been preserved in any of the Nagy-Mohos-tó pollen sequences (neither in NM I–II, nor in NM 2b: *Fig. 3*).

The transitional Late Glacial/Early Holocene vegetation can be analysed on the basis of the NM 2b-f pollen zone. The temperate oak forest had been established with typical elements, such as hazel, elm

6 *Willis et alii* (1998).

7 *K. J. Willis – P. Sümegi – M. Braun – A. Tóth:* Does soil change cause vegetation change or vica versa? A temporal perspective from Hungary. Ecology 78 (1997) 740–750.

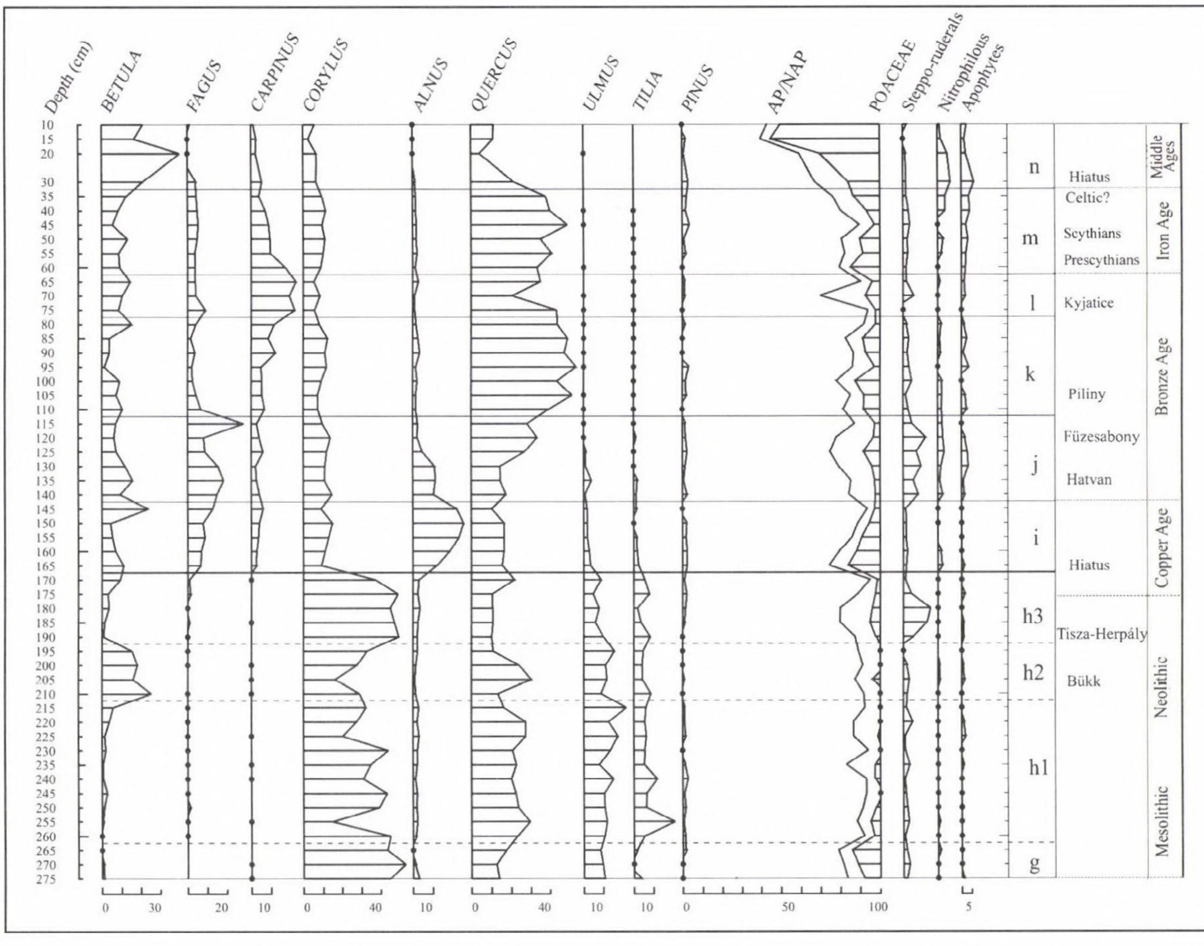

Fig. 3. The simplified percentage pollen diagram of selected taxa from the Kelemér–Nagy-Mohos-tó NM 2b profile (after Juhász [2005])

and linden (*Corylus, Ulmus* and *Tilia*). The herbaceous vegetation is made up of cold steppe elements (*Artemisia,* Caryophyllaceae, Chenopodiaceae), and the typical wet meadow taxa (Ranunculaceae, *Potentilla* sp., Rubiaceae) are also present. The values of the steppe herbs are much higher than the values known from other comparable sequences of the Early Holocene, and temperate tree taxa too make their appearance in the vegetation with high values. These samples were overlain by a clay layer devoid of pollen between 300–275 cm in the NM 2b sediment core;[8] the upper layers (NM 2b-g) represent an Early Holocene vegetation development, described later in this paper.

PHASES OF HUMAN DISTURBANCE AT THE MOHOS LAKES DURING THE EARLY HOLOCENE

The first three millennia of the Holocene, between *ca.* 9500 and 6500 calBP (dated to 8650±110 uncalBP at 283 cm and to 5515±45 uncalBP at 143 cm), are represented by zones NM-5 and NM-9 of the NM I–II profile[9] and by zones NM 2b-g and NM 2b-h of the NM 2b profile.[10] The slopes around the Nagy-Mohos-tó peat bog were covered by a mixed deciduous forest of a relatively constant species composition, despite the shifts in dominance and evidence for forest clearance. The Early Holocene hazel (*Corylus*) dominated mixed deciduous woodland (the lake basin was encircled by hazel shrub) was first interrupted by the brief spread of linden (*Tilia*) between *ca.* 8200 and 8000 calBP, noted also

8 *Juhász* (2002).
9 *Magyari* (2002).
10 *Juhász* (2002).

at Nyírjes-tó by Sirok,[11] Nagy-Mohos-tó (between 260 and 245 cm, at the very beginning of NM 2b-h1),[12] and Kis-Mohos-tó, although at the latter location the pollen profile indicated the spread of *Betula* instead of *Tilia*.[13] These changes coincide with the infilling of the lake basin, but *Betula* spread on the developing *Sphagnum* carpet at Kis-Mohos-tó, suggesting allogenic forcing. There is no evidence of human activity in the pollen records.

The vegetation subsequently returned to its previous state. Linden (*Tilia*) was again replaced by hazel (*Corylus*) until *ca.* 7850 calBP, when both elm and hazel may have been selectively exploited, a phenomenon described as the first elm decline by Enikő Magyari.[14] The simultaneous expansion of *Fraxinus* and *Betula*, *Picea* and other light-demanding trees suggest the opening-up of the forest canopy around Nagy-Mohos-tó. Ash (*Fraxinus*) probably benefited from the decline of elm (*Ulmus*) and its expansion can probably be attributed to felling or the coppicing of elm and hazel.[15] This small-scale disturbance was in all likelihood caused by members of mobile foraging groups since several Mesolithic campsites have been identified within a radius of 70–100 km.[16]

The second elm and hazel decline at *ca.* 7300 calBP clearly reflects human activity, indicated also by the appearance of Chenopodiaceae (from 235 cm in the NM 2b sequence[17]) and, also, of *Plantago lanceolata*.[18] The increase of *Artemisia* and Poaceae in both pollen sequences indicates that nearby Bükk communities (whose settlements have been identified in the area) practiced livestock grazing rather than crop cultivation near the bog during the Bükk period.[19]

According to Pascal Favre and Stefanie Jacomet, several Neolithic groups in Germany and Switzerland living in upland, mountainous regions used hazel and elm twigs, catkins and branches as livestock fodder during wintertime.[20] Adam Gardner has also suggested that the Neolithic groups (Alföld Linear Pottery) in the Mátra Mountains coppiced hazel and hornbeam between *ca.* 7350 and 6600 calBP.[21] It is possible that Bükk communities too practiced coppicing and that the less pronounced increase of oak in the Kis-Mohos-tó[22] and NM 2b sequences (NM 2b-h2 at 210–190 cm and the rise of *Betula*) may be attributed to human activity. The Holocene pollen diagram from Kis-Mohos-tó also indicates a decrease in the proportion of hazel during the same period (around 5200 BC),[23] although it is less striking owing to its lower resolution.

Following the short recovery of the forest around 7000 calBP (5000 and 4900 BC), elm declined again; this time in two phases (third and fourth elm decline according to Enikő Magyari[24]). The decline of the arboreal vegetation coincided with the rise of Cerealia and *Artemisia*, suggesting the appearance of arable fields, probably in the valley. This 300 years long period of farming and coppicing can be correlated with the presence of the Tisza–Herpály–Csőszhalom and Lengyel cultures in the region. It must here be noted that there is a discrepancy between the pollen evidence for intensive human activity and the rather scanty number of archaeological finds, which probably means that further field investigations are necessary in this region. Andrew Sherratt and Nándor Kalicz too assumed a depopulation

11 *A. R. Gardner:* Neolithic and Copper Age woodland impacts in northeast Hungary? Evidence from the pollen and sediment chemistry records. The Holocene 12:5 (2002) 541–553; cp. *Adam Gardner*, in this volume (pp. 87–106).

12 *Juhász* (2002).

13 *Willis et alii* (1998).

14 *Magyari et alii* (2001); *Magyari* (2002).

15 *H. M. Heybroek:* Diseases and lopping for fodder as possible causes of a prehistoric decline of Ulmus. Acta Botanica Neerlandica 12 (1963) 1–11.

16 *R. Kertész:* Data to the Mesolithic of the Great Hungarian Plain. Tisicum 8 (1993) 81–104.

17 *Juhász* (2002); *Juhász* (2005).

18 *Magyari* (2002).

19 *Sümegi* (1998); *Sümegi* (1999).

20 *P. Favre – S. Jacomet:* Branch wood from the lake shore settlements of Horgen Scheller, Schwitzerland: Evidence for economic specialization in the late Neolithic period. Vegetation History and Archaeobotany 7 (1998) 167–178.

21 *A. R. Gardner:* The Impact of Neolithic Agriculture on the Environments of South-East Europe. PhD Thesis, University of Cambridge. Cambridge 1999.

22 *Willis et alii* (1998).

23 *Willis et alii* (1998).

24 *Magyari et alii* (2001); *Magyari* (2002).

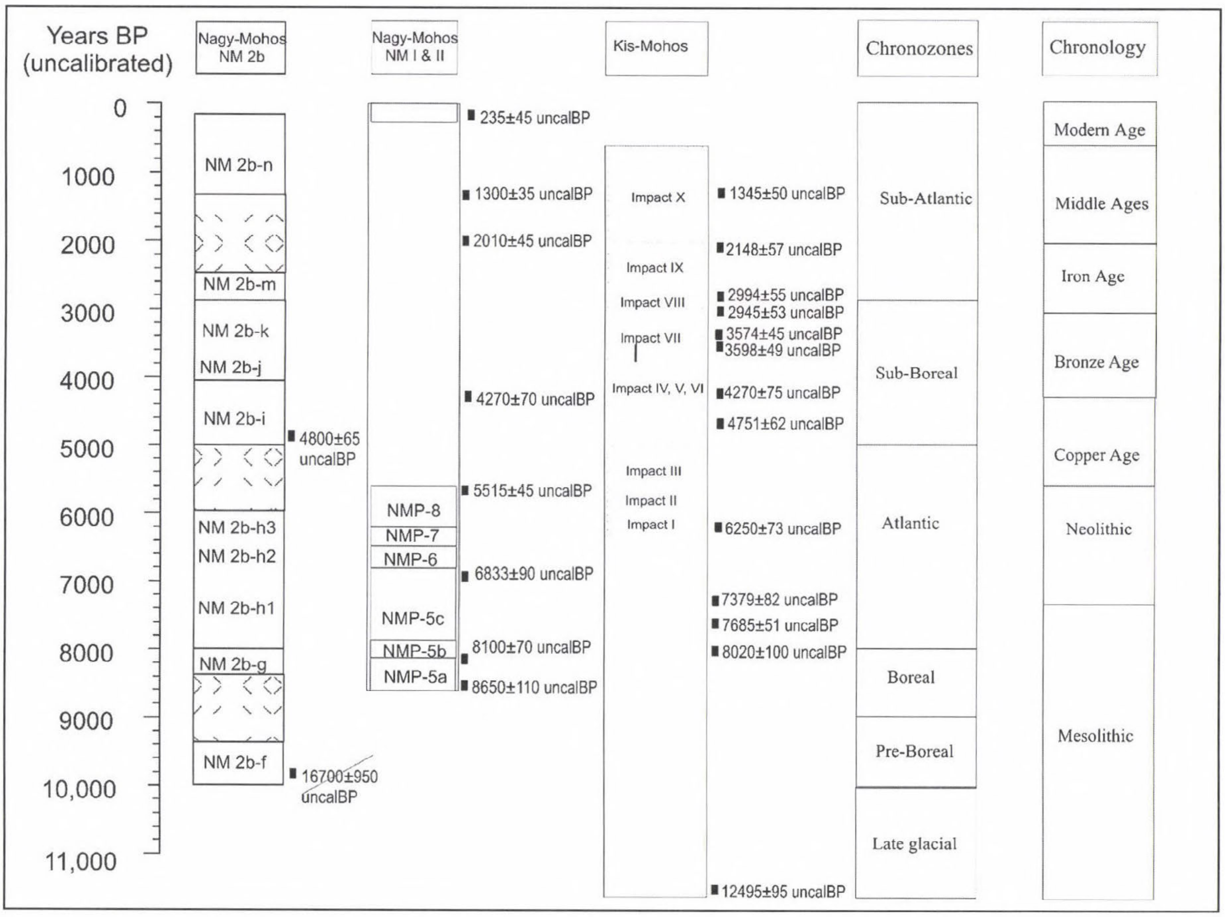

Fig. 4. The correlation of the Kelemér–Nagy-Mohos-tó NM I–II and NM 2b profiles with the Kelemér–Kis-Mohos-tó profile

in this region;[25] the palaeoecological evidence, however, indicates that the woodland around Kelemér was strongly affected by human activity and that the landscape changed significantly. The first erosion phases at Kis-Mohos-tó (Impacts I–III) most probably coincide with the second–fourth elm declines and erosion phases at Nagy-Mohos-tó *(Fig. 4).*

PHASES OF HUMAN DISTURBANCE AT THE MOHOS LAKES FROM THE MIDDLE TO THE LATE HOLOCENE

Around 5600 calBP (3700 BC), an important rise in the values of beech (*Fagus sylvatica*) can be noted in the Kis-Mohos-tó sequence *(Fig. 2)*, parallel to the decline of hazel *(Corylus avellana)*, elm (*Ulmus*) and oak (*Quercus*) in the woodland. A *ca.* 1000 years long hiatus (between 6000 and 5100 uncalBP) can be noted in the NM 2b sequence *(Fig. 3)*, reflected also in the radiocarbon date for the section at 169 cm *(Fig. 4)*. Sedimentation restarted at 4800±65 uncalBP (3400 BC), when beech (*Fagus*) is present with high values and hornbeam (*Carpinus*) has a continuous curve in the NM 2b-i zone, and a local maximum of *Alnus* can be noted at Nagy-Mohos-tó. The collective maximum of the copper content of the sediment and the charcoal concentration at Kis-Mohos-tó, as well as the notable increase of grasses (Poaceae), indicates a human impact at *ca.* 3200 BC (Impacts IV–VI).

25 *A. Sherratt:* The development of Neolithic and Copper Age settlements in the Great Hungarian Plain. Part 1: The regional setting. Oxford Journal of Archaeology 1 (1982) 287–316; *Kalicz N.:* Agyagistenek. A neolitikum és rézkor emlékei Magyarországon. Budapest 1970.

Several explanations have been proposed for the expansion of beech (*Fagus*) during this period, including climatic change[26] and soil change,[27] but anthropogenic influence seems more likely.[28] The spread of beech around the Mohos lakes can most probably be ascribed to intensive human activity (Late Copper Age Baden culture from 3500 to 2800 BC). However it seems less likely that, similarly to the process observed in present-day Scandinavia,[29] beech revived/renewed as the first, pioneer tree taxon on the disturbed soil of the burned forest. It seems more probable that beech populations benefited from the climatic change and from anthropogenic forest clearances,[30] which contributed to and accelerated the species change in the closed canopy oak woodland.[31] The growing expansion of hornbeam (*Carpinus*) can be observed in the woodland and the increase of this temperate tree taxon between 3200–2400 BC can be correlated with human activity (Impacts IV–VI, 5200–4400 calBP).[32] Hornbeam is very sensitive to shading, and the opening-up of the forest canopy encourages its spread – the continuous small-scale clearances resulted in the continuously high proportion of hornbeam in the mixed hornbeam-oak forests.[33]

The dominance of the hornbeam-beech-oak woodland remained typical for the Mohos lakes until *ca.* 3200 calBP (1200 BC), when it was again supplanted by oak (*Quercus*). This forest composition differs markedly from that of the Early Holocene oak forest. Hazel (*Corylus*) and elm (*Ulmus*) have much lower proportions, while beech (*Fagus*) and hornbeam (*Carpinus*) are present in this woodland. It is likely that human disturbances (Kyjatice culture, between 1250–900 calBC) also played a role in this major vegetation change, indicated by the high proportions of *Betula*, Filicales and the charcoal maximums in the pollen record. The construction of a chain of hillforts along the boundary of the Bükk Mountains and the Great Hungarian Plain too resulted in major forest clearing activity.[34]

Soil erosion became continuous from *ca.* 800 calBC (2800 calBP), when the proportion of woodland (AP) decreased. This period can be correlated with the presence of Scythian and Celtic tribes in the region. The high values of charcoal during this period at Kis-Mohos-tó and the geochemical record indicate that a Celtic population settled in this region. Pál Sümegi has suggested that the medieval castle at Kelemér–Várdomb was built over the site of an earlier fort constructed during the Celtic period.[35] A hiatus can be detected at the end of the NM 2b-m zone in the Nagy-Mohos-tó pollen sequence.[36] This hiatus can probably be attributed to an intensive human impact during the Celtic period – it seems likely that the peat was removed by the area's inhabitants to create an open water surface for drawing drinking water.

Sedimentation restarted around *ca.* 1300 calBP (690 calBC), represented by the NM 2b-n zone. During the Middle Ages (1000–1600 AD), the Kis-Mohos-tó was used for hemp rotting, reflected by the high *Cannabis* pollen content of the sediment layers. The peat layers were probably repeatedly removed for keeping the lake surface open.

The pollen record indicates that the region was not depopulated during the Migration period either and a major human impact can be noted during the Hungarian Conquest period (9th–10th centuries),

26 *H. J. Beug:* Vegetation history and climate changes in central and southeastern Europe. In: Climate change in later prehistory. Ed.: A. F. Harding. Edinburgh 1982, 85–102; *A. R. Gardner – K. J. Willis:* Prehistoric farming and the postglacial expansion of beech and hornbeam: a comment on Küster. The Holocene 9:1 (1999) 119–122.

27 *K. J. Willis:* The vegetational history of the Balkans. Quaternary Science Reviews 13 (1994) 769–788.

28 *K. Behre:* Anthropogenic indicators in pollen diagrams. Balkema. Rotterdam 1986; *S. Jahns:* On the Holocene vegetation history of the Argive Plain. Vegetation History and Archeobotany 2 (1993) 187–203; *K. J. Willis:* Where did all the flowers go? The fate of temperate European flora during glacial periods. Endeavour 20:3 (1996) 110–114.

29 *L. Björkman:* The establishment of Fagus sylvatica at the stand-scale in southern Sweden. The Holocene 9:2 (1999) 237–245.

30 *H. Küster:* The role of farming in the postglacial expansion of beech and hornbeam in the oak woodlands of Central Europe. The Holocene 7:2 (1997) 239–242.

31 Cp. also *Magyari* (2002); *Sümegi* (1999).

32 *Willis et alii* (1998).

33 *Májer A.:* Magyarország erdőtársulásai. Budapest 1968.

34 *Sümegi* (1998); *Sümegi* (1999); *Sümegi et alii* (2005).

35 *Sümegi* (1998); *Sümegi* (1999).

36 *Juhász* (2002); *Juhász* (2005).

when the high value of cereals and nitrophilous taxa can be correlated with a population growth, reflected also in the archaeological record.

The southern basin of Nagy-Mohos-tó (NM I–II[37]) was most probably exploited twice.[38] First during the Celtic period (100–50 BC) and later, most probably, during the 1920s by the landowner Diószeghy family. The peat was used for soil amelioration, a practice recorded also in the historical sources.[39]

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Magyari (2002)	*E. Magyari:* Climatic versus human modification of the Late-Quaternary vegetation in Eastern Hungary. PhD Thesis. Debrecen 2002.
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37 *Magyari* (2002).
38 *Magyari* (2002); *Sümegi* (1999).
39 *Gyulai I.*: A keleméri Mohos-tavak. Természet Világa 126 (1995) 137–138.

DETECTING ANTHROPOGENIC IMPACTS IN THE PALAEOBOTANICAL SAMPLES FROM CSARODA–NYÍRES-TÓ

Imola Juhász

INTRODUCTION

The results of the first palynological investigation of sediment cores from Csaroda–Nyíres-tó were published in 1957 by Ede Vozáry.[1] The first core (470 cm) represented the vegetation history of the area from Firbas zone VII to Firbas zone X (from the middle of the Atlantic to the Sub-Atlantic), the second core (780 cm) from Firbas zone V to Firbas zone X (from the middle of the Boreal to the Sub-Atlantic), with a 80 cm long hiatus between Firbas zone VIII and Firbas zone IX.[2]

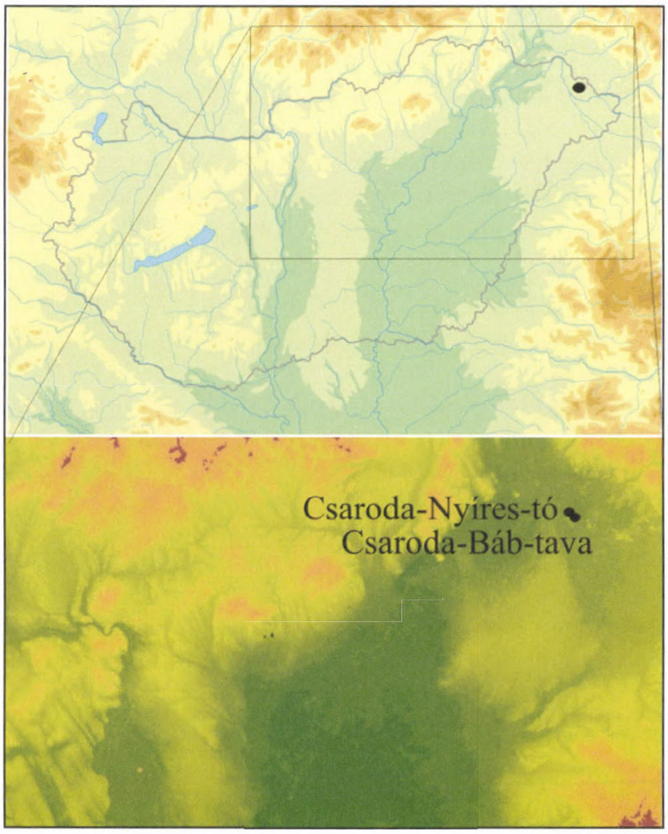

Fig. 1. The location of Csaroda–Nyíres-tó peat bog in north-eastern Hungary

The most recent investigation of palaeobotanical samples from Nyíres-tó at Csaroda was carried out by Guy James Harrington as part of his Master Course in Wolfson College, Cambridge, under the supervision of Dr. Keith Bennett. His dissertation, *Anthropogenic impact upon the Eastern Hungarian landscape*, was submitted to the University of Cambridge and defended successfully in 1995.[3] Unfortunately, this important, detailed and relatively well dated corpus of data has not been published since. This volume, whose main goal is to provide an outline of vegetation development during the Holocene in northern and north-eastern Hungary, would hardly be complete without the inclusion of this invaluable and essential body of data. In spite of our repeated efforts, and to our greatest regret, we were unable to contact the author. We nonetheless decided to present his data on the vegetation development of the Nyíres-tó oxbow lake at Csaroda and to re-evaluate it in the light of more recent evidence.

DESCRIPTION OF THE SITE, ANALYTICAL PROCEDURES, RADIOCARBON DATES

Nyíres-tó lies near Csaroda (22°30' E, 48°20' N) on the Bereg Plain, a well-defined area between the Tisza River and the Hungarian–Ukrainian border *(Fig. 1)*. The average altitudes vary between 106 and

1 *E. Vozáry:* Pollenanalytische Untersuchung des Torfmoores »Nyírestó« im Nordosten der Ungarischen Tiefbene (Alföld). Acta Botanica III:1–2 (1957) 123–134.

2 *F. Firbas:* Spät- und Nacheiszeitliche Waldgeschichte Mitteleuropas nördlich der Alpen. 1. Band: Allgemeine Waldgeschichte. Jena 1949.

3 *Harrington* (1995).

Average depth (cm)	14C age (uncalBP)	Probability (%)	Calendar age (calBC)
279	7670 ± 60	95.4	6640 BC (6530 BC) 6420 BC
273	6587 ± 110	94.2	5670 BC (5490 BC) 5310 BC
243	5683 ± 86	95.4	4720 BC (4535 BC) 4350 BC
160	1695 ± 40	95.4	240 AD (335 AD) 430 AD

Table 1. Radiocarbon dates for the Csaroda–Nyíres-tó peat bog (after Harrington [1995] and Sümegi [1999])

179 m a.s.l. The plain is part of the Tisza floodplain, although its eastern part is considered as flood-free. Nyíres-tó is an infilled oxbow lake of clay and organic matter overlying fluvial sands, which was detached from the Tisza River.[4] Because of the small basin size (1 ha), the reconstruction of vegetation development predominantly reflects the pollen influx from the local area (no broader than a few hundred meters).[5] The samples were processed using the standard procedures: their preparation followed a modified version of Berglund and Ralska-Jasiewiczova's method[6] and exotic marker grains (*Lycopodium* spores[7]) were added to enable statistical calculations, such as pollen concentration, rarefaction analysis[8] and Principal Components Analysis (PCA) using the PSIMPOLL programme.[9] Microscopic charcoal analysis was performed using Clark's point count method.[10]

During the coring process in January, 1994, a modified 5 cm diameter Livingston corer was used;[11] the sediment was described using the classification introduced by Troels-Smith.[12] A total of 86 sediment samples were taken from the 412 cm deep sediment core at 2 to 4 cm intervals.[13] Five evenly spaced samples were taken from the core and were sent for conventional bulk radiocarbon dating to the NERC Radiocarbon Laboratory in East Kilbride. Due to low carbon content, only two of these could be successfully processed. The sample at 280–278 cm gave a date of 7670 uncalBP (standard devia-

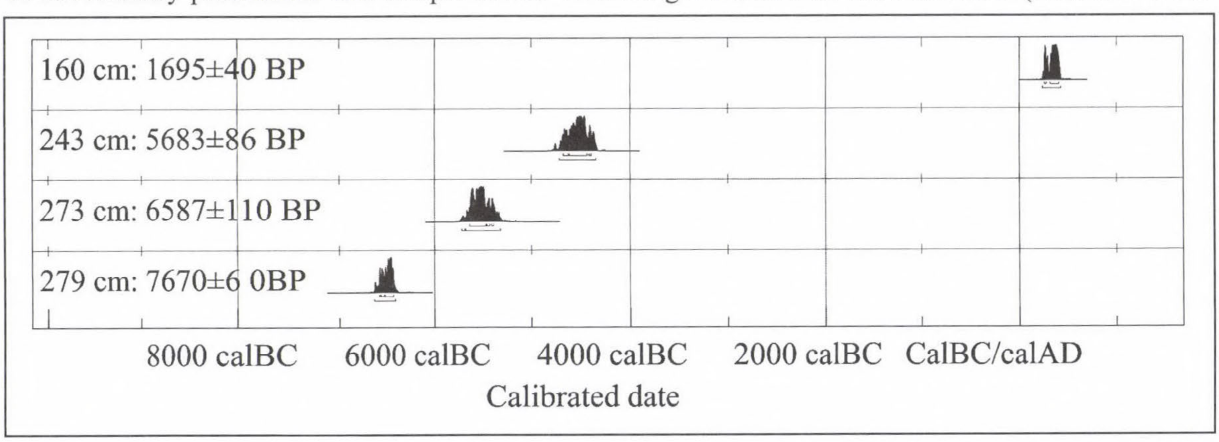

Fig. 2. Radiocarbon dates for the Csaroda–Nyíres-tó peat bog on a calibrated BC scale (Atmospheric data after Stuiver et alii [1998], OxCal v3.5 Bronk-Ramsey [2000])

4 *Sümegi* (1999)

5 *G. L. Jacobson – R. H. W. Bradshaw:* The selection of sites for palaeovegetational studies. Quaternary Research 16 (1981) 80–96.

6 *B. E. Berglund – M. Ralska-Jasiewiczowa:* Pollen analysis and pollen diagrams. *In:* Handbook of Holocene Palaeoecology and Palaeohydrology. Ed.: B. E. Berglund. London 1986, 455–484.

7 *L. J. Maher Jr.:* Statistics for microfossil concentration measurements employing samples spiked with marker grains. Review of Palaeobotany and Palynology 32 (1981) 153–191.

8 *Birks – Line* (1992).

9 *K. D. Bennett:* Pollen counting on a pocket computer. New Phytologist 114 (1990) 275–280.

10 *R. L. Clark:* Point count estimation of charcoal in pollen preparations and thin sections of sediments. Pollen et Spores 24 (1982) 523–535.

11 *H. E. Wright:* A square rod piston sampler for lake sediments. Journal of Sedimentary Petrology 37 (1967) 975–976.

12 *J. Troels-Smith:* Karakterisering af løse jordater. Danmarks Geologiske Undersøgelse Series IV. 3. 10 (1955) 1–73.

13 *Harrington* (1995) 18.

tion of 60 years) and the sample at 162–158 cm a date of 1695 uncalBP (the standard deviation of 40 years). Later, two other radiocarbon dates were published for the same sediment core.[14] The sample at 245–240 cm yielded a date of 5683 uncalBP (standard deviation of 86 years), the sample at 275–270 cm of 6587 uncalBP (standard deviation of 110 years). The dates were calibrated by Stuiver[15] and presented using the Oxcal 3.5 programme *(Table 1, Fig. 2)*.

THE PRESENT-DAY VEGETATION AND ENVIRONMENT

The Bereg Plain (part of the *Samicum* in the phytogeographical classification) is covered by oak-hornbeam forests with *Fagus* and oak-ash-elm gallery forests. Relict-like boreo-continental (Siberian) species are characteristic for the isolated peat bogs, such as Csaroda–Nyíres-tó and Csaroda–Báb-tava.[16] The recent vegetation at Nyíres-tó consists of a *Sphagnum* peat bog and stands of *Betula pubenscens* around the oxbow lake *(Fig. 3)*. Inside the bog, the vegetation is dominated by *Eriophorum vaginatum, Menyanthes trifoliata, Vaccinium oxycoccus, Drosera rotundifolia* and *Comarum palustre*. The *Sphagnum* spots are enclosed by alder and willow groves, within which there is an association of Dryopteridi-Alnetum with *Thelypteris palustris* and *Calamagrosti-Salicetum cinerea*, while the margins are occupied by reed-swamp associations (Scirpo-Phragmitetum with *Glyceria maxima*).[17] The territory lies in the area affected by the large-scale regulation of the Tisza River during the 19th century (1849–1907),[18] whose purpose was to bring greater areas of the floodplain under cultivation. In the past, the essentially different water supply system undoubtedly influenced the area of the catchment basin.

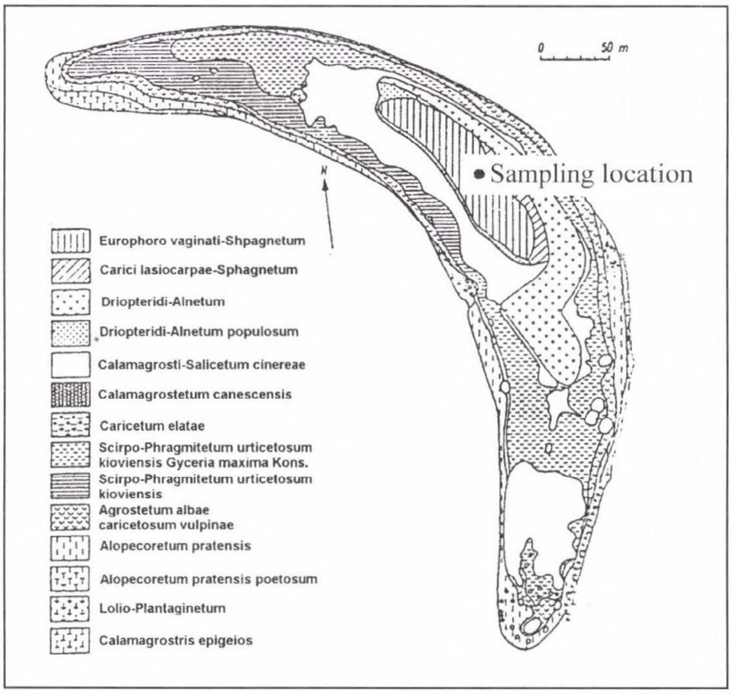

Fig. 3. The present-day vegetation of the Csaroda–Nyíres-tó peat bog (after Nagy et alii [1999])

THE RE-EVALUATION OF THE RESULTS OF THE POLLEN AND CHARCOAL ANALYSIS

The summary pollen percentage diagram was plotted against depth and calibrated BC/AD dates by extrapolating the two radiocarbon dates for the base and the top sediments. Harrington noted that the age of the basal sediment could hardly be 12,300 calBC since the sediments potentially represent fluvial deposits from the Tisza River or a catchment erosion, thus accounting for the relatively rapid deposi-

14 *Sümegi* (1999).

15 *Stuiver et alii (1998)*

16 *T. Simon:* Die vegetation die Moore in den Naturschutzgebieten der Nördlichen Alföld. Acta Botanica 6 (1960) 107–137.

17 *Nagy J. – Figeczky G. – Molnár M. – Selényi M.:* Adatok a beregi tőzegmohás lápok vegetációjának változásaihoz. Kitaibelia 4 (1999) 193–195.

18 *B. Lóczy:* Cultural landscape histories in Hungary – Two case studies. *In:* The cultural landscape. Past, present and future. Eds: H. H. Birks – H. J. B. Birks – P. E. Kaland – D. Moe. Cambridge 1988, 165–176.

tion. He tentatively assigned the base of the core to the early Postglacial (until new data would be available from a comparable context),[19] with the caveat that a stronger chronological framework for the basal sediment layers would be necessary to justify this assertion. While no new radiocarbon measurements are available for the base of the core, some new dates have been recently obtained for its middle section. These have been published by Pál Sümegi in his study presenting the results of an interdisciplinary research project for reconstructing the development of the natural environment in the Csaroda region, together with a detailed overview of the regional archaeological evidence and the geo-archaeological analyses.[20] The re-evaluation presented here is based on Harrington's palynological data.[21]

The description and interpretation of the pollen results

Harrington divided the pollen diagram *(Fig. 4)* into five Local Pollen Assemblage Zones (LPAZ) – labelled NYO-P1, NYO-P2, etc. – to distinguish them from the sedimentological, geochemical zones (NYO-C1, etc.). Several new, radiocarbon dated palaeoecological sequences have been published from this part of Hungary over the past nine years,[22] and we now have a much more detailed picture of vegetation development since Harrington wrote his thesis. In this paper, I shall present a new interpretation of the palaeobotanical evidence based on my assumption that the pollen deposition began no later than *ca.* 10,000–9500 uncalBP. However, the dating of the basal sediment remains crucial for the verification of this hypothesis. It is my belief that certain vegetation changes are more essential to understanding the vegetation history of north-eastern Hungary than has been earlier assumed. For this reason, I divided the pollen diagram into smaller and more detailed local pollen assemblage zones, which are labelled NYLPZ-a, NYLPZ-b, etc., to distinguish them from Harrington's original zones.

I divided the pollen diagram into seven Local Pollen Assemblage Zones with a further subdivision into two sub-zones in the case of two zones (NYLPZ-b1-b2 and NYLPZ-d1-d2). The most important change was the division of Harrington's NYO-P1 zone (412–292 cm) into three different LPAZs: NYLPZ-a (412–380 cm), NYLPZ-b (380–325 cm) and NYLPZ-c (325–294 cm) based on their information content[23] displaying recognizable pollen characteristics, on the basis of which they may be separated from adjacent zones and are internally as homogenous as possible. The zone boundary lines have been drawn at the points where changes in the pollen spectra are the most marked.

The problem of dating the basal part of the pollen sequence

Harrington believed that the entire basal zone (412–292 cm) was deposited during the early Postglacial (12,300–6400 calBC).[24] He reconstructed a mixed oak forest with a rich under-storey flora, and noted an increase in the abundance of spruce (*Picea*) to 20% after *ca.* 10,500 calBC (a date obtained by extrapolation), later replaced by oak (*Quercus*) and hazel (*Corylus*) (dated to *ca.* 8000 calBC). He noted that without finer dating control, this statement would remain unqualified[25] and that his timescale for the lowest part of the sequence is purely hypothetical. Pál Sümegi later described this zone as corresponding to the Late Glacial–early Postglacial period (from *ca.* 12,000 uncalBP), characterised by a predominantly

19 *Harrington* (1995) 15.
20 *Sümegi* (1999).
21 *Harrington* (1995).
22 *Willis et alii* (1995); *Willis et alii* (1997); *Sümegi P.:* Az utolsó 15.000 év környezeti változásai és hatásuk az emberi kultúrákra Magyarországon. *In:* A régésztechnikusok kézikönyve. Ed.: G. Ilon. Szombathely 1998, 367–395; *Juhász* (2002); *I. E. Juhász – G. Jakab – P. Sümegi:* Vegetation dynamics of a small Sphagnum peat bog from North-Hungary, from the Late-Pleistocene until late Holocene: palynological and macrobotanical data. Polen 14 (2004) 507–508; *Magyari* (2002); *Magyari et alii* (2000); *Magyari E. – Jakab G.:* Új horizontok a magyar lápkutatásban: szukcessziókutatás paleobryológiai és pollenanalitikai módszerekkel. Kitaibelia 5 (2000) 17–36, etc., to mention but the most recent and important works.
23 *H. J. B. Birks – A. D. Gordon:* Numerical Methods in Quaternary Pollen Analysis. London 1985.
24 *Harrington* (1995) 27.
25 *Harrington* (1995) 53.

coniferous forest[26] resembling present-day European boreal forests.[27] This forest is characterised by *Picea*, *Pinus* and *Betula* and the presence of deciduous taxa (*Quercus*, *Alnus*, *Tilia*, *Salix*), but without *Ulmus* and *Corylus*. It must be noted that coniferous taxa and birch have very high percentages (60–70%) in present-day boreal forests, while deciduous trees are scarcely represented (a maximum of 5%), with only some stands of broad-leaved trees. However, in this pollen diagram, *Picea* peaks at 380–360 cm, although this peak is not higher than 20%, while *Pinus* is represented with 2–5% only. It must be noted that Scots pine (*Pinus sylvestris*), a wind pollinated species, always has very high values (up to 50–60%), even though its presence is only regional during cold periods. *Betula* is present very sporadically and its values fluctuate widely. There is no evidence of *Juniperus* or any other typical cold elements. Grasses (Poaceae) are present with low values (5–8%) and there are only sporadic traces of other steppe species. In contrast to temperate forest taxa represented with high percentages, oak (*Quercus*), hazel (*Corylus*), elm (*Ulmus*) and linden (*Tilia*), the most typical members of early Holocene vegetation, have values of 10 to 20%. Ash (*Fraxinus*), alder (*Alnus*) and willow (*Salix*) are similarly well represented, as is fox-grape (*Vitis*), the latter species usually considered an indicator of warmer climatic periods.[28] If the area around Nyíres-tó was indeed an important temperate refugium, the problem of the absence of hornbeam (*Carpinus*) and the sporadic appearance of beech (*Fagus*) in the pollen sequence must be addressed. The differences between the pollen sequence from Nyíres-tó and the one from Bátorliget[29] are striking. At Bátorliget, the above mentioned Late Glacial forest is represented by the second pollen zone (BLP2), showing high values for *Pinus* (which dominates the sample), *Picea* and *Betula* and very low values for temperate taxa with the presence of Poaceae and *Artemisia*. The expansion of temperate taxa can only be detected later, during the Postglacial in the pollen sequence. A comparable early Holocene forest composition is represented by the pollen sequence from Sirok,[30] with similarly relatively high values of *Picea* and deciduous tree taxa. In view of the composition of the pollen assemblage and the high proportion of temperate tree elements, the age of the basal zone is probably

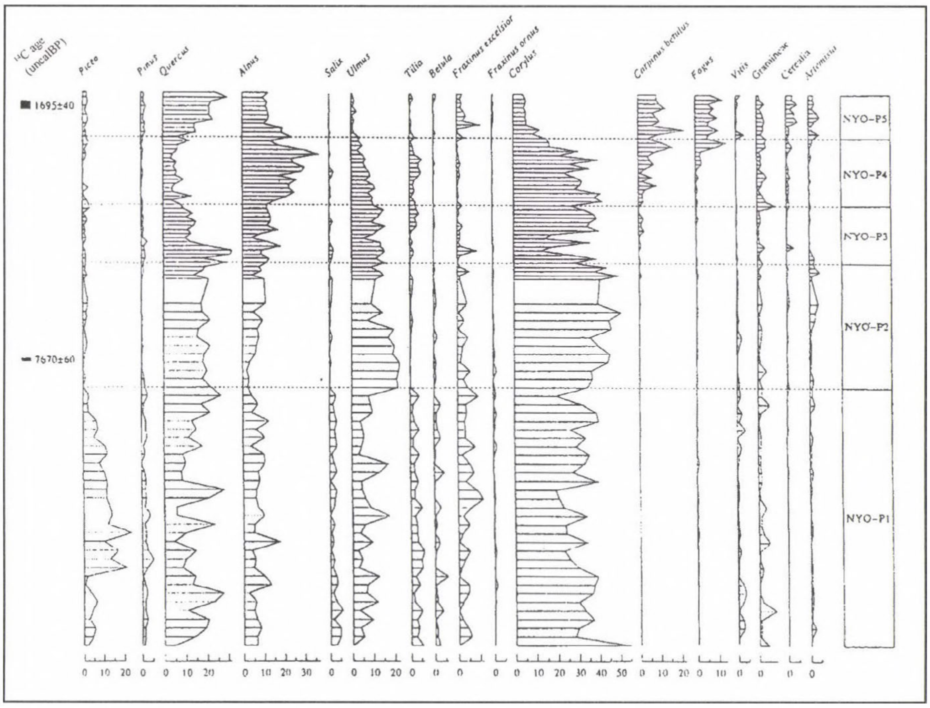

Fig. 4. Percentage pollen diagram of selected taxa from the Csaroda–Nyíres-tó peat bog plotted against depth (after Harrington [1995])

26 *Sümegi* (1999) 186.

27 *G. M. Peterson:* Recent pollen spectra from zonal vegetation in the western USSR. Quaternary Science Reviews 2 (1983) 283–321; *N. Nikolov – H. Hemisaari:* Silvics in the circumpolar boreal tree species. *In:* A system analysis of the global boreal forest. Eds: H. H. Shugart – R. Leemans – G. B. Bonan. Cambridge 1992, 13–84.

28 *J. Iversen:* The Late-glacial flora of Denmark and its relation to climate and soil. Danmarks Geologiske Undersøgelske 2 (1954) 88–119.

29 *Willis et alii* (1995).

30 *Gardner* (1999); *Gardner* (2002).

much later than earlier believed and most likely falls into the early Holocene. However, this question can only be resolved by new radiocarbon dates for the lower part of the sediment.

The new pollen zones after the re-evaluation of the pollen sequences are the following:

NYLPZ-a: 412–380 cm (10,000–9500 uncalBP, 9500–9000 calBC)
A mixed, oak (*Quercus*) and hazel (*Corylus*) dominated woodland characterises the basal zone of the pollen diagram, with the presence of coniferous taxa, such as Scots pine (*Pinus*) and spruce (*Picea*), and relatively high values of birch (*Betula*). All members of broad-leaved thermophilous forests are represented in the pollen assemblage: elm (*Ulmus*) and linden (*Tilia*) have significant percentages, and alder, willow and ash (*Alnus*, *Salix* and *Fraxinus*), the typical taxa of gallery forests, are also present, alongside sporadic traces of beech (*Fagus*) and relatively significant values of *Vitis*. Grasses (Poaceae), mugworth (*Artemisia*), Asteraceae and Caryophyllaceae pollens are also present. A strong forest cover is detected, with only patches of the steppe-like herbaceous taxa surviving around the closed mixed oak forest. This vegetation most probably corresponds to the vegetation at the beginning of the Holocene, when the broad-leaved oak forest appeared and developed, and only patches of the coniferous forest-forest steppe vegetation survived. The presence of fox-grape (*Vitis*) suggests a relatively high temperature during this period, while Cyperaceae, *Typha/Sparganium*, and Filicales pollens indicate a relatively low water level during this period.

NYLPZ-b: 380–325 cm (9500–8500 uncalBP, 9000–7500 calBC)
The second zone can be divided into two sub-zones on the basis of the changes in the pollen spectrum. A rise in the values of coniferous species can be noted in the first phase of this zone (NYLPZ-b1), parallel to a sharp decline in almost all broad-leaved taxa (*Quercus*, *Corylus*, *Ulmus*) except for *Tilia*. *Picea* is still represented with higher values during the second phase (NYLPZ-b2), while *Quercus* declines from 20 to 10%, *Corylus* from 40 to 25% and *Ulmus* from 10 to 5%. *Fraxinus excelsior* reaches its highest percentage, although with significant fluctuations. *Picea* peaks at 20% of the total pollen at 360 cm and *Pinus* shows a slight increase, from 2 to 5%. However, the peak of the coniferous woodland is not reflected at that amplitude in the concentration diagram, suggesting that it may in part be attributed to the appearance of wind or water transported extralocal pollen influx. *Picea* prefers more nutrient rich soils. There is a peak in the micro-charcoal concentration at the end of the previous zone, and also during the second phase of the zone. Values of Filicales also rise, usually a reflection of forest fire events. There is an increase in the palynological richness.

The second phase of this zone (NYLPZ-b2) is characterised by major fluctuations of different taxa, which is also reflected in the concentration diagram. At 258 cm, following an important, well defined peak of the *Quercus* curve, *Ulmus* and *Corylus* reach a temporary maximum, followed by that of *Tilia* and *Fraxinus*. The values of light-loving *Betula*, Filicales and the concentration curve of micro-charcoal elements also peak during this phase. At the same time, a second transitional pollen peak can be detected at the end of the second sub-zone. Again, *Quercus* peaks at even higher values than previously, *Corylus* too increases, followed by the peaks of *Fraxinus* and *Ulmus*. *Betula*, Filicales spores and micro-charcoal content similarly have minor peaks at those depths. An increase of *Artemisia*, Compositae Tubuliflorae (Asterioideae) and Compositae Liguliflorae (Cichorioidae), Chenopodiaceae, Umbelliferae (Apiaceae) can be detected in the herbaceous vegetation, and Cerealia grains make an appearance at the end of the zone. Although Harrington duly noted these changes, he did not interpret them as a reflection of anthropogenic impact. The correlation between non-arboreal components and *Centaurea* (not shown on the pollen diagram with a separate curve) with the temporary decline of *Corylus* and other tree taxa may indicate a practice of slash-and-burn agriculture in the area around the basin. Since Harrington considered the basal age to be much older than 10,000 uncalBP, he rejected this interpretation on the basis of the low degree of stratigraphic resolution. According to his time scale, each level represents about 200 years and thus periods of slash and burn agriculture would be undetectable unless there was substantial vegetation disturbance in the local area around the basin and sustained permanent clearances over many generations of prehistoric communities.[31] Accepting that the sedimentation rate was more rapid than earlier assumed (as at Csaroda–Báb-tava following the detachment of the oxbow lake[32]) and that this 60 cm thick sediment layer (spanning the period represented by NYLPZ-b) was deposited during roughly 1500 years (between 9000–7500 calBC), an anthropogenic impact may be assumed, in spite of the poor stratigraphic resolution. Fluctuating palynological richness values and sediments indicating active erosion in the basin can be noted during this period. Since the genuine age of the basal 130 cm of the core remains unknown and there are no new radiocarbon dates available for this section of the sediment, this hypothesis too remains highly speculative.

NYLPZ-c: 325–294 cm (8500–8000 uncalBP, 7500–7000 calBC)
Picea declined during this period, while *Pinus* retained constant values. The percentages of *Quercus* and *Corylus* increase, as do those of *Betula* and *Vitis* (appearing also on the concentration diagram). The other typical elements of the oak forest (*Tilia*, *Ulmus*) and *Alnus*, *Fraxinus* and *Salix* have relatively constant values. The grasses (Poaceae), *Artemisia* and Umbelliferae have significant values; Compositae (mostly of the Tubuliflorae-Cichorioideae type) have a peak in this zone. A slight opening up of the forest canopy can be detected and an increase in palynological richness can be noted chiefly at the beginning of the zone, although there are no obvious signs of human disturbance.

NYLPZ-d: 294–243 cm (8000–5500 uncalBP, 7000 BC–4500 calBC)
The fourth pollen zone corresponds to Harrington's second zone (NYO-P2). The sediment at 278–280 cm was dated to 7670 uncalBP, corresponding to the Early Neolithic. A shift in the vegetation is noted with the local expansion of *Corylus* and *Ulmus* (the latter reaching maximum values at 20%), which together with *Quercus* dominate the forest vegetation. Coniferous taxa become sporadic during this period; *Tilia* too decreases and becomes virtually absent, similarly to *Betula* and *Salix*. *Alnus* and *Fraxinus* also decline. There is a slight increase in *Artemisia*, Poaceae and Caryophyllaceae, which peak parallel to peaks in the palynological richness data, the latter increasing as the AP/NAP ratio decreases. The effects of a lithological change can be noted from the very end of the previous zone at 294 cm. The cause of this vegetation change is speculative: changes in land use may have triggered edafic changes or climatic change may have altered vegetation dynamics. Conditions favoured *Corylus* and *Ulmus* at the expense of Filicales, which totally disappear from the vegetation, although they had high values all along the base of the sediment core. *Nuphar* and *Typha* have high percentages too. Charcoal profiles indicate less charcoal in the area (mostly during the first part of the zone; NYLPZ-d1) or perhaps less charcoal entered the basin if the previous changes can be attributed to an extralocal pollen and charcoal influx. In terms of vegetation reconstruction, the absence of repeated fires would have encouraged the growth of deciduous trees. In the second phase of the zone (NYLPZ-d2), *Ulmus* decreases, and *Corylus* has even higher values, reaching a maximum of 50% at 258 cm. The beginning of the continuous curve of *Fagus* can be noted from this period, although sporadic *Fagus* pollen grains are present from the beginning of the pollen profile. High values of *Artemisia* and Cerealia pollens, together with an increase of Compositae tubuliflorae (Cichoroideae), Caryophyllaceae and Chenopodiaceae, indicate a human impact on vegetation development. The palynological richness increases significantly during this zone, as does charcoal concentration. The effect of human impact on the appearance and expansion of beech has been discussed by several scholars working in northern Hungary.[33]

NYLPZ-e: 243–204 cm (5500–4000 uncalBP, 4000–2000 calBC)
The vegetation is still predominantly woodland, although disturbances by fire causing stress in the forest can be noted. Its composition is similar to the previous woodland phase, although with a gradual decline of *Ulmus*. Woodland instability is reflected in the peak values first of *Corylus* (followed by a

31 *Sensu Harrington* (1995).
32 *Magyari* (2002).
33 *Gardner* (1999); *Gardner* (2002); *A. R. Gardner – K. J. Willis:* Prehistoric farming and the postglacial expansion of beech and hornbeam: a comment on Küster. The Holocene 9:1 (1999) 119–122.

decline), and the decrease of *Quercus* and, later still, a peak of *Fraxinus* and *Ulmus* and their temporary decline. These declines following maximum values can perhaps be attributed to anthropogenic disturbances in the form of arboriculture[34] or tree felling for building purposes,[35] a possibility also mentioned by Harrington.[36] The general rise in herbaceous taxa correlates with the charcoal peaks suggesting fire disturbance in the forest, which in turn favoured the expansion of herbaceous taxa, such as Poaceae, *Artemisia*, Caryophyllaceae, and perennial taxa, such as Apiaceae and Compositae (*Asteraceae*). An important phenomenon is the appearance and expansion of hornbeam (*Carpinus*) which together with *Tilia* benefited from the woodland disturbance. The background charcoal concentration perhaps corresponds to small domestic fires in the basin area, whilst the peak concentrations are suggestive of larger, more extensive fires. A possible forest clearance may have occurred with large fires (coupled with extensive slash-and-burn) for gaining land for agriculture and/or settlement. A Cerealia concentration peak was noted at 228 cm. Smaller fires (small-scale forest clearance) would increase hunting potential or provide better grazing for domestic animals. A new resurgence of Filicales can be noted in this period; its peak values follow the charcoal peaks. The larger proportion of NAP vegetation and the increase in palynological richness suggest that small-scale clearance possibly took place near the basin, leading to an increase of different vegetation mosaics.[37]

Alnus and *Fraxinus* are also present in the humid zones together with *Typha* and *Nuphar*, reflecting the presence of areas with a higher water level at the site.

NYLPZ-f: 204–172 cm (4000–2500 uncalBP, 2000–400 calBC)
The expansion of alder (*Alnus*), followed by hornbeam (*Carpinus*) and beech (*Fagus*) characterise the woodland during this period. These taxa increase at the expense of *Quercus*, *Ulmus*, and *Corylus*, which show a decline. *Ulmus* and *Fraxinus* may have been selectively cropped or disturbed.[38] *Fagus* was popular for charcoal production and it may also have been favoured as construction material by prehistoric communities.[39] A charcoal peak at 184 cm suggests some sort of fire disturbances, causing a tree succession from *Quercus* and *Corylus* to *Alnus*, *Carpinus* and *Fagus*. *Carpinus* and *Fagus* are generally late entrants in the forest succession and their expansion is usually associated with human disturbance, even though they are members of the autogenic succession. There is a peak in Poaceae values; Cerealia have a continuous curve and almost all the herbaceous taxa increase (Compositae Tubuliflorae, *Anthemis,* Caryophyllaceae and Chenopodiaceae). The gradual opening up of the forest canopy, which already started at the beginning of the previous zone, continues during this period. Umbelliferae (Apiaceae) have very high values, similarly to Filicales. *Nuphar* becomes sporadic and *Typha* also decreases. The presence of *Juglans* (not shown in the pollen diagram) most likely reflects its cultivation by human groups. *Alnus* probably expanded in the wetter part of the catchment, and an alder carr was probably formed. Filicales may have responded to the fire regimen in the catchment area. The increased palynological richness was a response to greater vegetation mosaics.[40]

NYLPZ-g: 172–152 cm (2500–1600 uncalBP, 400–1000 calAD)
The top of the core shows higher values of *Quercus*, *Fraxinus*, *Carpinus* and *Fagus*, together with the consistent presence of *Vitis*. *Pinus* and *Picea* too have higher values. These tree taxa expanded at the expense of *Alnus*, *Ulmus* and *Tilia*. The herbaceous taxa show a significant rise, reflected also in the AP/NAP ratios. Cerealia reach their maximum abundance at 6%; *Artemisia*, Compositae and

34 *B. Aaby:* Trees as anthropogenic indicators in regional pollen diagrams from eastern Denmark. *In:* Anthropogenic indicators in pollen diagrams. Ed.: K. E. Behre. Rotterdam 1986, 73–94.
35 *Behre* (1986).
36 *Harrington* (1995).
37 *Birks – Line* (1992).
38 *Behre* (1986).
39 *B. Amman:* Palynological evidence of prehistoric anthropogenic forest changes on the Swiss plateau. *In:* The cultural landscape. Past, present and future. Eds: H. H. Birks – H. J. B. Birks – P. E. Kaland – D. Moe. Cambridge 1986, 289–298.
40 *Birks – Line* (1992).

Chenopodiaceae reach their maximum concentrations. Umbelliferae (Apiaceae) and Caryophyllaceae are also represented. *Nuphar* and *Typha* re-appear with relatively high values. The charcoal peaks reflect the use of fire for land clearance, although Filicales do not increase significantly. The palynological richness reaches its maximum level. *Humulus/Cannabis* type pollens are present throughout the core. *Humulus* pollens were probably responsible for early pollen percentages, while *Cannabis* can only be detected from the beginning of the previous zone, parallel to the intensification of human impact on the vegetation and the extensive opening up of the forest canopy. Retting of *Cannabis* for rope production was also detected at Kelemér–Kis-Mohos-tó;[41] since, however, the Nyíres-tó basin was shallow and supported the growth of *Typha*, *Potamogeton*, *Myriophyllum* and *Nuphar* from at least 8000 calBC, it seems unlikely that rope production was practiced here since these plants would have hindered retting activities.[42]

The spread of herbaceous taxa may have been encouraged by increased forest burning in the catchment area. The diversity of vegetation mosaics is reflected by the palynological richness, and coincides with the increase of the NAP ratio, reflecting an increasingly open landscape. Grazing in forest clearances probably restricted the tree components and favoured the expansion of Umbelliferae and Compositae. The high values of Cerealia and the presence of *Linum* suggest that arable fields lay quite close to the basin since the heavy pollen grains of these taxa could hardly have been transported here from farther-lying ploughland.

THE COMPARISON OF THE POLLEN PROFILES FROM BÁB-TAVA AND NYÍRES-TÓ

The palaeoecological investigations conducted by Enikő Magyari at nearby Csaroda–Báb-tava yielded important data for vegetation development of this protected nature conservation area during the past 7800 calBP years.[43] An inter-site comparison of the two pollen diagrams has also been published.[44]

At the start of the pollen deposition at Báb-tava (7800 calBP), the oxbow lake was fringed by alder and willow, while mixed deciduous woodland covered the higher lying areas and oak-hazel-ash-elm woodland was also present. The landscape became densely forested towards 7200 calBP. Enikő Magyari argued that the low pollen concentration values of the early period could be attributed to the rapid detrital and minerogenic deposition characterising lowland oxbow lakes after their detachment. This assumption is supported by the radiocarbon dates, which allowed the calculation of sedimentation rates for this period. A very rapid infilling can be noted, which can most likely be attributed to inundations and erosion from the bank.[45] Did Nyíres-tó go through the same process after its detachment at the beginning of the Holocene?

The pollen diagram allows a detailed reconstruction of the Neolithic at Báb-tava, between 7800–6500 calBP.[46] From 6900 calBP, *Carpinus betulus* and *Fagus sylvatica* prevailed sporadically in macroclimatically favourable locations of the species rich woodland, and *Picea* and *Pinus* are also attested.

A comparison of the pollen profiles from Báb-tava and Nyíres-tó reveals a simultaneous hazel and elm decline in both diagrams (between 5300–4900 calBP). Even though these declines were probably contemporaneous, they appear at different times in the two pollen profiles, most likely due to imprecise dating. *Corylus* decline is restricted to a few samples only, preceded by a peak in *Artemisia* and a sediment change from fen-peat to lake mud at Nyíres-tó (at 243 cm).[47]

41 *Willis et alii* (1997).

42 *H. Godwin:* Pollen-analytical evidence for cultivation of Cannabis in England. Review of Paleobotany and Palynology 4 (1967) 71–80; *R. H. W. Bradshaw:* Modern pollen representation factors for woods in south-east England. Journal of Ecology 69 (1981) 45–70.

43 *Magyari* (2002).

44 *Magyari* (2002) 37–38.

45 *Magyari* (2002) 38.

46 *Magyari* (2002) Fig. 4.2.3, at 270–580 cm.

47 *Harrington* (1995).

The radiocarbon dates published by Pál Sümegi[48] indicate that the two comparable vegetation changes are close in time, although with an interval of at least 200 years between them (Báb-tava: 7200 calBP, Nyíres-tó: 7200–6500 calBP). Increases in *Quercus*, *Alnus*, *Fraxinus* values and the sporadic appearance of Cerealia and other anthropogenic taxa in both diagrams suggest anthropogenic disturbance, even though not directly on the lakeshore. The important fluctuations in *Corylus* frequencies in the area of both lakes provide additional evidence for coppice management in the mountainous region of northern Hungary during the Neolithic, as described by Adam Gardner,[49] Enikő Magyari[50] and the present author.[51] The increase of the palynological richness at both sites suggests small-scale forest clearance and an increase of the vegetation mosaics.

Around 6800 calBP, *Picea* and Filicales show a marked rise, followed by a peak of *Corylus* which coincides with very low total pollen concentrations and challenges the interpretation that these peaks reflect an actual vegetation change. Similar changes can be observed in the NYO-P1 zone[52] of the Nyíres-tó sequence (described as NYLPZ-a, b, c in this study). The highest values of these two taxa were noted at 320–380 cm at Nyíres-tó.

The minimum of total pollen concentrations combined with the dominance of resistant pollen types and the low pollen diversity is taken as an indication of its extralocal origin. It must also be noted that *Picea* produces very few pollen grains and has a considerably lower pollen production than a mixed oak forest. At Báb-tava, the sediment stratigraphy did not indicate any changes parallel to the rise in *Picea*, and thus a possible transportation by floodwater seems unlikely.[53]

At Nyíres-tó, the sediment during the phase with high *Picea* and Filicales values (earlier than 8000 calBP, NYO-P1 between 412–298 cm) shows a slight change at 368 cm (at the end of the NYLPZ-b1 sub-zone). Between 395–368 cm, the sediment is characterised by a gradually increasing clay content from the base to the top, with reddish iron-containing and bluish-green vivianite-rich laminations at some levels and a progressive rise in organic matter towards the top, while between 368–298 cm it is succeeded by a sediment layer consisting of greenish-grey, non-calcareous silty clay. The organic content is about 5% in this layer. The amount of vivianite decreases, but some iron-rich laminations and lenses still occur in the sediment.[54]

The period between 6700–6300 calBP is characterised by the expansion of *Corylus* and the expansion of woodland in the Báb-tava pollen diagram, as well as by the absence of anthropogenic indicators and the decrease of the vegetation mosaics. Enikő Magyari suggested a vegetation correspondence between the earlier period at 7800–7200 calBP and this one at 6700–6300 calBP.

Around 6200 calBP, *Picea* declines, there is a temporary fall in the *Corylus* curve parallel to a rise in *Fraxinus*. At 5800 calBP, an opening up of the forest canopy can be noted with light-demanding trees and a diverse herbaceous vegetation, with a rise in the micro-charcoal concentration, suggesting an origin from forest fires. Cerealia pollen have a continuous curve from as early as *ca.* 6000 calBP. Parallel to the continuing dominance of *Corylus*, an expansion of *Fagus sylvestris* and *Carpinus sylvatica* (from 5700 to 650 calBP) can be noted, similarly to NYLPZ-e at Nyíres-tó. Enikő Magyari also mentions the gradual retreat of *Fraxinus* from the woodland at Báb-tava,[55] which can also be noted in the pollen sequence from Nyíres-tó.[56] However, the *Fraxinus* decline is weaker in the NYO-P1 pollen zone (described as the Early Holocene local pollen assemblage zone of Nyíres-tó by Enikő Magyari) since *Fraxinus* only reaches a value of 10%. At this time, Báb-tava was still part of the active channel and there was no sediment accumulation. In the overlapping layers of the two sequences, *Fraxinus* is

48 *Sümegi* (1999).
49 *Gardner* (1999).
50 *Magyari et alii* (2000); *E. Magyari – P. Sümegi – M. Braun – G. Jakab – M. Molnár:* Retarded hydrosere: anthropogenic and climatic signals in a Holocene raised bog profile from the NE Carpathian Basin. Journal of Ecology 89 (2001) 1019–1032.
51 *Juhász* (2002).
52 *Harrington* (1995).
53 *Magyari* (2002) 39.
54 *Sümegi* (1999) 180.
55 *Harrington* (1995).
56 *Magyari* (2002).

present at both sites, but with lower values at Nyíres-tó, while at Báb-tava it often attains 10% between 7800–5750 calBP, although it virtually disappears later. Leaching and the reduction of seasonally inundated land might be one reason for the decline in ash, although selective felling may also have played a role.

An important vegetation change can be seen in both sequences at 3700 calBP (NYLPZ-f at Nyíres-tó): a decline of *Corylus* and *Ulmus*, while *Carpinus betulus* and *Fagus sylvatica* invade the woodland. In the mixed oak-hornbeam woodland, beech gradually increased. The expansion of *Carpinus* coincides with the rise of Cerealia, *Artemisia*, Poaceae and Chenopodiaceae in both sequences. The sediment accumulation rate shows a significant slow-down at Báb-tava around 2700 calBP, and a similar TPC rise can be noted at Nyíres-tó *(Fig. 5)*. The rise of *Carpinus* and *Fagus* was gradual in both diagrams, rather than a sudden response to large-scale disturbances. The anthropogenic disturbance led to woodland change. The selective clearance of *Corylus* and *Ulmus* by prehistoric communities can also be assumed in the case of the expansion of beech and hornbeam, although their rise was likewise gradual, rather than a sudden increase caused by large-scale disturbance.[57] A similar phenomenon can be noted in the case of the Kelemér–Nagy-Mohos pollen sequences.[58] At around 2600 calBP, *Carpinus* decreased at Báb-tava, to be succeeded by oak, beech and probably fir (*Quercus*, *Fagus* and *Abies alba*). At Nyíres-tó, the increase of these taxa parallels the decline of *Alnus*, *Ulmus* and *Corylus*, while *Carpinus* increases further. The area used as pasture and ploughland grew during this period. In addition to cereals, hemp (*Cannabis*) was cultivated at both sites. The increase of micro-charcoal peaks and the higher number of anthropogenic indicators reflect an extensive land use and the exploitation of the floodplain woodland. Both pollen sequences record vegetation development until *ca.* 1000 AD (950 calBP) and indicate even more extensive clearings in this area after the Hungarian Conquest.

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57 *Magyari* (2002).

58 *Magyari* (2000); *Juhász* (2002).

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THE EVOLUTION OF NÁDAS-TÓ AT NAGYBÁRKÁNY IN THE LIGHT OF THE MACROFOSSIL FINDS

Gusztáv Jakab – Pál Sümegi

LOCATION AND DESCRIPTION OF THE STUDY AREA

Nádas-tó at Nagybárkány lies on the northern side of Mt. Hármas-Határhegy, rising to a height of 516 m (360 m a.s.l.) in the Eastern or Pásztó Cserhát Mountains *(Fig. 1)*. There are two other lakebeds in its vicinity called Feneketlen-tó and Felső-tó, but these are smaller than Nádas-tó.

Nádas-tó can be reached in about 10 minutes along the tourist trail from Csepegőskút. The lakebed has an elongated, north–west oriented form, with a strongly narrowing extension in the south. Its length is roughly 100 m, its greatest width is 40 m and it covers an area of roughly 2000 m^2. The narrowing section is about 5–10 m wide.

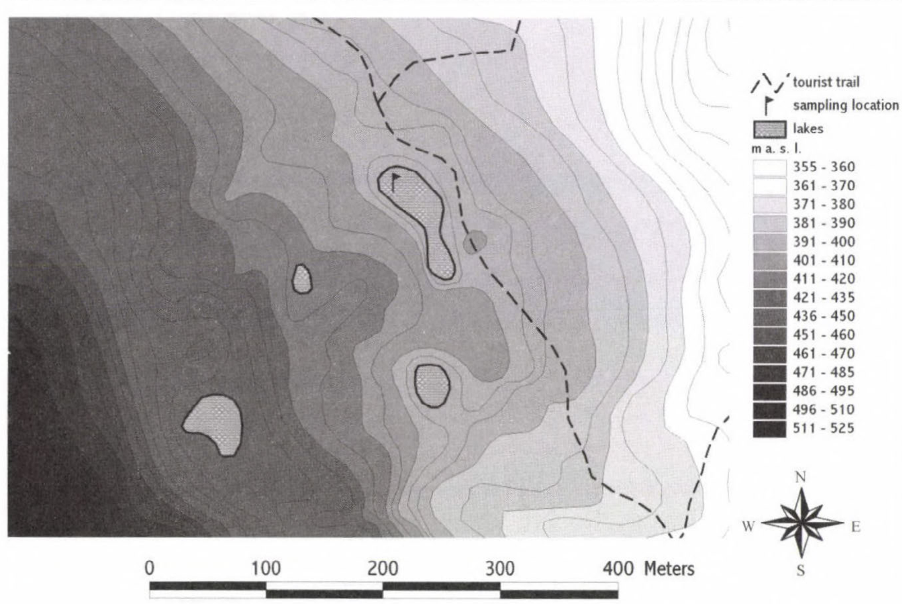


Fig. 1. Nagybárkány–Nádas-tó, with the sampling location

The lakebed is fringed by a sessile oak forest. The vegetation map of the lakebed is shown in *Fig. 2*. Three plant communities can be distinguished in the bog.

The central part of the bog is covered with *Sphagnum* willow swamp (*Salici cinereae-Sphagnetum recurvi*). This community is rather poor in species; it is characterised by a dominance of *Salix cinerea* and a peat moss carpet of *Sphagnum squarrosum*. This association is rather rare in Hungary, occurring in the well-watered, undrained valleys of the Great Hungarian Plain and the Northern Mountain Range, as well as in smaller local hollows. The willow swamp took the form of a floating mat owing to the heavy winter precipitation in the year of the sampling (2003). As a matter of fact, the bog could not be approached from the west.

The willow swamp is fringed by reed-beds (*Scirpo-Phragmitetum*), except on the western side. The reed-beds are similarly poor in species; the presence of *Lythrum salicaria, Lycopus europaeus* and *Utricularia vulgaris* can be noted.

Tall sedge communities (*Caricetum ripariae*) line the reed-beds. These communities are dominated by *Carex riparia*. Other species in this association include *Lysimachia vulgaris, Iris pseudacorus, Agrostis canina, Sparganium erectum, Alisma plantago-aquatica* and *Drepanocladus aduncus*.

The bog underwent significant changes since the preparation of the first vegetation map in 1959 *(Fig. 2)*.[1] The extension of the *Sphagnum* willow swamp was rather small at the time, and peat moss too covered a relatively small area only. Burr-reed communities (*Sparganietum erecti*) were typical for the area. In 2003, the willow swamp encroached on the one-time reed-beds, while the reed-beds replaced the former burr-reed associations. Burr-reed communities can no longer be observed in the area, indicating the oligotrophication of the bog and the expansion of peat moss associations.

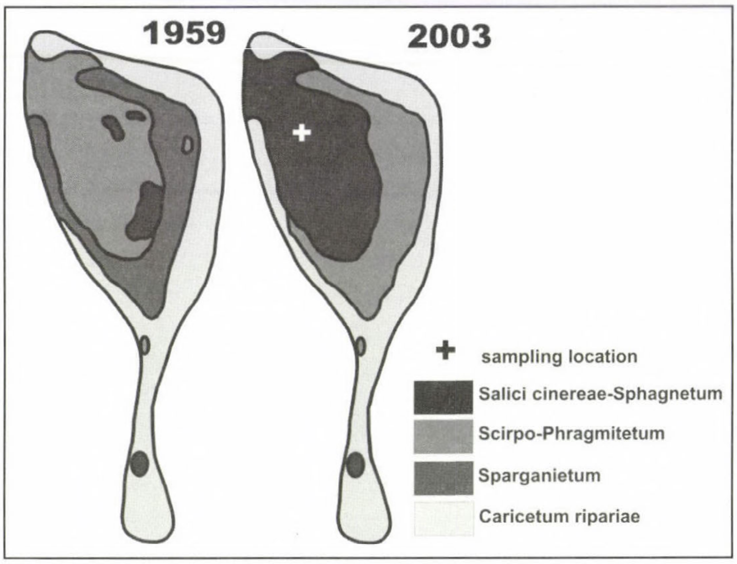


Fig. 2. Vegetation map of Nádas-tó in 1959 (after Máthé–Kovács [1959]) and 2003 (made by Gusztáv Jakab, showing the sampling location)

MATERIALS AND METHOD

This paper provides an overview of the results of the macrofossil analyses of the sediment core. Since analyses of this kind are rather rare in Hungary and its methods are therefore mostly unknown, it seems in order to start with a brief description of analytical procedures.

Pioneering palaeobotanical analyses on Quaternary sediment samples were based on the study of plant macrofossils.[2] One major advance compared to earlier approaches based on estimates was the introduction of the so-called QLCMA technique (semi-quantitative quadrat and leaf-count macrofossil analysis technique) developed in Southampton,[3] enabling detailed and precise analyses comparable to modern pollen analyses. The study of macrofossil remains has by now become an integral part of Quaternary palaeobotany.[4]

We used a modified version of the QLCMA technique.[5] Organic remains from peat and lacustrine sediments rich in organic matter can be divided into two major groups. Some remains can be identified with lower ranking taxa (specific peat components), while others cannot be identified using this approach (non-specific peat components).

Sediment samples can contain significant amounts of non-specific peat components, which reveal much about the hydrologic conditions and chemical composition of the area in which the sediment accumulated. The most important non-specific peat components are the following:

1 *Máthé – Kovács* (1959)

2 For the main methodological studies and new perspectives, cp. *G. Grosse-Brauckmann:* Analysis of vegetative plant macrofossils. *In:* Handbook of Holocene Palaeoecology and Palaeohydrology. Ed.: B. E. Berglund. Chichester 1986; *H. H. Birks:* Plant macrofossils in Quaternary lake sediments. Archiv für Hydrobiologie 15 (1980) 1–60; *H. J. B. Birks – H. H. Birks:* Quarternary palaeoecology. Baltimore 1980; *J. A. Janssens:* A quantitative method for stratigraphic analysis of bryophytes in holocene peat. Journal of Ecology 71 (1983) 198–196; *J. A. Janssens:* Methods in Quarternary Ecology 11. Bryophytes. Geoscience Canada 17:1 (1990) 13–24; *K. Rybníček:* A comparison of the present and past mire communities of Central Europe. *In:* Quaternary Plant Ecology. Eds: H. J. B. Birks – R. G. West. Oxford 1973, 237–261; *K. Wasylikowa:* Analysis of fossil fruits and seeds. *In:* Handbook of Holocene Palaeoecology and Palaeohydrology. Ed.: B. E. Berglund. Chichester 1996, 571–590.

3 *K. E. Barber – F. M. Chambers – D. Maddy – J. Brew:* A sensitive high resolution record of the Holocene climatic change from a raised bog in northern England. The Holocene 4 (1994) 198–205.

4 *H. H. Birks – H. J. B. Birks:* Future uses of pollen analysis must include plant macrofossils. Journal of Biogeography 27 (2000) 31–35.

5 *G. Jakab – P. Sümegi:* A new paleobotanical method for the description of Late Quaternary organic sediments (Mire-development pathways and palaeoclimatic records from S Hungary). ActaGeologica 47:4 (2004) 1–37; *Jakab – Sümegi* (2004b).

Undifferentiated monocotyledon remains (*Monocot. undiff.*): opaque or slightly pigmented rhizomes and epidermal tissue fragments, with elongated or short cells. Young, less differentiated *Phragmites* rhizomes are usually assigned to this category.

Unidentified organic material (*UOM*): irregularly shaped tissue fragments, often moderately decomposed. These can come from both monocotyledons and dicotyledons.

Unidentified bryophyte fragments (*UBF*): Only the tubular, brown pigmented "stem" survives in decomposed peat with the stub of the "leaf veins".

Sphagnum stems (*Sphagna undiff.*): The stems of peat moss can occur frequently in less decomposed peats. These do not have any special traits, enabling their species identification.

Charcoal: Tiny, 0.3–3 mm large charcoal fragments (macro-charcoal), probably of allochthonous origin. They are not identical with the micro-charcoal counts performed as part of pollen analyses, because these are larger. Their amount indicates the intensity of local fires.

Wood: Lignified plant tissues can be easily recognised from their compact, thick-walled wood fibres. Even though the remains cannot be identified on the species level, their amount can be a typical feature of the sediment.

In the case of specific peat components, the remains can often be identified on the species level. They are important for reconstructing the sediment deposition environment. The local vegetation often allows identification on the association level. The most important specific peat components are seeds, fruits, sporogons, mosses, rhizomes and epidermis (e.g. *Carex* species), leaf epidermis, other tissues and organs (hairs, tracheids, etc.), insect remains and Ostracoda shells. A good overview of the analysis of fossil seeds and mosses and the new perspectives provided by their study has recently been published by Enikő Magyari and the present author.[6] We used the textbook published by the present authors for the identification of herbaceous plant tissues.[7]

We took 3 cm^3 large sub-samples at 5 cm intervals from the core and calculated concentrations accordingly. We defined the amount of peat components on the 1 cm^3 level, and the amount of seeds on the 3 cm^3 level. The samples were washed through a sieve with a 300 μm mesh size. Concentration levels were determined by adding a known amount of indicator grains (0.5 g poppy seed, *ca.* 960 pieces) and by counting the poppy seeds and the remains using a stereo microscope in ten 10 mm by 10 mm quadrates in a Petri dish. Similarly to mosses, rhizomes can only be identified with a light microscope. We removed a hundred monocotyledon remains and mounted them in water on microscopic slides for determining the percentages of individual taxa and of Monocot. undiff. The values for different moss species and UBF were determined using a similar procedure. The concentration can be described with the following equation:

$$\text{macrofossil concentration} = \frac{\text{counted macrofossil (average) x 960 (total poppy seeds)}}{\text{counted poppy seeds (average) x sample volume (cm}^3\text{)}}$$

The tissue and moss remains were embedded in glycerine jelly on slides for later analyses. The seeds were preserved in Eppendorf tubes in a 1:1:1 mixture of glycerol, ethanol, formaldehyde and water.

We used the PSIMPOLL programme for plotting the analytical results.[8]

6 *Jakab – Magyari* (2000).

7 *Jakab – Sümegi* (2004).

8 *K. D. Bennett:* PSIMPOLL – A quickBasic program that generates PostScript page description of pollen diagrams. INQUA Commission for the study of the Holocene: working group on data handling methods. Newsletter 8 (1992) 11–12.

RESULTS OF THE MACROFOSSIL ANALYSES

The core was extracted from the north-western part of the bog, in the location shown in *Fig. 2*. We found peat down to a depth of 110 cm, under which lay water (floating mat) down to 130 cm. Between 130–300 cm, we found peat and peat-mud with varying organic content. Between 300–340 cm, there was a silty lacustrine sediment. The macrofossil diagrams are shown in *Figs 3–6*. The profile was divided into nine zones on the basis of the analyses.

NBM-1 (340–290 cm)

The macrofossil concentration was rather low in the lower silty sediment, poor in organic matter, suggesting a high water level, an oligo-mesotrophic water quality and a low vegetation cover. A narrow belt or patches of reed-beds probably lined the lakebed. The radiocarbon measurements and the pollen analysis indicated that this zone evolved at the time of the Pleistocene/Holocene transition, during the Dryas III and the Pre-Boreal.

Rough peat moss, *Sphagnum squarrosum*, a characteristic feature of the bog's recent vegetation, was already present at this time, even if in minimal amounts. The presence of peat moss belonging to the *Acutifolia* section is noteworthy. In contrast to earlier data,[9] the appearance of *Sphagnum* was not a recent event. The presence of various types of peat mosses can be demonstrated since the beginning

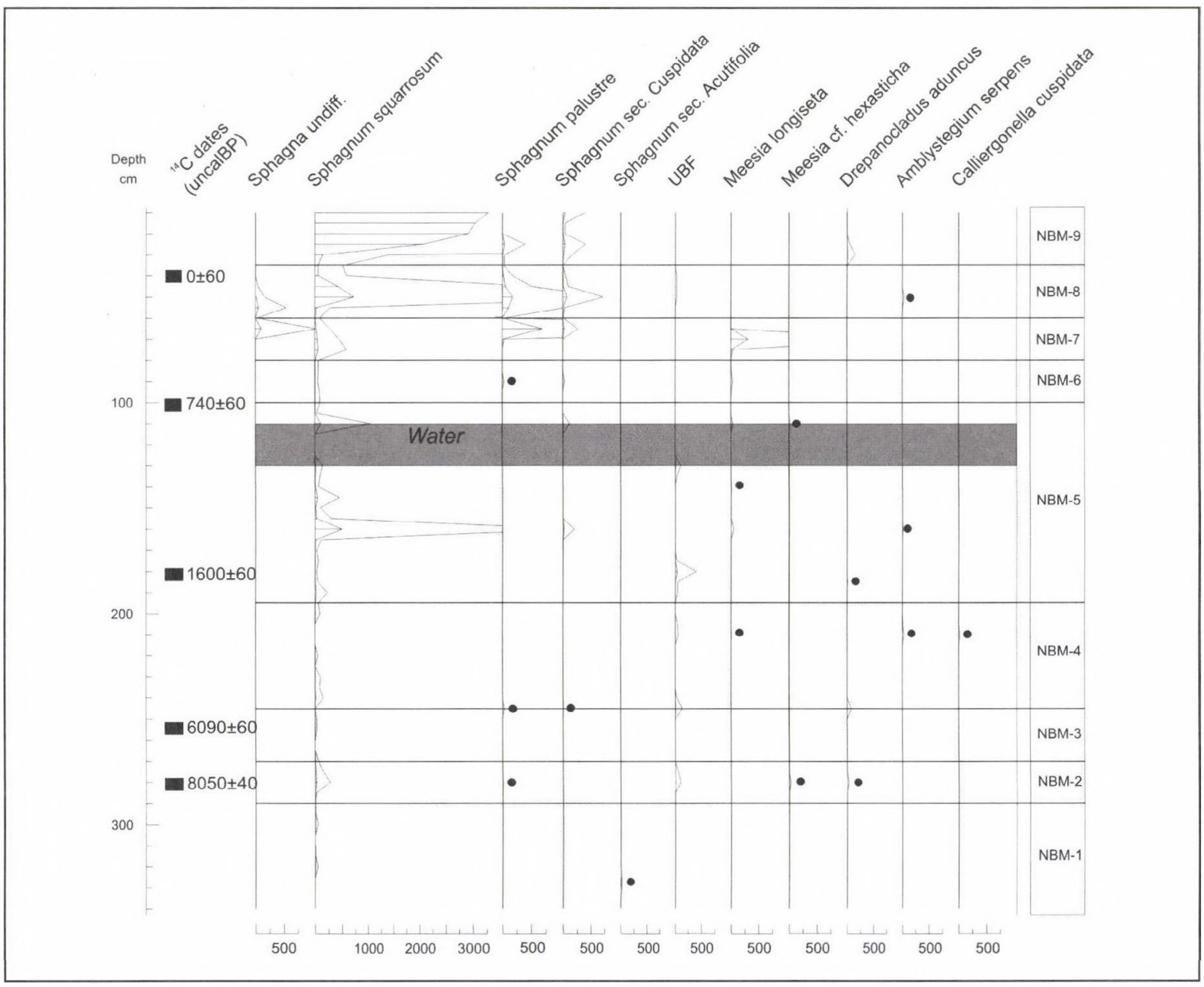


Fig. 3. Fossil mosses from Nagybárkány–Nádas-tó (pc/cm³)

9 *Máthé – Kovács* (1959).

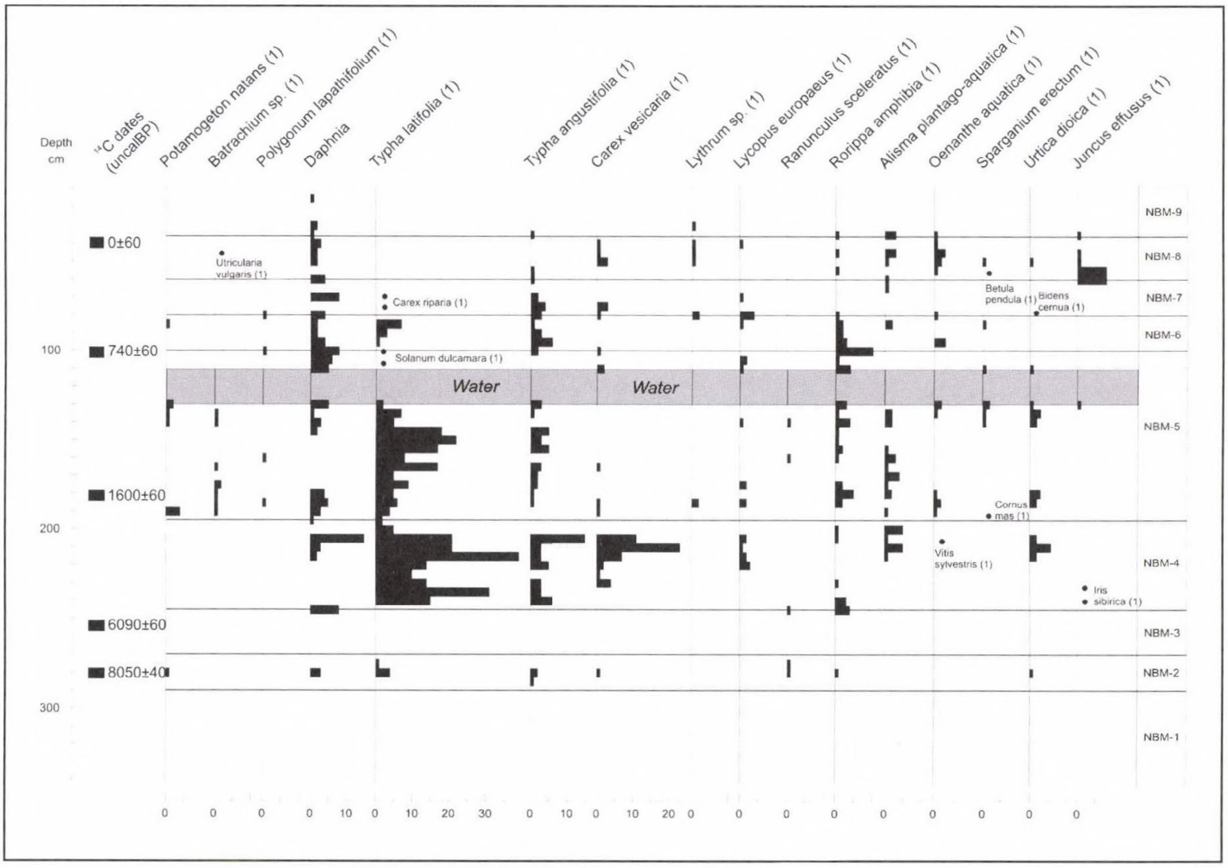


Fig. 4. Fossil seeds and Daphnia ephippia from Nagybárkány–Nádas-tó (pc/3 cm³; 1: seed)

of the lakebed's formation, even though their role only became significant from the last phase of the Holocene.

NBM-2 (290–270 cm)

The macrofossil concentration increased from 290 cm. The number of *Phragmites communis* rhizomes and *Sphagnum squarrosum* leaves increased in the sediment. *Typha angustifolia* and *Typha latifolia* made their appearance, together with the seeds of plants typical for reed-beds (*Ranunculus sceleratus, Rorippa amphibia, Alisma plantago-aquatica*) and *Daphnia* ephippia. Moss species include *Sphagnum palustre* and various brown mosses (*Drepanocladus aducus, Meesia* cf. *hexasticha*).

The macrofossils reflect a lower water level and a mesotrophic water quality. The reed-bed at the edge of the lakebed probably formed a continuous belt by this period. The area began to paludify. The radiocarbon measurements and the pollen analyses indicated that this zone evolved during the Boreal.

NBM-3 (270–245 cm)

The macrofossil concentration and the number of *Phragmites* decreased at 270 cm, and marshland and bog species disappeared, suggesting a rise in the water level. In the second part of the zone, after 6090±60 uncalBP, the macrofossil concentration and the amount of *Phragmites* again increased, parallel to the renewed appearance of various peat mosses (*Sphagnum squarrosum, Sphagnum sec. Cuspidata, Sphagnum palustre*) and moss species (*Drepanocladus aducus*). These changes reflect another decrease in the water level and the spread of marshland and bog vegetation. The radiocarbon measurements and the pollen analyses indicated that this zone developed at the beginning of the Atlantic.

NBM-4 (245–195 cm)

The radiocarbon measurements of the sediment samples between 187–176 cm indicated a hiatus of roughly 4400 years at the beginning of the zone. This sediment hiatus is also confirmed by the abrupt change in the pollen composition and the macrofossil analyses, reflecting a marked change in the environment. The extrapolation of the measurements suggests that this sediment hiatus developed around 330 uncalBC, during the period when the area was probably settled by Celtic groups, who probably deepened the peat bog which had evolved by then (a similar phenomenon was observed at Nagy-Mohos-tó near Kelemér[10]). However, the pollen from this sampling location did not include hemp (*Cannabis*) remains, suggesting that the lakebed was deepened to gain water. The huge amounts of wood found in the sediment can probably be associated with the function of the deepened lakebed; these hardly originated from trees which had fallen in from the edge of the lake, for considerably smaller amounts of wood accumulated in the sediment from later periods characterised by a more closed woodland in the area. Especially high amounts of wood were found at 225 cm (*ca.* 1000 pc/cm^3), perhaps the remains of a larger object or of some wooden structure associated with the lakebed's function.

The macrofossil concentration suddenly increased at the beginning of the zone, with strikingly high UOM values, indicating an eutrophic marshland environment. The *Phragmites* cover expanded significantly over the area. The zone contained high amounts of the leaf sheat epidermis of bogbean (*Menyanthes trifoliata*), which probably grew at the edge of the reed-bed facing the open water or in hollows. The occurrence of *Iris sibirica* seeds in the sediment is noteworthy. This section of the zone contained *Sphagnum squarrosum*.

Reed declined in the second half of the zone, parallel to the expansion of bulrush. The presence of *Typha latifolia* and *Typha angustifolia* could be noted. The bulrush bed probably grew on the southern side or along the lake's edge, because while seeds were highly represented, there were hardly any rhizomes. This period is characterised by *Carex vesicaria* and various moss species (*Amblystegium*

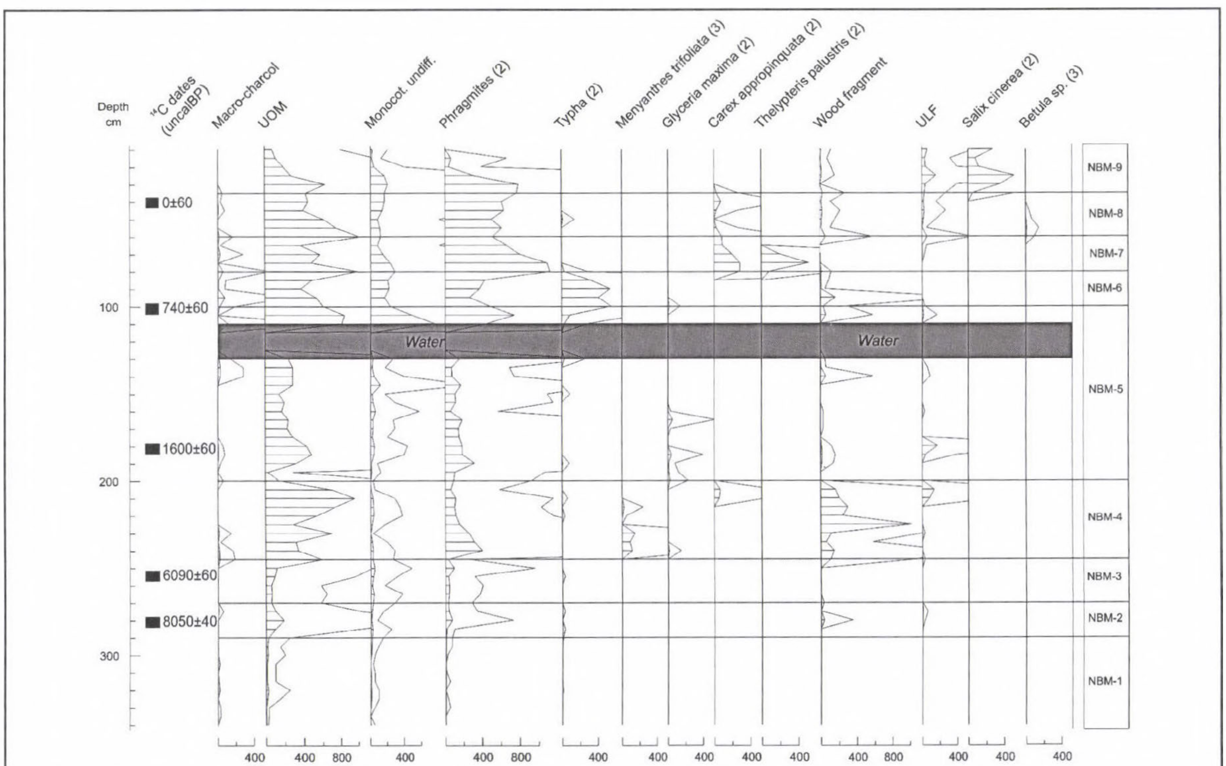


Fig. 5. Fossil plant tissues from Nagybárkány–Nádas-tó (pc/cm^3; 2: root, 3: leaf epidermis)

10 *Magyari* et alii (2000); *Magyari* et alii (2001).

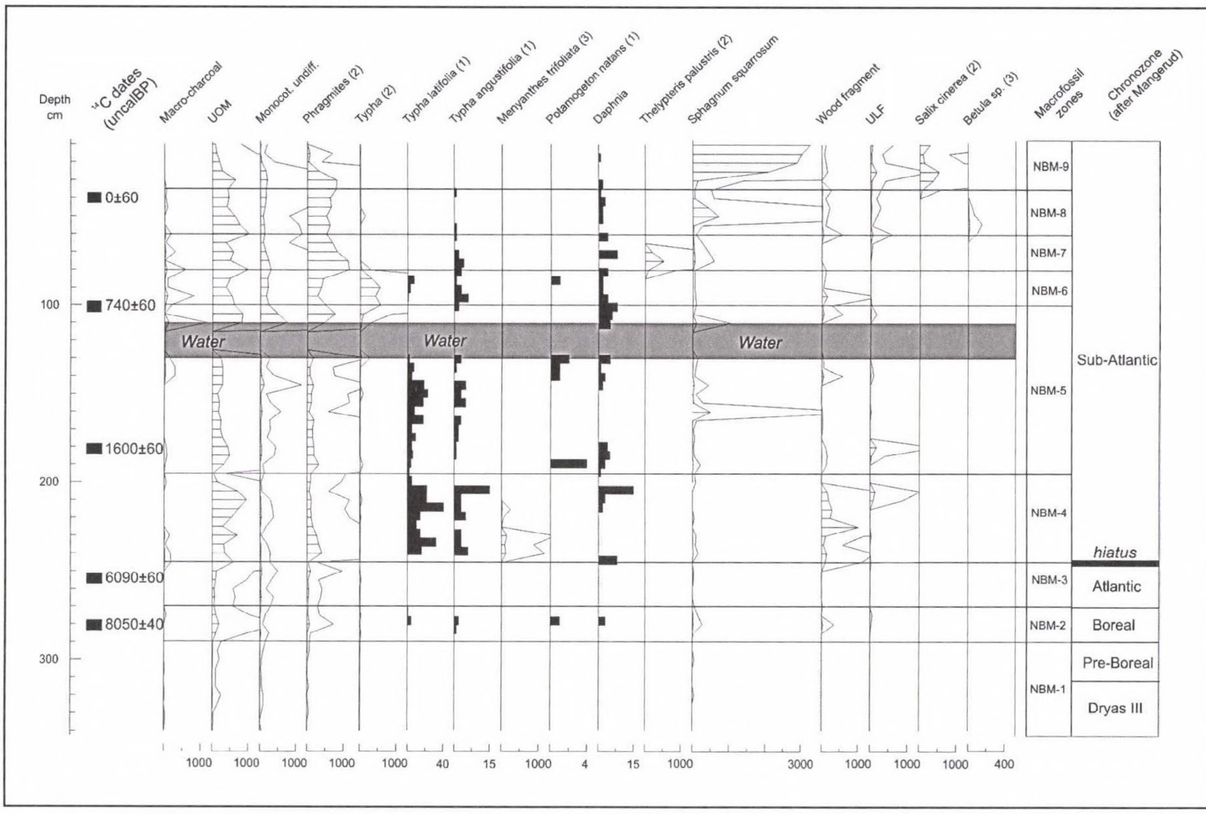


Fig. 6. Cumulative diagram of macrofossils from Nagybárkány–Nádas-tó, showing selected taxa (1: seed, pc / 3 cm³; 2: root, leaf epidermis, pc/cm³)

serpens, Calliergonella cuspidata, Drepanocladus aduncus). *Daphnia* ephippia occurred in high numbers, and the spread of eutrophic marshland species, such as *Lycopus europaeus, Rorippa amphibia, Alisma plantago-aquatica* and *Urtica dioica* could be noted. One noteworthy find is the seed of *Vitis sylvestris*.

The macrofossils indicate a lower water level and a meso-eutrophic water quality at the beginning of the zone, and a eutrophic water quality from 225 cm. The radiocarbon measurements and the pollen analyses indicated that this zone developed during the Sub-Atlantic, during the Late Iron and Roman Ages.

NBM-5 (195–100 cm; 130–110 cm: water)

The macrofossil concentration declined slightly in this zone. The concentration of *Phragmites* rhizomes was relatively low. Various pondweed species (*Potamogeton natans, Batrachium* sp., *Polygonum lapathifolium*) made their appearance, suggesting a relatively higher water level.

Sparganium erectum became typical. The reed-bed was quite species rich, with species such as *Lycopus europaeus, Lythrum* sp., *Ranunculus sceleratus, Rorippa amphibia, Alisma plantago-aquatica, Oenanthe aquatica* and *Urtica dioica*. The sample yielded *Cornus mas* seeds.

Changes resembling the ones in the previous zones could be noted in this zone too. The concentration of *Phragmites* rhizomes was quite high at the beginning of the zone, but declined continuously, parallel to the spread of *Typha*. The transition is marked by the lakebed's brief desiccation at 160 cm, with the significant increase of *Sphagnum squarrosum* peat moss. The water quality was meso-eutrophic, changing to eutrophic from 160 cm.

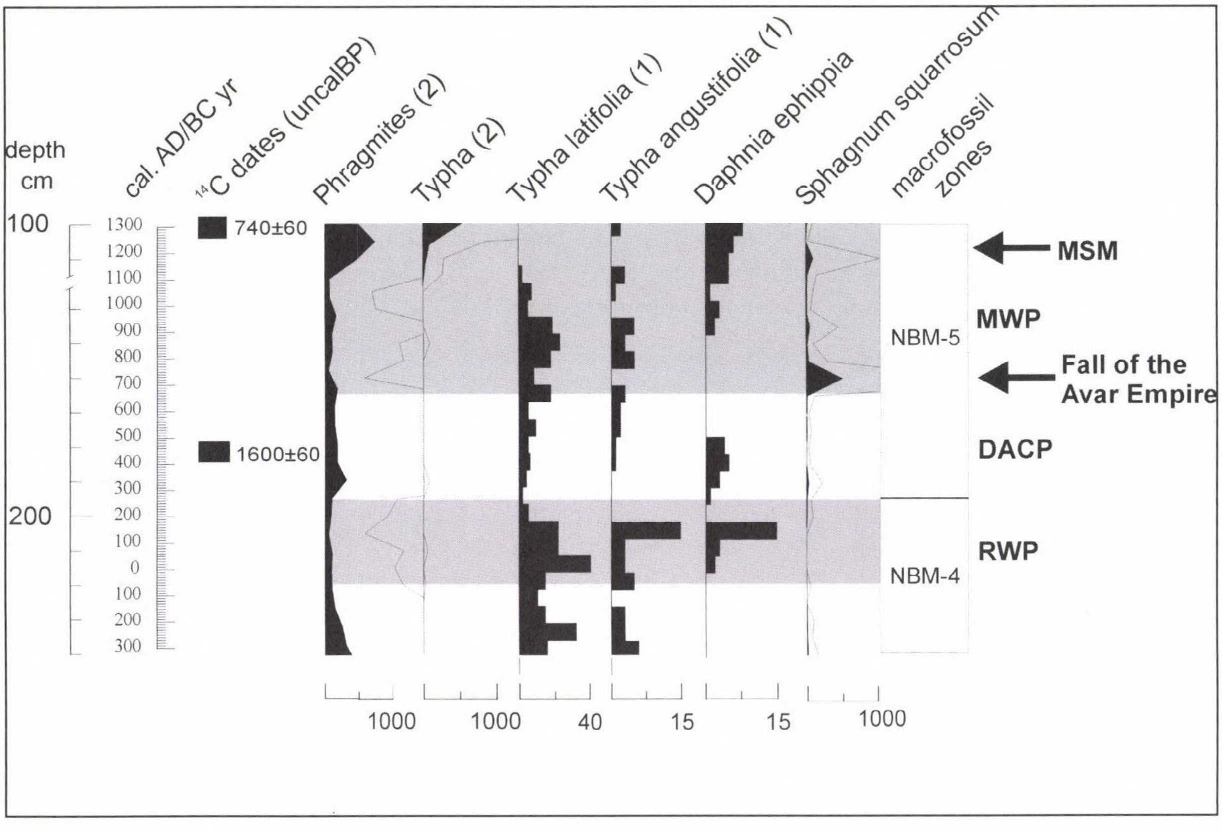
Between 130–110 cm, there was a water level (floating mat). Between 110–100 cm, the number of *Phragmites* rhizomes increased significantly, suggesting that the extent of the open water diminished and that reed-beds also covered the sampling location. *Typha* (rhizome) too appeared at the sampling location, although to a lesser degree only. The peak of *Rorippa amphibia* similarly indicates the decrease of the water level.

The radiocarbon measurements and the pollen analyses indicate that this macrofossil zone developed from the Migration period to the close of the Árpádian Age.

NBM-6 (100–80 cm)
The macrofossil concentration in this zone was extremely high. Many trees fell into the lakebed. The charcoal concentration too shows high values, reflecting the intensive exploitation of the environment. The expansion of bulrush at the sampling location can be noted (increase of *Typha* rhizomes), and the proportion of *Typha angustifolia* was higher than previously. *Typha angustifolia* gradually replaces *Typha latifolia*, indicating paludification and a higher water level.

This zone can be regarded as the first stage in the development of the present-day bog, when its central part was covered by a floating bulrush swamp at the expense of pondweed communities. This zone thus represents the lake/bog transition. It seems likely that the reed-bed broke loose from the sediment in consequence of rising water levels, leading to the formation of a floating mat. *Phragmites* were soon replaced by *Typha angustifolia*. From this point on, the changes in the vegetation were predominantly determined by autogenous processes.

NBM-7 (80–60 cm)
A genuine floating mat condition. As a result of intensive oligotrophication, a floating reed swamp (*Phragmitetum communis thelypteridetosum*) developed in the sampling location. The zone is dominated by *Carex riparia* and *Carex appropinquata*. The zone is characterised by abrupt changes, reflecting further oligotrophication. There is a large-scale increase in marsh fern (*Thelypteris palustris*), which



Fig, 7. Trophic fluctuations at Nagybárkány–Nádas-tó between 330 BC and 1300 AD. The grey areas indicate periods with a warmer climate (MSM: medieval solar activity maximum, MWP: medieval warm period, DACP: Dark Ages cold period, RWP: Roman Age warm period; the interbedded water layer between 130–110 cm has been omitted) later decreases, parallel to the expansion of a rare moss, *Meesia longiseta*. Following the decline of the latter, the values of peat mosses, especially of *Sphagnum palustris*, increases.

NBM-8 (60–35 cm)
A *Sphagnum* bog (*Phragmiti communis-Sphagnetum*) developed in consequence of oligotrophication in the sampling area. *Typha* species virtually disappeared. In addition to *Sphagnum squarrosum*, *Sphagnum palustre* and *Sphagnum* sec. *Cuspidata* are represented with significant values. The presence of *Utricularia vulgaris* in the zone is noteworthy. The amount of autochthonous tree remains (wood, ULF) increases in the zone. The presence of *Betula pendula* on the mire surface seems likely. The high values of *Juncus effusus* are also characteristic for this zone.

NBM-9 (35–10 cm)
The *Sphagnum* bog is replaced by a *Sphagnum* willow swamp in the last zone. The recent expansion of grey willow could be noted in the area. The number of reed-bed species and the extent of the reed-beds decreases, parallel to the increase of wood remains (wood, ULF). *Salix cinerea* remains (leaves, roots) are quite frequent. The values of *Sphagnum squarrosum* increase significantly.

DISCUSSION

The development of the bog can be divided into three main phases in the light of the macrofossil analyses. The first phase spanned the Late Glacial, the Early and Middle Holocene layers. The water quality in this phase was oligo-mesotrophic and mesotrophic. The water level was high, although with minor fluctuations. A hiatus of roughly 4400 years can be noted in the sediment after this phase, owing to peat-cutting during the Late Iron Age. The water level decreased slightly, the water quality became eutrophic and the lake was fringed by a macrophyte vegetation. This period was characterised by the fluctuation of the lake's trophic state. This phase can be dated to the first half of the Sub-Atlantic, lasting until the end of the Árpádian Age. The last phase, spanning the period up to the present, saw the paludification of the lake and the cessation of the open water surface. The succession sequence was characterised by autogenous processes.

The first phase of the bog's development, lasting until the Atlantic, was determined by relatively stable trophic conditions and smaller fluctuations in the water level. The macrofossil analyses of the sediments deposited during the Late Glacial and the Pre-Boreal did not indicate any changes. The water level decreased during the Boreal and the start of paludification can be noted, probably in consequence of the onset of a warmer and drier climate. On the testimony of the pollen profiles, this phase coincided with the appearance of thermophilous oak forests. The water level again rose at the beginning of the Atlantic; its decrease began from 6100 uncalBP, enabling the expansion of reed-beds. The macrofossil analyses of sediments from Lake Balaton too indicated a higher water level at the beginning of the Atlantic.[11]

The second phase of the bog's development lasted from *ca.* 330 uncalBC until the end of the Árpádian Age. The water level decreased and the lake was encircled by a marshland belt. This period was characterised by fluctuations in the trophic conditions, which can most likely be traced to climatic causes. *Fig. 7* shows the changes in the values of six peat components, which were typical for this phase, together with the historically recorded climatic phases.

Fig. 7 reveals that the *Phragmites* concentration in the sediment decreased during warmer periods in the Roman Age and the Middle Ages, parallel to the increase of *Typha* seeds and *Daphnia* ephippia. This reflects a competitive situation, characterised by alternating dominances of reed and bulrush in the lakebed. Reed and bulrush are both competitive species under favourable conditions. Bulrush is a light demanding plant. Reed grows higher, overshadowing bulrush and easily ousts the latter. At the

11 *Jakab G. – Sümegi P. – Szántó Zs.:* Késő-glaciális és holocén vízszintingadozások a Szigligeti-öbölben (Balaton) makrofosszília vizsgálatok eredményei alapján. FtKözl 153:3 (2005) 405–431.

same time, reed requires a relatively coarse sediment in order to anchor its roots, otherwise it collapses. Bulrush settles more easily in loose sediments.[12] It would appear that during periods of greater solar activity, the lake received more light, in part owing to the retreat of species forming higher and more closed woods (*Fagus*, *Carpinus*). The lake is ringed by high, steep mountains in the south and south-east *(Fig. 1)*, from where the high trees cast a shadow over the greater part of the lake. The expansion of phytoplankton at the time of greater solar activity is indicated by the increase of *Daphnia* feeding on them. The expansion of phytoplankton leads to the development of looser sediments, encouraging the spread of *Typha*.

The beginning and the close of the medieval warm period saw the maximum of solar activity. The first maximum, dated to 700–800 AD, caused significant droughts in the Carpathian Basin, and contributed to the decline and fall of the Avar Empire.[13] The end of this period around 1250 AD was marked by the so-called medieval solar activity maximum, which caused serious droughts in North America. The sudden expansion of *Sphagnum squarrosum* can be noted at the time of the two maximums.

Phragmites and *Typha* both declined around 800 AD, suggesting the brief desiccation of the bed, when peat moss temporarily covered the entire lakebed. The water level decreased for a longer period of time around 1200–1300 AD, enabling the expansion of the reed-bed over the lake's entire surface and causing the reduction of open water. This period can be correlated with the development of the present-day bog.

The development of the present-day bog and the commencement of peat accumulation can be dated to the end of the Árpádian Age. Around 1400 AD, the number of *Typha* rhizomes increases significantly, indicating a rise in water level and the formation of a floating mat. Successional sequence in the bog was from this point on characterised by autogenous processes, with a tendency towards a gradual oligotrophication. This development shares numerous similarities with the formation of two other Hungarian peat bogs at Csaroda–Báb-tava[14] and Kelemér–Nagy-Mohos.[15] Bog development passed through phases characterised by *Typha–Thelypteris palustris–Meesia longiseta–Sphagnum* spp. species in all three cases, suggesting some sort of regularity in the formation of Hungarian *Sphagnum* bogs.

SUMMARY

The Nádas-tó at Nagybárkány is a small peat peat bog in the eastern Cserhát Mountains. The formation of the lake can be traced back to the Lake Glacial. The sediments deposited in the lakebed provide a record of climatic and hydrologic changes. A higher water level could be demonstrated from the Late Glacial to the Atlantic, when the reed-beds covered a small area only. This was followed by a hiatus spanning *ca.* 4400 years, caused by the deepening of the lakebed during the Late Iron Age, around 330 BC. The water level decreased and the water quality was more eutrophic. A reed-bed evolved around the lake. Paludification began with a bulrush floating mat phase at the close of the Árpádian Age. The development of the peat bog underwent similar phases as at Csaroda–Báb-tava and Kelemér–Nagy-Mohos.

12 *S. M. Haslam:* Biological flora of the British Isles. Phragmites communis Trin. Journal of Ecology 60 (1972) 585–610; *L. Nurminen:* Macrophyte species composition reflecting water quality in adjecent water bodies of lake Hiidenvesi, SW Finland. Annales Botanici Fennici 40 (2003) 199–208; *H. Toivonen – S. Bäck:* Changes in aquatic vegetation of a small eutrophicated and lowered lake (southern Finland). Annales Botanici Fennici 26 (1989) 27–38.

13 *Györffy Gy. – Zólyomi B.:* A Kárpát-medence és Etelköz képe egy évezred előtt. *In:* Honfoglalás és régészet. Eds: Gy. Györffy. – L. Kovács. Budapest 1994, 13–37.

14 *Jakab – Magyari* (2000).

15 *Magyari et alii* (2000); *Magyari et alii* (2001).

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PRELIMINARY PALAEOBOTANICAL RESULTS FROM THE NÁDAS-TÓ PEAT BOG AT NAGYBÁRKÁNY: THE LATE HOLOCENE ENVIRONMENTAL HISTORY

Imola Juhász

INTRODUCTION

This study presents the results of the palaeobotanical analyses for the 320 cm core extracted from the peat bog at Nagybárkány–Nádas-tó. On the testimony of the palaeobotanical and the macrobotanical evidence, the lower section of the core (340–240 cm) accumulated during the Late Glacial and the Early Holocene; this is also confirmed by the radiocarbon measurements. Since one of the aims of this volume is to present the results of the palaeobotanical, malacological and macrobotanical analyses of the samples taken from different locations and to collate them with the archaeological record for the area of the sampling location from a palaeoenvironmental perspective, this study offers a description of the vegetation changes reflected by the upper section of the core from Nádas-tó, spanning the Late Holocene period, which is also of interest for the archaeologists studying the prehistoric cultures of this region.

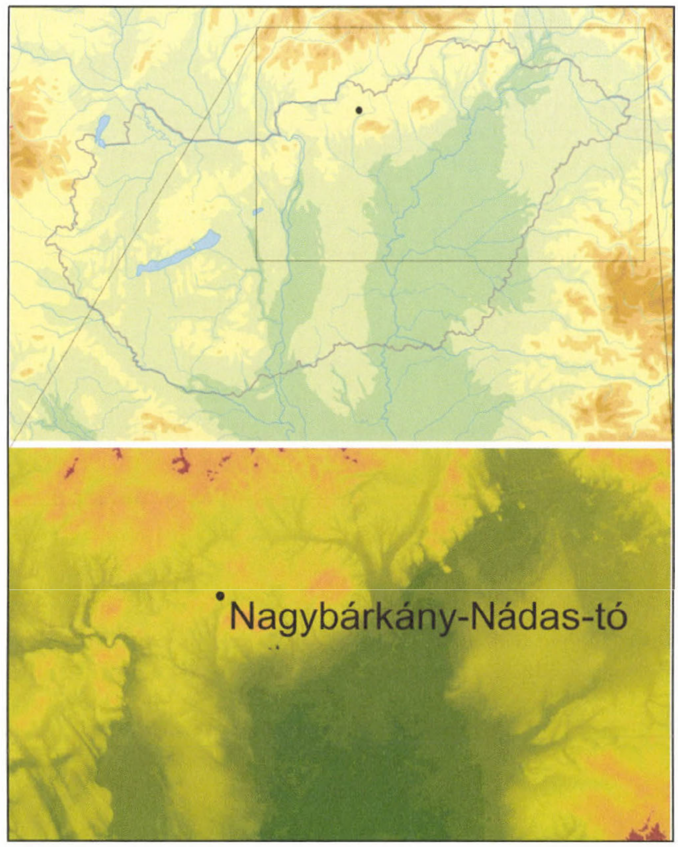

Fig. 1. Location of Nagybárkány–Nádas-tó in north-eastern Hungary

MATERIAL AND METHODS

The study area

The palaeoecological coring of the Nádas-tó peat bog at Nagybárkány *(Fig. 1)* was carried out in the north-western part of the bog, currently covered with a willow swamp, in May, 2003.[1]

Sediment sampling

The sampling of the 320 cm deep, undisturbed sedimentary sequences from the Nádas-tó basin was carried out using a 5 cm diameter Russian corer.[2] The main lithostratigraphic features of the sedimentary sequence were determined and analysed by Pál Sümegi *(Table 1)*. We found peat layers from the surface down to a depth of 110 cm, with an underlying water level (floating mat) to a depth of 130 cm. This

1 For a more detailed description of the sampling location, cp. *Gusztáv Jakab – Pál Sümegi* in this volume (pp. 67–68).
2 *H. E. Wright:* A square rod piston sampler for lake sediments. Journal of Sedimentary Petrology 37 (1967) 975–976.

was underlain by alternating layers of peat and peat mud sediment layers with highly varying organic contents to a depth of 248 cm.

Depth (cm)	Troels-Smith (1959) system	Description
0–40	Tb4	Recent *Sphagnum* peat
40–80	Dg2 Tb1 Th1	Peat mixed with limus detritus, made up mostly of *Typha* rhizomes
80–110	Dg2 Tb1 Th1	Limus detritus
110–130	–	Water
130–134	Dg2 Tb1 Th1	Burnt, charcoal rich peat layer
134–160	Ld3 Sh1	Dark brown eutrophic lacustrine sediment (clayey silt)
160–240	Ld3 Sh1	Clayey, silty sediment, with organic rich and inorganic rich laminae
240–248	Ld3 Sh1	Elastic dark brown silty clay, with interbedded organic material, and inwashed mass sediment (slir?)

Table 1. The lithological description of the Nagybárkány–Nádas-tó sequence (by Pál Sümegi)

Radiocarbon dating

Radiocarbon dating of the sequence was obtained by both bulk and AMS (Accelerator Mass Spectrometry) analyses. Four bulk samples of sediment were analysed for radiocarbon ages at the Nuclear Research Centre of the Hungarian Academy of Sciences, Debrecen, Hungary and one sample of plant macrofossils was analysed for AMS date at the radiocarbon dating facility in Poznań, Poland. In order to allow comparison with other archaeological data, the dates were calibrated using the Oxcal v.3.9 calibration programme,[3] using athmospheric data.[4] The original dates (^{14}C) are indicated as uncalBP, while the calibrated dates are indicated as calBC *(Table 2)*.

The radiocarbon dates indicate a hiatus of roughly 4600 years (from 4970 calBC to *ca.* 330 calBC) between 248–240 cm, meaning that we have no data of any kind for this period. The results of the radiocarbon measurements for the upper part of the sequence described in this study are shown in *Fig. 2* and in *Table 2*.

Sample number	Depth (cm)	Sediment type	δ13C(PDB) ± 0.2 [‰]	^{14}C age (uncalBP)	calAD/BC (2 σ)
deb-11110	NB-45	peat	–28.02	100% ± 0.40 pM 14C	1950–1960 calAD
deb-11098	NB-100	peat	–27.73	740 ± 60	1230–1300 calAD
deb-11009	NB-180	peat	–28.49	1600 ± 60	400–540 calAD

Table 2. Radiocarbon dates for the Nagybárkány–Nádas-tó sequence (prepared by Zs. Szántó)

3 *Bronk-Ramsey* (2000)
4 *Stuiver – Reimer* (1993)

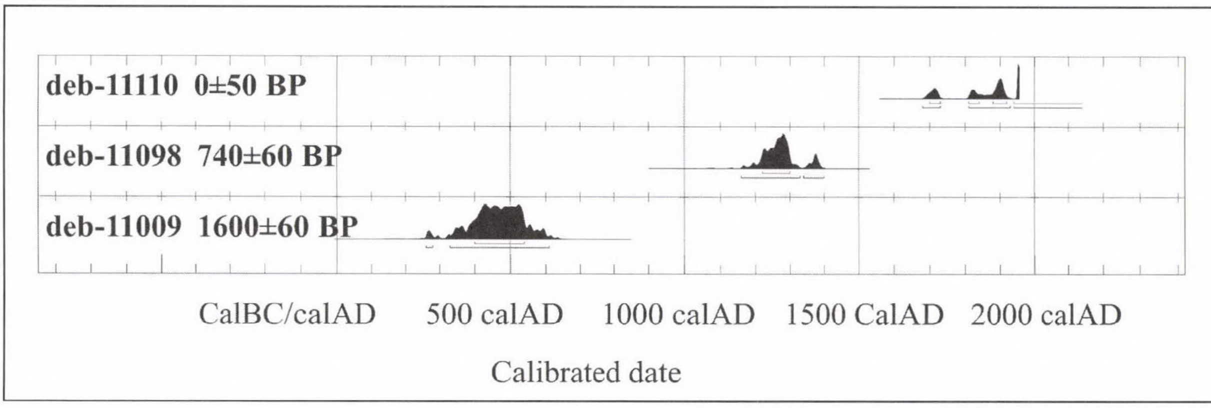

Fig. 2. Calibrated radiocarbon dates for the Late Holocene section of the Nagybárkány–Nádas-tó sequence (Atmospheric data after Stuiver et alii [1998], OxCal v3.5 Bronk-Ramsey [2000])

Pollen analysis

Samples for analysis of the pollen contained within the sediment were collected using a 1 cm^3 volumetric sub-sampler. The sampling interval was 8 cm throughout the core, with a finer interval of 4 cm for the lowermost section, between 312 and 248 cm. The uppermost 40 cm of the core (*Sphagnum* peat) was disturbed during the coring process and was thus unsuitable for palynological analysis. Samples were processed for pollen[5] with exotic pollen added to each sample in order to determine the concentration

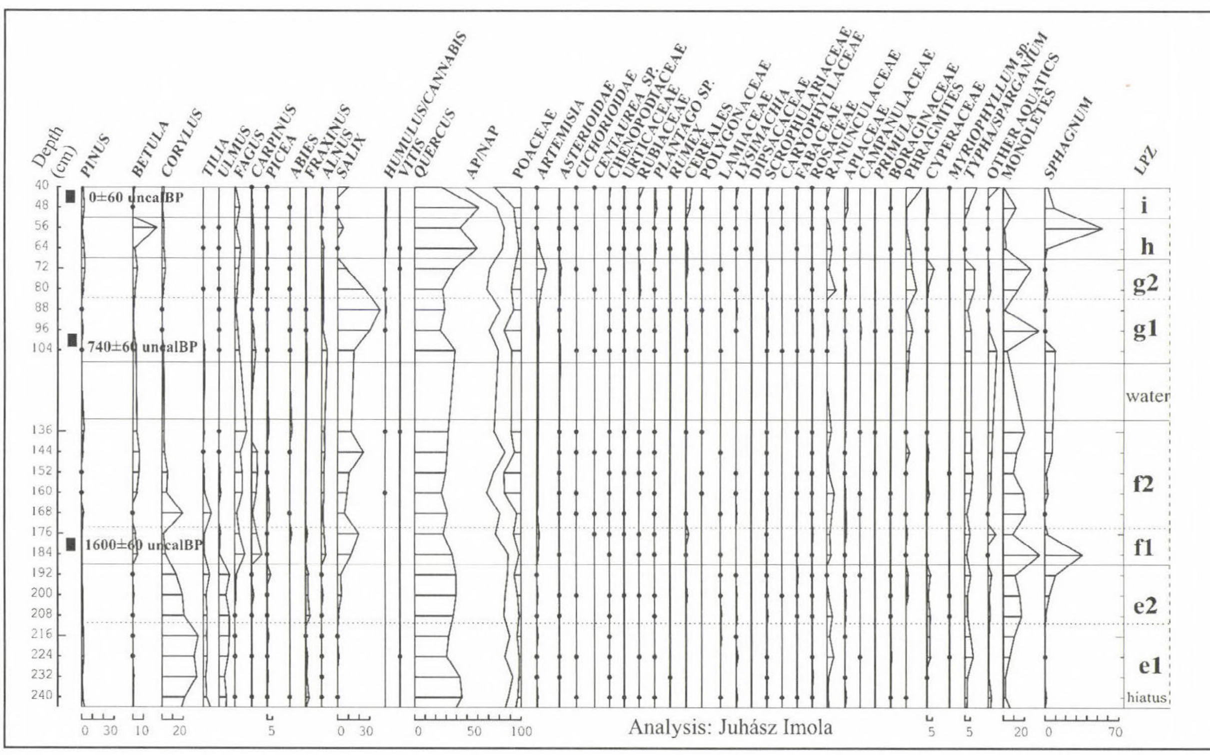

Fig. 3. The simplified pollen diagram of the Nagybárkány–Nádas-tó sequence for the Late Holocene

5 *B. E. Berglund – M. Ralska-Jasiewiczova:* Pollen analysis and pollen diagrams. *In*: Handbook of Holocene Palaeoecology and Palaeohydrology. Ed.: B. E. Berglund. New York 1986, 455–479.

of pollen.[6] A minimum count of 300 pollen grains per sample was made in order to ensure a statistically significant sample size.[7]

The preliminary results of the archaeobotanical and macrobotanical investigations of the entire sediment core have already been published.[8] Here I shall only present and discuss the data concerning the Late Holocene section of the sequence. The upper part of the pollen diagram (between 240–40 cm) was divided into five Local Pollen Assemblage Zones (LPAZ) from NBP-e to NBP-i, corresponding to the changes of the most important taxa *(Fig. 3)*. A more detailed data set (at 4 cm intervals) for the basal part of the sediment core (from 248 to 312 cm) will be published later.

RESULTS OF THE PALAEOBOTANICAL ANALYSES

The Late Holocene vegetation history of Nádas-tó

Zone NBP-e (240–192 cm)

Following the layers devoid of pollen between 248–240 cm, a species rich oak woodland can be noted at Nádas-tó. Even though beech (*Fagus*) and hornbeam (*Carpinus*) are sporadic during this zone, a closed forest canopy developed. The closing of the forest canopy can be linked to the sudden increase of hazel (*Corylus*) from 15 to 30% and to the constantly high values of oak (*Quercus*) in the first part of the zone (NBP-e1). This is followed by the decline of hazel, while linden (*Tilia*) and elm (*Ulmus*) maintain a continuous presence, parallel to the re-appearance of *Fagus* and *Carpinus* at the end of the zone (NBP-e2). Ash (*Fraxinus*), alder (*Alnus*) and willow (*Salix*) too increase at the end of the zone, following their sporadic presence at the beginning of the zone (NBP-e1). The herbaceous vegetation has very low values, with a low amount of pollen grains. However, almost all taxa of the previous zone are present, even if only sporadically, but only grasses (Poaceae) and mugwort (*Artemisia*) have a continuous curve. Typical species of the wet zones, such as *Ranunculus*, *Lysimachia*, Apiaceae, can also be noted. The most important change in the local vegetation is the disappearance of *Sphagnum* moss with a very sharp decrease in the species of the earlier bogland vegetation,[9] such as *Typha/Sparganium*, the Pteridophytes with Monolete spores (*Thelyptheris palustris*) and aquatic species (*Nuphar*, *Butomus*, *Potamogeton*). Their percentages again show a continuous rise and reach high values by the end of this zone (NBP-e2) and the beginning of the following zone (NBP-f; *Table 1, Fig. 3*).

On the testimony of the radiocarbon dates (1600±60 uncalBP, 470 calAD, at 184–176 cm) for the beginning of the next period ((NBP-f1), these layers were deposited as early as *ca.* 330 BC. It would appear that this vegetation – a closed forest without the already flourishing beach and hornbeam – developed after sedimentation restarted, following the cutting of the *Sphagnum* peat layers. Extrapolating from the available radiocarbon dates, the NBP-e1 sub-zone can probably be correlated with the period when the area was populated by Celtic groups. The hiatus in the peat layers may have been caused by these groups, who destroyed the peat bog, perhaps by digging out the peat for deepening the lake. A similar phenomenon was observed at nearby Kelemér–Kis-Mohos-tó,[10] where the high amount of hemp (*Cannabis*) pollens suggested that the lake had been used for retting hemp stalks for fibre. Even though there is no evidence for an increased amount of hemp pollen at Nádas-tó, it is possible that the same may be assumed at this site. Another possibility is that the small lake functioned as a source of water supply, or that peat was cut to for use as fuel. The second part of the zone (NBP-e2) is characterised by the re-appearance of *Sphagnum* moss layers, with *Thelypteris palustris*, *Typha/Sparganium* and

6 *J. Stockmarr:* Tablets with spores used in absolute pollen analysis. Pollen et Spores 13 (1971) 615–621.

7 *L. J. Maher:* Nomograms for computing 95% limits of pollen data. Review of Palaeobotany and Palynology 13 (1972) 85–93.

8 *Juhász et alii* (2004).

9 *Juhász et alii* (2004).

10 *K. J. Willis – P. Sümegi – M. Braun – A. Tóth:* Does soil change cause vegetation change or vica versa? A temporal perspective from Hungary. Ecology 78 (1997) 740–750; *K. J. Willis – P. Sümegi – M. Braun – K. D. Bennett – A. Tóth:* Prehistroric land degradation in Hungary: who, how and why? Antiquity 72 (1998) 101–113.

Cyperaceae. *Corylus* values decline, *Abies* shows a slight rise, with sporadic appearances of *Fagus* and *Carpinus*. The herbaceous vegetation again becomes quite species rich. The extrapolation of the radiocarbon dates suggests that this period most likely corresponds to the Roman period, when there was hardly any human activity in the broader area of the sampling location, enabling the re-commencement of peat accumulation.

Zone NBP-f (192–136 cm)
This zone is characterised by the opening up of the forest canopy and the increase of herbaceous elements. We divided this zone into two sub-zones. *Quercus* shows relatively constant values throughout the zone, while *Tilia* and *Ulmus* decline to very low values, parallel to the sudden rise of beech (*Fagus*) and hornbeam (*Carpinus*) at the beginning of the zone (NBP-f1, 192–176 cm). *Betula* develops again in the forest with a constant level, except for a temporary minimum at 168 cm, while *Corylus* has a temporary maximum, followed by a decline to its previous level. The second part of the zone (NBP-f2, 176–136 cm) is characterised by the increase of the grasses (Poaceae). Of the taxa typical for the marginal zone of the peat bog, *Salix* has high values with a decrease during the second sub-zone. *Alnus* is continuously present with low values, while *Fraxinus* shows a sporadic presence. Several anthropogenic indicator species are present in the herbaceous vegetation; cereal pollen grains were identified in the first sub-zone only. The radiocarbon date for the sediment section was 1660±60 uncalBP (470 calAD). *Centaurea cyanus*, *Plantago lanceolata* and *Plantago media/major* were identified for the entire period. The humid zones fringing the bog show a continuous presence. Following a maximum of *Sphagnum* moss and of *Thelypteris palustris* at the end of the previous zone (NBP-e2)/beginning of this zone (NBP-f1), a sudden decline can be noted in the pollen diagram at 168 cm, followed by their rise in the second part of the zone (NBP-f2). Cyperaceae and aquatic species (*Nuphar*, *Nymphea*, *Lemna*, *Butomus*) too have a temporary minimum at this depth, and a few *Myriophyllum verticillatum* pollen grains were also identified.

This period can most likely be correlated with the Migration period. A few minor traces of human impact can be noted at the end of the previous zone, which became more marked in this zone (NBP-f1). Although beech and hornbeam are present with relatively high values, the forest canopy gradually opened up by the end of the zone (NBP-f2). *Tilia*, *Ulmus* and *Corylus* were the species most heavily affected by human activity. The radiocarbon dates reflect a rather rapid sedimentation rate in this section of the pollen diagram. However, the high resolution does not allow the tracing of slight changes in vegetation development, and it is not possible to describe the exact nature of human impact in greater detail. Agricultural activity is reflected by the presence of cereals, *Plantago lanceolata*, *Centaurea cyanus* and some nitrophilous taxa (*Urtica*) in the NBP-f1 sub-zone.

Following the cessation of human activity, when *Corylus* and *Tilia* reach a temporary maximum, a new period of human impact is reflected by the increase of grasses and nitrophilous taxa in the NBP-f2 sub-zone. This impact can most likely be associated with the presence of a Slavic or ancient Hungarian population. The influence of these two anthropogenic periods is also indicated by the sudden, even if only temporary disappearance of the *Sphagnum* moss blanket at 168 cm, on the boundary of these two sub-zones (NBP-f1, f2), following the restart of peat accumulation at the end of the previous zone (NBP-e2)/beginning of this zone (NBP-f1). The high values of *Salix* and *Betula* reflect the presence of a willow swamp around the bog vegetation.

The medieval and modern vegetation history of Nádas-tó

Between 130–110 cm, there was an open water level with a floating mat above it, in the uppermost 100 cm. The analysis of the peat layers from 104–40 cm gave the following results:

Zone NBP-g (104–72 cm)
This zone, characterised by a relatively closed vegetation cover, was divided into two sub-zones. *Salix* is the dominant taxon, accounting for 40% of the total pollens in the first sub-zone (NBP-g1, between 104–88 cm); however, its values suddenly decline from 88 cm and it becomes virtually extinct by the end of the second sub-zone (NBP-g2, 88–72 cm). *Quercus* has high values too (between 30–40%) and shows a rise parallel to the decline of willow. Hemp (*Humulus*) is also present, in addition to a willow swamp. Other tree taxa show a sporadic presence, except for beech (*Fagus*) and hornbeam (*Carpinus*), which are present with minor, but continuous curves, together with *Betula*, *Corylus* and *Pinus*. *Tilia* and *Ulmus* are very sporadic. Of the herbaceous taxa, the grasses (Poaceae) have higher values in the NBP-g1 sub-zone, followed by a peak of several anthropogenic taxa (*Artemisia*, Asterioideae, Chenopodiaceae and *Plantago lanceolata*) in the NBP-g2 sub-zone, when human impact on the vegetation became more intensive – although cereals (*Triticum* and *Secale*) and *Urtica* are present throughout the zone. *Centaurea cyanus* and *Rumex* also appear in the vegetation of the site, and Ranunculaceae too expand in the second part.

Sphagnum is only sporadically present; *Phragmites*, *Typha/Sparganium* and Pterydophytes are well represented. Aquatic taxa (*Lemna*, *Potamogeton*, *Butomus*, etc.) gradually become sporadic, while Cyperaceae reappear and increase by the end of this zone (NBP-g2).

The radiocarbon dates for the base of the floating mat between 102–98 cm were 740±60 uncalBP (1260 calAD), corresponding to the late Árpádian Age. Willow swamp dominates the pollen assemblage, with the traces of *Humulus* and some *Alnus* stands at the beginning of the zone. The oak forest is present, but otherwise the pollen assemblage shows very low values for other tree taxa. A slight human impact can be seen at the beginning of the zone. Cereals are present with values rising towards the end of the zone. *Artemisia*, Asterioideae and the appearance of *Rumex*, *Centaurea* can be noted. The water level decreased during this period, reflected by the disappearance of aquatic species: *Phragmites*, *Typha/Sparganium* and some Cyperaceae are present, while *Sphagnum* is virtually absent.

Zone NBP-h (72–56 cm)
This zone indicates the closing of the forest canopy, with oak (*Quercus*) as the dominant tree taxon. *Fagus*, *Carpinus* and *Corylus* are also members of the forest. *Betula* has a temporary maximum, while *Salix* and *Alnus* decline. *Humulus* is present with a continuous curve. Very few herbaceous taxa can be noted – only Poaceae and *Artemisia* have continuous curves. Anthropogenic taxa are also present: the pollen grains of *Plantago lanceolata*, *Rumex* and cereals (*Triticum* and also *Secale*) were identified.

Of the species of peat bog-marsh vegetation, *Sphagnum* reaches a maximum peak at 70%, while *Thelypteris palustris* and *Phragmites* have low values. Cyperaceae, *Typha/Sparganium* and aquatic species are present sporadically.

This section of the sediment core can be correlated with the late Middle Ages. The closing up of the forest canopy can be noted, with a dominance of *Quercus* and *Betula*. Traces of human impact diminish, even though cereals, *Rumex* and *Plantago* reflect human activity near the site. The development of the *Sphagnum* blanket re-started, and there were some *Phragmites* around the pond.

Zone NBP-i (56–40 cm)
The uppermost section of the pollen sequence is also dominated by oak, with some beech and hornbeam. Willow *(Salix)* is present and rises towards the end of the zone; the herbaceous vegetation (Poaceae and anthropogenic taxa) increases and dominates the landscape. *Plantago lanceolata*, Cerealia, *Urtica* and *Rumex* have relatively high values. *Phragmites*, *Typha/Sparganium* are present in the local vegetation, together with *Thelypteris palustris*, although *Sphagnum* moss has lower values than in the previous zones.

The very end of the pollen sequence was dated to 0±60 uncalBP (1950 calAD), indicating a strong human impact on the vegetation cover, with high proportions of cereals, *Rumex* and *Plantago lanceolata* among the herbaceous taxa. The size of the oak forest decreases and willow re-appears. A closed

Sphagnum blanket covers the site, with *Phragmites* around the pond, where aquatic species and *Typha/ Sparganium* reappear, and *Myriophyllum verticillatum* is again present.

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Stuiver et alii (1998)	*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.

NATURAL ENVIRONMENT OR HUMAN IMPACT? A PALAEOECOLOGICAL STUDY OF TWO CONTRASTING SITES IN NORTH-EASTERN HUNGARY

Adam Gardner

INTRODUCTION

The position of Hungary as a frontier between the Central Asian steppes, the Balkan peninsula and the European interior has fostered a physical, biological and cultural environment of remarkable diversity. Situated beyond the limits of the Eurasian ice sheet during the last glaciation,[1] the geomorphology of the region reflects the intensity of periglacial, fluvial and aeolian processes which occurred during the late Quaternary.[2] Proximity to postulated Balkan forest refugia[3] and the presence of viable woodland populations within Hungary during the Full Glacial[4] suggest a Holocene vegetational development of prime importance for the Postglacial expansion of forest into Europe. Similarly, intensive archaeological research has demonstrated the importance of the region as a cultural dispersal zone through immigration of the Neolithic Körös culture[5] and invasion by Barbarian and Migration period groups during the first millennium AD (2000-1000 BP).[6]

In spite of this diverse environmental evolution, detailed palaeoecological investigations into the Holocene environmental development of Hungary have only recently been initiated. Despite a history of intensive archaeological research,[7] little study has been made of late Quaternary environmental change in Hungary, primarily due to the paucity of suitable sedimentary deposits. The pioneering work of Soó[8] and Zólyomi[9] initiated subsequent research into the late Quaternary vegetation of Hungary,[10] yet these studies were not dated radiometrically and can be used only for generalised descriptions of vegetation change throughout the Holocene. More recently, the work of Willis and her colleagues has produced a detailed basis for the reconstruction of late Quaternary environments in north-eastern Hungary through the use of well-dated physical and biological analyses of sedimentary sequences.[11]

Conspicuous amongst these records is that from Kis-Mohos-tó (hereafter KMT) near Kelemér in north-eastern Hungary.[12] Supported by thirteen ^{14}C determinations, this sequence has provided an insight into the impacts of human settlement since the Neolithic and records soil development amid Late Glacial and Holocene forest change. Nevertheless, this site is *ca.* 60 km from the fringe of the Alföld where the greatest efforts of archaeological investigation have concentrated and where almost continuous settlement is known since the Mesolithic.[13] Despite such records, however, there remain

1 *G. H. Denton – T. J. Hughes:* The Last Great Ice Sheets. New York 1981.
2 *Pécsi* (1970) *P. M. Márton – E. Szebényi – M. Wagner:* Alluvial loess (infusion loess) on the Great Hungarian Plain. Acta Geologica 22:1–4 (1979) 539–555; *A. Rónai:* Geological mapping of the Great Hungarian Plain. Acta Geologica 22:1–4 (1979) 355–365; *J. Szabó – E. Félegyházi*: Problems of landslide chronology in the Mátra mountains in Hungary. Eiszeitalter und Gegenwart 47 (1997) 120–128.
3 *Huntley – Birks* (1983); *Bennett et alii* (1991); *Willis* (1994).
4 *Willis et alii* (2000).
5 *Kosse* (1979); *Sherratt* (1982); *Sherratt* (1983).
6 *Szabó* (1971); *Trogmayer* (1980).
7 *N. Kalicz:* Die Frühbronzezeit in Nordost-Ungarn. ArchHung 45. Budapest 1968; *Szabó* (1971); *Kalicz – Makkay* (1977); *Kosse* (1979); *Trogmayer* (1980); *Sherratt* (1982); *Sherratt* (1983); *Kalicz – Raczky* (1987).
8 *R. Soó:* Die Vegetation und Enstehung der Ungarischen Puszta. Journal of Ecology 17 (1929) 329–350.
9 *B. Zólyomi:* Természetes növénytakaró a Tiszafüredi öntözőrendszer területén. Öntözésügyi Közlöny 7–8 (1946) 62–74; *Zólyomi* (1953).
10 E.g. *Járai-Komlódi* (1966); *Járai-Komlódi* (1968).
11 *Willis et alii* (1995); *Willis et alii* (1997); *Willis et alii* (1998); *Willis et alii* (2000).
12 *Willis et alii* (1997); *Willis et alii* (1998).
13 *Kertész et alii* (1994).

contentious issues concerning the environmental impact of prehistoric settlements from the Alföld, primarily related to the location of woodland resources known to have been used for fuel and raw materials.[14] In this paper, results are presented from physical and biological analyses of two sequences, one from Sirok–Nyírjes-tó in the Mátra Mountains of north-eastern Hungary and the other from Tarnabod in Heves County. Situated on the periphery of the Alföld, the Sirok site is close to a dense cluster of settlement sites inhabited continuously from the Mesolithic through to the present day, and has produced a reliable record of environmental impacts resulting from prehistoric activity on the plainlands. The Tarnabod site is 200 m from the tell site of Tarnabod–Templomföld.

STUDY SITES

Sirok

Sirok–Nyírjes-tó (47°55'81" N, 20°11'14" E) is a small oligotrophic peat bog on the fringe of the Mátra uplands *(Fig. 1)*, a range of low Miocene strato-volcanic hills[15] reaching a maximum altitude of 1015 m.[16] The site lies within a region of Tortonian andesitic and rhyolitic tuff on Pleistocene piedmont terraces, of which the near-surface lithology is loess loam and slope loess, intermixed with erosion debris and fossil soils.[17] Situated at 200 m above sea level, the basin is an ellipse approximately 200 m long and 100 m wide, surrounded by steep slopes supporting a gallery forest of *Quercus cerris*, *Carpinus betulus* and *Corylus avellana*. The edge of the basin is fringed by *Betula pubescens* and *Acer campestre* with *Phragmites communis* and Poaceae, whilst the surface of the basin is dominated by *Sphagnum* sp. with some juvenile *Betula pubescens* growing within the bog. Approximately 10 km to the south of the basin lies the double tell site of Tarnabod–Templomföld, dated to 7240 calBP[18] during the Neolithic Alföld Linear Pottery (ALP) culture phase. These belong to a series of tells clustered around the modern village of Tarnabod *(Fig. 1)*, which have produced typical ALP artefacts in addition to evidence for the use of raw materials and wild plant food from the upland forest.[19]

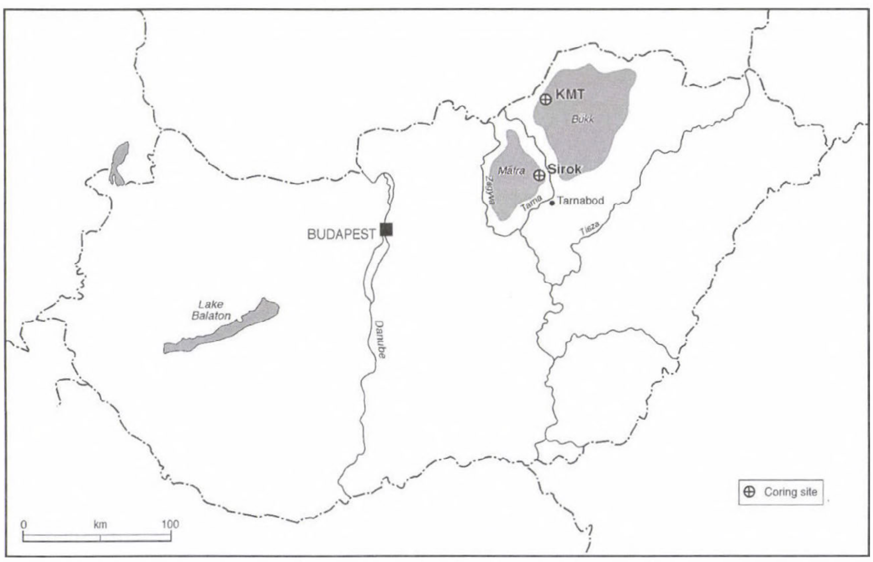

Fig. 1. Location of Sirok–Nyírjes-tó and dominant geographical features of north-eastern Hungary. Shading indicates boundaries of Mátra and Bükk regions

14 *B. Hartányi – M. Máthé:* Pflanzliche Überreste einer Wohnsiedlung aus dem Neolithikum in Karpaten-Becken. *In*: Festschrift Maria Hopf zum 65 Geburstag am 14 September 1979 Köln. Köln 1979, 97–114; *Kosse* (1979); *Kalicz – Raczky* (1987); *Kertész et alii* (1994).
15 *Földváry* (1988).
16 *Jámbor* (1989).
17 *Pécsi* (1970).
18 *Kohl – Quitta* (1963); *Kalicz – Makkay* (1977).
19 *Kosse* (1979).

Tarnabod

The oxbow lake (47°41'31" N, 20°14'40" E, 120 m above sea level) near the village of Tarnabod in Heves County is the remains of a meander loop of the Tarna River which is presently situated *ca.* 1 km to the north. The lake is kidney-shaped and measures 40 m on the long axis, 10 m at the maximum width and was isolated from the river at 29 ka BP.[20] Situated at the northern edge of the Great Hungarian Plain (Nagy Magyar Alföld), the surface geology is predominantly Quaternary floodplain mud with fluvial sands and some infusion loess and loessic deposits.[21] The greater part of the surrounding land supports arable crops, although nothing was growing during the field season. A small hedge line on the northern edge of the basin is composed of *Populus nigra*, *Alnus glutinosa*, *Salix cinera*, *Fraxinus excelsior*, *Acer campestre* and *Crataegus laevigata* and the surface of the basin is dominated by Poaceae.

Settlement of the region intensified during the Middle Neolithic Alföld Linear Pottery (ALP) phase, characterised by concentrations of houses on the floodplain and an increase in numbers of ALP sites over that of the preceding Körös culture.[22] In addition, ALP sites were clustered further to the north-west of the Alföld,[23] for example in the vicinity of Tarnabod–Templomföld, a double tell site dated to 7240 calBP[24] and located 200 m from the study site.

Methods

Continuous cores were extracted in overlapping sections from both sites using a modified Russian corer.[25] Pollen samples were processed using standard methods[26] with the addition of a sodium pyrophosphate treatment stage[27] to deflocculate clays. In addition, a 10 μm sieving stage[28] was included to remove fine debris from each sample. Tablets containing *Lycopodium clavatum* spores were added in order to calculate pollen concentrations.[29] Charcoal analysis was performed using the point-count estimation method of Clark[30] and a minimum count of 300 terrestrial pollen grains per slide was attained in order to ensure a statistically significant sample size.[31]

RESULTS

Radiocarbon dating

Results from AMS dating of the Sirok sequence are presented in *Table 1* which shows an internally consistent chronology for the sequence. The basal date is, however, considered *ca.* 3500 years too young on the basis of known biostratigraphy from other well-dated sequences in the region.[32] Acceptance of

20 Pál Sümegi, personal communication, 1997.
21 *Földváry* (1988); *Jámbor* (1989).
22 *F. Horváth:* A survey on the development of Neolithic settlement pattern and house types in the Tisza region. *In:* Neolithic of Southeastern Europe and its Near Eastern Connections. Ed.: S. Bökönyi. Budapest 1989, 85–102.
23 *Sherratt* (1983).
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29 *J. Stockmarr:* Tablets with spores used in absolute pollen analysis. Pollen et Spores 13:4 (1971) 615–621; *Maher* (1981) 153–191.
30 *R. L. Clark:* Point count estimation of charcoal in pollen preparations and thin sections of sediments. Pollen et Spores 24 (1982) 523–535.
31 *Maher* (1972) 95–124.
32 *Willis et alii* (1995); *Willis et alii* (1997); *Willis et alii* (1998); *Willis et alii* (2000).

this date would suggest that a forest characteristic of the Early Holocene[33] was present in Sirok during the mid-Holocene. By contrast, other available sequences from Hungary[34] show no such mid-Holocene assemblage and further support the Early Holocene date for expanding forest. Consequently the Sirok sequence has been subject to further verification by a process of sequence-slotting. This has been discussed fully elsewhere,[35] but essentially the basal age of the sequence has been extended to *ca.* 10,000 calBP following dissimilarity coefficients (DC) analysis of this and a similar sequence from nearby Kis-Mohos-tó (KMT).[36]

The Sirok basal date of 6640 calBP appears sound in that there is no reversal in the chronological sequence and the $\delta^{13}C$ value is acceptable for the sample material analysed *(Table 1)*.[37] The possibility exists, however, that the sample is a section of tree root which has penetrated the peat laterally along the interface between the limnic and telmatic deposits of the sequence. This sample was chosen as it marked the onset of peat growth in the basin, yet the stratigraphical position of the wood may, in retrospect, be a result of taphonomic irregularity. The DC analysis of the Sirok sequence against that of KMT has provided a numerical basis for evaluating the integrity of the Sirok timescale and has identified similarities between the basal sediments of Sirok and the Early Holocene of KMT which are sufficiently sound to support a common timescale. Thus, the 4.5 m sequence from Sirok–Nyírjes-tó can be confidently extended to 10,000 calBP, with a resolution of one sample every 113 calendar years, except for the close sample interval section where one sample represents 36 calendar years.

Attempts at dating the Tarnabod sediments by the AMS technique were frustrated by contamination of the sample with carbonates incorporated into the sediment as wind-blown dust. One sample was submitted to the Nuclear Research Centre of the Hungarian Academy of Sciences in Debrecen, Hungary for bulk radiometric dating. This sample was subject to rigorous pre-treatment to ensure the removal of all microscopic carbonate particles and root fibres and returned a determination of 6180±65 BP (Deb-4685, $\delta^{13}C$ -25.6 ‰) after $^{12}C/^{13}C$ correction. The sampling interval of the core is difficult to establish due to the lack of ^{14}C dates, but if the sequence is assumed to be at least 10,000 years old on the basis of pollen stratigraphy, each sample represents 200–250 calendar years.

Sediment stratigraphy

Sirok

The stratigraphical sequence from Sirok–Nyírjes-tó *(Table 1)* displays a three-stage transition from lake sediments through clay to peat. The base of the sequence (450–409 cm) is composed of silty-clay lake sediments, followed by a clay transitional unit at 409–390 cm and *Sphagnum* peat (390 cm–top). The inorganic residue of the basal clays *(Fig. 2)* is high at *ca.* 90%. The organic content is less than 10% until the transition to *Sphagnum* peat when it increases markedly to *ca.* 90% for the remainder of the profile. Inorganic resi-

Depth (cm)	Description
0–20	Acrotelm. Very dark brown (10YR 2/2) *Sphagnum* peat. nig: 3; strf: 0; elas: 4; sicc: 1 Tb4
20–390	Black (10YR 2.5/1) Sphagnum peat. nig: 4; strf: 0; elas: 4; sicc: 1 Tb4
390–409	Transition over 0.5 cm from *Sphagnum* peat to dark grey (5YR 4/1) dense clay. Fragments of wood and roots. nig: 3-4; strf: 0; elas: 1; sicc: 3 As4 Dg+
409–450	Dark grey (5YR 4/1) silty clay grading to olive grey (5YR 4/2) down-core. nig: 3; strf: 0; elas: 0; sicc: 3-4 As3 Ag1

Table 1. Main lithostratigraphical features for Sirok–Nyírjes-tó. Terminology follows that of Troels-Smith (1955) and Munsell soil colour charts

33 *Huntley – Birks* (1983); *Bennett et alii* (1991); *Willis* (1994).
34 *Willis et alii* (1995); *Willis et alii* (1997); *Willis et alii* (1998); *Willis et alii* (2000).
35 *Gardner* (1999).
36 *Willis et alii* (1997); *Willis et alii* (1998).
37 *M. Stuiver – P. J. Reimer:* Extended ^{14}C data base and revised CALIB 3.0 ^{14}C age calibration program. Radiocarbon 35 (1993) 215–230.

due decreases to values <10% and the carbonate curve displays a 'saw-tooth' profile reflecting irregular inputs of carbonate, perhaps from loessic sources.

Tarnabod

The sequence from Tarnabod is composed predominantly of clay with some traces of sand and infusion loess nodules *(Table 2)*. The presence of loess nodules up to 5 mm in size represents the sporadic introduction of carbonates ($MgCO_3$, $CaCO_3$) to the basin from local geological sources. These nodules were not sampled for analysis in order to avoid bias. Inorganic sediments dominate the sequence and record the importance of allogenic input to the basin.

Pollen stratigraphy

Depth (cm)	Description
0–20	Soil layer and root zone.
20–62	Heavy, massive greenish black (10GY 2.5/1) clay. nig: 2; strf: 0; elas: 0; sicc: 3 - 4 As4
62–120	Heavy, massive very dark grey (2.5Y 3/1) clay containing some sand traces and infusion loess nodules up to 5 mm in size. nig: 2; strf: 0; elas: 0; sicc: 3 - 4 As4 Gmin+

Table 2. Main lithostratigraphical features for Tarnabod. Terminology follows that of Troels-Smith (1955) and Munsell soil colour charts

Sirok

The percentage pollen diagram from Sirok–Nyírjes-tó has been divided into 7 zones *(Fig. 5a, Fig. 5b)* and influx data are presented against the same zonation *(Fig. 4)*.

Zone Sir-P1 (10,000–8950 calBP)
The basal zone of the sequence occurs during the limnic phase of the basin and is characterised by a mixed assemblage of arboreal and non-arboreal pollen. The dominant component in the assemblage is from the Poaceae, although *Picea*, *Quercus*, *Corylus* and Cyperaceae are also present in high values. Other arboreal taxa include *Pinus*, *Betula* and *Tilia*. Total pollen concentration is *ca.* 12,000 grains cm^{-3} and there is some evidence of burning from moderate concentrations of charcoal throughout the zone. The AP:NAP quotient in this zone displays minimum values for the entire sequence and the palynological richness index increases gradually towards the top of the zone.

Zone Sir-P2 (8950–8300 calBP)
This zone is characterised by maxima in both *Tilia* (28%) and Filicales (39%) and by reductions in all other taxa. Total pollen concentration increases slightly to 20,000 grains cm^{-3}, although charcoal concentrations are reduced. The AP:NAP quotient remains unchanged from zone Sir-P1 and the palynological richness index is in decline throughout.

Fig. 3. Summary pollen percentage diagram and supplementary spectra for

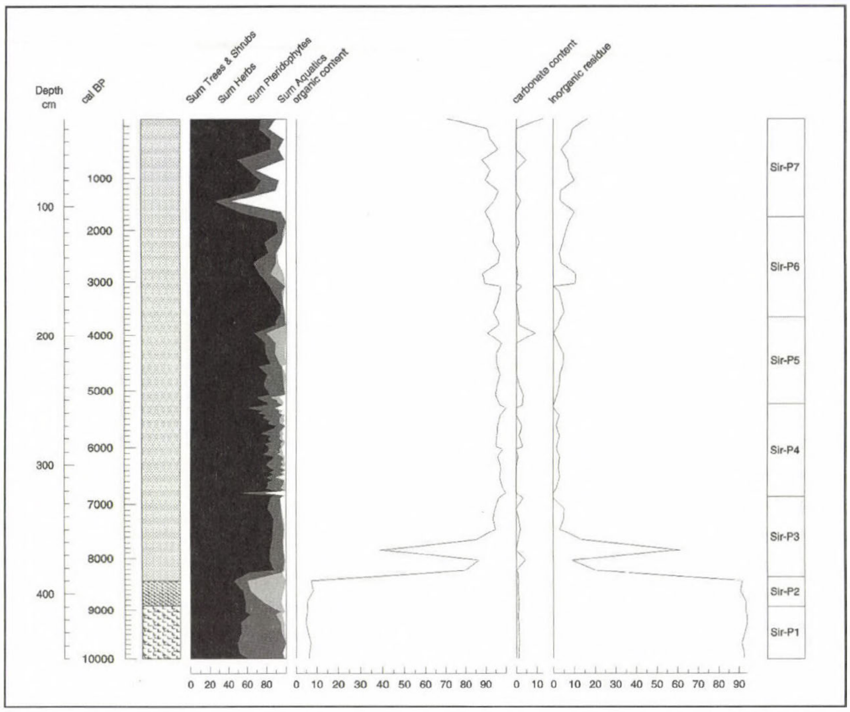
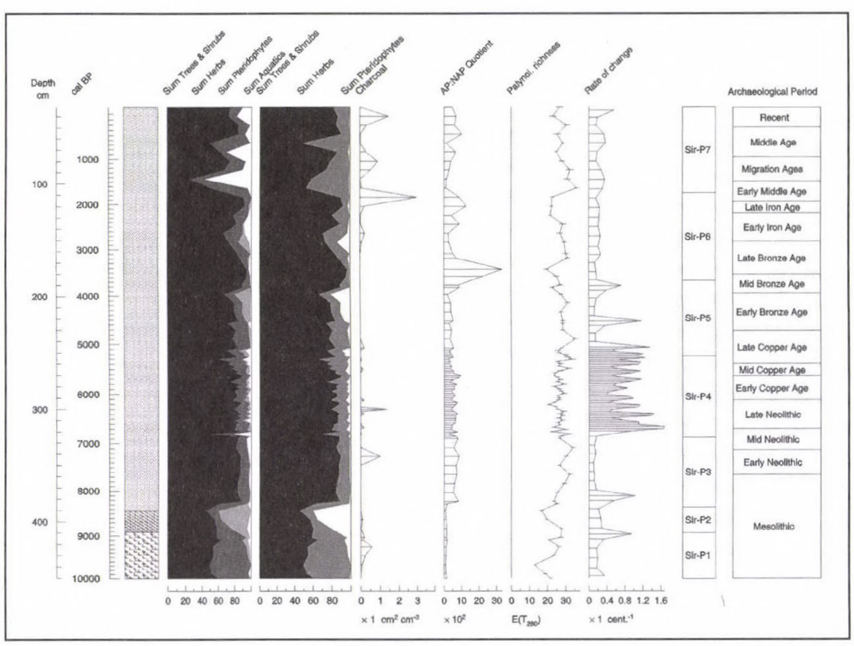


Fig. 2. Physical properties of Sirok–Nyírjes-tó sediments expressed as percentage of dry weight. Vertical scales indicate depth below surface and calibrated ^{14}C timescale. See Table 2 for explanation of stratigraphical column. Summary pollen percentage diagram and zonation included for comparative purposes



Sirok–Nyírjes-tó, presented against the established pollen zonation[38]

38 Summary diagrams are based on all terrestrial pollen and spores, with and without aquatic taxa. Supplementary spectra are: observed charcoal particles expressed as cm^2 of charcoal cm^{-3} of sediment; the ratio of arboreal to non-arboreal pollen; index of palynological richness expressed as E(Tn), where E = the expected number of taxa, T = the observed number of taxa and n = a standardised value representing the pollen count; rate of change derived from the chord distance dissimilarity measure. Scheme of archaeological periods derived from *Kalicz–Raczky* (1987); *Kosse* (1979); *Sherratt* (1982); *Willis et alii* (1998). Vertical scales indicate depth below surface and calibrated ^{14}C timescale. See Table 2 for explanation of stratigraphical column.

Zone Sir-P3 (8300–6900 calBP)

Zone Sir-P3 is characterised by a mixed deciduous forest assemblage which is dominated by *Corylus* but also comprises *Quercus*, *Tilia* and *Ulmus*. Also present at low values are *Picea*, *Pinus*, *Fagus*, *Alnus*, *Fraxinus*, *Carpinus orientalis* and *C. betulus*. Non-arboreal types are represented by Poaceae, Cyperaceae and *Ranunculus* and comprise 20% of the total pollen sum. Total pollen concentration is *ca.* 15,000 grains cm^{-3} and there is minimal evidence of burning from the charcoal spectrum. The AP:NAP quotient increases at the base of the zone and remains constant and the palynological richness index increases in the zone.

Zone Sir-P4 (6900–5200 calBP)

The dominant feature of this zone is the change in deciduous forest elements of the assemblage. Total arboreal pollen values fluctuate between 75% and 80% and the spectrum is dominated by *Corylus* at 40% total pollen. *Quercus* and *Carpinus betulus* are important components of the assemblage, reaching values in excess of 20%. *Tilia* and *Ulmus* are also important. Within the arboreal assemblage of this zone there are four cycles of change apparent which involve *Quercus*, *Corylus* and *C. betulus*. In each cycle, *Corylus* is reduced from 40% to 20% and *C. betulus* expands from background levels to values ranging from 20–40%. *Quercus* also expands during periods of *Corylus* decline but the amplitude of the response is less striking and falls within the range 20–30%. Of the non-arboreal types Cyperaceae dominates (*ca.* 10%) with Poaceae, Liliaceae, Filicales and *Sphagnum*. Total pollen concentration fluctuates between 5000 and 15,000 grains cm^{-3} and there is some evidence of burning from the charcoal curve. The AP:NAP quotient remains virtually unchanged from zone Sir-P3 and the trend of the palynological richness curve is steady, although a slight reduction is apparent at the base of the zone.

Zone Sir-P5 (5200–3700 calBP)

The high frequency variation of zone Sir-P4, demonstrated by the rate-of-change curve *(Fig. 3)*, is superseded by moderate changes in this zone. The dominant feature is the expansion of *Carpinus betulus* and *C. orientalis*. All other arboreal taxa remain constant or decline slightly. The dominant non-arboreal

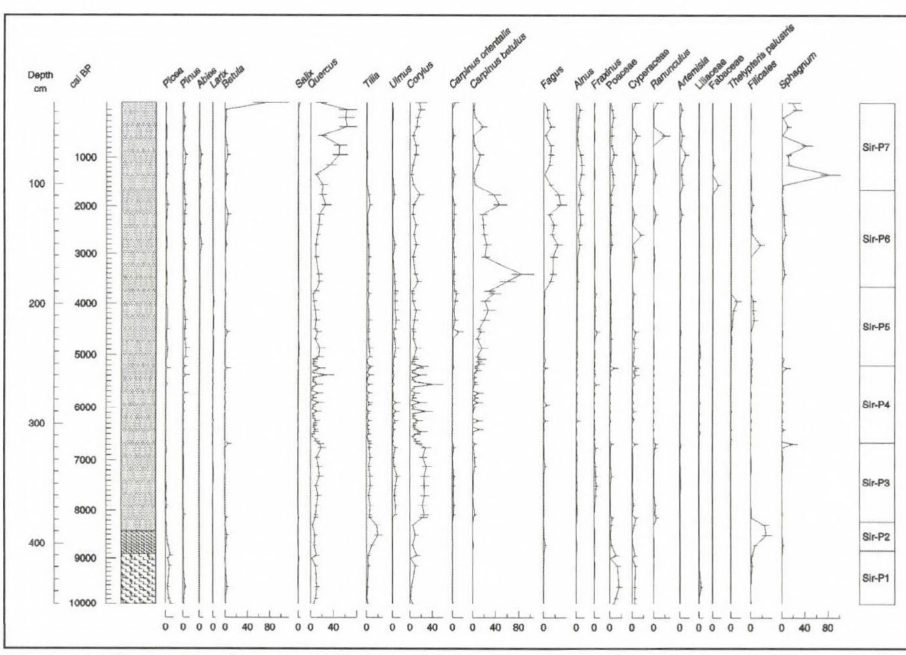


Fig. 4. Pollen influx diagram of selected major taxa from Sirok–Nyírjes-tó expressed as grains cm^{-2} $year^{-1}$ and plotted with 95% confidence intervals (Bennett [1994]; Maher [1972; 1981]). Zonation scheme as derived for pollen percentage data (Figs 5a–5b). Vertical scales indicate depth below surface and calibrated ^{14}C timescale. See Table 1 for explanation of stratigraphical column

component is Filicales, particularly *Thelypteris palustris*. The total pollen concentration value is *ca.* 15,000 grains cm^{-3} and there is minimal evidence of burning. The AP:NAP quotient increases at the top of the zone and the palynological richness curve declines slightly.

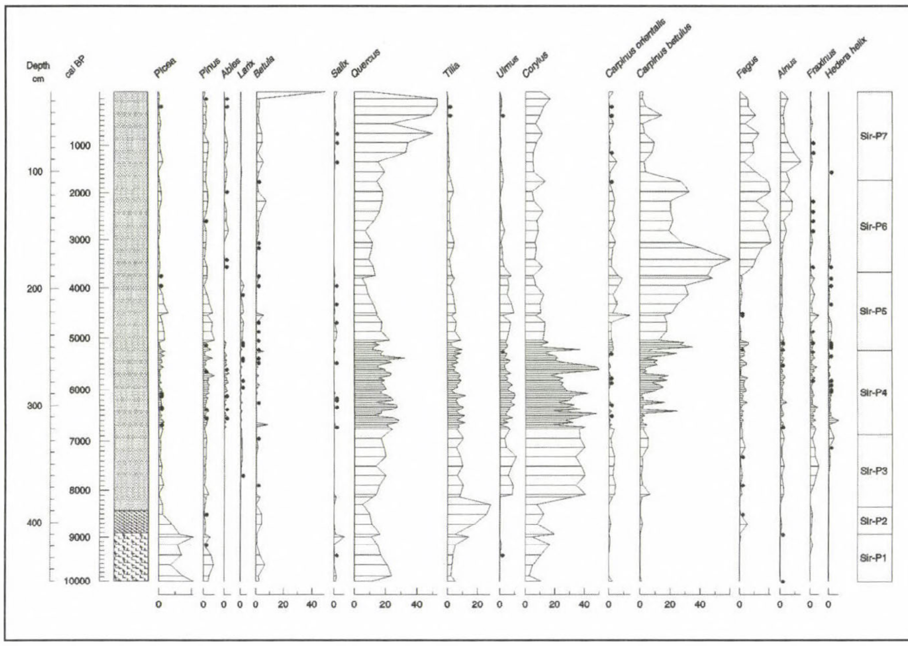


Fig. 5a. Pollen stratigraphy of major arboreal taxa from Sirok–Nyírjes-tó

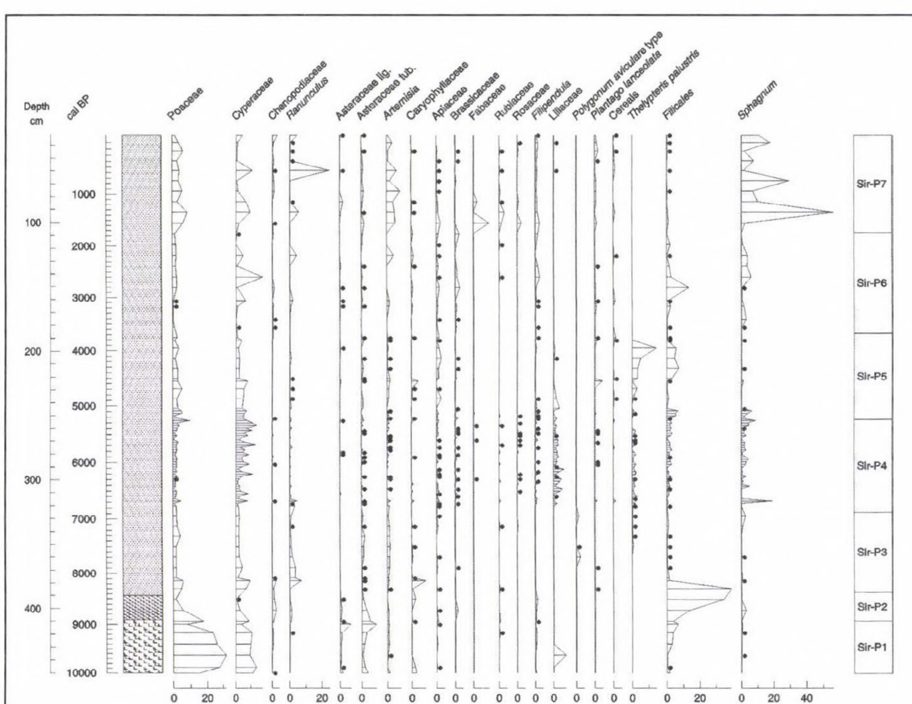


Fig. 5b. Pollen stratigraphy of major non-arboreal taxa from Sirok–Nyírjes-tó. Both diagrams expressed as percentages of all terrestrial pollen and spores. Dots indicate values <0.5%. Zonation performed by optimal splitting of information content. Vertical scales indicate depth below surface and calibrated [14]C timescale. See Table 1 for explanation of stratigraphical column

Zone Sir-P6 (3700–1750 calBP)
The maximum value and subsequent decline of *Carpinus betulus* and the expansion of *Fagus* dominate zone Sir-P6. Also important amongst the arboreal taxa are *Quercus*, *Corylus* and *Alnus*, while Cyperaceae and Filicales are predominant within the non-arboreal types. Total pollen concentration reaches maximum values in this zone as do charcoal concentrations, which peak towards the top. Similarly, the AP:NAP quotient displays maximum values in this zone.

Zone Sir-P7 (1750 calBP–present)
The uppermost zone is characterised by expansions in *Quercus* and *Sphagnum* throughout and a sharp increase in *Betula* at the top of the core. Concentration values remain high and the charcoal curve displays evidence of burning. The AP:NAP quotient shows an increasing trend throughout the zone and the index of palynological richness reaches maximum values.

Tarnabod

The core from the oxbow lake at Tarnabod was analysed at an interval of 2 cm *(Figs 6–7)*. Pollen of Asteraceae liguiliflorae has been excluded from the pollen sum due to a presumed local source. High values of this type have been interpreted by Turner as indicative of differential preservation of the pollen assemblage,[39] although in this case the good state of preservation of all other grains identified challenges this interpretation. Furthermore, grains of Asteraceae liguiliflorae pollen were commonly discovered clumped together during analysis, suggesting that pollen dispersal was incomplete and that the plants were growing nearby. A local source of pollen from plants growing on the lakeside is therefore assumed responsible for these high values. The diagram has been divided into two zones:

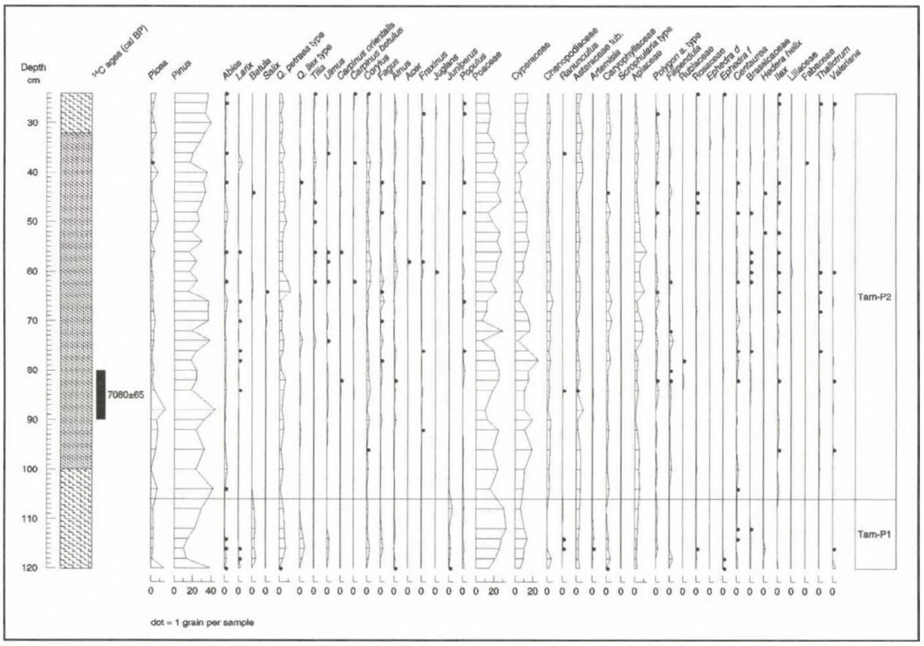


Fig.6. Pollen stratigraphy of Tarnabod, expressed as percentages of all terrestrial pollen and spores. Dots indicate values <0.5%. Zonation performed by optimal splitting of information content. Vertical scales indicate depth below surface and calibrated ^{14}C timescale. See Table 2 for explanation of stratigraphical column

39 *C. Turner:* Problems and pitfalls in the application of palynology to Pleistocene archaeological sites in western Europe. *In:* Palynologie Archéologique. Eds: J. Renault-Miskovsky – Bui-Thi-Mai – M. Girard. CNRS Notes et Monographies Techniques 17 (1985), 347–373.

