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TRANSITIONS
TO THE BRONZE AGE

Interregional Interaction and Socio-Cultural Change in the Third Millennium BC Carpathian Basin and Neighbouring Regions

Edited by
Volker Heyd, Gabriella Kulcsár and Vajk Szeverényi

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Front Cover

M.C. Escher's "Day and Night" © 2013 The M.C. Escher Company-The Netherlands.
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Back Cover

Interior decorated bowl fragments from Somogyvár-Kupavárhegy,
Hungary (photo by Fanni Fazekas)

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Contents

Editorial

TRANSITIONS: They can be smoothly and gradual or sudden and revolutionary.

- In prehistory it is normally difficult to see the sudden events;
- many keyword come to one's mind when thinking about transitions in prehistory

What are transitions? What makes the BA distinct from a Neolithic, or Copper Age; shift of paradigm: no one has really looked into the arrival of tin-bronze; would this book have been published some 20–30 years ago, half of the contributions would have dealt with the tin question;

- also, several contributions deal with the movement of people; wouldn't have been the same some 20–30 years ago;
- discontinuity, historical event ; catastrophy;
- interregional; interaction of regions; econmic change subsistence
- to the Bronze Age; Carpathian basin and neighbouring regions; long story; absolute dates; problems of nomenclature-terminology;

The annual meetings of the most significant archaeological association in Europe, the European Association of Archaeologists (EAA), provide each year an outstanding opportunity for dialogues between scholars of various countries and backgrounds. At the 16th meeting, held in September 2010 in The Hague, The Netherlands, Volker Heyd (University of Bristol), Gabriella Kulcsár (Hungarian Academy of Sciences, Budapest) and Vajk Szeverényi (Móra Ferenc Múzem, Szeged) organized a full-day conference session focusing on interregional contacts and social, economic and cultural change in the third millennium BC in and around the Carpathian Basin. The session turned out to be a great success with many interested and renowned specialists in attendance who could hardly fit into the rather medium-sized lecture room already inhabited by a grand piano. Encouraged by this success and understanding the long-standing need of tackling the question of the emergence of Bronze Age in this European region, we prepared this volume based on the papers given at the session. The 13 articles of this volume, all written in English, discuss problems of transition and change from the Late Copper to the Early Bronze Age, that is more than a whole millennium from the later 4th to the end of the 3rd millennium BC, investigating among others terminological and chronological issues, mobility, burial rites, metallurgy, special ceramics, animal husbandry and regional and interregional systems of connections.

The volume highlights various aspects of the structure and temporal and spatial dynamics of interregional interactions of the communities of the Carpathian Basin in the third millennium BC. Traditional typo-chronological issues are accompanied by the results of absolute dating, anthropological and biochemical investigations, statistical analyses, and contribute a great deal to our knowledge of the long-distance interaction zones and communication networks of the period. The publication of the volume will certainly promote communication between the archaeological schools of western and east central Europe, providing new aspects for future research as well.

Volker Heyd sets the over-arching theme and gives a wide-ranging review of the beginnings of the Bronze Age in central and southern Europe identifying important social processes that define this period. Gabriella Kulcsár and Vajk Szeverényi focus more narrowly on the Carpathian Basin and examine the terminological and chronological framework, investigate the issue of (dis)continuity and also identify various social changes during this crucial transition. Marzena Szmyt, Yuri Rassamakin and Elke Kaiser investigate various parts of and aspects in the north-Pontic steppe and forest-steppe region: while Szmyt focuses on interactions between steppe and forest-steppe communities characterized by eastern Globular Amphora and Yamnaya type materials, Rassamakin gives a review of the current knowledge about the emergence of the Yamnaya and various pre-Yamnaya societies in the Ukraine emphasizing changes in burial rites and material cultures; Kaiser finally examines the famous *kurilnitsy* of the steppe and the Caucasus foreland, and their relationship with the interior decorated pedestalled bowls of the Carpathian Basin. Back in the Carpathian Basin, Tünde Horváth and her colleagues, as well as Claudia Gerling and Horia Ciugudean, concentrate on kurgan/mound burials in eastern Hungary and western Transylvania and their possible interpretations, the latter two with reliance on stable isotope analyses. János Dani then highlights metallurgical production throughout the transition from the Late Copper to the Early Bronze Age with special attention to early copper shaft-hole axes. Manfred Woidich and Alexandru Szentmiklósi follow by publishing new evidence on the beginnings of the Early Bronze Age from the Romanian Banat area, while Jaroslav Peška and Miroslav Králík provide a sophisticated statistical analysis of the wide-spread "Nagyrév jugs" – characteristic one-handled jugs in Moravia and Hungary from 2600 to 2200 BC. Staying roughly in the same period, Róbert Patay presents a first overview of the important new Bell Beaker burial site of Szigetszentmiklós-xxx in central Hungary. This is complemented by Péter Csippán who studies economic change through the transition by comparing Late Copper and Early Bronze Age patterns of animal husbandry at a central Hungarian settlement. Finally, Neculai Bolohan and Andrei Asăndulesei investigate the Early to Middle Bronze Age transition directly east of the Carpathians through the study of Costişa type material and their settlements.

We are grateful to all these colleagues, working in seven European countries, not only for their efforts in bringing their ideas down to paper but also for their patience with us and their help und support during the editing process.

The publishing of the book was, as always, in the good hands of the Archaeolingua Foundation and Dr Elisabeth Jerem. We wish to thank her and Gergely Hős, our desktop editor, for their patience and perseverance with text, figures and our many requests over the last months.

This book would not have been possible without the financial support of the Hungarian National Cultural Fund. It was also supported by a János Bolyai Research Scholarship of the Hungarian Academy of Sciences for, and by a research leave for Volker Heyd granted by the School of Arts at Bristol University. We all are grateful for this support.

We think nothing describes better the theme of TRANSITIONS, which already stood in the foreground of then session in The Hague and which now centres in this book, than the wonderful woodcuts and lithographs of the Dutch painter and artist Maurits Cornelis Escher. Also as a reminescence for Den Haag, where we could visit the Escher Museum, we chose his famous picture "Day and Night", created in 1938 at the twilight of a terrible time when such kind of scholarly cooperation would not have been possible, to perhaps serve as an inspiration, or at least to consider the various aspects of perspectives, perception and geometry of transitions. We are thus also very grateful to *The M.C. Escher Company – The Netherlands* for allowing us to reproduce this masterpiece.

Bristol & Budapest, in November 2013

The Editors

Volker Heyd, Gabriella Kulcsár, Vajk Szeverényi

Europe at the Dawn of the Bronze Age

VOLKER HEYD

Abstract

What is the Early Bronze Age after all? When we are looking at the various European countries and address this question at regional level, we are certainly able to find scholarly publications that give us more or less useful definitions and interpretations, name the initial archaeological culture(s), graves, hoards and settlements, and accurately date their beginnings, apogee and end. But as soon as one tries to approach this question at the international level, or even attempts to oversee the wider European picture, then this becomes a complex task. It leaves us in a situation in which we need to offer criteria that help us understanding the mechanisms that make the Early Bronze Age different from the preceding Copper Age. In doing so, we may certainly not leave aside the different regional traditions, peculiarities and methodological approaches; it always is a Europe of the regions. Drawing from these, one gets aware of other important factors than the still widely used tin-bronze presence/absence. Such are, for example, arguments of cultural complexity, of levels of social and/or economic organisation, settlement choices and continuities, of trade and long-range exchange networks, of prestigious and exotic artefacts, of precious metals, the objects made of it and of their sheer weight, and of new ways of accumulating, thesauring and depositing them. Dismissing any attempt of establishing such defined Early Bronze Age structures in the 4th and at the beginnings of the 3rd millennium BC, and even confining those from the second quarter of the 3rd millennium BC to an emerging centre in the Aegean and the southern Adriatic, the focus of the article inevitably lies on the period of c. 2500–2200 BC. Here, three peripheries could be observed that firstly display these new ideas, values and achievements: the eastern and western Balkans and the southern Central Mediterranean; a fourth periphery might eventually be seen in southeastern Spain. For the first two centuries there seems only punctual transmission beyond these peripheries. Consequently, the Carpathian Basin is only displaying comparable Early Bronze Age structures in the phase IIb of the Hungarian chronological system when novel regionalized centres emerge around c. 2300 BC not only along the Middle Danube corridor (Reinecke A0) but also in northern Italy (Polada) and in southeastern Spain (El Argar). From now the gradual process accelerates and intensifies all over, and soon the trajectory includes regions further northeast, north and northwest.

While Yamnaya, Corded Ware and Katacombnaya are not playing any significant role in this interplay between c. 2500–2200 BC, it is the meeting with the predominantly western and Central European Bell Beaker network – in the 25th century BC at the peak of its expanding drive – which forecasts future pattern. Here, the question of identities, of multiple identities and changing identities over time is a key factor in the understanding of this transition from 'communal beaker' to 'personalised cup' users, from tanged dagger wearers and archers to those presenting the panoply of triangular riveted dagger, axe and halberd, from emblematic dress codes to the full set of metal-rich and exotic dress fittings and jewellery, or simply from ideology to elites. In such, the Early Bronze Age is, if one wants, a kind of capitalist world in embryo state and it is this re-orientation towards the southeast of then people in a new multi-polar world that determines Europe at the Dawn of the Bronze Age.

Introduction

What is the Early Bronze Age? When we are looking at the various European countries and address this question at the regional level, we are certainly able to find a lot of scholarly publications that give us more or less useful definitions and interpretations, name us the archaeological culture(s) that represent it, and accurately date, both relative and absolute, their beginning, apogee and end. But as soon as one tries to approach this question at the multi-regional and international level, or even attempts the wider European picture, then the situation becomes much more complex.

To date there is no clear-cut definition at European level of what the Early Bronze Age is about. For a long-time it was all about tin-bronze, its introduction and the artefacts manufactured out of it. But since metal composition and lead isotope analyses, and their results, have made it into everyone's mind, it is clear that the pathways of the archaeological cultures, traditionally seen as the earliest representatives of an Early Bronze Age, and the introduction of tin-bronzes are not leading in the same direction (e.g., Pernicka 1998; Krause 2003; Rahmstorf 2010).

This leaves us in a situation in which we need other criteria that help us understanding the mechanisms that make the Bronze Age different from the preceding Copper Age. In doing so, we may certainly not leave aside the different regional traditions, peculiarities and methodological approaches; it still is a Europe of regions. Drawing from these, and using scholarly work particularly of the last two decades, one becomes aware of important factors such as cultural complexity, or levels of social and/or economic organisation, of trade and long-range exchange networks, of exotic and prestigious artefacts, and of precious metals, the objects made of it and their weight. Another important point is seen in consistency and continuity, as the Copper Age often seemed to lack such (Heyd 2012). It is only from the Early Bronze Age that we have long and continuous occupations, no matter if one focuses on Thebes in Boeotia (Greece), probably the oldest town in Europe, the tell settlements in the Carpathian Basin, hillforts like Fuente Alamo in southern Spain, or the cemetery of Franzhausen in Austria, all in use for at least 500 years during the Early Bronze Age.

But this here shall not become a tick-box approach. Rather it is about discussing the various regions, their special situations, finds and features, and compare region by region in the search for super-regional

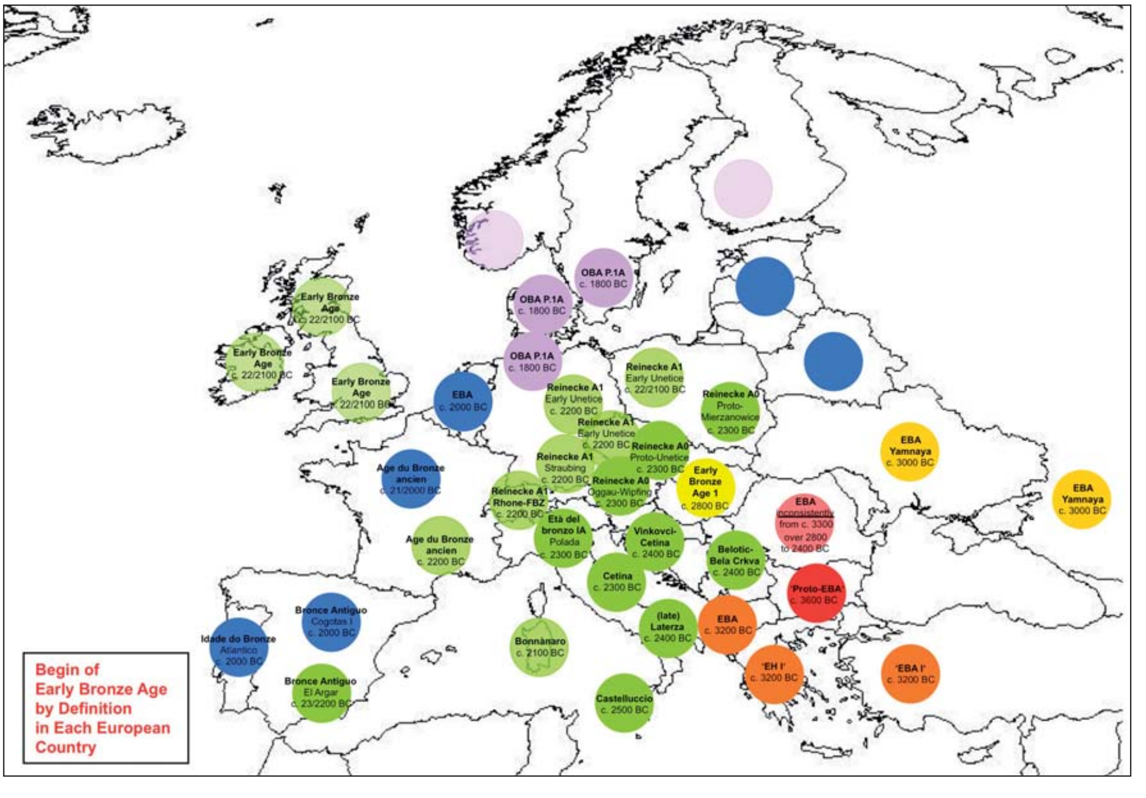

Fig. 1. Approximate absolute dates for the beginnings of the Early Bronze Age in the various European countries according to their respective terminological systems (drawing by author)

patterns of a structurally based Early Bronze Age. In such, it is useful first to take a look at the current state of research in the major European countries.

Linking geography, terminology and chronology

If one maps the time when the major European countries see the beginnings of the Bronze Age in absolute dates according to their various research traditions *(Fig. 1)*, a rather unexpected super-regional picture unveils. There is only partly a clear-cut, straight south – north, or southeast – northwest gradient over the European Continent as one would expect from the fact that most prehistoric innovations, since the Neolithisation of the European Continent, take this southeast to northwest pathway (Sherratt 1997). Instead one observes a strange pattern of some countries unexpectedly advancing, while others rather moderately "delaying" their beginnings of the Bronze Age. Nevertheless overall three cores are clearly visible: Firstly, there is the *Helladic* system of southeastern Europe with an earlier, *c.* 3000 BC, beginning of the Bronze Age. Secondly, the Central European, or *Reinecke* system, of *c.* 2200–2100 BC holds its position in the heart of the continent. And thirdly, the Scandinavian countries of northern Europe follow their own *Montelius* system, in which the beginning of the Bronze Age succeeds a Late Neolithic and is termed as the "Older Bronze Age" starting at around 1800/1700 BC.

However within and in-between these three blocks, countries do not follow stringent rules. This accounts in the first place for the southeast European countries of Bulgaria and Romania.

In Bulgaria, the definition which archaeological culture already is Early Bronze Age has been consistently put backwards in time, so that a so-called *proto* Bronze Age (Vajsov 2002) now dates to around 3600 BC, several centuries earlier than the beginning in Turkey and Greece. Logically, graves of this *proto* Bronze Age, such as from Durankulak *(Fig. 2)*, have nothing to do with a European Early Bronze Age. A similar situation accounts for Romania, where however – to be fair – three differing concepts of when an Early Bronze Age begins are in circulation: the one with the earliest beginnings (Vulpe 2001) is modelled against Bulgaria and sees the start with Coţofeni, around 3300 BC (if not with Cernavodă III at *c*. 3600 BC); the second (Roman 1986; Ciugudean 1996) follows the Hungarian approach, itself having chosen a way in-between the Helladic and Central European systems and setting up the beginnings of the Early Bronze Age at around 2800 BC; a third terminological system, more restricted to western Romania, goes beyond that and only regards the mid of the millennium as a turn towards the Bronze Age (Gogâltan 2005). A sort of an independent way was realized in the countries of the former Soviet Union. Here, the terminological beginning of an Early Bronze Age is widely recognized with the Yamnaya, thus dating to shortly before 3000 BC.[1] This system is therefore close to the Aegean, even if there are of course no direct connections at this early date. As already mentioned, Hungary as a country in the Central Carpathian Basin is not only located geographically, but also termino-chronologically between the Aegean and the Central European systems with their own beginning of the Early Bronze Age at around 2800 BC. Whether this is also useful in terms of a structural/content-based definition will be explained in detail below. However, it needs to be said that Hungary – and partly so Romania – is thus the only country with such an early start in the Carpathian Basin. Further on, towards Central and northern and northwestern Europe, the beginnings of an Early Bronze Age are more levelled and homogenious with no country producing a significant earlier or later outlier. However, some larger European countries, such as Italy, France and Germany, are divided along an imaginary south–north axis so that the beginnings of the Early Bronze Age appears to be delayed by one/two centuries in the respective northern parts. This probably indeed reflects past realities. Interestingly, the only early

[1] The only exception, to my knowledge, is in the south of Russia, in the Caucasus foreland, where the Maykop culture of the mid-fourth millennium BC is also regarded as being Early Bronze Age.

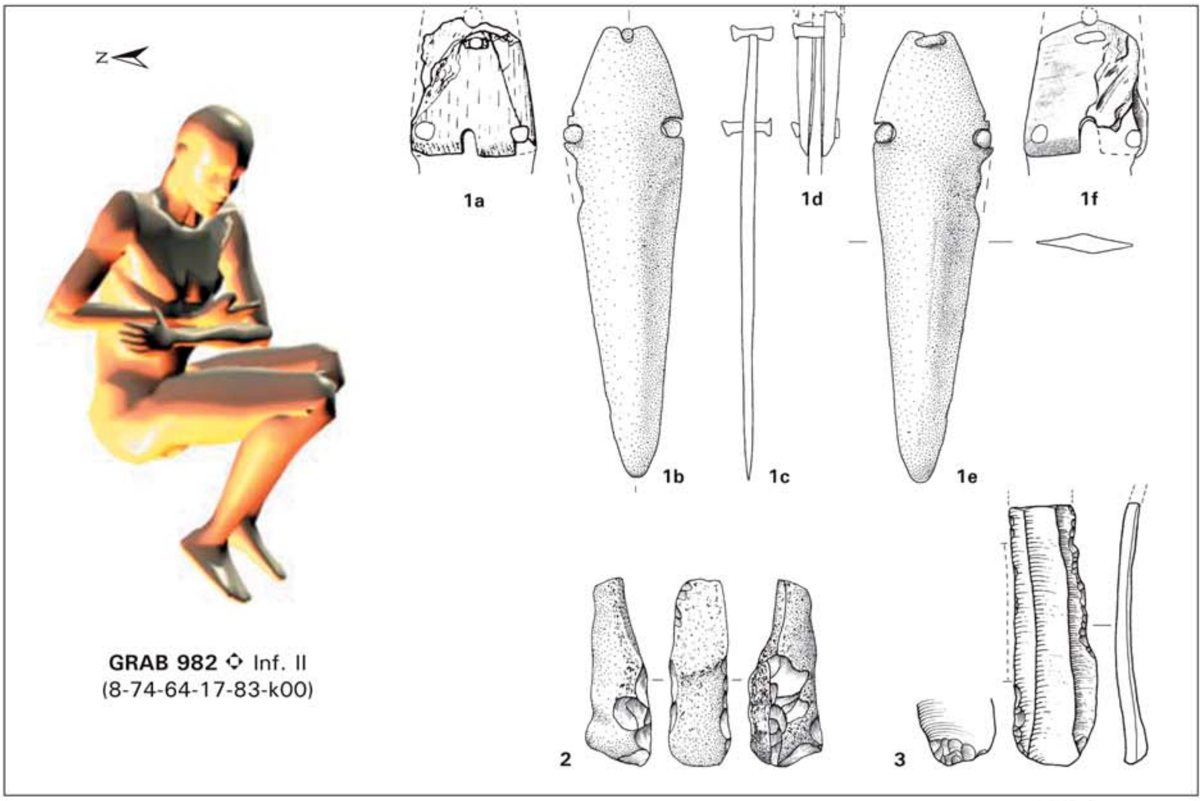

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*Fig. 2. Durankulak, Grave 982 as an example of the so-called proto Bronze Age in Bulgaria (*c*. mid-fourth millennium BC; after* VAJSOV *2002)*

"outlier" in northwestern Europe, Great Britain and Ireland, also appears realistic: Here exist indeed early tin-bronzes, extensive metalwork, some hoards and well furnished graves already before 2000 BC (e.g., NEEDHAM 2004). However, a few isolated tin-bronzes alone a Bronze Age do not make a Bronze Age; and exotic metals, heavy copper hoards and lavishly equipped graves already existed in the (classical) southeast European Copper Age (HEYD 2012). In this respect, a mid-fourth millennium BC *proto* Bronze Age does not exist, as does Yamnaya of around 3000 BC certainly not show Bronze Age features at all in southern Russia, the Ukraine and Moldova; and even the Early Helladic (EH) I of the Aegean is not demonstrating much societal and economic complexity one would expect for a true Early Bronze Age. All in all, and taking all country-based approaches together, the Bronze Age almost needs 2000 years to cross the Continent from one side to the other in order to establish itself: a very unlikely scenario, if not ridiculous!

So, if there is at all a period when one can speak about an Early Bronze Age which really deserves this term in the sense of a new level of social and economic complexity, of special artefacts and materials, of enhanced structures, consistency and continuity, then this can only be the period between around (2600–) 2500–2200 (–2000) BC. Let us therefore firstly have a brief overview about the cultural situation in Europe at around 2500 BC.

Europe at around 2500 BC

Europe at around 2500 BC can best be described as a chess board of archaeological entities in different cultural traditions. These traditions can easily be categorized into two blocks: on the one hand there are regionally dispersed archaeological cultures and groups, mostly defined by their respective pottery. These stretch geographically like a belt from the Balkans in the east, over the Carpathian Basin, Italy and France, including probably also parts of Spain and Portugal in the west. On the other hand there are the super-regional, expansionistic cultural phenomena, covering wide parts of the continent and connecting, through their respective social, economic, ideological and material packages, regions and landscapes that were previously culturally separated. During the first half of the third millennium BC, the most prominent of these phenomena is the Corded Ware complex. This seems to start at around 2850 BC (WŁODARCZAK 2009). With all its different regional groupings Corded Ware reaches from the Middle Volga in the east to the Rhine in the west, covering also much of Scandinavia. Its southern border follows a line from the western Alps, along the forelands of the eastern Carpathians, to the steppe/forest-steppe borderline deep in Russia. Just before 2500 BC, Corded Ware, Single Grave and Battle Axe, Rzucewo, Middle Dnieper and Fatyanovo-Balanovo cultures arrive at their peak of landscape occupation, domination and coherence. With the earlier (*c.* 3000 BC) but structurally related Yamnaya (Pit Grave culture) of the North Pontic steppe belt, also including regions west of the Black Sea (Lower Danube, Thrace and the eastern Carpathian Basin) in their distribution area for a few centuries, much of the Continent is covered. But by 2500 BC, the Yamnaya is already on the decline and is gradually transforming into the Katacombnaya (Catacomb Grave culture) while retreating to its North Pontic core zone (see below for more detail). Also, the regionally dispersed picture of different archaeological cultures and groups in the Balkans and the Carpathian Basin is due to the same process of incorporation into super-regional cultural phenomena, but a millennium before in form of the Cernavodă III-Boleráz and, from *c.* 3350 BC, the consecutive Baden-Coţofeni complex.[2] In the first half of the third millennium BC this system has already disintegrated, as was it transformed through interactions following the Yamnaya infiltration, and more regional aspects

[2] A contemporary process occurs north of the Carpathians and in Central Europe, from the Ukraine and north-eastern Romania to the Rhine, in the form of the expansion of the Globular Amphora culture. This culture is rightly regarded as one of the genetic and cultural bases of the following Corded Ware in the earlier third millennium BC.

prevail, particularly in pottery, so that by 2500 BC we see the currently up-do-date research situation of many cultures, groups and cultural aspects, such as Ezero B and Yunatsite IX-VIII in Bulgaria, Sitagroi Va/Dikili Tash IIIb in northern Greece, Glina III and Năeni-Schneckenberg in Romania, as well as the later Vučedol-Ljubljana complex in the southern Carpathian Basin and western Balkans, and Makó/ Kosihý-Čaka and Somogyvár in Hungary and Slovakia.

But Europe at 2500 BC would not be complete without two other cultural developments that are at that time on the brink of dominating the record in Europe for the next centuries: expanding from the west, the Iberian peninsula, it is the Bell Beaker phenomenon as the climax of these ideologically driven cultural phenomena; and from the southeast, namely the circum-Aegean region, the Early Bronze Age.

The period of the 'International Spirit' in the Aegean

Starting-point for all discussions of the Early Bronze Age is *Mesopotamia*. From the first centuries of the third millennium BC we see the development of new networks of exchange and trade, reaching its peak in the Sumerian Early Dynastic III and Akkadian periods. Its centre was in southern Mesopotamia, already urbanised since the fourth millennium BC und by then the most developed region world-wide. The political organisation behind at first consisted of more-or-less independent, rival city-states, out of which grew the hegemonial "empire foundation" of the Akkadian period at the close of the 24th century BC. Exchange and trade went far beyond its political and demographic centre and, inducing a network structure with regional nuclei, reach as far as Turkmenistan and Afghanistan in Central Asia, and also along the Arabian Peninsula and the Indian Ocean as far as the Harappa Culture of the Indus Valley and northwestern India. A new "Early Dynastic World-System", so to speak, develops (e.g., Matthews 2003). On its other, northwestern side, the Levantine-eastern Mediterranean and Anatolian regions, considered previously as being on the fringe of civilization ("gateway communities"), were now also integrated into this highly complex system of exchange and trade (Primas 2007, 6f.). Here early urban nuclei develop as well, subsequently forming further independent networks and developing their own peripheries. Last to be absorbed was the area around the Aegean of today's western Turkey and Greece, which was gradually incorporated into this system from *c.* 2750 BC, with fully developing a western nucleus of exchange and trade then in the third quarter of the millennium *(Fig. 3)*.

Four decades have passed since the discovery of the social, economic and technical achievements, and the results of wide-ranging communication, exchange and trade which appear as patterns in the archaeological record of these few centuries in which the Aegean (and particularly the Cyclades and south and Central Greece) was completely incorporated into this system. Colin Renfrew has described the situation very aptly with the term "International Sprit". Rightly, he sees in this concept the origin of a first European "civilisation" (Renfrew 1972). Since then many new discoveries have been made and insights gained, so that this very period of time – the Early Helladic-Cycladic-Minoan II and particularly its sub-period IIb – may be considered among the best investigated in European prehistory (e.g., Maran 1998; Wiencke 2000; Alram-Stern [Hrsg.] 2004 and many more). Without going into too great a detail, we may list as perhaps the most important advances: indications of a stratified society with many prestige and status objects of the elite, of urbanisation, a three-fold structured settlement system and population growth; quasi-monumental architecture and organised communal works; complex administration and standardised systems of measuring and weighting; economic specialisation and mass production such as wheel-made pottery; and of fair quantities of copper, gold and silver, among those the first tin-bronzes.