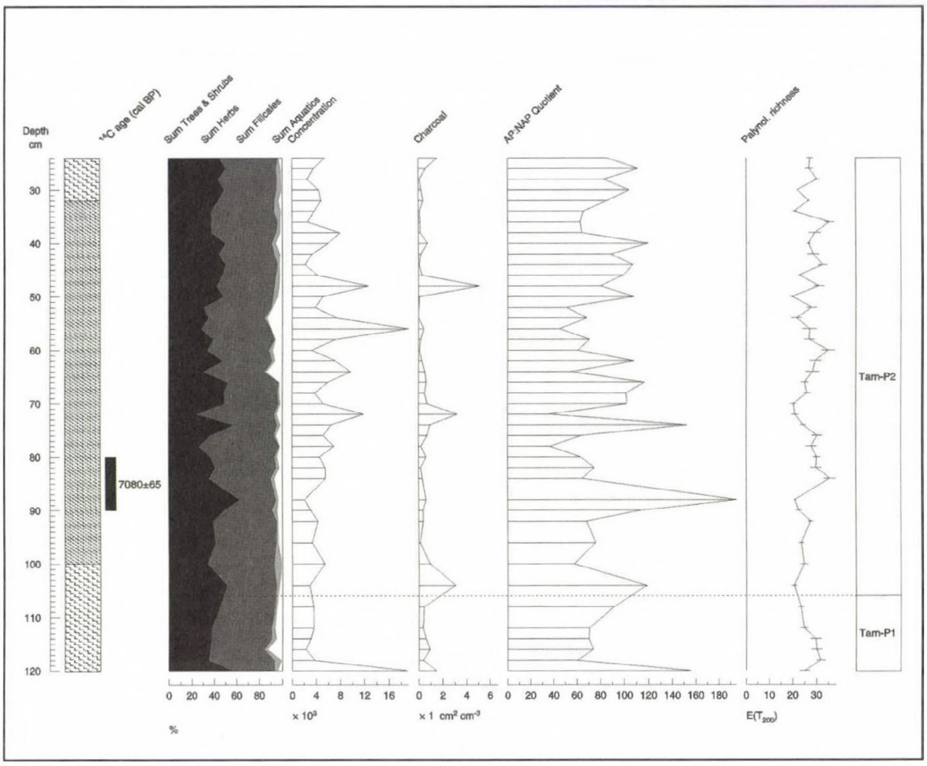


Fig. 7. Summary pollen percentage diagram and supplementary spectra for Tarnabod, presented against the established pollen zonation. Summary diagrams are based on all terrestrial pollen and spores. Supplementary spectra are: observed charcoal particles expressed as cm² of charcoal cm³ of sediment; the ratio of arboreal to non-arboreal pollen; index of palynological richness expressed as E(Tn), where E = the expected number of taxa, T = the observed number of taxa and n = a standardised value representing the pollen count; rate of change derived from the chord distance dissimilarity measure

Zone Tarn-P1 (120–106 cm; approx 10,000–8500 BP)

The basal zone is dominated by high values of *Pinus*, Poaceae and Cyperaceae with low values of additional arboreal types including *Picea*, *Betula*, *Quercus*, *Corylus*, *Fagus* and *Juniperus*. A variety of non-arboreal types are present, including Caryophyllaceae, Apiaceae, *Polygonum aviculare*-type, *Cannabis* and Filicales. Total pollen concentration is initially high at >20,000 grains cm^{-3}, although this reduced to *ca.* 5000 grains cm^{-3} from 118 cm (*ca.* 9000 BP). A high concentration of charcoal suggests significant burning. The AP:NAP quotient is high and peaks at the bottom of the zone, while the index of palynological richness is moderately high.

Zone Tarn-P2 (106–top; approx. 8500 BP–present)

Zone 2 displays few differences from the previous zone and is characterised by slight increases in deciduous arboreal taxa, namely *Quercus*, *Corylus*, *Fagus* and *Alnus*, and the greater importance of non-arboreal taxa such as Chenopodiaceae, Apiaceae and cereals. Poaceae and Cyperaceae dominate the non-arboreal component and values of *Sparganium* increase throughout the zone. Total pollen concentration increases to >7000 grains cm^{-3}, with a maximum value of *ca.* 20,000 grains cm^{-3} at 55 cm (*ca.* 3000 BP). Charcoal concentration remains high, peaking at 72 cm (*ca.* 5000 BP) and 48 cm (*ca.* 3400 BP). The AP:NAP ratio remains high but fluctuates markedly and the index of palynological richness is unchanged from the previous zone.

Sirok pollen stratigraphy interpretation

The base of the sequence from Sirok–Nyírjes-tó indicates an open parkland-type of landscape dominated by Poaceae, but in which scattered stands of both coniferous and broad-leaved trees are important. From *ca.* 8950 calBP, a shift in the composition of the vegetation occurs in which *Tilia* and Filicales become the dominant taxa and all other taxa decline, until *ca.* 8300 calBP, when *Corylus* expands rapidly to 40%, an event which is present in many European pollen diagrams at this time.[40]

The establishment of a mixed deciduous forest dominated by *Corylus* persists without change for *ca.* 600 years. This type of forest has no modern analogue[41] but is a feature apparent in several other pollen records from the region[42] and represents a distinct phase in the South-East European vegetation development.

From *ca.* 6900 calBP, a series of cycles occur during which *Corylus* declines and other taxa, most notably *Carpinus betulus*, expand briefly. The pollen influx diagram *(Fig. 4)* clarifies the magnitude of the initial disturbance and reveals a greater decline not seen in the percentage pollen diagrams *(Fig. 5a, Fig. 5b)*. Conversely, the influx response of *C. betulus* is less dramatic than the percentage response, indicating that although *C. betulus* contributed a greater proportion of pollen to the flux, the annual deposition of *C. betulus* pollen was actually very low. Moreover, the greatest increases in *Corylus* influx (*ca.* 6400, 6100, 5500, 5350 and 5200 calBP) occur with virtually no response in *C. betulus*. Notwithstanding these factors, it is plain that the previously stable forest is being disturbed in some manner and that *Corylus* is being selectively removed, allowing minor flourishes of *C. betulus* which are superseded by the rapid recovery of *Corylus*. Furthermore, minor increases in wet-habitat field-layer taxa such as *Thelypteris palustris* and some members of the Liliaceae, in addition to expansions in *Sphagnum* and Filicales, imply a change both in hydrological conditions and light penetration to the forest floor.

The removal of this disturbance is evident in the stabilisation of *Corylus* in reduced abundance and the expansion of *C. betulus* to a position of dominance within the forest, a component of the typical Postglacial forest succession for south-east Europe. Similarly, the subsequent expansion of *Fagus* and the continued presence of *Quercus* in abundance is indicative of a forest which is not subject to appreciable external disturbance. The summary diagram *(Fig. 3)* illustrates this point well: arboreal pollen reaches maximum values at *ca.* 3600 calBP and there is little variation in the forest composition.

The first appreciable forest clearance, presumably through anthropogenic activity given the increased charcoal concentration *(Fig. 3)*, occurs *ca.* 1850 calBP as *C. betulus* is reduced. The removal of the dominant forest element permits expansion in several taxa *(Fig. 5a, Fig. 5b)*, all of which are adapted to wetter conditions. At this time the *Sphagnum* which forms the peat dramatically increases production of spores, indicating a change in surface wetness.[43] Subsequently, the space created by the removal of *C. betulus* is filled by an expansion of *Quercus* from *ca.* 1400 calBP which persists to the present day.

Tarnabod pollen stratigraphy interpretation

The pollen assemblage from Tarnabod is remarkably stable throughout the Holocene and demonstrates similarities with the diagrams of Járai-Komlódi for the Alföld.[44] The high values of *Pinus* and non-arboreal types (primarily Poaceae and Cyperaceae) demonstrate the "openness"[45] of the floodplain surrounding the site. Values of 20–30% *Pinus* pollen indicate a primarily regional source[46] with a smaller

40 *Huntley – Birks* (1983).
41 *Rackham* (1988).
42 E.g. sites in *Willis* (1994); *Willis et. alii* (1997).
43 *K. E. Barber:* Peat Stratigraphy and Climate Change. Rotterdam 1981.
44 *Járai-Komlódi* (1966).
45 *B. Aaby – G. Digerfeldt:* Sampling techniques for lakes and bogs. *In:* Handbook of Holocene Palaeoecology and Palaeohydrology. Ed.: B. E. Berglund. London 1986, 181–194.
46 *G. M. Peterson:* Recent pollen spectra and zonal vegetation in the western USSR. Quaternary Science Reviews 2 (1983) 281–321.

contribution from trees growing locally. Jackson demonstrates for modern landscapes that 10% land cover of Pinus trees within 1 km of the sampling site is represented by pollen values between 10 and 14%. Low but constant values of *Picea* and *Quercus* suggest a small but viable population scattered across the landscape, probably occupying favourable well-drained positions on levées or loess banks. Similarly, low values of other deciduous arboreal types probably represent isolated pockets of woodland in a generally treeless landscape.

Increased abundance of herbaceous pollen during the occupation period of the tell site is probably related to agricultural activity. Values of Chenopodiaceae, Caryophyllaceae, Apiaceae, *Polygonum*, *Plantago* and cereals all increase after 7000 BP during the ALP culture phase. Pollen concentration values similarly demonstrate the importance of these types to the pollen flux and also reveal increased concentrations of Poaceae pollen from *ca.* 7000 BP. Arable plots were most likely present in the immediate vicinity, close to the drier land on which the settlement was situated.

No discernible clearance event is apparent at any time in the profile due to the generally open character of the landscape. Pollen values for *Pinus*, *Picea*, *Quercus* and *Corylus* from *ca.* 7000 BP display increases which may reflect a combination of several factors such as a change in the water table, soil temperature or climate. However, the limiting factor retarding the spread of trees throughout the Holocene is most likely related to periodic inundation by flood-waters.

DISCUSSION

Sirok

In the early Postglacial, the slopes around Sirok supported an open parkland composed of *Picea*, *Quercus*, *Tilia* and *Corylus* with open spaces dominated by Poaceae *(Fig. 5a, Fig. 5b)*. Moderate burning of the vegetation was occurring up to *ca.* 8900 calBP. A transition from lake to peat deposits occurred in the basin from 10,000–8300 calBP. Over the same interval distinct changes were also occurring in the vegetation, each of which corresponds to a different sedimentary unit: (1) a decline of *Picea*, *Pinus* and *Betula* and open-ground herbaceous elements (lake sediment); (2) a dramatic increase of *Tilia* and Filicales (clay); and (3) the establishment of closed deciduous forest (*Sphagnum* peat). In interpreting palynological changes during the transition from lake to peat deposits, the differences in pollen source area between the two sedimentary regimes must be appreciated.[47] In this example, however, the larger pollen source area represented in the lake sediment appears to represent the landscape as an open parkland, with minimal trunk-space pollen filtering. *Tilia* and Filicales were present at the base of the sequence but the expansion to 25–30% of the pollen sum between 8900 and 8300 calBP is unusual and not apparent in any other published diagram, although a sharp increase in *Tilia* at *ca.* 9500 BP (*ca.* 10,600 calBP) has been recorded at Bátorliget[48] and a peak in Filicales dated to *ca.* 9500 calBP is apparent at Kis-Mohos-tó.[49]

Tilia typically thrives on well-drained soils such as those of the English lowland[50] and is unlikely to have flourished on the waterlogged basin surface. However, dispersal of *Tilia* pollen is so poor that individual trees must have been within a few metres of the basin[51] and the possibility exists that a dense gallery forest (which is composed of *Corylus avellana*, *Carpinus betulus* and *Quercus cerris* at present), of which *Tilia* was a dominant component, developed on the well-drained slopes at the periphery of the basin.[52]

47 *Jacobson – Bradshaw* (1981).
48 *Willis et alii* (1995).
49 *Willis et alii* (1997).
50 *Tutin et alii* (1989); *Rackham* (1988); *J. R. Packham – D. J. L. Harding – G. M. Hilton – R. A. Stuttard:* Functional Ecology of Woodlands and Forests. London 1992.
51 *S. Nilsson – J. Praglowski:* Erdtman's Handbook of Palynology. Second edition. Copenhagen 1992.
52 *H. Ellenberg:* Vegetation Ecology of Central Europe. Fourth edition. Cambridge 1988.

The order Filicales includes taxa which characteristically thrive on burnt or nutrient-poor soils but specifically certain taxa (such as *Thelypteris palustris* and *Athyrium* sp.) which grow on wet ground.[53] The charcoal concentration for this section of the core decreases prior to the expansion of Filicales *(Fig. 3, Fig. 5b)*, therefore fire would appear to be an unlikely factor to account for this event. However, the gradual infilling of the lake revealed newly exposed land which could have been colonised by advantageous taxa such as Filicales. Therefore, the abundance of Filicales spores at this time can probably be explained in terms of colonisation of newly exposed land.

The sedimentary profile at the base of the sequence displays features characteristic of the Early Holocene. High concentrations of inorganic mineral influx *(Fig. 2)* at a time of sparse woodland *(Fig. 5a)* are features typical of the Holocene transition in Hungary[54] and represent an open parkland at the site growing on immature catchment soils. The inorganic influx between 10,000 and 8700 calBP suggests a prolonged episode of erosion of raw mineral soils.[55]

From 8300 to 5200 calBP, the forest around the site became dominated by *Corylus* with *Quercus*, *Tilia* and *Ulmus*. The expansion of *Corylus* to values >40% is a common feature of European Holocene pollen diagrams[56] and is conventionally taken to represent a shrub layer in a forest. However, *Corylus* produces little pollen when growing in the understorey[57] and the population must therefore have either been a dominant canopy component or growing on the fringe of the basin. The latter is a distinct possibility in small basins such as Sirok, yet the ubiquity of a pronounced *Corylus* phase in European Holocene pollen diagrams[58] is such that there may once have existed a forest community dominated by *Corylus* which has no modern analogue. By extension, this implies that *Corylus* may have existed as a canopy tree. Three palynologically indistinguishable species of *Corylus* exist in Europe, of which two (*C. avellana* and *C. maxima*) are shrubs and one (*C. colurna*) is a canopy tree reaching 22 m.[59] All are currently distributed throughout the Balkans[60] and are presumed to have been present throughout the Holocene.[61] Given the possibility of two alternative species for the Balkan region and the lack of any macrofossil evidence, it is impossible to say whether the *Corylus* spectrum represented in this sequence is a shrub layer on the fringe of the basin or a now extinct forest assemblage with *Corylus* in the canopy.

From 6900 to 5200 calBP, there were several forest cycles in which the dominance of *Corylus* in the sequence was periodically reduced and in which *Carpinus betulus* expanded rapidly. These cycles occurred over various timescales, the shortest detected with this sampling resolution being *ca.* 72 years and the longest *ca.* 288 years. This selective removal of *Corylus* and the subsequent expansion of *Carpinus betulus (Fig. 5a)* may be due to anthropogenic intervention on the landscape, given the respective ecology of the two taxa. However, the climate of this period was significantly different from that of today[62] and underlying climatic factors which could account for these events must also be examined.

Between approximately 7800 and 5700 calBP, the climate of Europe experienced conditions which have traditionally been described as "optimal" and which were designated as "Atlantic" under the Blytt-Sernander classification. These optimal climatic conditions were considered to be uniformly warmer and moister than present across Europe, yet recent research has shown this not to be the case. Cheddadi and his colleagues demonstrated that although the idea of a "climatic optimum" is acceptable for

53 *Tutin et alii* (1989).

54 *Willis et alii* (1995); *Willis et alii* (1997); *Willis et alii* (1998).

55 *F. J. H. Mackereth:* Some chemical observations on postglacial lake sediments. Philosophical Transactions of the Royal Society of London 250B (1966) 165–213; *D. R. Engstrom – H. E. Wright Jr.:* Chemical stratigraphy of lake sediments as a record of environmental change. *In:* Lake Sediments and Environmental History. Eds: E. Y. Haworth – J. W. G. Lund. Leicester 1984, 11–60.

56 *Huntley – Birks* (1983).

57 *Rackham* (1988).

58 *Huntley – Birks* (1983).

59 *Huntley – Birks* (1983); *A. R. Clapham – T. G. Tutin – D. M. Moore:* Flora of the British Isles. Cambridge 1987.

60 *Tutin et alii* (1989).

61 *Huntley – Birks* (1983).

62 *Kutzbach – Guetter* (1986); *B. Huntley – I. C. Prentice:* July temperatures in Europe from pollen data, 6000 years before present. Science 241 (1988) 687–690; *Huntley–Prentice* (1993); *Kutzbach et alii* (1993); *Cheddadi et alii* (1997).

northern Europe, conditions in South-East Europe at 6 ka BP (6800 calBP) were up to 4 °C cooler than present and precipitation was up to 200 mm year^{-1} greater.[63] Given that *Corylus* is more tolerant of cool summers and of wetter conditions than *Carpinus betulus*,[64] there is no apparent climatic reason for the onset of the periodic declines observed in the *Corylus* curve.

ALP and early copper-using cultures flourished on the sparsely wooded plains between 7300 and 5800 calBP[65] and the forests of the Mátra and Bükk Mountains represented the only reliable source of wood for raw materials, fuel and winter fodder, in particular for the nearby Tarnabod settlements which were occupied from 7240 calBP. The possibility exists that forest grazing and browsing by livestock from the ALP settlements gradually introduced a change in the forest composition, but the availability of grazing on the Alföld could have satisfied the requirements of the relatively small herds.[66] Nevertheless, the winter feed requirements of such herds would have involved considerable provision of fodder from leaves and young shoots of broad-leaved trees,[67] sustained through a woodland management regime which may also have provided underwood, timber and firewood.[68] Therefore, the coincident timing of these events in the pollen record and of the occupation of the Tarnabod sites suggests that the changes to the forest could be attributed to direct human activity.

Management of the woodland in the Sirok region by, for example, coppicing and pollarding would have ensured a continuous supply of raw material[69] for the Tarnabod settlements. These processes have hitherto been undetectable by palynological methods,[70] and inference of woodland management has been made only from artefactual evidence of woodland products in archaeological excavations[71] and archaeobotanical evidence for fodder in the dung of domestic animals.[72] The situation at Sirok, where evidence of arboreal pollen fluctuations coincides with known Neolithic activity, provides an opportunity to identify early woodland management practices. The term "woodland management" has been adopted here in preference to "coppicing" or "pollarding" to describe a process of sustainable supply of materials, as the latter terms have particular implications for social organisation and cultural land-use.[73] Nevertheless, the ecological terminology for these practices is impossible to avoid, and the term coppicing will be used in some instances to describe management of specific taxa.

Carpinus betulus was present as a minor element of the stable *Corylus* dominated forest for *ca.* 600 years and selective removal of *Corylus* through woodland management created the conditions into which *C. betulus* had the opportunity to expand. Interestingly, *Quercus* displays fluctuations during this period which switch in phase between those of *Corylus* and those of *C. betulus*, perhaps suggesting the presence of coppice "standards" for timber or pollards for fodder.[74]

Carpinus betulus seedlings are light-demanding and severe disturbance allows the establishment of new specimens[75] which, if left undisturbed, will grow and cast dense shade. Therefore, there must have been an external influence between 7000 and 5200 calBP which prevented the expansion of *C. betulus* into the forest canopy. *Carpinus betulus* also coppices extremely well[76] and is valued for fodder and as

63 *Cheddadi et alii* (1997).

64 *Huntley – Prentice* (1993).

65 *Sherratt* (1982); *Sherratt* (1983); *Willis et alii* (1998).

66 *Kosse* (1979).

67 *Haas et alii* (1998).

68 *Rackham* (1986).

69 *Evans* (1992).

70 *P. Rasmussen:* Pollarding of trees in the Neolithic: often presumed – difficult to prove. *In:* Experimental Reconstruction in Environmental Archaeology. Ed.: D. E. Robinson. Oxford 1990, 77–99.

71 E.g. *J. M. Coles – F. A. Hibbert – B. J. Orme:* Prehistoric roads and tracks in Somerset, England. 3. Sweet Track. PPS 39 (1973) 256–293.

72 *Haas et alii* (1998); *S. Karg:* Winter- and spring-foddering of sheep/goat in the Bronze Age site of Fiavè-Carera, northern Italy. Environmental Archaeology 1 (1998) 87–94.

73 *Rackham* (1986); *C. Watkins:* Britain's Ancient Woodland. Woodland Management and Conservation. Newton Abbot 1990.

74 *Rackham* (1986).

75 *Rackham* (1980).

76 *Rackham* (1980); *M. N. Evans – J. P. Barkham:* Coppicing and natural disturbance in temperate woodlands – a review. *In:* Ecology and Management of Coppice Woodlands. Ed.: G. P. Buckley. London 1992, 79–98.

a source of fuel, due to the high temperature at which it burns.[77] It is therefore reasonable to suggest that two management cycles were operative: *Corylus* coppice with a short rotation of 6–10 years and *C. betulus* coppice with a longer rotation of 15–35 years,[78] complicated by an additional harvesting of *Quercus* for timber or leaf fodder during both cycles. Clearly these cycles are too brief to register within the limits of the available temporal resolution (1 sample = *ca.* 36 years) but the varied timescales of these cycles (72–288 years) suggest that there may be a threshold level at which the signal of woodland management is apparent in the pollen record. This is especially relevant given the maturation age of both taxa: *Corylus* will produce pollen 5–7 years after coppicing[79] whilst *C. betulus* will not produce pollen for up to 15 years after coppicing.[80] Thus, successive management cycles of shorter duration than the maturation period of each taxon would produce a pollen record in which a decline is recorded, indicating periods of more intensive management which ultimately favoured *C. betulus*.

The recovery of the woodland from *ca.* 5200 calBP coincides with the abandonment of the settlements at Tarnabod[81] and a gradual eastward shift in settlement pattern during the Late Copper Age.[82] It is highly probable, therefore, that woodland recovery is linked to the abandonment of woodland management. This would have led to the inevitable closure of the canopy and the gradual accession of *C. betulus* to a position of dominance within the forest. *Fig. 5* shows that this process occurred over more than a millennium, barely registering on the rate of change curve but causing maximum values in the AP:NAP ratio, almost entirely from the expansion of *C. betulus*. Thus, Holocene forest processes recovered following abandonment of woodland disturbance and a vigorous stand of secondary taxa, in this case *C. betulus*, became established. Of particular significance is the apparent lack of any sedimentological disturbance during the entire period of coppicing and *C. betulus* expansion *(Fig. 5a)*, indicating that *ca.* 2000 years of woodland management did not destabilise the landscape.

The cessation of human influence allowed semi-natural forest processes to resume at Sirok and the expansion of *Fagus* occurred at the expense of the *C. betulus* canopy. This is evident in both percentage *(Fig. 5a)* and influx *(Fig. 4)* diagrams and is therefore not an artefact of interdependence of percentage data. Recent ecological studies[83] have demonstrated that the deep shade cast by *Fagus* restricts growth in all the forest taxa present, and the decline in *C. betulus* appears to be directly associated with the expansion of *Fagus*. However, *Fagus* does not achieve total dominance in the forest and merely restricts *C. betulus* to a position within a mixed deciduous assemblage containing *Quercus*, *Corylus*, *Tilia*, *Ulmus* and *C. orientalis*. The pollen influx diagram *(Fig. 4)* reveals the relative importance of these taxa and confirms the trends apparent in *Fig. 5a*, yet the summary diagram and AP:NAP ratio *(Fig. 3)* both display a net reduction in arboreal pollen values. Thus, the expansion of *Fagus* from *ca.* 3500 calBP appears to have coincided with a reduction in total forest cover which could represent an increase in forest grazing pressure.[84]

From *ca.* 1700 calBP to the present day, the vegetation around the basin changed once again and became dominated by *Quercus* with a greater proportion of non-arboreal taxa. Taxa tolerant of wetter conditions (e.g. *Alnus* and *Sphagnum*) expanded and charcoal concentrations increased *(Fig. 3)*, suggesting burning of the landscape. The most striking feature of these events is the expansion of *Quercus* to a position of dominance in the pollen assemblage. Clearly, the combination of increased burning, the removal of the deciduous tree cover and the apparent shift in the water table are related to increased impacts from anthropogenic activity, perhaps as a result of increased populations, lack of effective controls (e.g. coppicing) to mitigate against landscape degradation, or a combination of both.

The period from 1700 BP to the present represents a turbulent period in the cultural history of Hungary. The Roman Age (1950–1575 BP; AD 1–375) saw the colonisation of the Mátra region by

77 *Evans* (1992); *Mabberley* (1997).
78 *Evans* (1992).
79 *Evans* (1992).
80 *Huntley – Birks* (1983).
81 *Kalicz – Makkay* (1977).
82 *Sherratt* (1982).
83 *R. Peters:* Beech Forests. Dordrecht 1997.
84 *Newbold* (1983).

barbarian groups of Celts, Dacians, Vandals and Sarmatians followed by Migration period groups of Huns, Avars and Slavs between 1575 and 1055 BP (AD 375–895) and the Hungarian Conquest of 1055–995 BP (AD 895–955).[85] Not until the evolution of the Hungarian Kingdom from 995 BP (AD 955) did the population re-settle into village communities and return to managed use of woodland,[86] by which time the forest composition had totally changed. The response evident between 7000 and 5200 calBP is therefore not apparent over the past millennium. In addition *Quercus*, the dominant taxon present from *ca.* 995 BP (*ca.* 920 calBP), is a highly valued timber tree[87] with a mast which provides good fodder for livestock,[88] and the forests may therefore have been subject to an alternative form of managed use over longer cycles.

Tarnabod

The Tarnabod sequence offers an insight into the Holocene environments of the Alföld which differs enormously from the upland sequences of Sirok,[89] Kis-Mohos-tó,[90] Nagy-Mohos-tó[91] and the lowland sequences from Bátorliget[92] and Sárrét.[93] The dominant feature of the Tarnabod sequence is the apparent stability of the environment throughout the Holocene. No discernible erosion events are apparent from the geochemical or sedimentary records and there is no evidence for any process of soil change throughout the Holocene. The characteristic features of South-East European forest development are not readily apparent, but there are some similarities.

During the early Postglacial, the plain around the Tarnabod site was surrounded by open grassland with some pockets of woodland. Burning of the vegetation occurred regularly, probably from natural causes such as lightning strikes as only sparse evidence exists for Mesolithic population at this time.[94] The basal layers of the pollen diagram *(Fig. 6)* display a mixture of arboreal types including *Pinus*, *Picea*, *Betula*, *Quercus* and *Ulmus*, a feature typically seen in Holocene sequences from the region.[95] Total arboreal pollen was around 40% and there was a wide variety of herbaceous types dominated by Poaceae and Cyperaceae, again a characteristic of the early Postglacial. However, the development of dense forest typically seen in Early Holocene sediments did not occur at Tarnabod. Similarly, no indication of Late Glacial soil erosion or Holocene accumulation of organic sediments is apparent from the sedimentary record.

The small size of the basin limits the influx of pollen to a very small source area, perhaps only tens of metres from the basin edge.[96] The pollen record is thus reflecting the immediate environment, as demonstrated by the consistently high presence of herbaceous taxa including an extensive herbaceous assemblage characteristic of arable cultivation. Similarly, the abundance of clumped Asteraceae liguliflorae pollen throughout the sequence attests to a local source. Values of *Pinus* pollen in the region of 30% are derived from the regional pollen flux,[97] as are the lower values for *Quercus*. The immediate environment was not totally treeless, however: *Fig. 6* displays a low but continuous presence of poor

85 *Trogmayer* (1980); *Willis et alii* (1997).
86 *E. Fügedi:* Castle and Society in Medieval Hungary. Budapest 1986.
87 *Rackham* (1980); *Rackham* (1986); *Mabberley* (1997).
88 *Newbold* (1983).
89 *Gardner* (1999); *A. R Gardner:* Neolithic to Copper Age woodland impacts in northeast Hungary? Evidence from the pollen and sediment chemistry records. The Holocene 12:5 (2002) 541–533.
90 *Willis et alii* (1997).
91 *E. Magyari – P. Sümegi – M. Braun – G. Jakab – M. Molnár:* Retarded wetland succession: anthropogenic and climatic signals in a Holocene raised bog profile from north-east Hungary. Journal of Ecology 89 (2001) 1019–1032.
92 *Willis et alii* (1995).
93 *K. J. Willis:* The impact of early agriculture upon the Hungarian landscape. *In*: Landscapes in Flux: Central and Eastern Europe in Antiquity. Eds: J. Chapman – P. Dolukhanov. Colloquia Pontica 3. Oxford 1997, 193–206.
94 *Kertész et alii* (1994).
95 *Járai-Komlódi* (1968).
96 *Jacobson – Bradshaw* (1981); *S. Hicks – H. J. B. Birks:* Numerical analysis of modern and fossil pollen spectra as a tool for elucidating the nature of fine-scale human activities in boreal areas. Vegetation History and Archaeobotany 5 (1996) 257–272.
97 *Peterson* (1983).

pollen producers and dispersers such as *Picea*, *Abies* and *Populus* and a significant abundance of pollen from *Corylus*, *Fagus* and *Alnus*.

The vegetation surrounding the basin changed little throughout the Holocene and the environment must have been very similar to that apparent today. The immediate area surrounding the site has been open throughout the Holocene and has presented the ideal opportunity for the establishment of Neolithic agricultural fields without having to undertake any woodland clearance. Occupation of the adjacent tell site could be invoked as the mechanism for the lack of trees in the immediate environment, yet there is no evidence for woodland expansion before the origin of the settlement.

The lack of woodland on the Alföld has traditionally been viewed as a result of climatic limits retarding the growth of trees and favouring the development of a "cold loess steppe".[98] Peterson presents modern surface pollen data from a range of habitats in the former USSR and shows that the pollen spectra of the modern steppe comprise low (*ca.* 5%) values of *Quercus* and *Betula* with *ca.* 20% *Pinus* and a non-arboreal component of 60–70% dominated by Poaceae, Cyperaceae and Asteraceae.[99] Zone Tarn-P1 displays a similar pollen assemblage and therefore most likely represents a steppe vegetation assemblage. Nevertheless, the small but significant quantities of additional arboreal pollen types *(Fig. 6)* probably represent small pockets of woodland which existed in favourable areas such as sandy ridges[100] or close to watercourses.[101]

Recent research has shown from macroscopic charcoal and molluscan evidence that a range of arboreal taxa including *Pinus*, *Betula*, *Picea*, *Salix* and *Carpinus betulus* were present on the Alföld during the full Glacial,[102] despite a cold, arid climate with reconstructed January temperatures of –20 °C.[103] Clearly, the available evidence suggests that viable tree populations did exist on the plains at this time but in low abundance, although the dominant community was of steppe character more suited to low soil temperatures and low precipitation.[104] The development of a more extensive tree cover in the Holocene was probably limited by the continentality of the regional climate, with severe winters and very hot summers, and the desiccating effect of strong winds.[105]

The broad open landscape devoid of dense forest cover would have offered several distinct advantages to sedentary communities. Primarily, little effort was required to occupy the landscape as the sparse woodland offered no hindrance to settlement or planting of arable fields. Similarly, the open plains represented ideal pastoral country yet were a rich source of wild game[106] and the rivers of the region provided a reliable water source. The dense Neolithic settlement of the Tarna region[107] subsequently applied an additional limiting factor to the vegetational development of the plain through agricultural activity and, combined with climatic limitations, has probably prevented any development of closed forest at any time throughout the Holocene.

CONCLUSION

Sirok

At Sirok–Nyírjes-tó, Hungary, the palaeoecological sequence reveals a typical South-East European Holocene forest development. Coniferous woodland at the Late Glacial–Holocene transition was replaced rapidly by a mixed deciduous forest. The sedimentary regime during the early Postglacial was

98 *Zólyomi* (1953); *Járai-Komlódi* (1968).
99 *Peterson* (1983).
100 *Járai-Komlódi* (1968).
101 *Kertész et alii* (1994).
102 *Willis et alii* (2000).
103 *Kutzbach – Guetter* (1986); *Kutzbach et alii* (1993).
104 *Huntley – Prentice* (1993).
105 *O. W. Archibold:* Ecology of World Vegetation. London 1995.
106 *Kertész et alii* (1994).
107 *Kalicz – Makkay* (1977).

dominated by mineral allogenic deposition from erosion of raw catchment soils. The basin infilled with peat from *ca.* 8400 calBP and the sedimentary influx to the basin became dominated by authigenic deposition. *Corylus* expanded rapidly from *ca.* 8200 calBP and dominated the pollen assemblage. The pollen records from this study suggest that from 6800 calBP, anthropogenic activity hindered the slow expansion of *Carpinus betulus* to the extent that it became the forest dominant only after the cessation of controlled forest use at *ca.* 5200 calBP. The recovery of the forest continued up to an expansion of *Fagus* at *ca.* 3700 calBP. The first major clearance event was apparent from *ca.* 2000 calBP when AP values were reduced to *ca.* 50% and there was an increase in open-ground herbaceous types. Neither sediment chemistry nor bulk physical analyses reveal any evidence of landscape instability after the Early Holocene, suggesting that changes occurring in the catchment were of insufficient intensity to initiate soil erosion.

Tarnabod

The palaeoecological sequence from the archaeological site at Tarnabod, Hungary, has revealed a Holocene vegetation development which occurred under vastly different environmental conditions. The development of forest on the Alföld was limited by the effects of extreme continentality and desiccation which created a landscape sparsely populated by trees. These may have formed pockets of woodland in favourable areas, such as loess ridges and river levées. Consequently, no degradation of the environment is apparent from a vegetational perspective. Similarly, the sedimentary regime reveals no evidence for landscape degradation during the Holocene other than mineral influx from infusion loess. The conclusion drawn from these apparently stable conditions is that no discernible landscape degradation occurred at the archaeological site of Tarnabod as there was no requirement for any forest clearance prior to agriculture. The floodplain landscape surrounding Tarnabod was not closed and there was suitable open land readily available.

The most striking observation from the palaeoecological records in this study is that the earliest human impacts are noticeable only at the off-site locations. This may be the result of location of settlements which in this study are on floodplain sites next to rivers, where presumably ample naturally open space was available. Such locations would have made attractive settlement sites as there was minimal requirement for any clearance prior to occupation, and a reliable supply of water and aquatic resources was available.

The relationship of on-site and off-site impacts is fundamental to the understanding of the spatial extent of human activity. The archaeologically motivated on-site only approach could miss the earliest changes apparent in the palaeoecological record, yet the palaeoecologically driven off-site approach loses contact with the archaeological context of the area. On-site sequences should be recovered from as close to the archaeological site as possible and the off-site sequence should be located within 10 km. In addition, small basins are essential to capture the local signal of small-scale activity and the temporal resolution of the sampling interval should be sufficiently fine to capture the occupation period of the archaeological site.

The wealth of Early Neolithic sites in Hungary and new approaches to palaeoecological investigation outlined in this volume are fundamental to determining the environmental impacts of early agriculture. Palaeoecological sites must be chosen with caution, however, and must produce well-dated, continuous records with fine temporal and spatial resolution which can be related in space and time to the archaeological record.

Acknowledgements

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THE ENVIRONMENTAL HISTORY OF THE JÁSZSÁG

Pál Sümegi

INTRODUCTION

We investigated a palaeochannel at Meggyes-erdő near Jászberény in the centre of the Jászság subsidence basin on the northern fringes of the Great Hungarian Plain, which differed from the other palaeochannels and river-beds in the region *(Fig. 1)*. This palaeochannel had remained unaffected by the groundwater draining, river regulation, river-bed drying and dredging operations of the 19th and 20th centuries. It was thus possible to conduct environmental history analyses based on the sediments deposited in the oxbow lake. The infilled palaeochannel was fringed by hardwood and softwood gallery woods under forest management, while communities of reed sweet grass, sedge and reedmace thrived in the bed itself, and stagnant marshes too evolved in the bed. We opened a trench in the centre of the palaeochannel and we were thus able to observe the different features of sediment accumulation and to collect a considerably higher amount of sediment for the malacological analyses than if we had simply relied on cores.

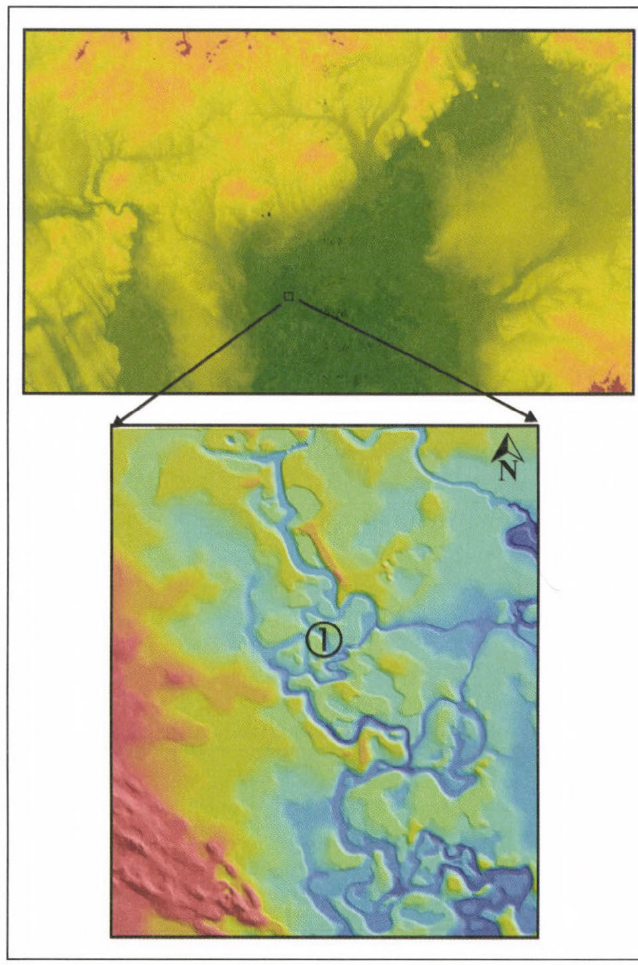

Fig. 1. Location of the study area

We selected this location for obtaining a profile because many prehistoric archaeological sites from the Mesolithic, the Neolithic, the Copper Age and the Bronze Age are known in the area owing to the systematic activity of Gyula Kerékgyártó, an amateur archaeologist from Jászberény, and we assumed that the sediment catchment basin would be suitable for reconstructing the environmental background of prehistoric cultures and their interaction with the environment.

Owing to its geomorphologic position, the investigated sediment catchment basin[1] provided information not only about the development of the marshland, but also about the impact of early food-producing communities and later cultures on the environment (forest clearing, crop cultivation). The thickest, most complete sediment sequence of roughly 2 m evolved in the centre of the marshland and by analysing this sequence we could prepare an overall environmental reconstruction and gain the fullest possible set of data on the environmental history of the study area.

1 *H. J. B. Birks – H. H. Birks:* Quaternary Palaeoecology. London 1980.

ANALYTICAL PROCEDURES

We opened a 2 m deep geologic trench in the centre of the marshland covered with reed sweet grass, which we complemented with an undisturbed boring down to 3 m, for we were unable to penetrate deeper than 2 m owing to the rapid rise of the groundwater. We cleared the profile and divided it into 10 cm sub-samples, which we submitted to sedimentological, isotope geochemical, pollen analytical and malacological analyses.

We employed the Casagrande aerometer method for determining particle size distribution in the sedimentological analyses[2] and the international Troels-Smith soft sediment classification scheme and symbols for describing the sediment sequence.[3] The carbonate and organic material contents were determined by the loss-on-ignition procedure as described by Dean.[4] The particle size distribution, the carbonate contents and the statistical parameters of grain textures were plotted using Bennett's PSIMPOLL software.[5]

We used the bones and peat in the samples for radiocarbon measurements: about 20–25 g mollusc shells, 6–10 g of charcoal and 0.5 kg of horse bones. The physical parameters of the measurements and the procedures used for obtaining them have been described in detail by Hertelendi.[6]

The mollusc fauna extracted at 10 cm intervals from the 5.4 kg sediment sample was assigned to palaeoecological groups after the species determination. The criteria of the palaeoecological categories were based on studies incorporating recent ecological works by Ant, Boycott, Evans, Ložek, Meijer and Sparks,[7] and on the distribution data and maps presented by Bába, Kerney, Liharev–Rammel'meier, Ložek and Soós.[8]

The pollen samples were examined using the Zólyomi–Erdtman $ZnCl_2$ procedure, the most generally applied procedure in Hungary,[9] because this procedure offers better results than other methods in the case of oxbow lake sediments.[10] The sediment sample from between 260–300 cm was sterile as regards pollen; as a matter of fact, the pollen conservation properties of the samples were generally rather poor. The determination of the pollen and spore grains was based on pollen reference material and illustrated manuals.[11]

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5 *K. D. Bennett:* PSIMPOLL – a quickBASIC program that generates PostScript page description files of pollen diagrams. INQUA Commission for the study of the Holocene: working group on data handling methods. Newsletter 8 (1992) 11–12.

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ANALYTICAL RESULTS

Results of the radiocarbon measurements

We submitted material from four samples for radiocarbon measurements to the Institute of Nuclear Research in Debrecen. The measurements on plant remains and bones gave the following results: 9055±70 uncalBP (deb-5945) between 1.5–1.4 m; 5598±90 uncalBP (deb-2684) between 1.2–1.1 m; 4400±60 uncalBP (deb-2469) between 0.8–0.7 m; and 862±50 uncalBP (deb-2721) at 0.4 m.

Results of the sedimentological analyses

Zone 1 (3.0–2.0 m)
Yellowish-brown clayey silt with iron concretions, limonite patches, the occasional carbonate precipitate, devoid of pollen, but containing a few badly preserved mollusc shells. The sequence indicates that the bedrock is made up of floodplain sediments, whose development, colour, appearance and particle composition is very similar to infusion loess formations. The geological position of the layer suggests that this formation had originally accumulated in a wet floodplain environment near the surface, and that owing to neotectonic movements at the beginning of the Holocene and the region's intensive subsidence, the infusion loess table on the southern fringes of the alluvial fan of the Zagyva River subsided and younger riverine sediments accumulated on its surface. The development of the sediment layer can be dated to the Late Glacial.

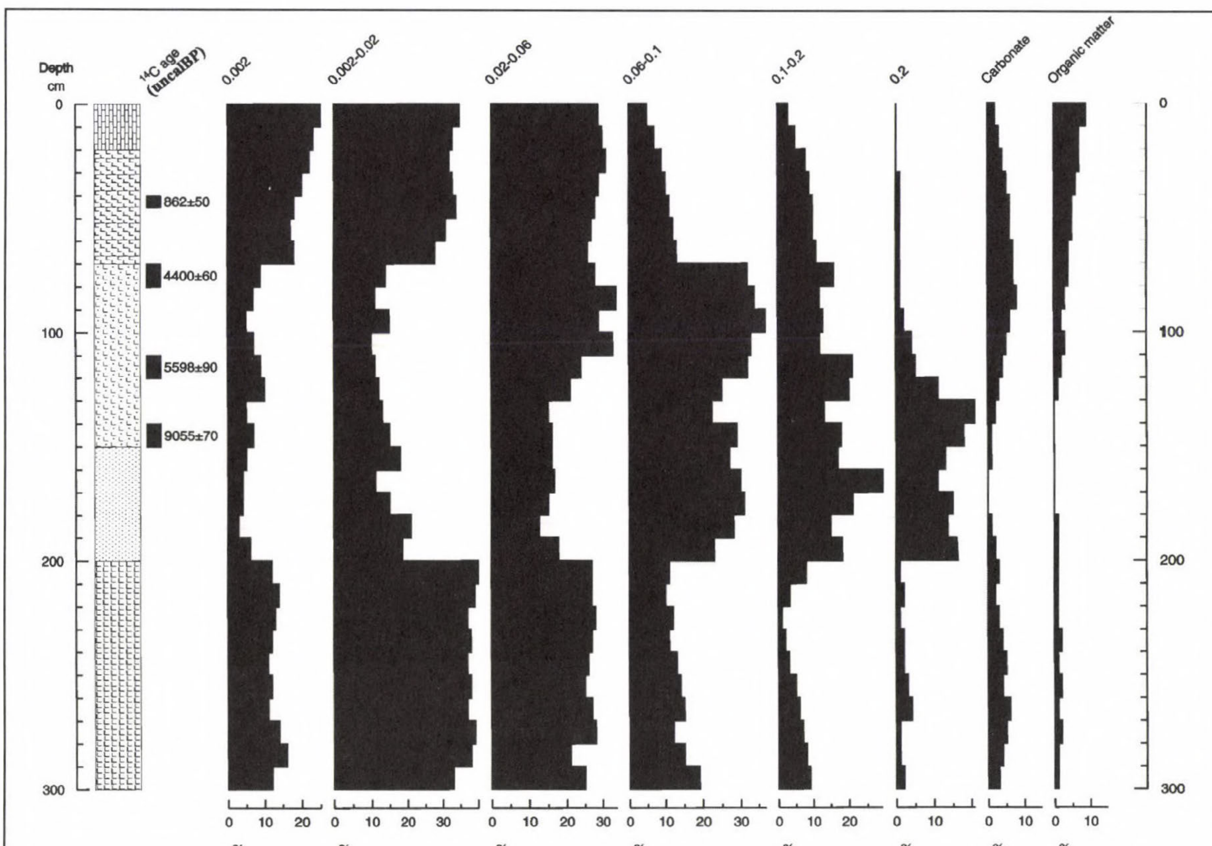

Fig. 2. The sediment sequence

Zone 2 (2.0–1.5 m)
Slightly cross-bedded layer of fine to very fine sand containing mollusc shells accumulated over the bedrock with a sharp boundary. The radiocarbon measurements indicated that this formation can be dated to the Early Holocene (10,000–8268 calBC).

Zone 3 (1.5–0.7 m)
Greenish-grey, silty sand containing mollusc shells, plant remains, small specks of charcoal, sand lenses and sand bands. The deposition and particle composition of this layer indicate that the lacustrine and riverine environment changed dynamically and that the palaeochannel was linked to the living river system at times of floods, again becoming isolated after the floodwater receded. This dynamically changing hydrological phase can be dated between 8268–3021 calBC.

Zone 4 (0.7–0.4 m)
Greyish-brown, brownish-grey clayey silt with limonite patches containing little carbonate and significant organic material, as well as mollusc shells. The layer did not contain sandy bands or lenses, suggesting that this sediment accumulated in a lacustrine, or more precisely, an oxbow lake environment. The sequence can be dated between 3021 calBC and 16 calAD.

Zone 5 (0.4–0.2 m)
Clayey silt, a eutrophic lacustrine sediment containing significant organic material, horse bones (*Equus caballus*)[12] and identifiable plant remains (reed, reedmace). Significant amounts of soil had been washed into this layer. The radiocarbon measurements dated this sediment horizon, a eutrophic lacustrine phase, to between 16 and 1206 calAD.

Zone 6 (0.2–top)
Peat layer containing sedge, reed sweet grass and reedmace, with the plant remains near the surface strongly decayed and decomposed and with limonitic precipitates. The infilling of the lake and its transformation into a marsh can be dated to the later 13th–early 14th century.

Results of the pollen analyses

Evaluable pollens were recovered from the section between 2.1 m and the top of the sequence.

Zone 1 (2.0–1.7 m)
The first pollen zone yielded Scots pine (*Pinus sylvestris*), spruce (*Picea*), and grass family (Gramineae) pollen. The pollen grains were very poorly preserved and it seems likely that the pollen material had desiccated after becoming embedded in the sediment.[13] This pollen zone can be correlated with the Late Glacial.

Zone 2 (1.7–1.2 m)
The pollen composition of the second pollen zone allows the reconstruction of a species-rich deciduous forest; there was also a significant amount of Scots pine pollen (perhaps washed in). This zone has high values of oak (*Quercus*), elm (*Ulmus*), willow (*Salix*), linden (*Tilia*) and hazel (*Corylus*), and the pollen grains were extremely well preserved. The zone indicates the development of an extensive Holocene temperate forests and a climatic optimum. The expansion of plants reflecting animal grazing (Umbellifera, *Polygonum,* Compositae) and the presence of small specks of charcoal (0.2–0.4 mm) in the sediments in the period before 6200–5598 uncalBP indicates human activity, most likely forest clearance. It seems likely that this change can be associated with the appearance of Neolithic communities in the region. This pollen zone spans the period from the Mesolithic to the Copper Age.

12 Determined by István Vörös of the Hungarian National Museum.
13 I would here like to thank Enikő Félegyházi for her generous help in determining the pollen samples.

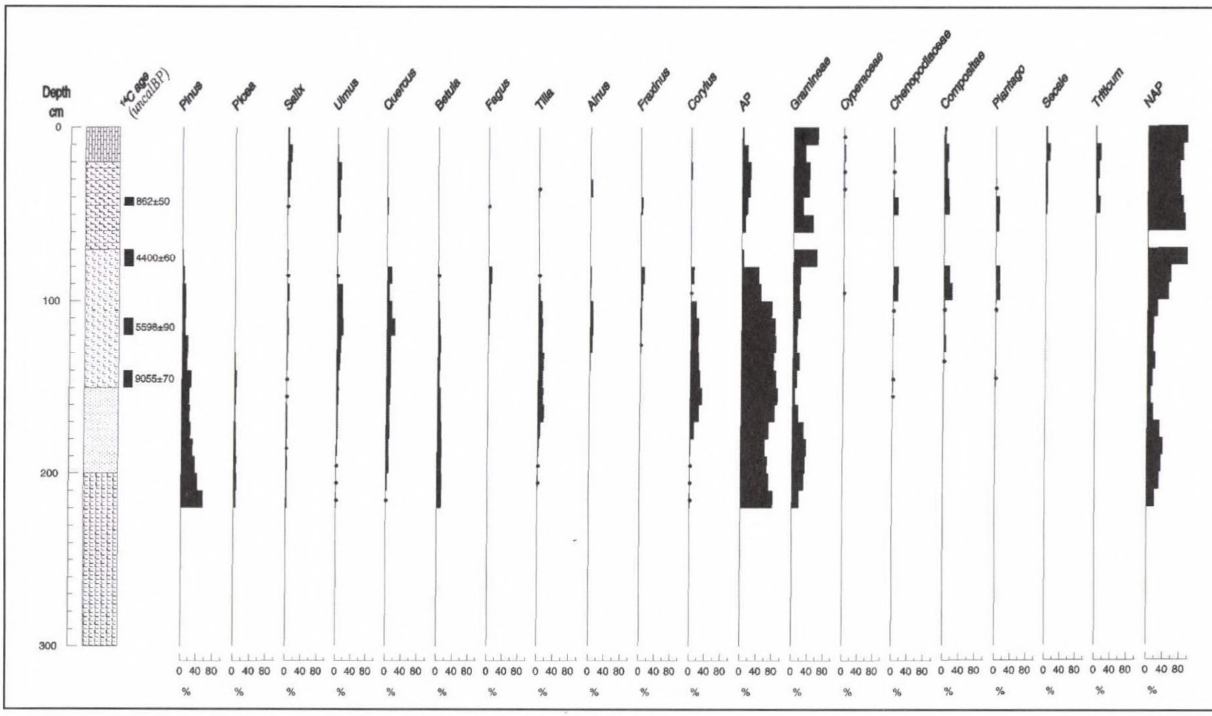

Fig. 3. The pollen sequence

Zone 3 (1.2–0.8 m)
The third pollen zone is dominated by temperate deciduous tree pollens; in addition to the earlier plants reflecting human disturbance, significant amounts of pollen from plantain (*Plantago*), another species indicating strong human impact, make their appearance. The pollen composition suggests forest clearing or the maintenance of earlier clearings and intensive grazing.

Zone 4 (0.8–0.6 m)
The fourth pollen zone is characterised by the total absence of arboreal pollens. This zone yielded grass family and ruderal weed pollens in a shrunken, poor state of preservation. This phase reflects forest clearance and the periodic desiccation of the sediment layer.

Zone 5 (0.6–0.4 m)
The fifth zone was almost totally devoid of pollen (the number of evaluable specimens was below 100); the non-statistical pollen material was rather poorly preserved and broken, and it was made up of herbaceous species, mainly of the grass (Gramineae) and plantain (Plantaginaceae) families. The entire region was affected by human activity: it seems likely that there were permanently occupied settlements along the palaeochannel, whose inhabitants were engaged in stockbreeding and who conducted extensive forest clearing.

Zone 6 (0.4–0.2 m)
Arboreal pollens re-appear in the sixth zone and the evaluable well preserved pollen material is dominated by the grass (Gramineae) and goosefoot (Chenopodiaceae) families. Arboreal pollens include elements of both hardwood and softwood gallery forests (willow, *Salix*; elm, *Ulmus*). Cereal pollens make their first appearance (wheat, *Triticum*), indicating cultivation in the study area. This level can be dated to the 13th century AD.

Zone 7 (0.2–top)
Although the proportion of arboreal pollens declined from 0.2 m, this material continues to be dominated by gallery wood elements. The proportion of cultivated cereals grew and significant amounts of

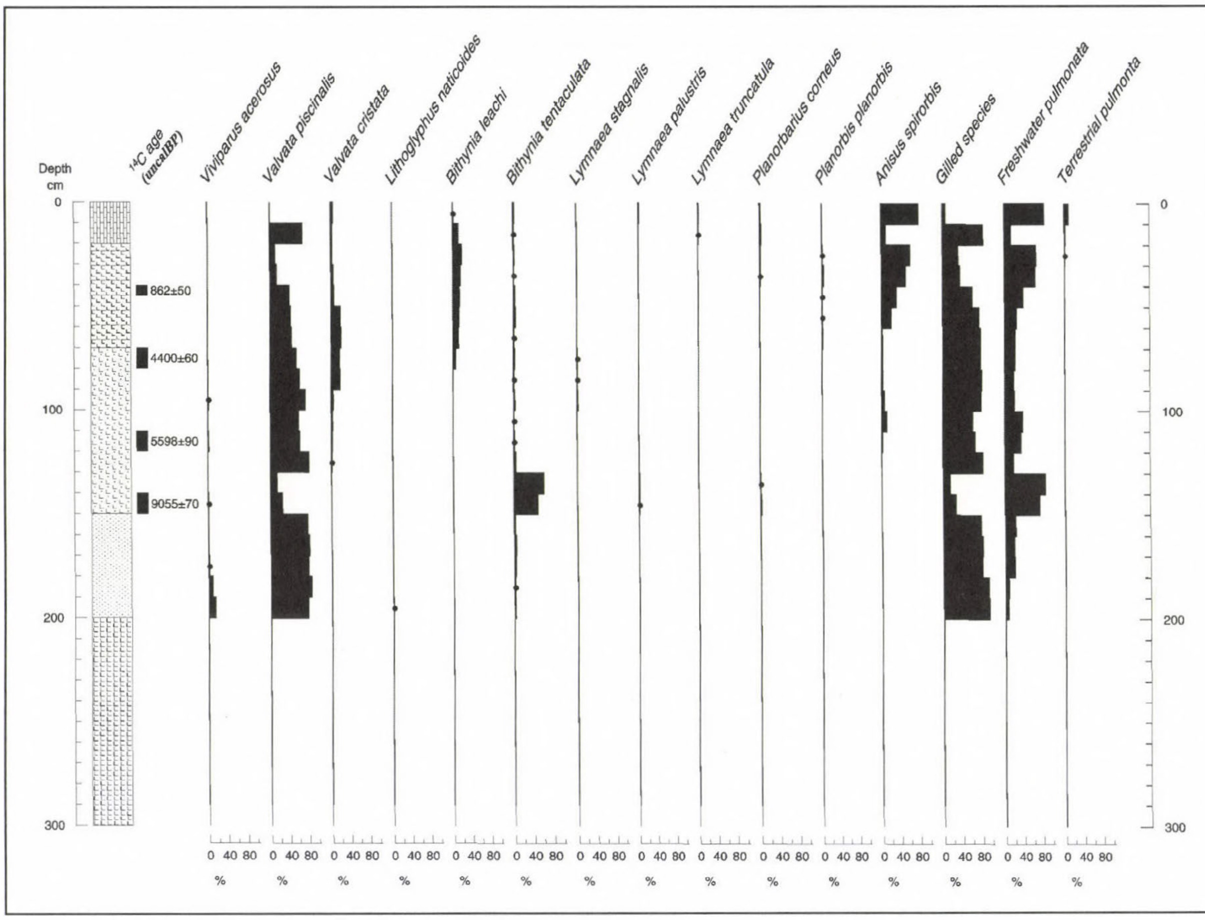

Fig. 4. Overview of the malacological analyses

rye (*Secale*) are present in addition to wheat (*Triticum*). This pollen zone can be dated to the 14th–15th centuries on the basis of the radiocarbon dates.

Results of the malacological analyses (Fig. 4)

The profile yielded 1529 individuals of 30 mollusc species. The proportion of aquatic gastropods was high, especially of gilled species, which only declined in the uppermost level of the trench.

Zone 1 (20.–1.5 m)
The first malacological zone was dominated by highly tolerant aquatic species (*Bithynia tentaculata*) and species preferring flowing water (such as *Unio crassus* and *Lithoglyphus naticoides*), the latter showing a dominance of *Valvata piscinalis*, whose ratio was over 80 per cent. According to the radiocarbon measurements, this horizon evolved between 8200–4400 calBC.
Zone 2 (1.5–0.7 m)
The dominance of *Valvata piscinalis* declined and more tolerant aquatic species thriving in the clayey substrate made their appearance in the second malacological zone. The proportion of taxa of the *Lymnaea* genus, as well as of the *Planorbis planorbis* and *Anisus spirorbis* species rose in this level. The radiocarbon measurements indicate that this zone can be dated between 4400–3000 calBC.

Zone 3 (0.7–0.4 m)
The proportion of gilled species declined strongly at the expense of pulmonate aquatic snails in the third malacological zone. The values of *Anisus spirorbis*, *Planorbarius corneus* and *Lymnaea stagnalis* rose, and *Gyraulus albus* and *Gyraulus laevis* made their appearance. The proportion of the cold tolerant

Bithynia leachi species and the *Valvata cristata* species preferring eutrophic waters covered with vegetation was outstanding in this zone.

Zone 4 (0.4–0.2 m)
The fourth malacological zone was characterised by the increasing dominance of *Planorbida* and *Lymnaea*.

Zone 5 (0.2–top)
The proportion of aquatic species and the number of individuals declined drastically in the fifth malacological zone, while the dominance of water bank, mesophilous, and xerophilous land species increased.

The composition of the mollusc fauna allows the reconstruction of a gradually infilling oxbow lake. The changes in the fauna indicate that this infilling was not even, but was characterised by intensive and less intensive periods of sediment accumulation. The changes in the malacofauna suggest that during periods in which there was a temporary link with living waters, sediment was not only deposited in the studied basin, but was also carried away, i.e. there were hiatuses in the older phase of the profile.

DISCUSSION AND SUMMARY

The environmental analyses allow the reconstruction of the following development sequence in the studied basin and its broader environs *(Fig. 5)*.

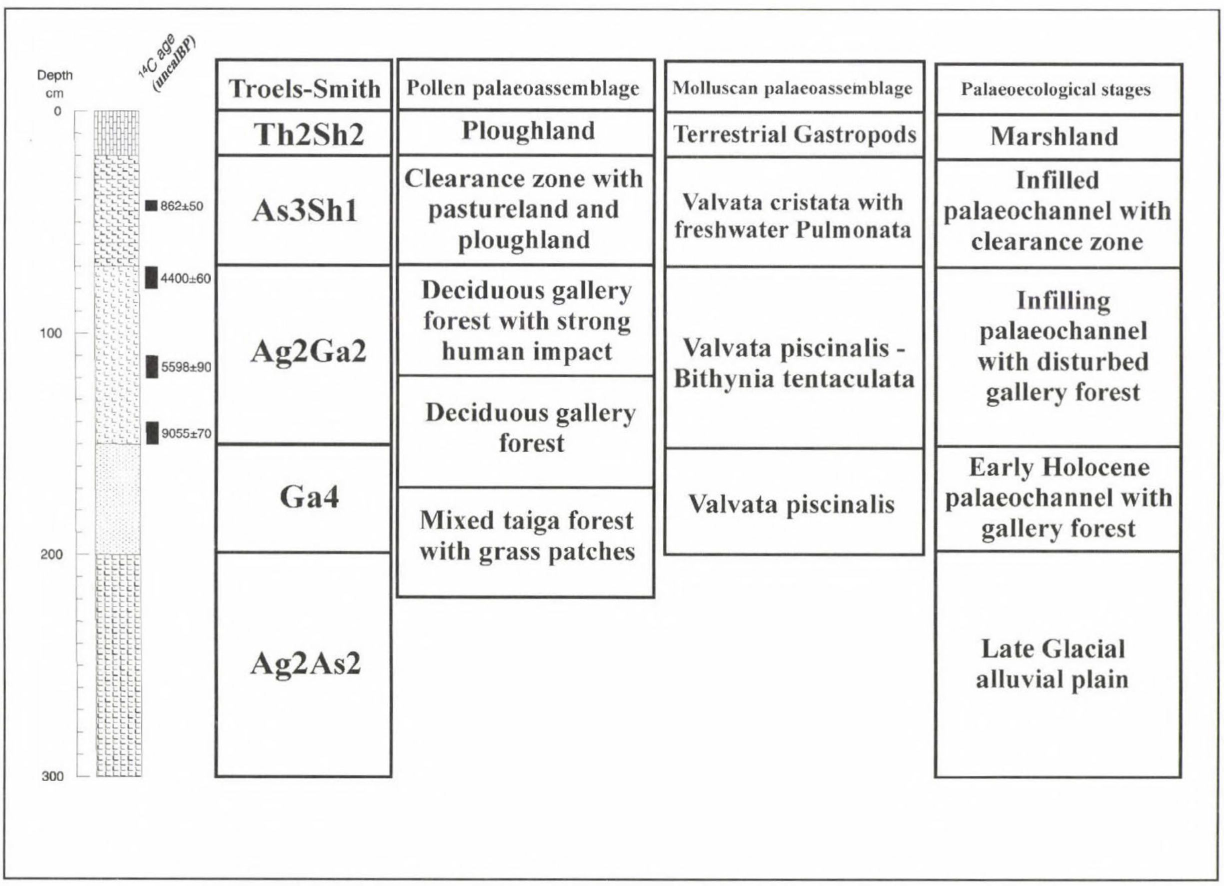

Fig. 5. Overview of the palaeoenvironmental analyses

Phase 1: The central areas of the Jászság subsidence were covered with forests of Scots pine and spruce, perhaps mixed with birch. The hinterland was characterised by extensive grassland (dry alluvial fan in the Jászfelsőszentgyörgy–Pusztamonostor area). The characteristics of the sediments suggest that either lower-lying infusion loess accumulated at the beginning of the Holocene as a result of neotectonic subsidence, or redeposited sediments in the Late Glacial or early Holocene.

Phase 2: In the later Mesolithic, closed woods dominated by oak, elm and linden, and gallery woods dominated by willow had evolved by 8268 calBC at the latest. This vegetation was either mixed with Scots pine at the beginning of the Holocene or significant amounts of Scots pine pollens were transported by floodwaters from the relict-like pine woods in the north to the studied sediment catchment basin. The composition of the malacofauna indicates that the palaeochannel was an active watercourse with living water. Traces of forest disturbance by slash and burn and grazing could be demonstrated at the close of the Mesolithic and the beginning of the Neolithic; the species diversity of the forests remained unchanged and human activity was indicated by the appearance and expansion of weeds tolerant of trampling and grazing.

Phase 3: This phase spans the period from the close of the Neolithic to the beginning of the Bronze Age. There is evidence for intensive human impact and extensive grazing, although the gallery forest survived; the plant species indicate increasing human activity in the region. The nature of the sediment too changed: the clay and organic material content increased (soil inwash?), the snail and shell fauna was gradually transformed, with the expansion of species typical for the benthos. Silting up began and there was a cyclical inflow of living water. The palaeochannel functioned as a channel for draining excess floodwater.

Phase 4: Spanning the period from the close of the Bronze Age to the end of the Iron Age, this phase is characterised by the absence of forests owing to forest clearance, extensive grazing, and the continuous presence of stockbreeding communities and cultures succeeding each other. No cereal pollens were identified from this phase. The infilling of the palaeochannel accelerated and the proportion of cold-tolerant mollusc species grew.

Phase 5: Human activity between the Roman period and the Middle Ages intensified, surpassing by far the intensity of the previous period. This phase is characterised by continuous grazing, soil degradation, and the complete silting up of the original riverbed. Gilled snails disappear from the sediment and are gradually replaced by pulmonate aquatic snails. The lake underwent a phase of eutrophication.

Phase 6: The pollen samples for the 12th–13th centuries indicate both the creation of fields for cereal cultivation and the presence of hardwood and softwood forests, indicating a mosaic of forest belts, pastures and ploughland. A eutrophic lake evolved in the palaeochannel.

Phase 7: In the 13th–14th centuries, the extent of natural forests decreased, while the size of cereal fields increased (perhaps reflecting a population growth). In addition to wheat, rye was now also grown, the latter perhaps indicating a cooler climate, suggesting the initial phase of the Small Ice Age of the 14th–15th century. A floating mat covered with reedmace, reed, reed sweet grass and sedge evolved in the palaeochannel.

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THE ORIGINS OF ALKALISATION IN THE HORTOBÁGY REGION IN THE LIGHT OF THE PALAEOENVIRONMENTAL STUDIES AT ZÁM–HALASFENÉK

Pál Sümegi – Elvira Bodor – Tünde Törőcsik

INTRODUCTION

Sediment cores were extracted from the one-time infilled riverbed at Zám–Halasfenék *(Fig. 1)* using a large corer with the help of the Geovil Company;[1] these were the first undisturbed samples recovered from the palaeochannels of the Hortobágy region, whose age and development has since long been debated,[2] which were submitted to palaeoenvironmental analyses. The importance of these samples and their analyses was crucial to clarifying these issues, seeing that palaeoecological studies conducted in this region since the 1980s have conclusively proven that in contrast to earlier theories,[3] the alkalisation of the Hortobágy region is not a relatively recent process triggered by river regulation, but one whose origins can be traced to the Late Pleistocene, tens of thousands of years ago.[4]

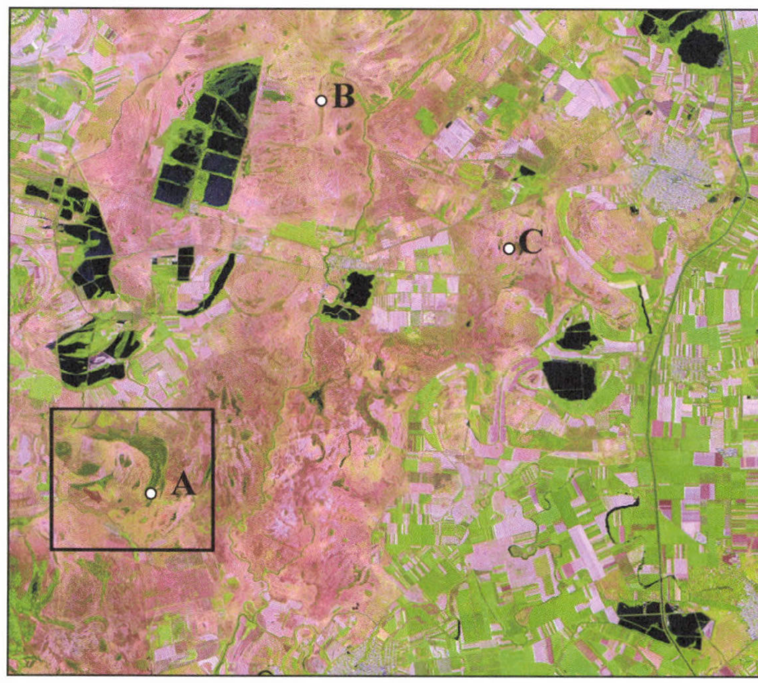

Fig. 1. Location of sampling areas in the Hortobágy region A. Zám–Halasfenék, B. Papegyháza–Papere, C. Szálkahalom–Fecskerét

The earlier mistaken hypotheses proposed by botanists and pedologists were based on assertions made by scholars of the earth sciences, according to whom the surface of the Hortobágy region had been formed at a relatively late date, during the past six thousand years of the Holocene. Geomorphological observations suggested that one of the major events in the geological development of the Hortobágy

1 We would here like to thank Tibor Horváth, managing director of the company, for his kind help.

2 *Sümegi* (1989); *Sümegi et alii* (1999a).

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4 *Sümegi* (1989); *Sümegi* (1997); *Sümegi* (2004); *Nyilas – Sümegi* (1991); *Gy. Szöőr – P. Sümegi – É. Balázs:* Sedimentological and geochemical facies analysis of Upper Pleistocene fossil soil zones discovered in the Hajdúság region, N-E Hungary. *In:* Quaternary environment in Hungary. Eds: M. Pécsi – F. Schweitzer. Studies in geography in Hungary 26. Budapest 1991, 47–59.

region was the lateral erosion of the Tisza River during the Holocene.[5] The formation of the levelled surface of the Hortobágy was until recently modelled[6] by assuming that the palaeo-Tisza had flown west to east in the eastern part of the Hortobágy, following its appearance in the region's eastern half, which was first dated to the Early Holocene[7] and, later, to the Late Pleistocene (17,000–16,000 years ago).[8] According to this model, the monotonous, levelled surface of the Hortobágy region was created by the lateral erosion of the palaeo-Tisza. Owing to the widespread acceptance of this model of landscape development, most botanists and pedologists assumed a relatively late, Holocene surface, soil and vegetation development, believing that alkalisation occurred during rather late historical periods.

The first data contradicting the theory that alkalisation was caused by human activity and river regulation were published in a university dissertation, presenting evidence for the presence of a buried solonchak soil on the boundary between the Hortobágy and the Hajdúság regions.[9] This was followed by a series of studies discussing the sedimentological and malacological evidence, according to which the uppermost layers of the Hortobágy landscape had evolved at the close of the Pleistocene, together with a reconstruction of the palaeoenvironment at the Pleistocene/Holocene transition.[10] Owing to the then still accepted academic topoi, these studies were rejected and dismissed by leading botanists, ecologists and environmental protection experts to the extent that we did not publish any other studies on this subject, except for the reports requested by the Directorate of the Hortobágy National Park. Fortunately, some botanists and ecologists later "discovered" our research results in the later 1990s, as did a new generation of scholars, who studied pedology and vegetation history from a fresh perspective, and who were willing to reconsider earlier analyses, hypotheses and academic topoi concerning alkaline vegetation and alkalisation.[11] They suggested that we should publish the findings of our investigations at Zám–Halasfenék.[12]

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6 *Félegyházi E.:* Adalékok a Tisza és a Szamos folyóhálózatának alakulásához a felső- pleniglaciális időszakban. Acta Geographica, Geologica et Meteorologica Debrecina 34 (1998) 203–218; *Félegyházi E. – Lóki J. – Szabó J.:* A folyó őstörténete, a mai Tisza kialakulása az Alföldön. *In:* A Tisza és vízrendszere I. Ed.: I. Teplán. Budapest 2003, 29–40.

7 *Borsy* (1969).

8 *Borsy* (1995).

9 *Sümegi* (1989).

10 *I. Nyilas – P. Sümegi:* Pointing out Cochlicopa nitens (Gallenstein, 1848), a new species for the Pleistocene in Hungary, in the territory of the Hortobágy National Park. Soosiana 17 (1989) 113–115; *Nyilas – Sümegi* (1991); *Sümegi et alii* (1999b).

11 *Molnár Zs.:* A Pitvarosi-puszták vegetáció és tájtörténete az Árpád-kortól napjainkig. Natura Bekesensis 2 (1996) 65–97; *Molnár Zs.:* Ősi és másodlagos (szikes) puszták a Tiszántúlon. *In:* A táj változásai a Kárpát-medencében. Ed.: Gy. Füleky. Gödöllő 1999, 231–233; *Zs. Molnár – A. Borhidi:* Hungarian alkali vegetation: Origins, landscape history, syntaxonomy, conservation. Phytocoenologia 33 (2003) 377–408; *Béres M. – Kalivoda B.:* A Közép Tisza vidéki táj változásának hatása az élővilágra. *In:* Ezer év a Tisza mentén. Ed.: Zs. Sági. Szolnok 2000, 31–50; *Barczi A. – Sümegi P. – Joó K.:* Adatok a Hortobágy paleoökológiai rekonstrukciójához a Csipő-halom talajtani és malakológiai vizsgálata alapján. FtKözl 133 (2003) 421–432; *Joó K. – Barczi A. – Molnár M. – Szántó Zs.:* Hortobágyi Csipő-halom talajtani vizsgálata. Agrokémia és Talajtan 52 (2003) 5–20; *Penszka K. – Joó K.:* Kunhalmok botanikai és talajviszonyainak vizsgálata. *In:* Összefoglalók az "V. Aktuális flóra- és vegetációkutatás a Kárpát-medencében" konferencia előadásairól. Keszthely 2002, 65; *Tóth T. – Kuti L. – Fórizs I. – Kabos S.:* A sófelhalmozódás tényezőinek változása a Hortobágy "Nyírőlapos" mintaterület talajainál. Agrokémia és Talajtan 50 (2001) 409–426

12 This request was made by the botanists, ecologists and environmental protection experts at the Botanists' Meeting held in March, 2004, at Keszthely; we decided to publish our findings in this volume.

ANALYTICAL PROCEDURES

We extracted a 10 m long series of overlapping cores using a 100 cm long corer in the centre of an abandoned palaeochannel covered with alkaline marsh vegetation. We divided the undisturbed core samples into 10 cm sub-samples. We submitted these sub-samples to sedimentological, isotope geochemical, pollen analytical and malacological analyses.

We employed the Casagrande aerometer method for determining particle size distribution in the sedimentological analyses[13] and the international Troels-Smith soft sediment classification scheme and symbols for describing the sediment sequence.[14] The carbonate and organic material contents were determined by the loss-on-ignition procedure as described by Dean.[15] The particle size distribution, the carbonate contents and the statistical parameters of grain textures were plotted using Bennett's PSIMPOLL software.[16]

We used the mollusc shells and the organic content in the samples for radiocarbon measurements. The physical parameters of the measurements and the procedures used for obtaining them have been described in detail by Ede Hertelendi.[17]

The pollen samples were examined using the Zólyomi–Erdtman $ZnCl_2$ procedure, the most generally applied method in Hungary,[18] because this procedure offers better results than other methods in the case of oxbow lake sediments.[19] The heavy mineral analysis of the sand sediments in the bedrock level of the core was carried out by György Gyuricza of the Hungarian Geological Institute, whom we would here like to thank for his conscientious work.

Unfortunately, mollusc remains were fragmentary and did not survive in all levels of the core, meaning that a continuous palaeoecological reconstruction based on the malacological finds was not possible; however, the mollusc fauna was suitable for characterising the circumstances under which individual sediment layers had been deposited.

THE ENVIRONMENT OF THE STUDY AREA

The coring procedure permitted and supervised by the Directorate of the Hortobágy National Park was conducted among marshland vegetation mixed with sedge and rush swards in the abandoned, infilled riverbed at Zám–Halasfenék on the outskirts of Félhalom (south of Szászberek) during winter, from the frozen surface in order not to disturb the migrating bird population or the vegetation. A Copper Age kurgan rises on the levee covered with infusion loess in the northern part of the riverbed, and several prehistoric and deserted medieval settlements (Szabolcs, Csécs, Zám) can be found in the broader environment, together with Migration period burials. We chose this location for coring because the heritage of several archaeological cultures and ancient populations have been identified in this area,[20] and thus the palaeoenvironmental data gained from the Halasfenék location would provide valuable information on the one-time environment of these cultures.

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13 *Vendel M.:* A kőzethatározás módszertana. Budapest 1959.

14 *J. Troels-Smith:* Karakterisering af løse jordater. Danmarks Geologiske Undersøgelse Series. IV. 3. 10 (1955) 1–73.

15 *W. E. Dean:* Determination of carbonate and organic matter in calcareous sediments and sedimentary rocks by loss on ignition: comparison with other methods. Journal of Sedimentary Petrology 44 (1974) 242–248.

16 *K. D. Benett:* PSIMPOLL – a quickBASIC program that generates PostScript page description files of pollen diagrams. INQUA Commission for the study of the Holocene: working group on data handling methods. Newsletter 8 (1992) 11–12.

17 *Hertelendi E.:* Izotópanalitikai célú műszer és módszerfejlesztések és azok alkalmazásának eredményei. CSc Thesis. Budapest 1990; *E. Hertelendi – É. Csongor – L. Záborszky – I. Molnár – I. Gál – M. Györffy – S. Nagy:* A counter system for high precision ^{14}C dating. Radiocarbon 32 (1989) 399–408.

18 *Zólyomi B.:* Magyarország növénytakarójának fejlődéstörténete az utolsó jégkortól. MTA Biológiai Osztályának Közleményei 1 (1952) 491–530.

19 Magyari in *Sümegi et alii* (1999b).

20 Cp. *János Dani* and *Károly Mesterházy* in this volume (pp. 283–300 and 387–393).

The area covered with infusion loess to the north of the riverbed was used as ploughland, while typical pastureland can be found in the southern part of the riverbed. All of the geomorphologic, pedologic and vegetation units characterising the Hortobágy region can be found around the Zám–Halasfenék riverbed. Even though the Hortobágy region is not particularly rich in macroforms, we found an astonishing diversity of microforms. All micromorphological elements of the alkaline *puszta* could be observed in the study area, from prehistoric burial mounds (called Cumanian mounds by the locals) to alkaline marshes. A most typical alkaline micro-surface evolved in the alkaline marsh and the alkaline *puszta*, in which the most typical alkaline morphological units could be distinguished.[21] The average height of the flood-free levee covered with infusion loess is 90 m; the artificial mound raised by the people of the Copper Age Pit-grave kurgans on the western part of the levee exceeds 93 m a.s.l.

A backswamp depression covered with alkaline marsh lies south–south-east of the loess ridge. Its form indicates that it had once been a river channel, which has been infilled and transformed into an elongated depression covered with reed-beds, reed-mace beds and alkaline marsh. The sedimentological conditions follow the terrain, leading to the evolution of catena topomorphological and sedimentological units.

The distribution of the recent vegetation resembles that of the sedimentological units, which follow the morphology and the elevation above sea level, and the groundwater levels. The over 3 m high mound raised by an ancient community is covered with *Agropyron pectinatum*, the typical plant thriving on these artificial mounds, It has been suggested that this species is a relict plant of the Late Pleistocene/Early Holocene steppe, similarly to *Stipa capillata*, *Salvio austriaca*, *Salvio nemorosa*, *Dianthus pontedere* and *Phlomis tuberosa*, which thrive not only on the mound, but also in several other spots on the infusion loess ridge.

The presence of these plant species confirms that this levee, covered with infusion loess which was transformed into a lag surface, preserves the vegetation of the Late Pleistocene/Early Holocene steppe. Several plant communities of the loessy steppe have survived in this region (*Salvio–Festucetum rupicola*, *Cynodonti–Poetum angustifoliae*), together with patches characterised by loessy steppe communities (*Astagalo–Festucetum rupicolae*), dominated by *Astragalus austriaca*. It seems likely that the differences in the composition of the loessy steppe communities were caused by one-time human activity and degradations of varying degree. An acacia wood was planted in the loessy steppe, which spread over the greater part of the levee, and eventually ousted and destroyed a part of the natural steppe vegetation. Moving towards the deeper-lying areas, we find the species rich vegetation of the alkaline *puszta* (*Achilleo–Festucetum pseudovinae*), in which loessy steppe and alkaline elements can be detected. The overwhelming majority of the vegetation covering the deeper-lying parts can be assigned to the *Artemisia* alkaline *puszta* (*Artemisio–Festucetum pseudovinae*), whose typical plants are *Festuca pseudovina* and *Artemisia maritima*.

One of the most distinctive types of alkaline areas developed on the continuously eroding surface on the edge of a steep slope. Only a pioneer, halophyte plant community (*Champhorosma annue*), whose most typical species are *Matricaria chamonilla* and *Champhorosma annua*, can thrive on this extremely raw solonets soil.

The surface slopes slightly from the edge of the alkaline bench towards the wetter alkaline flat floor. The alkaline slopes are covered with a mosaic of fescue grass and *Artemisia*, while a halophyte community of *Pholiurus pannonicus* and *Plantago tenuiflora* covers the wetter floor. The unit formed by the alkaline bench, the slope and the floor is fringed by alkaline meadows with indicator elements, such as *Glyceria fluitans*, *Agrostis alba, Alupecuretum pratensis, Beckmannietum erucaeformae, Limonium gmelini, Aster tripolium pannonicus*, and by communities of *Agrosti–Glycerietum*, *Agrosti–Alopecuretum pratensis* and *Beckmannietum erucaeformis*.

The marshland beyond the one-time river valley and levee, periodically covered with water, whose area dries up by late summer, is covered with reed and reed-mace vegetation, whose most typical species are *Phragmites australis*, *Schoenoplectus lacustris*, *Typha angustifolia* and *Cirsium brachycephalum*, with a mosaic of *Schoenoplectus tabernaemantani* and *Boloboschoenus maritimus* replacing the

21 *Strömpl G.:* A szik geomorfológiája. FöldrKözl 4–5 (1931) 62–74.

reed and reed-mace beds towards the shallower areas. A vegetation characterised by *Carex acutiformis* and *Juncus conglomeratum* forms extensive sedge tussocks on the fringes of the alkaline marshes and the strongly infilled marshland.

ANALYTICAL RESULTS

Results of the chronological analyses

The radiocarbon measurements indicated that the section between 9.1–9.0 m accumulated some 36 thousand years ago (the radiocarbon date gave values over 35,000 BP), while the section between 1.5–1,25 m developed about 5–6 thousand years ago (5200±200 BP). Sediment deposition was not continuously even: this is confirmed by the sedimentological and sediment facies analyses, which indicated a higher sedimentation rate in the bedrock layers and the sandy sediment with its higher proportion of sand contents, while the growing dominance of finer grains towards the overlying bed pointed towards a lower sedimentation rate.

Results of the sedimentological analyses

Zone 1 (10.0–9.5 m)
The bedrock of the 10 m deep core was made up of bluish-grey, poorly sorted clayey silt devoid of pollen, which lay between 10–9.5 m under the whitish-grey fine to medium sand between 9.5–8 m. The bedrock is made up of flood-plain sediment, into which the riverbed of the Halasfenék had been incised some 40–35 thousand years ago, according to the radiocarbon data.

Zone 2 (9.5–8.0 m)
Overlying this sedimentological zone was a well-sorted fine to medium sand containing an abundance of fine sand. The sand contained plant remains and small mollusc shells (*Lymneidae*, *Planorbidae*). The grain composition and the formation of the sediment suggest that this sequence was a riverbed sediment deposited during the active river phase to a thickness of 1.5 m. Earlier geological borings for mapping purposes at Halasfenék performed with the water-flushed technique and with a spiral corer with a diameter of 5 cm, did not yield undisturbed cores; the data gained from these surveys indicated that this layer thinned towards the edge of the one-time riverbed and had a thickness of 1.5 m only in the centre.

Zone 3 (8.0–7.0 m)
This zone was made up of a bluish-green coarse silt layer with slightly calcareous fine silt, containing finer sediment bands, 1 cm thick sand lenses and bands of greyish-white very fine to fine sand. This layer did not contain any reddish-brown iron-limonite concretions , but it did yield a few 3–4 mm large charcoals and mollusc shells.

Zone 4 (7.0–3.0 m)
Between 7.0–3.0 m we found a seemingly homogenous layer. The computer tomography analyses revealed that this fine to coarse silt layer with slight carbonate content devoid of any organic material was in fact made up of extremely thin, a few millimetres thick laminae.[22] Darker, reddish-brown bands with a varying thickness ranging from a few millimetres to a few centimetres, containing iron, limonite and goethite, were intercalated into the sediment in some places and could be observed from 6.5 m to the top of the core. The sedimentological analyses suggest that these bands are a reflection of the one-time groundwater level and their repeated occurrence in the several meters thick sediment sequence at various levels indicates that there was a significant fluctuation in groundwater levels, varying as much

22 *Hunyadfalvi Z.:* Heterogeneity analysis of clastic sediments by computerized X-ray tomographs. Acta Geologica Hungarica 47 (2004) 53–62.

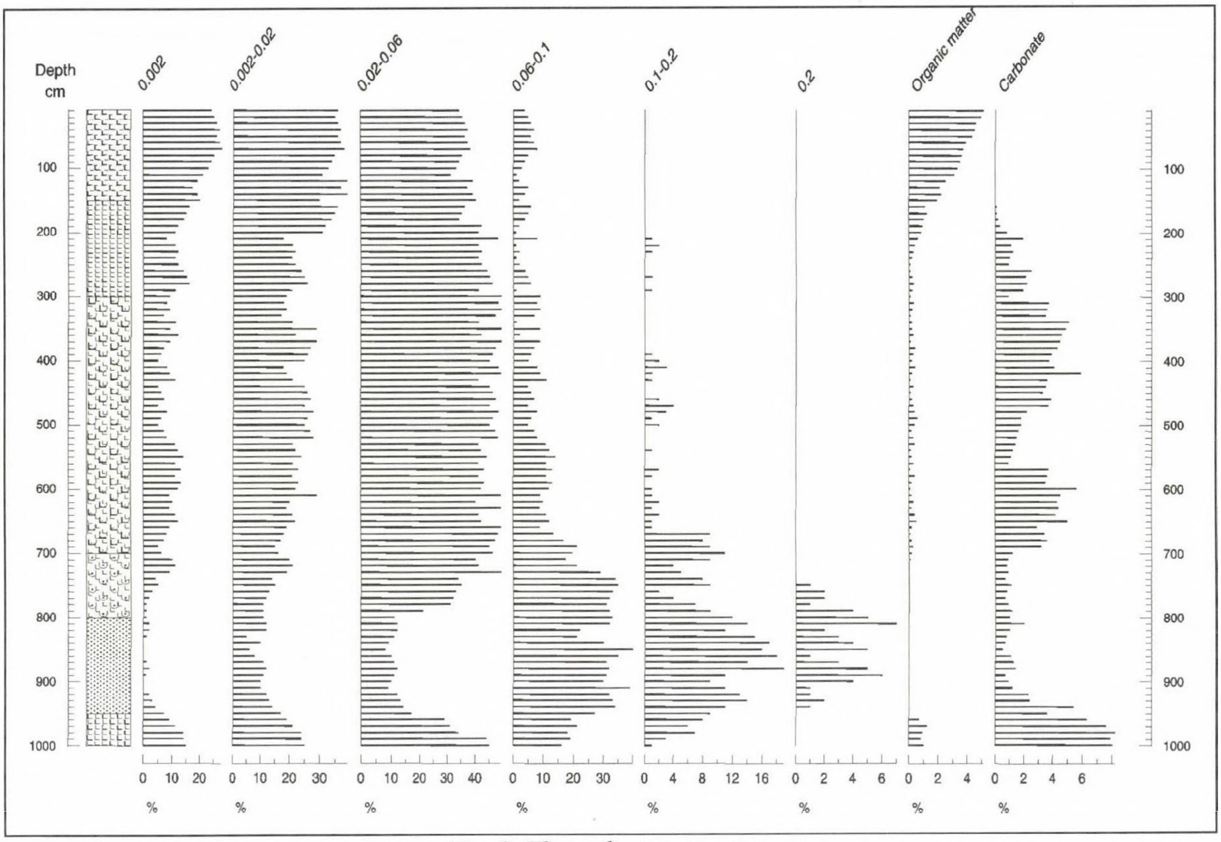


Fig. 2. The sediment sequence

as 4–5 m in the different seasons following the accumulation of the sediment. The facies and grain composition of this sediment layer resembles minerogenic sediments,[23] which developed in a lacustrine environment from aeolian dust and are typical for Pleistocene glacials.

Zone 5 (3.0–1.5 m)
The coarse silt content gradually decreased in this zone, parallel to the rise of fine silt and clay; we observed a brownish-grey silt with increasing clay and decreasing carbonate content towards the surface. The sediment was almost completely saturated with a limonite-goethite-iron containing material, indicating that the height of the groundwater table currently reaches this level.

Zone 6 (1.5 m–top)
From 1.5 m to the present surface, we found a dark brown clayey silt with increasing organic matter content, which in some spots contained identifiable plant remains (reed, sedge, reed-mace). Whitish-grey carbonate concretions could be observed at the base of this layer in addition to the iron-limonite-goethite precipitates. It would appear that the development of the marshland layer involved not only the formation of limonite-goethite bands, but also significant carbonate movement .

The sediment sequence reflects the infilling of a several kilometres long detached river channel from the active river phase to the marshland phase. The active river phase can be dated to the Middle Würm, the oxbow lake phase spans the period from to the close of the Middle Würm to the Upper Würm and the Late Glacial. A significant amount of aeolian dust (coarse silt) accumulated from the close of the Middle Würm and the beginning of the Upper Würm in the oxbow lake, which had probably become detached owing to tectonic movements.

23 *F. Oldfield:* Lakes and their drainage basins as units of sediment-based ecological study. Progress in Physical Geography 1 (1978) 460–504.

A more abundant clay content can be noted from the onset of the Holocene in the sediment catchment basin; organic matter and clay content rose significantly from the Late Neolithic and the beginning of the Copper Age. The lake system became eutrophic and was gradually transformed into an area seasonally inundated with water, developing first into a marshland and, later, into an alkaline marsh. The iron precipitates indicate that there were major fluctuations in the groundwater level either following the accumulation of lacustrine sediments (post-genetic) or contemporaneously (syngenetic). The sediment analyses suggest that the area was not affected by inundation from active rivers from the close of the Middle Würm and that aeolian dust and other material transported by floodwater accumulated in the riverbed. The formation of the channel, the sediment sequence and the minerogenic infill resemble the sediments of Fehér-tó in southern Hungary.[24]

Results of the pollen analyses

Zone 1 (800–630 cm)
The ratio of *Pinus sylvestris* pollens was by far the highest in the arboreal vegetation, and the entire pollen assemblage was dominated by the corroded pollen grains of this taxon. It would appear that the former came from local trees, while the corroded *Pinus* pollens were transported here from more distant regions by floodwaters.[25] Scots pine is followed by birch (*Betula*), predominantly downy birch (*Betula pubescens*), in the arboreal vegetation. The analyses of the pollen grains indicated that downy birch grew in taiga forests and in birch-marsh areas.

The composition of the arboreal vegetation and the dominance of *Pinus sylvestris* and *Betula* suggest the presence of a gallery wood; this is also confirmed by the sporadic presence of deciduous tree pollens, indicating a hardwood oak-ash-elm community, in which common oak (*Quercus robur*) was mixed with ash (*Fraxinus*) and elm (*Ulmus*). Hornbeam (*Carpinus*), a characteristic element of hardwood gallery woods[26] was also sporadically detected among the deciduous tree pollens. The flower pollens indicated the presence of hazel (*Corylus*) and dogwood (*Cornus*) in the shrub level. Alder (*Alnus*) and willow (*Salix*) grew on the floodplain along the river. Elm (*Ulmus*) was the second most important

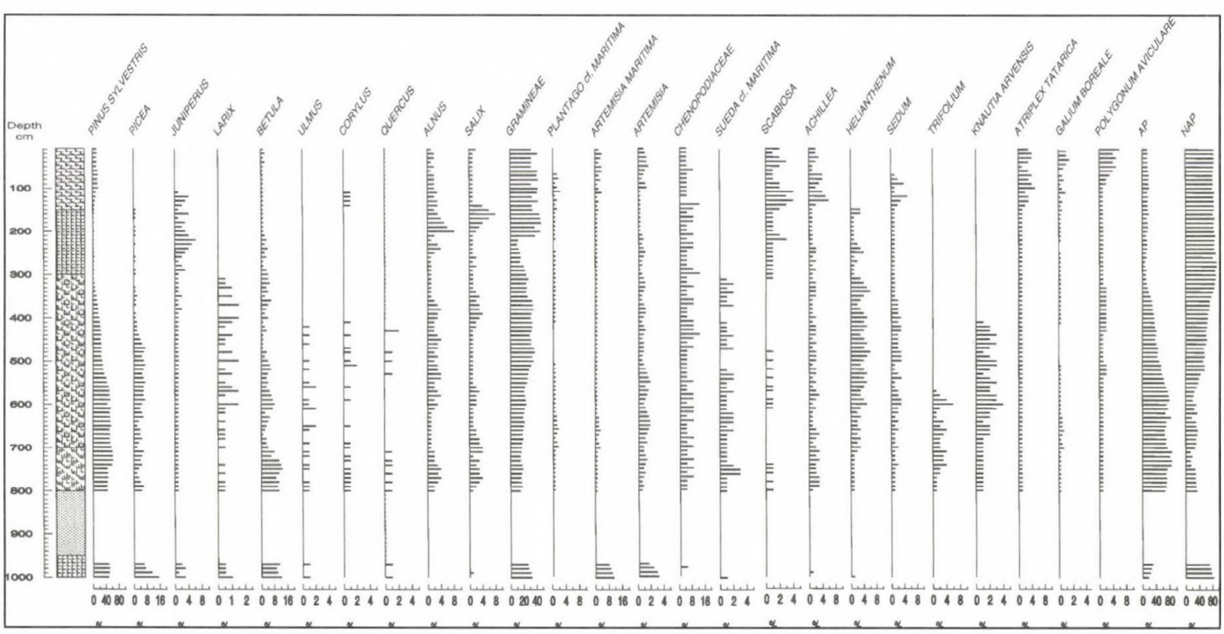


Fig. 3. The pollen sequence

24 *Sümegi et alii* (1999b).
25 *Digerfeldt* (1972).
26 *Jakucs* (1991).

species after *Pinus* and *Betula*, suggesting a higher groundwater level and neutral or slightly calcareous soil.[27]

This zone had the richest undergrowth both as regards the number of taxa and the number of pollen grains. An alkaline meadow covered with meadow foxtail grass, tussok grass (Poa) and clover (*Trifolium*) species developed beyond the hardwood gallery wood. The transitional variant to alkaline marshes had dense masses of flote-grass (*Glyceria fluitans*) mixed with flood sward species.[28] Halophyte taxa, occasionally occurring on alkaline soil, but preferring calcareous soil were also identified: Tatarian orache (*Atriplex tatarica*) and prostrate knotweed (*Polygonum aviculare*), occurring in alkaline marshes too. The pronounced presence of *Chenopodium* species suggests that the soil was slightly calcareous. Red goosefoot (*Chenopodium rubrum*), thriving mainly on alluvial and slightly alkaline soils, and nettle-leaved goosefoot (*Chenopodium murale*), a member of weed communities growing on calcareous soils, were identified.[29]

The increase of sea wormwood (*Artemisia maritima*) and *Festuca* in this zone perhaps reflects the emergence of *Artemisioa–Festucetum pseudovinae* communities thriving on the solonchak soils of *Artemisia* alkaline *puszta*s. The presence of halophyte yarrow (*Achillea*) indicates a slightly drier *Artemisia* alkaline *puszta*. The expansion of *Inula* can be noted towards the end of the zone, together with greater knapweed (*Centaurea scabiosa*), frequent on slightly calcareous dry sward and alkaline *puszta*, and possibly Hungarian knapweed (*Centaurea* cf. *pannonica*). The pollen zone reflects a strong, extensive alkalisation. The radiocarbon measurements for this zone gave a date around the close of the Middle Würm and the interstadial at the beginning of the Upper Würm. The pollen data indicating alkalisation at the close of the Pleistocene can be correlated with the alkaline paleosol layer identified on the fringes of the Hortobágy region which was dated to between 32,000–25,000 BP.[30]

An extensive littoral zone with reed and sweet grass (*Phragmites-Glyceria* community) evolved in the aquatic environment. The water was mesotrophic, as shown by the presence of *Botryococcus-Mougeotia-Pediastrum kawraisky*. The presence of the latter is proof that the water was not eutrophic, although only fragments of *Pediastrum kawraisky* were identified, suggesting that the climate was too warm for this species. Whorled milfoil (*Myriophyllum verticillatum*) and yellow meadow rue (*Thalictrum flavum*) indicate an alkaline water.

Zone 2 (630–580 cm)

Significant changes could be noted in this zone, shown also by the large-scale decline of sporomorpha. Pine decreases drastically and only a few *Betula* pollen grains survived. Even though *Ulmus* is represented by single specimens only in the arboreal vegetation, its presence is constant, and *Corylus* too occurs. *Artemisia*, thriving on calcareous alkaline soil in dry climate, suddenly expands among the herbaceous vegetation. *Sedum* becomes sub-dominant; most *Sedum* species prefer an extremely dry, very dry or moderately dry climate and can be found on calcareous alkaline or slightly calcareous soils. *Galium boreale* grows in desiccating bogs or under moderately wet, slightly calcareous conditions. The spread of greater knapweed (*Centaurea scabiosa*) and *Scabiosa* too reflects a much drier environment. Species preferring a moderately wet habitat, such as *Centaurea* cf. *pannonica, Atriplex, Sagina, Poa*, and *Artemisia maritima*, decline significantly. The decrease of the aquatic vegetation to a minimum in the aquatic habitat too indicates the onset of a drier climate. The few *Botryococcus*, *Lemna, Phragmites* and the constant presence of the sedge family (Cyperaceae) indicate more trophic conditons and a lower water-cover. *Sparganium*, a species growing in slightly calcareous water, makes its appearance.

Zone 3 (550–480 cm)

The overall number of pollen grains increased in this zone. This zone saw the appearance of walnut (*Juglans*), linden (*Tilia*), elderberry (*Sambucus*) and larch (*Larix*), whose presence points towards the

27 *Simon* (1992).
28 *Jakucs* (1991).
29 *Simon* (1992).
30 *Sümegi* (1989); *Sümegi* (1997); *Sümegi* (2004).

inception of a wetter climate, even though these pollen grains may have been transported here from farther-lying areas. An expansion of *Artemisia maritima* can be noted, together with the higher frequency of *Polygonum aviculare* thriving also on alkaline soil. *Taraxacum* too shows more pronounced values. The rise of *Botryococcus* in the aquatic habitat, and the re-appearance of *Myriophyllum verticillatum* and *Mougeotia, Zygnemataceae* indicate periodically recurring inundations and water-cover, or a wetter climatic phase.

Zone 4 (450–125 cm)
This zone can be divided into several sub-zones on the basis of sporomorpha counts and the pollen taphonomy.

Zone 4a (450–380 cm): The amount of sporomorpha declines to a minimum in this zone. Corroded *Pinus* pollens disappear and *Pinus sylvestris* becomes minimal. Only grasses and *Polygonum* species remain in the land vegetation. The low number of algae (*Botryococcus braunii, Spirogyra*) indicates a shallow, marshy water-cover, similarly to the presence of great burnet (*Sanguisorba officinalis*).

Zone 4b (380–220 cm): This zone is characterised by an increase in better-preserved pollens (better taphonomic conditions). The arboreal vegetation is dominated by common juniper (*Juniperus communis*) preferring slightly calcareous soils; *Pinus* occurs but sporadically. The land vegetation is chiefly represented by grasses (Poa), although with relatively high values of *Achillea*, *Atriplex* and sea plantain (*Plantago maritima*), an indicator of *Camphorosmetum annuae* barren alkaline spot. There are indications of a strong water inflow or inundation at 330 cm, shown by the appearance of *Malvales*, thriving by streams and rivers, and the high values of *Glyceria, Phragmites, Lemna* and *Botryococcus*. The water inflow is also reflected by the rise in Zygnemataceae and *Mougeotia* taxa. Poa too becomes abundant. The changes in the pollen composition indicate the gradual decline of water inflow and floodwaters from 270 cm.

Zone 4c (220–200 cm): Pollens from the arboreal vegetation virtually disappears in this zone. Pollens reflecting the land environment are chiefly represented by Poa pollens, while mostly *Botryococcus, Lemna, Glyceria* and *Phragmites* pollens have survived from the aquatic habitat.

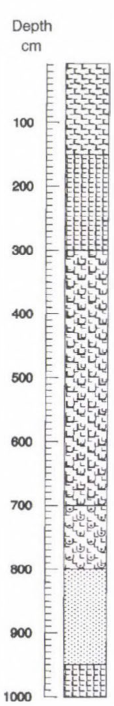
Zone 4d (200–130 cm): The increase of pollen and a markedly better pollen taphonomy can be noted, which peak at 130 cm. The arboreal vegetation is dominated by common juniper (*Juniperus communis*) preferring slightly calcareous soils; *Pinus sylvestris* and *Pinus* occur but sporadically. The land vegetation is chiefly represented by grasses (Poa), although with relatively high values of *Achillea*, *Atriplex* and sea plantain (*Plantago maritima*), an indicator of *Camphorosmetum annuae* barren alkaline spot. There are indications of a strong water inflow or inundation at 130 cm, shown by the appearance of Malvales, thriving by streams and rivers, and the high values of *Glyceria, Phragmites, Lemna* and *Botryococcus*. The water inflow is also reflected by the rise in Zygnemataceae and *Mougeotia* taxa. Poa too becomes abundant. High values can be noted for the sedge (Cyperaceae) and bulrush (*Scirpus*) family. The pollen composition of this sub-zone resembles that of Zone 3.

Zone 5 (130–20 cm)
This zone is characterised by the alternation of major inundations (wetter periods) and smaller inundations (drier periods). *Pinus* expands and becomes dominant during wetter periods and a few arboreal species, such as *Picea* sp., *Alnus* sp. and *Corylus* sp. make their appearance. The herbaceous vegetation is characterised by the rise of Pterydophyta, *Sedum, Scabiosa, Helianthemum*, *Artemisia, Chenopodium* and *Atriplex* pollens. Members of dry steppe meadow communities, such as pimpernel (*Anagalis* sp.) thriving on slightly calcareous soil, *Inula* sp. and *Atriplex* growing on dry alkaline *puszta*s, and milkwort (*Polygala*). The aquatic habitat is dominated by *Botryococcus* and *Spirogyra* taxa. *Lemna* and species of the littoral zone, such as *Gylceria* sp., *Phragmites* sp. become subordinate. One new taxon in this zone is *Potamogeton natans*; the values of *Sparganium*, which occurred in the Pleistocene layers, show a rise and *Myriophyllum verticillatum* too appears, indicating the rise of the water cover. The rise of the water level and of intensive inundations is confirmed by the sporadic presence of *Mougeotia*

and Zygnemataceae. Only *Concentricystes*,[31] reflecting soil erosion, and mosses (*Peltolepis quadrata*) remain by the end of the zone. The relatively significant proportion of *Concentricystes*[32] can most likely be associated with soil degradation, soil erosion and increased human activity.

DISCUSSION AND SUMMARY

The changes in the pollen composition allowed the separation of milder and wetter, and colder and drier climatic phases. The bedrock composition indicated the development of a mosaic patterning in the gallery wood, dominated by taiga elements, chiefly Scots pine, intermixed with deciduous trees. This vegetation covered the levees, while an alkaline vegetation and an alkaline marsh developed in the backswamp beyond it. The close of this vegetation phase can be correlated with the end of the Middle Würm and the commencement of the Upper Würm, when the investigated palaeochannel was detached from the living river. A roughly 30–40 km long channel-like oxbow lake evolved following the cessation of the living water inflow, which was periodically inundated from the emerging Tisza Valley. The sediment in this special sediment catchment basin contained pollen from the vegetation fringing the oxbow lake, although significant amounts of pine pollens, whose air bladders enabled them to float and be transported by floodwater,[33] also reached the basin. The pollen composition may thus be distorted by this taphonomic situation since a part of the pollen is not local, but extralocal. The changes in the pollen composition suggest that vegetation phases characterised by a drier, steppe dominance alternated with wetter climatic phases characterised by major inundations. The rise in the species number of aquatic plants, and in the spora and pollens ratios of species demanding a better water coverage, the increase



Sediment description (Troels-Smith)	Results of pollen analyses	Paleoecological stage
Sh2As2	Dry grassland with patches of alkaline steppe and marshland	Late Holocene marshland
As2Ag2	Temperate grassland with patches of alkaline steppe and marshland	Early Holocene marshland
Ag2As1Lc1	Cold grassland, forest-steppe with patches of alkaline steppe and alkaline marshland (number of pollen grains declines cyclically)	Upper Weichselian and Late Glacial oxbow lake (35,000-12,000 uncalBP)
Ag2Ga1Lc1	Mixed taiga (gallery) forest with alkaline marshland and grassland hinterland	Middle Weichselian gallery forest
Ga4	No pollen remains	Middle Weichselian palaeochannel (36,000-35,000 uncalBP)
As2Ag2	Grassland with taiga elements	Alluvial plain

Fig. 4. Overview of the palaeoenvironmental analyses

31 *M. Morzadec-Kerfourn:* Palaeoclimates and Palaeoenvironments from the Late Glacial to recent in the eastern Mediterranean east of the Nile Delta. The contribution of organic walled microfossils. Paléoclimats et Paléoenviroments Quaternaires 12 (1988) 267–275.

32 *Digerfeldt* (1972).

33 *P. L. Fall:* Pollen taphonomy in a canyon stream. Quaternary Research 28 (1987) 393–406.

of pine pollen which, floating on the floodwaters, were transported to distant regions and thus became over-represented in the pollen composition,[34] can be linked to these wetter phases.

The most typical change can be noted at the onset of the Holocene: in contrast to other profiles from Hungary, the pollen diagram did not indicate a rise in the values of woodland and, particularly, of deciduous woodland species, but simply reflected the decline of pine characterising the Pleistocene. It would appear that in this region the Pleistocene taiga forest was not supplanted by a deciduous woodland, but that the cold steppe was succeeded by a milder, temperate steppe and that in spite of continuous changes, this temperate steppe survived to the present. The changes in the spora and pollen composition of aquatic species indicate that the alternation of wetter phases with major floods and drier climatic phases continued during the Holocene, and that there were major fluctuations in the water cover and the water level *(Fig. 4)*.

The chronological analyses, earlier corings and the lithostratigraphical analogies to the sediments[35] indicate that they had been deposited continuously from the Middle Würm to the close of the Holocene. The pollen sequence thus spans the vegetation history of the past 35–40 thousand years, including the vegetation changes at the close of the Pleistocene and the beginning of the Holocene. The pollen profile is dominated by non-arboreal pollen even during the Holocene. In this sense, this pollen profile is unique and it can only be compared to other pollen sequences from the Hortobágy[36] because deciduous arboreal pollens did not become dominant in any one pollen zone. The unique nature of this profile is also reflected by the fact that every sample from the bedrock level to the top contained pollens reflecting the presence of an alkaline vegetation. This pollen composition provides evidence that alkalisation was continuous from the Middle Würm to the close of the Holocene. The alkaline species formed a vegetation intermixed with taiga during the Pleistocene, resembling the one which can be observed in southern Siberia, in the Altai foreland, where a steppe belt with alkaline elements was intermixed with deciduous woodland and taiga elements, breaking up into a mosaic of taiga interspersed with grass steppe and deciduous woodland in consequence of extremely diverse local orographic, hydrological and hydrographical conditions.[37] A landscape showing a similar mosaic patterning with a dominance of steppe elements developed in the Hortobágy region at the close of the Pleistocene and survived throughout the Holocene. Drier climatic phases saw the expansion of grassland, while the arboreal vegetation fringing the rivers increased during wetter phases; however, the proportion of steppe intermixed with alkaline vegetation remained dominant during the past 35 thousand years in the study area.

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34 *Ibidem.*

35 *Sümegi P.:* A negyedidőszak földtanának és őskörnyezettanának alapjai. Szeged 2001; *Sümegi P.:* Az utolsó 15.000 év környezeti változásai és hatásuk az emberi kultúrákra Magyarországon. *In:* A régésztechnikusok kézikönyve. Ed.: G. Ilon. Szombathely 1998, 367–397; *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:* The Upper Tisa Valley. Eds: J. Hamar – A. Sárkány–Kiss. Szeged 1999, 173–204; *Sümegi et alii* (1999a); *P. Sümegi – E. Magyari – Zs. Szántó – S. Gulyás – K. Dobó:* Man and environment in the Late Neolithic of the Carpathian Basin – a preliminary geoarcheological report of Polgár–Csőszhalom. Part II. *In:* MauerSchau 2. Festschrift für Manfred Korfmann. Hrsg.: R. Aslan – S. Blum – G. Kastl – F. Schweizer – D. Thumm. Remshalden–Grunbach 2002, 838–840.

36 *Sümegi* (2004).

37 *Sümegi P.:* Az ÉK-Magyarországi löszterületek összehasonlító őskörnyezeti és sztratigráfiai értékelése. PhD Thesis. Debrecen–Budapest 1996; *Sümegi et alii* (1999b).

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Sümegi et alii (1999a)	*Sümegi P. – Szilágyi G. – Molnár A.:* Szikesedés a Hortobágyon. Természet Világa 131:5 (1999) 213–216.
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PALAEOENVIRONMENTAL STUDIES OF THE POCSAJ MARSH

Pál Sümegi

INTRODUCTION

We extracted continuous cores using a Russian corer from the protected marsh in the Tövises channel lying on the northern outskirts of Pocsaj in north-eastern Hungary, near the border with Romania *(Fig.*

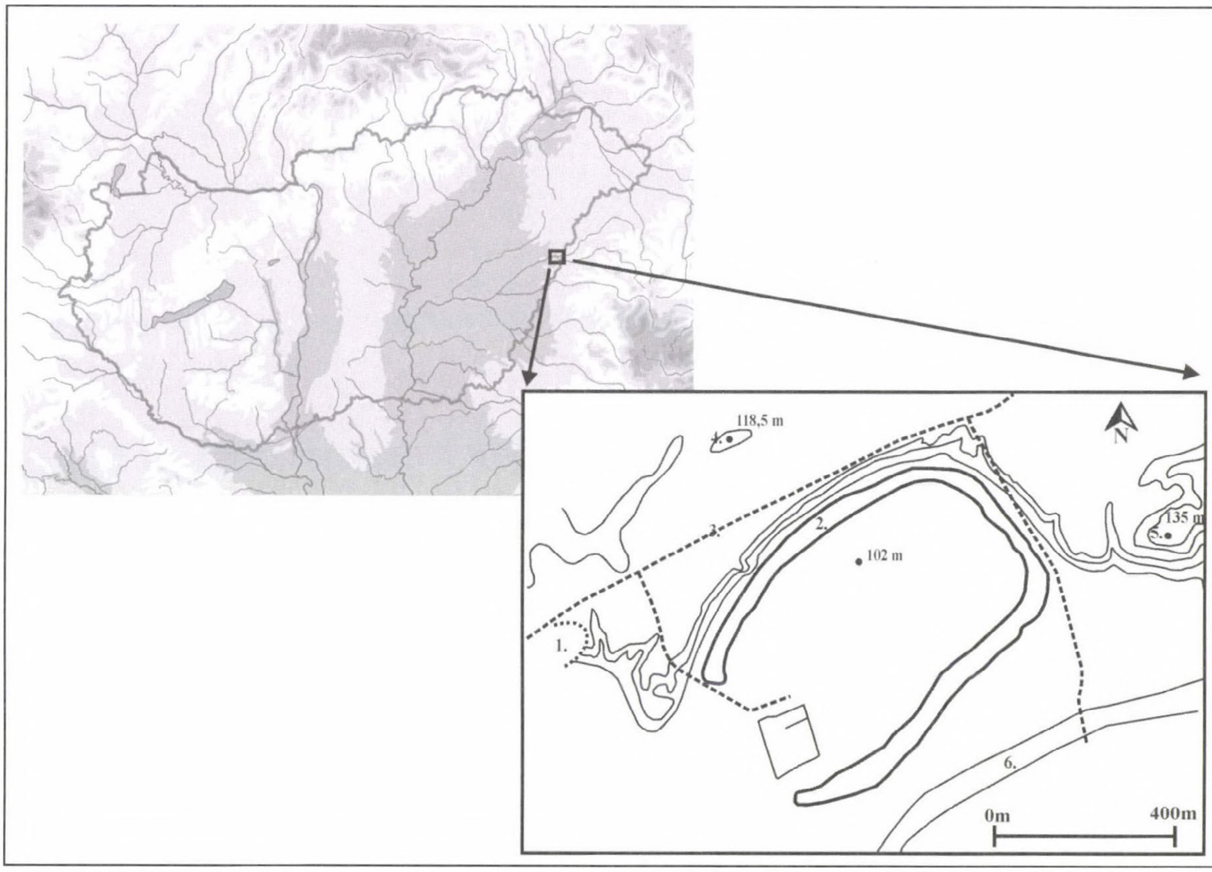

Fig. 1. Location of the study area
1. Sandpit at Pocsaj, 2. analysed infilled palaeochannel (ancient oxbow lake), 3. dirt track, 4. Ebédlő-halom (Bronze Age fort), 5. Lapos-halom (Bronze Age fort), 6. Ér Stream

1). The area itself is under the management of the Hortobágy National Park. The marshland is known for its many rare protected botanical (*Cicuta virosa, Menyanthes trifolia, Eriophorum angustifolium*) and zoological species (*Lacerta vivipara*). The marsh is covered with reed, willow, reed mace, reed sweet grass, bogbean and sedge communities. The borings performed with the permission of the Hortobágy National Park yielded a cross-section of all the communities in the sediment catchment basin, i.e. the one-time riverbed forming the basin of the marsh. We selected this location for sampling because several archaeological cultures had established their settlement on the high bluff,[1] and because the one-time

1 Cp. *János Dani* in this volume (pp. 301–318).

watercourse from which the Tövises Marsh had evolved had eroded the bank and thus lay immediately under it *(Fig. 2)*.

Owing to its geomorphologic position, the sediment catchment basin provided information not only about the development of the marsh,[2] but also about the impact of the first food-producing communities and later high cultures on the environment (forest clearing, crop cultivation). We selected the location of the cross-section on the basis of the borings for geologic mapping performed on the high bluff and in the marsh basin *(Fig. 2)* and we chose the sampling location for our palaeoenvironmental studies on the basis of the geologic borings. The thickest, most complete sediment sequence of roughly 3 m accumulated in the centre of the marsh; the analysis of this profile enabled an overall environmental reconstruction of the study area by providing the fullest possible data set on its environmental history.

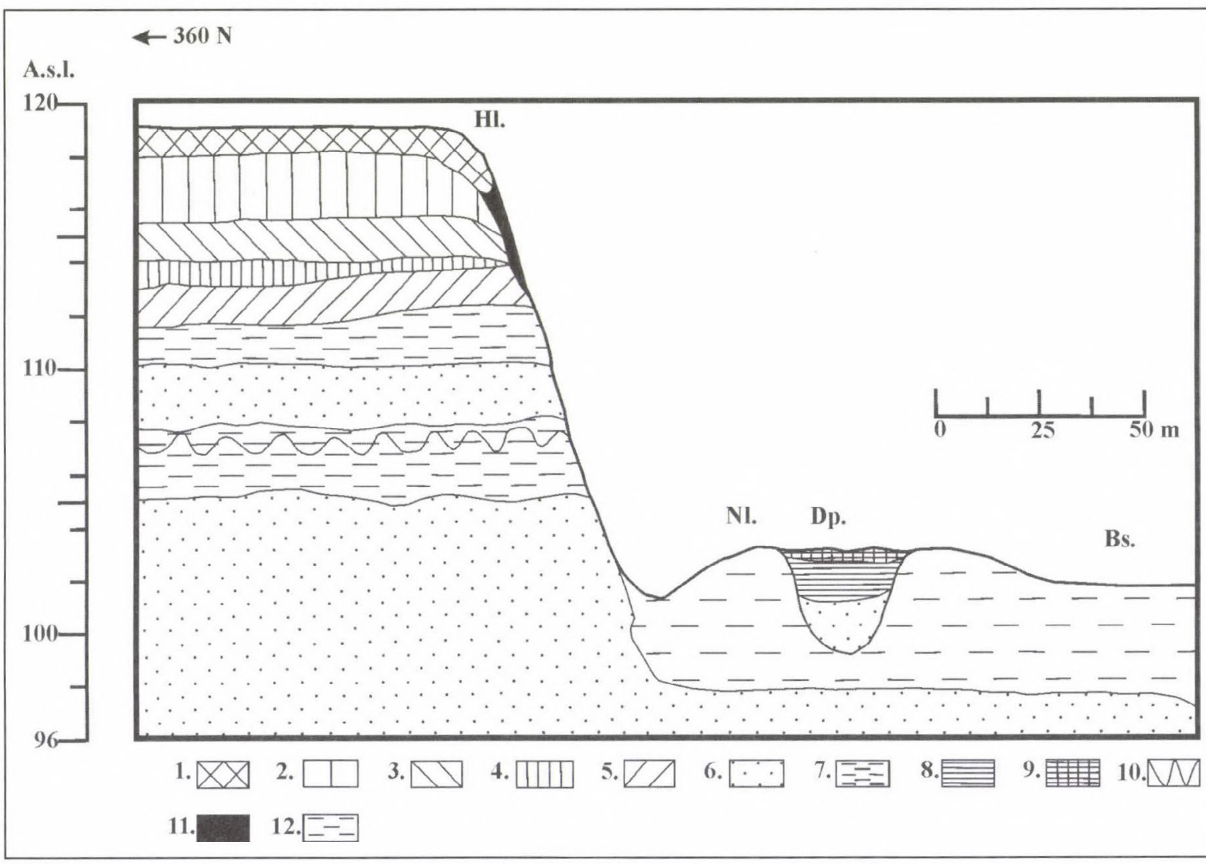

Fig. 2. The geological profile of the high bluff at Pocsaj
1. Recent soil, 2. Upper Weichselian loess, 3. upper paleosol at Pocsaj, 4. Middle Weichselian loess, 5. lower palaeosol at Pocsaj, 6. fluvial sand, 7. silt rich fluvial sediment, 8. oxbow lake sediment, 9. peat, 10. Periglacial layer deformation, 11. redeposited Holocene soil, 12. Holocene alluvial sediment, Dp: detached palaeochannel, Bs: Backswamp, Hl: High bluff line, N: Natural levee

2 *H. J. B. Birks – H. H. Birks:* Quaternary Palaeoecology. London 1980.

ANALYTICAL PROCEDURES

We extracted a 3 m long series of overlapping cores with a 40 cm long Russian corer and then divided the core samples into 10 cm sub-samples. We submitted the sub-samples to sedimentological, geochemical, isotope geochemical, pollen analytical and malacological analysis.

We employed the Casagrande aerometer method for determining particle size distribution in the sedimentological analyses[3] and the international Troels-Smith soft sediment classification scheme and symbols for describing the sediment sequence.[4] The carbonate and organic material contents were measured by the loss-on-ignition method as described by Dean.[5] The particle size distribution, the carbonate contents and the statistical parameters of grain textures were plotted using Bennett's PSIMPOLL software.[6]

We used the bones and peat in the samples for radiocarbon measurements: about 20–25 g mollusc shells and 6–10 g of charcoal. The physical parameters of the measurements and the procedures for obtaining them have been described in detail by Hertelendi.[7]

The mollusc fauna extracted at 10 cm intervals from the 5.4 kg sediment sample was assigned to palaeoecological groups after the species determination. The criteria of the palaeoecological categories were based on studies incorporating recent ecological works by Ant, Boycott, Evans, Ložek, Meijer and Sparks,[8] and on the distribution data and maps presented by Bába, Kerney, Liharev–Rammel'meier, Ložek and Soós.[9]

The pollen samples were examined using the Zólyomi–Erdtman $ZnCl_2$ procedure, the most generally applied method in Hungary,[10] because this procedure offers better results than other methods in the case of oxbow lake sediments, such as the sequence recovered from the Pocsaj Marsh.[11] The sediment from between 260–300 cm was sterile as regards pollen; as a matter of fact, the pollen conservation properties of the samples were generally rather poor. The determination of the spore and pollen grains was based on pollen reference material and illustrated manuals.[12]

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3 *A. Casagrande:* Die Aräometer-Methode zur Bestimmung der Kornverteilung von Böden und anderer Materialien. Berlin 1934; *Vendel M.:* A kőzethatározás módszertana. Budapest 1959.

4 *J. Troels-Smith:* Karakterisering af løse jordater. Danmarks Geologiske Undersøgelse Series. IV. 3. 10 (1955) 1–73.

5 *W. E. Dean:* Determination of carbonate and organic matter in calcareous sediments and sedimentary rocks by loss on ignition: comparison with other methods. Journal of Sedimentary Petrology 44 (1974) 242–248.

6 *K. D. Bennett:* PSIMPOLL – a quickBASIC program that generates PostScript page description files of pollen diagrams. Newsletter 8 (1992) 11–12.

7 *Hertelendi E.:* Izotópanalitikai célú műszer és módszerfejlesztések és azok alkalmazásának eredményei. CSc Thesis. Budapest 1990; *E. Hertelendi – É. Csongor – L. Záborszky – I. Molnár – I. Gál – M- Győrffy – S. Nagy:* A counter system for high precision ^{14}C dating. Radiocarbon 31 (1989) 399–408.

8 *H. Ant:* Faunistische, ökologische und tiergeographische Untersuchungen zur Verbreitung der Landschnecken in Nordwestdeutschland. Abhandlungen des Landesmuseums für Naturkunde zu Münster in Westfalen 25 (1963) 1–125; *A. E. Boycott:* The habitats of land mollusc in Britain. Journal of Animal Ecology 22 (1934) 1–38; *J. G. Evans:* Land Snails in Archeology. London. 1972; *Ložek* (1964); *T. Meijer:* The pre-Weichselian non-marine molluscan fauna from Maastricht–Belvédere Southern Limburg, the Netherlands. Mededelingen Rijks Geologische Dienst 39 (1985) 75–103; *B. W. Sparks:* The ecological interpretation of Quaternary non-marine mollusc. Proceedings of the Linnean Society of London 172 (1961) 71–80.

9 *Bába K.:* Magyarország szárazföldi csigáinak állatföldrajzi besorolásához felhasznált faj-area térképek. Folia Musei Historico-naturalii Musei Matraensis 8 (1983) 129–132; *Bába K.:* Magyarország szárazföldi csigáinak állatföldrajzi besorolásához felhasznált faj-area térképek II. Folia Musei Historico-naturalii Musei Matraensis 11 (1986) 49–69; *M. P. Kerney – R. A. D. Cameron – J. H. Jungbluth:* Die Landschnecken Nord- und Mitteleuropas. Hamburg–Berlin 1983; *I. M. Likharev – E. S. Rammel'meier:* Nazémnimi molluskami na CCCP. Moskva 1962; *Ložek* (1964); *Soós L.:* A Kárpát-medence Mollusca faunája. Budapest 1943.

10 *Zólyomi B.:* Magyarország növénytakarójának fejlődéstörténete az utolsó jégkortól. MTA Biológiai Osztályának Közleményei 1 (1952) 491–530.

11 Magyari in *Sümegi et alii* (1999).

12 *P. D. Moore – J. A. Webb – M. E. Collinson:* Pollen Analysis. Oxford 1991; *M. Raille:* Pollen et Spores d'Europe et d'Afrique du Nord. Marseille 1992.

ANALYTICAL RESULTS

Results of the sedimentological analyses

The following sediment zones could be distinguished in the sequence:

Zone 1 (3.0–2.6 m)
The bedrock was made up of whitish-grey fine to very fine sand lacking organic material and carbonates, with the occasional mollusc shell. The composition of the tiny sand is dominated by quartz, feldspars and mica. The grains were strongly worn. The sediment was cross-bedded and formed a typical riverine/fluvial sequence reflecting a high sedimentation rate.

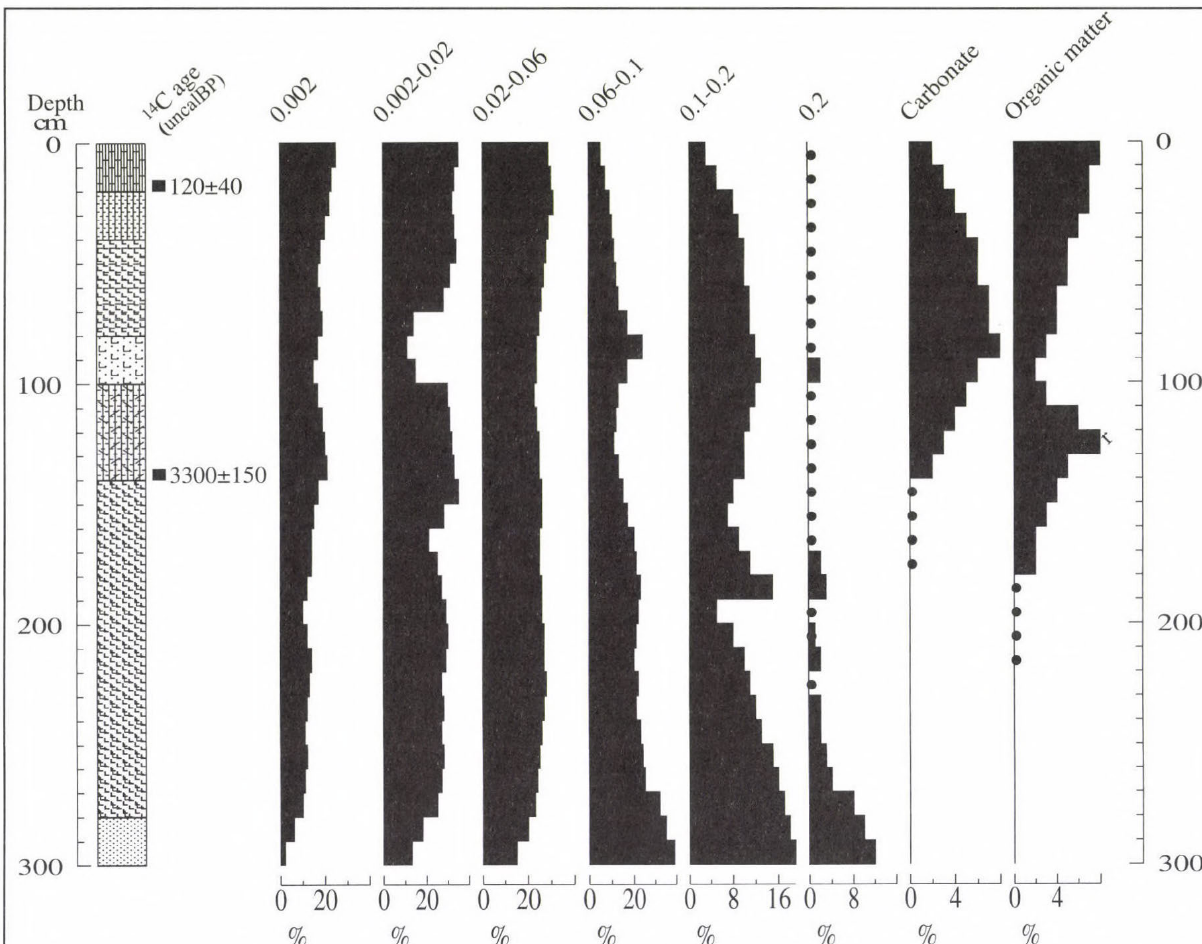

Fig. 3.The sediment sequence

Zone 2 (2.6–1.4 m)
A greenish-grey level with significant sand content lacking carbonates and organic materials, and a brownish-grey level of fine to coarse silt with a minimal amount of carbonates and organic material, as well as the occasional mollusc shell, was deposited on the fluvial bedrock with a sharp boundary, without any transition. This zone contained lacustrine (oxbow lake) sediments which were in some spots slightly laminated and contained sandy lenses and bands. The abundance of sand fraction suggests that the Tövises channel, which was earlier detached from the active river network, was re-connected to the living river channel at the time of seasonal floods, from where significant amounts of sandy sediments with coarser grains were transported to the basin. The sharp boundary indicates that the detachment of the oxbow lake from the river system had been a rather rapid process.

Zone 3 (1.4–1.0 m)
The organic and carbonate contents increased abruptly from 1.4 m. The accumulated brownish-grey clayey silt contained charcoal, remains of herbaceous plants (reed mace), bones and mollusc shells. The abundant organic material suggests that a floating mat developed in the oxbow lake.

Zone 4 (1.0–0.8 m)
The floating mat level was sealed by a well graded silty sand layer containing bands and lenses of clayey silt deposited from high energy flow. Either the oxbow was re-linked to the river system owing to tectonic or climatic reasons, or the living river was artificially diverted to the earlier detached oxbow. The latter, assumed human activity may be explained by the use of the shallow, easily warming oxbow lake for fish rearing as part of a floodplain economy.[13]

Zone 5 (0.8–0.4 m)
Following the interbedding of the fluvial layer, the oxbow filled up rapidly and another lacustrine layer of laminated, blackish-brown fine to coarse silt containing an abundance of clay, carbonate and organic material was deposited. The redeposited sediment of the loess from the high bluff appeared in the form of loessy interbeddings with significant carbonate content.

Zone 6 (0.4–0.2 m)
A reddish-brown silty clay layer (peat) containing intact seeds and plant remains accumulated near the surface. Its development can be associated with the 19th century river regulations, the decrease of the water level and the spread of the vegetation cover over the entire palaeochannel, leading to the formation of the marshland-bogland environment. The plant remains were dominated by reed (*Phragmites*), reedmace (*Typha*) and sedge (*Carex*) taxa.

Results of the pollen analyses[14]

The sequence contained statistically evaluable pollens from 2.6 m. The pollen grains were poorly preserved; many were crumpled and corroded. The proportion of these pollen grains was higher in the sediment layers in which the amount of sand fraction also increased. This observation is relevant because according to recent pollen analyses by Enikő Magyari, oxbow lakes form open systems, into which a part of the pollen grains are deposited through redeposition or transported there by floodwaters from more distant areas.[15] This seems to have been especially true of pine pollens, whose air bladders enabled them to float on and be transported by floodwater,[16] meaning that pine pollens recovered from oxbow sediments can have an extralocal origin. It must also be borne in mind that a drier environment, a high bluff covered with loess rose above the Tövises channel, whose hydrography, pedology and vegetation differed markedly from the alluvial plain of the Ér Valley.

The following palynological zones could be distinguished in the pollen material:

Zone 1 (3.0–2.6 m)
The section between 3.0–2.6 m of the sediment sample was sterile, even though several procedures were employed for recovering pollen grains. It seems likely that the original embedding conditions were unfavourable for the accumulation of pollens.

13 *Bellon T.:* Ártéri gazdálkodás az Alföldön az ármenetesítések előtt. *In:* Kárpát-medence történeti földrajza. Ed.: S. Frisnyák. Nyíregyháza 1996, 311–321; *Bellon T.:* A Tisza néprajza. Budapest 2003.

14 I would here like to thank Enikő Félegyházi of Debrecen University for her generous help in the evaluation of the pollen samples.

15 *Magyari* (2002).

16 *P. L. Fall:* Pollen taphonomy in a canyon stream. Quaternary Research 28 (1987) 393–406.

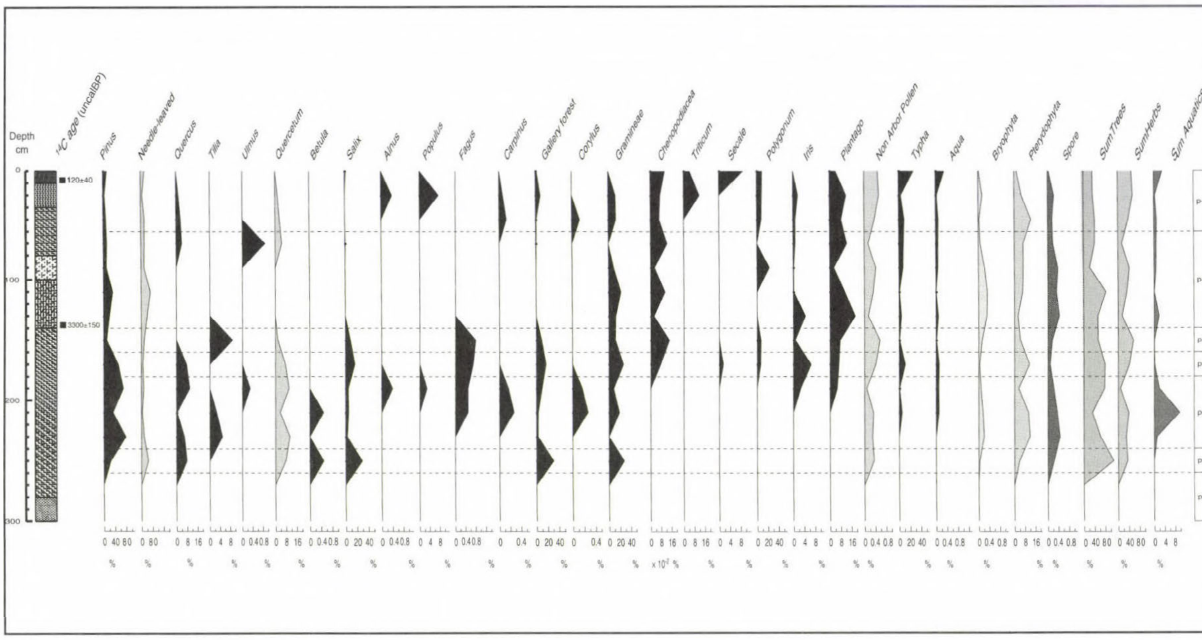

Fig. 4. The pollen sequence

Zone 2 (2.6–2.4 m)
The pollen assemblage and other pollen profiles from this region[17] suggest that this zone evolved in the Middle Holocene, probably between 5200 and 4400 calBC. The sample was dominated by species characterising softwood and hardwood gallery woods (*Quercus*, *Betula*, *Salix*), plants thriving in temperate closed woods (*Hedera*) and herbaceous species characterising woods with a wet undergrowth (ferns). The pollen composition suggests that the evolving oxbow lake was fringed by a closed gallery wood rich in species with a wet undergrowth. This is slightly contradicted by the abundance of grass pollens (Gramineae); however, recent environmental history studies conducted as part of a National Scientific Development Project (NKFP) have revealed that pollens from the dry grassland covering high bluffs are often found in the sediment catchment systems under them and that the pollens characterising both micro-environments can be present in similar proportion in the samples.[18]

Zone 3 (2.4–1.8 m)
Judging from the appearance of beech (*Fagus sylvatica*) and hornbeam (*Carpinus betulus*), as well as the evidence from other profiles,[19] this pollen zone evolved in the Middle Holocene, between 4400–3700 calBC. The pollen frequency of deciduous trees declined in this zone, parallel to the expansion of coniferous species. The increase of sand fraction originating from floodwaters in the sediment would suggest that the pine pollens were transported here by water from the Transylvanian Mountains. Still, this does not explain the decline of pollens from deciduous trees. It seems likely that the Neolithic communities living in this area undertook intensive forest clearance, which would explain this pollen assemblage. The practice of forest clearance is also supported by the gradual and, later, accelerating eutrophication of the lake and the increase of organic and carbonate content. The disturbance and clearance of the original species rich gallery wood is also reflected by the rapid spread of weed species tolerant of trampling and grazing (Chenopodiaceae, *Plantago*) and the rapid decline in the number of taxa. This zone saw the development of vegetation typical for an area used and inhabited continuously by stockbreeding communities. This vegetation phase probably lasted from the later Neolithic to the Middle Bronze Age. Although the sample did not contain pollens reflecting cereal cultivation, the spread of weeds and the evidence for forest clearing indicates that the area had been continuously settled; it

17 *Magyari* (2002).
18 *Jakab et alii* (2004).
19 *Magyari* (2002).

apparently lay on the fringes of the prehistoric communities' catchment area used for stockbreeding from the later Neolithic to the Middle Bronze Age. The increase of pine pollens is thus relative and can be attributed to the human impact on the vegetation resulting from extensive pasturing. The relative increase of pine pollens has also been noted in other pollen profiles from the Carpathian Basin.[20]

Zone 4 (1.8–1.0 m)
The pollen evidence for the human manipulation of the environment increased dramatically from 1.8 m, with peaks of plants characterising trampled surfaces and grazing areas. On the basis of the pollen composition and the radiocarbon data (3300±1500, 1600–1500 calBC), this pollen zone – reflecting a strong human impact[21] – can be correlated with the Middle Bronze Age. Several *Centaurea* species occur, such as greater knapweed, Tyrol knapweed and cornflower *(Centaurea scabiosa, C. nigrescens, C. cyanus)*. The joint occurrence and spread of knotweed (*Polygonum*) and cornflower (*Centaurea cyanus*) is an indication of agriculture[22] and ploughland cultivation,[23] reflecting an intensification of human impact. In addition to the expansion of the goosefoot family (Chenopodiaceae), the plantain family (Plantaginaceae) and the buckwheat family (Polygonaceae), cultivated species too make their appearance, and thus cereal cultivation can be demonstrated in addition to stockbreeding. The evidence for intensive human activity in this zone suggests permanently occupied settlement(s) in the area and extensive agricultural activity, probably on the loess-covered high bluff. The archaeological record confirms the palaeobotanical evidence because the remains of several Middle Bronze Age settlements have been identified in the loess-covered areas.[24] One striking feature is the spread of poisonous meadow plants (such as *Iris*), reflecting the creation of grazing lands, since the grazing of domestic species leads to the retreat of non-poisonous species, parallel to the relative increase of poisonous species not consumed by domestic herbivores.

Zone 5 (1.0–0.3 m)
The ratio of arboreal pollens decreased continuously from the Middle Bronze Age, while the proportion of weed species remained significant. The presence of cereal pollens showed a cyclical pattern. The proportion of arboreal and non-arboreal pollens too changed cyclically. These pollen data indicate that the study area had been continuously settled by food-producing communities and that even though the intensity of the human impact on the environment varied, this impact was continuous during the past 3000–3500 years. The pollen data indicate a new peak of human impact in the 19th century, probably as a result of the river regulations.

Results of the malacological analyses

The mollusc fauna allowed the reconstruction of the environmental changes in the sediment catchment basin. Seven malacological horizons could be distinguished in the sample which contained several hundred individuals of thirty-eight species.

Zone 1 (3.0–2.8 m)
This zone is characterised by the presence of *Valvata naticina*, a species preferring flowing water. The composition of the fauna shows a strong correlation with the composition of the sediment (*Fig. 3*) and

20 *P. Sümegi – E. Bodor:* Sedimentological, pollen and geoarcheological analysis of core sequence at Tököl. *In:* Százhalombatta Archaeological Expedition. Eds.: I. Poroszlai – M. Vicze. Budapest 2000, 83–96.

21 *Behre* (1981); *K. E. Behre:* The role of man in European vegetation history. *In:* Vegetation History. Eds: B. Huntley – T. Webb III. Handbook of Vegetation Science 7. Dordrecht 1988, 633–672.

22 *A. Danielsen:* Pollen analytical studies in Ostfold. Arbok for Universtet i Bergen. Matematisk Naturvitenskapelig Serie Oslo 1 (1969) 55–146.

23 *Behre* (1981).

24 *János Dani* in this volume (pp. 301–318).

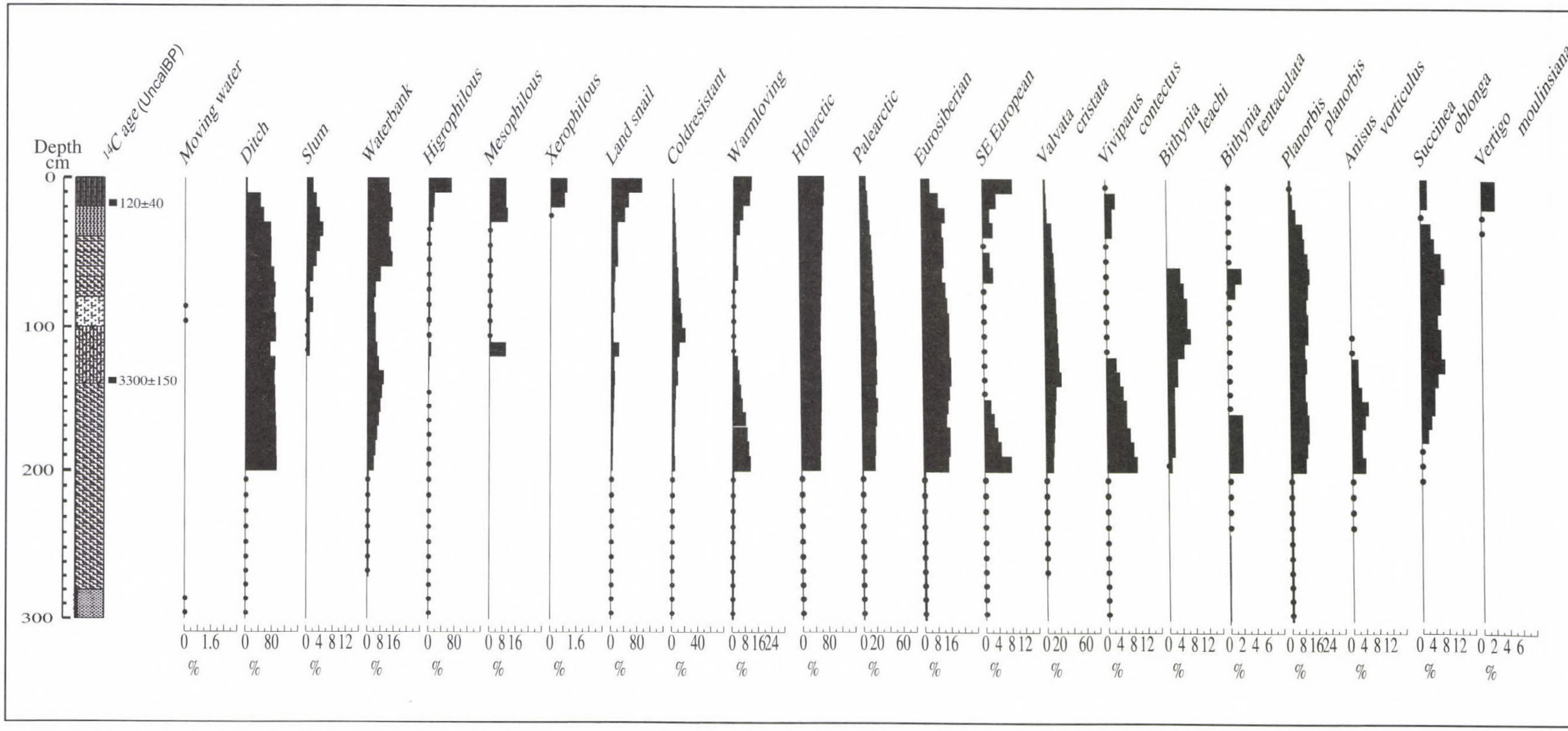

Fig. 5. The malacological sequence

definitely proves the development of a fluvial phase in the bedrock. The mollusc fauna indicates that this zone developed in the Holocene.

Zone 2 (2.8–2.0 m)
The fauna from this zone remained below the statistically evaluable 100 individuals/sample count. Aquatic species dominated, whose minimal water coverage demand is around 2 m. Species preferring eutrophic water make their first appearance. The species composition allows the reconstruction of an oligotrophic lake with a mild growth season temperature in the one-time riverbed forming the marsh basin.

Zone 3 (2.0–1.4 m)
Species preferring a lacustrine, permanent and stable, but not expressly fluvial aquatic environment dominate this zone (*Viviparus contectus, Planorbis planorbis, Anisus vorticulus*; *Fig 6*). The presence and dominance maximums of species preferring a milder climate and characterised by a South-East European distribution suggest that the sediment of this zone accumulated during a mild climatic phase (late Atlantic, early Sub-Boreal).

Zone 4 (1.4–1.0 m)
The proportion of aquatic species decreased, thermophilous species (*Anisus vorticulus*) declined, while species preferring eutrophic waters covered with vegetation (*Valvata cristata*) and cold tolerant species (*Bithynia leachi*) expanded. In addition to aquatic species, water bank and mesophilous terrestrial species too make their appearance. The composition of the fauna reflects a mosaic patterning in the habitat, probably with a floating mat, this being the only explanation for the simultaneous rise in the number of individuals of water bank amphibious species (*Succinea* spp.) and aquatic species. The species composition resembles the fauna of the floating island at Nagy-Mohos near Kállósemjén.[25] At the same time, species preferring a mesophilous terrestrial environment also make an appearance (e.g. *Vallonia costata*). The presence of these species is an indication of increasing soil erosion, similarly to the formation of the floating mat and the eutrophication of the lacustrine habitat, with the organic matter and phosphate probably washed in from the soil covering the high bluff. The malacological evidence harmonises neatly with results of the sedimentological analyses (the increase of clay and organic material), the pollen data (forest clearing) and seems to suggest that the formation of floating mats was probably the result of human impact on the environment. The formation of floating mats owing to anthropogenic influence is by no means a unique phenomenon; several similar cases can be cited from the Great Hungarian Plain.[26] The malacological record indicates that marsh formation occurred at a time when temperatures decreased and the climate turned cooler.

Zone 5 (1.0–0.8 m)
Valvata naticina, preferring flowing water, re-appears in this zone. The ratio of terrestrial species declines visibly, while the proportion of species demanding a constant water coverage increases significantly. The study area was inundated with living water: the oxbow, which had earlier been detached from the living river system, was activated. The significant proportion of cold tolerant species suggests that this occurred in a cooler and wetter climatic phase (end of the sub-Boreal, beginning of the Atlantic; Late Bronze Age).

Zone 6 (0.8–0.2)
This zone shows a dominance of *Valvata cristata*, a species preferring eutrophic waters, *Planorbis planorbis*, a very tolerant species, and *Succinea oblonga*, *Succinea putris* and *Oxyloma elegans*, thriving on water banks. The malacofauna allows the reconstruction of a rapidly eutrophicating, infilling lake with a dense vegetation cover, providing a habitat for species which are not chronological markers.

25 *Braun et alii* (1993).
26 *Braun et alii* (1993); *Jakab et alii* (2004).

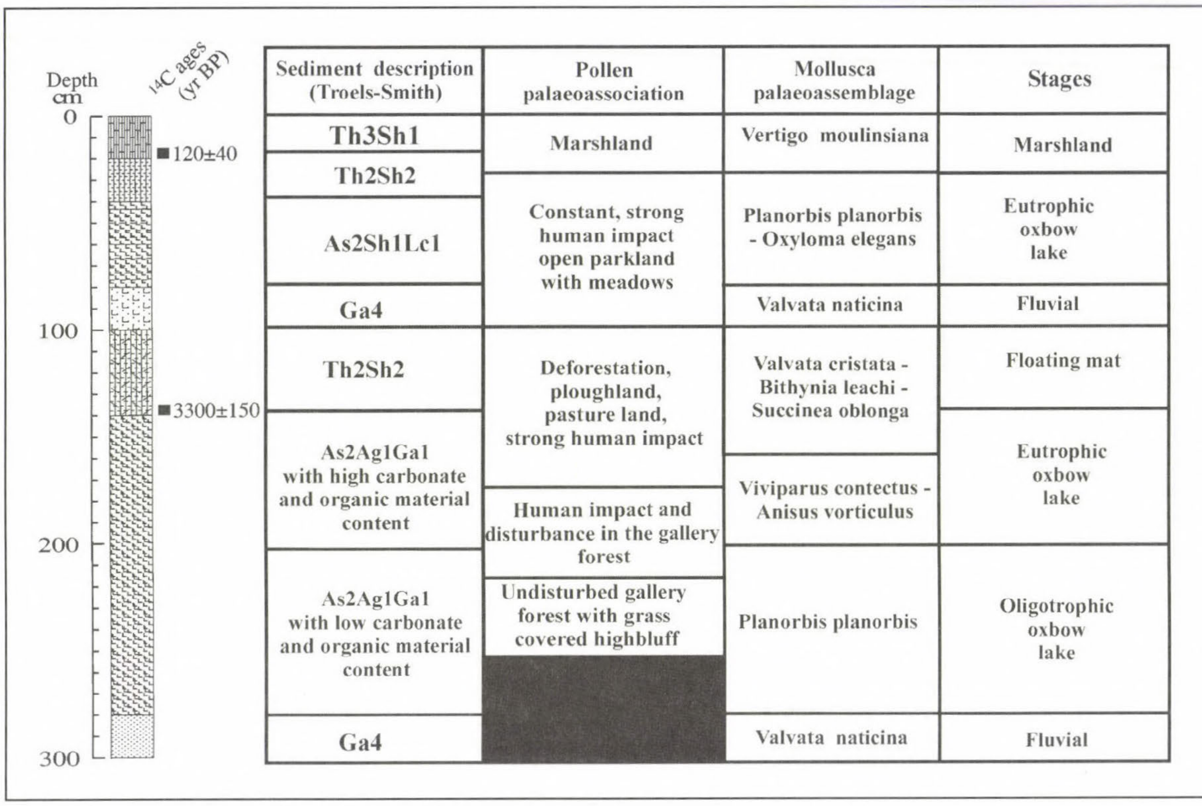

Fig. 6. Overview of the palaeoenvironmental analyses

The decline of *Bithynia leachi* and the rise in the proportion of the thermophilous species suggests a milder climatic phase during this sedimentation period.

Zone 7
This malacological zone developed near the present surface and reflects the invasion and expansion of terrestrial species preferring wet meadows and shores. Mesophilous and even xerophilous species appear in the centre of the studied marsh. This change points towards the rapid infilling of the lacustrine system in the marsh's centre, its desiccation and transformation into a marshland. The current environment of the marsh with its mosaic of willow swamps and marshes of reed sweet grass, reedmace and sedge developed in this phase.

SUMMARY

The evaluation of the data gained from the cores extracted from the centre of the Pocsaj Marsh allows the reconstruction of the following environmental history for this area *(Fig. 6)*:

Phase 1: A smaller riverbed extended under the Pocsaj high bluff in the Holocene, around 6500–6000 calBC in the Ér Valley. One section of this river was cut off from the active river system, and evolved into an oxbow lake around 5200–5400 calBC. The sediment sequence from this oxbow lake provided the basis for the environmental analyses.

Phase 2: A closed gallery wood rich in hardwood and softwood species evolved around the oxbow lake. The loess wall beside the lake was covered with an open, grassy vegetation. The oxbow was initially a 2–3 m deep, oligotrophic lake with clear waters.

Phase 3: The first evidence for the human disturbance of the gallery wood, namely changes reflecting animal grazing and forest clearance, can be dated around 5000–4400 calBC. These changes suggest that the study area functioned as an economic hinterland for the food-producing communities settling here and that it probably lay on the fringes of their settlements' outer zone (corresponding roughly to a circle with a radius of 5 km, a reasonable walking distance from the site).

Phase 4: In the Copper Age, from *ca.* 4400 calBC, the human impact on the environment – chiefly grazing – intensified and the originally oligotrophic lake gradually eutrophicated as a result of soil erosion due to decreasing vegetation cover.

Phase 5: The peak of anthropogenic impact can be dated to the Middle Bronze Age, when the gallery wood fringing the marsh was completely cleared and a floating mat developed in the marsh's centre. There were cereal fields, ploughlands and continuously occupied settlements in the direct environment of the marsh within a day's walking distance (i.e. roughly 5 km).

Phase 6: At the close of the Bronze Age, the oxbow lake was re-linked to the active river system and was inundated with living water. This process cannot be accurately reconstructed: it is possible that the changes in the fluvial system were caused by a cooler and wetter climate (evidence of which could be noted in the Pocsaj profile), but it is equally possible that this change can be attributed to human activity. Earlier palaeoenvironmental studies have revealed that Bronze Age communities manipulated the hydrological system of alluviums and channelled water from riverbeds near or around their tells for protection.[27] We cannot therefore exclude the possibility that the Late Bronze Age communities experimented with inundation under the Pocsaj high bluff, lying along the route through the Ér Valley leading to the copper, tin, antimonite and salt deposits in northern Transylvania and the sub-Carpathians.

Phase 7: The area was continuously inhabited after the Bronze Age. Even though the impact of food production showed a cyclical intensity, the destruction of the environment was continuous; the oxbow lake underwent eutrophication and was transformed into a eutrophic lake with patches of bogland and a marshland zone surrounded by ploughland and pastures.

Phase 8: In the 19th century, the oxbow lake was transformed into a mosaic of marshland, fens with sweet reed grass and willow swamps periodically covered with water as a result of channelling, river regulations and water management policies.

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27 *Sümegi P. – Kozák J. – Magyari E. – Tóth Cs.:* A Szakáld-Testhalmi bronzkori tell geoarcheológiai vizsgálata. Acta Geographica, Geologica et Meteorologica Debrecina 34 (1998) 165–180; *P. Sümegi – I. Juhász – E. Bodor – S. Gulyás:* Bronze Age agricultural impacts in the central part of the Carpathian Basin. In: Acts of the XIVth UISPP Congress, University of Liège, Belgium, 2–8 September 2001. BAR 1271. Oxford 2004, 107–111.

ANIMAL REMAINS FROM ARCHAEOLOGICAL EXCAVATIONS IN NORTH-EASTERN HUNGARY

Erika Gál

INTRODUCTION

New geo-archaeological research carried out in different regions of north-eastern Hungary was aimed at studying human impact on the landscape. Modern techniques in sedimentological, palynological and malacological analyses have opened new potentials in detecting the relationship between ancient peoples and their environment. Landscape exploitation, agriculture, hunting and animal keeping all reflect climatic and ecological conditions on the one hand and culturally idiosyncratic trends on the other.

This paper was written in connection with recent environmental studies. However, in the lack of new animal bone assemblages, the data presented here are based on already published assemblages. My aim is to offer an overview of environmental characteristics as reflected in animal bone deposits from the Palaeolithic to the Middle Ages. Since the studied materials originate from archaeological sites, they obviously reflect people's preferences in hunting and animal husbandry.

MATERIAL AND METHODS

As mentioned above, this paper presents already published archaeozoological data from north-eastern Hungary, the only exception being the material from the Scythian period settlement at Salgótarján–Industrial Park II, which is part of our own unpublished research project. A documentation of animal bone deposits was available from a total of 163 sites located in six counties (Borsod-Abaúj-Zemplén, Hajdú-Bihar, Heves, Jász-Nagykun-Szolnok, Nógrád and Szabolcs-Szatmár-Bereg). Although several settlements, such as Szolnok, Tószeg and Öcsöd, are located south of north-eastern Hungary in a geographical sense, they have nonetheless been included because the research area was defined on the basis of modern county boundaries.

Since data regarding animal remains was collected from the relevant publications, a detailed list of these sites and their discussion is not included in this paper. *Tables 1–8* sum up the data in a chronological, alphabetic and taxonomic order. The bibliographic reference is given in the case of each site.

The first part of this paper offers a brief survey of the most important sites and assemblages in a chronological sequence. Subsequently, an attempt is made to describe in detail the archaeozoological assemblages from sites excavated near the localities targeted by recent geo-archaeological research: Csaroda, Nagybárkány, Pocsaj, Sirok, Tarnabod and the Mohos Lakes area, as well as the Jászság and Hortobágy regions. Similarities and differences on the one hand, and historical changes on the other are considered in the discussion. Finally, an attempt is made to draw conclusions regarding the environmental and cultural characteristics of hunting and animal husbandry as reflected in the bone assemblages from north-eastern Hungary.

Owing to the synthetic nature of this review, information in the literature, i.e. in the articles written by various authors, had to be fitted into the same interpretive framework, in spite of inconsistencies in method and format. Levels of identification often varied between authors and even individual site reports. Since the majority of bone fragments from sheep and goat cannot be distinguished, the subfamily name Caprinae was used as a catch all term for these small ruminants. Precise species level identification, when available, was used in the tabulated faunal lists. The distinction between sheep and goat is important due to the different environmental requirements and modes of exploitation of these otherwise similar domesticates.[1]

Cervids posed a different problem. Both red deer and roe deer may sometimes be over-represented in faunal lists. Although antler from hunted stags and bucks can be recognised only in the presence of specimens fused to the frontal bone, antler remains have been traditionally counted together with the bones of animals killed. Moreover, the fragmentation of antler is also different from that of bone. Therefore, counting antler fragments together with bones (as was customary in earlier publications) may heavily bias the number of identifiable bone specimens (NISP), leading to an over-representation, especially of red deer.

Quantification problems have also been encountered. While the basic count of bones, the number of identifiable specimens (NISP) was available in publications, calculating the minimum number of individuals (MNI) was often neglected. Although these latter values, often criticised in the literature, cannot always be taken at face value, they are useful in fine-tuning information that is often distorted by differential fragmentation.

A CHRONOLOGICAL, FAUNAL AND CULTURAL OVERVIEW

The Palaeolithic

Although Palaeolithic settlements are not discussed from an archaeological point of view in this volume, we must mention some important sites from this period considering the numerous excavations in the Bükk Mountains and the Jászság region. On the testimony of the culture bearing layers yielding artefacts, most of the caves were settled during the Late Pleistocene. Remains of large mammals and birds were also deposited, in addition to the very abundant micromammal material usually found in these contexts.[2] Detailed palaeontological studies on the mammalian remains, as well as new results concerning the evolution of the fauna and climato-stratigraphy, were presented by Dénes Jánossy, Magdolna Járai-Komlódi and László Kordos.[3]

From an archaeological point of view, Subalyuk Cave in the Bükk Mountains is very important as the only site in Hungary, where the presence of Neanderthals has been detected so far. Two different layers provided bone materials in this cave. The older layer, assigned to the Mousterian culture, yielded remains of ibex, a wild goat (*Capra ibex*). The younger level, dated to the end of the Middle Palaeolithic, included the skeletal remains of Neanderthals.[4] A great number of animal remains were discovered in this cave, but only a few of the species may be considered hunted, others are probably natural deposits.[5] In addition to mammals, many birds were also identified from this site.[6]

Szeleta Cave – the eponymous site of the Szeleta culture – is also located in the Bükk Mountains. The presence of bones from wild goat, red deer (*Cervus elaphus*), reindeer (*Rangifer tarandus*), wild horse (*Equus* sp.) and mammoth (*Mammuthus primigenius*) were attributed to human hunting at this site. Based on the finds from culture bearing layers, this cave was dated tu the same period as Istállóskő Cave, located in the same area.[7]

Istállóskő Cave is one of the richest Palaeolithic settlements in Hungary. The over 31,000 bones included both mammalian and avian species. Twenty-one of the forty mammalian species were considered

1 *L. Bartosiewicz:* The role of sheep versus goat in meat consumption at archaeological sites. *In:* Transhumant pastoralism in Southern Europe. Eds.: L. Bartosiewicz – H. J. Greenfield. Budapest 1999, 47–60.

2 *Jánossy* (1986).

3 *Jánossy – Kordos* (1976); *Kordos L. – Járai-Komlódi M.:* Az elmúlt tízezer év klímaváltozásai Magyarországon. Időjárás 92 (1988) 96–100; *Kordos L.:* A magyarországi holocén képződmények gerincesfauna fejlődése, biosztratigráfiája és paleoökológiája. PhD Thesis. Budapest 1981; *Kordos L.:* Magyarország harmad- és negyedidőszaki emlősfaunájának fejlődése és biokronológiája. DSc Thesis. Budapest 1992.

4 *Simán* (2003) 83.

5 *Jánossy* (1986) 129–132.

6 *Vértes* (1965) 333.

7 *Simán* (2003) 83–85.

prey items by hunters. The dominance of cave bear (*Ursus spelaeus*) in the material (8543 remains of 777 individuals, 88% of the hunted game), was attributed to human hunting.[8] The uniquely abundant material representing sedentary birds, willow grouse (*Lagopus lagopus*) and ptarmigan (*L. mutus*) allowed a palaeoclimatic comparison between the different layers from this cave. Based on changes in the number of individuals of these cold climate species, Dénes Jánossy demonstrated that the climate was milder during both the Aurignacian and Magdalenian I and II cultures than during the phase between these two periods.[9]

The majority of Palaeolithic settlements are cave sites in the studied area. Fissures protected people both from animals and climatic hardship. Caves were used for storing provisions and protecting the fire. One of the few Palaeolithic open-air sites is the settlement of Bodrogkeresztúr–Henye. It is located on a hill at the confluence of the Bodrog and Tisza rivers. The inhabitants of this settlement hunted mainly mammoth and reindeer.[10]

Other important settlements from this period include Pilisszántó, Remetehegy, Puskaporos[11] and Mátraderecske. This latter site provided a mammoth skeleton from the Late Pleistocene, most probably the Würm I phase. The presence of prehistoric hunters at this site was shown by a flint fragment.[12] The blade, made from chalcedony, was provisionally dated to the Szeleta culture.[13]

Excavations in 1990 at the settlement of Jászfelsőszentgyörgy–Szunyogos uncovered an Upper Palaeolithic campsite. The geomorphological and stratigraphic study of the site was carried out by Pál Sümegi.[14] Of the 164 animal bones, 115 were non-identifiable fragments. The rest of the remains were identified as those of reindeer, horse and willow grouse *(Table 1)*. Remains of egg shell from the latter suggested that grouse eggs were gathered at the end of the spring.[15]

The Mesolithic

Mesolithic settlements are generally rare in Hungary. Finds from early excavations could hardly be classified for a long time into any of the Mesolithic cultures known abroad, and their interpretation was difficult.[16] Several settlements were discovered in the Bükk Mountains. Some cave sites located here, such as Jankovich Cave, Petényi Cave and the Rejtek I rockshelter, contained fossil finds from the Pleistocene/Holocene transition. The molluscan and vertebrate fauna were studied by Endre Krolopp, Dénes Jánossy, István Vörös and László Kordos. Palaeoclimatic investigations have been developed on the basis of the "vole-thermometer".[17]

The Rejtek I rockshelter near the village of Répáshuta yielded a very rich vertebrate assemblage, including the remains of fish, amphibians, reptiles, birds and mammals. This cave bone assemblage mainly contained remains of micro-mammals, but some skeletal parts of economically important mammals, such as bison, cervids, wild boar, hare and rabbit, were also found. The increase in temperature was reflected by the great number of amphibian (*Bufo*) and reptile (*Lacerta* and *Ophidia*) remains. The humid climate was indicated by an increase of bones from fieldmouse (*Micromys*) and mole (*Talpa europaea*) in the unique stratigraphic sequence of this rockshelter. A decline in boreo-alpine elements and the increasing number of humid-temperate forms in the vole fauna paralleled these phenomena.

8 *Vörös* (1984).
9 *D. Jánossy:* Fossile Ornis aus der Höhle von Istállóskő. Aquila 55–58 (1951) 205.
10 *Dobosi* (2003) 87.
11 *Jánossy* (1986).
12 *Vörös* (1975).
13 *Vértes* (1965) 227.
14 *Sümegi P.:* A Jászfelsőszentgyörgyi Szunyogos felső-paleolit telephely üledékföldtani és sztratigráfiai elemzése. Tisicum 8 (1993) 74–76.
15 *Vörös* (1993).
16 *Vértes* (1965) 212.
17 *Jánossy – Kordos* (1976); *Krolopp E. – Vörös I.:* Macro-mammalia és mollusca maradványok a Mezőlak-Szélmező pusztai tőzegtelepről. Folia Musei Historia Naturalis Bakonyiensis 1 (1982) 39–64.

Analyses of the vole remains from Petényi Cave showed similar results as regards the Pleistocene/ Holocene transition.[18]

Open site Epipalaeolithic and Mesolithic deposits yielded chiefly aurochs (*Bos primigenius*) remains. A complete skeleton of this species was excavated from the peat bogs at Kecel–Rózsaberek.[19] The Kecel–Tőzegtelep site yielded six bones of at least four aurochs and twelve remains of wild ass (*Asinus hydruntinus*).[20] The complete assemblage of animal remains from the Őrjeg peat bog was published by Sándor Bökönyi.[21]

The discovery of new settlements during the recent decades provided assemblages of atypical stone tools. The re-evaluation of Mesolithic sites and cultures (e.g. Eger culture) has considerably reduced the number of sites thought to have belonged to the Mesolithic.[22] Earlier Mesolithic finds from reliable contexts were known from Szekszárd–Palánk and Sződliget.[23] Authentic excavations and geoarchaeological surveys led by Róbert Kertész and Pál Sümegi in the last decade opened new perspectives in the study of this important archaeological period. The Jászság region seemed to be the most appropriate place for these studies due to its location at the ecotone between the Great Hungarian Plain and the Mátra Mountains.[24] This special ecological setting, as well as the proximity of a flint quarry, made this area equally important to Mesolithic hunter-gatherers and the farmers of the Körös–Criş culture, who had arrived from the Balkans and occupied the south-eastern part of the Great Hungarian Plain. Recently studied settlements include Jászberény I, Jásztelek I and Tarnaörs.[25] In addition to the Jászság region, traces indicative of the Mesolithic were also found at Pásztó–Mária-tanya. These finds would indicate that further Mesolithic sites may be expected in the valley of the Zagyva River.[26]

The Neolithic

A radical change took place in the life of prehistoric communities from the end of the Mesolithic onwards. Hunter-fisher-gatherer groups made contact with the new, Neolithic communities which penetrated the Carpathian Basin from the south-east. Arriving from the Balkans, these immigrant Körös–Criş groups gradually adapted to local conditions, and indigenous groups too learnt from them. From the very beginning of the Neolithic, the new subsistence strategies were based on agriculture and animal keeping rather than on hunting.

One interesting issue regarding the Körös–Criş population, which already possessed several domestic plants and animals such as cattle (*Bos taurus*), sheep (*Ovis aries*) and goat (*Capra hircus*), pig (*Sus domesticus*) and dog (*Canis familiaris*), is the question of what limited their northward expansion in the Carpathian Basin? One possible answer was offered by Pál Sümegi and Róbert Kertész,[27] who suggested that these communities with a cultural background and an econmomy rooted in the Mediterranean fell into an ecological trap under the environmental and Balkanic climatic conditions of the Carpathian Basin. They introduced the concept of the "East European–Balkanic Agro-Ecological Barrier" in prehistoric studies.

In contrast to their Mesolithic counterparts, Neolithic settlements, far greater in number, yielded numerous animal remains, often forming very rich bone assemblages. These deposits all originate from

18 *Jánossy* (1986) 153–158.
19 *Bökönyi* (1972) 22; *I. Vörös:* An aurochs (Bos primigenius Boj.) skeleton from the Mesolithic peat-bogs at Kecel–Rózsaberek. FolArch 37 (1987) 65–88.
20 *Bökönyi* (1972) 22.
21 *Bökönyi* (1972).
22 *R. Kertész:* Data to the Mesolithic of the Great Hungarian Plain. Tisicum 8 (1993) 81.
23 *Kertész R. – Sümegi P. – Kozák M. – Braun M. – Félegyházi E. – Hertelendi E.:* Mezolitikum az Észak-Alföldön. JAMÉ 36 (1994) 38.
24 *Kertész R.:* Kőkori vadászok. A Jász Múzeum Évkönyve (2001) 36–64.
25 *R. Kertész:* Mesolithic hunter-gatherers in the north-western part of the Great Hungarian Plain. Praehistoria 3 (2002) 281–304.
26 *Simán K.:* Őskőkori leletek Nógrád megyében. NMMÉ 18 (1992–1993) 249.
27 *Sümegi P. – Kertész R.:* A Kárpát-medence őskörnyezeti sajátosságai – egy ökológiai csapda az újkőkorban? Jászkunság 44 (1998) 156.

domestic features; cemeteries are not known from this period. In north-eastern Hungary, vertebrate remains are known only from two Early Neolithic Körös settlements. Both are located in the Jászság region: Kőtelek–Huszársarok and Szajol–Felsőföld. The latter site provided an abundant assemblage of animal bones *(Table 2)*.

The number of Middle and Late Neolithic settlements from which archaeozoological material was recovered is greater than that of Early Neolithic sites. Alföld Linear Pottery sites from the Middle Neolithic, as well as Tisza sites from the Late Neolithic are numerous. The settlements at Kompolt–Kistér,[28] Tiszavasvári–Deákhalmi-dűlő,[29] Polgár–Csőszhalom[30] and Berettyószentmárton[31] provided the richest animal bone assemblages from this period *(Table 2)*.

From the beginning of this period, five domestic animal species – those of the "Neolithic package"[32] – are present: cattle, sheep and goat, pig, and dog. Horse remains from this period have been assigned to a wild form. Domestic horse (*Equus caballus*) appears in Hungary by the beginning of the Middle Copper Age.[33] Dog, the first domesticate, played a special role in the human-animal relationship. At least three different types of human attitudes towards dog could be distinguished. Dog is the first domesticated animal and this may indicate humans' special interest in this species. It seems likely that dogs were kept for the protecton they provided around settlements; they also helped hunters in tracking down game and farmers in herding. There is also evidence that dogs were eaten even during historic times.[34] Finally, dogs were often sacrificed. Their articulated skeletons or skulls have been found in animal burials[35] and in foundation deposit as well.[36]

At least twenty-seven animal taxa were hunted during the Neolithic *(Table 2)*. It is difficult to decide whether some animals, such as the red fox (*Vulpes vulpes*), badger (*Meles meles*) or hamster (*Cricetus cricetus*) were indeed hunted by prehistoric communities or whether their remains represent a secondary "taphonomic gain" in deposits. We believe that these species may be associated with human activity only when they come from a reliable context (e.g. a grave) or when clear traces (cut marks, for example) indicate exploitation by humans, such as the skinning of hamsters.[37]

The most common hunted animals in the Neolithic were aurochs, Cervidae – red deer and roe deer (*Capreolus capreolus*) –, wild boar (*Sus scrofa*) and hare (*Lepus europaeus*). Bulls had a special meaning in the cult life of Early Neolithic communities as shown by clay figurines. According to Nándor Kalicz and Pál Raczky, bulls symbolised male fertility in the Early Neolithic.[38]

The most frequent carnivorous species encountered were red fox and wild cat (*Felis silvestris*). In addition to mammals, wild fowl, pond tortoise (*Emys orbicularis*) and fish (three taxa identified to a species level) were described from these animal bone assemblages. The Neolithic avifauna of Hungary is discussed in detail in a separate paper.[39]

Wild ass is an interesting faunal element in the Neolithic. This species occurred commonly in Hungary only in the Mesolithic and Neolithic, but later became extinct. Bone evidence of domestic donkey (*Asinus asinus*) is known in Hungary from the Iron Age and the Roman Age.[40]

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28 *Bartosiewicz* (1999).
29 *Vörös* (1994).
30 *Bökönyi* (1974) 394; *Schwartz* (1998); *Schwartz* (2002).
31 *Bökönyi* (1959) 54.
32 *S. Bökönyi:* Domestication models: the Anatolian-Mesopotamian and the others in Southwest Asia. *In:* Archaeozoology of the Near East Eds.: H. Buitenhuis – A. T. Clason. Leiden 1993, 5.
33 *Vörös* (2003b) 74.
34 *Bökönyi* (1974) 320; *Bökönyi* (1985) 272.
35 *Bökönyi* (1974) 367, 374; *Vörös* (1999a).
36 *Vörös* (1990a); *Vörös I.:* Késő középkori kutyatemetés Cegléd–Nyúlfülehalmon. CommArchHung (1995) 217–223; *Vörös* (1996).
37 *Bartosiewicz* (1999); *Bartosiewicz* (2003) 115, Fig. 14.
38 *Kalicz – Raczky* (1981) 17.
39 *Gál* (2004).
40 *Vörös* (2003b) 74.

The Copper Age

Similarly to the previous periods, a number of Copper Age deposits yielded animal remains. They originated mainly from settlement middens, but grave offerings were also excavated. The Middle Copper Age settlement at Tarnabod,[41] one of the localities recently targeted for geoarchaeological studies, and at Tiszalúc–Sarkad[42] yielded significant bone assemblages. The Late Copper Age settlement of the Boleráz culture at Gyöngyöshalász–Encspuszta[43] also provided a noteworthy collection of animal bones.

The earliest cemeteries found in Hungary are known from this archaeological period. Middle Copper Age graves excavated at Magyarhomorog (Bodrogkeresztúr culture) and Baja–Dózsa György Street (Baden culture) are among the first cultic contexts. Pig remains were found at the previous site and a cattle skull with an incomplete skeleton was excavated at the latter.[44]

The number of species identified from the Copper Age was great as well. Among farm animals, remains of a new species, domestic horse made its appearance. This animal was identified at seven settlements *(Table 3)*. Three hunted animals are new elements in comparison with the earlier fauna. Persian fallow deer (*Dama mesopotamica*) and elk (*Alces alces*) were identified in addition to red deer and roe at the Middle Copper Age settlement of Tiszalúc–Sarkad. Moreover, a number of lion (*Panthera leo*) remains were also brought to light at this site, in addition to the bones of other felids, such as wild cat and lynx (*Lynx lynx*).[45] Lion finds were published from the Boleráz site at Gyöngyöshalász–Encspuszta and from the Late Copper Age settlement of Tiszaföldvár–Brickyard as well.[46]

In contrast to the Neolithic, the number of Copper Age bird bone specimens, as well as the number of identified species is small. Pond tortoise and fish remains were collected from a number of sites. Four different fish species were identified in the bone assemblage from Gyöngyöshalász–Encspuszta.[47]

Although cattle remains were the most numerous in this period as well, the dominance of this species is not so evident in the Copper Age of north-eastern Hungary. Caprinae bones dominated several assemblages, such as the ones from Gyöngyöshalász–Encspuszta, Tiszavalk–Tetes and the Boleráz layer of Polgár–Basatanya. Furthermore, pig was the most frequent animal among the domestic species in the Baden deposits of the Polgár–Basatanya settlement *(Table 3)*.

The Bronze Age

Many Bronze Age sites yielded animal bones in north-eastern Hungary. These sites could be variously assigned to the Makó, Nyírség, Nagyrév, Hatvan, Gyulavarsánd/Otomani, Füzesabony, Vatya, Tumulus and Gáva cultures. Early and Middle Bronze settlements were especially numerous. Among the Early Bronze Age sites, the settlement at Gáborján–Csapszékpart yielded a rich deposit. The Middle Bronze Age settlements yielding the most abundant animal bone samples were Tiszalúc–Dankadomb, Bakonszeg–Kádárdomb and Tószeg–Laposhalom *(Table 4)*. In spite of the dominance of domestic animals (especially cattle), the large, Hatvan culture animal bone assemblage from Tiszalúc–Dankadomb also contained the remains of game animals (13% of the fragments), including beaver (*Castor fiber*), wolf (*Canis lupus*), brown bear (*Ursus arctos*), lynx and wild cat.[48]

In general, however, fewer animal species have been described from the Bronze Age than from the Neolithic or the Copper Age. Cattle, small ruminant and pig remains were excavated in the greatest numbers, and usually cattle remains were the most frequent. However, at the Gyulavarsánd settlement of Berettyóújfalú–Szilhalom, pig seems to have been the most exploited species. Horse was identified from a number of sites.

41 *Bökönyi* (1959) 60.
42 *Vörös* (1987).
43 *Vörös* (1982–1983); *Takács* (1982–1983).
44 *Bökönyi* (1974) 344, 380.
45 *Vörös* (1987) 125.
46 *Vörös* (1983).
47 *Takács* (1982–1983) 70.
48 *Bökönyi* (1974) 413.

In the case of three sites, wild animal species dominated the bone assemblages. Red deer and roe deer remains were excavated in remarkably high numbers at Füzesabony, Szilhalom and Tiszafüred–Ásotthalom *(Table 4)*. It must nevertheless be noted that that the antlers of both deer species differ taphonomically from bone samples because, as mentioned above, antler could have been collected without hunting as it is shed every winter.

Animal remains related to the cult life of Bronze Age communities are known from this area as well. The settlements at Jászdózsa–Kápolnahalom (Füzesabony culture) and Tószeg–Laposhalom (Hatvan–Füzesabony culture) yielded skulls of different wild and domestic species, which may represent foundation deposits. This aspect of the archaeozoological material will be discussed below.

Iron Age

During the Iron Age, the area under discussion formed an interface between the Scythian expansion from the south-east and the advance of the Celts from the west. Unfortunately, settlements providing animal bones from this period are few and far between. However, the relatively great number of ritual contexts is worth considering. A greater number of animal remains from settlement features were excavated, especially at the Early Iron Age settlement of Felsőtárkány–Várhegy[49] and the recently studied Scythian period settlement of Salgótarján–Industrial Park II.[50]

The twenty-nine Early Iron Age graves at Mezőcsát–Hörcsögös contained the remains of several domestic species. Scythian cemeteries at Törökszentmiklós–Surján and Tiszaszöllős–Csákányszeg-Gyep yielded only a few domestic animal bones. Cattle and sheep or goat remains were excavated from Graves 1 and 2 at Törökszentmiklós–Surján, and one individual of sheep or goat (Caprinae) from Grave 17 at Tiszaszöllős–Csákányszeg-Gyep.[51]

The Celtic graves mostly contained pig remains, often in association with sheep or poultry bones. Goose (*Anser domesticus*) bones were excavated at Rozvágy, while hen (*Gallus domesticus*) was found at Mátraszőlős and Tiszavasvári–Városföldje.[52] The latter site provided remains of a red fox as well.

At the Iron Age settlements of north-eastern Hungary, cattle and Caprinae were the most intensively exploited domestic animals. Among the hunted animals, Cervidae and wild boar yielded a great number of remains. A new species, bison (*Bison bonasus*) appears in the Iron Age fauna, which was identified at the Salgótarján–Industrial Park II settlement.[53] After its presence in the Late Pleistocene and Mesolithic, this species sporadically occured again in Hungary during the Neolithic, the Iron Age and later in the Middle Ages.[54] The last individuals of this originally native species were kept in game parks until the 18th century.[55]

During the Iron Age, the number of hunted species is further reduced in comparison with those identified at Bronze Age sites. This may, however, also be a consequence of fewer representative samples from the Iron Age. Species diversity, that is taxonomic richness, increases along with the number of identifiable bone specimens.

There is poor evidence for fowling and fishing in this region. Wild fowl were identified in small numbers, as well as domestic hen. However, domestic hen was first identified in north-eastern Hungary at the Scythian settlement of Jászfelsőszentgyörgy–Túróczi-tanya.[56] The presence of this species has also been documented at the Celtic cemeteries at Mátraszőlős and Tiszavasvári–Városföldje *(Table 5)*.

49 *Bökönyi* (1974) 360.
50 *Bartosiewicz – Gál* (2006).
51 *Bökönyi* (1974) 380, 399, 415–416.
52 *Bökönyi* (1974) 380, 395; *Vörös* (1998) 107–111.
53 *Bartosiewicz – Gál* (2006).
54 *Bökönyi S.:* Szarvas–1. lelőhely, egy késő-újkőkori telepészlet állatmaradványainak archaeozoológiai vizsgálata. A Magyar Mezőgazdasági Múzeum Közleményei (1986–1987) 89–103; *Vörös* (2003a) 57–59.
55 *Vörös* (2003b) 74.
56 *Bökönyi* (1974) 371.

Celtic burials both in Pannonia and northern Hungary tend to contain bones of poultry relatively frequently.[57]

The Roman period

North-eastern Hungary lay beyond the *limes* of the Roman Empire, in the so-called Barbaricum. Nevertheless, the peoples living here maintained lively contacts with the two closest Roman provinces, Pannonia in the west, on the right side of the Danube, and Dacia to the east.

Similarly to the previous periods – except the Iron Age – a great number of archaeological settlements yielded animal bone materials in this region. The most abundant deposits were recovered at the sites of Szirma, Szirmabesenyő and Tiszaföldvár–Brickyard.[58]

Species lists from this period vary. In addition to the most common meat-producing domestic animals, almost every deposit yielded horse and poultry remains *(Table 6)*. Donkey is known from three sites: the 2nd–3rd century settlement of Biharkeresztes–Ártánd-Nagyfarkasdomb,[59] Tiszaföldvár–Brickyard and Tiszavasvári–Városföldje.[60]

Beside the commonly occurring domestic animals, the tibia of a camel (*Camelus* cf. *dromedarius*) was identified at the Sarmatian settlement of Kompolt–Kistér. In the absence of precise dating, the presence of this specimen can most likely be linked to the major trading route,[61] which crossed the Barbaricum between Aquincum (the capital of Pannonia Inferior on the Danube) and Porolissum located along the northern *limes* of Dacia in the Carpathians.[62]

Many settlements yielded aurochs, Cervidae and wild boar remains, the most frequently hunted animals. However, all significant species of the wild fauna were hunted at the time *(Table 6)*.[63] Even brown bear was identified in the relatively small assemblage from Apagy–Peckés rét.[64]

The Migration period

In conventional terms, the Migration period in Hungary lasted from 271 AD, when the Romans abandoned the province of Dacia, to 895, the date of the Hungarian conquest.[65] The various sub-periods of this period are discussed together here as they provided few animal remains on the one hand, and a number of similarities can be noted regarding the type of sites and species recognised on the other.

The number of sites yielding animal remains from this period is considerable in north-eastern Hungary. Two main types of deposits may be distinguished: sporadic settlement features and cemeteries. Graves from the Avar period and from the Hungarian Conquest period are especially numerous *(Table 7)*.

Among the few sites that yielded settlement refuse, the Hun period section of the Tiszavasvári–Városföldje site,[66] the Germanic settlement of Füzesabony–Szikszópuszta,[67] the 5th–6th century site of Kisvarsány[68] and the Avar period sub-assemblage from Kompolt–Kistér[69] must be mentioned.

57 *Bartosiewicz L.:* Ordacsehi–Kécsimező temetőjének állatmaradványai. Somogy Megyei Múzeumok Közleményei 15 (2002) 66, Fig. 1.
58 *Vörös* (1990–1992) 59–60.
59 *Bökönyi* (1982) 263.
60 *Vörös* (1990–1992) 59.
61 *Bartosiewicz* (1999) 327–328.
62 *L. Bartosiewicz – J. Dirjec:* Camels in antiquity: Roman Period finds from Slovenia. Antiquity 75 (2001) 279–285.
63 *I. Vörös:* Farm and hunted animals from the Roman Imperial Period in Hungary (a sketch). Specimina Nova Universitatis Quinqueecclesiensis 16 (2000) 239.
64 *Vörös* (1990–1992) 34, Table 1.
65 *L. Bartosiewicz:* Hungary. *In:* Ancient Europe, 8000 B.C. to A.D. 1000: An Encyclopedia of the Barbarian World. Eds: P. Bogucki – P. J. Crabtree. New York 2004, 574–578.
66 *Vörös* (1999b).
67 *Vörös* (1989–1990).
68 *Bökönyi* (1974) 376.
69 *Bartosiewicz* (1999) 324.

The abundance of faunal elements decreases considerably in this period in comparison with previous ones. All domestic species are present, but cattle and Caprinae were the most preferred animals. Domestic ass was identified at Tiszavasvári–Városföldje.[70] The number of hunted animals is very small. Aurochs remains were found only at the 3rd–4th century site of Tar.[71] In addition to this species, only red deer, wolf and small mammals were identified *(Table 7)*.

Avar period graves most often contain the body parts of one particular species deposited beside the deceased. Horse skeletal parts were identified at the cemeteries of Hortobágy–Árkusi-ág and Tiszavasvári–Vöröshadsereg Street. The grave at Kiskunmajsa–Kőkút contained remains of a cattle. The cemetery at Jánoshida contained Caprinae and hen offerings as grave goods.[72] A special artefact was recovered from Grave 49 in 1933. A double pipe made from crane (*Grus grus*) ulnae was found in the right hand of the male skeleton.[73] Similar double pipes were excavated from other Avar period graves in this region. Graves 285 and 477 in the cemetery of Alattyán yielded comparable finds made from crane tarsometatarsi.[74]

Among the burials published from this region, only graves of the early Avar period cemetery at Tiszavasvári–Koldusdomb yielded remains of several species such as cattle, sheep, Caprinae and horse. The Avar period grave in the cemetery of Tiszaeszlár–Vörösmarty Street contained only the skull and feet of a horse interred with the human body. This arrangement was more typical of early Avar times. Later, entire horses were usually buried. The burial of the horse's head and feet with the deceased again became widespread in the Hungarian Conquest period. Horse skull and feet remains were found in graves at Biharkeresztes, Dormánd–Hanyi-puszta, Kenézlő, Sárospatak, Tiszabercel–Ráctemető and Tiszaeszlár–Bashalom.[75]

The first overview of burials with horse remains was published by Csanád Bálint. He studied the typology of the placement of horse remains within the graves in sixty-one burials from the Hungarian Conquest period in the Upper Tisza region.[76] A recent examination of seventy-eight burials with horse remains from a smaller area (Szabolcs and Nyírség) within this region was presented by István Vörös. Horse remains were placed in different positions in the grave; the separated head and feet remains may have been wrapped in horse hides. The placement of such hides also varied within the grave.[77]

The Middle Ages and the Ottoman period

Relatively few medieval animal bone assemblages have been excavated in north-eastern Hungary. Among these, Árpádian Age and Ottoman period settlements provided the richest animal find materials. Ottoman period deposits came mainly from high status settlements, such as castles.

Usually, cattle was the species that provided the greatest number of medieval animal remains. In two cases, however, other domestic animals dominated the bone assemblages. Pig remains were the most numerous at the settlement of Mátraszőlős–Kisvár, while Caprinae provided the richest bone material at Szolnok Castle. During the Middle Ages, an important change may be noted in comparison to the Migration period: pig became a more preferred animal than Caprinae across Hungary.[78] The reason is most probably that omnivorous pig can be kept in a relatively small place the year round, while Caprinae need grazing ground and they have to be pastured. It may also be hypothesised that the western (usually German speaking) settlers in the studied medieval sites were mainly interested in consuming pork, rather than secondary products (milk, wool etc.) provided by other farm animals. The effect of

70 *Vörös* (1999b) 256.
71 *Bökönyi* (1974) 409.
72 *Bökönyi* (1974) 368–369, 375.
73 *Bartha* (1934) 15–19.
74 *Kovrig* (1963) 173.
75 *Bökönyi* (1974) 348, 359, 374, 398, 410–411, 418.
76 *Bálint Cs.:* A honfoglalás kori lovastemetkezések néhány kérdése. MFMÉ (1969) 107–114.
77 *Vörös* (2001).
78 *L. Bartosiewicz:* Animal husbandry and medieval settlement in Hungary: A review. Beiträge zur Mittelalterarchäologie in Österreich 15 (1999) 139–155; *Bartosiewicz* (2003).

little understood ethnic tradition is also worth considering.[79] The lack of pig remains at Szolnok Castle can most probably be associated with the occupation of the castle by Ottoman Turks. It was noted in the original publication, however, that the animal bones underwent on-site sorting and a part of the sample was discarded before its deposition in the museum.[80]

Aurochs was no longer present in this region during the Middle Ages. The last record of this species from Hungary originates from the 10th century.[81] However, more hunted animals were identified than in the Migration period. In addition to hunting, the evidence of fowling and fishing is also available from some settlements, such as the bailiff's centre at Szabolcs, Túrkeve–Móricz and Szendrő, Upper Castle.[82] Aside from the turkey (*Meleagris gallopavo*) bone found at Szendrő, Upper Castle, the most interesting avian find from this period in the region is the bone evidence for a peacock (*Pavo cristatus*), excavated at Pásztó–Gothic House.[83]

Camel (*Camelus dromedarius*) bones were found at the 14th–17th century sites of Diósgyőr Castle and Eger Castle.[84] Although these sporadic finds cannot be connected with any particular human activity, it seems likely that the camel find is related to the Ottoman Turkish occupation in this area. Camel bone remains are known from two periods in the history of Hungary: camels were used as pack animals in military and trade movements during the Roman period and during the Turkish occupation.[85]

HUNTING AND ANIMAL HUSBANDRY IN NORTH-EASTERN HUNGARY

In this section, an attempt is made to summarise the faunal characteristics of specific areas examined within the framework of recent geoarchaeological projects. Locations in the most north-easterly area around the Mohos Lakes and Csaroda will be discussed first, followed by the Pocsaj area and the Hortobágy region. The southernmost part of the studied area is the Jászság region; Tarnabod lies at the northern edge of this large area. Finally, the environs of the nearby settlements at Sirok and Nagybárkány will be discussed. Owing to the great number of sites and the fact that with the exception of one settlement, the results from all the analysed sites have already been published, the following discussion will focus on the most important characteristics of the identified fauna, as well as on the most abundant deposits and most interesting finds.

The Mohos Lakes and the Csaroda area

The area of the Mohos Lakes is the northernmost among the studied regions. These lakes are ringed by the Borsod Hills. To the north, the area borders on the Aggtelek Karst, and the Bükk Mountains and the Bükk Plateau lie to its south. The next location discussed in this section is Csaroda, located about 200 km to the east. A lowland divided by the branches of the Tisza and Szamos rivers extends between the two sites.

The oldest bone deposit associated with human activity is known from Istállóskő Cave. This site provided an abundant assemblage both in terms of the number of remains and the species identified. Nevertheless, not all of these animals were hunted, for predators other than humans used the cave as well. Therefore, only animal species preyed upon by prehistoric hunters[86] were taken into consideration *(Table 1)*.

79 *É. Á. Nyerges:* Ethnic traditions in meat consumption and herding at a 16th century Cumanian settlement in the Great Hungarian Plain. *In:* Behaviours behind bones. The zooarchaeology of ritual, religion, status and identity. Proceedings of the 9th ICAZ Conference, Durham. Eds: S. Jones O'Day – W. van Neer – A. Ervynck. Oxford 2002, 262–270.

80 *Bökönyi* (1974) 406.

81 *Vörös* (2003a) 59; *Vörös* (2003b) 74.

82 *Vörös* (1990d); *Bökönyi* (1974) 420; *Tassi* (2005).

83 *Vörös* (2002) 351.

84 *Bökönyi* (1974) 358; *Vörös* (2002) 339.

85 *L. Bartosiewicz:* The archaeology of domestic animals. *In:* Hungarian archaeology at the turn of the millennium. Ed.: Zs. Visy. Budapest 2003, 63.

86 *Vörös* (1984) 12.

The Middle Neolithic settlement of the Bükk culture at Borsod–Derekegyházi-dűlő lay in the immediate proximity of the Mohos Lakes. It yielded only a few dozen animal bones. Domestic species, such as cattle, Caprinae and pig dominated the assemblage, while hunted animals were under-represented. The presence of aurochs and red fox are worth mentioning, however.[87]

The Late Neolithic Tisza culture settlement at Szerencs–Taktaföldvár yielded a richer bone assemblage than the previous site. The proportion of remains from domestic and hunted animals is almost identical. Among farm animals, the bones of cattle and pig occurred most commonly. Aurochs, wild boar and red deer provided the bulk of the meat consumed. In addition to hunting, fowling and fishing were also practiced.[88] The bone of a wild horse represents the northernmost evidence of this species during the Neolithic to date.

Copper and Bronze Age settlements yielded only scarce bone assemblages in this area. The assemblage excavated at the Iron Age site of Óhuta–Nagysánc in the Zemplén Mountains is also poor, but it contains the single known find of wild cat from this period.[89]

Szirma and Szirmabesenyő lie to the south, near the city of Miskolc. Bone assemblages from these sites were the richest among the collections dated to the Roman period. Cattle remains dominated in both deposits, followed by the bones of pig and Caprinae. Hunted animals were also identified. In addition to the most common games, remains of aurochs, beaver and badger were found at Szirma. A similar species composition was observed in the easternmost region of Hungary from this period. Of the settlements at Apagy–Peckés-rét and Beregsurány–Barátságkert, the latter was richer in archaeozoological material. The Apagy site, however, yielded more remains of hunted animals, including the bones of aurochs and brown bear.[90]

Of the poorly represented medieval sites, the high status settlements of the bailiff's centre at Szabolcs and Szendrő, Upper Castle are worth mentioning. Meat provisioning at the Árpádian Age site of Szabolcs was based on domestic animals, but hunting, fowling and fishing were also practiced. Cattle remains dominated the bone assemblage. Bison, Cervidae and wild boar were identified among the hunted animals.[91] The recently studied bone deposit from the 17th century site of Szendrő, Upper Castle yielded the most numerous remains from the Middle Ages in north-eastern Hungary. Cattle remains strongly dominated the bone deposit. The second most exploited domestic animals were pig and hen. In addition to the most common poultry species, turkey was identified from a tarsometatarsus fragment. According to the evidence of the spur, this individual was a male. Based on the remains of various species, hunting, fowling and fishing were also practiced around the castle.[92]

The Pocsaj area

Pocsaj lies south of Csaroda in Hajdú-Bihar County. The area is criss-crossed by the branches of the Berettyó, Kis Körös and Sebes Körös rivers. The prehistoric settlements at Berettyószentmárton and Berettyóújfalu yielded rich Late Neolithic assemblages of the Herpály culture. The Berettyószentmárton settlement is a major Neolithic site in north-eastern Hungary. Over 2700 animal bones were excavated, representing a broad scale of species. An interesting feature of the assemblage is that more wild animals were hunted than domestic animals slaughtered. Aurochs seems to have been the most preferred game; it represents 39% of the animals killed (MNI). The amount of aurochs bones (NISP) was followed by red deer, accounting for 20% of the total number of individuals. Among domestic animals, the bones of cattle (17%) and pig (9%) occurred most commonly. Small ruminants were surprisingly under-represented in this assemblage: sheep and goat made up only 3% of the total number of animals (MNI). The number of dogs was also very low (10 individuals).[93] Various wild species were hunted, such as

87 *Bökönyi* (1959) 50.
88 *Vörös* (1986) 98–124.
89 *Bökönyi* (1974) 389.
90 *Vörös* (1990-1992) 60.
91 *Vörös* (1990d) 166.
92 *Tassi* (2006).
93 *Bökönyi* (1959) 53–54.

beaver, wild cat, lynx and otter (*Lutra lutra*). In addition to mammal bones, a humerus fragment of a white-tailed eagle (*Haliaëtus albicilla*) was found as well.[94]

The bone and species composition of the sample from the eponymous site of the Herpály culture at Berettyóújfalú–Herpály is similar to that of the previous settlement, but the number of both the excavated remains and species identified were smaller. Skeletal parts of wild animals, such as aurochs, red deer and wild boar, were excavated in greater numbers than those of domestic animals, including cattle, Caprinae and pig.[95]

The Late Bronze Age settlement of the Gyulavarsánd culture at Berettyóújfalu–Szilhalom also yielded a considerable number of animal remains. Unusually, pig provided the most numerous bones and individuals, but cattle and Caprinae remains were also well represented. Various wild mammals, birds and pond tortoise were identified at this settlement.[96]

The site of the Nyírség culture at Gáborján–Csapszékpart lies quite near to the previously described settlements and it yielded hundreds of animal bones. Cattle was the best represented animal, followed by small ruminants and pig. Among the hunted species, red deer provided the most numerous remains.[97]

Another Middle Bronze Age settlement, the Gyulavarsánd culture site at Bakonszeg–Kádárdomb was established south-west of the afore-mentioned sites. It yielded the richest archaeozoological material from the Bronze Age in north-eastern Hungary. Cattle, Caprinae and pig were well represented at Bakonszeg–Kádárdomb, as well as red deer, wild boar and aurochs among wild animals. Brown bear, lynx, beaver and badger were also reported from this site.[98]

The Sarmatian settlement at Biharkeresztes–Ártánd-Nagyfarkasdomb from the 2nd–3rd centuries yielded a few hundred animal remains. Cattle bones were found in the greatest number, followed by Caprinae and pig remains. In addition to the most common domestic animals, domestic donkey was also identified in the bone assemblage from this site.[99]

The Hortobágy Plain

This Hortobágy Plain extends on both sides of the Hortobágy River, on the boundary of Hajdú-Bihar and Jász-Nagykun-Szolnok Counties. It covers approximately 27,000 hectares and its area includes what was one of the main grazing grounds in Hungary, home to famous stud farms and herds. Phytogeographic similarities between the south Russian steppe and patches of vegetation in the Great Hungarian Plain have attracted attention for decades.[100] In spite of local characteristics, it is quite common, for example, for the grass to burn out during the hot, continental summers.

Several thoroughly investigated settlements lie on the outskirts of Tiszavasvári, which have yielded animal bones from different periods. Three Alföld Linear Pottery sites are known from the Middle Neolithic: Tiszavasvári–Deákhalmi-dűlő, Tiszavasvári–Keresztfal and Tiszavasvári–Municipal cemetery. Tiszavasvári–Deákhalmi-dűlő was the richest settlement in terms of its archaeozoological material. Small ruminants dominated both the number of remains and the minimal number of individuals. They were followed both in MNI and NISP by cattle and pig bones. A horse bone also was found.[101] The settlement at Tiszavasvári–Municipal cemetery from the same period yielded fewer remains of the most common domestic and wild species.[102] Finally, the bone assemblage from Tiszavasvári–Keresztfal was of modest size, but it too contained remains of the afore-mentioned animals.[103]

94 *Jánossy* (1985) 68.
95 *Bökönyi* (1959) 55.
96 *Bökönyi* (1988) 124.
97 *Ibidem* 124.
98 *Ibidem* 124.
99 *Bökönyi S.:* Szarmata állatcsontleletek Biharkeresztes–Ártánd-Nagy- és Kisfarkasdombról. DMÉ (1982) 263.
100 *Bartosiewicz* (2003) 106.
101 *Vörös* (1994) 167–169.
102 *Ibidem* 177.
103 *Bökönyi* (1974) 417.

Tiszalúc is located west of Tiszavasvári. It yielded Late Neolithic, as well as Middle Copper Age assemblages. The material from the Neolithic settlement of the Tisza culture at Tiszalúc–Vályogos is not abundant. The most common domestic and hunted animals were identified with a clear dominance of cattle. The Bronze Age settlement of the Hatvan culture at Tiszalúc–Dankadomb, on the other hand, offered a large and rich assemblage. Aside from the dominance of cattle, Caprinae and domestic pig were represented more-or-less equally. The broad range of wild animals also included the remains of birds, among others, cormorant (*Phalacrocorax carbo*), possibly black stork (*Ciconia cf. nigra*), and crane.[104]

The town of Polgár lies south-west of Tiszalúc. Excavations in its surroundings brought to light the remains of many multi-period settlements. The Middle Neolithic settlement of the Szilmeg culture at Polgár–Basatanya provided only a small assemblage of animal remains. Cattle was the only species that yielded numbers of bones worth mentioning. Horse was identified from this site as well. A leg bone of a crane was also found at this settlement.[105]

The stratified tell settlement of the Tisza and Herpály cultures at Polgár–Csőszhalom provided the most abundant archaeozoological assemblages from north-eastern Hungary. The first excavation in 1957 yielded several hundred bones. Game animals dominated over domestic animals with 1670 remains of 479 individuals *versus* 730 remains of 270 individuals. In addition to the bones of mammals, the remains of fish, pond tortoise, purple heron (*Ardea purpurea*) and eagle owl (*Bubo bubo*) were identified. The range of wild animals, representing fourteen taxa, is more colourful than that of the domestic animals (five taxa).[106]

Recent excavations at Polgár–Csőszhalom conducted between 1989–2000 yielded new material. The animal bones unearthed both at the recently discovered horizontal settlement of Polgár 6 and the tell settlement at Polgár–Csőszhalom totalled almost 30,000 remains. Fundamental differences in animal composition were observed between the two sites. Remains of wild animals dominated at the tell settlement (53% *versus* 47%), while the remains of domestic species dominated over those of game animals (63% *versus* 37%) at the horizontal settlement. It is worth mentioning that small ruminants yielded few bones, suggesting that these animals held little interest for this community. The relatively great number of dog remains indicates the importance of this species in the life of prehistoric Polgár. Among the great number of hunted animals, interesting faunal elements include fallow deer, wild ass and brown bear.[107] The bird bone remains from this important site will be evaluated in the near future.

The animal bone sample from the Middle and Late Copper Age Bodrogkeresztúr and Baden layers at Polgár–Basatanya differed from the Neolithic assemblages. One characteristic feature of Copper Age materials is that the remains of small ruminants and pig dominate the middens. In addition to mammals, birds, pond tortoise and catfish (*Silurus glanis*) were also identified. The Bronze Age Füzesabony level of the settlement did not yield a rich animal bone assemblage. The most common domestic and wild mammals, as well as bones of pond tortoise, lizard, snake and fish were identified.[108]

The transitional Tiszapolgár–Bodrogkeresztúr site at Tiszavalk–Tetes yielded animal remains both from the cemetery and the settlement. Sixteen of the twenty-five graves contained animal offerings. Graves yilding only one animal species, as well as graves containing "species combinations" (cattle and sheep, aurochs and sheep, and cattle, sheep and pig) were found. Altogether six species could be identified from these skeletal parts, and sheep was the most frequent offering. In the domestic refuse, Caprinae remains were the most frequent, followed by cattle bones. Seven different skeletal elements of domestic horse were identified. A single bone of a spoonbill (*Platalea leucorodea*) was also found in the latter assemblage.[109]

104 *Bökönyi* (1974) 413–414.
105 *Bökönyi* (1959) 50; *Jánossy* (1985) 70.
106 *Bökönyi* (1974) 394.
107 *Schwartz* (1998); *Schwartz* (2002).
108 *Bökönyi* (1959) 55–64.
109 *I. Vörös:* Animal remains from the funeral ceremonies in the Middle Copper Age cemetery at Tiszavalk–Tetes. FolArch 37 (1986) 75–97; *Jánossy* (1985) 75.

The Middle Copper Age Hunyadihalom assemblage from Tiszalúc–Sarkad is the richest archaeozoological material from this period. Tens of thousands of bones from a great variety of taxa were excavated. Cattle remains highly dominated the bone assemblage, by over 40,000 remains. The second best represented domestic animal was pig, but the amount of this material made up only 10% of the cattle bone component. Also, this site yielded the most numerous domestic horse remains from the Copper Age. The list of wild animals is unique as well. Cervidae provided the mass of these bones. In addition to red deer, elk and Mesopotamian fallow deer were also identified in the assemblage. Different carnivorous species such as brown bear, wolf, red fox, wild cat, lynx and lion colour both the taxonomic and ecological pictures of this site. Among birds, waterfowl, eagles and crane were identified.[110]

The Celtic cemetery at Tiszavasvári–Városföldje yielded remains of sheep, pig, red fox (!) and domestic hen.[111] Bone deposits at this site contained several hundreds of remains. The excavations yielded cattle and Caprinae bones in great numbers, as well as the remains of a few hunted animals. Domestic donkey bones were also identified in the assemblage.[112] The settlements of Tiszavasvári–Paptelekhát and Tiszavasvári–Téglás were poorer in archaeozoological material. At the previous site, cattle and horse remains were numerous, while at the latter only a cattle horn core was found. Finally, an Avar period grave from Tiszavasvári–Vöröshadsereg Street yielded the skull of a 6–7 years old horse, and the Árpádian Age layers of the settlement at Tiszavasvári–Paptelekhát contained a few remains of cattle, pig and dog.[113]

The Jászság region

The Jászság region covers approximately 5000 hectares, and it includes areas along the Danube, Tisza, Körös, Zagyva rivers and the Sárrét marshland. This region is the southernmost section of the area discussed in this monograph. It lies in present-day Jász-Nagykun-Szolnok and Bács-Kiskun Counties. Even though many archaeological sites were uncovered in this region, the majority provided only meagre bone assemblages.

The earliest animal bone remains that may be connected to human activity in this region were excavated at the Upper Palaeolithic settlement of Jászfelsőszentgyörgy–Szunyogos. Species identified from this campsite – reindeer and willow grouse – belong to the Late Pilisszántó faunistic phase.[114] The number of remains from the settlement of Jászberény I hardly exceeded one hundred, but several species could be identified in it. Aurochs and wild horse (*Equus gmelini*) remains dominated this rare collection, but other species such as red deer, roe deer, wild boar, birds and pond tortoise were also identified.[115]

The Early Neolithic Körös settlement at Szajol–Felsőföld near Szolnok yielded a reasonably rich bone assemblage: 1439 specimens of at least 207 individuals were identified. The dominance of small ruminants, not only over the remains of cattle, but also over the rest of the other species is noteworthy. Bones of sheep and goat formed 47% of the total number of the remains collected, that is 63% of the minimum number of individuals. Aurochs was the most frequent among hunted animals.[116] In addition to mammals, four bird species indicative of aquatic and humid environments and big bustard (*Otis tarda*) were identified. A rich bird bone material consisting of waterfowl, terrestrial birds and corvids was identified at the Körös settlement of Szolnok–Szanda as well.[117]

The Körös site at Kőtelek–Huszársarok from the same period, and the Alföld Linear Pottery settlement from the Middle Neolithic at Jászberény–Cserőhalom yielded only a small number of bones.

110 *Vörös* (1987) 125; *Jánossy* (1985) 74.
111 *Vörös* (1999b).
112 *Vörös* (1990–1992) 59.
113 *Bökönyi* (1974) 418–419.
114 *Vörös* (1993).
115 *Kertész et alii* (1994–1995) 23.
116 *Vörös* (1980) 56–57.
117 *Jánossy* (1985) 73.

Cattle and Caprinae accounted for most of the bone remains.[118] Black-throated diver (*Gavia arctica*), grey heron (*Ardea cinerea*) and a crane were also identified at Kőtelek–Huszársarok.[119]

The Late Neolithic Tisza settlement at Öcsöd–Kovácshalom yielded a rich bone assemblage with over 10,000 remains. In addition to the domestic animals typical for the Neolithic, eighteen wild animal species, including fish, pond tortoise and bird were identified. The bones of wild ass are one of the latest occurrences of this species in Hungary. Cattle dominated the category of domestic animals while, surprisingly, roe deer bones were the most numerous in the group of hunted animals.[120]

The only representative material from the Bronze Age comes from Tószeg–Laposhalom. Cattle was the most frequently slaughtered animal, followed by horse, red deer and Caprinae. Remains of bison, brown bear and wolf were also excavated.[121] The tell settlement of Jászdózsa–Kápolnahalom yielded a few animal remains, but some of them were found in unusual contexts.[122] One of the settlement features contained the complete skulls of different animals such as aurochs, red deer, wild boar, brown bear and pig.[123] Unfortunately, the archaeozoological analysis of these remains has not been performed yet.

The settlement at Tiszaföldvár–Brickyard yielded archaeozoological remains from two different periods. A lion bone was recovered from Pit 6, dating from the late Middle Copper Age.[124] The Roman period Sarmatian deposit of this site provided thousands of bones. It is the richest archaeozoological material from this period in the region. Cattle remains, followed by the bones of Caprinae, dominated at this site. Other domestic species were well represented and domestic donkey was identified as well. On the other hand, only a few remains of hunted animals were found.[125]

Other sites from the Iron Age and the Roman Imperial period yielded scarce bone deposits. The same holds true for the Migration period and the Middle Ages in this region. The species composition from the Ottoman period site at Szolnok Castle, however, is noteworthy. The majority of remains belonged to small ruminants, that is Caprinae, while pig bones were not found at this site. Most probably, the bone deposit was accumulated by Turkish people, as the castle was under the Ottoman occupation.[126]

Tarnabod

The multi-period settlement at Kompolt–Kistér lies east of Tarnabod. It yielded about 3500 remains from four different periods. The most numerous bones were recovered from the Early Neolithic (Alföld Linear Pottery culture) and from the Sarmatian layers, while the Bronze Age Makó culture and the Avar period levels yielded much fewer animal remains. At this settlement, cattle bones were represented in great numbers, followed by Caprinae and pig remains. Wild animals were under-represented both in the Neolithic and the Sarmatian layers.[127]

Tarnabod is located on the boundary between the Hortobágy and Jászság regions. This settlement yielded one of the richest bone assemblages of the Copper Age Bodrogkeresztúr culture. Cattle provided the greatest numbers, both in terms of bones and individuals at this site, followed by small ruminants and pig. Remains of several wild animals, such as aurochs, Cervidae, wild boar, hare and birds were also excavated.[128]

The Boleráz site at Gyöngyöshalász–Encspuszta provided a rich animal bone assemblage. The settlement is located west of Tarnabod. Remains of small ruminants dominated the bone deposit. The

118 *Bökönyi* (1974) 369; *Vörös* (1980) 56–57.
119 *Jánossy* (1985) 71.
120 *Bökönyi* (1985).
121 *S. Bökönyi:* Die Wirbeltierfauna der Ausgrabungen in Tószeg vom Jahre 1948. ActaArchHung 2 (1952) 71–113; *Bökönyi* (1959) 62.
122 *Bökönyi* (1974) 370.
123 *J. Tárnoki:* The expansion of the Hatvan culture. *In:* Hungarian archaeology at the turn of the millennium. Ed.: Zs. Visy. Budapest 2003, 146.
124 *Vörös* (1983) 38.
125 *Vörös* (1990–1992) 59.
126 *Bökönyi* (1974) 406.
127 *Bartosiewicz* (1999) 324.
128 *Bökönyi* (1959) 60.

second best represented species was cattle. The under-representation of pig (thirteen bones of four individuals) is striking. Lion remains were found at this site, as well as the bones of pond tortoise and fish.[129] This latter group of animals included pike (*Esox lucius*; four individuals); catfish (three individuals); carp (*Cyprinus carpio*; four individuals) and sander (*Lucioperca lucioperca*; one individual).[130]

The sites of Füzesabony and Füzesabony–Szikszópuszta, east of Tarnabod, yielded bone materials from three different periods. Only a few remains of the most common domestic and wild animals were brought to light from the Copper Age Ludanice section of the Füzesabony–Szikszópuszta settlement,[131] while the latest, Migration period settlement part furnished only a few dozens of bones of the same, commonly occurring species.[132] The Bronze Age Füzesabony levels of the eponymous site at Füzesabony yielded a representative material from an archaeozoological point of view. Red deer remains (289) dominated in the assemblage, followed by cattle remains (188). Small ruminants and pig, as well as roe deer were represented by remarkable numbers of bones. Remains of brown bear, red fox, wild cat and fish were part of an interesting bone assemblage. A single leg bone of a crane was also recovered from this site.[133]

The town of Mezőkövesd is located north-east of Füzesabony, in Borsod-Abaúj-Zemplén County. Sarmatian levels from this site and the contemporaneous settlement of Mezőkövesd–Csörszárok yielded a few domestic animal bones in which Caprinae and cattle remains dominated.

The Nagybárkány and Sirok area

The last area to be discussed is located north of the Jászság region, west of the Hortobágy and south of the Mohos Lakes. Nagybárkány lies in Nógrád County, in the westernmost part of the studied area. Only a few archaeological sites are known from this part of the studied area. The Mátra Mountains rise to the south-east of Nagybárkány. The oldest animal remains from this area come from mammoth, excavated together with a blade of the Szeleta culture at the Mátraderecske site.[134]

North of Nagybárkány, the town of Salgótarján overlies sites from different periods. Salgótarján–Pécskő, one of the richest Copper Age sites, is representative of the Baden culture. Several hundreds of animal bones were excavated at this settlement. Cattle remains were the most frequent, but bones of other domestic species, as well as hunted animals were also found. Red deer and roe deer provided the most numerous finds among wild species, but brown bear and wild cat were identified, too. The Bronze Age Nyírség layers of this settlement were less rich, but the species composition is similar to that of the assemblage described above.[135] The Late Bronze Age Tumulus site at Salgótarján–Bread bakery yielded a negligible amount of animal bones. Cattle was the only species that was represented by a few dozen bones.[136]

The recently excavated settlement at Salgótarján–Industrial Park II yielded a great number of animal remains. Bones from the Copper Age layers were not numerous; in contrast, several thousands were recovered from the Scythian period settlement. Cattle and Caprinae remains were present in a comparably great number, over 1600 fragments each. Compared to these species, pig and game bones were under-represented. This site, however, yielded a relatively great number of horse and non-identifiable small Equidae bones, 129 specimens altogether. Twenty remains of bison were also excavated. Bird remains included the incomplete skeleton of a jackdaw (*Corvus monedula*), and elements of a goshawk (*Accipiter gentilis*) and a rook/hooded crow (*Corvus frugilegus/C. corone*) were identified. The detailed analysis of this bone deposit is in progress.[137]

129 *Vörös* (1982–1983).
130 *Takács* (1982–1983) 70.
131 *Vörös* (1990b).
132 *Vörös* (1989–1990) 199.
133 *Bökönyi* (1959) 65–66; *Jánossy* (1985) 72.
134 *Vörös* (1975).
135 *Bökönyi* (1968).
136 *Bökönyi* (1974) 397.
137 *Bartosiewicz – Gál* (2006).

Sirok lies in Heves County, close to the eastern edge of the Mátra Mountains. Only the Iron Age Hallstatt settlement of Felsőtárkány–Várhegy is located in this region. It yielded the second most representative animal bone assemblage after the Salgótarján–Industrial Park II site from this epoch. At this settlement, however, the dominant component of cattle bones in the assemblage was followed by pig remains, rather than those of Caprinae. Among game animals, the remains of red deer and wild boar were particularly numerous.[138]

Archaeozoological material was brought to light at the Iron Age and Roman period sites uncovered in the town of Szilvásvárad, south of the studied area. The assemblage from the Szilvásvárad–Sportpálya site dating from the Roman period was more abundant in bones than the Hallstatt period site at Szilvásvárad–Töröksánc.[139] Cattle and pig remains dominated in the bone collection. A few hunted animals were identified, such as red deer, roe deer, wild boar and brown hare.

Skeletal parts of pig and hen were found in the Celtic cemetery at Mátraszőlős.[140] The 13th century settlement at Mátraszőlős–Kisvár yielded the most abundant animal material from the Árpádian Age. One characteristic feature of this assemblage was that pig remains were the most numerous. Poultry was represented by domestic hen and goose. Few hunted animals, such as wild boar and hare yielded one bone each. In addition to these, a small number of fish remains were also found.[141]

DISCUSSION

Altogether 163 archaeological sites yielded animal bone assemblages from the period between the Palaeolithic and Middle Ages in north-eastern Hungary. Each period – except for the Palaeolithic, the Mesolithic, the Iron Age and the Middle Ages – was represented by twenty to thirty sites *(Tables 1–8)*. Areas which have recently been studied using a geo-archaeological approach, were generally represented by ten to fifteen sites, which yielded noteworthy animal bone collections. Since the many excavations conducted in the 20th century had widely differing research objectives, the richness of the animal bone assemblages varied. The location of settlements with rich bone assemblages is random in comparison with the geoarchaeological locations systematically selected for addressing palaeoenvironmental issues.

Very often, there is a hiatus between various periods within a region. This is largely due to the small number of excavated Iron Age and medieval sites compared with the number of Neolithic, Copper Age and Bronze Age ones. Although sites from the Migration period are quite numerous, these are mostly cemeteries, whose burials contained small numbers of bones representing but a few species (often only horse). Settlement sites are hardly known from this period in north-eastern Hungary.

Contrary to natural accumulations of plant and animal remains, animal bone deposits recovered from human settlements primarily reflect the dietary preferences and other needs of their occupants in selecting the hunted and/or slaughtered animals. The wild animal species were part of the coeval fauna and provide valuable information about the natural habitats around a particular settlement. Still, it must also be borne in mind that some species may not have been hunted. Other animals or their parts may have been traded (e. g. as trophies) and may thus originate far from the studied area. On the other hand, the list of game animals usually mirrors the fauna selectively, reflecting the main preferences of communities in one particular period and area, as well as the capability of hunting certain animals. In this respect, Palaeolithic and Mesolithic deposits would offer the most complete and accurate environmental picture as the meat provision was exclusively provided by hunting, fishing and gathering.

Animal husbandry is known only from the beginning of the Neolithic. Younger archaeozoological deposits usually include the remains of several domestic species. It may be presumed that the ratio of hunted *versus* domestic animals is higher in the case of the seasonally occupied early settlements. A

138 *Bökönyi* (1974) 360.
139 *Ibidem* 404–405.
140 *Ibidem* 380.
141 *Vörös* (1990c).

greater number of remains from domestic species would indicate more or less permanent settlements, where meat provision was based on animal husbandry. When drawing conclusions from bone assemblages, however, one has to bear in mind that the studied sample represents only a part of the original food refuse and not the bone deposit accumulated during the entire period of occupation.

None of the six regions discussed here provided successive faunas for all ages, and it is therefore impossible to continuously trace environmental changes. The Palaeolithic and Mesolithic occupants had an excellent knowledge of the habits and seasonal presence of wild animals. The additional sources of meat were exploited in the form of seasonal activities, highly adapted to the presence of, and access to, the wild animals targeted.

The Istállóskő Cave in the region of the Mohos Lakes yielded a very rich Palaeolithic fauna. Animals living at the altitude of 535 m included several species adapted to rocky and woodland habitats, but steppe species were identified as well. According to the radiocarbon dates, the cave was inhabited seasonally for thousands of years. Archaeozoological investigations indicated that most parts of the site were used as autumn-winter habitations.[142] Neolithic game species exploited in this region include forest and forest-steppe species such as Cervidae, red fox, wild boar, aurochs and wild horse. These animals, as well as wild cat and brown bear, were present during the Copper and Bronze Ages, as well as in the Roman period. Bison, hunted until the Middle Ages, became confined to game parks by the 18th century.[143] In general, poor assemblages of wild fowl and fish remains are known from this region. To some extent, this may be due to the mountainous environment, but chiefly to excavation techniques: the remains of small animals cannot be properly retrieved by hand. Dry and water-sieving, however, were seldom practiced at the sites under discussion here.

Sites in the Pocsaj area presented similar faunal elements, especially in the Neolithic and Bronze Age. Forest species, such as Cervidae, lynx, wild cat and brown bear, as well as forest-steppe animals (e.g. aurochs) were hunted. The wide marshy environments were suitable for the exploitation of waterfowl.

Similarly to the previous regions, the Hortobágy Plain was inhabited by forest and forest steppe game in prehistoric times. The Neolithic and Copper Age assemblages contained various species of Cervidae, as well as brown bear, wolf, red fox and wild cat. Among the steppe elements, lion was also identified in this region. Extensive grasslands in this region provided a favourable habitat for Equidae (wild horse, wild ass and domestic horse) whose remains were found in all periods.

The surroundings of Tarnabod yielded mainly animal materials from the Copper and Bronze Ages. Except for Equidae, all of the afore-mentioned species were identified. Lion remains originate from the Copper Age just like in the neighbouring Hortobágy area.

The Jászság region is one of the few areas that yielded Epipalaeolithic as well as Mesolithic finds. Reindeer, wild horse and willow grouse described from the campsite at Jászfelsőszentgyörgy–Szunyogos are all indicative of a taiga-steppe environment. This kind of habitat changed gradually to a deciduous forest environment during the Mesolithic.[144] Animal remains from this period – e.g. Cervidae, wild boar and aurochs identified at the Jászberény I settlement – support the observation that the climate became milder and more humid. The Neolithic faunal elements included both forest and forest-steppe species. Lion was identified from the Middle Copper Age, while bison from the Early Bronze Age. Bronze Age settlements in this area generally yielded numerous wild animal species. Many of these, such as brown bear, wolf, wild boar and red deer, indicate that major forests still existed here in the Middle Bronze Age. This observation is important because data obtained by geo-archaeological methods at Portelek–Meggyeserdő indicated the total absence of woodland starting from the end of this period throughout the Iron Age.[145]

142 *Vörös* (1984) 18–21.

143 *Vörös* (2003b) 74.

144 *P. Sümegi – R. Kertész – E. Rudner:* Palaeoenvironmental changes and human influence. *In:* Hungarian archaeology at the turn of the millennium. Ed: Zs. Visy. Budapest 2003, 53–54.

145 Cp. *Pál Sümegi*, this volume (pp. 107–114).

Even though only small zoological assemblages were brought to light at sites in the surroundings of Nagybárkány and Sirok, these furnished important data from the Copper and Iron Ages. Neolithic animal remains have not yet been excavated in this region. Wild animals typical for dense woodland habitats, such as Cervidae, brown bear, red fox and wild cat, as well as forest-steppe species, bison and aurochs, were identified.

It is clear from the above that no significant differences can be observed between the inventories of hunted animals from the studied regions. Data on domestic animals give an even more homogeneous picture, as cultural traditions in animal husbandry seem to have been maintained, sometimes even in the face of unfavourable environmental conditions. One case in point comes from a site in south-eastern Hungary. A major Caprinae assemblage was recovered from the Early Neolithic Körös site of Ecsegfalva 23. The marshy environment in this area was evidently unsuited to keeping Caprinae, a fact that was reflected also in the small sizes of sheep.[146] Arriving as they did from the Mediterranean, the early inhabitants of the Great Hungarian Plain apparently clung to their traditional form of animal husbandry and tried to maintain their original way of life even after their arrival to the Carpathian Basin. A similar phenomenon was observed in the case of the Scythian period settlement at Salgótarján–Industrial Park II. Pig would have been a domestic animal better suited to the hilly, forested habitat, but the inhabitants of the settlement nonetheless preferred sheep and goat.[147]

Among the species identified in the settlement refuse, cattle is the most frequent mammal in all periods, regardless of the geographical location of sites. Certainly, we know assemblages in which remains of small ruminants or pig dominated, but these cannot be linked to any particular period or region. The only exceptions are the animal remains originating from Ottoman Turkish contexts, in which pig bones are either absent or at least under-represented owing to the Islamic dietary tradition.

Sheep and goat, domesticated in the Near East where their wild ancestors lived, were introduced to the Carpathian Basin from the Balkans. At the beginning of the Neolithic, the wild and domestic forms of almost all other species lived parallel to each other in the region. Dog, the first domestic animal, originates from tamed wolves in the Mesolithic. The ancestor of cattle, aurochs, was a native species in the Carpathian Basin and it only became extinct in the 10th century.[148] Domestic pig appears also in the Neolithic, but has existed parallel to its wild ancestor in all historical ages.

The most recent evidence concerning the occurrence of horse suggest that the wild form survived on the present day territory of Hungary until the Mesolithic. Although horse remains from the Tiszapolgár settlements at Kenderes–Kulis and Kenderes–Telekhalom were ascribed to the domestic form,[149] the first occurrence of domestic horse in Hungary is more likely in the Middle Copper Age. The same holds true for wild ass, but bone evidence for the domestic form is known only from the Iron Age and the Roman period.[150] Copper Age remains of domestic horse were excavated in the Hortobágy, and at Tarnabod and Nagybárkány as well *(Table 3)*. The first proof for domestic donkey in the studied area comes from the Roman period, from the surroundings of Pocsaj *(Table 6)*.

Although a number of wild fowl species have been identified in bone assemblages from Neolithic sites, these have not been included in the tables published here, but have been discussed in a separate paper.[151] The frequency of bird remains decreases significantly after the Neolithic. The first evidence for domestic fowl – similarly to other Central European sites – is known from the Iron Age. The number of poultry remains increased noticeably during the Roman period, when different breeds seem to have been known.[152] The turkey tarsometatarsus, identified at the Ottoman period site of Szendrő, Upper

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146 *L. Bartosiewicz:* Plain talk. *In:* The Early Neolithic on the Great Hungarian Plain: investigations of the Körös culture site of Ecsegfalva 23, Co. Békés. Ed.: A. Whittle. Budapest 2006 (in preparation).

147 *Bartosiewicz – Gál* (2006).

148 *Vörös* (2003b) 74.

149 *Bökönyi* (1974) 373.

150 *Vörös* (2003b) 74.

151 *Gál* (2004).

152 *S. Bökönyi:* Animal husbandry and hunting in Tác–Gorsium. The vertebrate fauna of a Roman town in Pannonia. Budapest 1984, 94, 117.

Castle (lying beyond the Turkish occupied territories in Hungary), is the northernmost early evidence for this species in Hungary.

The development of cult practices in connection with different animals is an interesting subject in archaeology. The attitudes of ancient communities towards certain animals varied from period to period. It is reflected in the cave paintings and statuettes produced by the earliest humans, in idols present through the ages, as well as in animal burials and offerings of all kinds. The preference or, conversely, avoidance of flesh from certain species is another important cognitive aspect of animal exploitation.

The great number of Neolithic clay figurines includes various animal depictions.[153] Bull idols were found at the Körös settlement of Szolnok–Szanda in close proximity to each other. They suggest a special interest in these huge and powerful animals. Bull representations were associated with male virility.[154]

Aurochs horns were found under the house floors at the Late Neolithic settlement of Berettyóújfalu–Herpály.[155] Knowing that evidence for horns being used as building material has not been reported from other sites, they must have had a ritual meaning at the Herpály settlement. Similarly to these foundation deposits, dog remains were uncovered under the walls and floors of houses at the Bronze Age tell settlements of Jászdózsa–Kápolnahalom and Tószeg–Laposhalom. Skulls of other animals, such as aurochs, red deer, wild boar and brown bear, were placed in a pit under the floor of the inner ditch at Jászdózsa–Kápolnahalom.[156] The Bronze Age in Hungary is well known for its many bird representations. The ones from the settlement at Füzesabony are especially famous: no less than twenty bird idols, probably related to cults and rituals, were brought to light at this site.[157]

Remains of the most common domestic animals were found in cemeteries in the studied region. The majority of the animal remains from Iron Age deposits in north-eastern Hungary were grave goods. Domestic and wild mammals as well as poultry were buried with the deceased *(Table 5)*. The Migration period is famous for the great number of horse burials. In addition to the interment of complete horses, especially in the Avar period, the remains of this important and valuable animal seem to originate mainly from hides placed near the buried persons. Not only burials of men, but graves of women and children too contained horse remains.[158] This tradition is most characteristic of people of steppean origins. Religious habits are also reflected in archaeozoological remains from the Middle Ages. The consumption of meat was generally avoided in various periods of fasting, especially Lent, the forty weekdays lasting from Ash Wednesday to Holy Saturday. This time period commemorated Jesus' fasting in the wilderness, a custom connected to the purification process that preceded Easter. The tradition, however, allowed the eating of fish and even aquatic mammals such as beaver and otter. Another reflection of dietary habits and cultural traditions, which may often be noticed in bone deposits, is the lack or small proportion of pig remains in the deposits of settlements occupied during the Ottoman period mentioned above. Clear indications of this phenomenon have so far only been found at Szolnok Castle among the sites discussed here *(Table 8)*.

CONCLUSIONS

As has been discussed in detail by László Bartosiewicz,[159] the complex evaluation of faunas that have been formed over a long time and originate from wide areas is a rather difficult task, as a number of natural and anthropogenic factors must be taken into consideration. Hiatuses both from a chronological

153 *Bánffy – Goldman* (2003) 116–117.

154 *Kalicz – Raczky* (1981) 17.

155 *Bánffy – Goldman* (2003) 117.

156 *Vörös* (1996) 87.

157 *I. Szathmári*: The florescence of the Middle Bronze Age in the Tisza region: the Füzesabony culture. *In:* Hungarian archaeology at the turn of the millennium. Ed.: Zs. Visy. Budapest 2003, 156–158, Fig. 22.

158 *Vörös* (2001) 588–589.

159 *L. Bartosiewicz:* The emergence of holocene faunas in the Carpathian Basin: a review. *In:* The holocene history of the European vertebrate fauna. Modern aspects of research. Ed.: N. Benecke. Archäologie in Eurasien 6. Rahden/Westf. 1999, 73–90.

and regional point of view, as well as major differences in the aims of excavations make our task even more difficult.

The oldest (Palaeolithic and Mesolithic), as well as some of the younger periods (e.g. the Iron Age and the Middle Ages), are under-represented in terms of bone deposits and the species identified in north-eastern Hungary. The greatest number of sites and the richest zoological materials were excavated from the Neolithic, the Bronze Age and the Roman Imperial period.

The Palaeolithic and Mesolithic bone assemblages originated from the cave sites and the campsites of hunter-gatherers. Only wild animals were present in the Carpathian Basin during these periods. In addition to large game for meat provision, human communities also targeted fur animals. The hunting of mammals was often supplemented by fowling, fishing and gathering eggs and molluscs. Many of these animals were only available seasonally and they thus provide accurate data concerning the period of human activity and, consequently, of the occupation of settlements. Although fish bones were not found in the studied Palaeolithic and Mesolithic deposits, the artefacts related to fishing have been excavated at these sites and the location of the camps too suggest this activity.

Beginning with the Neolithic, meat was provided increasingly by domestic animals. The hunted species reflect not only the environmental characteristics of a particular region, but also the dietary preferences and cultural traditions of a particular community. Therefore, one always has to reckon with selective human activity. Nevertheless, wild animals reflect the mosaic patterning of the environment as reconstructed for every archaeological period.

Animal husbandry was based on the most common species, such as cattle, small ruminants and pig. Small differences concerning the species composition – e.g. the ratio of domestic and hunted animals or the ratio between the afore-mentioned domestic species – may be observed between sites. However, this general overview of north-eastern Hungary suggests that animal exploitation was influenced by a host of complex factors. These included the geographical position of settlements, the environmental/climatic conditions during the period in question, as well as human requirements. The environmental analysis of archaeozoological samples is further complicated by the fact that meat consumption and attitudes towards animals in general are culturally idiosyncratic. This tendency is clearly shown by some of the archaeozoological assemblages from north-eastern Hungary.

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Palaeolithic and Mesolithic sites	*Bos primigenius*	*Bison priscus*	*Rangifer tarandus*	*Alces alces*	*Cervus elaphus*	*Capreolus capreolus*	*Capra ibex*	*Rupicapra rupicapra*	*Sus scrofa*	*Equus ferus gmelini*	*Equus* sp.	*Lepus timidus*	*Leo spelaeus*	*Felis silvestris*	*Lynx lynx*	*Canis lupus*	*Vulpes vulpes*	*Meles meles*	*Martes martes*	*Putorius putorius*	*Crocuta spelaea*	*Ursus arctos*	*Ursus spelaeus*	*Mammuthus primigenius*	*Lagopus* sp.	Aves	*Emys orbicularis*	Reference
Bodrogkeresztúr–Henye*				×																				×				T. Dobosi (2003) 85.
Mátraderecske*																								×				Vörös (1975).
Subalyuk Cave*							×																			×		Jánossy (1979) 129–132; Vértes (1965) 333.
Szeleta Cave *			×		×		×				×													×				Simán (2003) 83–85.
Istállóskő Cave*	1	15/7	98/19	6/3	17/6		29/8	176/23	1		10/5	365/52	22/8	3/2	22/10	189/15	130/17	4/2	24/9	25/8	14/6	6/2	8543/573					Vörös (1984) 24–27.
Jászfelső-szentgyörgy–Szunyogos**			37/?								11/?														×			Vörös (1993) 78.
Jászberény I***	57/?				17/?	3/?			9/?	36/?																3/?	2/?	Kertész et alii (1994–1995) 23.

*Table 1. Palaeolithic (*), Epipalaeolithic** and Mesolithic (***) sites yielding animal remains (NISP/MNI) from north-eastern Hungary*

Early Neolithic sites	Middle Neolithic sites	Late Neolithic sites	Culture	*Bos taurus*	*Ovis aries*	*Capra hircus*	*Caprinae*	*Sus domesticus*	*Canis familiaris*	*Bos primigenius*	*Cervus elaphus*	*Dama* sp.	*Capreolus capreolus*	*Sus scrofa*	*Asinus hydruntinus*	*Equus* sp.	*Lepus europaeus*	*Cricetus cricetus*	*Castor fiber*	*Felis silvestris*	*Lyny lynx*
Kőtelek–Huszársarok			Körös	23/?			22/?			2/?	3/?		2/?	2/?						4/?	
Szajol–Felsőföld			Körös	576/46			680/131	2/2	4/2	48/9	13/3		9/2	16/4	1		5/3				
	Jászberény–Cserőhalom		ALPC	10/6			3./2			1	1										
	Kompolt–Kistér		ALPC	485/?	14/?	3/?	147/?	96/?	5/?	10/?	3/?			1			6/?				
	Tiszavasvári–Deákhalmi-dűlő		ALPC	380/28			423/46	75/24	2/2	23/8				3/3		1	1		1		
	Tiszavasvári–Keresztfal		ALPC	32/7			20/4	12/2	1	2/1	1						1				
	Tiszavasvári–M. cementery		ALPC	143/7			64/9	26/4	coprolite	11/5	2/?			1				×			
	Aggtelek–Baradla Cave		Bükk					?												×	
	Borsod–Derekegyházi-dűlő		Bükk	56/17			11/5	10/7		2/1	11/4		1				1				
	Tiszaszöllős–Csákányszeg		Bükk	1			2/2						1								
	Folyás–Szilmeg		Szilmeg	53/27			9/4	51/17	7/4	1	9/3		10/3	14/5						1	
	Polgár–Basatanya		Szilmeg	77/9			2/2	4/4	2/1							2/2					
	Tiszalök		?	155/?			72/?	54/?	1		2/?										
		Kisköre	Tisza	34/6			8/4	8/4	1	7/4			6/3	10/5							
		Öcsöd–Kovácshalom	Tisza	×	×	×		×	×	×	×		×	×	×		×		×	×	
		Polgár–Csőszhalom	Tisza	501/151			47/27	157/74	28/18	839/176	403/124		95/48	298/105						1	
		Polgár–Csőszhalom	Tisza	9233/?	64/?	78/?	359/?	4426/?	1187/?	1965/?	5393/?	5/?	3029/?	3701/?	1		174/?	70/?	8/?	40/?	
		Tiszalúc–Vályogos	Tisza	63/18			3/2	8/4		4/2	2/2		1	2/1							
		Berettyószentmárton	Herpály	392/207			43/36	180/111	10/10	1485/477	461/241		35/27	117/82			2/2		18/6	3/3	1
		Berettyóújfalu–Herpály	Herpály	70/27			21/12	32/22	6/4	287/82	82/39		4/4	36/22							
		Szerencs–Taktaföldvár	Tisza	314/28	2/1	13/5	17/6	32/14	1	43/14	47/10		18/5	50/14		1					

Table 2. Neolithic sites yielding animal remains (NISP/MNI) from north-eastern Hungary

Early Neolithic sites	Middle Neolithic sites	Late Neolithic sites	Culture	*Canis lupus*	*Vulpes vulpes*	*Lutra lutra*	*Meles meles*	*Martes martes*	*Ursus arctos*	*Spalax leucodon*	*Arvicola terrestris*	Aves	*Emys orbicularis*	*Esox lucius*	*Silurus glanis*	*Cyprinus carpio*	*Abramis brama*	Pisces	Reference
Kőtelek–Huszársarok			Körös		9/?							1	1					6/?	Vörös (1980) 56–57.
Szajol–Felsőföld			Körös		3/1		3/2					11						67/?	Vörös (1980) 56–57.
	Jászberény–Cserőhalom		ALP																Bökönyi (1974) 369.
	Kompolt–Kistér		ALP									2/?							Bartosiewicz (1999) 324.
	Tiszavasvári–Deákhalmi-dűlő		ALP							2/?	1		6/?					9/?	Vörös (1994) 167–169.
	Tiszavasvári–Keresztfal		ALP															2/1	Bökönyi (1974) 417.
	Tiszavasvári–M. cementery		ALP																Vörös (1989) 146–148.
	Aggtelek–Baradla Cave		Bükk																Bökönyi (1959) 50.
	Borsod–Derekegyházi-dűlő		Bükk		1														Bökönyi (1959) 50.
	Tiszaszöllős–Csákányszeg		Bükk									1							Bökönyi (1974) 415.
	Folyás–Szilmeg		Szilmeg	2/1															Bökönyi (1959) 49.
	Polgár–Basatanya		Szilmeg																Bökönyi, (1959) 50.
	Tiszalök		?		1														Vörös (1994) 177.
		Kisköre	Tisza		1				1			1							Bökönyi (1974) 375.
		Öcsöd–Kovácshalom	Tisza	×	×		×	×	×			×		×	×	×			Bökönyi (1985) 270–271.
		Polgár–Csőszhalom	Tisza	1	4/3		2/1		1			3	9/7					14/9	Bökönyi (1974) 394.
		Polgár–Csőszhalom	Tisza	7/?	5/?			1	1				55/?						Schwarz (1998); (2002) 853.
		Tiszalúc–Vályogos	Tisza															2/1	Bökönyi (1974) 414.
		Berettyószentmárton	Herpály	2/2	5/4	1	1												Bökönyi (1959) 54.
		Berettyóújfalu–Herpály	Herpály																Bökönyi (1959) 55.
		Szerencs–Taktaföldvár										5/?	10/?		×			×	Vörös (1986) 112.

Table 2 (cont'd)

Copper Age sites	Culture	*Bos taurus*	*Ovis aries*	*Capra hircus*	*Caprinae*	*Sus domesticus*	*Canis familiaris*	*Equus caballus*	*Bos primigenius*	*Cervus elaphus*	*Capreolus capreolus*	*Dama mesopotamica*	*Alces alces*	*Sus scrofa*	*Equus sp.*	*Lepus europaeus*	*Castor fiber*	*Felis silvestris*	*Panthera leo*	*Lyny lynx*	*Canis lupus*	*Vulpes vulpes*	*Lutra lutra*
Bodrogzsadány	Early Copper Age					2/2	2/2			3/1	3/3			2/2									
Tiszaigar–Csikóstanya	Early Copper Age	24/4				1			4/3					3/1	1								
Polgár–Basatanya	Early Copper Age	13/7			156/16	156/28	150/5		10/10	3/3	2/2			4/4	2	6/1							
Kenderes–Kulis	Tiszapolgár	82/20			96/25	68/16	1	1	10/4	4/2				4/2	1	1							
Kenderes–Telekhalom	Tiszapolgár	26/7			9/3	17/4	1	1	10/4	2/1				1									
Tiszavalk–Tetes	Tiszapolgár– Bodrogkeresztúr	181/?			225/?	93/?	4/?	7/?	5/?	7/?	3/?						3/?						
Derecske–Brickyard	Bodrogkeresztúr	158/23			10/6	20/7			20/9					1									
Magyarhomorog (grave)	Bodrogkeresztúr					?																	
Polgár–Basatanya	Bodrogkeresztúr	3/3			216/14	170/11		1															
Tarnabod	Bodrogkeresztúr	562/42			69/26	109/22	3/3		83/11	43/13	12/6			31/9		2/2							
Füzesabony–Szikszópuszta	Ludanice		1	skeleton		1					1					1							
Tiszalúc–Sarkad	Hunyadihalom	40438/?			1675/?	3543/?	44/?	116/?	788/?	1726/?	724/?	2/?	1	293/?		25/?	16/?	4/?	14/?	1	1	13/?	3/?
Gyöngyöshalász–Encspuszta	Boleráz	345/32			742/63	13/4	1	9/3		7/2	1			10/3		4/3	1		2/1				
Baja–Dózsa György Street (grave)	Baden	skeleton																					
Polgár–Basatanya	Baden	21/16	17/9			103/7				5/4	1												
Székely–Zöldtelek	Baden	21/7			53/9	7/5																	
Salgótarján–Pécskő	Baden	248/?			65/?	47/?	17/?	1	31/?	75/?	12/?			48/?		3/?	1	1			2/?		
Szabadszállás–Ágostonhalmi-dűlő	Baden	?	skeleton																				
Székely–Zöldtelek	Baden	31/7			39/9	19/5																	
Tiszaszöllős–Csákányszeg–Temető	Baden	1			4/3	1																	
Salgótarján–Industrial Park II	Late Copper Age	12/?			24/?	5/?	1		7/?	1													
Tiszaföldvár–Brickyard	Late Copper Age																		1				

Table 3. Copper Age sites yielding animal remains (NISP/MNI) from north-eastern Hungary

Copper Age sites	Culture	*Meles meles*	*Ursus arctos*	Aves	*Emys orbicularis*	*Esox lucius*	*Silurus glanis*	*Cyprinus carpio*	*Lucioperca lucioperca*	Pisces	Reference
Bodrogzsadány	Early Copper Age					2/2					Bökönyi (1974) 348.
Tiszaigar–Csikóstanya	Early Copper Age										Bökönyi (1959).
Polgár–Basatanya	Early Copper Age			1							Bökönyi (1959) 55–56.
Kenderes–Kulis	Tiszapolgár			1							Bökönyi (1974) 373.
Kenderes–Telekhalom	Tiszapolgár										Bökönyi (1974) 373.
Tiszavalk–Tetes	Tiszapolgár–Bodrogkeresztúr									13/?	Vörös (1986) 88.
Derecske–Brickyard	Bodrogkeresztúr										Bökönyi (1959) 60.
Magyarhomorog (grave)	Bodrogkeresztúr										Bökönyi (1974) 380.
Polgár–Basatanya	Bodrogkeresztúr				2/1		13/1				Bökönyi, (1959) 59.
Tarnabod	Bodrogkeresztúr			3/2							Bökönyi (1959) 60.
Füzesabony–Szikszópuszta	Ludanice										Vörös (1989–1990) 195–200.
Tiszalúc–Sarkad	Hunyadihalom	5/?	4/?								Vörös (1987) 125.
Gyöngyöshalász–Encspuszta	Boleráz				11/?	5/4	4/3	7/4	1		Vörös (1982–1983) 49; Takács (1982–1983) 70.
Baja–Dózsa György Street (grave)	Baden										Bökönyi (1974) 344.
Polgár–Basatanya	Baden			1							Bökönyi (1959) 61.
Székely–Zöldtelek	Baden										Bökönyi (1959) 62.
Salgótarján–Pécskő	Baden		1								Bökönyi (1968) 60–61.
Szabadszállás–Ágostonhalmi-dűlő	Baden										Bökönyi (1974) 400.
Székely–Zöldtelek	Baden										Bökönyi (1959) 60.
Tiszaszöllős–Csákányszeg–Temető	Baden									1	Bökönyi (1974) 415.
Salgótarján–Industrial Park II	Late Copper Age										Bartosiewicz–Gál (2006)
Tiszaföldvár–Brickyard	Late Copper Age										Vörös (1983) 38.

Table 3 (cont'd)

Bronze Age sites	Culture	*Bos taurus*	*Caprinae*	*Sus domesticus*	*Canis familiaris*	*Equus caballus*	*Bison bonasus*	*Bos primigenius*	*Cervus elaphus*	*Capreolus capreolus*	*Sus scrofa*	*Lepus europaeus*	*Castor fiber*	*Felis silvestris*	*Lyny lynx*	*Canis lupus*	*Vulpes vulpes*	*Lutra lutra*	*Meles meles*	*Ursus arctos*
Tószeg–Laposhalom	continuous Bronze Age occupation	240/82	56/38	43/29	23/16	117/37	9/5	14/7	58/30	31/14	6/5					1				1
Kompolt–Kistér	Makó	13/?	8/?	26/?	4/?						3/?									
Salgótarján–Pécskő	Makó	38/?	14/?	6/?				5/?	9/?	1	3/?									
Gáborján–Csapszékpart	Nyírség	275/13	123/7	118/7	16/5	21/4		18/6	86/7	9/4	20/5						1			
Nagyrév–Zsidóhalom	Nagyrév	2/2		1	1	1			5/2	1				1						
Hatvan	Hatvan	horn core																		
Tarnazsadány–Sándorrésze	Hatvan	129/15	29/7	29/6	1			1	1	2/2		1								
Tiszalúc–Dankadomb	Hatvan	1449/238	1054/183	852/165	63/20	118/38		51/27	279/88	39/15	56/28	5/2	8/3	1	1	4/2	3/2			1
Bakonszeg–Kádárdomb	Otomani–Gyulavarsánd	301/18	155/14	157/15	14/7	77/6		86/8	157/12	7/2	104/9		4/2	1	1				1	8/2
Berettyóújfalu–Szilhalom	Gyulavarsánd	195/13	194/14	243/17	21/3	24/3		21/4	77/7	11/3	10/3	1	1			1	8/2	1		
Füzesabony	Füzesabony	188/?	70/?	62/?	8/?	23/?		4/?	289/?	108/?	18/?			1			1			2/?
Polgár–Basatanya	Füzesabony	62/45	30/17	46/27	1	13/9		5/5	3/3	1										
Ároktő–Dongóhalom	Füzesabony	1				1														
Jászdózsa	Hatvan–Füzesabony	22/7	6/3	7/4	14/3			3/2	6/3	1	3/2									x
Mezőcsát–Pástidomb	Hatvan–Füzesabony	2/2	2/2	2/2	1	2/2			1	3/1										
Szihalom	Hatvan–Füzesabony	4/4							29/20	15/12										
Tiszafüred–Ásotthalom	Hatvan–Füzesabony	15/13	4/4	3/3	5/4				34/20	13/8	2/2	1								
Kelebia (cemetery)	Vatya	x		x	x	x														
Kengyel	Tumulus	16/5	10/3	4/2		3/2		3/2												
Korlát	Tumulus					skull														
Palotás–Homokos	Tumulus	2/2			1												1			
Rákóczifalva	Tumulus	2/2		3/3																
Salgótarján–Bread bakery	Tumulus	22/6	1	2/1					1											
Mezőcsát–Hörcsögös (grave)	Tumulus	x																		
Nagykálló	Gáva	93/24	57/10	19/10	110/5	20/9		7/4			2/1					1				
Soltvadkert (bronze workshop)	Late Bronze Age					1														

Table 4. Bronze Age sites yielding animal remains (NISP/MNI) from north-eastern Hungary

Bronze Age sites	Culture	Aves	*Emys orbicularis*	*Lacerta sp.*	Ophidia	*Esox lucius*	*Silurus glanis*	*Cyprinus carpio*	Pisces	Reference
Tószeg–Laposhalom	continuous Bronze Age occupation									Bökönyi (1959) 62.
Kompolt–Kistér	Makó									Bartosiewicz (1999) 324.
Salgótarján–Pécskő	Makó	1								Bökönyi (1968) 60–61.
Gáborján–Csapszékpart	Nyírség									Bökönyi (1988) 124.
Nagyrév–Zsidóhalom	Nagyrév									Bökönyi (1974) 385.
Hatvan	Hatvan									Bökönyi (1974) 367.
Tarnazsadány–Sándorrésze	Hatvan									Bökönyi (1974) 409.
Tiszalúc–Dankadomb	Hatvan	6/7	2/2			4/2	6/2		46/5	Bökönyi (1974) 413.
Bakonszeg–Kádárdomb	Otomani–Gyulavarsánd		1							Bökönyi (1988) 124.
Berettyóújfalu–Szilhalom	Gyulavarsánd	19/4	2/1							Bökönyi (1988) 124.
Füzesabony	Füzesabony	1							1	Bökönyi (1959) 65–66.
Polgár–Basatanya	Füzesabony		20/3	3/1	5/1				88/15	Bökönyi (1959) 64.
Ároktő–Dongóhalom	Füzesabony						1	2/1		Bökönyi (1974) 342.
Jászdózsa	Hatvan–Füzesabony									Bökönyi (1974) 370; Tárnoki (2003) 146; Vörös (1996) 87.
Mezőcsát–Pástidomb	Hatvan–Füzesabony								1	Bökönyi (1974) 381.
Szihalom	Hatvan–Füzesabony									Bökönyi (1974) 404.
Tiszafüred–Ásotthalom	Hatvan–Füzesabony	1								Bökönyi (1974) 411.
Kelebia (cemetery)	Vatya									Bökönyi (1974) 373.
Kengyel	Tumulus									Bökönyi 81974) 374.
Korlát	Tumulus									Bökönyi (1974) 377.
Palotás–Homokos	Tumulus									Bökönyi (1974) 391.
Rákóczifalva	Tumulus									Bökönyi (1974) 395.
Salgótarján–Bread bakery	Tumulus									Bökönyi (1974) 397.
Mezőcsát–Hörcsögös (grave)	Tumulus									Bökönyi (1974) 201.
Nagykálló	Gáva									Bökönyi (1974) 383.
Soltvadkert (foundry)	Late Bronze Age									Bökönyi (1974) 398.

Table 4 (cont'd)

Iron Age sites	Period or ethnic groups	*Bos taurus*	*Ovis aries*	*Capra hircus*	Caprinae	*Sus domesticus*	*Canis familiaris*	*Equus caballus*	*Bison bonasus*	*Bos primigenius*	*Cervus elaphus*	*Capreolus capreolus*	*Sus scrofa*	*Equus* sp.	*Lepus europaeus*	*Cricetus cricetus*	*Citellus citellus*	*Arvicola* sp.	*Felis silvestris*	*Vulpes vulpes*	*Ursus arctos*	*Anser* sp.	*Gallus domesticus*	Aves	Pisces	Reference
Felsőtárkány–Várhegy	Early Iron Age	142/24			46/8	89/16	5/2	7/3		11/2	150/25	6/2	72/10											1	1	Bökönyi (1974) 360.
Mezőcsát–Hörcsögös (graves)	Early Iron Age	×	×		×	×	×																			Bökönyi (1974) 380.
Szilvásvárad–Töröksánc	Early Iron Age	42/10			32/7	9/4	2/1	6/3					2/2													Bökönyi (1974) 404.
Jászfelsőszentgyörgy–Túróczi-tanya	Scythian	58/15			17/6	5/3	1	23/8		1	1												?			Bökönyi (1974) 371.
Salgótarján–Industrial Park II	Scythian	1698/?	186/?	58/?	1447/?	454/?	92/?	119/?	20/?	7/?	54/?	19/?	9/?	10/?	14/?	×	×	×		2/?	1			8/3		Bartosiewicz–Gál (2006).
Törökszentmiklós–Surján (cemetery)	Scythian	?			?																					Bökönyi (1974) 399.
Tiszaszöllős–Csákányszeg-Gyep (grave)	Scythian				1																					Bökönyi (1974) 416.
Garadna	Celtic							1																		Bökönyi (1974) 362.
Óhuta–Nagysánc	La Tène	42/10			11/6	27/8		5/3											1						1	Bökönyi (1974) 389.
Magyarhomorog (grave)	Celtic					?																				Bökönyi (1974) 380.
Mátraszöllős (cemetery)	Celtic					?																	?			Bökönyi (1974) 380.
Rozvágy (cemetery)	Celtic					?																?				Bökönyi (1974) 395.
Tiszavasvári–Városföldje (cemetery)	Celtic		2/?			×														skeleton			×			Vörös (1997–1998) 108.

Table 5. Iron Age sites yielding animal remains (NISP/MNI) from north-eastern Hungary

Roman Age sites	*Bos taurus*	*Ovis aries*	*Caprinae*	*Sus domesticus*	*Canis familiaris*	*Equus caballus*	*Asinus asinus*	*Bos primigenius*	*Cervus elaphus*	*Capreolus capreolus*	*Sus scrofa*	*Lepus europaeus*	*Cricetus cricetus*	*Citellus citellus*	*Castor fiber*	*Vulpes vulpes*	*Meles meles*	*Mustela putorius*	*Ursus arctos*	*Anser domesticus*	*Gallus domesticus*	*Emys orbicularis*	*Pisces*	Reference
Garadna–Kastélyzug	113/12		43/6	54/7	5/2	7/3			2/2	2/1											2/1			Bökönyi (1974) 362.
Biharkeresztes–Ártánd-Nagyfarkasdomb	143/10		98/9	57/7	287/5	70/7	1		1			4/1					1				1			Bökönyi (1982) 263.
Arka	103/11		12/5	23/7	46/2	1																		Bökönyi (1974) 342.
Szilvásvárad–Sports field	258/61		83/29	167/46	28/6	41/12			7/4	3/2	2/2	1									1			Bökönyi (1974) 405; Vörös (1993) 60.
Apagy–Plot of J. Barucha	93/38		52/22	62/17	5/2	10/6		4/2	10/3	1	6/3								2/1					Bökönyi (1974) 341.
Beregsurány–Barátságkert	259/?		29/?	63/?		13/?			2/?		1													Vörös (1993) 60.
Derecske	51/13				1	21/6																		Bökönyi (1974) 356.
Kompolt–Kistér	384/?	46/?	272/?	37/?	12/?	58/?		2/?	2/?	1			11/?	6/?							6/?		2/?	Bartosiewicz (1999) 324.
Kunbaracs–Beck-tanya	9/2		1																					Bökönyi (1976) 42–44.
Kunpeszér	11/2		4/2	1		2/1																		Bökönyi (1976) 42–44.
Kunszállás–Alkotmány Tsz.	128/4		219/7	71/4	100/4	41/3															9/1			Bökönyi (1976) 42–44.
Kunszentmárton	53/7		7/3	8/6	1	9/4														1				Vaday–Vörös (1979–1980) 117–139.
Kunszentmiklós–Bak-ér	127/7		83/7	35/6	3/3	42/4			1		2/1													Bökönyi (1976) 42–44.
Mezőkövesd	3/2		25/10																					Bökönyi (1974) 382.
Mezőkövesd–Csörsz Dyke	17/7		5/3	2/2		6/3																		Bökönyi (1974) 382.
Orgovány–Király-tanya	6/2		8/2	7/3					1													1		Bökönyi (1976) 42–44.
Öregcsertő–Csorna-puszta	13/3		2/1			2/1		1																Bökönyi (1976) 42–44.
Pókhalom	2/2		1	2/2		2/1																		Bökönyi (1974) 393.
Szabadszállás–Józan	125/6		117/7	10/3	233/5	7/3			1		4/1										3/2			Bökönyi (1976) 42–44.
Szirma	752/?		80/?	140/?	3/?	26/?			21/?	3/?					20/?		1							Vörös (1993) 60.
Szirmabesenyő	661/?		109/?	128/?	36/?	29/?		1	7/?		4/?													Vörös (1993) 60.
Szolnok-Szanda		2 skulls			skeleton																			Bökönyi (1974) 405.
Tiszaeszlár–Bashalom	10/5		3/3	7/4	1	16/2																		Bökönyi (1974) 410.
Tiszaföldvár–Brickyard	2602/?		1151/?	474/?	108/?	408/?	4/?	22/?	55/?	3/?	16/?	7/?				4/?		1						Vörös (1993) 59.
Tiszafüred–N. Kenderföldek	153/?		41/?	25/?	14/?	24/?			6/?															Vörös (1993) 59.
Tiszalök–Rázom	53/?		1	1		3/?																		Vörös (1993) 59.
Tiszavasvári–Paptelekhát	59/20		6/3	6/4	11/4	35/15			2/2															Bökönyi (1974) 418.
Tiszavasvári–Téglás	horn core																							Bökönyi (1974) 419.
Tiszavasvári–Városföldje	337/?		120/?	40/?	2/?	21/?	4/?		1	1	1	3/?												Vörös (1993) 59.
Törökszentmiklós–Surján	59/?		7/?	8/?		10/?																		Vörös (1993) 59.
Zalkod–Jakab-domb	93/?		25/?	28/?		3/?			4/?	2/?	20/?				1									Vörös (1993) 60.

Table 6. Roman Age sites yielding animal remains (NISP/MNI) from north-eastern Hungary

Migration period and Hungarian Conquest period sites	Period	*Bos taurus*	*Ovis aries*	*Capra hircus*	*Caprinae*	*Sus domesticus*	*Canis familiaris*	*Equus caballus*	*Asinus asinus*	*Bos primigenius*	*Cervus elaphus*	*Equus sp.*	*Cricetus cricetus*	*Citellus citellus*	*Canis lupus*	*Gallus domesticus*	*Grus grus*	Reference	Age of horses
Füzesabony–Szikszópuszta	German	44/?	23/?	12/?		16/?	2/?	5/?	2/?		2/?		2/?					Vörös (1989–1990) 199.	
Tar	3rd–4th centuries	14.10			2/2	1				1								Bökönyi (1974) 409.	
Kisvarsány	5th–6th centuries	31/8			22/4	12/5	1	11/2								1		Bökönyi (1974) 376.	
Alattyán–Tulát (cemetery)	Avar period																2/1	Kovrig (1963) 173.	
Hortobágy-Árkusi-ág (cemetery)	Avar period							×										Bökönyi (1974) 368.	
Jánoshida (cemetery)	Avar period				×											×	2/1	Bartha (1934) 18.; Bökönyi (1974) 369.	
Kiskőrös (cemetery)	Avar period	×														×		Bökönyi (1974) 375.	
Kiskunmajsa–Kőkút (grave)	Avar period	skull and skeleton																Bökönyi (1974) 375.	
Kompolt–Kistér	Avar period	34/?	5/?		30/?	3/?		5/?					2/?	11/?		3/?		Bartosiewicz (1999) 324.	
Tiszaeszlár–Vörösmarty Street (grave)	Avar period							skull and feet										Bökönyi (1974) 411.	5 years old
Tiszavasvári–Koldusdomb (cemetery)	Avar period	×	×		×			×										Bökönyi (1974) 418.	
Tiszavasvári–Vöröshadsereg Street (grave)	Avar period							skull										Bökönyi (1974) 419.	6–7 years old
Balotapuszta	Hung. Conquest							skull and feet										Bökönyi (1974) 345.	
Biharkeresztes	Hung. Conquest							skull and feet										Bökönyi (1974) 348.	9 years old
Dormánd–Hanyi-puszta	Hung. Conquest							skulls and feet										Bökönyi (1974) 359.	
Kenézlő	Hung. Conquest							skull and feet										Bökönyi (1974) 374.	3 years old
Magyarhomorog	Hung. Conquest											×			×			Bökönyi (1974) 380.	
Rétközberencs–Paromdomb	Hung. Conquest							×										Bökönyi (1958) 88.	
Sárospatak	Hung. Conquest							skull and feet										Bökönyi (1974) 398.	5 years old
Tiszabercel–Ráctemető	Hung. Conquest							skull and feet										Bökönyi (1974) 410.	5 years old
Tiszaeszlár–Bashalom	Hung. Conquest							skulls and feet										Bökönyi (1974) 410.	
Tiszanána–Csehtanya	Hung. Conquest				×	×		×										Bökönyi (1974) 414.	
Kiskundorozsma–Vöröshomok-dűlő	Hung. Conquest							skull and feet										Bökönyi (1974) 375.	
Kiskunfélegyháza	Hung. Conquest							skull and feet										Bökönyi (1974) 375.	4 years old
Városföld–Aranykalász Tsz.	Hung. Conquest							skull										Bökönyi (1974) 421.	5½ years old

Table 7. Migration and Hungarian Conquest period sites yielding animal remains (NISP/MNI) from north-eastern Hungary

Medieval sites	Period	*Bos taurus*	*Ovis aries*	*Capra hircus*	*Caprinae*	*Sus domesticus*	*Canis familiaris*	*Felis catus*	*Equus caballus*	*Bison bonasus*	*Cervus elaphus*	*Capreolus capreolus*	*Sus scrofa*	*Camelius dromedarius*	*Lepus europaeus*	*Castor fiber*	*Meles meles*	*Anser domesticus*	*Anas domesticus*	*Perdix perdix*	*Gallus domesticus*	*Meleagris gallopavo*
Garadna	Árpádian Age (9th–13th centuries)	29/7			8/4	12/4	1		1							1					1	
Csátalja–Vágotthegy (village)	Árpádian Age	53/17	27/13			28/12	4/2		19/5		1	1										
Sarud–Pócstöltés	Árpádian Age	60/3				18/3	1		156/5				7/1									
Szabolcs	Árpádian Age	243/36	45/14			58/13	148/1		32/7	2/2	2/2	58/1	8/6					2/1			2/1	
Tiszavasvári–Paptelekhát	Árpádian Age	27/8				1	15/5															
Kunhegyes–Jajhalom	Árpádian Age (11th–12th centuries)	10/3			2/2	2/1	1		12/2													
Mátraszőlős–Kisvár	Árpádian Age (13th century)	374/38	92/15			436/35	1		3/?				1		1		1	10/?			7/?	
Diósgyőr Castle	Árpádian Age (14th–17th centuries)						1							1								
Bodrogzsadány–Plot of J. Soltész	Ottoman period				1	2/2																
Nógrád Castle	Ottoman period	11/8			4/3	6/5			1		3/1	1										
Szendrő, Upper Castle	Ottoman period	4655/?	4/?	3/?	629/?	902/?	8/?	17/?	6/?		6/?	10/?	1		32/?			129/?	9/?	1	853/?	1
Túrkeve–Móricz	Ottoman period (15th–16th centuries)	441/?			320/?	221/?	30/?	200/?	209/?			1						15/?			26/?	
Pásztó–Gothic House	Ottoman period (16th century)	556/?			145/?	240/?	10/?		9/?			1	1					15/?	1		48/?	1
Szolnok Castle	Ottoman period (16th–17th centuries)	16/16	121/100	1					9/6													
Eger Castle	Ottoman period (17th century)													1								
Kecskemét–Bocskai Street	17th–19th centuries	3/3	3/2																			
Sárospatak Castle	17th–18th centuries	2/2	2/2																			

Table 8. Medieval sites yielding animal remains (NISP/MNI) from north-eastern Hungary

Medieval sites	Period	*Columba sp.*	*Sturnus vulgaris*	*Corvus cf. frugilegus*	Aves	*Emys orbicuéaris*	*Esox lucius*	*Silurus glanis*	*Cyprinus carpio*	*Abramis brama*	*Acipenser ruthenus*	*Stizostedion lucioperca*	Pisces	Reference
Garadna	Árpádian Age (9th–13th centuries)													Bökönyi (1974) 363.
Csátalja–Vágotthegy (village)	Árpádian Age													Bökönyi (1974) 353.
Sarud–Pócstöltés	Árpádian Age													Matolcsi (1975) 70.
Szabolcs	Árpádian Age							1	42/?					Vörös (1990) 166.
Tiszavasvári–Paptelekhát	Árpádian Age													Bökönyi (1974) 418.
Kunhegyes–Jajhalom	Árpádian Age (11th–12th centuries)													Bökönyi (1974) 379.
Mátraszőlős–Kisvár	Árpádian Age (13th century)												6/?	Vörös (1990) 223–225.
Diósgyőr Castle	Árpádian Age (14th–17th centuries)													Bökönyi (1974) 358.
Bodrogzsadány–Plot of J. Soltész	Ottoman period													Bökönyi (1974) 348.
Nógrád Castle	Ottoman period													Bökönyi (1974) 387.
Szendrő, Upper Castle	Ottoman period	4/1	1	1	55/?	195/?	29/?		6/?	5/?	1	1	85/?	Tassi (2006).
Túrkeve–Móricz	Ottoman period (15th–16th centuries)				43/?	1								Vörös 2002) 351.
Pásztó–Gothic House	Ottoman period (16th century)												11/?	Vörös 2002) 351.
Szolnok Castle	Ottoman period (16th–17th centuries)													Bökönyi (1974) 406.
Eger Castle	Ottoman period (17th century)													Vörös 2002) 339.
Kecskemét–Bocskai Street	17th–19th centuries													Bökönyi (1974) 372.
Sárospatak Castle	17th–18th centuries													Bökönyi (1974) 398.

Table 8 (cont'd)

REMARKS ON THE MESOLITHIC IN THE NORTHERN PART OF THE CARPATHIAN BASIN

Janusz K. Kozłowski

INTRODUCTION

Important discoveries made in the Tisza–Danube Interfluve in Hungary during the 1990s have considerably broadened our knowledge about Mesolithic settlement in the Carpathian Basin.[1] Simultaneously, a number of controversies arose as regards the chronological and taxonomical position of discovered finds together with a number of other issues, such as the origin of the Mesolithic in the Carpathian Basin, its relation to adjacent regions (primarily the Balkans and the loess uplands of Central Europe), and the significance of the Middle Danube Basin in the process of neolithisation.[2] In this paper I would like to contribute to the discussion of these issues.

CHRONOLOGICAL FRAMEWORK

Róbert Kertész identified the remains of several Mesolithic campsites along the one-time meanders of the Zagyva River in the Jászság region, the most important of which are undoubtedly Jászberény I and Jásztelek I. Both sites lay in the upper section of limy silts (layer C) covered by subfossile humic soil and were underlain by a level of limestone precipitations (layer B). The *Cepaea vindobonensis* shells and carbonates recovered from layer C of the Jászberény I site and submitted for radiocarbon dating gave the following dates: 8030±250 (Deb-1666), 7350±80 (Deb-2466) and 7154±62 (Deb-3155).[3] The dates do not take into account the reservoir effect, which is about 1350 years for shells from continental waters, i.e. this value should be deducted from the conventional radiocarbon age obtained from the measurements. The dates for the carbonates should also be treated with caution because the concentration of radiocarbon in acid surface waters changes within a broad spectrum in relation to the biosphere, and thus the differences between the radiocarbon dates and the genuine age are even greater.[4]

After taking into account the reservoir effect, the age of the samples from Jászberény I correspond to the period between 5395 and 4705 calBC, meaning that the entire Mesolithic in the Jászság region would have to be dated to the Neolithic, which is obviously impossible in view of the techno-morphological features of these finds.

It seems more likely that the carbonates submitted for radiocarbon dating had a post-genetic character and cannot date to the Mesolithic culture layers. Thus, Róbert Kertész was correct in noting that

1 *Kertész* (1993); *R. Kertész:* The present state of the research of the Mesolithic in the Great Hungarian Plain. JNSZMMK 49 (1994) 9–33; *Kertész* (1996); *R. Kertész – P. Sümegi – M. Kozák – M. Braun – E. Félegyházi – E. Hertelendi:* Archaeological and palaeoecological study of an Early Holocene settlement in the Jászság area (Jászberény I). Acta Geographica Debrecina 32 (1994) 5–49; *R. Kertész – P. Sümegi – M. Kozák – M. Braun – E. Félegyházi:* Mesolithikum im nördlichen Teil der ungarischen Tiefebene. JAMÉ 36 (1994) 15–61.

2 *J. Chapman:* The origins of farming in South-East Europe. Préhistoire Européenne 6 (1994) 133–156; *J. Makkay:* Theories about the origin, the distribution and the end of the Körös Culture. *In:* At the Fringes of Three Worlds. Hunter-Gatherers and Farmers in the Middle Tisza Valley. Ed.: L. Tálas. Szolnok 1996, 35–49; *M. Otte – P. Noiret:* Le Mésolithique du Bassin Panonien et la formation du Rubané. L'Anthropologie 105 (2001) 409–419; *Matejčiučova* (2004); *Bánffy* (2004) and others.

3 *Kertész* (1996) 23.

4 *A. Pazdur – T. Goslar – A. Michczynski – J. Pawlyta:* Zastosowanie metody radiowęglowej do datowania osádow młodszego czwartorzędu. *In:* Geochronologia Górnego Czwartorzędu w Polsce w świetle datowania radiowęglowego i luminescencyjnego. Red.: A. Pazdur – A. Bluszcz - W. Stankowski – L. Starkel. Wroclaw 1999, 17–42.

the age of the Mesolithic in the Jászság can only be determined on typological grounds. One can wholly agree with him that "the typological analysis of more recent finds called for modification of earlier views [concerning the late chronology of Jászberény I – J. K. K.], since the lithic assemblage of layer B2, overlying layer C at the Jászberény site I, is also dated to the Boreal."[5]

Correctly interpreting the typological premises, Róbert Kertész assigned the Jásztelek I site to the Boreal (specifically to the Late Boreal); on the other hand, the dating of the stray finds collected on the surface at Jásztelek I to the early phase of the Atlantic,[6] correlated with the early Körös–Starčevo phase,[7] is less plausible. These finds were merely individual trapezes, which Róbert Kertész regarded as a diagnostic feature of the Late Mesolithic settlement, even though trapezes are a standard component of lithic assemblages from various phases of the eastern Linear Pottery culture[8] and we know that stray Linear Pottery sherds have been found in the Jászság region.

Can we therefore assume, on the basis of our present knowledge about the Mesolithic in the Carpathian Basin, that there existed an extensive network of Late Mesolithic settlements in this region? A hypothesis of this type cannot be confirmed by one single site dated by geology or radiometry. Eszter Bánffy suggested that "the hypothetical presence of a Late Mesolithic population in the Carpathian Basin" is evidenced by two sites:[9] one in north-eastern Hungary (Tarpa–Márki-tanya) and the other in Transdanubia (Kaposhomok[10]). The finds from the site of Tarpa–Márki-tanya were recovered from humic soil overlying alluvial sand. Viola T. Dobosi distinguished three categories of finds in this assemblage:[11]

- Upper Palaeolithic (possibly earlier) patinated lithic artefacts,
- Late Pleistocene/Early Holocene stone artefacts, such as "hohe hobelartige Kratzer, winzige Klingen, Mikrolithen",
- Neolithic finds, including pottery and polished stone artefacts assigned to the Szatmár culture.

A closer look at the assemblage published by Viola T. Dobosi reveals that the identification of the Palaeolithic artefacts was based on the patination of their surfaces. This criterion is related to the view – held by German archaeology until the 1970s – that patina is an absolute indicator of the age of artefacts. However, later studies on the post-depositional changes of artefacts made from siliceous rocks have not confirmed this view. The separation of Late Pleistocene/Early Holocene artefacts was based on typological criteria. However, none of the artefacts published by Viola T. Dobosi – neither the short, high scrapers, nor, especially, the fairly irregular bladelets – support the suggested pre-Neolithic age of this part of the finds from Tarpa.[12] As a matter of fact, analogies drawn with the Late Palaeolithic material from Szekszárd do not seem particularly accurate.[13]

Viola T. Dobosi only associated a few polished stone tools with Neolithic pottery at Tarpa, ignoring the chipped stone artefacts from the site. The morphology of the end-scrapers and retouched bladelets published by her can be fitted into the framework of analogies with the chipped stone industry of the eastern Linear Pottery culture, including the Szatmár group.

The finds from Kaposhomok should be approached differently since this assemblage includes various microlithic blade forms shaped by steep retouches. Before the analysis of the Kaposhomok site is undertaken, it must be noted that the occurrence of trapezes not only in the Castelnovian, but also in the Epigravettian tradition may in some cases be regarded as a chronological marker. Stefan K. Kozłowski

5 *Kertész* (1996) 23.
6 *Ibidem* 24.
7 *R. Kertész – P. Sümegi:* Theories, critiques and a model: why did the expansion of the Körös–Starčevo culture stop in the centre of the Carpathian Basin. *In:* From the Mesolithic to the Neolithic. Eds: R. Kertész – J. Makkay. Budapest 2001, 223.
8 *J. K. Kozłowski:* The lithic industry of the Eastern Linear Pottery culture in Slovakia. SlovArch 27:2 (1989) 377–410; The Early Linear Pottery Culture in Eastern Slovakia. Prace Komisji Prehistorii Karpat 1. Ed.: J. K. Kozłowski. Krakow 1998.
9 *Bánffy* (2004) 51.
10 *Pusztai* (1957); *Marton* (2003).
11 *Dobosi* (1983).
12 *Ibidem* Figs 3–4.
13 *Ibidem* 11.

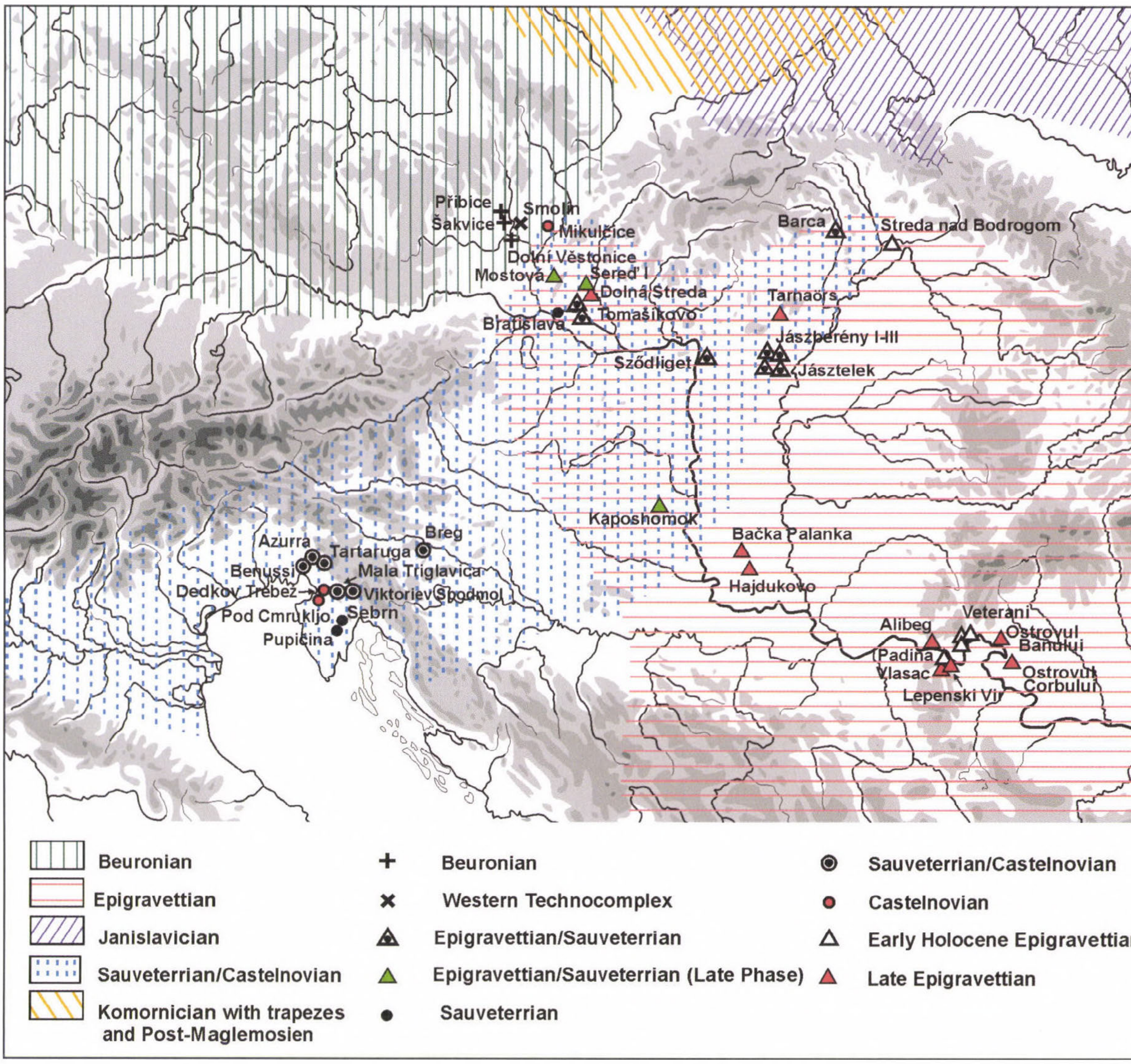

Fig. 1. The Carpathian Basin in the Mesolithic

pointed this out in his concept of a "trend with trapezes" originating from the western Mediterranean, where also regular blade technique appeared (debitage of the Montbani type).[14] At the very beginning of the Atlantic, the trend with trapezes spread to the east and gradually came to include the entire territory of France, Switzerland, Italy (chiefly northern Italy), the north-western Balkans and the western Pontic. In terms of taxonomy, this trend can be primarily observed in assemblages in which the regular blade technique is used (e.g. in the Castelnovian), although more recent publications have revealed that trapezes also occurred in Epigravettian assemblages from the very end of the Pleistocene.[15]

The analysis of the relatively best explored Epigravettian sequences on the Serbian side of the Danube, namely in the region of the Danube Gorges,[16] indicates that both the technological and typological elements of the "trend with trapezes" can be noted at these sites. The periodisation based on radiometric

14 *S. K. Kozłowski:* Les courants interculturels dans le Mésolithique de l'Europe occidentale. *In:* IX[e] Congrès UISPP. Colloque XIX. Les civilisations du 8[e] au 5[e] millénaire avant notre ère en Europe. Red.: S. K. Kozłowski. Nice 1976, 135–160.

15 *S. Ferrari – M. Peresani:* Trapezoids and double truncations in the Epigravettian assemblages of Northeastern Italy. Eurasian Prehistory 1:1 (2003) 83–106.

16 *J. K. Kozłowski – S. K. Kozłowski:* Lithic industries from multi-layer Mesolithic site Vlasac in Yugoslavia. Prace Archeologiczne 33 (1982) 11–110; *J. K. Kozłowski – S. K. Kozłowski:* Chipped stone industries from Lepenski Vir. Preistoria Alpina 19 (1983) 259–294; *I. Radovanović:* The Iron Gates Mesolithic. International Monographs in Prehistory, Archaeological Series 11. Ann Arbor 1996.

measurements includes an Early Atlantic phase with trapezes in the cultural sequence on the right (Serbian) bank of the Danube in the Danube Gorges region. The diagnostic role of trapezes is less obvious in some late assemblages of the Ostrovul-Banului–Schela Cladovei type on the Romanian side of the Danube Gorges.[17]

Since the trapezes from the Kaposhomok site were found together with other backed microliths, the Late Mesolithic age of these finds seems more likely.[18] Unfortunately, the Kaposhomok assemblage is a surface inventory, which in all likelihood includes finds from later periods too, as evidenced by the presence of pottery.[19] The macroblade elements,[20] which could date from as late as the Eneolithic, probably represent later elements. Still, the trapezes in the Kaposhomok assemblage[21] may have diagnostic significance as an indication of the late phase of the Mesolithic, even though this assumption must be treated with caution.

The lithic assemblages from Mesolithic sites in southern Slovakia, notably the ones which yielded trapezes (Sered I [Mačianske Vršky] and Dolna Streda[22]) are unfortunately surface collections from sand dunes along the lower reaches of the Vah River and the Little Danube. These lithic inventories include not only trapezes, but also the regular blade technique.[23] At the same time, inventories without trapezes, probably from earlier periods, have also been reported from the same territory, similarly collected on the surface of sand dunes (e.g. Tomašikovo[24] and Mostova[25]).

In view of the fact that there are no traces of Early Neolithic occupation on the sandy terrains of south-western Slovakia, the trapezes from Sered I and Dolna Streda cannot be accepted as evidence for Neolithic colonisation. Although lithics of the Middle Neolithic Lengyel culture, including double trapezoidal truncations,[26] also occur at Dolna Streda, these can be easily distinguished from Mesolithic trapezes. On the other hand, we can safely claim that the surface finds from Jásztelek I and from the south-western Slovakian sites of Hurbanovo–Bacherov Majer,[27] lying in the loess territory where Neolithic settlement was exceptionally dense, can likewise be regarded as intrusions of this type.

The dating based on techno-typological seriation does not allow the attribution of the south-eastern Slovakian sites to the Late Mesolithic, especially not the materials from Barca I,[28] which share the closest techno-morphological similarities with the sites in the Jászság region whose age was discussed above.

It follows from the above discussion that Mesolithic settlement during the Boreal occurs in the Great Hungarian Plain and in the Košice Basin, while scanty traces of Late Mesolithic settlement from the beginning of the Atlantic are recorded only on the fringes of these two regions, i.e. in the sandy areas along the lower reaches of the Vah River and in the foreland of the Villány Hills in Transdanubia.

The foreland of the Mátra Mountains could perhaps be included among these regions. The typological traits of the artefacts collected by Róbert Kertész from the sub-fossile humic soil at Tarnaörs may point to the Late Mesolithic age of these artefacts. Nonetheless, the dating of these finds to the Atlantic should be confirmed by radiometric measurements. The assemblage is dominated by the splintered technique, which was used for the production of fine, thin flakes, although splintered pieces may also have functioned as chisel-like tools. The few standard retouched tools included one trapeze, a trapezoidal double truncation with alternate retouch, and a flake end-scraper. The presence of a burin and a regular bladelet from radiolarite (the entire inventory is otherwise made up of low quality limnoquartzites) is by all means interesting.

17 *Boroneanț* (2000).
18 *Marton* (2003) Fig.1. 4–7.
19 *Dobosi* (1972).
20 *Pusztai* (1957) Pl. II. 1–2, 6.
21 *Ibidem* Pl. III. 1–4; *Bánffy* (2004) Fig. 4, upper row.
22 *J. Bárta:* Pleistocénne piesočné duny pri Seredi a ich paleolitické a mezolitické osídlenie. SlovArch 5 (1957) 5–72; *Bárta* (1959); *Bárta* (1965).
23 *Bárta* (1965) Pl. LXIII. 15–22, Pl. LXIV. 22, 29–31.
24 *J. Bárta:* Tomašikovo – mezoliticka stanica na Slovensku. ArchRozhl 7 (1955) 433–436; *Bárta* (1965) Pl. XLVI. 38–56.
25 *J. Bárta:* Mezoliticka industria z Mostovej pri Galante. ArchRozhl 12 (1960) 785–790; *Bárta* (1965) Pl. XLV.
26 *Bárta* (1959) Fig.5, Pl. II. 5–7.
27 *M. Mazalek:* Otazka vztahu mesolitu a neolitu. Anthropozoikum 3 (1954) 203–234.
28 *F. Prošek:* Mesolitická obsidiánová industrie ze stanice Barca I. ArchRozhl 11 (1959) 145–148.

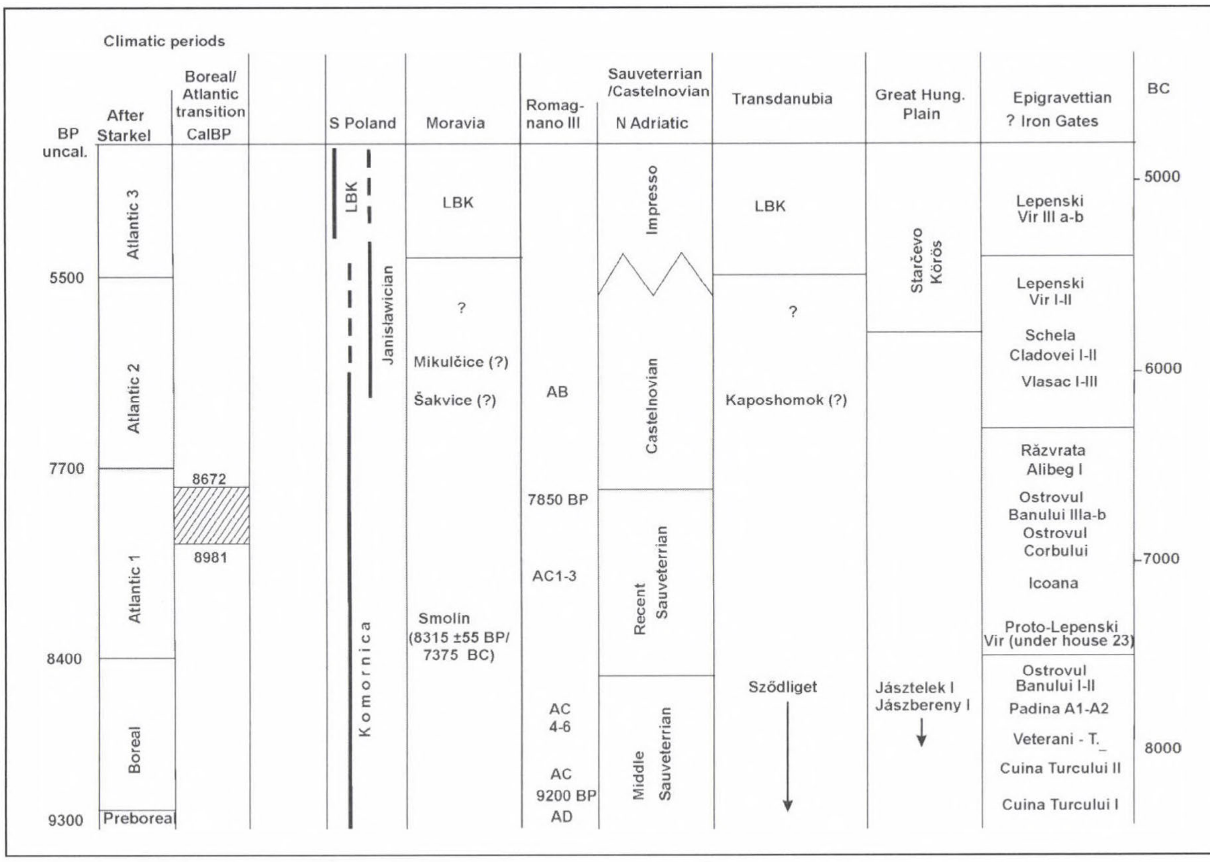

Fig. 2. Chronostratigraphic sequences of the most important Mesolithic taxonomic units in the Carpathian Basin

In conclusion, we may say that there is not one single absolute date which would confirm a Late Mesolithic settlement in the Carpathian Basin (including Transdanubia). The use of trapezes as an indicator of a "Late Mesolithic tool-kit"[29] is only justified in cases when trapezes are associated with other indications of a Mesolithic age, both as regards technological (regular blade technique, microburin technique) and morphological features (the presence of microliths made by steep retouches). Because trapezes occur in Neolithic assemblages, both in the Körös–Starčevo and the Linear Pottery culture, they can hardly be regarded as incontestable indicators of the late phase of the Mesolithic. This misunderstanding is the reason that Eszter Bánffy interpreted the surface finds from southern Transdanubia and the Vázsony Basin as Late Mesolithic.[30] The argument based on raw material (the presence of artefacts made from Szentgál radiolarite) can be rejected in view of the fact that the exploitation of this raw material can be noted during all phases of the Neolithic.

The shortcomings of the typological dating of surface finds from Transdanubia can be demonstrated in the case of the sites of Vöröstó and Mencshely, lying in the southern part of the Bakony Hills.[31] These sites were regarded as Mesolithic on the basis of typological features, which were once believed to be "Tardenoisian microliths"; however, the pieces actually published by Viola Dobosi[32] do not show geometrical microliths mentioned in the text.[33] The artefacts shown in the figures can be assigned to the "mediolithic" blade industry with typical single-platform Neolithic blade cores.

Subsequent excavations at Mencshely brought to light Neolithic artefacts, which included sickle inserts with high gloss.[34] In spite of this, Eszter Bánffy claimed that settlement traces of "earlier

29 *Bánffy* (2004) 61.
30 *Ibidem* 16.
31 *G. Mészáros:* A Vázsonyi-medence mezolit- és neolitkori települései. Veszprém 1948; *Dobosi* (1972).
32 *Dobosi* (1972) Fig. 4.
33 *Ibidem* 41.
34 *Bíró K.:* Mencshely–Murvagödrök kőanyaga. A Tapolcai Városi Múzeum Közleményei 2 (1991) 51–60.

population groups" had been destroyed by the settlement of late western Linear Pottery groups on the one hand, while on the other hand she asserted that the "question of whether the archaic types belong to the «Epipalaeolithic» or the Early Neolithic is almost inconsequential" because Neolithic groups had anyway adopted the forms of stone artefacts from "earlier local hunter-gatherer groups".[35] Thus, what should be proved by the detailed analysis of homogenous, well-dated assemblages becomes an a priori paradigm.

We should not forget that in the Balkans and on the Aegean islands, trapezes occur in various periods well after the Mesolithic, not only in the Early, but also in the Middle Neolithic,[36] the Eneolithic and the Early Bronze Age.[37] The re-introduction of trapezes can probably be associated (at least on the mainland) to periodic intervals, when the role of hunting increased, and the use of trapezes as projectiles for hunting weapons was re-discovered. Trapezes cannot in themselves, and without the context of the technology used for their production (regular blade technique, microburin technique), be regarded as an indicator of the Late Mesolithic.

TAXONOMICAL CONTEXT

There is, obviously, no need to prove that the description of the Mesolithic of the Carpathian Basin as "Tardenoisian" (often emphasised in older publications) has by now become totally anachronistic. The Middle Danube Basin lies at the meeting point of two major cultural provinces of the Mesolithic, namely of the Western Technocomplex, represented by the Sauvetarrian and the Beuron–Coincy culture (Beuronian), and the Balkanic Epigravettian. The Beuronian, deriving from the epi-Magdalenian tradition, with its distinctive triangular microliths with a broad base, retouched – most often – inversely, can be easily identified. These microlith types are absent from the Carpathian Basin. The distribution of these microliths in the west does not extend beyond Moravia. Thus, the easternmost systematically explored Beuronian site, dated to the Boreal by radiocarbon measurements, is Smolin on the Jihlava River.[38] Attempts were made to assign the site of Barca I in the Hornad Valley in eastern Slovakia to the Beuronian.[39] However, Stefan K. Kozłowski correctly challenged this attribution and noted that the lithic inventory from Barca I could equally belong to the Beuronian or the Epigravettian.[40]

The distinction between the Sauvetarrian and the Early Holocene phase of the Epigravettian is not simple, as both units evolved from the post-Pleniglacial, Late Pleistocene Epigravettian. The Sauvetarrian was distributed in the western Mediterranean, and was a reflection of the adaptation of local Epigravettian groups to the pre-Boreal environment. As regards technology, the appearance of hypermicrolithic products of blade debitage from subconical, burin-like and prismatic cores is essential. Another important feature was the spread of flake debitage based on discoidal cores. Geometric microliths functioned as projectiles made with the microburin technique. These were segments, backed points, truncated backed bladelets, triangles and, most importantly, double backed points (Sauvetarrian points).[41]

The frequent changes in technology and typology during the Pleistocene/Holocene transition in the western Mediterranean can be attributed to the difficult access to deposits of better quality lithic raw materials. The emergence of the Castelnovian, which is primarily distinguished by the technique

35 *Bánffy* (2004) 65.

36 *J. Lichardus – I. Gatsov – M. Gurova – I. K. Iliev:* Geometric microliths from the Middle Neolithic site of Drama–Gerena (southeast Bulgaria) and the problem of Mesolithic tradition in south-eastern Europe. Eurasia Antiqua 6 (2000) 1–12.

37 *C. Runnels:* The Bronze Age flaked industries from Lerna: a preliminary report. Hesperia 54 (1985) 357–391.

38 *Valoch* (1978).

39 *J. K. Kozłowski – S. K. Kozłowski:* Le Mésolithique à l'Est des Alpes. Preistoria Alpina 19 (1983) 37–56.

40 *Kozłowski* (2001) 265.

41 *A. Broglio:* The formation of the Mesolithic complexes in the Alpine Po valley region. *In:* Proceedings of the XIIIth Congress of the International Union of Prehistoric and Protohistoric Sciences, Forli, 8–14 September 1996. Section VII: The Mesolithic. Forli 1996, 41–46.

of regular blade production with standardised technical and metrical parameters, can be regarded as an indication of attempts to search for better quality raw materials at the beginning of the Atlantic.

The northernmost Sauvetarrian–Castelnovian sequences are known from Slovenian sites (the recently published Viktoriev spodmol Cave and the Mala Triglavica Cave[42]). Even though a Sauvetarrian/Castelnovian sequence has not yet been identified in the Carpathian Basin, it is possible that the Mačanske Vršky site can be correlated with the late phase of the Sauvetarrian (on the basis of the presence of trapezes),[43] while the Mikulčice site in Moravia can perhaps be assigned to the Castelnovian. The site of Šakvice in southern Moravia, which yielded Betey type segments[44] (whose occurrence outside France is unique), can also be assigned to the Western Mesolithic Technocomplex.

Other sites in the Carpathian Basin represent the northern Balkanic type of the Early Holocene Epigravettian tradition, even if the assemblages from these sites do exhibit the technological and stylistic impact of the Sauvetarrian. The best documented examples of the continuity of the Epigravettian tradition come from the sites in the Danube Gorges. The Late Pleistocene assemblages from Cuina Turcului contained straight and arched backed points in association with geometric microliths (scalene triangles, segments, and trapezes with three retouched sides), accompanied by a large number of short Tarnowa type end-scrapers.[45]

The Early Holocene (Preboreal/Boreal) phase of the Epigravettian in the Danube Gorges is represented by the Padina A1 and A2 sites, most importantly in sector II,[46] dated to between 9331±58 and 8138±121 BP.[47] On the Romanian side of the Gorges, levels I and II of the Ostrovul Banului site[48] can be assigned to the same phase. At Padina and Ostrovul Banului, arched and straight backed blades continue to occur, as do geometrical microliths, chiefly segments, scalene and isosceles triangles and truncated backed blades. Only a small percentage of these microliths was produced using the microburin technique. In the early phase of the Holocene, the bladelet technique occurs alongside the flake technique. The bladelet technique is based on small, single-platform cores without preparation, which in the advanced phase of reduction often had a second platform from which mainly flake blanks were detached.[49] Flakes were produced using single- and multi-platform cores and discoidal cores.[50] The splintered technique too began to be employed for the manufacture of microlithic blanks in this period.[51] Common tools included end-scrapers, raclette-type and denticulated flakes, short, dihedral burins on flakes, and some retouched flakes.[52] The Early Mesolithic phase of the Epigravettian is characterised by a low level of raw material and blanks selectivity.[53]

The sites investigated by Róbert Kertész in the Jászság region can be correlated with the Early Holocene (Boreal) phase of the Epigravettian in the Carpathian Basin. Assemblages from Jászberény I, II and from Jásztelek showed the presence of bladelet production technique from small, single-platform cores without preparation and flake production from multiplatform cores.[54] These debitage products did not come from different *chaînes operatoires,* but rather from consecutive stages of the same reduction sequence. Although the splintered technique occurs, it is not predominant. The retouched tool inventory shows a dominance of end-scrapers, mainly of short, often double specimens, also retouched

42 Viktorjev spodmol and Mala Triglavica. Opera Instituti Archaeologici Sloveniae 9. Red.: I. Turk. Ljubljana 2004.
43 *Kozłowski* (2001).
44 *B. Klima:* Nove mezoliticke nalezy na jizni Morave. ArchRozhl 5 (1953) 297–302.
45 *A. Păunescu:* Evoluția uneltelor și armelor de piatra cioplita descoperite pe teritoriul Romaniei. București 1970; *Boroneanț* (2000).
46 *Radovanović* (1981).
47 *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) 63–113.
48 *Boroneanț* (2000).
49 *Radovanović* (1981) Pl. I. 4–5, 12–13.
50 *Ibidem* Pl. I. 6–7, 15.
51 *Ibidem* Pl. I. 10–11, 14.
52 *Kozłowski* (2001) 268.
53 *D. Mihajlović:* Lithic technology and settlement systems of the Final Palaeolithic and Early Mesolithic in the Iron Gates. *In:* The Iron Gates in Prehistory: New Perspectives. Eds.: C. Bonsall – V. Boroneanț – I. Radovanović. BAR International Series. Oxford 2004, 1–8.
54 *Kertész* (1993) Pl. III.

flakes and notched-denticulated tools. The microliths chiefly comprise scalene triangles and segments, as well as backed bladelets and microlithic truncations. Generally speaking, these forms are typical of the Early Holocene Epigravettian. However, there were some typological and technological elements, overlooked in the original, 1993 publication of the finds, which do not quite fit the Epigravettian model – namely, a more frequent use of the microburin technique for the production of geometrical microliths and backed bladelets[55] than is usual in the Epigravettian and the occurrence of double backed points (Sauveterre points) typical for the Sauvetarrian. In other words, the determination of the taxonomical position of the lithic inventories from the Jászság region from the Boreal period is no easy task. We may conclude that even though these inventories chiefly exhibit traits of the Balkan Epigravettian, certain influences of the Sauvetarrian, perhaps from the upper Adriatic basin, can also be noted.

A similar taxonomic diagnosis can be proposed for the site of Sződliget near Budapest,[56] for Barca I in the Hernad Valley in southern Slovakia, and for the Tomašikovo site in south-western Slovakia,[57] as well as for the finds from Mostova.[58] which are perhaps less distinct in terms of typology and less numerous. The microliths in the lithic inventories from these sites contained scalene and isosceles triangles, segments, backed bladelets, and truncated backed bladelets. The common tools comprised mostly short end-scrapers, usually on flakes. Bladelets were detached from single-platform cores with slightly convex flaking surfaces.[59] At Sződliget, these blanks were also detached from carenoidal cores shaped on flake sides. Double-platform cores occur, too; these were exploited in a similar way as in the Epigravettian of the Danube Gorges (flake detachments from the opposite platform in the advanced phase of reduction[60]).

Róbert Kertész claimed that the Holocene Epigravettian in the Jászság region emerged independently of the Late Pleistocene Balkan Epigravettian and the Western Technocomplex. In his view, its emergence in the Jászság region "was basically rooted in the local Epigravettian which was culturally influenced from the west and the northwest."[61] This thesis is based on the presence of the Gravettian material collected by Viola Dobosi at the Jászfelsőszentgyörgy site (more precisely, at two locations: Szunyogos and Székesdűlő) in the Jászság region.[62] However, the macroblade industry at this site has little to do with the Late Glacial industries in the region and even less with the Mesolithic; it represents a typical Gravettian technology of blade production from double-platform cores with common flaking surfaces, with blade end-scrapers and backed bladelets. Moreover, the date for this site corresponds to the LGM (18,500±400).[63] The raw materials structure of the lithic inventory confirms its Gravettian affiliations (a large proportion of flint from southern Poland and the use of flint from the Prut River Basin).

It seems more reasonable to compare the Early Holocene industries in the Jászság region with the Late Glacial assemblage from Szekszárd–Palánk.[64] This assemblage, radiometrically dated to the Dryas III, exhibits all typical elements of the Late Glacial Balkan Epigravettian (e.g. points with the arched blunted back, segments, triangles and a dominance of short end-scrapers). This site provides evidence that Epigravettian groups from the Balkans reached the Middle Danube Basin at the very end of the Glacial, and it is therefore unnecessary to search for the roots of the Mesolithic industries in the Jászság

55 *Kertész* (1996) Pl. 8.

56 *Gábori M.:* Mezolitikus leletek Sződligetről. ArchÉrt 83 (1956) 177–182.

57 *Bárta* (1965) Pl. LXVI.

58 *Ibidem* Pl. LXV.

59 *Ibidem* Pl. LXVI. 56.

60 *Ibidem* Pl. LXV. 16–17, 19–20.

61 *Kertész* (1996) 25.

62 *V. Dobosi:* Jászfelsőszentgyörgy–Szunyogos, Upper Palaeolithic locality. Tisicum 8 (1993) 41–63; *V. Dobosi:* Antecedents: Upper Palaeolithic in the Jászság region. *In:* From the Mesolithic to the Neolithic. Eds: R. Kertész – J. Makkay. Budapest 2001, 177–192.

63 *E. Hertelendi:* Radiocarbon age of a bone sample from the Upper Palaeolithic settlement near Jászfelsőszengyörgy. Tisicum 8 (1993) 61.

64 *L. Vértes:* Die Ausgrabungen in Szekszárd–Palánk und die archäologische Funde. Swiatowit 1964, 24; *J. K. Kozłowski:* La fin des temps glaciaires dans le bassin du Danube moyen et inférieur. *In:* La Fin des Temps Glaciaires en Europe. Réd.: D. de Sonneville-Bordes. Paris 1979, 821–835.

region in the Gravettian of the LGM period or in the Sagvarian ("pebble Gravettian") of the period directly succeeding the LGM.

What remains to be discussed is the taxonomical position of a few assemblages, which have been dated to the Late (Atlantic) Mesolithic. After verification, only Kaposhomok in Transdanubia and the sites in south-western Slovakia (Dolna Streda, Sered I) have been assigned to this category.

As far as the typology of retouched tools is concerned, Kaposhomok, Dolna Streda and Sered I resemble earlier assemblages which could be assigned to the Epigravettian with Sauvetarrian influences. However, certain technological changes took place, such as the appearance of regular blades obtained from both prismatic single-platform cores[65] and double-platform cores with common flaking surfaces,[66] whose platforms were rejuvenated by tablet detaching.[67] These technological features may be ascribed to the impact of the trend expressed in the "horizon with trapezes" not only in the Castelnovian, but also outside its distribution.

If the attribution of the Tarnaörs site to the late phase of the Mesolithic is correct, it would imply that there were sites during this period on the northern fringes of the Great Hungarian Plain, whose chipped stone industry reflected a technological regression (e.g. the dominance of splintered technique), which can probably be explained by the extreme isolation of population groups, whose access to better quality raw materials in the nearby Mátra Mountains had been cut off.

RAW MATERIALS CIRCULATION

One popular theory promulgated in more recent studies concerns the assumption of an extensive network of interregional contacts between Late Mesolithic settlements, reflected in the circulation of lithic raw materials.[68] This thesis is exemplified by the presence of meso-local raw materials on Mesolithic sites, but chiefly by the occurrence of extra-local raw materials, sometimes from very distant regions. However, a closer look at Inna Matejčiučova's maps[69] reveals that the occurrence of flints from southern Poland in southern Moravian was documented on sites, which can be assigned to the Beuronian from the early phase of the Mesolithic (Smolin, Přibice, Mostova). The occurrence of Szentgál radiolarite too has been noted on Early Mesolithic sites in the Jászság region, as well as in Moravia (Smolin and Přibice).

The situation differs in the case of obsidian circulation. Obsidian has been reported from sites of the Lepenski Vir culture, but only from the phase contemporaneous with the Starčevo culture settlement, when also imports of northern Balkanic flint appear. This corroborates the view that the appearance of these imports can be explained by exchanges between the population of the Lepenski Vir culture and Neolithic communities. A similar explanation has been invoked for the appearance of obsidian on Late Mesolithic sites (mainly of the Janisławice culture) in south-eastern Poland.[70]

Firstly, imports of lithic raw materials from distant regions in the Mesolithic occur in the Early Mesolithic and, secondly, these imports are individual artefacts in the context of the predominance of local raw materials (for example, hornstone of the Krumlovský Les type, a source lying 15 km away, accounts for 83 per cent of the lithic inventory at Smolin and for 82 per cent at Přibice)[71] and, more rarely, of meso-local materials. In the case of Late Mesolithic sites, we may presume that the appearance of extra-local raw materials was most likely the result of contact with Neolithic groups, rather than

65 *Bárta* (1965) Pl. LXIII. 30–32.

66 *Ibidem* Pl. LXIII. 27–33.

67 *Ibidem* Pl. XLIII. 28–29.

68 *Matejčiučova* (2001); *Matejčiučova* (2003); *Matejčiučova* (2004).

69 *Matejčiučova* (2003) Fig. 12; *Matejčiučova* (2004) Fig. 7.

70 *B. Ginter:* Obsidianimporte im Spätpaläolithikum und Mesolithikum in Südpolen. *In:* Urzeitliche und Frühhistorische Besiedlung der Ostslowakei in Bezug zu Nachbargebieten. Hrsg.: B. Chropovský. Nitra 1986, 71–76; *M. Szeliga:* Stan badan nad naplywem obsydianu na ziemie polskie w starszej i srodkowej epoce kamienia. *In:* Starsza i srodkowa epoka kamienia w Karpatach Polskich. Red.: J. Gancarski. Krosno 2002, 339–358.

71 *K. Valoch:* Eine endpaläolithische Industrie von Přibice (Bez. Břeclav) in Südmähren. Casopis Moravskeho Musea 60 (1975) 45–77; *Valoch* (1978).

of the assumed existence of interregional exchange networks. In the Early Mesolithic, the presence of trace quantities of extra-local raw materials may have been the result of residential mobility over longer periods of time, rather than of the existence of exchange networks. This type of residential mobility in the Carpathian Basin is indicated by the overlapping distribution ranges of various typological units of the Mesolithic.

There are other reasons, too, why the hypothesis of raw materials circulation in the Mesolithic as a forerunner of Early Neolithic exchange networks for the procurement of raw materials in the western Linear Pottery complex cannot be accepted:

- a mass flow of extra-local raw materials can be noted already in the earliest Linear Pottery culture phase (in Lower Austria, this is represented by Szentgál radiolarite, accounting for up to 70 per cent; in central and northern Moravia, by southern Polish flints, also accounting for up to 70 per cent, e.g. at Kladniki[72]), while in the Mesolithic, especially in its late phase, the predominance of local raw materials is striking, with meso-local and extra-local raw materials occurring only in trace quantities. This is the main reason for rejecting the validity of the same explanatory model in the case of these two periods in terms of social anthropology.
- In the Mesolithic, imports of extra-local raw materials extended beyond the ethnographic boundaries outlined by techno-typological traditions of chipped stone industries (Beuronian, Janislavician, Sauvetarrian, Epigravettian, etc.), whereas in the Neolithic, the inflow of extra-local raw materials occurred within the same Linear Pottery cultural tradition, linking the territories where the Linear Pottery culture evolved (Transdanubia, western Slovakia, Moravia) with the territories falling within the later Linear Pottery diffusion. This system for the procurement of raw materials survived into the later phases of the Linear Pottery culture.[73]
- The Linear Pottery raw materials procurement systems have more in common with Gravettian procurement strategies from the pre-Pleniglacial period, when the search for the raw materials (including southern Polish and western Slovakian lithics) used in southern Moravia in great quantities (up to 90 per cent) was part and parcel of the seasonal migrations of Gravettian hunter-gatherers.

If the Tarnaörs site indeed represents the late phase of the Mesolithic, it most certainly confirms that certain forager groups had become isolated and exhibited technological regression enforced by the adaptation of techniques to raw materials available in a very restricted territory. The question arises as to whether the few descendants of Mesolithic hunter-gatherers were ready for neolithisation, and of whether they would have been able to adopt the Neolithic package and contribute to its further diffusion, or were they merely witnesses to the arrival of the first farmers and stockbreeders? Knowing that these groups inhabited areas which were peripheral to the loess uplands, the main zones where farming economies were distributed, their acculturation occurred at a later date. This model is confirmed by the presence of Mesolithic enclaves on the sandy territories bordering on the loess uplands of southern Poland inhabited by the Linear Pottery population. There is no evidence for any interaction between Mesolithic and Neolithic communities in this region. This situation only changed later, in the westernmost zone of the Linear Pottery expansion, where the role of local Mesolithic tradition, primarily the Beuronian, was stronger.[74]

72 *Matejčiučova* (2001).

73 *J. Lech:* A Danubian raw material exchange network: a case study from Bylany. *In:* Bylany Seminar 1987. Red.: J. Rulf. Praha 1989, 111–120.

74 *D. Gronenborn:* A variation on a basic theme: the transition to farming in Southern Central Europe. Journal of World Prehistory 13:2 (1999) 123–210; *M. Kaczanowska – J. K. Kozłowski:* Origins of the Linear Pottery Complex and the Neolithic Transition in Central Europe. *In:* The Widening Harvest. The Neolithic Transition in Europe: Looking Back, Looking Forward. Eds.: A. J. Ammerman – P. Biagi. Boston 2003, 227–248.

CONCLUSIONS

Half a century elapsed before the "Eger culture", a synonym for the Late Mesolithic, vanished from the maps of the Carpathian Basin,[75] even though the issue itself was raised as early as the 1970s.[76] Today, another model has been proposed, which assumes the presence of a dense Late Mesolithic settlement in the territories, where the Western Linear Pottery culture had its origins. As a matter of fact, the phantom of Late Mesolithic settlement in the Carpathian Basin is based on similar, uncertain premises as was the existence of the "Eger culture", namely on the false assumption of the homogeneity of materials collected from the surface, and the mistaken attribution of diagnostic significance to certain artefact types as absolute indicators of the late phase of the Mesolithic. In the case of the "Eger culture", these were bifacial points and "grobgerätiges" artefacts, while in the case of the alleged Late Mesolithic in Transdanubia, they were trapezes.

The origins of the Western Linear Pottery culture are by no means resolved. However, any discussion of Linear Pottery origins should not be based on an *a priori* preference for the autochthonous concept, but on the comparison of different models in the light of a valid critique of the available archaeological evidence.

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75 *L. Vértes:* Mezoliticheskiye nakhodki na vershine Gory Koporosh. ActaArchHung 1 (1951) 153–190; *Dobosi* (1972); *V. Dobosi:* Eger–Kőporostető. Revision d'une industrie à outils foliacées. Paléo supplement 1 (1995) 45–56.

76 *J. K. Kozłowski:* The problem of the so-called Daubian Mesolithic. *In:* The Mesolithic in Europe. Ed.: S. K. Kozłowski. Warszawa 1973, 325–330.

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A SETTLEMENT OF THE EARLY EASTERN LINEAR POTTERY CULTURE AT MORAVANY IN EASTERN SLOVAKIA: A PALAEOGEOGRAPHICAL AND ARCHAEOLOGICAL PERSPECTIVE

Tomasz Kalicki – Janusz K. Kozłowski – Marek Nowak – Marián Vizdal

INTRODUCTION

The Early Neolithic settlement at Moravany was discovered by Marcel Hamza, then a student of Prešov University, in 1998. The first trial excavations were undertaken the same year. The results turned out to be very promising, and it was therefore decided to begin an interdisciplinary research project. The investigations have been conducted since 2000 within the framework of a trilateral agreement between the Institute of Archaeology at the Jagiellonian University in Kraków, the Institute of Archaeology of the Slovakian Academy of Sciences in Nitra and the Philosophical Faculty of Prešov University. In addition to field campaigns, various archaeological, palaeoenvironmental and palaeoeconomical analyses were conducted.[1]

LOCATION AND ENVIRONMENTAL SETTING

The study area is located within the Ondava River basin in the eastern Slovakian Lowland, on the boundary between two major regions: the eastern Slovakian Hills and the eastern Slovakian Plain *(Fig. 1)*.

The eastern part of this Neogene basin, part of the Pannonian Basin subsystem, was filled up with Upper Badenian–Pliocene molasse (claystones, siltstones and sandstones) and Sarmatian–Pannonian volcanic rocks. Neotectonic movements of tectonic blocks occurred. Fault lines delimit depressional units with downthrow and elevated ones with uplift.[2] The Moravany site is located on the western slope of the horst: the Pozdišovski chrbát Range with small-scale uplift. This north–south oriented range is an elevation between two depressions: the Ondava Plain to the west and the Laborec Plain to the east. The Sarmatian (Kochanovce formation) and the Lower Pannonian (Sečovce formation) clays built this elevation. The Quaternary cover of slope deposits is irregular and very thin. Only the southern part of the Pozdišovský chrbát Range, 5 km south of the site, is covered with loess. The Quaternary alluvia of the Ondava, Topľa and Laborec rivers fill the depressions.[3]

The Pozdišovský chrbát Range (228 m a.s.l.), with planation surface on the top,[4] is a moderately differentiated morphostructure without aggradation. Its western and eastern slopes (slope 2–6°) are morphologically distinct and developed on tectonic disturbances. The lowland hilly relief of this part of the eastern Slovakian Hills is medium dissected.[5] The Moravany site lies on the western slope (170 m a.s.l.) of this range, about 60 m above the Ondava floodplain. It is delimited from the south by a small, dry valley of the Šarkan Creek. This periglacial valley was incised in the basement.[6] The excavated site

1 *Kaczanowska et alii* (2002); *M. Kaczanowska – L. Kaminská – J. K. Kozłowski – M. Nowak – M. Vizdal:* Ranoneolitická osada v Moravanoch, okr. Michalovce. Východoslovenský pravek 6 (2003) 45–63; *T. Kalicki – M. Nowak – M. Vizdal:* Geomorphology and palaeogeography of Early Neolithic site at Moravany (eastern Slovakia). Geomorphologia Slovaca (2004) 62–69; *Kozłowski et alii* (2003); *Nowak et alii* (2004).

2 *J. Maglay – R. Halouzka – V. Baňacký – J. Prostaš – J. Janočko:* Neotektonická stavba. *In:* Atlas krajiny Slovenskej republiky. Red.: R. L. Miklós – T. Hrnciarová. Bratislava–Banská Bystrica 2002, 78–79.

3 *Baňacký et alii* (1987).

4 *Kvitkovič* (1980).

5 *E. Mazúr – J. Činčura – J. Kvitkovič:* Geomorfológia. *In:* Atlas SSR. Red.: E. Mazur. Bratislava 1980, 46–47.

6 *Kvitkovič* (1980).

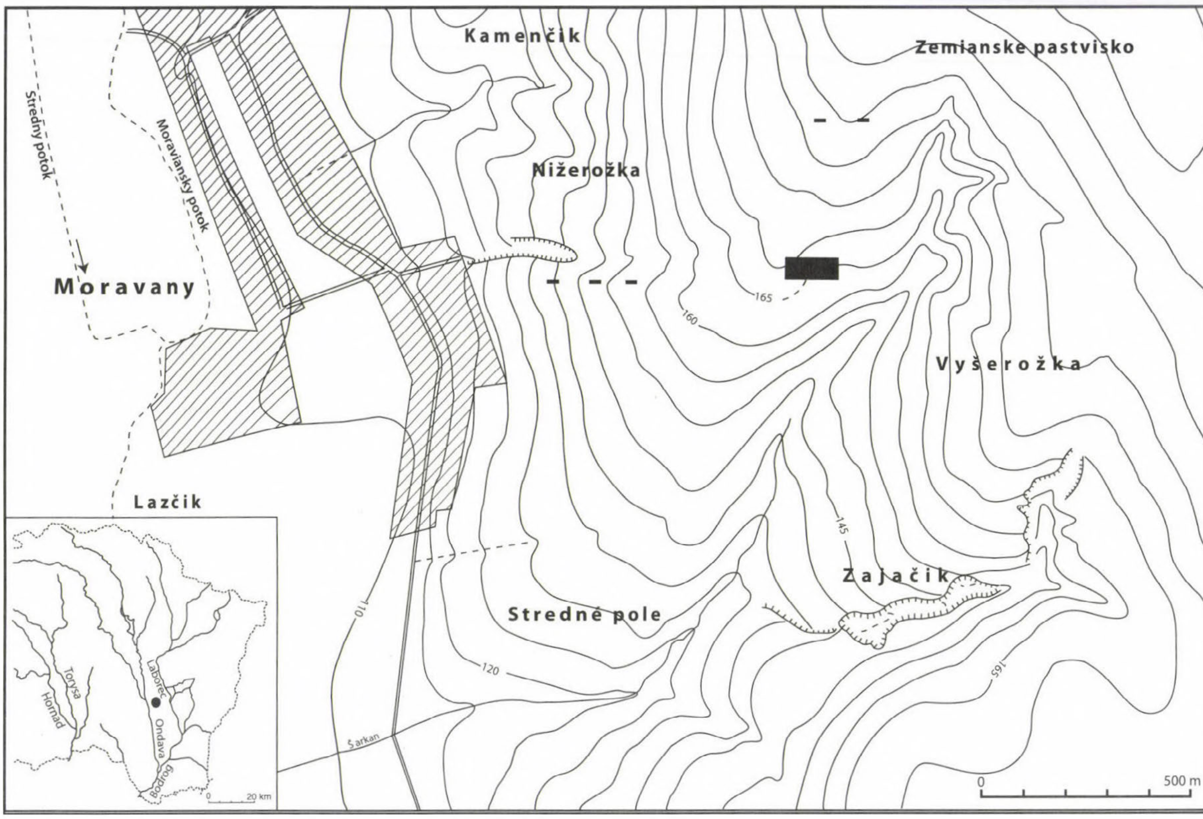

Fig. 1. Location of the site at Moravany (black rectangle) and the trial trenches (small black rectangles)

has an atypical topographical position since Early Neolithic sites in Upper Tisza Basin are concentrated in the lower part of the relief.[7]

The climate of the region is warm (with a mean July temperature of 8–9 °C; fifty or more days with daily maximum temperature over 25 °C annually on average), moderately dry (with a mean annual precipitation of about 600 mm; Konček's moisture index Iz = 0 to –20) with cool winter (with a mean January temperature below –3 °C).[8] The study site is located in a type of mesoclimate IIc that is to say warm and dry on east- and west-exposed slopes with a favourable insolation, optimum temperature and air humidity conditions.[9]

The Ondava and Topľa rivers have a rain-snow combined runoff regime, with floods during March and minimum discharges during September.[10]

Eutric to dystric planosols and (luvic-, albic-) stagnosols from colluvial deposits with very low content of humus in topsoil occur on the Pozdišovský chrbát Range, while rich in humus (above 2.3%) eutric fluvisols associated with gleyic and arenic eutric fluvisols from non-carbonate fluvial sediments dominate on the surrounding plains.[11]

7 *J. Chapman:* Social power in the early farming communities of Eastern Hungary – perspectives from the Upper Tisza. JAMÉ 36 (1994) 79–99; *M. Nowak:* Regional settlement patterns of the early phases of the Eastern Linear Pottery Culture in the Eastern Slovakian Lowland. *In:* The Early Linear Pottery Culture in Eastern Slovakia. Ed.: J. K. Kozłowski. Kraków 1997, 15–43.

8 *M. Lapin – P. Faško – M. Melo – P. Šťastný – J. Tomlain:* Klimatické obasti. *In:* Atlas krajiny Slovenskej republiki. Red.: R. L. Miklós – T. Hrnciarová. Bratislava–Banská Bystrica 2002, 95.

9 *M. Hess – T. Niedźwiedź – B. Obrębska-Starklowa:* Przyczynek do metod konstruowania szczegółowych map klimatycznych terenów górskich i wyżynnych. Zeszyty Naukowe UJ. Prace Geograficzne 41 (1975) 7–35.

10 *E. Šimo – M. Zaťko:* Typy rezimu odtoku. *In:* Atlas krajiny Slovenskej republiky. Red.: R. L. Miklós – T. Hrnciarová. Bratislava–Banská Bystrica 2002, 103.

11 *P. Bielek:* Obsah humusu v poľnohospodarskych podach. *In:* Atlas krajiny Slovenskej republiky. Red.: R. L. Miklós – T. Hrnciarová. Bratislava–Banska Bystrica 2002, 105; *R. Šály – B. Šurina:* Pôdy. *In:* Atlas krajiny Slovenskej republiky. Red.: R. L. Miklós – T. Hrnciarová. Bratislava–Banská Bystrica 2002, 106–107.

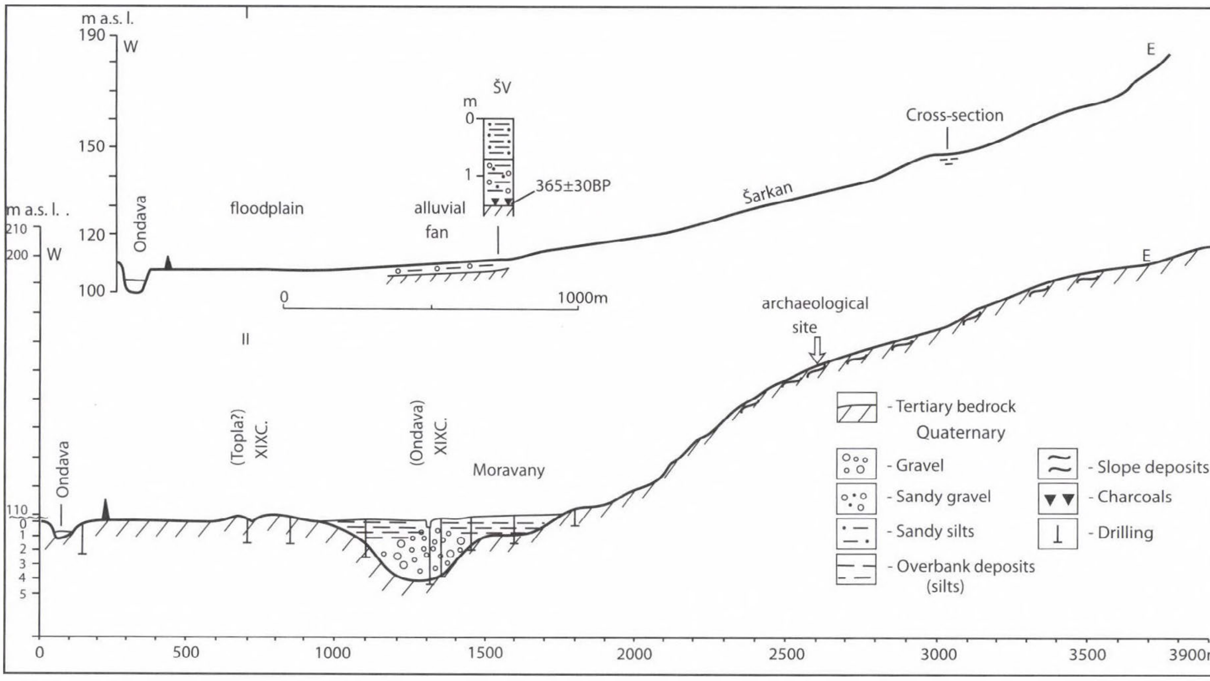

Fig. 2. Longitudinal profile of Sarkan Valley (I) and section across the Ondava River floodplain and slope with the archaeological site (II)

As to potential vegetation, the highest sites of the Pozdišovský chrbát Range were covered with oak forests with *Potentilla alba*, while the lowest slopes with lowland hygrophilous oak-hornbeam forests. Elm floodplain forests and willow-poplar floodplain forests along the river occurred in the valley bottom of the Ondava and Topľa rivers.[12]

STUDIES OF THE ARCHAEOLOGICAL SITE

The slope deposits covered the Tertiary clays of the Pozdišovský chrbát Range *(Fig. 2)*. They are very homogenous silts (Mz=6.3–6.7φ), badly sorted (δ=1.6–1.7) *(Figs 3–4)*. The charcoal layer lying about 1 m below the surface was dated to 19,980±460 BP *(Fig. 3)*.

Nearly 1500 m² of the site has been excavated *(Fig. 5)*. A dozen or so trial trenches were opened in the vicinity of the site, mainly in order to obtain geological and geomorphologic data.

About forty anthropogenic features sunk into the ground were identified in the archaeologically investigated section of the settlement. Most of these had a greyish-black clayey fill. In some of the pits, the lower part of the fill had a more intensive sooty colour. The features were usually noted at a depth of 30–40 cm and they were dug to a maximum depth of 110–120 cm from the present surface.

In terms of shape and dimensions, four types of features can be distinguished:

(1) Relatively large, circular or oval trough-like features with a diameter of about 1.5–5 m (Features 2/99A, 2/99B, 2/2000, 8/2000, 2/01, 8/01, 3/02, 4/02). One exceptional structure in this category is Feature 1/01 because its formation was clearly multiphase, even though its fill hardly contained any finds. It is possible that this part of the site was intentionally protected from dumping or leaving rubbish.

(2) Small features (nos 4/99, 1/2000, and 7/01) containing large amounts of daub fragments and distinct traces of fire (indicated by the reddish colour of the fill, and the presence of charcoal and ash). It seems that Feature 1/2000 can be interpreted as the remains of an oval, trough-shaped hearth. This interpretation is supported by the presence of a very hard, burnt layer of clay on the floor of the pit, which was furthermore lined with sherds. However, it is difficult to explain the situation found in Features

12 *Š. Maglocký:* Potencjalna prirodzena vegetacia. *In:* Atlas krajiny Slovenskej republiky. Red.: R. L. Miklós – T. Hrnciarová. Bratislava–Banská Bystrica 2002, 114–115.

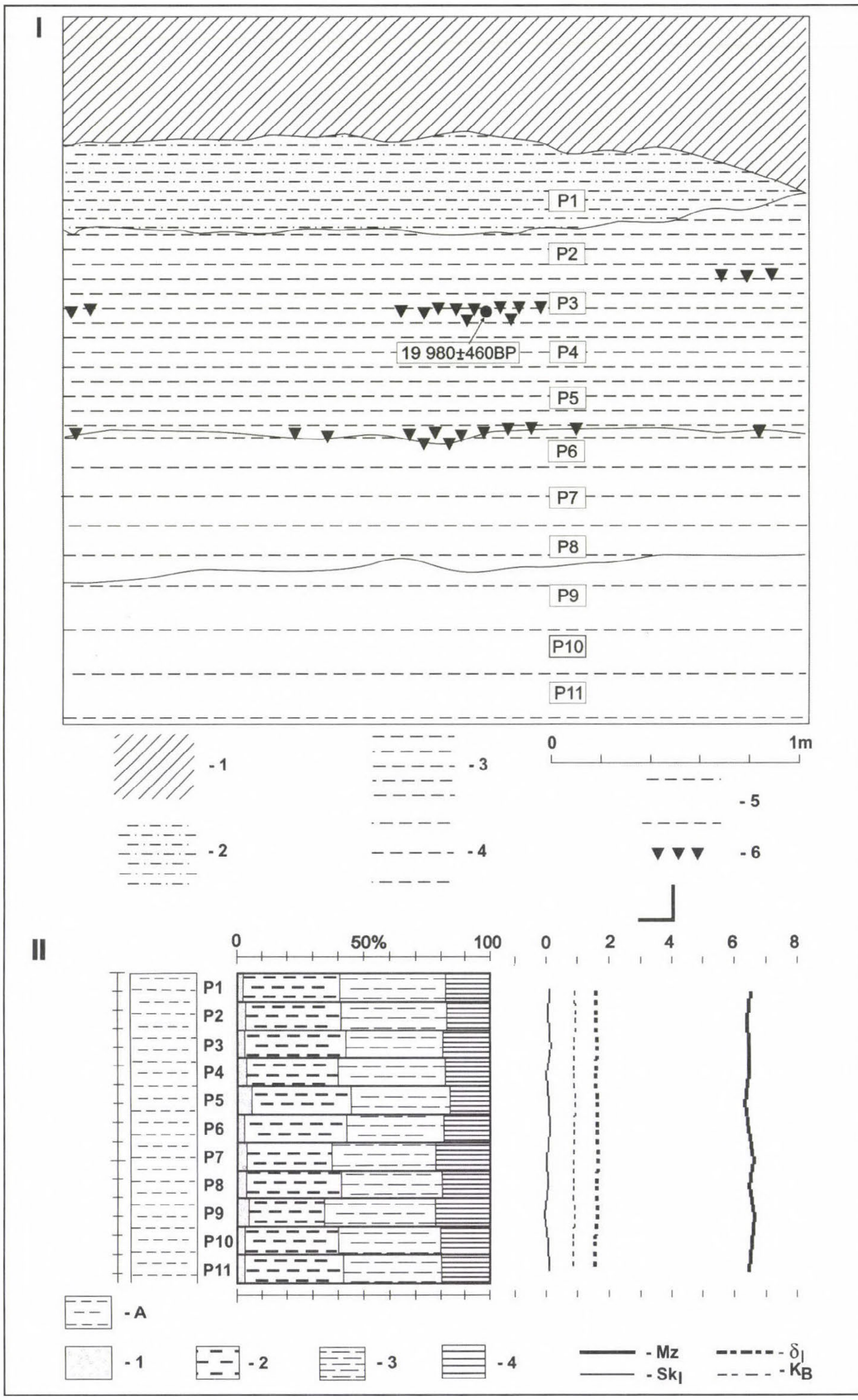

Fig. 3. Moravany. Cross-section north of unit D (I) and grain size composition with Folk-Ward's parameter distribution of sediments (II)

I. 1. Brown silts, 2. dark orange silts, 3. orange silts, 4. yellow-orange silts with orange points, 5. yellow-orange silts, 6. charcoals II. Sediments: A – silts; Fractions: 1. fine sand (2 to 4φ), 2. coarse and medium silt (4 to 6φ), 3. fine silt (6 to 8φ), 4. clay (above 8φ); Folk-Ward's distribution parameters: Mz: mean size diameter, δ_I: standard deviation, Sk_I: skewness, K_B: kurtosis

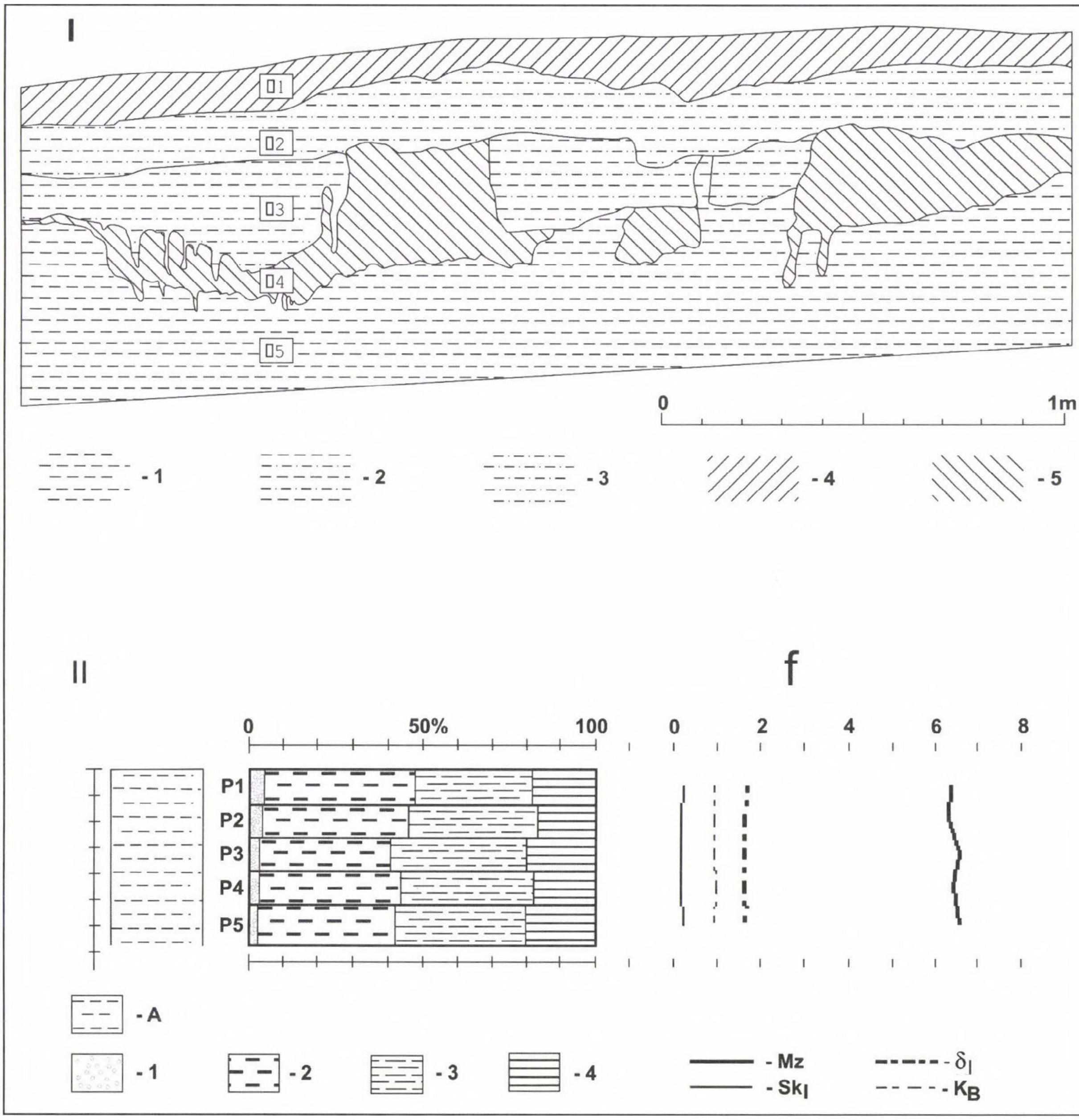

Fig. 4. Moravany. Cross-section W of unit E (I) and grain size composition with Folk-Ward's parameter distribution of sediments (II) (unit E is situated outside the area shown in Fig. 5, 15 meters east of unit C)
I. 1. Beige silts, 2. orange silts, 3. light brown silts, 4. brown silts, 5. dark brown silts,
II. Sediments: A. silts; Fractions: 1. fine sand (2 to 4φ), 2. coarse and medium silt (4 to 6φ), 3. fine silt (6 to 8φ), 4. clay (above 8φ); Folk-Ward's distribution parameters: Mz: mean size diameter, δ_I: standard deviation, Sk_I: skewness, K_B: kurtosis

4/99 and 7/01. The position of the daub lumps and the presence of undamaged and unburnt obsidian artefacts do not allow the interpretation of the features as the remains of hearths. Hypothetically, these might represent the remains of some sort of built structure (a wall, a fence, or the roof of a domed oven) plastered with clay, which slid or fell into the small pits.

(3) Pits into which in all likelihood wooden posts were set, i.e. post-holes. The most obvious examples are Features 3/2000 and 9/2000, and possibly also Feature 1/02. They are round in the horizontal and conical in the vertical cross-section. They were dug to a depth of about 90–100 cm from the present surface, and most have a diameter of about 50–60 cm. No finds were discovered in their fill. Small,

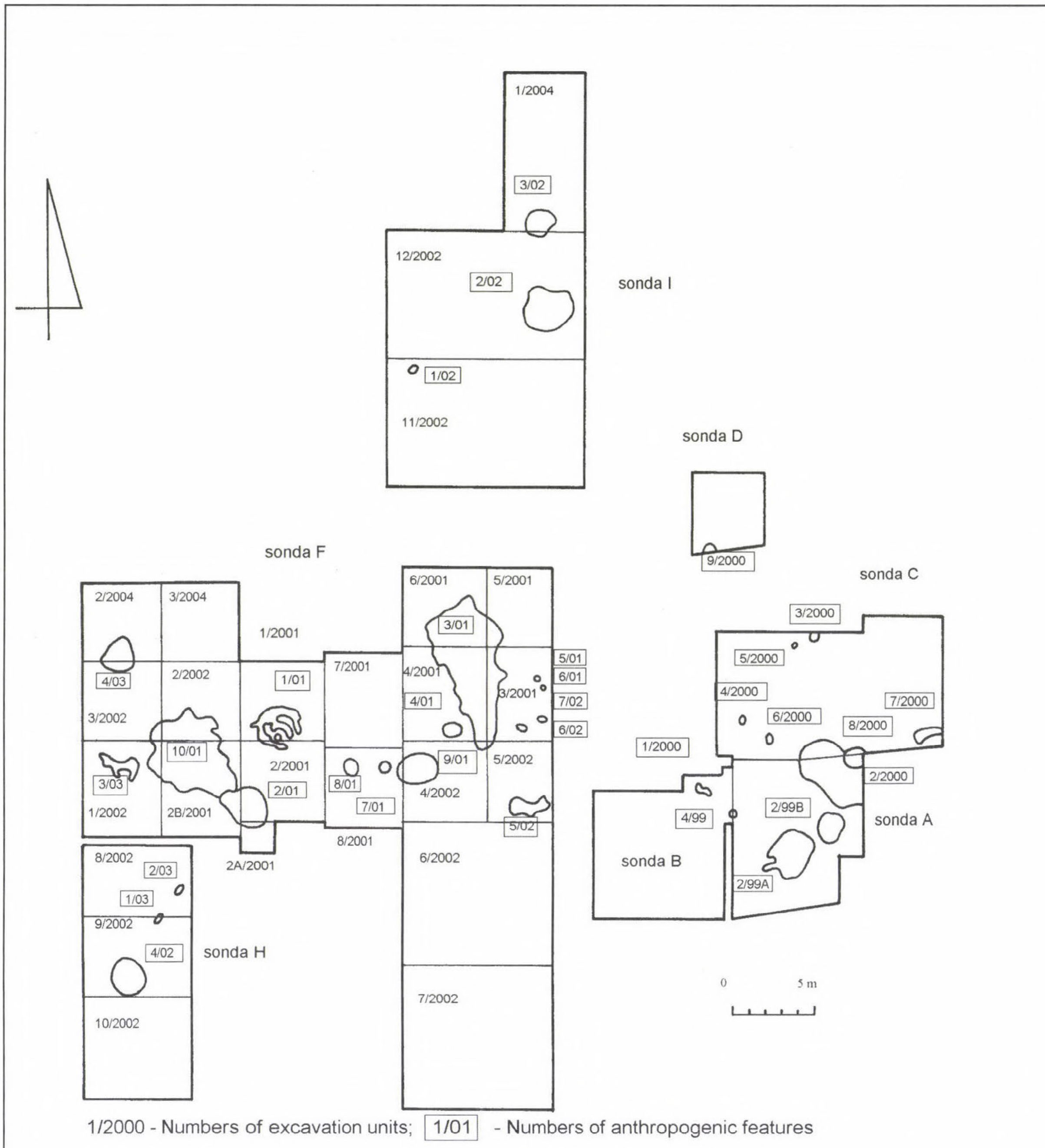

Fig. 5. Moravany. Distribution of excavation units and features in the central part of the settlement

circular, greyish areas, whose thickness is not too large (10–15 cm) were noted in Trench C (Features 4, 5 and 6/2000); the features in section 3/2001 in Trench F (Features 5/01, 6/01, 5/02, 6/02) were perhaps also remains of wooden posts set into shallow pits. Even if the latter features are taken into account, the lay-out of all the post-holes does not form any regular pattern.

(4) Features 3/01 *(Fig. 6)* and 10/01 are exceptional structures as regards their size. The horizontal cross-section revealed that their shape resembled an irregular trapezium. Both had a uniform, greyish-black fill containing numerous sherds, obsidian finds, daub fragments and charcoal, most of which lay mainly in the southern part of both pits. A functional interpretation of a feature of this type runs into obvious difficulties. Because of their rather large size, they have been tentatively interpreted as the remains of sunken dwellings. Comparable large, trough-like features in the settlements of the eastern

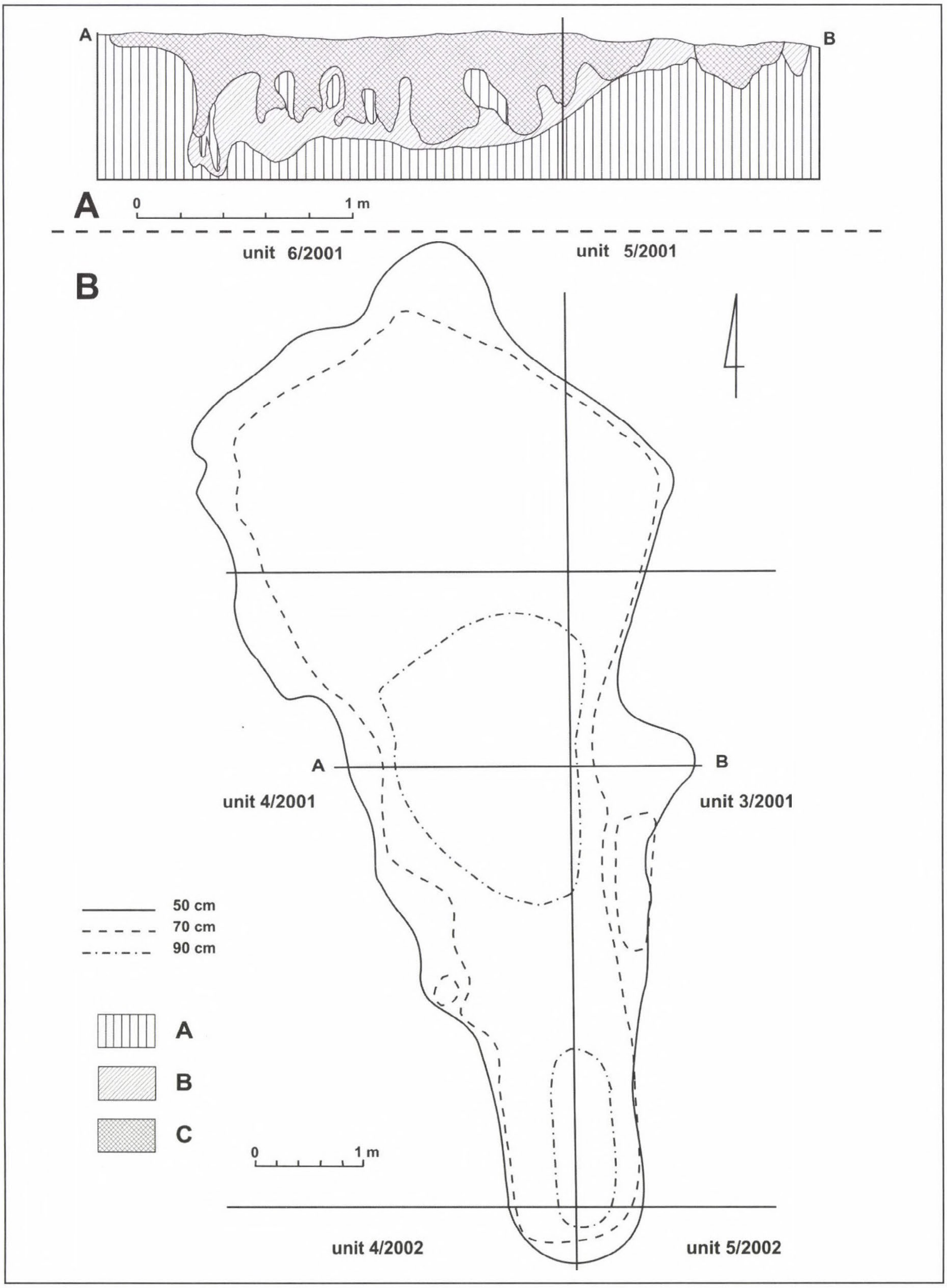

Fig. 6. Moravany. Cross-section (A) and horizontal outlines (B) of Feature 3/01
A. Dark brown clay, B. light black clayey sediment, C. black clayey sediment

Linear Pottery culture too have been interpreted along these lines.[13] The assumption that these features were habitation structures seems to be confirmed by the presence of regularly spaced protrusions along the sides of Feature 3/01. These can be regarded as post-holes arranged along the edges of the feature. On the other hand, these assumed post-holes may represent the remains of a dwelling (hut) lying by the pit. Moreover, the horizontal cross-section of Feature 3/01 does not quite point to a habitation structure. Its outline is not regular, being neither oval nor rectangular. The narrowing of the feature's southern part is one reason for doubt: the feature seems to be too narrow for a house in this part. This is why it seems more likely that Features 3/01 and 10/01 were clay extraction pits, i.e. long, irregular pits for the extraction of clay which was primarily used for daubing the walls of timber framed houses. Pits of this type, lying along the long wall of houses, occur frequently on Linear Pottery settlements,[14] and comparable pits have recently also been discovered in eastern Linear Pottery contexts.[15] Even though we did not discover any clear-cut traces of timber framed houses on either side of the above-mentioned features at Moravany, this does not necessary mean that this interpretation should be rejected, since the remains of such houses may have been completely destroyed by erosional processes.