This period between *c.* 2500 and 2200 BC seems also to have been a period whose climate favoured agricultural production. Graeme Barker has given an overview of the situation on the basis of many specialised studies (2005, 57f.) and sees the presence of an incipient traditional Mediterranean type

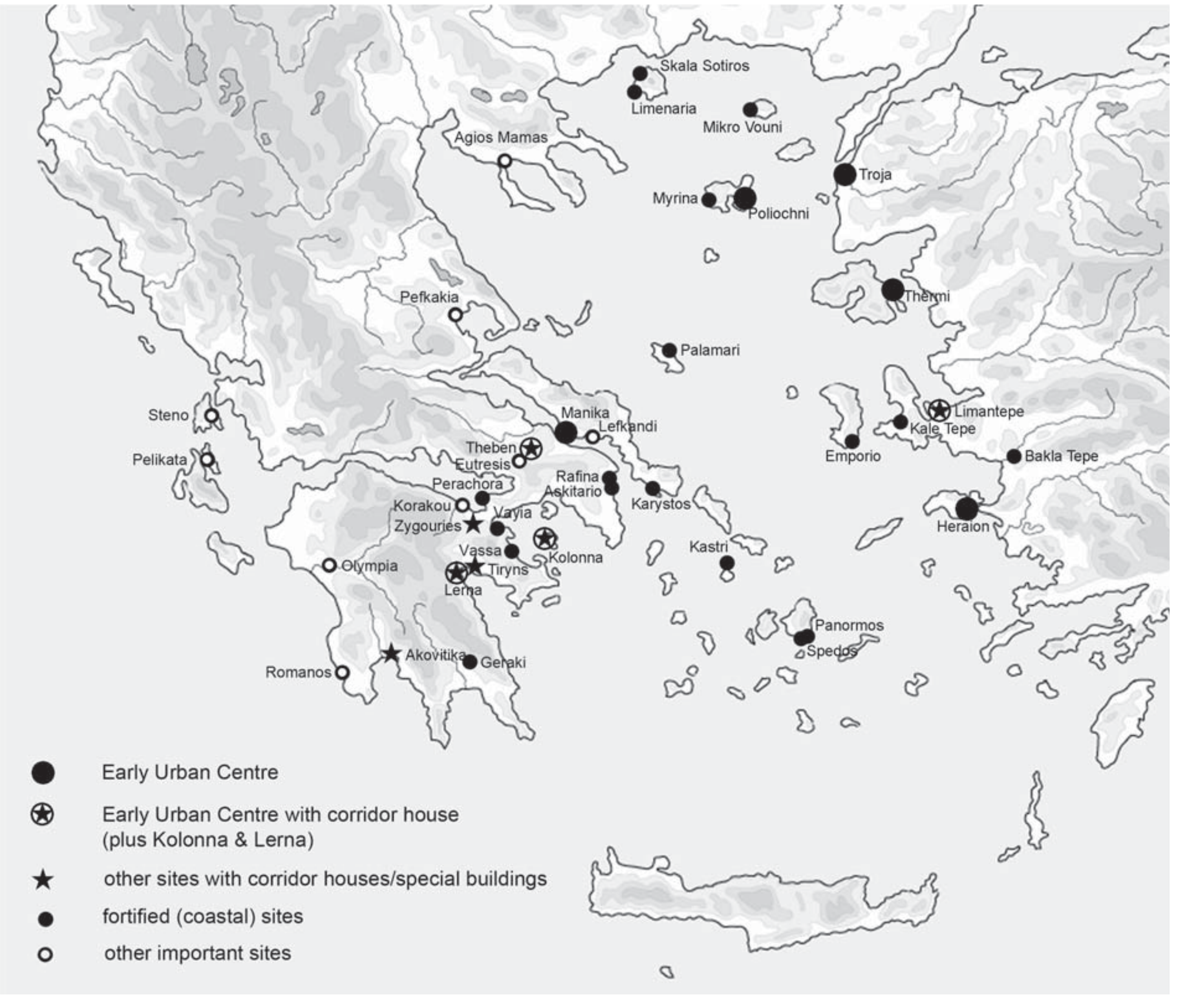

Fig. 3. The most important sites of the Early Bronze Age in the Aegean (drawing by author)

of landuse. This included Mediterranean *polyculture*, based on grain, wine and olive oil, the latter via connections with the Levant. A further form of "tree fruits" is represented by figs, with their high sugar content. The system is based, however, in mixed agriculture which was small-scale and intensive rather than large-scale and extensive. Together with the cultivation of a wide variety of grain crops, pulses and vegetables, there is an increase in domestic animals and a change in their death patterns, indicating the increased use of secondary animal products like wool, milk and cheese from the beginning of the third millennium BC. These products are certainly also the stimulus for the development of transhumance over short distances and of local summer pastures in the more mountainous regions. In addition, cattle or oxen were available as draught and ploughing animals for the cultivation of heavier soils, as well as donkeys for riding and as beasts of burden.[3] We still lack clearly dated finds to prove whether on the mainland the agro-technical innovation of terracing and thus alteration of the topography of the terrain was introduced. Heavy erosion and accumulation of sediment, securely dated to the second half of the third millennium BC, show the extent of soil cultivation at this time, but actually constitute evidence against the use of terracing.

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[3] The domesticated horse was, however, not yet available until the second millennium BC.

This favourable situation leads almost inevitably to a constant growth in population, which we are now able to trace archaeologically through many systematic surveys (e.g., Wright 2004). The overall population and population density probably reached levels in the third quarter of the third millennium BC which recur only in the Late Bronze Age. In southern and Central Greece we see this in the building and enlargement of new urban centres like Manika (*c.* 45 hectares), Thebes (*c.* 20 hectares), and many smaller, *c.* 1–4-hectare centres close to the coast. But at the same time this has the effect that large parts of the population, previously working in agriculture, abandon primary food production and move to crafts, manufacturing, trade and the service sector in the new centres. Subsistence and, to an increasing extent, some of peoples' wider basic needs. and everyday consumption are now covered by barter and trade. Autarchies are therefore lost and dependencies are created.

The determining factors in this trans-regional network are thus barter and trade; not only as external, "down-the-line" or long-distance trade, but also in the form of more small-scale domestic trade, for instance within communities sharing identical pottery traditions (Maran 1998; Broodbank 2000; Kilian-Dirlmeier 2005). This boom in trade becomes visible in the records firstly through exotic objects imported from distant worlds, such as a carnelian bead decorated with etched-in motifs in the recently discovered jewellery hoard at Kolonna on Aegina. This object, according to current knowledge, was possibly decorated in the Indus area (Pakistan), and could thus be one of the objects traded over the longest distance (Reinholdt 2008). Other key finds included the beams of jewellers' scales and standardized, partly marked stone weights, now known to be in use in the whole Aegean-Anatolian area and copying ultimately a Mesopotamian metronic system (Rahmstorf 2006). They attest to the particular significance of trade at this time, as do the manufactured goods made of metal (such as daggers, slotted spearheads, and gold/silver vessels), of other materials (such as the decorated bone tubes), and not the least the new international wheel-made pottery of the Lefkandi I-Kastri repertoire.

Even if it is difficult to prove this by archaeological means, grain and olive oil from surpluses, and preserved foodstuffs such as marine resources from the Aegean, almost certainly also had an important part to play in this short- and long-distance exchange. Consequently, maritime trade gains increased significance with these products which are profitable only in quantity, as compared with single high-value prestige items. This significance is supported by the proximity of the many newly emerging settlement sites to the coast, often located on sheltered bays, not only on both sides of the Aegean but also in the coastal zone of the northern Aegean, where the hinterland is in other respects very strongly tied to Balkan traditions. These sea-side settlements, particularly in southern Greece and the Aegean islands, soon become fortified centres in the Early Helladic IIb-period. Though they are not clearly distinguished from other, more inland settlements, we surely may assume that there are trading settlements used exclusively for the coastal navigation that was preferred at the time, and for international "down-the-line" trade. It remains to be seen whether this trade really only took place in the longships depicted on the Cycladic frying-pans (Broodbank 2000), or whether sailing boats were used, as known on the Nile probably from the fourth millennium BC onwards.

All these achievements and innovations, as well as the inclusion of this area as a further nucleus in the international network of exchange and trade with extensive contacts, naturally increased social complexity to an extent that had never before occurred in Europe, and was not to occur for a long time afterwards. Social hierarchies develop, a society with division of labour is established, systems of redistribution, social storage and for the exchange of prestige goods appear, and daily supplies are obtained through trade. The notion of territory, political control and even perhaps regional hegemony is born. Although this is not a check-list, it is clear that all these things are also signs of a "chiefdom" level of culture establishing itself over a wide area. Thus one may accept the assessment by Joseph Maran, who sees culture at this time as being "on the threshold of the birth of state structures" (Maran 1998, 443). Perhaps one can go so far as to accept that for a few hundred years this southeastern part of Europe took on the features of a developed culture, even if writing had not yet appeared, as far as we know. Even if one does not wish to go that far, there may be a consensus that between *c.* 2500 and 2200 BC around the Aegean, i.e. partly on European soil, we have a highly complex and dynamic system of communication and exchange which includes everything that we would imagine by the term "Early Bronze Age".

But this special system, and the world it was representing, was not a stable one. In the course of the 23rd century BC first Mesopotamia, then the Levant and Anatolia, and finally the Aegean region were experiencing some sort of progressing crisis (Maran 1998; 2007; Broodbank 2000). Finally, from around 2200 BC, most connections were broken and trade was cut off. Technologies such as wheel-made pottery and innovations such as measurement systems widely disappear. The times become unstable, settlements shrink in size and get eventually abandoned, demographic levels fall and there is a renewed concentration on primary agricultural production. People of foreign origin also take the opportunity of a serious weakening of the whole system to move in these disaster-struck regions. In the western Aegean this occurs in the Early Helladic III period, which lasts about two centuries, before the low point is reached after 2000 BC in the Middle Helladic.

New peripheries in the Balkans and southern Italy

At the time the Aegean was being incorporated as another core area in the international system of exchange and trade, neighbouring regions were also reacting, and peripheries advance further north and west, and entirely new ones come into being *(Fig. 4)*. In this process we recognize not only peripheries in the economic sense, as a hinterland with sources of raw materials and a market for finished goods, but also as regions in which an elite controlling the available resources participated in these developments, using them as a means to emblazon itself and trying to imitate them culturally and materially. At the same time new social and economic values, information and innovation, and also probably direct personal contact with people (mainly traders) from the core area, now reach regions which had never had access to such resources before. Thus new structures evolve and the level of social complexity rises generally, though it did not reach the level attained in the core. Thus the core area was not the only active place, and the peripheries were not the passive recipients, but rather the peripheries developed a dynamic and a life of their own. In such, however, each region reacted differently.

Three regions, now entirely within Europe, thus come into much closer contact and direct exchange with this Early Bronze Age Aegean network:

1. The eastern Balkans, with the hinterland of the northern Aegean, the European part of Turkey (Turkish Thrace) and Bulgaria, mainly south of the Balkan mountains;
2. The western Balkans, meaning large areas of former Yugoslavia and Albania, particularly the east Adriatic coastal area but also parts of the mountainous hinterland northwards as far as Slavonia and Syrmia (roughly the Sava valley); and finally also:
3. The southern Central Mediterranean area, particularly Sicily and Malta, but also Apulia.

It also seems that southern Spain and Portugal were reached, perhaps already as early as the second quarter of the third millennium BC, as a kind of fourth cultural periphery. This view has been suggested for a long time (Blance 1961), but has also provoked much critique over the decades (e.g., Chapman 1991) when scholars were generally more in favour of autochthonous developments. But the advance of complex fortified settlement sites, such as Los Millares (Almeria) and Zambujal (Torres Vedras, Portugal), and of a handful of even larger, so-called mega-villages like Valencina de la Conception and Marroquíes Bajos in southern Spain und Portugal are not easy to explain solely out of local evolution. Later publications (e.g., González Prats *et al.* 1994; Brandherm 1996; Mederos Martín 2000),

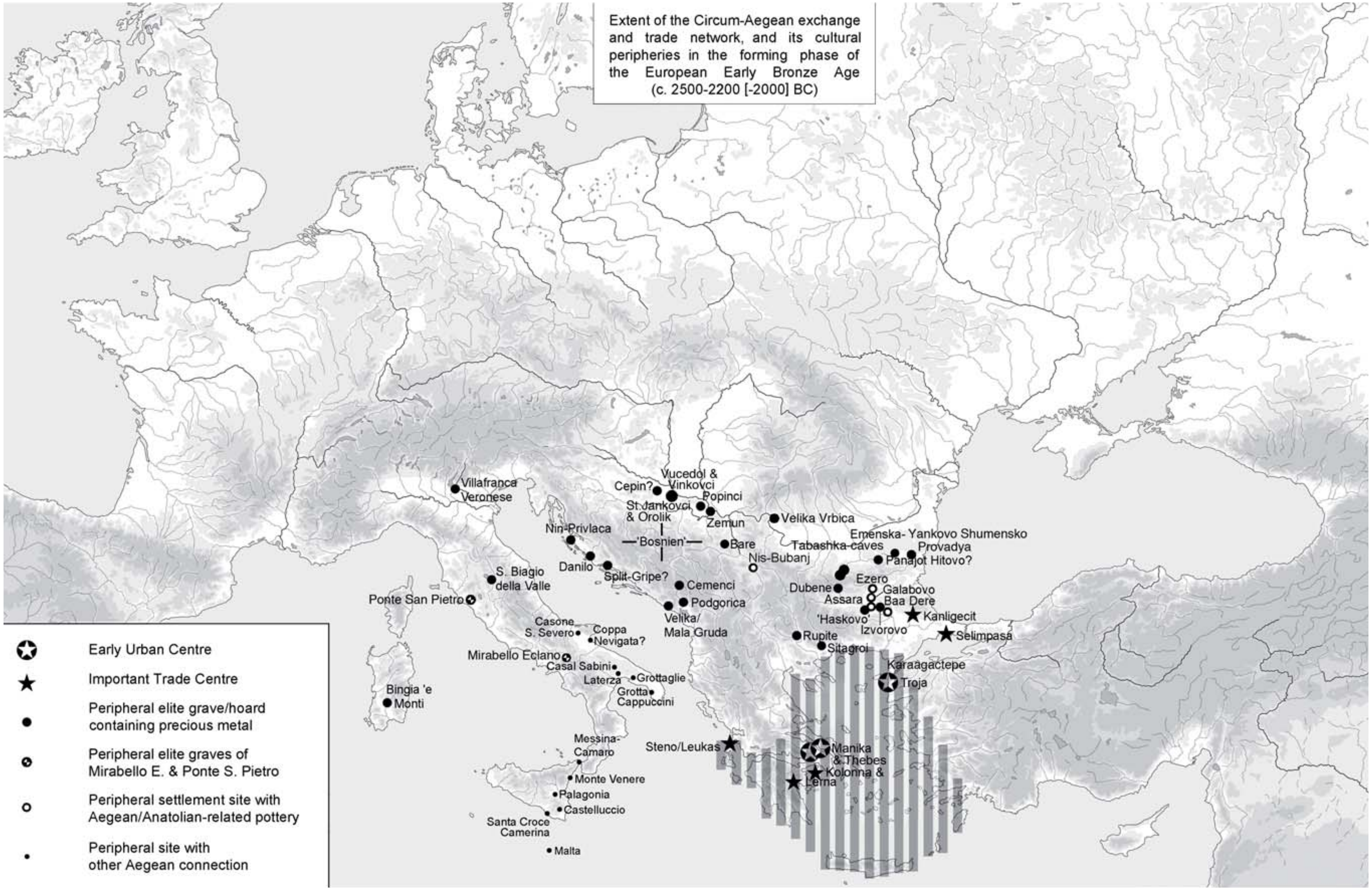

*Fig. 4. Map showing the extent of the circum-Aegean exchange and trade network and its cultural peripheries in the Balkans and Central Mediterranean in the formative phase of the Early Bronze Age (*c. *2500–2200 BC) (drawing by author)*

and the evidence presented therein, as well as an innovative research project on the exchange and use of ivory are now perhaps shedding new light on an early connection between the east and the very Mediterranean west (e.g., SCHUHMACHER – CARDOSO – BANERJEE 2009; SCHUHMACHER 2011). However, it is intriguingly not the Aegean that seems to be the starting point for these contacts, but tentatively rather the eastern Mediterranean Levantine region of modern-day Syria, Lebanon and Israel. The Iberian situation shall therefore not be discussed here in this context of the Aegean connections. It is nevertheless fair to mention that southern Iberia indeed displays some traits as discussed below for the Balkans and Italy that very well fit in this context of an emerging Early Bronze Age.

1. The eastern Balkans

The greatest progress in terms of new sites, artefacts and a better understanding about third millennium BC prehistoric archaeology has been made in this region *(Fig. 5)*. The Yamnaya groups in the steppes west of the Black Sea were still the dominant cultural element in the first half of the third millennium BC, but after the middle of the millennium there is a clear cultural shift towards the southeast and south. In this, the Helladic element is only weakly present, while many finds of northeastern Aegean and Anatolian provenance show the origin of this cultural current. One key site is Kanlıgeçit (Kırklareli province) in inland Turkish Thrace (ÖZDOĞAN – PARZINGER 2012); another key site will surely become the Selimpaşa Höyük (Istanbul), a coastal site 50 km west of the Bosporus entry at Istanbul's city centre (HEYD – AYDINGÜN – GÜLDOĞAN 2010).

Considerable parts of the Kanlıgeçit citadel have been excavated since the 1990s. The results are spectacular: Not only is there a fortified citadel with an impressive stratigraphy, encircled by a dry-stone glacis and mud-brick wall, a kind of tower or gatehouse with ashlar masonry and, inside, several large megaron houses with

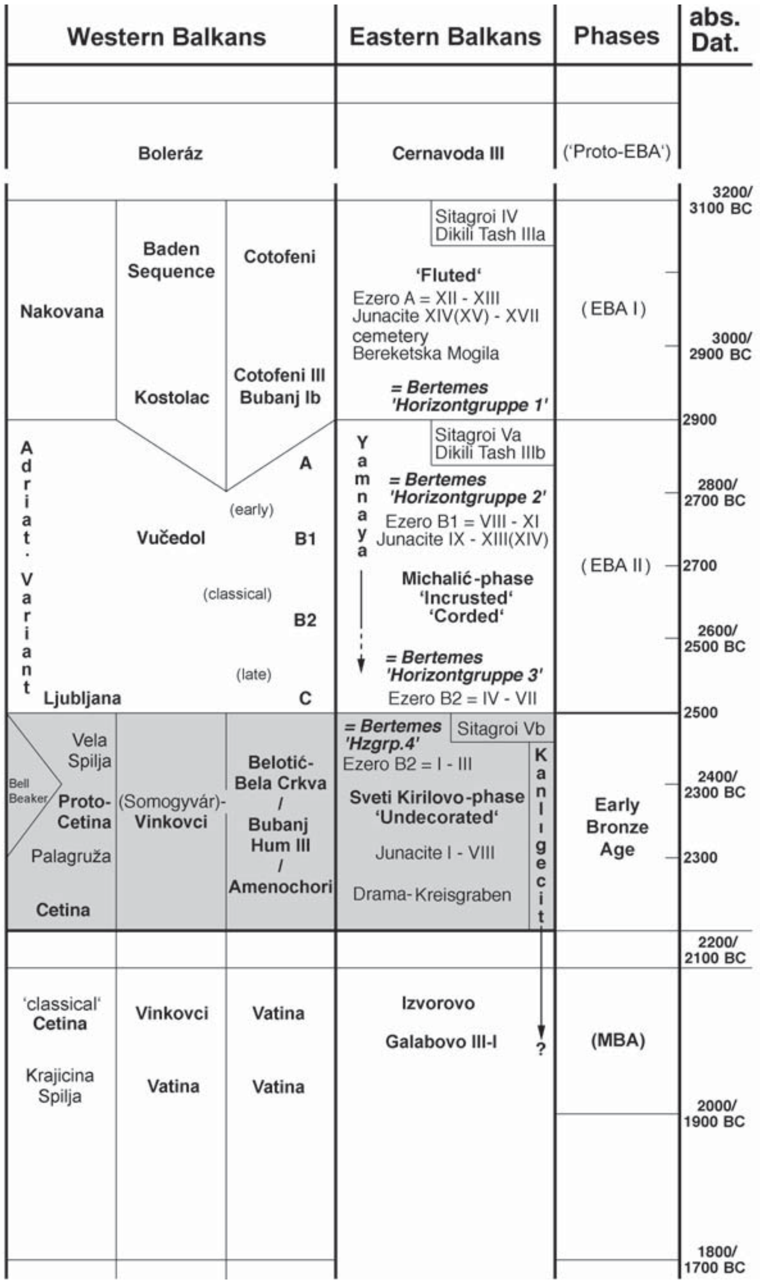

Fig. 5. Chronological correlation of archaeological cultures, groups and key site stratigraphic layers for the Balkans in the third millennium BC (drawing by author)

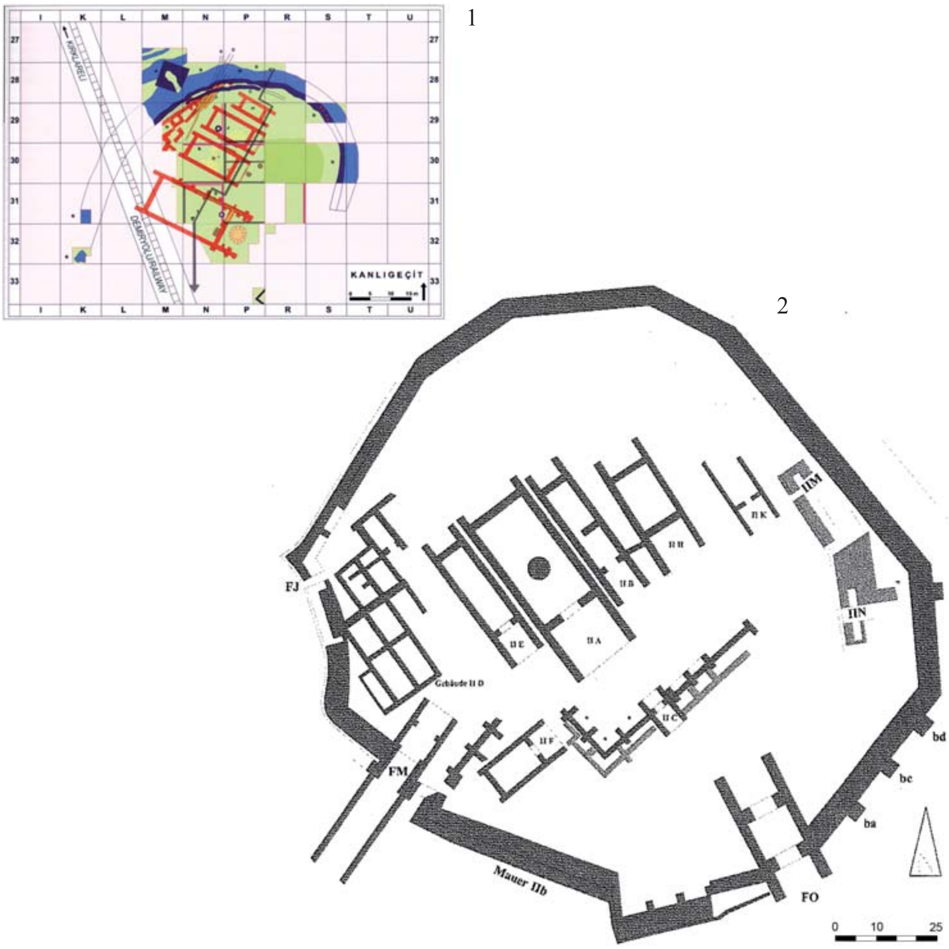

Fig. 6. Comparing Kanlıgeçit, phase 2b (1) with Troy IIc1–c3 (2). Note that both graphs are north up and show the same scale (after Özdoğan – Parzinger *2012, Abb. 37 and* Ünlüsoy *2011)*

encircling temenoi walls and buttresses in the manner of Troy II–III *(Fig. 6)*, and to a lesser degree of Küllüoba (Eskişehir province: e.g., Efe 2007), but in addition an external settlement of several hectares surrounds this centre. A high proportion of so-called Anatolian red slip-ware, wheel-made pottery and elements of the international Lefkandi I-Kastri ceramic repertoire, along with typically Anatolian clay idols (Karul 2005) and signs of a specialised economy (evidence for domesticated horses; many spindle whorls; potential exploitation of copper deposits in the nearby Strandža mountains) provide more evidence of an Anatolian trading colony in this part of Europe than of a local elite trying to copy the achievements of the south.