It must be emphasised that there were no stratigraphical relations between the features, the only exceptions beside Feature 1/01 (mentioned above) are Features 2/2000–8/2000 and 2/01–10/01. However, these features overlap to a small extent only, along their edges. On the whole, this would suggest that the Moravany site was a single-phase settlement.

PALAEOGEOGRAPHICAL STUDIES AROUND THE SITE

Palaeogeographical studies were carried out not only on the archaeological site, but also in the neighbouring area. Some boreholes and outcrops were situated on the sections across the Šarkan Valley and the Ondava floodplain *(Figs 2 and 7)*.

Buried soil dated to 19,890±120 BP (Poz-6322) occurs on the slope of the Šarkan Valley *(Fig. 7)*. The roughly 3 m thick sediments filled the flat bottom of this valley. The black clays at the top of the Tertiary sediments are probably buried soil, only partly preserved at the margin of the valley. This layer is covered with organic silts containing high amounts of charcoal and organic remains. Some zones with a sandy-gravel admixture could be distinguished within this silty unit. These deposits, on different levels, reflected the channel changes during the infilling of the valley. Future radiocarbon dates and pollen analyses of sediments will contribute to a better understanding of the changes caused by climatic fluctuations and human impact. Šarkan's alluvial fan *(Fig. 2)*, covering the margin of the Ondava floodplain, is very young because charcoals from the boundary between its sediments and the Tertiary bedrock were dated to 365±30 BP (1440–1640 calAD) (Poz-6323).

The present course of the Ondava River is also quite young; the river's current bed evolved following river regulation projects. A section across the floodplain revealed an older meandering belt, much closer to the eastern slope of the valley, which may have been active during the Early Neolithic. The profiles with three buried soils occur in the valley bottom near the study area. The middle fossil soils at Božčice (4 km to the north-east) in the Topla Valley were dated to 4720±300 BP, while the samples from Kladzany (15 km to the north) in the Ondava Valley to 4200±900 BP; the lower and upper ones could be correlated with the Pre-Boreal and the Sub-Boreal, respectively.[16]

13 *J. Makkay:* Some comments on the settlement patterns of the Alföld Linear Pottery. *In:* Siedlungen der Kultur mit Linearkeramik in Europa. Internationales Kolloquium Nové Vozokany, 17–20 November 1981. Hrsg.: J. Pavúk. Nitra 1982, 157–167; *Šiška* (1989) 42–46.

14 *E. Lenneis:* The beginning of the Neolithic in Austria – a report about recent and current investigations. DocPraeh 28 (2001) 99–116.

15 *L. Domboróczki:* The excavation at Füzesabony–Gubakút. Preliminary report. *In:* From the Mesolithic to the Neolithic. Proceedings of the International Archaeological Conference held in the Damjanich Museum of Szolnok, September 22–27, 1996. Eds: R. Kertész – J. Makkay. Budapest 2001, 193–215.

16 *Baňacký* (1987).

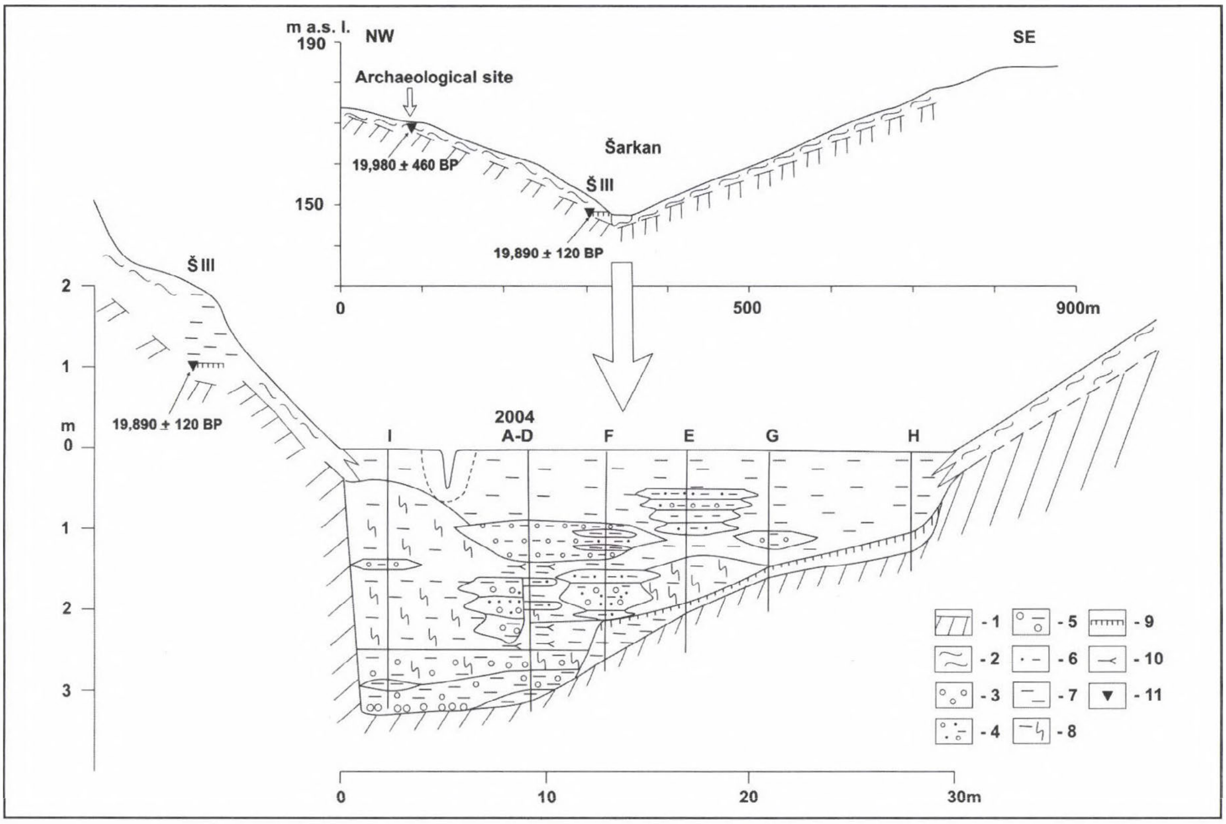

Fig. 7. Section across the Šarkan Valley

1. Tertiary clays, 2. slope deposits (deluvia), 3. gravels, 4. sandy gravels with silts, 5. silty gravels, 6. sandy silts, 7. silts, 8. organic silts, 9. buried soils, 10. detritus, 11. radiocarbon datings

POTTERY

Because erosional processes removed the anthropogenic layer associated with the Neolithic settlement, finds were preserved only in the fill of the pits and in other depressions in the prehistoric occupation level of the site.

The ceramics assemblage recovered to date during the excavations comprises nearly six thousand pottery sherds and several dozen miscellaneous clay finds. The majority of the pottery sherds (about 75 per cent) came to light from four features (nos 2/99A, 3/01, 2/01, 4/01). The other features yielded only a small number of ceramic fragments (ranging from a handful to several dozen). Even though not one single vessel was found in an intact state of preservation, the degree of fragmentation is not too great. Consequently, the index of the diagnostic traits of clay vessels can be regarded as relatively high.

The detailed mineralogical and technological analyses of the Neolithic pottery from Moravany and of the clay samples collected on the site were conducted at the Faculty of Materials Science and Ceramics of the University of Science and Technology in Kraków.[17] The results of the analyses concerning the permeability of the pottery samples (22–33 per cent) indicated their high porosity, indicating that vessels were fired at fairly low temperatures. As was to be expected, the clay samples collected on the site were characterised by a much lower permeability than that typical of samples of pre-processed clay.

The mineral phase composition of the analysed Neolithic sherds was similar in all cases *(Fig. 8)*. The analytical results indicated that the prepared clay from which the vessels were made was composed of clay minerals represented, chiefly of illite.

17 *Nowak* (2005); *E. Stobierska – P. Wyszomirski:* Badania ceramiczne i mineralogiczne słowackiej ceramiki neolitycznej ze stanowiska Moravany, Štredne poľo, okręg Michalovce. Manuscript. 2003.

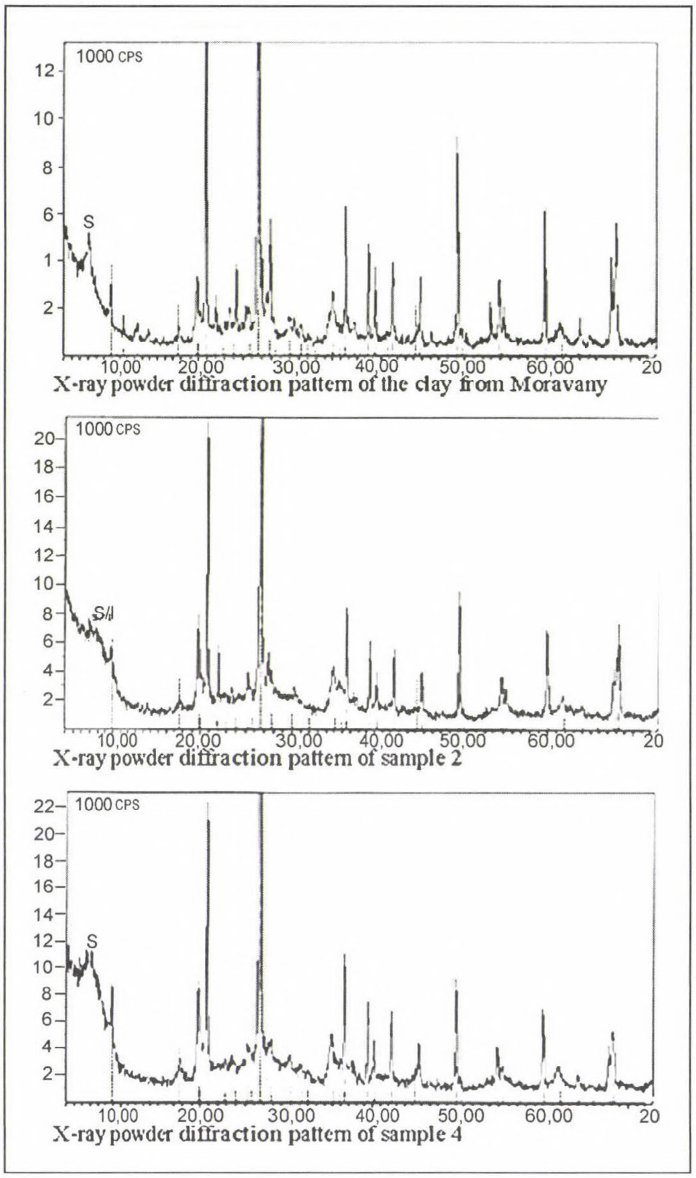

Fig. 8. Moravany. X-ray powder diffraction patterns of sample of clay from the site and of two samples of pottery

The detected non-clayey minerals were mainly quartz and, less frequently, feldspars and mineral ferric oxides. The fact that the mineralogical composition of the clay samples collected in the immediate vicinity of the excavation sites was largely similar suggests that this clay was probably used for making pottery vessels in the Neolithic.

The presence of higher concentrations of P_2O_5 in the sherds as compared to the raw clay is striking (1.14–6.38 per cent in ceramic samples and 0.31 per cent in the clay). This fact is confirmed not only by chemical analyses, but also by the analyses that were made on the minute sections of the fragments of the Neolithic sherds with the use of the SEM method. A higher proportion of phosphorus can be observed especially in sherds in which "tubular crystals", i.e. spongy structures, occur. A structure of this type is usually typical for bone biomaterial.[18] However, it would be difficult to confirm the assumption that these structures may perhaps be pieces of bone tissue. The validation of this possibility would require further, more detailed analyses on a larger body of material collected from other archaeological sites. These structures may equally well be the remains of organic substances, e.g. organic temper added on purpose (which, incidentally, can be observed with the naked eye in some sherds) or traces of the ethnographically confirmed practice of mixing clay with organic matter, such as excrement.

Regardless of organic temper, one unique technological feature of the Early Neolithic pottery from Moravany is the use of crushed, often thick-grained stones as a tempering agent; we have identified quartzite, menilithic hornstone and, possibly, obsidian. These are the raw materials used for the manufacture of chipped tools at the settlement. This temper has been identified in all the sherds found on the site, both in thin- and in thick-walled fragments (the only exception being a vase-like, collared vessel, described below). Some sherds had a mixed temper of crushed sherds and the organic temper mentioned above.

18 *M. F. Baslé – F. Grizon – C. Pascaretti – M. Lesourd – D. Chappard:* Shape and orientation of osteoblast-like cells (Saos-2) are influenced by collagen fibers in xenogenic bone biomaterial. Journal of Biomedical Materials Research 40 (1998) 350; *M. Pawlikowski – T. Niedźwiedzki:* Mineralogia kości. Kraków 2002.

The pottery recovered from the site falls into seven basic typological types.[19]

(1) Hollow-pedestalled bowls

Thin-walled sherds from the vessel part between the hollow pedestal and the bowl proper provide evidence for the use of such bowls . The diameter of these bowl parts ranges between 5–8 cm *(Fig. 10. 7, 9)*. Although the specimens in this category have been preserved only as fragments, we can distinguish vessels with conical and slightly bell-shaped pedestals. The bowls are characterised by the rectangular outline of their rim. It must be noted, however, that the rim fragments from hollow-pedestalled bowls cannot always be distinguished from the similar rim of flat-based bowls, conical bowls or deep, globular bowls. Aside from a few exceptions *(Fig. 10. 5)*, the rather poor state of preservation of the exterior of thin-walled vessels does not allow a reconstruction of their painted decoration. Patterns of lightly incised parallel lines *(Fig. 9. 4)* or meanders are relatively frequent. The possibility that the lightly incised linear patterns were combined with black painting, typical for the early phase of the eastern Linear Pottery culture,[20] cannot be excluded, but the black paint has not been preserved at Moravany.

(2) Conical bowls

The sherds from this vessel type have rectangular rims. Only the smallest bowls in this group have round rims.[21] The bowls probably varied a great deal in terms of their height and diameter. Because the soil conditions on the site were "aggressive," the black painted decoration, which probably ornamented these bowls, has not survived.

(3) Deep, globular bowls

Vessels assigned to this group vary in size. These bowls have a rectangular rim (with the exception of the smallest bowls) and a mild S shaped profile. The lower part of the belly was decorated with knobs which were occasionally provided with a horizontal perforation. The bowls were decorated with an incised patterns and sporadic traces of black painting have been preserved on some.

(4) Collared bowls

This group is rather heterogeneous because this particular feature can also be noted on different types of vessels; however, this category has been commonly accepted in the literature.[22] This group includes small collared vessels *(Fig. 9. 1, 7)* and globular vases. Their common feature is the rectangular cross-section of the belly and a cylindrical collar. The vessel belly was probably formed by pushing the walls of the vessel outwards from the inside. The belly is decorated with flat knobs and small loop handles are sometimes set on the vessel. Faint traces of black painted ornaments have survived on the exterior of these vessels. The fragments of a small vessel are decorated with an untypical incised pattern *(Fig. 9. 1)*. The fragments of a large vase-like vessel are decorated with a well-preserved black painted pattern of broad, wavy bands and thin parallel lines *(Fig. 9. 3)*. The clay from which this vessel had been made had almost no temper, which is exceptional at Moravany. We could even speak, tentatively, about an imported item in this case.

(5) Barrel shaped vessels

This group comprises medium to thick-walled sherds from barrel shaped vessels, distinguished by a very high content of mineral and organic temper. These sherds were discovered in Features 1/1998 (in Trench G, outside the area shown in *Fig. 5*), 2/99A, 3/01 and 2/01. The most common decorations are impressions *(Fig. 10. 6)* or a combination of impressions and incisions *(Fig. 10. 4)*. Some bear a patterns of oblique, short, incised lines *(Fig. 10. 3)*. Almost each vessel of this type had a double knob set on its upper part.

(6) Storage vessels

Features 1/1998 and 3/01 yielded fragments of thick-walled storage vessels. The sherds from these vessels were decorated appliqué ribs ornamented with round or oval impressions; sherds with patterns made by finger impressions too were assigned to this category *(Fig. 10. 8)*.

19 *M. Kaczanowska – L. Kaminská – J. K. Kozłowski – M. Nowak – M. Vizdal:* Slovensko-poľský výskum neolitického sídliska v Moravanoch. Archeologické výskumy a nálezy na Slovensku v roku 2000 (2001) 97–100; *Šiška* (1989).

20 *Vizdal* (1997) Fig. 11. 1–2, 3a–3b.

21 *M. Vizdal:* Archeologické výskumy a nálezy v Moravanoch okr. Michalovce. *In:* Archeológia v múzeách. Poprad 1998, 38–47, Fig. 4. 1.

22 *Šiška* (1989) 68.

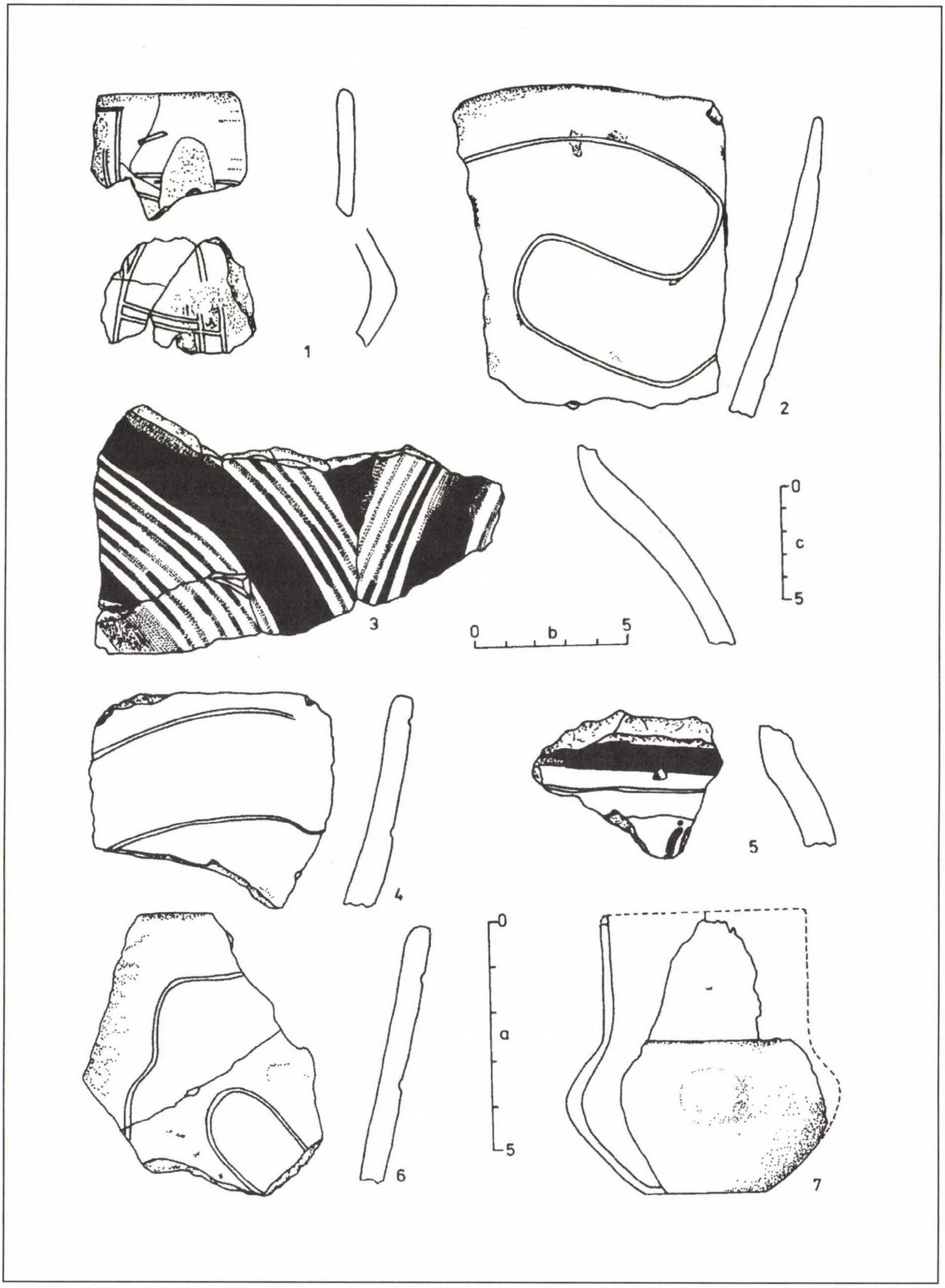

Fig. 9. Moravany. Selected pottery
Scales: a. 1, 5–6, b. 2, 4, c. 3, 7

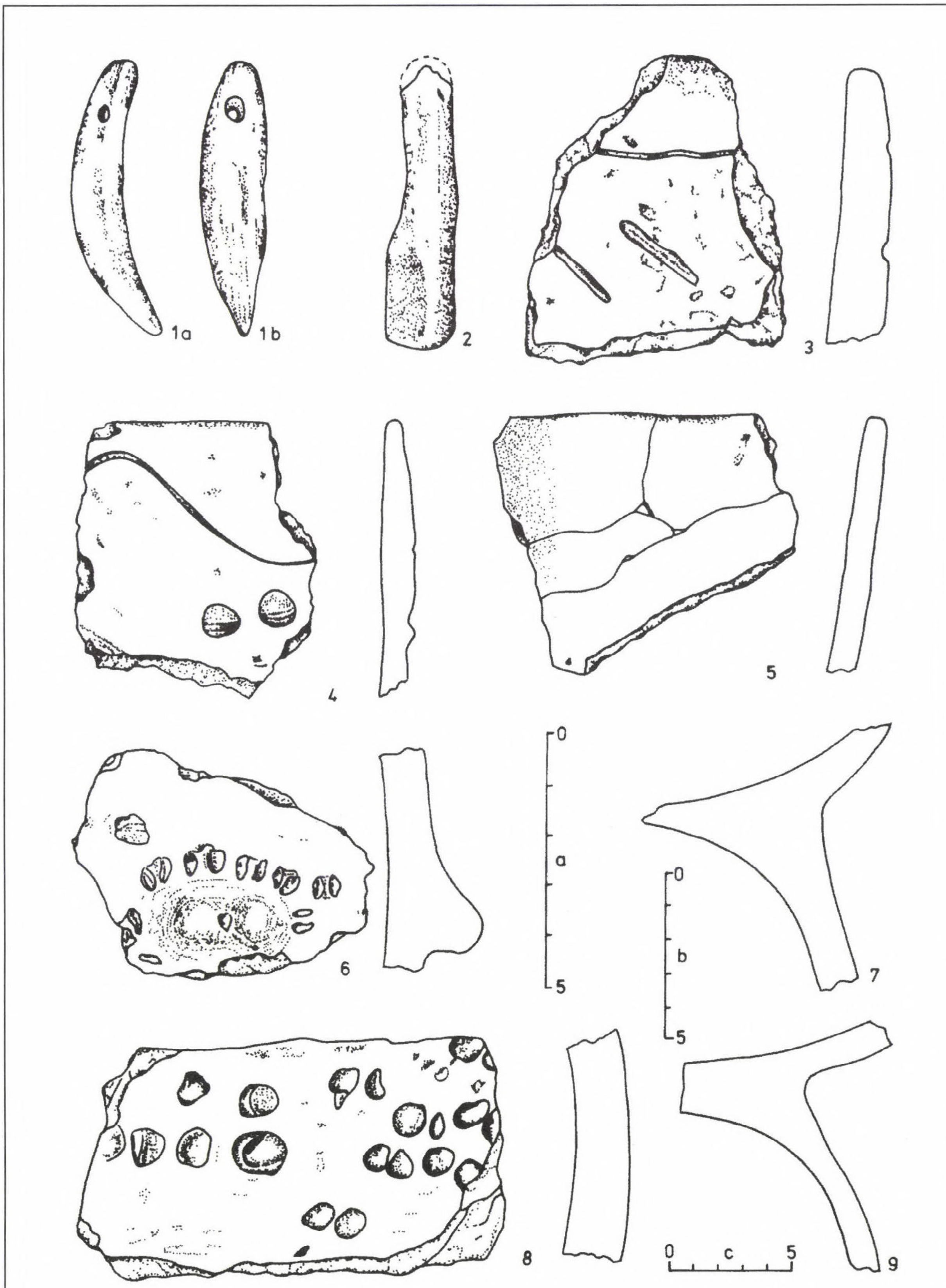

Fig. 10. Moravany. Selected pottery
Scales: a. 1–2, 7, 9; b. 3–4, 6; c. 5, 8

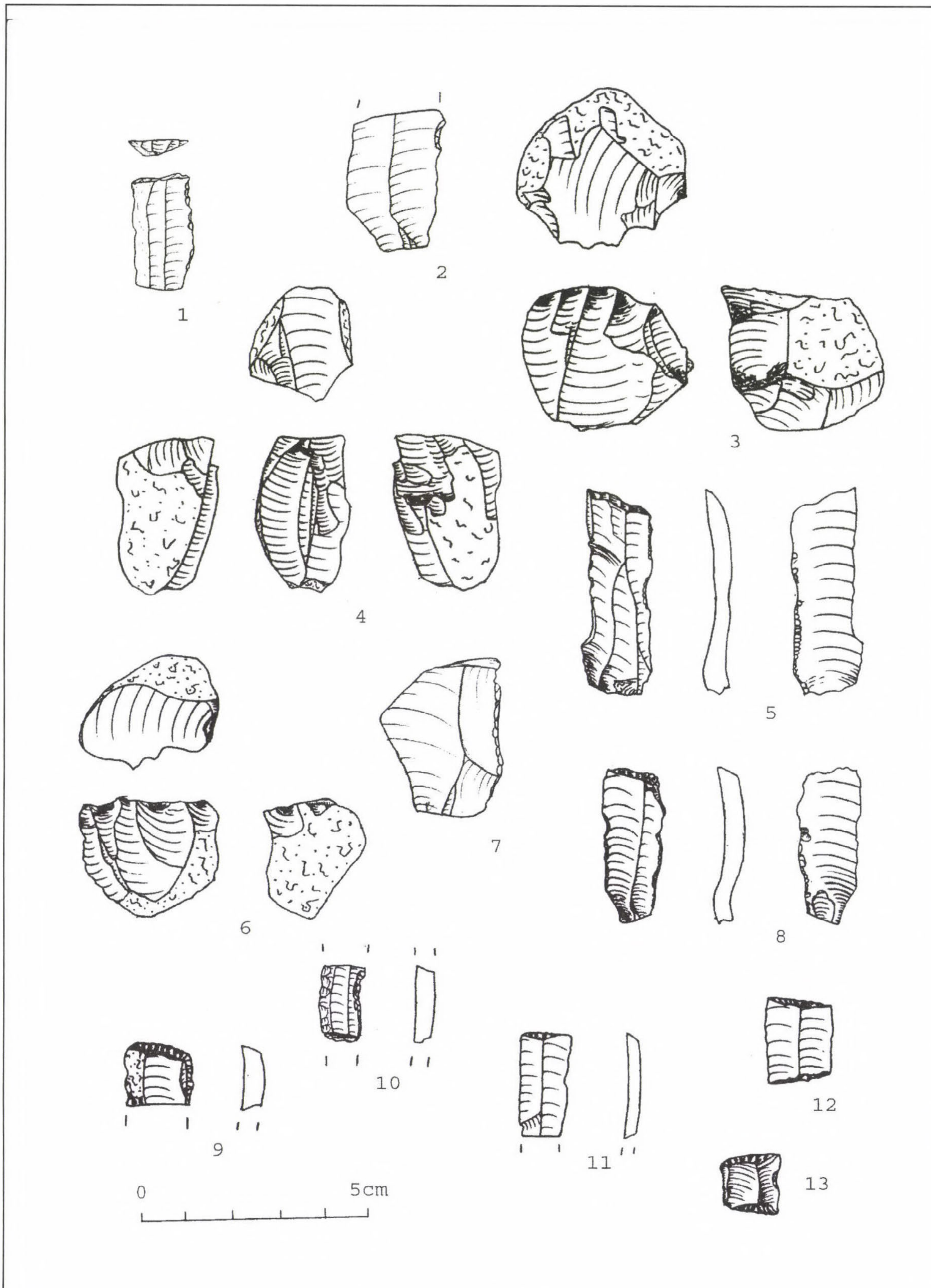

Fig. 11. Moravany. Selected chipped stone artefacts

The pottery from Feature 1/1998 had a decoration of flat, round knobs and a small boss in the centre. The surface of these vessels was intentionally roughened, probably by hand.

(7) Low, thick-walled bowls (roasting pans)

The bowls of this type include both conical, as well as slightly rounded forms. One fragment in this group comes from a miniature bowl.

Small, miscellaneous clay artefacts can probably be interpreted as articles with an ornamental functions, such as almost perfectly round clay pendants, fragments of a clay armring, a tooth shaped pendant *(Fig. 10. 1)*, a clumsily modelled (?) object in the shape of a rod (?) *(Fig. 10. 2)*.

The analysis of various features of the pottery from Moravany indicates that it can be assigned to the Early Neolithic, more precisely to the early phase of the eastern Linear Pottery culture.[23] For the time being, the standard methods of pottery seriation do not enable the separation of more than one evolutional phase in the ceramic inventory from Moravany. The pottery finds include specimens with more archaic traits (such as the thick-walled pottery with impressions) and pieces with later features (such as some of the black painted motifs). In the case of an assemblage of this type, there is always the danger of the subjective selection of certain features and of the overestimation of features considered to be typical of one or another culture group. It is not our intention to challenge the methodology used so far for distinguishing taxonomic ("cultural") units and phases, but merely to point out the "exceptions", which – after all – occur regularly and do not correspond to the accepted models. To sum up, in our opinion the pottery from Moravany can be assigned to the Kopčany group.[24]

STONE ARTEFACTS

Almost two thousand chipped stone artefacts were recovered during the excavations,[25] with roughly three-quarters of the lithic inventory brought to light from Feature 2A/99. A workshop was identified in the vicinity of this feature, where the full cycle of stone processing was carried out (from unworked nodules to tools), and tools were produced to meet the needs of one household. The workshop yielded a total of 1636 lithic artefacts, including 13 unworked nodules, 53 cores, 569 flakes, 344 blades, 513 chips, and 144 tools. The hypothesis that this workshop produced tools to satisfy the needs of the entire settlement has not been confirmed since the other features too contained artefacts representing various stages of stone processing, although these artefacts were less numerous (up to 100 specimens). Features 1/2000, 2/01 and 5/02 yielded unworked nodules; Features 3/99, 2/01, 3/02 and 4/02 yielded partially decorticated nodules and flakes (both cortical, as well as flakes in further stages of processing); and Features 10/01 and 3/02 contained partially cortical blades and blades showing use-wear. This would suggest that the full cycle of tool production was carried out in each household unit to meet the needs of the group in that particular household.

The raw materials structure shows the overwhelming preponderance of obsidian (in some features, obsidian accounts for 100 per cent of the raw material used). The proportion of obsidian in the largest lithic assemblage, recovered from Feature 2/99A, was as high as 88.1 per cent. Other raw materials, such as radiolarite and limnoquartzite (both of the Hungarian Boldogkőváralja type and of a Slovakian type, probably from the Slanské Mountains) do not exceed 4 per cent. Rhyolites, opals, quartzites and mudstones are extremely rare (less than 1 per cent). Interestingly enough, locally available raw materials in the alluvia of the Ondava River were exploited to a very small degree only, suggesting that the inhabitants of the Moravany settlement were accustomed to using obsidians and limnoquartzites from the deposits in the Hungarian-Slovakian borderland. Northern contacts are evidenced by the presence of radiolarities, probably from the Carpathian Mountains (the nearest deposits occur in the area of Šariš and Spiš). These radiolarites account for 3.1 per cent of all the chipped stone material in the inventory from Feature 2/99A; in contrast, this raw material is absent from the lithics recovered from several other

23 *Kalicz – Makkay* (1977) 18–37; *Šiška* (1989) 58–74.

24 *Vizdal* (1997) 44.

25 *Kaczanowska et alii* (2002) 192; *Kozłowski et alii* (2003) 136–139.

features. A unique artefact at Moravany is a trapeze made of chocolate flint, found in Feature 2/2000 *(Fig. 11. 12)*. This artefact would point to possible contact with the western Linear Pottery culture distributed in the territories on the northern side of the Carpathians. One amusing coincidence in the light of the above is the discovery of a trapeze made of the same type of limnoquartzite as the one known from Moravany on the site of the earlier phase of the western Linear Pottery culture at Gwoździec (in the Zakliczyn area in southern Poland), lying along the Transcarpathian route leading through the Dunajec and the Poprad valleys.

The technique of blade production from small, single-platform cores, with the preparation usually limited to the platform *(Fig. 11. 3–4, 6)* is identical with one employed at other eastern Linear Pottery sites.[26] Two fragments of large limnoquartzite blades *(Fig. 11. 2)* may be quoted as evidence for the macroblade technique. The dimensions of the preserved fragments indicate that these specimens can be regarded either as imports from the Körös culture province or that they echo the Körös technology. The blade could not have been made on the Moravany site since no debitage from macroblade cores has been found. It should at this point be recalled that at Méhtelek, for example, certain elements of the macroblade technique were observed, which can be linked to the import of Balkanic limnoquartzite and which document the technological tradition of the Starčevo culture.[27]

The morphology of tools from Moravany does not differ from the other tools of the early eastern Linear Pottery culture. This is primarily evidenced by the predominance of blades and bladelets with lateral retouch *(Fig. 11. 10)*, accounting for over 60 per cent of all obsidian tools. Additionally, retouched flakes *(Fig. 11. 7)*, end-scrapers *(Fig. 11. 8–9)*, truncations *(Fig. 11. 1, 11)*, splintered pieces, perforators and a high number of geometric microliths *(Fig. 11. 12–13)* also occur among the lithics. The largest group among the microliths is made up of trapezes, which resemble the specimens occurring in large numbers on eastern Linear Pottery sites.[28] It must here be noted that in addition to bi-truncated trapezes, a trapeze retouched on three sides was also found, together with a triangular point and an angulated backed piece. While trapezes with lateral retouch on three sides are known from Körös sites, the two other forms seem to hark back to Mesolithic industries with Epigravettian tradition which were distributed in the Carpathian Basin. Angulated backed implements have also been reported from western Linear Pottery sites on the Middle Danube (e.g. from Brunn 2) and we are inclined to regard these forms as evidence for interaction with Mesolithic groups.[29]

The lithic industry from Moravany shares numerous similarities with other assemblages of the early eastern Linear Pottery culture. One characteristic feature is the preference for raw materials from deposits in the Zemplin Plateau between Hungary and Slovakia; another is the evidence for the penetration of the Šariš and possibly also of the Spiš area, and even for contact with western Linear Pottery groups on the northern side of the Carpathians.

The lithic inventory from Moravany included also polished tools (flakes and small trapezoidal axes), made chiefly from mudstone. About ten elongated or egg-shaped polishers were found, as well as two grinder fragments and a grinding-stone. Several dozen lumps of ochre were found, most of them coming from Feature 4/02.

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26 *J. K. Kozłowski:* The lithic industry of the Eastern Linear Pottery Culture in Slovakia. SlovArch 37 (1989) 377–410.

27 *J. K. Kozłowski:* Evolution of lithic industries of the Eastern Linear Pottery Culture. *In:* From the Mesolithic to the Neolithic. Proceedings of the International Archaeological Conference held in the Damjanich Museum of Szolnok, September 22–27, 1996. Eds: R. Kertész – J. Makkay. Budapest 2001, 247–261; *E. Starnini:* Typological and technological analysis of the Körös Culture stone assemblages of Méhtelek–Nádas and Tiszacsege (North-East Hungary). JAMÉ 36 (1994) 101–111.

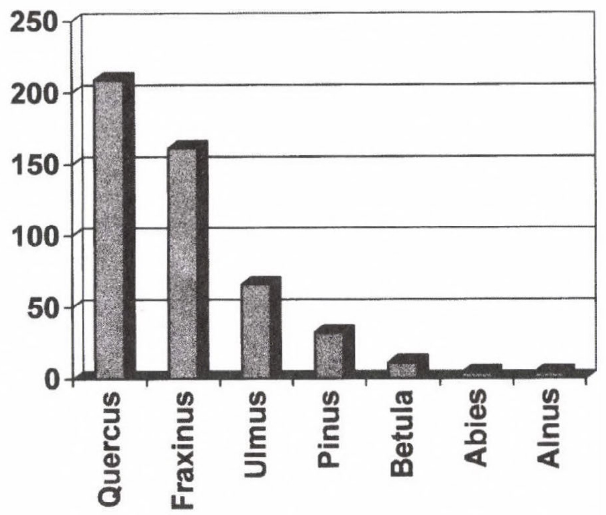
28 E.g. at Slavkovce, Feature E/88: *M. Kaczanowska – J. K. Kozłowski:* Lithic industries. *In:* The Early Linear Pottery Culture in Eastern Slovakia. Ed.: J. K. Kozłowski. Kraków 1997, 177–255.

29 *M. Kaczanowska – J. K. Kozłowski:* Origins of Linear Pottery Complex and the Neolithisation of Central Europe. *In:* The Widening Harvest: the Neolithic Transition in Europe. Looking Back, Looking Forward. Eds: A. Ammerman – P. Biagi. Boston 2002, 227–248.

ARCHAEOBOTANICAL ANALYSES

The archaeobotanical analyses of charcoals indicated the distinct predominance of deciduous trees: oak, ash and elm *(Fig. 12)*. Wood from pine, birch and fir was used to a lesser extent. The wet-sieving of the fill from the pits identified yielded a large number of grain macroremains; however, in cases when a precise examination was possible, only *Triticum dicoccum* was identified. Among wild plants, the goosefoot family (Chenopodiaceae), grasses (Graminae), soap-wort (*Saponaria* sp.), and brome grass (*Bromus* sp.) showed the highest frequency. Plant imprints on daub fragments came mainly from cereals and grasses; in the cases when an exact determination was possible, *Triticum dicoccon*, *Triticum monococcum* and *Hordeum vulgare* were distinguished.

I



II

Cerealia/Gramineae – 268
Cerealia – 34
Triticum dicoccon/monococcum – 175
Triticum dicoccon – 27
Triticum monococcum – 4
Hordeum vulgare – 7
Graminae – 6
Bromus sp. – 2
Quercus – 1
Alnus - 1

III

Triticum dicoccon – 6
Triticum monococcum – 1
Cerealia – 2
Chenopodium album – 14
Cenococcum – 12
Saponaria officinalis – 9
Graminae – 7
cf. Solanum nigrum – 1
Bromus sp. – 1
Stellaria graminea – 1
Viola sp. - 1

Fig. 12. Moravany. Archaeobotanical analyses of charcoals (I), daub (II) and wet-sieved samples from anthropogenic features (III)

RADIOCARBON CHRONOLOGY

So far, we have obtained twenty-four radiocarbon dates from anthropogenic structures *(Table 1)*. These dates call for some comment. The dates of Ki-9247, Ki-10372 and Ki-10374 are obviously too early when compared with the general dating of the eastern Linear Pottery culture.[30] It would appear that these samples were polluted with Late Pleistocene fossil charcoals. The Ki-11738, Ki-11740 and Ki-11739 dates are decidedly too late. The remaining dates generally fall within the second half of the 6th millennium BC. However, in our opinion, it seems most unlikely that the settlement was permanently occupied for almost five centuries. Therefore three possibilities should be considered: (a) there were two periods of occupation at the settlement, one around 5500/5400 BC, the other around 5200 BC, (b) the settlement was occupied around 5500/5400 BC only (meaning that the dates around 6200–6100 BP are a little too late), and (c) the settlement was occupied around 5200 BC only (meaning that the dates around 6500–6300 BP are a little too early). The preliminary analysis of the archaeological finds indicates that the latter option is the least probable.

Sample No.	Date BP	Sample	Feature	Depth
Ki-9247	6990±110	charcoal	2/99A	85 cm
Ki-10372	6940±60	charcoal	3/01	75 cm
Ki-10374	6910±60	charcoal	3/01	85 cm
Ki-11152	6580±70	charcoal	10/01	65 cm
Ki-9249	6570±120	charcoal	2/99B	67 cm
Ki-10375	6570±60	charcoal	3/01	85 cm
Ki-11149	6520±80	charcoal	3/01	75 cm
Ki-11730	6510±90	pottery	3/01	65 cm
Ki-11732	6360±90	pottery	2/01	75 cm
Ki-10373	6340±60	charcoal	3/01	85 cm
Ki-11148	6310±70	charcoal	3/01	75 cm
Ki-10370	6280±60	charcoal	2/01	55 cm
Ki-11737	6280±100	pottery	3/01	65 cm
Ki-11738	6280±100	pottery	3/01	55 cm
Ki-11150	6270±70	charcoal	3/01	75 cm
Ki-9251	6250±300	charcoal	sounding C	60 cm
Ki-10371	6250±60	charcoal	2/01	75 cm
Ki-11731	6230±90	pottery	3/01	55 cm
Ki-11734	6220±100	pottery	2/01	75 cm
Ki-11151	6190±70	charcoal	10/01	65 cm
Ki-11736	6140±100	pottery	2/01	65 cm
Ki-11738	5970±90	pottery	1/98	55 cm
Ki-11740	5880±120	pottery	2/01	65 cm
Ki-11739	5430±120	pottery	2/99A	55 cm

Table 1. ^{14}C dates from Moravany

DISCUSSION AND CONCLUSION

It has so far been impossible to determine, even tentatively, the boundaries of the settlement and thus we do not know its actual extent or its possible functions. However, the results of the investigations indicate that it was not a seasonal camp or a briefly occupied settlement. This is confirmed by the following evidence: (a) the full chain of lithic (mainly obsidian) tool production; (b) large features, some of which contained a rich archaeological material; (c) post-holes; and (d) contact with the territories north of the Pozdišovský Range, including Transcarpathian regions.

The chronological position of the settlement at Moravany indicates that its occupants may have belonged to the first Neolithic farmers and stockbreeders in the eastern Slovakian Lowland. Because there are no conclusive traces of Late Mesolithic occupation in eastern Slovakia, we can hardly talk about

30 *E. Hertelendi – N. Kalicz – P. Raczky – F. Horváth – M. Veres – E. Svingor – I. Futó – L. Bartosiewicz*: Re-evaluation of the Neolithic in eastern Hungary based on calibrated radiocarbon dates. Radiocarbon 37 (1995) 239–244; *F. Horváth – E. Hertelendi:* Contribution to the 14C based absolute chronology of the Early and Middle Neolithic Tisza region. JAMÉ 36 (1994) 111–135.

local neolithisation based on indigenous hunter-gatherer populations. Neither does the technology of tool manufacture point to local neolithisation, seeing that it is related to the Early Neolithic traditions of the Great Hungarian Plain. The currently available evidence suggests that the Moravany settlement was established by a late Körös group, which arrived to Moravany from outside the territory of the eastern Slovakian Plain around 5500 BC. The starting point of this migration probably lay in the central areas of the Great Hungarian Plain or the territory of present-day Transcarpathian Ukraine. It seems more likely that the Körös groups, which penetrated the Upper Tisza Basin and perhaps even crossed the main ridge of the Eastern Carpathians,[31] were better adapted to upland and inter-montane environments.

The point of view presented above has certain implications for the overall approach to the neolithisation of the Upper Tisza Basin. It may be assumed that in the eastern Slovakian Lowland this process took place, at least in part, independently of the general trajectory of development in north-eastern Hungary, which eventually led to the emergence of the eastern Linear Pottery culture (Alföld Linear Pottery) from the Körös culture. The main tendency in the Great Hungarian Plain was a smooth transition from the Körös culture, through local transitional stages such as the Méhtelek and the Szatmár groups, to the Alföld Linear Pottery proper.[32] In eastern Slovakia, the initial phase of the Early Neolithic was probably rooted directly in the late phase of the Körös culture, while the subsequent course of neolithisation was basically independent of the Méhtelek–Szatmár–ALP development. In other words, an autonomous and to some extent distinctive material culture emerged around the mid-6th millennium BC in the eastern Slovakian Lowland and in the Košice Basin,[33] which, however, was nonetheless part of the general eastern Linear Pottery style.

The high topographical location of the Early Neolithic settlement at Moravany must have meant difficulties as regards water supply, unless as a result of the humid, Atlantic climate, prevalent also in this region,[34] the Šarkan Creek, which at present is a perennial creek, flowed at the bottom of the currently dry valley. This permanent creek probably had a single, more deeply incised channel. On the other hand, the high position of the settlement is climatically favourable, with a lower number of inversions and the best thermal and humidity conditions.

No traces of Early Neolithic human activity have so far been discovered in the sediments of valley floors. It seems likely that any changes in the environment were very small and local. The buried soil on the floodplains indicates a dominance of vertical accretion in the bottom of the main valley and an alternation of phases of increased overbank deposition and phases of soil formation. Small valleys, such as the Šarkan Valley, were filled after the Late Pleniglacial/Late Glacial incision. Because slope erosion removed the layers associated with the Early Neolithic settlement, preserved only in the anthropogenic pits, the alluvial filling is probably younger than the Neolithic. The alluvial fan from the last centuries points to strong slope erosion caused by human activity under the climatic condition of the Little Ice Age in the 15th–17th centuries.

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31 *S. Marinescu-Bîlcu:* Les Carpates Orientales et la Moldavie. *In:* Atlas du Néolithique européen. L'Europe orientale. Éd.: J. Guilaine – J. K. Kozłowski – M. Otte. Liége 1993, 191–241.

32 *Kalicz – Makkay* (1977).

33 *Šiška* (1989) 58–67.

34 *G. Gabris – E. Horváth – A. Novotny – K. Ujházy:* Environmental changes during the last-, late- and post-glacial in Hungary. *In:* Physico-geographical research in Hungary. Eds: Á. Kertész – F. Schweitzer. Budapest 2000, 47–62.

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Kaczanowska et alii (2002) — *M. Kaczanowska – L. Kaminská – J. K. Kozłowski – M. Nowak – M. Vizdal:* Badania wykopaliskowe na wczesnoneolitycznej osadzie w miejscowości Moravany na wschodniej Słowacji w latach 1998–2001. Materiały i Sprawozdania Rzeszowskiego Ośrodka Archeologicznego 23 (2002) 173–199.

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Nowak et alii (2005) — *M. Nowak – T. Kalicki – J. K. Kozłowski – M. Kaczanowska – Ľ. Kaminská – M. Lityńska-Zając – E. Stobierska – M. Vizdal – P. Wyszomirski:* A settlement of the Early Eastern Linear Pottery Culture at Moravany (Eastern Slovakia). L'Institut d'Archéologie de l'Universite de Cracovie. Recherches Archéologiques de 1999–2003. Kraków 2005 (in press).

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THE CSARODA AREA DURING THE MESOLITHIC, THE NEOLITHIC AND THE COPPER AGE[1]

Eszter Bánffy

EVIDENCE FOR MESOLITHIC HUNTERS

The Csaroda area, the Bereg Plain is the north-eastern extension of the sandy table-land known as the Nyírség. It is part of the Upper Tisza region in a broader sense, but in the historic or, better said, prehistoric sense, this area lies on the fringes of the Great Hungarian Plain, the northern mountains and the "gateway" to Transylvania. This location played a decisive role in the area's prehistory. Extending to the Bihar Mountains in the east and the Great Hungarian Plain in the west, the Szilágyság, the Szatmár Plain, and the valleys of the Berettyó, the Black Körös, the Rapid Körös, the Kraszna and the Ér rivers were dotted with marshlands. In contrast to the first occupants of the Tisza and the Körös regions, we know very little about the Mesolithic hunter-gatherer groups and the Neolithic and Copper Age agrarian and stockbreeding communities in this region. This area has more recently been targeted for interdisciplinary research and thus the settlement history outlined here will no doubt be refined or even partly re-written in the light of these studies.

According to Janusz K. Kozłowski's study on the Mesolithic, the northern part of the Great Hungarian Plain and the Ér Valley was colonised by the remnants of population groups migrating northwards from the Balkans.[2] Juraj Bárta too emphasised the survival of Western European traditions in the development of this region.[3] The stone tools of the Mesolithic from the area between Gura Baciului/Bácsi torok near Kolozsvár and Ciumeşti/Csomaköz near Bátorliget have been extensively studied by Transylvanian prehistorians. In Hungary, Róbert Kertész has devoted his energies to clarifying various issues of the Mesolithic, and as a result of his studies we now have a fairly good picture of Mesolithic settlements and the lifeways of Mesolithic communities in the Jászság area, lying on the northern fringes of the Great Hungarian Plain. It seems likely that most of his conclusions are also valid for the Upper Tisza region in north-eastern Hungary, seeing that conditions were not much different there.[4] No matter what the cultural background of the population which settled in the Csaroda area, and irrespective of which tool-making tradition they followed, they left two major impacts on the environment. Slash-and-burn was perhaps used for clearing and maintaining clearings and paths, which could be identified in layers dated to 7000 B.C., and the sudden increase in hazel pollen too indicates the presence of Mesolithic hunter-gatherer groups. Evidence from other parts of Europe too shows that local communities exploited the favourable climatic changes by small-scale forest clearing to encourage higher yields by warmth-loving plants, such as hazel.[5]

1 The settlement history outlined here is based on the environemtal research conducted by Pál Sümegi and his colleagues (*Sümegi* 1999). I would here like to thank him and Imola Juhász for their generous help. For Imola Juhász's study on the pollen profile from Nyíres-tó at Csaroda, cp. pp. 55–66 in this volume.

2 *J. Kozłowski:* The problem of the so-called "Danubian Mesolithic". *In:* The Mesolithic in Europe. Ed.: S. K. Kozłowski. Warszawa 1973, 315–330.

3 *J. Bárta:* Das Paläolithikum und Mesolithikum. *In:* Vorschlag der Chronologie der Vor- und Frühgeschichte in der Slowakei. SlovArch 28:1 (1980) 129, 136.

4 *Kertész* (1994); *Kertész R.:* Az Alföld őstörténeti vázlata a mezolitikum és a kora neolitikum időszakában (A Jászsági ősrégészeti modell jelentősége). JászÉvk (1995) 62–80; *Kertész* (1996).

5 *D. Gronenborn:* A variation on a basic theme: The transition to farming in Southern Central Europe. Journal of World Prehistory 13:2 (1999) 123–210; *M. Zvelebil:* Mesolithic prelude and neolithic revolution. *In:* Hunters in transition. Ed.: M. Zvelebil. Cambridge 1986, 5–15; *M. Zvelebil – M. Lillie:* Transition to agriculture in Eastern Europe. *In:* Europe's first farmers. Ed.: T. D. Price. Cambridge 2000, 57–92.

The small, mobile communities of the period, who established temporary campsites during their seasonal migrations corresponding to the rhythm of the migrating animal herds, had a subsistence based on fishing, hunting and gathering. Similarly to the Carpathian Basin and the greater part of Europe, the Csaroda area was sparsely settled. According to some estimates, the population density was no higher than 0.1/km².[6] In addition to the sites on the other side of the Hungarian–Ukrainian border, Mesolithic finds similar to the ones from Csaroda have been reported from Hugyaj[7] and Tarpa.[8]

The plainland dotted with marshland and sandy ridges and criss-crossed by streams and rivers provided an ideal environment for Mesolithic communities, well suited to their life-style. Genuine river terraces did not evolve in the Ér Valley and thus the hunters followed the migrating animal herds along the constantly shifting watercourses.[9] Similarly to their knowledge of plants, the pre-Neolithic hunters following the animal herds were familiar with the behavioural patterns and reproductive cycle of deer and aurochs. It is possible that dog, a species domesticated before the onset of the Mesolithic, had become man's companion and was in fact used for herding wild animal herds, which could thus be controlled to some extent.[10]

THE EARLY NEOLITHIC – THE BEGINNINGS OF A PRODUCTION ECONOMY

The small population groups colonising the Bereg plainland, who transplanted the Neolithic innovations to this region, apparently arrived from the Banat and western Transylvania, and not from the Great Hungarian Plain. From her examination of the lithics brought to light at various sites in Transylvania and the Partium (Ciumeşti/Csomaköz, Gura Baciului/Bácsi torok, Livada, Iclod/Iklód–La Doroaie, Moreşti/Malomfalva, Leţ/Léc, etc.), Zoia Maxim concluded that the river valleys and the upland areas were inhabited by late Mesolithic communities, when the first "civilisational" innovations reached this region.[11] Iuliu Paul regarded the indigenous contribution important enough to suggest that the agrarian communities arriving from the Balkans found food-producing groups in the area, which he described as a local Prăcriş group (a name derived from the Criş culture, the Romanian counterpart of the Early Neolithic Körös–Starčevo group in the Great Hungarian Plain).[12] Attila László emphasised the existence and significance of a very early sedentary phase in Transylvania, going as far as to claim that the Gura Baciului/Bácsi torok site predated Ocna Sibiului/Vízakna and the Cîrcea–Gradinile group, the earliest Neolithic sites in the southern Carpathians.[13] Zoia Maxim based her conclusions concerning the

6 *A. Zimmermann:* Austauschsysteme von Silexartefakten in der Bandkeramik Europas. Universitätsforschungen zur Prähistorischen Archäologie 26. Bonn 1995, 8.

7 *Vértes L.:* Az őskőkor és az átmeneti kőkor emlékei Magyarországon. A Magyar Régészet Kézikönyve I. Budapest 1965, 212; *V. T. Dobosi:* Mesolithische Fundorte in Ungarn. *In:* Aktuelle Fragen der Bandkeramik. Hrsg.: J. Fitz. Székesfehérvár 1972, 42.

8 *V. T. Dobosi:* Ausgrabung von Tarpa–Gehöft Márkus. CommArchHung (1983) 5–18; *R. Kertész:* Data to the Mesolithic of the Great Hungarian Plain. Tisicum 8 (1993) 89–90.

9 *Maxim* (1999) 27–30, 221–222.

10 *R. Tringham:* The Mesolithic of Southeastern Europe. *In:* The Mesolithic in Europe. Ed.: S. K. Kozłowski. Warszawa 1973, 551–572.

11 *Maxim* (1999) 27–30, 221–222.

12 *I. Paul:* Vorgeschichtliche Untersuchungen in Siebenbürgen. Alba Iulia 1995, 62–67.

13 *A. László:* Sur le début du néolithique de la Roumanie: quelques considérations concernant la période "Protostarčevo". *In:* Préhistoire d'Anatolie. Genèse de deux mondes I. Éd.: M. Otte. ERAUL 85. Liège 1998, 176–177.

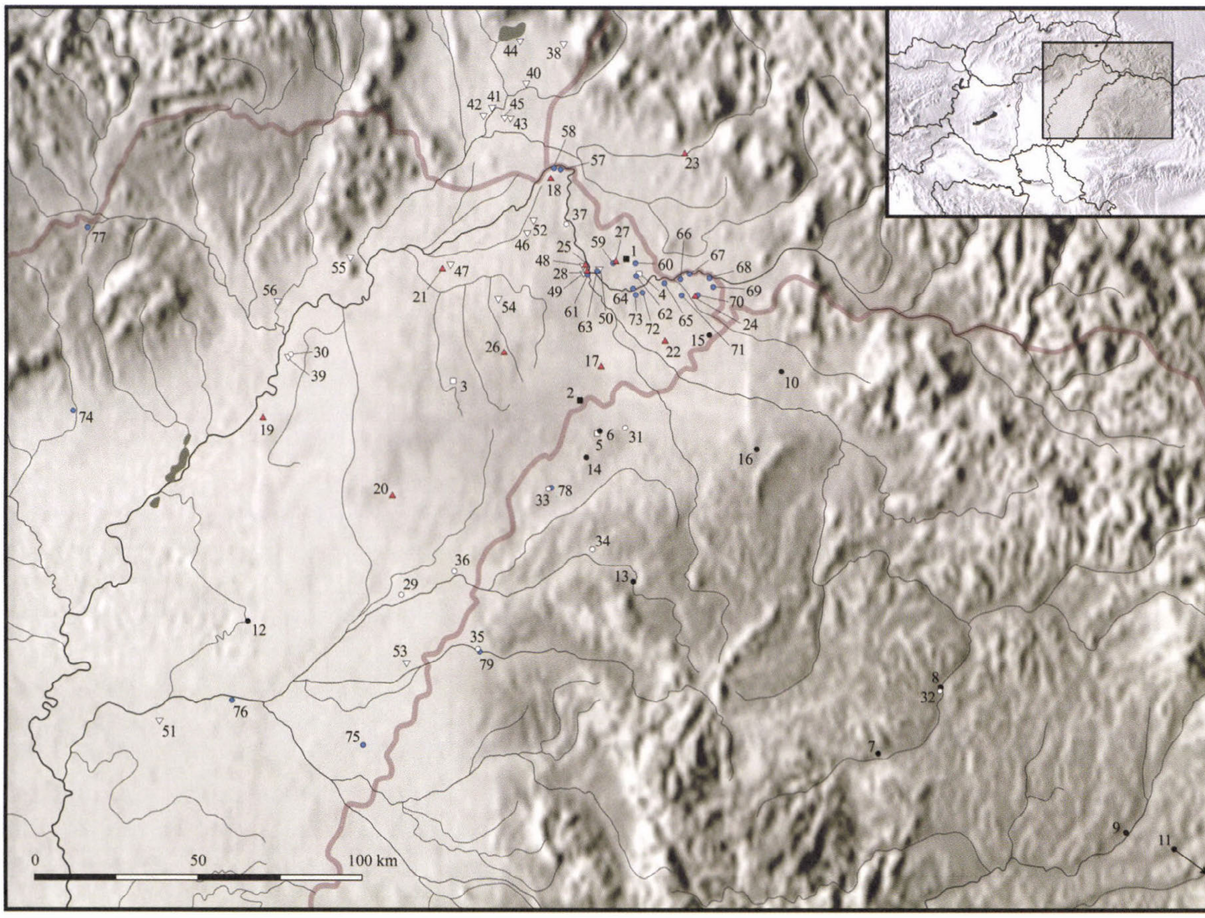

Fig. 1. Sampling locations and archaeological sites:
a. Palaeoecological sampling locations: 1. Csaroda, 2. Bátorliget; Mesolithic sites in the Csaroda area: 3. Hugyaj, 4. Tarpa, 5. Ciumeşti
b. Early Neolithic sites in the Csaroda area: 6. Ciumeşti, 7. Gura Baciului, 8. Iclod, 9. Moreşti, 10. Livada, 11. Leţ, 12. Ecsegfalva, 13. Suplacul de Barcău, 14. Pişcolţ, 15. Méhtelek, 16. Homorodul de Sus
c. Middle Neolithic sites in the Csaroda area: 17. Nagyecsed, 18. Tiszabezdéd, 19. Tiszacsege, 20. Ebes, 21. Ibrány, 22. Szamossályi, 23. Mukačevo, 24. Kölcse, 25. Kisvarsány, 26. Pócspetri, 27. Tákos, 28. Vásárosnamény
d. Late Neolithic sites in the Csaroda area: 29. Herpály, 30. Polgár, 31. Carei, 32. Iclod, 33. Valea lui Mihai, 34. Marghita, 35. Sîntandrei, 36. Esztár, 37. Cserepeskenéz
e. Early and Middle Copper Age sites in the Csaroda area: 38. Tibava, 39. (Tisza)Polgár, 40. Drahnov, 41. Veľké Raškovce, 42. Oborin, 43. Čičarovce, 44. Lučka, 45. Krisovská Liesková, 46. Kisvárda, 47. Nagyhalász, 48. Kisvarsány, 49. Vásárosnamény, 50. Jánd, 51. Szarvas, 52. Fényeslitke, 53. Magyarhomorog, 54. Székely, 55. Bodrogkeresztúr, 56. Tiszalúc
f. Late Copper Age sites in the Csaroda area: 57. Zsurk, 58. Záhony, 59. Tákos, 60. Márokpapi, 61. Vásárosnamény, 62. Tarpa, 63. Jánd, 64. Tivadar, 65. Szatmárcseke, 66. Tiszakóród, 67. Tiszacsécse, 68. Tiszabecs, 69. Uszka, 70. Kölcse, 71. Túristvándi, 72. Nagyar, 73. Kisar, 74. Kompolt, 75. Sarkadkeresztúr, 76. Endrőd, 77. Ózd, 78. Valea lui Mihai, 79. Sintandrei

neolithisation of the region on earlier research and on the countless studies published on this subject.[14] In her view, the many sites identified in the region extending to Kolozsvár indicate that Neolithic groups first advanced northward and north-eastward through the Olt Valley and, slightly later, through the Maros and White Körös valleys.[15]

The Neolithic innovations spread fairly rapidly and subsistence patterns based exclusively on hunting and gathering were soon supplanted by one based on food production. The Upper Tisza region is one of the regions in the Carpathian Basin, whose ecological conditions favoured neolithisation around 6000 BC.[16] In other words, the prehistoric groups living in this region had earlier simply exploited the region's resources, whereas from the Neolithic they actively began manipulating and transforming the environment. This is when the process lasting up to the present began. The changes in the pollen sequences were preceded by evidence for slash and burn (indicated by micro-charcoal in the geoarchaeological samples) in order to gain tracts of arable land and pastures. The wood was also used for house construction: earlier makeshift tents and huts were replaced with saddle-roofed houses with daub walls built around a framework of posts. The remains of several houses of this type have been uncovered in the Great Hungarian Plain.[17] A heap of burnt daub, probably the remains of a house with above-ground, upright walls, has recently been found at Ecsegfalva in the north-eastern part of the Great Hungarian Plain.[18] Local groups apparently "paid" for various elements of the Neolithic package from the south – domesticated plants, the offspring of sheep and goat, the know-how of house construction and pottery making – with valuable lithics procured from the mountains.

It is possible that the hunter-gatherer groups first only asked for various objects, vessels and foodstuffs made from cereals in exchange for the lithics. It seems likely that the Neolithic innovations only proved attractive once the thought occurred to these indigenous groups that they too could make clay vessels, they too could experiment with retouching their stone tools, that they too might try sowing the seeds received from the newcomers, and that they too could master the art of house construction and try their hand at it. What degree of co-operation is necessary for mastering the skills of house construction, sowing and harvesting or pottery making? The domestication of animals was probably the least difficult of these since the indigenous hunters were no doubt familiar with the behaviour of herds, including the behavioural patterns of female animals rearing their young, and they were also quite experienced in processing slaughtered animals. It is also possible that these hunter-gatherer groups participated in the local domestication of aurochs owing to their better knowledge of local conditions. These are some of the phases described by social scientists and ethnologists studying group behaviour; it is to be hoped that prehistorians studying the neolithisation of the Carpathian Basin will some day have sufficient evidence to raise and, more importantly, answer these questions.

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14 *E. Comşa:* La civilisation Criş sur le territoire de la Roumanie. ActaArchCarp 1 (1959) 173–190; *E. Comşa:* Materiale de tip Starčevo descoperite la Liubcova. SCIV 17 (1966) 355–361; *E. Comşa:* Données sur la civilisation de Dudeşti. PZ 46:2 (1971) 195–249; *E. Comşa:* Quelques problèmes concernant la civilisation de Ciumeşti. ActaArchCarp 13 (1972–1973) 39–50; *E. Comşa:* Date privind procesul de neolitizare pe teritoriul României. Aluta (1976–1977) 19–24; *D. Berciu:* Contribuţii la problemele neoliticului în România în lumina noilor cercetări. Bucureşti 1961; *N. Vlassa:* Cultura Criş in Transilvania. ActaMusNap 3 (1966) 9–47; *N. Vlassa:* Sondajul de salvare de la Gura Baciului, com. Baciu, or. Cluj. ActaMusNap 5 (1968) 371–378; *N. Vlassa:* Eine frühneolithische Kultur mit bemalter Keramik der Vor-Starčevo–Körös Zeit in Cluj–Gura Baciului, Siebenbürgen. PZ 47:2 (1972) 174–197; *N. Vlassa:* Cea mai veche faza a complexului cultural Starčevo–Criş in România. ActaMusNap 9 (1972) 7–38; *I. Paul:* Săpăturile arheologica din vara anului 1960 de la Ocna Sibiului. MCA 9 (1970) 97–104; *G. Lazarovici*: Cultura Starčevo-Criş în Banat. ActaMusNap 6 (1969) 3–26; *G. Lazarovici:* Cultura Vinča A in Banat. ActaMusNap 7 (1970) 473–488; *G. Lazarovici:* Gornea. Preistorie. Reşiţa 1977; *G. Lazarovici:* Neoliticul Banatului. Cluj–Napoca 1979; *G. Lazarovici:* Die Periodisierung der Vinča-Kultur in Rumänien. PZ 56:2 (1981) 169–196; *M. Nica:* La culture Dudeşti en Olténie. Dacia N.S. 20 (1976) 71–103; *M. Nica:* Nouvelles données sur le néolithique ancien d'Olténie. Dacia N.S. 21 (1977) 13–54; *M. Nica:* La groupe culturel Cîrcea–Gradinile dans le contexte du néolithique Balcanique et Anatolien. ActaMusNap 32 (1995) 11–28; *M. Nica:* Die mesolithischen und neolithischen Kulturen Olteniens im Kontext des mittel- und südosteuropäischen Neolithikums. Analele Banatului S. N. 7–8 (2000) 133–160; *G. Lazarovici – Z. Maxim:* Gura Baciului. Cluj–Napoca 1995.

15 *Maxim* (1999) 29.

16 *Sümegi – Kertész* (2001) Fig. 5.

17 *W. Meier-Arendt:* Überlegungen zur Herkunft der linienbandkeramischen Langhauses. *In:* Neolithic of Southeastern Europe and its Near Eastern Connections. Ed.: S. Bökönyi. Budapest 1989, 183–189.

18 *A. Whittle:* New research on the Hungarian Early Neolithic. Antiquity 74 (2000) 13–14.

Be as it may, it is still unclear why the waterlogged and marshy Bereg region and the Ér Valley, not really suited to cultivation, was so attractive to early agrarian groups. One plausible explanation is that in addition to local lithics, the sources of obsidian – one of the most valuable resources during the Neolithic – lay nearby in the Tokaj Mountains, which would explain why these groups settled in proximity to these sources. The high number of obsidian tools found on early settlements supports this possibility.[19] The sand with bitumen contents around Suplacul de Barcău/Berettyószéplak must also be mentioned. It seems likely that bitumen, an organic substance used for decorating pottery wares during the Neolithic, was a prized commodity, as shown by the fact that its use has also been documented in the eastern part of the Great Hungarian Plain.[20]

The first finds from this region were published by Ida Kutzián in her monograph on the Körös culture.[21] An overview of the Early Neolithic sites in the Ér Valley was published by Doina Ignat; the ones in the Szilágyság were discussed by Éva Lakó and Gheorghe Lazarovici, while Tibor Bader reviewed the ones in Szatmár County.[22] There can be no doubt in the light of the cultural connections with the Banat and northern Transylvania that the Csaroda area was colonised by Criş groups from Transylvania, expanding from the east. The Körös culture, which rapidly advanced northward in the Great Hungarian Plain, stopped along an imaginary line – i.e. not a genuine geographic boundary – between Szolnok and Berettyóújfalu. This halt has been variously explained with the presence of indigenous and perhaps hostile Mesolithic groups living in the Upper Tisza region and the Northern Mountain Range,[23] and with a natural ecologic barrier marking the northern boundary of the South-East European food-producing way of life.[24] Since the currently available evidence suggests that interaction between Mesolithic and Neolithic groups was peaceful both in Transdanubia and in eastern Hungary, the explanation invoking an agro-ecologic barrier seems more plausible.[25]

Csaroda lies in this frontier region and the answer to this question is crucial for the Szatmár-Bereg region. Several major Early Neolithic sites have been identified in this area. Most outstanding among these is the Méhtelek settlement, whose pottery and unique sculpture clearly link this site to the Transylvanian Criş culture.[26] Gheorghe Lazarovici reached a similar conclusion from his study of the finds from nearby Ciumeşti/Csomaköz and Pişcolţ/Piskolt.[27]

The investigation of the Csaroda area offers yet additional evidence for the reconstruction of prehistoric settlement patterns around 5700 BC. The changes in the environment suggest that a food-producing economy, involving the cultivation of the first domestic cereals and the raising of sheep, goat and probably cattle, had been transplanted to this region together with a sedentary way of life. The first permanent settlements with daub-walled houses made their appearance. Similarly to the transition to the Neolithic in Transdanubia, the first phase of this transformation was not coupled with dramatic changes.[28] The communities in the Bereg region did not entirely abandon their earlier subsistence strategy of hunting, fishing and gathering.[29] Intensive agriculture was first practiced in the Middle Neolithic.

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19 *Kalicz–Makkay* (1976); *Starnini* (1994).

20 *Ignat* (2001) 70.

21 *Kutzián I.:* A Körös-kultúra. DissPann II. 23. Budapest 1944.

22 *É. Lakó:* Raport preliminar privind săpăturile de salvare executate în anii 1978–1979. ActaMusPor 4 (1980) 31–34; *G. Lazarovici – É. Lakó:* Săpăturile de la Zauan – campania din 1980 şi importanţa acestor descoperiri pentru neoliticul din nord-vestul Romaniei. ActaMusNap 18 (1981) 13–44; *T. Bader:* Despre figurinele antropomorfe în cadrul culturii Criş. ActaMusNap 5 (1968) 383–388.

23 *Makkay* (1982).

24 *Kertész R. – Sümegi P.:* Teóriák, kritika és egy modell: miért állt meg a Körös–Starčevo kultúra terjedése a Kárpát-medence centrumában? Tisicum 11 (1999) 9–23; *Sümegi – Kertész* (2001).

25 *E. Bánffy:* The late Starčevo and the earliest Linear Pottery groups in Western Transdanubia. DocPraeh 27 (2000) 173–185.

26 *Kalicz – Makkay* (1976); *Starnini* (1994).

27 *Lazarovici – Németi* (1983).

28 *Bánffy* (2004) Chapter 9.

29 *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:* The Upper Tisa valley. Eds: J. Hamar – A. Sárkány-Kiss. Szeged 1999, 173–204.

Nándor Kalicz and János Makkay had noted many decades ago that the sites of the old "Szatmár group" at Nagyecsed, Tiszabezdéd, Tiszavalk, Tiszacsege, Ebes, Ibrány and Ciumeşti/Csomaköz in the Berettyó, Szamos and Ér Valleys and in the Upper Tisza region can hardly be understood without assuming contact with Transylvania.[30] Körös elements are more dominant than Linear Pottery traits in the early Alföld Linear Pottery (Szatmár II) assemblages from Nagyecsed–Péterzug and Tiszabezdéd–Servápa.[31] Based on these features, Kalicz and Makkay assigned these sites to their Szatmár I group, together with Méhtelek and Homorodul de Sus/Felsőhomorod.[32] Following his excavation of the Kőtelek–Huszársarok site, Pál Raczky noted that the assemblages of the Szatmár II group "contained many formal and ornamental elements whose origins could only be explained through the Transylvanian branch of the Körös culture."[33] According to Romanian prehistorians, north-western Transylvania and the Partium were colonised during the late Starčevo–Criş period,[34] characterised by the assemblages from Ciumeşti/Csomaköz and nearby Pişcolţ/Piskolt, the implication being that any cultural impact could at the most only have affected the late Körös distribution extending to the Berettyó River in the Great Hungarian Plain and the formative Alföld Linear Pottery (Szatmár II) groups. Early Alföld Linear Pottery sites, however, are lacking between the Nyírség and the Hortobágy.[35] Katalin Kurucz noted that the finds from the early sites on the Szatmár Plain (up to the Szamossályi site) differed from the assemblages in more westerly areas to the extent that "any genetic relation between the two seems very doubtful."[36] The later development in this region definitely confirms this observation. Very few of the late Alföld Linear Pottery groups ornamented their pottery with painting, and the ones that did applied painted bands after the vessel had been fired. Curiously enough, this is the single region occupied by the "Esztár–Szamos Region Painted Pottery group": this group too used the intricate and lovely ornamental motifs of the other Alföld Linear Pottery groups (and especially of the Bükk group), albeit these motifs were not incised, but painted onto the vessel surface, as shown by its name. Cultures with painted pottery were fairly widespread in this period and in the Late Neolithic too, but their distribution essentially fell east of Hungary's present-day borders and coincided with the one-time Criş distribution.

It is striking that while the earliest Alföld Linear Pottery phase seems to be absent from the southern part of the Great Hungarian Plain,[37] the Szatmár II sites form dense clusters along the Tisza and its tributaries from the Ér Valley through the Upper Tisza region to the Bükk, the Mátra and the Cserhát Mountains. The two Szatmár II settlements uncovered during the excavations preceding the construction of the M3 motorway at Mezőkövesd–Szentistván-Mocsolyás and Füzesabony–Gubakút can be

30 *N. Kalicz – J. Makkay:* Probleme des frühen Neolithikums der nördlichen Tiefebene. Alba Regia 12 (1972) 78; *Kalicz – Makkay:* (1977); *Makkay* (1982).

31 *Kalicz – Makkay* (1977) 20.

32 *N. Kalicz – J. Makkay:* Probleme des frühen Neolithikums der nördlichen Tiefebene. Alba Regia 12 (1972) 92; *Kalicz – Makkay* (1976) 22.

33 *Raczky P.:* A korai neolitikumból a középső neolitikumba való átmenet kérdései a Közép- és Felső-Tiszavidéken. ArchÉrt 110 (1983) 161–194; *Raczky P.:* Megjegyzések az "alföldi vonaldíszes kerámia" kialakulásának kérdéséhez. *In:* Régészeti tanulmányok Kelet-Magyarországról. Szerk.: Németh P. Debrecen 1986, 31; *Raczky P.:* A Tiszavidék kulturális és kronológiai kapcsolatai a Balkánnal és az Égeikummal a neolitikum, rézkor időszakában. Újabb kutatási eredmények és problémák. Szolnok 1988, 27.

34 *G. Lazarovici:* Cîteva probleme privind sfârşitul neoliticului timpuriu din Nord-Vestul României. ActaMusNap 27 (1980) 13–30; *G. Lazarovici:* Die Periodisierung der Starčevo-Kultur in Rumänien. *In:* III. Internationaler Thrakologischer Kongress Wien 1980. Sofia 1984, 94–110; *G. Lazarovici:* Neoliticul timpuriu in România. ActaMusPor 8 (1984) 49–104; *Maxim* (1999); *Ignat* (2001); *Lazarovici – Németi* (1983).

35 *Kurucz* (1989) 14–15.

36 *Ibidem* 15.

37 The single early site in the south is Hódmezővásárhely–Terefok. *Horváth* (1994).

fitted into this series.[38] These sites lie fairly close to the Mesolithic settlements identified in the Jászság area, to the late Mesolithic sites in the Zagyva Valley and the lower reaches of the Tarna River.[39] The early Linear Pottery sites too cluster in the valleys extending to the mountain region, in the Hernád and Bodrog Valleys to the east and the meanders of the upper reaches of the Tisza River.[40] It has been suggested that riverside settlements in the area between the Great Hungarian Plain and the mountainous region to its north acted as a kind of "marketplace" for the interaction, the possible co-existence and mixing of groups with different lifestyles during different periods of the Neolithic and the Copper Age in Hungary.[41]

On the testimony of the lithic finds, interaction between different groups in western Transdanubia and the Balaton region was stimulated by the trade of radiolarite from the Szentgál mine. A similar situation can be assumed in the case of the Csaroda area, the only difference being that the most valuable raw materials of the Northern Mountain Range were limnoquartzite from the Mátra Mountains and obsidian from Tokaj. The stone tools found on early Alföld Linear Pottery sites and, also, on Körös sites were predominantly manufactured from these two rocks.[42] It would appear that these raw material sources were controlled by Mesolithic groups both in Transdanubia and in the Northern Mountain Range, and that the main cause and incentive for contact and interaction was the trade of these lithics. The indigenous groups presumably received Neolithic technologies in exchange for the lithic raw material in the Great Hungarian Plain too, similarly to the situation assumed for Transdanubia.[43] One other difference between the two regions is that in the Upper Tisza region, the indigenous Mesolithic groups controlling the raw material sources came into contact not with one, but with two immigrant populations: the Körös groups expanding up to the Szolnok–Berettyó line from the south, and the Criş groups advancing from the Ér and Berettyó Valleys to Szatmár and towards Tokaj along the Tisza (no doubt attracted by the sources of the valuable lithic raw material). The mediating role undoubtedly survived into the late Alföld Linear Pottery phase: the eastern boundary of the Bükk distribution lay in the Szatmár-Bereg region.[44] In his 1929 monograph, Ferenc Tompa quotes a Bükk site near Mukačevo/Munkács, where

38 *Kalicz N. – S. Koós J.:* Mezőkövesd–Mocsolyás. Újkőkori telep és temetkezések a Kr. e. VI. évezredből. *In:* Utak a múltba. Az M3-as autópálya régészeti leletmentései. Eds: P. Raczky – T. Kovács – A. Anders. Budapest 1997, 28–33; *N. Kalicz – S. J. Koós:* Eine Siedlung mit ältestneolithischen Hausresten und Gräbern in Nordostungarn. *In:* Antidoron. Completis LXV annis Dragoslavo Srejović ab amicis collegis discipulis oblatum. University of Belgrade, Faculty of Philosophy, Vol. 17. Beograd 1997, 125–135; *Kalicz N. – S. Koós J.:* Település a legkorábbi újkőkori sírokkal Északkelet-Magyarországról. HOMÉ 39 (2000) 45–76; *L. Domboróczki:* The excavation at Füzesabony–Gubakút. Preliminary report. *In:* From the Mesolithic to the Neolithic. Proceedings of the International Archaeological Conference held in the Damjanich Museum of Szolnok, Sept. 22–27, 1996. Eds: R. Kertész – J. Makkay. Budapest 1996, 193–214; *Domboróczki* (1997); *Domboróczki* (1999) 15–47; *L. Domboróczki:* Településszerkezeti sajátosságok a középső neolitikum időszakából, Heves megye területéről. ΜΩΜΟΣ I. Fiatal Őskoros Kutatók I. összejövetelének konferenciakötete, Debrecen 1997. november 10–13. Eds: E. Gy. Nagy – J. Dani – Zs. Hajdú – L. Selmeczi. Debrecen 2001, 67–94; *L. Domboróczki:* The radiocarbon data from neolithic archaeological sites in Heves County (North-Eastern Hungary). Agria 39 (2003) 5–76.

39 *Kertész* (1994); *Kertész* (1996); *R. Kertész – P. Sümegi – M. Kozák – M. Braun – E. Félegyházi – E. Hertelendi:* Mesolithikum im nördlichen Teil der Großen Ungarischen Tiefebene. JAMÉ 36 (1994) 15–61. I would here like to thank Robert Kertész and László Domboróczki for informing me about their excavation at Tarnaörs, conducted in 2002.

40 *Kurucz* (1989) distribution maps.

41 *Kalicz* (1994); *Raczky et alii* (1994); *E. Bánffy:* Újkőkor, rézkor. *In:* Kompolt–Kistér: újkőkori telep. Újkőkori, bronzkori, szarmata és avar lelőhely. Leletmentő ásatás az M3 nyomvonalán – Kompolt–Kistér. Eds: T. Petercsák – J. J. Szabó. Eger 1999, 13–170.

42 *Kalicz – Makkay* (1976) 23; *Starnini* (1994); *E. Starnini:* Stone industries of the early neolithic cultures in Hungary and their relationships with the mesolithic background. Societa Preistoria Protoistoria Friuli–Venezia Giulia, Trieste 8 (2000) 207–219; *E. Starnini:* The Mesolithic/Neolithic transition in Hungary: the lithic perspective. *In:* From the Mesolithic to the Neolithic. Proceedings of the International Archaeological Conference held in the Damjanich Museum of Szolnok, Sept. 22–27. Eds: R. Kertész – J. Makkay. Budapest 2001, 395–404; *K. T. Bíró:* Lithic materials from the Early Neolithic in Hungary. *In:* From the Mesolithic to the Neolithic. Proceedings of the International Archaeological Conference held in the Damjanich Museum of Szolnok, Sept. 22–27. Eds: R. Kertész – J. Makkay. Budapest 2001, 89–100; *Domboróczki* (1997); *K. T. Bíró:* Advances in the study of early neolithic lithic materials in Hungary. *In:* Prehistoric studies in memoriam Ida Bognár-Kutzián. Ed.: E. Bánffy. Antaeus 25 (2002) 237–241; *Maxim* (1999).

43 *Bánffy* (2004) Chapter 10.

44 *Kalicz – Makkay* (1977) 43–45. A settlement of the Bükk culture was investigated at Oros, east of Nyíregyháza (*Korek* 1951) and to the north, at Paszab near Ibrány (*Tompa* 1929, Pl. 42).

painted pottery fragments were found;[45] this site lies quite close to Csaroda, but on the other side of the border with the Ukraine. The single Middle Neolithic group which decorated its pottery wares with painting was the Esztár–Szamos Region Painted Pottery culture, whose sites are known in the Csaroda area, e.g. at Kölcse, Kisvarsány, Pócspetri, Tákos and Vásárosnamény.[46] Observations made at a new Esztár site found slightly south of Csaroda in the Berettyó–Ér region indicate that the typical Linear Pottery longhouse was still in use during this period.[47] The importance of the Csaroda area during the Early and Middle Neolithic thus probably lay in its role in the trade of various commodities, rather than its fertile soil, suited to crop cultivation.

THE LATE NEOLITHIC

Improving food producing techniques and better yields enabled communities living in the Great Hungarian Plain, characterised by fertile soils, to establish permanent settlements, which were occupied over a long period of time. This sedentary way of life led to the emergence of a rather unique settlement type known as settlement mounds (also called *tells*, an Arabic word), after their Near Eastern and South-East European origins. These settlement mounds accumulated from several successive occupation levels – when the settlement burnt down, which happened rather frequently owing to the easily inflammable roof structure and the open hearths, the occupants did not move elsewhere, but simply levelled the burnt debris and erected new, often similarly oriented houses over the old ones. After several levellings following the destruction caused by fire, the new houses were built over a rather thick occupation layer – the tell settlements flourishing over several hundred years grew into 4–5 m high mounds. It seems likely that smaller villages and satellite settlements surrounded the major tells.[48] This emerging centralised settlement system can be interpreted as the initial phase of a socio-economic process towards urbanisation. However, in contrast to the ancient Near East, this process was halted in the Great Hungarian Plain and social development took an entirely different course at the beginning of the Copper Age.

Middle Neolithic traditions no doubt played a role in that pottery painting was unknown in the Tisza culture, evolving from and eventually succeeding the Alföld Linear Pottery; in contrast, the pottery of the Herpály culture flourishing on the eastern fringes and the north-eastern part of the Great Hungarian Plain was characterised by lovely painted wares. While few differences can be noted in the life-style of the communities occupying the tell settlements in the two regions, their pottery wares differ significantly. It seems likely that these differences can be traced to the eastern cultural contacts of the region or perhaps to differences in the ethnic make-up of these communities.

One of the most remarkable tell settlements lies at Herpály, by an ancient meander of the Berettyó River.[49] In addition to the long occupation sequence and the rich find assemblages, one feature by which this settlement stands out is that its occupants built two-storey houses, whose floor was insulated using thick wooden logs. Elements of this construction technique can be traced to the east. Relics of everyday life, as well as of cult practices were recovered from this site. Many finds indicated the central role of aurochs and of bulls in rituals: these included genuine aurochs horns buried under house floors and the decoration of hearth corners and other areas of the house with stylised clay horns.[50] Several graves were uncovered in the areas between the houses and under house floors, most of which were child burials.

45 *Tompa* (1929) Pl. 61.

46 *Kalicz–Makkay* (1977).

47 *Hajdú Zs. – Nagy E. Gy.:* Újabb neolit leletek Hajdú-Bihar megyéből. *In:* "Biharország" neolitikuma. Válogatás a környék újkőkori leleteiből. Ed.: L. Selmeczi. Debrecen–Oradea 2000, 33–37.

48 *Makkay* (1982) Chapter 5.

49 *N. Kalicz – P. Raczky:* Preliminary report on the 1977–1982 excavations at the Neolithic and Bronze Age tell settlement at Berettyóújfalu–Herpály. Part I: Neolithic. ActaArchHung 36 (1984) 85–136; *N. Kalicz – P. Raczky:* Berettyóújfalu–Herpály. A settlement of the Herpály culture. *In:* The Late Neolithic of the Tisza region. Ed.: L. Tálas. Budapest–Szolnok 1987, 105–125.

50 *N. Kalicz – P. Raczky:* The precursors to the "horns of consecration" in the Southeast European Neolithic. ActaArchHung 33 (1981) 5–20.

The burial of the deceased on settlements was a common practice during the Neolithic; at the same time, children often received a different treatment after their death than did adults, perhaps owing to a belief in the cyclical nature of birth and death.[51] The burial ground containing the graves of the adult population of the Herpály settlement remains unknown.

The Csőszhalom site near Polgár, the northernmost tell settlement in Europe, lies in the Upper Tisza region, slightly closer to Csaroda. Following the first investigation in 1957,[52] the successive excavation campaigns revealed that an extensive single-layer settlement lay beside the central mound.[53] In addition to the high number of burnt house remains and the rich find material, as well as the burials furnished with a variety of grave goods and symbolic burials, the importance of this site lies in the fact that it lay at the meeting point of two culture provinces, of two different worlds, and that one of its functions was to provide a setting for communal, non-everyday activities. Csőszhalom appears to have been a kind of distribution centre maintained jointly by the Late Neolithic Lengyel culture of Transdanubia and the Late Neolithic painted pottery groups of the cultural complex occupying the north-eastern areas of the Great Hungarian Plain. The finds from the Late Neolithic settlements in the Polgár area indicate that their occupants had created an intricate web of contacts extending to Transdanubia, the Northern Mountain Range, Little Poland and the Partium.[54] A settlement site showing a similar blend of cultures, yielding finds of the Iclod and Petreşti cultures, as well as of artefacts from Polgár–Csőszhalom has been recently uncovered near Carei/Nagykároly.[55]

The exploitation of the lithic resources in the northern mountains, the evidence for contact with the Partium, Transylvania and the southern part of the Great Hungarian Plain sheds new light on the role of the Bereg region – it is quite obvious that major trade routes led through this region. There are no tell settlements in the Csaroda area and it is more difficult to identify the single-layer settlements. No systematic field surveys have yet been conducted here which would provide data on how densely this area was occupied in the Late Neolithic. It seems likely that future surveys will identify a number of Tisza settlements in the Bereg region.[56]

Owing to lack of research, we do not know of any significant Late Neolithic settlements in the Szatmár, Nyírség and Bereg regions. Since, however, Late Neolithic settlements abound in the Körös and Berettyó Valleys and in the Upper Tisza region up to Slovakia and Carpatho-Ukraine, it seems most unlikely that the area between them was unoccupied. It must here be noted that several Late Neolithic settlements are known from the other side of the border with Romania, in the area extending from Valea lui Mihai/Érmihályfalva to Marghita/Margita.[57] Aside from the lack of research, this "blank spot" can also be explained by the fact that the discovery of archaeological sites is no easy task on the plain covered with wind-blown sand, in a landscape made up of a mosaic of sand ridges and sand hills. It would be interesting to know more about the possible role of the Szatmár Plain and the Ér Valley as a mediator and perhaps an active player in shaping contacts between the Upper Tisza region and western Romania.

There is one other reason why it seems most unlikely that the Bereg Plain had not been occupied during the Late Neolithic. The huge aurochs horns placed under house floors as votive deposits at Herpály and the thousands of aurochs and domesticated cattle bones brought to light at this site suggest that

51 *E. Bánffy:* Cult and archaeological context in Central and South East Europe in the Neolithic and Chalcolithic. Antaeus 19–20 (1990–1991) 183–250.

52 The finds and findings of the excavation conducted by I. Bognár-Kutzián will be published by the present author.

53 The large-scale excavations directed by Pál Raczky were part of the archaeological investigations conducted along the planned track of the M3 motorway. *Raczky et alii* (1994); *Raczky et alii* (1997); *Raczky et alii* (2002).

54 *Raczky et alii* (1994); *Raczky et alii* (1997); *Raczky et alii* (2002); *Kalicz* (1994).

55 *N. Iercoşan:* Descoperiri arheologice in aşezarea neolitica târzie de la Carei "Cozard" Groapa nr. 2. Satu Mare 13 (1996) 23–58.

56 *Korek J.:* A Tiszai-kultúra néhány kérdése Észak-Magyarországon. *In:* Régészeti tanulmányok Kelet-Magyarországról. Ed.: P. Németh Debrecen 1986, 45–59; *J. Korek:* Die Theiss-Kultur in der mittleren und nördlichen Theissgegend. IPH 3. Budapest 1989.

57 Neoliticul in Judetele Bihor şi Hajdú-Bihar. Red.: A. Chiriac – L. Selmeczi. Debrecen–Oradea 1999–2000.

the settlement had been one of the centres of aurochs domestication.[58] A centre of this type, engaged in the keeping and breeding of this massive species, could hardly have existed without support from the neighbouring communities living in the river valleys for two reasons. The first of these is that the wild animals were probably captured by the occupants of the smaller villages. The other is that even though a part of the domesticated animals was processed at the Herpály settlement, as shown by the immense amount of animal bones, it seems likely that their greater part was traded to other communities – and the potential customers were no doubt the communities occupying the smaller settlements in the area. As a matter of fact, a few similar settlement sites are known near Herpály: Esztár and Sîntandrei/Biharszentandrás lying fairly close, and Cserepeskenéz by the Tisza, slightly more to the north. Thus the lack of sites and finds from the Csaroda area can be attributed to the lack of research.

THE EARLY AND MIDDLE COPPER AGE

Around 4400–4300 BC, the flourishing economy and sedentary lifestyle of the Late Neolithic was suddenly disrupted, and life on the settlements occupied over long centuries ceased. The main reason for this change can be sought in climatic factors.[59] As a result of a warmer and drier climate, the harvest yields of the fields lying around the tell settlements, at a distance of no more than a day's walk, could no longer support the occupants of these settlements. Sedentism based on intensive cereal cultivation was no longer a viable option and thus Late Neolithic communities switched to an economy based on stockbreeding. The shift to stockbreeding called for new grazing lands and communities were thus forced to abandon their former, secure settlement mounds and establish smaller, temporary winter and summer campsites while herding their animals. This is the reason why the number of settlements during the Early Copper Age shows a sudden increase, in spite of the fact that there were probably no population changes and neither is there evidence for a sudden population growth. The appearance of Copper Age sites in the Csaroda area may create the false impression that the sparsely inhabited area was abruptly colonised!

The more mobile life-style meant an expanding range of long-distance contacts. Cultural and trade contacts in the vast area between the Carpathian Basin and the Balkans brought a certain uniformity to the material culture, together with a rather striking new feature. The earlier prestige commodities – obsidian and Spondylus from the Mediterranean used for making jewellery articles – were replaced by metal ornaments and, later, metal tools. The copper remains found in the sediments of Nyíres-tó at Csaroda, probably washed in by rainwater, suggest that copper smelting and copper metallurgy was practiced in the area from the very dawn of the Copper Age. This metal was initially used for the manufacture of jewellery; later, heavy copper implements and weapons were also produced. A number of gold finds indicate that metallurgy was not restricted to copper. The spread of metallurgy revolutionised the technology of the period and contributed to the emergence of a ranked society.

The distinctive gold pendants of the Early Copper Age, distributed from eastern Slovakia to the Lower Danube region and the Aegean, show a striking similarity to each other. The earliest pieces, such as the ones from Tibava/Tiba in Slovakia are visibly imitations of Spondylus discs, while later gold pendants have been interpreted as stylised human depictions. Copper, which had already been used for making smaller ornaments on some Late Neolithic settlements, began to be used for manufacturing copper axes in great numbers during the Early Copper Age Tiszapolgár culture. The eponymous site of this culture lies in the Upper Tisza region, not too far from Csaroda. Several Tiszapolgár sites are known from the Bereg region. Tiszapolgár finds have been reported from Drahnov/Deregnyő, Veľké Raškovce/Nagyráska, Oborin/Abara, Čičarovce/Csicser, Lučka/Lucska and Krisovská Liesková/Ungmogyorós in

58 *Bökönyi S.:* Környezeti és kulturális hatások késő neolitikus Kárpát-medencei és balkáni lelőhelyek csontanyagán. Budapest 1986.

59 *E. Bánffy:* Transdanubia and Eastern Hungary in the Early Copper Age. JAMÉ 36 (1994) 291–296.

eastern Slovakia, and from Kisvárda, Nagyhalász, Kisvarsány, Vásárosnamény and Jánd,[60] all of which lie quite close to Csaroda.

The abundance of Early Copper Age sites might seem surprising in an area from which settlements of the preceding Late Neolithic period are barely known. The explanation is to be sought in the change of life-style mentioned above. Large, nucleated settlements disappeared, to be replaced by smaller, dispersed and temporary settlements and campsites; very often, only a few lost implements or a copper axe is found, adding a new site to the list of already known Early Copper Age sites in the Tisza region. There is, however, an even more significant difference between the two periods. Neolithic communities buried their dead within the confines of the settlement, in the open areas between the houses, around the houses or under house floors. The are few cemeteries separate from the settlement, especially in the Tisza region; the focus of life, the symbol of permanence was the settlement, the setting of everyday and ritual activities, and of birth and death. When the occupants were forced to abandon their earlier settlements, their sense of security too vanished. The oft-changing campsites and small hamlets could not fulfil this role. This is the reason that the emphasis shifted from the settlement. One of the places to which Copper Age man periodically returned was the cemetery, the resting place of the deceased, which now became the symbol of permanence. Several extensive cemeteries, some with hundreds of burials, are known from this period – the high number of graves and the changes in the grave goods indicate that communities buried their dead in these burial grounds over a long period of time. The arrangement of the graves into rows suggests that the burials were marked and could be easily identified. The best-known, most thoroughly analysed Early Copper Age cemetery was excavated by Ida Kutzián at Tiszapolgár–Basatanya, where the transition to the Middle Copper Age could also be traced.[61]

The other important symbol of permanence was the setting of ritual activities, again separate from the settlements. Earlier, religious life had been conducted on the settlement, usually inside houses. Under the new circumstance of the Copper Age, separate ritual centres were created, which were regularly visited both by local communities and mobile groups. Circular "sacred places" of this type ringed with timber posts have been identified near Füzesabony and at Szarvas (the latter dating to the Middle Copper Age).[62] Early Copper Age settlements enclosed within circular ditches are known from the southern part of the Great Hungarian Plain and the Banat.[63] These settlements indicate that the climatic changes, the settlement patterns and social processes broadly characterising the Great Hungarian Plain resulted in a slightly different development south of the Körös rivers. No matter how our knowledge of Copper Age settlement patterns is refined, the general picture of small settlements and extensive, long-lived cemeteries remains valid for the Bereg region.

The transformation of Copper Age society is reflected not only in the changed settlement patterns and settlement structure, the manufacture of heavy copper implements, the appearance of burial grounds separate from settlements and the establishment of central cult places. The grave goods deposited in the Early and Middle Copper age burials of the cemeteries in eastern Hungary reflect striking differences between the wealth, the social status and rank of the deceased. Pál Patay, the renowned expert of the Copper Age, has excavated several cemeteries of the Middle Copper Age Bodrogkeresztúr culture, representing a continuation of Early Copper Age traditions and probably also of the population. The burial grounds at Fényeslitke, Tiszavalk and Magyarhomorog were used by a few families,[64] as shown by the skeletal analyses.[65] A sure indication of social ranking is that lavishly furnished graves included also child burials – very often, the child burials contained even more jewellery articles and other goods

60 *I. Bognár-Kutzián:* The Early Copper Age Tiszapolgár culture in the Carpathian Basin. ArchHung 48. Budapest 1972.

61 *I. Bognár-Kutzián:* The Copper Age Cemetery of Tiszapolgár–Basatanya. ArchHung 42. Budapest 1963.

62 *Á. Sz. Kállay:* Die kupferzeitliche Ringanlage von Füzesabony. JMV 73 (1990) 125–130; *J. Makkay:* Eine Kultstätte der Bodrogkeresztúr-Kultur in Szarvas und Fragen der sakralen Hügel. MittArchInst 10–11 (1980-1981) 45–57.

63 Kind personal communication by Wolfram Schier and Florin Draşovean about their excavation at Uivar/Újvár near Temesvár; *Parkinson et alii* in press (2005).

64 *Patay P.:* A Bodrogkeresztúri kultúra temetői. RégFüz II. 10. Budapest 1961; *Patay P.:* A fényeslitkei rézkori temető. JAMÉ 11 (1969) 15–62; *P. Patay:* Die hochkupferzeitliche Bodrogkeresztúr-Kultur. BRGK 55 (1974) 1–71; *P. Patay:* Das kupferzeitliche Gräberfeld von Tiszavalk–Kenderföld. FontesArchHung. Budapest 1978.

65 *J. Nemeskéri:* Der äneolithische und kupferzeitliche Mensch in Ungarn. Bericht über den V. Internationalen Kongress für Vor- und Vorgeschichte. Hamburg 1961, 599–601.

than the adult graves. This would suggest that social status was not simply based on individual merit, but was hereditary, with children of high-prestige families inheriting their high status. The heavy copper implements and weapons, and the buried hoards – the most famous of which is the Tiszaszőlős treasure – imply that flourishing Copper Age societies did not always strive for peaceful co-existence and cultural and trade contacts. Social differences, the uneven distribution of available resources and access to better quality grazing lands were no doubt the source of conflicts and clashes.

Not far from the marshlands in the Csaroda area lies the Tibava/Tiba cemetery, whose burials abounded in copper and gold finds.[66] Another important Copper Age site in the area must also be mentioned here because its stratigraphy was crucial to establishing the relative chronology of the Middle and Late Copper Age.[67] The Székely–Zöldtelek settlement lies among the sand ridges of the Nyírség area, west of Csaroda.

The distribution of Early and Middle Copper Age sites in the Csaroda area indicates that the Szatmár-Bereg region and the Ér Valley lay on the fringes of the major cultural complexes in the Great Hungarian Plain. There is no evidence that the inhabitants of the Bereg Plain maintained any contact with the Cucuteni population, distributed from Transylvania and Moldavia to the Prut River, or with the related Tripolye groups in southern Russia. New cultural impacts at the close of the Middle Copper Age arrived from the Balkans, rather than from the east. The appearance of vessels with handles ending in a flat disc (the so-called *Scheibenhenkel*) at the close of the Bodrogkeresztúr period, distributed up to Slovakia, are an indication of cultural impacts from the south. This period, known as the Hunyadi-halom phase, was a time of unrest. A settlement dating from the post-Bodrogkeresztúr period has been uncovered at Tiszalúc.[68] The archaeological record suggests that this phase was culturally bound to Transdanubia and to the heartland of Central Europe by many strands.[69]

THE LATE COPPER AGE

The development begun at this time ushered in the Late Copper Age in the Carpathian Basin and led to a formerly unknown cultural uniformity between the eastern and western half of the region. Signs of these changes have been documented in the late Middle Copper Age assemblages both from Transdanubia and the Great Hungarian Plain. A number of mixed find assemblages containing pottery continuing local Middle Copper Age traditions and vessels decorated in a style comparable to Lower Danubian wares were distinguished following Nándor Kalicz's pioneering work in this field.[70] Assemblages of this type have recently been unearthed at Kompolt near Füzesabony, and at Sarkadkeresztúr and Endrőd in the Körös region;[71] they were labelled Protoboleráz finds because they preceded the widely distributed Boleráz culture. These assemblages were the prelude to the marked cultural complex extending from Asia Minor to Switzerland, called Baden culture after an Austrian site. Very little is known about the settlements of the different Baden groups (perhaps reflecting different ethnic backgrounds) since house remains are rarely found and only refuse pits have so far been uncovered on most settlement sites. Much more is known about the funerary practices of this cultural complex. Some groups practiced inhumation, depositing cattle and other animals into the grave, while other groups cremated their dead and placed the ashes into urns. One northern group deposited the ashes into anthropomorphic urns:

66 *S. Šiška:* Pohrebisko Tiszapolgárskej kultury v Tibave. SlovArch 12 (1964) 293–356.

67 *Kalicz N.:* Rézkori sztratigráfia Székely község határában. ArchÉrt 85 (1958) 3–6.

68 *P. Patay:* Die Kupferzeitliche Siedlung Tiszalúc–Sarkadpuszta und die Hunyadihalom-Kultur. *In:* Neuere Daten zur Siedlungsgeschichte und Chronologie der Kupferzeit des Karpatenbeckens. IPH 7. Hrsg.: T. Kovács. Budapest 1995, 109–115.

69 *I. Bognár-Kutzián:* Das Neolithikum in Ungarn. ArchAu 40 (1966) 249–280; *L. A. Horváth:* Beiträge zur Chronologie der mittleren Kupferzeit in der Grossen Ungarischen Tiefebene. ActaArchHung 46 (1994) 73–105.

70 *N. Kalicz:* Beiträge zur Kenntnis der Kupferzeit im ungarischen Transdanubien. *In:* Die Kupferzeit als historische Epoche. Hrsg.: J. Lichardus. Bonn 1991, 347–387.

71 *Bánffy E. – T. Bíró K.– Vaday A.:* Újkőkori és rézkori telepnyomok Kompolt 15. sz. lelőhelyen. Agria 23 (1997) 19–57; *Bondár M.:* Rézkori idol Sarkadkeresztúrról. BMMK 20 (1999) 37–45; *Bondár M.:* Rézkori és korabronzkori településmaradvány Gyomaendrődön. BMMK 20 (1999) 47–65.

funerary vessels comparable to the well-known urns from Ózd–Center are known also from Miskolc and Rimavska Sobota/Rimaszombat.[72] Interestingly enough, sites become scarcer towards the eastern fringes of the Great Hungarian Plain: János Banner's catalogue mentions but a handful of sites scattered around Debrecen, along the Berettyó River and near Nyíregyháza. He lists two sites on the other side of the border with Romania: Valea lui Mihai/Érmihályfalva and Sîntandrei/Biharszentandrás.[73]

It is not mere chance that parallel to the visible decline of Baden sites, burial sites with find assemblages documenting the distinctive mortuary practices of an alien population appear in eastern Hungary. Typical features of the landscape in the Great Hungarian Plain are the kurgans dotting the plainland. These man-made mounds date from various periods: some are Neolithic tells, while others are burials from the Migration period. We know from István Ecsedy's research that many of these mounds, over one hundred in Szabolcs-Szatmár-Bereg County alone, were raised in the Copper Age.[74]

It was earlier believed that the tall, robust newcomers buried under the mounds conquered the Baden population of Mediterranean stock and brought an end to their culture. It has since become clear that this was not the case; rather, we may speak of the slow infiltration and settlement of smaller eastern population groups, who arrived to the Great Hungarian Plain in several successive waves. Some of these groups survived until the Early Bronze Age. Who were these newcomers, whose settlements remain unknown, and only their burial mounds survived, containing the deceased sprinkled with red ochre, laid to rest on their back in an extended position with drawn-up legs? It would appear that they were members of nomadic tribes and groups, who were victims of the climatic changes at the dawn of the Copper Age bringing a warmer and drier climate to the southern Russian steppe too. Being mobile pastoralists, they began migrating westward; their appearance in the Lower Danube region led to major cultural transformations, whose effects reverberated to the Balkans and the south-eastern areas of the Great Hungarian Plain along the Maros River. Arriving in several successive waves, the immigrants settled in the northern part of the trans-Tisza region too, thus coming into contact with the Baden population.

The meanders of the Tisza River in the Upper Tisza region and the Csaroda area are both dotted with Copper Age burial mounds. There is a kurgan by Csaroda too, and several others are known south of Záhony along the Tisza, up to the country's eastern border (Tákos, Márokpapi, Vásárosnamény, Tarpa, Jánd, Tivadar, Szatmárcseke, Tiszakóród, Tiszacsécse, Tiszabecs, Uszka, Kölcse, Túristvándi, Nagyar, Kisar).[75] Seeing that the earliest appearance of this population can be documented in the Decea Mureşului/Marosdécse cemetery, dating to the Cucuteni A–B phase which can be synchronised with the Hungarian Middle Copper Age, it is possible that one of the routes along which this population arrived led to the Great Hungarian Plain though the Partium and the Upper Tisza region: the marshy valleys of the Ér, Berettyó, Szamos and Kraszna rivers, a route used since the Mesolithic.

We may say that many cultures and communities migrated through or settled in the Csaroda area from the turn of the 7th–6th millennia, when prehistoric man first began manipulating his environment. These communities maintained peaceful trade relations with their neighbours and they mediated cultural impacts from the eastern Carpathian range, from Transylvania and the Banat to the Bükk and Mátra Mountains during the thirty centuries from the Mesolithic through the Neolithic to the close of the Copper Age.

72 *N. Kalicz:* Die Péceler (Badener) Kultur und Anatolien. StudArch 2. Budapest 1963; *J. S. Koós:* Neuere Erkenntnisse zur Verbreitung der menschenförmigen Urnen in Nordost-Ungarn. In: A kőkortól a középkorig Ed.: G. Lőrinczy. Szeged 1994, 201–209; *I. Kovács:* Archéologické vyskumy v okrese Rimavska Sobota (1978–1984). Rimaszombat 1985.

73 *J. Banner:* Die Péceler Kultur. ArchHung 35. Budapest 1960.

74 *Ecsedy* (1979).

75 *Ibidem* 126.

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Raczky et alii (1997) — *P. Raczky – W. Meier-Arendt – E. Nagy – K. Kurucz – Zs. Hajdú:* Polgár–Csőszhalom-dűlő. Újkőkor végi telep és sírok a Kr. e. V. évezredből. *In:* Utak a múltba. Az M3-as autópálya régészeti leletmentései. Eds: P. Raczky – T. Kovács – A. Anders. Budapest 1997, 34–43.

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THE NEOLITHIC AND THE COPPER AGE IN THE SAJÓ–BÓDVA INTERFLUVE

Piroska Csengeri

There is little information about the Neolithic and the Copper Age settlement patterns in the direct environs of the Mohos lakes and Kelemér, and it seemed instructive to extend the study of prehistoric settlement patterns to the Hungarian section of the area between the Sajó and Bódva rivers. In the following, I shall attempt to provide a broad outline of the settlement patterns, the most important sites and the material culture of the Neolithic and the Copper Age.

THE NEOLITHIC

The results of the palaeo-ecologic investigations at the Kis-Mohos and Nagy-Mohos lakes have conclusively proven that human activities had a profound impact on the environment in the Kelemér area during the Neolithic and the Copper Age. These investigations also furnished evidence for human settlement in the area during these periods.[1] No Neolithic sites were known around the Mohos lakes at the time of these palaeo-ecologic studies. Archaeological investigations conducted in the area since these studies have identified the remains of two Middle Neolithic sites.

During the 2000 season of the excavation of the medieval castle at Kelemér–Mohosvár, lying between the Kis-Mohos and Nagy-Mohos lakes, Tamás Pusztai found a number of Middle Neolithic pottery sherds which, unfortunately, could not be associated with any settlement features.[2] The rather worn sherds came from thick-walled, medium thick-walled and thin-walled, orange and grey coloured vessels tempered with chaff and grit. The pottery fragments included sherds from both household and fine wares. Three fragments enabled the dating of the finds: a rim sherd, a body sherd and a basal sherd were decorated with thick bundles of incised lines typical for the Bükk culture. A small obsidian core and a small trapezoidal stone axe were also found. Although nothing is known about the Neolithic village, the finds nonetheless indicate that a Bükk community had settled on this elevation.

The Putnok–Szörnyű-völgy site lies on a stream bank on the western side of the road leading from Putnok to Kelemér, about 1000 m north of the town's boundary and roughly 2600 m south-east of the Mohos lakes *(Fig. 1)*. The site was identified by Tamás Pusztai on November 28, 2000, during his inspection of the area.[3] He found Neolithic artefacts under the thick forest soil in the walls of the illegal mine and noted that the earth had been removed to a depth of 3 m over a roughly 20 m by 20 m large area.[4]

On July 9, 2004, we surveyed the area in order to assess the site's condition and to determine the location of a potential rescue excavation. Although we saw many finds, we did not observe the remains of any settlement features, which seemed to confirm Tamás Pusztai's opinion that the finds did

1 *Sümegi* (1998); *Willis et alii* (1998); *Kertész – Sümegi* (1999); *Magyari et alii* (2000); *E. Magyari – P. Sümegi – M. Braun – G. Jakab – M. Molnár:* Retarded wetland succession: anthropogenic and climatic signals in a Holocene raised bog profile from north-east Hungary. Journal of Ecology 89 (2001) 1019–1032; *Sümegi* (2001).

2 *Pusztai T.:* Kelemér–Mohosvár 2000. évi feltárásai. HOMÉ 41 (2002) 72. I would here like to thank Tamás Pusztai for his kind permission to study the finds. For the excavation, cp. also the reports under no. 3160–01 in the Archaeological Archives of the Herman Ottó Museum. No Neolithic finds came to light during the 2003 season (cp. Herman Ottó Museum Archaeological Archives, no. 3594–04). The museum's archaeological collection has Neolithic finds from Kelemér–Mohosvár (inv. no. 53.365.1) which were donated by Gusztáv Lux.

3 For the report, cp. Herman Ottó Museum Archaeological Archives, no. 3048–00.

4 On March 13, 2002, Tamás Pusztai again collected Neolithic finds at Szörnyű-völgy, but he did not report any changes in the site's condition. Herman Ottó Museum Archaeological Archives, no. 3258–02.

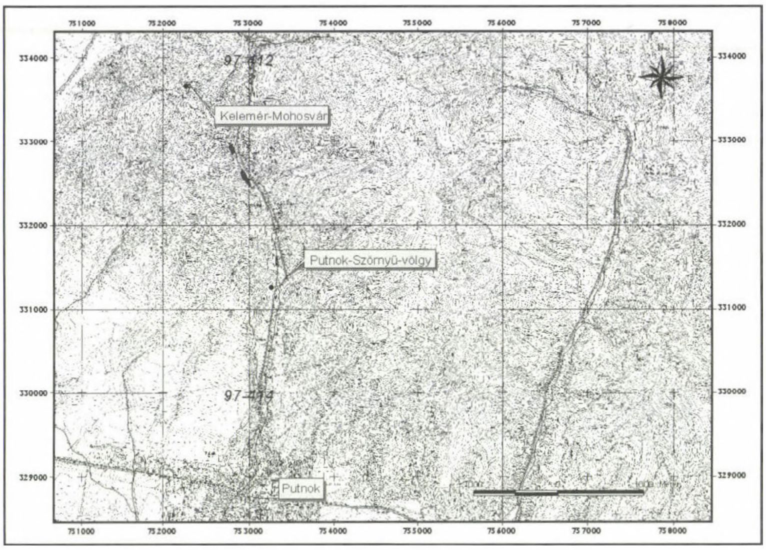

Fig. 1. The location of the archaeological sites at Kelemér–Mohosvár and Putnok–Szörnyű-völgy

not indicate an *in situ* archaeological site, but were rather objects in a secondary position washed away from a higher-lying location by the Szörnyű-völgyi Stream.[5] Continued mining operations in July or August destroyed another portion of the site. During our next survey we noted that the finds came to light from the boundary between the brown forest soil and the underlying black layer.

We conducted a ten-day excavation between October 12 and November 12, 2004. We uncovered a roughly 100 m² large area, in which we distinguished two occupation levels. One of these contained the remains of an Árpádian Age settlement – parts of two small rectangular sunken buildings, three refuse pits and the firing plate of an oven – lying at a depth of 10–30 cm from the present surface in the 50–100 cm thick brown forest soil. The finds from this level included pottery fragments decorated with bundles of wavy lines, iron artefacts and iron blooms.[6]

After clearing the medieval occupation level, it became clear that there was a Neolithic settlement here and that the finds collected earlier had not been in a secondary position. The Neolithic settlement level lay at a depth of 80 cm, in the upper 20–40 cm of the black layer underlying the brown forest soil. We uncovered the *in situ* burnt debris of a timber-framed house with upright daub walls *(Figs 2–3)*.[7] The remains of the collapsed wall covered an area of 4.3 m (north-west–south-east) by 1.6–2.5 m (north-east–south-west) in the trench and contained fragments of burnt daub with twig and other plant impressions on their lower part. Among and under the daub fragments lay pottery fragments, a miniature vessel, four clay beads of different shape and size, a few chipped stone implements and debitage.

Fig. 2. "In situ" house debris (collapsed wall) at the Middle Neolithic site of Putnok–Szörnyű-völgy

5 Cp. Herman Ottó Museum Archaeological Archives, no. 3605–04.
6 For a description of the settlement features and their find, cp. *Tamás Pusztai*, in this volume (pp. 411–424).
7 The excavation drawing *(Fig. 3)* was made by Mrs. András Sáfrány of the Herman Ottó Museum. I would here like to thank her for her conscientious work.

The pottery fragments came from medium thick and thick-walled undecorated household vessels, as well as from decorated and undecorated thin-walled wares. Both were tempered with chaff.[8] Most were orange coloured or had a light brown or grey core, with an orange or light brown slip (or its remains). The pottery sherds were extremely worn and broken into small fragments, and incised patterns only survived on a few sherds. The parallelly incised bundles of thin lines are typical for the Bükk culture, suggesting that the settlement had been established by a community of this culture. The pottery finds resemble the ones from Kelemér–Mohosvár, the only exception being that grit had not been used as a tempering agent at the Putnok site.

We did not find any other settlement features during the excavation of the Neolithic level. The debris from the collapsed wall lay in the north-western corner of the trench *(Figs 2–3)*. It seems likely that the rest of the building and the floor with the remains of various house furnishings and other finds lay directly beside the investigated area. It would certainly be useful to excavate other parts of the site too; until then, there is need for the site's increased protection.

We did not find any post-holes under the burnt debris and since only a section of the house was excavated, there is little evidence for its size, form and construction technique. Neither can we draw any conclusions regarding the settlement layout. We can merely rely on the findings of two other extensively investigated Bükk sites in this respect.

Between 1981 and 1987, Stanislav Šiška excavated a settlement of the Bükk culture at Šarišské Michaľany/Szentmihályfalva lying on a hill ("Fedelemka") in the Šariš region. The settlement extended over an area of 0.4–0.5 hectares (finds from other periods were also uncovered at the site). An area of *ca.* 3000 m² was investigated, in the course of which a total of 248 settlement features and 18 burials of the Bükk culture were brought to light. The excavator distinguished two construction phases and reconstructed a settlement consisting of a few houses with an open area in the centre.[9]

The post-holes of several buildings were uncovered. The houses were flanked by long pits. The size of one house could be precisely established (House 203): the east–west oriented, oblong building measured 4.7 m by 7.7 m and was divided into two roughly equal rooms. Three rows of three post-holes were found. In addition to post-holes and burnt daub debris, the extensive debris remains of two larger houses destroyed by a sudden conflagration were also uncovered. The burnt daub remains of the latter two covered an area of 4.15 m by 6.35 m (House 1) and 4 m by 6.3 m (or 4.3 m by 7 m; House 123) respectively. House 1 contained a plastered hearth, a polished stone tool, a quernstone, a cache of radioralite cores, clay loom-weights and pottery fragments, while House 123 yielded a large amount of pottery sherds and polished stone implements. House 1 was south-east to north-west oriented, House 123 was north-west to south-east oriented. Šiška dated the settlement to the Bükk II (Bükk AB and B) and the early Bükk III (Bükk C) phase.[10]

A settlement dating to the Bükk AB phase was brought to light south-east of Sajószentpéter, in an area called Kövecses (lying on the administrative boundary between Sajószentpéter and Sajóecseg) on a one-time terrace of the Sajó River in 2001, when a gas-pipe was laid. The site was investigated by Judit S. Koós and the present author between July 30 and August 22, 2001. In addition to Early Iron Age (Scythian) and Migration period settlement features, the remains of a Bükk village were also uncovered on the roughly 3000 m² large area, of which the village covered about 1500 m². The surrounding area was covered with vegetation and thus we were unable to estimate the original size of the one-time settlement.[11]

The excavations brought to light sections of the burnt daub debris of two above-ground houses, a large clay extraction pit, several smaller refuse pits, post-holes and a contracted inhumation burial into which ochre had been placed as a grave good. The position of the burnt daub debris (Features 13 and 15) suggested that the houses had been north to south oriented. The debris of House 13 covered a 14 m by 13.5 m large area, the debris of House 15 extended over a 12 m by 8.5 m large area. The two buildings

8 The finds from the excavation still await conservation and restoration.
9 *Šiška* (1986); *Šiška* (1995); *Šiška* (1998).
10 *Šiška* (1986); *Šiška* (1995); *Šiška* (1998).
11 *Csengeri* (2003) 31.

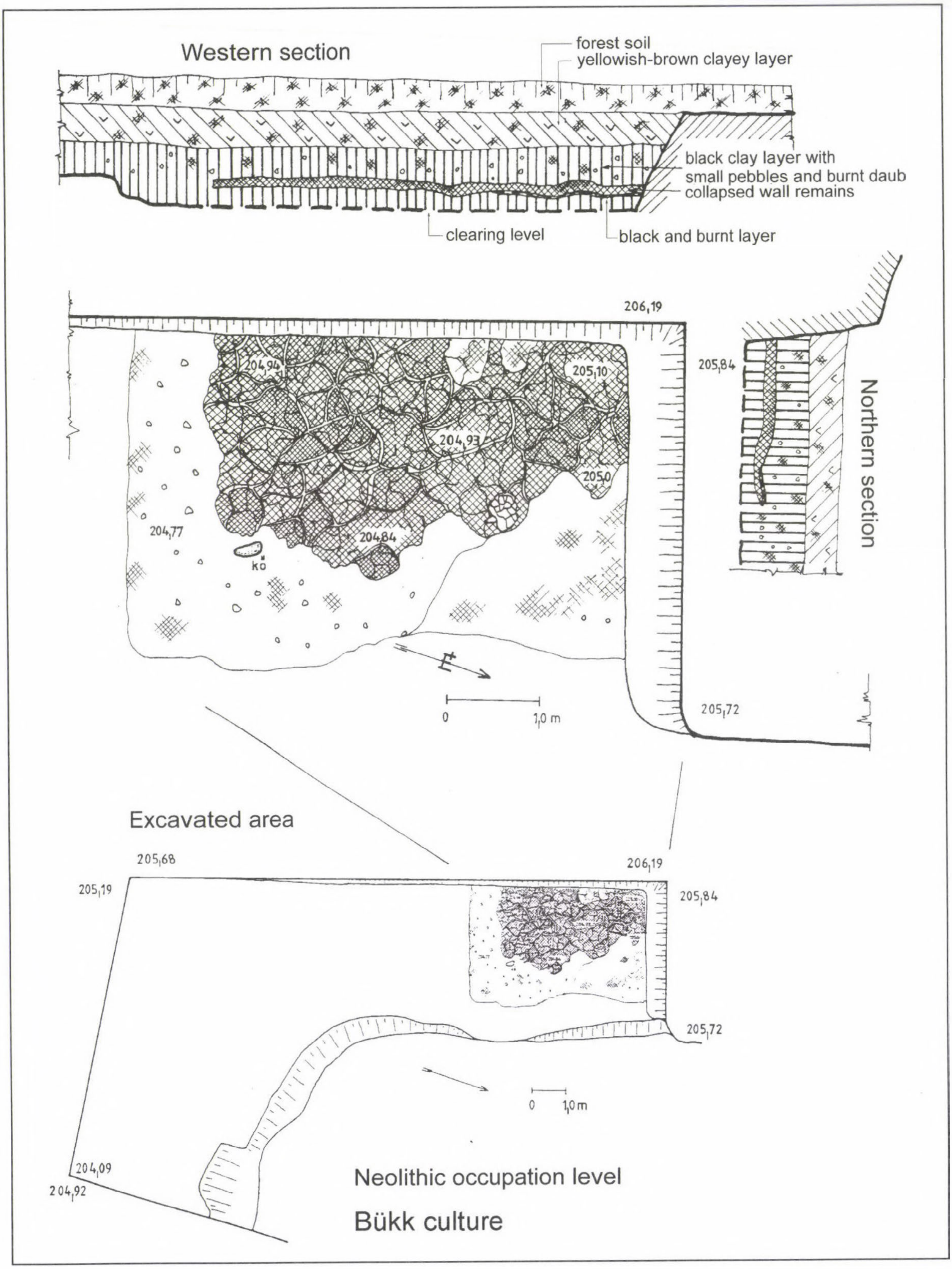

Fig. 3. Occupation level of the Middle Neolithic settlement at Putnok–Szörnyű-völgy (drawing by Mrs András Sáfrány)

had apparently been destroyed by a sudden conflagration, as shown by the many finds which still lay *in situ*: broken clay vessels, chipped and polished stone tools. No settlement features were found in the area between the houses, suggesting that the buildings lay at some distance from each other on this settlement (or in this section of the settlement) and formed discrete units with the activity areas around them. Charred wood remains lay among the debris of House 13. The ground plan of the building could not be reconstructed from the refuse pits and post-holes under the debris.[12]

The house remains from these two sites provide a broad outline of the characteristic features of the Bükk settlements sited on elevations beside watercourses.[13]

The palaeo-ecologic studies conducted in the area of the Mohos lakes indicated changes in the vegetation during the Middle Neolithic caused by human activity in the area. After the Pleistocene, the greater part of Central Europe, including the Carpathian Basin, was covered with closed deciduous forests. The sediments from Kis-Mohos-tó indicated that the first changes in this environment in the Kelemér area can be dated to between 5400–4800 BC. Oak and hazel pollen declined, while fern and birch pollen reached a maximum; at the same time, pollen from cultivated plants did not increase. The first of the two micro-charcoal peaks reflects the creation of clearings around the bog, suggesting the presence either of grazing land or the creation of open spaces for settlement by Middle Neolithic communities. The second micro-charcoal peak was made up of finer charcoal specks from farther-lying areas, confirming the settlement of the Bükk groups and pottery production "on an industrial scale" calling for large amounts of wood.[14]

The analysis of the sediments from Nagy-Mohos-tó reflcted a change by the Middle Neolithic. Around 5250 BC, the samples indicated the decline of elm and hazel pollen and a rise in ash pollen. This change was interpreted as a reflection of the specialised economy of the Bükk culture, involving nomadic pastoralism, the winter foddering of the livestock with foliage and hazel twigs, as well as the trade in pottery and lithic raw material.[15] Around 5000 and 4900 BC, the decline of elm pollen and the rise of Glumaceae and *Artemisia* indicating trampling suggested the creation of smaller fields for cereal cultivation.[16] This period can be correlated with the Late Neolithic, corresponding to the Tisza and Lengyel cultures.[17] The radiocarbon dates, however, fall into the life-span of the Bükk culture,[18] which survived until the emergence of the Tisza culture in the Lower Tisza region.

The palaeo-ecologic data from Kis-Mohos-tó suggest that human impact on the environment ceased during the Late Neolithic in the Kelemér area. The area became uninhabited, leading to the closing of the forest canopy and soil regeneration.[19]

The pollen diagrams harmonise with the archaeological record, according to which Early and Late Neolithic settlement remains have not yet been identified in the Hungarian section of the Sajó–Bódva Interfluve; only the presence of the Middle Neolithic Alföld Linear Pottery (ALP) and its groups could be documented.

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12 *Ibidem* 32–33.

13 In 2003, a section of a Bükk settlement was investigated by the present author as part of a rescue excavation at preceding the construction of the road bypassing Garadna in the Hernád Valley (Site 2). The investigated area was roughly 2000 m^2 large and yielded finds from several periods. In addition to many refuse and storage pits, several hearths (one with its walls preserved up to a height of 60 cm), twelve burials and the fragments of a storage jar with a human face depiction were brought to light. Unfortunately, no house remains (post-holes or burnt debris layers) fell into the excavated area and thus it is impossible to reconstruct the layout of the settlement. In view of the fact that the burials lay about 20–30 cm under the present surface and most were not indicated by the dark patch of a grave pit, it seems likely that the house remains had been destroyed by erosion and agricultural activity.

14 *Sümegi* (1998) 373–374; *Willis et alii* (1998) 108–109; *Kertész – Sümegi* (1999) 82–83; *Sümegi* (2001) 29.

15 *Magyari et alii* (2000) 122–123.

16 *Ibidem* 123.

17 *Ibidem* 123.

18 *E. Hertelendi – N. Kalicz – P. Raczky – F. Horváth – M. Veres – É. Svingor – I. Futó – L. Bartosiewicz:* Re-evaluation of the Neolithic in Eastern Hungary based on calibrated radiocarbon dates. Radiocarbon 37 (1995) 239–251, Table 1; *E. Hertelendi – É. Svingor – P. Raczky – F. Horváth – I. Futó – L. Bartosiewicz – M. Molnár:* Radiocarbon chronology of the Neolithic and time span of tell settlements in Eastern Hungary based on calibrated radiocarbon dates. *In:* Archaeometrical Research in Hungary II. Eds: L. Költő – L. Bartosiewicz. Budapest–Kaposvár–Veszprém 1998, 61–69, Table 1.

19 *Sümegi* (1998) 374; *Sümegi* (2001) 29.

The expansion of the Early Neolithic Körös culture came to a halt in the middle of the Great Hungarian Plain (roughly at the Kunhegyes–Berettyóújfalu line)[20] and did not penetrate the Sajó–Bódva Interfluve. The reason for this halt is that the northernmost boundary of the habitat and tolerance of the cultivated plants and domesticated animals brought to the Carpathian Basin from the Balkans by the first food-producing communities coincided with the Central European–Balkanic agro-ecologic barrier owing to the mosaic patterning of the soils and the climatic zones in the Carpathian Basin. North of this boundary, Mesolithic groups probably continued their former lives uninterrupted.[21] Although traces of Mesolithic occupation have not yet been found in the Sajó–Bódva Interfluve, the palaeo-ecologic study of the sediments at Nagy-Mohos tó has revealed the cyclical decline of elm and ash pollen during the Late Mesolithic and the Early Neolithic, suggesting the selective gathering of their foliage for use as animal fodder, indicating the presence of human communities.[22]

According to Róbert Kertész and Pál Sümegi, the Mesolithic groups occupying the "Neolithic adaptation zone" in the foreland of the Northern Mountain Range, north of the agro-ecologic barrier, gradually adopted Neolithic lifeways (adapted to the local conditions) under cultural impacts from the Körös population. This led to the emergence of the ALP,[23] which colonised the mountainous region through the river valleys and advanced as far as the next agro-ecologic barrier in the Carpathian piedmont.[24] In the ensuing period, corresponding to the Tiszadob group and the Bükk culture, these communities crossed the ecologic barrier in the Carpathian piedmont and advanced into the region beyond it. Following a period of successful adaptation, the Bükk culture crossed the next agro-ecologic barrier in the Carpathian uplands and colonised that region too.[25]

Although János Makkay agreed that the northward advance of the Körös groups was halted by an environmental barrier, he challenged the existence of an agro-ecologic barrier of this type in certain regions, such as the Szolnok area and the Tokaj region. In his view, the Körös advance was blocked by the indigenous Mesolithic population, which controlled the lithic resources in the mountain ranges, and which later became the ALP.[26] László Domboróczki has argued that the similarities between the settlement patterns and the finds of the Körös culture and the earliest ALP phase, the high proportion of domestic animals in the animal bone samples from Szatmár II contexts, as well as the similarities in the anthropologic traits of the two populations strongly suggest that they were related. He believes that the indigenous Mesolithic population can hardly have played a role in the emergence of the ALP owing to the lack of sites and find assemblages reflecting the long process of adaptation.[27] Domboróczki suggested that the indigenous population adopting the Neolithic life-style be identified with the Tiszadob group and the Bükk culture in this region since these groups emerged at a relatively late date (allowing sufficient time for the process of adaptation) and their anthropologic make-up differs too.[28]

The following section offers an overview of the Neolithic sites in the Hungarian section of the Sajó–Bódva Interfluve and the data they provide. The list of sites is based on the archaeological information from sixty-three modern settlements in the area, including the ones on the left bank of the Sajó,

20 *Kalicz – Makkay* (1977) 1–20; *Makkay J.:* A magyarországi neolitikum kutatásának új eredményei. Az időrend és a népi azonosítás kérdései. Budapest 1982, 42–54. A settlement lying north of this boundary was recently investigated at Tiszaszőlős–Domaháza-Puszta. László Domboróczki suggested that the Körös culture had only advance as far as the Carpathian foreland along the Tisza River and that the zone along the Tisza should be studied separately from the areas lying farther away from the river as far as colonisation is concerned. Cp. *Domboróczki* (2003) 40.

21 *Kertész – Sümegi* (1998) 156; *Kertész – Sümegi* (1999) 81; *Kertész – Sümegi* (2001); *Kertész – Sümegi* (2003).

22 *Magyari et alii* (2000) 121; *Kertész – Sümegi* (2003) 27; *Sümegi P.:* Preneolitizáció – egy Kárpát-medencei, késő-mezolitikum során bekövetkezett életmódbeli változás környezettörténeti rekonstrukciója. *In:* ΜΩΜΟΣ II. Őskoros Kutatók II. Összejövetelének konferenciakötete. Debrecen, 2000. november 6–8. Eds: E. Gy. Nagy – J. Dani – Zs. Hajdú. Debrecen 2004, 24.

23 *Kertész – Sümegi* (1998) 156; *Kertész – Sümegi* (1999) 81–82; *Kertész – Sümegi* (2001); *Kertész – Sümegi* (2003).

24 *Kertész – Sümegi* (1999) 83; *Kertész – Sümegi* (2001).

25 *Kertész – Sümegi* (1999) 84; *Kertész – Sümegi* (2001).

26 *Makkay J.:* A Jászság-határ és az indoeurópai őstörténet: régészeti tények és nyelvtörténeti vonatkozásaik. Tisicum 12 (2001) 61–62.

27 *Domboróczki* (2003) 33–43.

28 *Ibidem* 41–43.

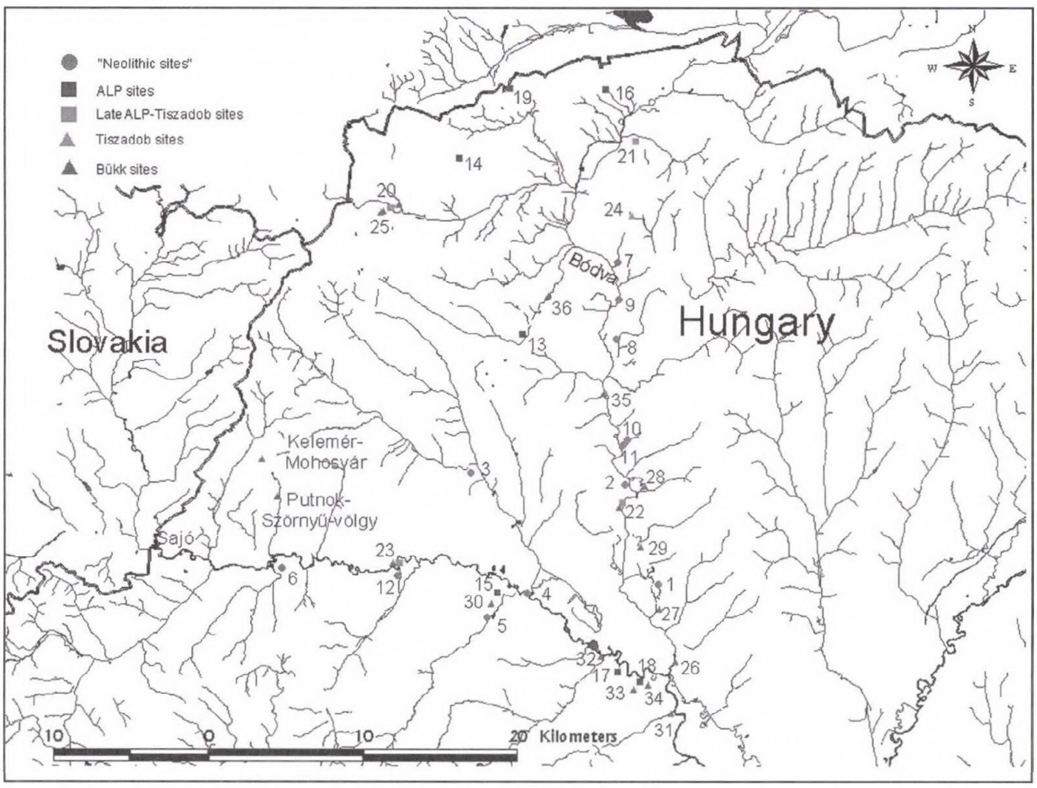

Fig. 4. Neolithic sites in the Sajó–Bódva Interfluve

the right bank of the Bódva and at the confluence of the two rivers.[29] The data were gathered from the information contained in the Central Archaeological Archives of the Hungarian National Museum, the Archaeological Archives and the inventory books of the Archaeological Collection of the Herman Ottó Museum, the annual excavation reports published in the museum's yearbook and in other archaeological books and journals. Unfortunately, the finds in the Archaeological Collection of the Herman Ottó Museum could not be studied owing to the renovation of the museum's storerooms.

The following sites are known from the area *(Fig. 4)*:

"Neolithic": 1. Borsodszirák,[30] 2. Edelény–Borsodi határ-Gátrajáró,[31] 3. Felsőnyárád, Site 2,[32] 4. Kazincbarcika–bank of the Sajó Stream,[33] 5. Kazincbarcika–bank of the Tardona Stream,[34]

29 These settlements are the following: Aggtelek, Alsószuha, Alsótelekes, Bánréve, Berente, Boldva, Borsodszirák, Bódvalenke, Bódvarákó, Bódvaszilas, Dövény, Dubicsány, Dusnokpuszta, Edelény, Égerszög, Felsőkelecsény, Felsőnyárád, Felsőtelekes, Gömörszőlős, Hét, Hidvégardó, Imola, Izsófalva, Jákfalva, Jósvafő, Kazincbarcika, Kánó, Kelemér, Komjáti, Kurityán, Martonyi, Múcsony, Ormosbánya, Perkupa, Putnok, Ragály, Rudabánya, Serényfalva, Sajóivánka, Sajókaza, Sajónémeti, Sajópüspöki, Sajószentpéter, Sajóvelezd, Szalonna, Szendrő, Szendrőlád, Szin, Szinpetri, Szögliget, Szőlősardó, Szuhafő, Szuhakálló, Szuhogy, Teresztenye, Tornakápolna, Tornanádaska, Tornaszentandrás, Trizs, Vadna, Varbóc, Zádorfalva and Zubogy.

30 Donated by Béla Györgyi in 1966. Herman Ottó Museum inv. no. 67.8.1–7. The sites appear on the map *(Fig. 4)* according to the numbering in this list.

31 Mária L. Wolf's field survey in 1988. Cp. *S. Koós J.:* A Herman Ottó Múzeum ásatásai és leletmentései 1988–1990. HOMÉ 28–29 (1991) 650.

32 The area was inspected by the present author in 2003. Herman Ottó Museum Archaeological Archives, no. 3467–03.

33 Herman Ottó Museum inv. no. 75.28.1–30. Cp. *Gádor J. – Hellebrandt M.:* A Herman Ottó Múzeum leletmentései és ásatásai 1975-ben. HOMÉ 15 (1976) 67.

34 Magdolna Hellebrandt's inspection of the area in 1972. Herman Ottó Museum inv. no. 72.17.1–16. Cp. *Gádor J. – Hellebrandt M.:* A Herman Ottó Múzeum 1972. évi leletmentései. HOMÉ 12 (1973) 600.

6. Sajóvelezd–Railway,[35] 7. Szalonna,[36] 8. Szendrő,[37] 9. Szendrő–Csehi-puszta-dűlő 2,[38] 10. Szendrőlád–Borda,[39] 11. Szendrőlád–Papkert,[40] 12. Vadna.[41]

ALP: 13. Alsótelekes,[42] 14. Jósvafő–Szelcepuszta,[43] 15. Kazincbarcika,[44] 16. Komjáti–Vecsembükki zsomboly,[45] 17. Sajószentpéter I,[46] 18. Sajószentpéter–Sajóecseg, railway guard-house,[47] 19. Szögliget–Hosszú-tető-Julcsa Cave.[48]

Late ALP, Tiszadob group: 20. Aggtelek–in front of the Baradla Cave,[49] 21. Bódvarákó–Esztramos-hegy-Szentandrási Cave,[50] 22. Edelény–bank of the Boldva Stream, quarry,[51] 23. Vadna–Railway bridge towards Dubicsány.[52]

Tiszadob group: 24. Martonyi Cave.[53]

Bükk culture: 25. Aggtelek–Baradla Cave,[54] 20. Aggtelek–in front of the Baradla Cave,[55] 26. Boldva–Reformed Church,[56] 27. Borsodszirák–Egres-dűlő,[57] 22. Edelény–bank of the Boldva Stream, community quarry,[58] 28. Edelény–Borsod-Derékegyháza,[59] 29. Edelény–Finke, 17–18 Fő Street,[60]

35 Collected by Márton Rozsnyói in 1954. Herman Ottó Museum inv. no. 73.11.694.

36 Donated by Károly Erdős. Herman Ottó Museum inv. no. 53.214.1.

37 Donated by Árpád Tuza (Herman Ottó Museum inv. no. 53.186.1), István Terray in 1896 (Herman Ottó Museum inv. no. 53.198.1) and Éva Vozáry in 1951 (Herman Ottó Museum inv. no. 53.199.1–2).

38 In the course of the field survey in the area between Bánréve, Borsodszirák, Tornanádaska and the Hungarian–Slovakian border in 2000, Zoltán Czajlik identified several other prehistoric sites. However, the date and cultural attribution of these sites was not specified. Cp. the reports in the 2000 volume of *Régészeti kutatások Magyarországon* and the report in the Herman Ottó Museum Archaeological Archives (no. 3296–02). Cp. also *Czajlik Z.:* Szendrő–Csehi-puszta-dűlő 2. Rövid jelentések. *In:* Régészeti kutatások Magyarországon 2000. Ed.: J. Kisfaludi. Budapest 2003, 208.

39 Donated by István Kövér. Herman Ottó Museum inv. no. 53.364.1.

40 Donated by Gyula Lengyel. Herman Ottó Museum inv. no. 53.215.1.

41 Donated by Pál Göőz (Herman Ottó Museum inv. no. 53.217.1), collected by Lajos Czövek in 1979 (Herman Ottó Museum inv. no. 79.20.6–8). Cp. *Hellebrandt M. – Simán K.:* Régészeti kutatások Borsod-Abaúj-Zemplén megyében 1979. évben. HOMÉ 19 (1980) 97.

42 *Kalicz – Makkay* (1977) 186.

43 *Korek – Patay* (1958) 21; *Kalicz – Makkay* (1977) 187.

44 *Korek – Patay* (1958) 14–15; *Kalicz – Makkay* (1977) 135–136 (late ALP).

45 *Kalicz – Makkay* (1977) 187.

46 *Kalicz – Makkay* (1977) 152; *Kalicz N. – S. Koós J.:* Újkőkori arcos edények a Kárpát-medence északkeleti részéből. HOMÉ 39 (2000) 22 (presumably ALP).

47 Field survey by Magdolna B. Hellebrandt and P. Tóth in 1985. Herman Ottó Museum inv. no. 85.13.1–28. Cp. *B. Hellebrandt M. – Lovász E.:* A Herman Ottó Múzeum ásatásai és leletmentései 1985–86. HOMÉ 25–26 (1988) 271.

48 *Rezi Kató G.:* Szögliget–Hosszú-tető–Julcsa-barlang. *In:* Régészeti kutatások Magyarországon 2000. Ed.: J. Kisfaludi Budapest 2003, 227.

49 *Korek* (1970); *Kalicz – Makkay* (1977) 119. It is possible that the entire assemblage can be associated with the Bükk culture. Cp. *Csengeri P.:* A bükki kultúra temetkezése Mezőzomboron. Ősrégészeti Levelek 3 (2001) 13.

50 Katalin Simán's rescue excavation in 1982. Herman Ottó Museum inv. no. 83.1–149. *Wolf – Simán* (1982) 110.

51 *Korek – Patay* (1958) 26; *Kalicz – Makkay* (1977) 128.

52 *Korek – Patay* (1958) 21; *Kalicz – Makkay* (1977) 182.

53 *Korek – Patay* (1958) 28; *Kalicz – Makkay* (1977) 141.

54 *Korek – Patay* (1958) 19–21; *Kalicz – Makkay* (1977) 118–119; *Kemenczei T. – K. Végh K.:* A Herman Ottó Múzeum leletmentései és ásatásai 1966-ban. HOMÉ 7 (1966) 391; *Kemenczei T.:* Új régészeti leletek az aggteleki Baradla-barlangból. HOMK 8 (1969) 1–6; *Gádor – Hellebrandt* (1975) 135; *Gádor J. – Hellebrandt M.:* A Herman Ottó Múzeum ásatásai és leletmentései 1976-ban. HOMÉ 16 (1977) 77; *Wolf – Simán* (1982) 110; *Rezi Kató G.:* Aggtelek–Baradla-barlang. *In:* Régészeti kutatások Magyarországon 2000. Ed.: J. Kisfaludi. Budapest 2003, 133. More recent finds in the Herman Ottó Museum: donation by György Dénes (inv. no. 74.28.1–12), donation by Gyula Zsolczai, cave director (inv. no. 77.39.1–59); finds from Katalin Simán's field survey in 1981 (inv. no. 81.12.1–15).

55 *Korek* (1970); *Kalicz – Makkay* (1977) 119.

56 Ilona Valter's excavation in 1976–78. Herman Ottó Museum Archaeological Archives, no. 1436–79; Herman Ottó Museum inv. no. 78.30.1–119, 79.25.1–312. Cp. also *Korek – Patay* (1958) 26–27; *Kalicz – Makkay* (1977) 186.

57 Tamás Pusztai's inspection of the site in 1998. Herman Ottó Museum Archaeological Archives, no. 2620–98.

58 *Korek – Patay* (1958) 26; *Kalicz – Makkay* (1977) 128.

59 *Korek – Patay* (1958) 21–26, *Kalicz – Makkay* (1977) 127; *Gádor – Hellebrandt* (1975) 136.

60 *Korek – Patay* (1958) 26; *Kalicz – Makkay* (1977) 127.

30. Kazincbarcika,[61] 31. Sajóecseg,[62] 32. Sajószentpéter,[63] 33. Sajószentpéter–Kövecses,[64] 34. Sajószentpéter–Nyilas railway guard-house,[65] 35. Szendrő–Büdöskút-puszta,[66] 36. Szendrő–Ördöggáti Csengő Cave,[67] 23. Vadna–Railway bridge towards Dubicsány.[68]

The above list indicates that there are at least thirty-six known Neolithic sites in this area. It is possible that the find spots without a closer specification of their location can be located more precisely and perhaps be identified with an already known site; conversely, they may represent entirely new, yet unidentified sites. The archaeological literature and the records in the Herman Ottó Museum do not mention one single Early or Late Neolithic site in the area.

The assemblages labelled "Neolithic" without a closer date probably come from Middle Neolithic settlements (the ALP or one of its groups). The same holds true for the finds labelled "ALP", most of which were donated to the museum or originate from old surface collections. These cannot always be regarded as representative in terms of dating.

A total of five sites can be associated with the Tiszadob group and at least seventeen with the Bükk culture (including the Kelemér–Mohosvár and Putnok–Szörnyű-völgy sites). Prehistorians are divided as regards the relation between these two ALP groups. Jan Lichardus has argued that the Tiszadob group and the Bükk culture were contemporaneous; in his view, the eastern boundary of the Bükk distribution lay west of the Bodrog River and the contact zone between the two also lay in this area.[69] Nándor Kalicz and János Makkay claimed that the distribution of the two cultures was more or less identical and that they succeeded each other.[70]

The examination of the relevant find assemblages for my dissertation on the ALP groups in northern Hungary indicated that the Tiszadob settlements in the Northern Mountain Range were restricted to the river valleys (Bodrog, Hernád, Sajó and Bódva valleys) and that they were distributed over a smaller area than earlier assumed. It is possible that the Tiszadob communities did not need to or were unable to exploit the more unfavourable environments in the mountainous region. In contrast, the sites of the Bükk culture can be found throughout the mountain region, suggesting that the Bükk communities had successfully adapted to and were capable of exploiting these less favourable environments too.

The closer examination of the museum finds (although not yet completed) also revealed another interesting phenomenon as regards the Neolithic use of caves in the Northern Mountain Range. In contrast to earlier claims that these assemblages contained mixed ALP–Tiszadob–Bükk finds,[71] indicating that all three groups settled in them, I found that these assemblages were actually made up of Bükk wares only. The pottery attributed to the ALP and the Tiszadob group was in fact made up of the thick-walled, decorated household vessels of the Bükk culture. This overall picture might obviously be modified by future research. One intriguing issue is how and why caves were utilised in the Middle Neolithic. Were they settled permanently, or were they merely temporary refuges or perhaps the settings of ritual activities? Future research will no doubt clarify this point.[72]

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61 *Korek – Patay* (1958) 14–15; *Kalicz – Makkay* (1977) 135–136.

62 *Korek – Patay* (1958) 13; *Kalicz – Makkay* (1977) 151–152.

63 *Korek – Patay* (1958) 14; *Kalicz – Makkay* (1977) 152 (Sajószentpéter II).

64 *Csengeri* (2003).

65 Field survey by Mária Wolf and Katalin Simán in 1982. Herman Ottó Museum inv. no. 85.16.1–27.

66 *L. Wolf M. – Simán K.:* A Herman Ottó Múzeum ásatásai és leletmentései 1984-ben. HOMÉ 24 (1986) 352.

67 *Korek – Patay* (1958) 28; *Kalicz – Makkay* (1977) 156.

68 *Korek – Patay* (1958) 21; *Kalicz – Makkay* (1977) 182.

69 *J. Lichardus:* Studien zur Bükker Kultur. Saarbrücker Beiträge zur Altertumskunde 12. Bonn 1974, 14–15.

70 *Kalicz – Makkay* (1977) 38–39, 43–45. It seems to me that the latter view is more acceptable in the light of the archaeological record.

71 *Korek – Patay* (1958); *Kalicz – Makkay* (1977) 101–102.

72 In 2001–2003, the entire Hungarian section of the Baradla–Domica Caves was systematically surveyed as part of a joint research project by the Aggtelek National Park, the Hungarian National Museum and the Herman Ottó Museum. This project was directed by Gábor Rezi Kató (the present author also participated in the survey). The Neolithic finds of the impressive amount of material collected during the survey can without exception be assigned to the Bükk culture. We also found several settlement features, such as hearths, post-holes and occupation levels. The evaluation of the finds and documentation is still in progress.

Of the Tiszadob sites listed above, the one at Bodvarákó–Esztramos-hegy-Szentandrási Cave and the Martonyi Cave, a yet unidentified site from which a pottery fragment is known, can only be tentatively associated with the Tiszadob group. It also seems necessary to re-examine the assemblage found in the area in front of the Aggtelek–Baradla Cave site.

In sum we may say that the archaeological record confirms that the Hungarian section of the Sajó–Bódva Interfluve was occupied during the Neolithic: ALP, Tiszadob and Bükk communities all settled in the river valleys, while the mountainous area between the two rivers providing a less favourable environment and means of livelihood was only occupied by the Bükk culture. There is no evidence that this area had been inhabited during the Early and the Late Neolithic. However, in order to confirm this broad picture, it will be necessary to re-examine the currently known find assemblages. New sites and new finds will undoubtedly modify the picture based on the currently available palaeo-ecologic and archaeological record, and provide new insights into Neolithic settlement patterns, the density and inter-relations between the settlements and the life-style of Neolithic communities.

THE COPPER AGE

We know far less about the Copper Age settlement patterns in this area than about its Neolithic occupation. For example, not one single Early, Middle or Late Copper Age site has yet been identified in the Kelemér area. The peat layers dating from after 4300 BC were all removed during mining operations from the southern basin of Nagy-Mohos-tó, where the palaeo-ecologic studies were conducted, and thus no information could be gained concerning the impact of Copper Age communities on the environment.[73] The analysis of the sediments from Kis-Mohos-tó have revealed that the forest regeneration begun during the Late Neolithic ceased around 4000 BC, roughly at the time when the Bodrogkeresztúr culture appeared, and that the composition of nearby woodlands changed.[74] Elm, oak, linden and hazel pollen declined, while beech, birch and hornbeam pollen rose. The amount of copper in the sediment catchment basin too increased. These changes can be attributed to human activity, including copper mining and smelting, with the charcoal necessary for these activities gained by felling beech.[75]

The amount of copper in the sediments of Kis-Mohos-tó increased and reached its maximum during the next period, corresponding to the Baden culture,[76] beginning from 3200 BC; the cores also indicated the cyclical changes in the pollen ratios of hornbeam, beech and birch, as well as traces of strong erosion, indicating intensive tree felling activity for procuring wood necessary for copper metallurgy, the use of ploughs in cultivation and the spread of wheeled wagons.[77]

The Copper Age settlements and burial grounds in the Hungarian section of the Sajó–Bódva Interfluve were studied using the same procedure as in the case of the Neolithic. The following sites are known from the area *(Fig. 5)*:

73 *Magyari et alii* (2000) 123.

74 On the basis of the available radiocarbon dates, the Early Copper Age of the Carpathian Basin can be dated between 4500/4400–4000 BC and the Middle Copper Age between 4000–3600/3500 BC. Cp. *P. Raczky:* New data on the absolute chronology of the Copper Age in the Carpathian Basin. *In:* Neuere Daten zur Siedlungsgeschichte und Chronologie der Kupferzeit des Karpatenbeckens. Hrsg.: T. Kovács. IPH 7. Budapest 1995, 54.

75 *Sümegi* (1998) 374; *Willis et alii* (1998) 109; *Magyari et alii* (2000) 123; *Sümegi* (2001) 30.

76 M. Johnson dated the Boleráz group between 3700–3300 BC and the classical Baden culture between 3300–2800 BC (quoted by *N. Kalicz:* Über die Absolutchronologie der Kupferzeit Ungarns und die Doppelspiralkopfnadeln von Südosteuropa bis zum Nahen Osten. Antaeus 25 [2002] 380). The Baden culture is generally dated between 3500–3000 BC (cp. *Bondár* [2002] 15).

77 *Sümegi* (1998) 375–376; *Willis et alii* (1998) 109–110; *Magyari et alii* (2000) 123–124; *Sümegi* (2001) 30.

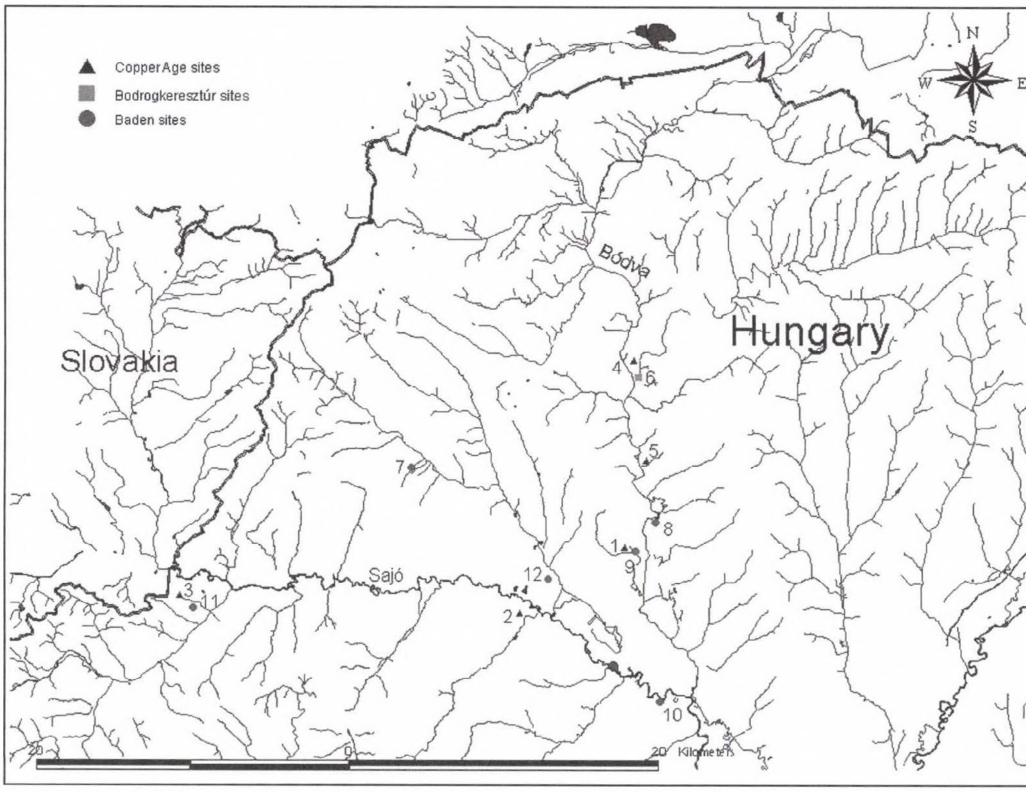

Fig. 5. Copper Age sites in the Sajó–Bódva Interfluve

"Copper Age": 1. Edelény–Kistábla,[78] 2. Kazincbarcika,[79] 3. Sajópüspöki–Kisvölgy-oldal,[80] 4. Szendrő,[81] 5. Szendrőlád–Borda,[82]

Bodrogkeresztúr culture: 6. Szendrő,[83]

Baden culture: 7. Dövény,[84] 8. Edelény–Borsod,[85] 9. Edelény, 4 Hámán Kató Street,[86] 10. Sajószentpéter–Sajóecseg, railway guard-house,[87] 11. Sajópüspöki–above the Center station,[88] 12. Szuhakálló–Railway station.[89]

A total of twelve Copper Age sites could be identified. There are no settlements or cemeteries from the Early Copper Age Tiszapolgár period, which fits in neatly with the palaeo-ecological record. The major monographs on the Copper Age in Hungary, including Pál Patay's studies on the Middle Copper Age,[90] mention one single find spot from the region, where an assemblage of two copper articles was found (Szendrő).[91] No other Bodrogkeresztúr or Hunyadihalom sites are currently known. Studies on the Late Copper Age[92] quote finds from two settlements: three pottery fragments from Edelény–Borsod

78 The sites appear on the map *(Fig. 5)* according to the numbering in this list. *Gádor – Hellebrandt* (1975) 131.
79 Collected by Márton Rozsnyói. Herman Ottó Museum inv. no. 73.11.451–457.
80 Collected by Márton Rozsnyói. Herman Ottó Museum inv. no. 73.11.427–450.
81 Donated by Gyula Wittner. Herman Ottó Museum inv. no. 53.333.1–3.
82 Donated by István Kövér. Herman Ottó Museum inv. no. 53.364.1.
83 *Patay* (1958) 303; *Patay* (1974) 67.
84 *Banner* (1956) 94.
85 *Ibidem* 94.
86 Magdolna Hellebrandt's rescue excavation in 1977. Herman Ottó Museum inv. no. 78.11.1–13.
87 Mária Wolf and P. Tóth's field survey. Herman Ottó Museum inv. no. 88.13.1–28.
88 Collected by Márton Rozsnyói. Herman Ottó Museum inv. no 73.11.233.
89 Collected by Pál Patay in 1959. Herman Ottó Museum inv. no. 60.33.1–6.
90 *Patay P.:* A bodrogkeresztúri kultúra temetői. RégFüz Ser. II. 10. Budapest 1961; *Patay* (1974).
91 *Patay* (1958) 303; *Patay* (1974) 67.
92 *Banner* (1956); *G. Nevizánsky:* Grabfunde und Überbauerscheinungen der Träger der Badener Kultur im zentralen Gebiet des Karpatenbeckens. SlovArch 33 (1985) 249–270; *Bondár* (2002).

and one from Dövény.[93] The review of museum finds and archival data complemented these sites with a few additional Baden assemblages. Unfortunately, the cultural attribution of the find assemblages lumped under "Copper Age" finds is not possible without a personal examination of the finds.

The single Bodrogkeresztúr find came to light in the Bódva Valley, while Baden sites can be found in the Sajó and Bódva Valleys: in the Szuha Valley between the two (Szuhakálló, Dövény; *Fig. 5*). The settlements and burials of the Ózd–Piliny group, dating to the late Baden period, whose material culture shares numerous similarities with the Bosáca group and the Kostolac culture, are known from the Sajó and Ipoly valley and their environs.[94] Some of these sites are hilltop settlements,[95] and several burial grounds of the group lie in the Ózd area (Stadion, Kőaljatető, Center, Szentsimon, etc.). The use of anthropomorphic urns can be linked to the Ózd–Piliny group.[96] This would imply that the discovery of the sites of this group can be expected in the Hungarian section of the Sajó Valley and in the less favourable environment of the Sajó–Bódva Interfluve.

The scanty data do not enable a more precise picture of the Copper Age settlement patterns in this area. In the lack of excavation data, there would be need for planned excavations in order to enrich our knowledge of this period.

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93 *Banner* (1956) 94.

94 *Ibidem* 186–187; *Patay* (1999) 50–51.

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96 *J. S. Koós:* Neuere Erkentnisse zur Verbreitung der Menschenförmigen Urnen in Nordost-Ungarn. *In:* A kőkortól a középkorig. Tanulmányok Trogmayer Ottó 60. születésnapjára. Ed.: G. Lőrinczy. Szeged 1994, 205; *Patay* (1999) 51.

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THE NEOLITHIC OF NAGYBÁRKÁNY AND ITS ENVIRONS

Gábor Bácsmegi – Szilvia Fábián

Even though Kisterenye, the first prehistoric site to be discovered in Nógrád County, was excavated in the earlier 19th century,[1] over one hundred years elapsed before Neolithic research was begun in earnest. The first Lengyel pit was uncovered by Pál Patay at Nógrádkövesd.[2] Only stray finds reached the museum until the late 1970s. Between 1979–1985, Virág Soós investigated a Zseliz settlement at Szécsény–Ültetés, preceding plans to construct a dam.[3] The Csesztve–Stalák site was first investigated by Viola Dobosi and Judit Tárnoki;[4] the excavations were continued by Sára Kató (the finds are, sadly, still unpublished). During the next years, the only Neolithic finds reaching the museum were the ones collected during field surveys or presented to the museum as stray finds. The field surveys conducted by László Tóth, an inhabitant of Pásztó, must be mentioned here, even though his activity was chiefly restricted to the southern part of Nógrád County. A number of preliminary excavations and rescue excavations preceding major construction projects took place from the late 1990s. Linear Pottery and Lengyel finds were brought to light in 2002 near Karancsság,[5] and a Lengyel pit was excavated near Nőtincs prior to the construction of a sewage plant. In 2003, a few settlement features of the Zseliz culture were uncovered on the bank of the Tarna River near Cered. The systematic field surveys and excavations to be conducted over the next few years will no doubt enrich our knowledge of the Neolithic of this region, which has a key role in view of its geographic location.

By the mid-6th millennium BC, subsistence patterns based on a production economy adapted to the Central European climatic and environmental conditions had spread over the northern areas of the Carpathian Basin and the greater part of Europe. A large, fairly homogenous culture evolved: the Central European Linear Pottery, whose regional group in Transdanubia (including Nógrád County) is known as the Transdanubian Linear Pottery (TLP). The cradle of this culture probably lay in the contact zone between the Körös–Starčevo complex and the earliest Linear Pottery territory – the Carpathian Basin can thus be regarded as a secondary centre of neolithisation in Europe. The Linear Pottery province extended to the Harz Mountains in the north, the Rhine in the west and to the Danube and its tributaries in the south during the earliest Linear Pottery phase, and it was characterised by rather uniform settlement patterns and a fairly homogenous culture and economy.[6] Linear Pottery sites have been reported from the greater part of Bavaria, from the Czech–Moravian Basin, from the northern areas of Lower Austria and the northern Burgenland, from Transdanubia down to the Drava River, from both sides of the Danube, from western Slovakia (up to the Garam River), from the southern part of Little Poland up to the Odera and the Upper Vistula region and, sporadically, from the Bug region.[7]

The Nagybárkány area, i.e. the Cserhát Mountains and the Nógrád Basin, fell into the Central European Linear Pottery distribution area. Together with the Gödöllő Hills, this region marks the eastern and north-eastern fringes of its distribution in the Carpathian Basin. The first reliable evidence for Neolithic settlement comes from the Notenkopf period, representing the middle TLP period,[8] when the

1 *Kubinyi F.:* Nógrád vármegyében fekvő Kis Terenne helység határában Hársas nevű hegyben találtatott régiségekről. Sas (1933) 105–138.
2 *Patay* (1956) 186–187.
3 *Soós V.:* Előzetes jelentés a Szécsény–ültetési zselizi telep feltárásáról. NMMÉ 8 (1982) 7–46.
4 *V. T. Dobosi – J. Tárnoki:* Excavations in Csesztve–Stalák. CommArchHung (1987) 5–14.
5 *Bácsmegi* (2003).
6 *H. Quitta:* Zur Frage der ältesten Bandkeramik in Mitteleuropa. PZ 38 (1960) 164–165, Fig. 3; *Lüning* (1991) 32, Abb. 4.
7 *Kalicz* (1988) 135–136; *Lüning* (1991) 32, Abb. 4.
8 A few pottery sherds collected during field surveys (e.g. at Csécse–Temetőpart) may indicate a settlement dating to the early TLP phase.

culture developed along a new trajectory and became independent of the Balkanic-Aegean region. This development saw a large-scale expansion – the sites of the Central European Linear Pottery culture were distributed from the Parisian Basin to the Dniester and there was also a dramatic rise in the number of sites.[9] The Linear Pottery complex were made up of various regional groups, which are chiefly distinguished on the basis of the manufacturing techniques and decoration of their pottery wares. The Nagybárkány area, the Cserhát and the Nógrád Basin was part of the eastern TLP distribution, characterised by pottery ornamented with incised lines interrupted with impressed dots or "musical notes" motifs, after which the Notenkopf Pottery culture was named. In Hungary, Notenkopf Pottery sites are distributed in north-eastern Transdanubia, from Lake Fertő to the Sió mouth, north-east of an oblique imaginary line drawn across the centre of Transdanubia, in the Danube Valley (including the eastern bank), in the Gödöllő Hills, the Nógrád Basin and in the Cserhát up to the Zagyva River.[10]

A substantial number of Notenkopf sites have been identified in the region, especially in the southern part of Nógrád County. However, the only site excavated to date is the Karancsság settlement, where two occupation surfaces and the associated settlement features were uncovered.

Linear Pottery settlements were generally established near water, usually at the foot of a hill or on low hill ridges (as at Salgótarján–Dobó Katica Street), and Notenkopf sites are no exception since they too lie on the low ridges flanking the streams, often forming a chain of settlements (as at Szarvasgede–Kerekdomb and Szarvasgede–Tűzköves 1 and 2). Population movements probably took place along stream valleys; elevations lying higher than 350 m were not occupied, conforming to the general Linear Pottery pattern. The Linear Pottery communities chose areas with an adequate water supply and with loessy or, more rarely, brown forest soil suitable for crop cultivation for their settlements. The Linear Pottery distribution shows a correlation with the climatic zones suitable for agricultural activity, having an annual rainfall of 900 mm and annual mean temperature of 7 °C.[11]

The currently known easternmost Notenkopf site in Nógrád County has been identified at Kazár–Rákóczi telepi Road; in the south, Notenkopf sites are known also south of the county's border. There are few sites whose finds represent the Notenkopf culture only (e.g. Palotás–Rókás-dűlő, Varsány–Középbérc, Kazár–Rákóczi telepi Road, Szurdokpüspöki–Külső Szélgát); most sites also yielded Zseliz finds (e.g. Karancslapújtő, Ludányhalászi–Gravel pit, Karancsság, Pásztó–Mária-tanya, Pásztó–Feketeribizli sarok, Szurdokpüspöki–Belső Szélgát, Jobbágyi–Bánya, Jobbágyi–Vám-part, Héhalom–Dengelegi oldal 1 and 2). The chronological relation between the Notenkopf and Zseliz population was clarified by Juraj Pavúk.[12]

Of these sites, excavations have only been conducted at Karancsság, where a stratigraphic sequence could also be observed. The two lowermost occupation surfaces (Levels 8–9) and the features dug from them yielded Notenkopf finds, while the overlying occupation surfaces and their features (Levels 6–7) contained Zseliz finds. The import finds indicate that the site can be dated to the middle Zseliz phase.

Zseliz pottery ornamented with bundles of two or more incised lined interrupted with deep stabs, a pattern which evolved from Notenkopf decoration, appeared in the Nagybárkány area in the late TLP period. Transitional sites of this type have been identified at Mátranovák–Dózsa Street and Ludányhalászi–Gravel pit, east of the Zagyva River.

The Zseliz distribution more or less corresponds to the preceding Notenkopf one, the only difference being that its territory was narrower towards the west and north-west. In Moravia and in the greater part of Lower Austria, Notenkopf pottery was succeeded by Šarka type wares.[13] In the north-west, in Burgenland and the eastern areas of Lower Austria, Zseliz pottery occurs together with Notenkopf wares. Beyond the Danube, the Zseliz culture was distributed throughout south-western Slovakia and Zseliz groups advanced as far as Little Poland and the Upper Vistula region through the Tátra passes

9 *Kalicz* (1988) 177, 184; *Lüning* (1991) Abb. 4.

10 *Kalicz* (1988) 182–183.

11 *B. Sielmann:* Der Einfluss der Umwelt auf die neolithische Besiedlung Südwestdeutschland. Acta Praehistorica et Archeologica 2 (1971) 180–188; *E. Lenneis:* Neue Ergebnisse zur Erforschung der ältesten Linearbandkeramik in Österreich. Zalai Múzeum 2 (1990) 10–11.

12 *Pavúk* (1969) 271–365.

13 *Kalicz* (1988) 206.

(the "Moravian Gate").[14] In the west, the Zseliz culture was distributed up to the western arc of the Carpathians in southern Moravia, while its eastern distribution extended to the Upper Ipoly region. The Hungarian territory of the Zseliz culture was more or less identical with the Notenkopf distribution, including the Gödöllő Hills and the Nógrád Basin, where its eastern boundary was marked by the Zagyva River.[15] More recent investigations have revealed that Zseliz groups also settled east of the Zagyva Valley, as shown by the Mátranovák site, representing the early Zseliz phase, and the settlement at Cered–Tarnapart, where various settlement features were uncovered in 2002. The significance of the latter site is that it is sited slightly to the east of the upper reaches of the Ipoly River, regarded as the culture's eastern boundary.

Similarly to the Notenkopf sites, there were few sites which only yielded finds of the Zseliz culture (e.g. at Szécsény–Ültetés, Cered–Tarnapart, Szurdokpüspöki–Hollósdomb, Nógrádmegyer).

One of the most extensively investigated Middle Neolithic sites, yielding a rich assortment of finds, is the settlement at Szécsény–Ültetés. The site lies 3 km from Szécsény, on a ridge by the right side of the road leading to Nagylóc. The broader area is part of the northern Szécsény Hills in the Nógrád Basin, lying in the northern foreland of the Cserhát Mountains. The two regions can barely be distinguished from each other; the micro-region covers some 220 km^2 and is characterised by a hill chain with hills rising to between 149 m and 442 m.[16] The top of the ridge is a roughly north to south oriented extensive plateau. The hill is quite steep on three sides, only on the southern side, where it narrows, is there a lack of any natural defence. The Lóci Stream flows directly under the hill and the Ipoly River to the north is also quite close. A wide plain extends to the north-west, i.e. the settlement was established on the boundary between the plainland and the hilly region. Settlement traces were observed over the entire plateau. The scatter of the surface finds and the clusters of burnt daub indicated the one-time presence of two or three buildings, which had been sited at some distance from each other and had lain around the central area of the hilltop. The house remains suggest smaller houses with daub walls, surrounded by clay extraction pits, storage pits and refuse pits. A darker strip of earth was noted at the southern end of the plateau, beyond which there were few Zseliz pottery fragments. This might be interpreted to mean that the settlement had been artificially fortified in this area.

The excavation yielded a rich assemblage of finds. The proportion of decorated fine wares and the number of human face pots, which reflected Neolithic beliefs and had a special role, as well as the number of pottery fragments with anthropomorphic and zoomorphic depictions was quite high in the ceramic sample. The abundance of stone finds was also striking and the wide variety of lithic types can be associated with the many different import pottery finds from this settlement. The import wares included Bükk, Szakálhát, Szilmeg, Esztár and Sopot pottery, with a few sherds indicating even more far-reaching contacts. Taken together, they reflect the wide-ranging cultural contacts of the Zseliz community occupying the settlement near Szécsény. The geographic setting of the area, its openness towards the west, the proximity of the Ipoly River (and, also, of the Danube along this river) provided significant advantages for the area's occupants. Since the settlement lay at the junction of natural trade routes, it is quite possible that the community exploited this excellent strategic position, controlling the trade route leading from Slovakia to the Danube Valley and also participating in the exchange network. The late Middle Neolithic population of the region could easily establish and maintain contact with the Neolithic cultures of the Great Hungarian Plain along the stream valleys penetrating the Cserhát Mountains, along the Zagyva (flowing north to south) and along the Tisza.

The abundant and varied lithics too are a reflection of the wide-ranging contacts, shown also by the fragments of imported pottery. Outstanding among these are obsidian from the Tokaj Mountains and Bükk wares, suggesting that raw material provided by Bükk communities was processed locally at the Szécsény settlement and that stone implements were then traded to other regions.

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14 *A. Kulczycka-Leciejewiczowa:* The Linear and Stroked Pottery Cultures. *In:* The Neolithic in Poland. Ed.: T. Wislański. Wrocław–Warszawa–Kraków 1970, 25.

15 *Kalicz* (1988) 206.

16 *Marosi S. – Somogyi S.:* Magyarország kistájainak katasztere. Budapest 1990, 791.