Kanlıgeçit is so far the only excavated example of this Anatolian ideal in Europe. Under suspicion as being a second site is the settlement of Mikhalich-Baa Dere (oblast Haskovo) at the southern foreland of the Sakar Mountains only a stone's throw away from the modern Bulgarian-Turkish border. From here features are published that look very similar to the basic design of Kanlıgeçit, like the presence of both a citadel and an extended outer settlement, as well as stone foundation and mudbrick architecture for the fortress rampart (Stefanova 2000; 2004a). However, we have evidence for more of such Anatolian red slip-ware and/or wheel-made imported pottery, not only from Mikhalich-Baa Dere, but also from the local, partly fortified late Ezero culture settlements of Assara (Haskov; Leshtakov 2003), Gălăbovo (Stara Zagora; which seems to continue till the next chronological watershed of 2200 to *c.* 2000 BC: Leshtakov 2002) and from Tell Ezero (Stara Zagora) itself. To top this, we also know of local imitations

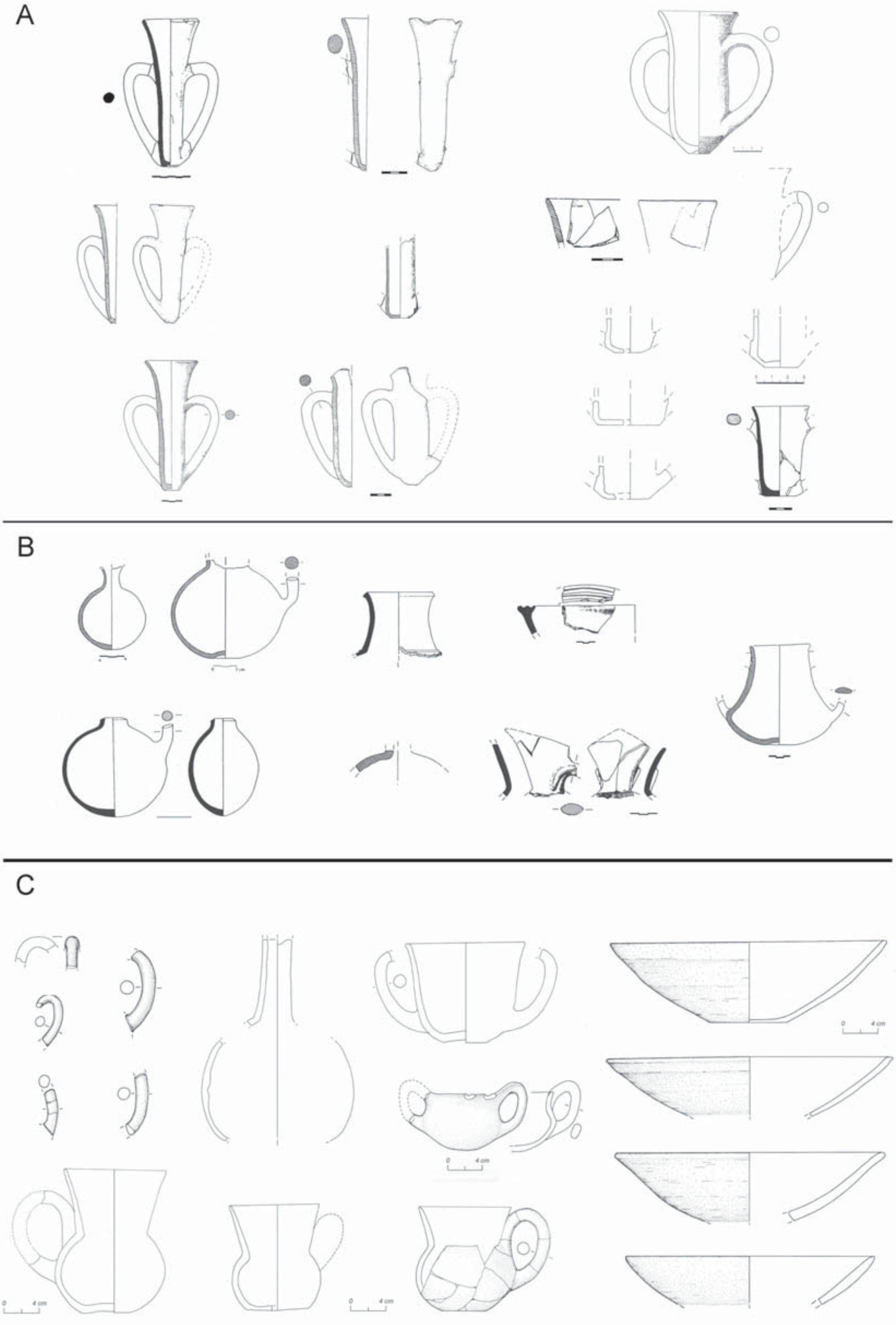

Fig. 7. Turkish Thrace and Bulgaria: Elements of the Lefkandi I-Kastri pottery repertoire, other later third millennium BC pottery imports, and potential imitations – A: depas *cups and their imitations from Mikhalich-Baa Dere, Assara and Gŭlŭbovo (after* S*TEFANOVA* *2004b;* L*ESHTAKOV* *2006); B: other wheel-made pottery from Gălăbovo (after* L*ESHTAKOV* *2006); C: examples of "international" Early Bronze Age pottery from Kanlıgeçit (after* Ö*ZDOĞAN* *–* P*ARZINGER* *2012)*

of the Lefkandi I-Kastri ceramic repertoire (STEFANOVA 2004b; RAHMSTORF 2006) *(Fig. 7)*. Additional pottery evidence, as yet unpublished, from Altan Tepe, Cherna Gora and Mudrets (LESHTAKOV 2002) demonstrates that we must be dealing with extensive networks of exchange in the upper Thracian plain of Bulgaria (LESHTAKOV 2006) in this local so-called Early Bronze Age 3 period. From adjacent Turkish Thrace, the already mentioned coastal Marmara Sea site of Selimpaşa Höyük has also delivered wheel-made Trojan plates and pithoi fragments, and red-slip sherds are known as stray finds from the Kınalı Köprü site west of Silivri (Istanbul), not far away from Selimpaşa. Finally, depata and other international fabrics are also attested from earlier excavations at the Karaagaçtepe (DEMANGEL 1926) site near the European side of the Dardanelles, showing its importance, besides the Bosporus, in transmitting these novelties.

Fig. 8. Bulgaria – the fenestrated copper/bronze axe from the so-called Haskovo treasure (after AVRAMOVA – TODORIEVA 2005)

The presence of settlers, and potential traders, from Anatolia and the persistent cultural current from the southeast clearly cause a dramatic increase in the social complexity of this zone. We see this in the graves of local leaders and elites, their ritual sites and buried hoards; they adorn themselves with jewellery of gold and silver, new metal fittings for clothing, and equip themselves with weapons of a foreign type, such as the exotic fenestrated bronze(?) axe from Haskovo *(Fig. 8)*, the only of its kind in Europe, new alloys and vessels made of precious metals. The evidences from a looted tumulus at Rupite (Blagoevgrad; *Fig. 9*) in the southwest Bulgarian Struma valley (LESHTAKOV 2011), from tumuli and attached ritual features at Dăbene (Plovdiv; HRISTOV 2005; 2007; 2011), *c.* 20,000 (!) golden artefacts, most of them small rings but also a golden (ritual) dagger *(Fig. 10A)*, in the northwest and looted grave(s) or hoard(s) near Haskovo in the southeast of the Thracian Plain (AVRAMOVA – TODORIEVA 2005), and also from another tumulus at Izvorovo (Haskovo; BORISLAVOV 2010) in the southern Sakar mountains *(Fig. 11)* show this dramatically. But it is certainly only the tip of the iceberg. For with the recently discovered gold and/or silver hoards[4] from Provadiya (Varna), Yankovo Shumensko (Shumen), Panayot Hitovo (Tărgovishte; FOL – LICHARDUS – NIKOLOV [Hrsg.] 2004), plus the previously excavated treasures from the cave sites of Emenska Peshtera (Lovech; NIKOLOVA – ANGELOVA 1961) and Tabashka Peshtera (Lovech; HRISTOV 2000), we have indications that this trend succeeded in spreading to the regions north and northeast of the Balkan mountains, if only delayed by one or two centuries.

Intriguing are the four further aspects which highlight the close links:

1) Silver: Modern-day Bulgaria is rich in gold, but has only a few silver sources and it seems none of these has been exploited in the Copper and Bronze Ages. However, many of the lavish graves, ritual and treasure finds mentioned above yielded artefacts made of silver. Among them are some magnificent objects, each weighting more than 100 grams, such as the lunula-like (neck?) jewellery from Panayot Hitovo and the Emenska and Tabahska caves, or the bracelets from Rupite. This situation makes it

4 Krassimir Leshtakov, Sofia, made me aware of some of these new finds, and also explained the circumstances of their discovery and further backgrounds to me. I am grateful for his support.

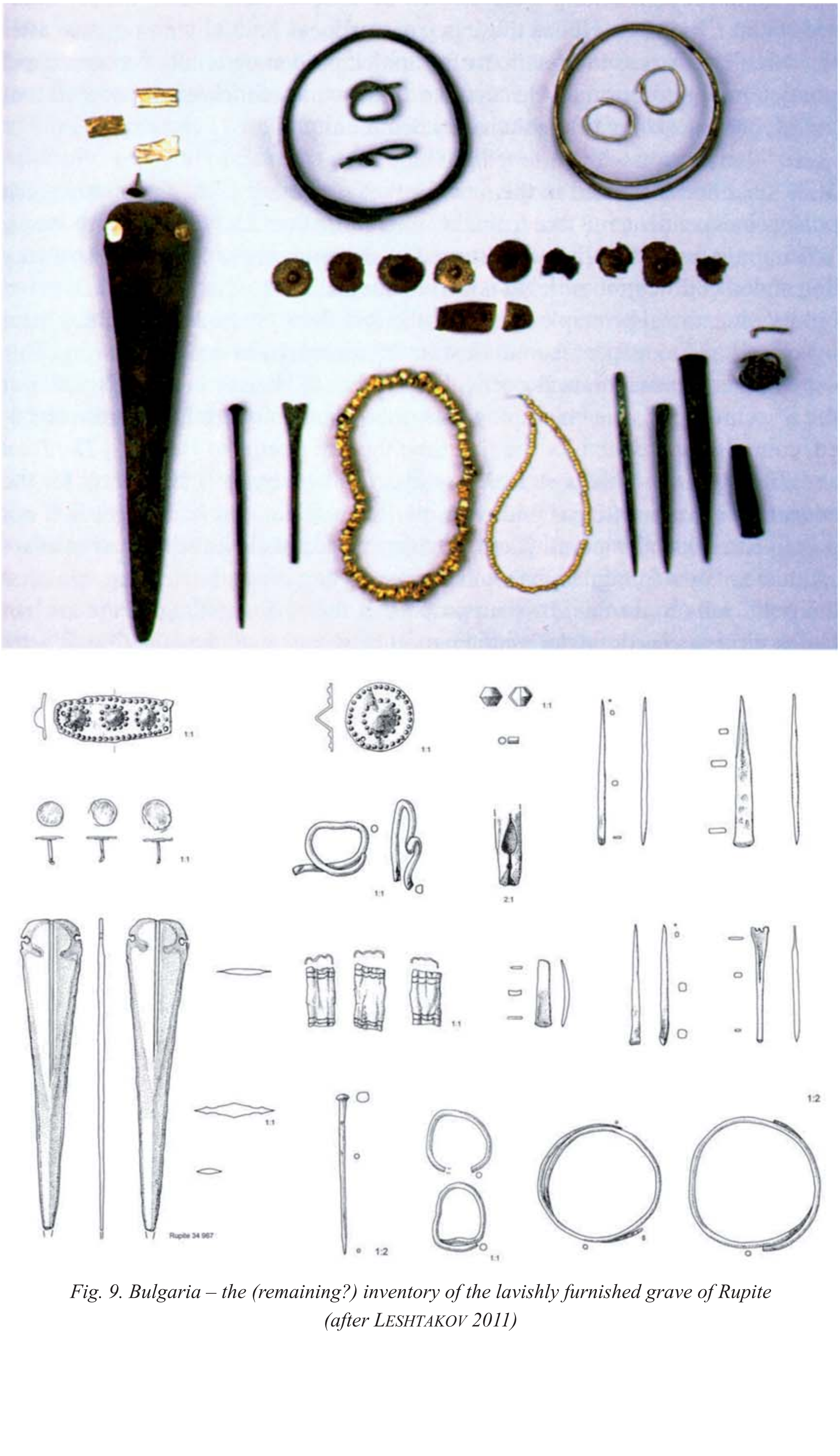

Fig. 9. Bulgaria – the (remaining?) inventory of the lavishly furnished grave of Rupite (after Leshtakov 2011)

A

B

Fig. 10. The two golden daggers of third millennium BC Europe – A: Dăbene, Bulgaria (after H*RISTOV 2007); B: Mala Gruda, Montenegro (after* P*RIMAS 1996)*

obvious that all silver was imported, in all likeliness from Anatolia, or the Aegean, where silver was continuously in use from the fourth millennium BC.

2) Early tin-bronzes: Only a tiny fraction of copper/bronze artefacts are analysed. However even so, some have come out as being true, intentionally alloyed, tin-bronzes *(Fig. 12A)*. These comprise various objects, from pins (such as from Golyamata Mogila, grave 19; and from Mudrets), a bracelet (Mikhalich), a bowed band of unknown function from Kanlıgeçit, a miniature cup from Ovcharitsa 2 (3.56% of tin), to chisels and axes (LESHTAKOV 2006). The daggers from Rupite and Haskovo are also suspected, as it is not unlikely that the fenestrated axe from Haskovo also consists of tin-bronze. All these objects without doubt demonstrate the close exchange connections between Anatolia and the Aegean on the one side and southeastern Europe on the other.

3) Dress pins: Mentioned already as objects frequently made of tin-bronze, dress pin are a group of artefacts that suddenly appear in Bulgarian sites from *c.* 2500 BC. Good examples come from the category of sites which are anyway in suspicion to be Anatolian colonies or emporia, or those showing the closest affinities: Kanlıgeçit, Mikhalich-Baa Dere, Assara, Gălăbovo, Mudrets and the burial context of Rupite *(Fig. 12B)*. Most of these pins are clear copies of those found in Anatolia, such as in Troy or Küllüoba (e.g., EFE – FIDAN 2006), or to put it in another way, both represent the same typological family. Beyond this common background, one must also assume that along these pins probably came a new dress code, new dressing customs and, not unlikely as shown by the many spindle-whorls from Kanlıgeçit, a dressing material not completely new but now of better quality and wider availability: wool.

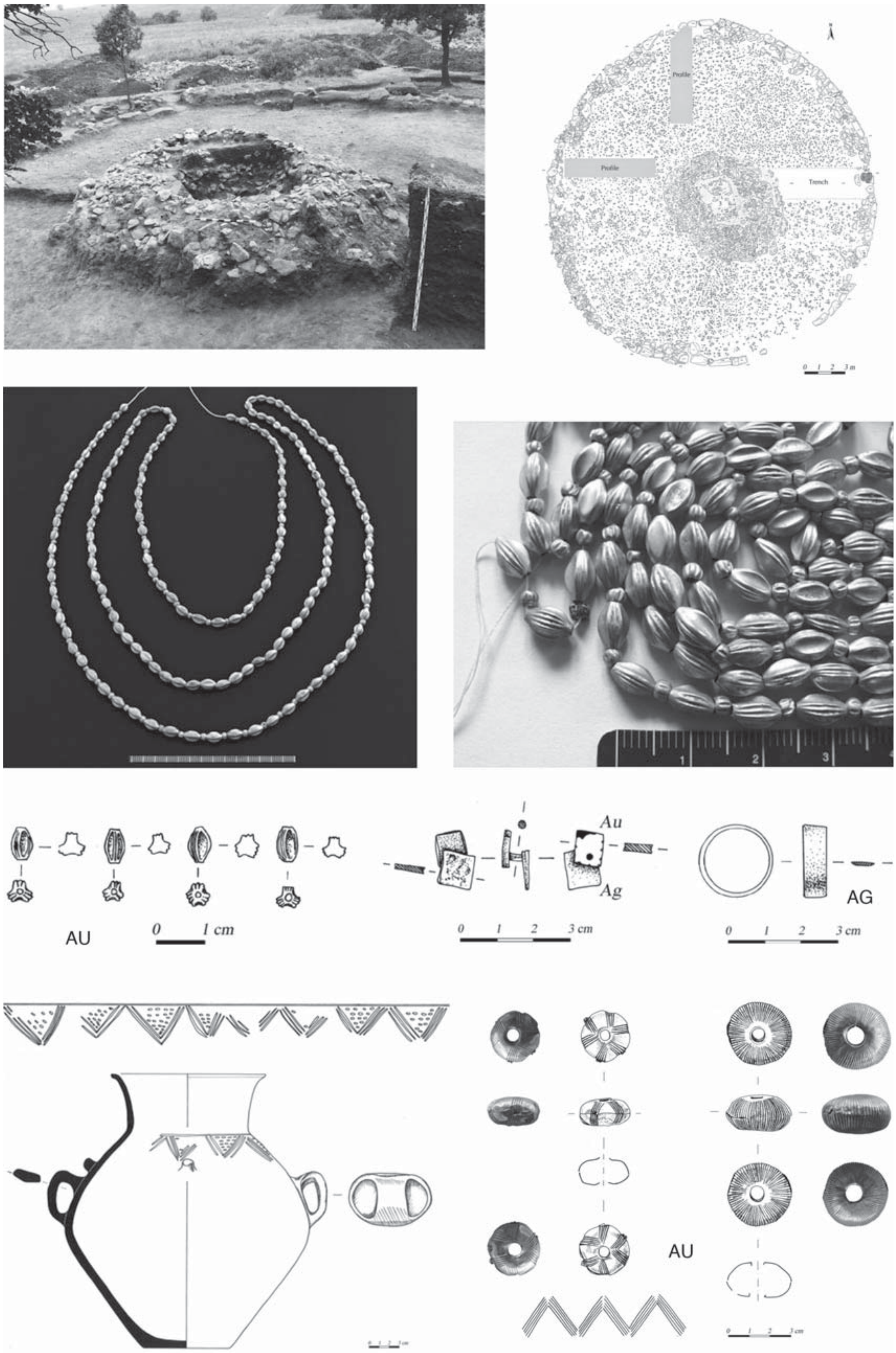

Fig. 11. Bulgaria – burial features and parts of the inventory of the lavishly furnished grave of Izvorovo (after BORISLAVOV *2010)*

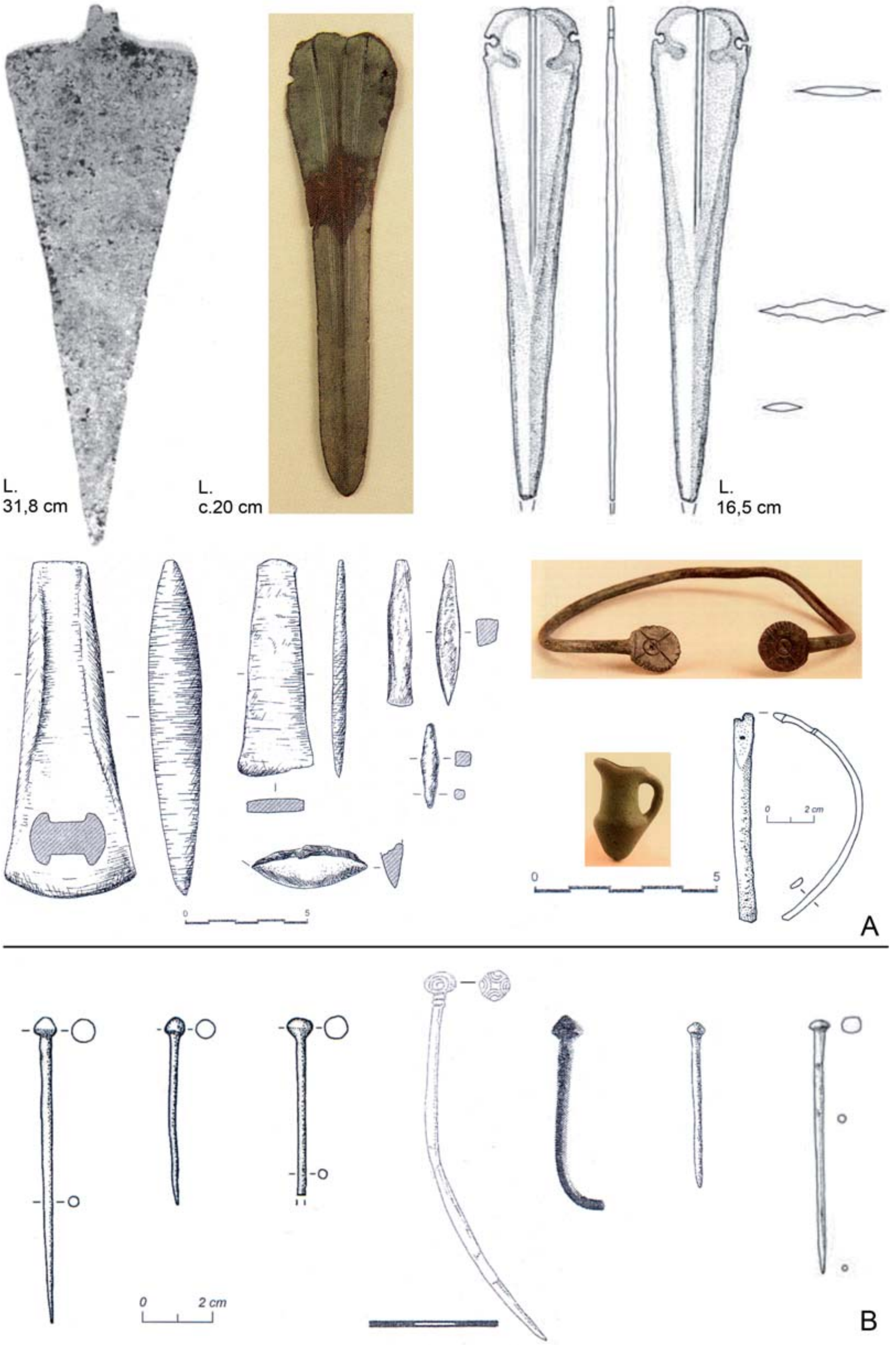

Fig. 12. Turkish Thrace and Bulgaria – A: early tin-bronzes (after Avramova – Todorieva 2005; Fol – Lichardus – Nikolov [Hrsg.] 2004; Leshtakov 2006; 2011; Özdoğan – Parzinger 2012; the daggers have to be seen with a question mark due to missing detailed analyses) and B: metal dress pins (after Özdoğan – Parzinger 2012; Stefanova 2000; Leshtakov 2003; 2006; 2011; note that most, if not all, pins do also consist of tin-bronze)

4) Torcs: Stefan Alexandrov has recently (2011) published several newly surfaced golden torcs. These come form the sites of Novae-Svishkov (Veliko Tărnovo), Veliko Tărnovo, Shumen-Eldaz Tabiya, Bogdanovo near Dobrich, Anchialo/Pomorie near Burgas, as well as one of an unknown provenance. To add is firstly another torc of unknown provenance in Bulgaria, included in the Sofian ARES collection (Fol – Lichardus – Nikolov [Hrsg.] 2004), and secondly the fantastic Svishkov treasure, discovered last year (2012). It yielded, in a pottery vessel, at least six golden torcs and other golden and bronze objects. Its likely date is around 2000 BC and probably many of the other torcs in this list are also dating to the time slot of *c.* 2200–1900 BC, a date when most torcs become widespread and indeed iconic in Early Bronze Age continental Europe. However, it is the material that matters here, and gold and silver torcs are an absolute rarity in wider Europe. It is only at the Levantine coast, and in Anatolia and Greece where they are widely known, such as the examples from Ikiztepe, Eskiyapar, Troy, Poliochni, Antiparos, etc.

Thus we have more than a local effect; rather, it is the widespread realisation of a "chiefdom" system based on prestige goods. Nevertheless local terminology speaks nonsensically of the second half of the fourth and the first half of the third millennium BC as an "Early Bronze Age" – however, one should recognise a structurally defined "Early Bronze Age" only in relation to this local Early Bronze Age 3, i.e. roughly the second half of the third millennium BC. This is justified through the application of the "chiefdom" system concept, but also by the advanced economic matters, the segmented system of settlement behind it and the many innovations of the time. Anything else makes no sense in a trans-regional context, and particularly in comparison with the circum-Aegean regions and Anatolia.

2. The western Balkans

As with the eastern Balkans, in the third millennium we see in wide areas of the western Balkans the appearance of larger and more varied gold and silver objects, more prestige goods and exotic finds. We also see elites, the way they represented themselves in graves, hoards and hierarchically structured settlement sites and settlement systems. However, there are clear differences in the structures themselves and particularly in their dating. For if this increase in complexity in Bulgaria and Turkish Thrace occurred there suddenly with the local Early Bronze Age 3, and therefore after *c.* 2500 BC, then we are here dealing with a development of this kind at a period as early as 2750 BC or even earlier (Maran 1998; Harrison – Heyd 2007; Primas 2007, 9f.). This is shown by the well-known graves of Mala and Velika Gruda (Primas 1996), of Danilo-Tumul Ivankovaca (Govedarica 1989) in Croatia and of Podgorica-Tološi, Gruda Boljevića (Baković – Govedarica 2009) in Montenegro[5] *(Fig. 13)*, a Bosnian axe hoard of unknown provenance with axes of an exotic silver/copper alloy (Born – Hansen 2001), as well as the hierarchically structured settlement of Vučedol *(Fig. 14)* und similar sites along the Danube and Sava rivers in Croatia and Serbia.

The Vučedol site is of particular interest: It is estimated to have housed a living population of 1100–1500 inhabitants (Forenbaher 1994), thus making it with certain a regional centre and generally one of the largest third millennium BC settlements outside the Aegean, even if the calculation by Stašo Forenbaher seems set somewhat too high for a site of *c.* 3 hectares. The site also shows a clear stratification, not only in form of the ordinary settlement versus the acropolis-like elevation called Gradac, and the metallurgical evidences from there, but also due to the discovered houses. Normal houses at Vučedol are rectangular and 5.6–6.3 m wide and 7.3–8.3 m long. The main building on the Gradac measures 15.5×9.5 m and is perhaps double-storied, or has a roof-floor, thus showing at least the triple surface size of all ordinary houses.

[5] These are already regarded as being Early Bronze Age by Baković – Govedarica (2009, passim).

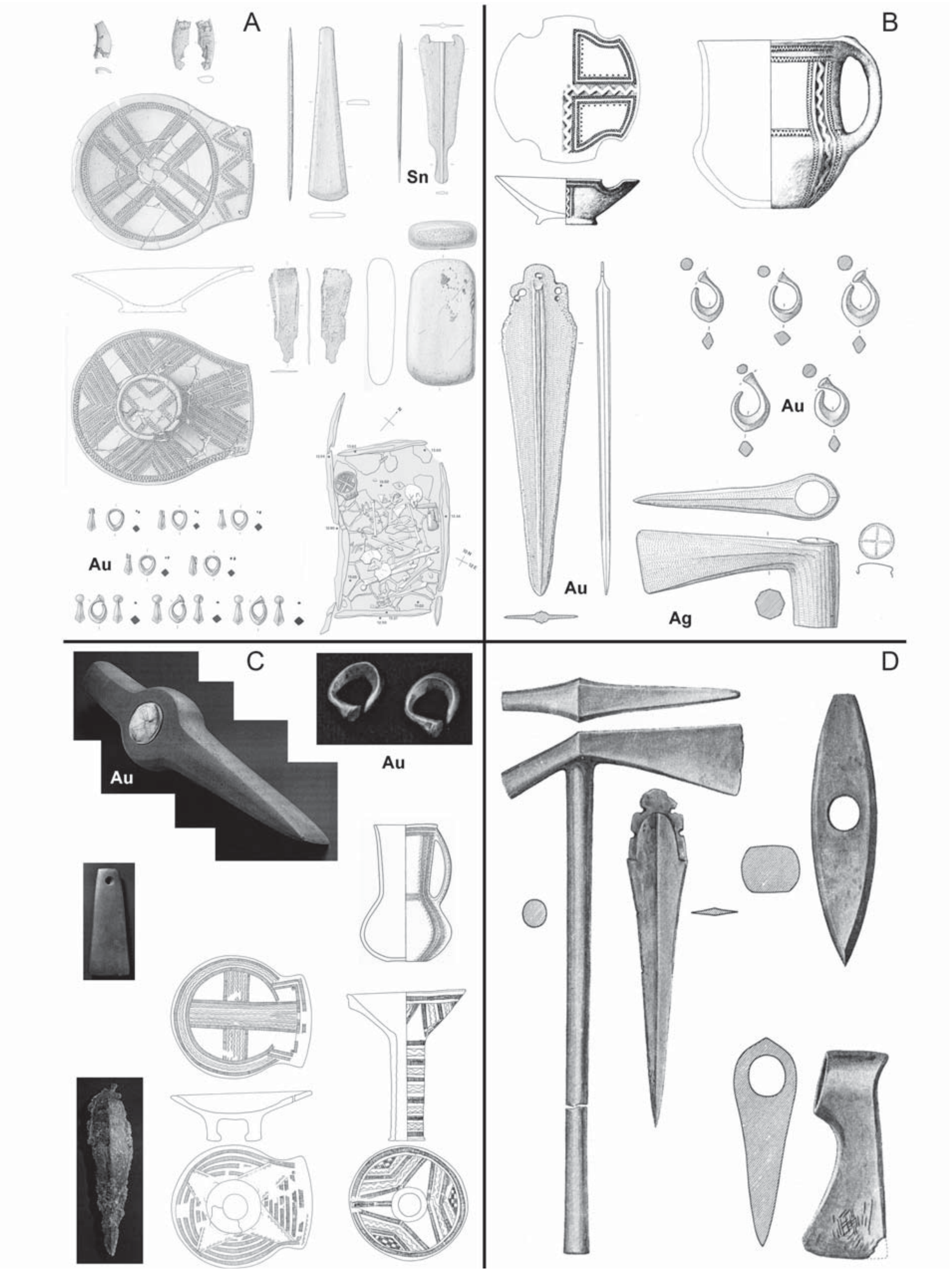

Fig. 13. Former Yugoslavia: lavishly furnished graves belonging to the first half of the third millennium BC – A: Velika Gruda; B: Mala Gruda; C: Podgorica-Tološi ("Boljevića Gruda"); D: Danilo-Tumul Ivankovaca (after HARRISON – HEYD *2007, Fig. 48)*

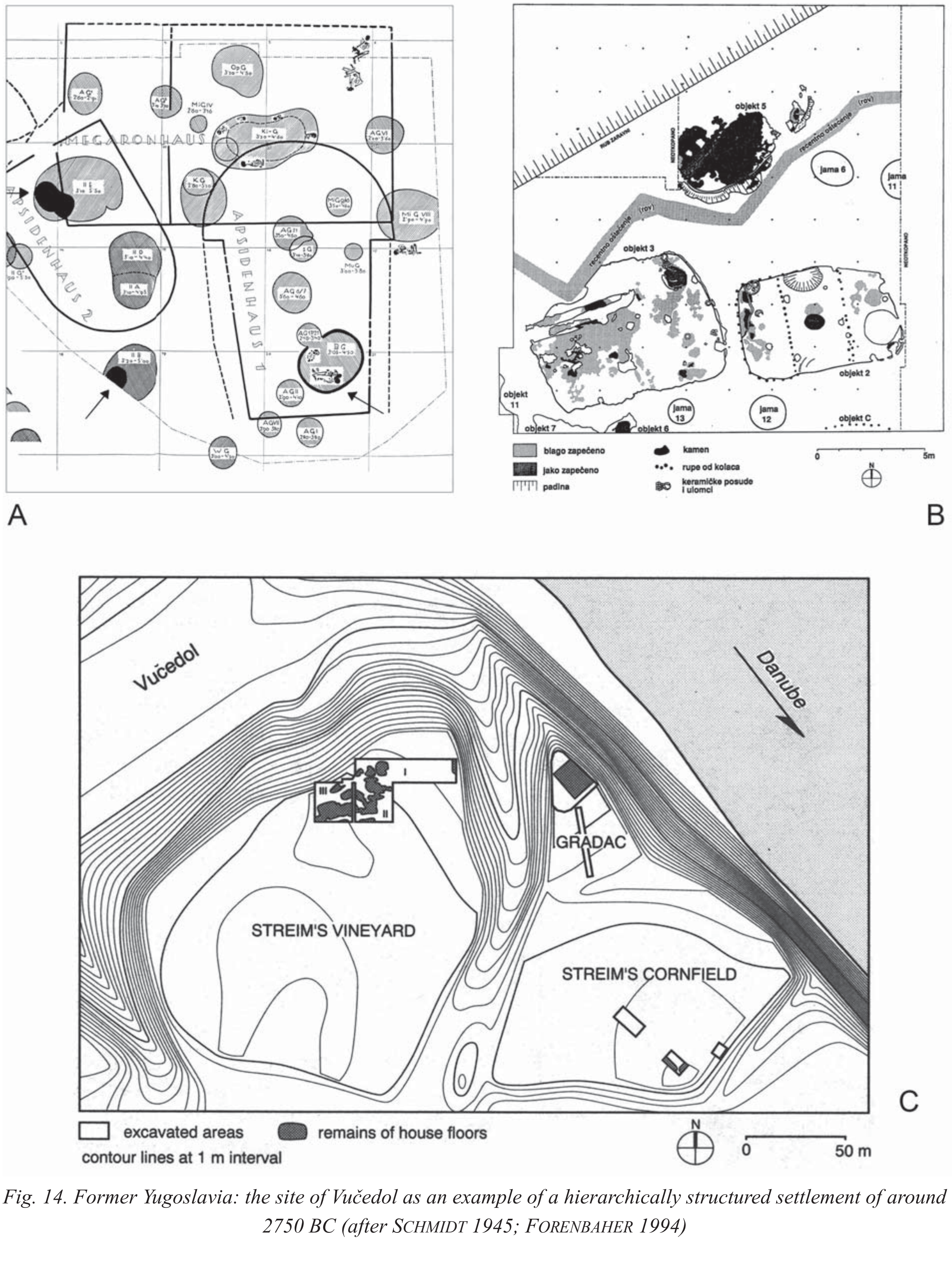

Fig. 14. Former Yugoslavia: the site of Vučedol as an example of a hierarchically structured settlement of around 2750 BC (after SCHMIDT *1945;* FORENBAHER *1994)*

Further on, the gold dagger weighing 108.8 g from Mala Gruda (cf. *Fig. 10B*), axes made from supposedly exotic silver/copper alloys, a knife of tin bronze with 7.3% tin content from Velika Gruda, and a polished rectangular-shaped object with intriguingly almost exactly the same weight as an Aegean/Near Eastern *Mina* standard[6] are all evidence of very early exchange connections in the eastern Mediterranean area. In this one cannot overlook the coastal location of many important sites and their direct access to the Adriatic. This makes them an ideal hub for links further up the Adriatic coast and its many islands, as well as over to southeastern Italy only some 80 kilometers away at its nearest spot. Clearly in this early exchange and trade connection the roughly contemporary Early Helladic cemetery of Steno on the Ionian island of Levkas is of great importance (Kilian-Dirlmeier 2005; Maran 2007; Primas 2007, 9).

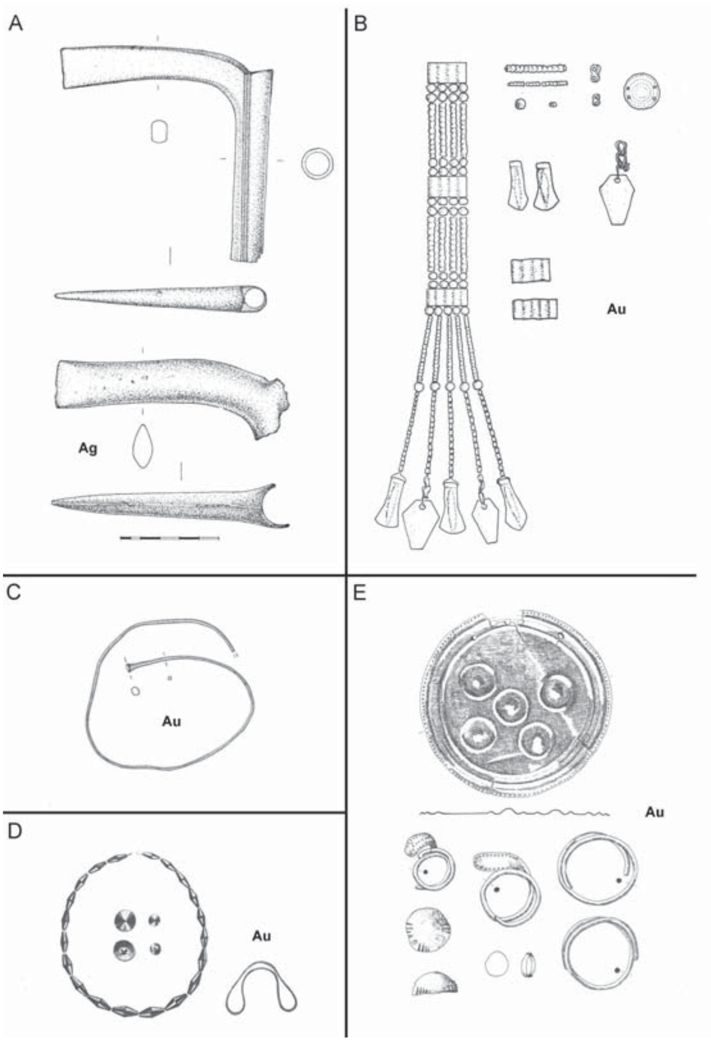

Fig. 15. Former Yugoslavia: "heavier" gold and silver finds belonging to the second half of the third millennium BC – A: Stari Jankovci, Croatia; B: Bare, Serbia; C: Cemenci, Montenegro; D: Nin-Privlaka, Croatia; E: Orolik, Croatia (after Balen – Mihelić 2003; Srejović 1976; Della Casa 1996; Glogović 2003; Majnarić-Pandzić 1975)

This connection between the Aegean/east Mediterranean and local elites who took part in this system and possibly also controlled it, remains in place during the second half of the third millennium BC, even if the cultural background of the western Balkan area changes markedly. The previously dominant Vučedol complex, using mainly incrustation as pottery ornamentation, falls apart, as do its several variants, shortly after the middle of the millennium, and more regional groups appear – like Vinkovci in Slavonia and Syrmia, Bubanj Hum III and Armenochóri in eastern Serbia and Macedonia, Belotić-Bela Crkva in Central Serbia and Cetina along the Adriatic coast (Maran 1998). The factor connecting them is now largely undecorated pottery, and the dominance of cups and jugs, plates and bowls. The same development may be observed at this time in Bulgaria. However, rich finds of silver and gold from probable and attested graves and hoards clearly demonstrate continuity *(Fig. 15)*:

– the inventory of gold jewellery from a probable burial mound in Nin-Privlaka in Dalmatia (Glogović 2003);

[6] I thank Lorenz Rahmstorf, Mainz, for this information which is also published in the meanwhile: Rahmstorf 2010, 685, footnote 13.

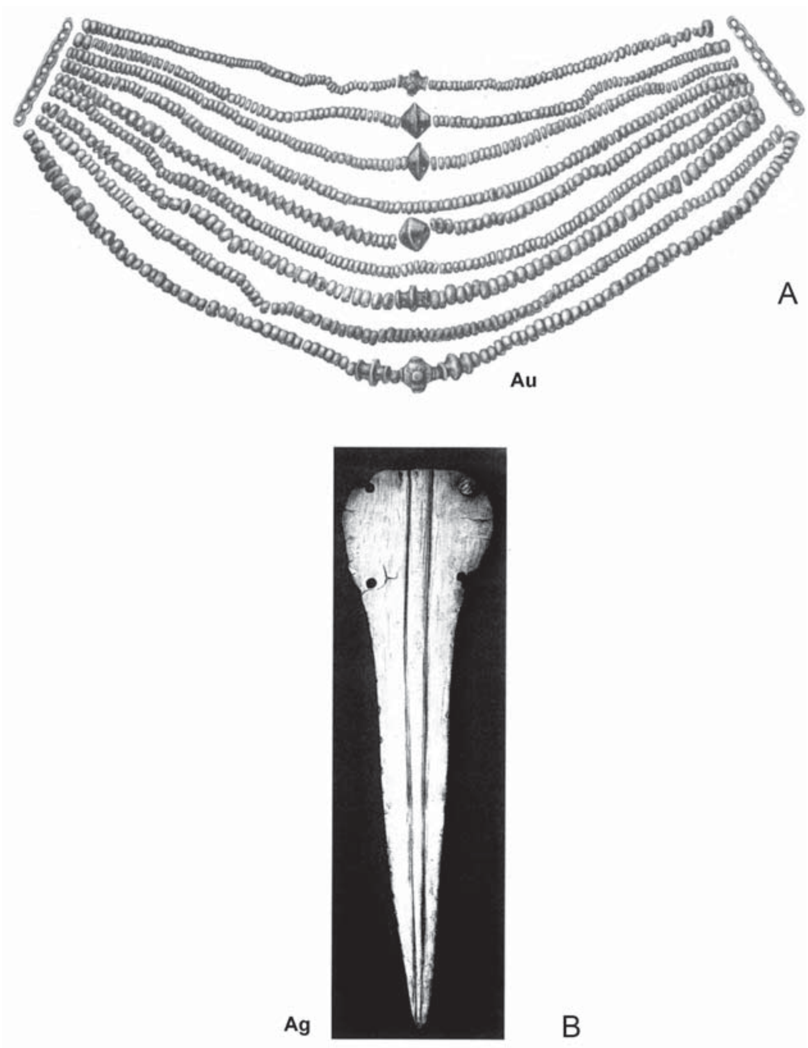

Fig. 16. A: Gold compound necklace from Velika Vrbica (Serbia), now in the Serbian National Museum Belgrade (after Čović [ed.] 1983); B: Silver dagger of unknown provenance, now in the Hungarian National Museum Budapest (after Foulon [dir.] 2001)

– the two axes of cupellated silver (*c.* 300 g), probably of Aegean origin, found along with rich gold jewellery which got lost, at Stari Jankovci (Balen – Mihelić 2003; 2007);
– the gold jewellery from the mound of Bare near Rekovac with its obvious Aegean links (Srejović 1976);
– the treasure of Orolik (Majnarić-Pandzić 1975; 75.56 g of gold in total);
– a grave with gold diadem (39.95 g) from Zemun-Šljunkara (Vranić 1991); and
– the tumulus site of Cemenci from where a gold bracelet is named (Della Casa 1996); however, in the context of the numerous golden torcs mentioned above from Bulgaria it is rather to be regarded as a fragment of another torc.

Also worth mentioning in this context is an unprovenanced riveted silver dagger with prominent midrib (Foulon [dir.] 2001) in the National Museum, Budapest *(Fig. 16B)*. This old 19th century find could very well be from a region of the former Austro-Hungarian Empire. Croatia and Serbia would be prime candidates on the basis of the connection described above. This long list might even be expanded to include a second early find, the famous gold necklace from Velika Vrbica (Kladovo; Bor) in eastern Serbia *(Fig. 16A)*. This compound necklace, in the inventory of the National Museum in Belgrade since at least 1855, comprises almost one thousand golden beads and has so far unanimously been dated to the later Early Bronze Age and/or transition to the Middle Bronze Age, thus well after 2000 BC (Čović [ed.] 1983, 522, 527, t. 76. 9, 13). However the best comparisons for the golden chain spacers and the central bi-conical beads are indeed from the Troy treasures, from Poliochni and now from the Dăbene site. Moreover, golden beads of the common form in the necklace are also well attested from Anatolia, the Aegean and now Bulgaria. This seriously questions the conventional dating, particularly when taking into account the unsecure circumstances, whether hoard or destroyed grave, and the missing contextual information of this find. Thus, the additional golden lunular pendants, supposed to belong to the find and instrumental in dating it, are more than unclear to really belong to the same context.

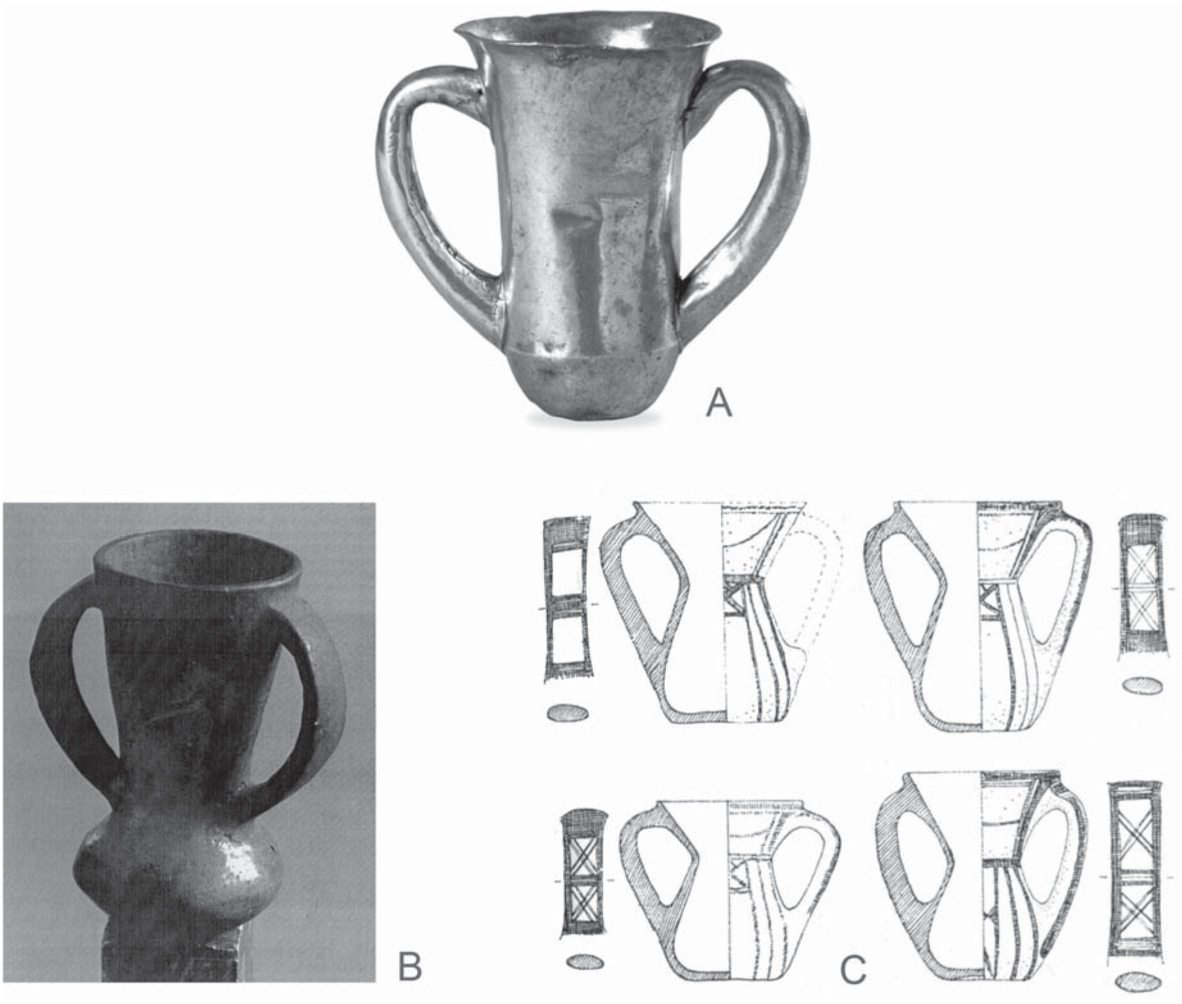

Fig. 17. Potential imitations of depas *cups from (B) Niš-Bubanj/Novo Selo (Serbia) and (C) Santa Croce Camarina (Castelluccio culture, Sicily) compared with (A) a silver* depas *of unknown provenance but likely of Anatolian/Aegean origin, now in the British Museum (after* Stojić – Jocić *2006;* Tusa *1983; http://www.britishmuseum.org)*

Chronologically rather doubtful, still, are the finds of Popinci (gold jewellery), Split-Gripe (the gold jewellery of the treasure, which may not belong to the Early Copper Age hammer axes) and the uncertain find of Čepin (Balen – Mihelić 2007). The same applies to some hoards with golden hair/temple or ear rings from the south of the Carpathian Basin, summarized by Bernhard Hänsel and Petra Weihermann in two publications (Hänsel – Weihermann 2000; Weihermann 2001) and attributed to the Early and Middle Bronze Age. At least some might also belong to this time slot of 2500 to 2200 BC, particularly for its later half when developments towards complexity all over accelerate (see also below in the section concerning the connection with the Carpathian Basin).

As far as we know, settlements from this time no longer demonstrate the strict hierarchical divisions found at Vučedol. But this might be a lack of proper field investigation. Nevertheless, alongside regionalisation there seem to be the beginnings of local centralisation processes, as the large Tržnica tell settlement in the town centre of Vinkovci shows (Dimitrijević 1982; Gogâltan 2005; Kalafatić 2006). To top this, the important gold/silver finds of Stari Jankovci and Orolik are only a few kilometres away, as is the earlier site of Vučedol. Thus local "concentration" is a keyword to be applied here. In addition, a second connecting axis to the Aegean area, via the river systems of the Serbian Morava and

Vardar-Axios also seems to become significant at this time, though this does not emerge clearly from the record. But a vessel from Niš-Bubanj/Novo Selo (Stojić – Jocić 2006) shows that it is of importance, however; the form of this vessel *(Fig. 17B)* can only be understood if one is familiar with Aegean wheel-made drinking vessels, and their silver imitations (or are these the original?), of the *depas* form.

Overall, we note a development between the Adriatic, Sava/Danube and Vardar-Axios similar to the one in the eastern Balkans, in which a "chiefdom" system based on prestige goods came into being. Exchange and down-the-line trade, particularly along the Ionian and Adriatic coast, are of prime importance, and it is obvious that the recently discovered Early Bronze Age shipwreck of Kefalonia (Cevoli 2006) gives us the clue as to the main means of transport for this connection. Local terminology rightly sees in the cultural changes of the second half of the third millennium BC the beginnings of the Early Bronze Age in this region. This can also be proven structurally; as is the case later in many other regions of Europe (see below), cultural regionalisation, the rather small areas in which cultural identity was established, and the abandoning of decoration on pottery, must be among the fundamental criteria of such a definition. The fact that this occurred in the Vinkovci area together with aspects of centralisation, elite graves and hoards of precious metal, proves the argument is watertight. A second important role in this is played by the Cetina group of Dalmatia (Della Casa 1995): Budding off from the dissolving Adriatic variant of the Vučedol complex, and at the same time incorporating elements the Bell Beaker phenomenon (also see below), early Cetina apparently had a quite different social agenda, as shown on the one hand by the conspicuous absence of prestige goods and, on the other, its drive to expand. For not only do we come across Cetina finds on the other side of the Adriatic in Italy, probably from the 24th century onwards, but also to the south in Albania and then in the Peloponnese, where Cetina finds have a particular role in the transition from Early Helladic II to III (around *c.* 2200 BC) (Maran 1998; Nicolis 2005).

3. The southern Central Mediterranean area

The third European region having direct exchange links with this Early Bronze Age Aegean network is southern mainland Italy and Sicily, along with Malta. Here, too, knowledge about Early Bronze Age connections with the Aegean is nothing radically new. In fact, there is a long tradition in Italian prehistory highlighting these earliest Italo-Aegean contacts (e.g., Cazzella 2003; Palio 2004; La Rosa 2005; Maran 2007; Cazzella – Pace – Recchia 2007; cazzella – cultraro – Recchia 2010; Ingravallo – Tiberi – Lonoce 2010; Recchia 2010). But unlike the situation in the Balkans described above, the social background seems predominantly different: We find far less prestige goods made of precious metal, nor do we have such a direct evidence of local elites, in contrast to those in the Balkans who left a distinct portrait of themselves through their graves, hoards and settlements. This is partly because of local traditions, particularly burial ritual: In the centre and south of Italy there are mostly collective graves in natural and artificial grottos and caves, and therefore the individual, and its previous social and economic position, is certainly not displayed in the same ostentatious way. There are, nevertheless, a handful of outstanding burials dated to already the first half of the third millennium BC and belonging to the various regional Copper Age contexts of Gaudo, Rinaldone and Remedello. These comprise burials from Mirabella Eclano (tomba del capo tribù; Campania), Ponte San Pietro (tomba della Vedova; Lazio), San Biagio della Valle (Umbria) and Villafranca Veronese (Veneto).[7] There are, however, no similar exceptional graves and burials belonging to the 2nd half of the millennium.

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7 Salzani 2007; I do not regard the Villafranca Veronese grave as a Bell Beaker burial, would however date it to the last one/two centuries before the introduction of the first beakers in northern Italy.

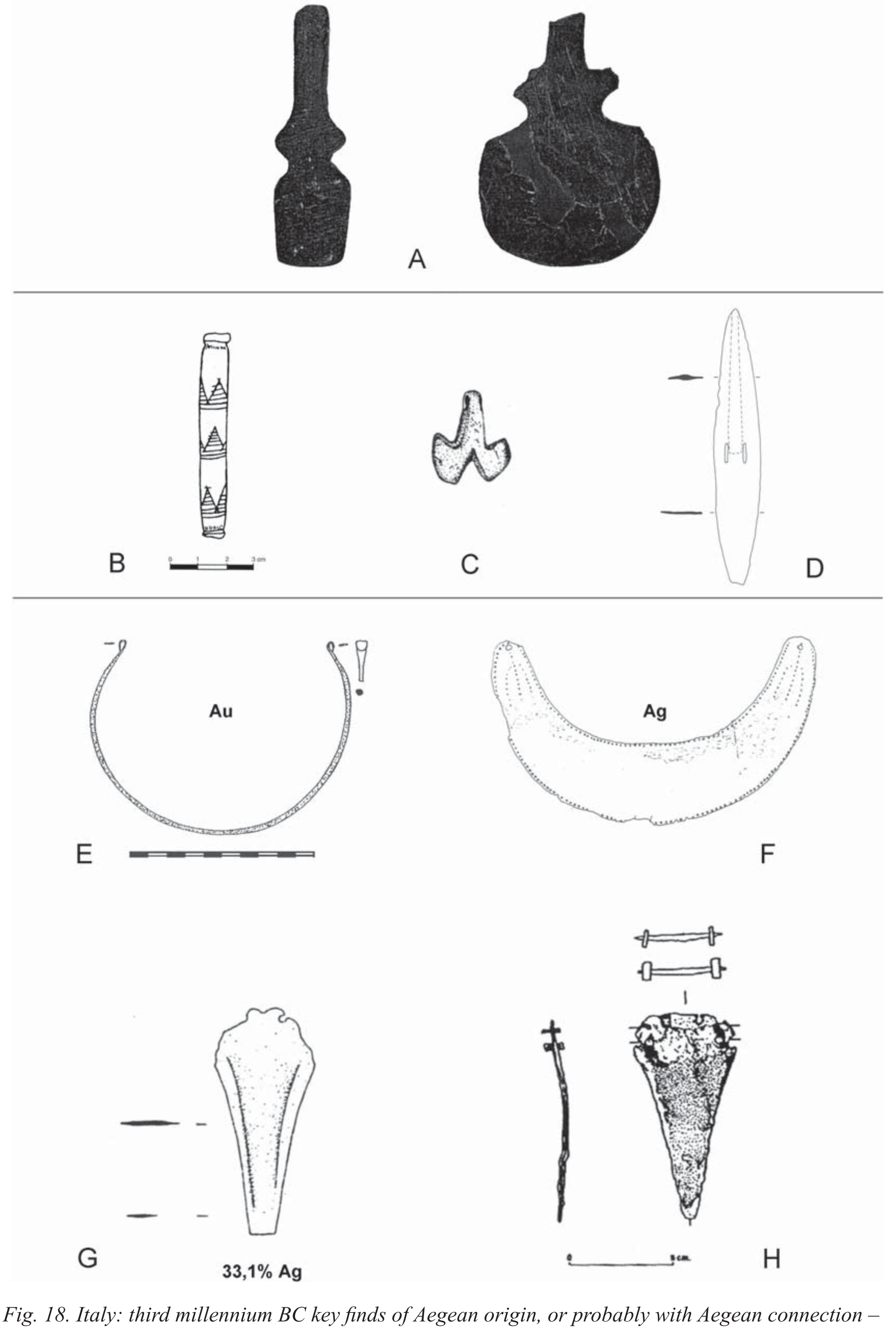

Fig. 18. Italy: third millennium BC key finds of Aegean origin, or probably with Aegean connection – A: Camaro; B: Casone San Severo; C: Grotta Cappuccini; D: Monte Venere; E: Bingia `e Monti; F: Villafranca Veronese; G: San Biagio della Valle; H: Palagonia (after Bacci 1997; Cazzella 2003; Ingravallo 2002; Leighton 1999; Atzeni 1998; Salzani 2007; De Angelis 1996; Albanese Procelli 2003)

In addition there is the problem of relative and absolute chronology, also affecting the accurate dating of these graves, still causing difficulty today (MARAN 1998, 364f.; 2007). This is also true of the settlement sites. Although the beginnings of fortified settlements near the coast, like Coppa Nevigata in Apulia, seem to reach back into the final third millennium BC, as shown by the Cetina sherds found in it (RECCHIA 2010), we have no other reliable comparison between sites. Thus in the case of many of the relevant small finds made of metal, bone, stone and clay, described below, the exact chronological point cannot always be fixed beyond doubt, especially as some of the most important artefacts have no evident context *(Fig. 18)*.