The analysis of the import pottery from the Szécsény–Ültetés settlement[17] supports Katalin T. Biró's study on the chipped stone implements[18] and the conclusions drawn from her study of the circulation of stone implements and lithic raw material, namely that there was a spectacular increase in the amount of lithics in the central areas of the Great Hungarian Plain by the end of the Middle Neolithic and, also, that these lithics included increasingly more imports, such as Transdanubian radiolarite and Polish chert from the north. It seems likely that the Zseliz population was one of the chief actors in the lithics trade,[19] a possibility confirmed by the Zseliz imports found on Szilmeg, Szakálhát and Vinča sites and, conversely, imported pottery of these cultures on the Szécsény site. The study of the lithics found at Olszanica in southern Poland too indicates that the Zseliz population played an important role in the Middle Neolithic obsidian trade.[20]

The significance of the Szécsény–Ültetés site lies in the fact that the settlement was occupied over a fairly long period of time. The ornamental motifs of the fine wares and their comparison with ceramic assemblages from other Zseliz sites suggests that the life of the settlement spanned two phases. With the exception of a few sherds from the early Zseliz IIa phase, the greater part of the pottery can be assigned to the Zseliz IIb and the early Zseliz III phase, i.e. the culture's florescence; the assemblage included also a few undecorated, polished, thin-walled biconical bowls with an S profile and some sherds with painted decoration,[21] which can be correlated with the Vorlengyel horizon.[22] The human impact on the environment was rather intense during the span of the Zseliz culture, documented also by the available pollen data.[23]

In this region, the Zseliz culture was succeeded by the early phase of the Late Neolithic Lengyel culture. The preceding Protolengyel phase has not yet been identified in Nógrád County. The Lengyel distribution included Transdanubia, the Gödöllő Hills, the territory of Nógrád County, a part of Austria, southern Moravia, western Slovakia and southern Poland. At the close of the early Lengyel phase and during the classical phase, the Lengyel culture also occupied the Upper Tisza region.[24] Lengyel wares were decorated with painted patterns which, however, disappeared by the late phase (Lengyel III). Incised decoration, which occurs sporadically in the culture's early phase, vanished by the classical Lengyel phase.

Early Lengyel sites yielding incised pottery have been identified at Bánk–Sewage works, Csesztve–Stalák and Karancsság in Nógrád County. At the latter site, the Lengyel occupation was represented by levels 4 and 5; two graves, dug from level 5, were uncovered during the excavations.[25] The skeletal analyses revealed that the graves contained female burials.[26] This early phase is closely allied to the Aszód–Svodin circle. We will have a better understanding of the cultural contacts of the early Lengyel sites in Nógrád County after the completion of the current investigations.

Most of the sites dating to the classical Lengyel phase are only known from stray finds (Szécsény–Dögtér, Szécsény–Gravel pit, Hugyag–Aranyospart, Pásztó–Homok, Csesztve–Mihókdomb), although excavations have been conducted at Nógrádkövesd[27] and Patvarc–Öreg Hradistye.[28]

17 *Fábián* (2002) 73–79.

18 *K. T. Biró:* Chipped stone industry of the Linearband Pottery Culture in Hungary. *In:* Chipped stone industries of the early farming cultures in Europe. Eds: J. K. Kozłowski – S. K. Kozłowski. Warszawa–Kraków 1987, 154–155.

19 *K. T. Biró:* Lithic implements and circulation of raw materials in the Great Hungarian Plain during the Late Neolithic Period. Budapest 1998, 50.

20 *S. Milisauskas:* Early Neolithic Settlement and Society at Olszanica. Memoirs of the Museum of Anthropology, University of Michigan, Number 19. Ann Arbor 1986, 165.

21 *Fábián* (2002).

22 *A. Točík – J. Lichardus:* Die neolithische Grube in Vyčapy–Opatovce. PamArch 55 (1964) 276–278; *J. Lichardus:* Beitrag zur chronologischen Stellung der rot und gelb inkrustierten Bükker Keramik. ŠtudZv 17 (1969) 224–230; *J. Pavúk:* Zur Bedeutung der Importe in Vinča für die Chronologie des Neolithikums. ŠtudZv 13 (1964) 49–50; *Pavúk* (1969) 332–338, 351–352; *J. Pavúk:* Súčasný stav štúdia lengyelskej kultúry na Slovensku. PamArch 72 (1981) 292.

23 *Imola Juhász*, in this volume (pp. 79–85).

24 *N. Kalicz:* Wenden des Spätneolithikums im Oberen Theissgebiet. JAMÉ 36 (1994) 266–267.

25 *Bácsmegi* (2003).

26 *Köhler K.:* A lengyeli kultúra embertani leletei Karancsság lelőhelyről. Ősrégészeti Levelek 5 (2003) 33.

27 *Patay* (1956) 186.

28 *E. Bánffy:* Cult objects of the neolithic Lengyel Culture. Connections and Interpretations. Budapest 1997, 18, Fig. 7. 3.

The final phase of the Lengyel culture (phase III) can be assigned to the Early Copper Age, even though the changes are more chronological in nature since lifeways did not change significantly. Most of the sites assigned to this phase lie in the Balassagyarmat area (Csesztve–Stalák, Csesztve–Nagypart, Patvarc). A stray Early Copper Age axe found at Patvarc has its best parallels among the similar Tiszapolgár finds.[29]

The single site in the Nagybárkány area from this period is the one at Vizslás–Újlak. Even though no Early Copper Age finds are known from the southern part of Nógrád County (in spite of the fact that it is an archaeologically fairly well investigated area), it seems unlikely that the area had been uninhabited.

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29 *Bácsmegi G. – Tankó K.:* Kora rézkori balta a Nógrád megyei Patvarcról. Ősrégészeti Levelek 4 (2002) 16–17.

THE COPPER AGE IN THE NAGYBÁRKÁNY AREA

Gábor Bácsmegi

The research of the Copper Age in Nógrád County has mainly focused on the Baden culture and only a few, although rather noteworthy finds represent the heritage of earlier cultures. The first excavation yielding Copper Age finds was conducted at Piliny–Várhegy, where, in addition to the well-known Late Bronze Age finds, artefacts of the Baden culture were also brought to light.[1] A hoard of Copper Age axes dating from the Middle Copper Age was turned up by the plough at Nógrádmarcali in 1933. Pál Patay investigated a Baden settlement at Galgaguta after World War 2; Baden finds were later brought to light at Salgótarján–Pécskő by József Korek and Pál Patay.[2] Following the excavation at the latter site, Baden assemblages only reached the Kubinyi Ferenc Museum in Szécsény from local citizens, who reported and brought archaeological finds to the museum. Outstanding among the latter is a larger assemblage of Baden pottery from the agricultural co-operative at Szurdokpüspöki, which was presented to the Szécsény museum in 2002 following a report of these finds by one of the locals. The most recent excavation was conducted at Nagybátony in 2004, where Szilvia Guba uncovered a number of Baden features.[3] It may in general be said that the sites investigated to date were without exception settlements; Copper Age burials have not yet been excavated in Nógrád County.

Only a handful of Lengyel III sites are known from the Early Copper Age. The changes in the Lengyel culture have a chronological relevance at the most since lifeways did not undergo a radical transformation compared to the culture's earlier phases. The Csesztve–Stalák, Csesztve–Nagypart and Patvarc sites can be dated to this period. Finds assigned to the Lengyel III phase in the Nagybárkány area have been brought to light at Vizslás–Újlak.

The archaeological record for the Middle Copper Age is slightly more complete. The Lengyel culture survived in some parts of Nógrád County (Ludanice culture), in spite of the fact that the greater part of Transdanubia, with which this region maintained close cultural ties, was occupied by the Balaton–Lasinja culture (a complex whose cultural make-up included southern elements). The survival of Lengyel III sites into the Middle Copper Age has been demonstrated on a few sites in Nógrád County (Csesztve–Stalák, Vizslás–Újlak-Május 1 Street), although independent sites representing this period have also been found, e.g. at Szécsény–Gravel pit and Salgótarján–Industrial park II, where a few pits have been uncovered.[4]

The diminution of the culture's earlier distribution can be observed not only throughout Transdanubia, but also in Nógrád County, because the Ludanice sites all lie north of the Cserhát Mountains, with the areas to the south occupied by the Bodrogkeresztúr culture. The evidence from field surveys indicates that Bodrogkeresztúr communities settled along the Zagyva River and its drainage lying south of the Cserhát Mountains. The known sites include Pásztó–Kurta-völgy, Pásztó–Mária-tanya, Csécse–Tóth-tanya and Csécse–Bikarét.[5] The western boundary of the Bodrogkeresztúr distribution is uncertain since there are no finds from this period in that area. The hoard of stone blades found at Nagykálló can also be linked to the Bodrogkeresztúr culture. Pál Patay attempted to clarify the find circumstances of this hoard, but he did not discover any other finds in the area.[6]

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1 *Nyáry A.:* A Piliny–Várhegyi őstelep. ArchÉrt 29 (1909) 415–432.
2 *Korek* (1968).
3 The excavator's kind personal communication.
4 *Vaday A.:* Salgótarján, Ipari-park II. *In:* Régészeti kutatások Magyarországon 2001. Ed.: J. Kisfaludi. Budapest 2000, 31–38.
5 Sites from this period were mostly identified by László Tóth, an inahbitant of Pásztó, during his field surveys.
6 *Patay P.:* A kállói kőpenge lelet. FolArch 11 (1960) 15–20.

Major advances can be noted in metallurgy during the Middle Copper Age. The number of large, heavy copper implements, chiefly axes and pickaxes, grew significantly during the Bodrogkeresztúr period, and the use of gold too became more widespread compared to the Early Copper Age both in the Bodrogkeresztúr and the Balaton–Lasinja culture. Several copper implements came to light in Nógrád County, among which the hoard of pickaxes from Nógrádmarcali is perhaps the most significant: one of the axe types was named after this site.[7] A copper axe was also found at Balassagyarmat.

Little is known about the cultural transformations marking the close of the Middle Copper Age in this region. Sites from the formative period of the Baden culture are virtually unknown; only the finds collected at Pásztó–Hidegvölgy-dűlő can be associated with the so-called Protoboleráz horizon, marking the emergence of the Baden culture. The lack of research is the main reason that this is the single site from this period known to date.

Even though sites of the Late Copper Age Baden culture are more abundant in Nógrád County, their majority falls outside the study area. These sites include both hilltop settlements (Salgótarján–Pécskő, Piliny–Várhegy) and settlements established on the plainland (Szurdokpüspöki–Agricultural co-operative, Jobbágyi–Petőfi Street, Szécsény–Gravel pit, Szécsény–Nagy S. Street, Nagybátony–Maconka, Nagybátony–Bánya Road apartment houses).

The Baden period marks the first epoch in the history of the Carpathian Basin, when the entire region was occupied by the same cultural complex. One possible reason for this is that the Baden population used four-wheeled wagons, which revolutionised transport and communications. The Zagyva and the Tarján valleys linking southern Slovakia with the Great Hungarian Plain, which were suitable for functioning as north to south trade routes, both lie near Nagybárkány.

Little is known about the final period of the Baden culture in this area. Finds of the late Baden culture have been excavated at Salgótarján–Pécskő,[8] and this is the single site from where a typical bowl with interior decoration of the Early Bronze Age Makó culture is known. Since, however, this bowl was a stray find, its stratigraphic context remains unknown and it cannot be established whether the bowl came from an independent Makó site or whether it reflects the survival of the Pécskő settlement into the Early Bronze Age. This problem will probably remain unresolved owing to the large-scale destruction of the Pécskő site.

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7 *Patay P.:* Die hochkupferzeitliche Bodrogkeresztúr-Kultur. BRGK 55 (1974) 3–71.

8 *Korek* (1968).

THE COPPER AGE IN THE JÁSZSÁG AND THE MÁTRA FORELAND

Róbert Patay

The apparently unbroken Late Neolithic development in the eastern half of the Carpathian Basin came to an abrupt halt and the network of tell settlements, which emerged from the end of the Middle Neolithic, disintegrated for yet not wholly understood reasons in the second third of the 5th millennium BC.[1] Climatic changes and the internal tensions of the Late Neolithic socio-economic structure undoubtedly played a major role in this collapse. The onset of a cooler climate transformed the environment and, as a result, there was a shift from the former intensive agrarian economy calling for a sedentary lifestyle to a more mobile subsistence strategy based on stockbreeding, in which crop cultivation played a less emphatic role.[2] Settlements became smaller and more briefly occupied, and cemeteries were now separate from the settlements. The separation of settlement and cemetery reflected a change in religious beliefs and in the social fabric. Cemeteries became the main communal focus and the symbol of permanence, as well as the setting for ritual activities. Burial rites became stricter and social differences were reflected in the grave goods deposited in burials: some of the deceased were provided with a rich assortment of goods, while others with almost none for the journey to the otherworld. In addition to the continuity in the material culture and pottery, a number of striking differences can also be noted: the Copper Age saw the disappearance of clay figurines and the custom of decorating pottery with painted patterns. Earlier prestige commodities, such as Spondylus, bitumen and obsidian, were replaced by copper and gold, and heavy copper implements made their appearance.[3]

The beginning of the Copper Age is marked by the appearance of the Tiszapolgár culture around 4500–4400 BC in the Jászság and the southern Mátra foreland, the area discussed in this study.[4] The archaeological record and the anthropological evidence both indicate the survival of the local population,[5] and strong cultural impacts from the Lengyel culture.[6] There were intensive contacts between the cultures of neighbouring regions: the late Lengyel, Cucuteni, Erősd, Petreşti, Sălcuţa and the Tiszapolgár cultures. This network of contacts determined the trajectory of subsequent development, which eventually moved towards a homogenisation affecting the entire Carpathian Basin at the beginning of the Late Copper Age.[7]

There is scanty evidence for occupation in the Early Copper Age *(Fig. 1)*.[8] A few settlement features have been uncovered at Tiszanána–Dinnyehalom[9] and Kisköre–Szingehát.[10] The burials of the cemetery section excavated near Besenyszög contained pottery, copper bracelets, stone axes and jewellery strung of limestone beads.[11] Richly decorated pottery fragments and a broken stone axe, assigned to the

1 *Makkay J.:* A magyarországi neolitikum kutatásának újabb eredménye. Az időrend és a népi azonosítás kérdései. Budapest 1982, 156–163.

2 *Bognár-Kutzián* (1972) 185–186; *Horváth – Virág* (2003) 125.

3 *Horváth* (1983) 66–68; *Horváth – Virág* (2003) 125–126; Északkelet-Magyarország a rézkorban, a Kr. e. V–III. évezredben. *In:* Utak a múltba. Az M-3-as autópálya régészeti leletmentései. Eds: T. Kovács – P. Raczky – A. Anders. Budapest 1997, 45.

4 The dates are given according to calibrated radiocarbon dates. Cp. *S. Forenbacher:* Radiocarbon dates and absolute chronology of the central European Early Bronze Age. Antiquity 67 (1993) 237–238.

5 *Bognár-Kutzián* (1972) 221–222; *Zoffmann* (1992) 39–44; *Zoffmann* (2001) 53.

6 *Ecsedy* (1981) 75–76; *Bognár-Kutzián* (1972) 203–204.

7 *Ecsedy* (1981) 76; *Roman* (1971) 130.

8 According to the documentation in the Dobó István Castle Museum in Eger, a Tiszapolgár burial was uncovered at Aldebrő–Ürgedomb as part of a rescue excavation (Museum Archives, 348). The museum's collection contained a few atypical body sherds from among the finds.

9 RégFüz 40 (1987) 24.

10 RégFüz 19 (1966) 16.

11 RégFüz 39 (1986) 15.

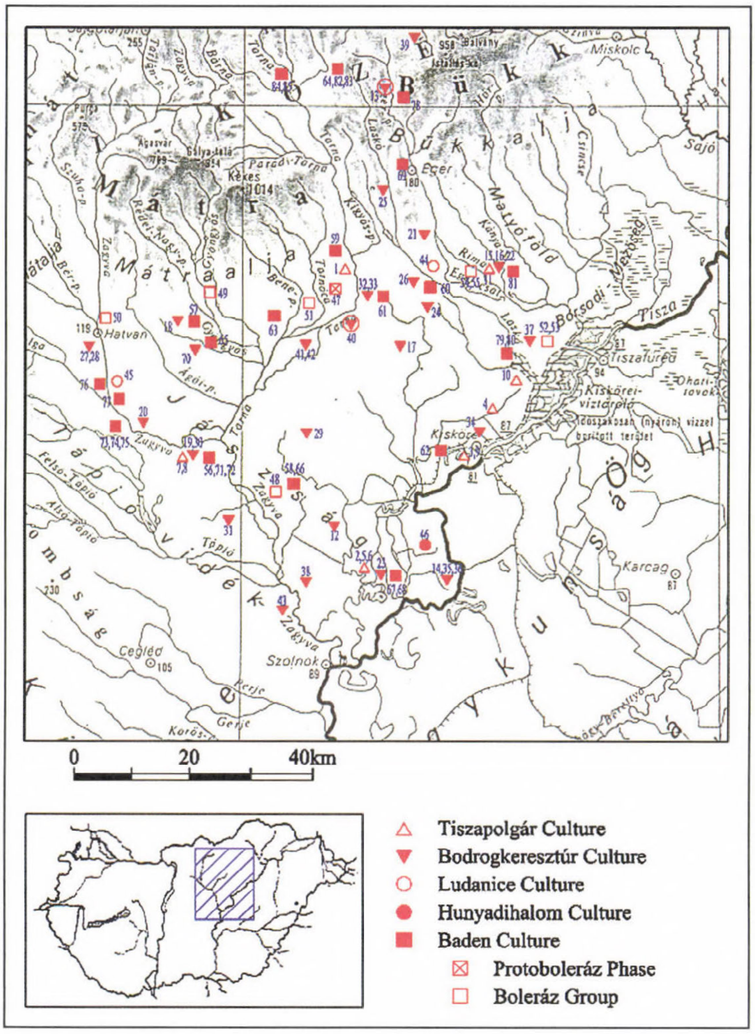

Fig. 1. Copper Age sites in the Jászság and the Mátra foreland

culture's Kisrétpart group, were also found at Besenyszög *(Figs 3–7)*.[12] In addition to the above, stray finds of the Tiszapolgár culture have been reported from Besenyszög–Kockalapos,[13] Jászberény,[14] Kisköre,[15] Poroszló[16] and Szihalom.[17] A copper hammer-axe from Kisköre can probably also be dated to this period.[18]

The Middle Copper Age Bodrogkeresztúr culture appearing around 4000 BC is a direct continuation of the Tiszapolgár culture.[19] The Bodrogkeresztúr economy too was characterised by pastoralism and the dominance of stockbreeding. The settlements were probably briefly occupied, this being the reason that they can only be identified with difficulty. Even though the number of excavated Bodrogkeresztúr settlements has grown in the past few years, our knowledge of the culture is based on cemetery finds. The intensification of contacts with neighbouring cultures, the maintenance of the trading networks created during the Early Copper Age, undoubtedly had an impact on material culture. The influence of the Kisrétpart group of the Tiszapolgár culture and cultural impacts from the Sălcuţa culture played an especially important role. The origins of the Bodrogkeresztúr population can for the greater part be traced to the Late Neolithic population. The anthropological evidence too confirms that the Bodrogkeresztúr population can be derived from the preceding Tiszapolgár groups.[20]

The number of known Middle Copper Age sites is much higher than those of the Early Copper Age. Cemetery sections have been investigated at Tenk[21] *(Fig. 2)* and Nagykörű–Hidashát;[22] a burial ground with forty burials has been excavated at Jászladány.[23] One of the burials from Tenk contained a copper dagger, a rare find from this period.[24] The grave goods from Jászladány included a heavy copper axe

12 Damjanich János Museum (Szolnok), inv. no. 68.97.1–24.
13 Damjanich János Museum (Szolnok), inv. no. 69.16.71.
14 *Bognár-Kutzián* (1972) 51.
15 *Ibidem* 52.
16 *Ibidem* 72–73, Pl. XIV. 19.
17 *Ibidem* 85–86, Pl. LXIV, 1–6.
18 *Patay* (1984) 40, Taf. 9, 156.
19 *I. Bognár-Kutzián:* The Copper Age Cemetery of Tiszapolgár–Basatanya. ArchHung 42. Budapest1963, 510; *Patay* (1974) 57–58.
20 *Zoffmann* (1992) 39–44; *Zoffmann* (2001) 53.
21 ArchÉrt 93 (1966) 293.
22 *Patay* (1961) 59–61, Pl. XXV.
23 *Patay* (1944–45).
24 ArchÉrt 93 (1966) 293.

and gold jewellery.[25] A cemetery and the settlement of the community which buried its dead there were investigated at Jászberény–Borsóhalom,[26] and settlement remains (chiefly pits) were brought to light at Jászfelsőszentgyörgy–Túróczi-tanya[27] and on the outskirts of Maklár.[28] Stray surface finds indicating the presence of one-time settlements have been reported from Jászberény–Peresi földek,[29] from the area between Kál and Tarnabod,[30] from the Nagykörű area[31] and from Tarnaméra.[32]

The Bodrogkeresztúr sites investigated at Szihalom are unique among the contemporary sites of the Carpathian Basin.[33] The detailed analysis of the finds suggests that the deceased interred in the Szihalom–Sóhajtó cemetery and the woman provided with a rich assortment of grave goods laid to rest in a grave brought to light at Szihalom–Pamlényi-tábla, lying roughly 100 m away from the former burial ground, were members of the same community.[34] A section of this community's settlement has also been excavated.[35]

New raw materials became the medium for the accumulation of wealth: malachite, copper and gold expressed the rank and social prestige of both individuals and communities. The use of massive, heavy copper implements became widespread during the Bodrogkeresztúr period, reflected by the many copper finds (most of them unfortunately stray finds) from this period found in the Jászság and the Mátra foreland. Various types of axe-adzes and flat axes are known from Dormánd,[36] Egerszalók,[37] Jászapáti,[38] Jászboldogháza,[39] Kápolna,[40] Poroszló,[41] Szászberek,[42] Szilvásvárad[43] and Tarnaméra.[44] It is possible that native copper from the Mátra Mountains was used for their manufacture.[45] This period saw the more extensive use of gold. In addition to the gold jewellery found in the Jászladány cemetery,[46] gold articles were found also at Hatvan: a large gold breast ornament, interpreted as a stylised female depiction.[47] There is evidence that the trade in metal ores created contact between regions lying far from each other and that these contacts had a profound influence on the cultures of this period.[48]

It has been suggested that in terms of its cultural development, the territory of Heves County had culturally belonged to the Nitra Basin during the Middle Copper Age.[49] The eastern boundary of the Ludanice culture, a direct continuation of Lengyel traditions, is uncertain.[50] Neither is it clear whether

25 *Patay* (1944–45) Pl. V. 11–12, 15–18, Pl. VI. 5.
26 *Csalog* (1961) 53–58, 144–150.
27 Damjanich János Museum (Szolnok), Archives 59–1968, 65–2968.
28 Dobó István Castle Museum (Eger), Archaeological Archives, 212. The finds can no longer be found in the museum's collection.
29 *Poroszlai* (1990).
30 *Kalicz* (1966) 5.
31 Damjanich János Museum, Archives, 60–1968.
32 *Kalicz* (1966) 5.
33 *Szabó* (1997); *Váradi* (1997).
34 *Marton – Patay* (2005).
35 *Váradi* (1997) 51.
36 *Patay* (1984) 49, Taf. 15. 203.
37 *Ibidem* 27, Taf. 4. 54.
38 *Ibidem* 93.
39 *Ibidem* 82–83.
40 *Ibidem* 35–36, Taf. 7. 121.
41 *Ibidem* 83.
42 *Patay* (1974) Taf. 2, 7; *Patay* (1984) 95.
43 *Ibidem* 91, Taf. 49. 511.
44 *Ibidem* 84, Taf. 47. 485.
45 *Kalicz* (1992) 7.
46 *Patay* (1944–45) Fig. V. 11–12, 15–18.
47 *Patay* (1958) 37–46, XV–XIX., Pl. 15. 11; *Raczky* (1999) 26.
48 *Kalicz N.:* A Balaton-Lasinja kultúra történeti kérdései és fémleletei. ArchÉrt 109 (1982) 3–17; *N. Kalicz:* On the Chronological Problems of the Neolithic and Copper Age in Hungary. MittArchInst 14 Beheift 2 (1985) 28–29; *Kalicz* (1992); *Raczky* (1999).
49 *Bánffy et alii* (1997) 38.
50 *J. Pavuk – J. Bátora:* Siedlung und Gräber der Ludanice-Gruppe in Jelšovce. Nitra 1995, 130–132.

Ludanice groups had actually settled in this region[51] or only exerted a cultural influence.[52] A number of find assemblages (Mónosbél,[53] Tarnabod,[54] Kompolt,[55] Szihalom–Sóhajtó,[56] Jászfényszaru[57]) exhibit traits of both the Bodrogkeresztúr and the Ludanice culture. It is my belief that the Mátra foreland was a kind of transitional zone, where cultural impacts from both cultures played a role. The ditch system and the finds from a sacrificial pit uncovered at Füzesabony–Pusztaszikszó were assigned to the Ludanice culture. This site is an important reflection of Middle Copper Age beliefs and ritual activities.[58]

Even though there are major differences between the two, the Hunyadihalom culture is regarded as a direct continuation of the Bodrogkeresztúr culture.[59] Heavy copper implements are lacking from Hunyadihalom assemblages and the pottery too changed significantly. Large cemeteries were abandoned and the stylistic traits of the few known statuettes show a break with earlier types.[60] The appearance of the Sălcuța culture in the Carpathian Basin has been invoked as a possible explanation for these changes,[61] as has the tendency towards homogenisation through the intensive interaction between various Copper Age cultures.[62] The single Hunyadihalom site known in this area is the one at Kőtelek–Huszársarok.[63]

A complex cultural transformation can be noted at the close of the Bodrogkeresztúr period in the Carpathian Basin and in the neighbouring southern and south-eastern regions, marked by the appearance of new types of find assemblages. The period marked by the Cernavoda III culture[64] and the proto-Boleráz horizon[65] can be attested in the south and the south-east. Assemblages of this type, however, are for the time being lacking in the north.[66] Proto-Boleráz traits can barely be distinguished among the finds from the settlement excavated at Nagyút–Göbölyjárás.[67] Kompolt–Site 15, yielding finds showing a blend of Ludanice and proto-Boleráz elements, can perhaps be assigned to this horizon.[68]

The proto-Boleráz horizon marks the last phase in the process towards homogenisation, leading to the formation of the Baden culture.[69] This process culminated in the emergence of the Baden culture, spanning the period from 3600–3500 BC to 2800–2700 BC.[70] The local elements (the Bodrogkeresztúr and Hunyadihalom cultures) were coloured by successive waves of cultural impacts from the south.[71]

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51 *Kalicz* (1966).

52 *P. Patay:* Bodrogkeresztúr–Dudince–Ludanice. Musaica XIV (1963) 11–21, 140–141.

53 *Patay* (1961) 58–59.

54 *Kalicz* (1966).

55 *Bánffy et alii* (1997) 38.

56 *Marton – Patay* (2005).

57 *Stanczik* (1975) 17–18.

58 *Sz. Kállay* (1988) 21–50.

59 *Bognár-Kutzián* (1973) 306–307; *Patay P.:* A tiszalúc–sarkadi telep ásatásának eddigi eredményei. FolArch 38 (1987) 114; *P. Patay:* Die kupferzeitliche Siedlung Tiszalúc–Sarkad und die Hunyadi-halom-Kultur. *In:* Neuere Daten zur Siedlungsgeschichte und Chronologie der Kupferzeit des Karpatenbeckens. Hrsg.: T. Kovács. IPH 7. Budapest 1995, 110.

60 *P. Patay:* Beiträge zur Kunst der Kupferzeit. MAG 118–119 (1989) 42–43.

61 *Bognár-Kutzián* (1972) 194–195, 209; *Bognár-Kutzián* (1973) 47–48.

62 *Ecsedy* (1981) 79; *Kalicz N.:* Újabb adatok a rézkori hunyadihalmi csoport időrendjéhez. SzMMÉ (1979–1980) 43-58; *Roman* (1971) 115–116.

63 RégFüz 13 (1975) 15.

64 *Ecsedy I.:* Újabb adatok a tiszántúli rézkor történetéhez. BMMK 2 (1973) 3–15.

65 *Bondár M. – D. Matúz E. – Szabó J. J.:* Rézkori és bronzkori településnyomok Battonya határában. MFMÉ–Studia Archaeologica IV (1998) 9–15; *Bondár M.:* Rézkori és kora bronzkori településmaradvány Gyomaendrődön. BMMK 20 (1999) 47–49.

66 *Bondár* (2002) 6.

67 *Bondár* (2001) Fig. 4–6; *Bondár* (2002) 9.

68 *Bánffy et alii* (1997) 38.

69 *L. A. Horváth:* Beziehungen zwischen der Tiefebene und Transdanubien in der mittleren Kupferzeit. Zalai Múzeum 2 (1990) 81–100; *Kalicz* (1991) 375–381; *Kalicz* (2001).

70 *Bondár* (2002) 8–9, Fig. 4; *Horváth – Virág* (2003) 127.

71 *Horváth* (1983) 73; *Kalicz* (1991) 380–381; *Kalicz* (2001) 91.

The earliest Baden phase is represented by the Boleráz group.[72] The settlement at Gyöngyöshalász[73] and the pottery fragments collected during the field survey conducted in the Hatvan area represent the initial phase of the Boleráz group. The settlements uncovered at Poroszló[74] and Szihalom[75] are typical for the classical Boleráz period. Boleráz finds were also collected during a field survey near Alattyán.[76] Several sites of the classical Baden period are known from this area. These include two burial grounds, one at Jászberény–Cserőhalom,[77] the other at Vámosgyörk–Fuel plant,[78] as well as a number of settlements, such as the one at Tarnalelesz–Szentdomonkos, where burnt daub fragments and floor remains indicated the one-time presence of houses with above-ground walls.[79] Only refuse pits were uncovered at other settlement sites (Aldebrő,[80] Kál–Legelő,[81] Nagyfüged–Ejzella,[82] Vámosgyörk–Fuel plant[83]). The sites at Jászberény, Jászfelsőszentgyörgy,[84] Jászfényszaru *(Figs 8–10)* and Besenyszög,[85] identified during field surveys, suggest a fairly intensive settlement. Finds of the Kosztolác groups, representing the late Baden period, have been reported from Alattyán–Kiskert,[86] while the ones from Mónosbél,[87] Tarnalelesz[88] and Váraszó[89] indicate that Baden groups settled in the hilly region between the Mátra and the Bükk Mountains. The withdrawal to the hilly region and the river valleys can perhaps be associated with the cultural transformation during the late Baden period,[90] heralding the advent of the Bronze Age in the Carpathian Basin.[91]

APPENDIX: THE SITES MENTIONED IN THE STUDY

Tiszapolgár culture

Cemeteries, cemetery sections

1. Aldebrő–Ürgedomb, Gravel pit (Dobó István Castle Museum, Archaeological Archives 348)
2. Besenyszög, Hunyadi Road (RégFüz 39. [1986] 15)

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72 *V. Němejcová-Pavúková:* Sídlisko bolerázskeho typu v Nitrianskom Hradku–Vyskom brehu. SlovArch 12 (1964) 163–268; *V. Němejcová-Pavúková:* Počiatky bolerázskej skupiny na Slovensku. SlovArch 27 (1979) 17–55; *V. Němejcová-Pavúková:* Typologische Fragen der relativen und absoluten Chronologie der Badener Kultur. SlovArch 39 (1991) 59–90; *Torma I.:* Adatok a badeni (péceli) kultúra bolerázi csoportjának magyarországi elterjedéséhez. VMMK 8 (1969) 91–108; *Torma I.:* Die Boleráz-Gruppe in Ungarn. *In:* Symposium über die Entstehung und Chronologie der Badener-Kultur. Hrsg.: B. Choropovský. Bratislava 1973, 483–512.

73 *Szabó* (1982–83) 5–34.

74 *Korek* (1985) 193, 196–198, 202; *P. Patay:* Vorbericht über die Ausgrabungen zu Poroszló–Aponhát. FolArch 27 (1976) 196.

75 *Szabó* (1997) 55; *Váradi* (1997) 51.

76 *Korek* (1985) 204, Fig. 8.

77 *Poroszlai* (1990) 14.

78 *Farkas* (2001) 9–16, 26.

79 Dobó István Castle Museum (Eger), Archaeological Archives, 460.

80 Dobó István Castle Museum (Eger), Archaeological Archives, 185.

81 *Bondár* (2002).

82 *Bondár* (2002).

83 *Farkas* (2001) 9.

84 *Poroszlai* (1990).

85 Damjanich János Museum (Szolnok), inv. no. 69.29.1–43.

86 *M. Bondár:* Funde der Kostolác- und Spätbadener Kultur. ActaArchHung 36 (1984) 65, Abb. 1. 1–20.

87 *Banner* (1956) 93.

88 Dobó István Castle Museum (Eger), Archaeological Archives 93; *Ibidem* 460.

89 *Ibidem* 187.

90 *Banner* (1956) 187; *N. Kalicz:* Die Péceler (Badener) Kultur und Anatolien. StudArch 2. Budapest 1963, 86; *Patay P.*: A badeni kultúra Ózd-Pilinyi csoportjának magaslati térképei. HOME 37 (1999) 45–56.

91 I would here like to thank Csilla Ács, Marietta Csányi, Péter Langó, János József Szabó and Adél Váradi for kindly showing me the documentation and the unpublished finds from their excavations. The illustrations were edited by Sándor Péter Zoltán. I also wish to thank István Ecsedy for his helpful comments on draft versions of this study.

Settlements

3. Kisköre–Szingehát (Dobó István Castle Museum, inv. no. 68.6.1–98, 100–111, 113–123, 125–165, 170–233, 235–292, 296–343, 346–481; RégFüz 19 [1966] 19)
4. Tiszanána–Dinnyehalom (Dobó István Castle Museum, Archaeological Archives 451, 453; RégFüz 40 [1987] 24)

Stray finds

5. Besenyszög (Damjanich János Museum inv. no. 68.97.1–24)
6. Besenyszög–Kockalapos (Damjanich János Museum, inv. no. 69.16.71)
7. Jászberény–Alsómuszáj (*Bognár-Kutzián* [1972] 51)
8. Jászberény–Kutyina (*Bognár-Kutzián* [1972] 51)
9. Kisköre (*Bognár-Kutzián* [1972] 52)
10. Poroszló–Ráboly (*Bognár-Kutzián* [1972] 72–73, Pl. XIV. 19)
11. Szihalom (*Bognár-Kutzián* [1972] 85–86, Pl. LXIV, 1–6)

Bodrogkeresztúr culture

Cemeteries

12. Jászladány (*Patay* [1944–45])
13. Mónosbél (*Patay* [1961] 58–59)
14. Nagykörű–Hidashát (*Patay* [1961] 59–61, Pl. XXV)
15. Szihalom–Pamlényi-tábla (*Váradi* [1997]; *Marton – Patay* [2005])
16. Szihalom–Sóhajtó (*Szabó* [1997]; *Marton – Patay* [2005])
17. Tenk (ArchÉrt 93 [1966] 293; Dobó István Castle Museum, Archaeological Archives 268)
18. Vámosgyörk–Fuel plant (*Farkas* [2001] 17–27)

Settlements

19. Jászberény–Borsóhalom (*Csalog* [1961] 147, 149)
20. Jászfelsőszentgyörgy, Túróczi-tanya (Damjanich János Museum, Archives 59–1968, 65–1968)
21. Maklár–Koszpérium (Dobó István Castle Museum, Archaeological Archives 212)
22. Szihalom–Pamlényi-tábla (*Váradi* [1997]; *Marton – Patay* [2005])

Stray finds

23. Besenyszög (Damjanich János Museum, inv. no. 68.97.1–24)
24. Dormánd (*Patay* [1984] 49, Taf. 15. 203)
25. Egerszalók (*Patay* [1984] 27, Taf. 4. 54)
26. Füzesabony–Dormándi Road (Dobó István Castle Museum, inv. no. 99.1. 28, 99.1.161)
27. Hatvan (*Patay* [1961] 89, Pl. XXXIII. 2)
28. Hatvan–Újtelep (*Patay* [1958] 39, Pl. XV. 11)
29. Jászapáti (*Patay* [1984] 93)
30. Jászberény–Peresi földek (*Poroszlai* [1990] 14, Pl. II. 1–6)
31. Jászboldogháza (*Patay* [1984] 83–83)
32. Kál, 2 km east of Tarnabod (*Kalicz* [1966] 5)
33. Kápolna (*Patay* [1984] 35–36, Taf. 7. 121)
34. Kisköre (*Patay* [1984] 40, Taf. 9. 156)
35. Nagykörű–Öregkaráddűlő (Damjanich János Museum, inv. no. 68.86.1–9)
36. Nagykörű–Tiszapart (Damjanich János Museum, Achives 60–1968; Damjanich János Museum, inv. no. 68.84.1–12 to 69.103.1–2)
37. Poroszló–Ráboly (*Patay* [1984] 83)
38. Szászberek (earlier Besenyszög) (*Patay* [1975] Taf. 2. 7; *Patay* [1984] 95)
39. Szilvásvárad (*Patay* [1984] 91, Taf. 49. 511)

40. Tarnabod–Bábitag (*Kalicz* [1966])
41. Tarnaméra (*Patay* [1984] 84, Taf. 47. 485)
42. Tarnaméra–Peresdűlő (*Kalicz* [1966] 5)
43. Újszász (*Patay* [1938] 7)

Ludanice culture
44. Füzesabony–Pusztaszikszó (*Sz. Kállay* [1988])
45. Jászfényszaru (*Stanczik* [1975] 17–18)

Hunyadihalom culture
46. Kőtelek–Huszársarok (RégFüz 28 [1975] 13)

Proto-Boleráz horizon
47. Kompolt, Site 15 (*Bánffy et alii* [1997])

Baden culture
Boleráz group

Settlements
48. Alattyán–Kunér (*Korek* [1985] 204, Fig. 8)
49. Gyöngyöshalász (*Szabó* [1982–83])
50. Hatvan (*Kalicz* [2001] 396)
51. Nagyút–Göbölyjárás II (*Bondár* [2001] Figs 4–6; *Bondár* [2002] 9)
52. Poroszló–Aponhát (*Patay* [1976] 196)
53. Poroszló–Ráboly (*Patay* [1973] 342; *Korek* [1985] 193, 198, 202, Figs 3–4)
54. Szihalom–Pamlényi-tábla (*Váradi* [1997] 51)
55. Szihalom–Sóhajtó (*Szabó* [1997] 55)

Classical Baden

Cemeteries
56. Jászberény–Cserőhalom (*Poroszlai* [1990] 14)
57. Vámosgyörk–Fuel plant (*Farkas* [2001] 9–16, 26)

Settlements
58. Alattyán–Kiskert (*Bondár* [1984] 65, Abb. 1. 1–20)
59. Aldebrő, sankbánya (Dobó István Castle Museum, Archaeological Archives 185, inv. no. 62.40.1–2)
60. Füzesabony–Transformer station (Dobó István Castle Museum, Archaeological Archives 104)
61. Kál–Legelő I. (*Bondár* [2002])
62. Kisköre–Szingehát (Dobó István Castle Museum, inv. no. 68.6.1–98, 100–111, 113–123, 125–165, 170–233, 235–292, 296–343, 346–481)
63. Nagyfüged–Ejzella (*Bondár* [2002])
64. Tarnalelesz–Szentdomonkos, Nagyszékhegy (Dobó István Castle Museum, Archaeological Archives 460).
65. Vámosgyörk–Fuel plant (*Farkas* [2001] 9)

Stray finds
66. Alattyán (*Banner* [1956] 92, Taf. LXI. 20)
67. Besenyszög (*Banner* [1956] 92, Taf. LXI. 11)
68. Besenyszög–Templomhát (Damjanich János Museum, inv. no. 69.29.1–43)

69. Eger (*Banner* [1956] 93, Taf. LXII. 3)
70. Jászárokszállás, André sand pit (Damjanich János Museum, inv. no. 71.6.1–2)
71. Jászberény–Refrigerator Factory (*Poroszlai* [1990] 15)
72. Jászberény–Mészhomok brickyard (*Banner* [1956] 92–93, Taf. LXI. 1, 3–4, 6, 8–10, 12–15, 17, 19; *Poroszlai* [1990] 13)
73. Jászfelsőszentgyörgy, this side of the Zagyva River (*Poroszlai* [1990] 16, Pl. II. 8–9)
74. Jászfelsőszentgyörgy, beyond the Zagyva River (*Poroszlai* [1990] 16)
75. Jászfényszaru–Égés (collected by I. Kolozs, local historian)
76. Jászfényszaru–Szegek (collected by I. Kolozs, local historian)
77. Mónosbél (*Banner* [1956] 93)
78. Poroszló–Ráboly (Dobó István Castle Museum, Archaeological Archives 363)
79. Poroszló, Vár (RégFüz 32 [1979] 132; RégFüz 37 [1984] 93; Régészeti Kutatások Magyarországon. Ed.: J. Kisfaludi. Budapest 2000, 194)
80. Szihalom (*Banner* [1956] 93, Taf. LXII. 10–11)
81. Tarnalelesz–Hamuhegy (Dobó István Castle Museum, Archaeological Archives 93, inv. no. 61.35.1–26)
82. Tarnalelesz–Szenterzsébet, Nagykő (Dobó István Castle Museum, inv. no. 55.244.1–2)
83. Váraszó–Héregvár (Dobó István Castle Museum, Archaeological Archives 187)
84. Váraszó–Őrhegy (Dobó István Castle Museum, inv. no. 74.4.1–38)

Fig. 2. Finds from the Bodrogkeresztúr cemetery at Tenk

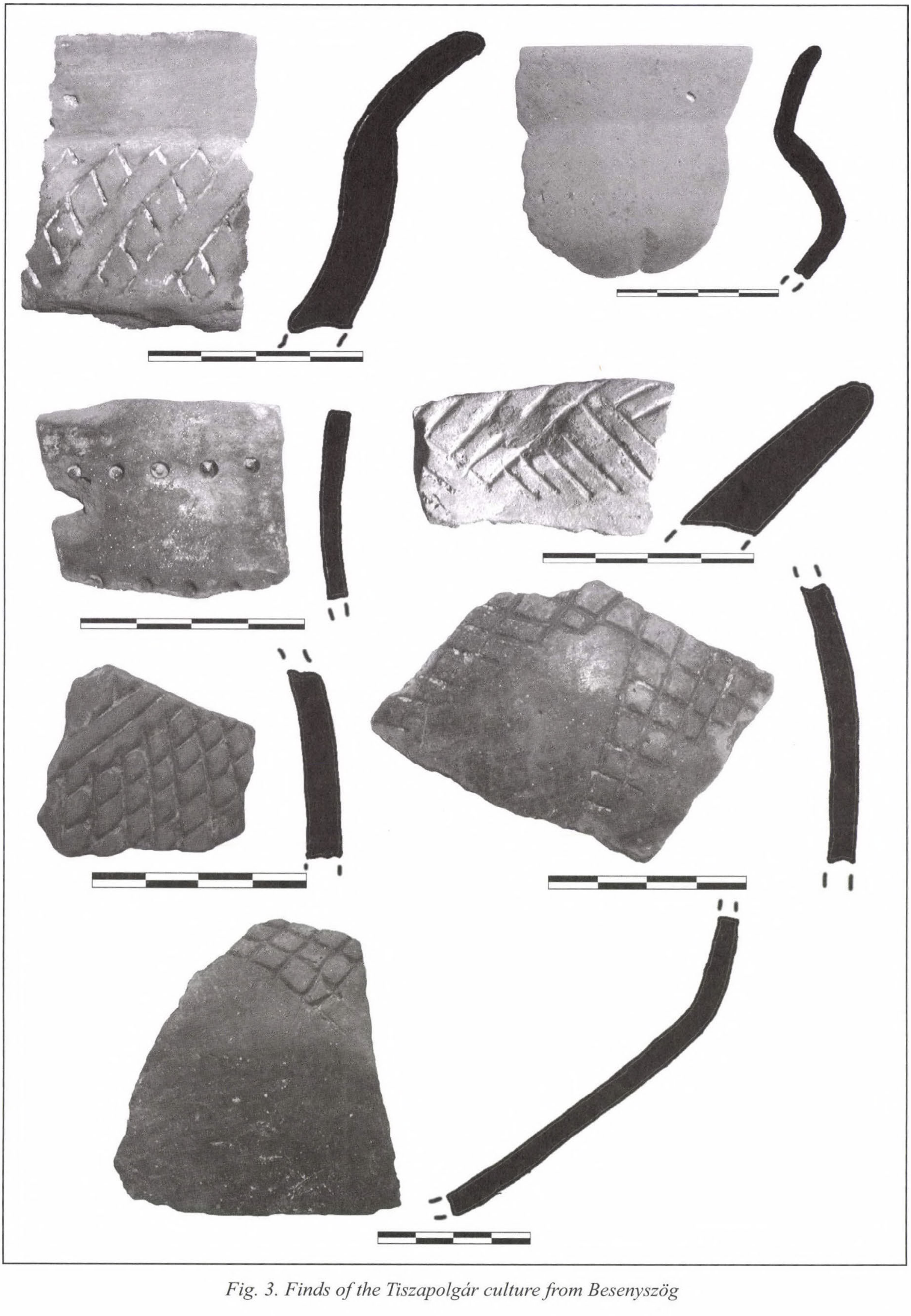

Fig. 3. Finds of the Tiszapolgár culture from Besenyszög

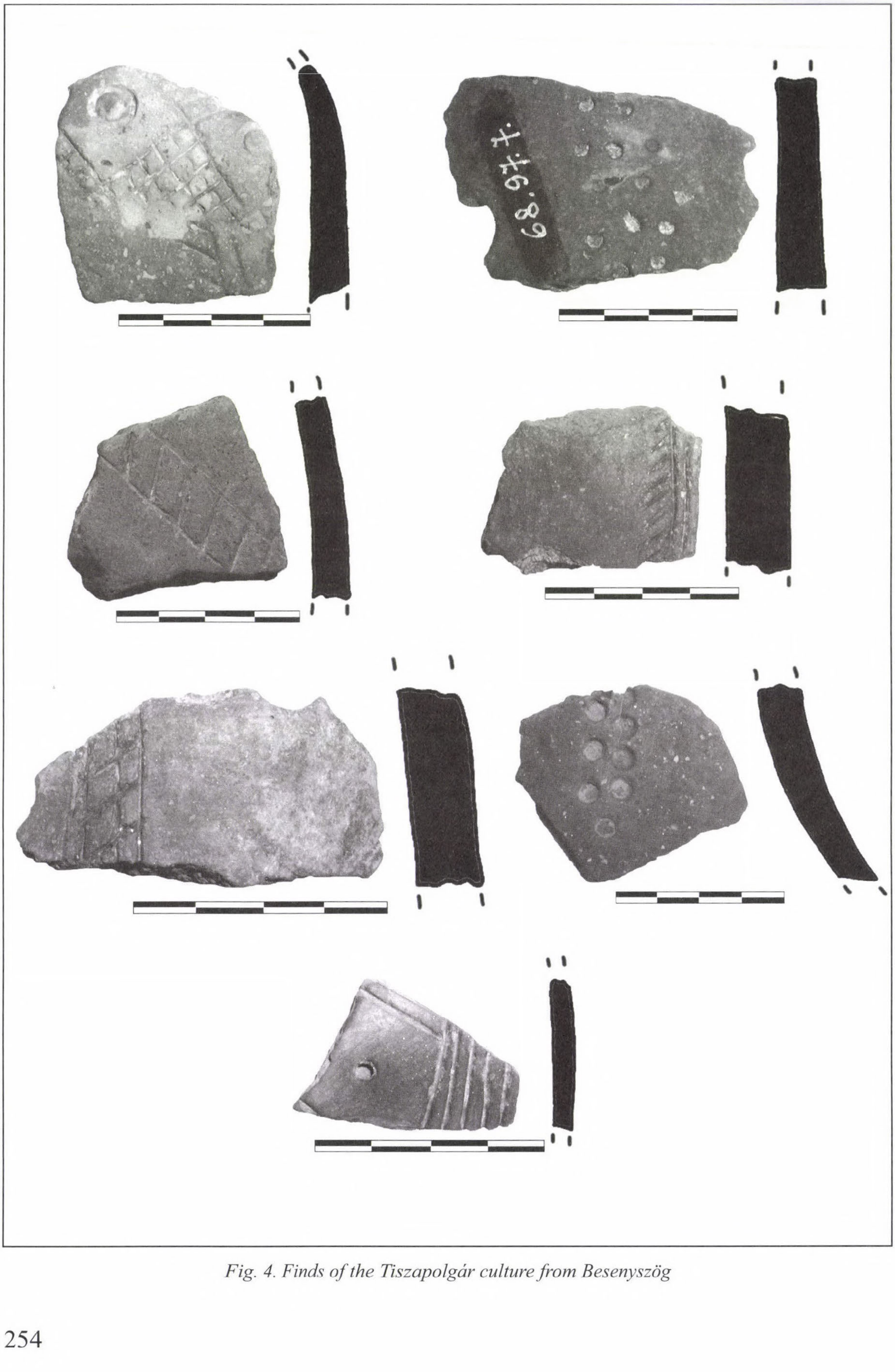

Fig. 4. Finds of the Tiszapolgár culture from Besenyszög

Fig. 5. Finds of the Tiszapolgár culture from Besenyszög

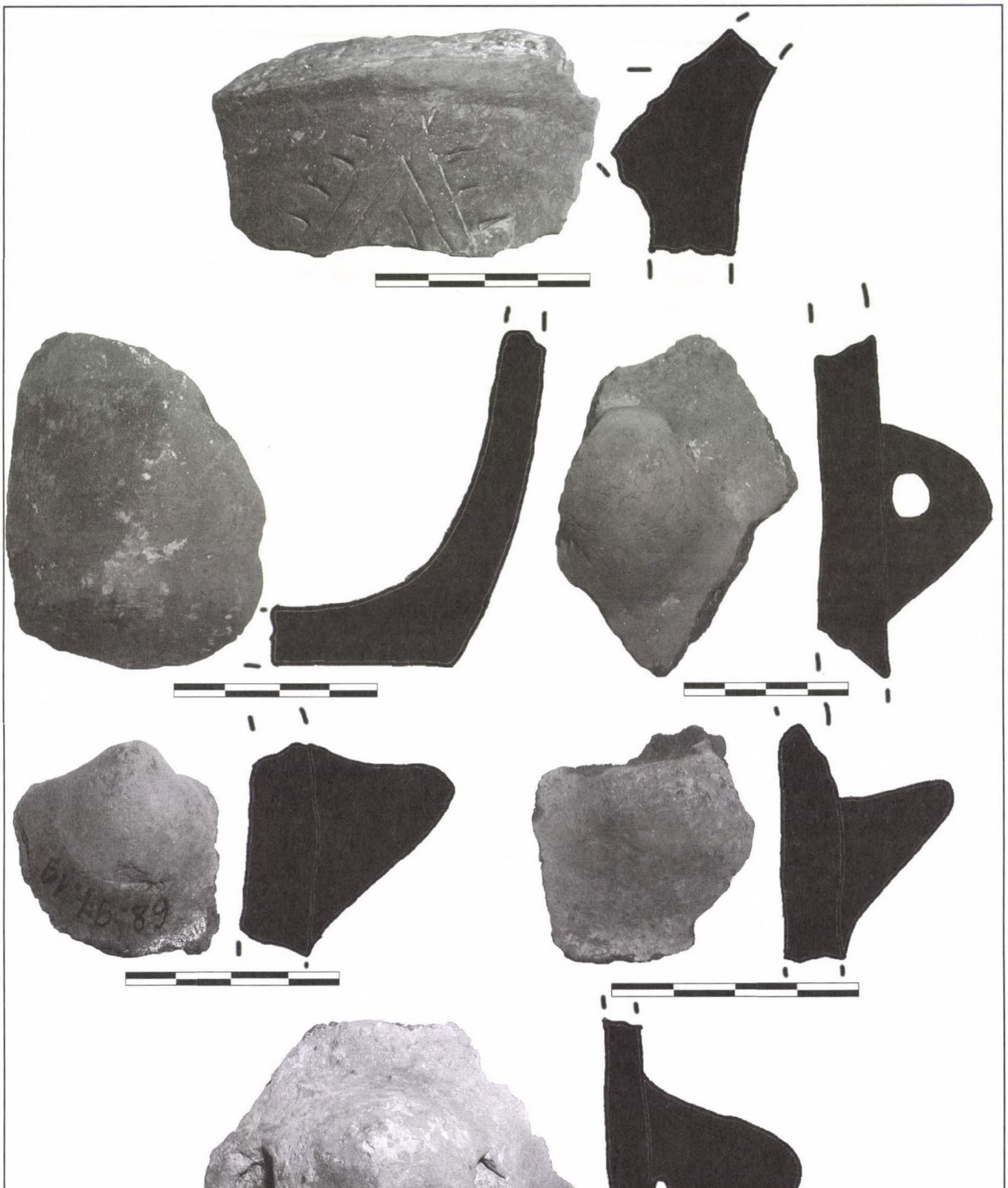

Fig. 6. Finds of the Tiszapolgár culture from Besenyszög

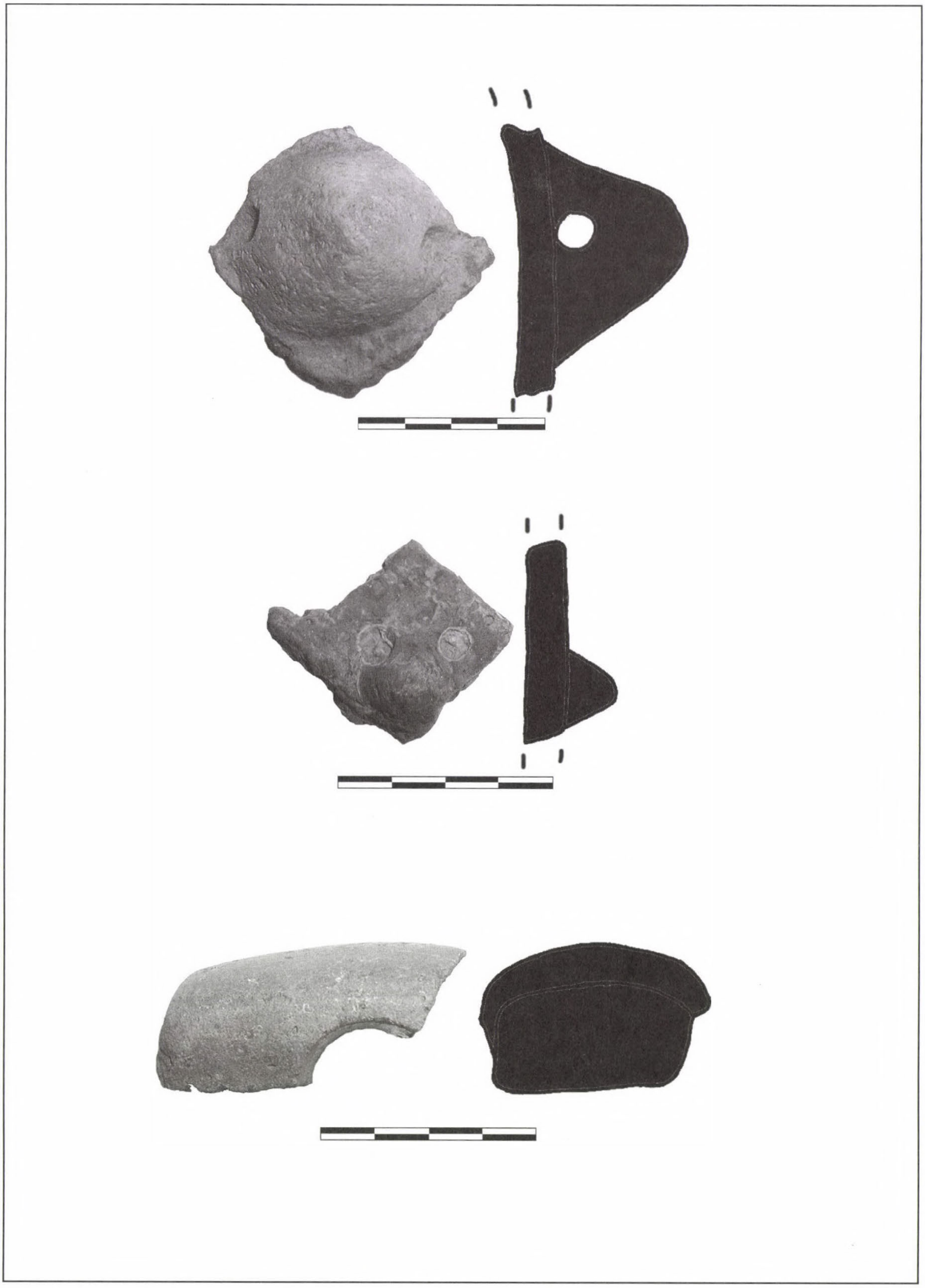

Fig. 7. Finds of the Tiszapolgár culture from Besenyszög

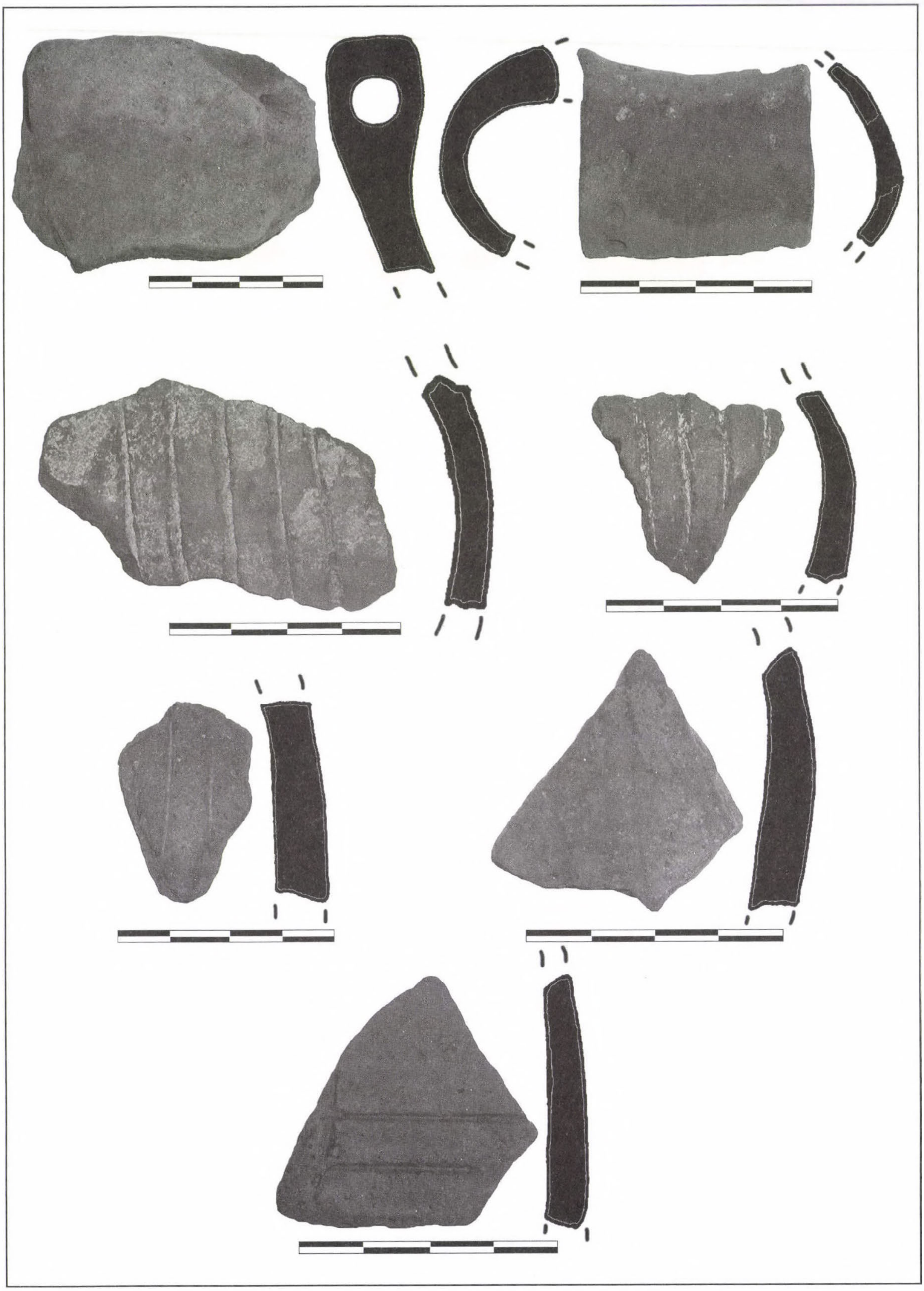

Fig. 8. *Finds of the Baden culture from Jászfényszaru–Égés*

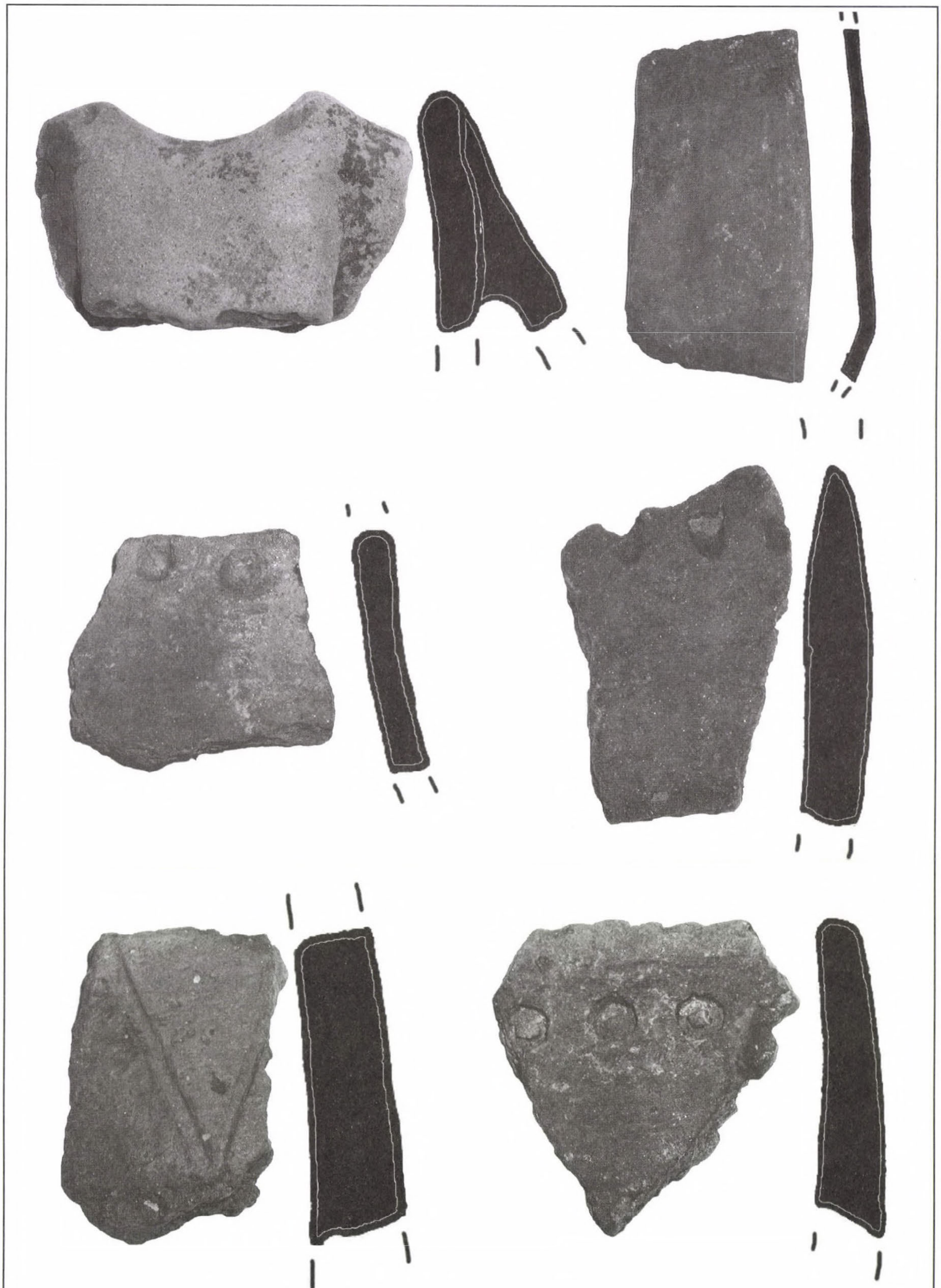

Fig. 9. Finds of the Baden culture from Jászfényszaru–Szegek

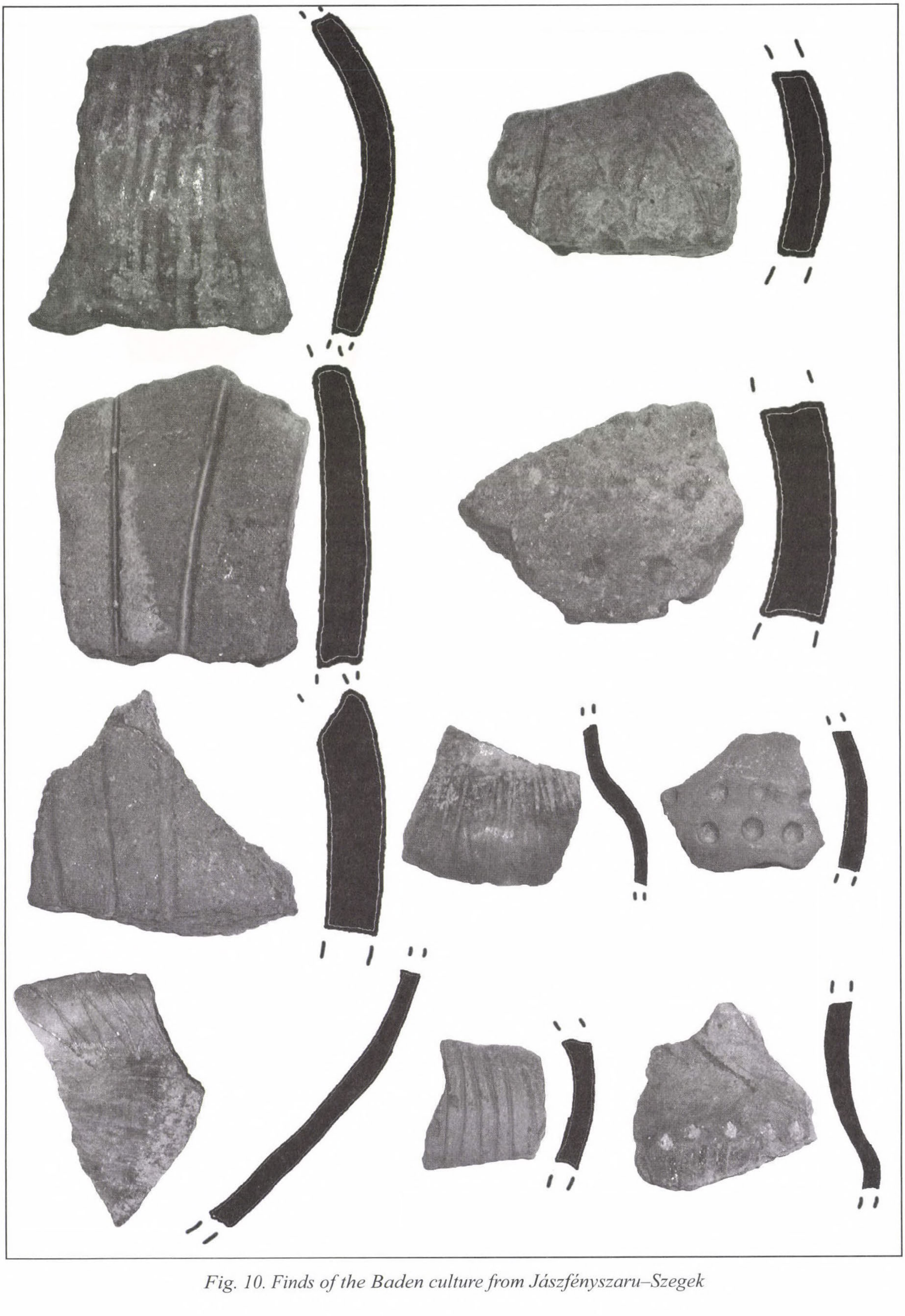

Fig. 10. Finds of the Baden culture from Jászfényszaru–Szegek

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BRONZE AGE SETTLEMENT PATTERNS IN THE NAGYBÁRKÁNY AREA

Viktória Kiss – Gabriella Kulcsár

The Nagybárkány area lies at the meeting point of the Cserhát and Mátra Mountains. The two mountain regions are separated by the Zagyva Valley and the river links the region to the northern fringes of the Great Hungarian Plain. The geographic environment played a key role in the distribution of archaeological cultures: in the following we shall see that even though the archaeological record of this region is more or less homogenous, there were some periods in which the mountain regions and the plain were occupied by communities with a different cultural background. The pollen sequence from Nagybárkány does not contain any zones corresponding to the Bronze Age – probably owing to intensive peat-cutting during the Iron Age – and thus it does not provide additional information for a better understanding of the Bronze Age in this region. In the following, we shall briefly review the Bronze Age development in the western areas of the Northern Mountain Range, based mainly on new research results.

In contrast to archaeological models for Central and South-East Europe, the beginning of the Bronze Age in the Carpathian Basin is usually linked to the changes following the disintegration of the Baden culture, the major cultural complex of the Late Copper Age, and the appearance of new cultures in the first centuries of the 3rd millennium. One of the most striking changes was the emergence of bronze metallurgy which, though still based on copper, nonetheless reflected new metalworking techniques.

The first undoubtedly Bronze Age population is represented by the Makó–Kosihy–Čaka culture.[1] There is little in the archaeological record to indicate that Makó groups settled in the mountain regions. Makó finds have been reported from Salgótarján–Baglyashegy,[2] Salgótarján–Pécskő[3] and Piliny–Várhegy[4] to the north of Nagybárkány, as well as from Ecseg–Várhegy a little farther to the south.[5] The presence of the Makó culture in the upland regions is attested by the Perőcsény–Jancsihegy site on the western fringes of the Börzsöny Mountains.[6] No other finds of the culture are known to the north of these sites, although there are a few upland sites to the north-west, in Slovakia.[7]

The settlement of the Makó culture in the southern foreland of the Mátra Mountains and the northern fringes of the Great Hungarian Plain was for a long time marked by a few stray finds and an inhumation burial, which had not been uncovered professionally (Heves–Paptag, Kömlő, Tarnazsadány[8]); farther to the east, in Borsod-Abaúj-Zemplén County, only sites of the Nyírség culture were known.[9] Evidence for the presence of the Makó culture on the northern fringes of the Great Hungarian Plain increased following the excavations preceding the construction of the M3 motorway in the 1990s and the publication of the finds from earlier research. The Makó settlements in the region were small, hamlet-like

1 *Kalicz* (1968) 77–84, Abb. 3; *N. Kalicz:* Neue Aspekte über die Chronologie der Nyírség-Gruppe. SlovArch 29 (1981) 73, Abb. 5; *Bóna* (1992a) 11, Frühe Bronzezeit, Maps I–II; *G. Kulcsár:* The distribution of the Makó culture in South-Eastern Hungary. Bibliotheca Musei Apulensis 8 (1998) 43–44, Map 3; *J. Dani:* Die Urnengräber der Makó-Kultur aus Komitat Hajdú-Bihar (Ost-Ungarn). Bibliotheca Musei Apulensis 8 (1998) 55–66, Abb. 1, Karte 1; *Kalicz-Schreiber – Kalicz* (1997) Abb. 1; *Kulcsár – Szabó* (2000) 40; *Dani* (2001) Map 2; *Kulcsár* (2002a); *Tóth* (2003) 67, Fig. 1.

2 *Kalicz* (1968) 79, Fo. 29.

3 *J. Korek:*. Eine Siedlung der Spätbadener Kultur in Salgótarján–Pécskő. ActaArchHung 20 (1968) 37–58; *Kalicz* (1968) Fo. 29, 31, 79, Taf. III. 6–11, 13–14; 46, 52, Fig. 6. 2–3.

4 *Patay* (1999) 52, Fig. 6.

5 *Bóna* (1992a) 11, 21–22.

6 MRT 9, site 23/19, 286–287, Pl. 13. 1–15.

7 *J. Vladár:* Zur Problematik der Kosihy–Čaka-Gruppe in der Slowakei. SlovArch 14 (1966) 245–336; *Kulcsár* (2002a).

8 *Kalicz* (1968) 79–80, Fo. 32, 34, 70, Taf. III. 1, 2, 4.

9 *Kalicz* (1968) 68–69, Fo. 94–120.

settlements, made up of a few pits (Boldog–Railway station, Kompolt–Kistér, Tarnabod–Berekalja;[10] Polgár–Király-érpart, Site 1; Polgár–Nagy Kasziba, Site 12[11]). The culture's more extensive settlements are known from the Great Hungarian Plain (Tiszaluc–Sarkad,[12] Oszlár–Nyárfaszög,[13] Csongrád–Pig farm[14]).

Our knowledge of the mortuary practices of the Makó culture has been enriched by the six urn burials uncovered at Kál–Legelő III (the currently known largest cemetery section), the inurned and scattered cremation burial from nearby Kompolt–Kistér, the scattered cremation burial from Jászdózsa, a cremation burial from Mezőkövesd–Mocsolyás and the urn graves from Oszlár.[15] It would appear that inurned cremation burials were the norm in the culture's distribution territory east of the Danube.[16] Archaeological investigations conducted over extensive areas have shown that Makó burials occur near the culture's settlements too (Kompolt–Kistér, Oszlár–Nyárfaszög). The small grave groups probably reflect a society based on small family units, corresponding to what can be gleaned from the settlements.[17] An inhumation burial found at Tarnazsadány[18] can probably also be assigned to the Makó period; the burial rite and the vessel with asymmetrical handle found in the grave reflect the far-flung cultural and trade contacts of the period.[19]

Even though the analysis of additional, professionally excavated assemblages will be necessary for determining the early and late phase of the Makó culture (corresponding to the Early Bronze Age 1–2 periods), a few chronological conclusions can already be drawn. The survival of the culture into the Early Bronze Age 2 phase, chiefly on the northern fringes of the Great Hungarian Plain and in the Northern Mountain Range, has since long been assumed[20] and recent finds from northern Hungary seem to confirm this.[21] In addition to the survival of the late Makó culture, Nándor Kalicz and Rózsa Kalicz-Scheiber suggested that the early Nagyrév culture was distributed in the north too, in areas north-east of the Zagyva River.[22]

Although recent research has demonstrated a late Makó presence on several sites on the northern fringes of the Great Hungarian Plain (e.g. at Kompolt–Kistér and Oszlár–Nyárfaszög), a similar welcome increase in our knowledge is still lacking as regards the Northern Mountain Range. The currently known assemblages, mostly stray finds, merely indicate that the presence of the Makó culture must by all means be reckoned with on the earlier or later occupied upland settlements (some of which were

10 *Kalicz N.:* A kora bronzkori Makó kultúra két települése Heves megyében. Agria 34 (1998) 5–32; *Gogâltan* (1999).

11 *Sz. Máthé M. – Csányi M. – Tárnoki J. – Dani J. – Hajdú Zs. – Raczky P.:* Polgár–Kengyelköz. Kora bronzkori település a Kr. e. III. évezredből. *In:* Utak a múltba. Az M3-as autópálya régészeti leletmentései. Eds: T Kovács – P. Raczky – A. Anders. Budapest 1997, 59–60; *Dani J.:* A kora bronzkori Nyírség-kultúra települései Polgár határában. DMÉ (1999) 68.

12 *Szathmári* (1999a); *Szathmári* (1999b).

13 *Kalicz N. – Koós J.:* Oszlár–Nyárfaszög. Késő bronzkori telep a Kr. e. XII. századból. *In:* Utak a múltba. Az M3-as autópálya régészeti leletmentései. Eds: T Kovács – P. Raczky – A. Anders. Budapest 1997, 66–71; *Koós* (1998); *Koós* (1999).

14 *Tóth K.:* Előzetes jelentés a Csongrád–Sertéstelepen feltárt kora bronzkori településrészletről. *In:* Régészeti kutatások Magyarországon 1998. Ed.: J. Kisfaludi. Budapest 2001, 25–36; *Tóth K.:* A Makó–Kosihy–Čaka-kultúra településeiről. *In:* ΜΩΜΟΣ II. Őskoros Kutatók II. Összejövetelének konferenciakötete. Eds: E. Gy. Nagy – J. Dani – Zs. Hajdú. Debrecen 2004, 79–92.

15 *Kalicz N. – Koós J.:* Mezőkövesd–Mocsolyás. Újkőkori telep és temetkezés a Kr.e. VI. évezredből. *In:* Utak a múltba. Az M3-as autópálya régészeti leletmentései. Eds: T Kovács – P. Raczky – A. Anders. Budapest 1997, 28–33; *Koós* (1998); *Gogâltan* (1999); *Koós* (1999); *Dani J. – Kulcsár G.:* Kora bronzkori temetkezés Jászdózsa–Kápolnahalomról. Ősrégészeti Levelek 2 (2000) 44–48; *Kulcsár – Szabó* (2000); *Kulcsár* (2002b).

16 *Kulcsár* (2002b); *Tóth K.:* Kora bronzkori temetkezések Szeged–Kiskundorozsma határában. MFMÉ–Studia Archaeologica VIII (2002) 31–75.

17 *Kulcsár – Szabó* (2000) 38; *Kulcsár* (2002b); *Tóth* (2003) 69.

18 *Kalicz* (1968) Fo. 70. 80, Taf. III. 2.

19 *Kalicz* (1968) 82; *Kalicz-Schreiber R.:* A Somogyvár–Vinkovci kultúra dél-észak irányú közvetítő szerepe a korabronzkorban. BudRég 28 (1991) 13; *Kulcsár* (2002b).

20 *I. Ecsedy:* Die Siedlung der Somogyvár–Vinkovci Kultur bei Szava und einige Fragen der Frühbronzezeit in Südpannonien. JPMÉ 23 (1979) 67–136, Abb. 9; *Bóna* (1992a) 16.

21 *Koós* (1998) Abb. 2; *Kalicz-Schreiber – Kalicz* (1999) Fig. 2; *Szathmári* (1999a); *Szathmári* (1999b); *Dani* (2001) Map 2; *Kulcsár* (2002a); *Kulcsár* (2002b).

22 *Kalicz-Schreiber – Kalicz* (1997) Abb. 2; *Kalicz-Schreiber – Kalicz* (1999) Fig. 2.

fortified), even though the nature and intensity of settlement remains unclear. It must be borne in mind that the finds from these sites provide very little information on the settlement patterns of the culture and on possible contact with early Hatvan groups. There is nothing to indicate a direct development from the Makó to the Hatvan culture, even though it seems likely that late Makó groups provided the basis for the Hatvan culture.

During the Middle Bronze Age, this area was occupied by the Hatvan culture, which appeared at the end of the Early Bronze Age. The origins of this tell culture have not been wholly clarified. Nándor Kalicz had earlier regarded the Hatvan population as a blend of the Nyírség culture, the eastern population known from kurgan burials and southern Balkanic groups.[23] István Bóna first believed that the Hatvan culture was a successor of the Makó culture; he later modified his views and suggested that the Hatvan culture was an amalgam of the Makó culture, of Corded Ware groups arriving from beyond the eastern Carpathians and of Transylvanian groups using textile impressed pottery (Braşov–Gesprengberg).[24] Gábor Vékony emphasized the role of the population living beyond the Carpathians (the Folteşti III–Zăbala culture) and of the Jigodin culture, distributed in north-eastern Transylvania.[25] It has recently been suggested on the basis of a few stray finds that the Hriadky–Rozhanovce phase of eastern Slovakia, characterised by pottery wares with brushed and textile impressed decoration, can perhaps be identified with the earliest Hatvan group.[26]

The Hatvan distribution extended from the Ipoly River to the Bodrog River in the Northern Mountain Range and to the Körös mouth along the Tisza in the south.[27] Tell settlements and upland, occasionally fortified settlements occur farther to the north during the Bronze Age than they did during the Late Neolithic.[28] The northernmost tell settlements of the Hatvan culture lie in south-eastern Slovakia (e.g. Včelince/Méhi),[29] suggesting that in addition to the Pannonian forested steppe, Bronze Age communities also drew the sub-Mediterranean and Central European forest zone into the sphere of tell-based economies.[30]

In addition to the sites indicated by stray finds (Ecseg–Várhegy, Jobbágyi, Karancskeszi, Karancslapujtő, Kazár, Ságújfalu–Várhegy, Salgótarján–Zagyvapálfalva, Szécsény–Benczurfalva, Szécsény–Várdomb, Szirák, Szurdokpüspöki, Zagyvaszántó, Vámosgyörk), a few Hatvan tell settlements in the Nagybárkány area have been archaeologically investigated: the eponymous site at Hatvan–Strázsahegy, Kisterenye–Hársashegy, Piliny–Várhegy, Piliny–Leshegy and Szécsény–Kerekdomb.[31] The sequence from Aszód–Manyik (excavated by Ilona Stanczik) was published by Judit Tárnoki: the site was occupied from the close of the Early Bronze Age/onset of the Middle Bronze Age (Levels III–II) until

23 *Kalicz* (1968) 185; *Kalicz* (1969) 25; *Kalicz* (1984) 192.

24 *I. Bóna:* Geschichte der frühen und mittleren Bronzezeit in Ungarn und im mittleren Donauraum. Annales Universitatis Budapestienensis de Rolando Eötvös Nominatae, Sectio Historica III (1961) 10; *Bóna* (1984) 151–152; *Bóna* (1992a) 22–23.

25 *Vékony G.:* Erdély őskora. *In:* Erdély története a kezdetektől 1606-ig. I. Eds: L. Makkai – A. Mócsy. Budapest 1987, 24.

26 *J. Bátora:* Die Anfänge der Bronzezeit in der Ostslowakei. SlovArch 29 (1981) 9, 11–12; *Dani* (2001) 136, Map 4.

27 *Kalicz* (1968) 114–130, Abb. 4; *Kalicz* (1984) 192–193, Karte 4; *Bóna* (1992a) 16; *Kovács* (1995) Fig. 4, Fig. 6; *Dani* (2001) 136, Map 5.

28 Cp. *Csányi M. – Sz. Máthé M. – Poroszlai I. – Szathmári I. – Tárnoki J. – Vicze M.:* A bronzkori tell-kultúrák kutatástörténete Magyarországon. *In:* Dombokká vált évszázadok. Bronzkori tell-kultúrák a Kárpát-medence szívében. Ed.: P. Raczky. Budapest–Szolnok 1991–1992, 5, and the maps on the inner jackets; *Bóna* (1992a) 16–17.

29 *T. Nesporová:* K problematike hatvanskej kultúry na južnom Slovensku. SlovArch 17 (1969) 370–402, Obr. 1; *Furmánek – Marková* (1992); *Furmánek – Veliačik – Vladár* (1999) 41–42, Abb. 8; *Marková* (2001) Abb. 1.

30 *P. Sümegi – E. Bodor:* Sedimentological, pollen and geoarchaeological analysis of core sequence at Tököl. *In:* Százhalombatta Archaeological Expedition. Annual Report 1. Eds.: I. Poroszlai – M. Vicze. Százhalombatta 2000, 83–97, Fig. 3.

31 *Kubinyi F.:* Magyarországon talált kő- és bronzkori régiségek. ArchKözl 2 (1861) 93, 102–103, Taf. XI. 52–53; *Nyáry J.:* A pilini Leshegyen talált csontvázakról. ArchKözl 9 (1873) 16–26; *Nyári A.:* A Pilin-várhegyi konyhahulladékhelyről. ArchÉrt 22 (1902) 350–356; *Nyári A.:* Ásatás a szécsényi Kerekdombon (Nógrád megye). ArchÉrt 27 (1907) 229, Figs I–IV; *Tompa F.:* Bronzkori lakótelep Hatvanban. ArchÉrt 48 (1935) 16–35; *Patay* (1954) 16–17; *Kalicz* (1968) 120–122, Taf. LXXXIX–XCIV; *Kalicz* (1969) 25–26; *Kalicz* (1984) 194, Taf. LIX. 5; *T. Kovács:* Die bronzezeitliche Siedlung von Süttő – Eine kurze Übersicht. SlovArch 36 (1988) 124; *Kovács* (1989) Figs 1–6, Fig. 7. 1–9, Fig. 8. 3; *T. Kovács:* Die verbliebenen Funde des bronzezeitlichen Gräberfeldes von Dunakeszi im Ungarischen Nationalmuseum. CommArchHung (1989) 69, Abb. 13. 9.

the late Hatvan period (Level I).[32] According to Judit Tárnoki, the tell settlements of the Hatvan culture include the sites at Héhalom–Templomdomb and Patvarc–Öreg Hradistye.[33]

The Jászdózsa–Kápolnahalom site must be mentioned from the broader region since the investigation of this settlement contributed to improving the excavation techniques of stratified settlements and also served as the basis for refining the chronology of the Hatvan culture.[34] The 6 m high settlement mound at Jászdózsa was encircled by a 4 m deep ditch, in which foundation deposits were placed when the ditch was dug: the intact skulls of brown bear, aurochs, boar, deer and pig.[35] The excavators found stream pebbles on the ditch floor, suggesting that the tell's one-time occupants transformed a bed of the Nyavajka Stream for creating the defencework (a similar observation was made at Szakáld–Testhalom[36]). A total of 16 occupation levels could be distinguished in the 5.4 m thick sequence, which spanned the period between 2200–1600 BC.[37] The lowermost levels (Levels XVI–XI) can be associated with the early and classical Hatvan phase. At this time, the settlement had an estimated population of 150–200 people and about 15 to 20 houses measuring 12 m by 4–5 m on the average. The hoard of thirty-seven golden lock-rings and small gold spangles, a bronze axe, a bronze pickaxe, an assortment of jewellery articles, amber and faience beads, perforated dog teeth and bird claws deposited in a vessel found under a burnt house floor in Level XI[38] suggests that the destruction of the settlement can be attributed to external factors. The next levels (Levels X–VI) are characterised by the appearance of Füzesabony patterns in pottery ornamentation and the construction of smaller houses. Comparable changes on other Hatvan settlements were earlier explained by the western expansion of the Füzesabony culture. Ilona Stanczik's excavations have revealed that these changes should not be attributed to a Füzesabony invasion, but rather to the culture's strong cultural (and perhaps political) impact. The uppermost levels (Levels V–I) yielded finds of the Koszider period.[39]

Although the number of the culture's inurned and scattered cremation burials is rather low, the available evidence suggests that the Hatvan population buried its dead near the settlements in smaller or larger family grave groups.[40] Recently published burials from the broader region include the ones from Hatvan, Bag and Tápióság.[41] Owing the practice of cremating the dead, we know little about how bronze and gold jewellery was worn (gold lockrings and small spangles from Jászdózsa, bronze neckrings from Hatvan and Zaránk[42]); however, the anthropomorphic statuettes from Aszód, Benczúrfalva

32 *T. Kovács:* Review of the Bronze Age settlement research during the past one and a half centuries in Hungary. *In:* Bronze Age Tell Settlements of the Great Hungarian Plain I. Eds: T. Kovács – I. Stanczik. IPH 1. Budapest 1988, 17–25, Fig. 1; *Tárnoki* (1988) 137–139, 143–144.

33 *Tárnoki* (1996) 92.

34 *I. Stanczik:* Befestigungs- und Siedlungssystem von Jászdózsa–Kápolnahalom in der Periode der Hatvan-Kultur. *In:* Beiträge zum bronzezeitliche Burgenbau in Mittel-Europa. Hrsg.: B. Chropovský – J. Herrmann. Berlin–Nitra 1982, 377–388; *I. Stanczik – J. Tárnoki:* Jászdózsa–Kápolnahalom. *In:* Bronzezeit in Ungarn. Forschungen in Tell-Siedlungen an Donau und Theiss. Hrsg.: W. Meier-Arendt. Frankfurt am Main 1992, 120–127; *Csányi – Stanczik – Tárnoki* (1999–2000); *Tárnoki* (2003) 146–147.

35 *Tárnoki* (2003) 146.

36 *Sümegi P. – Kozák J. – Magyari E. – Tóth Cs.:* A Szakáld–Testhalom bronzkori tell geoarcheológiai vizsgálata. Acta Geographica Debrecina 34 (1996–1997) 181–202; cp. also *P. Sümegi – I. Juhász – E. Bodor – S. Gulyás:* Bronze Age Agricultural Impacts in the central part of the Carpathian Basin. *In:* Acts of the XIVth UISPP Congress, University of Liège, Belgium, 2–8 September 2001. BAR 1271. Oxford 2004, 107–111.

37 *P. Raczky – E. Hertelendi – F. Horváth:* Zur absoluten Datierung der bronzezeitlichen Tell-Kulturen in Ungarn. *In:* Bronzezeit in Ungarn. Forschungen in Tell-Siedlungen an Donau und Theiss. Hrsg.: W. Meier-Arendt. Frankfurt am Main 1992, 43–44.

38 *Bóna* (1992b) 54; *Csányi – Tárnoki* (1992) 202, Kat. Nr. 368; *Csányi – Stanczik – Tárnoki* (1999–2000).

39 *I. Bóna:* Die mittlere Bronzezeit Ungarns und ihre südöstlichen Beziehungen. ArchHung 49. Budapest 1975, 169; *Kovács* (1989) 3; *Szathmári I.:* A bronzkor (Kr. e. 2800–800). *In:* A Magyar Nemzeti Múzeum régészeti kiállításának vezetője. Kr. e. 400.000–Kr. u. 804. Ed.: T. Kovács. Budapest 2002, 49–51; *Tárnoki* (2003) 146.

40 *J. Tárnoki:* Die Bestattungsitten der Hatvan-Kultur. *In:* Bronzezeit in Ungarn. Forschungen in Tell-Siedlungen an Donau and Theiss. Hrsg.: W. Meier-Arendt. Frankfurt am Main 1992, 88–91; *Tárnoki* (2003) 148.

41 *Kalicz* (1968) 121, 125; *Kalicz* (1969) 26; *Somogyvári Á.:* Bronzkori sírok Hatvanban. Agria 20 (1984) 47–71; *Tárnoki* (1988) 139–143; *Szabó J. J.:* A bronzkori hatvani kultúra sírja Hatvan–Kisfaludy u. 54. sz. lelőhelyről. *In:* Egri történelmi évkönyv. Szerk.: Misóczki L. Eger 1994, 57–64; *Gál K.:* A hatvani kultúra sírja Tápióságon. StudCom 28 (2004) 143–153.

42 *Kalicz* (1968) Taf. LXXXVIII. 1–8; *Kalicz* (1969) 27; *Kalicz* (1984) 200, T. LVII. 24–28.

and Szurdokpüspöki[43] provide some information in this respect. Local metalworking is indicated by the clay tuyères from the Hatvan area.[44]

A part of the settlements mentioned above (Aszód, Ecseg–Várdomb, Hatvan–Strázsahegy, Piliny–Várhegy, Salgótarján–Zagyvapálfalva, Szécsény–Benczurfalva, Szécsény–Kerekdomb, Vámosgyörk–Atkári lapos, Zagyvaszántó–Sósdomb) can be dated to the Koszider period, as can a few burials from Vizslás.[45] Judit Tárnoki assigned the finds from the pits uncovered at Buják–Tarisznyapart, a small village independent of the tells, to this period.[46] The cultural attribution of the finds from this region is still controversial. Ilona Stanczik, István Bóna and Judit Tárnoki regarded the Zagyva Valley and the Tiszazug area as part of the late Hatvan distribution, characterised by a pottery style resembling Füzesabony wares.[47] In contrast, Tibor Kovács suggested the presence of a regional late Füzesabony group (Bodrogszerdahely phase), whose ethnic elements included surviving Hatvan groups in the Ipoly–Zagyva–Tápió region.[48] Slovakian scholars (in whose terminology the Füzesabony culture is called the Otomani culture after Ladislav Hájek) tend to accept the latter theory.[49] It follows from the above that Levels VII–VI of the Včelince settlement in south-east Slovakia, lying north-east of Nagybárkány, were assigned to the Hatvan period, Levels V–IV to the Füzesabony (Otomani) period and Level III to the Koszider period.[50] It must also be borne in mind that certain motifs which were earlier regarded as typical for the Füzesabony culture (such as the channelled bosses on Vatya and Perjámos pottery) are now interpreted as a general ornamental motif of the Koszider period, i.e. as chronological indicators, independent of a particular culture.[51] In order to resolve this issue, it might be instructive to study not only the interaction between different pottery styles, but also the changes in mortuary practices. The appearance of inhumation graves in the late phase of the Hatvan culture in the Tiszazug area (Szelevény[52]) can probably be seen as a Füzesabony influence, while the cremation burials in the biritual cemeteries of the Bodrogszerdahely culture can, in contrast to their earlier interpretation,[53] be regarded as the influence of a late Hatvan population.[54] A better understanding of these phenomena can only be hoped from the detailed publication of Hatvan and Füzesabony settlement and burial finds from other regions.

The changes affecting the entire Carpathian Basin in the mid-2nd millennium BC are reflected in the abandonment of tell settlements. The concealment of valuable bronze articles and ornate weapons made during the Koszider period by the occupants of the tell settlements and the subsequent abandonment of these settlements is generally attributed to the expansion of the Tumulus culture from the west.[55] These

43 *Kalicz* (1968) Taf. CXIII. 1–4; *T. Kovács:* The Bronze Age in Hungary. Budapest 1977, 80, Figs 8–9; *T. Kovács:* Glaubenswelt und Kunst. *In:* Bronzezeit in Ungarn. Forschungen in Tell-Siedlungen an Donau und Theiss. Hrsg.: W. Meier-Arendt. Frankfurt am Main 1992, 78, Abb. 40; *Csányi – Tárnoki* (1992) Kat. Nr. 452–453.

44 *Kalicz* (1984) 200–201, T. LVII. 20–23, 29–30; *Bóna* (1992b) 50; *Csányi – Tárnoki* (1992) Kat. Nr. 348–350.

45 Cp. *Kovács* (1989).

46 *Kalicz* (1968) 121; *Tárnoki* (1996), 55, 92, Pls 50–90.

47 *Bóna I.:* Tószeg–Laposhalom (1876–1976). SzMMÉ (1979–1980) 93; *Csányi M. – Stanczik I.:* Előzetes jelentés a Tiszaug-kéménytetői bronzkori tell-telep ásatásáról. ArchÉrt 109 (1982) 253; *Bóna* (1984) 157; *Stanczik I.:* Jászdózsa–Kápolnahalom bronzkori telep. DSc Thesis. Budapest 1988; *Bóna* (1992a) 36; *I. Bóna:* Tószeg–Laposhalom. *In:* Bronzezeit in Ungarn. Forschungen in Tell-Siedlungen an Donau und Theiss. Hrsg.: W. Meier-Arendt. Frankfurt am Main 1992, 108–109; *Tárnoki* (1996) 81, 86–87, 95–96.

48 *Kovács* (1989) 16; cp. also *Kemenczei* (1963).

49 *M. Novotná – B. Novotný:* Karpaten- und Donauregion in der frühen und mittleren Bronzezeit. *In:* Absolute Chronology: Archaeological Europe 2500–500 BC. Ed.: K. Randsborg. Acta Archaeologica 67, Suppl. 1. Copenhagen 1996, 94–95; *Furmánek – Veliačik – Vladár* (1999) 43, 49–52, Abb. 13; *V. Furmánek – J. Vladár:* Synchronisation der historischen Entwicklung im Nordteil des Karpatenbeckens im 2. Jahrtausend v. Chr. *In:* Der Nordkarpatische Raum in der Bronzezeit. Hrsg.: C. Kacsó. Baia Mare 2001, Abb. 1.

50 *Furmánek – Marková* (1992); *Furmánek – Marková* (1996) 137; *Furmánek – Veliačik – Vladár* (1999) 53; *Furmánek – Marková* (2001) 106–107, Abb. 2–3; *Marková* (2001) Abb. 2.

51 *Kovács* (1989) 19; *P. Fischl K.:* Klárafalva–Hajdova I. *In:* Látták Trója kapuit. Bronzkori leletek a Közép-Tiszavidékről. Ed.: P. Havassy. Gyula 1997, 94–98; *P. Fischl* (1997) 18–21.

52 *P. Fischl* (1997) 21.

53 *Kemenczei* (1963) 177.

54 *Bóna* (1992a) 29; cp. also *Dani J. – V. Szabó G.:* Temetkezési szokások a Polgár határában feltárt középső bronzkori temetőkben. *In:* ΜΩΜΟΣ III. Őskoros Kutatók III. Összejövetelének konferenciakötete. Ed.: G. Ilon. Szombathely 2005, 92–93, 98–99, Abb. 2.

55 *Bóna* (1992b) 58–64, Zeittabelle.

bronze assemblages are assigned to the so-called Koszider hoards: the hoards from this region include the bronze assemblages from Level III of the Včelince settlement and the old finds from the same site.[56] The decline of tell economies is often ascribed to climatic changes. In his analysis of the animal bones from the Jászdózsa tell, Sándor Bökönyi noted that while the ratio of domestic animals (sheep/goat, pig, cattle, horse, dog) remained more or less the same in proportion to each other (with a rise in cattle at the expense of sheep/goat in the late Hatvan period), the ratio of wild animals rose significantly during the Koszider period. In his view, this change could be explained by environmental factors, specifically the onset of a wetter climate – however, the same changes could not be demonstrated in the case of the contemporary Tószeg–Laposhalom settlement.[57]

The cultural changes following the Koszider period did not entail an ethnic change in many regions of the Carpathian Basin. The survival of the local Middle Bronze Age population into the Late Bronze Age has since long been demonstrated on the basis of the pottery wares of the Piliny culture, named after the Piliny–Borsos site near Nagybárkány. In accordance with the earlier theory, according to which the Füzesabony culture had vanquished and replaced the Hatvan culture during the Middle Bronze Age, it was earlier assumed that the Füzesabony culture formed the basis of the Piliny culture and that the former had been joined by Tumulus groups, as well as Middle Bronze Age groups from the Great Hungarian Plain fleeing northward from the Tumulus advance.[58] The transition could be observed at the Včelince tell settlement: the Koszider level was labelled "Otomani–Piliny horizon" by the excavators, while the overlying level (Level II) was dated to the developed Piliny culture.[59] New research, however, would suggest that the late Hatvan population played a more significant role than earlier assumed.[60] Václav Furmánek could distinguish burials dating from the transitional period in the Šafarikovo cemetery.[61]

Similarly to the distribution of Middle Bronze Age cultures, the Piliny distribution too extended into south-east Slovakia.[62] The southern boundary on the northern fringes of the Great Hungarian Plain is marked by the expansion of the Tumulus culture (e.g. Bag, Maklár, Jánoshida[63]). On the basis of the cemetery at Salgótarján–Zagyvapálfalva, Tibor Kemenczei distinguished the Zagyvapálfava group in the western Piliny distribution territory, west of the Eger Stream, in the area extending to the Ipoly and the Garam rivers.[64] Several stray finds indicating possible settlements have been found in the Nagybárkány area (Apc, Atkár, Gyöngyöspata, Kisterenye–Hársashegy, Nagylóc, Nógrádszakál, Pásztó, Piliny–Várhegy, Rimóc, Sóshartyán, Szécsény–Benczúrfalva-Majorhegy, Szirák, Zagyvaszántó). Very little is known about the settlements – only pits have been excavated at Patvarc–Hradistye and Palotás.[65]

The large urn cemeteries of the Piliny culture are better known: 237 cremation burials were uncovered at the eponymous site of Piliny–Borsos, 972 at Nagybátony and 221 at Zagyvapálfalva. According to Pál Patay's estimates, the Nagybátony cemetery had originally contained some 1500–2000 burials

56 *M. Novotná:* Hortfunde sog. Koszidertyp aus dem Gebiet der Slowakei. Musaica 17 (1966) 12–13, Tab. II–VII; *A. Točík – J. Vladár:* Prehľad bádania v problematike vývoja Slovenska v dobe bronzovej. SlovArch 19 (1971) 416–423, Obr. 27; *Bóna* (1992b) 58; *Furmánek – Marková* (1996).

57 *S. Bökönyi*: Jagd und Tierzucht. *In:* Bronzezeit in Ungarn. Forschungen in Tell-Siedlungen an Donau und Theiss. Hrsg.: W. Meier-Arendt. Frankfurt am Main 1992, 71–72, Abb. 33; cp. *Erika Gál* in this volume (pp.139–174).

58 *Kemenczei* (1963) 171–172; *Kemenczei* (1965) 8, 23; *Kalicz* (1969) 29; *Furmánek* (1977); *V. Furmánek:* Die Anfänge der Pilinyer Kultur. SlovArch 28 (1981) 37–49; *Bóna* (1984) 166; *Bóna* (1992b) 64.

59 *Furmánek – Marková* (1992); *Furmánek – Marková* (1996) 137; *Furmánek – Veliačik – Vladár* (1999) 53; *Furmánek – Marková* (2001) 107–109, Abb. 4–5; *Marková* (2001), Abb. 2.

60 Cp. *Bóna* (1992a) 17: Mittlere Bronzezeit III. Endphase, rest-Hatvan–proto-Piliny.

61 *Furmánek* (1977); *Furmánek – Marková* (2001) 107.

62 *Kemenczei* (1984) Abb. 1; *Bóna* (1992a) 17; *Kovács* (1995) Fig. 9; *Furmánek – Veliačik – Vladár* (1999) Abb. 27.

63 *Kovács T.:* A halomsíros kultúra leletei Bagon. FolArch 16 (1965) 65–86; *Kalicz* (1969) 29, Fig. 7; *Csányi M.:* Árokkal körülvett sírok a halomsíros kultúra jánoshidai temetőjében. ArchÉrt 107 (1980) 153–164; *M. Csányi:* The Tumulus culture: invaders from the west. *In:* Hungarian archaeology at the turn of the millennium. Ed.: Zs. Visy. Budapest 2003, 161–163.

64 *Kemenczei T.:* A pilinyi kultúra bárcai csoportja. HOMÉ 4 (1964) 7; *Kemenczei* (1965) chart on p. 23; *Kemenczei* (1967); *Kemenczei* (1984) 13.

65 *Patay* (1954); *Kemenczei* (1967) 233–253; *Kemenczei* (1984) 13–14, 97–108.

and the graves in the Zagyvapálfalva burial ground too ran into about one thousand.[66] The cemetery at Radzovce in Slovakia contained a similarly high number of burials (totalling 1334 graves with the burials of the Kyjatice culture).[67] The grave finds from the area include the ones from Apc, Csesztve, Csitár, Hugyag, Karancslapujtő, Kazár, Kisterenye, Litke, Mátraverebély, Nógrádsáp, Sóshartyán, Szécsény, Szirák and Szurdokpüspöki.[68]

The metalwork of the Piliny culture developed from the types common in the Koszider period and in the Tumulus culture. The local manufacture of the bronze articles recovered from burials and various hoard horizons (Forró, Ópályi, Aranyos, Rimaszombat) is indicated by finds of moulds and raw material ingots (Aszód, Benczurfalva, Kisterenye, Piliny, Zagyvaszántó).[69]

Later, the Piliny culture gradually changed as a result of cultural impacts from the Transdanubian Urnfield culture and the Slovakian Lausitz culture. The new culture was labelled Kyjatice culture. Its distribution corresponds to that of its predecessor: Kyjatice sites occur in the Northern Mountain Range and in south-eastern Slovakia, with upland sites becoming more typical than previously.[70]

Upland fortified sites of the Kyjatice culture in the Nagybárkány area include Szanda–Várhegy and Mátraszentimre–Ágasvár. Comparable sites farther afield in the Börzsöny Mountains include Perőcsény–Halyagos and the fortified settlements at Felsőtárkány–Várhegy and Szilvásvárad–Töröksánc farther to the east. A log cabin-like building was uncovered at Mátraszentimre–Ágasvár, while the excavations at Felsőtárkány–Várhegy brought to light houses with daub walls built against the defenceworks. These houses measured 3.5 m by 6.5 m and had a hearth.[71] Unfortified upland settlements have been found at Szécsény–Benczúrfalva-Majorhegy, Karancsalja–Kápolnahegy and Radzovce in Slovakia.[72] Some Kyjatice groups settled in the caves of the karst mountains.[73] In addition to the sites mentioned above, a settlement protected by a ditch has been found at Ludas in the Mátra foreland during recent excavations.[74]

The burials indicate the survival of the cremation rite. The largest urn cemetery of the Kyjatice culture was uncovered at Szajla in Hungary. The burial ground uncovered at the eponymous site at Kyjatice and a part of the burials in the Radzovce cemetery can also be assigned to the Kyjatice culture.[75]

The manufacture of the articles in the Piliny and Kyjatice hoards, such as the bronze swords,[76] and the bronze jewellery known from the graves, the construction of the massive timber-laced ramparts

66 *Patay P.:* Előzetes jelentés a nagybátonyi temető ásatásának eredményeiről. ArchÉrt 81 (1954) 33–47; *Kemenczei* (1967); *Kemenczei* (1984) 14–16.

67 *Furmánek* (1977) 257; *Furmánek – Veliačik – Vladár* (1999) 90–100, Abb. 40–41.

68 *Kemenczei* (1967); *Kemenczei* (1984) 97–108.

69 *Patay* (1954) 21; *T. Kemenczei:* Die Metallindustrie in der Pilinyer Kultur. MFMÉ (1964–1965) 49–55, *T. Kemenczei:* Die Chronologie der Hortfunde von Typ Rimaszombat. HOMÉ 5 (1965) 106–175; *M. Novotná:* Die Bronzehortfunde in der Slowakei. Bratislava 1970; *A. Mozsolics:* Bronze- und Goldfunde des Karpatenbeckens. Depotfundhorizonte von Forró und Ópályi. Budapest 1973, 111–115; *Kemenczei* (1984) 20–26, 112–122; *T. Kovács:* Jungbronzezeitliche Gußformen und Gießereien in Ungarn. Veröffentlichungen des Museums für Ur- und Frühgeschichte Potsdam 20 (1986) 193, Abb. 3; *Kovács* (1995) 23–24, Pls 16–18.

70 *Kemenczei* (1970) 17–78; *Kemenczei* (1984) 40–57, Abb. 2; *Kemenczei* (1995) Fig. 10; *Furmánek – Veliačik – Vladár* (1999) 101–103, Abb. 35; *V. Szabó* (2003) 163, 165.

71 *Kalicz* (1969) 30; *Kemenczei* (1984) 41, Abb. 14; *D. Matuz E.:* A kyjaticei kultúra földvára Felsőtárkány–Várhegyen. Agria 27–28 (1992) 5–84; *D. Matuz E.:* A kyjaticei kultúra földvára Bükkszentlászló–Nagysáncon. HOMÉ 32 (1994) 9–54; *D. Matuz E. – Sz. Kállay Á.:* Késő bronzkori–kora vaskori településrészlet Mátraszentimre–Ágasváron. Agria 29–30 (1994) 43–65; *D. Matuz E.:* Késő bronzkori és kora vaskori háztípusok és rekonstrukciós kísérleteik. BudRég 31 (1997) 211–227; *Kemenczei* (1995) 28; *V. Szabó* (2003) 165.

72 *Kemenczei* (1984) 41; *V. Furmánek:* Burganlagen der Kyjatice-Kultur. *In:* Studia nad grodami epoki brązu i wczesnej epoki Żelaza w Europie Środkowej. Red.: J. Chochorowski. Wroclaw 1989, 74; *Szilas G.:* Karancsalja–Kápolnahegy – egy újabb magaslati telep a késő bronzkorból. Ősrégészeti Levelek 2 (2000) 61–65.

73 *Kemenczei* (1970) 30; *Hellebrandt M.:* A Kyjatice kultúra újabb lelőhelye. HOMÉ 12 (1973) 589–593; *Kemenczei* (1995) 28; *Furmánek – Veliačik – Vladár* (1999) 103.

74 *V. Szabó* (2003) 165; Domboróczki L.: Régészeti kutatások Ludas, Varjú-dűlőn 1998 és 2002 között (Előzetes jelentés). In: Régészeti kutatások Magyarországon 2002. Ed.: J. Kisfaludi. Budapest 2004, 5–23.

75 *V. Furmánek:* Kyjatice – eponymní lokalita archeologické kultury. SlovArch 34 (1986) 319–328; *Kemenczei* (1995) 28.

76 *Kemenczei* (1984) 144–152.

protecting the hillforts and of the log houses called for enormous quantities of wood.[77] The bronzesmiths of the region catered not only to local demand for we know that the bronze weapons manufactured in this area were exported to distant regions. Tree-felling undoubtedly had a major impact on the landscape – which would undoubtedly be reflected in the pollen profiles from Nagybárkány, had not Iron Age intrusions destroyed the layers containing Bronze Age pollen sequences.

The decline of the Kyjatice culture and the close of the Bronze Age in the early 8th century BC can be attributed to the appearance of an eastern population. The arrival of mounted nomadic groups, whose artefacts included iron implements in addition to bronze ones, marked the beginning of a new epoch: the Iron Age.[78] Preceding the arrival of the Scythians proper, this new population is known as the pre-Scythians or the Mezőcsát culture after an important site. The burials of this population are known from the foothills of the Mátra and Bükk Mountains (Kisterenye, Szanda, Füzesabony, Sirok).[79] Contact between the newcomers and the locals is reflected by the occurrence of pottery wares known from pre-Scythian burials on the upland settlements of the Kyjatice culture.[80]

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77 *T. Kemenczei:* Bronze Age metallurgy. *In:* Hungarian archaeology at the turn of the millennium. Ed.: Zs. Visy. Budapest 2003, 171; *V. Szabó* (2003) 165.

78 *Kemenczei* (1995) 29–30.

79 *Patay* (1954) 22; *Kemenczei* (1970); *Patek E.:* A Szabó János Győző által feltárt "preszkíta" síranyag. A Füzesabony–Mezőcsát típusú temetkezések újabb emlékei Heves megyében. Agria 25–26 (1990) 61–118; *O. Ožďáni – R. Kujovský:* Das vordringen fremder ethnischer Gruppen in den Nordkarpatenraum in der ausklingenden Spätbronzezeit. *In:* Der Nordkarpatische Raum in der Bronzezeit. Hrsg.: C. Kacsó. Bibliotheca Marmatia 1. Baia Mare 2001, 353–368; *T. Kemenczei:* The beginning of the Iron Age: the pre-Scythians (8th century B.C.). *In:* Hungarian archaeology at the turn of the millennium. Ed.: Zs. Visy. Budapest 2003, 177–178, Fig. 1.

80 *E. D. Matuz:* Archäologische Denkmäler der östlichen und südlichen Beziehungen im Fundmaterial der Erdwälle der Kyjatice-Kultur in Nordungarn. *In:* Der Nordkarpatische Raum in der Bronzezeit. Hrsg.: C. Kacsó. Baia Mare 2001, 299–313.

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BRONZE AGE SETTLEMENT PATTERNS IN THE CSARODA AREA

Viktória Kiss – Gabriella Kulcsár

The Bereg Plain, bordered by the Tisza River in the west and south, extends into the Ukraine and is enclosed by the arc of the Carpathians in the east. In the south and in the west, the area blends into the landscape of the Upper Tisza region. On the testimony of the maps prepared as part of the First Military Survey conducted in the 18th century, this area was covered with extensive woodland and peat bogs during the historical ages.[1] The analysis of the pollen profiles from Nyíres-tó near Csaroda has enriched our knowledge of the area's prehistoric environment. It would appear that rather intensive human activity can be demonstrated in the lake's direct environment during the late 4th and throughout the 3rd millennium BC. The pollen samples yielded evidence for a series of smaller forest fires from around 3400 BC, indicating forest clearance by slash-and-burn and the onset of cereal cultivation. The decline of oak (*Quercus*) suggests that this tree had perhaps been used as a construction material. The species composition of woodlands changed after the clearance, reflected in the appearance of light-loving species (such as beech and hornbeam), the mosaic patterning of the environment and the presence of cereals (only sporadically around 3000 BC and continuously from 2000 BC). These data clearly indicate that the broader area had been brought under cultivation.[2] The geochemical analyses of the soil samples from Nyíres-tó revealed that the lake's water-level increased and that open water replaced the earlier marshland.[3]

The conclusions drawn from the environmental data on the vegetation history of the roughly two millennia spanning the Late Copper Age and the Bronze Age cannot be confirmed by a sufficient corpus of archaeological finds. Owing to the area's rather peripheral location within Hungary, there are few finds or find assemblages which have been recovered through systematic investigations. The number of finds is similarly low in the eastern half of the Bereg Plain in the Ukraine. The archaeological overview of this area will therefore be set against the background of the prehistory of the Upper Tisza region.

Hungarian prehistorians usually correlate the onset of the Bronze Age with the cultural transformations following the disintegration of the Baden–Pécel culture, the major Late Copper Age cultural complex of the Carpathian Basin, and the emergence of bronze metallurgy.[4] The environmental and historical data suggest a late Baden presence in the broader environs of Nyíres-tó.[5] However, the identification of late Baden finds in the north-eastern part of the Carpathian Basin is practically impossible, seeing that the typical traits of the late Baden culture cannot be clearly defined without a re-assessment of the culture's internal chronology and typology in the light of new finds.[6] Although the arrival of smaller population groups, mainly from the Eastern European steppe (Pit-grave kurgans, Corded Ware

1 *Frisnyák S.:* Szabolcs-Szatmár-Bereg megye földrajzi képe. *In:* Szabolcs-Szatmár-Bereg megye monográfiája I. Történelem és kultúra. Ed.: L. Cservenyák. Nyíregyháza 1993, 17, 42–44, Fig. 1, Fig. 19.

2 *G. J. Harrington:* Anthropogenetic impact upon the eastern Hungarian landscape. MSc dissertation. Department of Plant Sciences, University of Cambridge 1995; *Sümegi* (1999) 187, 196, Fig. 8. Cp. also *Imola Juhász* in this volume (pp. 55–66).

3 *Sümegi* (1999) 185, 187, 196–198.

4 *Ecsedy I.:* Rézkori hagyományok és a bronzkori technika kezdetei. *In:* A bronzkor kincsei Magyarországon. Ed.: B. Maráz. Pécs 1995, 33, 37.

5 *M. Bondár:* Neuere Funde der Kostolac- und der Spätbadener Kultur in Ungarn. ActaArchHung 36 (1984) 81; *Bóna* (1986) 25; *M. Bondár:* Thoughts on continuity (The Baden Culture). Antaeus 19–20 (1990–1991) 34–36; *Bóna* (1993) 74; *Dani* (2001) 129–130, Map 1.

6 *Dani* (2001) 130; *Bondár M.:* A badeni kultúra kutatási helyzete Magyarországon (vázlat). MFMÉ–Studia Archaeologica 8 (2002) 7–30.

culture), to the areas occupied by late Baden groups in the Upper Tisza region and the Nyírség has been adequately documented, their finds have not been identified in the Bereg area.[7]

In the mid-3rd millennium BC, various cultures continuing late Vučedol traditions, but blending them with features taken from other cultural traditions appeared in the greater part of the Carpathian Basin. First among these was the Makó–Kosihy–Čaka culture adapting to the most diverse environments, whose presence can be documented in the extensive territory between southern Moravia and the Ér Valley, south-western Slovakia and the Banat. In the north-east, the usually inurned cremation burials of this group can be traced up to the Ér Valley (Valea lui Mihai–Gara C.F.R./Érmihályfalva, Grave 3;[8] Foieni–Fântâna Păşune/Mezőfény–Legelő-kút,[9] Pişcolţ–Nişipărie/Piskolt–Sand pit[10]); the sites include a possible settlement (Ciumeşti–Bostănarie/Csomaköz–Tökös[11]) and various stray finds.[12] The archaeological record indicates that the culture was not distributed beyond the Tisza in the north-east and that its northern boundary was marked by the river, the only exception being the Tiszalúc–Sarkadpuszta settlement.[13] A few stray finds indicate possible settlements in the north-east: the unpublished finds from Kisvárda–Boldogasszony Street and the fragment of a bowl with interior decoration from Tiszabercel–Nagyrét.[14] The identity of the population inhabiting the Bereg Plain in the Early Bronze Age is uncertain.[15] There are only scanty traces in the archaeological record of the communities arriving here at the very beginning of the Bronze Age, i.e. in the area between the settlements along the Tisza (the Polgár area) and the burials in the Ér Valley. In addition to a few stray bowls with interior decoration, the burials in the Debrecen area offer a starting point in this respect. These find assemblages outline a uniform regional and chronological horizon documenting the presence of the Makó culture before the arrival of the earliest Nyírség groups.[16]

The mainly stray finds of bowls with interior decoration and their fragments are usually assigned to the Makó culture, mostly because their presence in the heritage of the Nyírség culture cannot be conclusively proven. Many such finds mark the initial phase of the Bronze Age (Debrecen–Bellegelő, Debrecen–Co-operative vineyard, an unprovenanced find from Hajdú County, Nyírgyulaj–Inner area, an unprovenanced find from Szabolcs County, Tiszabercel–Nagyrét, Tiszacsege, and Tiszadada–Brickyard area).[17] The fragments of two bowls decorated with cord impressions in their interior must also be mentioned here (Nagyhalász–Királyhalom, Nyíregyháza–Morgó[18]). The origins of the population making and using these bowls and other corded ware finds (variously derived from Eastern Europe, the northern Pontic and Central Europe), their exact chronological position and their role in the Early Bronze Age of the Carpathian Basin has still not been clarified.[19]

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7 Cp. *Kalicz* (1968) 16–22, Abb. 1; *I. Ecsedy:* The peoples of the pit-grave kurgans in Eastern Hungary. FontesArchHung. Budapest 1979, 51–52, 57, Fig. 3, Supplementum I; *Bóna* (1986) 24; *Dani* (2001) 130–133, Map 1; *Kiss* (2004) 244.

8 *M. Roska:* Staţiunea preistorică de la Valea lui Mihai. AISC 1928–1932 (1932) 79, Fig. 8–10.

9 *Németi* (1979) 525; *Németi* (1996) 31; *Kacsó* (1997).

10 *Németi* (1979) 527–535.

11 *Roman – Németi* (1986) 216.

12 *Németi* (1979) 532–535; *Roman – Németi* (1994–1995) 25; *Németi* (1996) 34; *Dani* (1998) 59; *Kulcsár* (1998) 44, Map 3; *Dani* (2001); *Kulcsár G.:* A Kárpát-medence kora bronzkori problémái a Makó–Kosihy–Čaka- és a Somogyvár–Vinkovci-kultúra időszakában. PhD Thesis. Budapest 2002.

13 *Szathmári* (1999a); *Szathmári* (1999b).

14 *Kalicz* (1968) 66, Taf. XXIII. 17–19.

15 Cp. *Dani* (2001) Map 2.

16 E.g. *Roman – Németi* (1986); *Németi* (1996) 31–32, 34; *Kacsó* (1997); *Kalicz-Schreiber – Kalicz* (1997) Abb. 1; *Kulcsár* (1998) 43–44, Map 3; *Dani* (1998) Abb. 1, Karte 1; *Kalicz-Schreiber – Kalicz* (1999) Fig. 1; *Dani* (2001) Map 2.

17 *Kalicz* (1968) 64, 66, 68, Taf. XII. 1a–b, 2, 7a-c, Taf. XVI. 2, Taf. XVII. 4–5, Taf. XXIII. 17–19.

18 *Kalicz* (1968) 42, 65, Taf. I. 18, Taf. XXVI. 1–2.

19 *Kalicz* (1968) 42; *Kalicz* (1984) 117–118; *Bóna* (1986) 27; *P. Roman – A. Dodd-Opritescu – P. János:* Beiträge zur Problematik der schnurverzierten Keramik Südosteuropas. Mainz am Rhein 1992, 64; *F. Bertemes:* Überlegungen zur Datierung und Bedeutung der schnurverzierten Keramik im nordöstlichen Karpatenbecken und Siebenbürgen. *In:* Das Karpatenbecken und die osteuropäische Steppe. Hrsg.: B. Hänsel – J. Machnik. Rahden/Westf 1998, 191–209.

The small, hamlet-like settlements characterising the Makó culture have been identified and investigated along the left bank of the Tisza (Polgár–Nagy Kasziba, Polgár–Király-érpart[20]). Another probable settlement of this culture is indicated by the finds from Tiszavasvári-Paptelekhát,[21] while a large settlement has been excavated at Tiszalúc–Sarkad, north of the Tisza.[22]

Inurned cremation burials were the norm in the eastern Makó distribution (Debrecen–Köntöskert,[23] Gáborján–Csapszékpart,[24] Oros–Inner area,[25] Szabolcs County[26]). A symbolic burial, whose rite could not be established, has been reported from Létavértes–6 Irinyi Street.[27] The two inhumation burials known from this region differ from the mortuary practices of the Makó and the Nyírség culture; the cultural attribution of the grave pottery from these burials is also uncertain (Debrecen–Elep 25, Tiszacsege[28]). The burials in question probably date from the late Makó period, from the Early Bronze Age 1–2 transition.

During the second phase of the Early Bronze Age, north-eastern and eastern Hungary was occupied by the Nyírség culture,[29] from the Berettyó mouth to the eastern Slovakian plain and the Boržava/Borzsa area (in the Ukraine) up to Mukačevo/Munkács along the eastern fringes of the Great Hungarian Plain, and it is therefore likely that Nyírség groups also settled in the Bereg Plain.[30] The settlement network of small hamlets reflects the Nyírség population's adaptation to the environment in the Nyírség and the Upper Tisza region.[31] The investigated settlement sites usually consist of a few pits (Nyírpazony, Paszab–Szőlőhomok, Tiszavasvári–Paptelekhát, Tiszaeszlár–Bashalom, Nyíregyháza–Csárdaszállás).[32] Extensive forest clearing activity for gaining new agricultural land can be demonstrated in several places in the Nyírség,[33] similarly to the evidence from the Csaroda area. Still, the fact remains that there are no traces of the dense settlement network of small hamlets characterising the Nyírség culture east of the Tuzsér–Nyírbátor line. It is possible that the Nyírség communities settled more sparsely in the Bereg region, although future research may result in the identification of new sites.

Similarly to the briefly occupied small hamlets, the burial grounds of the culture are also small, containing no more than a few urn burials (such as the ones at Kállósemjén, Kántorjánosi, Kótaj, Oros, Andrid–Dindeşti/Érendréd–Érdengeleg and Tiszavasvári–Városföldje).[34]

At the close of the Early Bronze Age, after the classical Nyírség period, the archaeological record indicates the appearance of a population which cremated and inurned its deceased, but used different pottery wares. It was earlier believed that this population represented a continuation of the Nyírség culture. The finds from the Ér Valley were first labelled Nyírség II–Szaniszló (Nir–Sanislău) phase.[35] The

20 *Sz. Máthé M. – Csányi M. – Tárnoki J. – Dani J. – Hajdú Zs. – Raczky P.:* Polgár–Kengyel-köz. Kora bronzkori település a Kr. e. III. évezredből. *In:* Utak a múltba. Az M3-as autópálya régészeti leletmentései. Eds: T. Kovács – P. Raczky – A. Anders. Budapest 1997, 59–61; *Dani J.:* A kora bronzkori Nyírség-kultúra települései Polgár határában. DMÉ (1997–1998) 68.

21 *Kalicz* (1968) 86, Taf. 18. 1–2, 6–13.

22 *Szathmári* (1999a); *Szathmári* (1999b).

23 *Németi – Dani* (2001) 103–104, Fig. 8, Fig 12.

24 *Dani* (1997) 56–57.

25 *Kalicz* (1968) Fo. 87, 68, Taf. 16. 9; *Kalicz* (1984) 113, Taf. XXVII. 5; *Dani* (1997) 57; *Kulcsár* (1998) 43.

26 *Kalicz* (1968) 68, 74, Taf. 16. 7; *Kalicz* (1984) 113, Taf. XXVII. 7.

27 *Dani* (1998).

28 *Kalicz* (1968) 64, Taf. XIII. 8, 10; cp. also *G. Kulcsár:* Die Makó–Kosihy–Čaka Kultur im Spiegel einiger Bestattungen. Antaeus 25 (2002) 441–465; *Dani J.:* A Nyírség-kultúra temetkezései Hajdúnánás–Fekete-halom lelőhelyről. Ősrégészeti levelek 6 (2004) (in print).

29 *Kalicz* (1968) 63–70, Abb. 3; *Bóna* (1986) 26–27, Map IV; *Kalicz* (1984); *Istvánovits et alii* (1988) 26; *Bóna* (1992a) Frühe Bronzezeit I-II; *Bóna* (1993) 75; *Kalicz-Schreiber – Kalicz* (1997) Abb. 2.

30 *Dani* (2001) Map 3.

31 *Kalicz* (1968); *Bóna* (1986) 27; *Dani* (2001) 133–135.

32 *Kalicz N.:* A korabronzkori nyírségi csoport telepe Nyírpazony határában. ArchÉrt 94 (1967) 3–19; *Kalicz* (1968); *Németi – Dani* (2001) 113.

33 *K. J. Willis – P. Sümegi – M. Braun – A. Tóth:* The Late Quaternary Environmental History of Bátorliget, N-E. Hungary. Palaeogeography, Palaeoclimatology, Palaeoecology 118 (1995) 25–47.

34 *Kalicz* (1968) 67–69, 73–74; *Bóna* (1986) 26; *Bóna* (1992a) 11; *Istvánovits – Kurucz* (1992) 38, Pl. VI. 2; *Dani* (1997); *Német – Dani* (2001).

35 *Bader* (1978) 30.

finds of this group were later identified in north-eastern Hungary and in the eastern Slovakian plainland. However, no traces of this population have yet been found on the Bereg Plain – the nearest site is Kántorjánosi, from where a vessel of this type has been reported.[36]

At the close of the Early Bronze Age and the beginning of the Middle Bronze Age, the archaeological culture of the region underwent a significant transformation, signalled by the appearance of tell cultures, which had a major impact on the Middle Bronze Age history of the Great Hungarian Plain. Simultaneously, there is a visible growth in the pollen frequencies of alder (*Alnus*), linden (*Tilia*) and hornbeam (*Carpinus betulus*) and, concurrently, a decline of hazel (*Corylus*) and elm (*Ulmus*) in the pollen profiles from the Csaroda area, reflecting human activity and cereal cultivation on the river floodplains. The vegetation changes are also an indication of the onset of a drier climate in the broader environs of Nyíres-tó. The archaeological record, however, shows that Bronze Age communities did not settle by the lake until the developed phase of the Late Bronze Age.

During the first phase of the tell cultures, the Tisza and the Kraszna rivers were lined with sites of the Ottomány (Otomani I) culture.[37] It must here be noted that in contrast to their Slovakian and Romanian colleagues, Hungarian prehistorians use the label Ottomány culture to describe a late Early Bronze Age group.[38] Several theories have been proposed for the origins of this culture: it has been variously derived from the Nyírség culture,[39] and from the Szaniszló phase, regarded as a continuation of the Nyírség culture, which absorbed southern (Gyula–Roşia) elements, together with adoption of the life-style of the Balkanic tell cultures.[40] Some prehistorians, however, interpret the appearance of the Ottomány culture as reflecting the arrival of a new population from the south practising inhumation, which assimilated local groups.[41]

Excavations on the tell settlements of the Ottomány culture in the Ér Valley[42] and along the Berettyó River have provided a wealth of information about this population (e.g. Berettyóújfalu–Herpály, Layer 4[43]). The sites in the broader Csaroda area are mostly single-layer settlements, such as the one at Rétközberencs–Paromdomb, where Nándor Kalicz uncovered seven houses.[44] Surface finds from Ajak, Berzec, Szamossályi, Olcsva–Szamospart and Vásárosnamény–Kastélydomb suggest similar settlements.[45] Another Ottomány settlement has been uncovered by Eszter Istvánovits and Katalin Almássy as part of the archaeological investigation of the border crossing point at Csengersima.[46]

The cultural attribution of the grave finds from this period is often problematic owing to the difficulty of separating Ottomány assemblages from finds of the early Füzesabony period. As a result, some prehistorians assign this area to the Füzesabony distribution, while others regard it as part of the Ottomány territory.[47] The two north–south oriented inhumation burials with the deceased laid on

36 *Istvánovits – Kurucz* (1992) 38, Pl. VI. 1; *Bóna* (1993) 77; *Dani* (2001) 135–136, Map 4.

37 *Bóna* (1986) 28, Map IV; *Vékony* (1987) 24, Map 4; *T. Kovács:* Review of the Bronze Age settlement research during the past one and a half centuries in Hungary. *In:* Bronze Age Tell Settlements of the Great Hungarian Plain I. Eds: T. Kovács – I. Stanczik. IPH 1. Budapest 1988, 17–25; *Sz. Máthé* (1988) Fig. 1, Fig 21; *Bóna* (1992a) 16, 30, Frühe Bronzezeit III–Mittlere Bronzezeit I; *Kovács* (1995) Fig. 4.

38 Cp. *Kalicz* (1968) 181; *Kalicz* (1970) 26; *Kovács* (1984) 235; *T. Bader:* Bemerkungen zur Bronzezeit im Karpatenbecken: Otomani/Füzesabony Komplex. Überblick und Fragestellung. JMV 80 (1998) 3–108.

39 *Kalicz* (1968) 64–65; *Kalicz* (1970) 29.

40 *Bóna* (1986) 28; *Sz. Máthé* (1988) 43–44, Fig. 21; *Csányi et alii* (1991–1992) 10; *Bóna* (1992a) 15, 21, 29–30, 16; *Bóna* (1993) 78–79.

41 *P. Roman – I. Németi:* Epoca bronzului in Nord-Vestul României. Symposion Thracologica 8 (1990) 37–38; *Roman – Németi* (1994–1995) 25–32; *Dani* (2001) 138, Map 5; *Németi – Dani* (2001) 115–117; *Németi – Molnár* (2001) 74; cp. also *Kiss* (2004) 251.

42 *Bader* (1978) 32–37, Pl. XXXIV; *Sz. Máthé* (1988) 27–122, Fig. 21; *Bóna* (1992a) 29–30; *Németi – Molnár* (2001) 72.

43 *Sz. Máthé* (1984) 137–139; *M. Sz. Máthé:* Bakonszeg–Kádárdomb. *In:* Bronzezeit in Ungarn. Forschungen in Tell-Siedlungen an Donau und Theiss. Hrsg.: W. Meier-Arendt. Frankfurt am Main 1992, 166; *M. Sz. Máthé:* Berettyóújfalu–Herpály-Földvár. *In:* Bronzezeit in Ungarn. Forschungen in Tell-Siedlungen an Donau und Theiss. Hrsg.: W. Meier-Arendt. Frankfurt am Main 1992, 171.

44 *Kalicz* (1970).

45 *Bóna* (1986) 28, Map IV; *Bóna* (1992a) 30; *Bóna* (1993) 79.

46 János Dani's kind personal communication.

47 *Kovács* (1982) 158; *Bóna* (1986) 28, Map IV; *Bóna* (1992a) 16–17, 26–30, Frühe Bronzezeit III–Mittlere Bronzezeit I; *Bóna* (1993) 79–80; *Dani* (2001) 138–140; *Kiss* (2004) 252–253.

different sides in a contracted position from Nagydobos–Health Centre were assigned to the earliest Füzesabony period on the basis of the pottery and the bronze jewellery deposited in the graves,[48] while two vessels, stray finds from what was probably a cremation burial at the same site,[49] were attributed to the Ottomány culture.[50] István Bóna later regarded both the inhumation and the cremation burials from Nagydobos and the finds from Baktalórántháza – earlier assigned to the Trichterbecher culture[51] – as part of the archaeological legacy of the Ottomány culture.[52] János Dani has recently argued that the inurned burial from Baktalórántháza–Funeral Parlour and the Besenyőd grave, as well as the burials at Kisvarsány–Gubényi kert and Vásárosnamény–Czine Miklós' plot can be attributed to the Füzesabony culture, noting that the burial rite reflected cultural impacts of the Ottomány culture.[53]

Following this formative phase characterising the beginning of the Middle Bronze Age, the Csaroda area became part of the Gyulavarsánd distribution.[54] The origins of this culture have not been entirely clarified; on most tell settlements, the Gyulavarsánd levels overlie the earlier Ottomány levels, and most Romanian prehistorians use the cultural label of the preceding period to denote what in their opinion was a direct development (Otomani II–Vărşand period). Márta Máthé too accepted this continuity on the basis of the uninterrupted Ottomány–Gyulavarsánd sequence observed at Herpály and other sites (such as Ottomány–Várhegy).[55] In István Bóna's view, however, the settlements without a preceding Ottomány occupation indicate that the Gyulavarsánd culture represents an entirely new culture. The tell settlements of the culture lie in Ér Valley and along the Berettyó and Körös rivers.[56] The open settlements (Rétközberencs–Paromdomb, Jánkmajtis–Halomdűlő, Fehérgyarmat, Cégénydányád) enclose the broader area of Nyíres-tó,[57] suggesting that the bog's environment provided a hinterland for the culture's economy.[58]

The male burial uncovered at Ópályi–Model Farm contained the typical bronze weapons of the period (a shaft-hole axe and a dagger) and a rich array of jewellery.[59] The three north–south oriented inhumation graves at Vásárosnamény–Lumber Yard can be dated to the late phase of the Gyulavarsánd culture (Ottomány III) on the basis of the thirty-two vessels recovered from the burials dated to the Koszider period, the last phase of the Middle Bronze Age.[60]

The Felsőszőcs culture settled in this region in the mid-2nd millennium, in the Late Bronze Age succeeding the Koszider period. The deeply incised, lime encrusted patterns decorating its pottery suggest that its emergence reflects a blend of the Gyulavarsánd culture and of the Middle Bronze Age

48 *Bóna* (1975) 166, Taf. 200; *Kovács* (1982) 158; *Bóna* (1986) 28; *Istvánovits – Kurucz* (1992) 41–42, Pl. XVIII.

49 *Istvánovits – Kurucz* (1992) 41, Pl. XV. 1, 3.

50 *Bóna* (1992a) 30; *Bóna* (1993) 79; *Dani* (1997) 57; *Dani* (2001) 131, 138–139.

51 *Kalicz N.:* A baktalórántházi sírlelet. JAMÉ 2 (1959) 7–17; *Bóna* (1986) 25, 27.

52 *Bóna* (1993) 79, notes 93–94.

53 *Bóna* (1975) 165, Taf. 199; *Kovács* (1982) 158; *Kovács* (1984) 237; *Bóna* (1986) 28; *Dani* (1997) 56–57, Abb. 6, Taf. XI; *Dani* (2001) 134, 140.

54 *Bóna* (1975) Maps I–II; *Bóna* (1986) 28–29, Map IV; *Bóna* (1992a) 17, 30–31, Mittlere Bronzezeit I–II; *Bóna* (1992b) 54; *Bóna* (1993) 80.

55 *Sz. Máthé* (1984); *Sz. Máthé* (1988) 43–44; *Csányi et alii* (1991–1992) 10.

56 *Bóna* (1975) 123–124; *I. Ordentlich:* Poselenie v Otomani v svete poslednih razkopok. Dacia 7 (1963) 115–138; *Bader* (1978) 30–52, Pl. XXXIV; *Bóna* (1986) 29–30; *Sz. Máthé* (1988) Fig. 1; *Bóna* (1992a) 30–31; *Zs. Székely:* Aşezările şi necropola culturii Otomani de la Pir (Judeţul Satu Mare). Thraco-Dacica 21 (2000) 103–146.

57 *Kalicz* (1970); *Bóna* (1975) Taf. 152; *Bóna* (1986) 28, Map IV; *Istvánovits et alii* (1988) 27, 39–40, Pls IV–V; *Bóna* (1992a) 21, 30; *Bóna* (1992b) 55–58; *Bóna* (1993) 79–80.

58 *Sümegi* (1999) 196.

59 *J. Németi:* Descoperiri funerare din epoca bronzului în jurul Careiului. Satu Mare 1 (1969) 57–71; *Bóna* (1986) 28; *Bóna* (1992a) 31; *Istvánovits–Kurucz* (1992) 45, Pl. XXIX; *Bóna* (1993) 79–80; cp. also *Kiss* (2004) 254–255.

60 *Bóna* (1986) 30; *Bóna* (1992a) 17, 32, Mittlere Bronzezeit III, 40–41, Zeittabelle; *M. Csányi – J. Tárnoki:* Túrkeve–Terehalom. *In:* Bronzezeit in Ungarn. Forschungen in Tell-Siedlungen an Donau und Theiss. Hrsg.: W. Meier-Arendt. Frankfurt am Main 1992, 159–165; *Bóna* (1993) 80–81; *C. Kacsó:* Die Endphase der Otomani-Kultur und die darauffolgende kulturelle Entwicklung im Nordwesten Rumäniens. Apulum 36 (1999) 107, 108; *T. Kovács:* Bronzezeitliche Gräber mit eigenartigen Formen- und Motivschatz aus dem oberen Theissgebiet. *In:* Morgenrot der Kulturen. Frühe Etappen der Menschheitsgeschichte in Mittel- und Südosteuropa. Festschrift für N. Kalicz zum 75. Geburtstag. Hrsg.: E. Jerem – P. Raczky. Budapest 2003, 525–533.

Wietenberg culture of Transylvania.[61] Felsőszőcs sites are clustered in the Upper Tisza region, in the Nyírség, in south-eastern Slovakia and in Carpatho-Ukraine.[62] A single-layer settlement has been excavated at Rétközberencs–Paromdomb; other Felsőszőcs sites include Ajak, Berkesz, Gyulaháza, Jánkmajtis, Panyola and Pócspetri. The cremation burials of this culture are known from Berkesz and the Satu Mare/Szatmárnémeti area.[63] The Zajta hoard, an important relic of the region's bronzeworking reflecting the continuation of Middle Bronze Age metallurgical traditions, can be assigned to the Felsőszőcs culture.[64]

Large burial mounds reflecting new cultural impacts from the east can be found between Gyulaháza and Nyírkarász, a little to the west of the Bereg Plain. The wooden kist or wooden burial chamber under the burial mound contained the remains of the deceased who had been cremated on a pyre; the best analogies to the lavish costume and the weapons deposited in the burials can be quoted from Transylvania and the area beyond the Carpathians, from the Noua, Komarovo and Sabatinovka cultures. Eastern type bronze articles have been found at Ajak, Berkesz, Besenyőd, Mátészalka and Szakoly, as well as in various bronze hoards, the latter assigned to the Felőr/Uriu–Domahida/Domăneşti or Ópályi hoard horizon.[65] The analyses of pottery wares, bespeaking a blend of late Felsőszőcs and Tumulus traits, and the interpretation of the eastern impacts led to the proposal of different theories. Most Hungarian prehistorians link the burials to the elite of the Berkesz culture, which in their view assimilated the Felsőszőcs population and also blended Tumulus and eastern groups,[66] while the simple inurned burials from the same area were interpreted as the graves of the commoners of local origin. The interpretation of the latter is problematic since most of these graves were not uncovered in the course of professional excavations (Ajak, Apagy, Berkesz, Demecser, Gulács, Nyírlugos, Nyírtass, Szakoly, Székely, Vaja[67]). Few settlement traces have been identified to date (e.g. at Berkesz–Csonkásdűlő and Székely–Bencehegy) and none have yet been excavated.[68] According to this model, the Felsőszőcs culture survived in its eastern distribution, in Transylvania (Lăpuş culture, cp. the Lăpuş/Oláhlápos tumulus burials[69]) after the emergence of the Berkesz culture. Other prehistorians believe that the cultural impacts from the east played a minor role; they associate the Nyírkarász burial mounds with the Felsőszőcs culture, together with the Ópályi horizon.[70] The many bronze and gold hoards known from Szabolcs-Szatmár-Bereg County, some of which were found in the Csaroda area (Barabás, Beregsurány, Fejércse, Gelénes, Gulács, Hete, Jánd, Tákos, Tarpa) were used and deposited during this period.[71] Their manufacture

61 *Kalicz* (1960) 12–13; *Kemenczei* (1963) 183; *Vékony* (1987) 26; *Kacsó* (1987) 68; *Bóna* (1992a) 32; *Bóna* (1993) 81; *C. Kacsó:* Noi date cu privire la prima fază a culturii Suciu de Sus. Apulum 32 (1995) 83–97; *Kiss* (2004) 255–257.

62 *Kovács* (1995) 23, Fig. 9; *V. Furmánek – J. Vladár:* Synchronisation der historischen Entwicklung im Nordteil des Karpatenbeckens im 2. Jahrtausend v. Chr. *In:* Der Nordkarpatische Raum in der Bronzezeit. Hrsg.: C. Kacsó. Baia Mare 2001, 85–90, Abb. 4.

63 *Kalicz* (1960); *Mozsolics* (1960) 118, Abb. 1; *Kovács* (1966–1967); *Kacsó* (1987); *Bóna* (1986) 30–31; *Istvánovits et alii* (1988) 27, 52, Pl. VIII. 1; *Bóna* (1993) 81–82, note 114.

64 *Bóna* (1992b) 58; *Bóna* (1993) 81.

65 *Bóna I.:* Tiszakeszi késöbronzkori leletek. HOMÉ 3 (1959–1961) 15–38; *Mozsolics* (1960) 120–122; *A. Mozsolics:* Der Bronzefund von Ópályi. ActaArchHung 15 (1963) 65–84; *A. Mozsolics:* Bronze- und Goldfunde des Karpatenbeckens. Depotfundhorizonte von Forró und Ópályi. Budapest 1973; *Kovács* (1966–67) 52, Pl. 18; *Kemenczei* (1963) 183–184; *T. Kemenczei:* Das spätbronzezeitliche Urnengräberfeld von Alsóberecki. FolArch 32 (1981) 69–94; *Kemenczei* (1984) 28–29; *Almássy et alii* (1997) 19–25, Fig. 10.

66 *Kemenczei T.:* A pilinyi kultúra tagolása. ArchÉrt 92 (1965) 3–26, Fig. 7; *Kovács* (1966–67) Fig. 19; *Kemenczei* (1984) Abb. 1.

67 *Kovács* (1966–67); *Bóna* (1986) Map IV; *Bóna* (1993) 81–84.

68 *Kemenczei* (1984) 28–39; *Bóna* (1986) 31; *Bóna* (1993) 82–83; *Kalicz–Koós* (1997) 70.

69 *Kacsó* (1987) 75; *C. Kacsó:* Zur chronologischen und kulturellen Stellung des Hügelgräberfeldes von Lăpuş. *In:* Der Nordkarpatische Raum in der Bronzezeit. Hrsg.: C. Kacsó. Baia Mare 2001, 231–278; *F. Gogâltan:* The settlement of Căşeiu and some problems concerning the late Bronze Age in the center and northern Transylvania. *In:* Der Nordkarpatische Raum in der Bronzezeit. Hrsg.: C. Kacsó. Baia Mare 2001, 191–214, Pl. VII.

70 *E. A. Balaguri:* Kultura Felsőszőcs (Suciu de Sus). *In:* Arheologija Vengrii, konyec II tüszjacseletyija do n. e. – I tüszjacseletie n. e. Red.: V. S. Titov – I. Erdélyi. Moskva 1986, 83–93; *Vékony* (1987) 27; *J. Kobal':* Der Depotfund von Chudl'ovo (Kr. Uschgorod, Transkarpate, Ukraine). JAMÉ 39–40 (1997–1998) 33–53.

71 *Istvánovits – Kurucz* (1992) Map 2; *Bóna* (1993) 83–85; *Almássy et alii* (1997) 25–46, Fig. 10; *J. Kobal':* Magyarországról elszármazott réz- és bronzkori fémtárgyak a Kárpátaljai Honismereti Múzeum gyűjteményében. JAMÉ 41 (1999) 38–41, Abb. 1.

undoubtedly involved the use of enormous quantities of wood (cp. the human impact on the environment reflected in the soil samples from the Bátorliget marshland around 1390 BC[72]).

The second half of the Late Bronze Age saw the appearance of a new culture on the Great Hungarian Plain, named Gáva culture after a site lying west of the Bereg region. Its appearance was earlier regarded as reflecting the arrival of new population groups.[73] However, the homogenous material culture appearing over an extensive area is now interpreted as the uniformisation of various late Tumulus groups, as well as of local pottery and bronzeworking traditions. This process of homogenisation reached its conclusion after a transitional period observed throughout the Great Hungarian Plain (termed Gáva I or proto-Gáva period).[74] Development in the Upper Tisza region, however, differed slightly from other areas in the Great Hungarian Plain owing to the cultural and ethnic impacts from the east.[75]

The finds of the Gáva culture occur throughout the trans-Tisza area and occasionally also on the right bank of the Tisza River.[76] A complex related to the Gáva culture settled to the east: the Transylvanian Reci–Mediaş culture and the Gáva–Holihrady culture, distributed east of the Carpathians.[77] In addition to stray pottery finds, the occupation of the area around Nyíres-tó during the Late Bronze Age is indicated by a few bronze articles and jewellery pieces (Ajak, Apagy, Demecser, Nagykálló, Nyírgyulaj, Nyírlugos, Olcsvaapáti, Szakoly, Tiszabecs), as well as the smelting furnace uncovered at Tákos, reflecting the importance of bronzeworking.[78] Although very little is known about settlements,[79] the evidence from the Great Hungarian Plain reveals a dense settlement network and a more intensive settlement.[80] The culture's distribution territory included also formerly uninhabited areas, which can probably be explained by a developed economy based mainly on cattle breeding and agriculture.[81]

In most parts of the Great Hungarian Plain, the life of the Gáva culture was brought to an end by the appearance of a new population, migrating here along the Lower Danube and the Tisza at the beginning of the 8th century BC, an event marking also the onset of the Iron Age.[82] The archaeological finds of the mounted nomadic pre-Scythians or Mezőcsát culture have not yet been identified in the Nyírség region and the Bereg Plain, suggesting the survival of the local Late Bronze Age communities until the Scythian Age (8th–6th centuries BC).[83]

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72 *P. Sümegi – T. Deli:* Results of the quartermalacological analysis of the profiles from the central and marginal areas of Bátorliget marshland. *In:* The Geohistory of Bátorliget marshland. Eds: P. Sümegi – S. Gulyás. Budapest 2004, 204–205; *Kiss* (2004) 259; *P. Sümegi:* The results of paleoenvironmental reconstructions and comparative geoarcheological analysis for the examined area. *In:* The Geohistory of Bátorliget marshland. Eds: P. Sümegi – S. Gulyás. Budapest 2004, 326–330.

73 *Kemenczei T.:* A gávai kultúra leletei a miskolci múzeumban. HOMÉ 10 (1971) 53–55; *Kemenczei* (1984) 86; *Kovács* (1995) 24; *Kalicz–Koós* (1997) 70.

74 *T. Kemenczei:* Die Siedlungfunde der Gáva-Kultur aus Nagykálló. FolArch 33 (1982) 73–95; *Kemenczei* (1984) 72–73; *B. Genito – T. Kemenczei:* The Late Bronze Age Vessels from Gyoma 133. S. E. Hungary. CommArchHung (1990) 113–125; *Bóna* (1993) 86; *V. Szabó* (1999) 66–69.

75 *Bóna* (1993) 86.

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78 *Bóna* (1993) 89.

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81 *V. Szabó* (1999) 69.

82 *Kemenczei* (1984) 86; *Kemenczei T.:* Kora vaskori leletek Dél-Borsodban. HOMÉ 25–26 (1988) 98.

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THE HORTOBÁGY IN THE BRONZE AGE

János Dani

Very little is known about the Bronze Age history of the Hortobágy. No systematic excavations designed to gain a better understanding of this period have been conducted in this region and the number of currently known Bronze Age sites is rather low. The archaeological collection of the Déri Museum in Debrecen only has stray finds from the Hortobágy. The single, rather brief study on the prehistory of the Hortobágy was written by Lajos Zoltai, who studied the *puszta* for many decades.[1] In the lack of professionally excavated find assemblages, the region's Bronze Age history can only be pieced together by using the evidence unearthed in the course of excavation conducted on the fringes of the *puszta*.

THE EARLY BRONZE AGE

Any discussion of the Early Bronze Age must begin with a brief overview of a significant component of Eastern European origin of the preceding Copper Age. The people of the Pit-gave Kurgans (Yamna culture) raised burial mounds (kurgans) over the graves of high-ranking individuals in the Hortobágy,[2] usually on the high bluff flanking one-time rivers and watercourses.[3] Zoltai excavated several such kurgan graves, many of which contained burials sprinkled with ochre, often without any grave goods, with the deceased sometimes laid to rest in a wooden burial chamber (Bajnokhalom, Bivalyhalom, Mátai or Árpád-halom, Papegyháza, Duna-halom, Fene-halom, Halász-laponyagok, Képhalom, Méhes-halom, Pipások).[4] The burial chamber uncovered at Balmazújváros–Kárhozott-halom in 1953 dates from the same period: the deceased was laid to rest in a supine position with the knees raised and two lock-rings of silver wire placed in the wooden chamber.[5]

Although usually dated to the Late Copper Age, some of the kurgans raised by the Pit-grave population may actually have still been used for burial at the dawn of the Bronze Age, as shown by the burials of phase 2 at Sárrétudvari–Őrhalom. It is therefore quite possible that communities of the late phase of the Pit-grave culture too played a role in the Early Bronze Age of eastern Hungary.

The Hortobágy fell within the distribution of the Makó culture in phase 1 of the Early Bronze Age. The fragment of a footed bowl decorated in its interior, a typical vessel of the Makó culture, was found in the plastering of a Migration period hearth uncovered on the territory of the Avar cemetery at Tiszacsege–Sóskás *(Fig. 1. 1)*.

1 *Zoltai* (1911b) 46–47.

2 Zoltai gave a description of the burial mounds dotting the Hortobágy: "seven mounds on this side of the watercourse, twenty beyond the watercourse in the Máta area, sixteen in the Zám area and nineteen in the Ohat area in the Hortobágy *puszta*," which he then listed separately. *Zoltai L.:* Jelentés a Debreczeni Városi Múzeum 1906. évi régészeti ásatásairól. I. Basahalma megásatása. MKÉ 1 (1907) 24–25.

3 *Zoltai* (1911b) 12, 46, map of the Hortobágy *puszta*; *Zoltai* (1938) 6–7, map of the mounds around Debrecen.

4 *Zoltai L.:* Jelentések múzeumunk 1909. évi ásatásairól. Jelentés Debreczen sz.kir. város múzeuma 1909. évi állapotáról. I. Ásatások a Hortobágyon. Debrecen 1910, 32–33; *Zoltai L.:* Jelentés Debreczen sz.kir. város múzeuma 1910. évi működéséről és állapotáról. Jelentések halmok megásatásáról. Debrecen 1911, 37–40; *Zoltai L.:* Jelentések Debreczen sz.kir. város múzeumának és közművelődési könyvtárának 1922. és 1923. évi működéséről és állapotáról. II. Jelentés Debreczen sz.kir. város múzeumának 1923. évi működéséről és állapotáról. Debrecen 1924, 11–12; *Zoltai L.:* Jelentés Debreczen sz.kir. város múzeumának és közművelődési könyvtárának 1924. évi működéséről és állapotáról. Jelentés Debreczen sz.kir. város múzeumának 1924. évi működéséről és állapotáról. Debrecen 1925, 8; *Zoltai L.:* Jelentés Debreczen sz.kir. város múzeumának és közművelődési könyvtárának 1925. évi működéséről és állapotáról. IV. Kutatómunkák és kirándulások. Debrecen 1926, 8; *Zoltai* (1938) 12, 13, 18, 20, 23, 25, 37, 43–45; *I. Ecsedy:* The peoples of the pit-grave kurgans in Eastern Hungary. FontesArchHung. Budapest 1979, 15, 16, 17.

5 *Csalog J.:* A balmazújvárosi Kárhozott-halom feltárása. FolArch 6 (1954) 42–43, Figs 5–8, Pl. X.

Fig. 1. Finds of the Makó culture

1. Tiszacsege–Sóskás, stray find, 2. Tiszacsege–Sand pit, grave goods of an inhumation burial, 3. Nagyhegyes–Elep 25 (K. Lajter's field), grave goods of an inhumation burial, 4. Egyek – 289 Dorogmai Road (János Tóth's yard), 5–8. Tiszacsege (?), stray finds

Stray finds indicating a settlement of the Makó culture have been reported from two sites on the outskirts of Hortobágy: Hortobágy–Bridge[6] and Hortobágy–Nyíróhodály[7] *(Fig. 2. 1–2)*.

A small one-handled jug, a grave good from an inhumation burial, was collected by János Makkay at Tiszacsege–Sand pit *(Fig. 1. 2)*.[8] The vessel can be culturally assigned to the Makó culture. Another inhumation burial yielding a characteristic one-handled cup of this culture *(Fig. 1. 3)* came to light at Nagyhegyes–Elep (Károly Lajter's field).[9] Both burials can be dated to the end of the Early Bronze Age 1–beginning of the Early Bronze Age 2 period, together with other similar burials.[10]

Early Bronze Age pottery fragments from Tiszacsege, without a closer specification of the findspot and the find context, were inventoried in 1987.[11] The pottery sherds included typical Makó vessel fragments, as well as a few Nyírség sherds. The most interesting find was a small conical altar set on four knob feet decorated with incisions along the rim and vertically set incised ribs *(Fig. 1. 8)*.

A biconical, one-handled cup with a slightly conical neck and outturned rim was collected as a stray find during János Sőregi's rescue excavation in November, 1935 at Egyek by the road leading to Tiszadorogma *(Fig. 1. 4)*.[12]

The plainland areas of the Upper Tisza region were occupied by the Nyírség culture during the Early Bronze Age 2 period; however, there is no evidence for the time being that the culture had settled in the Hortobágy. Neither have sites of the Sanislău/Szaniszló culture, which succeeded the Nyírség culture in the Early Bronze Age 3 period, been identified in this region.

The boundary between the Hatvan culture and the Ottomány culture (the latter known mainly from its tell settlements in the Berettyó region and the Ér Valley), the two tell cultures emerging at the time of the Early Bronze Age–Middle Bronze Age transition, probably ran across the Hortobágy.[13]

The barbotine decorated one-handled cup of the Hatvan culture from Egyek *(Fig. 2. 3)*, perhaps originating from a cremation burial, can be dated to this period.[14] The stray finds collected during János Sőregi's rescue excavation in 1935 by the road to Tiszadorogma included fragments of textile-impressed Hatvan amphorae.

The tell settlement of the Hatvan culture at Tiszafüred–Ásotthalom was probably established at this time. The three scattered cremation burials uncovered at Tiszafüred–Majoroshalom were perhaps graves of the occupants of the Ásotthalom settlement.[15]

THE MIDDLE BRONZE AGE

The settlements of the Hatvan culture were in many places succeeded by those of the Füzesabony culture in the area between north-eastern Hungary and the Middle Tisza region during phase 2 of the Middle Bronze Age. At the same time, the Hortobágy was a kind of contact zone between these two major cultures during the Middle Bronze Age 2–3 periods.[16]

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6 Déri Museum (Debrecen), inv. no. IV.1911.50.4.

7 Déri Museum (Debrecen), inv. no 54.9.1.

8 Déri Museum (Debrecen), inv. no. 78.201.1. Cp. also *Makkay J.:* Tiszacsege. ArchÉrt 85 (1958) 202; *Kralovánszky* (1965) 42; *Kalicz* (1968) 64, Fo. 19, Taf. XIII. 8.

9 Déri Museum (Debrecen), inv. no. 1941.9. *Sőregi J.:* Jelentés a Déri Múzeum 1941. évi működéséről. A Déri Múzeum gyarapodása 1941-ben. IV. Érem- és Régiségtár. DMÉ (1942) 54; *Kalicz* (1968) Fo. 18, 64, Taf. XIII/10.

10 *R. Kalicz-Schreiber:* Siedlungsfunde und ein Brandgrab der frühbronzezeitlichen Makó-Kultur in Budapest. Zalai Múzeum 5 (1994) 40.

11 Déri Museum (Debrecen), inv. no. 87.86.1–10. The inventorying of the finds was carried out by Márta Sz. Máté. Since large-scale, regular excavations have only been conducted in the Sóskás area at Tiszacsege, it seems likely that these finds too came to light in that area.

12 Déri Museum (Debrecen), inv. no. 1936.15.2. *Sőregi* (1936a) 82.

13 *Kovács* (1982) Abb. 2; *Bóna* (1992) 16, EBA III–MBA I map.

14 Glass plate negative in the Archaeological Archives of the Déri Museum. The vessel was part of the private collection of Dezső Tóth, a pharmacist working in Egyek.

15 *Kovács* (1991–1992) 28; *Kovács* (1995) 173.

16 *Kovács* (1982) Abb. 7; *Bóna* (1992) 17, MBA I–MBA III maps.

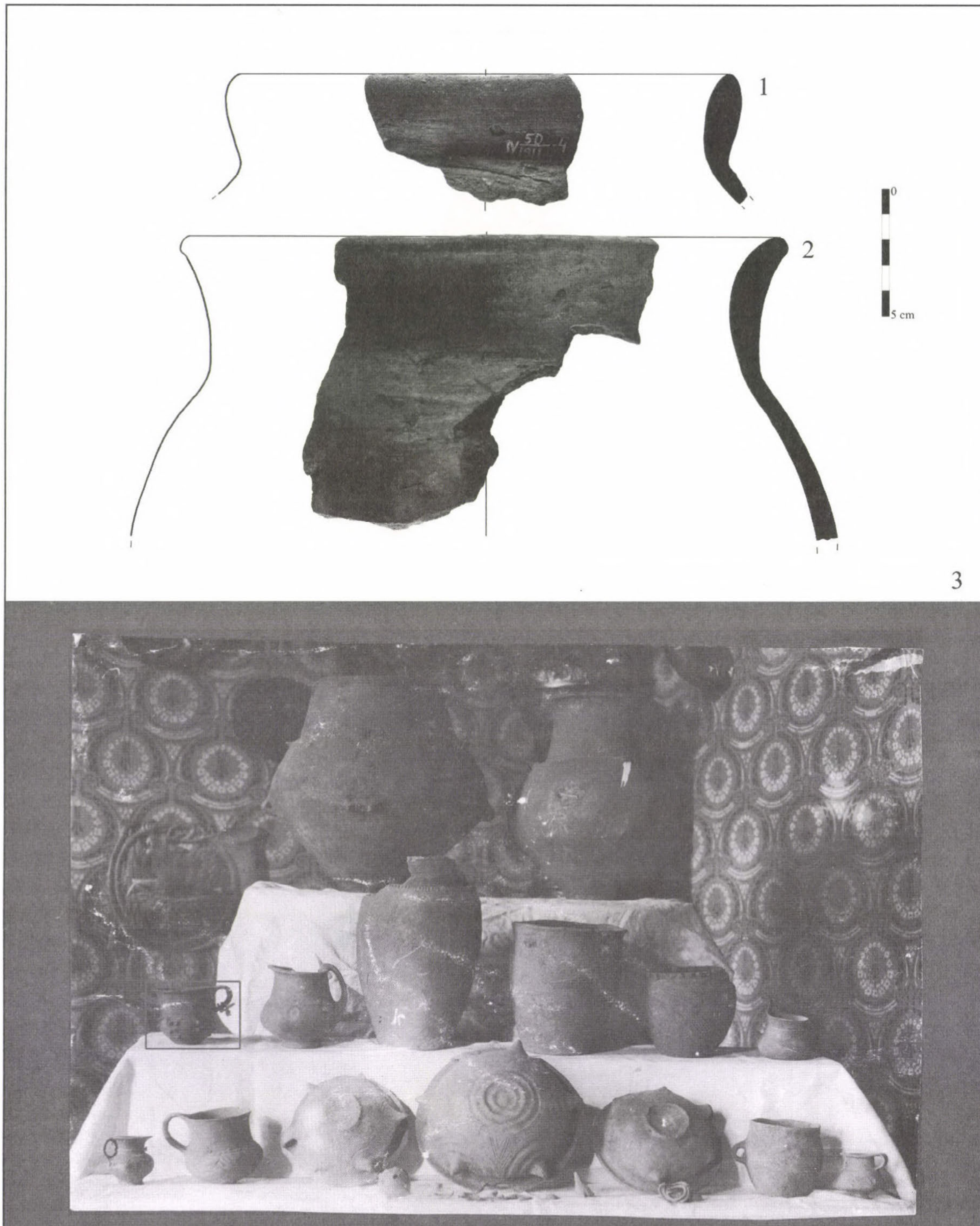

Fig. 2.
1. Hortobágy–Bridge, 2. Hortobágy–Nyíróhodály, 3. archive photo of the finds in Dezső Tóth's private collection, with the Hatvan cup shown in frame

Typical Füzesabony pottery appears in the levels overlying the Hatvan layers on the tells of the Tisza region, for example at Tiszafüred–Ásotthalom,[17] Jászdózsa–Kápolnahalom,[18] Aroktő–Dongóhalom,[19] Polgár–Kenderföld-Kiscsőszhalom,[20] Polgár–Ásotthalom,[21] Tószeg–Laposhalom[22] and Alsóvadász–Várdomb,[23] suggesting that the newcomers assimilated the local Hatvan population.[24]

Finds of the Füzesabony culture are known mostly from sites on the fringes of the Hortobágy region.

A cup with a high-drawn handle from Hortobágy–ditch beside the Keserű Woods[25] can be regarded as an import of the Transylvanian Wietenberg culture on the basis of its decoration of a triple running dog motif *(Fig. 3. 1)*.

Several Middle Bronze Age pins were presented to the museum in 1923 from Hortobágy–Ohát-Telekházi major. Most are broken; the single identifiable type has a twisted shank and a flat recoiled head or a swelled head *(Fig. 3. 2)*,[26] known from the cemeteries of the period.

One of the major tell settlements of the Füzesabony culture was excavated at Tiszafüred. The investigation of the Ásotthalom site was begun in the late 19th century.[27] The tell settlement is encircled by several cemeteries established on the sandy alluvial cones of the Tisza: Tiszafüred–Majoroshalom, Tiszafüred–Fertőihalom and Tiszafüred–Nagykenderföldek.[28] The burial ground at Majoroshalom is one of the largest cemeteries of the culture with its 635 graves and spans the entire Füzesabony sequence from its early phase to the appearance of the Tumulus culture.[29]

A one-handled miniature cup with a flattened globular body decorated with channelled bosses and two incised zig-zag lines came to light during road maintenance work at Tiszafüred–Patkós csárda *(Fig. 3. 3)*.[30] In view of its intactness, it may have been a grave good from a burial.[31] The intact cup with channelled boss on its belly from Tiszacsege may similarly have been a grave good *(Fig. 3. 4)*.[32]

Seven adult inhumation burials were uncovered by Tivadar Lehoczky in Egyek in 1903;[33] the graves represented the culture's late, Bodrogszerdahely/Streda nad Bodrogom phase. In his report of

17 *Kovács* (1992) 132–133, and the chronological chart, *ibidem* 41.

18 *I. Stanczik – J. Tárnoki:* Jászdózsa-Kápolnahalom. *In:* Bronzezeit in Ungarn. Forschungen in Tell-Siedlungen an Donau und Theiss. Hrsg.: W. Meier-Arendt. Frankfurt am Main 1992, 123–127, and the chronological chart, *ibidem* 41.

19 Kind personal communication of Klára P. Fischl, who excavated the site.

20 Kind personal communication of Márta Sz. Máthé and Magdolna Vicze, who excavated the site.

21 Finds collected by Gábor V. Szabó and the present author during their field survey of the area, and the results of the borings conducted by Pál Sümegi and János Kozák.

22 *Bóna I.:* Tószeg–Laposhalom. *In:* Bronzezeit in Ungarn. Forschungen in Tell-Siedlungen an Donau und Theiss. Hrsg.: W. Meier-Arendt. Frankfurt am Main 1992, 105–113, and the chronological chart *ibidem* 40.

23 Chronological chart *ibidem* 41.

24 *T. Kovács:* Einige neue Angaben zur Ausbildung und inneren Gliederung der Füzesabony-Kultur. *In:* Südosteuropa zwischen 1600 und 1000 v. Chr. Hrsg.: B. Hänsel. Berlin 1982, 290; *J. Dani – M. Máthé, Sz. – G. Szabó:* Ausgrabungen in der bronzezeitliche Tell-Siedlung und im Gräberfeld von Polgár–Kenderföld (Vorbericht über die Freilegung des mittelbronzezeitlichen Gräberfeldes von Polgár–Kenderföld, Majoros-tanya). *In:* Bronzezeitliche Kulturerscheinungen im karpatischen Raum. Die Beziehungen zu den Benachbarten Gebieten. Ehrensymposium für Alexandru Vulpe zum 70. Geburtstag, Baia Mare 10–13. Oktober 2001. Hrsg.: C. Kacsó. Baia Mare 2003, 94–96; *Dani J. – V. Szabó G.:* Temetkezési szokások a Polgár határában feltárt középső bronzkori temetőkben *In:* ΜΩΜΟΣ III. Őskoros kutatók III. összejövetelének konfrenciakötete Szerk.: Ilon G. Szombathely 2005, 98–99.

25 Déri Museum (Debrecen), inv. no. IV.1912.20.

26 Déri Museum (Debrecen), inv. no. IV.1923.40–41. The pin type cannot be precisely determined because its head is broken.

27 *Kovács T.:* Tiszafüred–Ásotthalom. *In:* Dombokká vált évszázadok. Bronzkori tell-kultúrák a Kárpát-medencében. Ed.: P. Raczky. Budapest–Szolnok 1991–1992, 44–45; *Kovács* (1992).

28 *Kovács* (1975) 5, 8, Fig. 2; *T. Kovács:* Bestattungssitten der Füzesabony-Kultur und das Gräberfeld von Tiszafüred–Majoroshalom. *In:* Bronzezeit in Ungarn. Forschungen in Tell-Siedlungen an Donau und Theiss. Hrsg.: W. Meier-Arendt. Frankfurt am Main 1992, 96.

29 *Kovács* (1991–1992) 28; *Kovács* (1995) 173.

30 DM inv. no. IV.68.14.1. It is my belief that the vessel has been mistakenly inventoried as coming from Tiszacsege. The roughly sketched map inside the vessel allowed the identification of its findspot as the hill on the western side of the Patkós inn on the outskirts of Tiszafüred.

31 *Mesterházy K.:* A Déri Múzeum régészeti tevékenysége 1966–68. DMÉ (1970) 75, Fig. 23.

32 Déri Museum (Debrecen), inv. no. IV.59.2.1.

33 *Lehoczky T.:* Az egyeki őskori telep (Hajdú m.). ArchÉrt 23 (1903) 365–374; *Lehoczky T.:* Adatok hazánk archaeologiájához különös tekintettel Beregmegyére és környékére II. Az őskortól a magyarok bejöveteléig. Munkács 1912, 20–22.

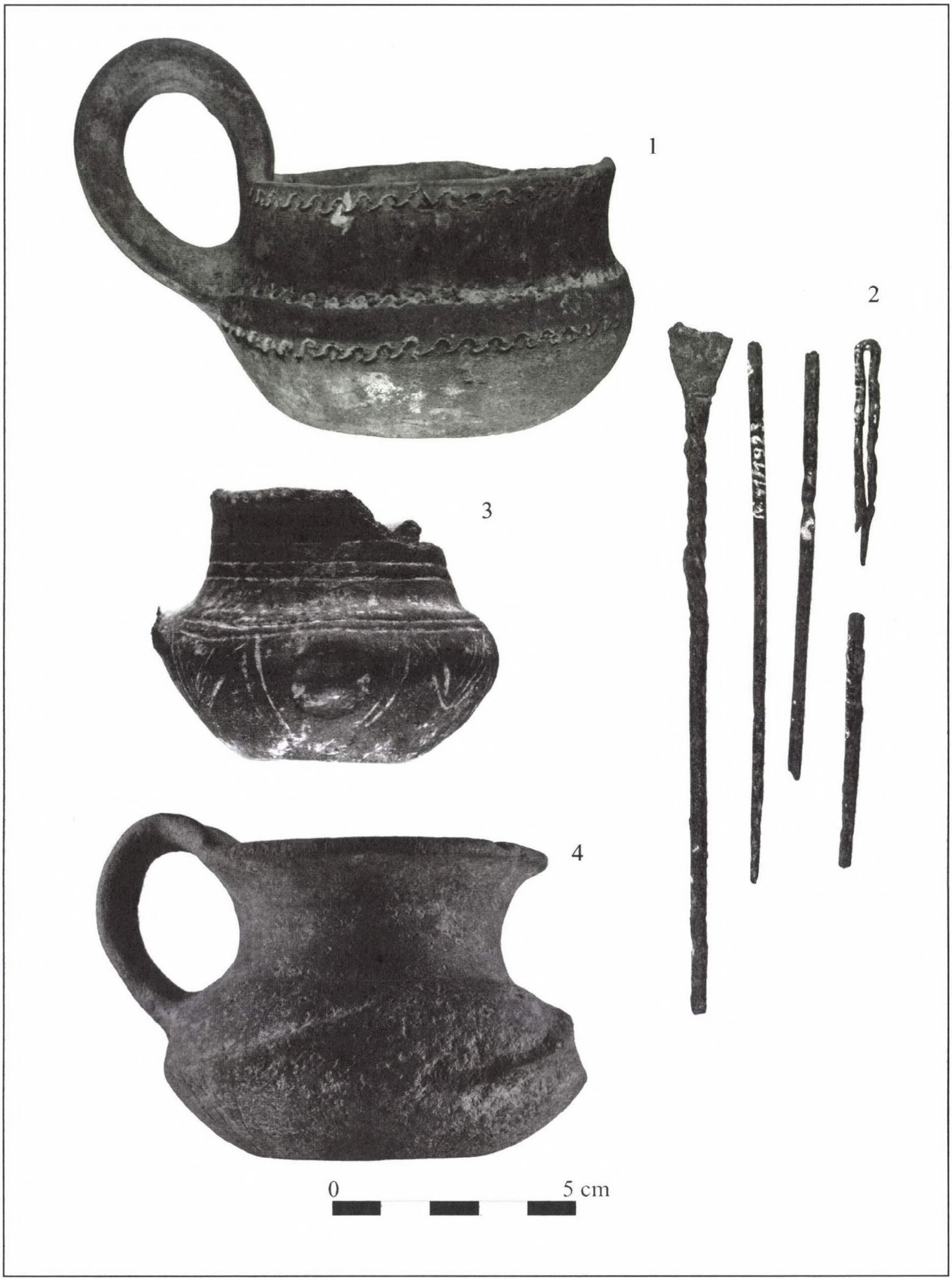

Fig. 3. Middle Bronze Age finds
1. Hortobágy–ditch beside the Keserű Woods, stray find (Wietenberg culture), 2. Hortobágy–Ohat-Telekházi major, stray finds of bronze pins, 3. Tiszafüred–Patkós csárda, stray find, 4. Tiszacsege, stray find

the excavations conducted by the Tiszafüred Museum Association, Béla Milesz too mentions Bronze Age inhumation graves from Egyek.[34] Late Füzesabony graves were also excavated by Lajos Zoltai in 1906.[35] Tibor Kovács identified the site of the cemetery as an area called Bodajcs-oldal on the basis of Zoltai's description and concluded that the inhumation burials were probably part of the same burial ground.[36] In 1935, János Sőregi was informed that vessels had come to light during sand mining at 289 Dorogmai Road (J. Tóth's yard); in the autumn of the same year, he excavated five inhumation burials, which yielded vessels representing the Füzesabony culture's Bodrogszerdahely phase. He also investigated the ditch beside the road leading to Tiszadorogma, from which he recovered finds dating from the same period, but without any context.[37] Vessels from what had probably been late Füzesabony burials were presented to the Déri Museum in 1971 from an area called Szöghatár.[38]

The fortified tell settlements and the associated cemeteries on the western fringes of the Hortobágy – Tiszafüred, Egyek, Ároktő and Polgár, the latter slightly to the north – all lie along the one-time, meandering bed of the Tisza. It seems likely that the location of these settlement was determined by the proximity of a fording place over the river and that their establishment was motivated by a conscious decision to control these crossing-places.[39]

THE LATE BRONZE AGE

The Great Hungarian Plain, and thus the Hortobágy too, was occupied by the Tumulus culture in phase 1 of the Late Bronze Age. The arrival of the Tumulus population is reflected in the cemeteries uncovered at Tiszafüred–Majoroshalom, Tiszafüred–Fertőihalom and Tiszafüred–Nagykenderföldek.[40] A total of 365 burials were uncovered at Majoros, four at Fertőihalom and two at Kenderföldek. The cemetery was biritual, containing 132 inhumation graves (36 per cent), 111 cremation graves (99 inurned and 11 scattered cremation burials and one whose rite was uncertain; 30.4 per cent) and 122 graves whose rite could not be established.[41]

One of the most important, still not wholly excavated site of the Tumulus culture lies at Egyek.[42] The best prehistorians of the day had conducted excavations in the village and in an area called Szőlőhegy: Tivadar Lehoczky (1903), Ede Tariczky and Béla Milesz (1904), András Jósa (1906), Lajos Zoltai (1906–1911), and János Sőregi (1935) in the early 20th century,[43] as well as after World War 2:[44]

34 *Milesz B.:* A tiszafüredi múzeum. ArchÉrt 25 (1905) 184–185.