If we nevertheless try to proceed chronologically, then amongst the earliest finds showing Aegean connections are two stone "violin figurines" found in 1991 and 1996/7 at a Piano Conte site in Camaro outside Messina in Sicily. It is in no way accidental that there are burials at the same site, which interestingly include an adult burial covered with the sherds of a large pithos (BACCI 1997). This may confirm a funeral context for the figurines. There are no others of this kind in Sicily or the entire Central Mediterranean area, and indeed the best parallels are found in the Aegean area, where one would place them roughly in the first half of the third millennium BC.[8]

A second watershed from 2500 till about 2200 BC, i.e. the peak Early Helladic IIb period, gives probably the chronological background of more finds. To here belong:

- the small decorated bone tube which was found as a single find in Casone San Severo in northern Apulia (CAZZELLA 2003), with excellent parallels in the necropolis of Steno in Levkas (grave R4), mentioned above;
- the small anchor-shaped amulet made of shell, possibly *Spondylus*, found in the Grotta Cappuccini in southern Apulia (INGRAVALLO 2002), with clear connections to the Aegeo-Balkanic clay anchors; specimens of such clay anchors are also known from Corfu, Albania and Malta;
- the find of an Aegeo-Anatolian slotted spearhead with haft tongue from Monte Venere near Taormina in Sicily (LEIGHTON 1999); again an isolated find, for which reason a date to the Early Helladic III-period, i.e. after *c.* 2200 BC, is also possible;
- a few copper sheet objects, with a shape varying between elongated rectangular and oval, with two rivets next to each other on one of the short sides (SKEATES 2005), of a kind known from several Italian graves of this period (e.g., from the "Cavità dei Sassi Neri", Grosseto; Laterza, grave 3, Taranto; Grotta Cappuccini, Lecce), and corresponding best with the "spatulae/scrapers" of Steno and several Cycladic graves, particularly in Chalandriani (HEKMAN 2003; KILIAN-DIRLMEIER 2005);
- furthermore, a neck-ring made of single round-sectioned gold wire from a Bell Beaker context from Bingia `e Monti in Sardinia (ATZENI 1998, fig. 8); the best (roughly) contemporary parallels for such neck-rings, or torcs, made of precious metal come from Anatolian, Greek (compare in particular again the graveyard of Steno and the graves R4 and R15b with their silver torc-like artefacts), now Bulgarian and probably Dalmatian (Cemenci, see above) sites; and finally,
- various silver finds, among them the two most important graves with silver grave-goods *(Fig. 19)* from the middle and second half of the third millennium BC from Villafranca Veronese in the Veneto (a lunula, 28 cm wide, reportedly with 99% silver content; SALZANI 2007) and San Biagio della Valle in Umbria (a riveted dagger of the Guardistallo type with a strange copper-silver alloy of 33.1% silver; DE ANGELIS 1996; next comparisons for this exotic metal are found

[8] There are however similarities with violin-shaped clay idols which are probably from the last quarter of the third millennium BC, and are known to come from the Peloponnese, Montenegro and Albania: MARAN 2007, 17, Pl. IV.

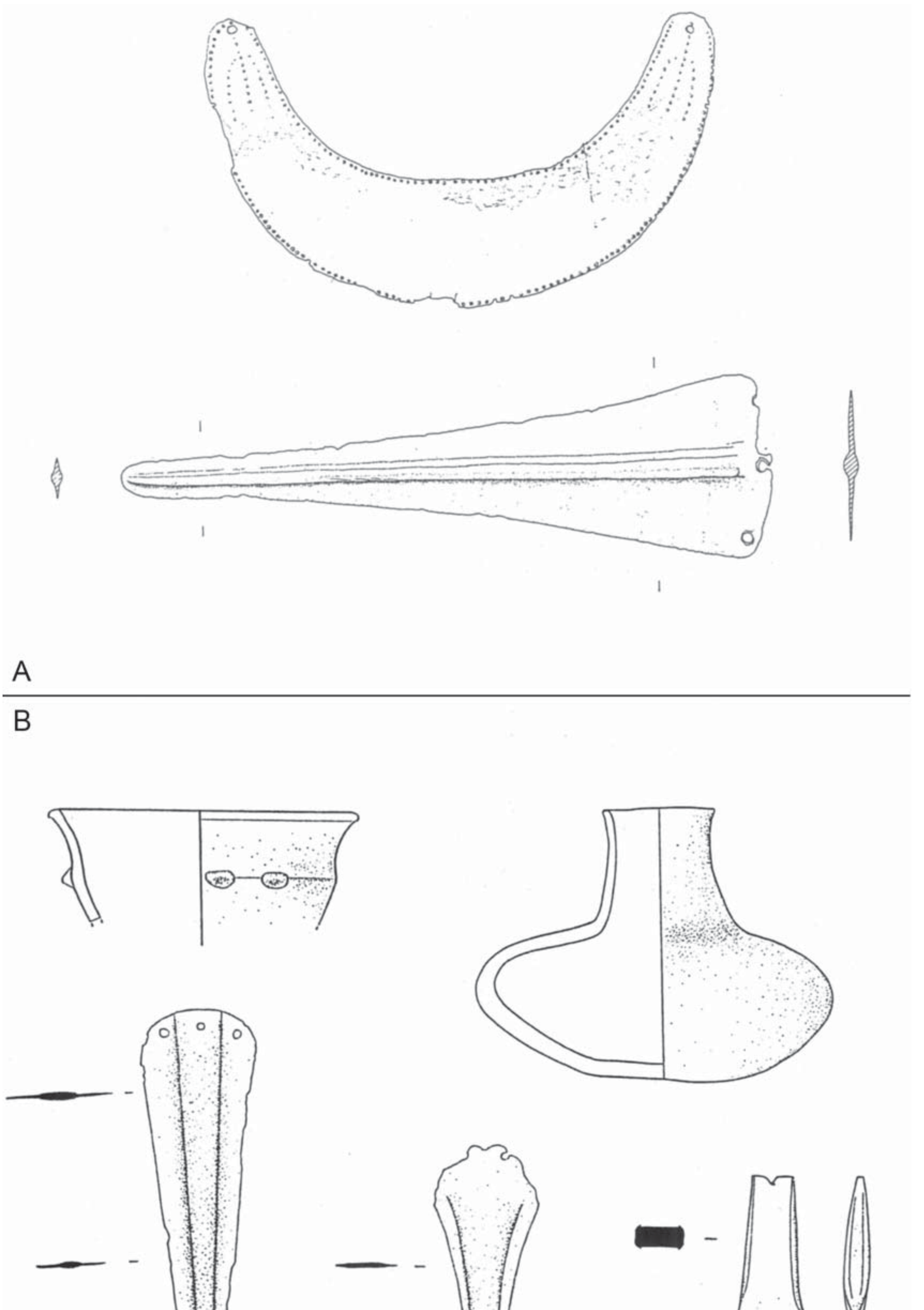

Fig. 19. Italy: the inventories of the lavishly furnished graves of (A) Villafranca Veronese (after SALZANI 2007) and (B) San Biagio della Valle (after DE ANGELIS 1996)

in Bosnia, Dalmatia and, intriguingly Anatolia[9]). As these, and some more specimens, have not been analysed, it remains uncertain whether they are of cupellated, perhaps Aegean, silver or of local ores, from Sardinia and the Toscana for instance. The geographical distribution would perhaps tend support to the latter (Anzidei – Aurisicchio – Carboni 2007).

In many of the finds mentioned, the connection with the cemetery of Steno on the Ionian island of Levkas is significant (Kilian-Dirlmeier 2005). Looking at the Steno finds themselves, one is also struck by the typical long and narrow obsidian blades made using a highly specialised pressure-flaking technique, such as are also known from the Grotta Cappuccini, from Laterza itself and other south Italian sites. However, further studies are needed to determine whether the technique and material were imported from the Aegean, or rather a local obsidian from Lipari was in use.

The third watershed in the connections between the Aegean and southern Italy may be placed after *c.* 2200 BC (Maran 2007). From this chronological horizon come the famous bossed bone plaques *(ossi a globuli)*, such as those from the Casal Sabini (Bari) and the Grotta del Pipistrello Solitario (Taranto), not to forget those found in considerable numbers from Sicily (Leighton 1999; Distefano 2006). To this horizon also belong graves and artefacts from the Castelluccio necropolis (Orsi 1892; Leighton 1999; Palio 2004), eponymous for the Early Bronze Age Castelluccio culture in Sicily. Graves here contain, along with the bossed bone plaques, such outstanding items as what appears to be a scale-beam (grave 22), bronze tweezers (grave 23), and fragments of a bronze vessel, probably a cup (grave 31). There are interesting indications of other imported weapons, like a Sicilian riveted dagger from Palagonia, grave North 5, where the rivets are arranged in a trapeze shape, a feature that otherwise occurs only on Aegean examples (Albanese Procelli 2003). This might also apply for some Castelluccio two-handled jugs, such as those from Santa Croce Camarina (Tusa 1983, fig. 50), when compared with the "depas cups" in the Aegean (cf. *Fig. 17C*). The similarity is indeed striking.

The same is true for the trans-Adriatic Balkan connections, again nothing nearly new throughout the third millennium BC (e.g., Ingravallo – Tiberi – Lonoce 2010), shown by of asymmetrical handles on other Castelluccio jugs, as well as cups with elbow-formed handles, butted handles and/or handle-protomes which came into vogue in a relatively narrow time-window of the Early Bronze Age along the Italian Adriatic coast, but also in Central and northern Italy. However, their trans-Adriatic connections, and the contemporaneity with east Thracian and Bulgarian Early Bronze Age 3 cups and their handle protomes (dating to around the transition third/fourth quarter of the third millennium BC) are so striking *(Fig. 20)* that there must have been a kind of trajectory linking these regions. This is in particular evident because no other Early Bronze Age region uses this kind of handles for their cups.

Finally we must mention Malta, where eastern Mediterranean connections with the Tarxien Cremation Cemetery are evident (the description of the latter site seems almost like that of a tumulus) when looking at small finds (e.g., clay anchors), metal artefacts (e.g., silver beads) and pottery links (Evans 1971; Cazzella – Pace – Recchia 2007).

Overall it seems that the finds and sites listed above are only the proverbial tip of the iceberg of Aegeo-Italian connections *(Fig. 21)*. The wide spectrum of finds is revealing, from traded goods to prestige objects to imitations. The significance of the Steno site on the Ionian island of Levkas is also noteworthy in its function as a cultural intermediary, for forms originating in the southern Greek mainland and on the Cyclades, then going into the Adriatic and over to Apulia and Sicily. It also seems clear that these Ionian-Apulian-Sicilian as well as trans-Adriatic connections – and probably also the presence of people from the Aegean and Balkans – have a central significance in the origins of the Early Bronze

[9] I am grateful to Barbara Horejs, Vienna, for pointing me to the contemporary wider, and more eastern, background of these copper/silver alloys.

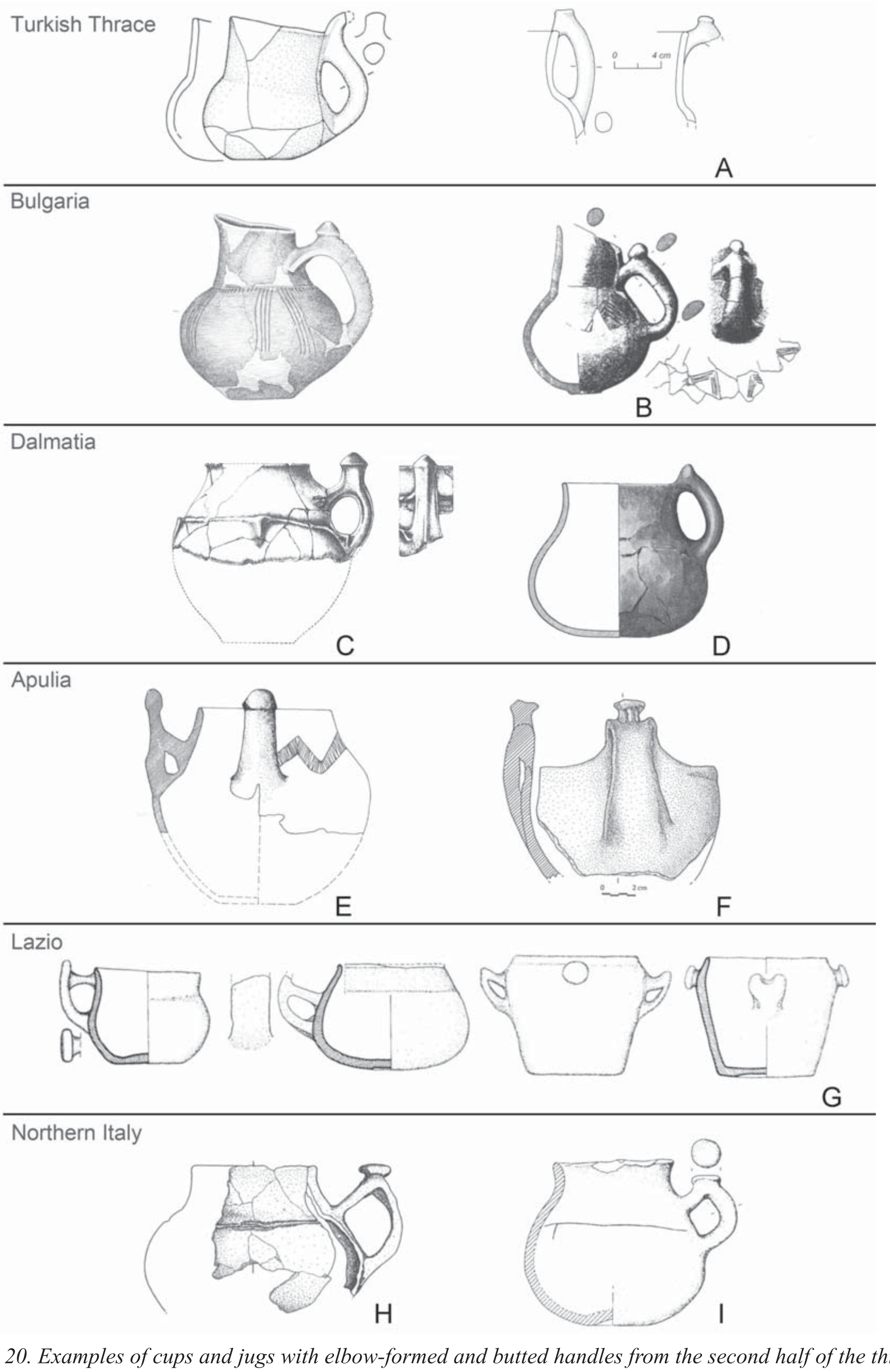

Fig. 20. Examples of cups and jugs with elbow-formed and butted handles from the second half of the third millennium BC in Turkish Thrace, Bulgaria, Dalmatia and Italy – A: Kanlıgeçit, Turkish Thrace; B: Drama, Bulgaria; C–D: Guvnine and Preocani, Dalmatia; E–F: Tursi and Grotta Cappuccini, Apulia; G: Fosso Conicchio, Lazio; H–I: Aosta and Lavagnone, Northern Italy (after various authors)

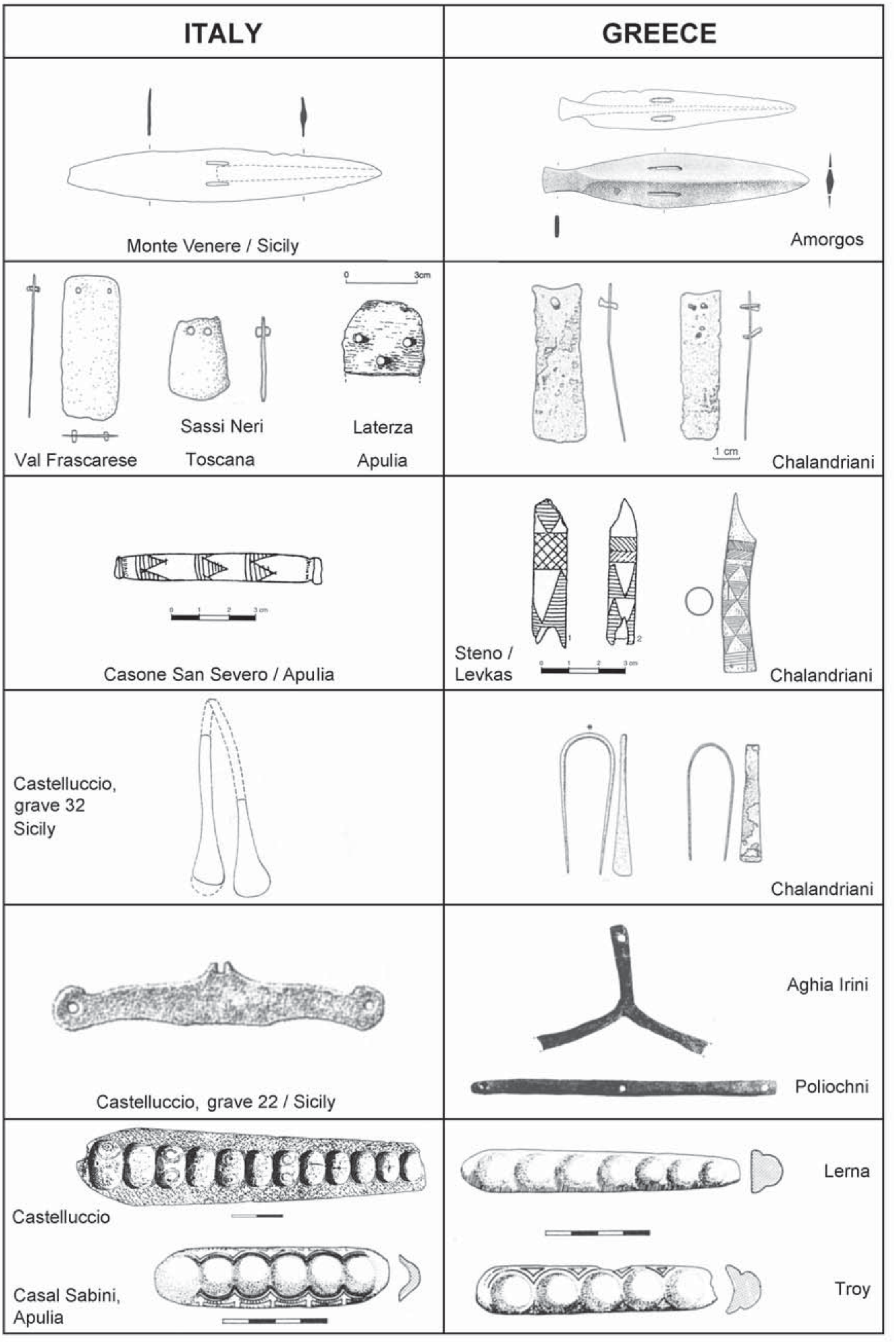

Fig. 21. Italy and Greece: later third millennium BC Italian finds of Aegean, or probable Aegean origin and their comparisons in Greece (and Troy) (after various authors)

Age on the Italian peninsula. Italian scholars also consider that this chronology is not coincidental. The favoured conclusion today sees a progressive development from south to north and from east to west, with a culturally regionalised background and a definition that is still to be standardised: Castelluccio in Sicily would then already be affected in the 25th century BC (Leighton 1999), Apulia, the Marches and Caput Adriae (Cetina) in the 24th (Nicolis 2005), and northern Italy (Polada) in the 23rd (De Marinis 1999); the western half of Italy, however, seems to be included only from the 22nd century (Sarti – Leonini 2007).

Even if each region is different and shows its own characteristics, these peripheral areas in the Balkans and in southern Italy are very important in the transmission of Early Bronze Age cultural structures in Europe as will be explained in the next section. However, hitherto they have seldom been considered as such.

Beyond the peripheries: the gradual transmission of new ideas, values and achievements

There seems only limited transmission of valuable goods to regions beyond these peripheries between 2500 and 2200 BC. This coincides with an absence of outstanding settlements or houses, hoards containing precious metals,[10] of rich graves distinguished by their lavish provision of grave-goods, of objects made of precious metal and other rare and exotic material, and/or of superior ways of constructing the graves. The few exceptions of over-average individual Bell Beaker graves like those of the Amesbury Archer in Wiltshire, Fuente Olmedo in Castile, Markt in Bavaria and now Hulín-Pravčice 2 in Moravia (e.g., Peška – Kalábek 2008) cannot much alter this picture. This is particularly striking if one takes into the account that all Bell Beaker metal, discovered so far in graves, settlements and hoards in all of Europe, merely amounts to 100 kg of copper and perhaps one kilogramm of gold. To put it into the right order: a single Reinecke A2-period Early Bronze Age hoard can yield nearly the same!

And yet, we observe distinct changes in the pattern of sites and artefacts, first in a wide arc stretching from the Lower Danube (Romania) via the Carpathian Basin and its immediate adjacent regions, as far as northern Italy. These range from innovations in material culture and changes in pottery to shifts in the organisation of settlement sites and in regional settlement pattern. Thus the group of objects gradually appear, at first as single artefacts in more isolated findspots that were later to characterise the inventory of the Central European Early Bronze Age after 2300 BC (the Reinecke A0, A1 and A2 periods). These include new elements in weaponry like triangular riveted daggers, halberds and flanged axes. In ornaments and clothing, the composite necklaces,[11] lunulae, torcs and other neck ornaments are important, as are metal diadems, bracelets and *Noppenringe,* as well as other ring and metal sheet, and bone and shell jewellery. In burials of the 23rd century BC, the first dress pins made of copper or bone are noteworthy. In general, more metal gradually appears in graves and settlements, with different kinds of copper increasingly present, in terms of both alloy and isotopic origin; in addition, we find the first tin bronzes (Bertemes – Heyd 2002).

A key region for the transmission from the Aegean peripheries discussed above to the regions further north and west is indeed the Carpathian Basin in the heart of the European continent, covered by modern-day countries of Romania, Hungary, Serbia and Croatia, Austria, Czech Republic (Moravia), Slovakia and Ukraine (Transcarpathia).

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[10] The well-known metal hoard of Perşinari (Romania) which might be included by some observers in a list of this kind, is of a later date, more likely the beginning of the second millennium BC: Vulpe 1995. Also the new hoard of Svishkov in northern Bulgaria, with its lavish golden torcs, likely dates to around 2000 BC or slightly thereafter. I am grateful to Stefan Alexandrov, Sofia, for letting me know photos of the objects found in this important hoard.

[11] See the list of bone spacers for such composite necklaces coming from Initial Bronze Age graves in Slovakia, Poland, Hungary and Romania at: Popescu 2001.

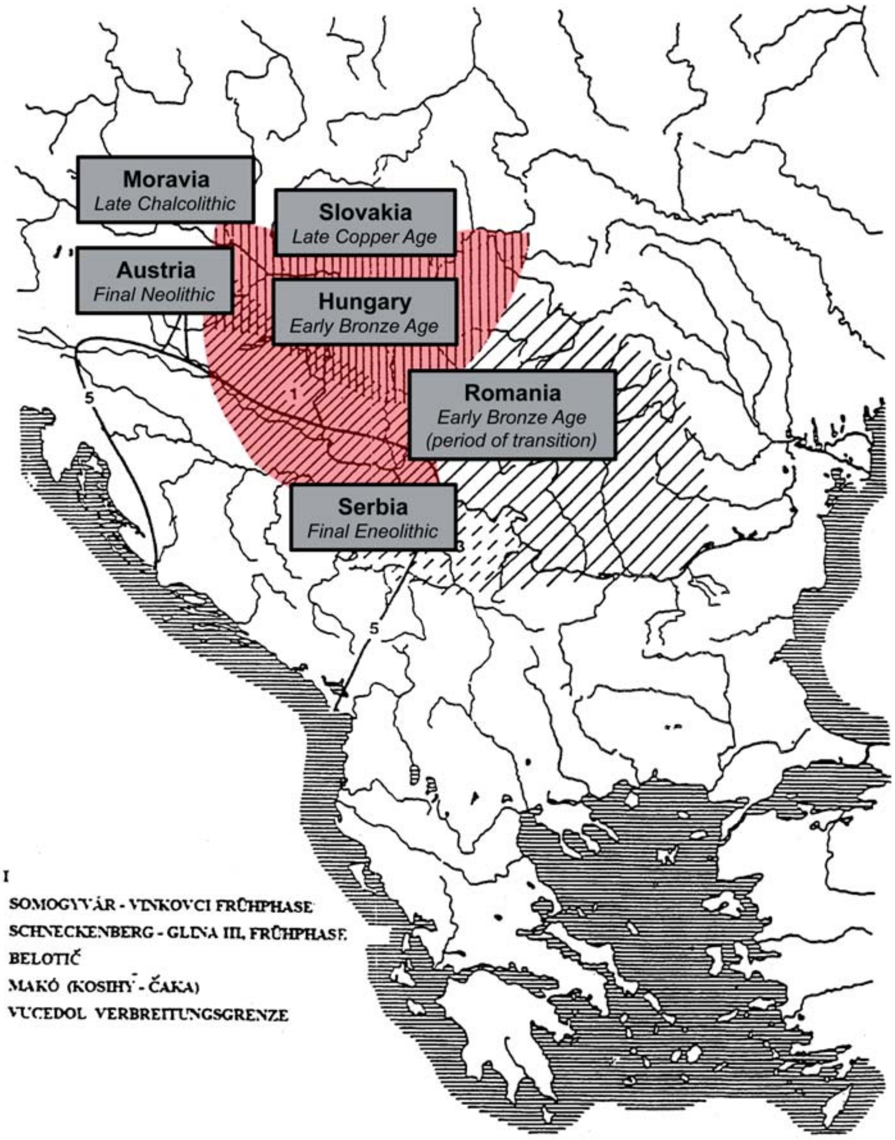

Fig. 22. Attribution of Makó/Kosihý-Čaka and Somogyvár-Vinkovci according to the terminological systems in the countries of its distribution (background map after Kalicz-Schreiber – Kalicz *1997)*

The Beginnings of the Bronze Age in the Central Carpathian Basin: regional tradition or wider European picture

Terminologically, the beginnings of the Bronze Age are not uniform in the Carpathian. The reality is in fact a kind of micro-cosmos of what is going on in Europe as a whole: each country uses its own scheme *(Fig. 22)*, and depending on the country and its tradition, or even current vogue, one time the Early Bronze Age starts at *c.* 3300 BC (Coţofeni, Romania), *c.* 2800 BC (Makó/Kosihý-Čaka, early Somogyvár, Hungary), *c.* 2500–2400 BC (Vinkovci, Serbia and Croatia), *c.* 2300–2200 BC (Oggau-Wipfing/Proto-Únětice, Austria and Moravia), *c.* 2300–2200 BC (Veselé-Chłopice/Nitra, Slovakia) and *c.* 3000 BC (Yamnaya, Ukraine). This obviously somehow more reflects a historical east–west divide, or gradient, than as one would expect, and is advocated here, a south to north/northwest European development.

Leaving aside the nonsense idea of Coţofeni being Bronze Age, or a transitional period towards the Bronze Age, the horizon of Makó/Kosihý-Čaka and (early) Somogyvár, as the representatives of the Early Bronze Age I in the Hungarian terminology, to which also Livezile of western Transylvania and some northern aspects of (a Transdanubian) Vučedol can be added, is an interesting one for the discussion of when a true, structurally defined Bronze Age should begin. This Early Bronze Age I indeed brings many changes in settlement systems, burial customs and material culture, in particular the now mostly plain pottery (Kulcsár 2009). Likewise are the regional differences in the Carpathian Basin not that huge as they appear at first glance through the regionally diverse cultural terminologies. The settlement organisation, as far as we possess an overview, is quite similar despite some settlements infortified positions in southern Transdanubia; inhumations and cremations do indeed have different centres of gravity, are however equally distributed in the Carpathian Basin and are also very similar in terms of their grave, burial and equipment customs; and pottery categories and forms are mostly interchangeable between Makó, Kosihý-Čaka, Somogyvár and Livezile, if one only considers contemporary materials, which is however quite tricky to realize due to the lack of a proper phasing and not always available ^{14}C dates. Therefore the original Zók concept, or a Vučedol-Zók, is still very interesting and describes probably much better the situation in the Central Carpathian Basin at the time lot of *c.* 2800 to 2500 BC than the actual, rather fragmented cultural scenario. But is this Zók already Early Bronze Age in a wider European sense? Realistically, not that much!

In terms of complexity there is not much one can put into the balance:

- the settlements are rather moderate in size and composition; not a single larger one stretching over several hectares is known; there are, however, some in southern Transdanubia which are in defensive positions, but this is not uncommon in wider Europe in this and prior periods, and in no way is there anything comparable to the hierarchically structured site of Vučedol;
- there are no known lavishly equipped graves such as those described above from Montenegro and Dalmatia; if at all, then the graves of Sárrétudvari stand out, however recent research has shed light on their special relationship with the Apuseni mountains and speculated on the reasons why these people migrated to the plain which might also explain their equipment (Gerling *et al.* 2012);
- shafthole axe hoards do exist as are known many single shafthole axes which should belong to this period; however, there is not a single true shafthole axe accompanying a burial; there are also metalworker hoards, including simple and bivalve casting forms and other tools; these do also occur as founder's deposits in refuse pits; some of the hoards can be quite lavish, such as the Vâlcele/Bányabükk treasure with at least 55 shafthole axes, weighting several tens of kg of copper; however this hoard dates to around 3000 BC, thus predating the beginnings of the Hungarian Early Bronze Age I;
- we have no record of tin-bronzes, of gold and silver objects, of exotic foreign objects, or of real prestige goods such as axes and daggers in the graves (except of Sárrétudvari) of the Hungarian Early Bronze Age I period.

Equally, among the many gold artefacts, assembled in the exhibition catalogue "Trésors préhistoriques de Hongrie" (Foulon [dir.] 2001), there is not a single one that can securely be dated to this period of 2800–2500 BC. This situation continues well into the subsequent period, the Early Bronze Age IIa of the Hungarian system, *c.* 2500–2250 BC, and indeed the inventories of later Makó and Somogyvár do not alter that much. We have now, however, the first smaller gold and silver artefacts in our records, mostly hair rings and sheet jewellery weighing only a few grams from Bell Beaker graves of the Budapest-Csepel group (Endrődi 2012). This corresponds well with the rest of the Bell Beaker *East Group* and one can easily assume the same level of social and economic achievements (Heyd 2007a).

There is thus a great difference here in the Carpathian Basin when compared with the situation in the Balkans. Obviously, we are not having the same level of societal and/or economic complexity. And yet, very interesting and far-reaching are the significant changes in the pottery inventory, manifested after 2500 BC. In parts of Romania, as in the entire Carpathian Basin and in Italy, there is a general decrease in decoration on pottery. Vessels are no longer messengers, or symbols indicating affiliation to an identity group or differentiation from other groups. Instead, specific functional aspects of vessels are put in the foreground. At the same time the repertoire of forms shifts towards a preference for cups and jugs, plates and bowls, that is to say more personalised drinking vessels with handles and open shapes for eating. This is of course not a complete novelty in these regions and we are well aware of archaeological groups or cultures in the preceding centuries whose characteristics included a general lack of decoration on pottery, or where jugs, cups, and bowls, both low and deep, are common. Now, however, the innovation consists in the fact that both, loss of decoration and cups/jugs and plates/bowls, progressively cover the entire zone. In addition they now appear widely in burial ritual. As such, these cups and plates become even a diagnostic criterion for an advanced phase of the Central European branch of the Bell Beaker phenomenon (and beyond in parts of western Europe), where they are well-known as the *Begleitkeramik* ("accompanying pottery") (cf. NICOLIS [ed.] 2001).

In looking at the underlying factors in abandoning decoration and altering the range of forms, one first notices these changes in the new peripheries described above. However, we would not be wrong to trace the primary cause back to the Aegean core. Here the first impulses seem to be given by the appearance of the first wheel-made pottery of the completely undecorated Lefkandi I-Kastri repertoire, with its *depas* cups, tankards and saucers (BROODBANK 2000; RAHMSTORF 2006). Not only does mass production of pottery begin, and pots become goods for trans-regional trade, but there is an increase in the prestige and value of these often high-quality drinking and eating vessels, as shown by specimens of these same vessel-shapes made of gold and silver, for instance from the Troy hoards. In the final analysis it may be the institution of the "symposium" originating in the Near East, with its associations of elite image-cultivation, hospitality and dependency relationships (HELWING 2003), that appears in the record as far away as Central Europe, though in very attenuated form.

While this development is gradually progressing throughout the third quarter of the third millennium BC in a wide arc stretching from the mouth of the river Danube, along the bow of the Carpathian Mountains, down to the Alps to also include the Italian peninsula, we recognize shifts in the organisation of settlement particularly in the Carpathian Basin. Here we note a gradual return to tell settlements (GOGÂLTAN 2005), obviously as a development from south to north with the site of Vinkovci-Tržnica being the first in Florin Gogâltan's list, followed by Dunaföldvár-Kálvária along the Danube (SZABÓ 1994), and then a suit of other early Nagyrév culture sites, such as

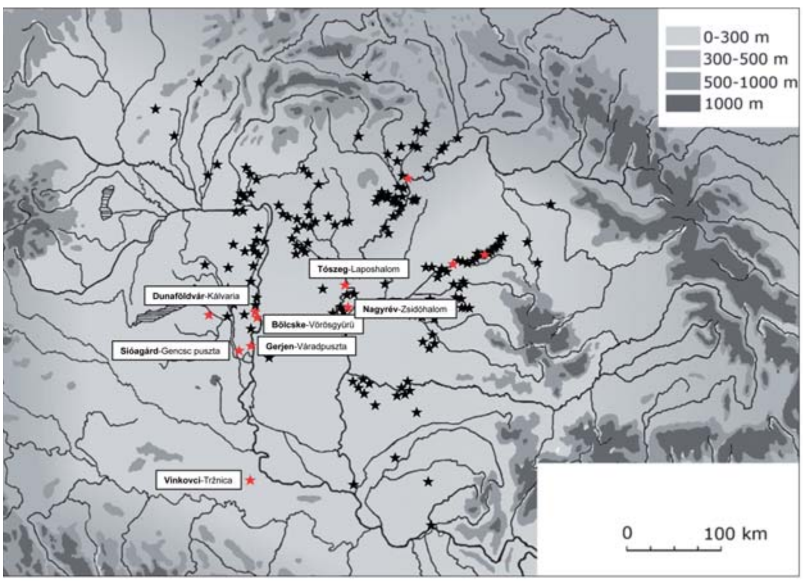

Fig. 23. Re-occupying the tell settlement sites of the Carpathian Basin in the Early Bronze Age IIa (after GOGÂLTAN 2005)

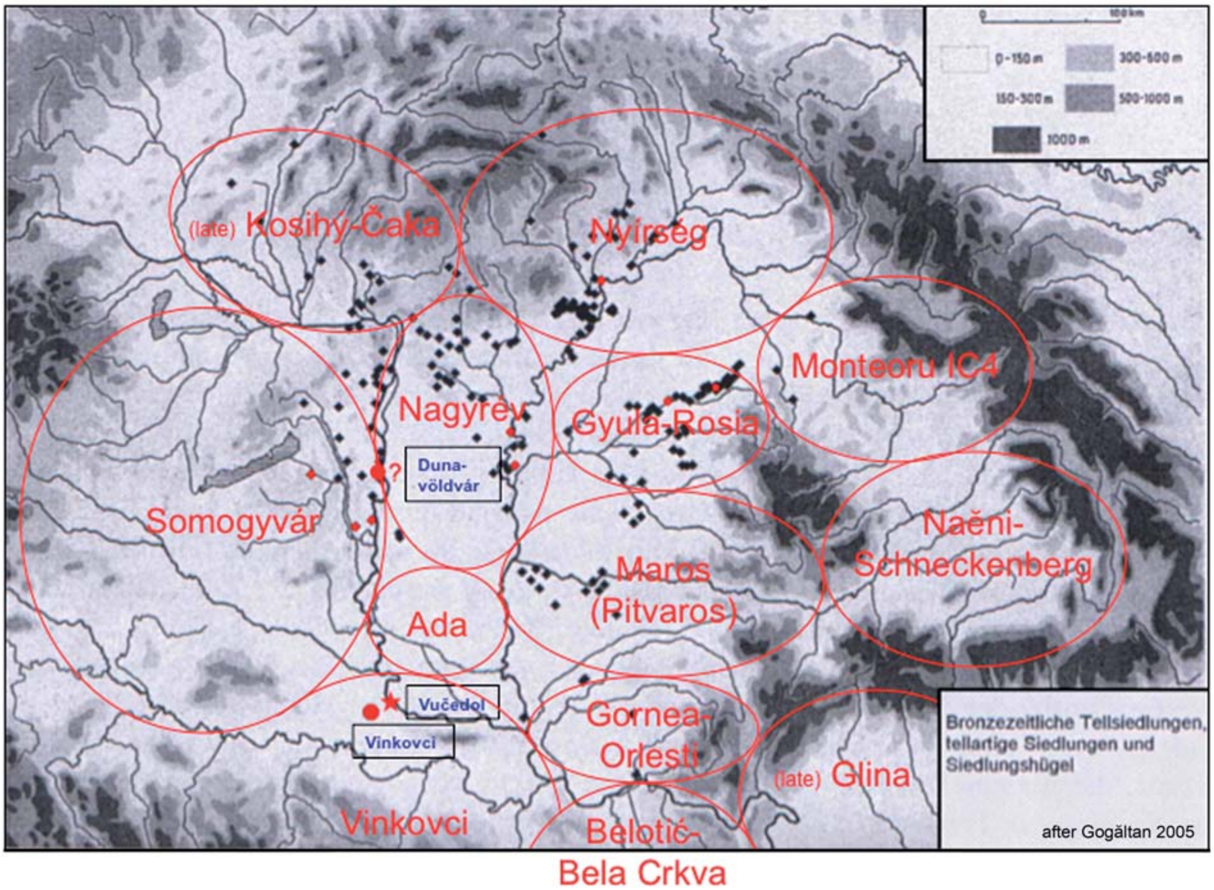

Fig. 24. Scheme of the various cultural groups at the beginnings of the Hungarian Early Bronze Age IIa (drawing by author; background map after GOGÂLTAN *2005)*

Bölcske-Vörösgyűrű, Sióagárd-Gencs puszta (Várdomb), Gerjen-Váradpuszta, Tószeg-Laposhalom and Nagyrév-Zsidóhalom, dating from the last quarter of the third millennium BC *(Fig. 23)*. Just as settlements are now often preferred in protected locations, this development comes at the beginning of the rise of central places and thus probably also the rise of "segmentary" systems of settlement. Likewise important is the factor of continuity. In this case of the named tell settlements, and many more which get re-settled a century or two later, they are continuously occupied for the next five-six centuries or even longer.

This is closely compatible with the changes in regional organisation in the Carpathian Basin and its surroundings. While in the second quarter and the middle of the third millennium BC we still had trans-regional cultural phenomena like Vučedol and Makó/Kosihý-Čaka, we soon, from about 2400 BC onwards, see a more fragmented archaeological cultural pattern with half a dozen new regional cultural units *(Fig. 24)*, such as – besides the still continuing (late) Makó/Kosihý-Čaka and (late) Somogyvár – Nagyrév, Nyírség, Gyula-Roșia, Maros (Pitvaros), Ada, Gornea-Orlești, rightly distinguished from each other in burial ritual as well as pottery (MARAN 1998; BERTEMES – HEYD 2002; VOLLMANN 2005). This process is obviously part of identity creation in smaller areas, possibly a sign of the genesis of tribal organisations. Considered together with the changes in the organisation of settlements mentioned above, it could also be a sign of the birth of chiefdoms.

We do not see these chiefs in their graves or, as a kind of a communal effort, in their hoards. What we observe, however, are again gradual changes, like the appearance of various find objects,

Fig. 25. The copper/bronze halberd from a Bell Beaker Csepel grave of the Szigetszentmiklós-Felső Ürge-hegyi dűlő cemetery near Budapest (after PATAY *2008, 34)*

eventually making up the inventory of the Early Bronze Age in the Carpathian Basin, now as individual isolated artefacts in contexts of the period between 2500 and 2250 BC. The copper/bronze halberd of a Bell Beaker grave of the recently excavated Szigetszentmiklós-Felső Ürge-hegyi dűlő cemetery is such a find *(Fig. 25)*. Incidentally, we have halberds in that period otherwise only in hoards and some tombs on the Italian peninsula, which in turn helps in understanding the axis of cultural currents at the beginning of the Early Bronze Age in the Carpathian Basin. Another find are early roll-headed pins and *Noppenringe* likewise from Bell Beaker graves of the Budapest region, such as from the also recently excavated giant cemetery of Budakalász-Csajerszke (CZENE 2008). From the site of Budapest-Albertfalva come a further roll-headed pin and an awl made of intentionally alloyed tin-bronze (ENDRŐDI *et al.* 2003). This list could be easily extended to include yet further innovations and "exotic" objects such as early triangular riveted daggers, bone pins and sheet jewellery. But again, these are only isolated finds that can be found in these early contexts. Never do they appear in combinations.

The fact that they occur just in the graves of the Bell Beaker-Csepel group no doubt depends on the broad absence of cemeteries and graves of the period from 2500 to 2250 BC in other parts of Hungary. From the moment when we have graves before us in the south of Hungary, we also see the manifestation of these innovations in their equipment customs and, even more, in a fully developed form. Key examples for this are the two smaller necropoles of Kiskundorozsma-Hosszúhát-halom (BENDE – LŐRINCZY 2002) and Sándorfalva-Eperjes (TROGMAYER 2001) in Csongrád County. Culturally rather belonging to the Maros/Pitvaros group than the neighbouring Ada, they are dated to the very beginnings of the Hungarian Early Bronze Age IIb (P. FISCHL – KULCSÁR 2011) and are very well comparable with Reinecke A0/A1a graves from the northwestern limits of the Carpathian Basin (BERTEMES – HEYD 2002). Towards the same direction refers interestingly also a good proportion of the pottery, as well as the grave and burial customs; but this is another question.

The ^{14}C dates of some of the graves fit to this chronological classification, which, in the case of the grave 56 of Kiskundorozsma, begin from the mid-23rd century BC. But this is in my opinion only a rough classification, since both cemeteries appear chronologically consistent and uniform while the ^{14}C dates in the 2-sigma range cover a wide span of 300 years. Because of these inconsistencies, and the plateau in the calibration curve in this period, it cannot be ruled out that the onset of both cemeteries already belongs the early/mid 23rd century BC.

Anyway, these graves represent for the first time in the Carpathian Basin an equipment of dress fittings (bone pins), jewellery (torc, bracelets, hair/temple rings) and weapons (dagger) that, as a combination, will become iconic in the next centuries for the Central European Early Bronze Age *(Fig. 26)*. So this also sets the beginning of a long continuity even if the full implementation in terms of a structurally defined Early Bronze Age seems to have only been manifested in the course of 21st/20th century BC. This might also be the right period when the big (metal) hoards start to appear in our records (HANSEN 2005; KISS 2012, 89ff.).

Altogether, and summarising the above said, one can perhaps assume three consecutive phases of a *Bronze Age-isation* in the Central Carpathian Basin:

1. incorporated innovations from *c.* 2400 BC: first (exotic) objects that later become iconic for Early Bronze Age burials are now found as single objects in graves; cultural fragmentation

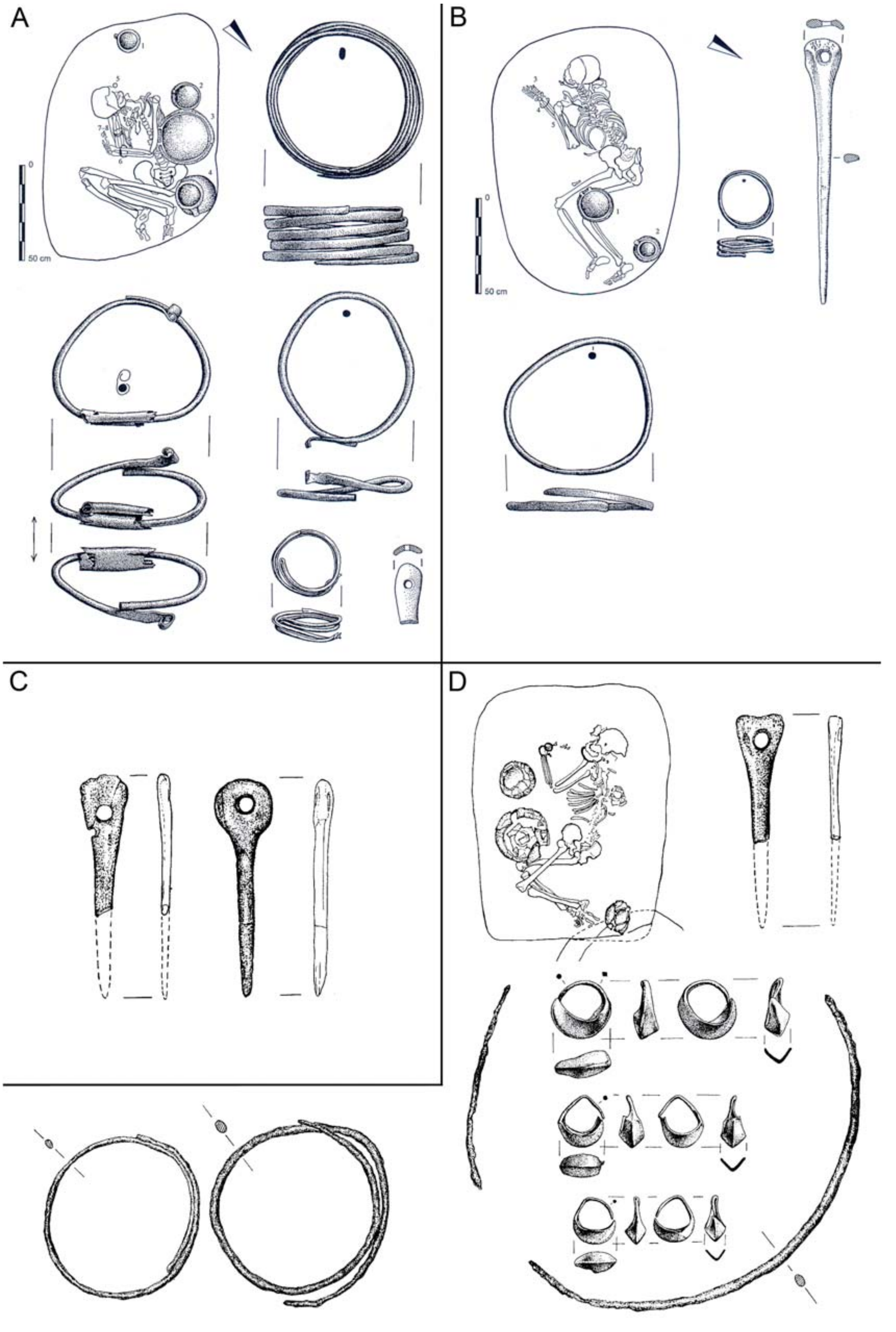

Fig. 26. Reinecke A0/A1a graves from southern Hungary: the metal and bone inventory of Sándorfalva-Eperjes and Kiskundorozsma-Hosszúháthalom (Ada/Maros group) – A: Kiskundorozsma, Grave 56; B: Kiskundorozsma, Grave 55; C: Sándorfalva, Grave 9; D: Sándorfalva, Grave 169 (after Bende – Lőrinczy *2002;* Trogmayer *2001)*

begins; at the same time re-settling of some tells in south-Central Hungary;
2. emancipation from traditions from *c.* 2300 BC: graves and graveyards with the complete Early Bronze Age equipment custom emerge; cultural fragmentation gradually continues; tell re-settling expands;
3. continuity and consistency in occupying the cemeteries and tells; cultural fragmentation manifest from *c.* 2200 BC; tell formation further expands; other innovations gradually incorporated; increasing level of complexity.

Central Europe and northern Italy

The same three phases towards an initial Early Bronze Age can also be seen when moving further to the north and northwest, in those parts of Central Europe at the western edge of the Carpathian Basin and also in parts of northern Italy. Here too, after the first incorporation of novelties in the *Begleitkeramik* phase of the Beaker period, significant changes occur in the course of the 23rd century BC (Reinecke A0) when with Oggau-Wipfing in eastern Austria, Proto-Únětice in Moravia and Chłopice-Veselé in Lesser Poland and western Slovakia the first cultural units and their graves appear that emancipate from previous traditions and start to display the new Early Bronze Age equipment and burial custom. This is then gradually followed by the further regions west and north along the upper Danube, Elbe, Oder and Rhine during the 22nd century BC (Reinecke A1). Earlier Bell Beaker cemeteries are now abandoned everywhere, and new Early Bronze Age ones established, and these were to be in part maintained for several centuries without interruption, as for instance in Franzhausen in Lower Austria (Neugebauer – Neugebauer 1997). Alongside continuing regional fragmentation, we also find centralisation in the form of the first fortifications on hills, particularly in more southerly areas. At the same time the characteristic longhouses come to predominate both as living places and as the foci of a new form of settlement planning (Bertemes – Heyd 2002).

Northern Italy probably goes the same pathway. Earliest graves displaying the new equipment and burial rules are probably to date to about the same time than the Reinecke A0/A1a phase of Central Europe. This is shown by graves such as from Romagnano Loc and particularly La Vela di Valbusa in the Trentino, but probably also in Aosta-St.Martin-de-Corléans (Marzatico – Tecchiati 2001; De Marinis 2003), and represented by their globular cups and bone, shell and metal jewellery *(Fig. 27)*. Interestingly, some of the graves here are the first to be realized as proper individual graves after at least two centuries during the middle and late Beaker periods for which no Bell Beaker graves and burials are merely recorded in northern Italy. Another novelty is the pithos grave of children, such as from Mezzocorona Borgonuovo, Nogarole di Mezzolombardo, Volano San Rocco (Nicolis 2005) and La Vela (Endrizzi *et al.* 2011), again in the Trentino. Franco Nicolis rightfully sees the Adriatic as the link over which these kinds of innovations and new ideas are spread to northern Italy. For him, particularly the bone Montgomery toggles testify to this link, concentrated in northern Italy around Lake Garda and in the Trentino, testify to this link. They are also known from the western Aegean, however in Early Helladic III contexts, therefore dating to 2200 BC. The same specimens are well attested in Bell Beaker graves in Central and northwestern Europe too, certainly with absolute dates much earlier than 2200 BC. In the same direction might point some Cetina finds in northeastern Italy (Boaro 2005). Particularly the site of Montesei di Serso and its visible Ljubljana and Cetina connections show, although chronologically not uniformly, that this link reaches deep into the Alps, into the region where the first burials appear. Another argument are the elbow handles, typical for the north Italian Early Bronze Age, and knobs on top of the handles of cups and jars, as mentioned above, such as from Aosta, Lavagnone and other sites. These no doubt, also link across the Adriatic to the western Balkans. So, there clearly is a "formative or archaic moment" (Marzatico – Tecchiati 2001, 28) of the north Italian Early

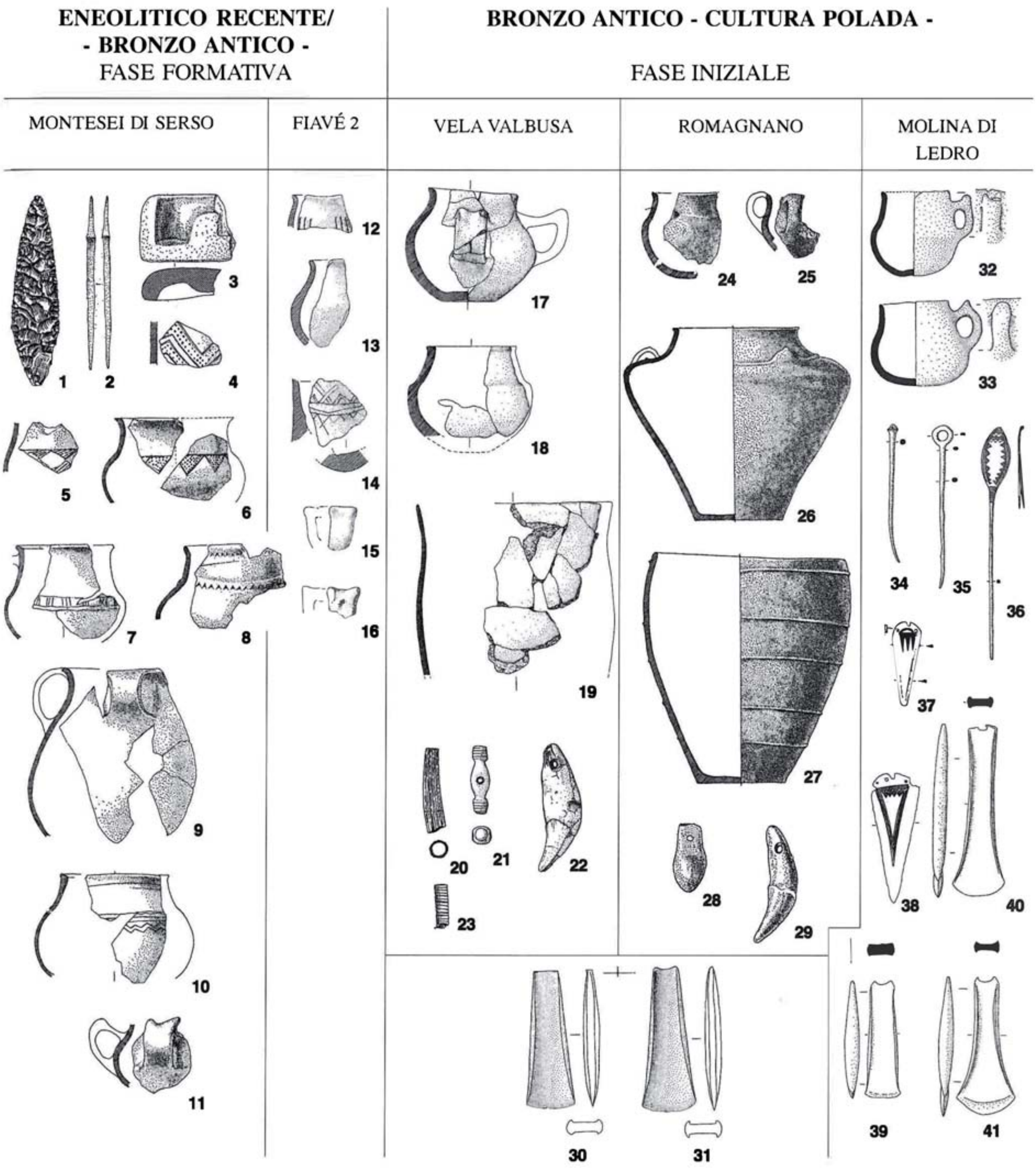

Fig. 27. The material culture of the earliest Bronze Age in northern Italy (reproduction of M*ARZATICO* – T*ECCHIATI 2001, fig. 1)*

Bronze Age, probably not much delayed when compared with south-Central Hungary in the heart of the Carpathian Basin and contemporary to the Reinecke A0/A1a phase of Central Europe northwest of the Carpathian Basin, as demonstrated by similar cup forms and other funerary equipment. Instrumental for this new development can be in both cases only the proximity to the western Balkans, on the one hand via Syrmia and on the other along the Adriatic, and its role as a kind of Aegean periphery. In Italy this is anyway supplemented by its own Aegean finds in the south and southeast.