35 *Zoltai* (1907b) 30–33, Figs 14–17; *Löfkovits A. – Zoltai L.:* Jelentés Debreczen sz. kir. város múzeuma 1907. évi állapotáról. II. A múzeum gyarapodása. Debrecen 1908, 36, lower picture; *Zoltai* (1910b) 41–42.

36 *Kovács* (1965) 75; *Kovács* (1966) 177.

37 *Sőregi* (1936a) 82.

38 Déri Museum (Debrecen), inv. no. IV.77.34.1–3. *Nepper – Sz. Máthé* (1973) 39, Figs 3.–4.

39 In part to control the trade with the areas north and south of the river, and in part for strategic and defence considerations.

40 *Kovács* (1975).

41 *Kovács* (1975) 41.

42 For an overview of the research in the Szőlőhegy area and in the village, cp. *Zoltai* (1907b) 30–31; *Zoltai* (1910b) 40–46; *Kovács* (1965); *Kovács* (1966) 159–180.

43 In addition to the investigations mentioned above, the villagers donated finds of the Tumulus culture to the Déri Museum on several occasions: vessels and fragments from Tumulus burials found in József Nagy's vineyard (Déri Museum, Debrecen, inv. no. 1921.8.1–13); a large urn from Ohat, found by the Egyek–Csege road (Déri Museum, Debrecen, inv. no. 1927.1); vessel with a lug handle (the urn of a cremation burial) found east of Egyek during road construction work (inv. no. 1933.14); a small, knob decorated one-handled cup from the inner part (?) of Egyek (Déri Museum, Debrecen, inv. no. 1935.6.3); the urn, the covering bowl, a small suspension vessel and a bronze bracelet from 315 Vágóhíd Street (Déri Museum, Debrecen, inv. no. 1941.1–4); vessels from disturbed urn burials found on Kálmán Nagy's plot (Déri Museum, Debrecen, inv. no. 1941.22.3–6; *Fig. 6. 1*); two globular one-handled cups with funnel necks from Egyek–2 Tisza Street (Déri Museum, Debrecen, inv. no. 56.4.1–2). Cp. also *Sőregi* (1936a) 82.

44 *Kralovánszky* (1965) 38; *Kovács* (1965) 76.

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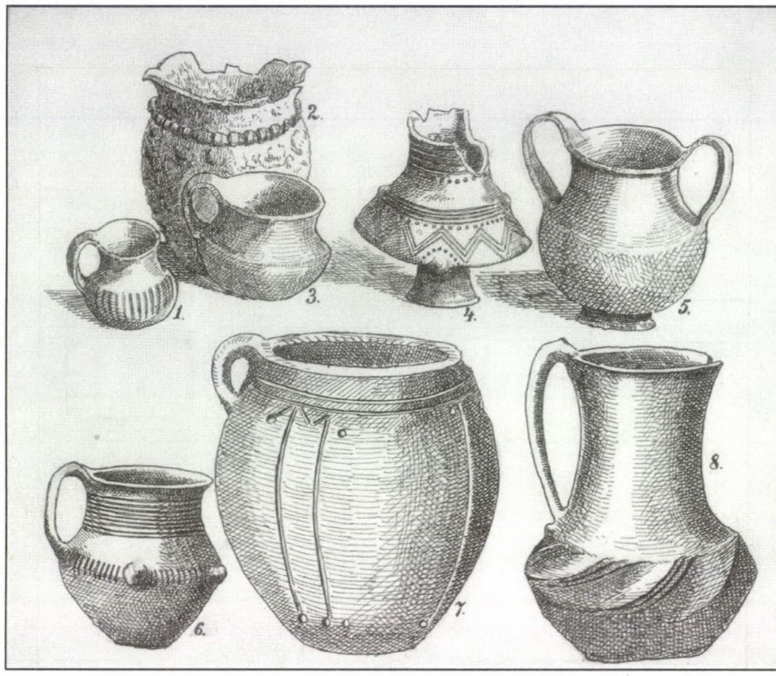

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Fig. 4.
1. Egyek–Szőlőhegy, grave goods of the Middle and Late Bronze Age burials on a drawing made by Lajos Zoltai, 2. vessels from the inurned burials uncovered at Egyek and Hajdúbagos

József Csalog (1952),[45] Ervin Mérey Kádár (1953),[46] Alán Kralovánszky (1956)[47] and, finally, Tibor Kovács (1962). The finds collected by István Balogh in 1954 at 7 Deák F. Street in 1954 suggest that the assemblage represents some sort of cult paraphernalia *(Fig. 6. 2)*.[48] The investigations conducted by Lajos Zoltai yielded eighty-eight conscientiously documented grave assemblages *(Figs 4–5)*, while Tibor Kovács's excavations brought to light twelve Late Bronze Age inurned burials.[49] In his publication of the finds, Kovács distinguished a regional group of the Tumulus culture in north-eastern Hungary, the so-called Egyek group, based on the finds from Egyek and other comparable assemblages from Szabolcs-Szatmár-Bereg, Borsod-Abaúj-Zemplén and Hajdú-Bihar counties.[50]

The Reinecke Br C period is now generally equated with the Tumulus culture, which had a number of regional groups (Hajdúbagos, Rákóczifalva, Egyek, Tápé) owing to the different traditions at the close of the Middle Bronze Age (some of which can perhaps be traced to different ethnic backgrounds).[51]

The map of the Egyek cemetery published by Tibor Kovács shows the extensive areas which have not been investigated yet, suggesting that the greater part of the urn cemetery in the Szőlőhegy area still awaits excavation;[52] this is also corroborated by the high number of burials in the contemporary burial ground at Tiszafüred–Majoros.

A greyish, rounded biconical cup with a high drawn handle of the Tumulus culture dating from the early phase of the Late Bronze Age was found at Tiszacsege–Rókahát *(Fig. 7. 1)*.[53] A red cylindrical vessel stand with fenestrated body and profiled base from Tiszacsege–Machinery station *(Fig. 7. 2)* probably also dates from the Late Bronze Age.[54]

The location of the major Tumulus culture cemeteries (often overlapping with Füzesabony burial grounds) suggests that their siting was motivated by the same considerations as the choice of location of the Füzesabony settlements along the Tisza.

The finds of the period succeeding the Tumulus culture (Reinecke Br D–Ha A1) are known from several sites on the northern fringes of the Hortobágy. Stray finds indicating a settlement have been found at Egyek–Rókahát (700 Felvég).[55] Stray finds from this period were also collected by the road to Dorogma during János Sőregi's 1935 excavation.[56]

Gábor V. Szabó dated the Late Bronze Age vessel depot made up chiefly of large storage jars brought to light during the rescue excavation of an Avar cemetery at Tiszacsege–Sóskás in 1982 to the Ha A1 period, i.e. the pre-Gáva period preceding the Gáva culture.[57]

45 *Csalog J.:* Egyek. ArchÉrt 81 (1954) 72.

46 *Mérey Kádár E.:* Egyek–Rózsástelek. ArchÉrt 82 (1955) 95.

47 *A. Kralovánszky:* Egyek. ArchÉrt 85 (1958) 82.

48 Déri Museum (Debrecen), inv. no. IV.54.1.1–17. The entire assemblage cannot be describea here, but the following finds must be mentioned: four miniature vessels, a small knob decorated footed cup, a one-handled cup decorated with a lime encrusted pattern of the Felsőszőcs culture and a small double vessel (a miniature urn topped with a bowl with pinched rim). Three vessels in the assemblage showed traces of secondary burning. Cp. also *Balogh I.:* Egyek. ArchÉrt 83 (1956) 97.

49 *Kovács* (1966) 160–179.

50 *Kovács* (1966) 198.

51 *T. Kemenczei:* Nordostungarn in der Spätbronzezeit. *In:* Südosteuropa zwischen 1600 und 1000 v. Chr. Hrsg.: B. Hänsel. Berlin 1982, 306, Abb. 1; *M Csányi:* The Tumulus culture: invaders from the west. *In:* Hungarian archaeology at the turn of the millennium. Ed.: Zs. Visy. Budapest 2003, 162; *T. Kemenczei:* Bronze Age metallurgy. *In:* Hungarian archaeology at the turn of the millennium. Ed.: Zs. Visy. Budapest 2003, 170.

52 *Kovács* (1966) Figs 1 and 23.

53 Déri Museum (Debrecen), inv. no. 66.181.1.

54 Déri Museum (Debrecen), inv. no. IV.66.22.1. In Mesterházy's study, both vessels are described as coming from the same findspot (Tiszacsege–Machinery station); *Mesterházy K.:* A Déri Múzeum régészeti tevékenysége 1962–1965 (Leletkataszter). DMÉ (1965) 19–59, Fig. 18. 1 and 34, Fig. 34. 2, 55.

55 Déri Museum (Debrecen), inv. no. 1935.64.1–5. The finds from this site included the neck fragment of a thin-walled graphitic urn decorated with horizontal channelling, a globular urn with vertical channelling on its belly, a cylindrical fenestrated vessel stand and the basal fragment of an omphalos cup decorated with a combination of lightly incised concentric circles and garlands. Cp. *Sőregi* (1936b) 55.

56 Déri Museum (Debrecen), inv. no. IV. 1935.15.1, 4, 5.

57 Déri Museum (Debrecen), inv. no. IV.1984.13.1–18. *V. Szabó G.:* A tiszacsegei edénydepó. Újabb adatok a Tisza-vidéki késő bronzkori edénydeponálás szokásához. MFMÉ–Studia Archaeologica 10 (2004) 81–113, Fig. 2. 2, Figs 3–7, Fig. 9. 1–19.

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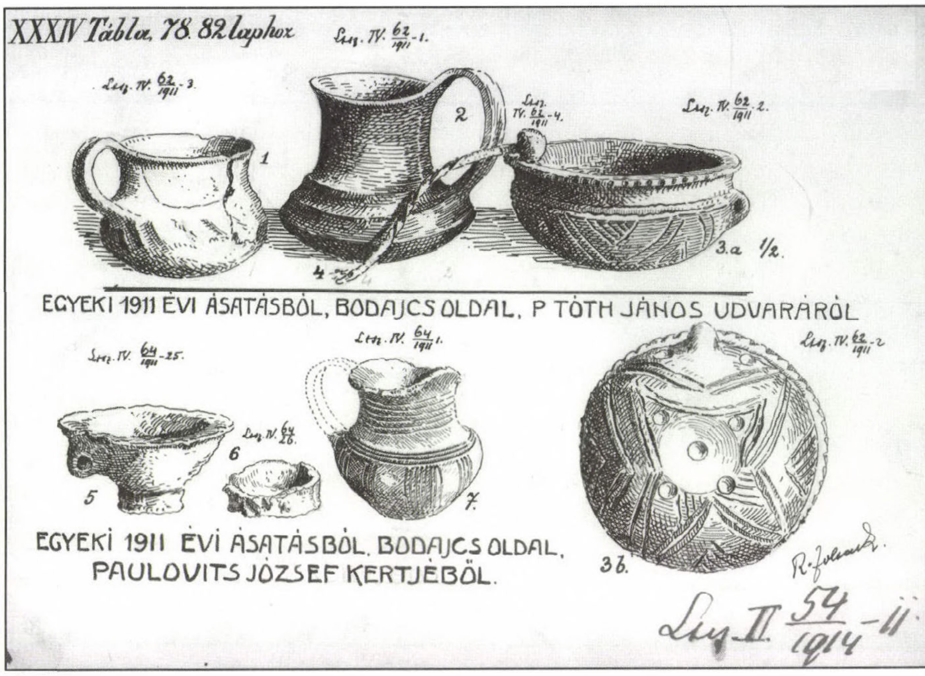

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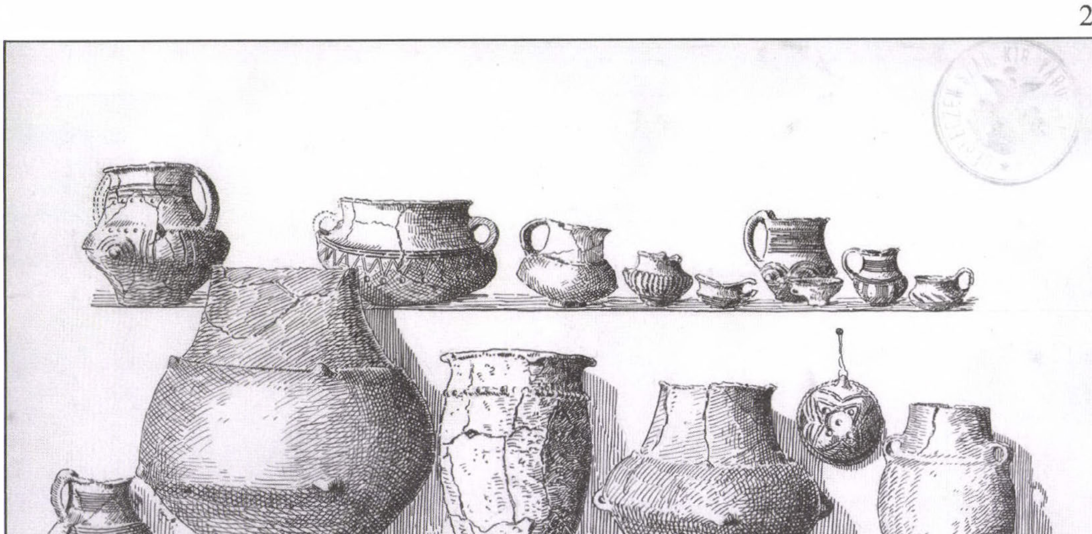

Fig. 5.
1–2. Egyek–Szőlőhegy, grave goods of the Middle and Late Bronze Age burials on drawings made by Lajos Zoltai

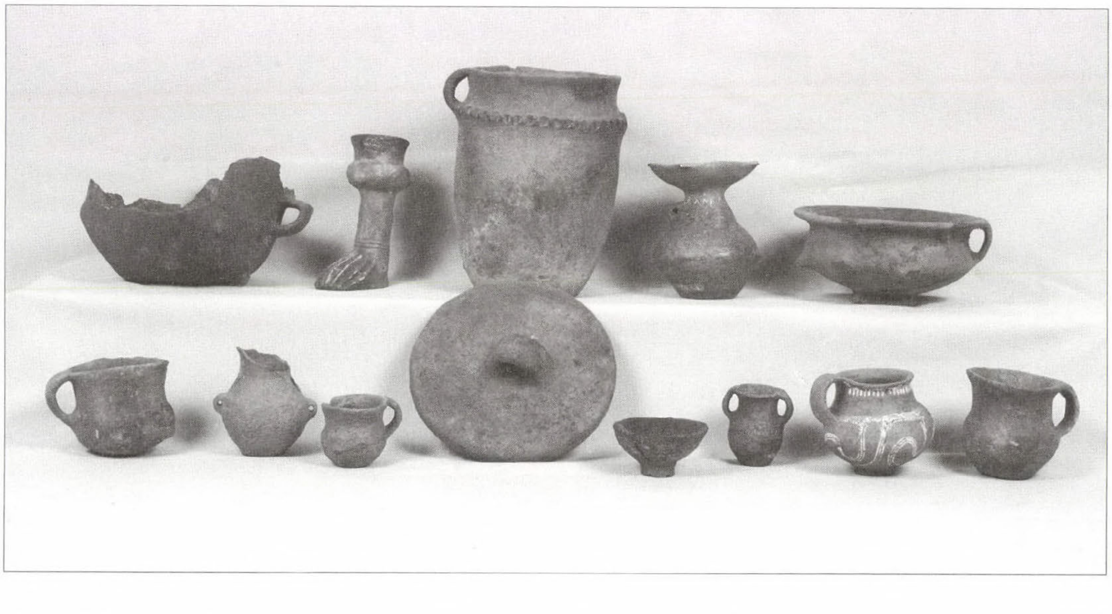

Fig. 6. Finds from Egyek–Pótaköz-7 Deák F. Street (Kálmán Nagy's plot)
1. Finds uncovered in 1941, 2. finds uncovered in 1954

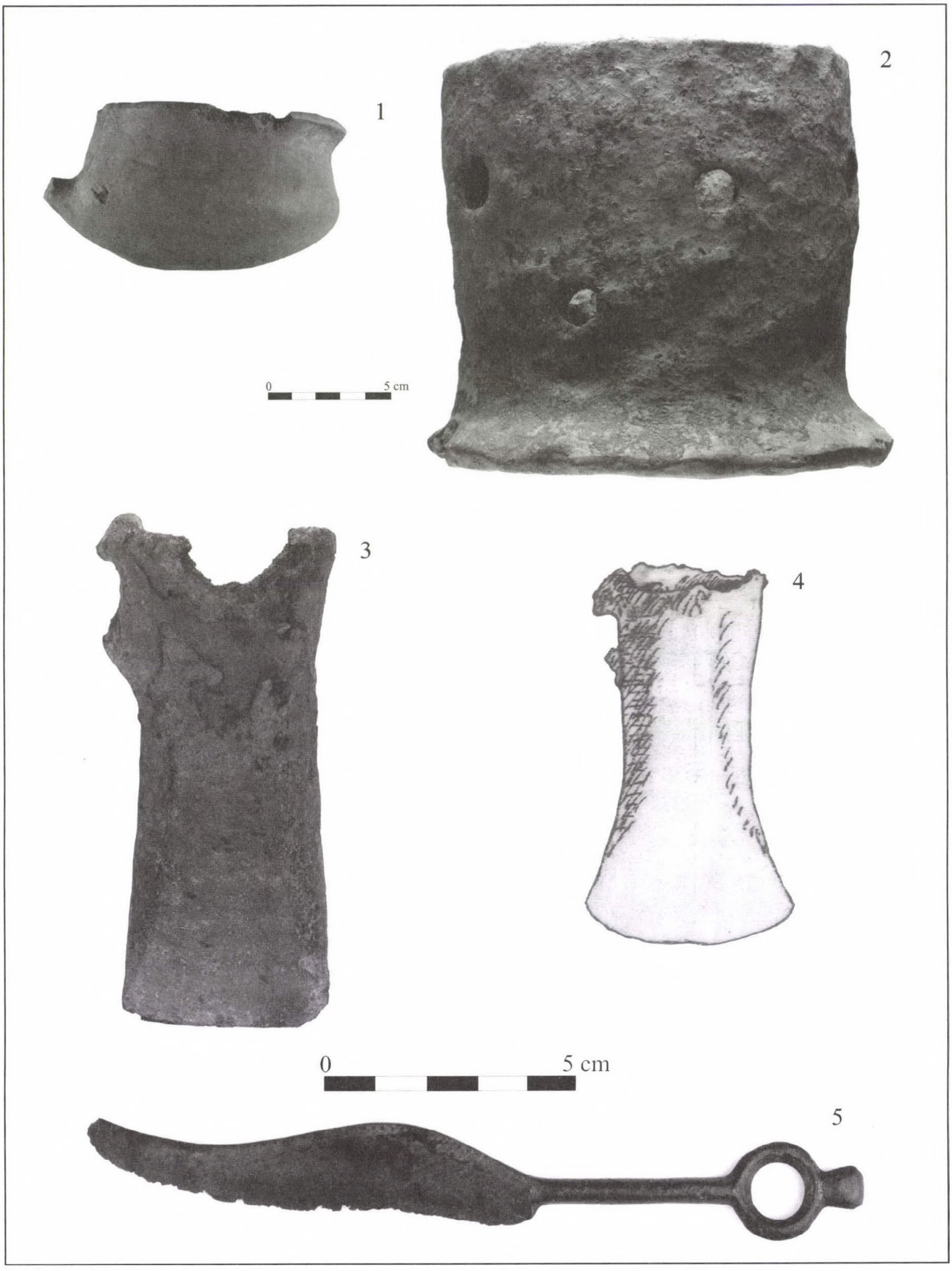

Fig. 7.
1. Tiszacsege–Rókahát, stray find, 2. Tiszacsege–Machinery station, stray find of a vessel stand, 3. Hortobágy–Ohat-Völgyes, stray find of a bronze socketed axe, 4. Hortobágy–Road leading to Máta, stray find of a bronze socketed axe, 5. Balmazújváros–Reformed church, stray find of a bronze knife with ringed hilt

The metalwork of this period is represented by the hoards of the Ópályi horizon. A few stray socketed axes, found at Hortobágy–Ohat-Völgyes and in the ditch running beside the Hortobágy–Máta road, represent this horizon in the Hortobágy *(Fig. 7. 3–4)*.[58]

Sites of the Gáva culture, distributed throughout the Great Hungarian Plain during the last phase of the Late Bronze Age, are known from several locations in the *puszta*. Stray finds indicating Gáva settlements have been found at several spots in the village of Hortobágy: the rim fragment of a polished pot with a lug handle (Hortobágy–Nyíróhodály; *Fig. 8. 2*),[59] a miniature biconical vessel decorated with channelling on the shoulder (Hortobágy–Méheshalom, from the bank of the Árkus; *Fig. 8. 1*),[60] the shoulder fragment of a dark brown polished urn with red interior and channelled decoration, and a red bowl fragment with dark brown interior and channelled decoration (Hortobágy–Kandra-halom, also from the bank of the Árkus; *Fig. 8. 3–4*).[61] In view of the area's topography, it seems likely that the finds found by the Hortobágy bridge,[62] at Hortobágy–Csárda,[63] and by the road leading to Máta[64] all come from the same extensive Gáva settlement *(Fig. 9)*.[65]

Another Gáva settlement is known from Tiszafüred–Kenderföldek.[66] A bowl fragment decorated with a channelled boss was found together with Early Bronze Age pottery sherds at Tiszacsege–Sand pit,[67] and the collection of the Hungarian National Museum too has stray Gáva finds from Tiszacsege (without a closer specification of the findspot).[68] The shoulder fragment of a shiny black polished urn with channelled decoration came to light at Balmazújváros–Daru *(Fig. 8. 6)*,[69] and a black polished urn fragment with orange interior and oblique channelled decoration was found at Újszentmargita–Nagyszög-major (on the bank of the Selypes Brook) *(Fig. 8. 5)*.[70]

The rich metalwork of the Gáva culture is reflected in the hoards from Karcag–Zádor-híd,[71] Balmazújváros–Fiáth birtok,[72] Újszentmargita–Erdőtanya,[73] Polgár–Folyás-Szilmeg,[74] Nádudvar–Bojár-Hollós[75] (containing a Jenišovice type one-handled bronze cup dating from the Ha B1 period),[76] Nádudvar–Halomzug,[77] Püspökladány–Középhát (three bronze swords),[78] Püspökladány–Meggyes (two Kurd type bronze situlae),[79] and Egyek–Kendertag (three Jenišovice type cups, one Fuchsstadt type cup and

58 Déri Museum (Debrecen), inv. no. IV.1923.42; IV.1910.1052.
59 Déri Museum (Debrecen), inv. no. 54.9.1.
60 Déri Museum (Debrecen), inv. no. 64.15.1.
61 Déri Museum (Debrecen), inv. no. IV.1910.1046.
62 Déri Museum (Debrecen), inv. no. IV.1911.50.3, 5–7.
63 Déri Museum (Debrecen), inv. no. IV.1912.41.2–4.
64 Déri Museum (Debrecen), inv. no. IV.1913.476.1, 4, 5; IV.1913.68.3–6; IV.1913.69.2, 4, 7a–c.
65 *Kemenczei* (1984) 157, no. 48.
66 *Ibidem* 166, no. 127.
67 Déri Museum (Debrecen), inv. no. IV.65.111.2. *Kralovánszky* (1965) 42; *Kemenczei* (1984) 166, no. 124a.
68 *F. Kőszegi:* Beiträge zur Geschichte der Ungarischen Urnenfelderzeit (H A-B). ActaArchHung 12 (1960) 149, Taf. LXXXI. 1–4; *Kemenczei* (1984) 166, no.124b.
69 Déri Museum (Debrecen), inv. no. 1909.186; 1908.1231. *Kemenczei* (1984) 152, no. 6.
70 Déri Museum (Debrecen), inv. no. 1915.235.1.
71 *Kemenczei* (1984) 174, no. 26, Taf. CXCVII–CXCVIII; *Mozsolics* (2000) 51–52, Taf. 44–45.
72 *Sőregi J.:* A Déri Múzeum 1943–1947. évi működése. I. Jelentés az 1943. évről. DMÉ (1948) 9, Fig. 2; *Kemenczei* (1984) 169, no. 3, Taf. CXCb; *Mozsolics* (2000) 34–35, Taf. 4.
73 Déri Museum (Debrecen), inv. no. 1980.94.1–13. *Kralovánszky* (1965) 42; *Kemenczei* (1984) 189, no. 76; *Mozsolics* (2000) 88, Taf. 112.
74 *Ibidem* 66, Taf. 74–75.
75 Déri Museum (Debrecen), inv. no. 52.148.1–11.
76 *Patay* (1968) 76, 78, Figs 25–26; *Kemenczei* (1984) 176, no. 33a; *Mozsolics* (1985) 151–152; *Patay* (1990) 62, Taf. 42. 103; *Mozsolics* (2000) 57, Taf. 55.
77 Déri Museum (Debrecen), inv. no. 71.65.1–112. *Sz. Máthé* (1972); *Nepper – Sz. Máthé* (1973) 49–50, Figs 11–14, Fig 16; *Kemenczei* (1984) 176, no. 33b; *Mozsolics* (2000) 57–59, Taf. 56–60.
78 Déri Museum (Debrecen), inv. no. 69.37.1a-b; 72.77. *Nepper – Sz. Máthé* (1973) 52; *Kemenczei* (1984) 181, no. 51a; *Mozsolics* (1985) 179, Taf. 19.1–3.
79 Déri Museum (Debrecen), inv. no. 72.81.1–2. *Patay P.:* Három bronzüst. DMÉ (1981) 59–62, Figs 1–5; *Kemenczei* (1984) 181, no. 51b; *Mozsolics* (1985) 179–180.

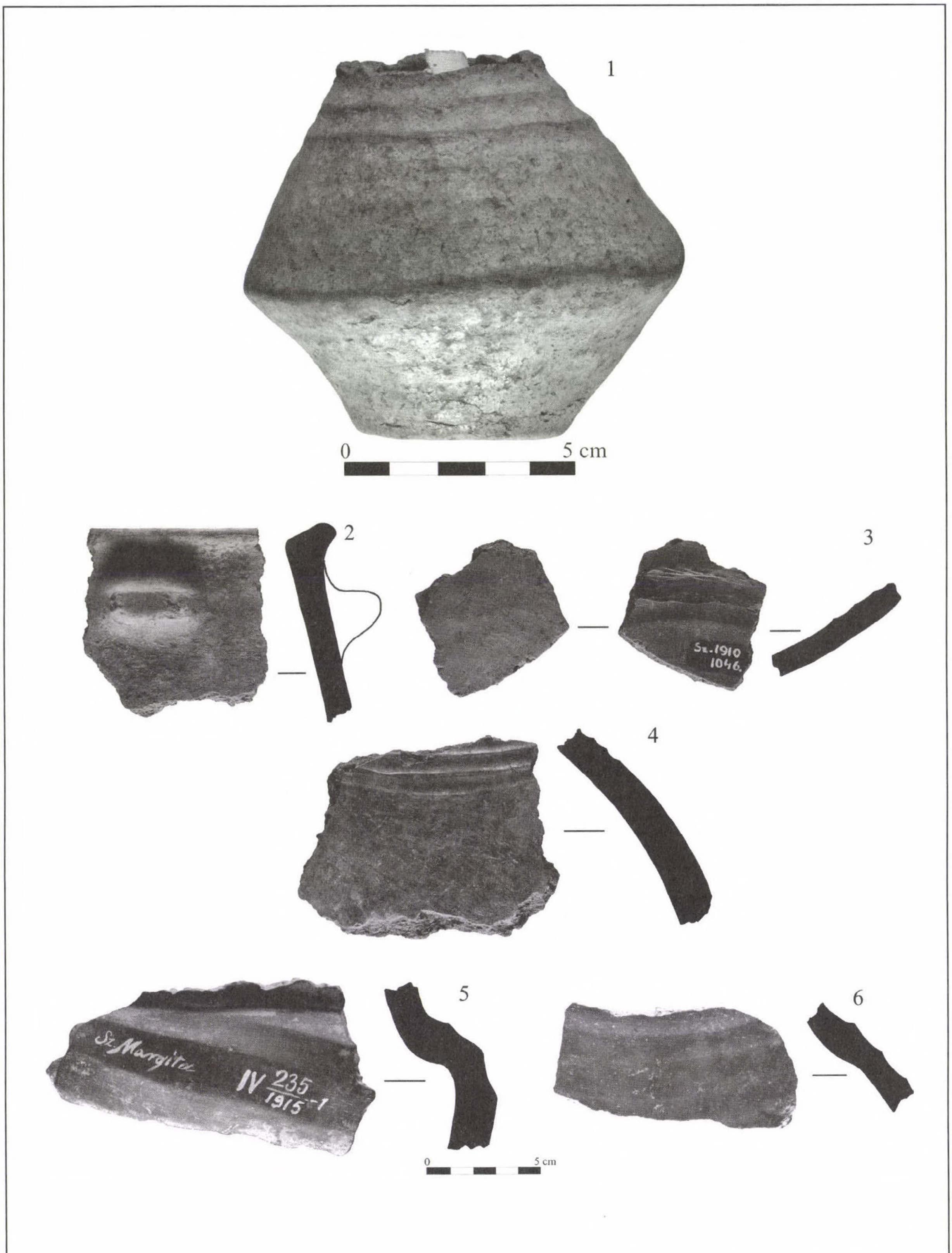

Fig. 8. Stray finds of the Gáva culture

1. Hortobágy–in front of Méheshalom (Árkus bank), 2. Hortobágy–Nyíróhodály, 3–4. Hortobágy–Kandra-halom area (Árkus bank), 5. Újszentmargita–Nagyszög-major (bank of the Selypes Brook), 6. Balmazújváros–Daru one Egyek type cup dating from the Ha B1 period).[80] These hoards can all be assigned to Mozsolics's Hajdúböszörmény horizon (B VIa), corresponding to the Ha B1 period.

Pottery fragments indicating the presence of a possible Gáva settlement were found together with bronze hoards at Nádudvar–Halomzug[81] and Újszentmargita–Erdőtanya.[82]

The ring hilted bronze knife with decorated bent-back blade found near the German Reformed Church at Balmazújváros *(Fig. 7. 5)*,[83] whose best analogies can be quoted from the Buj and Szendrőlád hoards, can be assigned to the Gyermely horizon (Mozsolics B Vc) preceding the Hajdúböszörmény horizon.[84]

* * *

A glance at the distribution of Bronze Age sites in the Hortobágy reveals that only Early Bronze Age (Makó) and Late Bronze Age (Gáva) sites are known from the heartland of the *puszta*. The Middle Bronze Age sites can, with one single exception, all be found in the Tisza Valley, on the elevations rising above the floodplain, which remained dry even in times when the surrounding areas covered with meadow and alluvial soils were temporarily inundated.

Even though the Hortobágy is rather poorly researched, the differences between the distribution of Middle Bronze Age, and Early and Late Bronze Age sites is nonetheless striking. Two possible explanations can be cited in this respect:

(1) The climate was perhaps drier at the beginning of the Early Bronze Age and at the close of the Late Bronze Age, this being the reason that Makó and Gáva communities settled in the relatively lower-lying heartland of the Hortobágy. Similarly, a drier climate can be assumed in the Late Copper Age, at the time when the kurgans of the Pit-grave culture were raised.

During the Middle Bronze Age, the Hortobágy was probably a mosaic of waterlogged areas, marshland, undrained lakes and areas temporarily inundated by the Kadarcs, Hortobágy and Árkus rivers, and the floods of the Tisza from the north-west, owing to the wetter climate.[85] This would also explain why, similarly to the tell cultures of the Middle Tisza region,[86] the Middle Bronze Age tells and cemeteries were established west of the Hortobágy, on the elevations along the meanders of the Tisza and on the larger alluvial cones.

(2) Recent research has demonstrated that alkalisation had begun at a rather early date[87] and thus the other reason that the Hortobágy region was sparsely populated can be attributed to its poor soil,[88] which was more suited to semi-nomadic and nomadic stockbreeding than to intensive agriculture, the economic basis of the tell cultures.

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80 *Sőregi* (1936b) 57–58, Figs 18–19; *Patay* (1968) 78, Figs 27–28; *Kemenczei* (1984) 172, no. 15, Taf. CXCIII; *Patay* (1990) 57–58, 60, 65, and Taf. 39. 86, Taf. 40. 90–92, Taf. 42. 104; *Mozsolics* (2000) 43, Taf. 27–29.

81 Déri Museum (Debrecen), inv. no. 71.65.113–118; *Sz. Máthé* (1972) 400, Abb. 7; *Nepper – Sz. Máthé* (1973) 50, Fig. 15; *Kemenczei* (1984) 159, no. 77.

82 Déri Museum (Debrecen), inv. no. 1980.94.14.

83 Déri Museum (Debrecen), inv. no. IV.1908.68.

84 *Mozsolics* (1985) 41, 106–107, 192, Taf. 260.1–2, Taf. 263.20.

85 *Zoltai* (1911b) 11–12, map of the Hortobágy puszta; *Zoltai L.*: Debrecen vizei. Folyók, folyások, völgyek, erek, fokok – Tavak, fertők, fenekek, laposok, mocsarak, rétek, tiszták. Árkok, csatornák, gátak, kutak. Debrecen 1935, map of the waters around Debrecen.

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88 *Zoltai* (1911b) 9–10.

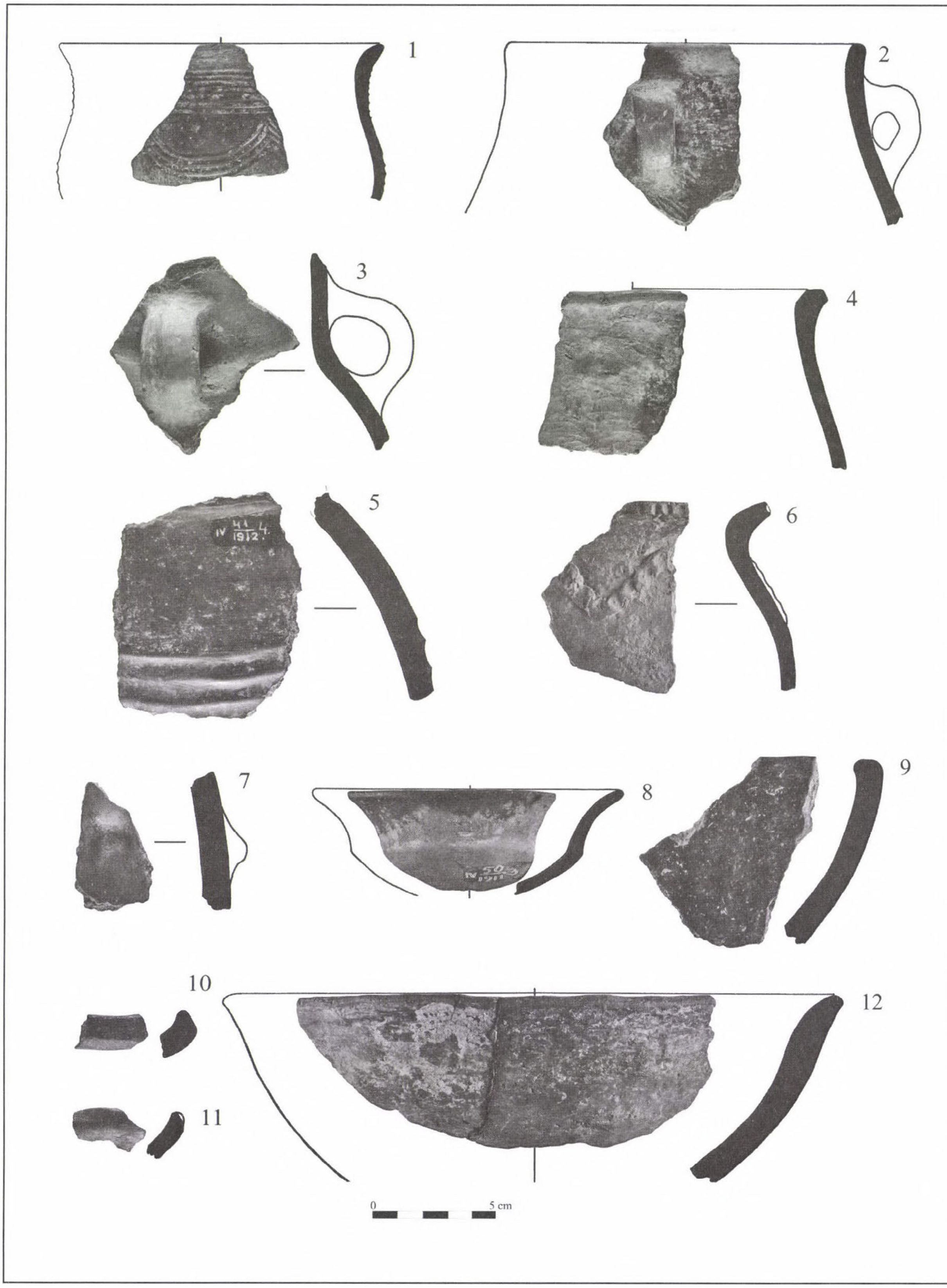

Fig. 9. Settlement finds of the Gáva culture
1–12. Selection of stray finds found in the Hortobágy–Csárda area ("beside the bridge", "Csárda" and "Road leading to Máta")

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THE POCSAJ AREA IN THE BRONZE AGE

János Dani

With the exception of János Makkay's excavation in 1957,[1] the Pocsaj area has not been archaeologically investigated. In the lack of excavations and systematic field surveys, only a few archaeological sites are known and the archaeological topography of the village remains a task for the future.

The finds from the Pocsaj area in the Archaeological Collection of the Déri Museum of Debrecen are, with the exception of the 1957 excavation, all stray finds. It is these finds and the few reports in the Archaeological Archives from which the Bronze Age history of the area can be reconstructed.[2]

In the Early Bronze Age 1 period, the Pocsaj area was part of the distribution of the Makó culture, which occupied the greater part of the Carpathian Basin. The eastern boundary of the Makó distribution falls into the neighbouring Ér Valley in north-western Romania. Several burials have been reported from this area: one grave was found under the Gáborján–Csapszékpart tell[3] and another at Létavértes–Irinyi Street, on the site of the former Móric Nagy manor house.[4] Makó burials – chiefly solitary inurned graves – are also known from the Romanian section of the Ér Valley: Valea lui Mihai–Gara C.F.R/Érmihályfalva–Railway station,[5] Ciumeşti–Bostănărie/Csomaköz–Tökös,[6] Foieni–Fântâna Păşunii/Mezőfény–Legelő kút[7] and the small burial ground containing seven graves at Pişcolţ–Nisipărie/Piskolt–Homokos domb.[8]

Small hamlet-like settlements have been identified in several locations around Berea/Bere[9] and Ciumeşti–Via veche/Csomaköz–Ó-Szőlő.[10] In 2002, Krisztián Szilágyi uncovered three refuse pits yielding a rich find assemblage at Kismarja–Nagymarjai-dűlő Site 1 as part of a rescue excavation when gas-pipes were laid. A settlement section was uncovered at Hosszúpályi–Sand pit the same year. The site itself was since long known from the lavishly decorated footed bowl in the collection of the Reformed College in Debrecen. Over forty settlement features and four inurned burials were brought to light in 2004–2005 during a rescue excavation at Berettyóújfalu–Nagy Bócs-dűlő, one of the largest Makó settlements.

During the Early Bronze Age 2 period, the dry elevations in the Pocsaj area were probably occupied by the Nyírség culture, distributed from the south-eastern Slovakian plain to the Körös region in the south and the Ér Valley in the east. Single-layer settlements of this culture have been identified under

1 *Makkay* (1958) 201. I would here like to thank János Makkay for his kind permission to publish the finds from Leányvár.

2 In addition to the various find assemblages and the documentation preserved in the museum archives, Bronze Age settlement patterns in the Pocsaj area can only be reconstructed by extrapolating from the Bronze Age history of the broader region.

3 *Sz. Máthé* (1988) 38, Pl. 46. 7; *Dani* (1988) 57–60, Abb. 2, Abb. 3. 1–3.

4 *Dani* (1988) 55–57, Abb. 1, Abb. 3. 4.

5 *M. Roska:* Staţiunea preistorică de la Valea lui Mihai. AISC 1 (1932) 78, Figs 8–10; *Németi* (1996) 34, Fig. 7. 2–8; *Kacsó* (1997b) 425; *Németi* (1999) 39, no. 29 a4, 101, Fig. 44.

6 *Németi* (1996) 30, Fig. 9. 6, Fig. 10. 1; *Kacsó* (1997b) 426–427, Fig. 1. 1–4; *Németi* (1999) 51, no. 36 II b4, 101, Fig. 25, 44.

7 *Kacsó* (1997a) 428, Fig. 3. 5–8; *Németi* (1996) 31; *Németi* (1999) 55, no. 37 VI b and 40 i, 101, Fig. 25, 44.

8 *J. Németi:* Morminte de la inceputul epocii bronzului descoperite la Pişcolt (Jud. Satu Mare). SCIVA 30:4 (1979) 527–536; *Németi* (1996) 32, 36, Fig. 7. 2–8; *Németi* (1999) 44, no. 33 e3, 101, Fig. 44.

9 Măcriş/Sóskás: settlement (*Kacsó* [1997b] 427–428, Fig. 3. 1–4; *Németi* [1999] 56, no. 37 Xb, 101, Fig. 44), Platoul Acastâului or spânzurătoarei/Akasztófalapos: settlement (*Kacsó* [1997b] 427, Fig. 2. 6–16; *Németi* [1999] 57, no. 37 XIc, 101, Fig. 44); Togul evreului/Zsidó-tag: settlement (*Németi* [1999] 59, no. 37 XX c, 101, Fig. 44), Via capătul sudic/Berei szőlő: settlement (*Németi* [1999] 57, no. 37 XII b2, 101, Fig. 25, 44).

10 *Kacsó* (1997b) 427, Fig. 2. 1–5; *Németi* (1999) 52, no. 36 IV.a, 101, Fig. 25, 44.

the tell settlements at Gáborján–Csapszékpart,[11] Esztár–Fenyvesdomb[12] and Bakonszeg–Kádárdomb,[13] as well as at Hencida–Málédomb[14] and Konyár–Búzástó.[15] The well-known bird shaped vessel (askos) from Hosszúpályi was found in the 1870s.[16] Finds typical for the Nyírség culture have been reported from several sites around Berea/Bere[17] and Ciumeşti/Csomaköz.[18]

In the Early Bronze Age 3 period, the area was occupied by the Sanislău/Szaniszló culture, distributed over roughly the same area as the preceding Nyírség culture, as shown by the density of sites in the Berettyó–Ér Valley. Countless settlements and inurned cremation burials are known from the Bihar area and the Ér Valley in Romania up to the Ecsed marshland: Bakonszeg–Kádárdomb (settlement under the Ottomány tell);[19] Gáborján–Csapszékpart (settlement under the Ottomány tell);[20] Andrid–Dâmbul Taurului/Érendréd–Bikadomb (settlement);[21] Bere/Berea;[22] Berveni–Cetate/Börvely–

11 *Sz. Máthé* (1988) Pl. 44. Pl. 45. 3–7, 10–12.

12 *Sz. Máthé* (1988) 36–37.

13 *Sz. Máthé* (1988) 30–31, Pl. 12. 15–1, Pl. 20. 21, 18; 19. 10.

14 *Kalicz* (1968) 64, no. 7.

15 *Makkay* (1957 36; *Kalicz* (1968) 64, no. 8, Taf. XIII. 6.

16 *Kalicz* (1968) 64, no. 10. Taf. XI. 1.a-c.

17 Cetatea Iepurelui/Nyúlvár: settlement (*Bader* [1978] 121, Pl. IV. 1–2, 4–10; Pl. VIII. 2–5, 8–9; *Roman – Németi* [1986] 210, no. IV. 2; *Németi* [1999] 58, no. 37 XIII.b, 101, Fig. 25, 44); Măcriş/Sóskás: settlement (*Bader* [1978] 24, 120, Pl. VI. 6; *Németi* [1999] 56, no. 37 Xb, 101, Fig. 25, 44); Platoul Acastâului or spânzurătoarei/ Akasztófalapos: settlement (*Bader* [1978] 121, Pl. VI. 7; *Németi* [1999] 57, no. 37 XIc, 101, Fig. 25, 44); Togul Cantorului/Kántor-tag: settlement (*Bader* [1978] 24, 121, Pl. VI. 2, 5; *Németi* [1999] 58, no. 37 XV b, 101, Fig. 25, 44); Togul Dolarului/Dolláros: settlement (*Bader* [1978] 25, 120–121, Pl. VI. 3, 4; *Németi* [1999] 56, no. 37 IX b4, 101, Fig. 25, 44.); Togul Evreului/Zsidó-tag: settlement (*Bader* [1978] 21, 120; *Németi* [1999] 59, no. 37 XX c, 101, Fig. 44); Togul Sfântu Gheorghe/Szentgyörgy-tag: settlement (*Kacsó* [1972] 32–33, Figs 3–4; *Bader* [1978] 21, 120, Pl. VII. 2–4, 8, 9; *Roman – Németi* [1986] 210, no. IV. 3; *Németi* [1999] 59, no. 37 XIX d, 101, Fig. 25, 44); Via, capătul nordic/Berei szőlő: settlement (*Kacsó* [1972] 32–33, Figs 1–2; *Bader* [1978] 121, Pl. VI. 10, 11, 13–15, 18–20; *Roman – Németi* [1986] 210, no. IV. 1; *Németi* [1999] 57, no. 37 XII a, 101, Fig. 25, 44).

18 Bostănărie/Tökös: settlement (*Ordentlich – Kacsó* [1970] 51–58, Fig. 5; *Ordentlich* [1971] 22; *Bader* [1978] 123; *Roman – Németi* [1986] 210, no. III 1; *Németi – Roman* [1995] 29; *Németi* [1996] 30, Fig. 9. 6, Fig. 10. 1; *Németi* [1999] 51, no. 36 II b5, 101, Fig. 25, 44); Moara/Malomháta: settlement (*Bader* [1978] 24, 123, Pl. VII. 10–12, 14; *Németi* [1999] 50, no. 36 I a2, 101, Fig. 25, 44); O dună plată or Lăpuşul Mare/ Nagylapos: settlement (*Bader* [1978] 24, 123, Pl. VII. 13; *Németi* [1999] 52, no. 36 VIb, 101, Fig. 25, 44).

19 *Sz. Máthé* (1988) 27–32, Figs 2–10, Pl. 11. 18; *M. Sz. Máthé:* Bakonszeg–Kádárdomb. *In:* Bronzezeit in Ungarn. Forschungen in Tell-Siedlungen an Donau und Theiss. Hrsg.: W. Meier-Arendt. Frankfurt am Main 1992, 166–167.

20 *Sz. Máthé* (1988) 37–40, Figs 18–20, Pl. 43, Pl. 45. 1, 2, 9, Pl. 42. 3, 4, 7.

21 *Németi* (1999) 27, no. 13 a1, 101, Fig. 44.

22 Cetatea Iepurelui/Nyúlvár: settlement (*Bader* [1978] 121, Pl. V. 2, 5; *Roman – Németi* [1986] 210, no. IV. 2; *Németi* [1999] 58, no. 37 XIII, 101, Fig. 25, 44); Măcriş/Sóskás: settlement (*Németi* [1999] 56, no. 37 Xb, 101, Fig. 25, 44.) Mirişte lui Csányi/Csányi sűrűje: disturbed urn burials (*Bader* [1978] 23, 121, Pl. IX. 4, Pl. XC. 24; *Németi* [1969] 60, Pl. XVI. 3–5; *Németi* [1996] 29, Fig. 9. 1–2; *Németi* [1999] 54, no. 37 II a, 101, Fig. 25, 44); Movila Libuc/Libuc-hegy: settlement (*Németi* [1999] 55, no. 37 V b, 101, Fig. 25, 44); Platoul Acastâului/Akasztófalapos: settlement (*Németi* [1999] 57, no. 37 XIc, 101, Fig. 25, 44); Togul Cantorului/Kántor-tag: settlement (*Bader* [1978] 121, Pl. VI. 1; *Németi* [1999] 58, no. 37 XV b, 101, Fig. 25, 44); Togul Dolarului/Dolláros: settlement (*Németi* [1999] 56, no. 37 IX b4, 101, Fig. 25, 44); Togul Sfântu Gheorghe/Szentgyörgy-tag: settlement (*Kacsó* [1972] 32–33, Fig. 4. 1–4; *Bader* [1978] 120, Pl. VI. 8, 12, 16, 17, 18, IV. 3; *Roman – Németi* [1986] 210, no. IV. 3; *Németi* [1999] 59, no. 37 XIX d, 101, Fig. 25, 44); Via capătul nordic/Berei szőlő: settlement (*Kacsó* [1972] 32–33, Fig. 1. 3; *Bader* [1978] 121, Pl. VI. 8, 12, 16, 17, 18, Pl. IV. 3; *Roman – Németi* [1986] 210, no. IV. 1; *Németi* [1999] 57, no. 37 XII a, 101, Fig. 25, 44).

Fig. 1.
1. View of Pocsaj–Leányvár from the south-west, 2. view of the Ér Valley from the Leányvár settlement, 3. the protective ditch enclosing the Leányvár settlement

Társziget (settlement);[23] Carei/Nagykároly;[24] Căpleni/Kaplony;[25] Ciumeşti/Csomaköz;[26] Dindeşti–Cetate/Érdengeleg–Várdomb (settlement under the Ottomány tell protected with a ditch and rampart);[27] Foieni/Mezőfény;[28] Ghenci/Gencs;[29] Moftinu Mic–Hanul Messzelátó/Kismajtény–Messzelátó csárda (settlement);[30] Otomani–Cetăţuie/Ottomány–Várhegy (settlement under the Ottomány tell protected with an artificial ditch and a "promontory-like" rampart);[31] Pişcolţ–Nisipărie/Piskolt–Homokos domb (settlement);[32] Portiţa–Horgoş/Portelek–Horgos (settlement);[33] Resighea–

23 *Németi* (1999) 73, no. 49 a3, 102, Fig. 44.

24 Bobald Livada or Bobald I/Bobádi domb: settlement at the base of the Ottomány tell protected with a ditch (*Roman – Németi* [1986] 211, no. VIII; *Németi* [1999] 64, no. 43 Ia, 102, Fig. 44); Bobald VII/Bobald VII: settlement (*Németi* [1999] 66, no. 43 VII.b, 101, Fig. 44); Bobald VIII/Bobald VIII: settlement (*Roman – Németi* [1986] 211, no. 43 VII2; *Németi* [1999] 66, no VIII.b, 102, Fig. 44); Bobald X [spre Sânmiclăuş]/Bobald X: settlement (*Németi* [1999] 66, no. 43 X.c, 102, Fig. 44.); Bobald XI [spre Sânmiclăuş]/Bobald XI: settlement (Németi [1999] 66, no. 43 XI.b, 102, Fig. 44).

25 Cetate, lângă drumul Căminului/Király földek or Vár ("Kuplovár"): circular settlement protected with two ditches and a rampart (*Bader* (1978] 122, Pl. XI. B; *Roman – Németi* [1986] 211, no. VIII1; *Németi* [1999] 78, no 52g1, 102, Fig. 44); Malul canalului Poştei, lângă cimitirul reformat: settlement (*Roman – Németi* [1986] 211, no. VIII2; *Németi* [1999] 77, no 52c2, 102, Fig. 44).

26 Bostănărie/Tökös: urn cemetery (*Ordentlich – Kacsó* [1970] 51–58, Fig. 5; *Roman – Németi* [1986] 210, no. III 1; *Németi* [1996] 30, Fig. 9. 6, Fig. 10. 1; *Németi* [1999] 51, no. 36 II b5, 101, Fig. 25, 44]; Curtea C.A.P.: settlement (*Roman – Németi* [1986] 210, no. III. 3); Grajduri C.A.P. Moara/Malomháta: urn cemetery (*Ordentlich–Kacsó* [1970] 58–59; *Roman – Németi* [1986] 210, no. III. 2; *Németi* [1969] 63; *Németi* [1996] 30, Fig. 9. 4, 7, Fig. 11. 1; *Németi* [1999] 50, no. 36 I a2, 101, Fig. 25, 44); "Lingă pădure": settlement (*Roman – Németi* [1986] 210, no. III. 4); O dună plată or "Păşunea mare"/Nagylapos: settlement (*Németi* [1999] 52, no. 36 VI b,101, Fig. 25, 25, 44).

27 *Roman – Németi* (1986) 211–212, no. X; *Németi* (1999) 25, no. 12 a1 101, Fig 44.

28 Curtea grajdurilor fosta C.A.P. or Cărămidărie: urn burial (*Németi* [1969] 63, Pl. XVI. 2, Pl. XVII. 1–2; *Bader* [1978] 23, 124, Pl. IX. 7; *Roman – Németi* [1986] 210–211, no. V.; *Németi* [1996] 31, Fig. 1. 3; *Németi* [1999] 60, no. 40a1, 101, Fig. 44); Punct trigonometric, hotarul spre Urziceni/Messzelátó: settlement (*Németi* [1999] 62, no 40j3, 101, Fig. 44).

29 Capătul satului spre Carei: settlement (*Németi* [1999] 72, no. 48 i, 102, Fig. 44); Lângă calea ferată Carei–Tiream/ Nagykároly–Mezőterem railway: settlement (*Németi* [1999] 72, no. 48 n1, 102, Fig. 44).

30 *Németi* (1999) 80–81, no. 54 e, 102, Fig. 44.

31 *Bader* (1978) 36, 126; *Roman – Németi* (1986) 212; *Németi* (1999) 34, no. 22a1, 101, Fig. 44.

32 *Németi* (1969) 63, Pl. XVII. 6; *Roman – Németi* (1986) 198–204; *Németi* (1996) 32, 36, Fig. 7. 2–8; *Németi* (1999) 44, no. 33 e4, 101, Fig. 44.

33 *Németi* (1999) 24, no. 10 b1, 101, Fig. 44.

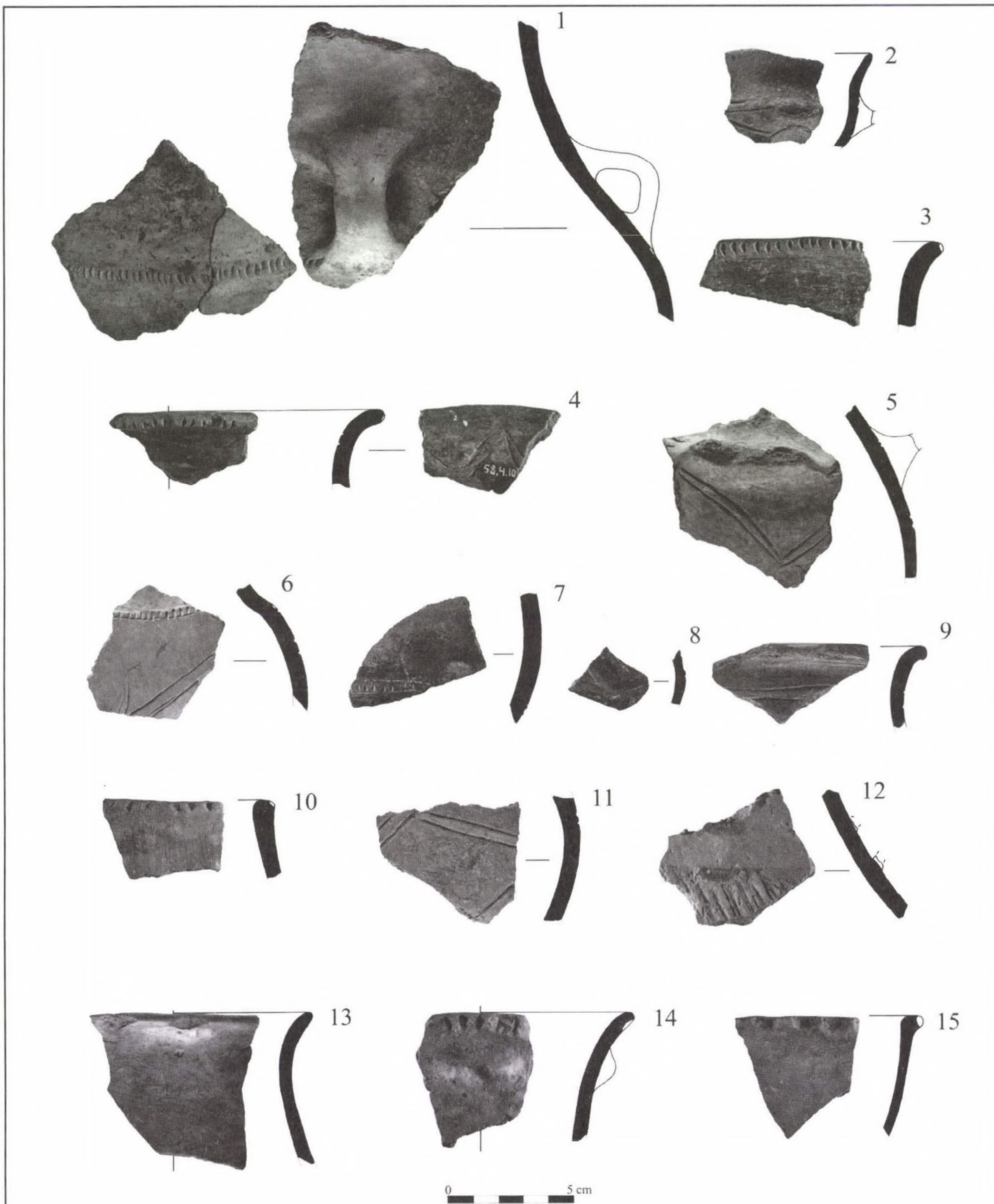

Fig. 2. Selection of finds from János Makkay's 1957 excavation at Pocsaj–Leányvár

Livada/Reszege–Gyümölcsös (settlement);[34] Sanislău/Szaniszló;[35] Săcueni–Cetatea Boului/Székelyhíd–Ökörvár (settlement and an inurned burial under the Ottomámy tell);[36] Sălacea–Dealul Vida or Cetatea/Szalacs–Vida hegy or Várhely (settlement and an inurned burial under the Ottomány tell);[37] Tiream/Mezőterem;[38] Urziceni/Csanálos.[39] It has by now been conclusively proven that the Sanislău/Szaniszló culture can be regarded as the genetic forerunner of the Ottomány culture, known for its tells in this region.[40]

The eastern boundary of all three Early Bronze Age cultures was marked by the Ér Valley, most likely because (a) the eastern Nyírség sandy soil changed into a hard meadow soil in this zone, (b) the Ér Valley, a former Tisza bed, formed a boundary not only pedologically, but also topographically and morphologically, and (c) the cultures, which had originally adapted to an entirely different environment and expanded from the Transylvanian heartland, did not advance beyond this line.

One of the best known sites of the Ottomány culture, which emerged during the transition from the Early to the Middle Bronze Age, is Pocsaj–Leányvár. In 1954, Pálma K. Gnandt collected Bronze Age sherds in the sand pit northeast of Leányvár,[41] and several other finds from the site had reached the Déri Museum[42] before János Makkay's small sounding excavation in 1957 *(Fig. 2)*.[43] The clay wagon model, which made Leányvár one of the best-known sites in Hajdú-Bihar County and the Great Hungarian Plain, comes from this site.

The site lies northeast of Pocsaj on the tip of a promontory-like extension of a sand ridge rising above the one-time floodplain of the Ér *(Fig. 1. 1–2)*. The settlement was protected with a deep ditch *(Fig. 1. 3)*. The survey of the site[44] revealed that the settlement was made up of two parts: a "citadel"-

34 *Németi* (1999) 46, no. 34 e2, 101, Fig. 44.

35 Lângă cimitirul ortodox, stângă drumului spre Horea: settlement (*Németi* [1999] 48, no. 35 h, 101, Fig. 44); Nisipărie/Homokos domb or Homokbánya: settlement and two inurned burials (*Németi* [1969] 63–64, Pl. XVII. 3–5; *Bader* [1978] 127; *Roman – Németi* [1986] 204, no. II, 210, Fig. 7. 9; *Németi* [1996] 32; *Németi* [1999] 66, no. 35 c1, 101, Fig. 44); Pe malul canalului nou săpat, La cca. 250 m de la punctul Ciumeşti–Bostănărie: settlement (*Németi* [1999] 48, no. 35 n2, 101, Fig. 44).

36 *Bader* (1978) 36–37, 39, 128; Pl. XXXII. 11; *Roman – Németi* (1986) 212; *Németi* (1996) 33; *Németi* (1999) 37, no. 25 Cf, 101, Fig. 44.

37 *Bader* (1978) 36, 128; *I. Ordentlich:* Anordnung und Bau der Wohnungen im Rahmen der Otomanikultur in Rumänien. Dacia 12 (1968) 141–153; *Ordentlich* (1971) 28; *I. Ordentlich:* Contribuţia săpăturilor arheologice de pe Dealul Vida (Comuna Sălacea, Jud. Bihor) la cunoaşterea culturii Otomani. Studii şi Comunicări 2 (1972) 63–84; *Roman – Németi* (1986) 212; *Németi* (1996) 33; *Németi* (1999) 34, no. 21 b1, 101, Fig. 44.

38 Cânepişte or Movila Cânepii, and Holmul cânepii/Kendereshalom: settlement under the Ottomány tell (*Roman – Németi* [1986] 211, no. IX; *Németi* [1996] 33–34, Pl. I. 4; *Németi* [1999] 20, no. 8a1, 101, Fig. 44); Valea pârâului Tiream/Teremipatak: settlement (*Németi* [1999] 22, no. 8m1, 101, Fig. 44).

39 Lângă drumul Căminului/Kálmánd: settlement (*Roman – Németi* [1986] 211 no. VI; *Németi* [1999] 63, no. 41 j1, 101, Fig. 44); Nisipărie veche: settlement (*Németi* [1999] 62, no. 41 b, 101, Fig. 44); Valea pârâului "Fabricii de hârtie": settlement (*Németi* [1999] 63, no. 41 i1, 101, Fig. 44).

40 *P. Roman:* Probleme în legătură cu perioada timpurie a epocii bronzului şi începuturile culturii Otomani. SCIVA 35:3 (1984) 272; *Németi* (1996) 36; *Németi J. – Dani J.:* Néhány kora bronzkori sír az Érmellékről (Románia) és a Nyírségből (Magyarország). Adalékok ÉK-Magyarország és ÉNy-Románia kora bronzkorához. JAMÉ 43 (2001) 95–126; *Bóna* (1992) 21, 29; *Sz. Máthé M.:* Adatok az Ottomány-kultúra eredetéhez (Kutatási vázlat). *In:* Történeti és néprajzi tanulmányok. Ed.: Z. Újváry. Debrecen 1994, 27–31; *J. Németi – P. Roman:* Epoca bronzului timpuriu din Nord-Vestul Românei. Satu Mare 1990, 38; *Németi – Roman* (1995) 30; *J. Németi – Zs. Molnár:* Data about the beginning of the tell settlements from the N-W part of Romania. *In:* Studia Archaeologica et Historica Nicolao Gudea dicata. Red.: C. Cosma – D. Tamba – A. Rustoiu. Zalău 2001, 67–93; *Németi J. – Molnár Zs.:* A tell telepek elterjedése a Nagykárolyi-síkságon és az Ér völgyében. Kolozsvár 2002, 74–77.

41 *K. Gnandt:* Pocsaj–Leányvár. ArchÉrt 83 (1956) 97; *Kralovánszky* (1965) 42.

42 The first finds were presented to the Déri Museum in 1912: these were found by Oszkár Asbóth in the ploughland lying by the Leányvár *(Fig. 4. 1–11)*. Other finds from the Leányvár were given to the museum in 1934 by Béla Fekete, a teacher in Derecske (inv. no. IV.1934.19.1–2), and finds from the site were again donated to the museum in 1970. *Löfkovits A. – Ecsedi I. – Zoltai I.*: Jelentés Debreczen sz.kir. város múzeumának 1912-ik évi működéséről és állapotáról. A Múzeum gyarapodása. IV. Régiség és éremtárunk. Debrecen 1913, 16; *Zoltai L.:* Jelenetés a Déri Múzeum 1934. évi működéséről. IV. Érem- és régiségtár. DMÉ (1935) 48–49.

43 Déri Museum (Debrecen), inv. no. 58.4.1–35. *Makkay* (1958) 201; *Kralovánszky* (1965) 41.

44 The survey was conducted by Szabolcs Cifra and the present author on December 6, 2004.

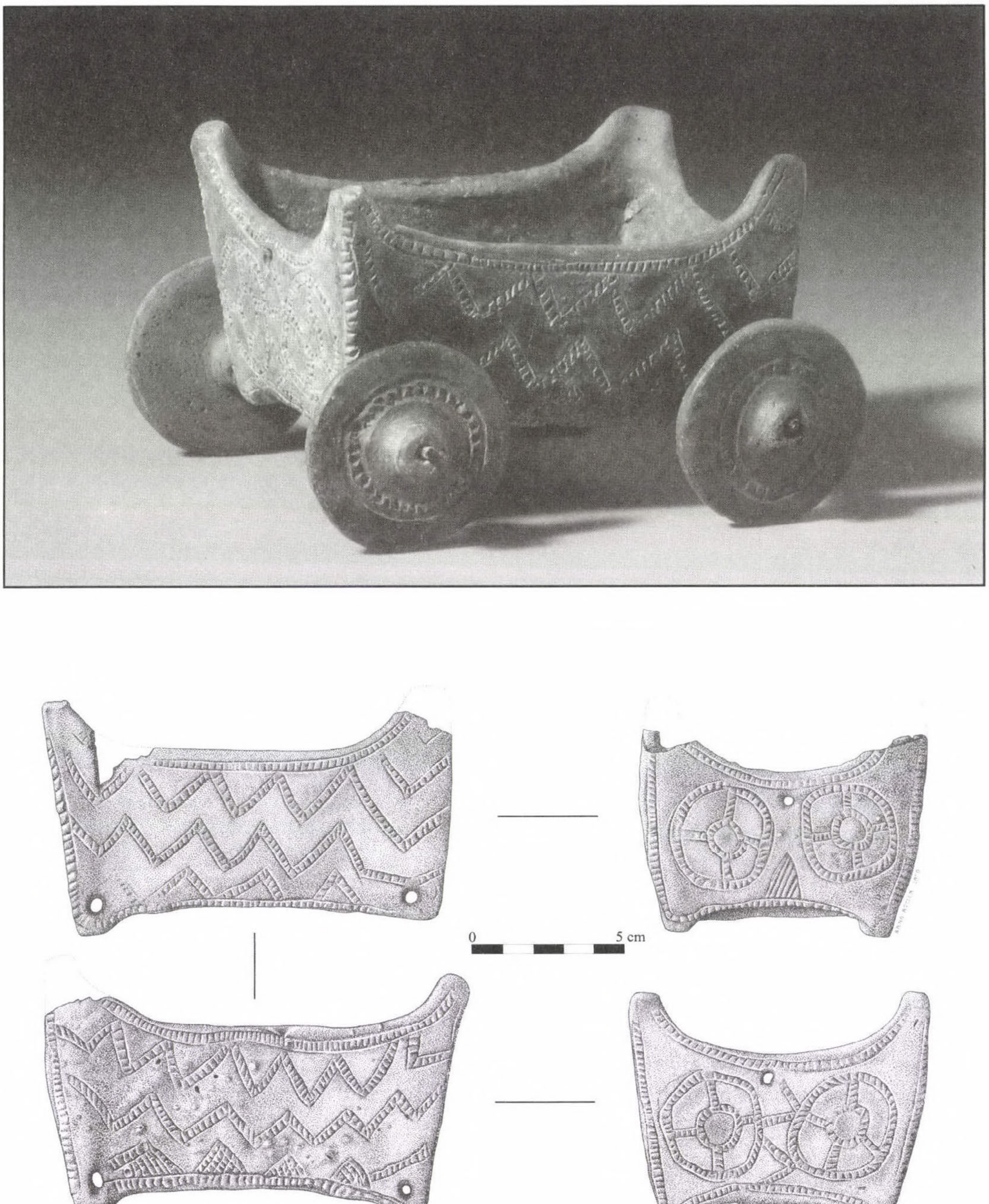

Fig. 3. The clay wagon model found at Pocsaj–Leányvár (after Bóna [1992] Abb. 34 and Mesterházy [1976] Figs 1–2)

like area protected by the ditch and a settlement lying on a low terrace beyond the ditch. The Leányvár was not a simple hillfort, but a tell settlement enclosed within a ditch.

The wagon model donated to the Déri museum in 1966 is decorated with white lime encrusted patterns: a series of hatched triangles and zig-zag lines on the long sides and a pattern of hatched four-spoked wheels, hatched triangles and zig-zag lines on the short sides *(Fig. 3)*. Károly Mesterházy, who first published the wagon model, correctly dated it to the beginning of the Middle Bronze Age and, similarly to István Bóna,[45] he assigned it to the Gyulavarsánd culture.[46] A good analogy to the wagon model from Pocsaj–Leányvár was brought to light during the excavation of the Ottomány tell settlement at Sălacea–Dealul Vida/Szalacs–Vida-domb,[47] suggesting that the specimen from Pocsaj should likewise be culturally assigned to the Ottomány culture.

The remains of red ochre inside the Pocsaj wagon model imply that it was not an article used in daily life (e.g. a toy). The two perforations under the rim on the short sides may have served for suspending this ritual object.[48] The interpretation of the wagon model as a ritual object is supported by the clay wagon model found in a child burial of the Košťany–Füzesabony culture at Nižná Myšľa/Alsómislye,[49] which perhaps symbolised the journey/transportation of the deceased to the otherworld.

Clay wagon models had earlier been recovered exclusively from settlements.[50] Most of these sites were fortified tell settlements, representing the upper tier of the settlement hierarchy.[51] It may thus be assumed that wagon models were perhaps part of the cult paraphernalia of a tribal sanctuary in the major settlements, which functioned as central places.

In 1970, József Kiss donated an intact one-handled cup decorated with channelled bosses to the Déri Museum *(Fig. 4. 12)*.[52] Its intact state suggests that it came from a burial in the cemetery belonging to the settlement.

The finds presented to the Déri Museum in 1912 *(Fig. 4. 1–11)*[53] and the recent survey of the site indicated the presence of an outer horizontal settlement in an area called Nagy-tatár. The museum's archaeological holdings also contain Middle Bronze Age pottery sherds from Kopaszdomb, another location on the village's outskirts.

The Pocsaj area is considered to be the gateway to the Ér Valley. This is not mere chance for this area can be regarded as linking[54] the Ottomány tells dotting the marshy Berettyó Valley[55] and the similar Ottomány settlements in the marshy, waterlogged Ér Valley.[56]

45 *Bóna* (1992) 74, Abb. 34.

46 *Mesterházy* (1976) 223, Figs 1–5.

47 *I. Ordentlich – N. Chidioşan:* Cărucioare miniatură din lut aparţinînd culturii Otomani (epoca bronzului) de pe teritoriul României. Crişia 5 (1975) 27–44, Pl. II. 1–2.

48 *Mesterházy* (1976) 229.

49 *K. Olexa – D. Gašaj:* Nižná Myšľa v dobe bronzovej. I. Košice 1996, 20; *D. Gašaj:* Fortified settlements and their economic life. *In:* Między Mykenami a Bałtykiem. Kultúra Otomani-Füzesabony – Between Mycenae and the Baltic sea. The Otomani-Füzesabony culture. Ed.: J. Gancarski. Krosno–Warszawa 2002, 49, Fot. 55.

50 *Mesterházy* (1976) 229.

51 *Bóna* (1992) 74.

52 Déri Museum (Debrecen), inv. no. 70.11.1.

53 Déri Museum (Debrecen), inv. no. IV.1912.157.1–11.

54 *Sz. Máthé* (1988) Fig. 1.

55 Túrkeve–Terehalom, Bakonszeg–Kádárdomb, Berettyóújfalu–Szilhalom, Berettyószentmárton–Korhány, Berettyóújfalu–Herpály-Földvár, Gáborján–Csapszékpart, Esztár–Fenyvesdomb.

56 Săcueni – Cetatea Boului/Székelyhíd–Ökörvár, Otomani–Cetăţiua/Ottomány–Várhegy, Otomani–Înainte de insulâ/Ottomány–Elősziget, Sălacea–Dealul Vida/Szalacs–Vida-domb, Dindeşti–Cetate/Érdengeleg–Vár, Pir–Cetate/ Szilágypér–Vársziget, Tiream–Holmul cânepii (Movila cânepii) or Cânepişte/ Mezőterem–Kendereshalom, Carei–Bobald Livada or Bobald I/Nagykároly–Bobádi-domb.

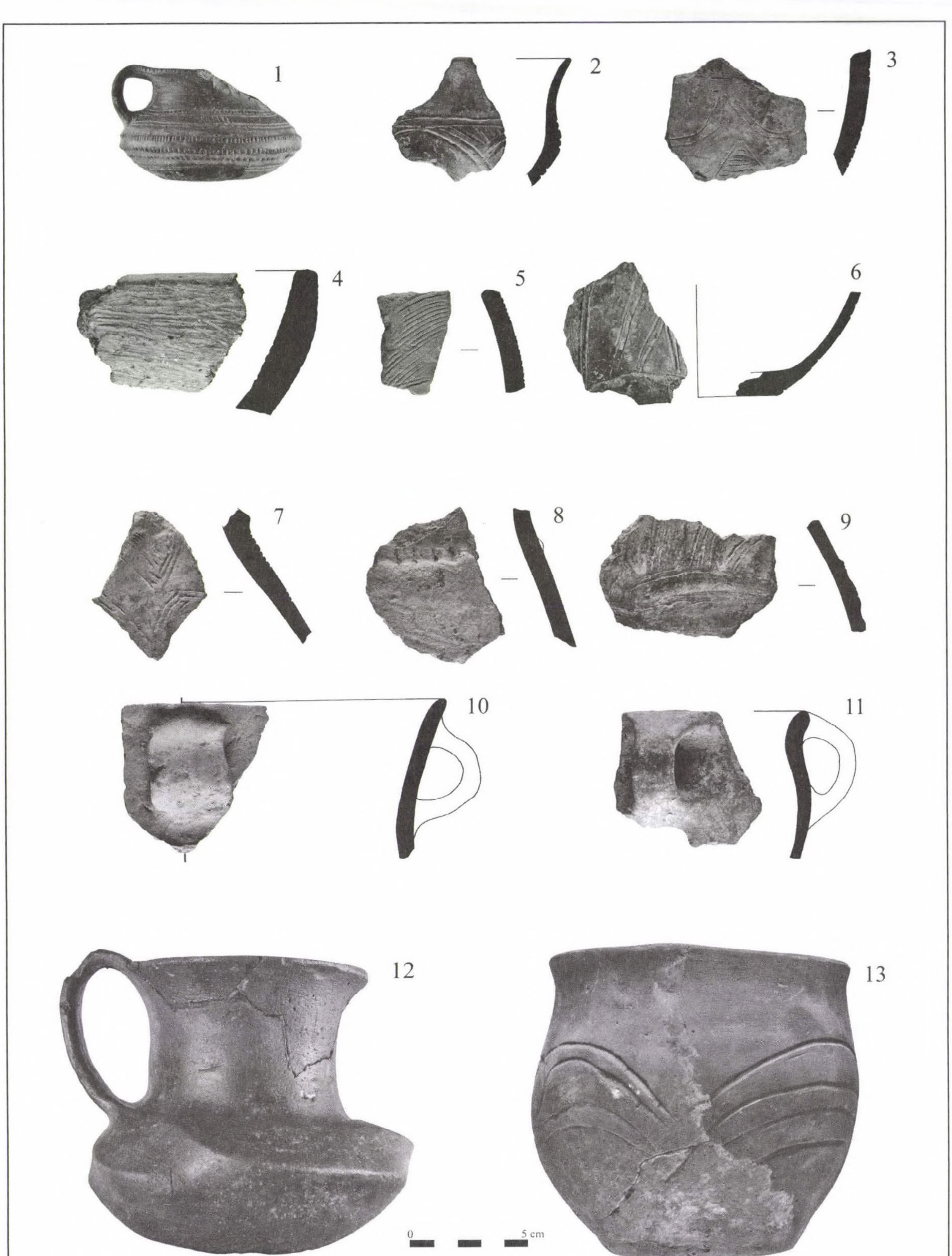

Fig. 4.
1–11. Finds from the ploughland beside the Leányvár settlement presented to the Déri Museum in 1912 (Oszkár Asbóth's gift), 12. cup from the Leányvár settlement presented to the museum in 1970, 13. vessel from the Leányvár settlement presented to the museum in 1982

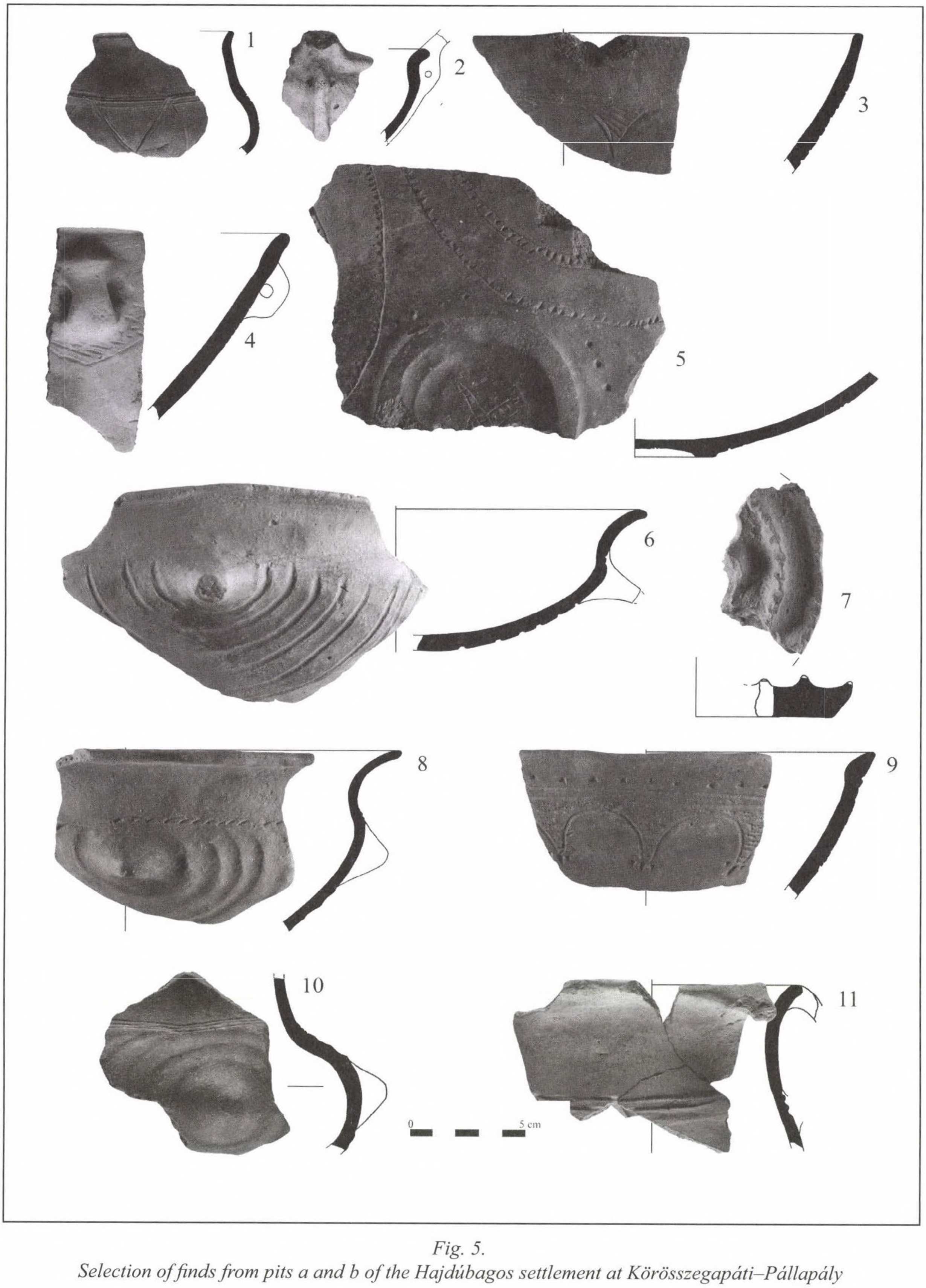

Fig. 5.
Selection of finds from pits a and b of the Hajdúbagos settlement at Körösszegapáti–Pállapály

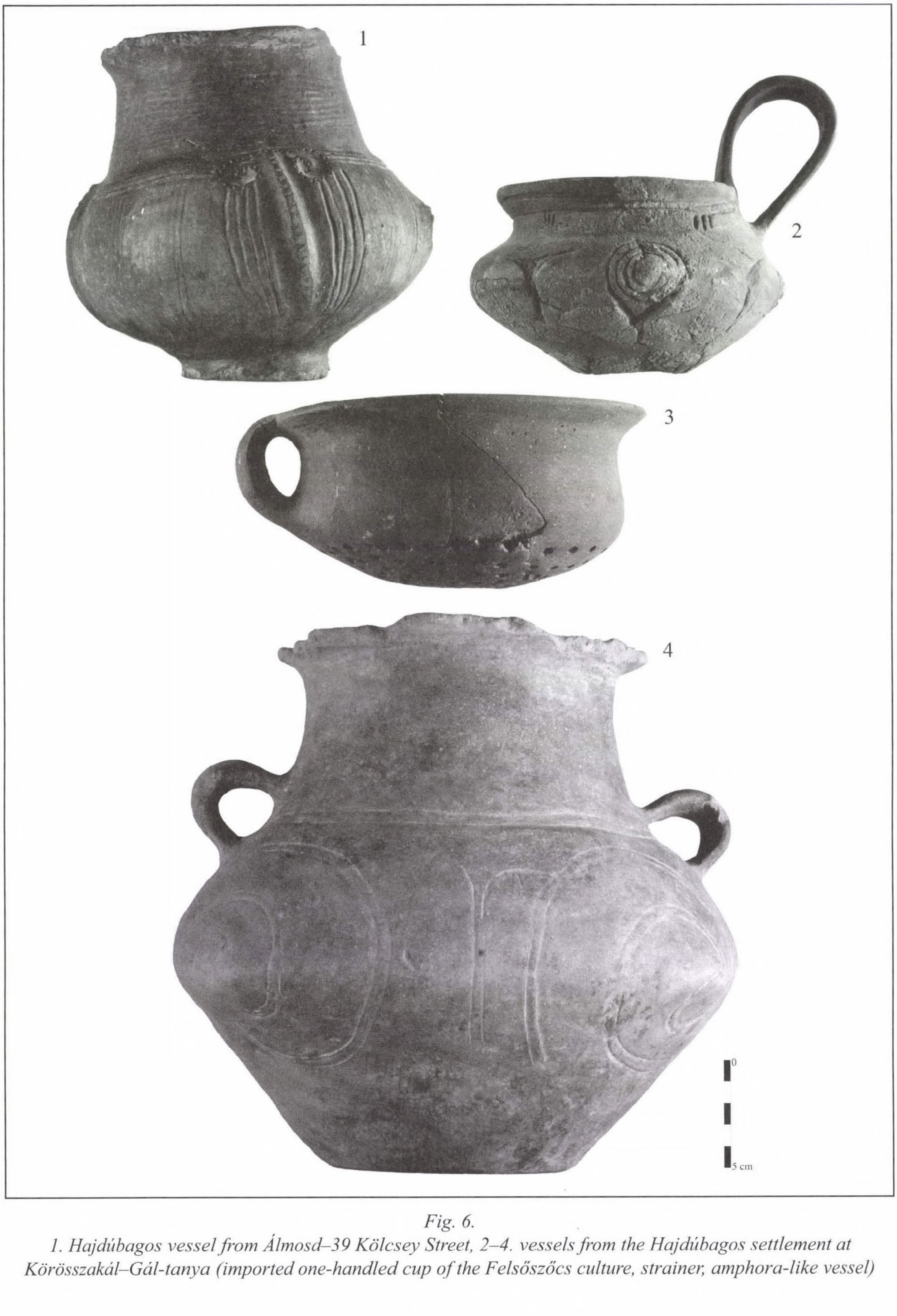

Fig. 6.
1. Hajdúbagos vessel from Álmosd–39 Kölcsey Street, 2–4. vessels from the Hajdúbagos settlement at Körösszakál–Gál-tanya (imported one-handled cup of the Felsőszőcs culture, strainer, amphora-like vessel)

Burials of the Ottomány culture have been uncovered at Berettyóújfalu–Szilhalom (inurned cremation burials),[57] Berea–Colina cu măcriş /Bere–Sóskás (two inhumation graves)[58] and Ciumeşti–Bostănărie/Csomaköz–Tökös (grave 3/1964, a contracted inhumation burial).[59]

Not far from Pocsaj lies the Middle Bronze Age tell settlement of Esztár–Fenyvesdomb (or Fenyvespart), some 300 m from the present course of the Berettyó.[60] The site was first identified by János Makkay during his field survey in the Berettyó Valley;[61] finds from this site reached the Déri Museum from the late 1950s. The occupation levels were disturbed by a medieval building (most likely a church) and Márta Sz. Máthé, who excavated the site, could only separate the main occupation levels of the island-like tell enclosed within a ditch.[62] The use-life of the settlement could not be precisely determined owing to the medieval intrusions. It would appear that the settlement was founded in the Ottomány II (Gyulavarsánd) period and that its occupation extended into the Koszider period marking the end of the Middle Bronze Age, at least judging from the finds recovered from the upper levels.

The Hajdúsámson hoard horizon representing the metalwork of the flourishing tell cultures can be correlated with the classical phase of the Middle Bronze Age (Reinecke Br A2). The finds in the collection of the Nagyvárad museum include a Hajdúsámson–Apa type sword from Bihar County, which was found together with a dagger with rounded hafting plate with four rivets and a ribbed, willow leaf shaped blade.[63] Middle Bronze Age stray finds are also known from Esztár–Körtvélyesi domb[64] and Esztár–Viráglapos-major.[65] The finds from the latter include Koszider period pottery, similarly to the assemblages from Esztár–Fenyvesdomb. The burials of this period are represented by the burials uncovered at the tell settlements of Tiream–Cânepişte/Mezőterem–Kendereshalom[66] and Pir–Cetate/Szilágypér–Vár.[67] The deceased were inhumed[68] at both sites and they were provided with a rich assortment of pottery.

The hoards from Gepiu/Gyapjú or Roşiori/Biharfélegyháza,[69] and Sînnicolau Român/Oláhszentmiklós[70] in the Ér Valley can be dated to the Koszider and the ensuing Tumulus period.

The Koszider period (Reinecke Br B1) marked the end of the oft-described tendency towards homogenisation in the artefactual material[71] and of the flourishing political, economic and spiritual life organised by the regional centres in the tell settlements. Beside the transformation of the material culture, changes can also be noted in settlement patterns and, often, in mortuary practices. Tells indicating a

57 *Sz. Máthé* (1988) 33, 35–36, Fig. 11, Pl. 27:5–6. In addition to the two inurned burials, two other scattered cremation burials without any grave goods were also uncovered.

58 Grave 1/1962 contained twelve vessels, Grave 2/1962 contained eight vessels. *Németi* (1969) 57–60, Pl. X. 1–5, Pl. XI. 1–7, Pl. XII. 1–7; *Németi* (1996) 29, Pl. I. 3–7, 9, Fig. 1. 2, Fig. 4, Fig. 6. 2, Fig. 7. 1.

59 *Németi* (1969) 60–62, Pls XIII–XV; *Németi* (1996) 30, Pl. I. 8, Fig.1. 1, Fig. 2, Fig. 3, Fig. 5, Fig.6. 3.

60 Middle Bronze Age finds from Esztár–Földvár can be found in the Archaeological Collection of the Déri Museum under inv. no. 59.11.1–13. It seems likely that the Földvár site is identical with the Fenyvesdomb tell settlement.

61 *Makkay* (1957) 33, Site 69.

62 *Sz. Máthé* (1988) 36–37, Fig. 17.

63 *Mozsolics* (1967) 130, Taf. 66. 1; *Petrescu-Dîmboviţa* (1977) 41, Pl. 5. 1–2, harta 1/5.

64 Déri Museum (Debrecen), inv. no. 65.33.1 and 65.59.2; The site appears under no. 95 in János Makkay's survey report (*Makkay* [1957] 30).

65 Déri Museum (Debrecen), inv. no. 65.60.1.

66 Two north-north-west by south-south-east oriented contracted inhumation burials. *Németi* (1969) 64–65, Pl. XVIII. 1–9; *Németi* (1996) 33–34, 37.

67 *Németi* (1996) 31–32, 36; *Zs. Székely:* Aşezările şi necropola culturii Otomani de la Pir (Judeţul Satu Mare). Thraco-Dacica 21 (2000) 103–146.

68 There was one cremation burial in the Pir/Szilágypér cemetery. A pythos burial containing the skeleton of a child was also found here.

69 *Mozsolics* (1967) 139, Taf. 61. 1; *Petrescu-Dîmboviţa* (1977) 43, Pl. 7. 9, Pl. 8, harta 1/10. The site appears as Gyapjú in Mozsolics's monograph and as Biharfélegyháza in Petrescu-Dîmboviţa's study.

70 *Petrescu-Dîmboviţa* (1977) 44, Pl. 11. 5–8, Pl. 12. 1–2, harta 1/14.

71 *T. Kovács:* The Bronze Age in Hungary. Budapest 1977, 16–17; *Bóna* (1992) 32–38; *Csányi M.:* Bronzkor. *In:* Szolnok megye a népek országútján. Szolnok megye története a régészeti leletek tükrében. Ed.: P. Raczky. Szolnok 1982, 43; *Csányi M. – Tárnoki J.:* Bronzkori tell-telepek a Közép-Tisza-vidéken. *In:* Vendégségben őseink háza táján. Állandó régészeti kiállítás a szolnoki Damjanich János Múzeumban. Ed.: L. Madaras. Szolnok 1996, 35–36; *V. Szabó* (1999) 62–65; *I. Poroszlai:* The Koszider period. *In:* Hungarian archaeology at the turn of the millennium. Ed.: Zs.Visy. Budapest 2003, 161.

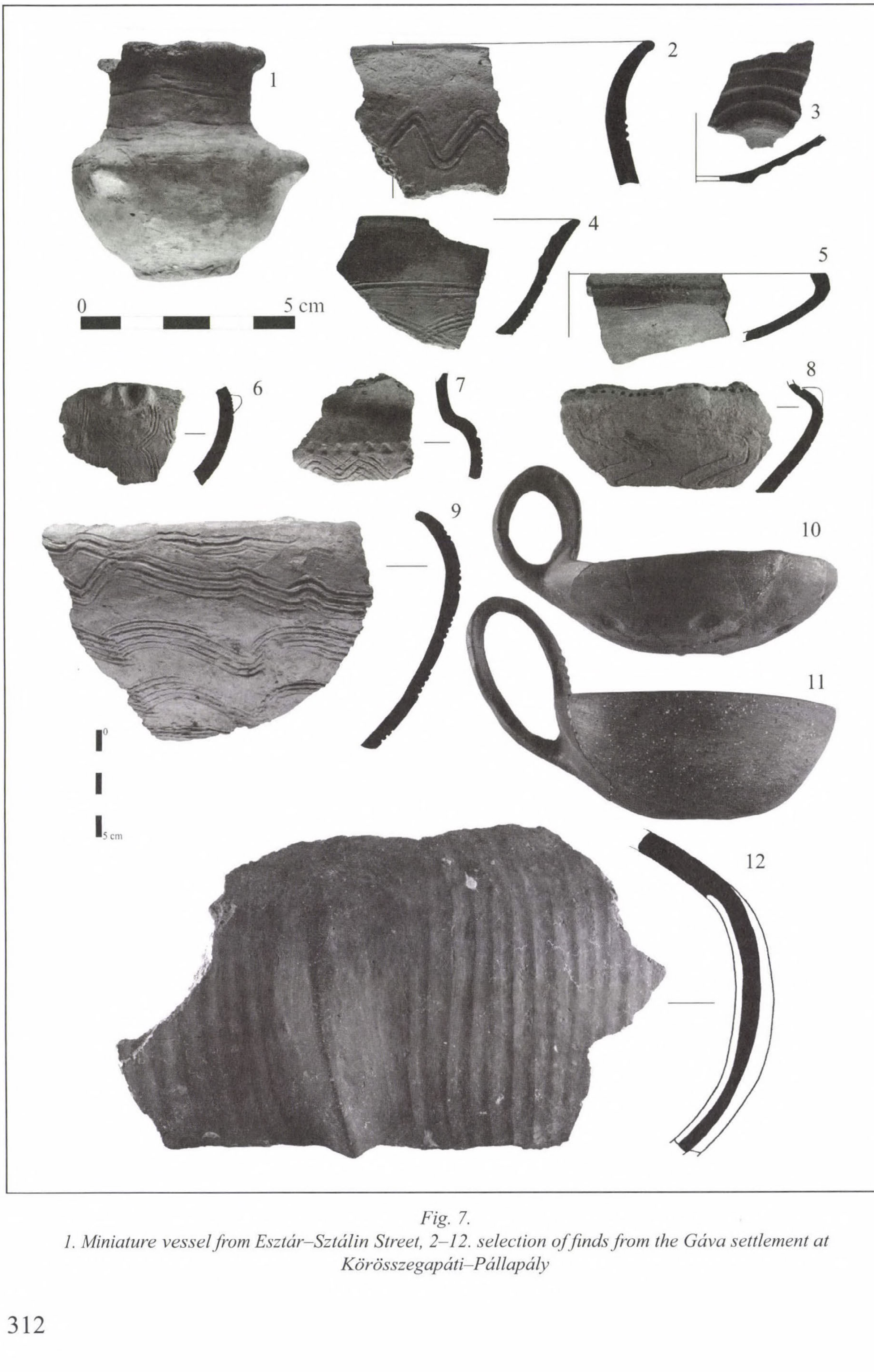

Fig. 7.
1. Miniature vessel from Esztár–Sztálin Street, 2–12. selection of finds from the Gáva settlement at Körösszegapáti–Pállapály

sedentary life-style disappear, to be replaced by extensive single layer settlements reflecting more mobile lifeways. The Pocsaj area became part of the Hajdúbagos distribution; this group was named after the site of the urn cemetery excavated by Lajos Zoltai in 1909.[72] The pottery of the Hajdúbagos group is coloured by elements of both Tumulus wares and the ceramic traditions of the late Koszider population, which had abandoned its earlier tell settlements. In view of the many common elements, Tibor Bader had earlier labelled this period Ottomány/Otomani IV, in order to bolster his theory of a continuous development.[73] The Hajdúbagos group is a regional variant of the Tumulus culture; in Romania, however, the group has been labelled Pişcolţ–Cehăluţ/Piskolt–Magyarcsaholy group after the find assemblages from the Romanian section of the Ér Valley.[74] This period can be correlated with Reinecke's Br B2–C phase and spans the period between 1400–1300 BC. Settlement finds are known from Pişcolţ–Nisipărie Piskolt-Homokos domb, recovered from pits.[75]

A typical vessel of the Hajdúbagos group was found north of Pocsaj in the western end of the Ér Valley at Álmosd–39 Kölcsey Street, which probably came from a burial *(Fig. 6. 1)*. Other finds include the assemblages from Körösszegapáti–Pállapály (pits a, b and c; *Fig. 5*) uncovered by Sándor Monok,[76] which are now part of the archaeological collection of the Déri Museum. Another Hajdúbagos vessel was found together with a characteristic one-handled cup of the Felsőszőcs culture *(Fig. 6. 2, 4)* at Körösszakál–Gál-tanya during sand mining.[77] The miniature vessel imitating a Tumulus culture urn from Esztár–Sztálin Street *(Fig. 7. 1)* most likely dates from this period.[78]

The burials of the Hajdúbagos group from the Ér Valley are known from Ciumeşti–Bostănărie/ Csomaköz–Tökös (Grave 6/1964, an inurned burial),[79] Sanislău–Păşună/Szaniszló–Legelő (an inurned burial),[80] and Valea lui Mihai/Érmihályfalva–Breslelor Street.[81] According to János Németi, the vessels found at Valea lui Mihai–"Groapa cu lut"/Érmihályfalva–"Agyaggödör" had perhaps been the grave goods of an urn burial.[82]

No finds dating from the Reinecke Br D, the so-called pre-Gáva period, are known from the Pocsaj area.[83] The type finds of this period were earlier labelled Berkesz–Demecser group in the eastern part

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72 *Zoltai L.:* Jelentések Múzeumunk 1909. évi ásatásairól. Jelentés Debreczen sz. kir. város múzeuma 1909. évi állapotáról. II. Ásatás a hajdúbagosi Daraboshegyen (Bronzkori urnatemető). Debrecen 1910, 34–40; *T. Kovács:* A hajdúbagosi bronzkori temető. FolArch 21 (1970) 27–47.

73 *Bader* (1978) 62.

74 *C. Kacsó:* Bronzul tîrziu în nord-vestul României. Symposia Thracologica 8 (1990) 42–43; *Kacsó* (1997a); *C. Kacsó:* Die Endphase der Otomani-Kultur und die darauffolgende kulturelle Entwicklung im Nordwesten Rumäniens *In:* Kultúra Otomani-Füzesabony. Rozwój, chronológia, gospodarka. Materiały z konferencji archeologicznej Dukla, 27–28.11.1997. Red.: J. Gancarski. Krosno 1999. 85–112; *Németi* (1978); *Németi* (1999) 125–126, 172.

75 *Németi* (1978) 106–114, Fig. 3. 2, 4–5, Fig. 6. 10, Fig. 11. 1–2, 4–5.

76 *M. Nepper – Sz. Máthé* (1987) 56, Fig. 18.

77 *Ibidem* 51, Fig. 16.

78 Déri Museum (Debrecen), inv. no. 59.12.1.

79 *Németi* (1969) 62, Fig. 2. 2, Pl. XI. 8; *Németi* (1996) 30, 37, Fig. 5.

80 *Németi* (1978) 114, Fig. 5. 3–4; *Németi* (1996) 33, 37, Fig. 9. 5.

81 *Németi* (1996) 37.

82 *Németi* (1978) 115, Fig. 4. 1–4; *Németi* (1996) 37.

83 Our knowledge of this period has been greatly enriched by Gábor V. Szabó's research. *V. Szabó G.:* A Csorva-csoport és a Gáva-kultúra kutatásának problémái néhány Csongrád megyei leletegyüttes alapján. MFMÉ–Studia Archaeologica 2 (1996) 9–109; *V. Szabó* (1999) 66–68; *V. Szabó* (2003) 163–164.

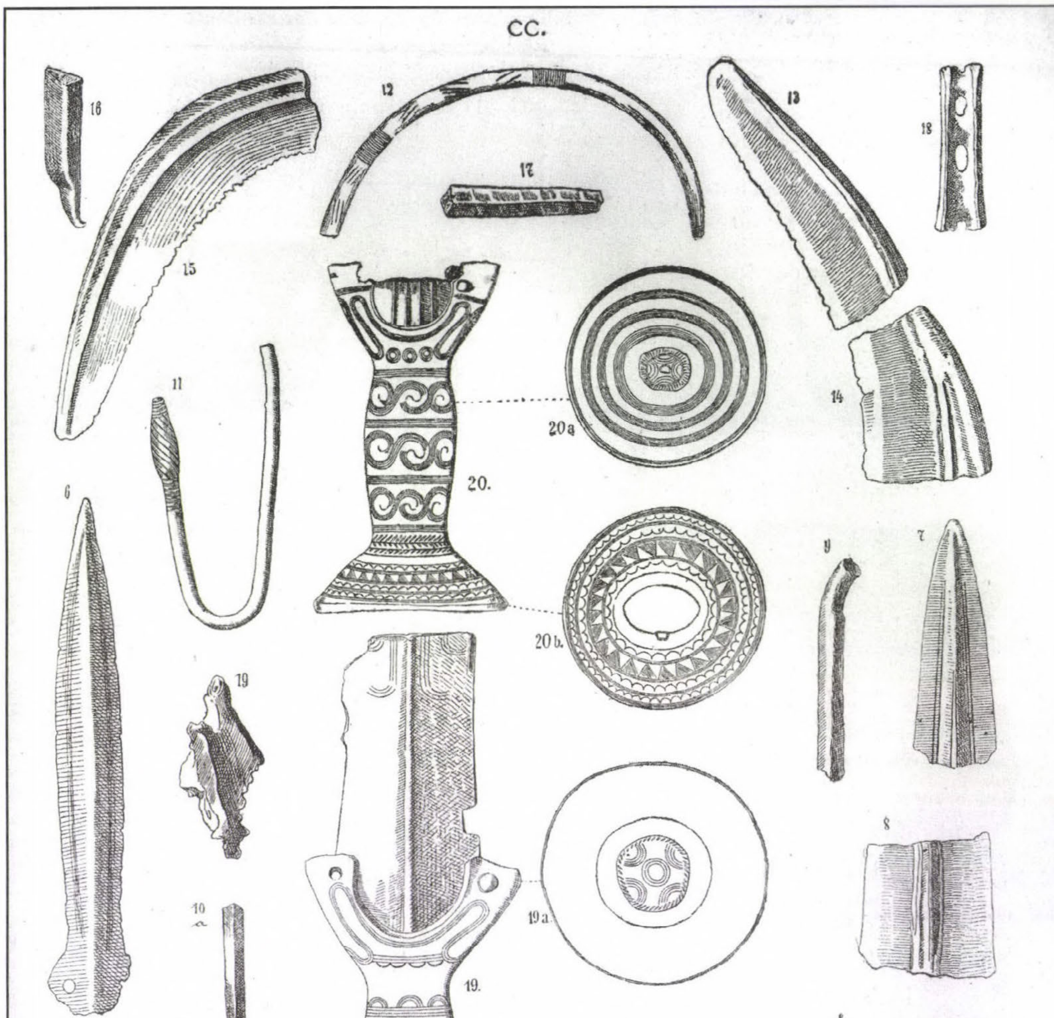

Fig. 8. The so-called "Kaszapuszta" bronze hoard (finds from Pocsaj–Kaszapuszta and Bihardiószeg [Diosig]; after Hampel [1896] Taf. CC)

of the Great Hungarian Plain.[84] The Igriţa group inhabiting the caves in the Rapid Körös Valley on the other side of the border can be roughly dated to this period.[85]

A number of sites representing the Ópályi and Uriu–Domaneşti hoard horizon (Mozsolics B IV b) are known from the Ér Valley and the Berettyó region. The hoards containing the metalwork of this period were chiefly found on the other side of the border with Romania: Căuaş/Érkávás hoards I and II,[86] Valea lui Mihai/Érmihályfalva hoards I and II,[87] Mişca/Micske,[88] Tîrguşor/Asszonyvására,[89] Cherechiu/Kiskereki[90] and Ciocaia/Csokaly.[91] The articles in these hoards range from jewellery (bracelets and amulets) to implements (sickles) and weapons (pickaxes, socketed axes and swords).

Several gold hoards of the Ópályi hoard horizon (containing chiefly bracelets with double spiral or simple tapering terminals) are known from the area: Biharkeresztes–Railway Station,[92] Căuaş/Érkávás,[93] Marghita/Margitta,[94] Oradea/Nagyvárad,[95] Săcueni/Székelyhíd,[96] Pericei/Szilágyperecsen,[97] Firiteaz/Féregyháza,[98] Hajdúszoboszló[99] and Nyíracsád.[100] The chronology of these gold bracelets with double spiral terminals is slightly problematic for the first specimens were made in the Late Bronze Age (13th–12th centuries BC) and they survived into the Early Iron Age (8th century BC, pre-Scythian Age), albeit in a slightly changed form.[101]

The interpretation of the various groups blending post-Koszider and Tumulus traditions in the area east of the Tisza during the Reinecke Br B2–D period is no easy task in view of the rather chaotic terminology which, as Nikolaus Boroffka has wryly remarked, is a dire consequence of a tendency to name a new group after each new site. In contrast to other prehistorians, he emphasised the common traits linking these groups and proposed an interpretation resembling T. Bader's Otomani IV, the impli-

84 *T. Kovács:* Eastern connections of North-Eastern Hungary in the Late Bronze Age. FolArch 18 (1967) 27–58.

85 *I. Andriţoiu:* Civilizaţia tracilor din Sud-Vestul Transilvaniei în epoca bronzului. Bucureşti 1992, 69–72; *I. Emődi:* Necropola de la sfîrşitul epocii bronzului din peştera Igriţa. SCIVA 31:2 (1980) 229–273; *I. Emődi:* Descoperiri din epoca bronzului din Peştera Mişidului. Crişia (1995) 9–21; *I. Emődi:* Descoperiri de la sfârşitul epocii bronzului din Peştera Ungurului (jud. Bihor). ActaMusNap 34 (1997) 485–503; *N. Chidioşan – I. Emődi:* O descoperire de la sfîrşitul epocii bronzului şi începutul Hallstattului în peştera Mişidului, com. Şuncuiuş, jud. Bihor. Thraco-Dacica 2 (1981) 161–167; *N. Chidioşan – I. Emődi:* Grupul cultural Igriţa de la sfîrşitul epocii bronzului. SCIVA 33:2 (1982) 287–293; *N. Chidioşan – I. Emődi:* Descoperirile arheologice din peştera Izbîndiş (comuna Şuncuiuş) aparţinînd grupului cultural Igriţa. Crişia 13 (1983) 17–32; *D. Ignat:* Aşezarea de la sfîrşitul epocii bronzului de la Suplacu de Barcău (jud. Bihor). Crişia 14 (1984) 9–26; *I. Andriţoiu:* Consideraţii asupra materiale arheologice aparţinînd bronzului tîrziu descoperite în împrejurimile Devei. Sargetia 16–17 (1983) 125–137. In János Németi's view, the Igriţa group betrays cultural impacts from the south (Cruceni–Belegiş culture) and is slightly later than the sites yielding Hajdúbagos finds (*Németi* [1999] 173).

86 *Mozsolics* (1973) 131; *Petrescu-Dîmboviţa* (1977) 54, Pl. 30. 6–9, harta 2/15.

87 *Mozsolics* (1973) 131–132, Taf. 46; *Petrescu-Dîmboviţa* (1977) 72, 118–119, Pl. 72. 1–4, Pl. 275. 8–11, Pl. 276, harta 2/86, harta 3/75. It must here be noted that while Amália Mozsolics and Mircea Petrescu-Dîmboviţa agree as regards the date of hoard II, they differ on the chronological position of hoard I: Mozsolics assigned it to the Ópályi horizon, while Petrescu-Dîmboviţa to the later Cincu–Suseni (Ha A1) horizon.

88 *Petrescu-Dîmboviţa* (1977) 64, Pl. 55. 12–25, Pl. 56. 1–20, harta 2/54.

89 *Ibidem* 70, Pl. 66. 1–6, harta 2/77.

90 *Ibidem* 55, harta 2/17.

91 *Ibidem* (1977) 55, Pl. 33/2–7, harta 2/18.

92 *Mozsolics* (1973) 191, Taf. 100; *Kemenczei* (1999) 63–79, Kat. 42.

93 *Mozsolics* (1973) 193, Taf. 95. 3.

94 *Ibidem* 199.

95 *Ibidem* 200, Taf. 83–85, Taf. 86. 4–9; *Kemenczei* (1999) 66, Abb. 38–39, Kat. 51.

96 *Mozsolics* (1973) 206, Taf. 95, 1.

97 *Ibidem* 206, Taf. 101. 1; *Kemenczei* (1999) Kat. 55.

98 *Mozsolics* (1973) 194, Taf. 78. 1–5, Taf. 79. 1–6, Taf. 80. 1; *Kemenczei* (1999) 66–67, Abb. 37, Kat. 50.

99 *Mozsolics* (1973) 195, Taf. 101. 2; *Kemenczei* (1999) Kat. 44.

100 *Mozsolics* (1973) 201, Taf. 99. 1–3; *Kemenczei* (1999) 64, Abb. 34, Kat. 43.

101 *T. Kemenczei:* Zu früheisenzeitlichen Goldfunden aus dem Karpatenbecken. *In:* Handel, Tausch und Verkehr im Bronze- und Früheisenzeitlichen Südosteuropa. Hrsg.: B. Hänsel. München–Berlin 1995, 333–335, 342, Abb.5–6; *Kemenczei* (1999) 67–70.

cation being that the common denominator of these groups is the lingering influence of the Ottomány culture.[102]

From the Ha A1 period, the close of the Bronze Age, to the end of the Ha B period, the Pocsaj area was part of the Gáva distribution, extending from the Upper Tisza region and the Transylvanian heartland to the southern part of the Great Hungarian Plain.[103] Stray finds of this culture have been found at Körösszegapáti–Pállapály *(Fig. 7. 2–12)*,[104] Esztár–Kiserdő,[105] Esztár–Viráglapos major, Hencida–Zöldfa Street,[106] Nagykereki[107] and Bagamér–Szőlőskert.[108] The Gáva culture established its extensive, single layer settlements on the islets ringed by the marshland of the Ér in the river valley.[109]

The metalwork of the Gáva culture, produced on an almost industrial scale in the bronzeworking centres of the Upper Tisza region and Transylvania, is known from a series of hoards. One of these, found in 1893 at Pocsaj–Kaszapuszta (dated to Ha A1), reached the Hungarian National Museum and was published by József Hampel in his first monograph on the Hungarian Bronze Age.[110] Containing sixteen mostly broken artefacts, the hoard was probably a founder's hoard intended for re-melting. Amália Mozsolics assigned this hoard to the Kurd horizon (B Vb) *(Fig. 8)*.[111] The bronze situla found at Hosszúpályi in 1904 comes from the same period,[112] as do the bronze hoards from Biharia/Bihar,[113] Cheşereu/Érkeserű,[114] Cubulcut/Érköbölkút[115] and Sînnicolau de Munte/Hegyközszentmiklós.[116]

Amália Mozsolics assigned the hoard from Gáborján–Kásásmajor[117] and the two cup-hilted swords from Nagyvárad[118] to the slightly later Gyermely horizon (B Vc). She distinguished two cup-hilted swords and two broken sword blades among the bronze articles brought to light at Kaszapuszta,[119] which in her opinion probably originated from Diosig/Bihardiószeg and could be assigned to the Hajdúböszörmény hoard horizon (Mozsolics B VIa).[120]

In Romania, the hoards contemporary with the Hajdúböszörmény horizon (Ha B1) from the Romanian section of the Ér Valley were assigned to the Moigrad–Tăuteu horizon: these include the hoard containing a one-handled bronze cup and a bronze helmet identical to the one from Hajdúböszörmény found at Pişcolt–Via veche/Piskolt–Ószőlő,[121] and the depot finds from Săcueni/Székelyhíd[122] and Sălard/Szalárd.[123]

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102 *N. Boroffka:* Probleme der späten Otomani-Kultur. *In:* Kultúra Otomani-Füzesabony – rozwój, chronológia, gospodarka. Materiały z konferencji archeologicznej Dukla, 27–28.11. 1997. Hrsg.: J. Gancarski. Krosno 1999, 113–129.
103 *V. Szabó* (2003) 163.
104 Stray settlement find. Uninventoried, in the collection of the Déri Museum (Debrecen).
105 *Kemenczei* (1984) 155, Nr. 35.
106 *Ibidem* 156, Nr. 46.
107 *Ibidem* 159, Nr. 80.
108 *Ibidem* 152, Nr. 5.
109 *J. Németi:* Descoperiri de la începutul Hallstattului în zona Careiului. Satu Mate 1981–82; *Németi* (1999) 107–108, 126, 173, Fig. 47. One of the largest settlements is Căuaş/Sighetia–Érkávás/Sziget.
110 *Hampel* (1896) Taf. CC.
111 *Mozsolics* (1985) 177.
112 *Ibidem* 129, Taf. 190.5.
113 *Petrescu-Dîmbovița* (1977) 84, Pl. 118. 2–20, harta 3/6.
114 *Ibidem* 88, Pl. 128. 5–9, harta 3/19.
115 *Ibidem* 90–91, Pl. 134. 5–14, harta 3/25.
116 *Ibidem* 107, Pl. 186. 11–13, harta 3/62.
117 *Mozsolics* (1985) 120–121; *M. Nepper I. – Sz. Máthé M.:* A Hajdú-Bihar megyei múzeumok régészeti tevékenysége 1977–1980. DMÉ (1983) 95–115.
118 *Ibidem* 156.
119 József Hampel described finds which had reached the museum on several different occasions as coming from the same hoard.
120 *Mozsolics* (1985) 177.
121 *Petrescu-Dîmbovița* (1977) 132, Pl. 314. 4–5, harta 5/21.
122 *Ibidem* 133, Pl. 315. 3–26, harta 5/25.
123 *Ibidem* 133–134, Pl. 316–317, Pl. 318. 1–6, harta 5/26.

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THE KELEMÉR AREA IN THE IRON AGE AND THE ROMAN PERIOD

Magdolna B. Hellebrandt

Throughout history, man has sustained himself by exploiting the surrounding plant and animal world, by cultivating and breeding, in order to gain some of the materials for his clothing and home. Rocks and metals, the raw materials for his tools, too were drawn from the surrounding world.

The north-eastern regions of Hungary, the mountainous area encompassed by the Sajó, Szuha and Bódva rivers, where mountains rise to over 300 m on the average, played a key role in the Iron Age, the last millennium of prehistory. The importance of the area lies in the abundance of its metal and mineral resources. Copper was mined at Rudabánya many centuries earlier.[1] The high number and richness of bronze finds around Szendrő and Szendrőlád indicate a flourishing bronze metallurgy and an organised society, as well as an active commodities trade.[2] Hillforts and earthen forts ensured control over ore deposits. Rising above the surrounding floodplain, these strongholds – which undoubtedly also functioned as political and trade centres – form a chain in the mountain foreland. Enormous quantities of wood were used for their construction. These forts are the following from west to east *(Fig. 1)*.

The remains of an omega shaped fort enclosed by a ditch and rampart on the Rima bank near Lenartovce/Lénártfalva north-west of Bánréve in Slovakia can be made out on aerial photos.[3]

The fort at Putnok–Pogonyipuszta stands at the western entrance of the Putnok Valley, where the road along the Kelemér Stream led towards the mountains to Imola, Alsótelekes, Felsőtelekes and Rudabánya, passing by present-day Kelemér and the Mohos lakes. The fort was built on the northern bank of the Sajó River, in a spot where the surface rises gently. The horseshoe shaped ramparts can be clearly made out on the 1:10,000 map. The distance between the two ends of the horseshoe is 1100 m, while the broadest section of the arc is 600 m long. Water from the Keleméri Stream was led into the ditch. The southern, open end of the rampart extends into the area called Mocsár [marshland]-dűlő; the Sajó River flows some 600 m away from here. The dark arc of the horseshoe can be easily discerned on the aerial photographs in the Map Archives of the Museum of Military History, most clearly on photos made in 1952.[4] The line of the ditch was recorded on the maps of the so-called Second Military Survey carried out between 1856–1860,[5] which also show the wide floodplain of the Sajó River.[6] A hand-drawn map from 1880 in the Borsod-Abaúj-Zemplén County Archives[7] marked the westernmost lands of Putnok in an area called "Két sáncz közi" [between two ramparts], west of an area called Tilalmas-pást.[8]

A hand-drawn map from the 18th century marked a place called "Föld Vár" [earthen fort] south of Sajókaza towards Sajóivánka.[9] The fort lay in a strategically important location, along the road leading from the Sajó River into the mountains towards Felsőnyárád and Felsőkelecsény, where it forked into two, one branch running north-westward to Ragály and Trizs, the other north-eastward, passing Rudabánya and Szuhogy into the Bódva Valley. In his overview of the toponyms in this area, László

1 *B. Hellebrandt* (2003) 288.
2 *T. Kemenczei:* Die Spätbronzezeit Nordostungarns. ArchHung 51. Budapest 1984; *B. Hellebrandt* (2002a) 66–71.
3 Map Archives of the Museum of Military History (Budapest), doc. no. 3635, year of flight: 1955; *B. Hellebrandt* (2004) 173.
4 *B. Hellebrandt* (2004) Fig. 9.
5 Map Archives of the Museum of Military History (Budapest), sheet XXXVII–43; *B. Hellebrandt M.:* A putnoki kard. Ősrégészeti Levelek 4 (2002) 76–78, Fig. 4.
6 *Balogh B.:* Putnok mezőváros múltja és újabb kora 1881-ig. Rimaszombat 1894, 16–17; *Csorba Cs.:* Gömör vármegye katonai leírása. 1780-as évek. Miskolc 1993, 74.
7 Inv. no. U 516.
8 *B. Hellebrandt* (2001) 70.
9 Borsod-Abaúj-Zemplén County Archives (Miskolc), Bm T. 172.

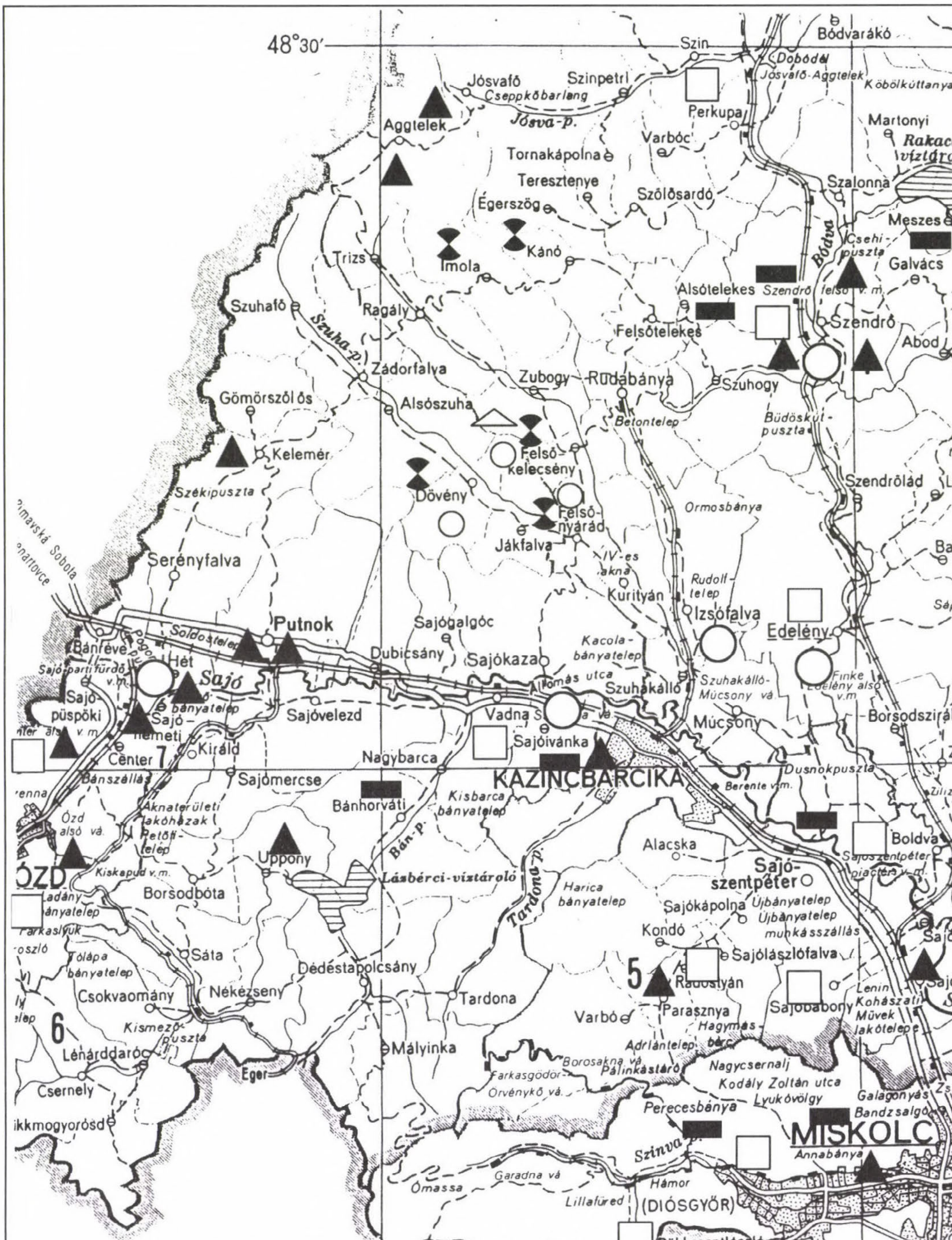

Fig. 1. Map of sites

Key: O: Earthen forts; ○: fortified settlement or fort; ▬ Scythian finds; □ Celtic finds; △ Celtic coin finds;
▲ Barbarian sites

Dobosy mentions the Sajókaza earthen fort, now a hay field almost completely enclosed by the Sajó.[10] Today, no visible traces of any defenceworks remains; it is possible that they had been washed away by the river during the millennia. Early Iron Age and Roman period pottery sherds were collected in the

10 *Dobosy* (1973) 55.

Sajókaza area on the left bank of the Sajó in April, 2001, during a field survey. The wide floodplain, extending to the Szuha Valley is marked on the maps of the Second Military Survey.[11]

The southern tip of Mt. Gede by Izsófalva, extending into the surrounding marshy plain, was transformed into a fort at the point where the Ormos stream flowing by the fort's western side from the Rudabánya Valley joins the Szuha, and the Mák Stream flowing along its eastern side runs towards the Szuha, reaching it at Szuhakálló. The maps of the First and Second Military Survey[12] have preserved the one-time conditions: waterlogged areas and floodplains dot the area between the mountains, also beyond Kurityán and Felsőnyárád. The distance between the two sides of the omega shaped fort is 1200 m, its width to the Izsófalva peak is 800 m. There is a lower terrace or bulwark-like sentry post in the fort's southern part, from where the plainland extending under the fort could be easily controlled and was no doubt suitable for repelling the first assault of an attack. In autumn, 2003, we opened a trial trench 20 m east of the dirt track leading to the cellars on the Koplaló-tető. The roughly north–south oriented trial trench measuring 9 m by 1.3 m (diverging a little to the east) was opened 20 m from the dirt track leading north from Izsófalva to Rudolftelep, which ran across the mountain to Mt. Koplaló along the one-time rampart. The southern foot of Mt. Koplaló is loessy; the cellars were dug into this loess, and the terracing can be seen up to the mountain's peak. Many of these cellars collapsed around 1959 owing to mining activity at Rudolftelep. The loess extends southward at the foot of Mt. Kopasz. It could be traced for 2 m in the trench from the trench's northern end, after which it changed into a mixed soil and then into hard yellow soil. An intrusion was noted at a distance of 1.2 m from the trench's southern end. We deepened the trench and the contours of the intrusion with a brownish fill (a former ditch with pebbles on its floor) stood out well against the hard yellow soil. The ditch was also observed in the trench's eastern and western wall, as well as in the southern wall, where we also noted charcoal remains. The one-time ditch was 1.2 m wide at a depth of 2.1 m; it narrowed downwards and was dug into the hard yellow virgin soil to a depth of 60 cm. When the ditch was dug, the earth from it was heaped on both sides and this line can still be made out on aerial photographs. The northern rampart was about 7 m wide at its base, roughly corresponding to the width of the hard soil.

The fort at Edelény–Kenderföldek[13] was built west of the Bódva, south of the Egres. The fort has an elongated omega shape, the distance between the two sides is 900–1000 m, its greatest width is 600 m. The line of the ramparts constructed from the earth dug out from the ditch can be clearly made out on aerial photographs from 1956 in the Map Archives of the Museum of Military History.[14] The ditch was filled with the waters of the Bódva. It seems likely that the rampart was renewed several times. The fort fell into disuse once the political and/or military situation changed and it lost its former importance. The north-eastern section of the roughly 2 m high ramparts was washed away by the floods of the Bódva. Houses were built atop the surviving, curved sections of the ramparts in the last third of the 20th century: present-day Katona József Street and Móra Ferenc Street in the north-east, together with the residential zone in the area called Kenderföldek. In 2001, we tried to determine the location of the fort's ditch. Trench I measured 74 m by 0.6 m. The groundwater level lay at a depth of 1.6 m. The walls of the trench collapsed along a 14 m long section in the trench's northern end. It seems likely that this 14 m long section with the looser soil can be identified with the one-time water-filled ditch.

The trade route to the Gömör–Szepes Ore Mountains led through the Bódva Valley. Ferenc Tompa regarded this valley as the northern gateway of Borsod County.[15]

The fort perched on the hill rising above Szendrő–Major lies south of Szendrő. The maps of the Second Military Survey[16] show that the Bódva was flanked by extensive floodplains. The ramparts of the fort were still visible in the Middle Ages and the northern boundary of the village of Ivánka was marked by the ramparts. The distance between the two sides of the fort is 1100 m, its greatest width is 550 m. The road from Szendrő through Szuhogy to Rudabánya passes the fort.

11 Map Archives of the Museum of Military History (Budapest), sheet XXXIX-43, prepared between 1856 and 1860.
12 *B. Hellebrandt* (2002b) Figs 18–19.
13 *B. Hellebrandt* (2002b) 15–37.
14 Photograph no. 450/655.
15 *Tompa F.:* A lausitzi kultúra Borsodban. FolArch 1–2 (1939) 29.
16 *B. Hellebrandt* (2002b) 23.

The range of the Gömör–Szepes Ore Mountains, rich in iron ore deposits, narrows towards the south. The width of the iron ore vein by Alsótelekes is 1000 m in some spots, ending abruptly at a fault line.[17] The northern Borsod iron ore region extends along the middle reaches of the Sajó, along the section between the Rima and the Bódva mouths.[18] Together with other ores, iron ore deposits occur in several locations, for example at Szendrőlád,[19] at Szuhogy in the Lucska Valley and in the Berek Valley.[20] Slag remains have been reported from almost every settlement in the Szuha Valley. The iron ore was not processed locally, but farther away.[21] János Szendrei observed traces of early ore mining in the area between the Sajó and the Bódva as early as the 19th century.[22] József Butykay sent clay tuyères from Felsőkelecsény[23] and Imola[24] to the Hungarian National Museum. The finds from Imola included also a copper chisel. In his report, János Szendrei described the slag heaps at Dövény. The collections of the Hungarian National Museum also include clay tuyères from Égerszög,[25] Bódvalenke[26] and Komjáti.[27] Gyula Nováki conducted a series of excavations at Imola, Trizs and Felsőkelecsény, based on Gábor Vastagh's field surveys. He uncovered a series of iron furnaces; the pottery sherds lying among the slag remains dated mainly from the 9th–10th centuries, while the spurs from Trizs came from 11th–12th centuries. József Korek excavated a comparable iron smelting furnace at Uppony.[28] Two other smelting furnaces were investigated by László Révész and Mária Wolf at Trizs–Vörössár in 1986.[29] Farther to the north, pottery fragments of the Kyjatice culture were found together with an ore pounder at Kovácsi.[30] Traces of bog iron mining were uncovered by Elena Miroššayová at Čečejovice/Csécs near Košice/Kassa, where she uncovered a series of pits; the archaeological features and their finds dated from the Early Iron Age.[31] It seems likely that these settlements, specialising in iron smelting, were not all active at the same time. They were established near woodland because enormous quantities of wood were needed to stoke the furnaces.[32] The study of local toponyms is also very instructive.[33] The name "Vaskapu" [Iron Gate] is marked on a 1:50,000 map from 1949 in the area north of Rudabánya and south of Szőlősardó; another "Vaskapu" is marked north of Trizs. Other toponyms in this category include "Kovácsos hegy" [Smithy Mountain] south of "Vaskapu" towards Trizs, a "Kovácsos domb" [Smithy Hill] between Trizs and Imola, a "Puszta Vassas erdő" [Iron Woods] north of Szuhafő (on the other side of the border with Slovakia), "Kovácsos domb" [Smithy Hill] south-east of Putnok–Kakasvár towards Dövény and "Kovácsos bérc" [Smithy Peak] between Putnok and Sajógalgóc. It is not mere chance that the same map shows "Halmok" [mounds] above "Puszta Vassas erdő", northwest of Trizs and north of Szuhafő, on the Slovakian side of the border. A 1:10,000 map mentions a "Kovácsos hegy" [Smithy Mountain] west of Izsófalva by the 219.1 m high summit. The remains of fortified settlements or hillforts *(Fig. 1)* have been reported from Dövény–Őrfatető, Dövény–Őrhegy, Felsőkelecsény–Őrhegy, Felsőnyárád–Kis-

17 *Szentiványi F. – Vas J. – Reményi V.:* Föld- és telepismerettan. Budapest 1951, 141.
18 *Heckenast* (1968) 147–151.
19 *Balogh* (1950).
20 *Pesty F.:* Borsod vármegye leírása 1864-ben. Szerk.: Tóth P. Miskolc 1988, 337.
21 *Heckenast* (1968) 149–150.
22 *Szendrei J.:* Őskori ércbányászat nyomai Borsodmegyében. ArchÉrt (1878) 281–282.
23 Hungarian National Museum (Budapest), inv. no. 323/1876.17.
24 Hungarian National Museum (Budapest), inv. no. 323/1876.18–19.
25 Hungarian National Museum (Budapest), inv. no. 136/1877. 12; no. 18 is an Iron Age (?) sherd.
26 Hungarian National Museum (Budapest), inv. no. 136/1877.19–21 (Iron Age?).
27 Hungarian National Museum (Budapest), inv. no. 136/1877.1–3 (clay tuyères), 4–9 (pottery sherds).
28 *Nováki Gy.:* A magyarországi vaskohászat régészeti emlékei. *In:* A magyarországi vaskohászat története a korai középkorban. Eds: G. Heckenast – Gy. Nováki – G. Vastagh – E. Zoltay. Budapest 1968, 38.
29 Archives of the Herman Ottó Museum (Miskolc), 1988–87.
30 *Repiszky T.:* Ásványlelőhelyek és bányarégészet a Kárpát-medencében. *In:* Kutatások Pest megyében. Tudományos konferencia II. Ed.: Zs. Korkes. Szentendre 1999, 12.
31 *E. Miroššayová:* Sídlisko neskorej doby halštatskej v Čečejovciach. SlovArch 42 (1994) 37, 53–55.
32 *Vastagh G.:* Az ásatásokkal feltárt kohászati maradványok műszaki vizsgálatának eredményei. *In:* A magyarországi vaskohászat története a középkorban. Eds: G. Heckenast – Gy. Nováki – G. Vastagh – E. Zoltay. Budapest 1968, 79.
33 *Heckenast* (1968) 162.

őrhegy and Felsőnyárád–Nagyőrhegy. Unfortunately, most of these forts have perished,[34] and it also seems likely that a number of similar sites have not yet been identified in this little researched area.

At Rudabánya, the iron ore was not covered with soil and could be mined on the surface in the highest areas of Mt. Ruda and at its south-western tip at the Mt. Mogyorós. Rain and snow regularly washed out iron ore on the steep eastern side of the Bányavölgy [Mining valley]. Tibor Podányi noted in the 1950s that the road leading to Szuhogy and Szendrő on the Mt. Mogyorós ran above surface iron ore vein.[35] This observation was confirmed by more recent deep boring data, such as the ones from 1983, which indicated that spathic iron ore could be traced to depths of 0–9.2 m, 1–14.3 m and 0–7.7 m in the investigated areas, with the thickness of the useful material being 5 and 9.3 m respectively.[36] In November, 1954, Sándor Soproni conducted a rescue excavation at Rudabánya.[37] Oil-lamps and mining tools were discovered in old mining galleries, which were subsequently taken to Budapest by András Tasnádi-Kubacska, then working in the Geological Institue, to be displayed at an exhibition. Accompanied by the mining engineer and the mine foreman, Sándor Soproni inspected two old galleries at the Rudahegy mine. The two old galleries began about 20–25 m from the entrance to the main gallery. One could not be entered owing to the collapsed walls, while the other was 1 m wide on the average and could be entered if one stooped slightly. Marks left by mining tools could still be seen on the walls of the gallery and the way-shafts. Mining techniques were rather rudimentary. The marks suggested that the tools used by ancient miners had been 12–15 mm wide pointed chisels with a square cross-section. The marks were 5–10 cm long.

The walls of the gallery were of soft marl and the short marks suggested the use of a small hammer. The extracted ores were probably placed in a pouch and the miners crawled to the surface on their bellies. In the lack of any finds, Sándor Soproni was unable to determine the age of the gallery. The form of the oil-lamp, which was drawn at his request, was reminiscent of Roman firmam lamps.

György Szabó visited Rudabánya in 1955–56. According to his report, picks were used for mining; the rock was in cracked in some spots, indicating that a fire was set against the rock to weaken and crack it.[38]

The use of iron is indicated by pieces of iron slag found at Aggtelek, at several locations around Szendrő *(Fig. 2)*,[39] and in the valley of the Bán Stream, as well as at Kelemér, where Bálint Simon collected iron slag and Roman Imperial period pottery sherds.[40]

Bitter battles were fought for the control over iron ore resources throughout history. It is not mere chance that in addition to other artefacts, bronze and iron arrowheads too were found in the Ördöggát Cave near Szendrő.[41] Tibor Kemenczei dated these finds to the 6th century BC.[42] Similar arrowheads were brought to light at Alsótelekes.[43] The site lies on Dolinka Hill (274 m a.s.l.) in the Rudabánya Mountains. Most graves were dug into the 15–30 cm thick humus overlying the rock, although some were carved into the rock itself. About fifty to one hundred burials were destroyed by stone and marble quarrying. A total of 184 graves containing 192 burials were uncovered during the excavations from 1959 to 1964, when an overall area of 940 m^2 was investigated.[44] There were twenty-two inhumation graves, the rest were cremation burials (with some scattered cremation ones). Four grave groups could be distinguished; various finds without any associated ashes, came to light in each. Grave 109 yielded a lavishly ornamented shaft-hole pickaxe made from iron, whose best analogy came to light in Grave 40 of the Eger–Nagyeged burial ground. There is a general consensus that the various artefacts harking back to eastern prototypes were manufactured locally by the Scythian Age population of the Carpathian

34 *Nováki Gy. – Sándorfi Gy.:* A történeti Borsod megye várai. Budapest–Miskolc 1992, 56.

35 *Podányi* (1957) 72.

36 Magyarország mélyfúrási alapadatai. Ed.: P. Bohn. – Kiss K. Budapest 1983, 839–840, 844.

37 Hungarian National Museum (Budapest), A.56.R.I.

38 György Szabó's report, Archives of the Herman Ottó Museum (Miskolc), no. 322–68.

39 *B. Hellebrandt* (2003) 289; *Dobosy* (1973) 69–75.

40 Now in the archaeological collection of the Herman Otto Museum (Miskolc), inv. no 78.10.1–85.

41 *Leszih A.:* Borsod megyei szkíta leletek. FolArch 1–2 (1939) 12, Fig. 6.

42 *Kemenczei* (1994) 88.

43 *Patay P.:* Az alsótelekesi vaskori temető. FolArch 13 (1961) 27–49; *Kemenczei* (1994) 84, Fig. 3.

44 *Patay – B. Kiss* (2001–2002) 79.

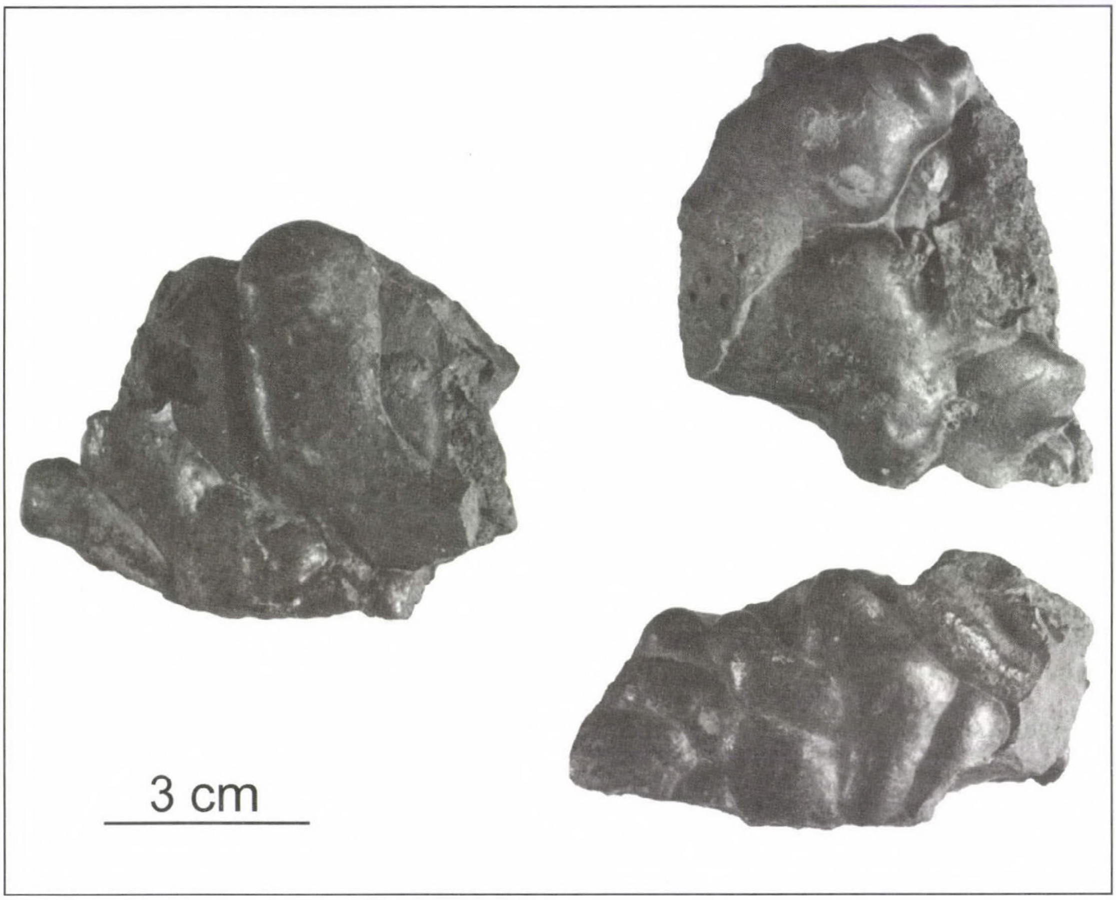

Fig. 2. Iron slag lumps from Szendrő (photo by Géza Kulcsár)

Basin; as a matter of fact, Mihály Párducz believed that one of these manufacturing centres lay in the Gömör–Szepes Ore Mountains.[45] Tibor Kemenczei noted that these ironworking centres were active from the 6th century BC.[46] It is possible that the bracelets were also made locally.[47] The finds from the burials indicated that the earliest, western section of the cemetery was opened in the third quarter of the 7th century BC. The burials in this section contained hand-thrown cups with high-drawn handles, while the later, eastern cemetery section yielded an assortment of weapons, finely decorated bracelets, pins and wheel-turned pottery. It seems likely that the community using this cemetery did not survive until the Celtic conquest for there are no finds indicating a Celtic cultural impact.

Scythian finds have been brought to light at Szendrő–Temetődomb from a burial:[48] the grave goods included a one-handled cup, a bracelet and an iron pickaxe. Other sites yielding Scythian artefacts are Bánhorváti, Miskolc and Sajószentpéter.[49] Advancing from the west in the early 4th century BC, the Celts conquered the local population in this area. A glance at the map showing the Scythian and Celtic sites *(Fig. 1)* reveals that Celtic finds usually occur in areas which had a Scythian population. A lovely Celtic dagger from Szendrő was presented to the Hungarian National Museum in the 19th century. The dagger was allegedly found together with an iron knife, but it is unlikely that they were part of the same

45 *M. Párducz:* Graves from the Scythian Age at Ártánd. ActaArchHung 17 (1965) 190; *Patay – B. Kiss* (2001–2002) 104–106.

46 *T. Kemenczei:* Mitteleisenzeitliche Köcherbeschläge aus dem Alföld. FolArch 37 (1986) 132; *Kemenczei* (1994) 94.

47 *Patay – B. Kiss* (2001–2002) 118.

48 *B. Hellebrandt* (2002a) 84–86.

49 *B. Hellebrandt M.:* Szkíta kori temető Kesznyéten–Szérűskerten. HOMK 25–26 (1988) 122–124; *B. Hellebrandt M.:* A szkíta kultúra emlékanyaga az Alföld és a hegyvidék találkozásánál. *In:* Hatalmasok a viadalokban. Az Alföld szkíta kora. Ed.: P. Havassy. Gyula 2001, 58; *Kemenczei T.:* Az Alföld szkíta kora. *In:* Hatalmasok viadalokban. Az Alföld szkíta kora. Ed.: P. Havassy. Gyula 2001, 7–36.

assemblage. The finds were first published by János Szendrei.[50] The dagger has a bronze hilt and a double-edged iron blade; when found, it was folded (its folded length was 27 cm, its smoothed-out length is 49 cm). The anthropoid hilt has a smooth surface and terminates in a pair of curved Y shaped limbs ending in flat knobs. The section between the upper two arms of the Y is decorated with a pattern which according to Paul Reinecke was the barbaric imitation of the Greek palmetto motif.[51] The reverse of the hilt is decorated with a pair of antithetic triskels and hatching between the two "limbs", and triskels adorn the knobs too.[52] Manufactured throughout the Celtic Age, anthropoid daggers developed from the antenna-hilted swords of the Early Iron Age. Six such daggers are known from Hungary. Depictions of daggers of this type can be found on coins from Gaul. The Celtic coins from Munkács bear a depiction of the hilt on their reverse, under a horse figure.[53] Celtic warriors were equipped with a double-edged iron sword and spears. Iron sheep shears were found in the Ördöggát Cave near Szendrő. A grave assemblage containing a fragmentary iron sword, a broken iron knife and a 31.5 cm long iron spearhead was presented to the Hungarian National Museum from Szín, lying farther north.[54] A folded iron sword, a chain of figure-of-eight links and iron scissors came to light at Sajókaza–Ormospuszta.[55] One-handled cups, pots, a large, curved, button-hilted iron knife and various sherds were found in Edelény.[56] The distribution of Celtic coin finds from the Sajó Valley is shown in *Fig. 1*. An Audoleon type coin is known from the Miskolc area; the Bükkszentlászló hoard and the coin found at Miskolc–Diósgyőr can be assigned to the Cotinus type, with a semi-hemispherical protuberance on the reverse replacing the head on which it was modelled. Celtic coins have been reported from Sajókaza and Rimaszombat.[57] Karl Pink mentions a Celtic coin from Felsőkelecsény, although he erroneously locates the site to Tolna County.[58] This is obviously an oversight, for the 1882 edition of the *Gazetteer of the Lands of the Hungarian Crown* mentions fourteen settlements called Kelecsény, all of which lie east of the Garam River, i.e. in the country's northern part. The *Gazetteer* located Felsőkelecsény to Borsod County. The 1913 and 1973 editions of the *Gazetteer* too locate Felsőkelecsény to Borsod County. A Celtic coin find in this region is hardly surprising in view of the known route to the mining region from Sajókaza, which passed through Felsőnyárád and Felsőkelecsény.[59]

It would appear that the richness of the ore deposits was not the single attraction of the area between the Sajó and the Bódva. The Celts mixed graphite into the clay for the manufacture of certain pottery wares. Graphitic vessels were more heat resistant. Graphite occurs on the surface in the Aggtelek area, in the Szendrő area and at Edelény. At the two latter locations, graphite and anthracite occur between Devonian limestone banks. At Edelény, the thickness of graphite-anthracite ranges between 7.2 m and 16.1 m.[60] Surface outcrops have been noted at Edelény, Szendrőlád and Gadna; at the latter location, the graphite has a pleasing greyish-black colour, a greasy texture and is mined with pickaxes on the surface. The graphite has iron ochre inclusions to a depth of 2–3 m, being much purer deeper down.

50 *Szendrei J.:* Hazai adatok az archaeologiához. Borsod megye őstelepei. ArchÉrt (1883) 136–137.

51 *Reinecke P.:* Magyarhoni emlékek a La Tène-kor kezdetéről. ArchÉrt (1898) 314.

52 *M. Szabó – É. Petres:* Decorated Weapons of the La Tène Iron Age in the Carpathian Basin. IPH 5. Budapest 1992, Cat. no. 59, Pl. 60.

53 *Pink* (1939) Taf. XXII. 429–430.

54 *Hunyadi I.:* Kelták a Kárpátmedencében. RégFüz 2. Budapest 1957, 184.

55 *K. Végh* (1969) 75.

56 *B. Hellebrandt M.:* A Bódva-völgy története az őskor utolsó évezredében. *In:* Tanulmányok a Bódva-völgy múltjából. Eds: M. Bednár – T. Rémiás. Putnok 1999, 101, Fig. 11.

57 *Pink* (1939) 140, 136, 144.

58 *Pink* (1939) 136.

59 The coin collection of the Herman Ottó Museum (Miskolc) has a Celtic coin from Felsőkelecsény (Dess. 278), which was presented to the museum in 1928 from the Ragályi estate. According to the description, it was found together with five similar pieces in 1870. *B. Hellebrandt M.:* Régészeti tanulmányok Miskolc korai történetéből. *In:* Miskolc város történetének dokumentumai II. Ed.: T. Rémiás. Miskolc 1992, 60, Fig. XIV. 2.

60 *Radócz Gy. – Oswald Gy.:* A Szendrői hegység paleozóos korú grafitos-antracitos összetételeinek kutatási terve. Archives of the Hungarian State Geological Institue, no. T.5625. Budapest 1969, 2–3, 6; *Sinnyei I.:* Jelentés az edelényi grafitkutatás eredményeiről. Miskolc 1967.

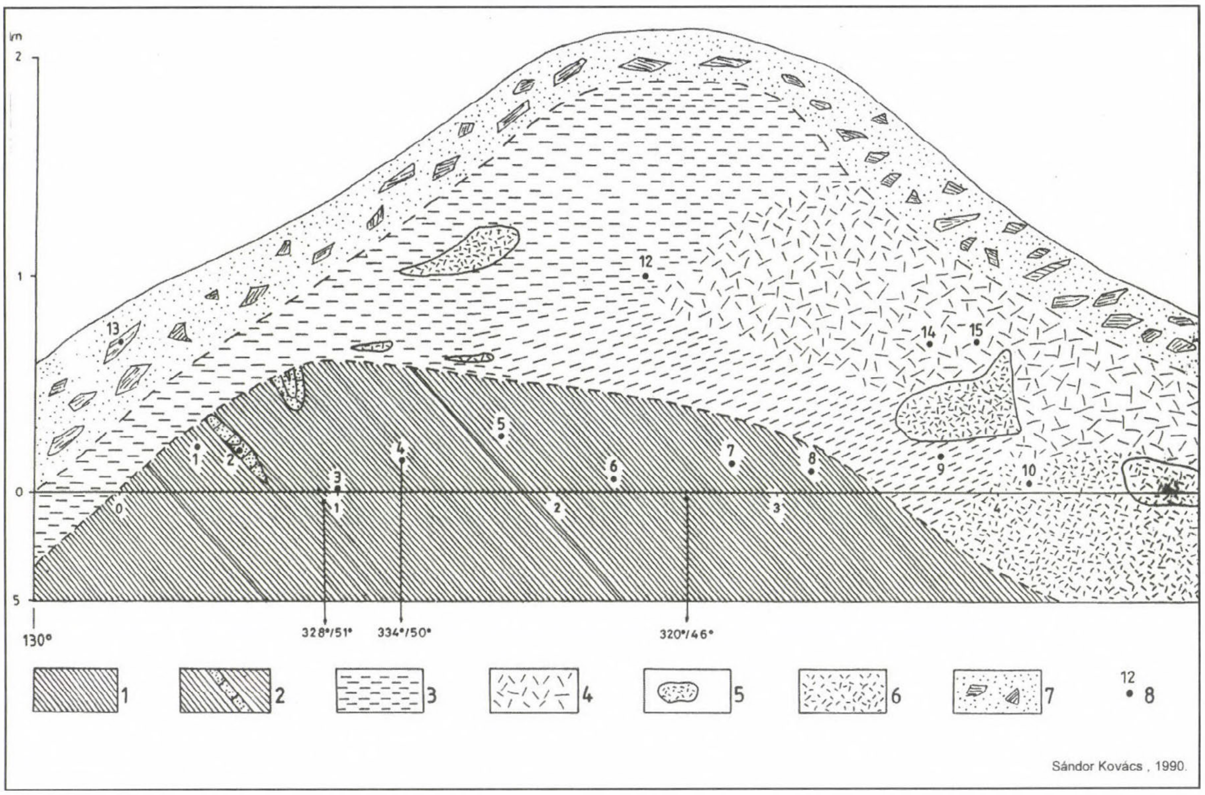

Fig. 3. The lower section of the trench through the phyllite (graphite) deposit at Szendrőlád
1. Phyllite, 2. siliceous limestone, 3. fragmented phyllite debris indicating re-bedding (Pleistocene), 4. displaced phyllite debris, 5. quartzite, 6. quartzite debris, 7. loose phyllite debris mixed with soil (Holocene), 8. sampling locations

According to earlier surveys, there is an estimated 260,000 m^3 of graphitic schist to be mined.[61] In 1969–1970, the State Geological Institute conducted a survey of the graphite deposits in the Szendrő Mountains.[62] A trenching programme for identifying graphite zones was undertaken in the Bordás Valley near Szendrőlád. Dr. Elemér Nagy's report states that graphitic formations or, to be more precise, formations with organic contents occur in the Palaeozoic deposits of the Szendrő Mountains. On the basis of the X-ray diffraction analyses, he recommended that the graphitic formations should be labelled sericitic clay schist (phyllite). The phyllite formations in the Szendrő area were also studied by Csaba Péró, according to whom it was the most extensive surface formation in the mountain region, extending from an investigated deposit west of Szendrő to the eastern end of Rakaca and the western end of Gadna.[63] The locals told the geologists that they used the black earth to paint the base of their houses.[64]

The stream bed is strewn with thick graphitic phyllite debris at the confluence of the Helle and the Tóharaszti Streams. The trenching was undertaken in the steep southern bank of the stream, above the thick phyllite debris *(Fig. 3)*. The sampling area was *ca.* 5 m wide, its height above the stream level was *ca.* 1 m at the edges and *ca.* 2 m in the middle. The trench was cleared to a depth of 0.5 m under the stream level. The geologists found that the rock was for the greater part glossy phyllite with leaf-like

61 *Schréter Z.:* Jelentés a Gadna község határában levő grafitos pala előfordulásról. Magyar Állami Földtani Intézet Adattár F.I.51. Budapest 1949, 1–3.

62 *Nagy E.:* Jelentés a Szendrői hegység környéki grafitkutatáshoz kapcsolódó vizsgálatokról. Magyar Állami Földtani Intézet Archívuma no. T. 2565. Budapest 1970. I am greatly indebted to geologist Pál Szlabóczky for calling my attention to this survey.

63 *Kovács S. – Péró Cs. – Madarasi A. – Prónay Zs. – Sajó I. – Solymár Gy. – Lantai Cs. – Árkai P. – Hermesz M.:* A Szendrői fillit formáció. *In:* A Szendrői hegység grafittartalmú képződményeinek földtani, geofizikai és minőségi vizsgálata. Prepared by the Nógrád County branch of TIT, under the co-ordination of M. Hermesz. Archives of the Hungarian State Geological Institute, no. 17403. Budapest 1990, 33. I would here like to thank Sándor Kovács and Csaba Péró for sharing this information with me and for their kind permission to publish the drawing.

64 According to Sándor Kovács, this was the piece of information which helped to identify the deposits.

plates along the foliation plane or wavy foliation. Surveys to identify possible occurrences of manganese iron ore were also conducted at Szendrőlád.[65]

These raw materials were also mined and used by the communities living in this area in later centuries. The mainly Celtic population of Transdanubia had been subdued by the Romans; in contrast, the regions east of the Danube were settled by successive waves of population groups called barbarians by the Romans. Numerous settlements of these peoples, rich in pottery finds, have been identified *(Fig. 1)*. These include Domaháza, Hangony and Szentsimon along the Hangony Stream.[66] Hut remains, hearths, ovens,[67] and refuse pits were uncovered in 1951 during the excavation preceding the construction of the sports stadium at Ózd. The finds from this settlement provide a fascinating insight into the culture of this period.[68] The life of the settlement spanned some one hundred years, from 250 to 350 AD.[69] Márton Rozsnyói reported finds from Uppony, from the hill rising above the iron smelting furnace.[70]

Sites of the Roman period show a concentration along the Sajó (Sajópüspöki, Sajónémeti, Hét, Putnok, Sajógalgóc[71]) and in the Miskolc area. Settlement finds, mainly pottery sherds (rim fragments from wheel-turned vessels, body sherds decorated with wavy lines), as well as a few intact and fragmentary quernstones and slag were collected by Bálint Simon at Kelemér and presented to the Miskolc museum. Other sites from this period include the northern and southern outskirts of Szendrő,[72] Csehi and Garadna, where pottery and slag was collected. Nándor Kalicz found late Celtic sherds and slag on the eastern side of Mt. Mogyorós near Rudabánya.[73] The sites at Aggtelek and Jósvafő also date from this period.[74]

The systematic survey of the area would undoubtedly result in the identification of many new sites. The map of the currently known sites *(Fig. 1)* reveals that the Iron Age and Roman period settlements, forts and fortified places along the Keleméri and Bódva streams and their tributaries north of the Sajó Valley encircle the mining region.

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65 *Balogh* (1950).

66 *K. Végh* (1969) 69, 70; the finds are now in the Archaeological Collection of the Herman Otto Museum (Miskolc).

67 *Korek J.:* Kelta edényégető kemence Ózdon. HOMÉ 2 (1958) 79–81.

68 *M. Párducz – J. Korek:* Eine Siedlung aus der Kaiserzeit in Ózd. ActaArchHung 10 (1959) 159–194; *B. Hellebrandt M.:* Az ózdi régészeti gyűjtemény. HOMK 12 (1973) 37–51.

69 *K. Végh* (1975) 76.

70 József Korek's report in the Archives of the Herman Ottó Museum (Miskolc), no. 479–68.

71 *B. Hellebrandt* (2001) 79–80, 82–83; the finds are now in the Archaeological Collection of the Herman Otto Museum (Miskolc).

72 *B. Hellebrandt* (2002a) 90–94.

73 *Podányi* (1957) 72.

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K. Végh (1969)	*K. Végh K.:* Kelta leletek a miskolci múzeumban. HOMÉ 8 (1969) 75.
K. Végh (1975)	*K. Végh K.:* Régészeti adatok Észak-Magyarországról, I–IV. századi történetéhez. HOMÉ 13–14 (1975) 65–129.

THE TARNABOD AREAIN THE IRON AGE AND THE ROMAN PERIOD

Magdolna B. Hellebrandt

Ancient communities often settled along the Tarna Stream, south of the Mátra Mountains. The Early Iron Age, the pre-Scythian period was an especially turbulent epoch.[1]

Nándor Kalicz conducted a series of field surveys in the Tarnabod area. In 1966, he learnt that a gravel pit was opened about 2 km southeast of the settlement (near the former Ezüstkalász Co-operative) and that skeletons and vessels had come to light during the mining operations.[2] The rescue excavation was conducted by Nándor Kalicz and István Torma,[3] who identified the exact position of the three disturbed burials *(Fig. 1)*. These were as follows:

Grave 1: A disturbed inhumation burial with an urn.

Grave 2: A disturbed inhumation burial. The skeletal remains and the urn fragments lay at a depth of about 150 cm.

Grave 3: A disturbed inhumation burial. The fragments of a large vessel lay at a depth of 140 cm.

Four trial trenches (nos I–IV) were opened by the eastern wall of a sandpit on the territory of the co-operative. Each trench was 33 m long and 0.75 m wide, with the exception of Trench I, which was 23 m long. The trenches were north–south oriented in order to detect the Early Iron Age inhumation burials, which were usually west–east oriented. The dark patch indicating Grave 4 was found in Trench III.

Grave 4: Oblong grave pit narrowing slightly towards the feet. An inhumation burial with the skeleton lying in an extended position on its back and the arms positioned along the body. The deceased was west–east oriented, with the skull turned left towards the west *(Fig. 2. 1)*. Depth: 140 cm. A large vessel decorated with four knobs was placed a little further from the skull, to its left *(Fig. 3. 13)*. Cattle bones were found above the left pelvic bone of the medium well preserved skeleton.

An oblong patch in Trench I indicated another burial (Grave 5, *Fig. 2. 2*).

Grave 5: An inhumation burial with the skeleton lying in an extended position. The upper part of the body was tilted slightly to the left, the skull tilted to the left; the right arm lay on the ribs with the lower arm bent; the hand bones were found beside each other. The only grave good from this burial was a large black vessel, which lay partly on the left upper arm bone *(Fig. 3. 14)*.

The trial trenches were cleared to a depth of 80–90 cm, to the virgin soil, but no additional graves were found. István Torma opened Trench V (length: 30 m, width: 0.75 m) at the western end of the sandpit. The virgin soil lay at a depth of 80–90 cm, but no graves were found. Another 7 m long, 0.75 m wide, north–south oriented trench was opened 2.25 m from the sandpit's south-eastern corner, but no graves were found here either. The burials were dated to the Hallstatt C period by Mihály Párducz.[4]

A pre-Scythian burial ground was found in the sandpit at Tarnaörs–Csárdamajor in 1962. János Győző Szabó uncovered four graves in 1964, and the locals brought to light another four burials and their finds.[5] Most graves were female burials, the only exceptions being two graves containing adult males; all were inhumation burials and were oriented west to east (in cases where the orientation could be noted). The graves lay about 6–7 m apart. The grave pits were *ca.* 2 m long, their width exceeded 120 cm. The excavation report mentions that in one grave the deceased was laid on its stomach and that the legs and arms had been broken. This burial had an inverse orientation. Clay vessels and bronze

1 *Kemenczei T.:* A preszkíta kor az Alföldön (Kr. e.VIII. század–VII. század első fele). *In:* Hatalmasok viadalokban. Az Alföld szkíta kora. Ed.: P. Havassy. Gyula 2001, 7–12.

2 *Patek* (1989–90) 69.

3 Archives of the Hungarian National Museum, XIX.226/1966, inv. no. 7862.

4 *Párducz* (1969) 37.

5 Archives of the Hungarian National Museum, XVI.287/1964, inv. no. 7219; *Patek* (1989–90) 67–68.

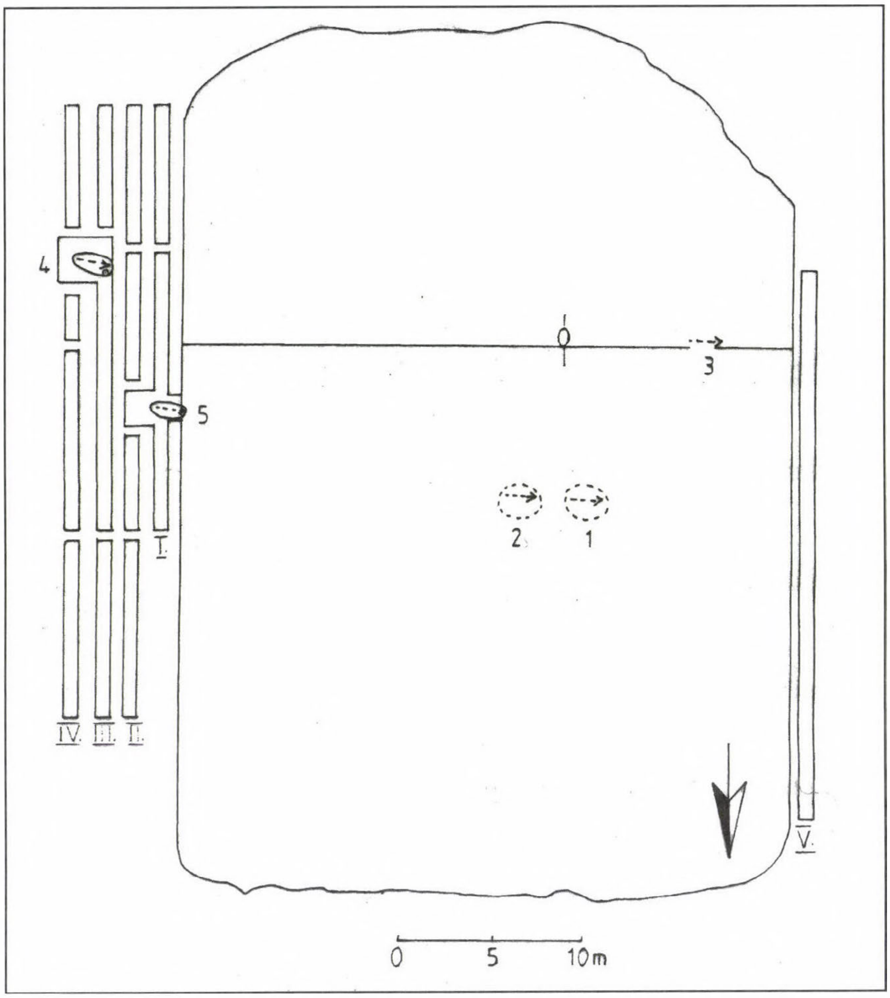

Fig. 1. Tarnabod. Map of the cemetery (after Nándor Kalicz and István Torma's documentation)

jewellery *(Fig. 3. 2–12)* were deposited on the left side of the skull. Other grave goods included a polishing stone, a carved bone plaque *(Fig. 3. 1)* and the bones of a large mammal. An area of 300 m^2 was investigated during the excavation.

A skeleton and a vessel dating from the pre-Scythian Age came to light at Boconád–Dobogó. The site was investigated by János Győző Szabó in 1962.[6] He collected pottery sherds at Zaránk–Erkihalom in 1967.[7]

It is clear from the above that a number of pre-Scythian burial grounds were opened in the Tarnabod area.[8] This is hardly surprising because the heartland of the pre-Scythian culture lay between the southern fringes of the Cserhát–Mátra–Bükk Mountains and the Tisza.[9] At the same time, only one single pre-Scythian settlement is known from this region: the one uncovered at Kompolt–Tagi rét, where a well was excavated (Feature 258).[10] The well was dug into a roughly 10 m by 20 m large natural depression. The well shaft was cylindrical: at a depth of 150 cm, its diameter was 315–320 cm, narrowing to 175–180 cm lower down. The floor of the well shaft was dished and was covered with a layer of gravel which also served to filter the water. The lining was constructed from timbers *(Fig. 4. 6)*. Four courses

6 *Szabó J. Gy.:* Boconád–Dobogó. RégFüz 16. Budapest 1962, 22; *Patek* (1989–90) 69.
7 *Patek* (1989–90) 69.
8 *Patek* (1989–90) 61–118; *D. Matuz et alii* (1998) 56–57.
9 *Szabó* (1970) 77.
10 *D. Matuz et alii* (1998) 41–62.

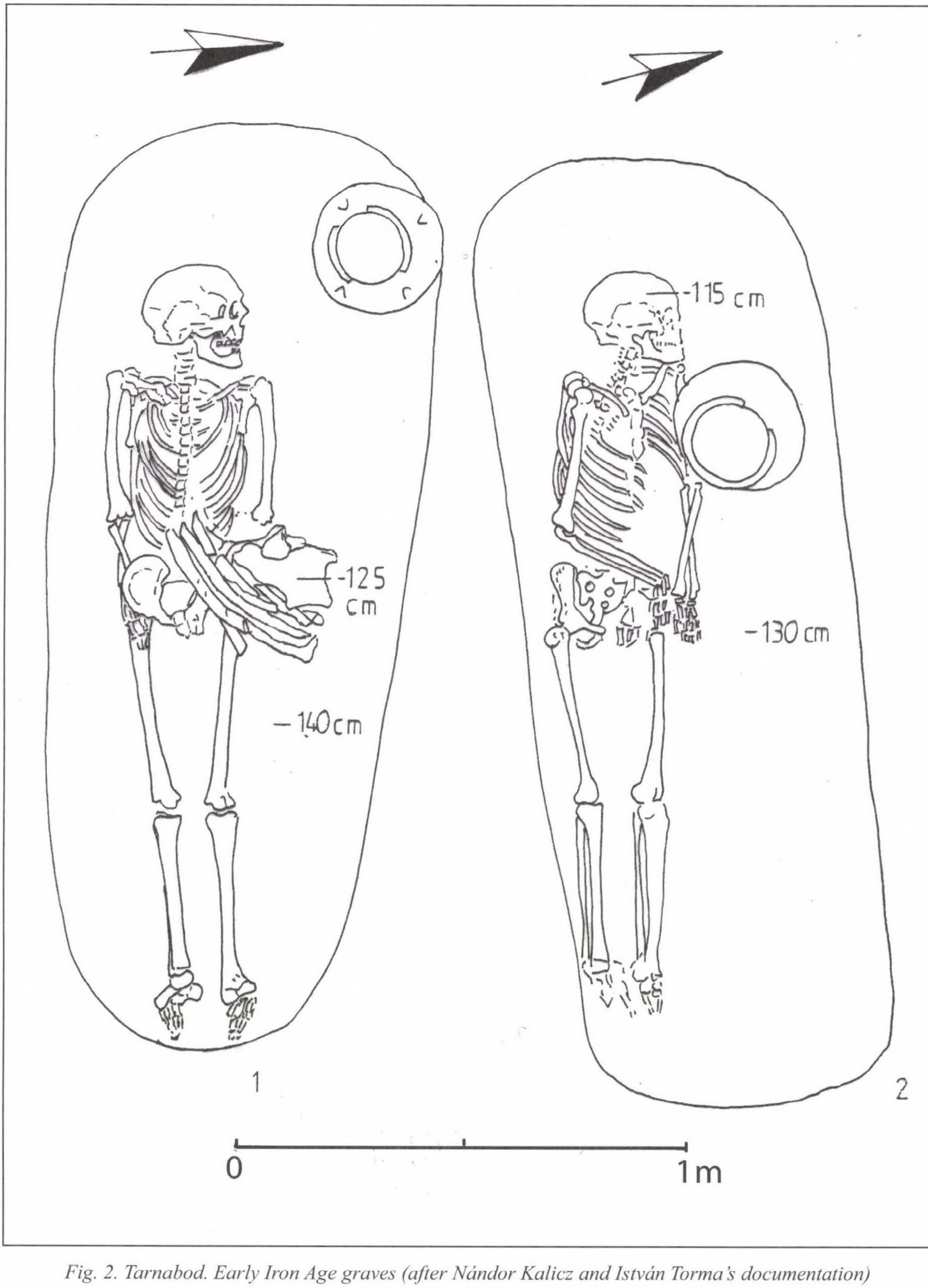

Fig. 2. Tarnabod. Early Iron Age graves (after Nándor Kalicz and István Torma's documentation)

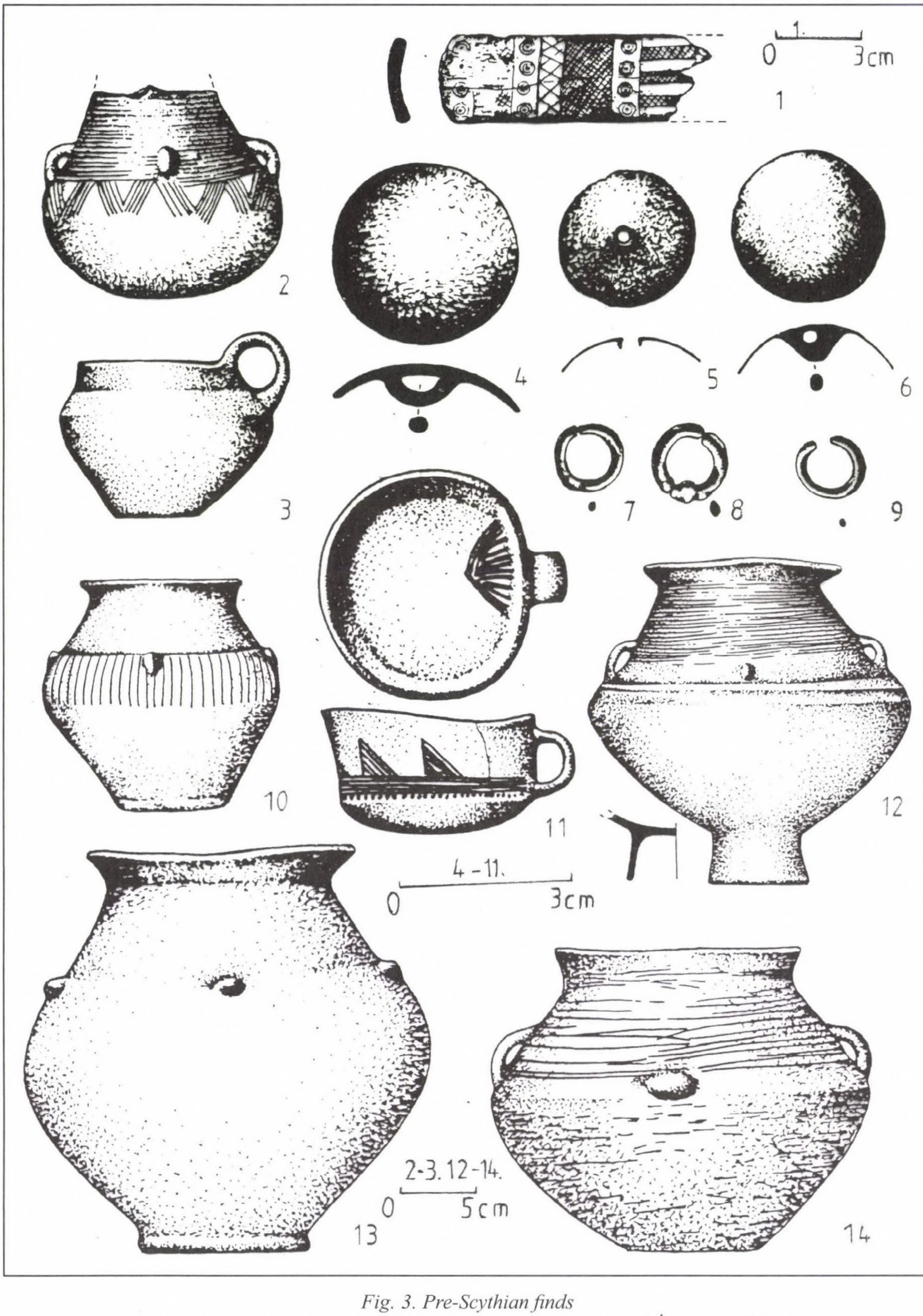

Fig. 3. Pre-Scythian finds
1–12. Tarnaörs, 13–14. Tarnabod (after Márta D. Lacza and Ágoston Dékány)

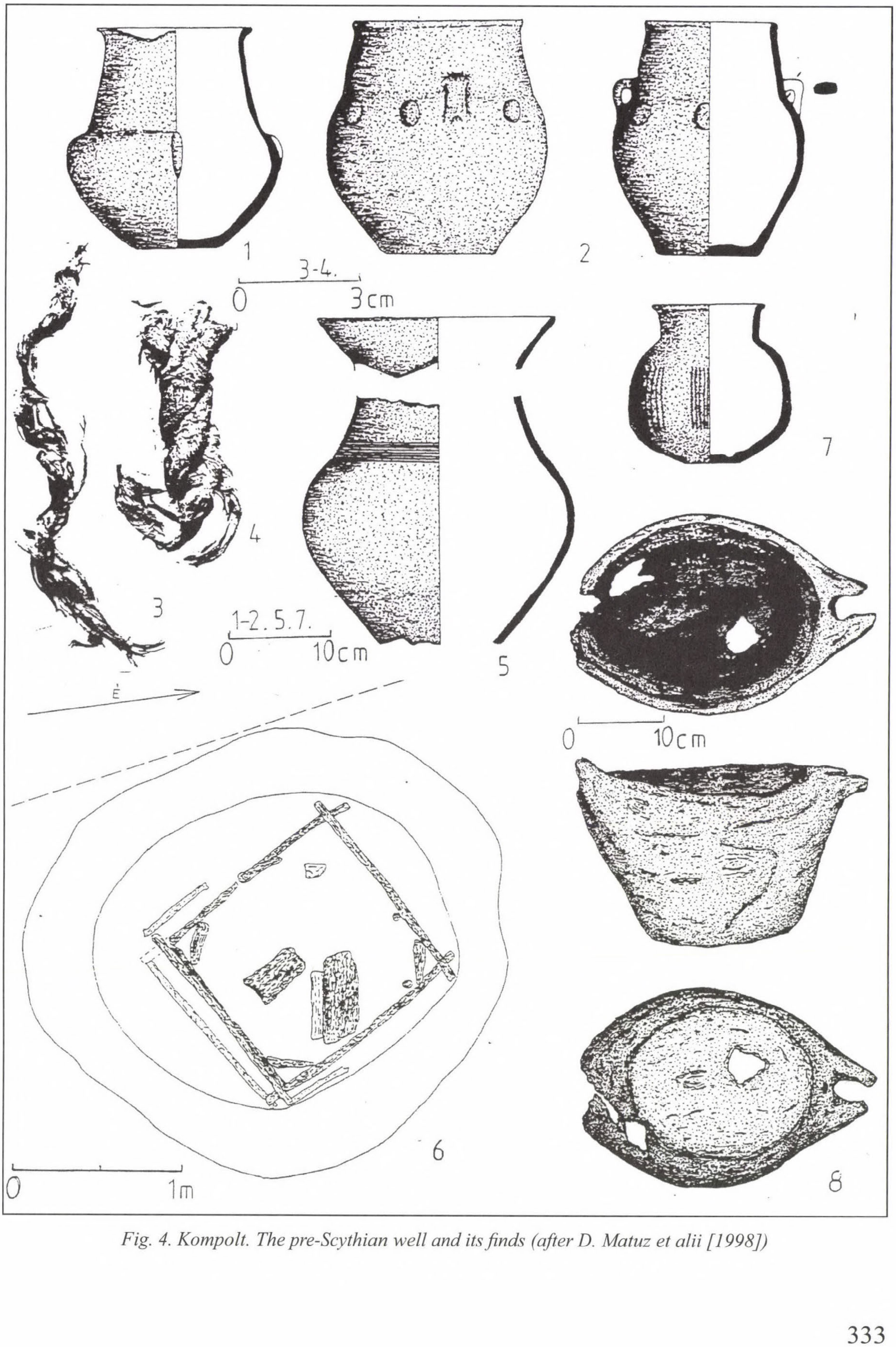

Fig. 4. Kompolt. The pre-Scythian well and its finds (after D. Matuz et alii [1998])

of the interlocking timber lining survived; the remains of another timber lining were uncovered on three sides. The examination of the wood remains revealed that pedunculate oak, sessile oak and beech were used for constructing the timber lining. The finds from the well included an urn with outturned rim, an ovoid mug, urn fragments and a two-handled vessel *(Fig. 4. 1–2, 5, 7)*, as well as the fragments of a bark vessel and a wooden vessel with two handles *(Fig. 4. 8)*. The vessels were lowered into the well for drawing water with a rope twisted from two or three strands *(Fig. 4. 3–4)*. The vessels had a capacity of 1.25, 3.2 and 4.2 litres respectively. The well had been cleaned once. The closed find assemblage from the Kompolt well can be dated to the Hallstatt B3 period (corresponding to the 8th century BC); the artefacts represent the material culture of the Mezőcsát group,[11] similarly to the finds from the pre-Scythian cemetery uncovered at Szeged–Algyő.[12]

The Scythian Age saw the arrival of a new population with a new culture from the east. The most typical finds of this period were recovered from the twenty-four graves of the cemetery section excavated at Heves by János Győző Szabó in 1963.[13] The investigation was carried out on two plots which were labelled cemetery section A and B in the publication. A total of thirteen inurned cremation burials, two scattered cremation burials and nine inhumation burials were uncovered. The graves representing different burial rites did not form separate clusters, but occurred together, suggesting that the differences in mortuary practices could perhaps be traced to differences in social status or that women perhaps clung to the rites from the preceding period. This is confirmed by István Kiszely's anthropological examination of the skeletal remains, according to which the inhumation graves contained the burials of women and children, while the cremation graves were mostly male and child burials. The custom of cremating the dead spread rather slowly. The scattered cremation burials (Cemetery A, Grave 2; Cemetery B, Graves 21, 24) were the richest, indicating that these graves contained the high-ranking members of the community. Electrum jewellery, bronze bracelets and weapons were exclusively recovered from these burials. The inhumation burials were west–east oriented, with the head towards the west. Six of these burials contained grave goods; a similar ratio was observed for the cremation burials too. Graves 10 and 11 represented a double inurned burial; a skeleton was found beside Grave 5b, an inurned burial; and a child's skeleton lay beside the ashes covered with a bowl in Grave 15–16. Comparable double burials have been found in other cemeteries from this period, e.g. at Kesznyéten–Szérűskert.[14] In spite of the differences in the burial rite, the finds from the Heves cemetery were remarkably uniform. The wheel-turned wares were represented by three conical bowls with indrawn rim set on a low ring base and two cups with high-drawn handles, which came to light in the lavishly furnished scattered cremation burials and in Grave 14, an inurned burial. The hand-thrown vessels included urns, bowls, mugs and cups. One unusual vessel form was a biconical bowl with elongated neck whose widest circumference was under the carination. The most typical jewellery article was the earring: a bronze spiral covered with electrum with one conical terminal and the other with a thin bronze ribbon wound around it; other ornaments included by beads of glass paste, bronze and amber. Cast bronze bracelets were recovered from the two scattered cremation burials, while iron bracelets were found in three inhumation graves. The position of the skeleton in Grave 17, a male burial, suggested that the deceased had been interred with his arms and feet bound together, and that only an iron bracelet was deposited in the grave. János Szabó Győző concluded that iron had probably been vested with magical properties. Spindle whorls were found in four graves (two of these contained a pair each). Three burials yielded a polishing stone, one a quernstone (all made from sandstone). The polishing stone lay under the urn in the cremation burials and behind the skull in the inhumation burial. Grave 5b, an urn burial, yielded an iron knife, as did Grave 21, a scattered cremation burial, which also contained a whetstone. The Scythian cemetery at Heves contained the burials of commoners. It can be dated to the late Hallstatt C–early Hallstatt D

11 *D. Matuz et alii* (1998) 57.
12 *D. Matuz E.:* A Szeged–Algyő 258. kútkörzet területén feltárt preszkíta temető. MFMÉ–Studia Archaeologica 6 (2000) 150.
13 *Szabó* (1970) 55–128.
14 *B. Hellebrandt M.:* Szkíta kori temető Kesznyéten–Szérűskerten (1984–85. évi ásatás eredménye). HOMÉ 25–26 (1988) 107–108.

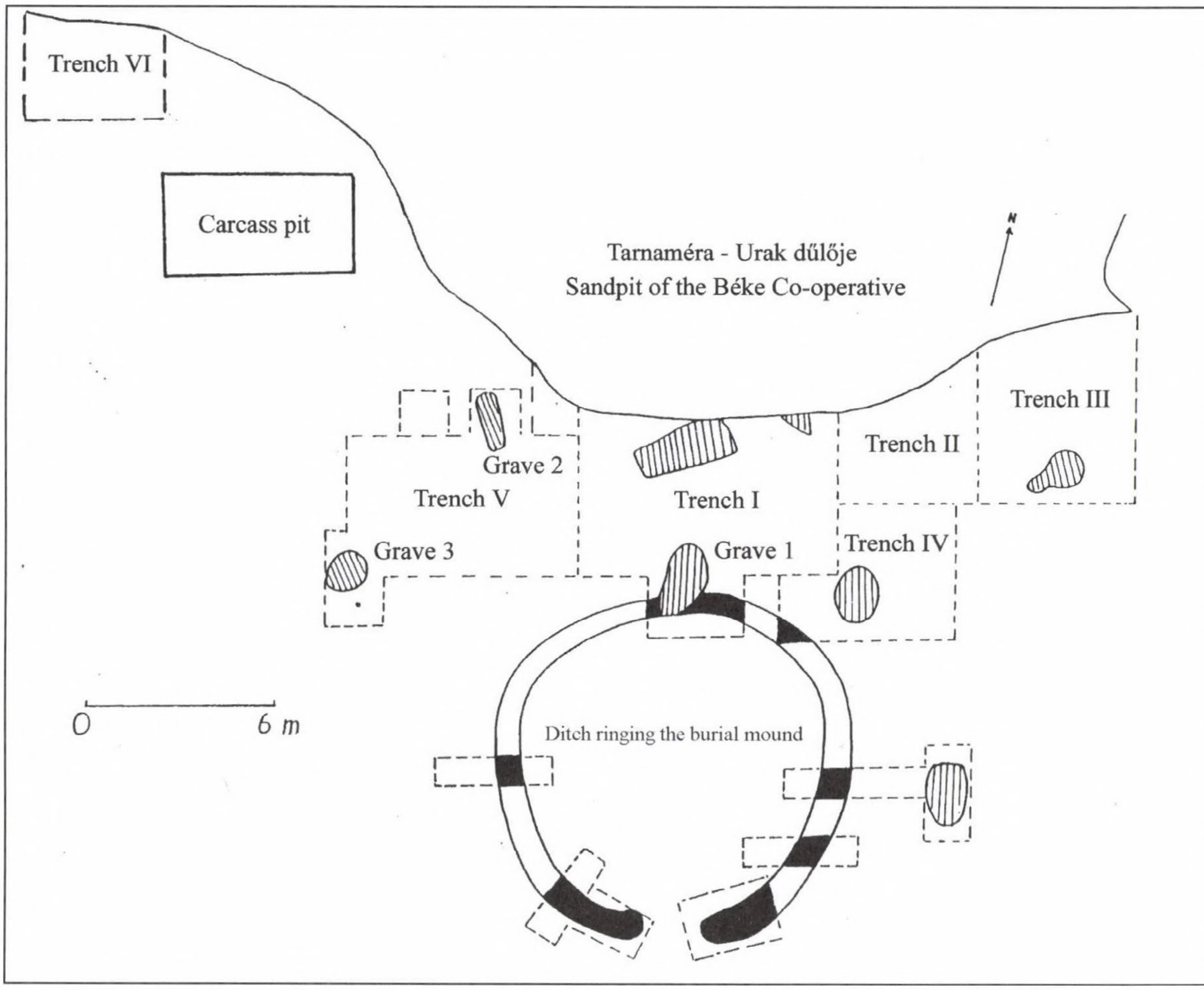

Fig. 5. Tarnaméra–Urak dűlője. Map of the site (after János Győző Szabó's documentation)

period, corresponding to the 5th century BC. The high-ranking members of Scythian communities were laid to rest under burial mounds, such as the one at Tarnabod.

János Győző Szabó uncovered two Scythian burials in the sandpit at Tarnaörs–Rajnapart in 1972. One was an inhumation, the other a cremation burial. A pintadera lay between the ashes in the urn burial.[15] Scythian finds were brought to light at Kompolt–Tagi rét.[16] Human skeletons and Late Iron Age pottery sherds came to light in the sandpit beside the guard-house at Tarnaméra, in the area between the Öreg-Tarna and the Kis-Tarna streams towards Tarnazsadány. The site was excavated by Ágnes Sós in 1951.[17] János Győző Szabó uncovered two Scythian burials and two pit-houses on a small hill in the sandpit of the Béke Co-operative at Tarnaméra in 1965.[18] One important observation made during the excavation was that the burial mound was ringed by a ditch *(Fig. 5)*. The ditch was 105 cm wide and 140 cm deep, and was originally horseshoe shaped with a diameter of 12 m. Celtic pottery sherds were recovered from the ditch, from a depth of *ca.* 90 cm. Even though János Győző Szabó could not excavate the burial owing to the lack of funds, he opined that the ditch had enclosed a Scythian grave. An oval pit measuring 2 m by 1.5 m with a depth of 1.5 m lay 2.5 m away from the eastern end of the ditch. The pit yielded Scythian pottery sherds. Scythian burial mounds had been uncovered at Tarnabod in a

15 Archives of the Hungarian National Museum, XVIII.175/1972, inv. no. 9857.
16 *D. Matuz et alii* (1998) 41.
17 Archives of the Hungarian National Museum, 18.T.I. inv. no. 4163.
18 Archives of the Hungarian National Museum, XXII. 384/1965.

location variously called Téglás domb or Őrdomb,[19] lying about 250 m east of the gravel pit. The low, round artificial mound lay near a dirt track; a rescue excavation was made necessary by the co-operative's plans to build a silo pit. Nándor Kalicz opened a 15 m long, 1.5 m wide trench along the mound's longitudinal axis.[20] A handful of pottery sherds, a few iron fragments and calcinated bone splinters were recovered down to a depth of 0.75 m. At a depth of 0.8 m, he noted that the mound was built from a thick layer of earth. A 0.6 m wide section of a ditch encircling the mound was observed in the northern and southern end of the trench in the humus of the one-time original surface. The discoloured patch in the dark humus was interpreted as the remains of the yellowish sandy earth removed from the ditch, which had been levelled on both sides of the ditch. The number of finds increased from a depth of 0.8 m and the number of iron articles too grew. As it turned out, most of these were the remains of an iron scale armour made up of small iron plates with one end cut straight, the other rounded, and pierced in several spots. Bronze scales of this type were also found. The grave itself was a cremation burial; some of the bones lying among the burnt bone fragments had been grave goods judging from the fact that they were worked. These articles were found over a small area, and probably marked the location of the grave. Most of the burnt scales lay in one heap at a depth of 1 m. A semi-oval dark patch was observed at a depth of 1.1 m, which in Nándor Kalicz's opinion most likely indicated the grave pit. He enlarged the trench by opening a 30 m x 1.3 m large new trench by the western wall of the trench. After reaching the virgin soil, the western half of the oblong grave pit was also outlined. The patch of another grave was noted a little farther from its northern end. The first patch contained a burial, Grave 1. The virgin soil lay at a depth of 1.1–1.3 m, and the remains were deposited into a small depression. It was probably a cremation burial for there was a scatter of bone splinters. A spindle whorl was found in the eastern end and a broken iron pickaxe in the western end. Although there were no visible traces of grave robbing, the position of the grave goods nonetheless suggested that the grave had been looted. Grave 2 lay on the western side of Grave 1, at a depth of 2 m from the present surface. A broken jug handle was found at a depth of 1.1 m (its other half was recovered from Grave 1). The patch of discoloured earth in the grave's northern part was cleared: the pit was interpreted as a robber pit. The grave robbers had dug down to a depth of 2.4 m. The robber pit sloped towards the north from the floor of Grave 2, and its northern wall was quite steep. This shaft was dug deep into the sandy virgin soil; its fill contained yellow sandy layers. A broken, perforated millstone was found on the floor of the robber pit. Nándor Kalicz also excavated the two sections of the ditch falling into the trench.[21] Both had a fill of yellow sand and mixed humus. The grey discolouration in the northern part indicated the one-time presence of some organic substance, perhaps decayed wood, but its original form could not be reconstructed. Both sections of the ditch were dug into the virgin soil to a depth of 0.4 m, which lay 1.3 m under the present surface. It seems likely that the graves were enclosed by this ditch. According to Nándor Kalicz, it is possible that wooden posts had been set into the ditch. It seems likely that there had been a wooden burial chamber under the mound, similar to the one brought to light at Fehérvár–Csurgó. A mound was raised over the graves after the burial ceremony; this mound currently rises to a height of 0.8 m (0.4 m along the edges).

The Scythian burial enclosed by a ditch was published by Mihály Párducz.[22] The most interesting grave goods were the scales from the scale armour. A total of seven intact and two broken bronze scales were brought to light;[23] their length ranged between 2.6–2.7 cm, their width between 1.2–1.5 cm. A total of 123 intact iron scales were recovered together with about four hundred fragments from roughly one hundred iron scales. The pottery sherds came from a bowl with indrawn rim, a barrel shaped pot and a large one-handled jug or two-handled kantharos. We know from analogous finds from Russia that bronze scale armours were replaced by iron ones from the mid-6th century and during the 5th century. On the basis of a comparable scale armour from Ártánd, the Tarnabod burial can be dated no earlier than the turn of the 6th–5th centuries BC.[24]

19 *Párducz* (1969) 37–39.
20 Archives of the Hungarian National Museum, XIX.226/1966. inv. no. 7862.
21 *Párducz* (1969) Fig. 3.
22 *Ibidem* 37–54.
23 *Ibidem* Pl. III. 1–11.
24 *Ibidem* 40.

Nándor Kalicz found a Scythian iron dagger in the southern part of Tarnabod.[25] The 20.2 cm long weapon was single-edged. Another rather ill-preserved, 37.6 cm long dagger came to light in an area called Báb, lying roughly 1.5 km west of Tarnabod.[26]

Celtic finds have been reported from Besenyőtelek–Szőrhát, a cemetery which had been used earlier, at the time of the Scythian Age–Celtic Age transition. The cemetery itself could be assigned to the La Tène C period.[27] The excavation of the site was conducted by János Győző Szabó in 1961–62. A bracelet with a diameter of 9 cm dating from the La Tène B2–C period was found at Heves–Szőlők.[28]

Late Iron Age pottery fragments came to light at Tarnaméra by the road running between the Kis-Tarna and the Öreg-Tarna. A spindle whorl and pottery finds were collected in an area called Urak dűlője.[29] These finds take us into the Roman period history of the region. The area called Urak dűlője lies west of Tarnaméra, by the southern bank of the Tarna, i.e. the Csörsz Dyke *(Fig. 6. 1)*. According to János Győző Szabó's report, inhumation burials were brought to light during sand mining operations in this area in 1964.[30] Grave 1 was taken to the local history collection in Tarnaméra, while the grave goods from Grave 2, two fragments of a larger vessel, were sent to the Eger museum. Grave 3 did not contain any finds, at least according to the workers' recollections. Grave 4 yielded thirteen triangular plaques, two six-petalled rosettes and three small tubes, which, together with thirteen carnelian beads and two paste beads, lay around the neck vertebrae. Two fragments of a round silver mirror were found among the beads. The other finds from this grave were four fragments of a bracelet of twisted wire and an asymmetrical, biconical spindle whorl. Only a part of the skeletal remains were preserved (one of the thigh bones, the humerus and the shoulder blades). The skull fragments were collected from various spots. The depth of the grave was about 1.2 m, its width was 1.13 m. The workers showed the patch of Grave 5, which had allegedly contained no finds; however, János Győző Szabó found a small triangular gold plaque in the mine's wall. He dated the burials to the 1st century AD, and linked them to the Jazygians.

Several late Sarmatian refuse pits and two burials, one Scythian, the other a 2nd century Sarmatian grave, were found in this area during the 1960s.

In 1965, János Győző Szabó conducted a rescue excavation in the same area, in the sandpit of the Béke Co-operative. The excavated area lay on a low hill.[31] He found the following graves:

Grave 1: The grave pit had an irregular egg shape *(Fig. 7. 1)* and was a north–south oriented disturbed male burial. The skeletal bones lay scattered at different depths. Pottery fragments *(Fig. 6. 4–5)* were found near a modern ditch, which cut through the grave's southern end.

Grave 2: The grave pit was oblong with rounded corners *(Fig. 7. 2)*, its length was 2.05 m, its width was 0.75 m. The burial was south-south-east by north-north-west oriented and contained a woman laid to rest in an extended position with the arms beside the body. The grave was 0.9 m deep. Its grave goods were as follows *(Fig. 6. 2–3, 6–7)*: 1. a pot by the right side of the skull, 2. various beads (paste beads with a diameter of 1–2 mm between the shinbones, carnelian beads by the waist on the right side, near the kneecap, large carnelian beads by the neck), 3. an iron fragment by the left side of the skull, 4. a pig tooth by the right shinbone, about 6–8 cm higher than the skeletal bones, and animal bones by the right kneecap. A spindle whorl was found when the discoloured patch of the grave pit was cleaned; it lay in the region of the waist. A small biconical vessel was found in the region of the feet before the grave was excavated.

Grave 3: The grave pit was egg shaped *(Fig. 7. 3)*; its length was 1.66 m, its width was 1.37 m, its depth was 0.65–0.70 m. Its north–south orientation diverged to the west by 34 degrees. The grave pit contained nothing but a skull fragment.

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25 *Ibidem* Pl. VII. 1 a-b.

26 *Ibidem* 40. Pl. VII. .2.

27 *B. Hellebrandt M.:* Celtic Finds from Northern Hungary. Corpus of Celtic Finds in Hungary III. Budapest 1999, 161–165.

28 B. *Hellebrandt* (1992) 98.

29 *Ibidem* 101.

30 Archives of the Hungarian National Museum, VII.95/1964.

31 Archives of the Hungarian National Museum, XVIII.315/1968, inv. no. 8712.

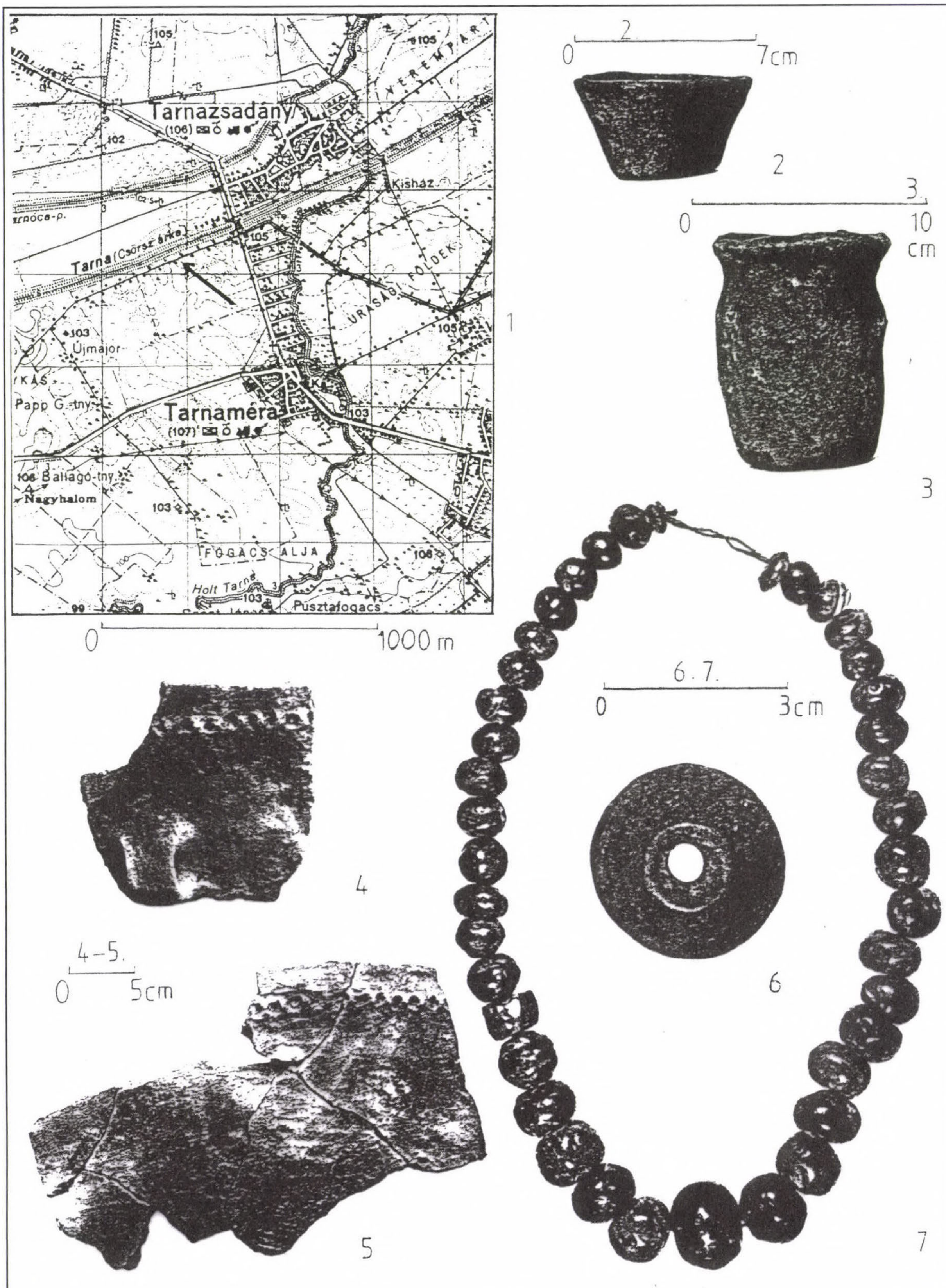

Fig. 6. Tarnaméra–Urak dűlője. 1. Map of the site with the Csörsz Dyke, 2–3, 6–7. finds from Grave 2, 4–5. finds from Grave 1 (after János Győző Szabó's documentation)

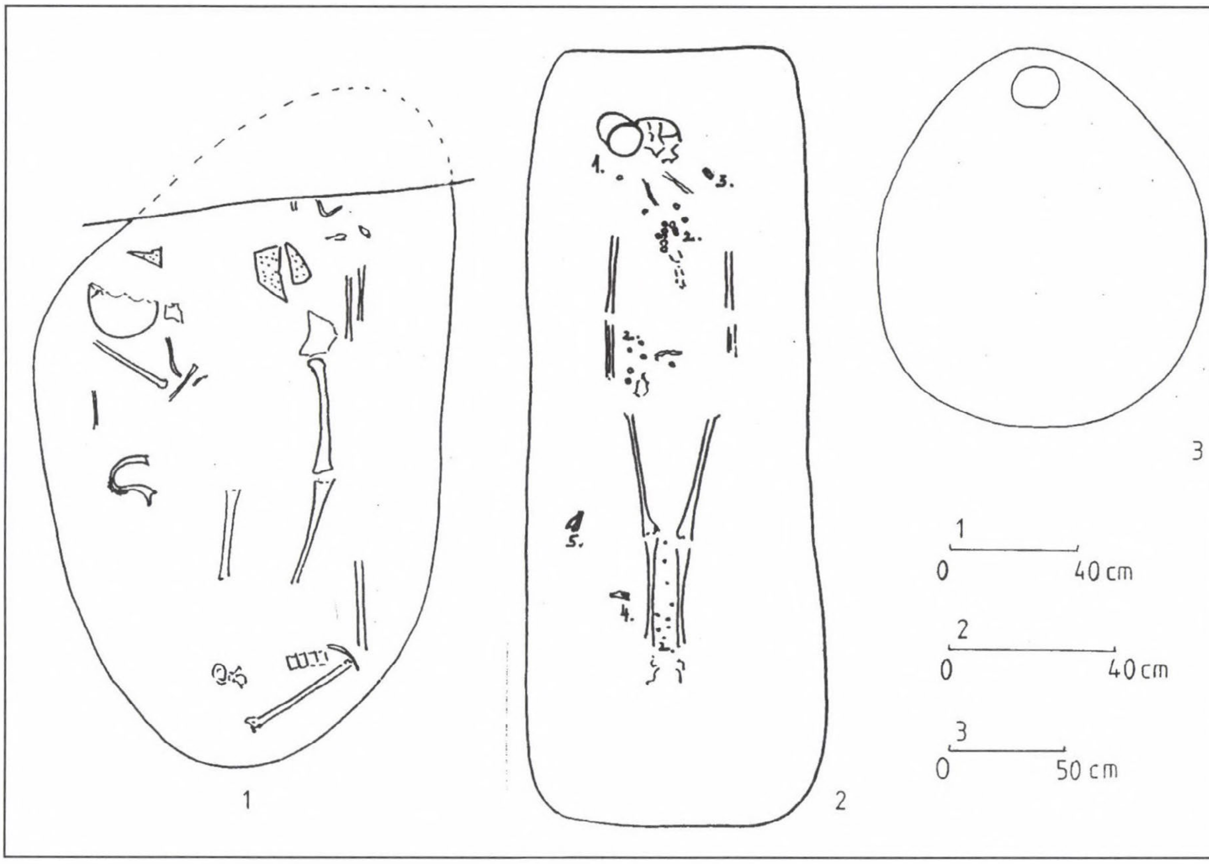

Fig. 7. Tarnaméra. Graves 1–3 (after János Győző Szabó's documentation)

The excavator assigned the graves to the Sarmatian period.

A few Sarmatian graves came to light in the sandpit at Heves–Vásártér in 1962;[32] burials from the same period were also reported from the area of the swimming pool. Several finds turned up during levelling work in an area called Berekalja-dűlő, lying between the Tarna Stream and Báb-tanya west of Tarnabod.[33] Nándor Kalicz uncovered a total of eight Sarmatian pits; each was cylindrical and had a flat floor. Some contained a few pottery sherds and animal bones. The most important settlement in this region was excavated in 1994 by Andrea Vaday at Kompolt, on the right bank of the Tarna during the large-scale excavations preceding the construction of the M3 motorway. The importance of this settlement lies in that it lay beside the Roman road leading east from Aquincum; the settlement itself could be reached within five or six days from the Roman province of Pannonia. Roman merchants passed along this road, as did the barbarians visiting the trade centres along the *limes*. Eastern trade was quite intensive from the late 2nd century to the earlier 3rd century.[34]

Four oblong, sunken houses were uncovered during the excavation. Two houses were oriented south-south-west by north-north-east, the other two had a west–east orientation. Their floor area was 15.8 m^2, 11.48 m^2, 11.2 m^2 and 4.4 m^2, respectively. Two houses had an internal pit and a hearth was found inside two houses. Ten wells were excavated. It seems likely that the reason for the high number of wells was that the settlement lay a little away from the river and the water was needed for watering the animals; an alternative explanation is that the wells were not all contemporaneous. The storage pits were round or oval, their diameter ranged between 10 cm and 90 cm, and the deepest one was 140 cm deep. Two shaft furnaces were also uncovered. Four open-air hearths were identified, around which lay animal bones, but these were not burnt. The Kompolt settlement had a rather loose layout without any

32 Archives of the Hungarian National Museum, XXI.528/1962.

33 Archives of the Hungarian National Museum, XXIII.263/1974.

34 *Vaday (*1999) 179–231.

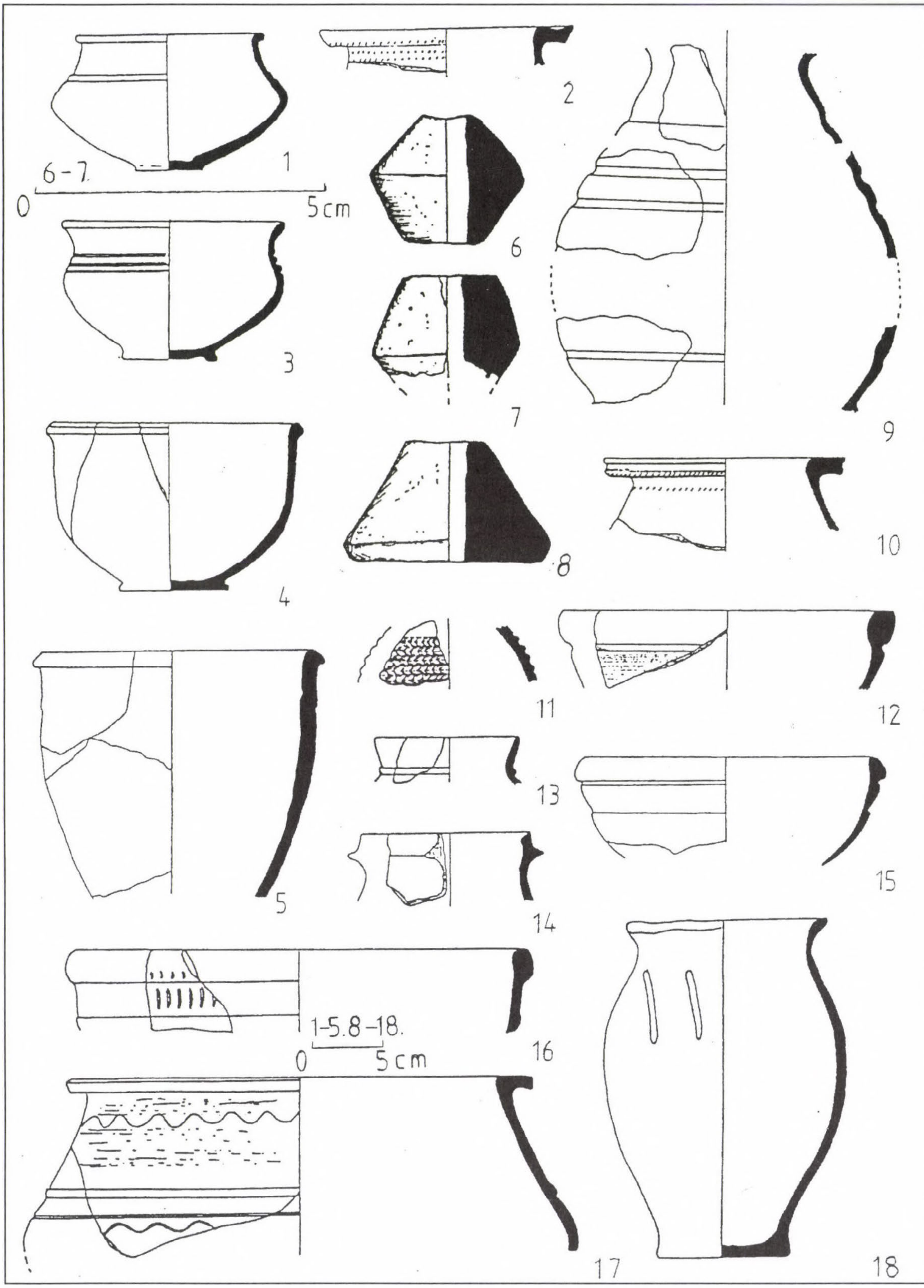

Fig. 8. Kompolt. A selection of the pottery finds (after Vaday [1999])

streets. Andrea Vaday noted that the settlement's occupants preserved many elements of the Sarmatians' pastoralist culture. She believes that a part of the Sarmatian population pursued a sedentary life-style, but the successive waves of new groups from the east revived the traditions of pastoralism. The occupants raised cattle, horse, sheep, goat, pig and poultry, and they also kept dogs. The most abundant category of finds was pottery *(Fig. 8)*, although most of the ceramics brought to light were broken. A total of 3910 sherds came from wheel-turned fine wares, 170 from wheel-turned household pottery and 1649 from hand-thrown household pottery. Only 1837 pieces could be assigned to a particular vessel type. Most came from jar shaped vessels, but bowls, pots and vessel lids were also well represented. Plates were quite rare and occurred mostly among the Roman imports. Traces of repair were observed in nine cases, suggesting that pottery was an easily replaceable commodity. Other finds included spindle whorls, bone implements, an awl and bone skates. Opaque white glass beads were recovered from several features, while a slightly angular, opaque red bead was found in one feature. Both types were typical for the 3rd century AD. Jewellery articles were represented by a bronze wire bracelet. The pottery finds included Germanic wares decorated with a smoothed-in band; the twenty terra sigillata fragments were Roman imports, as was the 18 cm long fragment of a pair of sheep shears. In her evaluation of the settlement and its finds, Andrea Vaday noted that when the fields and grazing lands were exhausted, the settlement's occupants probably packed their belongings and moved elsewhere. The extensive Kompolt settlement can be dated to the second third of the 3rd century AD.

Pál Patay identified the remains of a Sarmatian settlement at Tarnabod–Bábi tag, near the macadam road leading to Boconád.[35]

János Győző Szabó uncovered six late Sarmatian burials at Tarnaörs–Rajnapart.[36]

The most impressive human impact on the environment in the Tarnabod area was undoubtedly the construction of the Csörsz Dyke (sometimes called the Devil's Dyke). Starting from the Danube Bend, the ramparts of the Csörsz Dyke enclosed the Great Hungarian Plain. As Sándor Soproni has aptly noted, the Pilis and the Börzsöny Mountains formed a natural barrier in the Danube Bend, and thus the logical starting point of the dyke was the meeting point of the mountains and the plainland. The Csörsz Dyke ran eastward and then turned south towards the Lower Danube against the backdrop of the Carpathians, where the navigation of the Danube Gorges from Moesia was more difficult.[37] Hungarian archaeologists have studied this impressive rampart system since the 19th century.[38] Éva Garam, Pál Patay and Sándor Soproni conducted a series of field surveys along the Csörsz Dyke between 1962–1968. They excavated a few sections of the dyke, for example at Tarnabod and Tarnazsadány.

Flowing along the northern outskirts of Tarnabod in a roughly east to west direction, the Tarna River was led into the Csörsz Dyke in the 19th century. Nándor Kalicz collected pottery sherds of the Piliny culture during his inspection of the locations of dike construction projects after World War 2.[39] The excavation conducted by Sándor Soproni with the aim of determining the dyke's age took place in October, 1962.[40] Trench 1 was opened by the eastern side of the bridge leading out from Tarnabod, on the southern bank of the Tarna in the present-day floodplain, perpendicular to the river, i.e. the 2 m wide trench lay between the embankment and the river. The northern part of the trench was cleared to a depth of a 1 m, the southern end to a depth of 2.1 m. The following layer sequence was observed in the southern section of the trench: 0–10–15 cm: brown, modern alluvial humus, followed by black humus down to 90 cm, which contained pottery sherds, then a grey, mixed clayey layer down to 170 cm, followed by a grey layer to the clayey virgin soil at a depth of 205 cm. The Csörsz Dyke cut through this sequence in the northern part of the trench; the fill of the dyke could be well distinguished *(Fig. 9. 1)*. The northern half of the Csörsz Dyke is identical with the present bed of the Tarna.[41] Trench 2, measuring 2 m by 3 m, was also opened on the southern bank of the river. Pottery fragments of the Bronze Age

35 Archives of the Hungarian National Museum, X.259/1963.
36 Archives of the Hungarian National Museum, XVIII.175/1972. inv. no. 9857.
37 *Soproni* (1969) 49.
38 *Ibidem* 43.
39 *Soproni S.:* Tarnabod. ArchÉrt 90 (1963) 298; *T. Kemenczei:* Die Spätbronzezeit Nordostungarns. Budapest 1984, 108.
40 Archives of the Hungarian National Museum, V.148/1963.
41 *É. Garam – P. Patay – S. Soproni:* Sarmatisches Wallsystem im Karpatenbecken. RégFüz II. 23. Budapest 1983, Fig. 6.

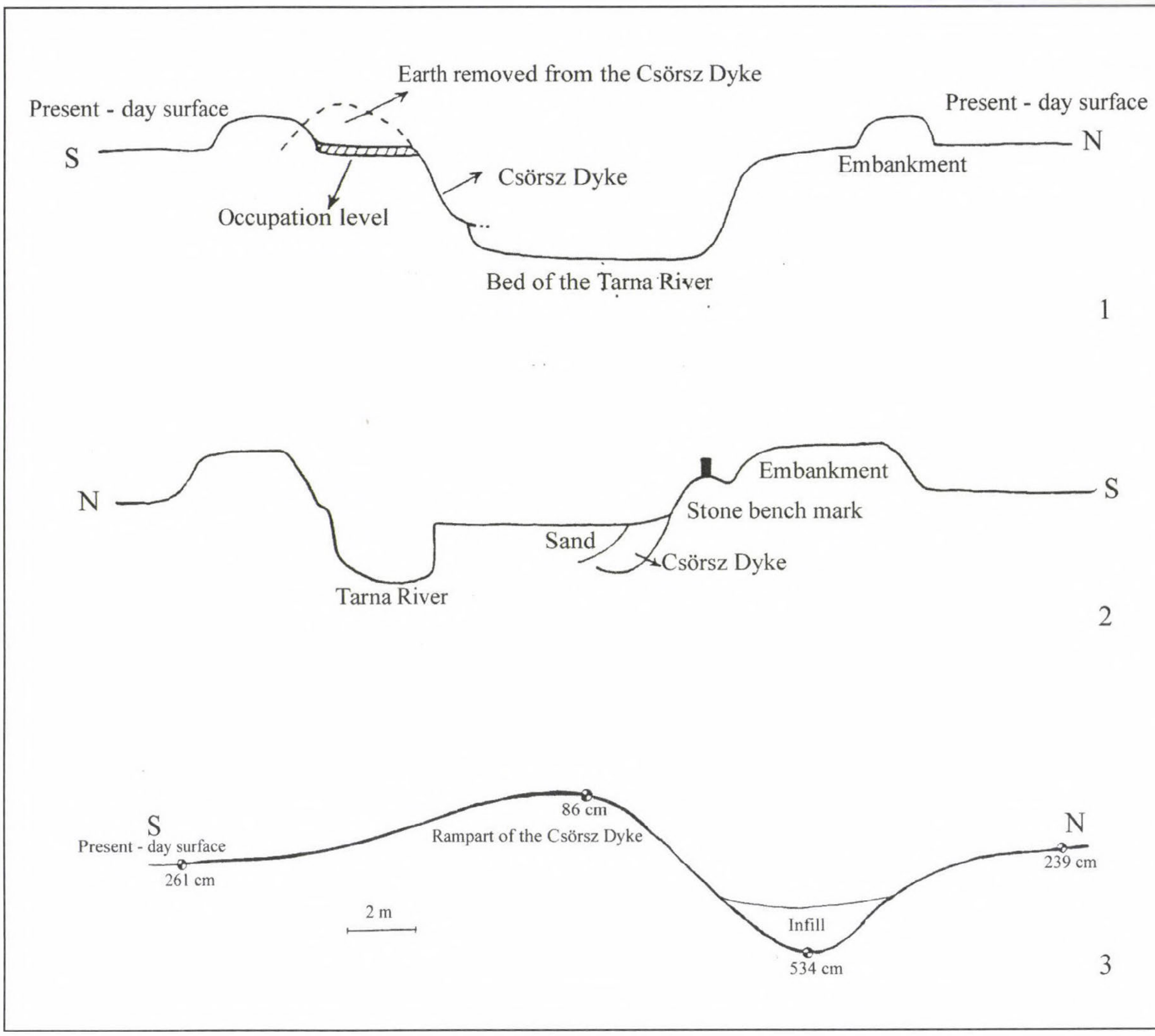

Fig. 9. The Csörsz Dyke

1. Tarnabod, 2. Tarnabod–Kál, 3. outskirts of Kál (after Sándor Soproni's documentation)

Piliny culture came to light between 20–60 cm. These sherds lay in a secondary position, suggesting that the dyke had cut through a Piliny settlement. Trench 3 was opened east of Trench 2, at the place where the Tarna changes its course from north–south to east–west and flows into the Csörsz Dyke. The original bed of the Tarna can still be seen – today it is an oxbow. A stone functioning as a bench mark can be seen in the inner face of the embankment; it probably marks the originally highest point of the Csörsz Dyke. Trench 3 *(Fig. 9. 2)*, oriented north-west to south-east and measuring 10 m by 0.8 m, was opened in order to clarify the point where the river was led into the Csörsz Dyke. The Tarna flows into the Csörsz Dyke in the area delineated by co-ordinates 589–590 (north–south) and 523–524 (east–west) at point 112.0. The rampart of the Csörsz Dyke survived in a fairly good condition, although the ditch itself was deepened for draining excess water. The investigation of the Csörsz Dyke was continued on the outskirts of Kál. Trench 4 was opened east of Trench 3 *(Fig. 9. 3)*. The floor of the Csörsz Dyke lay 170 cm below the floor of the channel dug to drain excess water. The ditch slopes steeply from the modern embankment. The one-time black humus overlay a yellow, clayey layer, into which the ditch was dug. Its fill was black at the base and greyish-black humus on top. The difference between the level of the present top of the rampart of the Csörsz Dyke and the floor of the ditch is 4.48 m.

In 1963, the southern bank of the Tarna between Tarnabod and Tarnazsadány was relocated by a few metres; the earth-moving operations necessary for the construction of the embankment were done by machines. During his inspection of the location, Nándor Kalicz found a Scythian and Sarmatian pit, as well as the remains of six destroyed burials.[42] Pál Patay conducted a rescue excavation in July, 1963.[43] The trenches were perpendicular to the river, and they were opened in the place where he had collected Sarmatian pottery sherds at the base of the embankment. He found the southern edge of the Csörsz Dyke. He also opened a 3 m wide trench in the floodplain, where he had found Sarmatian pottery fragments. The finds recovered from the trench were Sarmatian pottery sherds, which lay under the fill of the dyke's ditch, for they were found some 3–5 m away from the southern edge of the dyke and the base width of the dyke was about 6–8 m.

Nándor Kalicz investigated another section of the embankment construction area lying at Tarnazsadány–Sándor-része,[44] at the same time as Pál Patay's excavation. He excavated five Sarmatian burials lying in roughly the same zone. The excavator machine had partially destroyed a child's skeleton. The skeletal remains in these graves were rather poorly preserved. One of the burials yielded a Roman bronze coin. Another grave, a disturbed male burial, contained a sword, a vessel and a fibula.

Sándor Soproni noted that a Sarmatian burial dating from the period between 220–300 AD was found at the location of the dyke's rampart on the outskirts of Tarnazsadány.[45] The stratigraphic evidence suggested that the Csörsz Dyke had been constructed after the early Sarmatian period. The ditch and rampart only offered protection against mounted nomads. Sándor Soproni reviewed the historical evidence, according to which the Goths attacked Dacia in 264–270, which led to the evacuation and abandonment of the province. The changed political situation prompted the Romans to create an advance line of the *limes* and a buffer state against the incursions of the Goths and other barbarian peoples. We know that Marcus Aurelius planned the creation of two new provinces, Sarmatia and Marcomannia, and this is the reason that Sándor Soproni identified the Csörsz Dyke with the *Limes Sarmatiae* enclosing the Sarmatian lands. The construction of the ditch and rampart system called for the type of grandiose planning and engineering skills of which only the Romans were capable at the time. Counterforts were built on Sarmatian territory beyond the Roman *limes*; one of these stood at Hatvan–Gombospuszta, by the crossing-place over the Zagyva River. The ramparts excavated at Kál and Kompolt, both lying east of Hatvan, were probably part of the external defence line.[46] It seems likely that the defence of the ramparts was fulfilled by the occupants of nearby settlements.

Sándor Soproni did not regard his research findings as being the final word on the Csörsz Dyke.[47] New excavations and the re-evaluation of older ones will no doubt contribute to a better understanding of this exciting archaeological and historical issue.

42 Archives of the Hungarian National Museum, X.259/1963.

43 Archives of the Hugnarian National Museum, VIII.97/1964.

44 Archives of the Hungarian National Museum, X.259/1963.

45 *Soproni* (1969) 45.

46 *Ibidem* 51.

47 *Ibidem* 52.

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THE SIROK AREA IN THE IRON AGE AND THE ROMAN PERIOD

Magdolna B. Hellebrandt

The history of the settlements in the Tarna Valley, lying at the meeting of the Mátra and Bükk Mountains, was to a large extent determined by their geographic environment. The high mountains and the ore resources, primarily copper, zinc and gold, as well as the trade routes passing through the piedmont played a decisive role in lives of the peoples settling here.

Fig. 1. Sirok and its environs on an early 20th century map
Key: ○ Artificial ridge on Mt. Péter; ○ tumulus burials; • terraces on Kisvárhegy; ◐ Bronze Age cemetery at Szajla; ▬ pre-Scythian cemetery at Sirok–Akasztómály; △ findspot of a silver barbarian coin; ▲ late Celtic settlement at Sirok–Akasztómály

Significant amounts of copper were found during bygone millennia on Mt. Darnó and in the area called Nagyrézoldal [Great Copper Slope] west of Sirok *(Fig. 1)*. The first mention of copper lumps dates from 1845, when József Holló, a herdsman of Recsk, found native copper in one of the gullies of Mt. Aszalás between Bájpatak and Miklósvölgy.[1] In 1849, a piece of native copper weighing 8 *pfund* (4 kg) was discovered under a bush and taken to Eger. According to local lore, much larger lumps of native copper were sometimes found – one of these weighed roughly 112 kg and had been taken to

1 *Kiss* (1957) 4.

Fig. 2. The Szajla hillfort on an aerial photo

the National Museum in Vienna. The Treasury commissioned Lajos Oszwald, a mining engineer, to investigate these finds. A report was drawn up and sent to Count Lajos Nyári, the mine comptroller at Szomolnok, on whose orders a detailed survey was begun. The last large lump of native copper measured 44.1 cm by 22.05 cm by 9.8 cm and weighed 28.6 *pfund* (14.3 kg). One part of this lump of native copper was not laminar, but made up of several nodules.

The deep-boring data from the 1980s[2] indicated the presence of porphyric copper at Recsk. According to the published data, native copper could be found between 0–200.1 m (with a useful content extending down to 198 m) at one location, while at another location copper deposits were noted between 0–117 m (with the entire deposit having useful content). Non-ferrous ores – copper, zinc and iron – were detected between 0–49 m (with the useful content extending down to 49 m) at another location. A fourth location indicated the presence of copper, zinc and iron between 0–114 m (the thickness of the useful content extended down to 105 m). According to deep-boring data from 1984,[3] the samples contained copper and molybdenum between 0–200 m. Another sample contained copper, molybdenum, lead and zinc between 0–149 m. The deep-boring data from 1985 and 1988 yielded similar results,[4] indicating that copper and various non-ferrous metal ore deposits were accessible from the surface. Copper and zinc are both necessary for bronze casting. The other metal resource in the Mátra Mountains was gold,[5] even if in lesser quantities.

Mt. Darnó is part of the Bükk Mountains as regards its geologic structure, and part of the eastern range of the Mátra Mountains in terms of its morphology. Haematite iron ore can be found on its northwestern slope, on the southern side of the valley separating it from Mt. Kis.[6] These ores could be easily mined from the surface, and they were undoubtedly exploited in various historic periods – it seems likely that much blood was shed for their possession. An examination of the aerial photographs of this area reveals an artificial ridge under Mt. Péter,[7] southwest of Szajla *(Fig. 2)*; a comparison of the photo with the 1:25,000 map of the same area *(Fig. 3)* shows that this fortification is protected by marshland from the northwest, the southeast and the southwest. The ridge itself is some 2 km long and 1.2 km wide, and it appears to have been a hillfort *(cp. Fig. 1)*. Tibor Kemenczei excavated several stone-packed burials over

2 Magyarország mélyfúrási adatai 1983. Eds: P. Bohn – K. Kiss. Budapest 1983, 720–734.

3 Magyarország mélyfúrási adatai 1984. Eds: P. Bohn – K. Kiss. Budapest 1984, 893–899.

4 Magyarország mélyfúrási adatai 1985. Eds: P. Bohn – K. Kiss. Budapest 1985, 1007–1076; Magyarország mélyfúrási adatai 1988. Eds: P. Bohn – K. Kiss. Budapest 1988, 981–1010.

5 *Kiss J.:* Nagygalya–Nagylipót–Aranybányafolyás (Mátrahegység) ércesedése és vulkanologiai felépítése. Archives of the Geological Institute of Hungary (no. T.407). Budapest 1958, 29–30.

6 *Kiss* (1957) 37; *Félegyházi Zs. – Vecsernyés Gy.:* Jelentés a siroki Darnóhegy területén az 1969. évben végzett 1:5000 méretarányú újrafelvételről. Archives of the Geological Institute of Hungary (no. T 2325). Budapest 1969, 50.

7 Map Archives of the Museum of Military History, film/photo no. 925/5274, print no. 25778. Taken in 1962.

which an earthen mound had originally been raised. Indicating disturbances, the light patches on the aerial photos suggest that there had been several large burial mounds in the area. The Szajla–Nagyhalom site is mentioned among the castles, forts and fortified places of Heves County,[8] although it must be noted that after his survey of the site, Gyula Nováki concluded that the site was not a hillfort or a castle. It was probably a burial mound (cp. *Fig. 1*), similarly to the one at Koponyatető to its north.[9]

Fig. 3. The Szajla hillfort on a 1:25,000 map

Nagyhegy, Kisvárhegy and Nagyvárhegy *(Fig. 4)* lying south of Sirok probably had a similar strategic function. Unfortunately, these mountains are heavily forested, and only after lumbering operations will it be instructive to make a few aerial photos, which will hopefully contribute new data. Gyula Nováki did not consider the Nagyvárhegy [Great Castle mountain], alternately called or Liszkóvár [Liszkó Castle], to have been a castle or hillfort.[10] The Kisvárhegy [Small Castle Mountain] is a solitary mountain, whose peak rises on the southern side, where Gyula Nováki noted two ditches of unknown date and function.[11] The mountain top slopes towards the northern side. There are two semi-circular terraces at the base of the peak; the upper terrace is 4–5 m wide, the one directly under it is 1.5 m wide. Gyula Nováki found a few pottery sherds and some burnt daub fragments here, which he tentatively assigned to the Late Bronze Age (cp. *Fig. 1*).

8 *Nováki – Baráz* (2000) 28, 29.

9 I would here like to thank archaeologist László Fodor and curator Mrs György Ficsór of the Dobó István Castle Museum in Eger for their generous help in mapping the sites.

10 *Nováki – Baráz* (2000) 28.

11 *Nováki Gy.:* Őskori várak. *In:* A Bükki Nemzeti Park. Hegyek, erdők, emberek. Ed.: Cs. Baráz. Eger 2002, 362.

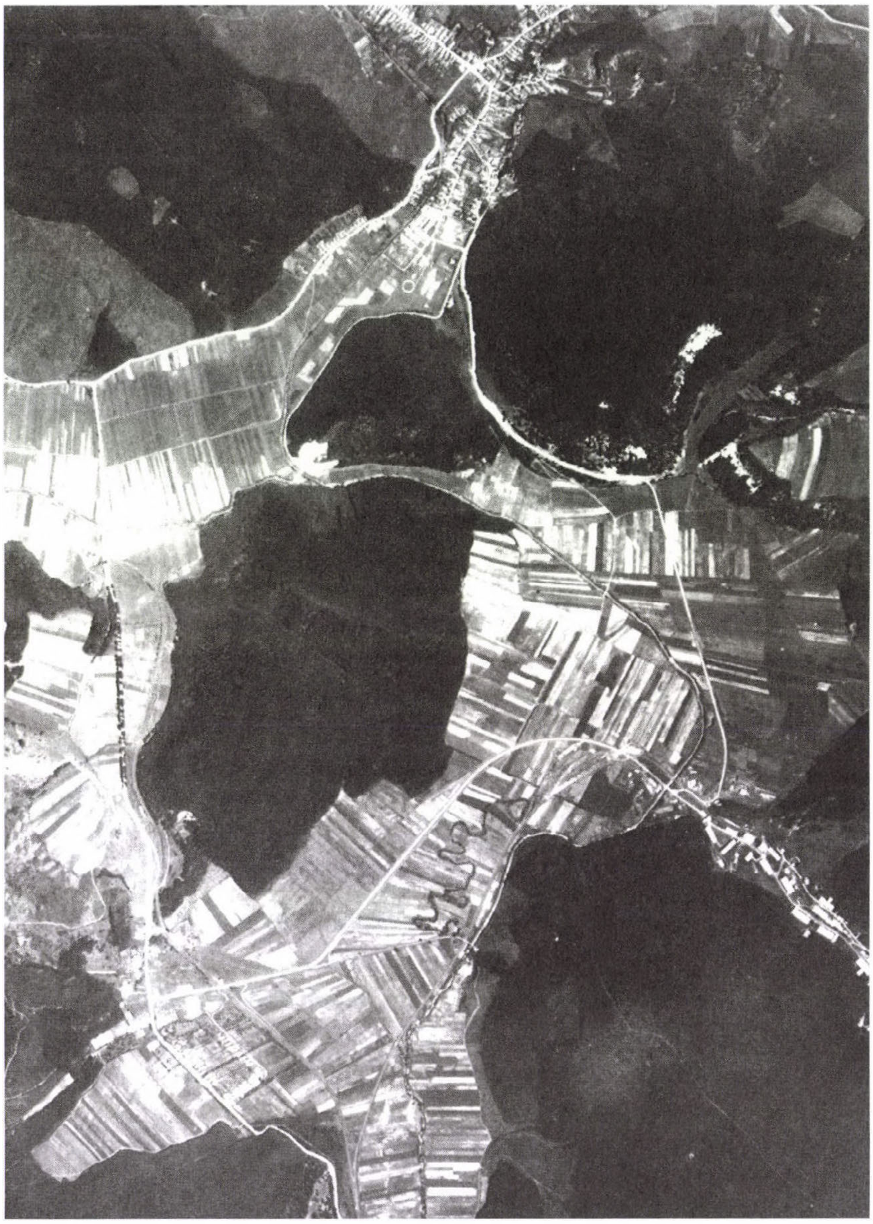

Fig. 4. The southern area of Sirok on an aerial photo

Another site known from the archaeological literature is Darnó–Várhegy [Castle mountain],[12] which János Győző Szabó visited during his excavation at Sirok. He did not detect any remains suggesting a hillfort,[13] and neither did Gyula Nováki.[14]

Similarly to other hillforts in the area, the one at Szajla was probably built in the Late Bronze Age or Early Iron Age.[15] A cemetery from this period has been reported from Szajla, where János Győző Szabó and Béla Kovács uncovered four inurned burials in 1960.[16] The site lies on the southern slope of the hill, rising on the southern bank of the Tarna Stream, at the junction of the Sirok–Szajla roads (on the land belonging to the Búzakalász Farm Co-operative; cp. *Fig. 1*). In 1963, the site was endangered by plans to use earth from the hill to construct an embankment. The rescue excavation was conducted by Tibor Kemenczei,[17] who uncovered ninety-five burials,[18] which in his opinion represented about one-quarter of the entire burial ground. He noted that the cemetery's southern boundary lay at the foot of the hill and that its western boundary was marked by the second silo pit, and he also identified the burial ground's northern boundary. Any remaining graves lay to the east. The excavated section of the cemetery contained cremation burials. The ashes were usually placed in urns (e.g. Graves 1–2, 4, 17, 19, 22–24, 26–27, 30–31) or, more rarely, in a cup (Graves 16 and 37). Some were scattered cremation burials (Graves 28, 44, 71). In Grave 53, the ashes were placed in a bowl together with a bracelet, with the bowl set in a larger urn, similarly to Grave 81, which too had a small bowl containing the ashes deposited in an urn. Several

12 *Bartalos Gy.:* Heves vármegye őskora. *In:* Heves vármegye. Ed.: S. Borovszky. Budapest 1909, 436.
13 Archives of the Hungarian National Museum, XIV.227/1970, inv. no.9295. Excavation diary, entry for July 7.
14 *Nováki – Baráz* (2000) 28.
15 *M. B. Hellebrandt:* Urzeitliche Erdwalle und Wasserburgen. Bibliotheca Marmatia 2 (2003) 222.
16 Archives of the Hungarian National Museum, V.1960/260, inv. no. 5142; *Kemenczei* (1984) 135–136.
17 Archives of the Hungarian National Museum, IX.234/1963, inv. no. 6744, and VIII.98/1964, inv. no. 7031.
18 *Kemenczei* (1984)135–142.

bronze articles were recovered from the burials: spangles (Graves 49 and 51), a bronze razor (Grave 47), a broken bronze artefact (Grave 39) and bronze bracelets (Graves 17, 53, 60). Some burials yielded bronze pins (Graves 17, 19, 45; *Fig. 5. 9*), a few of which were broken (Graves 47 and 65; *Fig. 5. 17)*. The bronze pin was stuck into the ground in Grave 76, while in Grave 87 the pin was found beside the urn. Animal bones were recovered from Graves 13, 21–22, 43, 63, 65 and 85; their number was rather low compared to the number of burials. Almost all of the graves had a stone packing of larger boulders or stone slabs. Graves 15–16 had a single stone packing, even though Grave 15 did not contain any ashes. Graves 21–22, 57–58, 60–62 and 63–64 were similarly found under a single stone packing *(Fig. 6)*. Graves 24 and 31 were encircled with stones. The small pot containing the ashes in Grave 14 and the urn in Grave 32 were set on a stone slab. The four burials uncovered by János Győző Szabó and Béla Kovács in 1960 had a similar stone packing: the floor of each grave pit was lined with flat sandstone slabs and the burials were encircled with stones. Stones were sometimes set on the vessels, for example on the cups in Graves 1, 4, 17, 22, 23, 25–27, 29, 33, 36, 70, 72 and 84; the pot in Grave 17 was separately covered with a stone, as was an urn in Grave 25, while the urn in Grave 62 contained a stone and a stone slap was set on one of the cups too. A small stone was found inside the urn in Grave 64. The urn containing the ashes was covered with a bowl in twenty-one burials, as were the urns in Graves 58 and 70, which did not contain any human remains. Some graves contained symbolic burials only for none of the vessels deposited in the grave, which usually had a stone packing, contained any human remains (Graves 3, 5, 15, 25, 34, 40, 41, 54, 61, 69, 70, 72, 76, 78, 83, 84, 89 and 95). These eighteen burials represent one-fifth of the excavated graves. It has been suggested that the symbolic burials were made for community members who had died far from their homes. One of the graves uncovered by János Győző Szabó and Béla Kovács contained a stone measuring 20 cm by 40 cm by 70 cm, which had been set into the ground and probably functioned as a grave marker.

The pottery recovered from the burials recalled the wares of preceding periods, namely the early Urnfield culture, but in a slightly changed form, adapted to the taste of the Hallstatt A period *(Fig. 5)*.[19] Some vessels showed the influence of the Piliny and Kyjatice cultures. The date of the cemetery could thus be established: the Szajla burial ground was used by an Urnfield community at the time of the Late Bronze Age–Early Iron Age transition.

Settlement remains and a pottery kiln from the same period were found by Árpád Nagy in 1968 at Sirok on the southern slope of Szt. Iván Hill, facing the entrance to the Mátravidék Foundry.[20]

The nine burials uncovered by János Győző Szabó in 1969–70 at Sirok–Akasztály date from the so-called pre-Scythian period. The cemetery lies on a hilltop (cp. *Fig. 1*). The graves contained inhumation burials and lay 6–7 m from each other *(Fig. 7)*. The excavation diary, the description of the burial rite written by the excavator and Erzsébet Patek's study on these graves provide the following information:[21] the first burial was cleaned by the finders and thus very little is known about it. Graves 1, 4 and 8 were north-west–south-east oriented, while Graves 2, 3, 5–7 and 9 were west–east oriented. The grave pits were oblong with rounded corners (e.g. Graves 3, 7) or elongated elliptical in form (e.g. Graves 2 and 8). Graves 4 and 9 were disturbed by grave-robbers and the form of the grave pit could not be determined. The length of the longest grave pits ranged between 210–240 cm, their width between 90–123 cm, while the grave depth ranged between 25–200 cm. The deceased were laid on their back, the head was turned to face north, with the exception of the individual buried in Grave 6, who was buried in a contracted position on the right side. According to János Győző Szabó's observation, the skeletons lay nearer the right side of the grave and the grave goods were usually deposited in the northern part of the grave pit, along the left side of the skeleton and by the skull,[22] as in the case of Graves 7 and 8 *(Fig. 8. 1–2)*. Each burial contained a large, urn sized vessel; Graves 2 and 3 had a bowl, while a one-handled cup was deposited in Graves 3, 4, 5 and 7, and a little pot in Grave 8. Grave 3 contained

19 *T. Kemenczei:* Zur Verbreitung der spätbronzezeitlichen Urnenfelderkultur östlich der Donau. FolArch 26 (1975) 66.

20 Archives of the Hungarian National Museum, XVIII.196/1971, inv. no. 9553.

21 Archives of the Hungarian National Museum, XVII.215/1969, inv. no. 8977; XIV.227/1970, inv. no. 9295; *Patek* (1989–1990) 65–67.

22 *Patek* (1989–1990) Pl. 34. 1–4.

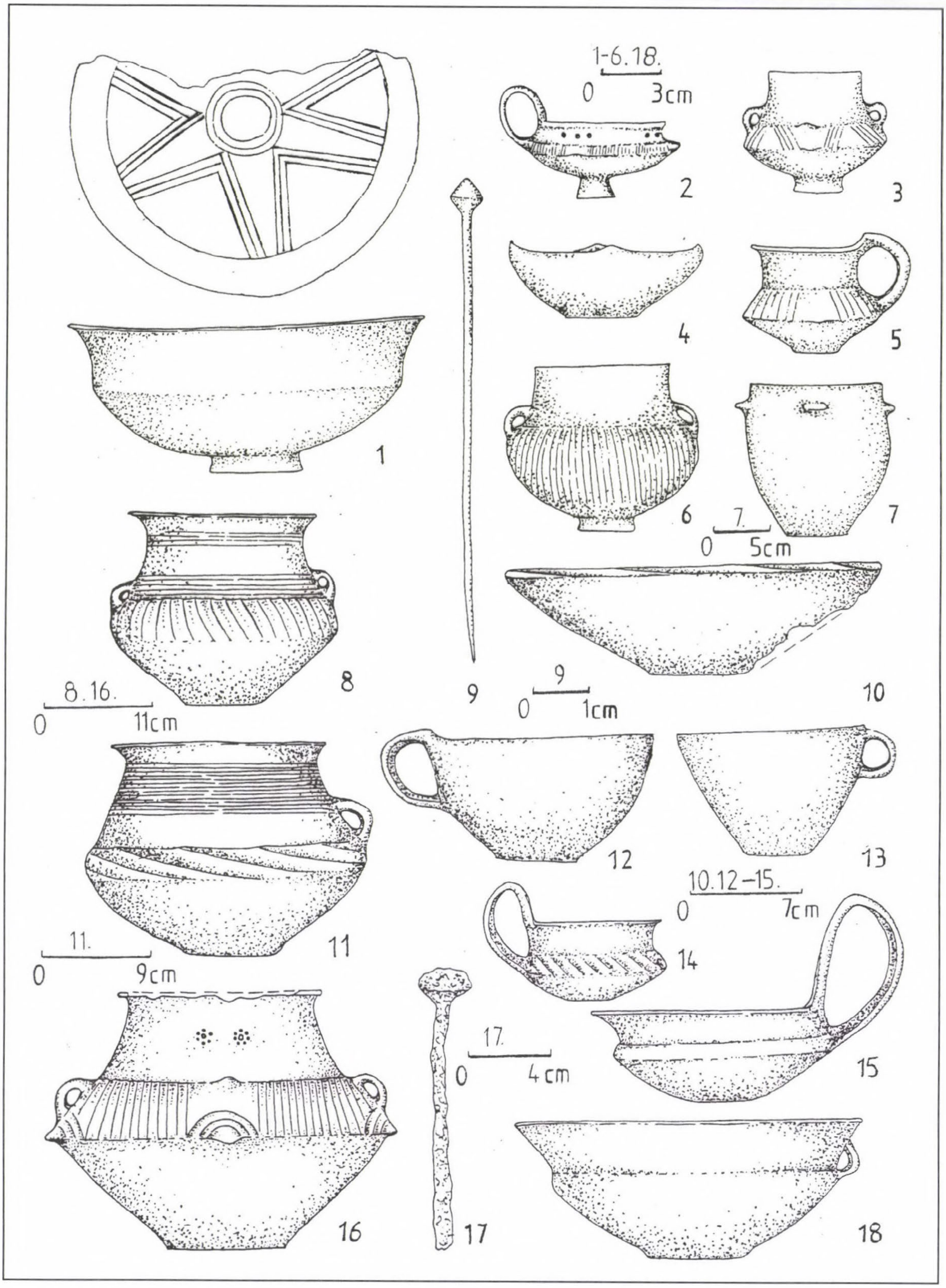

Fig. 5. A selection of the Late Bronze Age and Early Iron Age finds from Szajla (after Tibor Kemenczei)

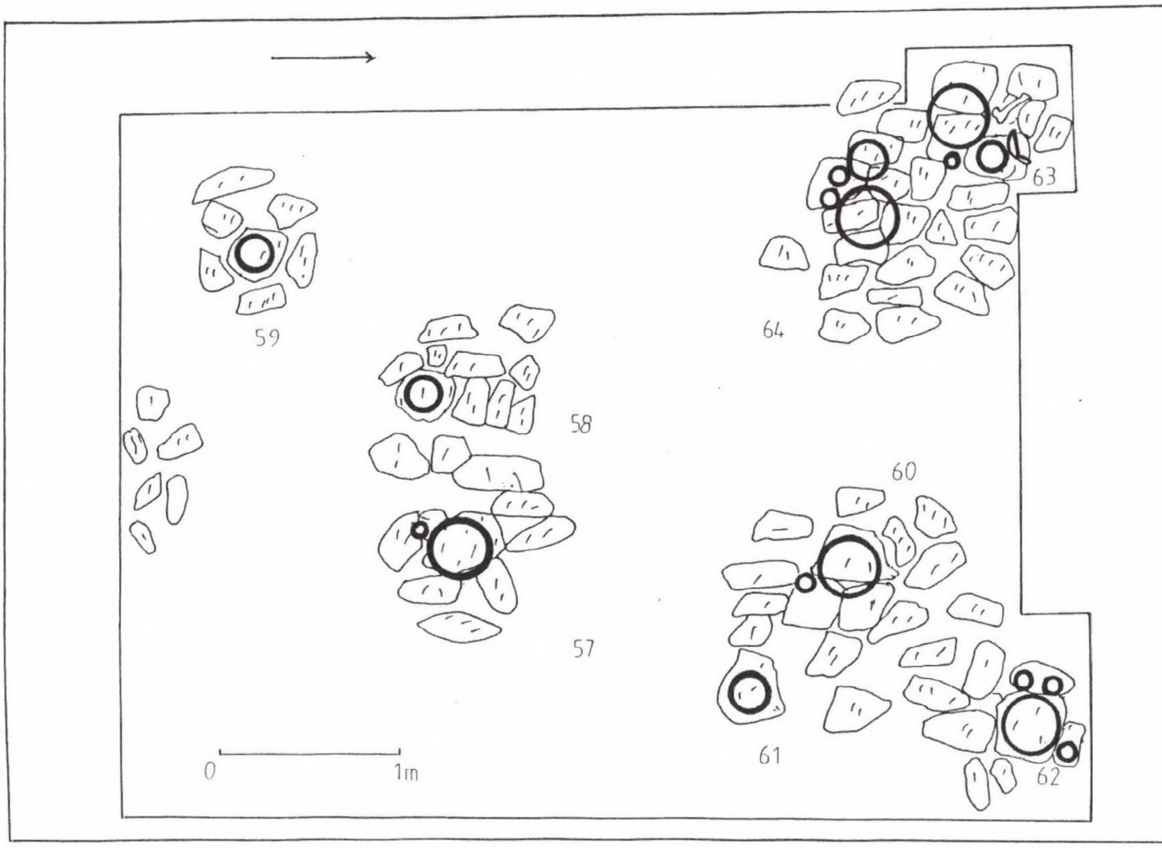

Fig. 6. Szajla, Trench IX with the stone packed urn burials (after Tibor Kemenczei's documentation)

three vessels. A sandstone slab was deposited in Graves 2, 3, 5 and 7; in Grave 7, it lay behind the skull, while in the other burials it was found beside the left foot. Erzsébet Patek interpreted similar slabs as grinding stones,[23] but this seems unlikely in the case of the Sirok graves since they were made from sandstone. Burials containing stones are not uncommon in the Scythian Age, even in cemeteries lying in plainland areas, such as Kesznyéten.[24] Quernstones were found in the graves uncovered in the burial grounds at Orosháza–Gyopáros[25] and Szentes–Vekerzug.[26] A similar sandstone slab was recovered from the Scythian Age cemetery excavated at Sándorfalva–Eperjes (Grave 165).[27] It seems likely that these stones had a symbolic meaning.

János Győző Szabó uncovered four rectangular north–south oriented pits in 1969–70. Their length was roughly 250 cm, their width ranged between 50–72 cm and their depth between 180–221 cm. Only one of these pits contained any finds: the skeletal remains of a deer (lacking the skull and pelvic bones) according to Sándor Bökönyi's determination. At the time, the excavator believed that these pits could be associated with the burials. However, we know that late Celtic houses were also uncovered at the site and, as it later turned out, these pits lay around these houses. Their north–south orientation would have made them perpendicular to the pre-Scythian graves and another circumstance challenging their association with the burials is that we know that it was customary to bury deer in separate pits during the Roman period.

In his summary of the excavation, János Győző Szabó noted that the most graves contained female burials. He assumed that men and women had been buried in separate grave groups: the women were

23 *Patek* (1989–1990) 71.

24 *B. Hellebrandt M.:* Szkíta kori temető Kesznyéten–Szérűskerten (1984–85. évi ásatás eredménye). HOMÉ 25–26 (1988) 111.

25 *T. Juhász I.:* Az Orosháza–gyopárosi szkítakori temető. ArchÉrt 99 (1972) 214.

26 *M. Párducz:* La cimitière hallstattien de Szentes–Vekerzug II. ActaArchHung 4 (1954) 32, 50.

27 *Galántha M.:* Előzetes jelentés a Sándorfalva–eperjesi szkíta kori temetőfeltárásról. MFMÉ (1982–1983) 119.

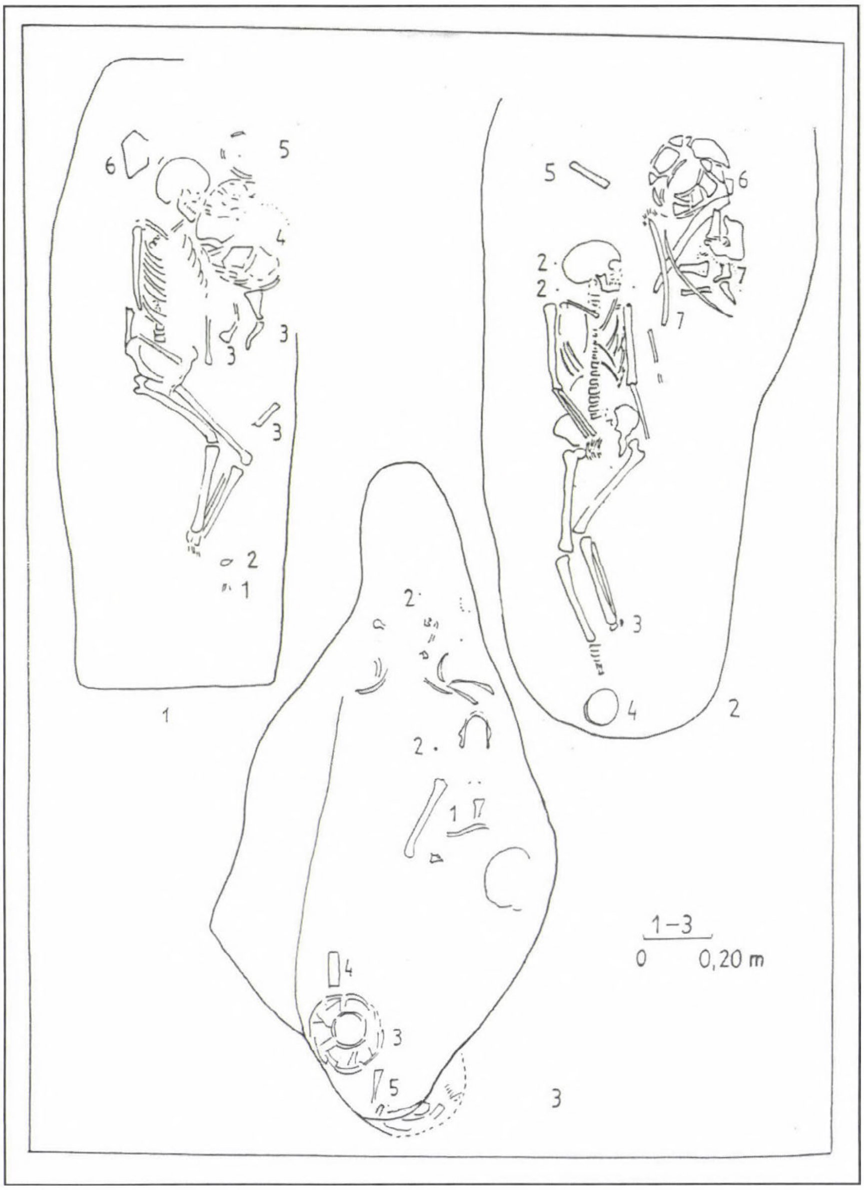

Fig. 7. Sirok–Akasztómály. Pre-Scythian graves. 1. Grave 7, 2. Grave 8, 3. Grave 9 (after János Győző Szabó's documentation)

interred on the ridge (Graves 5, 3, 2, 7 and 9), with Grave 1 and Grave 8, the burial containing the gold articles, a little to south.

The most intriguing finds among the grave goods were what Erzsébet Patek called bone plaques and what János Győző Szabó described as bone laths. These are typical for the pre-Scythian graves *(Fig. 9)* of the Füzesabony–Mezőcsát group and have not been found in other contexts in the Carpathian Basin. Neither are comparable pieces known elsewhere, which makes their interpretation rather difficult. The bone plaques are slightly convex, their surface is carefully smoothed or polished, and they usually bear a pattern of lightly incised lines. Erzsébet Patek noted that the spirals, hatched triangle motifs and infinite patterns resemble the ornamentation of the pottery finds from the Bronze Age–Iron Age transition.[28] János Győző Szabó suggested that these bone plaques were perhaps needle-cases because they often lay near needles.[29] Erzsébet Patek discarded this interpretation, claiming that they were more often found without needles and should rather be regarded as the ornaments of a textile pouch and that the incisions along the edges of these bone plaques served to keep the thread by which they were attached in place.[30]

The pottery finds bespeak influences from the earlier Kyjatice and Gáva cultures, with the former being more dominant in the case of find assemblages from Heves County.

Many burials contained animal bones. In most cases they were simply set on the floor of the grave pit, and only occasionally were they placed in a vessel, as in Grave 3, in which the sheep bones were found in a bowl.[31] János Győző Szabó interpreted the animal bones found by the vessels on the left side of the skeleton as the remains of the funerary feast. Cattle ribs and sheep bones lay beside the skull in Grave 8, a female burial with gold earrings and beads. The left forelimbs of sheep were deposited in Graves 3,

28 *Patek* (1989–1990) 70.
29 *Szabó J. Gy.:* A hevesi szkítakori temető. Hozzászólás az Alföld szkítakori népességének kérdéséhez. EMÉ 7 (1969) 75.
30 *Patek* (1989–1990) 71.
31 *Ibidem* 66.

5, 7 and 8, while Grave 2 contained the right metacarpal. Grave 4, a child burial, yielded sheep astragali, which had probably functioned as toys; they were placed by and between the feet. Béla Balázs suggested a similar interpretation for the fourteen sheep articular bones found by the left hand in Grave 6 of the Tibolddaróc cemetery.[32] The animal bones found in the Sirok grave were determined as follows by Sándor Bökönyi:

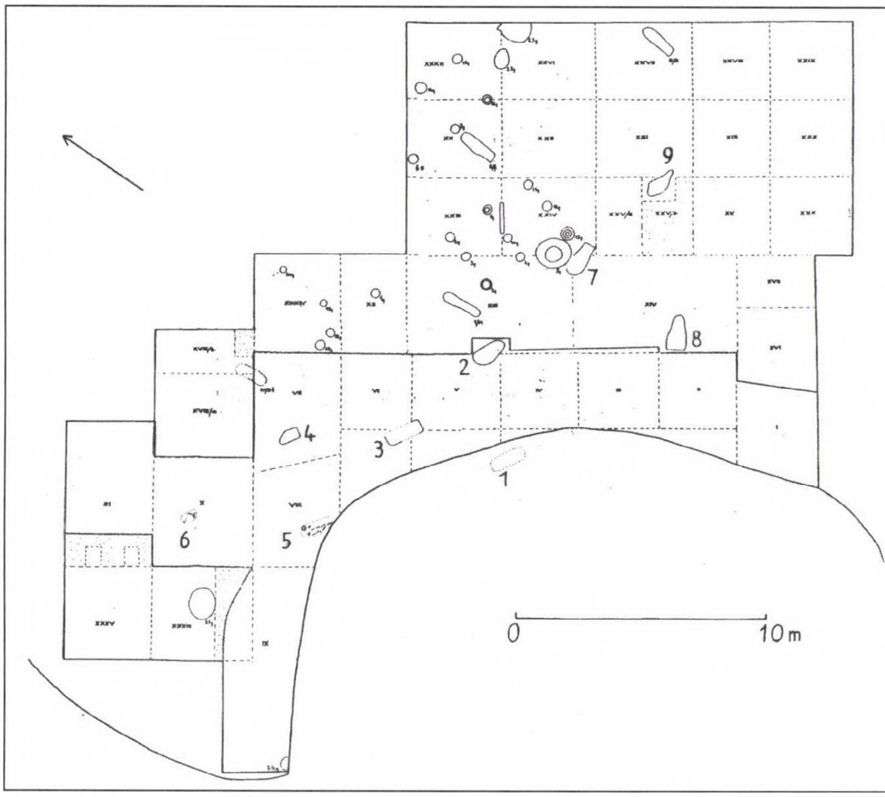

Fig. 8. Sirok–Akasztómály. Excavation map of the 1969–70 season (after János Győző Szabó's documentation)

Grave 2: right sheep scapula, radius and ulna; sheep pelvic bone fragment (subadultus);

Grave 3: left sheep scapula, radius and ulna, half of the left pelvic bone (subadultus);

Grave 4: three sheep astragali from an adultus, three sheep astragali from a subadultus;

Grave 5: sheep lumbar vertebrae, sacrum and ribs (adultus);

Grave 7: sheep left forelimb and right pelvic bone (adultus);

Grave 8: sheep left forelimb (subadultus); cattle lumbar vertebra, sacrum, two ribs, two caudal vertebrae (adultus);

Grave 9: the animal bones have not been analysed yet.

The anthropological analysis of the human skeletal remains was performed by Kinga Éry.[33] Her examination of several cemeteries in Heves County revealed that female burials outnumbered male ones. In her view, this could be explained by polygamy, but in view of the symbolic burials at Sirok it is also possible that some members of the male population had not been buried in the community cemetery, but far from their home, e.g. on the battlefield. Kinga Éry noted that the men were often lower in stature than women and that men included more brachycephalic individuals. Most individuals could be assigned to the dolichocephalic, Mediterranean type with cromagnoid (Andronovo) traits; the latter could also be observed in the case of brachycephalic individuals. This Kazakhstan trait fits in with the archaeological finds indicating that the pre-Scythian population of Heves and Borsod counties had arrived to the Great Hungarian Plain from the southern Russian steppe.

On the basis of the finds and their analogies, Erzsébet Patek dated the Sirok cemetery to the HB 2–3, i.e. to the 9th–8th centuries BC.

Gyula Bartalos mentioned that he knew of several prehistoric antiquities found in the area of Sirok Castle.[34] He had acquired a barbarian silver coin bearing a laureate head on the obverse and a barbarian rider on the reverse (cp. *Fig. 1*). According to Bartalos, the coin had a test cut "similarly to the other pieces", suggesting that it had not been a stray find, but part of a coin hoard. The practice of cutting on

32 *Balázs B.:* A tibold-daróczi (Borsod megye) bércúti őstelep. ArchÉrt 25(1905) 415.

33 *Éry K.:* Embertani vizsgálatok Heves megye Kr. e. VIII. századi népességén. Agria 25–26 (1989–1990) 123.

34 *Bartalos Gy.:* Egervidéki "kaptár-kövek" és barlangok. ArchÉrt 11 (1891) 137.

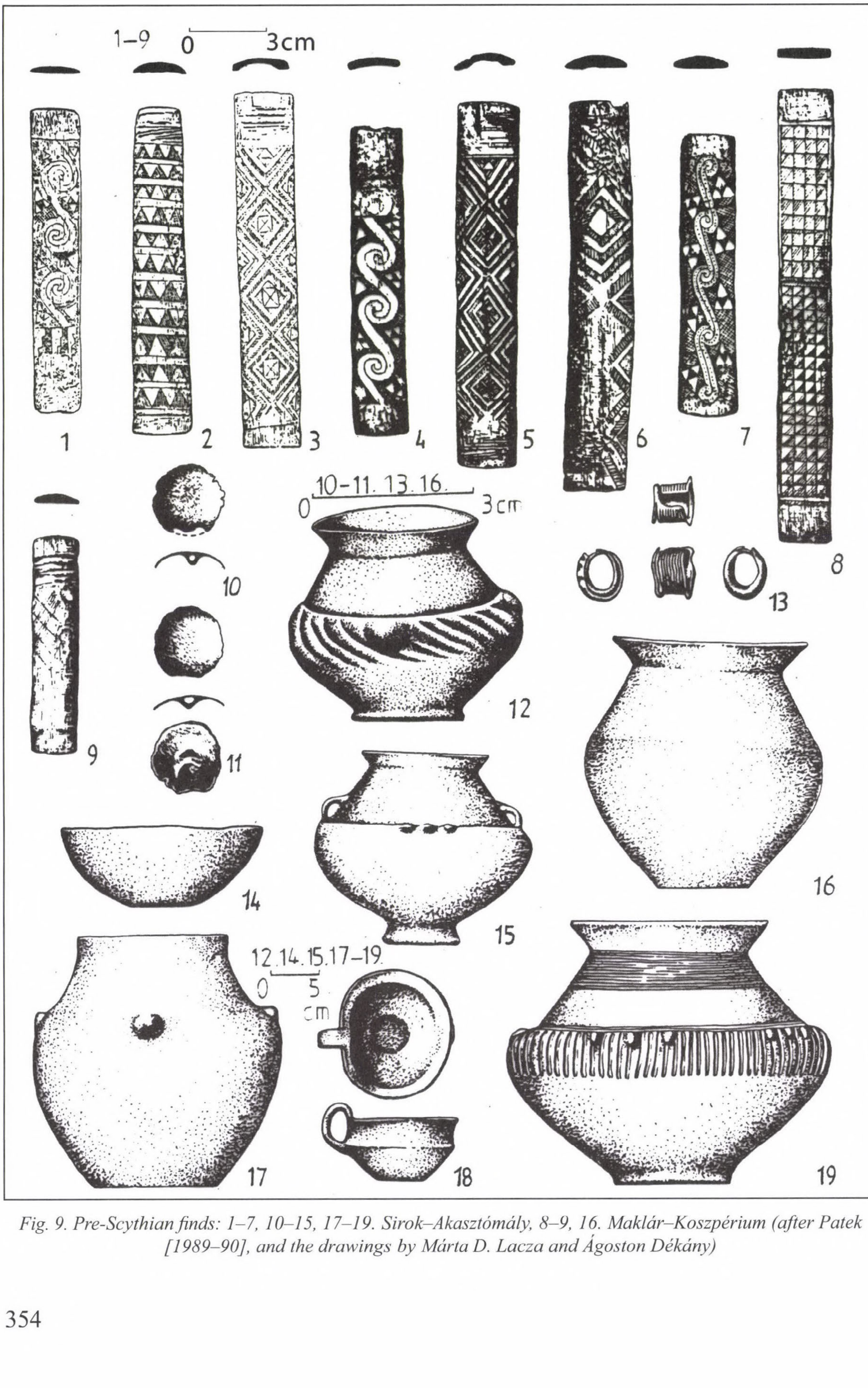

Fig. 9. Pre-Scythian finds: 1–7, 10–15, 17–19. Sirok–Akasztómály, 8–9, 16. Maklár–Koszpérium (after Patek [1989–90], and the drawings by Márta D. Lacza and Ágoston Dékány)

barbarian coins was unknown in Western Europe, but was customary in the Eastern Mediterranean[35] (only silver coins from the Carpathian Basin exhibit this feature). There are sharp chisel cuts on coins with a legible or fragmentary legend, i.e. on original Macedonian issues, and on their imitations. Coins were often counterfeited in the 4th–3rd centuries BC by silver-plating copper coins and one technique of testing whether a coin was a counterfeit was to cut it, usually on the reverse.[36] The practice of test cutting coins was abandoned at the turn of the 3rd–2nd centuries BC. Another coin, a barbarian copy of tetradrachm issued by Philip of Macedonia is also known from Sirok.[37]

In 1970, János Győző Szabó uncovered nine post-holes of a timber framed house with daub walls at Sirok–Akasztómály. Together with two other partially excavated houses and the associated pits, these buildings represented the late Celtic period (cp. *Fig. 1*). The floor of the first house did not survive; its presence was indicated by the post-holes, the pottery sherds and the burnt daub fragments. The house had an external size of 6.9 m by 4.5 m and an internal one of 6 m by 4 m. The excavator noted that the house probably had two rooms.[38] The post-holes of the first house were as follows:

Northern row: Post-hole 8 (diameter: 64 cm by 76 cm at a depth of 60 cm, total depth: 74 cm, finds: a few red sherds and many fragments of burnt daub); Post-hole 9 (diameter: 59 cm, depth: 90 cm, finds: many sherds and burnt daub fragments; a reddish patch with charcoal measuring 40 cm by 36 cm was observed inside it); Post-hole 11 (diameter: 53 cm, depth: 98 cm, finds: large pottery sherds);

Southern row: Post-hole 2 (diameter: c. 40 cm); Post-hole 4 (indicated by a patch with charcoal and burnt daub fragments measuring 44 cm by 42 cm, depth: 92 cm, finds: many fragments of burnt daub and a little charcoal); Post-hole 13 (diameter: 95 cm at a depth of 50 cm, a patch measuring 25 cm by 30 cm containing burnt daub fragments was observed inside it);

Middle row: Post-hole 3 (diameter: c. 40 cm); Post-hole 10 (diameter 54 cm at a depth of 70 cm, finds: a few fragments of burnt daub and charcoal, but no pottery fragments); Post-hole 12 (diameter: 30 cm at a depth of 85 cm).

A refuse pit yielding Celtic pottery sherds could be associated with the first house (Pit 5: circular shape, with a diameter of 105 cm at a depth of 50 cm, widening at a depth of 80 cm and elliptical at a depth of 130 cm, measuring 220 cm by 196 cm; its greatest depth was 143 cm).

The second house was uncovered in Trenches XX and XXXII. It measured roughly 5 m by 6 m. Its post-holes were as follows:

Northern row: Post-hole 14 (depth: 107 cm); Post-hole 15 (diameter: 68 cm by 86 cm at a depth of 84 cm, total depth: 100 cm; it did not contain any finds);

Southern row: Post-hole 6 (diameter: 63 cm by 71 cm at a depth of 81 cm, total depth: 98 cm; it did not contain any finds); Post-hole 7 (diameter: 90 cm under the humus and 45 cm at its floor, total depth: 97 cm; finds: a few pottery sherds and fragments of burnt daub); Post-hole 16 (diameter: 26 cm at its base).

A refuse pit (no. 22) could be associated with this house.

The following post-holes could be associated with the third house: Post-hole 17 (diameter: 64 cm at a depth of 60 cm, total depth: 72 cm, finds: pottery sherds and a few fragments of burnt daub); Post-hole 18 (diameter: 75 cm at a depth of 50 cm, total depth: 60 cm, finds: pottery sherds and fragments of burnt daub); Post-hole 19 (diameter: 60 cm at a depth of 40 cm, total depth: 74 cm); Post-hole 20 (diameter: 44 cm by 38 cm at a depth of 50 cm, total depth: 68 cm; it did not contain any finds).

The first house was wholly excavated, while only a part of the second and third house fell into the investigated area. The latter two buildings had a structure similar to the first house. According to János Szabó Győző, the houses were built about 5.5 m apart and were arranged in a chequerboard pattern. Since the longitudinal axis of the houses was west to east oriented, he assumed that their entrance faced east, as did their windows. Pit 21 in Trench XXXIII resembled Pit 5.

35 *Kovács I.:* Az ógörög, barbarus és római köztársasági ezüstérmeken látható utólagos bevágásokról. Erdélyi Múzeum 4 (1940) 1–14.

36 *Pink* (1939) 39–40.

37 *Ibidem* 36, 145.

38 *M. B. Hellebrandt:* Celtic Finds from Northern Hungary. Corpus of Celtic Finds in Hungary III. Budapest 1999, Fig. 11. 170.

The Sirok area and the Tarna Valley was inhabited from the Late Bronze Age and Early Iron Age to the close of the Roman period and even later. The metal ores and other resources in this region, and the products made from them, were traded both in times of war and peace.

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THE NAGYBÁRKÁNY AREA IN THE IRON AGE, THE ROMAN PERIOD AND THE MIGRATION PERIOD

Andrea Vaday

Nagybárkány and its broader area are not among the archaeologically thoroughly investigated settlements of Nógrád County as regards the period from the Iron Age to the Conquest period. In contrast to the many Bronze Age sites known from this area, evidence for the presence of various populations during the Iron Age and subsequent epochs can only be quoted from the broader environs of Nagybárkány. One of the reasons for this can probably be sought in the mountainous area, which was less attractive for settlement than the river valleys. Another is that the identification of archaeological sites is more difficult on mountain terrain than on the plainland.

In addition to the Early Iron Age hillforts at Mátraszőlős and Kerekbikk, Scythian Age burials are known from Mátraszele–Kerekdomb. A Scythian settlement was investigated during the excavations preceding construction work at Salgótarján–Industrial Park II.

Traces of Celtic settlement in the Late Iron Age abound in the river valleys. Celtic graves have been reported from Mátraszőlős–Királydomb and Pásztó–Mucsi-domb. The section of a Celtic settlement was brought to light at Mátraszőlős–Kerekdomb.

A number of settlements were established in higher lying regions during the Roman period. The remains of a Roman Age settlement were found at Mátraszele–Jánosakna and at a location west of Tar, where 50–60 small pits were found over a 100 m by 150 m large area during the construction of Road 21. Most of these pits yielded Germanic finds. Various settlement features and pottery kilns were brought to light at Kazár in 2002–2003.

Graves from the Hun period were found at Bátonyterenye in the Zagyva Valley and at the Salgótarján–Industrial Park II site. Five Avar burials were uncovered in the early 1950s near 18 Dózsa György Street at Mátraverebély–Kishegy.[1] Ágnes Sós excavated a Slavic cemetery containing cremation burials some 150–200 m from the Mátraszőlős–Pásztó junction.

1 Pál Patay' kind personal communication.

THE JÁSZSÁG IN THE IRON AGE, THE ROMAN PERIOD AND THE MIGRATION PERIOD

Andrea Vaday

The Jászság region is a plainland extending from the alluvial cones in the foreland of the Mátra Mountains to the floodplain of the Tisza River. It was formed by the region's subsidence and the infilling activity of the Zagyva and Tarna rivers. The Zagyva River often changed its course on the slightly sloping plainland and its seasonal floods left waterlogged bogs and marshes. The Jászság region was a mosaic of marshland, woodland and gallery woods. Softwood groves lined the floodplains, while higher-lying areas were covered with hardwood groves.[1] The western fringes of the region – the south-eastern wing of the alluvial cones of the Galga and Zagyva rivers – are covered with sand, on which brome grass and white poplars thrived. It must be emphasized that the current landscape of the Jászság region differs significantly from the prehistoric and historic one since the river regulations and draining operations led to the disappearance of former marshlands, whose area was colonised by alkaline steppe plant communities. This must be borne in mind when evaluating the prehistory and history of this region because the settlement of various population groups was to a large extent determined by the environment. Even though the scarcity or density of sites from one or the other period on the distribution maps can in part be attributed to the lack of research in a particular area,[2] it is in some cases a consequence of the natural environment in this region.

THE IRON AGE

Hungary was divided into two major culture provinces at the beginning of the Iron Age. The area west of the Danube was part of the eastern Hallstatt world, while the Great Hungarian Plain and the northern mountain region was occupied by steppean pre-Scythian and, later, Scythian groups.[3]

The Early Iron Age: the pre-Scythians

The 8th century BC saw major changes in the Great Hungarian Plain (and in the Jászság region). The archaeological record indicates that the Late Bronze Age agrarian population abandoned its settlements,[4] new burial practices made their appearance and the archaeological assemblages too contain a number of novel elements. The lifeways of the immigrant groups differed markedly from those of the

1 Pedunculate oak and ash forests. The Pap Forest at Jászdózsa is one of these.

2 Before the political changes and the start of major construction projects, the rescue excavations and the few planned archaeological investigations were, for the greater part, conducted near the local museum; the activity of enthusiastic locals and the personal interest or research project of a particular archaeologist too played an important role in the extent to which an area was investigated. Thus, for example, the activity of Viktor Hild and his collection of finds from the Jászság region can be strongly felt in the case of certain periods. Éva Garam, Pál Patay and Sándor Soproni conducted a series of field surveys in the northern part of the Jászság along the line of the one-time Csörsz Dyke (known also as the Devil's Dyke and the Roman Dyke). Ilona Stanczik, who at one time worked in the Damjanich János Museum in Szolnok, too conducted field surveys in the region.

3 *Kemenczei* (2003) 177.

4 It is still uncertain whether the newcomers occupied an uninhabited area or, similarly to other periods, the area only appears to have been unoccupied owing to the static chronological framework, which could not be refined in the lack of new, well-documented excavations. It seems likely that the newcomers only destroyed the centres of the area's former overlords and that the local Late Bronze Age population survived, adopted the newcomers' culture and was eventually assimilated by them.

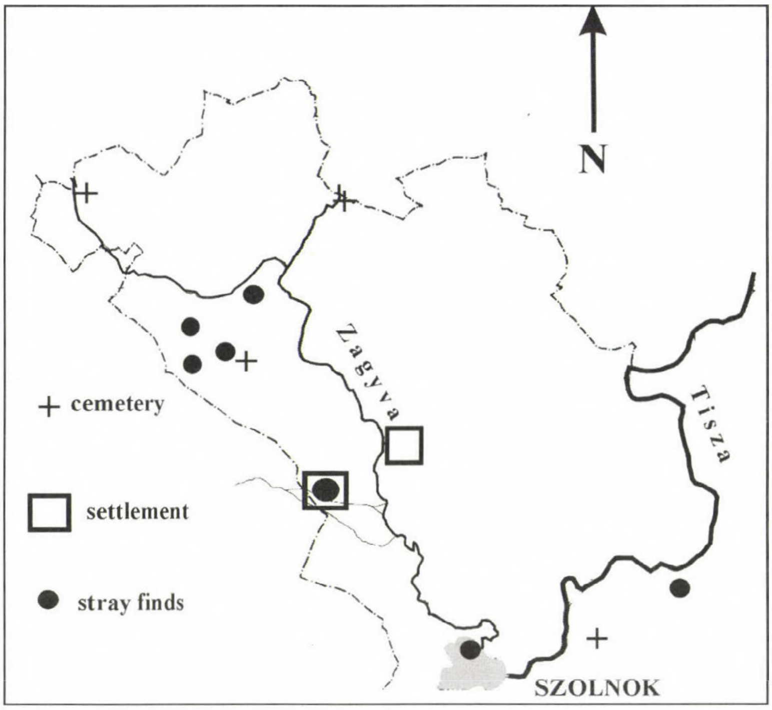

Fig. 1. Scythian sites in the Jászság region

Late Bronze Age population, which had formerly controlled the region. The spread of a nomadic life-style means that burials and hoards are the prime sources for our understanding of this period.[5] Owing to the scarce number of settlements, there is little information on the day-to-day lives and the economy of this new population during the transitional and the subsequent period. During the pre-Scythian period, the Jászság was apparently unoccupied (at least according to our present knowledge), with sites only known from the north and north-east in the mountain foreland and in the southern part of the Great Hungarian Plain.[6] It would appear that the mosaic of marshlands and the woodlands characterising the Jászság region was not particularly suited to nomadic pastoralism.

The Middle Iron Age: the Scythians

The appearance of the nomadic Scythians, a population of eastern, Iranian stock, in the mid-7th century BC again brought fundamental changes.[7] The archaeological record indicates a rather loose settlement network, suggesting that the Scythians assumed political control of the Jászság region, but did not actually settle there in great numbers. The observation concerning the Early Iron Age is also valid for this period: most of the known Scythian finds were recovered from burials. The settlements of the Scythian period reflect a sedentary population engaged in crop cultivation and stockbreeding, suggesting that the former population survived into this period.

The map *(Fig. 1)* shows the Scythian sites of the Jászság region, reflecting that this region was loosely settled at this time. It would appear that the Zagyva Valley and the areas west of it were more densely populated during the Scythian rule.

The Late Iron Age: the Celts

The Celtic expansion during the 5th–4th centuries BC again brought ethnic and cultural changes. The Celts first settled in Transdanubia, from where they advanced to the Danube in the earlier 4th century BC. They crossed the river somewhere in the Danube Bend. The Celtic expansion continued in the La Tène B period, although their arrival did not threaten the Scythian population of the Great Hungarian Plain at this time.[8] The Jászság region came under Celtic rule, when the Celtic troops from the Rhine region, who had set out against the Balkans, suffered a catastrophic defeat during their campaign and were

5 This phenomenon is by no means unique: similar changes can be noted in the Great Hungarian Plain during the Roman Age after the arrival of various nomadic tribes.

6 The nearest sites are the burial grounds at Füzesabony–Kettős-halom and Füzesabony–Öregdomb, and the hoard found at Besenyszög–Fokorú-puszta. *Kemenczei* (2003) 177–179, Fig. 3.

7 It must here be noted that the Jászság was not a separate ethnic or cultural region, but was part of the politico-cultural unit of a larger region, as in the Early Iron Age.

8 *E. Jerem:* The Late Iron Age: the Celts of the La Tène period. *In:* Hungarian archaeology at the turn of the millennium. Ed.: Zs. Visy. Budapest 2003, 194.

forced to retreat; they dispersed and, amongst others, they occupied the Great Hungarian Plain too in the late 4th century and the early 3rd century. It is therefore hardly surprising that Celtic settlements and cemeteries can first be documented from the second third of the 3rd century BC.

The Celtic Age meant a fundamental change compared to earlier periods because in addition to the archaeological finds, there are several written sources on the Celts, who appeared on the horizon of the Graeco-Roman world.

The currently known Celtic sites in the north-eastern part of Jász-Nagykun-Szolnok County cluster along the Zagyva River *(Fig. 2)*. The sites show a dense scatter towards the north, in the Jászberény area.[9] The biritual cemeteries of the La Tène C–D period have yielded many outstanding and often unique finds, enriching our knowledge of the Celts in Hungary.[10]

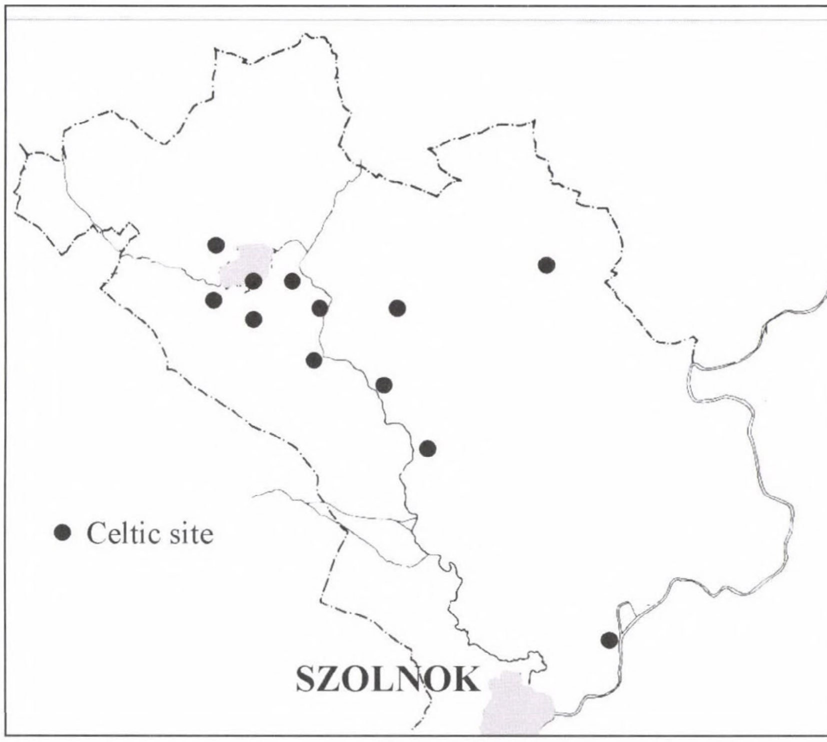

Fig. 2. Celtic sites in the Jászság region

The Celtic rule in the Great Hungarian Plain was brought to an end by the westward expansion of the Dacians. However, genuine Dacian sites have not yet been found in the Jászság.[11]

The Dacians' political control over the Jászság was shattered by the arrival of a new immigrant population, the Jazygians, a mounted nomadic people of Iranian stock arriving from the east in the last quarter of the 1st century AD.

THE ROMAN PERIOD: THE SARMATIANS

Similarly to the pre-Scythian and the Scythian period, the archaeology of the nomadic Jazygians is known from their burials. After their arrival, the Jazygians occupied the northern half of the Danube–Tisza Interfluve, as evidenced by the inhumation burials in the small graveyards containing gold jewellery of eastern origins. They probably lived peacefully with the local Celts (who were earlier under Dacian overlordship),[12] and blended their own eastern culture with elements adopted from Celtic material culture, which they adapted to their own taste. From the arrival of the Jazygians, the Great Hungarian Plain – including the Jászság region – was occupied by Sarmatian tribes throughout the Roman Age. Swelled by newly arrived population groups, the Sarmatians expanded southward, first occupying the entire Danube–Tisza Interfluve, then occupying the area beyond the Tisza after Trajan's Dacian wars.

9 It is still unclear whether the greater density of sites should be attributed to the route of the Celtic conquest or the fact that the area has been more thoroughly researched.

10 One of these unique finds is the dragon-headed drinking horn found at Jászberény–Cserőhalom. *Kaposvári Gy.:* A Jászberény–cserőhalmi kelta temető. ArchÉrt 96 (1969) 178–198.

11 It is yet impossible to date stray pottery finds more precisely; Dacian wares have been found in association with both Celtic and Sarmatian finds.

12 The names of the northern towns in Ptolemy's list indicate a Celtic origin for these settlements. Cp. *Vaday A.:* A szarmata barbaricum központjai a Kr. u. 2. században. Barbaricumi Szemle 1 (2003) 9–22.

New territories were brought under Sarmatian rule at the time of the Marcomannic Wars, when the Sarmatians extended their rule over the north-eastern parts of the Great Hungarian Plain. A series of changes can be noted during the 4th century AD, most important among these being the alliance with the Roman Empire (against whom they had earlier fought bitter wars), in order to halt the advance of the Goths and other tribes fleeing westward from the Hunnish advance. A system of earthwork ramparts encircling the Sarmatian settlement territory was constructed with Roman help; a section of this rampart system lies in the northern part of the Jászság.[13]

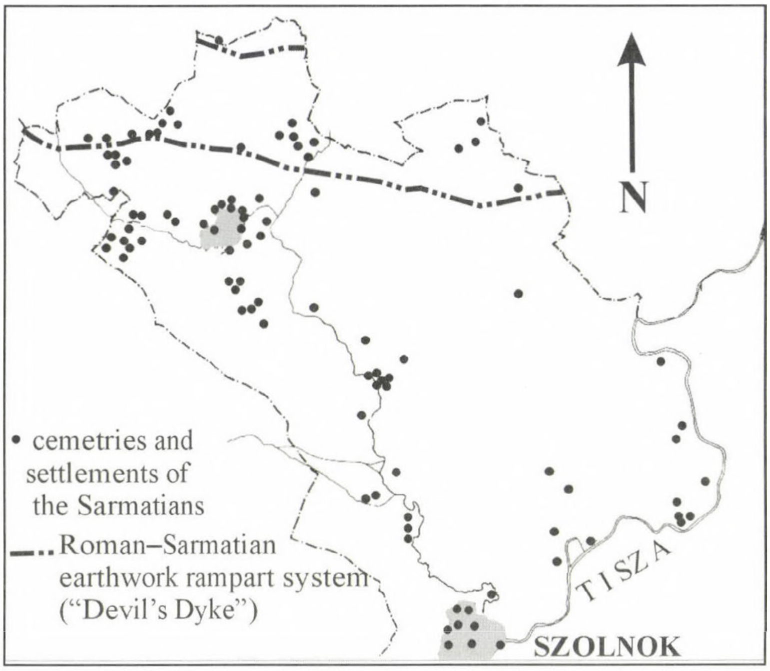

Fig. 3. Sarmatian sites in the Jászság region

The population of the region grew dynamically in the Roman Age, from the 2nd century AD. Countless Sarmatian settlements have been identified, most of them lying along watercourses and military and trade routes. The Sarmatian settlement network was greatly influenced by the road leading from Aquincum to Porolissum (present-day Moigrad), along which Roman wares reached the Sarmatian Barbaricum from the mid-2nd century AD. A new wave of Sarmatian immigrants, the Alans, arrived in the late Roman period; together with other population groups from the east, they transformed the culture of the Sarmatian Barbaricum.

The map showing the distribution of Sarmatian sites[14] illustrates the extent to which the Jászság region has been researched *(Fig. 3)*.

THE MIGRATION PERIOD: THE GEPIDS AND THE AVARS

The brief Hunnish occupation left a visible impact on the late Sarmatian material culture. No Hunnish finds have yet been found in the Jászság. Following Attila's death, the Gepids advanced southward from their settlement territory in the north and occupied a part of the Great Hungarian Plain. The early sites of the Gepidic kingdom are clustered in the Körös–Maros–Tisza triangle, although the occasional Gepidic settlement and cemetery has also been found along the Tisza. The Jászság region lay on the fringes of the Gepidic kingdom, at least according to the currently available evidence. The Avar conquest affected the entire territory of the Great Hungarian Plain, including the Jászság.

The research of the Avar period in the Jászság primarily meant the investigation of cemeteries. Several burial grounds are known from this region, while settlements have been identified at the confluence of the Zagyva and its western tributary. It must be borne in mind that the Jászság was not a distinct political or economic unit and the archaeological record from this region should be set against the background of the Avar Khaganate in the Carpathian Basin.

During the early Avar period, cemeteries can be found along both banks of the Zagyva River, with a denser cluster along the river's lower reaches. The reason for this is that there was probably a crossing

13 The toponym *Jászárokszállás* preserves the name of this earthwork rampart.

14 The map is based on *A. Vaday:* Die sarmatischen Denkmäler des Komitats Szolnok. Ein Beitrag zur Archäologie und Geschichte des sarmatischen Barbaricums. Antaeus 17–18 (1989).

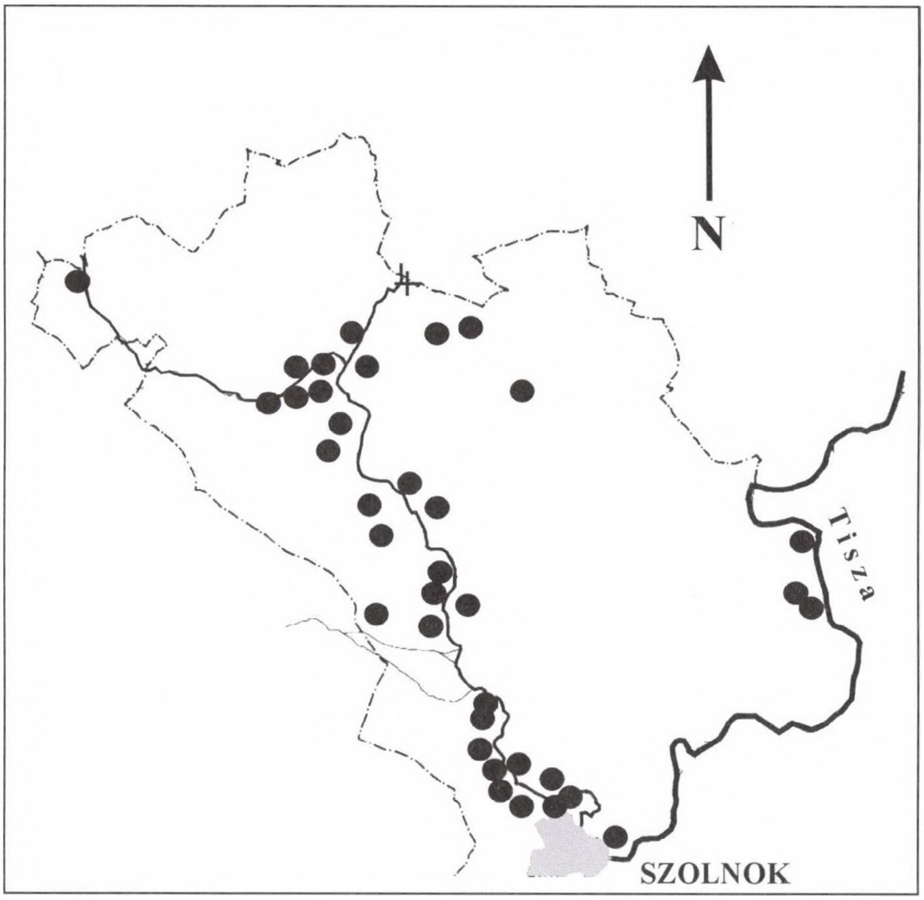

Fig. 4. Avar cemeteries in the Jászság region

place at the Zagyva–Tisza confluence at Szolnok, which had evolved in earlier times and remained a major junction of the trade and military routes used in the Avar period.[15] In the late Avar period, settlements were also established farther from the river and cemeteries can be found in the Zagyva–Tisza Interfluve too. The sites indicating possible Avar cemeteries in the Jászság too all lie along the Zagyva River *(Fig. 4)*.

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15 However, the extent to which a particular area has been researched cannot be excluded either since archaeological research in Jász-Nagykun-Szolnok county was chiefly conducted in the areas around the Damjanich János Museum of Szolnok.

ENVIRONMENT AND SETTLEMENT IN THE JÁSZSÁG IN THE 10TH TO 14TH CENTURIES "SWAMPY MARCHLAND": THE PALAEOECOLOGICAL EVALUATION OF THE JÁSZSÁG IN HISTORICAL RESEARCH

Péter Langó

INTRODUCTION

"In the Conquest period, this sandy and swampy marchland was, like all other landscapes, most characteristic around its centre: a bogland, a marshland. Its fringes facing the Tisza were settled already in early times. ... Only that part of this landscape became the Jászság, which was really a subsided bog: the catchment area of the Zagyva and Tarna and its sandy fringes,"[1] is how Ferenc Fodor, a renowned geographer of the earlier 20th century, characterised the environment of historic Jászság. Ferenc Fodor's description was in part based on his own observations, made around the mid-20th century,[2] and in part on the scientific studies of the preceding two hundred years.[3] Following the positivist, static approach so typical for his research, he suggested that the area became a marshland not during the post-medieval period, but had been one in earlier times too. He believed that the ecological features described in 18th century sources had been constant, and had been first changed by later river regulations. He failed to take into consideration that the biological and physical environment had already been modified by human activity well before that time, and that environmental changes may have been caused by non-anthropogenic processes as well.[4] In his opinion, this area had always been "a marchland, and only the area, which is now the Jászság, had been a marchland; the ancient Hungarians of the Conquest period had not entered this region."[5]

Ferenc Fodor compared his static palaeoecological assumptions with historical sources. From the results of these two disciplines he concluded that the king settled the Jász[6] here because there was no other use for this "swampy marchland". This area, unsuited to agriculture, could be neither exploited, nor bestowed, this being the reason that the region functioned as a marchland in the 10th century, separating

1 *Fodor* (1942) 77.

2 *Fodor* (1942) 470–471.

3 *Palugyay I.:* Jász-kún kerületek s Külső Szolnok vármegye leírása. Pest 1854; *Fodor* (1942) 476–500; *Tóth J.:* A Jászkunság helyzete a 18. sz. végén (Bedekovich Lőrinc kéziratos könyve). Jászsági Füzetek 13. Jászberény 1976, 23; *Buschmann F:* Jászberény és környéke természetvilágának kutatástörténete 1795–1992. JászÉvk (2001) 108–109.

4 *N. Brown:* History and Climate Change: A Eurocentric Perspective. London 2001; *R. Brázdil:* Historical Climatology and Its Progress after 1990. *In:* People and Nature in Historical Perspective. Eds: J. Laszlovszky – P. Szabó. Budapest 2003, 197–227.

5 *Fodor* (1942) 77.

6 The ethnonym "Jász" is used in this study instead of the more widespread "Jazygians". This was a conscious decision: the term "Jazygians" is the outcome of a misunderstanding, whose origins can be traced to the 17th century. It is based on a piece of erroneous information in Petrus Ransanus' late 15th century chronicle (*Iazigibus, quae Germaniae natio et ipsa est, seu vulgo verbo corrupto Iaz se ipsi appellant*; Ransanus, Index II). The mistaken identification of the Jász with the Jazygians was pointed out by János Melich in the early 20th century and his arguments were accepted by Hungarian scholarship. Since most Hungarian scholars published their studies in Hungarian, for a Hungarian public, they paid little attention to the fact that translators continued to use the term "Jazygian" in the foreign language summaries of their articles. Fortunately, most Hungarian scholars discarded this usage in more recent works: in a recent study, Gyula Németh used the term "die Jassen", while András Pálóczi Horváth opted for the form "Iasians". Nóra Berend used the form "As" in her study. The word "Jász" used in this study is the traditional form derived from the region's name, reflecting the Russian antecedent of the Hungarian term and the link between the region and the ethnonym of its inhabitants. Cp. *Melich J.:* A Jász népnévről. Magyar Nyelv 8 (1912) 193–199; *Németh Gy.:* Eine Wörterliste des Jassen, der ungarländischen Alanen. Berlin 1959; *Pálóczi Horváth* (1989); *Berend* (2001); *Langó* (2000a) 100, note 165.

the Kabars from the ducal settlement area.[7] Later, eastern populations arriving from the steppes were settled here by the king. This marshland landscape, rich in pasture land, provided a suitable environment for the stockbreeding, nomadic Pechenegs and, later, for the Jász and the Cumanians pursuing a similar life-style.[8] In addition to geographical considerations, he tried to bolster his view with linguistic arguments in the case of the Pechenegs and with historical sources in the case of the Jász.[9]

According to Ferenc Fodor, the life-style of the Jász, who enjoyed the territorial privileges of the nobility and had military obligations towards the sovereign, was largely determined by the environment. The ecological features favoured the preservation of steppe traditions, and thus the heathen Jász did not create a permanent settlement system before the 15th century, but practiced seasonal migration with their animals. Plant cultivation and permanent settlements appeared only after the Franciscans began the conversion of the population living in the Jászság.[10]

After Ferenc Fodor there were no historians in the later 20th century, who studied the medieval history of this people or this region in such depth. Later studies mostly reviewed the results of earlier research,[11] and as a matter of fact, a number of papers on this subject[12] contained methodological errors, which inevitably led to false conclusions, as was later pointed out.[13] More recently, there has been a welcome increase in studies discussing the early history of the Jász,[14] as well as in the number of historical works discussing the history of the medieval Jász in detail.[15]

The first critique of Ferenc Fodor's theory came from archaeology.[16] Archaeologists played a significant role in the study of steppe populations of eastern origin,[17] and their contribution to clarifying the early history of the Jászság and the Jász was of great importance. László Selmeczi's seminal work

7 *Fodor* (1942) 132.

8 *Ibidem* 248.

9 *Ibidem* 77, 125–136.

10 *Ibidem* 77–78, 115, 248.

11 *Maksay F.:* A magyar falu középkori településrendje. Budapest 1971, 91; *Tóth J. – Tóth M.:* A jászok őstörténete. *In:* Magyarrá lett keleti népek. Eds: V. Szombathy – Gy. László. Budapest 1988, 164–175; *Pálóczi Horváth* (1989).

12 *Szabó L.:* A középkori jászsági lakosság etnikai jellegéhez. Jász Múzeum Évkönyve 1874–1974 (1974) 21–41; *Szabó L.:* A jász etnikai csoport I.: A jász etnikum és a jászsági műveltségi egység néprajza. Szolnok 1979; *Szabó L.:* Jászság. Budapest 1982; *Bakos P.:* A jászok a Kárpát-medencében 1526-ig. Zounuk 13 (1998) 147–184.

13 *Kiss J.:* Hogyan készül Szolnokon a megyetörténet. Századok 118 (1984) 549–562; *Langó* (2001a); *Langó* (2001c).

14 *Györffy Gy.:* A Jászság települése. *In:* Emlékkönyv a túrkevei múzeum fennállásának 30. évfordulójára. Szerk.: Dankó I. Túrkeve 1981, 69–72; *Györffy* (1990) 312–318; *V. Ciocâltan:* Alani şi începuturile statelor Româneşti. Revista istoricâ 6 (1995) 935–955; *Kocsis* (1998); *Langó* (2001a); *Langó* (2001c); *Langó* (2001b); *Fejős B:* Az alánok és a kereszténység. *In:* Nomád népvándorlások, magyar honfoglalás. Szerk.: Felföldi Sz. – Sinkovics B. Budapest 2001, 36–44.

15 *V. B. Kovalevskaya:* Kavkaz i alani. Moskva 1984; *V. A. Kuznetsov:* Ocherki istorii alan. Ordzhonikidze 1984; *V. Kouznetsov – J. Lebedensky:* Les Alains. Cavaliers des steppes, seigneurs du Caucase. Paris 1997, 101–153; *A. Alemany:* Sources on the Alans. A Critical Compilation. Leiden–Boston–Köln 2000, 116–299, 372–386; *Berend* (2001) 57–58; *Kristó* (2003) 233–243.

16 *Kaposvári* (1955).

17 *Pálóczi Horváth A.:* A csólyosi kun sírlelet. FolArch 20 (1969) 107–134; *Mesterházy K.:* Ismaélites, Busurmans, Bulgares de la Volga. *In:* Les questions fondamentales du peuplement du bassin des Carpathes du VIII[e] au X[e] siècle. Réd.: L. Gerevich. Budapest 1972, 195–211; *A. Pálóczi Horváth:* Situation des recherches archéologiques sur les Comans en Hongrie. Acta Orientalia Academiae Scientiarum Hungaricae 22 (1973) 201–209; *A. Pálóczi Horváth:* Le costume coman au Moyen Age. ActaArchHung 32 (1980) 403–427; *Hatházi G.:* 14. századi ruhakorongpár Sárosdról és viselettörténeti kapcsolatai. ArchÉrt 114 (1988) 106–120; *Hatházi G.:* A perkátai kun szállástemető (Előzetes beszámoló az 1986–88. évi feltárásokról). MFMÉ (1991) 651–674; *G. Hatházi:* Anmerkungen zur Frage der Verfestigung des kumanischen Siedlungnetzes. *In:* Verfestigung und Änderungen der ethnischen Strukturen im pannonischen Raum im Spätmittelalter. Internationales Kulturhistorisches Symposion Mogersdorf. Band 25. Eisenstadt 1994, 27–40; *Pálóczi Horváth A.:* Hagyományok, kapcsolatok és hatások a kunok régészeti kultúrájában. Karcag 1994; *Hatházi G.:* Besenyők és kunok a Mezőföldön. *In:* Zúduló sasok. Új honfoglalók – besenyők, kunok, jászok – a középkori Alföldön és a Mezőföldön. Ed.: P. Havassy. Gyula 1996, 39–56; *Hatházi G.:* A besenyő megtelepedés régészeti nyomai Fejér megyében. Savaria 22:3 (1996) 223–248; *Hatházi G.:* Halas kun székközpont és magyar mezőváros a középkorban. *In:* Kiskunhalas története I. Eds: J. Ö. Kovács – A. Szakál. Kiskunhalas 2000. 169–302; *Kovács L.:* Jász kauricsiga-amulettek Magyarországon. JAMÉ 43 (2001) 249–257; *Horváth F.:* A csengelei kunok ura és népe. Budapest 2001; *Horváth F.:* Újabb vezéri sír leletei a Kiskunságból: Kiskunmajsa–Kuklis-tanya. MFMÉ–Studia Archaeologica 9 (2002) 369–386; *V. Székely Gy.:* Kun eredetű tárgyak és kulturális elemek Nyárlőrinc középkori temetőjében. *In:* A Jászkunság kutatása 2000. Eds: E. Molnár – E. Bathó – E. Kiss. Jászberény–Kiskunfélegyháza 2002, 35–45; *Hatházi G.:* A kunok régészeti emlékei a Kelet-Dunántúlon. Opuscula Hungarica 5. Budapest 2004.

transformed our knowledge of the medieval material culture of this people,[18] and his research opened new horizons for historical studies as well.[19] His findings have greatly enriched our knowledge about this population group and this field of research has become much more complex, calling for entirely new approaches and historical models.

Palaeoecological investigations can add new insights into the biological and geographical environment of the population that once lived here. Research of this type will undoubtedly contribute to sketching a new map of the one-time landscape. The comparison of the environmental and archaeological record will also shed light on whether Ferenc Fodor's earlier model is still valid or is in need of revision in the light of new findings.

10TH–11TH CENTURY ARCHAEOLOGICAL FINDS FROM THE JÁSZSÁG

Ferenc Fodor believed that the ancient Hungarians did not settle in the territory of the marshy Jászság in the 10th century, but "left it as a marchland between the ducal territories and the Kabars."[20] This assertion, however, was shown to be mistaken as early as 1942 in the light of the then available sources. Géza Supka and, later, Nándor Fettich published the assemblage purchased by the Hungarian National Museum in 1914 as grave goods of the Conquest period found at Jászfényszaru.[21] Serious doubts were raised regarding the 10th century date of some of the objects, and neither could the exact find context of the assemblage be later clarified.[22] What is certain, however, is that with the exception of the two bracelets, the finds can be dated to the 10th century. It seems likely that this Conquest period material was found somewhere near Jászfényszaru.

The question is whether the finds purchased in 1914 could have originated from the Jászfényszaru–Kórés site. In the summer of 2002, a 10th century grave was found near the Kórés Stream. The date of the grave goods suggests that the two assemblages came from the same site. This seems to be confirmed by the fact that a female burial uncovered in 2002 was dug into the edge of a Sarmatian settlement. The presence of remains from these two periods together at the site would explain the Roman date of the pair of bracelets among the finds brought to the Hungarian National Museum. However, the available evidence only allows speculation on whether the two assemblages came from the same site, and the circumstances of the 1914 donation are not particularly helpful for resolving this question.[23]

Other finds are known from the vicinity of the Kórés site, from an area called Borjújárás. The finds indicated a commoners' cemetery.[24] In 2001, István Kolozs, a local amateur historian, drew our attention to another cemetery of the early Árpádian Age at Szegek, north-east of the area which had earlier been called Borjújárás, near Virágoshalom. The strongly eroded site lies on an elevation on the left bank of the Zagyva River. A few graves had been disturbed by agricultural activity. The burials were further destroyed by sandstorms called "Jász-rain" by the locals.[25] István Kolozs discovered another cemetery disturbed during construction work in the spring of 2004, north-east of the Szegek site near

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18 *Selmeczi* (1981); *Selmeczi* (1992a); *Selmeczi* (1992b); *Selmeczi* (1994a); *Selmeczi L.*: A magyarországi jászok régészeti kutatása. *In:* Zúduló sasok. Új honfoglalók – besenyők, kunok, jászok – a középkori Alföldön és a Mezőföldön. Ed.: P. Havassy. Gyula 1996, 81–87; *Selmeczi* (2001).

19 *Selmeczi* (1992b); *Selmeczi* (1994b); *Selmeczi L.*: A jászok etnogenezise. *In:* Tanulmányok és közlemények. Szerk.: Újvári Z. Szolnok–Debrecen 1995, 127–144; *Selmeczi L.*: A jászok betelepülése a régészeti leletek tükrében. *In:* Zúduló sasok. Új honfoglalók – besenyők, kunok, jászok – a középkori Alföldön és a Mezőföldön. Ed.: P. Havassy. Gyula 1996, 67–80.

20 *Fodor* (1942) 132.

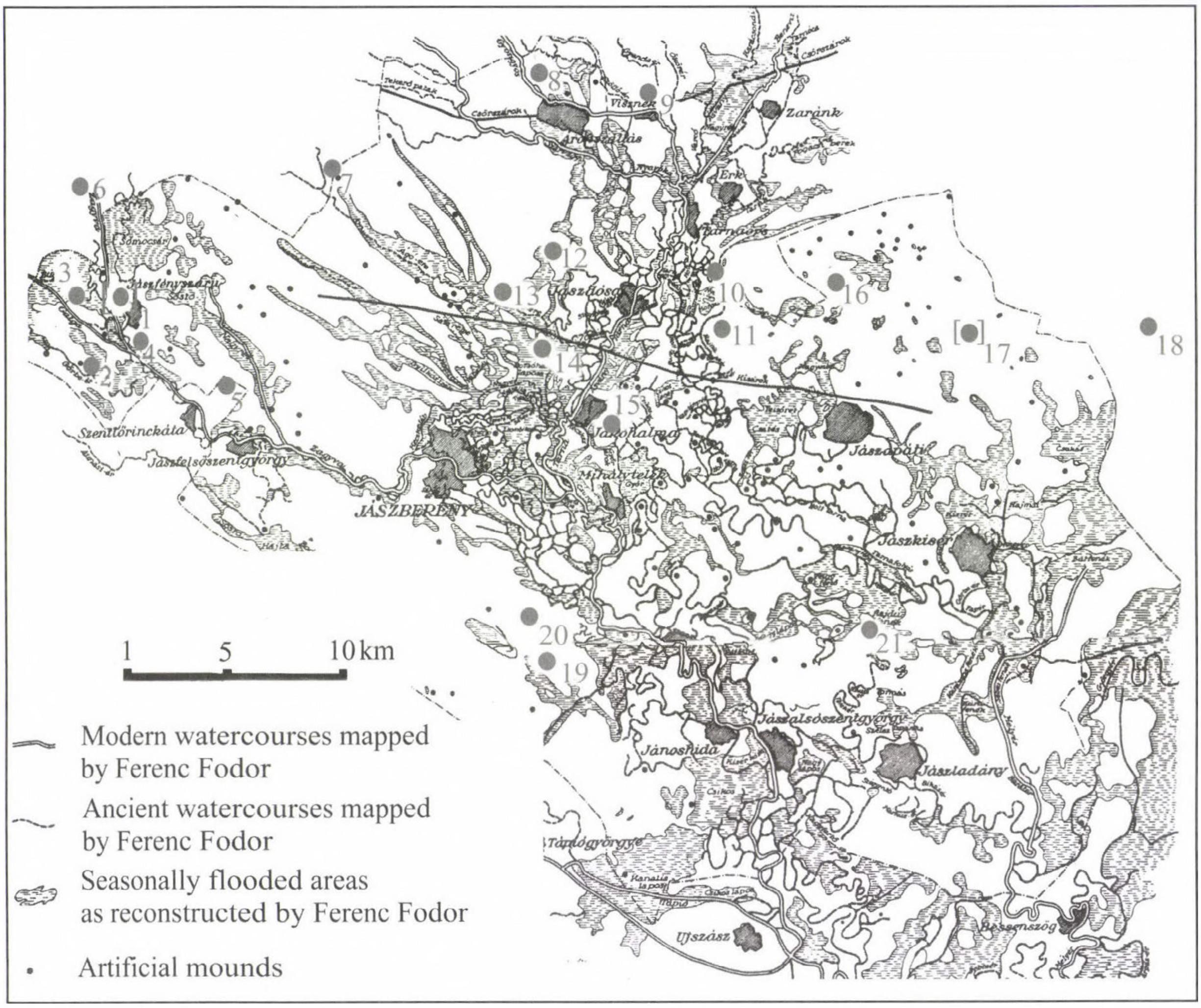
21 *Supka G.*: A Nemzeti Múzeum Régiségtárának gyarapodása 1914-ben. Közlemények a Nemzeti Múzeum Érem- és Régiségtárából I. Budapest 1916, 44–66; *Fettich N.*: Adatok a honfoglalás kor archaeologiájához. ArchÉrt 45 (1931) 72–77; *Mesterházy K.*: Jászfényszaru. *In:* The Ancient Hungarians. Eds: I. Fodor – L. Révész – I. M. Nepper – M. Wolf. Budapest 1996, 321–322.

22 *Kurunczi – Langó* (2000).

23 *Kurunczi – Langó* (2000).

24 *Hild* (1975) 183.

25 *Bordás A.*: A Jászság környezet állapotáról. JászÉvk (1993) 106.



Map 1. 10th–11th century archaeological sites in the Jászság
1. Jászfényszau (the assemblage found in 1914), 2. Jászfényszaru–Kórés, 3. Jászfényszaru–Borjújárás, 4. Jászfényszaru–Szegek, 5. Szentlőrinckáta, 6. Boldog–Téglaház part, 7. Jászágó, 8. Jászárokszállás–Gyöngyös Stream, 9. Visznek–Kecskehegy, 10. Tarnaörs–L. Kerek's field, 11. Tarnaörs–Rajnapart, 12. Jászdózsa–Kápolnahalom, 13. Jászdózsa–Négyszállás School, 14. Jászberény–Négyszállás, 15. Jászjákóhalma, 16. Jászszentandrás–Jónás-tanya, 17. Jásziván y, 18. Novaj, 19. Jászberény–Alsómuszály, 20. Jászberény–Csegelapos, 21. Jászalsószentgyörgy–Teleki-dűlő
[•] stray finds

Pusztamonostor, on the outskirts of Szentlőrinckáta. A substantial part of the cemetery, which had contained many hundreds of graves, has been destroyed by now. The only piece of information for the date of these disturbed and destroyed graves is István Kolozs' observations and an S terminalled lock-ring rescued by him. The site perhaps represents a commoners' cemetery opened in the late 10th or early 11th century. Another cemetery in the Jászfényszaru area can probably be dated to the same period. These graves, dated between 950 and 1050,[26] were found at Boldog–Téglaházpart, three kilometres north-east of Borjújárás.[27]

A richly furnished female burial from the Conquest period was found at Jászágó, between Pusztamonostor and Jászárokszállás, in the north-eastern part of the Jászság.[28] Another cemetery from the same period was discovered at Jászárokszállás, near the Gyöngyös Stream. According to the description

26 *Révész* (1996) 259.
27 *Szabó* (1969) 57.
28 *Fodor* (1984) 161; *Fodor* (1986) 139.

of Viktor Hild, who reported the site, the locals had destroyed 10th century graves here.[29] Based on the description of the burial rites and the pendant dress ornaments, which had found their way into the Szolnok museum, the burial ground appears to have been used by a poorer community. The cemetery of another 10th century community was found a few kilometres north of this sand-hill, on the bank of the Gyöngyös Stream, at Visznek–Kecskehegy.[30] The site of yet another burial ground has been identified four kilometres south-east of the Visznek cemetery, on the left bank of the Tarna, in the vicinity of Tarnaörs, on László Kerek's land. The articles recovered from the eleven graves, furnished with horse remains and horse-harness, suggest a date in the 10th century for the partially excavated cemetery.[31] The solitary burial of a young man came to light some 1800 metres from this site, in an area called Rajnapart. The silver harness ornaments and the golden plaques decorating his clothes suggest that members of a wealthier family were buried here in the 10th century.[32]

New assemblages are known from the Jászdózsa and Jászjákóhalma areas. Jászdózsa–Kápolnahalom was the first 10th century site discovered in the Jászság. A bone plaque reinforcing the quiver mouth found at this site[33] was sent to József Hampel by Gyula Bartalos.[34] József Hampel discussed the object in his study written in 1900.[35] Another cemetery was uncovered north of this site, at Jászdózsa–Négyszállási School.[36] The pottery sherd from one of the burials can be broadly dated to the 10th–11th centuries. Another site is located south of Kápolnahalom, at Jászberény–Négyszállás, from where László Madaras reported a settlement and a cemetery of the early Árpádian Age.[37] Moving south, a 10th century sabre found near Jászjákóhalma demonstrates the presence of the ancient Hungarians in this area.[38]

Six graves, probably part of a larger cemetery, were excavated at Jászszentandrás–Jónás-tanya east of Tarnaörs. The prosperity of the one-time community is indicated by the silver belt mounts deposited in the burials.[39] The cemetery was not excavated completely, as shown by a number of recent finds from this site. Another 10th century community, which chose a sand-hill near Jászapáti as the site of its cemetery, was probably also wealthier than the average. The grave goods of a male burial excavated in 1979 suggest that the families of this community could afford to bury their kin in clothes decorated with gold.[40] Another burial ground is known east of this site, between Jászivány and Jászszentandrás.[41] The bone stiffening plaque of a bow found at this disturbed site indicates the one-time presence of a 10th century community. The burial ground of another settlement lay to the south-east near Pély, indicated by pendant dress ornaments and boot mounts.[42]

A similar dense scatter of sites can be observed in the Jászberény area. A 10th century cemetery was excavated near Alsómuszály. The twisted wire jewellery and the bronze bracelet with coiled terminals[43] suggest that some of the graves can be dated to the middle third or second half of the 10th century.[44]

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29 *Hild* (1975) 159–60.

30 *Szabó* (1969) 57.

31 *I. Dienes:* Tarnaörs. ArchÉrt 83 (1956) 103; *Szabó* (1969) 55; *Révész* (1996) 257.

32 *Révész* (1996) 257.

33 *László Gy.:* A kenézlői honfoglaláskori íjtegez. FolArch 7 (1955) 114.

34 *Hild* (1975) 158.

35 *Hampel J.:* A honfoglalási kor hazai emlékei. *In:* A magyar honfoglalás kútfői. Eds: Gy. Pauler – S. Szilágy. Budapest 1900, 740–741.

36 *Fehér et alii* (1962) 45, No. 509; *Madaras* (2001) 119.

37 *Madaras* (2001) 120.

38 *Ibidem* 121.

39 *Kaposvári* (1955) 39.

40 *Madaras L.:* Jászapáti. *In:* The Ancient Hungarians. Eds: I. Fodor – L. Révész – I. M. Nepper – M. Wolf. Budapest 1996, 236.

41 István Törőcsik's kind personal communication.

42 *Szabó* (1969) 55; *Révész* (1996) 257.

43 *Szőke B.:* A honfoglaló és kora Árpád-kori magyarság régészeti emlékei. Budapest 1962, 69; *Révész L.:* A karosi honfoglalás kori temetők. Régészeti adatok a Felső-Tisza-vidék X. századi történetéhez. Miskolc 1996, 89–92; *Langó* (2000b) 42–44.

44 *Fehér et alii* (1962) 44, No. 505; *Madaras* (2001) 119.

Silver gilt dress ornaments, indicating another 10th century cemetery, were found nearby, on a sand-hill at Jászberény–Csegelapos.[45]

Only one cemetery from this period is known from the southern part of the Jászság: the one at Jászalsószentgyörgy–Telek-dűlő. The sixteen graves of the cemetery yielded 11th century articles.[46]

FINDS OF THE ÁRPÁDIAN AGE FROM THE JÁSZSÁG (FROM THE 11TH CENTURY TO THE EARLIER 13TH CENTURY)

The area did not become depopulated in the later phase of the Árpádian Age either. A continuous occupation is indicated by some of the above-mentioned cemeteries, which were continued, or opened, during the reign of King St. Stephen (1000–1038), such as the ones at Jászfényszaru–Borjújárás, Jászfényszaru–Szegek, Szentlőrinckáta, Boldog–Téglaházpart, Jászdózsa–Négyszállási School, Jászberény–Négyszállás and Jászalsószentgyörgy–Telek-dűlő. The date of the finds from Jászfényszaru–Csányi-puszta is uncertain.[47] A date in the later 10th or the beginning of the 11th century was suggested for the animal-headed open bracelet,[48] while an iron spur indicates a later date.[49]

As a consequence of the spread of Christianity, churchyard cemeteries appeared in the region as well.[50] One such partially excavated churchyard cemetery with 220 graves was opened in the 11th century at the site of Jászberény–Szent Pál-halom.[51] The cemetery was certainly in use by the mid-11th century, as shown by a coin of King St. Ladislas (1077–1095),[52] and it remained in use until the Mongolian invasion of 1242.[53] Another church and cemetery were found a few kilometres north-east of this site, at Jászberény–Necsőegyháza.[54] A church was built on top of the Bronze Age tell settlement at Jászdózsa-Kápolnahalom; this church too had a graveyard.[55] The burials underneath the foundation walls of the church suggested that there had been an earlier church, whose layout differed from the later one, or that the site had been used as burial ground even before the construction of the church.[56] György Györffy identified the village at Kápolnahalom as the village of Hajóhalom, then lying in Heves County, based on the regestrum of the prebendary of Gyulafehérvár (present-day Alba Iulia in Romania), where István V held a diet in 1271.[57] A Romanesque church and its cemetery were discovered on the southern outskirts of Jászberény, on a sand-hill known as Tetemház-halom of Csíkos.[58]

Beside the cemeteries, settlements are also known from the period. In the north, the settlement at Jászfényszaru–Barátok-tava was the earliest excavated settlement; the remains of a church and a village from the Árpádian Age were uncovered on a sand-hill.[59] Thanks to the research of István Kolozs, a local amateur historian, a settlement was identified near the above-mentioned Árpádian Age cemetery at

45 *Fehér et alii* (1962) 44, No. 506; *Madaras* (2001) 119.

46 *Hild* (1975) 164; *Madaras* (2001) 118.

47 *Fehér et alii* (1962) 45, Nr. 311.

48 *L. Kovács:* Das frühárpadenzeitliche Gräberfeld von Szabolcs. Budapest 1994, 123, 137.

49 *Madaras* (2001) 120.

50 *Ritoók* (1997); *Ritoók Á.:* Szempontok a magyarországi templom körüli temetők elemzéséhez. *In:* „Et tu sholaris" Ünnepi tanulmányok Kubinyi András 75. születésnapjára. Szerk.: Romhányi B. F. – Grynaeus A. – Magyar K. – Végh A. Budapest 2004, 115–123.

51 *Csalog* (1954); *Csalog J.:* Jászberény–Szentpálhalom. ArchÉrt 82 (1955) 101; *Csalog* (1964); *Gedai I.:* A magyar pénzverés kezdete. Budapest 1986, 65.

52 *Csalog* (1954); *Fehér et alii* (1962) 44, No. 507.

53 *Csalog* (1964).

54 *Madaras* (2001) 120.

55 *Komáromy J.:* Adatok Szolnok várának történetéhez. A Jászberényi Jászmúzeum Évkönyve (1938–1943) 72–74; *Gallus S.:* A Nemzeti Múzeum próbaásatása a jászdózsai Kápolnahalomban és környékén. A Jászberényi Jászmúzeum Évkönyve (1938–1943) 306–307; *Nemeskéri L.:* A Jászdózsán feltárt késő-árpádkori koponyák és csontvázak embertani vizsgálatának előzetes eredményei. A Jászberényi Jászmúzeum Évkönyve (1938–1943) 40–44, 307–308; *Bóna I.:* Jászdózsa–Kápolna halom. RégFüz. II. 20. Budapest 1966. 13.

56 *Ritoók* (1997) 167–168.

57 *Györffy* (1963–1998) Vol. III, 97; *Györffy* (1983) 11–23; *Selmeczi* (1992a) 12.

58 *Komáromy* (1943); *Hild* (1975) 94–99, 167–68.

59 *Hild* (1975) 165; *Selmeczi* (2001) 138–139.

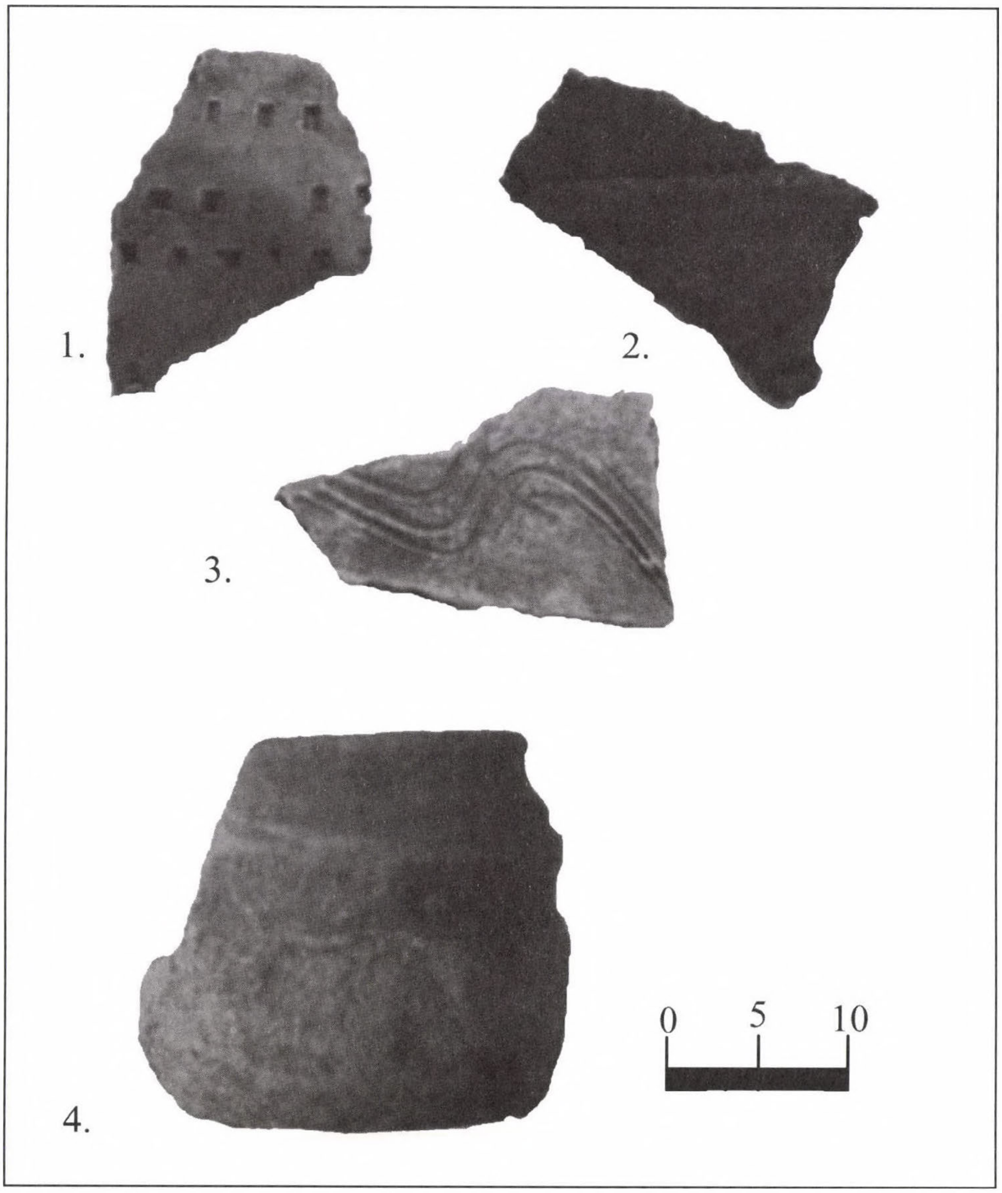
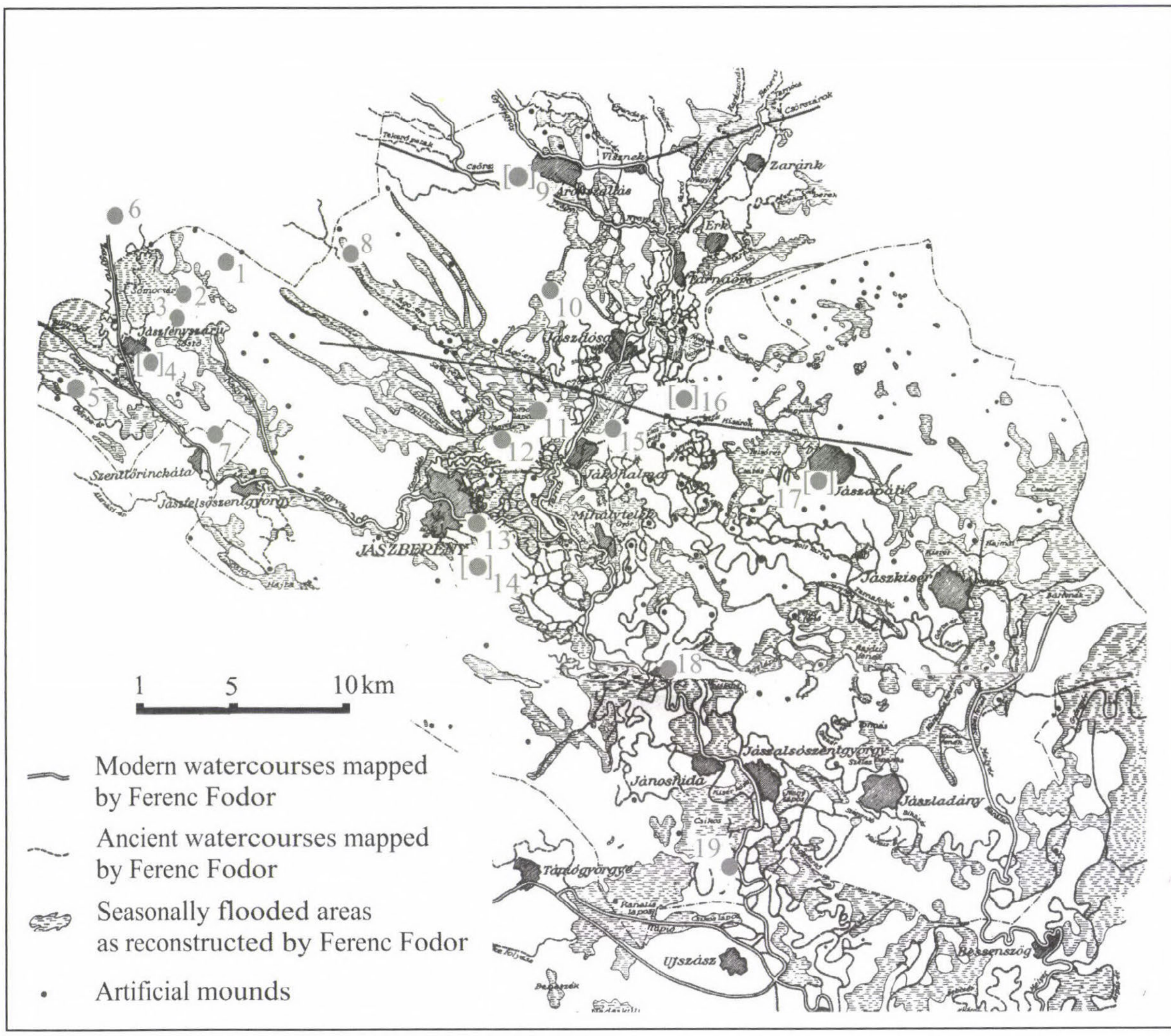


Fig. 1.
1–2, Árpádian Age pottery from Boldog, 3. late medieval pottery from Boldog, 4. fragment of a 15th century cup from Szentlőrinckáta

Szentlőrinckáta as well. The pottery fragments found on a sand-hill near the cemetery indicate that the village was founded in the 11th century. The settlement was not deserted after the Mongolian invasion either, as shown by stray finds of wheel-turned pottery sherds and fragments of a 15th–16th century cup *(Fig. 1. 4)*. István Kolozs identified another settlement in the area called Kórés, near the road to Zsámbok, two kilometres north of the Conquest period cemetery and the Sarmatian settlement. The sherds collected at the site indicated that the settlement was occupied between the 11th and 13th centuries. Remains of a village were found north of Jászfényszaru, near the Zagyva River, in the vicinity of Boldog as well. The pottery finds suggest that the settlement was founded in the 13th century (*Fig. 1. 1–2*), and survived into the 14th and 15th centuries (*Fig. 1. 3*). István Kolozs discovered another village near Jászfényszaru. The 13th century sherds found on a sand-hill at Szőlők alja suggest that there was a third settlement between Barátok-tava and the Zsámbok road. A house from the Árpádian Age was excavated by archaeologists near Jászárokszállás in the northern Jászság.[60]

60 *Madaras* (2001) 121.



Map 2. Árpádian Age archaeological sites in the Jászság
1. Jászfényszaru–Csányi-puszta, 2. Jászfényszaru–Barátok-tava, 3. Jászfényszaru–Szőlőkalja, 4. Jászfényszaru (iron spearhead, a stray find), 5. Jászfényszaru–Kórés, 6. Boldog, 7. Szentlőrinckáta, 8. Jászágó, 9. Jászárokszállás–Kopaszhalom, 10. Hajóhalom (Kápolnahalom), 11. Jászberény–Borsóhalma, 12. Jászberény–Necsőegyháza, 13. Jászberény–Szent Pál-halma, 14. Jászberény (coin hoard), 15. Jászjákóhalma–Nevada-tanya, 16. coin hoard found between Jászdózsa and Jászjákóhalma, 17. Jászapáti (coin hoard), 18. Alattyán (documentary evidence for the settlement, but no archaeological finds), 19. Jászberény–Csíkos-Tetemház-halom
[•] stray finds

The next Árpádian Age settlement south-east of Jászfényszaru is known from the environs of Jászágó, on the right bank of the Ágó Stream.[61] An 11th century vessel found near a 10th century grave suggests that a permanently occupied settlement was established at a relatively early date.[62] The village was still populated in the first half of the 13th century, as indicated by a foundation sacrifice published by István Fodor.[63] The settlement was probably destroyed during the Mongolian invasion and was never rebuilt.[64] Another settlement of the period was located near the already mentioned cemetery at

61 *Fodor* (1984) 161–162; *Fodor* (1986); Selmeczi (1994a) 61–63.
62 *Fodor* (1986) 141.
63 *Fodor* (1986).
64 *Selmeczi* (1994a) 66.

Jászberény–Négyszállás.[65] A few kilometres south, there was another village at Jászjákóhalma–Nevada-tanya. The occupation of the site was indicated by a kiln from the Árpádian Age and several pits.[66]

Alattyán had already been settled at this time, as shown by its mention in the *Regestrum Varadiense* (1219).[67] The village, then part of Heves County, never became a Jász settlement, but was an estate of László Alattyáni of the Aba kindred, called the "Kun" (Cumanian).[68] Jánoshida, south-west of Alattyán, was also founded quite early; its provosty is first mentioned in a charter from 1235.[69]

Further information about the era is provided by Árpádian Age coin hoards and stray finds. Two of the three hoards from the Jászság were found in the vicinity of Jászberény. The first assemblage was published by Johann Seidl in 1856.[70] The coins in this hoard were minted during the reign of King St. Stephen and Andrew I (1046–1060). The denarii of András I suggest that the hoard was probably buried in the later 11th century.[71] The assemblage from Jászberény–Borsóhalom was probably buried at a later date.[72] Coins[73] issued during the ducal (1048–1060) and royal (1060–1063) period of Béla I were found in a clay vessel with stamped bottom in 1958.[74] The coin find from Jászapáti was probably buried in the same period, as indicated by the András I coins of the preserved assemblage.[75] The hoard found between Jászapáti and Jászdózsa, [76] containing 3400 Friesach dinars, was most likely concealed in the face of the Mongolian invasion.[77]

Of the stray finds, a spearhead found at Jászárokszállás–Kopaszhalom and a sword fragment from the environs of Jászfényszaru can probably be dated to this period.[78]

THE JÁSZ IN THE JÁSZSÁG DURING THE MIDDLE AGES

The growing number of charters issued from the 13th century on provides us with ample source material for the research of the period.[79] This is the most significant group of written sources for this period, and their use can hardly be neglected by archaeologists.[80] As regards the Jász, a number of major historical questions can be resolved by the modern analysis of this group of sources. In addition to philological research, however, the conclusions based on archaeological finds may contribute significantly to our knowledge.

Aside from medieval written sources,[81] the slightly later Turkish defters (tax registers),[82] charters[83] and Latin documents[84] too contain a wealth of information on the later Middle Ages. The comparison

65 *Madaras* (2001) 120.

66 *Kertész R.*: Időutazás a Jászságban. Jászkunság 43 (1997) 127–133; *Madaras* (2001) 121.

67 VarReg 224.

68 *Györffy* (1963–1998) Vol. III, 62.

69 *Csánki* (1890–1913) Vol. I, 29; *Györffy* (1963–1998) Vol. III, 104–105.

70 *J. Seidl:* Beiträge zu einer Chronik der archäologischen Funde in der österreichischen Monarchie. Archiv für Kunde österreichischer Geschichtsquellen 15 (1856) 316; I would here like to thank László Kovács for kindly drawing my attention to this find.

71 *Kovács* (1997) 290.

72 *Ibidem.*

73 *Saltzer E.*: A történelmi Magyarország területén fellelt 156 Árpádházi éremkincslelet összefüggő áttekintése. Budapest 1996, 58; *Kovács* (1997) 104–112.

74 *Parádi N.*: Magyarországi pénzleletes középkori cserépedények (XI–XVII. század). ArchÉrt 90 (1963) 206–207.

75 *Polgár* (1995) 149.

76 *Ibidem* 151.

77 *Törőcsik I.*: Királyság – egy középkori falu történeti és régészeti adatai. Múzeumi kutatások Csongrád megyében 2001. Szeged 2002, 29–36.

78 *Hild* (1975) 188–189.

79 *Berend* (2001) 3–4.

80 *Selmeczi* (1992a) 11–13.

81 *Gyárfás* (1870–1885) Vols. II–III; *Benedek – Zádorné Zsoldos* (1998).

82 *Fekete* (1968); *Bayerle* (1998).

83 *Hegyi K.*: Jászberény török levelei. Szolnok Megyei Levéltári Füzetek 11 (1988).

84 *Gyárfás* (1870–1885) Vol. IV; *Botka* (1988).

of the topographical data contained in the written sources and the archaeological finds allows the reconstruction of the process of Jász settlement.

Ever since the works of György Pray and Péter Horváth,[85] scholars have linked the appearance of the Jász in the Carpathian Basin to that of the Cumanians.[86] It has also been suggested that they arrived to the Carpathian Basin in the 10th century with the ancient Hungarians.[87] Recent research has conclusively proven that the arguments favouring a 10th century settlement are untenable.[88] Many historians assumed a possible later settlement.[89] László Selmeczi's excavations, however, have furnished irrefutable evidence that the Jász moved into the area with the Cumanians.[90] The joint settlement can be confirmed by arguments taken from the study of written sources as well.[91]

László Selmeczi's research also shows that, after their arrival, the Jász were settled along the Zagyva and Tarna rivers by the king.[92] Recent research does not support the suggestion that the Jász first settled outside the Jászság[93] and moved there only later.[94] Thus we have to reckon with the presence of this people on the territory of historic Jászság by the later 13th century. Archaeological excavations have revealed that the Jász had in part settled in villages destroyed during the Mongolian invasion,[95] although in other cases they built new settlements farther away from the earlier villages.[96]

One example for the latter is Jászfényszaru. Recent research has shown that after their arrival, the Jász founded their settlement away from the villages which had existed here before the Mongolian invasion.[97] It is uncertain, however, whether the name Fényszaru (Fövenyszarm~*Fewenzarw*,[98] "gravel horn") goes back to the period before the Mongolian invasion, as suggested by László Selmeczi.[99] The late occurrence of the name[100] and Károly Takács' research indicate that the name of the settlement could well originate from the later 13th or the 14th century.[101] László Selmeczi has convincingly shown in the case of Jászágó that the first appearance of a name in the written sources at a late date does not in itself provide enough evidence about its date and the circumstances of its origin.[102]

There were numerous other, smaller settled areas around early Fényszaru. One of these was identified in the north-western part of the modern village, in an area called Virágoshalom, where István Kolozs found 14th century sherds. He identified another contemporaneous site in the area called Kórés. 13th–14th century pottery fragments were found in the freshly ploughed soil *ca.* 500 metres east of the Sarmatian settlement and the Conquest period cemetery. One of the settlements can probably be identified with Kisfényszaru, listed in a Turkish tax register from 1570, the other with Szentandrás puszta.[103]

Another early Jász settlement was found within the territory of modern Jászfényszaru. As a result of László Selmeczi's untiring research,[104] the one-time settlement of *Zent Kozmademjen descensus* was

85 *Horváth* (1801).
86 *Langó* (2001c).
87 *Fodor* (1942) 111, 152; *Györffy* (1990) 54–59.
88 *Langó P.:* Megjegyzések az alánok és a magyarok 10. századi együttes beköltözéséhez. Wosinsky Mór Múzeum Évkönyve 21 (2001) 321–342; *Langó P.:* Ladány, Varsány, Oszlár. Keleti néptöredékek és a korai helynevek kapcsolata. Limes 2003:3 (2003) 39–54.
89 *Karácsonyi J.:* A székely-magyar kérdés. Magyar kisebbség 2 (1923) 610–613; *Fodor* (1942) 134; *Györffy* (1990) 312–315; *Kristó* (2003) 233–243.
90 *Selmeczi* (1981); *Selmeczi* (1992a) 15; *Selmeczi* (1992b) 103–104, 147; Selmeczi (1994a) 66.
91 *Langó* (2001c) 163–170.
92 *Selmeczi* (1981); *Selmeczi* (1992a) 11–15; *Selmeczi* (1992b) 101–113; *Selmeczi* (1994a).
93 *Györffy* (1990) 316–318.
94 *Langó* (2001b); *Langó* (2001c) 167–168.
95 *Parádi* (1991); *Selmeczi* (1992a) 12.
96 *Selmeczi* (1994a); *Selmeczi* (2001).
97 *Selmeczi* (2001) 139.
98 *Takács* (2000a).
99 *Selmeczi* (2001) 139.
100 CD X, 7, 462.
101 CD IX, 5, 415; *Györffy* (1963–1998) Vol. IV, 194; *Takács* (2000a) 132–133.
102 *Selmeczi* (1994a) 58–59.
103 *Bayerle* (1998) 80.
104 *Selmeczi* (2001).

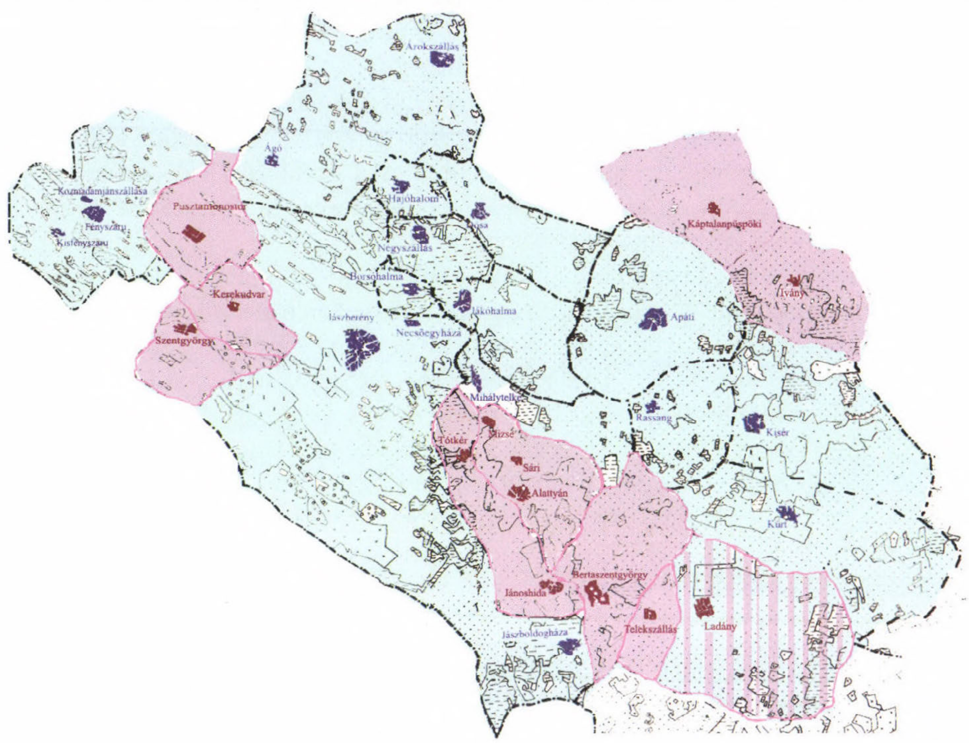
identified on the hillside called Kozma-part.[105] The excavations have shown that Kozmadamjánszállása "may have been an Árpádian Age settlement abandoned after the Mongolian invasion," which was rebuilt by the Jász.[106] The reasons for the final abandonment of the settlement were also clarified: the area "became part of Jászfényszaru by the 14th century and had merged into its territory."[107]

East of Jászfényszaru lay a settlement known as *Ágo possesio*. The medieval Jász remains found there were first described by Viktor Hild.[108] A late medieval Gothic figural candlestick published by István Fodor[109] was discovered here as well. The systematic research of medieval Jászágó was carried out by László Selmeczi. Following his excavations, it has become clear that that the Jász, after arriving in the later 13th century, chose a new place for their settlement and did not rebuild the village, which was destroyed during the Mongolian invasion.[110] The church and the churchyard cemetery date from the close of the 13th and the beginning of the 14th century,[111] similarly to the graves found in the churchyard at Kozmadamjánszállás.[112] The layout of the medieval settlement could be reconstructed on the basis of the 15th century church and 14th–15th century dwellings.[113] East of the village of Ágó, destroyed in the Fifteen Years' War, lay Árokszállás, marking the north-western border of the Jász settlement area. According to the data contained in charters, it was an early Jász settlement.[114] A decree issued by the Palatine Miklós Kont indirectly reflects the expansion of the Jász to a settlement called Árumellék, for it forbade the locals to use the woods, meadows and fields (*terras arabiles, silvas, prata*) owned by Domonkos Pásztó and his companions.[115] The late medieval occupation of the area is indicated by a bronze ring.[116]

On the testimony of the excavated graves, occupation did not cease after the Mongolian invasion at the site of Jászdózsa–Kápolnahalom, identified with medieval Hajóhalom.[117] Evidence for the prosperity of the village is found in written sources as well.[118] László Selmeczi suggested that the village was populated by the Jász in the 14th century, who restored the earlier Romanesque church and raised a new, Gothic hall church in its place.[119] Négyszállás lay near Jászdózsa–Kápolnahalom, to its south-west. The first finds from this settlement were collected by József Prückler (Pórteleki) and József Komáromy.[120] László Selmeczi conducted a systematic research in the area and published the finds.[121] He excavated the church, the cemeteries and parts of the former settlement.

The settlement of Dósa, the predecessor of modern Jászdózsa, lay south-east of Négyszállás.[122] Similarly to Fényszaru, László Selmeczi suggested a late foundation date for this Jász settlement. In his opinion, Hajóhalom and Jászdózsa were not contemporaneous,[123] since the first mention of Jászdózsa appears much later in written sources (1433) than the last reference to Hajóhalom (1345).[124] He believed his view was supported by archaeological evidence as well, since "there are no medieval remains within

105 *Gyárfás* (1870–1885) Vol. III, 554.
106 *Selmeczi* (2001) 129–130.
107 *Ibidem*.
108 *Hild* (1975) 176–177; *Türk A.*: Középkori liliomos pecsétgyűrű a Csongrád megyei Nagytőke határából. MFMÉ–Studia Archaeologica 7 (2001) 379–390.
109 *Fodor* (1984).
110 *Selmeczi* (1994a) 66.
111 *Ibidem* 66.
112 *Selmeczi* (2001) 138.
113 *Selmeczi* (1994a) 68.
114 *Fodor* (1942) 142–143.
115 *Gyárfás* (1870–1885) Vol. III, 502.
116 *Hild* (1975) 181.
117 *Bóna* (1972).
118 *Györffy* (1963–1998) Vol. III, 97; *Györffy* (1983) 11–28.
119 *Selmeczi* (1992a) 12.
120 *Prückler J.*: Négyszállási gyűrű-lelet. Jászberényi Jászmúzeum Évkövnye (1937) 55; *Prückler J.*: Újabb Jászberény–négyszállási leletek. Jászberényi Jászmúzeum Évkönyve (1938–1943) 126–128; *Komáromy* (1943); *Selmeczi* (1992a) 9–11.
121 *Selmeczi* (1992a); *Selmeczi* (1992b) 101–230.
122 CD VIII, 3, 5; *Selmeczi* (1992b) 139.
123 *Selmeczi* (1992a) 12.
124 *Györffy* (1963–1998) Vol. III, 97.