The next stage of the north Italian Early Bronze Age is then reached when the first wetland settlement sites are established. This can be seen as the beginning of the classical Polada and the Lavagnone 2 layer (near Desenzano del Garda, Brescia) and its dendrodates testify that this is realized at latest from *c.* 2077 ± 10 BC (DE MARINIS 1999). Further important wetland and lakeside sites, like Molina di Ledro and Fiavé, demonstrate that this is a widespread, roughly contemporary phenomenon here. Their rich metal inventory with the typical flanged axes, triangular daggers and various forms of jewellery, mostly belonging to after 2000 BC, proves the fully establishment of an Early Bronze Age society by that time (DE MARINIS 2005).

Similar changes occur at the same time, that is in the 23rd/22nd century BC, in southeastern Spain, where, for instance, the El Argar culture likewise brings a more regionalised system of influence, with hillforts functioning as a focus (cf. LULL *et al.* 2009). These hillforts, such as Fuente Álamo, Gatas and El Oficio in the Almería province, are then occupied and expanded for the next 500 years at least, thus showing the same constants of continuity like in Central Europe. We also see changes on the British Isles, where there is increased circulation of copper in the 22nd and 21st centuries BC, topped by artefacts made of tin-bronzes in significant numbers. Following this, the accumulation of wealth and practice of hoarding begins; exotic materials for jewellery like amber, jet, faience and shells are found in increasing quantities, and are now distributed over an ever-expanding area. This is an accelerating trend that stretches right across Europe, a gradual and continuous process involving the intensification of all the cultural subsystems from *c.* 2200 BC and then massively in the 21st century BC.

The next stage is then reached from *c.* 2000 BC when in wide parts of temperate Europe a system of intensified exchange and trade becomes established in the frame of the so-called Early Bronze Age Reinecke A2-period. Based now on a hierarchically organised society, with many prestige and status objects belonging to the then elites, and culminating in their lavishly equipped graves (such as Leubingen and Helmsdorf in Germany, Łęki Małe in Poland, Thun-Renzenbühl in Switzerland, Kernonen en Plouvorn and Saint Adrien in Brittany, and Bush and Clandon barrows in Wessex) and the large metal hoards, we also see precious metal vessels, economic specialisation, specialised craft production and widely available tin bronze. No doubt, these are components of a cultural package of the kind that had arrived around the Aegean some 500 years earlier.[12] A true Bronze Age is now established over much of Europe.

Meeting the Bell Beaker network

The Bell Beaker phenomenon also pertains, over most of its distribution area, to the period between *c.* 2500 and 2200 BC (cf. NICOLIS [ed.] 2001). In a few regions we see Beaker traditions continuing until the 21st century BC, but by 2000 BC even the very latest beakers, only rudimentarily displaying the original form and decoration idea, had ceased to be made. As for its beginnings, it is only on the Iberian Peninsula that we have secure radiocarbon evidence for an earlier Bell Beaker formation. This reaches perhaps back as early as *c.* 2700 BC, bringing it thus into the chronological range of a Europe-wide transformational horizon that so altered the appearance of societies in both east and west (HARRISON – HEYD 2007).

There is still much speculation in our efforts to understand the origins of the iconic pottery form that the Bell Beakers represent, and of the groups of people producing and using them as their communal

[12] Two facts are of particular interest here. Firstly, this (i.e. after 2000 BC) is the very period when a low point in social complexity is observed in the western Aegean (except of Crete) in the early Middle Helladic period: e.g., HIELTE 2004. Secondly, the only Aegean-linked object outside of the here defined peripheries is the famous slotted spearhead of the Kyhna hoard in eastern Germany. Is it pure accident that the only precious metal torc outside the Aegean and its peripheries is that from the Dieskau hoard/grave, not that far away from Kyhna?

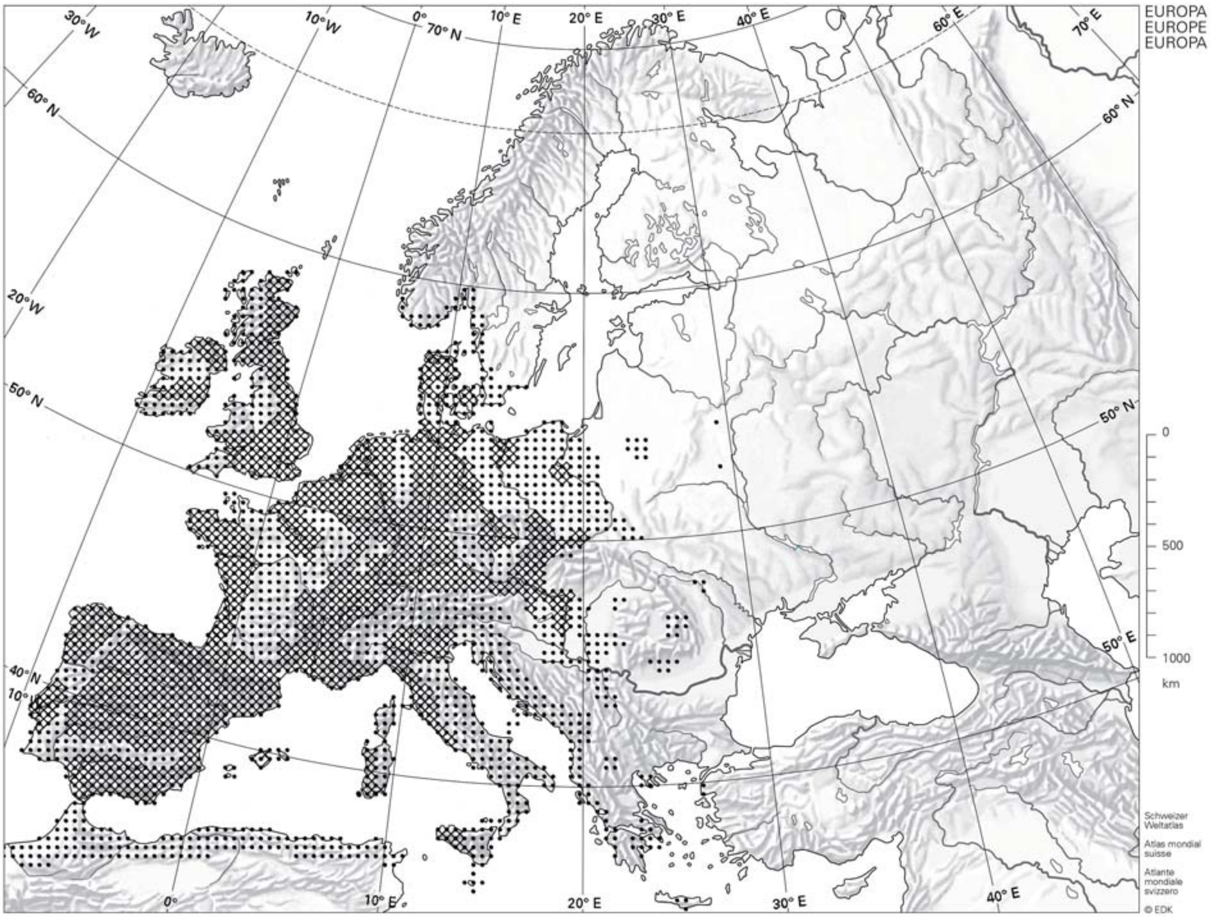

Fig. 28. Schematic Bell Beaker distribution in Europe (map by author)

symbol in the European west. Much safer ground is reached, however, when describing the outlook of this formative phase: characteristic early Bell Beakers are the tall-narrow monotone comb-stamp decorated, so-called *Maritime* beakers, including their cord-zoned and inner-rim decorated variety (CZM-Beakers). Additionally, the all-over-corded Beakers (AOC-Beakers) also seem to have had an early start, perhaps even as early as the *Maritime* beakers.

This early Iberian Bell Beaker tradition is apparently confined to parts of the peninsula for over a century. At this early stage, the Bell Beaker package is not yet fully developed, lacking for example two of its most prominent components, the tanged copper daggers and the wristguards. It was perhaps around 2600 BC when the phenomenon seemingly altered its ideas, imaginations, values and world-view (i.e. its ideology), and an expansionistic drive – almost missionary in its appearance – became the dominant element. This is the moment when the first Bell Beaker vessels, and the people regarding them as their common symbol, were bypassing the Pyrenees along the Atlantic and Mediterranean coastline, reaching for example the mouth of the Rhône or Brittany, perhaps in the later the 26th century BC. From now on, the phenomenon accelerates dramatically, with more people being involved, and seizing the opportunity to promote themselves by adopting the by now well-defined package of novelties, and with the community of Beaker users growing. At the same time, around 2500 BC, Bell Beakers expand geographically to encompass more distant regions *(Fig. 28)*. By integrating an increasing number of local populations, with their various traditions, the phenomenon was itself being transformed, from being the driver of change to being a part of more established regional cultures with their own distinct flavour. This, in turn, shaped the course of developments over the succeeding centuries.

The Bell Beaker phenomenon thus became pan-European in nature (e.g., Nicolis [ed.] 2001; Czebreszuk [ed.] 2003), with its centre of gravity located firmly in the western half of the continent. If we take an overview of its distribution, four larger geographical entities can be discerned (Heyd 2007a): an Atlantic domain, a Mediterranean domain, the Central European or *East Group*, and a Beaker tradition in the western part of the northern European plain, also including southern Scandinavia. Within these entities, regional Beaker networks, such as the Rhenish Beaker or Upper Italian Beaker group, can be distinguished. Even within these networks differences can be demonstrated, sometimes going down to county level.

This distribution is the result of an expansion that clearly follows the Atlantic and Mediterranean coasts and the main river systems, such as the Rhône, Rhine and Danube, and their tributaries. However, distinct regional traditions incorporated by the respective new Beaker users are also responsible, and a geographically staggered west–east impulse, resulting in weaker and stronger centres, and secondary and tertiary regions of Beaker expansion. This is particularly evident in Italy where the cultural geography of the underlying Copper Age cultures is decisive for the Beaker distribution from 2500 BC on (Vander Linden 2005; Maran 2007). So Remedello societies of the north and Rinaldone in the west were more receptive to Beaker novelties than Conelle and Laterza in the Adriatic basin, resulting in an uneven distribution of Beaker pots. The same is visible as far south as Sicily, where Bell Beakers users only set foot and established a Beaker core in the previous Conca d'Oro area, in the west of the island. Therefore burial and settlement customs, material culture such as domestic pottery, and economic resources and subsistence economies vary greatly across Europe and in the regions, while the overarching iconic Beaker vessel and the Beaker package act like a glue for the diversity, creating the image of "similar but different" (Czebreszuk [ed.] 2003).

Beside these four domains, and their regional networks and distinct cultures, a kind of eastern Bell Beaker periphery has recently come to prominence (Heyd 2007b). This is manifested in the form of syncretistic cultures, "…adopting different components of the Bell Beaker ideology and the package in its repertoire … transforming it together with parts of their own traditional inventory to build a new identity" (Heyd 2007b, 102) and located in a zone following a virtual line from Central Poland in the north to the heel of the Italian peninsular in the south (roughly between the 15th to the 20th degree of eastern longitude). These syncretistic Beaker/local cultures start about 100–200 years after the more western regional Beaker cores but are, seen from a different angle, the dominant regional players in the slightly later formation of the Early Bronze Age. Representatives from north to south are the archaeological cultures of Iwno (and partly Trzciniec) in the western Baltic region; Chłopice-Veselé in Lesser Poland, western Slovakia and eastern Moravia; Pitvaros/Maros in the southeastern Carpathian basin; as well early Cetina in the Adriatic basin; and the Grotta Cappuccini aspect of the Laterza-Cellino San Marco culture in southeastern Italy. It is important to note that the last two concern regions that are among the Early Bronze Age Aegean peripheries described above.

Beyond these ideological peripheries there is even a marginal eastern zone of more remote Bell Beaker traces (Czebreszuk – Szmyt [eds] 2003; Heyd 2007b). These Bell Beaker margins include parts of eastern Poland, Moldova and Romania, as well as Malta in the south. Major diagnostic elements are the wristguards, or their imitations in bone and clay. If one includes some early flint dagger types, and there is good reason to think that the dagger idea is propagated in the context of the Beaker phenomenon in the north, these influences even reached the Baltic States, Finland and Belarus.[13] Surprisingly perhaps, one

[13] A similar situation is described as far north as Norway when assessing the distribution of tanged arrowheads and their Beaker connection: Østmo 2009, fig. 2.

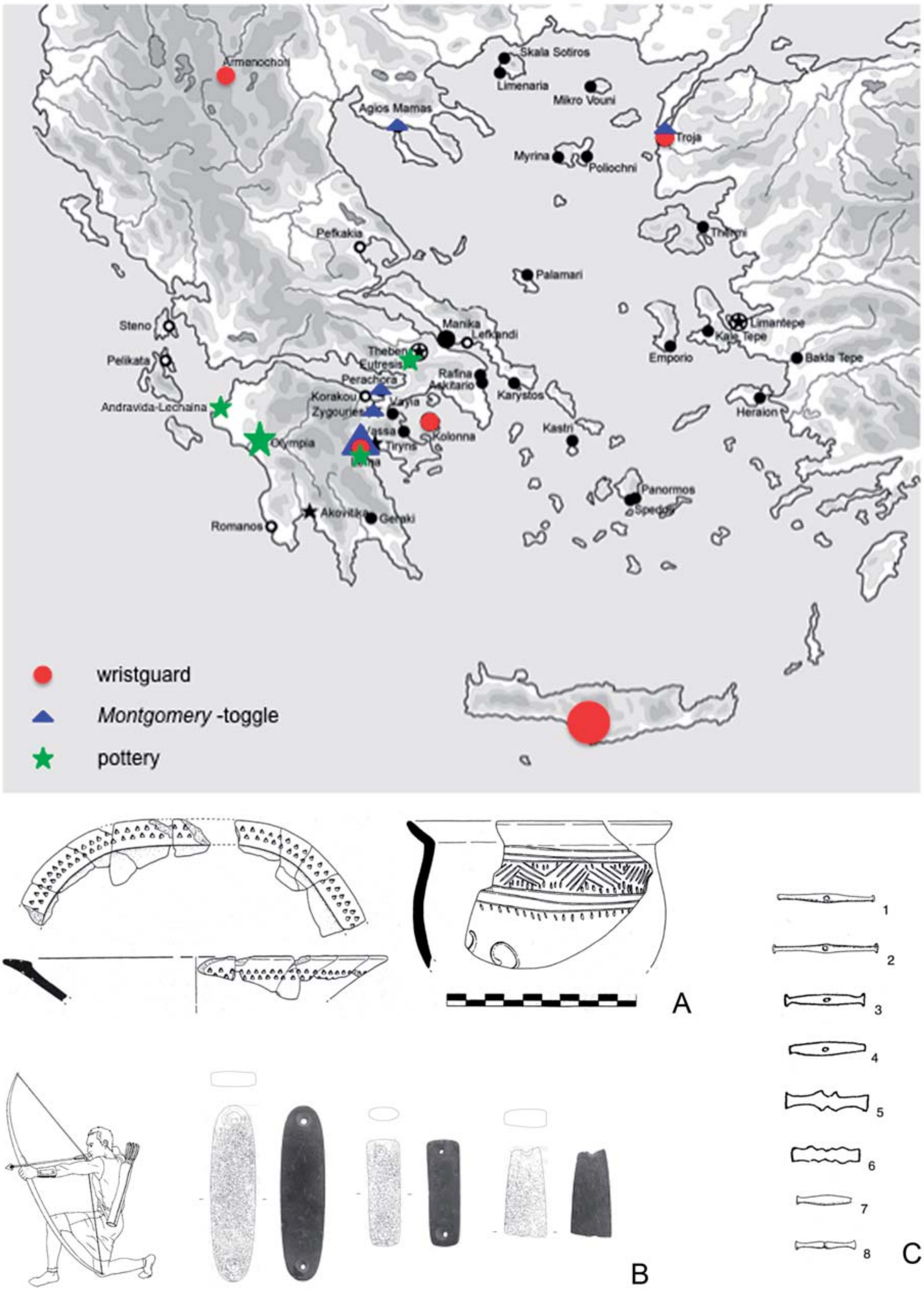

Fig. 29. The distribution of Bell Beaker elements, along some examples, in Greece and the Aegean (map by author) – A: Olympia (after ALRAM-STERN [Hrsg.] 2004 [Beitrag Rambach]); B: Kolonna (after RAHMSTORF 2008), C: Montgomery toggles from various Greek sites (after MARAN 1998)

can argue that these Beaker margins also reached as far as the Early Bronze Age core, namely to Greece, Crete and the Aegean *(Fig. 29)*. This European southeast has only recently come into the focus of the Beaker research (Heyd 2007b; Maran 2007; Rahmstorf 2008). Beside conspicuous pottery evidence from Olympia, it is again the wristguards that form the majority of the diagnostic Beaker elements.[14]

As a result of this recent interest, more wristguards, both the broader four-holed and the oblong-narrow two-holed, are now known from the Aegean than from the whole of Italy, for example. Whilst the Cretan and Trojan specimens cannot be attributed to a specific period within the wider Early and Middle Bronze Age, the five wristguards from Lerna in the Argolid and the three plates from Kolonna on Aegina come from secure contexts (Rahmstorf 2008). They almost all date to Early Helladic III levels (as does the pottery evidence from Olympia), thus after 2200 BC in absolute terms. This makes them late Beaker, as compared to the Central and western European examples. The best explanation for the relatively late appearance of these Aegean wristguards, and other Bell Beaker related finds, lies with further Adriatic pottery of the Dalmatian Cetina that also reached the Peloponnese in the later third millennium BC. Joseph Maran has described their background and context in detail (e.g., 1998), and he is surely right in seeing at work a migratory event, bringing Early Bronze Age Adriatic people incrementally to southern Greece for some decades from the transition of early Helladic II to III. And since early Cetina is one of those syncretistic Bell Beaker cultures of its southeastern periphery as shown above, this best explains the manifestation of these Bell Beaker package elements deep in southeastern Europe.

Bell Beaker ideological peripheries and initial Bronze Age cultural, social and economic peripheries therefore meet from the 25th century BC in the Central Mediterranean, on both sides of the Adriatic basin including much of the western Balkans as well as southern Italy and Sicily. Here, people from the two directions, and the very different value systems and world-views, may have greeted each other. There are even marginal Beaker elements that reached the Early Bronze Age core in the Aegean, if only from 2200 BC. But more decisive for the further course of development are the new cultural, social and economic ideas and values, ultimately originating in the Aegean, and their materialization and reception, that reached beyond this contact zone, deep into continental Europe – by then regions with Beaker occupation, soon to become the new Early Bronze Age focal points.

On the retreat: Late Yamnaya, Katacombnaya and Corded Ware groups around 2500 BC

Another aspect should briefly be highlighted here when discussing this interplay of the time around 2500 BC between progressing "Early Bronze Age-*isation*" from the southeast and expanding "Bell Beaker-*isation*" from the west: groups of the Later Yamnaya, the Katacombnaya and the European Corded Ware complex *(Fig. 30)*. However, as touched upon in the introduction, the importance that lies in the steppe cultures for the further course of developments has already widely diminished by the time of the mid of the millennium. Those graves of the Yamnaya – in the first quarter of the third millennium BC the dominating and innovative factor in the southeast and east-Central European lowlands (Harrison – Heyd 2007) – that one would put "late" judged on the base of their ^{14}C-dates and associated finds, are now significantly reduced in their numbers; there is even a total lack of them in the Carpathian Basin. Beside, the transformation from Yamnaya to Katacombnaya in the core area of the steppe cultures north and northeast of the Black Sea also falls approximately in this period of between 2600–2400 BC. No doubt, this must have affected the basic societal systems deeper than the visible changes in sepulchral and burial customs let us assume on first glance. One can perfectly imagine that also subsistence economy,

[14] The Montgomery bone toggles, as analysed by Maran 1998; Nicolis 2005 and Rahmstorf 2008, should be added. Their Europe-wide distribution and chronology shows that they probably took the same pathway as the wristguards.

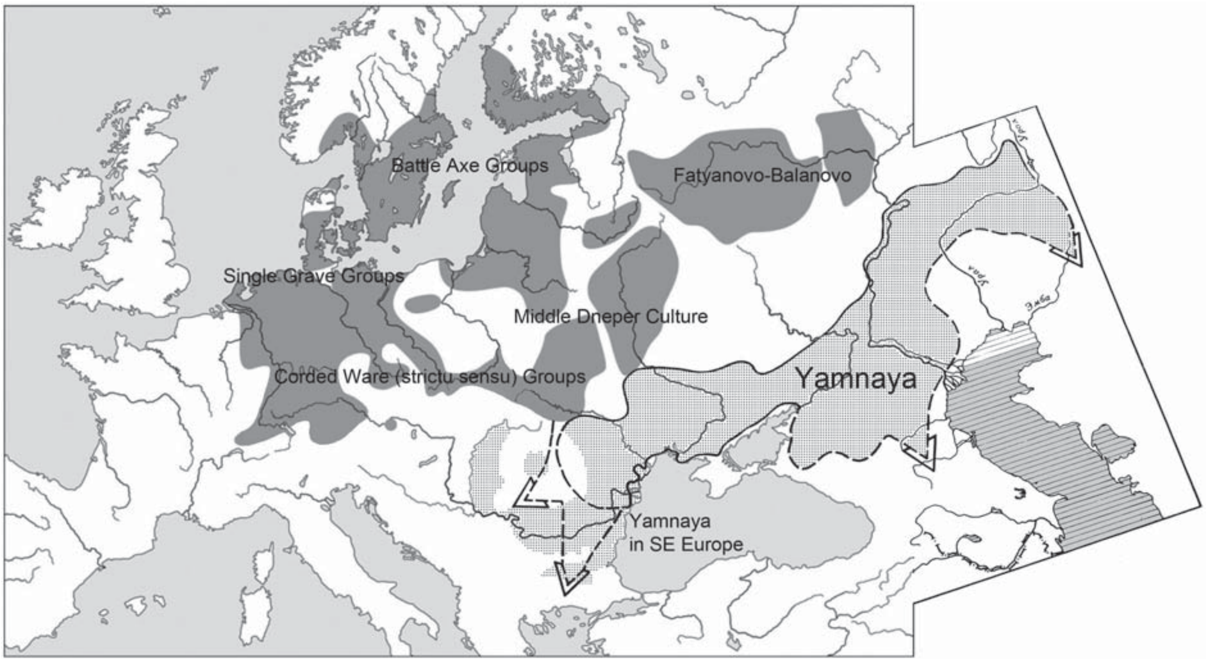

Fig. 30. Schematic Yamnaya and Corded Ware distribution in Europe (background map and Corded Ware distribution based on Müller *et al. 2009, modified; Yamnaya distribution based on* Merpert *1974 and* Heyd *2011). Note that the Yamnaya west expansion is now dated to c. 3050 BC while the Corded Ware complexs in Europe seems not to start prior to 2850 BC*

communication and mobility, and exchange patterns are altered for major parts of the population. One effect, important for our concern here, is that Katacombnaya is mostly retreating to the regions beyond the Danube delta: in Bulgaria south of the Balkan Mountains, graves attributed to the Katacombnaya in the literature and dated by associated finds to the period of around 2500 BC, are not completely unknown, such as grave 12 from Golyama Detelina, barrow 2, or perhaps graves 1–2 from Mednikarnovo-Iskritza, barrow 2. But real lateral catacomb constructions are not among those (Leshtakov 2006). The same is true for Romania, from where some more late graves are published, but only a few sites have delivered evidence for catacombs, such as from Smeeni-Movila Mare, graves 1, 23, 27 and 28 (Muntenia). Only Moldova still knows them in significant numbers. Whatever happened in detail, one gets the impression that it was this loosening grip of Yamnaya-Katacombnaya populations on the landscapes south of the Balkan Mountains at this time that have facilitated the cultural reorientation described above, and thus the advance of the Anatolian/Aegean Early Bronze Age ideas. To add, speculatively, the reason why our eastern Balkans network periphery remains restricted to the European part of Turkey and southeastern Bulgaria, and only haltingly transgresses the Balkan Mountains, may lie in the continuing presence of these steppe populations who were still settling, albeit in reduced numbers, along the Lower Danube, in the Dobrudža and in parts of eastern Romania.

It remains to discuss the evidence for the Corded Ware and Single Grave groups. Indeed, both do reach super-regionally in Central, northern and eastern Europe in the period around 2500 BC, and interact with the expanding Bell Beaker phenomenon in the regions along the Rhine, Elbe, Oder and Danube rivers, as well as in the north European lowlands and in southern Scandinavia (e.g., Nicolis [ed.] 2001; Czebreszuk [ed.] 2003). However, this interaction works out in a regionally quite diverse pattern: While in some regions the respective Bell Beaker groups increase rapidly and soon dominate the records, as for example in large parts of the Bell Beaker *East Group* (Heyd 2007a), in others an equilibrium is more or less established between the two, such as perhaps in Jutland; and in a group of more remote regions (such as in southern German Franconia and the Tauber river valley) Bell Beaker users cannot get a proper foot on the soil, and Corded Ware groups still dominate the records for the centuries between 2500 and 2200 BC. As a general message, it can be sent out that pure Corded Ware units gradually decrease in numbers during these centuries, more in the south and the west than in the north and east. Their ideology seems to have faded and no longer has the strong grip to keep people in their rows. Nevertheless, the users of Corded Ware beakers, or those still living in this tradition – now transformed to utilize no more cord for the beaker decorations but incised, impressed and stamped techniques instead; or *pot beaker* and *Riesenbecher*; and strongly varying in their burial customs – are reaching the period of around 2200–2000 BC in wide parts of Central Europe; a period when the previous contradistinction "Bell Beaker–Corded Ware" is finally overcome with the formative Early Bronze Age (Bertemes – Heyd 2002). But altogether neither Yamnaya, nor Katacombnaya, nor Corded Ware and other related groups do play anymore a significant role in much of Europe after 2500 BC.