Map. 3. The settlements occupied by the Jász, or in possession of nobles of Jász stock (areas marked with blue), or other nobles (marked with red) in the early 15th century. The settlement at Ladány (marked with hatching was occupied by the Jász at this time; however, it later became a nobleman's private estate

the territory of Jászdózsa."[125] He suggested a late date for the foundation of Fényszaru, based on similar archaeological considerations and his interpretation of the documentary evidence.[126] His opinion, however, is not supported by the evidence he cited. One of the main problems is that in both cases the medieval village lay within the area of the modern settlement, similarly to many other medieval settlements (e.g. Jászberény, Jászárokszállás and Jászapáti in the Jászság). Modern construction works have often destroyed the archaeological remains of earlier periods. Another problem is that the modern settlement overlies the earlier one, and thus the possibly preserved remains of earlier settlements cannot be investigated. As a result of these difficulties, the lack of medieval remains from a modern settlement is not sufficient proof in itself for its late foundation.

The interpretation of the documentary evidence can be challenged as well. The earliest charters containing names of Jász settlements from the Jászság are later than the first mention of Hajóhalom in the written sources.[127] Furthermore, a comparison of the date of the charters mentioning Négyszállás and the archaeological evidence cited by László Selmeczi reveals that the date of the first mention of a settlement's name is by no means conclusive as regards the date of its foundation. His analyses have shown that Négyszállás was already settled by the later 13th century;[128] at the same time, the settlement is first mentioned in a charter from 1391.[129]

In the case of Jászdózsa, László Selmeczi's arguments are undermined by the observations of István Bóna, who excavated the Jászdózsa–Kápolnahalom site. He pointed out that the church uncovered at the site had been used until the 16th century and he dated the last phase of the excavated cemetery to

125 *Selmeczi* (1992a) 11.
126 *Selmeczi* (2001) 138–139.
127 *Gyárfás* (1870–1885) Vol. III, 27, 495–496.
128 *Selmeczi* (1992a) 15; *Selmeczi* (1992b) 103–105.
129 *Gyárfás* (1870–1885) Vol. III, 514.

this period as well,[130] meaning that Hajóhalom had not been abandoned in the 14th century, but was occupied until the 16th century. László Selmeczi's arguments concerning the archaeological remains of Kápolnahalom can only be accepted if Hajóhalom is identified with early Dósa. The identification of the two settlements, however, is not supported by either the archaeological, or the documentary evidence.

The settlement of Borsóhalma lay four kilometres north-west of Dósa, on the right bank of the Tarna. It is described as a Jász settlement when it first appears in the charters (1449).[131] Similarly to Hajóhalom, it was occupied during the 15th century[132] and abandoned in the 16th century.[133] Opposite Borsóhalma, on the left bank of the Tarna, lay Jászjákóhalma, which together with Jászberény is the earliest Jász settlement mentioned in the written sources.[134] Necsőegyháza, in the environs of modern Jászberény, was the estate of Imre Barthalos of Borsóhalom.[135] Nothing is known about the inhabitants of the settlement, which is described as a *praedium* in the 1449 charter. Although it is possible that its original population remained there after the Mongolian invasion, the possibility that the Jász occupied the earlier settlement cannot be excluded either.[136] The late medieval occupation is indicated by a key found at Sándor Juhász' farmstead and a 15th century golden ring.[137] Beside Necsőegyháza, the charter also mentions the holdings Fügedegyháza and Lantha,[138] which most certainly lay near Necsőegyháza, as indicated also by a court decision issued during the legal dispute between Imre Barthalos' widow and Péter Pethe.[139] Their exact location, however, is uncertain.[140]

Jászberény was sited on the left bank of the Zagyva. It first appears in the charters in 1357, when its voivode, László of the Örs kindred, became embroiled in a legal dispute with Domonkos Csupor about an area called Horgasmelléke.[141] Jászberény was a settlement of outstanding importance by this time.[142] Its central location within the Jászság ensured its continuous prosperity in the 14th century. In the 15th century, it was one of the judicial centres (*Sedibus*) together with Négyszállás, Árokszállás and Fényszaru.[143] The increasing prosperity of the settlement is also shown by the surviving medieval remains. The size of the Franciscan church built in the later 15th century reflects its regional role.[144] In the late Middle Ages, Jászberény became a regional centre and attracted increasingly more people from the surrounding settlements. Its layout, which can be reconstructed from post-medieval sources, evolved gradually in the 15th century. The Hungarians who settled among the Jász of Jászberény had their own separate quarter: their town quarter was called Magyarváros ["Hungarian town"], which formed one administrative unit with Jászváros ["Jász town"], the town quarter inhabited by the Jász.[145]

The settlements between Jászberény and Jászfényszaru were not occupied by the Jász.[146] The Jász villages were royal holdings in the 13th century and remained so later on, while these settlements became parts of noblemen's estates and ecclesiastic properties quite early. The Jász, who enjoyed a better status than local serfs, did not settle in these places.[147] Pusztamonostor was first an ecclesiastic

130 *Bóna* (1972) 71.
131 *Gyárfás* (1870–1885) Vol. III, 622; *Benedek – Zádorné Zsoldos* (1998) 20.
132 *Gyárfás* (1870–1885) Vol. III, 684–695; *Benedek – Zádorné Zsoldos* (1998) 20.
133 *Fodor* (1942) 147; *Bayerle* (1998) 80.
134 *Gyárfás* (1870–1885) Vol. III, 495–496; *Benedek – Zádorné Zsoldos* (1998) 64–65.
135 *Gyárfás* (1870–1885) Vol. III, 622–623.
136 *Madaras* (2001) 120.
137 *Hild* (1975) 171–172.
138 *Gyárfás* (1870–1885) Vol. III, 622.
139 *Gyárfás* (1870–1885) Vol.III, 689.
140 *Bagi* (2002) 127–128; *Szabó J. Gy.:* Adatok a patai főesperesség korai történetéhez. *In:* Tanulmányok Gyöngyösről. Eds: P. Havassy – P. Kecskés. Gyöngyös 1984, 21–89.
141 *Gyárfás* (1870–1885) Vol. III, 495–496.
142 *Kubinyi A.:* Városfejlődés és városhálózat a középkori Alföldön és az Alföld szélén. Szeged 2000, 70.
143 *Gyárfás* (1870–1885) Vol. III, 665; *M. Kring:* Kun és jász társadalomelemek a középkorban. Századok 65 (1932) 41.
144 *Gyárfás* (1870–1885) Vol. III, 534; *Komáromy J.:* Adatok Jászberény XV–XIX. századbeli építészetéhez. *In:* A Jászberényi Jászmúzeum Évkönyve (1938–1943) 162–163; *Szántó K.:* A jászberényi ferences templom története. Budapest 1974; *Belényesy K. – Szebeni A.:* Jászfényszaru középkori temploma. *In:* Szállástól a mezővárosig. Tanulmányok Jászfényszaru és a Jászság múltjáról. Ed.: P. Langó. Jászfényszaru 2000, notes 145–163, 147.
145 *Fekete* (1968) 73–76; *Botka* (1988) 186–187, 212–213; *Bayerle* (1998) 78–79.
146 *Györffy* (1963–1998) Vol. III, 62–63, Vol. IV. 501.
147 *Langó* (2001a); *Langó* (2001c).

and, later, a nobleman's property;[148] in the 19th century it was still part of Heves County.[149] Kerekudvar (Tyukod), on the left bank of the Zagyva (*iuxta fluvium Zagyowa*),[150] was first the estate of the royal goldsmiths, then of Péter Kátai, later of János, son of Chak, and finally of Uldvin of Harsundorf.[151] The estate had several other owners in the later Middle Ages.[152] Pusztamonostor and Kerekudvar were occupied until the end of the Middle Ages, as shown by sources of the Ottoman period.[153]

Later Jászfelsőszentgyörgy was not part of the Jász villages in the Middle Ages either.[154] Known as *posessio Zenthgerg*, the settlement is first mentioned in a 1331 perambulation as a neighbour of Kerekudvar and the holding of the prebendary of Vác.[155] The village was abandoned after the Turkish occupation, for it is does not appear in the 16th century defters.[156] The Jász occupied the deserted settlement at this time. The immigrants, however, moved in before 1558, as indicated by a Latin document, which lists *Felseozetggŷeorg* among the Jász settlements.[157] The village appears frequently among the Jász settlements in later Latin and Hungarian sources as well.[158]

South of Jászberény, Tótkér, Jánoshida[159] and the already mentioned Alattyán[160] had been noblemen's holdings since the Árpádian Age. Haczok, on the right bank of the confluence of the Zagyva and the Tarna,[161] and Iva[162] were the estates of the provosty of Ság. Farkas and Kér, mentioned as the holdings of Mikó,[163] may be located to this area as well. The latter was erroneously linked to Hatvan by Ferenc Fodor.[164] The Mizsei kindred was named after the village of Mizse, located between Alattyán and Jászberény.[165] It later became the property of other families,[166] similarly to Sári, between Mizse and Alattyán.[167] By the Ottoman period, Sári is described as lying on the outskirts of Mizse in the written sources.[168]

Mihálytelke, a holding of the Jász noble Imre Barthalosy in the 15th century, also lay south of Jászberény, near the confluence of the Zagyva and the Tarna.[169] Together with neighbouring Fenékpuszta, this village remained occupied later as well.[170] Thanks to research by Viktor Hild and, later, József Komáromy, medieval Jászboldogháza can be precisely located.[171] The village is first mentioned in 1458, when the settlement was represented by Zubor in a Jász delegation sent to the king.[172] The village still existed in the 16th century and was apparently abandoned during the Fifteen Years' War, as indicated by a coin find rescued by József Csalog.[173] The settlement lay in the same area as the Árpádian Age vil-

148 *Csánki* (1890–1913) Vol. I, 68; *Fodor* (1942) 146; *Györffy* (1963–1998) Vol. III, 62, 121.
149 *Hild* (1975) 192; *Kuruncz – Langó* (2000) 219; *Langó* (2000a) 168.
150 AOT II, 529; *Györffy* (1963–1998) Vol. III, 107.
151 AOT II, 115.
152 *Ibidem* 529–531, 583–584; *Csánki* (1890–1913) Vol. I, 64; *Fodor* (1942) 146; *Benedek – Zádorné Zsoldos* (1998) 92–94.
153 *Bayerle* (1998) 80–82, 92.
154 *Fodor* (1942) 374–374.
155 *Benedek – Zádorné Zsoldos* (1998) 92.
156 *Fekete* (1968); *Bayerle* (1998).
157 *Botka* (1988) 211.
158 *Botka* (1988) 216, 227, 238, 247, 257.
159 *Benedek – Zádorné Zsoldos* (1998) 1, 3, 50–51.
160 *Ibidem* 1–6.
161 *Csánki* (1890–1913) Vol. I, 688; *Györffy* (1963–1998) Vol. III, 97.
162 *Ibidem* 102–103.
163 *Ibidem* 107; *Benedek – Zádorné Zsoldos* (1998) 1, 3–4, 71, 95–96.
164 *Fodor* (1942) 141.
165 *Györffy* (1963–1998) Vol. III, 116.
166 *Benedek – Zádorné Zsoldos* (1998) 127–133; *Bagi* (2002) 126.
167 *Csánki* (1890–1913) Vol. I, 69; *Györffy* (1963–1998) Vol. III, 130; *Benedek – Zádorné Zsoldos* (1998) 132; *Bagi* (2002) 126.
168 *Bayerle* (1998) 94.
169 *Gyárfás* (1870–1885) Vol. III, 622–623.
170 *Fodor* (1942) 369; *Botka* (1988) 211, 257; *Bayerle* (1998) 93–94.
171 *Hild* (1975) 94–99, 167–168; *Komáromy* (1943) 120–126.
172 CD VIII, 3, 5; *Gyárfás* (1870–1885) Vol. III, 637.
173 *Parádi* (1991) 205, 211, 215.

lage, which had been destroyed during the Mongolian invasion. The immigrant Jász rebuilt the earlier Romanesque church in Gothic style.[174]

The last Jász settlement east of Mihálytelek was Apáti.[175] The settlement (*descensus*) had a stone-built church dedicated to the Virgin Mary already in 1391 (*ecclesiae beatae Mariae virginis lapideae de eadem Apathy*).[176] Today, Jászszentandrás and Jászivány are part of the Jászság, even though they became Jász settlements in the post-medieval period.[177] Jászszentandrás belonged to the chaplain of Eger in the Middle Ages and was abandoned in the 14th century. The arrow-head found by the locals during the construction of the new church around the beginning of the 1900s, indicates an Árpádian Age occupation.[178] The village, also mentioned as Káptalanpüspöki,[179] was abandoned by the 15th century. The Jász repeatedly tried to settle here, but were unsuccessful every time.[180] Modern Jászivány, then called Iván, was partly in the possession of the Miskolc kindred around the end of the 13th century.[181] The village later became the property of László Pálóczy, the Lord Chief Justice.[182]

South of Apátiszállás lay Rassang, first mentioned in 1421.[183] Together with the representatives of the other Jász settlements, the village delegate was present at the ceremony, in the course of which István Rozgonyi took possession of his holdings in Heves County.[184] The village was occupied during the Ottoman rule as well, as evidenced by a 16th century stove tile found by Viktor Hild on its territory.[185] A tax register from 1570, however, lists the settlement as a deserted village, suggesting that the village population had decreased dramatically by that time.[186] East of Rassang, near a smaller stream, lay Jászkisér.[187] The settlement (*possessionis Kyser*) is first mentioned in a 1392 perambulation of the vicinity of Apáti.[188] In contrast to Rassang, however, the village remained a significant settlement in later times too.[189]

Jászalsószentgyörgy lay between Boldogháza and Rassang, on the left bank of the Zagyva. It was not a Jász settlement in the Middle Ages.[190] Although a charter from the end of the 14th century mentions it as a settlement with a church,[191] its population was not particularly large, since a title deed issued by King Sigismund in 1401 describes the settlement as a deserted village owing to the lack of inhabitants. The area became the estate of the Cumanian Csirke family;[192] in the 15th century it passed into the ownership of the Sempsei (Semsey) family[193] and, later, of the Abádi and the Bessenyi families. It was finally acquired by the Church.[194] The village appears as Bertaszentgyörgy (*descensus Bertha Szent-György*) in a 1466 perambulation;[195] in the Ottoman tax registers and 17th century sources it is often

174 *Hild* (1975) 94–99, 167–168; *Komáromy* (1943) 120–126; *Parádi* (1991) 199–201, 216.

175 *Gyárfás* (1870–1885) Vol. III, 512–518; *Vándorffy J.*: Jászapáti egyházának múltja és jelene. Eger 1895, 7; *Soós I.*: Az egri egyházmegyei plébániák történetének áttekintése. Budapest 1985, 372; *Mező A.*: Patrocíniumok a középkori Magyarországon. Budapest 2003, 428.

176 *Gyárfás* (1870–1885) Vol. III, 516.

177 *Fodor* (1942) 424.

178 *Hild* (1975) 88, 200.

179 *Gyárfás* (1870–1885) Vol. III, 116.

180 *Ibidem* 577–578, 638–639.

181 Györffy (1983) 11–26.

182 *Gyárfás* (1870–1885) Vol. III, 656–659; *Benedek – Zádorné Zsoldos* (1998) 64.

183 *Gyárfás* (1870–1885) Vol. III, 569–572; *Benedek – Zádorné Zsoldos* (1998) 68.

184 *Gyárfás* (1870–1885) Vol. III, 601–603; *Benedek – Zádorné Zsoldos* (1998) 61.

185 *Hild* (1975) 172.

186 *Bayerle* (1998) 83.

187 *Fodor* (1942) 374.

188 *Gyárfás* (1870–1885) Vol. III, 505; *Benedek – Zádorné Zsoldos* (1998) 55–56.

189 *Fodor* (1942) 375.

190 *Ibidem* 351.

191 *Gyárfás* (1870–1885) Vol. III, 165; *Lippay J.*: Jász-Alsó-Szentgyörgy nagyközség történeti vázlata és templomának századik évfordulója. Jászberény 1893, 6.

192 *Gyárfás* (1870–1885) Vol. III, 614–615; *Benedek – Zádorné Zsoldos* (1998) 1–3.

193 CD X, 6, 814–817; *Gyárfás* (1870–1885) Vol. III, 248; *Benedek – Zádorné Zsoldos* (1998) 3, 5–6.

194 Jász-Nagykun-Szolnok várnegye múltja és jelene. Szerk.: Scheftsik Gy. Pécs 1935, 402.

195 *Gyárfás* (1870–1885) Vol. III, 658.

called "Gály Szent György".[196] The latter name was probably conferred on the village[197] after the name of one of its owners, the Gál ~ Gerla family (*Gerla de Zenthgwrgh*).[198] The settlement was destroyed in the 16th century and was re-settled only in 1557. The Jász probably moved in during the re-occupation in 1557, as shown by the inventory of Eger Castle drawn up a year later.[199]

The inhabitants of neighbouring Telekszállás probably moved to Jászalsószentgyörgy in the 17th century.[200] The village between Ladány and Alsószentgyörgy was listed as lying on the outskirts of the latter in the post-medieval period. An economic document from the 17th century called this settlement "*Ladán Szent György*".[201] Similarly to Alsószentgyörgy, the village (occupied from the Árpádian Age) was not a Jász settlement in the Middle Ages. Its late medieval period is indicated by a key, described by Viktor Hild,[202] and hoard of 25,000 denarii from King Sigismund's reign, found in 1994.[203]

Today, the southernmost Jász settlement is Jászladány. The name of the village first appears in 1399 (*ville Ladan*), in the text of a perambulation.[204] Similarly to Jászalsószentgyörgy, it was probably not inhabited by the Jász. Its population could not have been significant; a royal decree issued in 1401 listed it as a deserted village.[205] It seems likely that the Jász occupied the place at this time.[206] Later, in the 15th century, this village too became the property of the Csirke and Semsei families.[207] We do not know, however, whether the Jász managed to preserve their earlier status as *iobagiones castri*,[208] or whether, as a result of the land endowment, they were also removed from under the royal authority.

Today, the territory of the Jászság ends at Jászladány; in the Middle Ages, however, the Jász lived in more southerly areas as well, as shown by a charter written to the Jász captains of Újszász.[209] The settlement later was represented by Pál Gozthan in a Jász delegation sent to King Matthias.[210] Beside Újszász, there were numerous other settlements, which were not part of the Jászság after the Jász had attained their liberty in the 18th century, but were inhabited or owned by the Jász in the Middle Ages. One of these was Kürt, located between Jászladány and Jászkisér and owned by the Jász noble László Kompolth of Kozmadamján and his family after 1409.[211] After the extinction of the Kompolth family, the village became the property of Sebestyén Rozgonyi, voivode of Transylvania.[212] The Jász, however, did not relinquish the possession of the area easily, as shown by a letter of Péter Horváth written to István Rozgonyi.[213] Matters took a favourable turn under the Ottoman occupation and by 1570 the estate belonged to Jászberény.[214] Újfalu, present-day Nádújfalu in Heves County, was also the estate of the Kompolth family.[215] A few Jász lived in the environs of Füged, present-day Nagyfüged in Heves County.[216] Vidszállás, a settlement mentioned in a single source only, may also have been a Jász settlement.[217] István Gyárfás identified it with Vid puszta near Tápióbicske.[218] This is not the only area in

196 *Botka* (1988) 257; *Bayerle* (1998) 90.
197 *Fodor* (1942) 351.
198 *Gyárfás* (1870–1885) Vol. III, 603.
199 *Botka* (1988) 211.
200 *Gyárfás* (1870–1885) Vol. IV, 134; *Fodor* (1942) 351–352.
201 *Botka* (1988) 257.
202 *Hild* (1975) 185.
203 *Polgár* (1995) 151.
204 *Gyárfás* (1870–1885) Vol. III, 536.
205 *Benedek– Zádorné Zsoldos* (1988) 1–3.
206 *Gyárfás* (1870–1885) Vol. III, 564; *Benedek – Zádorné Zsoldos* (1988) 70–71.
207 *Gyárfás* (1870–1885) Vol. III, 248; *Benedek – Zádorné Zsoldos* (1988) 71.
208 *Langó* (2001a).
209 *Gyárfás* (1870–1885) Vol. III, 581–582; *Kocsis* (1998) 31–32.
210 CD VIII, 3, 5; *Gyárfás* (1870–1885) Vol. III, 637.
211 *Gyárfás* (1870–1885) Vol. III, 559–560; *Benedek – Zádorné Zsoldos* (1998) 67–69; *Bagi* (2002) 126–127.
212 *Benedek – Zádorné Zsoldos* (1998) 70.
213 *Gyárfás* (1870–1885) Vol. III, 711; *Benedek – Zádorné Zsoldos* (1998) 70.
214 *Bayerle* (1998) 87.
215 *Gyárfás* (1870–1885) Vol. III, 621–622.
216 *Ibidem* 603.
217 *Ibidem* 690.
218 *Ibidem* 255.

Pest County, which can be associated with the Jász. The Jász from Ladány and Kisbér had possession of Hegyes and Külsőhegyes, both in Pest County.[219]

There were numerous Jász villages in the Jászság, whose exact location is not known. Fügedegyháza and Lanthó, which probably lay somewhere near modern Jászberény,[220] have already been mentioned above. It has been impossible to locate Jászszarvas. The settlement appears in charters from the 15th century on,[221] and according to the documentary evidence, it lay somewhere around Újszász, Jászboldogháza and Jászladány.[222] Viktor Hild and József Komáromy identified the village with the Jászberény–Tetemháza site;[223] this turned out to be erroneous, as shown by József Csalog and Nándor Parádi's studies, for this site is identical with medieval Jászboldogháza.[224] Neither do we know the exact location of a settlement called Pazsán, mentioned in a report of the prebendary of Buda from 1466.[225]

According to the data contained in the charters, there were numerous non-Jász settlements in modern Jászság, which can no longer be located. These include Barasó, mentioned in 1387,[226] and Bény near Kerekudvar, as well as Tarcsa, probably located somewhere near Jászárokszállás.[227]

HISTORICAL JÁSZSÁG AND THE MEDIEVAL HISTORY OF THE JÁSZ

Following the above overview of settlement history, let us turn back to Ferenc Fodor's arguments, and compare the settlement data with the results of the environmental analysis conducted by Pál Sümegi.

What should first be noted is that Ferenc Fodor's concept of settlement history was rightly criticised by later research. Between the Hungarian Conquest and the Ottoman occupation that ended the Middle Ages, the Jászság was not the clearly identifiable unit as conceived by Ferenc Fodor. The communities living here since the 10th century maintained close ties with other communities living in Pest and Heves Counties.

The examination of the known Conquest period graves from the Jászság does not enable the identification of a local unit resembling the ones in the Small Hungarian Plain[228] or the area of the Maros estuary.[229] A more detailed study of the richly furnished female burials in the north-western part of the Jászság will perhaps allow the identification of certain traditions, which might enable the definition of a smaller unit of this kind. The currently known 10th–11th century archaeological finds from the area do not allow a genuine in-depth study of the area and its cultural and other contacts. Three-quarters of the sites linked to the ancient Hungarians were uncovered in the northern Jászság, with the southern areas yielding few finds only. Given the current state of research, however, this cannot be regarded as a characteristic feature of settlement patterns, but rather a reflection of the blank spots in the research of this region. In the northern part of the Jászság, archaeological work has received enthusiastic support from local amateur historians (such as István Kolozs, mentioned above, and Sándor Macsi). In the southerly areas of the Jászság, however, local support of this kind has been much scarcer. The varying density of sites is a consequence of the unevenness of research.

Contrary to Ferenc Fodor's views, the ancient Hungarians occupied the entire area. Settlements and cemeteries can be found on elevations rising above one-time rivers. These locations always provided favourable conditions for occupation, as indicated by earlier remains on these sites (a Sarmatian settlement at Jászfényszaru–Kórés, a settlement of the Baden culture at Jászfényszaru–Szegek, Sarmatian

219 *Benedek – Zádorné Zsoldos* (1998) 71.
220 *Fodor* (1942) 145; *Benedek – Zádorné Zsoldos* (1998) 20, 36, 72, 113; *Bagi* (2002) 128, notes 22–23.
221 *Gyárfás* (1870–1885) Vol. III, 583–585; *Kocsis* (1998) 31–32; *Benedek – Zádorné Zsoldos* (1998) 169–170.
222 *Horváth* (1801) 64; *Gyárfás* (1870–1885) Vol. III, 209–211; *Fodor* (1942) 140–141.
223 *Hild* (1975) 94–99, 167–168; *Komáromy* (1943) 120–126.
224 *Parádi* (1991).
225 *Gyárfás* (1870–1885) Vol. III, 657–658; *Fodor* (1942) 142.
226 *Benedek – Zádorné Zsoldos* (1998) 92–93.
227 *Fodor* (1942) 138.
228 *Szőke B.:* Adatok a Kisalföld IX. és X. századi történetéhez. ArchÉrt 81 (1954) 119–137.
229 *Kürti B.:* Régészeti adatok a Maros-torok vidékének 10–11. századi történetéhez. *In:* A kőkortól a középkorig. Tanulmányok Trogmayer Ottó 60. születésnapjára. Ed.: G. Lőrinczy. Szeged 1994, 369–386.

remains at Boldog–Téglaházpart, an Avar cemetery at Visznek–Kecskehegy, Scythian and Sarmatian remains at Tarnaörs–Rajnapart and a major, regional Bronze Age centre at Jászdózsa–Kápolnahalom). The analysis of palaeobotanical samples has revealed that the economy of the ancient Hungarians who settled here was predominantly based on the stockbreeding. The horse bones found in the sediment samples suggest that horses too played an important role in the economy. The importance of horse-breeding is confirmed by archaeological finds as well. The grassy steppeland evolving after the deforestation of the preceding epoch favoured the continuation of the traditional lifestyle. The newcomers lived in harmony with the surrounding natural landscape. Significant environmental changes did not occur during this period and, as a consequence, the wounds of earlier forest clearings started to heal slowly.

The investigation of the archaeological remains of the Árpádian Age is fraught with similar difficulties as that of the 10th–11th centuries. Only one settlement is known south of the Jászapáti–Jászberény line, while five sites have been identified in the environs of Jászfényszaru, a much smaller settlement. This comparison clearly reflects the anomalies of research.

On the testimony of the available sources, it would appear that the settlements established along watercourses were characteristic Árpádian Age villages. The archaeobotanical finds indicate that the population of this area was predominantly engaged in stockbreeding. Horse-keeping retained its significance, as shown by a charter concerning Alattyán, which existed by this time. In 1219, the village was populated by the so-called "saddle-holder" grooms of the abbey of Pásztó.[230] Stockbreeding did not influence the reforestation of the region. By the beginning of the 13th century, considerable hard- and softwood forests had developed. This process of forestation draws attention to another factor as well: the use of wood by local communities was apparently well below that of earlier periods. This might be explained in part by a smaller population size, and in part by the reduced need for wood in the construction of contemporary dwellings (sunken houses, felt yurts).[231]

By the 13th century, some of the villages had been donated by the kings. The change of ownership probably played an important role in the transformation of the regon's economy in the first half of the century. Due to land endowments, cereal cultivation gained in importance. These changes can be identified by environmental archaeological research too. The appearance and increase of cereal pollens and the weed flora of cultivated fields (such as the goosefoot family) in the samples reflect the impact of this process on the environment.

The first phase of the Árpádian Age ended with the Mongolian invasion in 1242. The incursion of Batu Khan's army resulted in major changes in the earlier settlement structure. The population of the area ravaged by the nomadic troops decreased significantly. Béla IV resettled the Cumanians as part of his defence policy. A large group of the Jász, who arrived with them, were settled in the area of the modern Jászság by the sovereign.[232]

The early Jász settlement network can be reconstructed from the evidence reviewed in the above. It has also become clear what György Györffy mistook for evidence supporting a late date for the settlement of the Jász. The renowned historian believed that in the 13th century the later Jász villages were still occupied by Hungarians and that the Jász, who appear in the written sources only in the 14th century, only moved in around the 1300s. He regarded the 14th century Jászság as a coherent unit, where non-Jász settlements could be found but sporadically (Alattyán, Mizse and Sári). If, however, the noblemen's estates of the area are plotted on a map, it is clear that a much larger area was the private property of the nobles in the 14th century than he had assumed.[233] Jász villages were often wedged in-between these noblemen's holdings. Thus, the Jász villages in royal possession did not form a coherent territorial unit in the 14th century as assumed by earlier research.

230 VarReg 224; *Györffy* (1963–1998) Vol. III, 66.

231 *Bóna I.:* Vázlat a lakóházak történetéről a Kárpát-medencében. Ethnographia 99 (1988) 401–411; *Róna-Tas A.:* Nomád sátor, árok és kerítés. *In:* Honfoglalás és néprajz. Eds: L. Kovács – A. Paládi-Kovács. Budapest 1997, 173–183; *Szentgyörgyi V. – Buzás M. – Zentai M.:* Az Árpád-kori házak „nyele". *In:* Heves megyei régészeti közlemények 2. Eds: T. Petercsák – A. Váradi. Eger 2000, 311–330; *Bencze Z. – Gyulai F. – Sabján T. – Takács M.:* Egy Árpád-kori veremház feltárása és rekonstrukciója. Budapest 1999.

232 *Langó* (2001c) 162–163.

233 *Györffy* (1990) 300–301.

With time, some of these holdings became the property of Cumanian and Jász nobles. The Cumanian estates in the region, however, were not a consequence of their role as "auxiliaries of the Jász", as suggested by some scholars, since a relationship of this type cannot be demonstrated between these two peoples.[234] The appearance of Cumanian estates can be explained by the geographical proximity of the Kunság (Cumania), similarly to the Jász estates in Heves and Pest Counties.[235]

The administration of the territory of the later Jászság was not uniform either. In the Middle Ages, Jánoshida and Tótkér belonged to Pest County, while the other Jász villages and noblemen's estates were mostly part of Heves County. In a few cases, however, charters mention a particular area as lying in Szolnok or Pest County.[236]

It is thus quite obvious that we can hardly talk about a territorially and administratively uniform Jászság in late medieval times either. The immigration of the Jász was not the outcome of the geographical and economic factors suggested by Ferenc Fodor. Károly Takács has convincingly demonstrated that medieval communities lived in harmony with their environment.[237] They were aware of and exploited the possibilities offered by the seasonal floods of the rivers flowing through the region. They strove to counter unfavourable processes with the means at their disposal. Water played an important role in the economy. Charters mention fishponds[238] and water-mills.[239]

The economy of the area also changed during this period. Crop cultivation, whose importance had increased in the period of earlier land endowments, became dominant. In addition to wheat, rye cultivation increased too. Contrary to earlier assumptions,[240] the region's economy was dominated by crop cultivation, rather than stockbreeding. Reforestation ceased, indicating a growing demand for wood. The use of wood reflects not only the increased demand for this commodity, but – indirectly – also a population growth. Forests gave way to meadows and ploughland. The gradual population growth of the 14th century is also indicated by the organised expansion of the Jász settlement territory, with attempts to occupy neighbouring deserted lands and, also, more distant areas. The hunger for land is a reflection of the prosperity of Jász settlements.

With the help of the historical model (frontier society) used by Nóra Berend,[241] we can also answer the question of the inner dynamics of the economic development of the Jász communities. The legal status of the Jász, close to that of the *iobagiones castri*, provided numerous economic advantages for the population.[242] These advantages were cleverly exploited by the Jász for their own benefit and they continuously tried to increase the number of royal privileges bestowed upon them. By the 15th century, the legal status of the Jász seemed so advantageous that serfs from neighbouring noble estates joined them.[243] The archaic elements of the legal status of the Jász meant fewer burdens than the ones borne by the serfs on the nobles' estates. The Jász exploited these economic opportunities, as shown by the continuous growth of their villages during the Middle Ages. While the population of the neighbouring noblemen's holdings moved away, if possible, the Jász attempted to gain possession and occupy these deserted lands.

234 *Langó* (2000a); *Langó* (2001a).

235 *Gyárfás* (1870–1885) Vol. III, 563–564.

236 AOT II, 115–116; *Csánki* (1890–1913) Vol. I, 668; *Györffy* (1963–1998) Vol. III, 102.

237 *Takács* (2000a); *Takács K.:* Árpád-kori csatornarendszerek kutatása a Rábaközben és a Kárpát-medence egyéb területein. Korall 1 (2000) 27–61; *Takács K.:* Árpád-kori csatornarendszerek kutatása a Rábaközben és a Kárpát-medence egyéb területein II. Korall 2–3 (2001) 297–314; *Takács K.:* Árpád-kori csatornarendszerek kutatásának eredményei. Vízügyi közlemények 83 (2001) 266–287; *K. Takács:* Medieval hydraulic system in Hungary: written sources, archaeology and interpretation. *In:* People and Nature in Historical Perspective. Eds: J. Laszlovszky – P. Szabó. Budapest 2003, 289–311.

238 *Gyárfás* (1870–1885) Vol. III, 684–687.

239 *Szikszai M.:* Adatok a jászsági vízimalmok történetéhez. A Jász Múzeum Évkönyve (1975–2000) 191–209.

240 *Langó* (2001c) 166–167.

241 *Berend* (2001).

242 *Kocsis* (1998); *Langó* (2001a); *Kocsis Gy.:* A Jászság társadalma, népessége, gazdálkodása a XVI–XVII. században. PhD Thesis. Budapest 2002, 7.

243 *Gyárfás* (1870–1885) Vol. III, 341.

The medieval Jász not only lived in harmony with their environment, but also exploited the resources of the region. In contrast to the unfavourable environment reconstructed by 19th–20th century scholars, recent research and the study of the settlement patterns has shown that the area was by no means unfavourable. In the case of the Jász, we witness a case of successful assimilation. They strived to exploit the potentials of the environment and rapidly adapted to the possibilities it provided: they created permanent settlements[244] and adopted cereal cultivation.[245] The advantages of their legal status drew many people to the area both during the Middle Ages and the Ottoman occupation.[246] The memory of these privileges played an important role in the later formation of a separate Jász identity. The Jász tried to portray their earlier, favourable legal status as a form of noble privileges in the socially even more strictly stratified Hungarian Kingdom of the post-medieval period. Eventually, the myth of these noble privileges enabled the Jász to gain their liberty, when the entire community was liberated from the burdens of serfdom.[247] The emergence of nationalistic attitudes, nourished by the cultural impact of the Enlightenment, had their influence on the Jász as well; they nurtured earlier beliefs of descent from the nobility and Jász nationality, which in turn formed the basis of many modern myths.[248]

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244 *Selmeczi* (1994b).
245 *Gyárfás* (1870–1885) Vol. III, 109.
246 *Mészáros K.:* Jászfényszaru összeírásai a XVII–XVIII. század fordulóján (1699–1705–1710–1713). *In:* Szállástól a mezővárosig. Tanulmányok Jászfényszaru és a Jászság múltjáról. Ed.: P. Langó. Jászfényszaru 2000, 165–219.
247 *Kiss J.:* A Jászkun Kerület a Német Lovagrend földesúri hatósága idején (1702–1731). Budapest 1979.
248 *Langó* (2001c) 151–160.

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THE HORTOBÁGY IN THE HUNGARIAN CONQUEST PERIOD

Károly Mesterházy

Together with a number of other elements signalling transformation compared to preceding periods, the history, the settlement patterns, the economy, the population density and the road network of the Hortobágy region underwent a profound change after the Hungarian Conquest period. The first of these is that only from the 10th or 11th century can a particular area in this region be called the Hortobágy. This area, although not clearly defined to this very day, appears to have been smaller than any area, which was called the Hortobágy since 1701, the first time that the minutes of the town of Debrecen designated the area of the neighbouring *puszta* uniformly as the Hortobágy. Until then, the documents simply record the names of the one-time villages, such as Zám puszta, Máta, Elep, Angyalháza, etc. Previously, the toponym Hortobágy always designated a river.[1] The foundation charter of the Százd monastery from 1067, known from a transcript drawn up two hundred years later, contains the detailed perambulation of the area and a description of its inhabitants and their occupation: *"Marchia Chartybak: ab occidente ex parte Chartybak in capite acervus Basy, inde ad viam, que venit de Zondonek et ducit ad Chegen usque ad angulum vally, inde flectitur per ryppam vene deorsum, ubi versus monticulum ultratur, inde ad alium monticulum, qui est cum villa Solu, inde tendit ad acervum Fygudy usque ad acervum Marci, inde dirigitur ad terminum cum Chordy usque monticulos, unde tendens ad pirum stantem in argo perducit ad predictum Basi acervum."*[2]

No matter how the toponyms of this perambulation are interpreted, there are very few secure starting points for their identification since the Hortobágy is dotted with various mounds, most of which have names dating from the post-medieval period. The only toponyms which can be identified with certainty are Szandalék and *Chordy* (identified with Hort), which merged into Polgár. The road leading to *Chegen* is another one: *Chegen* is usually identified with Cégény, lying north-west of Hajdúhadház.[3] However, it seems unlikely that such a distant village would have been mentioned as a point of orientation in the Szandalék area, especially in view of the fact that there were several settlements between the two. If *Chegen* is identified with (Tisza)Csege, the toponyms appearing in the quoted passage can be localised to the north-western part of present-day Hortobágy. In this case, the boundary of the area does not even extend to the Hortobágy River, since the name of the watercourse is not mentioned once. Péter Németh suggested that the village of Hortobágy lay south of Polgár.[4] The uncertainty is enhanced by the fact that Szandalék and Hort are both toponyms in Balmazújváros, from where a road could have led to Cégény. The waters of the Hortobágy River need not be mentioned in this case either. Another reason for this uncertainty is that the remains of the one-time village of Hortobágy have not been identified yet either during field surveys or during excavations. Today, the Hortobágy is a larger area than implied by the perambulation, both in the ethnographic sense and as a geographic micro-region.[5] Even the area of the Hortobágy National Park corresponds better to a settlement territory than what was described as *Chartybak*, which was neither a village, nor a manorial estate, but a marchland (*marchia*) with uncertain boundaries. This expression was never used for a settlement by the clerics who drew up the charters.

Two Conquest period sites are known from the heartland of this area: one lies west of the Árkus on the Sóshát, where one or more burials were found, the other on nearby Bajnok-halom [Bajnok mound], where two other graves came to light. The former is not included among the Conquest period graves

1 *Ecsedi* (1914) 5, 85.
2 *Györffy* (1992) 184, no. 58.
3 *Mesterházy K.:* Hajdúhadház a népvándorlás- és korai Árpád-korban. *In:* Hajdúhadház múltja és jelene. Ed.: Gy. Komoróczy. Debrecen 1972, 28.
4 *Németh* (1997) 95.
5 *Marosi S. – Somogyi S.*: Magyarország kistájainak katasztere I. Budapest 1990, 204.

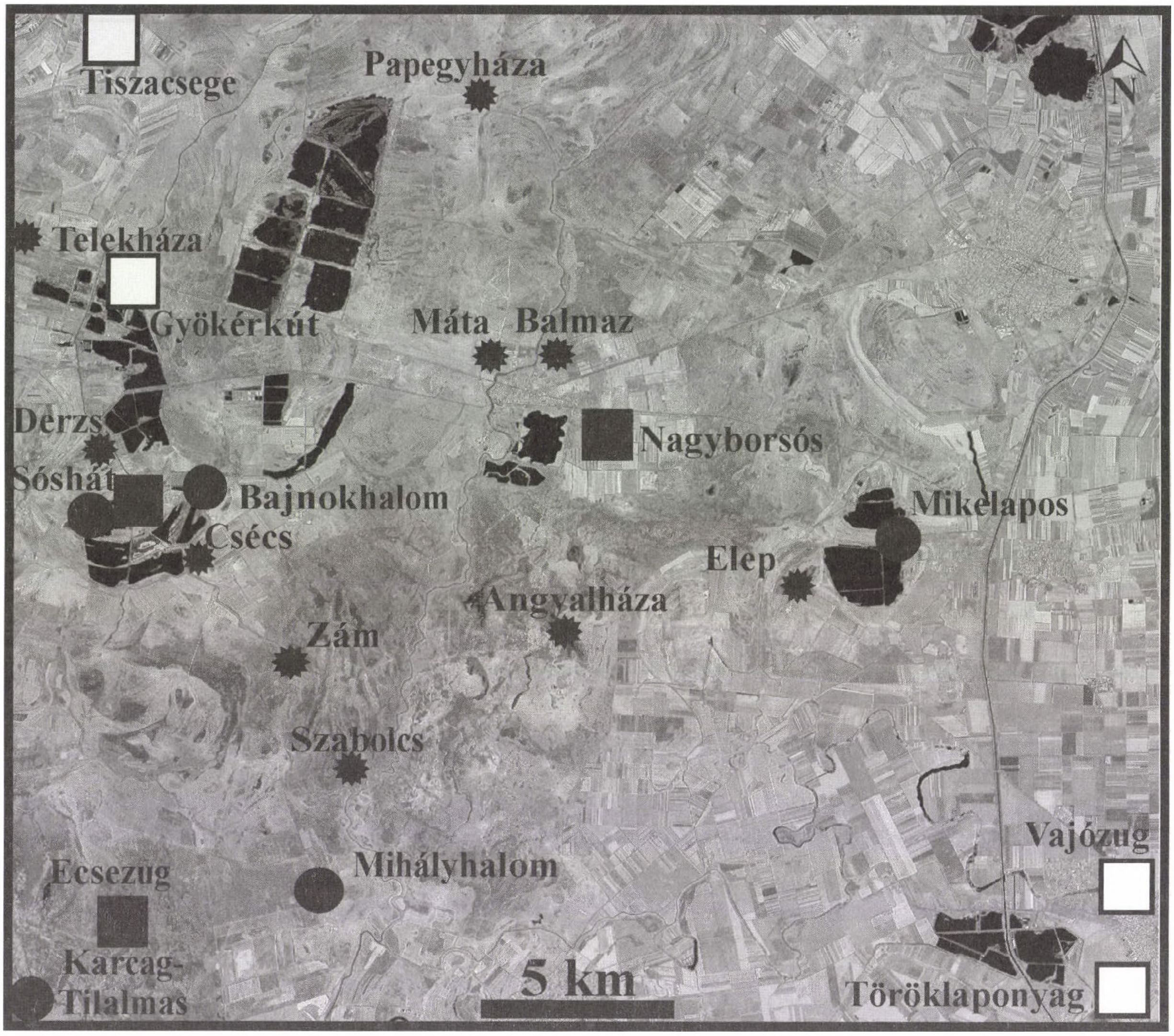

Fig. 1. Archaeological sites in the Hortobágy
Key: ■ Avar period cemeteries (8th century); ● Hungarian Conquest period cemeteries (10th century); □ Árpádian Age cemeteries (10th–11th centuries); ✸ deserted villages (11th–13th centuries)

because Elvira H. Tóth, who conducted the excavations, interpreted the graves as burials containing unique finds, which were part of the Avar cemetery in the same location and dated them to the Avar period. The site lies about 1200–1800 m west of the former Árkus State Farm. There was a roughly 600 m long and 30–40 m wide, west–east oriented sand ridge in the northern part of the one-time Csécs marshland. As elsewhere in the Hortobágy, sand-mining was either occasional or part of a larger project performed with machines. Richly furnished Avar equestrian graves were discovered in 1954 during mining operations,[6] and again in 1957.[7] The remaining section of the cemetery was uncovered by Attila Horváth and Elvira H. Tóth in 1959–60, when the sand ridge was exploited as a source of building material for the construction of the Csécs fish-ponds and, also, for creating an islet in the northernmost pond (Pond 1).[8] In other words, the hill on which the rich Avar cemetery and the Conquest period burial ground was established rose above the Csécs marshland and the plainland of the *puszta*, which was in-

6 *Balogh I. – Mérey-Kádár E.:* Hortobágy–Árkus. ArchÉrt 83 (1956) 100; *Mesterházy K. – Sz. Máthé M. – M. Nepper I.:* A régészeti kiállítás. *In:* Vezető a Déri Múzeum kiállításaihoz. Debrecen 1978, 33; *Kralovánszky* (1965) 35; *Szentpéteri* (2002) Vol. I, 107

7 *Makkay J.:* Balmazújváros–Hortobágy. ArchÉrt 85 (1958) 200.

8 *H. Tóth E.:* Balmazújváros–Hortobágy-Árkus. ArchÉrt 87 (1960) 238; *H. Tóth E.:* Balmazújváros–Hortobágy-Árkus. ArchÉrt 88 (1961) 292; *Szentpéteri* (2002) Vol I, 107.

undated at the time of floods. It seems unlikely that the original number of burials can be reconstructed even after the publication of the cemetery and its finds.

The two burials on the Bajnok mound were perhaps part of a smaller family graveyard. In 1909, Lajos Zoltai, who was the first to investigate the Hortobágy mounds, found a Conquest period equestrian grave dug into a prehistoric mound, which yielded a rather simple warrior's equipment (a horse-bit, a pair of stirrups and arrowheads). Lajos Zoltai did not investigate the site, for the complete excavation of mounds was not customary at the time.[9] In 1964, Gyula Gazdapusztai found a child burial during his investigation of the prehistoric site; however, the cemetery was not excavated due to the lack of funds.[10] The Bajnok mound lies 950 m from the eastern bank of the Árkus,[11] and was only covered with water for a brief time at the time of extensive floods.

The other Conquest period burial grounds lie either on the fringes of the Hortobágy or beyond it: on the western edge of Nagyhegyes, at Elep–Mikelapos and Nádudvar–Mihályhalom. The solitary female burial found at Mihályhalom was not dug into the larger Miskahalom [Miska mound] after which the co-operative centre was named, but into a smaller, flatter mound by milestone 23 on the Nagyiván road.[12] The two braid ornaments, the bone buckle, the necklace and the two coins used as dress ornaments recovered from this burial can be dated to the mid-10th century or its third quarter, and the burial itself indicates the presence of a wealthier middle layer of the Conquest period in this region.[13]

The most important 10th–11th century finds came to light at Nagyhegyes, on the outskirts of the one-time village of Elep, when fish-ponds were dug at Mikelapos and Fertőlapos. The first burials came to light on the east–west oriented ridge between the two bogs on the southern fringes of Mikelapos, when a channel was dug. One was the grave of a wealthy girl or woman, whose grave goods included a pair of braid ornaments and strings of beads braided into her hair,[14] resembling the finds from the Mihályhalom burial. Some ten or eleven burials were destroyed when the channel was dug, but thirty-five could be professionally excavated (a total of forty-six burials were found): these included a contracted inhumation burial of the Pit-grave culture[15] and three Sarmatian graves.[16] About 100 m to the east, the remains of the village were also found: a sunken hut, which yielded the rim fragment of a hand-thrown clay cauldron.[17] Unfortunately, the excavation was not continued owing to the lack of funds. The cemetery contained both 10th century and, on the testimony of a coin find, 11th century graves, indicating that the community using the cemetery lived here continuously. About 2 km north-west of the village lie the remains of the Görbehát church, uncovered by János Sőregi in 1934. Lajos Zoltai identified this church as the parish church of Elep.[18] If this identification is correct, it is possible that the village found on the fringes of Mikelapos had relocated to Görbehát in the 12th century.

There was a small Conquest period cemetery on the fringes of present-day Hortobágy by the Gyökérkút railway station, established on a prehistoric burial mound called Bujárlaponyag. This mound was levelled during the construction of the Eastern Main Canal and the single surviving relic of the one-time burial ground was an S terminalled lock-ring of silver wire. This hair ornament became popular in the early 11th century in the Great Hungarian Plain. The settlement of Árkus-teleke, mentioned in various charters, can probably be sought in this area.[19] It seems likely that the archaeological and the documentary evidence can be juxtaposed and that the cemetery of Árkus or Árkus-teleke lay on the small mound.

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9 *Zoltai* (1909) 15–16, 33; *Zoltai L.:* Debrecen sz. kir. város múzeuma. ArchÉrt 45 (1915) 132; *Fehér et alii* (1962) no. 206.
10 *Gazdapusztai Gy.:* Balmazújváros–Hortobágy-Árkus. ArchÉrt 92 (1965) 229.
11 *Zoltai* (1909) 32.
12 *Makkay J.:* Nádudvar–Mihályhalom. ArchÉrt 85 (1958) 207.
13 *Csallány* (1959) 308.
14 *Ibidem* 304.
15 *I. Ecsedy:* The people of the pit-grave kurgans in Eastern Hungary. FontesArchHung. Budapest 1979, 18.
16 *Balogh I. – Csallány D. – Erdélyi I. – Szabó Gy. – Wenger S.:* Nagyhegyes–Elep–Mikelapos. ArchÉrt 84 (1957) 90.
17 *Mesterházy K.:* Honfoglalás kori kerámiánk keleti kapcsolatai. FolArch 26 (1975) 107, 111.
18 *Sőregi* (1934) 105–147; *Németh* (1997) 69–70, 90, 92.
19 *Zoltai* (1925) 58; *Németh* (1997) 25.

The cemeteries lying beyond the Hortobágy proper, on the fringes of the Hortobágy National Park, preserve the memory of one-time settlements, which increase the number of known villages in the relatively loose network of known settlements. One of these is the cemetery at Karcag–Tilalmas,[20] another is a grave find from Kunmadaras, relics from the burial of a warrior interred with his horse,[21] and a burial reported from Egyek.[22] Other sites which can be mentioned in this respect include the equestrian burial from Hajdúböszörmény–Vidi puszta,[23] the grave goods found at Tiszacsege–Rákóczi Street,[24] the cemeteries at Vajózug[25] and Töröklaponyag[26] in Nádudvar and a handful of finds associated with the parish church of a few early settlements, which were earlier assigned to the pre-Christian period in the 1962 gazetteer of Conquest period and early Árpádian Age graves and cemeteries: Ohat–Telekháza,[27] Újszentmargita–Koponyacsárda,[28] Hortobágy–Köveshalom (the village of Csécs),[29] Hortobágy–Szabolcsok-Kövesházi halom[30] and Hortobágy–Görbehát (Elep).[31]

The known sites span a period of two centuries. Their majority dates from the 10th century, from the Conquest period. The remaining sites, however, can be assigned to the later 11th century, when a series of villages with parish churches appear, such as Ohat (present-day Telekháza), the church of the village of Csécs on the Köveshalom [Stony mound], the parish church of Szabolcs on the Kövesházi halom [Stone building mound] and the church of Szentmargita (Újszentmargita–Koponyacsárda). The number of these sites totals fifteen. In contrast, the population of the Avar period, spanning some 250 years, established twice as many settlements, as shown by the thirty known sites (Balmazújváros–Hortobágy-Árkus, identical with the Hortobágy–Sóshát site; Balmazújváros–Daruföld-Kondoros part; Balmazújváros–Eastern Main Canal; Balmazújváros–Co-operative center; Debrecen–Hortobágy-Nagyborsós; Egyek–Erzsébet kert; Egyek–Fő Street; Egyek–Ohat-Pusztakócs fishpond; Nádudvar–Nyárzug; Polgár–Tiszapart; Polgár–Service house; Polgár–Nagycsőszhalom; Polgár–Folyás; Tiszacsege–Nagykecskés-Hortobágy; Tiszacsege–Nagymajor; Tiszafüred–Inner area; Tiszafüred–Majoros; Tiszafüred–oxbow lake; Tiszafüred–Tiszapart; Kúnmadaras; Karcag–Ecse zug; Karcag–Berekfürdő; Karcag–Bugyogói halom-Tilalmas State Co-operative; Karcag–Apavára; Karcag–Kistelek; Tiszaörs–Kilenceshalom; Tiszaörvény; Újszentmargita).[32] The period between the reign of King St. Stephen and the Mongolian invasion of 1241 shows a rise in the number of settlements (István Ecsedi lists thirty-two villages).[33] The number of sites was low both in the early Avar period and the early Conquest period, no doubt owing to the small number of the newly-arrived populations. The population density rose with time (the majority of the Avar sites can be assigned to the late Avar period); however, the descendants of the ancient Hungarians of the Conquest period only become "visible" in the archaeological record from the 12th century. We also know that the Hortobágy was occupied by a rather prosperous and large community during the late Avar period (the Sóshát cemetery has been continuously destroyed since 1954, meaning that it had originally contained considerably more burials than the fifty known graves). The preponderance of the Avar population is even more striking since the excavation of the extensive Avar cemetery at Tiszafüred–Majoros with its 1283 burials[34] – a comparably large population cannot be demonstrated even as late as the early Árpádian Age (the Conquest period cemetery at Tiszafüred,

20 *Fehér et alii* (1962) no. 528.
21 *Fehér et alii* (1962) no. 603.
22 *Dienes I.:* A honfoglaló magyarok. Budapest 1972, 85.
23 *L. Kovács:* Der landnahmenzeitliche ungarische Grabfund von Hajdúböszörmény–Erdőstanya. ActaArchHung 31 (1981) 81–103.
24 *Kralovánszky* (1965) 42.
25 *Mérey-Kádár E.:* Nádudvar–Vajózug. ArchÉrt 83 (1956) 103.
26 *Mesterházy K.:* Adatok a honfoglalás-kori magyar köznépi család szerkezetéhez. DMÉ (1968) 131.
27 *Balogh I.:* Ohat–(T)Elekháza. ArchÉrt 83 (1956) 207; *Németh* (1997) 144–145.
28 *Németh* (1997) 177; *Fehér et alii* (1962) no. 1170.
29 *Zoltai* (1909) 29–32; *Zoltai* (1925) 34–35; *Fehér et alii* (1962) no. 209.
30 *Németh* (1997) 170; *Zoltai* (1925) 50–51.
31 *Sőregi* (1934) 105; *Fehér et alii* (1962) no. 208.
32 *Szentpéteri* (2002).
33 *Ecsedi* (1914) 84–93; *Zoltai L.:* Debrecen sz. kir. város határának kialakulása és birtokainak megszerzése. *In:* Debreceni Képes Kalendárium. Debrecen 1917, 1–30.
34 *É. Garam:* Das awarenzeitliche Gräberfeld von Tiszafüred. Budapest 1995.

for example, had 115 graves).[35] According to the 1067 perambulation, the Hortobágy *marchia* had 104 servant families (*mansio*) living on the estate – however, since only a copy of this charter made two hundred years later has survived, this figure may be an exaggeration similar to the passage on Ártánd in the Garamszentbenedek charter from 1075, which mentions 120 families (*domus*).[36]

The scanty population of the Hortobágy is especially striking if compared to the northern areas of Szabolcs County, such as the Rétköz region,[37] which had one of the highest settlement densities in the Conquest period. This can probably be explained by the environment. The Hortobágy inclines not towards the Tisza, but towards the Körös rivers,[38] and thus the retreat of floodwaters was much slower and, moreover, the water flowed southward.[39] Floods usually reached the Hortobágy from the direction of Tiszadob and Tiszacsege,[40] and rushed freely southward through the one-time watercourses. These included not only the Hortobágy River in the lowest-lying area of this region, but also the palaeo-Sajó and the palaeo-Zagyva, which had been cut off, but had not ceased, when the Tisza River incised its current course.[41] The floodwaters did not recede into the Tisza, but advanced to the Körös rivers and flowed back from there. The other important factor was the elevation above sea level. Most parts of the Hortobágy region lie 88–92 m a.s.l., with only the sand dunes flanking the Tisza and the so-called "Cumanian" mounds (the artificial mounds raised during prehistory and later ages) rising above the plainland.[42] The highest among these mounds is the Bürök-halom by Nagyiván, rising to a height of 105 m. None of the mounds in the Hortobágy are this high: the Köves-halom by Csécs is 92.3 m high, the mound on which the Zám church was built is 90.1 m high, while the Kettős-halom is 94.9 m high, the surrounding land being no more than 88–90 m high. (The elevation data published by I. Balogh are relative to the level of the Adriatic,[43] the ones quoted here to the level of the Baltic Sea.)

It must be borne in mind that the flood-free elevations in the Rétköz region have an average height of 93–103 m a.s.l. and that only areas lying higher than 100 m a.s.l. were suitable for settlement.[44] The communities settling in the Hortobágy had to seek out locations suitable for settlement in lower-lying areas – and we know that the entire Hortobágy was virtually a huge floodplain covered permanently or seasonally with water, which was unsuited to permanent settlement.[45] It follows that the conditions of settlement and subsistence differed markedly from those in flood-free areas or in the Rétköz region, where the floods receded into the Tisza. It seems likely that stockbreeding played a more prominent role in the economy than agriculture, and that settlements were concentrated elsewhere. The major cemeteries all lie on the fringes of the *puszta*, around Tiszafüred, Elep and Nádudvar. The population concentration during the Avar period can probably be explained by a relatively drier period with smaller floods and a more rapid floodwater recession. The need for draining floodwater was realised during the Árpádian Age and one of the watercourses was converted into a drainage channel – its memory is preserved by the name of the Árkus [Ditched] Stream, on whose bank was a small village called Árkusd [Ditched] or Árkusteleke [Ditched plot].

The reason for extensive stockbreeding in the Hortobágy was not simply that the region was one huge floodplain; another passage in the already quoted Százd foundation charter sheds light on the one-time conditions: *"Sumpma tocius numeri concluditur calculo, videlicet CIIII mansus servorum, XXX equites XX Ungari et (X) Bisseni, sex lanifice et linifice, X vinee et ortus apium, X copule equorum, C*

35 The Ancient Hungarians. Eds: I. Fodor – L. Révész – I. M. Nepper – M. Wolf. Budapest 1996, 290.

36 *Györffy Gy.:* Az Árpád-kori Magyarország történeti földrajza I. Budapest 1966, 595; *Györffy* (1992) 215, no. 73/II.

37 *Dienes I.:* A Szabolcs megyei honfoglalás és kora Árpád-kori temetők terepbejárási naplója. Szabolcs-Szatmár-Beregi Szemle 31 (1996) 287–372; *Istvánovits* (2003).

38 *Ecsedi* (1914) 63; *Borsy* (1969) 86–88; *Somogyi* (1969) 101.

39 *Balogh* (1953) 141–142.

40 *Balogh* (1953) 142; *Beluszky P.:* A Nagyalföld történeti földrajza. Budapest–Pécs 2001, 44, 47.

41 *Somogyi* (1969) 101.

42 *Borsy* (1969) 86; *Marosi S. – Somogyi S.:* Magyarország kistájainak katasztere I. Budapest 1990, 204.

43 *Balogh* (1953) 141.

44 *Istvánovits* (2003) 245.

45 *Somogyi S.:* A magyar honfoglalás földrajzi környezete. Magyar Tudomány 33 (1988) 865–866; *Somogyi S.:* Hazánk vízrajza a honfoglalás idején és változásainak tájrajzi vonatkozásai. *In:* A táj változásai a honfoglalás óta a Kárpát-medencében. Ed.: Gy. Füleky. Gödöllő 1997, 42–44.

boves, D oves, CC porci." Its translation reads as follow: "Included in this are the 104 family members of the servants, 30 horsemen, 20 Hungarians and 10 Pechenegs, 6 wool and linen weavers, 10 vineyards and apiaries, 10 pairs of horses, 100 oxen, 500 sheep and 200 pigs."

The 10th–11th century estates of the Sárköz region in Tolna County provide a good parallel to the Conquest period settlement of the Hortobágy region. According to the records concerning various areas of the Sárköz in the possession of the Pannonhalma, Pécsvárad and Szekszárd abbeys and the Dömös provostry, the horse-grooms, horsemen, armed retinue, mounted messengers, wagoner servants and other herdsmen of the abbots were recruited from among the inhabitants of the Sárköz.[46] Even though the archaeological record is patchy, the few incomplete burial grounds known from the Hortobágy support Bertalan Andrásfalvy's suggestion that the origins of the 11th century mounted servants can be traced to the free herdsmen. Today, these free herdsmen of the 10th century are described as the weapon bearing freemen and their families of the middle layer. The change in their status began sometime in the later 10th century. These armed freemen remained free even while they served their master: the kindred leaders or the Church.[47] During the social transformation, some rose to become *miles* and, later, members of the nobility, while others became impoverished and swelled the ranks of the lower status people. In the mid-10th century, they were part of the wealthier members of society: the men were buried with their arms (bow, arrows, quiver) and their horse, while women were laid to rest with simple braid discs, rings, necklaces with silver pendants (Nádudvar–Mihályhalom) and silver bracelets (Egyek). Differences in costume more or less disappeared by the 11th century, and the grave goods placed in burials were not necessarily an indication of social status. Rank and legal standing were not reflected in burial customs, but were expressed in other ways. The rich and the poor were buried separately in the church graveyards, with the differences expressed by the grave's proximity to the church or its position nearer to or farther away from the graveyard's main path.

In addition to the solitary burials and small family burial grounds in the Hortobágy, the number of villages founded on higher lying ground is rather low; moreover, these villages were not contemporaneous. The Elep and Tiszafüred cemeteries were opened at a fairly early date, sometime in the earlier 10th century. The date of the establishment of the destroyed cemetery at Bujárlaponyag is uncertain; what we do know is that it was already in use in the early 11th century. The burial grounds at Nádudvar–Vajózug date from the same period, although it is unclear when they were opened and when they were abandoned. The cemetery at Töröklaponyag suggests that a part of the newly established villages can be linked to a new population. It seems likely that the new villages with a church (Csécs, Ohat, Zám) appearing in the late 11th and early 12th century were not founded by the descendants of the original settlers, but by communities brought to the region from elsewhere, as part of a conscious settlement policy.

46 *Andrásfalvy B.:* A sárköziek gazdálkodása a XVIII. és XIX. században. Pécs 1965, 5.

47 *Bolla I.:* A jogilag egységes jobbágyosztály kialakulása Magyarországon. Budapest 1983, 176–179; *Györffy Gy.:* A magyarság keleti elemei. Budapest 1990, 158, 167–168.

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THE 10TH–11TH CENTURY SETTLEMENT HISTORY OF NAGYBÁRKÁNY, SIROK AND TARNABOD

Miklós Takács

Not one single 10th–11th century settlement or cemetery from the Hungarian Conquest period and early Árpádian Age has yet been reported from the environs of the three sampling locations at Nagybárkány, Sirok and Tarnabod. Neither are there any references to sites from this period in the gazetteer compiled by Géza Fehér, Kinga Éry and Alán Kralovánszky in 1962, on the maps showing the sites in Heves County published by János Győző Szabó and Károly Mesterházy, or in László Révész's re-examination of the finds from Heves County.[1] The Archaeological Archives of the Dobó István Castle Museum in Eger do not contain any information on possible sites from this period either.[2] In the lack of primary data, we can hardly make any categorical statements. This study will therefore present a hypothesis, which will no doubt be modified once finds from this period have come to light.

The Northern Mountain Range and the northern fringes of the Great Hungarian Plain have been extensively researched during the past seven decades by archaeologists specialising in Migration period archaeology, ever since István Györffy noted that the conspicuously high number of place-name pairs in this region preserve the memory of the transhumance pastoralism of the Conquest period.[3] The interest in the region did not wane even after it was proven that the duality of the toponym pairs cited by him could be explained otherwise.[4] The continuing interest in this region can, for the greater part, be attributed to János Győző Szabó, the archaeologist working in the Dobó István Castle Museum in Eger, who was the archaeological supervisor of the central third of this region. He played an outstanding role in the archaeological research of the 10th–11th century from the 1960s to the 1980s.[5]

As a result of this increased interest, the region's 10th–11th century settlement history can be reconstructed from the available evidence. The analyses by János Szabó Győző, Károly Mesterházy and László Révész[6] suggested that the region's environmental duality meant not only that various subsistence strategies were practiced, but also indicated ethnic differences in the population. Hungarian researchers studying the 10th–11th century finds from the Northern Mountain Range and the northern fringes of the Great Hungarian Plain were less interested in the lifeways of the communities settling here; they focused on reconstructing the ethnic relations. In the following, I too shall discuss this issue.

The region's ethnic diversity can in part be traced to the centuries preceding the Hungarian Conquest, i.e. to the Avar period. The topographic scatter of Avar sites[7] suggests that the Avars preferred to settle in the plainland areas of the Carpathian Basin. The reason for the similarity between the Avars' and the ancient Hungarians' choice of settlement location was that both populations were engaged in an economy based on stockbreeding.[8] In other words, the boundary between the Slavs and the stockbreeding communities had probably evolved by the 7th–8th century in this region.[9] The excavations at

1 *Fehér et alii* (1962); *Szabó* (1968) 245–251; *Szabó* (1969) 54–55; *Mesterházy* (1996) 861–874; *Révész (*1996) 255–273.

2 I would here like to thank Adél Váradi of the Eger museum for her help in the archival research.

3 *Györffy I.:* Gazdálkodás. *In:* A magyarság tárgyi néprajza. A magyarság néprajzának második kötete. Budapest n. d., 108–109.

4 *Kiss L.:* Földrajzi nevek etimológiai szótára 1–2. Budapest 1988.

5 Cp. *Bóna I.:* Szabó János Győző (1929–1986). Agria 35–36 (1989–1990) 5–15.

6 *Szabó* (1968) 245–251; *Szabó* (1969) 54–55; *Mesterházy* (1996) 861–874; *Révész (*1996) 255–273.

7 Archäologische Denkmäler der Awarenzeit in Mitteleuropa I–II. Hrsg.: J. Szentpéteri. Budapest 2002, colour map supplements.

8 *Bóna I.:* A népvándorlás kor és a korai középkor története Magyarországon. *In:* Magyarország története I/1. Eds: Gy. Székely – A. Bartha. Budapest 1984, 329–331.

9 *Mesterházy* (1996) map 876.

Mátraszőlős–Késedomb provided new insights into the region's settlement history[10] since in view of its environmental features, the site lies in the Slavic settlement zone. The pottery finds,[11] and especially the hand-thrown pots with notched rim[12] were wares typically used by Avars.[13] Lying near the sampling location at Nagybárkány, the Mátraszőlős site offers a number of insights, which contribute to filling in the details of the general picture. The environment of the Mátraszőlős site and the duality of the finds suggest that any reconstruction of the ethnic conditions in this micro-region on the basis of the currently available evidence must proceed with extreme caution. Another important site lying close to the archaeobotanical sampling location at Tarnabod is Kompolt, where an Avar settlement surviving into the 9th century (i.e. surviving the collapse of the Avar Khaganate) was uncovered during the rescue excavations preceding the construction of the M3 motorway.[14] It has been suggested that some sections of the settlement still existed at the turn of the 9th–10th centuries, and its occupants lived to see the Hungarian Conquest. This issue will be discussed in detail in the evaluation of the site's Avar finds.

The latest find assemblages from the Kompolt site suggest that the northern fringes of the Great Hungarian Plain were not uninhabited at the time of the ancient Hungarians' arrival. The numerous scattered bits of evidence suggest that the same holds true for the greater part of the Carpathian Basin.[15] It is not mere chance that the ancient Hungarians preferred the plainland since, similarly to Avars, they were probably engaged in stockbreeding and had a semi-nomadic life-style.[16] The density of Conquest period sites on the northern fringes of the Great Hungarian Plain was a characteristic element of the 10th century settlement network. The sites in this region include Aldebrő, Besenyőtelek, Dormánd, Erdőtelek, Füzesabony, Heves, Kál and Tarnaörs,[17] which lie either in the direct environs of the Tarnabod sampling location or a little farther away. The topographical position of these sites suggests that the Tarnabod area too fell into the ancient Hungarians' settlement territory, even if no traces of a settlement or cemetery have yet been found.

The situation is slightly more complicated in the case of Sirok and Nagybárkány in the Northern Mountain Range, lying quite far from each other in terms of environmental geography. In the lack of archaeological finds, one good starting point for the reconstruction of the settlement history of Sirok, lying on the eastern edge of the Bükk plateau, is the linguistic analysis of the early medieval toponyms of the Northern Mountain Range.[18] The etymology of the place-names suggests that this micro-region was part of the Slavic settlement territory in the mountains during the 10th–11th centuries too. Still, it must be borne in mind that there were smaller Hungarian language islets within this Slavic settlement territory. The known find assemblages too call for a more in-depth analysis. The finds from various micro-regions in the Northern Mountain Range indicate that the ancient Hungarians established settlements in the valleys of the Bükk and Mátra foreland. One good example is Eger, the later county seat. Several 10th century graves containing the burial of individuals interred according to the typical pagan Hungarian rite – i.e. with a partial horse burial, weapons – have been uncovered in the valley of the Eger Stream (Eger–Almagyar, Eger–Kiskanda, Eger–Répástető, Eger–Szépasszonyvölgy, Maklár and Novaj).[19] In the lack of finds, however, it is uncertain whether the ancient Hungarians had settled by the Tarna Brook, flowing on the outskirts of Sirok, east of Eger. Knowing that the lack of sites can be attributed both to the lack of settlement and to archaeological bad luck, it seems best to avoid any categorical statements in this respect. What we do know is that the ancient Hungarians settled along the lower reaches of the Tarna, as shown by the sites in the southern part of Heves County listed above.

10 *Cs. Sós* (1970) 97–103.
11 *Ibidem* Figs 5–6.
12 *Ibidem* Fig. 6. 10.
13 *T. Vida:* Die awarenzeitliche Keramik I. (6.–7. Jh.). Berlin–Budapest 1999, Pl. 47. 1, Pl. 49. 2, Pl. 70. 2.
14 *Vaday A. – Takács M.:* A Kompolt–kistéri tanyai lelőhely két edényégető kemencéje. Agria (2005) (in press).
15 *Szőke B. M.:* A 9. századi Nagyalföld lakosságáról. *In:* Az Alföld a 9. században. Ed.: G. Lőrinczy. Szeged 1993, 33–43.
16 *M. Takács:* Ungarn als südlicher Nachbarn von Polen an der Wende des 1. und 2. Jahrtausends. Die Lebensform der Ungarn im Spiegel der schriftlichen und archäologischen Quellen. *In:* The Neighbours of Poland in the 10th Century. Ed.: P. Urbanczyk. Warsawa 2000, 157–191.
17 *Révész* (1996) 256–258.
18 *Kniezsa* (1938) 61–62 and the map supplement.
19 *Révész* (1996) 256.

Caution must be exercised in the case of Nagybárkány too since the Karancs Valley lies a mere 20 km from the sampling location. Several well-known sites, such as Karancsalja, Karancslapújtő, Piliny and Sóshartyán,[20] testify to the settlement of the ancient Hungarians in this micro-region in the 10th century. We may therefore say that even though both sampling locations lay in what can be regarded as a Slavic settlement zone on the basis of the linguistic evidence,[21] the actual area of the sampling location lay near a valley in which the ancient Hungarians had settled. This would imply that the results of the archaeobotanical analyses should not be treated as being relevant for the early history of one single ethnic group.

Another caveat in this respect is that the Slavic communities already living in the area and the newly-arrived Hungarian groups should not be seen as closed units. Linguistic studies have shown that both western and southern Slavic elements can be demonstrated in the dialects and the place-names of the Slovaks living in the Northern Mountain Range and to its north.[22] Some Slavists explain this with the alleged early medieval (9th century) migration of southern Slavic groups. In addition to the speculative nature of the linguistic arguments and the attempts to link the essentially undatable finds to a specific chronological horizon,[23] one notable point in the critique of these studies is that the authors of these studies consider the dialectal diversity of the Slavic population of the region as a proven fact, which they try to explain by citing population movements.

Similarly to the Slavs, the find assemblages which can be securely linked to the ancient Hungarians settling on the northern fringes of the Great Hungarian Plain contain few elements reflecting a possible internal diversity. The starting point in this case too is a modern category of evidence – which, in terms of methodology, can be rightly criticised. This is the ethnographic observation that the northern zone of the Hungarian linguistic territory was occupied by a group which, in addition to a Hungarian ethnic consciousness, regarded itself as Palóc.[24] Csanád Bálint attempted to trace this unique regional consciousness to the Conquest period using archaeological arguments,[25] claiming that the Palóc ethnic consciousness preserved the memory – by now dissociated from its original context – of the Kabars, who had joined the ancient Hungarians on the steppe in the 9th century. His line of reasoning was received favourably by many scholars, even though he based his arguments on the regional distribution of certain artefact types and burial customs, which are in themselves hardly suitable for conclusively proving the origins of a post-medieval regional ethnic consciousness. Historian Gyula Kristó noted that this theory was by all means worthy of further study.[26] Anthropologist Kinga Éry cited Csanád Bálint's arguments for explaining the unique anthropological traits of the 10th century communities buried in the cemeteries in the northern zone of the ancient Hungarians' settlement territory.[27] These anthropological studies, however, also revealed that the individuals buried in the Conquest period cemeteries of the Northern Mountain Range shared numerous anthropological features with individuals laid to rest in northern and north-eastern Transdanubia, meaning that a region where Palóc ethnic consciousness cannot be demonstrated during the 19th–20th century should also be drawn into further studies in this field.

This brief study has examined the three sampling locations from an archaeological perspective based on the archaeological evidence from the broader area of these locations. Since, however, medieval archaeology is a field of archaeology, which must also consider the documentary evidence analysed by historiography, the following section will focus on the relevant written data.

It must first be noted that all three sampling locations lie on the outskirts of villages, which are first mentioned in charters dating from after the 11th century. Tarnabod first appears as *Bod* in 1215,[28]

20 *Fehér et alii* (1962) 45, 61–62, 67.
21 *Kniezsa* (1938) 61–62 and the map supplement.
22 *Katičić* (1992) 234.
23 For a critique of this approach, cp. *Katičić* (1992) 234.
24 *Kósa L – Filep A.:* A magyar nép táji-történeti tagozódása. Budapest 1978, 158–159.
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26 *Dienes I. – Kristó, Gy.:* Opponensi vélemények Bálint Csanád: Dél-Magyarország a X. században c. kandidátusi értekezéséről. ArchÉrt 105 (1978) 122; *Kristó Gy.:* A magyar állam megszületése. Szeged 1995, 196–197.
27 *Éry K.:* A Kárpát-medence embertani képe a honfoglalás korában. *In:* Honfoglalás és régészet. Ed.: L. Kovács. Budapest 1994, 219.
28 *Györffy* (1987) 74.

Nagybárkány as *Bárkány* in 1220,[29] while Sirok is first mentioned in 1320.[30] The lack of 11th century written data does not necessarily imply that the area of the three locations was uninhabited. Even in the lack of archaeological and topographical surveys in the area, we may assume that the three settlements were founded before their first mention centuries later, a phenomenon that has been observed elsewhere in Hungary.

Secondly, it must be noted that two of the three sampling locations lie near an early administrative centre. Tarnabod lies in the neighbourhood of Heves, which perhaps functioned as the first centre of the royal county of Heves. It is difficult to say anything about the role of this assumed centre in the region's administration because – in contrast to the early centres of the other royal counties – the remains of an earthen fort have not been identified yet at Heves.[31] Another reason why the consideration of the possible administrative role of Heves runs into difficulties is that Eger was the county's centre from the very moment of the foundation of the Hungarian state. Eger's central role was assured by the town being an episcopal seat from 1004 (or from 1009 according to other analyses).[32] The importance of the sampling location at Sirok is that this settlement neighbours on Eger in the east.

Finally, a few words about the Kabars in the light of the written sources. The interpretation of the northern zone of the 10th century Hungarian settlement territory as a region falling outside the settlement territory of the ancient Hungarians proper, which had perhaps been settled by Kabars, seemed evident to Csanád Bálint because countless studies on Hungary's 11th century history based on the written sources had advocated this view, ever since the introduction of modern critical historiography in the late 19th century. The main argument was that Anonymus' *Gesta* anachronistically defined the ethnic background of Sámuel Aba, the third Hungarian sovereign (1041–1044), as Cumanian.[33] Sámuel Aba's life can only be reconstructed in broad lines owing to the scantiness of the written sources.[34] It seems likely that the future sovereign's career was based on a good marriage. He could only rise to become the country's palatine from his estates in the Mátra region by marrying one of King St. Stephen's sisters.[35] The end of his life is also blurred. We know that after his defeat in the Battle of Ménfő in July, 1044, he was killed during his flight towards the Tisza. Many historians, archaeologists and architectural historians believe that he was first laid to rest in the crypt of the Feldebrő church.[36] Since Feldebrő lies in the Tarna Valley, this piece of information indirectly confirms the 11th century importance of the region in which Tarnabod, one of the sampling locations, lies. However, additional evidence is needed to confirm that Sámuel Aba had indeed been first buried in the Feldebrő church, for it has recently been suggested that the Feldebrő church was built after 1060, i.e. sixteen years after Sámuel Aba's death.[37]

Finally, it must be reiterated that the archaeological context of the three sampling locations cannot be described owing to the lack of sufficient data. This situation can only be remedied by a series of excavations in order to gain an insight into the local archaeological material.

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30 *Györffy* (1987) 131.

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32 *Györffy* (1987) 84.

33 For one typical example of the arguments presented in the older historical literature, cp. *Marczali H.:* Magyarország története az Árpádok korában (1038–1301). A magyar nemzet története. Budapest 1896, 13–14.

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37 *Tóth S.:* A 11–12. századi Magyarország Benedek-rendi templomainak a maradványai. *In:* Paradisum palantavit. Bencés monostorok a középkori Magyarországon. Szerk.: Takács I. Pannonhalma 2001, 232–236; *Buzás G.:* A feldebrői egykori apátsági templom építészeti kapcsolatai. *In:* Örömzenélés Kovalovszki Júlia tiszteletére. Eds: P. Gróf – K. Varga. Manuscript. Budapest 2001, 45–51.

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NOTES ON THE MEDIEVAL HISTORY OF SIROK AND TARNABOD

Csilla Zatykó

Sirok and Tarnabod, the two settlements discussed in this study, both lie in Heves County, in the Tarna Valley, but in entirely differing environments. Sirok Castle and the associated settlement was built in the river valley separating the Mátra and the Bükk Mountains in a mountain environment suitable for controlling the road leading from Eger to Pétervására and the north to south roads. Tarnabod lies by the lower reaches of the Tarna River, in a plainland environment on the fringes of the Great Hungarian Plain.

None of the archaeobotanical samples taken from the two sampling locations yielded data concerning the Middle Ages. In the following, I shall offer a brief overview of the medieval history of the two areas based on the documentary evidence from charters and other records, and a description of the typical regional and economic elements based on this evidence.

Both settlements were part of the Aba kindred's estates in the Mátra region. Sirok lies on the eastern edge of these estates, neighbouring on the lands of the Eger bishopric in the Eger Valley, while Tarnabod lies near Feldebrő, where the Aba kindred built its monastery in the 11th century.[1]

Tarnabod was probably in the possession of Lesták Nagy of the Aba kindred. It is listed in the *Várad Regestrum* as Bud in 1215. During the Mongolian invasion of 1242, the village and its church were destroyed together with many other settlements lying along the road from Muhi to Pest. The church was apparently rebuilt, for it is mentioned in the tithe register of 1333.[2] The central monastery building dedicated to the Holy Cross at Debrő was probably also ravaged at the time of the Mongolian invasion. The neighbouring settlements of Báb (today an abandoned field on the outskirts of Tarnabod), Debrő, Csal (on the territory of present-day Aldebrő), Verpelét, Nagyút, Kál, Nagykompolt and Kiskompolt were also part of the Aba kindred's estates. In 1280, Ladislaus IV decreed the imposition of a tax on travellers to finance the rebuilding of the Benedictine abbey which had been founded in the 13th century.[3] The two Gothic chalices, found in the 1980s during the construction of a barn, had no doubt been part of the abbey's furnishings.[4] The abbey was destroyed during the Ottoman period.

The might of the Aba kindred is indicated by the earthen forts in the area, which were usually built by the secular aristocracy. Debrő Castle rose over the one-time village of Csal. Even though it is first mentioned in 1411, the 13th–14th century pottery from its site suggests that its construction can be dated earlier.[5] One of the largest earthen forts in this area, the Verpelét fort, was constructed by the Verpelét branch of the Aba kindred in the 11th–12th centuries. Its function was transferred to the earthen fort at Tarnaszentmária–Várhegy after its destruction.[6] During the 14th–15th centuries, some of the estates of the Aba family were taken over by the Rozgonyi family (Debrő, Csal, Kál)[7] and the Szécsényi family of the Kacsics kindred (Nagyút).[8]

1 *Györffy* (1987) 50, 78; *Tóth S.:* A 11–12. századi Magyarország Benedek-rendi templomainak maradványai. *In:* Paradisum plantavit. Bencés monostorok a középkori Magyarországon. Ed.: I. Takács. Pannonhalma 2001, 232–236; RégFüz I. 36 (1983) 80.

2 *Borovszky S.:* Heves vármegye. Magyarország vármegyéi és városai. Budapest n. d., 78; *Györffy* (1987) 51.

3 HMM I, 82; *Györffy* (1987) 109.

4 RégFüz I. 41 (1988) 86.

5 *Nováki Gy. – Baráz Cs.:* Őskori és középkori erődített telepek, várak Heves megye Mátrán kívűli területén. Agria 34 (2000) 11–12.

6 *Dénes J.:* A Mátra-hegység Árpád-kori várai. *In:* Castrum Bene. Várak a 13. században. Ed.: L. Horváth. Gyöngyös 1990, 47–48, Fig. 2. 7.

7 MOL Dl., 13161 (1438)

8 *Györffy* (1987) 117.

Sirok and its environs were in the possession of the Borh-Bodon branch of the Aba kindred. Built after the Mongolian invasion,[9] the castle is first mentioned in 1320, in a charter drawn up under the castle,[10] when King Charles Robert ordered the seizure of the castle from Bodon's son Demeter and Lesták Nagy, who had allied themselves with Máté Csák. The castle was donated to a Czech knight called Chenyk in 1331,[11] but six years later, the castle is again mentioned as royal property.[12] In 1372, Miklós Domoszlai of the Aba kindred renovated the castle for 2000 florins taken from his own pocket, and in exchange King Louis the Great pledged the castle with all its holdings to him.[13]

In the 15th century, the castle passed into the possession of the Tari family, together with its villages, which included Sirokalja, Nagybereg (present-day Nagy-berek on the outskirts of Sirok), Szajla,[14] Rácfalu. Rozsnak (present-day Rozsnak puszta on the outskirts of Sirok), Terebes and Verpelét.[15] The importance of Sirok is reflected in its description as a market town in 1454.[16] In 1465, when the Tari family pledged their estates in the region to Mihály Guthi Országh and János Kompolthi's sons, the toll collected under the castle, the Nagyberek toll and the mill in Tarna are listed among the assets.[17] The pledged estates were given to the Pásztói family; the documents of the case mention the obligation to return the horses and the sheep belonging to Sirok Castle.[18] In 1472, György Tari was dispossessed by King Matthias for blinding Péter Pásztói, and his estates, together with Sirok Castle and an *oppidum* by the same name, were donated to Mihály Guthi Országh and Miklós Kompolthi.[19]

In 1478, the latter took possession of the estates of Sirok, Nagyberek, Rozsnak and of the *praedium* of Rozsnok,[20] indicating that similarly to Szajla,[21] there were other dual structure settlements at the time. The village of Rozsnak was deserted by the 16th century; its church, built in the 12th–13th century and enlarged with a gallery around 1430, and the thirty-seven burials in the church graveyard were excavated by Béla Kovács in the 1960s.[22]

Lake Nyírjes, the sampling location at Sirok, is probably first mentioned in a charter from 1489. János Kompolthi complained that Mihály Országh and his sons had harvested the fish-pond in joint usage under Sirok Castle and sold the fish for about 2000 florins.[23] The fish-pond came into their possession as the castle's holding; a castle inventory from 1687 mentions the two-wheel mill of the large fish-pond in the valley.[24] The value of the fish-pond is indicated by the value of the harvesting and we know that the maintenance and cleaning too raised its value.

An idea about the medieval usage of fish-ponds can be gained from the entry concerning Debrő, lying between Tarnabod and Sirok, in the 1570 inventory of Ónod Castle, according to which the Debrő fish-pond was harvested every three years and the estate received payment for the fish.[25] That the payment received for the fish covered the costs of maintaining the pond is indicated by an *urbarium* drawn up 150 years later. The inventory of the Debrő estate again mentions the fish-pond, recommending that its use should be discontinued because the fish caught after sluicing the pond did not cover the costs of

9 *Sándorfi Gy.:* A magyar várépítészet korai szakaszáról, irodalmi adatok és terepbejárások alapján. ArchÉrt 106 (1979) 250.
10 AOT I, 573; MOL Dl, 50676.
11 AOT II, 449.
12 *Györffy* (1987) 131.
13 *E. Fügedi:* Castle and society in medieval Hungary (1000–1437). Budapest 1986, 105; MOL Dl, 6047.
14 The village of Kétszajla is described as a holding of Sirok in 1329. AOT II, 396.
15 MOL Dl, 14855 (1454)
16 *Csánki D.:* Magyarország történeti földrajza a Hunyadiak korában. I. Budapest 1890, 56; MOL Dl, 11840.
17 MOL Dl, 16161.
18 MOL Dl, 17411 (1472)
19 MOL Dl, 59603.
20 MOL Dl, 18065.
21 Cp. note 14.
22 *Kovács B.:* Románkori templomok feltárása Heves megyében. EMÉ 5 (1967) 51–60.
23 MOL Dl, 19538.
24 "*In valle Piscina magna*" and "*Super illam Piscinam est Mola una duorum Lapidum, magnae importantia esse dicitur*". Cp. *Fülöp* (2004) 150.
25 UC 112, 1, 1570: the inventory of Ónod Castle.

cleaning the pond.[26] These data are probably also valid for the sampling location in Tarnabod where, similarly to Debrő, the pond was created by damming one of the Tarna's meanders.[27] In 1677, various fish species, such as carp, sturgeon, beluga sturgeon, stellate sturgeon and sterlet, are listed in connection with Debrő, Kál and Nagyút.[28]

After the extinction of the Kompolthi family in 1511, Sirok and its estate passed to the Országh family. In 1561, after the Gönc assembly of 1555 decreed that the castle be fortified and that its cavalry be brought up to a hundred horsemen, Kristóf Országh strengthened the lower castle with an angle tower.[29] After the fall of Eger in 1552, the castle's garrison fled upon hearing of the Turks' advance. Sirok remained in Turkish hands until 1686, when the Turks abandoned the castle without a fight, leaving behind their equipment and food supplies, as evidenced by the castle's 1687 inventory.

The lower castle of Sirok Castle was excavated by Béla Kovács in the 1960s, while the citadel was investigated by András Fülöp in 2003.[30] The investigation of the lower castle revealed that the ditch system cut into the rock defending the castle also had an economic function: ovens and smaller storage facilities had been created too. The post-holes of a wooden house were brought to light in the lower castle, together with a stable, a well and large grain storage pits.[31] The medieval pottery finds were dominated by Ottoman period wares; other finds included iron implements, such as a hoe and a sickle.[32] The sedilia-like cavities hollowed into the rock separating the lower castle from the citadel can be interpreted as niches for beehives in view of similar beehive niches known in other areas of the county,[33] indicating bee-keeping. The beehives taken away by a merchant from Rozsnyó can probably be associated with these.[34] The 16th century tax registers of Sirok and the neighbouring villages mention the tithes paid after hives.[35]

This brief overview does not offer a detailed account of the medieval history and archaeology of these two areas; the focus was on certain elements of the area's settlement history and historical environment. Archaeological field surveys and sounding excavations in the area of the sampling locations will no doubt yield fresh insights.

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26 UC 94, 13.

27 *Adam Gardner* in this volume (pp. 87–106).

28 UC 25, 43: the inventory of Ónod Castle.

29 HMM III, 551.

30 *Kovács B.:* Sirok. *In:* Várépítészetünk. Ed.: L. Gerő. Budapest 1975, 250–254; *Fülöp* (2004).

31 HMM III, 557–558; *Fülöp* (2004) 146.

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34 *Fülöp* (2004) 146.

35 *Bán P.:* Heves- és Külső-Szolnok vármegye 1548. Eger 1981; *Bán P.:* Heves- és Külső-Szolnok vármegye 1549. Eger 1988, 8; *Fekete L.:* A hatvani szandzsák 1550. évi adóösszeírása. Jászberény 1968, 57.

THE MEDIEVAL ENVIRONMENT AND SETTLEMENT HISTORY OF THE NAGYBÁRKÁNY AREA

Csilla Zatykó

The archaeological literature does not mention any Árpádian Age or late medieval sites in the Nagybárkány area and few sites of this period are known from the broader area. In the following I shall discuss certain aspects of the medieval settlement pattern based on the information on the region's estates and settlement history contained in various studies on this region and on the data concerning the landscape recorded in the relevant charters.

In the early Árpádian Age, Nagybárkány and the neighbouring settlements in the south-western foothills of the Cserhát Mountains lay in part on the fringes of the Záh kindred's estates, on the eastern fringes of the Kacsics kindred's estates and in part on the royal estates between the estates owned by the Kacsics and Záh kindreds. Hollókő Castle and the neighbouring settlements were part of the Kacsics estates, together with the settlements of Zsuny and Almás, which lay on the territory of present-day Kisbárkány (their memory is preserved by place-names).[1] First mentioned in 1220, Bárkány remained in the possession of various members of the Záh kindred until 1265,[2] while neighbouring Sámsonháza, a holding of Nógrád Castle, was part of the royal estates and later became part of the queenly estates until 1439. The village of Zsember, destroyed at a fairly early date, near Mt. Tepke between the Garáb and the Zagyva, was a castle holding.[3]

During the 13th century, the Kacsicses increased their estates with land from the disintegrating royal castle holdings; however, they temporarily lost their estates because Ban Simon of the Kacsics kindred played a leading role in the conspiracy to assassinate Gertrude, King András II's wife in 1213. Another branch of the kindred later redeemed the greater part of the estates and thus the Kacsicses again became one of the major landowners in Nógrád County by the end of the century. Most of the castles built in this region after the Mongolian invasion in 1241 can be linked to this family. Hasznos Castle near the one-time royal castle at Ágasvár, however, was erected by the Rátot kindred, which also held estates in Nagybárkány. The origins of Fejérkő Castle, which only appears in 15th century documents and is known to have been ruinous by 1409, are uncertain.[4] The castle passed into the ownership of Kóka (called *Kachy*) after 1290 and the castle could equally well have been built by the Kacsicses[5] or by Sámson Verebes, a relative of the Záh family, after whom Sámsonháza near Fejérkő was named.[6]

The donation of the royal castle estates began during the social and economic transformations in the later 13th century. One of these was the donation of 1265, whereby István Porcz of the Rátót kindred (the ancestor of the Pásztói, Tari and Kazai families) was granted the advowson of the Cistercian monastery at Pásztó and Ágasvár Castle, together with its properties of Kutasó, Bárkány and Tar.[7]

According to the description in the charter, the boundary of the Bárkány estate lay somewhere near Lake Nádas. The boundary was traced from the road leading from Bárkány to Mt. Sátor (*Saturhygh*). It crossed Mt. Sátor (today called Mt. Sátoros) and continued north-eastwards to *Borsodpotoka*

1 *Györffy* (1998) 226.
2 *Györffy* (1998) 228–229.
3 NMM, 37–40; *Györffy* (1998) 322.
4 *Gerő L.*: Magyar várak. Budapest 1968, 150; *Fügedi E.*: Vár és társadalom a 13–14. századi Magyarországon. Budapest 1977, 139–140; *Sándorfi Gy.*: A magyar várépítészet korai szakaszáról, irodalmi adatok és terepbejárások alapján. ArchÉrt 106 (1979) 212.
5 *Simon Z.*: A várak szerepének változása a középkori Nógrád megyében. NMMÉ 14 (1988) 114.
6 *Györffy* (1998) 218, 240.
7 MOL Dl, 595; ÁUO XI, 388.

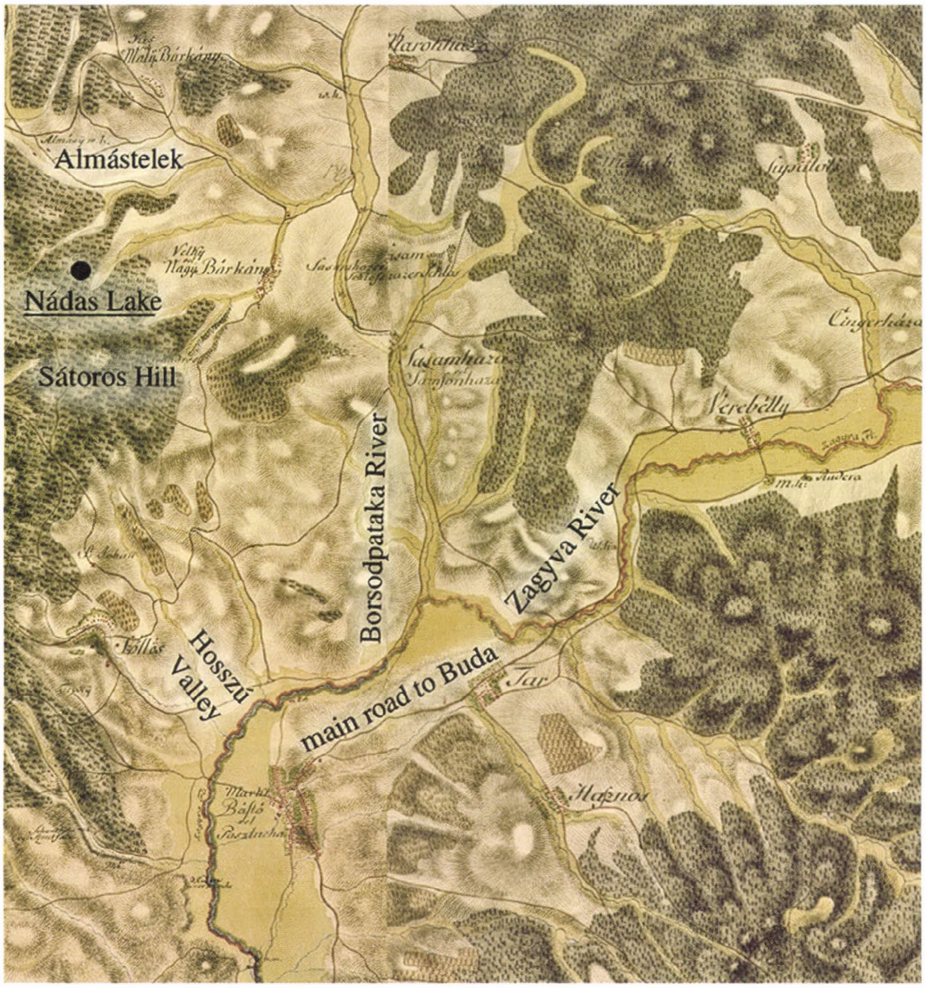

Fig. 1. Identifiable place-names of the perambulation charter issued in 1265 (First Military Survey, Collo XVI–XVII, Sectio XVI–XVII)

(present-day Kis-Zagyva Stream[8]), from where it ascended Mt. *Buckulese*. From here, it probably ran north and then west towards a certain *Tochozo*, passing by *Telkesfev* and then turning south by Péter Illés's land. At Telkesfő, the boundary bordered on Kristóf's land, who inherited two ploughs of land in *Lucin* (present-day Lucfalva).[9] Péter Illés's land was a settlement called Almástelek, which in 1327 passed from the rebellious sons of Péter Illés of the Kacsics kindred into the possession of Tamás Szécsényi, who had remained loyal to King Charles Robert.[10] The boundary then again reached Mt. Sátor by turning south at one-time Almástelek, lying south of present-day Kisbárkány. Mt. Sátor bordered on the fields of the Premonstratensian abbey at Garáb, founded around 1170 by the Kökényes–Rénold kindred, and on the settlement of Szőlős.

The perambulation of the Tar estate provides a description of the areas east and south-east of Nagybárkány. The perambulators proceeded westward from the Hasznos Brook, crossed the meadow called Hasznos and reached the road leading to Buda;[11] after crossing the Zagyva by the boundary stone under an apple-tree called *Lussad*, they reached a place by the name of Bálványkő. They marked the boundaries of Szőlős *terra* and passing by Hosszúaszó (*Hozzyozov*, present-day Hosszúvölgy), they crossed the *Borsodpotoka* stream (present-day Kis-Zagyva). Passing by Szárazaszó (*Zarozozou)* and *Coryluspotoka*, they reached the valley of the *Solumuspotoka* (Szalajka Stream?), which neighbours on Vereb (present-day Mátraverebély). They crossed to the eastern bank of the Zagyva at a place called *Kuveys* (present-day Mt. Kőszirt?), and passing through the *Worreozowelgh* valley, they reached *Guedenporologa* and, finally, the Mátra at Ágasvár *(Fig. 1)*.

In addition to containing the medieval form of countless toponyms, the charter provides an insight into certain characteristic features of the landscape. Very few plant names were recorded: oak trees are mentioned in the perambulation of Kutasó, pear and apple trees on the outskirts of Tar. Later, 15th

8 *Györffy* (1998) 211.
9 CD IV/2; *Györffy* (1998) 270.
10 *Ibidem* 229.
11 *Ibidem* 222.

century data reveal that the Mátra, the end point of the Tar perambulation, was a forested area belonging to the village and Ágasvár (Mátra erdő, Mátrahegye erdő), which is mentioned together with the settlement's toll booth and mill.[12]

Although the perambulations passed by the edge of cultivated estates, some expressions and toponyms preserve the memory of how the landscape was exploited. Meadows lying near Bárkány (by *Borsodpotoka*) and Tar (by the Hasznos Brook) are mentioned in the charter, together with a coppice wood, i.e. a regenerating forest area in the case of Tar (*Ereztewenwys-permissoria*) and Kutasó (*Benkeerestewene*, "Benke's coppice"). Vineyards and the division of areas suitable for vine planting are mentioned in the charter detailing the estates of Told, a settlement near Kutasó.[13] The word "parlag" [fallow] in the toponym *Geudenporloga* preserved the memory of ploughland which had been abandoned or left to lie fallow.

15th century sources mention that a mill called Köves (*Kewes*) stood on the Hasznos estate by the Hasznos Stream (present-day Kövecses Stream), which had been pawned for 132 gold florins by György Tari.[14] The stream and the mill also appear in the documents concerning the harassment of a local peasant, describing how members of the Pásztoi family set upon the house of a peasant tenant called Máté Tolyntha one evening in 1489, chased him onto the roof and beat him. The witnesses were summoned to the mill by the Hasznos Stream.[15] The hostilities did not end, for in 1502, the Pásztois again attacked Tolyntha's house with their peasants: they dismantled the fence, dug a ditch in its place and diverted the Hasznos Stream into the ditch.[16] Several mills were built along the Hasznos Stream: 16th century charters mention mills called Kecskés, Agyagos, Füzes and Fövenyes by the stream.[17]

An area called Tarszurdok (present-day Szurdokalja) and a forest called Henczvölgye, probably lying on the northern outskirts of Tar between Tar and the one-time settlement of Boldogasszonyháza, are mentioned in the description of another 15th century harassment case. In 1469, Benedek Hencz protested that his land had been occupied and turned into a hayfield by Boldizsár Verebély of Boldogasszonyháza, who felled his forest and carried off the timber, causing him damages of 200 gold florins.[18] In addition to providing valuable insights into the local environment and land management conditions, this document also presents a typical case of toponyms derived from personal names.

The settlement network of the Árpádian Age can also be traced in the perambulation charter. Kutasó, Bárkány and Tar are listed as *villae*, while several smaller or larger settlements, whose names often contain a personal name, are described as *terra* (e.g. *terra Told, terra Natosd, terra Iwanch, terra Zeleus*). The so-called *terra* type settlements either grew into villages or were abandoned, and they gradually disappear from the descriptions contained in charters during the 14th–15th centuries, reflecting the process whereby the loose settlement system of the Árpádian Age was transformed into larger villages with a regular plot and landholding system.

The analysis of the pollen samples from Nádas-tó indicate a drop in the lake's water level in the later 13th century (1230–1300 calAD) and the growing impact of human activity on the environment. Cereal cultivation spread in the area, especially of wheat (2/3) and rye (1/3). The increase of cultivated fields and the transformation of the earlier system of land holdings were a reflection of the economic, social and settlement historical aspects of the changes which can be observed throughout Hungary during this period.

During the struggle for the throne following the extinction of the House of Árpád, the Kacsicses first supported Charles Robert, but later, together with the Záh kindred, they joined the nobles, who rallied to Máté Csák's side against the sovereign. Following the dispossession after the Battle of Rozgony in 1312 and Máté Csák's death in 1321, the Kacsics estates and castles were acquired by Tamás Szécsényi of the Kacsics kindred, who had been among the supporters of the Charles Robert; in 1327, he also acquired

12 MOL Dl, 15886 (1463); MOL Dl 16161 (1465)
13 MOL Dl, 95806; *Györffy* (1998) 307.
14 MOL Dl, 15019 (1456)
15 MOL Dl, 38799.
16 MOL Dl, 90266.
17 *Varga L.:* Malmok a pásztói egyház szolgálatában. NMMÉ 26 (2002) 82–84.
18 MOL Dl, 16927.

possession of Hollókő and Sztrahora Castles and its land holdings, which had been confiscated from the rebellious sons of Péter, son of Illés.[19] The charter of donation contains a perambulation of the holdings of Hollókő.

Fig. 2. Identifiable place-names of the charter issued in 1327 (First Military Survey, Collo XVII, Sectio XVI)

The boundary was traced from Székelcsepataka (*Zekelchepataka*, present-day Hollókői Stream). After passing *Toth* and *Rawoz* fields, it ran along the *Sun* River (present-day Zsunyi Stream) by the boundary of the estates of the Garáb church to Zsunytelek (*Sunteluk*, present-day Zsunyi puszta) and Almástelek (*Almasteluk*, present-day Almás). Crossing the Zsuny Stream, it turned south to a place called Szilvaberek (*Zylvaberuk*) and Mt. *Rudas* (present-day Mt. Nagy-Rudas), from where it led to Mt. Sátoros (*Saturus*) along a road and through a valley. The boundary was apparently retraced from this point and continued towards Nagylóc and Nagyrimóc. According to the description in the charter, there was a linden tree (*hotffa*) on the peak of Mt. Sátoros and a lake (*lacus*) at its summit. A heap of stones beside the lake probably functioned as a boundary marker: the charter accurately reports that the estates of the Garáb church lay west of this point, Szőlős to the south, Bárkány to the east and the Almás fields belonging to Hollókő to the west. It seems likely that medieval Mt. *Saturus* designated not only present-day Mt. Sátoros, but also incorporated the north-western side of the Kerek-Bükk Mountains, extending to present-day Mt. Hármashatár, for otherwise the village of Bárkány would be in the west and Almástelek would be much farther in the north-east. As regards the lake on the summit, it is unclear which of the smaller lakes around Lake Nádas was meant *(Fig. 2)*.

The archaeobotanical analyses of the samples from the lake indicated that the forests became denser after the Árpádian Age. The typical tree species was oak, but beech, hornbeam and hazel were also present. Oak (*tul* and *kercina*) is often mentioned as a boundary tree among the plant species occurring in charters; linden is mentioned but once, while place-names such as *Almasteluk* [Apple plot], *Kysalmas* [Small apples] and *Zylvaberuk* [Plum grove] reflect the presence of fruit trees.

Similarly to the one in the 13th century, the settlement network was characterised by larger villages and the survival or even birth of smaller, hamlet-like settlements. For example, Almástelek near present-day Kisbárkány is mentioned several times from 1282.[20] In 1455, it appears as Pusztaalmás (*Pwzthaalmas*),[21] indicating that it had become a deserted settlement, but later it is again described as an inhabited place. *Toth* and *Rawoz terra* lay not far from Zsunytelek, while *Zent Iwan terra* (perhaps identical with present-day Cserhátszentiván) and *Deedháza* were near Kutasó.

19 MOL Dl, 2419; AO XI, 268; *Györffy* (1998) 251.
20 CD VII/3, 454.
21 MOL Dl, 14943.

The loose settlement network of periodically emerging and deserted settlements is illustrated by present-day Krakkó-puszta and its environs, lying about 6 km north-east of Nagybárkány. According to a charter from 1350, Miklós Széchy gave *Karakou*, his deserted estate, to the nobleman Lőrinc Vizslásverebi for settlement.[22] The settlement appears in the charters in 1413, when Imre Derencsényi was put in possession of the by then deserted holding of *Arnoldfelde, Martonosfelde, Bakpeterfelde, Symapapfelde, Leurynczhaza, Crakkow* (present-day Krakkó-puszta), *Leanthelek, Lukatheleke, Myhalwelge, Kekenyes* (present-day Kökényes-puszta) and *Kakfelde*.[23] These settlements, whose names were in most cases formed from a personal name with the suffix "-földe" [field], "-háza" [house], "-telke" [plot], lay in the area bordered by Kazár, Kisterenye and Nagykeresztúr; by the 15th century, however, they had merged into the territory of the neighbouring larger settlements (Terenye, Kazás, Vizslás).

The changes in the settlement structure also led to the emergence of market towns. Pásztó and Tar, the two manorial centres of the Pásztói and Tari families of the Rátót kindred lay near Nagybárkány. Pásztó grew into a town granted the right to hold markets at a fairly early date; in 1407, the town was granted urban rights of the Buda type following the intercession of Lőrinc Tari, *ispán* of Nógrád. The settlement had its own school; the schoolmaster's house is a beautifully renovated market town burgher's house, one of Hungary's unique monuments.[24] Neighbouring Tar too evolved into a smaller central place[25] with the right to levy a toll and was granted tax exemption by King Matthias in 1459.[26] However, owing to its proximity to Pásztó, it did not develop into a major urban centre. Mátraverebély, another nearby settlement, was granted the right to hold markets in 1398, but similarly to Városterenye and Inászó, the settlement catered to local demands only.

The ownership of the estates again changed in the later 15th century. After the extinction of the Szécsényis in 1459, their estates passed to László Szécsényi's sons-in-law, Mihály Guthi Országh and Albert Losonczy; a little later, in 1472, the possessions of the Taris too passed to Mihály Guthi Országh and the Kompolthi family.

By the time Buda fell to the Turkish forces in 1541, the castles in the region – Ágasvár and Fejérkő Castles, whose location was mentioned in 1410 – were in ruins.[27] Hasznos Castle still stood, but it was apparently unsuitable for withstanding a serious siege for its fortification was decreed in 1546. The Turkish occupied area extended to the Szécsény–Rimóc–Hollókő–Nagybárkány–Verebély line between the Zagyva and the Ipoly in 1548.[28] Szécsény and Hollókő were taken after the fall of Drégely Castle (1552), bringing the region under Turkish dominion. A total of eight tax-paying households were registered in Nagybárkány in 1550;[29] of the neighbouring settlements, Zsuny had become deserted by 1546. Lucin, Kutasó and Told were described as deserted in 1559, while Sámsonháza and Almás remained inhabited until 1590. Four families were registered in Márkháza in 1559, who, however, all lived in Nagybárkány and only commuted to Márkháza to tend their fields.[30] Nagybárkány and Kisbárkány revived after the Ottoman period, while the erstwhile villages of Zsuny and Almás became deserted.

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THE ARCHAEOLOGICAL INVESTIGATION OF KELEMÉR–MOHOSVÁR AND THE MEDIEVAL SETTLEMET HISTORY OF THE KELEMÉR AREA

Tamás Pusztai

Impacts on both the local and the regional level could be distinguished during the archaeological investigation of human activity around the Mohos Lakes in the Middle Ages. The investigation of local impacts called for a search for the archaeological traces of human activity within a 1 km radius around the Mohos Lakes, while the reflection of possible of impacts beyond this area in the archaeological record

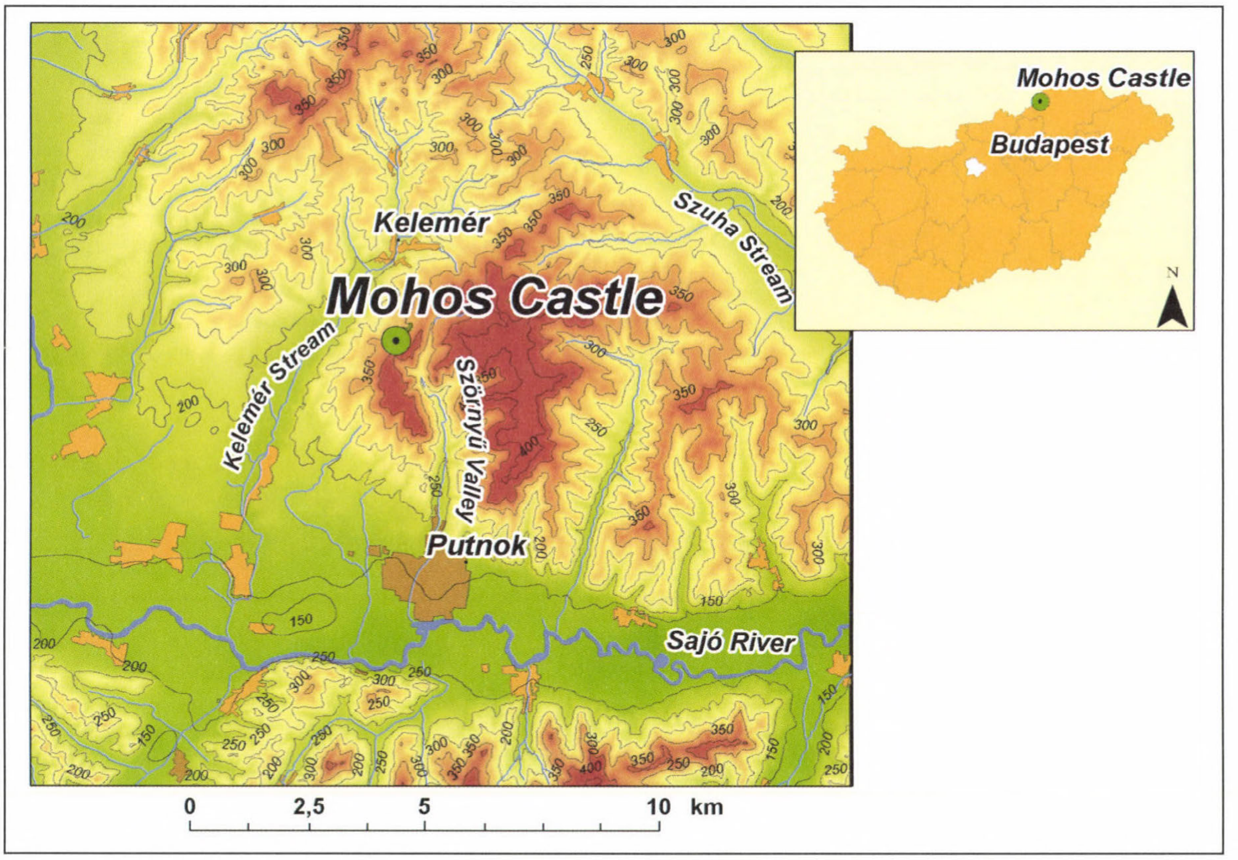

Fig. 1. The research area

are discussed in the section on regional impacts, covering the medieval settlement history *(Fig. 1)*.

As regards the local impacts, we were in a most favourable situation because the Herman Ottó Museum of Miskolc conducted a series of excavations in 2000–2003 in the castle built on the hill rising by the northern shore of Lake Kis-Mohos, between the two lakes.[1] The study of local impacts is essentially based on the results of these excavations.

According to our present knowledge, there are no other archaeological sites within a 1 km radius around the Mohos Lakes apart from Mohosvár [Mohos Castle]. It must also be noted that a detailed archaeological survey of the site's direct environment has not been conducted yet.

1 The excavations were conducted by the present author.

In contrast to most archaeological excavations, a detailed environmental reconstruction based on the findings of a wide array of scientific analyses of the Mohos Lakes by Kelemér was available.[2] The palaeoenvironmental investigation of the Mohos Lakes (involving sedimentological, geochemical analyses, pollen studies, radiocarbon dating) was carried out in the 1990s by an international team under Pál Sümegi. The analysis of the sediment cores extracted from Lake Kis-Mohos enabled the reconstruction of the climatic and environmental changes in this area during the past 15 thousand years in a resolution of one hundred years. In addition to palaeoenvironmental elements, the geochemical and palaeontological analyses also shed light on the agricultural and industrial activities conducted in the area, as well as on the impact of human activity on the environment.[3] The historical interpretation of the palaeoecological analyses has been published by Pál Sümegi.[4]

The main elements of the historical interpretation in the light of the palaeoecological investigation of the Mohos Lakes were the following:

The changes in the vegetation and the geochemical studies indicated an intensifying and diverse human activity beginning with the settlement of the first food-producing communities in the Neolithic.[5] The historical interpretation of these analyses was encumbered by the fact that an archaeological survey comparable to the scientific investigations is not available for this area. It was hypothesised on the basis of the sediment cores extracted from Lake Kis-Mohos that the foundations and the basic outlay of the medieval castle on the Vár-domb [Castle Hill] can be traced to the Iron Age. The samples indicated major soil erosion and intensive local forest clearing by slash-and-burn. It seems likely that the landslip which created the bog was raised in the Migration period in order to create a lake for retting hemp. Continuous erosion and a pollen composition typical for open areas suggested a continuous human impact and a permanently occupied settlement (hillfort). The environmental changes indicated a similarly intensive human activity between the 10th–15th centuries. It would appear that the site of the medieval castle was also fortified in the 10th–11th centuries.[6]

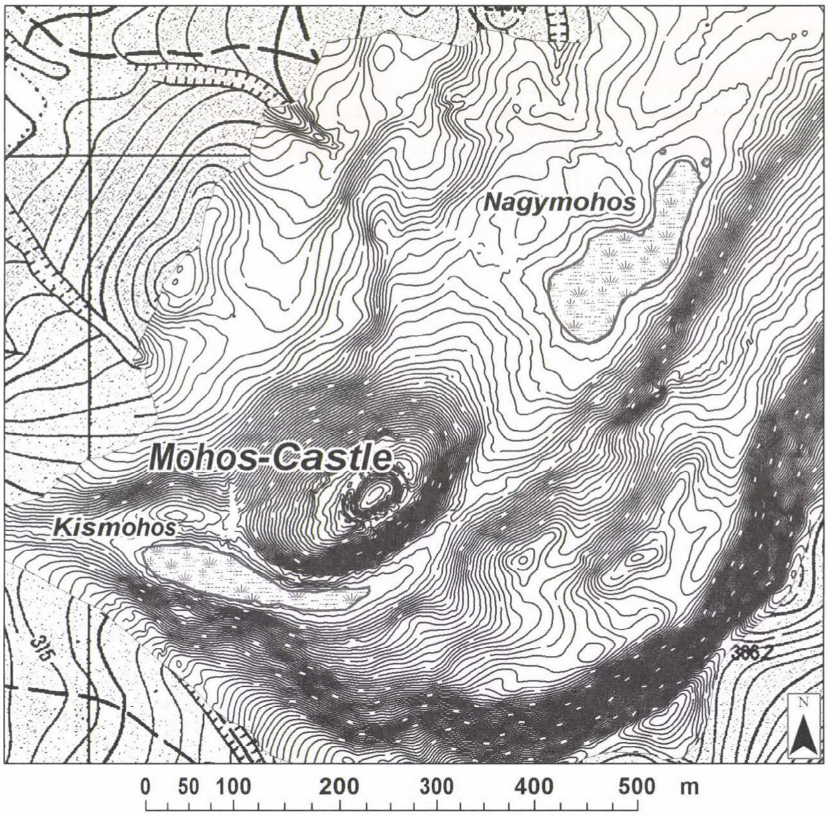

Fig. 2. The geodesic survey of Mohos Castle

2 *Sümegi* (2000); *E. Magyari – P. Sümegi – M. Braun – G. Jakab:* Retarded hydrosere: anthropogenic and climatic signals in a Holocene raised bog profile from the NE Carpathian Basin. Journal of Ecology 89 (2002) 1019–1032.

3 *Sümegi* (2000) 15.

4 *Sümegi* (1998) 373–378.

5 *Sümegi* (2000) 15.

6 *Sümegi* (1998) 376, 377; *Sümegi* (2000) 17–18.

The pollen contents of the sediment cores reflected the species composition of the vegetation within a 20–1000 m radius of the bogs.[7] Unfortunately, there was no archaeological database containing sufficient information about sites in the direct environment of the Mohos Lakes. It was therefore necessary to investigate the archaeological traces of human activity in the area around the Mohos Lakes using archaeological methods. This survey was begun in 2000 by the Herman Ottó Museum in Miskolc.

THE PRELIMINARIES TO THE ARCHAEOLOGICAL INVESTIGATION

The first contour survey of the castle for archaeological purposes was prepared by Gyula Nováki in 1992;[8] a more detailed micro-contour survey of the castle and its broader environment was undertaken by the Tocsolya Bt. on behalf of the Aggtelek National Park in 2000. These two surveys formed the geodesic basis of the archaeological investigations begun in 2000 *(Fig. 2)*.

A good overview of previous research and of the relevant historical records concerning the castle was written by László Dobossy in 1975[9] and by Gyula Nováki and Sebestyén Sárközy in their article about the castles in Gömör County.[10]

In 1232, Kelemér was in the possession of the Gut-Keled kindred and remained their estate until the mid-15th century. Following the kindred's division of their estates in 1338, Kelemér passed into the ownership of István, son of Lőrinc, son of Dorog. The castle is not mentioned in the document detailing the division of the estates – it first appears in a 14th century document (drawn up between 1338–1387), when it is mentioned as the site of a castle. In 1397, King Sigismund donated the village of Kelemér and the ruinous Mohos Castle to Péter, son of Mihály of Dob. A charter from 1430 too mentions the castle site. Gyula Nováki and Sebestyén Sárközy suggested that the castle may have been put into use again in the mid-15th century since one of the minutes of the Reformed church in Szuhafő, no doubt drawn up on the basis of original records, mentions that in 1449–1450 Wza Bereck of Panith, vice-*ispán* of Gömör, officiated in the lawsuit between the Kakas family of Kaza and the Putnoki family, in which members of the Kakas family were charged with harassing the region together with the Hussites from their base at Mohos Castle, which had been built in the Kelemér Forest.

The hill on which Mohos Castle was built rises 45 m above the Kis-Mohos bog. The castle hill is encircled by a 14–20 m wide deep ditch with a rampart along its outer bank. In the south-east, the rampart blends into a terrace; its southern section is open towards Kis-Mohos and the ends of the rampart curve away.[11] The area enclosed by the ditch is 40 m by 20 m and is roughly 0.07 ha large. The ramparts enclose an area of 75 m by 50 m. A roughly 18–20 m wide and 120 m long terrace with a marked edge extends along the north-western side of the castle beyond the ramparts; underneath the terrace is the steep mountainside *(Fig. 3)*.[12] The inner area of the castle was heavily disturbed at the time of the excavations. Owing to the many robber and mining pits, it proved impossible to determine where the former buildings had stood; only the lime mortar debris on the surface indicated the one-time presence of stone buildings.[13] In his description of his survey of the castle's area in 1966, László Dobossy mentioned that he had found the remains of a vaulted room in the castle's eastern part.[14] The micro-contour survey conducted before the commencement of the archaeological excavation revealed various micro-topographical features in the western and northern part of the terrace beyond the rampart, which suggested

7 *Sümegi* (1998) 368.

8 Archaeological Archives of the Herman Ottó Museum, inv. no. 2328–1993.

9 *Dobossy* (1975).

10 *Nováki – Sárközy* (1999) 339.

11 Since this open area lies on the steepest side of the hill, it could hardly have functioned as an entrance; it probably drained the excess water in the ditch. *Nováki – Sárközy* (1999) 336.

12 Gyula Nováki and Sebestyén Sárközy regarded this terrace as the castle's outer part. They noted that only an excavation could clarify whether it had been fortified along the edges. *Nováki – Sárközy* (1999) 338.

13 A part of the castle's stones were used during the construction of Fridrik Pogány's manor house in the 1840s. The remaining stones were removed by Dezső Diószegi, the later owner at the turn of the 19th–20th century, for re-use in the construction of a manor house and stables. *Nováky – Sárközy* (1999) 339.

14 *Dobossy* (1975) 27.

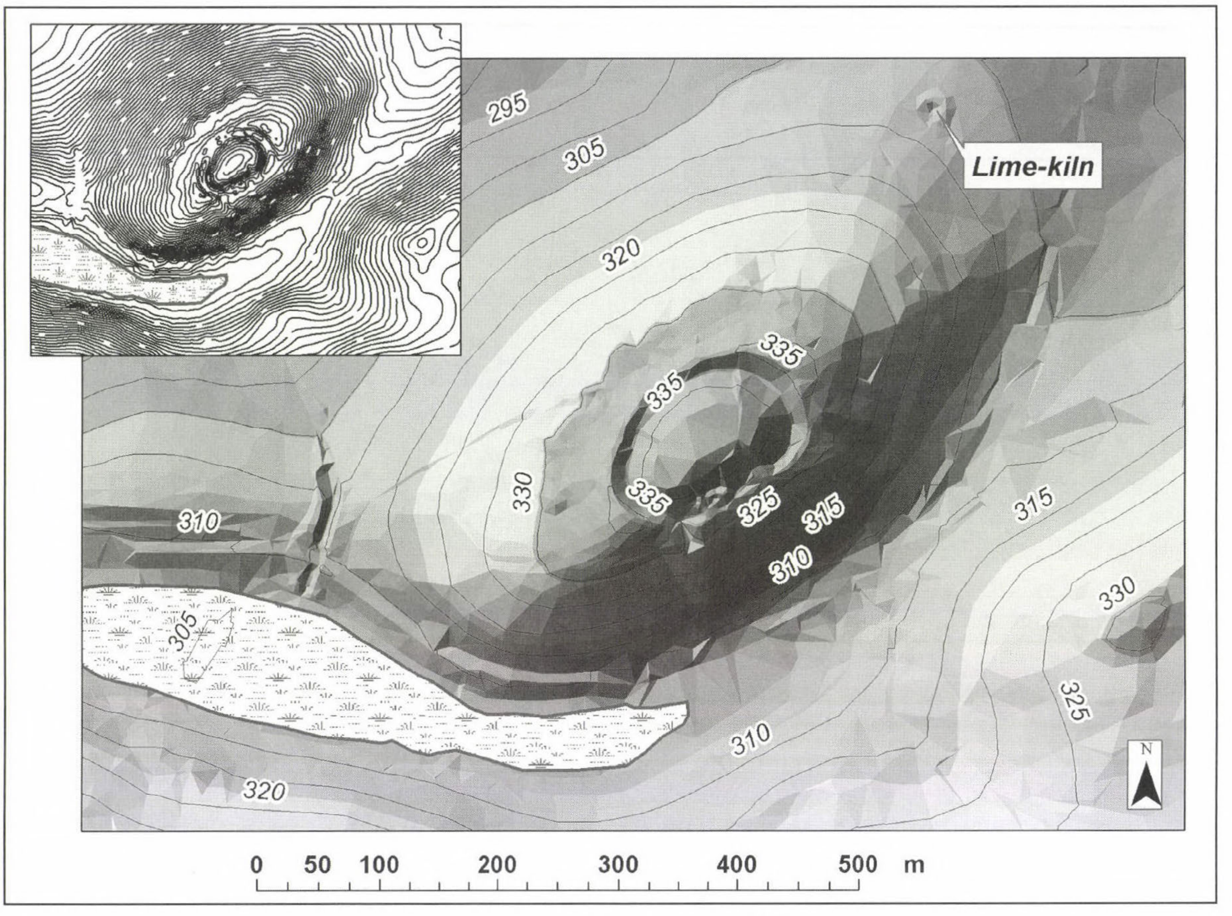

Fig. 3. The terrain model of Mohos Castle

the presence of outer buildings. A number of artificial depressions, which can probably be associated with the castle, were identified during the contour survey and the archaeological field survey of the area between the Lake Kis-Mohos and Nagy-Mohos at the eastern base of the castle hill.

Although of an extremely poor quality, an aerial photograph of the area made in 1952 shows a regular, roughly 25 m by 23 m large rectangular feature in the central area of Mohos Castle. The ditch and rampart enclosing the oval area of the castle can also be made out on this photograph.

The archaeological excavations focused on four areas:

(1) The castle's interior area.

(2) We cut through the rampart in order to determine the rampart's structure and its building periods.

(3) We also investigated the area beyond the rampart in order to determine whether there had been any buildings erected during the castle's use-life or in preceding periods.

(4) We also investigated the function of the depressions identified during the contour survey and the archaeological field survey near Lake Nagy-Mohos.

The excavation of the castle's interior area

We uncovered about two-fifths of the castle's interior until the end of 2003. We left the north-western part of the castle in its original condition for later control excavations.

The hilltop enclosed by the ditch and rampart was levelled before the construction of the castle was begun. The earth from the ditch was not dumped in the castle's interior area, but was incorporated into the rampart on the outer bank of the ditch. A stone curtain wall encircled the roughly oblong shaped inner area of the castle. Several post-holes and stake-holes lay beside the curtain wall along the interior face of its southern section, and we found similar post-holes and stake-holes along the outer face. Some of these can be interpreted as the remains of the scaffolding used during the construction of the curtain wall, while others as the remains of medieval defenceworks pre-dating the construction of the curtain wall.

The largest diameter of the area enclosed by the curtain wall is 22 m x 17 m; the size of the area was 0.029 ha (294 m^2), meaning that the area encircled by the ditch was considerably narrowed.

A round tower stood in the centre of the area enclosed by the wall. Its diameter was 9 m, its wall thickness was 3 m. The internal floor level of the tower was destroyed by later intrusions. The stonework survived to a height of 2 m in the tower's north-western section; the wall core was of stones set in mortar with a facing of roughly hewn stones.

Wooden structures were built against the interior of the curtain wall. We uncovered the charred timbers and the floor of a log building. Charred wheat amounting to several sacks' worth lay on the floor. The thick burnt debris above the wheat grains covering the floor probably represented the remains of the building's clay plastering. The debris contained burnt quartz boulders the size of a child's head; their function still eludes us. The building can be dated to the late 13th–early 14th century on the basis of the white pottery sherds with incised spiral patterns from vessels turned on a slow wheel found on the floor, which could be assigned to the 13th century, and a Viennese denarius from 1282–1308 recovered from the burnt debris layer.

A small building with brick flooring and timber framed walls was found by the southern section of the curtain wall. The charred remains of another rectangular building built around a wooden framework were uncovered in the south-western corner. A clay oven lay beside this building by the western side of the castle. The charred remains of the timber logs from the building in which this oven stood were found in the oven walls up to a height of 80 cm.

The remains of another stone structure, perhaps a tower, were uncovered outside the western section of the curtain wall. The excavation of this building is still in progress *(Figs 4–5)*.

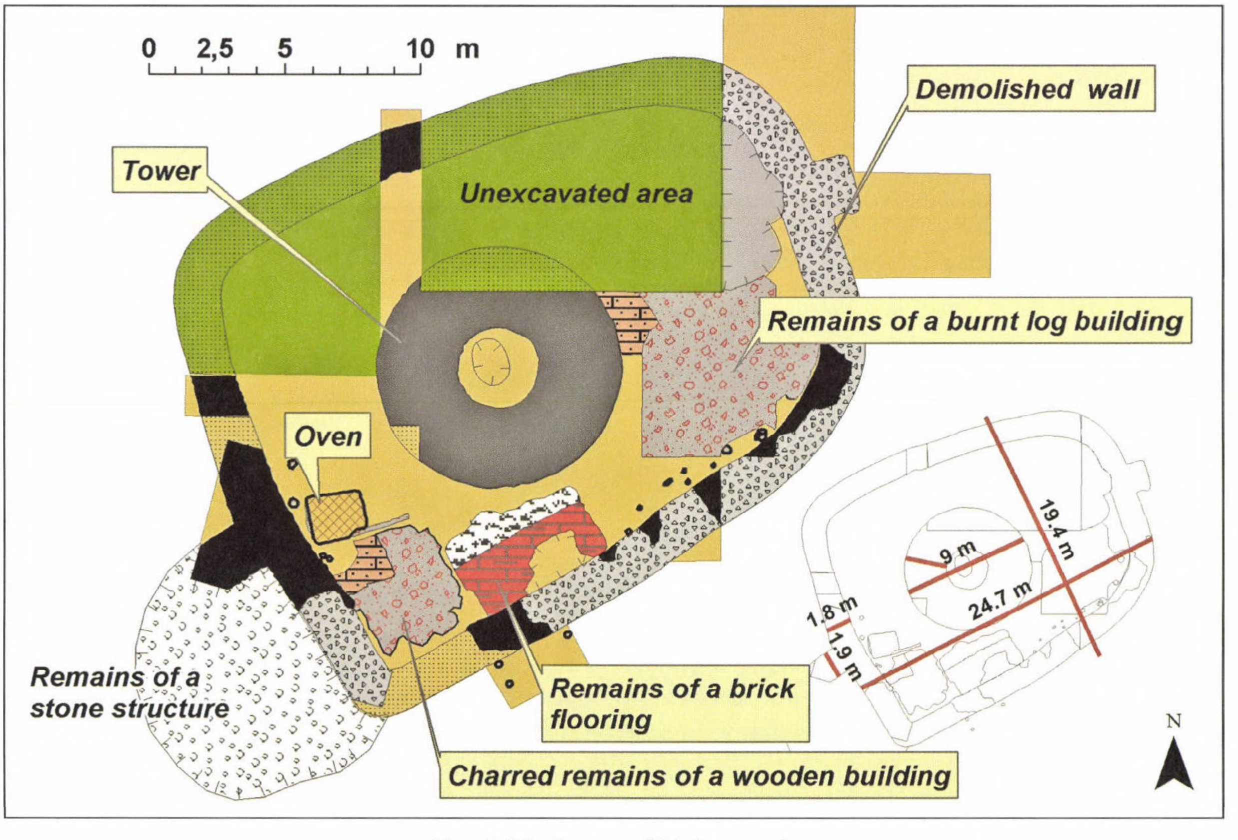

Fig. 4. The layout of Mohos castle

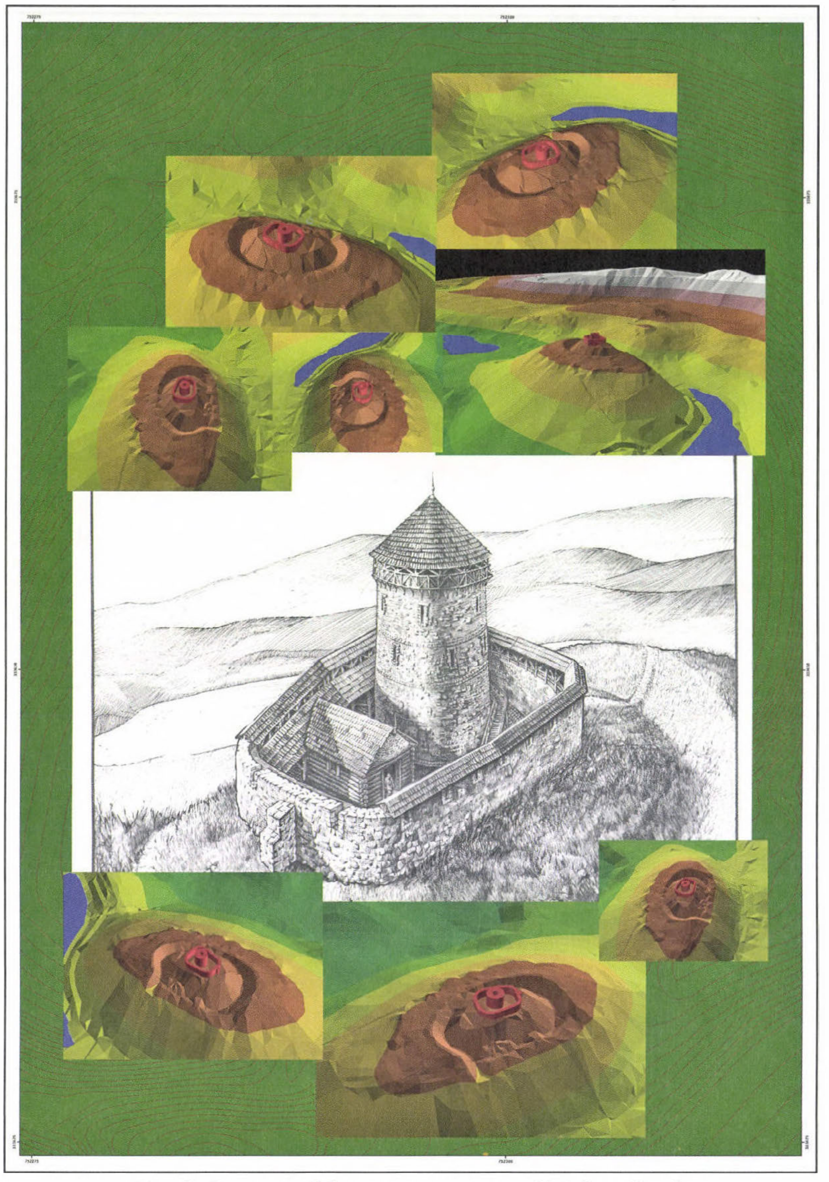

Fig. 5. One possible reconstruction of Mohos Castle

The cistern probably lay east of the tower; its excavation remains a task for future research.

The castle was destroyed by a violent conflagration.

Neolithic pottery sherds were also recovered from the trenches opened in the castle's inner area.

The rampart

The east–west section through the rampart on the castle's western side[15] brought to light the remains of a Neolithic settlement on the plateau. The remains of this prehistoric settlement were incorporated into the rampart in the 13th century. The lower layers of the rampart yielded finds from the Neolithic settlement (pottery, an obsidian blade and polished stone axe), which can be assigned to the Bükk culture. Overlying this layer was a clayey fill devoid of any finds. 13th century pottery fragments lay on the hard-trodden and ashy surface of this layer. The upper layer was mixed with chaff and brick rubble from the Árpádian Age. The defencework of the castle was constructed by using the earth from the ditch and the area beyond it for erecting the rampart. The brick debris perhaps indicates that the rampart was topped with some other structure.

The outer plateau beyond the rampart

We opened two trenches to investigate whether there had been any buildings here during the castle's use-life or during other periods.

Trench III was opened on the western plateau. The relatively even pebbly virgin soil underlying the thin layer of forest soil had been levelled at the time of the rampart's construction. The elevations observed during the contour survey were in part natural and in part the remains of the rampart. We did

15 Its east–west length is 22 m, its width is 2 m, and its eastern end terminates in the rampart's axis. Knowing that the section through the rampart would mean the destruction of the castle's outer defenceworks, we only cut through the midline. The building periods and, in part, its structure could be clarified. The subsequent reburial of the trench meant that the damage to the rampart could be decreased.

not find any traces of buildings in this area. The debris of a building constructed of stones laid in a bed of mud was found in Trench IV opened on the northern plateau, lying on the boundary of the rampart's base and the levelled area. The stones lay on the surface and we did not find any foundation trenches. In view of the size of the castle's interior area and its layout, the stables probably lay in this area.

The depressions at the foot of the castle hill

Only one of the two depressions lying at the foot of the castle hill has been investigated so far. The investigation is still in progress.

The remains of a lime-kiln used during the construction of the castle were found in the trenches opened in this area. A layer of limestone mixed with molten slag and red burnt clay lay under the thin forest soil. The archaeological finds from this layer can be dated to the 13th century.

DISCUSSION

The archaeological investigations revealed that there had been a Bükk settlement on the site of the later castle during the Neolithic. There were no traces suggesting that this Neolithic settlement had been fortified. The historical interpretation of the data yielded by the analyses of the sediment cores from Lake Kis-Mohos, according to which there was a major Celtic and a 10th–11th century settlement in the area, has not been borne out by the archaeological record. The explanation for the human impact on the environment of the Mohos Lakes during these periods must thus be sought in the broader area of the lakes.

The construction of the castle can be dated to after the Mongolian invasion in 1241 on the basis of the recovered finds. The reason that the castle is not mentioned in the document concerning the division of the estates of the Gut-Keled kindred from 1338 was that the castle had probably perished in the early 14th century, during the clashes preceding the ascension of King Charles Robert.[16]

We prepared a digital terrain model of the area based on the geodesic survey of the castle and its environs *(Fig. 3)*. It is instructive to compare the slope steepness map generated from the terrain model with the results of the archaeological investigations for it allows the identification of the relatively level areas suitable for settlement and the erection of various buildings which should be archaeologically investigated and, also, the identification of areas with a relatively low slope steepness, from where the castle could be approached with minimum effort. The latter can be identified with the area beside the dirt-track leading to the castle from the west. It has been mentioned above that the castle was destroyed by a violent conflagration, probably caused by an enemy assault. This is also supported by the arrowheads found in the castle and its environs. Since the ditch prevented the finds from the castle's interior area to be washed out towards the west, north and south, the context of the finds found in this area – whether scattered over the surface or buried – must be studied with care. Following a systematic survey of the castle's environs with a metal detector, we found quite a high number of arrowheads in the western part of the castle hill, the area from where the castle could be most easily approached in terms of slope steepness. These finds have been tentatively associated with the castle's destruction. The analysis of the castle hill's slope steepness allows the identification of the areas around the castles, from where the sediments washed into the Mohos Lakes originated *(Fig. 6)*.

In order to study the impact of Mohos Castle on its environment, the castle's function must first be determined. The most general interpretation, which can in part be traced to the Romantic attitude of the 19th century, regards castles as military installations, whose function was to control roads and defend borders. At the same time, however, castles often functioned as the centre of an estate, as the residence of its owner or as a repository of its owner's wealth.

The area enclosed by the curtain wall is hardly larger than the area of a modern suburban house: 294 m^2 (0.0294 ha). The tower took up about 63 m^2. Other buildings were set against the curtain wall, again encroaching on the available open space. The interior of the tower with its 3 m thick walls was

16 Cp. *Kristó Gy.:* Az Anjou-kor háborúi. Budapest 1988, 74, 126, 135.

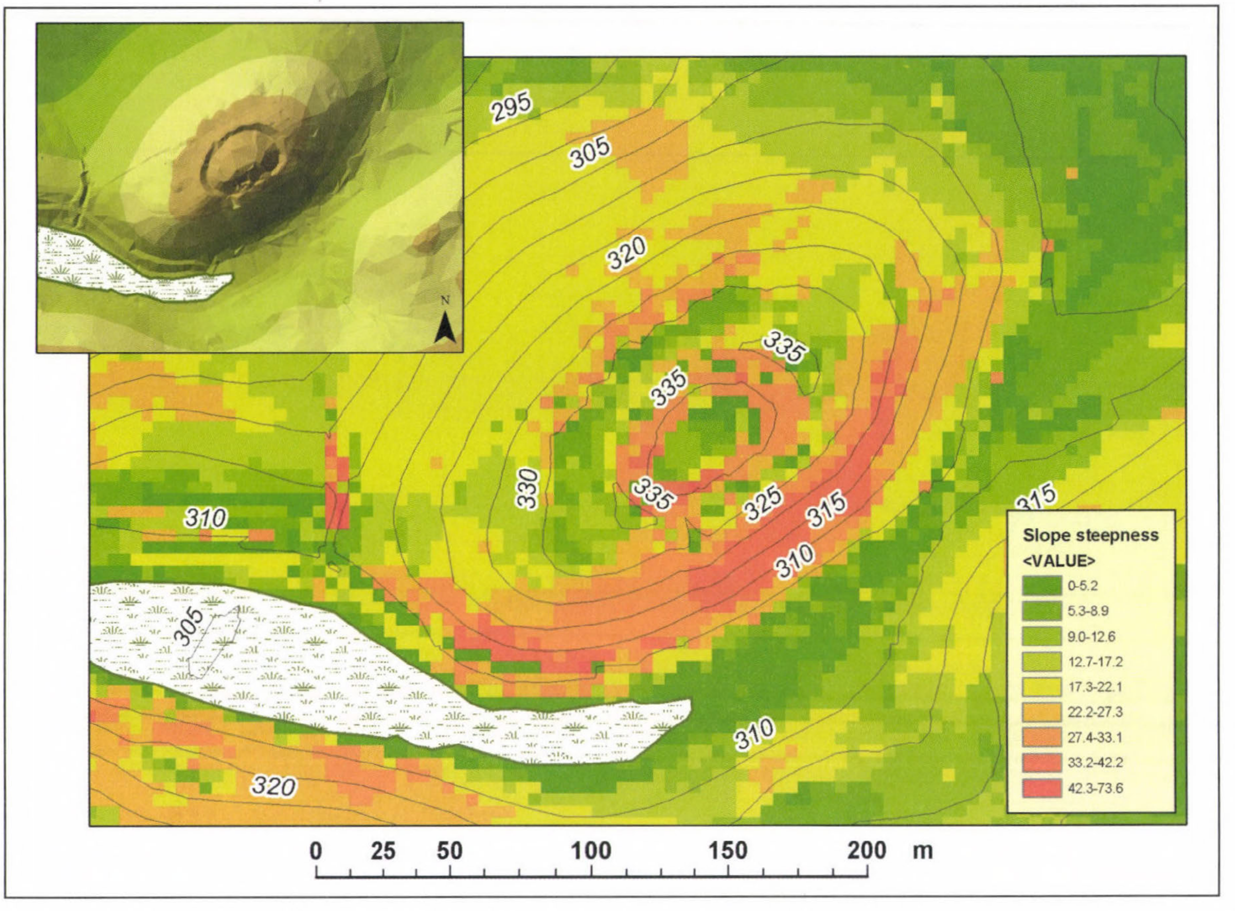

Fig. 6. The slope steepnesss in the environs of Mohos Castle

hardly suitable for serving as a residence and, as a matter of fact, there were no archaeological traces indicating that it had been used as a residential building. The tower can thus be interpreted as a keep, rather than as a residential tower. Even though the archaeological evidence – the carefully built log buildings and the oven – suggests that the castle had been occupied continuously, there is nothing in the find material distinguishing it from the usual artefacts of the average contemporary village. Neither did we find the remains of a more impressive stone structure (a "palace"). The finds themselves would suggest that its owner had not spent a great deal of time in the castle and that its defence was entrusted to his men.

This castle, used for perhaps less than fifty years in the 13th–14th century, is rather small compared to our general idea of castles; at the same time, its structural features made it suitable for ensuring its owner's power. The castle apparently functioned as the repository of its owner's goods (such as valuables and title deeds), as least judging from the rather massive tower and the ploughshare brought to light in the building built against the outer face of the curtain wall (perhaps a tower). Ploughshares were important implements during the Middle Ages and they were often kept in churches.

The construction of the curtain wall and the tower(s), and of the ditch and rampart protecting the castle called for considerable effort, which raises the question of to what extent Mohos Castle can be regarded as a structure designed to represent its owner's power. Considering the fact that the majority of the population in the broader region still lived in sunken huts during the 13th–14th century, the castle may have served this purpose in spite of its small size. Even so, the question remains: whom was the castle supposed to impress? Who could see the castle? The other question is what could be seen from the castle – in other words, if its function was to control the road, how was this implemented in practice? This question could be easily resolved if the extent of the present-day forest cover resembled the medieval one. However, we know that the castle hill and the direct environs of the castle were not

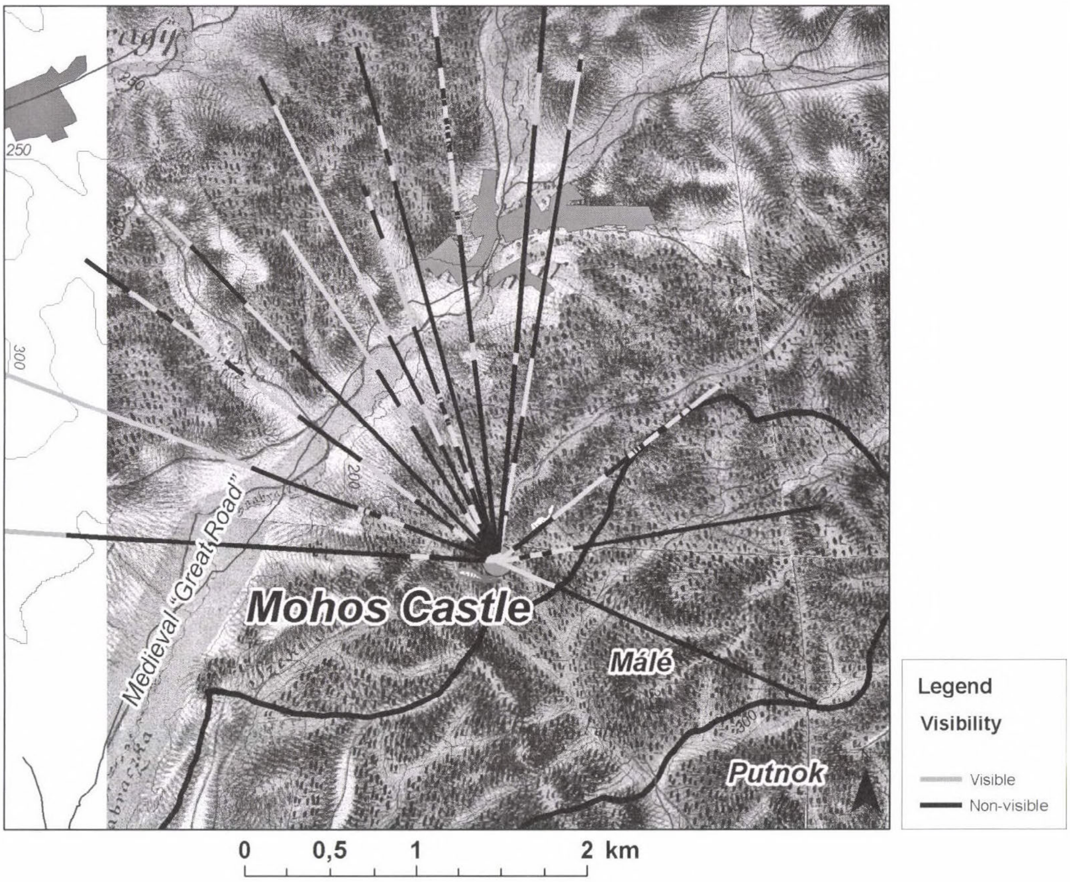

Fig. 7. The visibility of Mohos Castle

forested in the 13th–14th centuries and thus this issue could not be studied in the field owing to the present conditions. In order to analyse the visibility conditions, we used the digital terrain model of the castle's direct environs and a terrain model (DDM10) generated from the data of a 10x10 grid based on the 1:50,000 map of the broader region. The height of the tower uncovered during the excavation probably equalled or even exceeded its diameter, and thus we calculated with a 9 m high tower *(Fig. 5)*. A road branched off towards the valley of the Szuha Stream north of Putnok from the medieval road in the Sajó Valley. Known as the “Great Road”, this road ran along the valley of the Keleméri Stream north of Mohos Castle. We used the data contained in the maps of the late 18th century First Military Survey and of the mid-19th century Second Military Survey, which probably reflected more accurately the medieval conditions, in order to plot its track. We then fitted these maps onto modern ones, after identifying landscape points common to both. The track of the roads identified from the 18th–19th century maps were then plotted on the digital terrain model.

Judging from its church built in the Middle Ages, the village of Kelemér was probably sited where it is today. An examination of the visibility conditions in a few directions from the castle indicated that Mohos Castle could not be seen from the village of Kelemér. In other words, the castle was not designed to symbolise its owner's power for the tenant peasants living in Kelemér. As regards the castle's function of controlling roads, we may say that the road through the Szörnyű Valley from Putnok to Kelemér was practically invisible from the castle, and only a few sections of the medieval “Great Road” in the valley of the Keleméri Stream could be seen. As a matter of fact, even these road sections lie so far from the castle that one could at the most wave at the travellers from the tower, but it was hardly possible to actually control the road from the castle *(Fig. 7)*. It would appear that the castle's primary function was to safeguard its owner's goods.

The analysis of the visibility conditions leads us to the study of the castle's broader environs. The castle lies in the southern part of Árpádian Age Gömör County. In the Árpádian Age, Gömör County was restricted to the catchment area of the Sajó River. The county's most important road led along this river. The "Great Road" mentioned above branched off from this road towards the east, towards Ragály, linking the road along the Sajó with the one in the valley of the Szuha Stream. The medieval villages, whose inhabitants had some sort of impact of the environment of the Mohos Lakes, lay along this road. The currently known settlement network had evolved by the end of the Árpádian Age, and only a few smaller settlements disappeared during the post-medieval period.

Many of the Árpádian Age place-names have Slavic origins, suggesting that the ancient Hungarians settling in this area lived side-by-side with a Slavic population. The region was occupied by the Hanva kindred at the time of the Hungarian conquest around 900; merging with the scanty local population, they established a series of villages in southern Gömör County.[17] The toponyms recorded during the 13th–14th century perambulations reveal that around 1300, the region's population spoke Hungarian north and west of the Mohos Lakes, roughly up to the Balogvár–Jolsva–Rozsnyó line, i.e. the current ethnic boundary.[18]

In the Árpádian Age (10th–13th centuries), the other major ironworking centre beside the one by the country's western border lay in northern Borsod and a part of Gömör County. The archaeological finds (tuyères, slag, furnaces) outline the area where iron metallurgy was practiced during the 10th–12th centuries. Finds of this type have been reported from Rudabánya, the Szuha Valley and their broader environs. The find indicating iron smelting "nearest" to Kelemér came to light at Szuhafő lying by the source of the Szuha Stream.[19] The archaeological finds, the toponyms and the data contained in various charters from the Árpádian Age indicate that iron smelting was practiced over a roughly 5000 m^2 large area. Iron production on this scale could hardly have been the private business of the local population. We may therefore assume that similarly to the situation in western Hungary, the emerging Hungarian state administration directed and controlled iron production in this region. Searching for the traces of this administrative framework in the western part of the northern Borsod iron producing region, we found an area called Vasvár [Iron Castle] near Ózd in the Hangony Valley.[20] It would appear that the area's iron production was controlled from here.

In November–December, 2004, Piroska Csengeri of the Herman Ottó Museum in Miskolc excavated a site lying 2500 m south of the Mohos Lakes at Kelemér. The site lies on the western side of the Szörnyű Valley (marked as Forrás Valley on historical maps) extending between Putnok and Kelemér. A small gully runs into the Szörnyű-völgyi Stream, flowing towards Putnok, about 1 km north of Putnok. During a field survey conducted in 2000, Dezső Nagy from the Ecological Institute in Miskolc and the present author found Neolithic artefacts in the wall of the sand-pit in this area.[21] The 2004 excavation sought to clarify the context of these finds. Overlying the Neolithic layers were two partly destroyed Árpádian Age sunken huts, whose floor lay 0.5 m below the one-time ground level, and a pit with a burnt fill. The finds from these two houses and the pit dated from the 12th century. The finds included iron slag and an iron bloom with a diameter of 20 cm.[22] The site functioned as the settlement and workplace of a population engaged in iron production during the 12th century *(Fig. 8)*.

The location of this iron producing settlement corresponds to the siting of other similar settlements in this region. All were established by a small stream, which were so shallow as to dry up during the dry seasons. They often lie beside a spring or a well. Another shared feature is that they were almost always situated in a place, where a valley branched into two, or where a smaller side-valley or gully joined the valley.[23]

17 *Ila* (1944) Vol. I, 50.

18 *Györffy* (1963–1987) Vol. II, 465–466.

19 *Heckenast et alii* (1968) 78.

20 *Ibidem* 147.

21 Archaeological Archives of the Herman Ottó Museum, inv. no. 3048–00. The EOV co-ordinates of the site are as follows: Y=753280.00; X=331250.00.

22 I would here like to thank archaeologist Piroska Csengeri for her kind permission to inspect the finds.

23 *Heckenast et alii* (1968) 63.

Aside from the western Slavs settled in this area during the great colonisation wave of the 13th century (the ancestors of the Slovaks), the population engaged in iron smelting can perhaps in part be linked to the southern Slavs of the Körös region, as shown by the place-names in the iron production region of the Árpádian Age.[24]

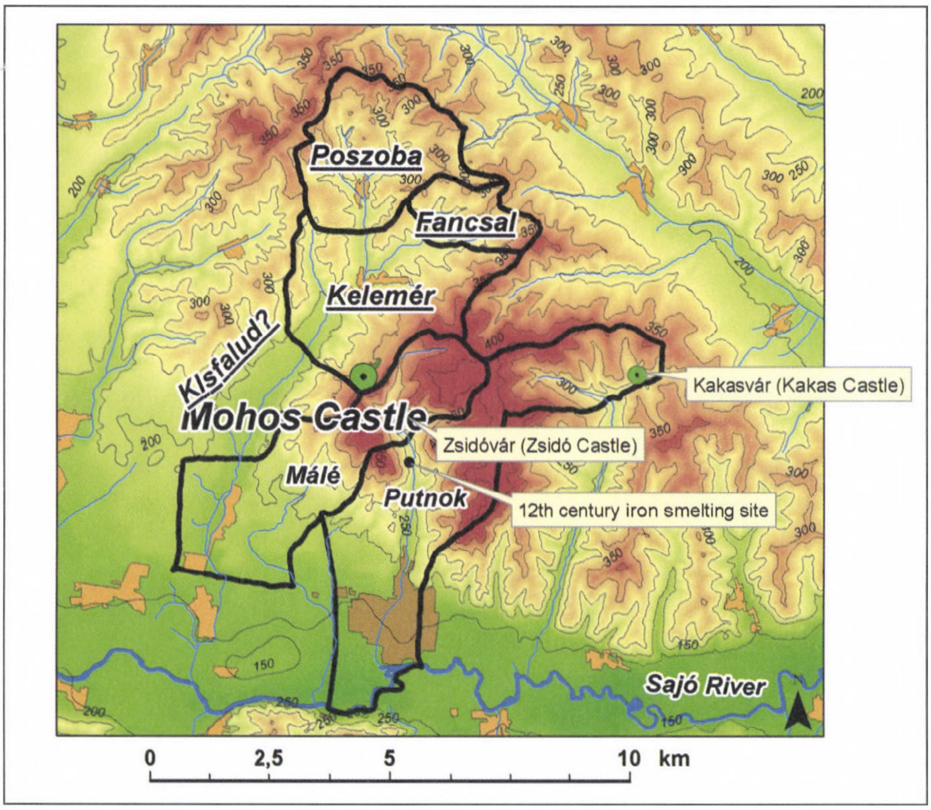

Fig. 8. The medieval settlement boundaries and castle sites around Mohos Castle

Even though iron slag has been found by almost every village in the Szuha Valley, the data contained in the charters indicate that these villages were established at a later date than the archaeological finds from the 11th–12th centuries. The iron smelting sites in this region apparently predated the emergence of permanent villages. It is unclear why iron production ceased in southern Gömör and northern Borsod counties during the 12th and, in some places, during the 13th century. The iron ore deposits in Gömör and the Szepesség region began to be exploited after iron smelting ceased in this region. It is possible that the iron smelters of the region moved northwards.[25] The Mongolian invasion did not devastate this region to the extent as the Great Hungarian Plain because the forested mountains provided shelter. The impact of King Béla IV's policy encouraging the construction of stone castles and the emergence of castle manorial estates, the settlement of *hospites* and the development of mining in the north could be felt to a greater extent.[26]

In the Middle Ages, Kelemér was in the ownership of the Gut-Keled kindred, which also possessed the neighbouring villages of Poszoba and Fancsal in 1338.[27] When examining the medieval settlements in the broader area of the castle and the Mohos Lakes, it seems instructive to examine not only these settlements, but also another village, Málé, and Putnok, a market town, which during the Middle Ages functioned as a central place. As regards the medieval settlement network in the area around the Mohos Lakes, medieval Kelemér lies in roughly the same place as the modern village; Poszoba was located where the present-day village of Gömörszőlős can be found, while the memory of Fancsal (a deserted village) is preserved by a toponym on the northern outskirts of Kelemér. The settlement of Málé lay on the site of the modern village of Serényfalva. Its remains were identified by the present author at Ófaludűlő in autumn, 2004. The medieval market-town of Putnok is a bustling town today.

The medieval boundaries of these settlements were reconstructed by archivist Tamás Bodnár of the Borsod-Abaúj-Zemplén County Archives in 2004 *(Fig. 8)*. The most remarkable element of his

24 *Györffy* (1963–1987) Vol. II, 462, 466.
25 *Heckenast et alii* (1968) 150–151.
26 *Györffy* (1963–1987) Vol. II, 469.
27 *Ibidem* 514, 517.

reconstruction is the relationship between the castles and the settlement boundaries. The boundaries of Putnok, for example, extended to the territory of the Kakasvár [Kakas Castle] in the northeast, most likely a medieval castle built by the Kakas family of Kaza (present-day Sajókaza). The inhabitants of Putnok had clashed oft-times with the Kakas family of Kaza. The castle built by the Kakas family during the 13th century no doubt disturbed the town-dwellers. They solved this problem by extending the town's boundaries to include Kakas Castle and its environs, even though this area differs from the other areas annexed to Putnok as regards the terrain. A similar situation can be noted in the case of the medieval village of Málé, lying southwest of the Mohos Lakes at Kelemér. The boundary of the village juts out in the north-east. This protrusion encloses a hill on the eastern side of the Szörnyű Valley. The hill lies by the road from Putnok to Kelemér in the Szörnyű Valley, east of the Pálma Brook, some 1.2 km from the Mohos Lakes. The hill is the southern extension of a range of hills. Ferenc Szmorad, the forestry inspector of the Aggtelek National Park called attention to the defenceworks made up of three ramparts separating the hilltop from the range in the north. The fortification itself was called Zsidóvár [Zsidó Castle].[28] We collected Late Bronze Age–Early Iron Age finds in the area enclosed by the ramparts during our survey in 2001. It is possible that – just as in the case of Putnok – the boundaries of Málé were extended to include the area of the Zsidóvár, which seemed suitable for the construction of a castle. In the Middle Ages, Málé was owned by members of the Rátót kindred. The reason for the extension of the settlement's boundaries may have been the construction of nearby Mohos Castle at Kelemér by the Gut-Keled kindred. If this was indeed the case, Málé illustrates an instance of when a nearby castle "begat" a new castle, even if only embrionically.

What were these settlements like in the Middle Ages?

According to a charter from 1338, there were about forty-five households in Putnok. This period coincides with the emergence of a legally uniform, dependent peasantry in Hungary, meaning that this number coincides with the number of plots.[29] The settlement had a population of about three hundred at the time.[30] The vineyards of Putnok are first mentioned in this charter. The northern boundary of vine cultivation can be drawn just a little beyond Putnok.[31] By the 14th century, the settlement had grown: it had its own church, a mill, a toll-booth and the right to hold markets. The settlement had two major streets, which intersected at the junction of the Forrás Valley (today's Szörnyű Valley) and the road. Putnok's later, 16th century history was shaped by the Turkish wars and the maintenance of its castle. Although first mentioned in 1561,[32] the stronghold itself was fortified earlier. Until 1681, the inhabitants of Gömör County were regularly ordered to Putnok Castle, which had been declared a border fortress, to perform maintenance work and to build the palisade.[33] The castle's defenceworks were for the greater part made up of an earth-and-timber palisade, whose construction called for vast amounts of timber. The number of Putnok's inhabitants declined steadily during the wars: in 1551 there were forty-three tax-paying heads of tenant peasant families, while in 1568 the tax registers mention eight whole and five half-plots.[34] By 1574, there remained only six whole and two half-plots, and four cotters; forty-nine plots are described as deserted.[35] In 1576–1578, the area was devastated by the plague.[36] By the close of the 17th century, Putnok had been abandoned by its inhabitants, who had moved to an area slightly farther from the castle and settled in newly-founded Putnokfalva for about forty to fifty years.[37] The rebuilding of the town was begun by the area's new owners, the Count Serényi family in the first half of the 18th century.

28 Ferenc Szmorad's report: Archaeological Archives of the Herman Ottó Museum, inv. no. 3049–00. The EOV co-ordinates of the hillfort are as follows: Y=753149; X=339815

29 *Györffy* (1963–1987) Vol. III, 536.

30 *Bodnár* (2001) 111.

31 *Tóth P.:* Szempontok a borsodi mezővárosok középkori és koraújkori történetének vizsgálatához. Miskolc 1994, 114.

32 *Balogh B.:* Putnok mezőváros múltja s újabb kora. Rimaszombat 1894, 33.

33 *Bodnár* (2001) 135.

34 *Ila* (1944) Vol, I. 303.

35 *Bodnár* (2001) 133.

36 *Ila* (1944-1976) Vol I, 270.

37 *Idem* Vol. III, 238.

Málé had forty-one whole plots in 1427, indicating that it was quite an important village. In 1566, the Turkish and Mongolian troops torched the village; its inhabitants fled and only rebuilt five houses in 1570. The number of its inhabitants dwindled to one-quarter of the former occupants, the average number being about ten families during the 18th century. The village became wholly deserted during the wars and the unending troop movements of various armies between 1680 and 1690. Some of the former inhabitants moved to Putnok, others found new homes in more distant regions. None of them returned. In the early 18th century, the Count Serényi family, the new owners of the village, brought Slovaks and Moravians Slavs to settle the village.[38]

Kelemér had forty tenant holdings (*porta*) in 1472. Its life during the Middle Ages was fairly uneventful – but rather turbulent in the post-medieval period.[39] In 1566, the Turks torched the village. Until the close of the 16th century, Kelemér was largely uninhabited, abandoned by its former occupants owing to the high Turkish taxes. The major national independence movements from the late 17th century and the vastly increased tax burdens, the plague and the famine in its wake was the reason that only two tenant peasants were registered in the national census of 1720. The number of occupied tenant holdings was about one-fifth of the medieval one. In 1773, there were twenty families.

The impact of human activity during the Middle Ages on the environment of the Mohos Lakes as reflected in the archaeological record can be summed up as follows:

The direct environment: Following the destruction of the Neolithic settlement on the hill rising beside the Mohos Lakes, the next traces of human settlement date from the 13th century, when the hill was fortified. The erection of the defenceworks (ditch, rampart), the construction work (and the associated lime burning activity), the continuous occupation in the castle, its destruction in a conflagration and the clearing of the vegetation and the forest in the castle's direct environs were the main forms of human impact in the area of the Mohos Lakes. The archaeological record indicates that the castle was not inhabited after the earlier 14th century.

The broader environment: The Mohos Lakes lie in a region in which many archaeological traces of iron smelting have been discovered from the early Árpádian Age (10th–12th centuries). The 12th century settlement found on the outskirts of Putnok and the occurrences of iron slag can also be linked to iron production. It seems likely that the archaeological traces of charcoal burning and of iron smelting itself could be identified with systematic field surveys in other areas too, in the neighbouring stream valleys in the broader environs of the Mohos Lakes. The present-day settlement network had evolved by the end of the 13th century. Compared to conditions in the 15th century, the population of neighbouring villages declined drastically during the 16th century owing to the Turkish wars. The forests in the area were no doubt affected the demand for the timber necessary for the maintenance of the Putnok castle in the 16th–17th centuries. The decay of the settlements and the population decline were only stopped by the conscious settlements in the 18th century.[40]

38 *Ibidem* 4.

39 *Ila* (1944–1976) Vol. II, 485.

40 The environmental changes after the 18th century are illustrated by the maps showing how the environment was exploited, based on the relevant maps in various archives, the 17th–19th century sheets of the maps prepared during the First, Second and Third Military Surveys, modern maps and aerial photographs made by the Ecological Institute in Miskolc under the direction of Dezső Nagy. *Nagy D.:* Tájtörténeti kutatások a Gömör-Tornai-karszton I. A történelmi táj rekonstrukciója az ANP környezetében az I–III. Katonai Felmérések alapján. Aggteleki Nemzeti Park füzetek 2 (2003) 107–143.

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Dobossy (1975)	*Dobossy L.:* Várak és őrhelyek Ózd környékén. Miskolc 1975.
Heckenast et alii (1968)	*Heckenast G. – Nováki Gy. – Vastagh G. – Zoltay E.:* A magyarországi vaskohászat története a korai középkorban. Budapest 1968.
Györffy (1963–1987)	*Györffy Gy.:* Az Árpád-kori Magyarország történeti földrajza I–III. Budapest 1963–1987.
Ila (1944–1976)	*Ila B.:* Gömör megye I–IV. Budapest 1944–1976.
Nováki – Sárközy (1999)	*Nováki Gy. – Sárközy S.:* Várak a magyarországi Gömörben. HOMÉ 37 (1999) 329–348.
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ABBREVIATIONS

ActaArchCarp	Acta Archaeologica Carpatica (Kraków)
ActaArchHung	Acta Archaeologica Academiae Scientiarum Hungaricae (Budapest)
Acta Biologica	Acta Biologica Academiae Scientiarum Hungaricae (Budapest)
Acta Geologica	Acta Geologica Academiae Scientiarum Hungaricae (Budapest)
ActaMusNap	Acta Musei Napocensis (Cluj–Napoca)
ActaMusPor	Acta Musei Porolossensis (Zalău)
AISC	Anuarul Institutului de Studii Clasice (Cluj–Napoca)
AO XI	Anjou-kori Oklevéltár XI. 1327. Ed: T. Almási. Budapest–Szeged 1996.
AOT	Anjoukori okmánytár I–VII. Eds: I. Nagy – Gy. Tasnádi Nagy. Budapest 1878–1920.
ArchAu	Archaeologia Austriaca (Wien)
ArchÉrt	Archaeologiai Értesítő (Budapest)
ArchHung	Archaeologia Hungarica (Budapest)
ArchKözl	Archaeologiai Közlemények (Budapest)
ArchRozhl	Archeologické Rozhledy (Praha)
ÁUO XI	Árpád-kori Új Okmánytár XI. Szerk.: Wenzel G. Pest 1873.
BAR	British Archaeological Reports (Oxford)
BMMK	A Békés Megyei Múzeumok Közlemémyei (Békéscsaba)
BRGK	Bericht der Römisch-Germanischen Kommission (Berlin)
BotKözl	Botanikai Közlemények (Budapest)
BudRég	Budapest Régiségei (Budapest)
CD	Codex Diplomaticus Hungariae ecclesiasticus ac civilis. Studio et opera Georgii Fejér. I–XI. Budae 1829–1844.
CommArchHung	Communicationes Archaeologicae Hungariae (Budapest)
DissPann	Dissertationes Pannonicae (Budapest)
DMÉ	A Debreceni Déri Múzeum Évkönyve (Debrecen)
DocPraeh	Documenta Praehistorica (Ljubljana)
EMÉ	Az Egri Múzeum Évkönyve (Eger)
ERAUL	Études et Récherches Archéologiques de l'Université de Liège (Liège)
FolArch	Folia Archaeologica (Budapest)
FontesArchHung	Fontes Archaeologici Hungariae (Budapest)
FöldrÉrt	Földrajzi Értesítő (Budapest)
FöldrKözl	Földrajzi Közlemények (Budapest)
FtKözl	Földtani Közlöny (Budapest)
HMM	Heves megye műemlékei I–III. Szerk.: Voight P. Budapest 1978.
HOMÉ	A Herman Ottó Múzeum Évkönyve (Miskolc)
HOMK	A Herman Ottó Múzeum Közleményei (Miskolc)
IPH	Inventaria Praehistorica Hungariae (Budapest)
JAMÉ	A Nyíregyházi Jósa András Múzeum Évkönyve (Nyíregyháza)
JászÉvk	Jászsági Évkönyv (Jászberény)
JMV	Jahresschrift für Mitteldeutsche Vorgeschichte (Berlin)
JNSZMMK	Jász-Nagykun-Szolnok Megyei Múzeumok Közleményei (Jászberény)
JPMÉ	A Janus Pannonius Múzeum Évkönyve (Pécs)
JbRGZM	Jahrbuch des Römisch-Germanischen Zentralmuseums Mainz (Mainz)
MAG	Mitteilungen der Anthropologischen Gesellschaft in Wien (Wien)
MCA	Materiali şi Cercetări Arheologice (Bucureşti)
MFMÉ	A Móra Ferenc Múzeum Évkönyve (Szeged)

MittArchInst	Mitteilungen des Archäologischen Instituts der Ungarischen Akademie der Wissenschaften (Budapest)
MKÉ	Múzeumi és Könyvtári Értesítő (Budapest)
MOL Dl	Magyar Országos Levéltár Diplomatikai Levéltár (Budapest)
MRT 9	Dinnyés I. – Kővári K. – Kvassay J. – Miklós Zs. – Tettamanti S. – Torma I.: Pest megye régészeti topográfiája XIII/2. A szobi és a váci járás. Magyarország Régészeti Topográfiája 9. Budapest 1993.
NMM	Nógrád megye műemlékei. Szerk.: Dercsényi D. Magyarország műemléki topográfiája III. Budapest 1954.
NMMÉ	A Nógrád Megyei Múzeumok Évkönyve (Salgótarján)
PamArch	Památky Archeologické (Praha)
PBF	Prähistorische Bronzefunde (München–Stuttgart)
PPS	Proceedings of the Prehistoric Society (Cambridge)
PZ	Praehistorischer Zeitschrift (Berlin)
RégFüz	Régészeti Füzetek (Budapest)
SCIV	Studii şi Cercetări de Istorie Veche (Bucureşti)
SCIVA	Studii şi Cercetări de Istorie Veche şi Arheologie (Bucureşti)
SlovArch	Slovenská Archeológia (Bratislava)
StudArch	Studia Archaeologica (Budapest)
StudCom	Studia Comitatensia (Szentendre)
ŠtudZv	Študijné Zvesti Archeologického Ustavu Slovenskej Akadémie Vied (Nitra)
SzMMÉ	Szolnok Megyei Múzeumok Évkönyve (Szolnok)
UC	Urbáriumok és összeírások a Magyar Országos Levéltárban (Urbaria et Conscriptiones). CD-ROM. Ed.: I. H. Németh. Budapest 2004.
VariaArchHung	Varia Archaeologica Hungarica (Budapest)
VMMK	A Veszprém Megyei Múzeumok Közleményei (Veszprém)
ZsO II/2	Zsigmond-kori Oklevéltár II (1400–1410) II. rész. Ed.: E. Mályusz. Budapest 1958.
ZsO IV	Zsigmond-kori Oklevéltár IV (1413–1414). Eds: I. Borsa – E. Mályusz. Budapest 1994.

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