Exploring the antagonism between 2500 and 2200 BC: a brief discussion

As briefly described in the introduction, the Bell Beaker phenomenon represents the climax of these ideologically driven cultural phenomena, having dominated the course of events on the European Continent for almost one-and-a-half millennia. With Bell Beakers, the western half of the Continent is incorporated in these expansionistic phenomena for the first time. The whole became a truly European phenomenon, by virtue of the distribution of influences to the eastern peripheries and adjacent margins, representing more distant parts of the Bell Beaker idea. However, Bell Beakers are not only the climax, but also represent the end-point of this true epoch, for which more an idea, a message and a particular world-view are the centre of gravity. This fits the expansive and aggressive, almost missionary, outlook well. One also gets the impression that there was an attempt to convert, not always peacefully, as many people as possible for this newly emerging community. The emblematically decorated Bell Beaker, the symbol, and before that to some extent the Corded Ware beaker, are the ideal communal drinking vessel for this: on average enough content so that several persons can consume a special drink out of it; a form that forces one to use both hands for drinking; and then to hand it over, again with both hands, in an almost ritual manner, to one's neighbour.[15] However, it was not so much the Bell Beaker itself, but two other elements of the Beaker idea and package that reached the peripheries and margins more often, and must therefore have been more interesting as innovations for newcomers of any cultural background. These are the dagger idea, no matter if made of metal or, in the north in southern Scandinavia and along the Baltic Sea, of flint (Sarauw 2008); and the archery idea, materialised in the arrowheads and wristguards (Fokkens – Achterkamp – Kuijpers 2008). Both were obviously very attractive for distant peoples, so that they did not hesitate to acquire these elements in their own repertoire, even if they, in the distance, may not have completely understood the message lying behind them. But within the wider framework of individualisation und internationalisation, such daggers were prestigious enough to become highly regarded all over in Europe; likewise, the societal acceptance of archery, with the wristguard as its symbol of adherence, brought advantages in hunting and more in warfare.

The Early Bronze Age, expanding from the southeast at the same time, is fundamentally different. It is a gradual process; more a cultural re-orientation than a different ideology. It also has a clear trajectory, ultimately originating in the Aegean, the eastern Mediterranean and beyond, and then crossing the

[15] This communal way of drinking makes the true difference to the more personalised drinking vessels of the beginning of the Early Bronze Age. In such, it qualifies other considerations of potential internal connections between the Bell Beaker idea and southeastern European Early Bronze Age (cf. Maran 2007; Rahmstorf 2008).

Continent from the southeast to the northwest. Thus the first regions in Europe displaying new Early Bronze Age structures are no wonder bordering the Aegean, western Anatolia and Greece as in the cases of the eastern and western Balkans, the Adriatic and the southeast Italian peninsula. A next stage then sees this trajectory continuing further to the north and west, and bringing new lifeways for the people to the Central Carpathian Basin, including its northwestern border already part of Central Europe, and to northern Italy. It probably also includes southeastern and southern Romania, not much discussed here.[16] With some certainty, this also comprises southern Spain and the forming El Argar culture, although its links are, if proved to be true, different in displaying rather an eastern Mediterranean and northern African trajectory. Much of Central Europe then follows suit within a relatively short time span. But by now this system is already becoming a rapidly accelerating, multi-polar world and many new centres are radiating more independently, such as when looking at southern France and its links with both northern Italy and western Central Europe (Vital – Convertini – Lemercier [eds] 2012). This makes the whole picture a more complex one.

Economic and social aspects were at the top of its agenda: production, the exchange of surplus and the first *real* trade, as well as the systematic accumulation of possession and wealth; this includes in particular an enhanced role of metals, their exploitation as ores, alloying, manufacturing as finished products, marketing and hoarding. As such, it also stands for a Europe of new values and new symbols of wealth and power; a kind of capitalist world in embryo, if one wants, for the then European people. These see new categories of weapons, prestigious objects of personal adornment, new dress codes, golden/silver drinking cups, exotica etc., in sum a package of ultimately southeastern innovations. All this makes the Early Bronze Age a Europe of emerging complexity and the rise of local elites. Because for most of continental Europe they had previously been Beaker users, in the same way the privileged people of the Beaker period became the new elites of the Early Bronze Age (Heyd 2007a, 370). But geographical position and timeline are crucial in this. The centre of gravity around 2500/2400 BC still lay on the Bell Beaker side for much of Europe, while around 2300/2200 BC it shifted towards the new Early Bronze Age agenda. And soon, after 2000 BC, these elites were fully established and became archeologically visible in their princely graves, hoarding practices, abundance of weapon and jewellery, and monumental burial places (tumuli), settlements (hillforts) and longhouses.

This antagonism therefore also refers to the question of identities, multiple identities and the change of identities over time. Particularly apparent is this development in the Central Mediterranean region, and particularly in the Adriatic basin, where, as shown above, both “worlds” do meet in an early stage of their respective expansions, in the course of the 25/24th century BC. Here, it is the Cetina of the Adriatic basin that best represents this occurrence of multiple and changing identities: not only is one and the same archaeological culture a Bell Beaker ideological periphery, but at the same time an Aegean periphery of the emerging Early Bronze Age. In such, Cetina is perhaps an early forerunner of subsequent, full-flange Bronze Age developments. More important is, however, the fact that it is in no way an accident that the Central Mediterranean region becomes from the Early Bronze Age onwards an important international player at the crossroad of streams of exchange, trade and people.

[16] See in particular the so-called Pre-Verbicioara finds, and the distinct plain cups and tankards, discussed by Nica 1998.

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Transition to the Bronze Age: Issues of Continuity and Discontinuity in the First Half of the Third Millennium BC in the Carpathian Basin

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Abstract

The aim of the article is to investigate the issue of continuity and discontinuity during the Late Copper Age-Early Bronze Age transition in the Carpathian Basin. A previous generation of scholars reconstructed a sharp break in material culture between these two periods, A new chronological model is sketched based on the currently available radiocarbon dates for this crucial transition and the immediately following period, and considerable overlap is suggested between assemblages previously dated to the Final Copper Age and the beginning of the Early Bronze Age, verifying the existence of a transitional period ca. *2800–2600 BC. A cursory review of material culture and other phenomena also indicate some continuity. The fundamental importance of interregional interaction in this transition is emphasized and demonstrated through a few examples.*

Introduction

The issue of continuity and discontinuity at the transition from the Late Copper Age to the Early Bronze Age in the Carpathian Basin received fairly little attention for a long time, and has regained the interest of scholars only in the past decade. The aim of this volume is to remedy this problem, and our paper is an attempt to summarize various aspects of this transition in a number of regions of the Carpathian Basin and to provide a framework for more detailed discussions that will follow. Our paper will briefly review the terminology of the period under study in various research traditions – although with a focus on Hungary – and discuss issues of chronology, the question of the beginning of the Bronze Age and its possible overlap with some assemblages stylistically dated to the Late Copper Age (and vice versa). We will also examine a few well-known case studies that exemplify the importance of interregional interaction at the beginning of the Early Bronze Age in the Carpathian Basin and the immediately surrounding regions.

While many of the issues reviewed here are only the basic tools of archaeological research, they are often not based on factual data alone, but are burdened with preconceptions that distort the ways in which we conceptualize the observable changes that took place in the period, which have wide-ranging implications for the study of social, economic and ideological transformations around and immediately after 3000 BC. One of these is an outdated insistence on the use of a rigid concept of "archaeological cultures" (comp. FURHOLT 2008). At the end of the article we will point out a few directions we think should be followed when studying this crucial transition in the prehistory of the Carpathian Basin.

A traditional cultural-historical framework

During the history of research the chronological frameworks used to organize Bronze Age materials in the Carpathian Basin have gone through tremendous change and development. To complicate the matter further, there are a number of different systems that are used simultaneously, usually by scholars working in different national traditions, although in some cases there are variations even within a single country (for a comparative chronological chart of all the major systems see GOGÂLTAN 1998; 1999).

The first systematic chronological framework for the Bronze Age in Hungary was based on early excavations at tell settlements in the eastern part of the country. The most important among these was the site Tószeg-Laposhalom, excavated in many campaigns and by many scholars between the late 19th century and the 1970s (for a review see Banner – Bóna – Márton 1957; Bóna 1981; 1992b). The chronology created by Ferenc Tompa based on his excavations (Tompa 1937, 61–64) was taken over by V. Gordon Childe, and became the basis of the chronology of the Bronze Age in the area (Childe 1929, 246–391). That system was continued and modified mostly in Amália Mozsolics's work, who also excavated at Tószeg (Mozsolics 1952), and developed her own system mostly based on metal objects (Mozsolics 1967; 1968; 1973; 1985; Mozsolics – Schalk 2000).

The system currently used in Hungary was developed by the early 1980s by a number of Hungarian scholars and concerned mostly the Copper Age and the Early and Middle Bronze Ages (Bándi 1982; Kalicz 1982; Kalicz-Schreiber 1982; Kovács 1982; Patay 1982). According to this system the Bronze Age was divided into three main phases: Early, Middle and Late. All these phases are in turn divided into three sub-phases (1–3), which in certain areas and at certain times can be divided into even smaller units (a–b). This system has since been elaborated and refined in certain aspects (for the Carpathian Basin e.g., Kalicz-Schreiber 1989, Fig. 7; and Ecsedy 1979b; Bóna 1992a; Bondár 1995; 2001; Kalicz-Schreiber – Kalicz 1997; Dani 2005; Kulcsár 2009a; Reményi 2009; for a wider region e.g., Maran 1998; Bertemes – Heyd 2002; Harrison – Heyd 2007), but has remained unchanged in its fundamental aspects.

Traditionally, the Late Copper Age of the Carpathian Basin *(Fig. 1)* is characterized by the emergence of the so-called "Baden phenomenon" with its characteristic pottery style, biritual burial rites, cattle burials, etc. (see e.g., Banner 1956; Kalicz 1963; Bondár 2001; 2002; Horváth 2008; 2012; Furholt – Szmyt – Zastawny [eds] 2008; Furholt 2009). The distribution area of the "phenomenon" and stylistically related material culture covers a huge, spatially non-contiguous area centred on the Carpathian Basin with smaller "patches" in southern Germany, Austria, Moravia, southern Poland, northeastern Croatia, northern Serbia, western and southern Romania and Bulgaria (for recent distribution maps see Horváth – S. Svingor – Molnár 2008, Fig. 5; Horváth 2011a). In its late phase the so-called Kostolac type material makes its appearance, also in a non-contiguous area throughout the basin, whose assessment as either a separate "culture" or a special style of pottery decoration remains controversial (see e.g., Roman 1980; Bondár 1984; see also Horváth 2011a; 2012 for a different chronological assessment). The same period to the east, in northwestern Romania (the areas Maramureş, Transylvania, Crişana, Oltenia, western Muntenia), northeastern Serbia and northwestern Bulgaria is characterized by the closely related Coţofeni type material (e.g., Roman 1977; Ciugudean 2000). In the eastern part of the Carpathian Basin in eastern Hungary east of the Tisza River, and in a large, non-contiguous area in Romania, northern Bulgaria and Serbia large numbers of burial mounds, so-called kurgans, appear at the end of the Copper Age with Pre-Yamnaya or Yamnaya (Pit Grave) type material that is usually considered to be of eastern, steppe origin (for Hungary see Ecsedy 1979a; Kalicz 1989; 1998; most recently: Dani 2011; Heyd 2011; Horváth 2011b; Dani –Horváth 2012). The last important group of Late Copper Age material – which provides already a transition to the Early Bronze Age – is labelled after its type site at Vučedol near Vukovar and has a distribution area mostly in northeastern Croatia – Syrmia and eastern Slavonia – in its early phase (e.g., Dimitrijević 1956; 1977–78; 1979; Durman [ed.] 1988).

The northwestern part of the Carpathian Basin – western Slovakia and eastern Moravia – is characterized by Bošáca and Kostolac type materials in the Final Copper Age. According to the most recent data, to the south we encounter sites with Jevišovice type material (Šuteková 2008; 2010). Similar assemblages are known in large parts of Moravia (Medunová-Benešová 1977) and from Lower Austria as well, labelled Mödling-Zöbing (Ruttkay 1995).

The beginning of the Bronze Age in the central part of the Carpathian Basin can be sketched along two lines *(Fig. 1)*. If we simplify a rather complicated situation we may say that in southern Transdanubia, Slavonia and Syrmia late Vučedol and then Somogyvár-Vinkovci type materials can be found. Most of

Fig. 1. Cultural geography of the Carpathian Basin in the earlier 3rd millennium BC (the archaeological groups dating to roughly the first quarter are marked in black, the ones dating to the second quarter in blue)

the Great Hungarian Plain, northern Transdanubia and southwest Slovakia are characterized by Makó-Kosihy-Čaka type finds (comp. e.g., Bóna 1992a, 15; Kalicz-Schreiber – Kalicz 1997, Abb. 1; Reményi 2009, maps 1–2).

With regard the issue of the transition from one major chronological phase to the other, the case of sites with Vučedol style material has been usually seen unproblematic, since there is an obviously continuous development between the early and later phases in terms of material culture and settlement structure as well. The distribution of Somogyvár-Vinkovci style material appears to overlap to some extent with that of Vučedol style material, and seems to be later in most cases, although most sites that yielded both material groups remain unpublished. Here stylistic continuity is less apparent, although it does exist to some extent. In Transylvania, Late Copper Age Coţofeni style material develops smoothly into EBA Livezile. In the other areas of the Carpathian Basin no stylistic continuity has been observed between Late Baden and Kostolac on the one hand and Makó-Kosihy-Čaka and Somogyvár-Vinkovci on the other. It has to be emphasized, however, that due to the traditional culture concept, no-one has actually looked for such stylistic and typological connections, since the beginning of the Bronze Age was accepted to be marked by large population movements, mostly from the Balkans (for an exception see Horváth – Kulcsár 2012). This view, however, has to be questioned in the light of new chronological data.

A new chronology

In the past decade a series of new data from the Late Copper and Early Bronze Age have made us rethink the process of this transition (see esp. Horváth 2011a; 2011c; 2012b; Horváth – Kulcsár 2012; Kulcsár 2012a; 2013). New finds and new radiocarbon data[1] from both periods made us realize that the process of transition is much more complex both in terms of chronology and the issue of (dis)continuity.

[1] All radiocarbon dates were (re)calibrated using OxCal v4.2.3 (Bronk Ramsey 2013), using the IntCal13 atmospheric curve (Reimer *et al.* 2013). All dates are calibrated BC dates with 1σ (68.2%) probability, unless otherwise stated.

With regard to chronology, two lines of evidence must be emphasized: absolute dates for the end of Baden style material and absolute dates for the beginning of Early Bronze Age type materials. With regard to the former, previous views placed it between *ca.* 3000 BC and 2700 BC (Forenbaher 1993; Korfmann – Kromer 1993; Raczky 1995; Stadler *et al.* 2001). Today, however, a new series of radiocarbon dates are available for the classic and late phases of Baden type material, some of which are somewhat contradictory, but seem to push the end of this type of material somewhat later. A series of dates were published by Eva Maria Wild and colleagues in 2001 (Wild *et al.* 2001). This series contained five dates from the final Baden phase (Baden IVa, Ossarn II), which placed the end of this group of finds to *ca*. 3160–2870 BC.

A new series of dates associated with Late Copper Age Baden material are known from the famous cemetery of Budakalász-Luppa csárda (Bondár – Raczky [eds] 2009). Here two dates from Graves 174 and 158 can be placed to the end of the sequence, already between 2900–2680 BC. Zsuzsanna Siklósi's suggestion that the younger date of these two graves may be the result of reservoir effect (Siklósi 2009, 458) is unacceptable, since that would in fact make the dates older, not younger. Nevertheless, both dates already fall partly into the flat section of the calibration curve between *ca*. 2870 and 2580 BC, thus it is possible that they come from samples dated between 2900 and 2800 BC. This would also be more in line with the typological analysis of the grave goods (Siklósi 2009, 458), although it has to be pointed out that the usability and correctness of the ceramic typology worked out by Viera Němejcová-Pavúková in a number of works (Němejcová-Pavúková 1974; 1981; 1991) has been questioned on numerous occasions (e.g., Bondár 2002; Horváth – S. Svingor – Molnár 2006; 2008), and has actually been shown to contradict radiocarbon dates (Horváth – S. Svingor – Molnár 2006; esp. 2008; although see now Horváth 2011c, 54–55). It is, however, also quite possible that these graves can actually be dated to the period between 2800 and 2600 BC.

A series of 20 dates from the large, long-lived settlement of Balatonőszöd-Temetői dűlő (Horváth – S. Svingor – Molnár 2006; 2008; Horváth 2011c; [ed.] 2012a, 689–716) provided a significant contribution to the absolute chronology of the Late Copper Age. Among the dates three seem to be quite late within the Boleráz/Baden sequence: 2910–2700, 2890–2700 and 2860–2580 BC. Two dates were even later – 2460–2290 BC and 1960–1770 BC – although there is an admitted possibility that they came from EBA samples and were mixed up subsequently (Horváth 2011c, 48, note 66).

A radiocarbon dated site with final Baden type material (Baden III/IV) from Hungary is known from Nagykanizsa-Billa. Here four dates scatter between 3300–2900 BC, but one is dated to 2840–2500 BC (Stadler *et al.* 2001). Baden dates from the site of Tiszavasvári-Wienerberger Téglagyár have also been cited as evidence for a late end, an Early Bronze Age survival, of Baden style material (Horváth 2011c, 56, note 69; Dani – Horváth 2012, 97). The dates place the site to 3140–2400/2200 BC (Dani – Horváth 2012, 97: 3860 ± 50 BP, 2457–2235 (1σ) cal BC; see Horváth *et al.*, this volume).

At the moment more than a dozen radiocarbon dates are available from northern Vučedol contexts (Durman – Obelić 1989; Forenbaher 1993) and three dates from the primary grave of Velika Gruda in Montenegro that is stylistically identical or very closely related to Vučedol style material (Primas 1996). The north Balkan dates place this material to *ca*. 3090–2300 BC, where most of the dates fall before 2600 BC, although many of the old dates have an unacceptably high standard deviation. The dates from Velika Gruda fall between 3080 and 2625 BC, where the excavator's estimate for the "true date" of the burial was 2800–2700 BC (Primas 1996, 52). Two measurements from Zók-Várhegy in Hungary are also similar: 2880–2670 BC and 2860–2580 BC (Della Casa 1995, 572). Consequently, we can probably date Vučedol style material in the Carpathian Basin and the northern Balkan to *ca.* 3000–2600 BC, thus bridging the Final Copper Age and the Early Bronze Age through the transitional period.

If we have a look at the dates of the earliest Early Bronze Age assemblages, some overlap with these Late Copper Age sites becomes probable. There are two sites that have to be highlighted in this respect. The first is the burial mound on the Kalvarienberg at Neusiedl am See in Burgenland, Austria (RUTTKAY 2002; 2003). The material of the grave seems to belong to the Somogyvár-Vinkovci style from the beginning of the EBA (although Elisabeth Ruttkay would prefer to term it Late Vučedol: RUTTKAY 2002), but the radiocarbon dates of the samples taken from the skeleton place it to *ca.* 2860–2620 BC (STADLER 2002). The other similar date comes from another burial mound at Sárrétudvari-Őrhalom in eastern Hungary (DANI – M. NEPPER 2006). Here the primary, Late Copper Age interment at the bottom centre of the mound was followed by a number of rich Early Bronze Age secondary burials with Makó and Livezile style ceramic grave goods. Grave 4 was radiocarbon dated to *ca.* 2870–2620 BC, Grave 9 to *ca*. 2840–2490 BC (SZÁNTÓ *et al.* 2006).

These two assemblages are dated to the same 200 year period to which some of the latest Copper Age finds are placed by radiocarbon dates as well. There are two possible interpretations of this situation. The first is, that since all these dates fall into the flat section of the calibration curve between *ca.* 2870 and 2580 BC, it is possible that the Late Copper Age assemblages date to the first half of this section, while the Early Bronze Age ones to its second half, we just simply cannot differentiate between then due to the shape of the curve. This way there would be no overlap between the finds assigned to these two phases. The other possible scenario – gaining increasing acceptance – is that there is an overlap between these assemblages within this 200-year timespan, indicating that object types that are traditionally kept separate chronologically were in fact used at the same time in different regions of the Carpathian Basin. Accordingly, the transition between the Copper and the Bronze Age was not that abrupt and clear-cut as previously believed, and the process has to be rethought.

If we move forward to the Early Bronze Age, the traditional distinction between EBA 1 and 2a (e.g., Makó 1 and 2 phases, Somogyvár-Vinkovci 1 and 2) seems again problematic, since the calibrated radiocarbon dates are not always in agreement with the results of the typological analysis.

Altogether fifteen ^{14}C dates are known from sites with Makó-Kosihy-Čaka style assemblages. Six of these dates – from four sites: Domony (KALICZ 1968; DANI 2005; DANI – KISJUHÁSZ 2013), Nyíregyháza-Császárszállás (DANI 2005; DANI – KISJUHÁSZ 2013), Kismarja (DANI 2005; DANI – KISJUHÁSZ 2013) and Sárrétudvari-Őrhalom (DANI – M. NEPPER 2006) – are assigned to the first phase (EBA 1) on typological grounds. Four sites – Szeghalom-Környe (G. SZÉNÁSZKY 1987–1988), Üllő, Site 5 (KŐVÁRI – PATAY 2005), Battonya-Georgievics tanya (BONDÁR – D. MATUZ – SZABÓ 1998) and Berettyóújfalu-Nagy-Bócs-dűlő (DANI – KISJUHÁSZ 2013) – are assigned to the second phase (EBA 2a) – although in the last case the authors recognized the contradiction between the radiocarbon dates and the traditional interpretation of the typological repertoire of the site.

The earliest dates come from the graves of the above-mentioned Sárrétudvari kurgan. If we carry out a Bayesian analysis of the dates of the stratified graves from the tumulus, assigning them to three phases, of which the first two (Grave 12 and Grave 10) belong to the Late Copper Age and the third (Graves 4 and 9) to the Early Bronze Age, the date of Grave 4 will not be any more precise (2870–2600 BC), while the span of the date from Grave 9 will shorten a bit to 2860–2580 BC *(Fig. 2)*.

The second earliest date comes from Nyíregyháza-Császárszállás, Feature 72, dated to 2840–2460 BC. This site had only two features with Makó style material, both of which are dated with radiocarbon. Feature 140 has a date 2470–2300 BC, which is later than the other date, with practically no overlap between the two at a 1σ range. Interestingly, Feature 72 with the earlier date contained a ceramic fragment with characteristic Nyírség style decoration, which is supposed to start only in EBA 2. Some 20 features with Nyírség style material were also found at the site, with two radiocarbon dates, which are, however, later. If we accept the premise that these two features are contemporary, combining the two dates may provide a more exact time-span for the occupation. The combined date of the two radiocarbon measurements from EBA 1 features is 2550–2340 BC.

Two samples from two features were dated from Kismarja, Site 1. A sample from Feature 12 is dated to 2550–2300 BC, while Feature 13 seems to be somewhat later, 2430–2200 BC. This second date is more in the range expected for Makó phase 2 assemblages. The combined date for the site is 2450–2290 BC.

Although Szeghalom-Környe has been assigned to Makó phase 2 on typological grounds (G. SZÉNÁSZKY 1987–1988), its radiocarbon date is identical to that from Kismarja, Feature 12: 2550–2300 BC (RACZKY – HERTELENDI – HORVÁTH 1992, 43, Nr. 18). The case of Battonya-Georgievics tanya is similar: it is assigned to phase 2 on typological grounds, but the radiocarbon date is closer to the ones listed above: 2460–2290 BC.

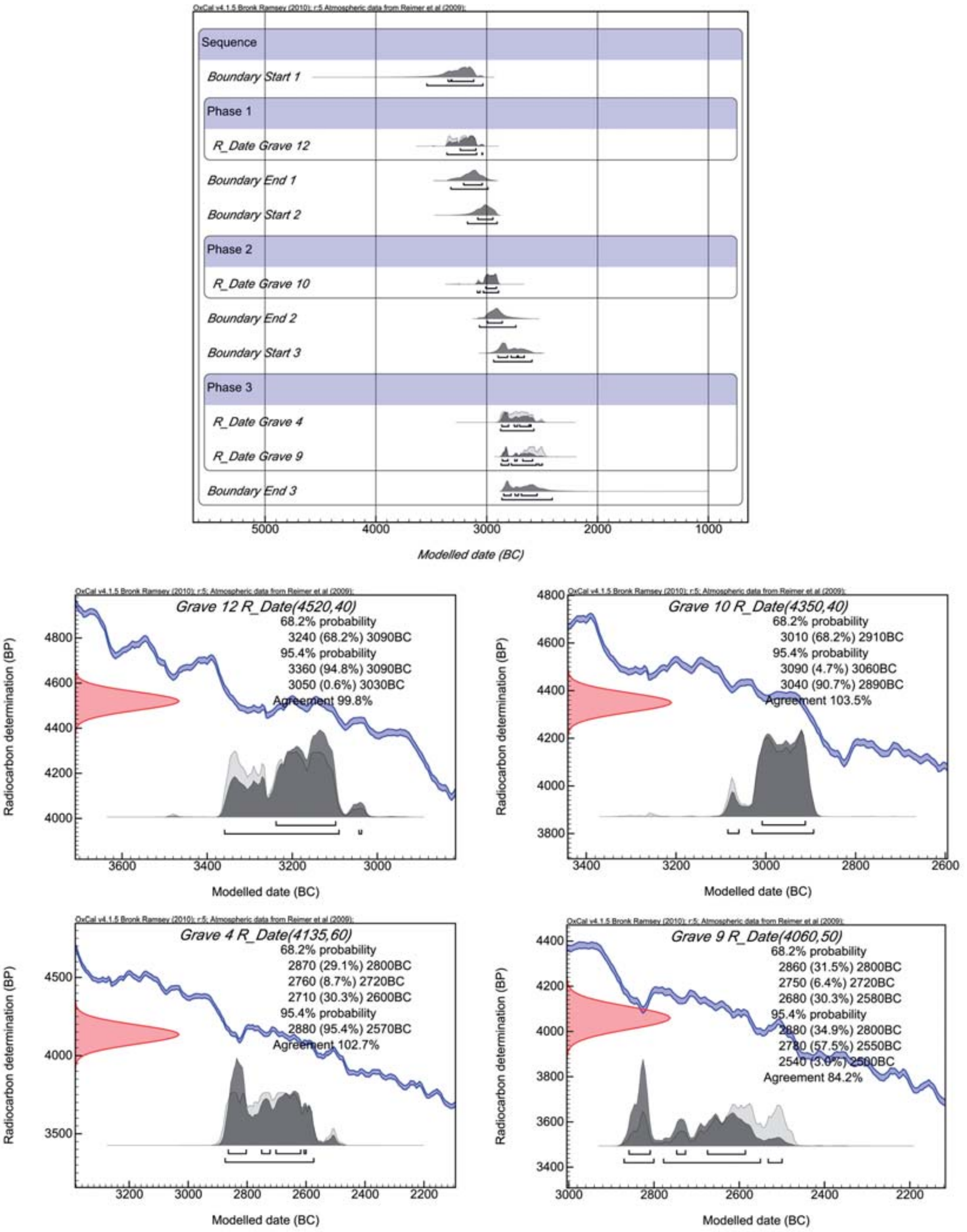


Fig. 2. Bayesian analysis of radiocarbon dates of the burial mound Sárrétudvari-Őrhalom

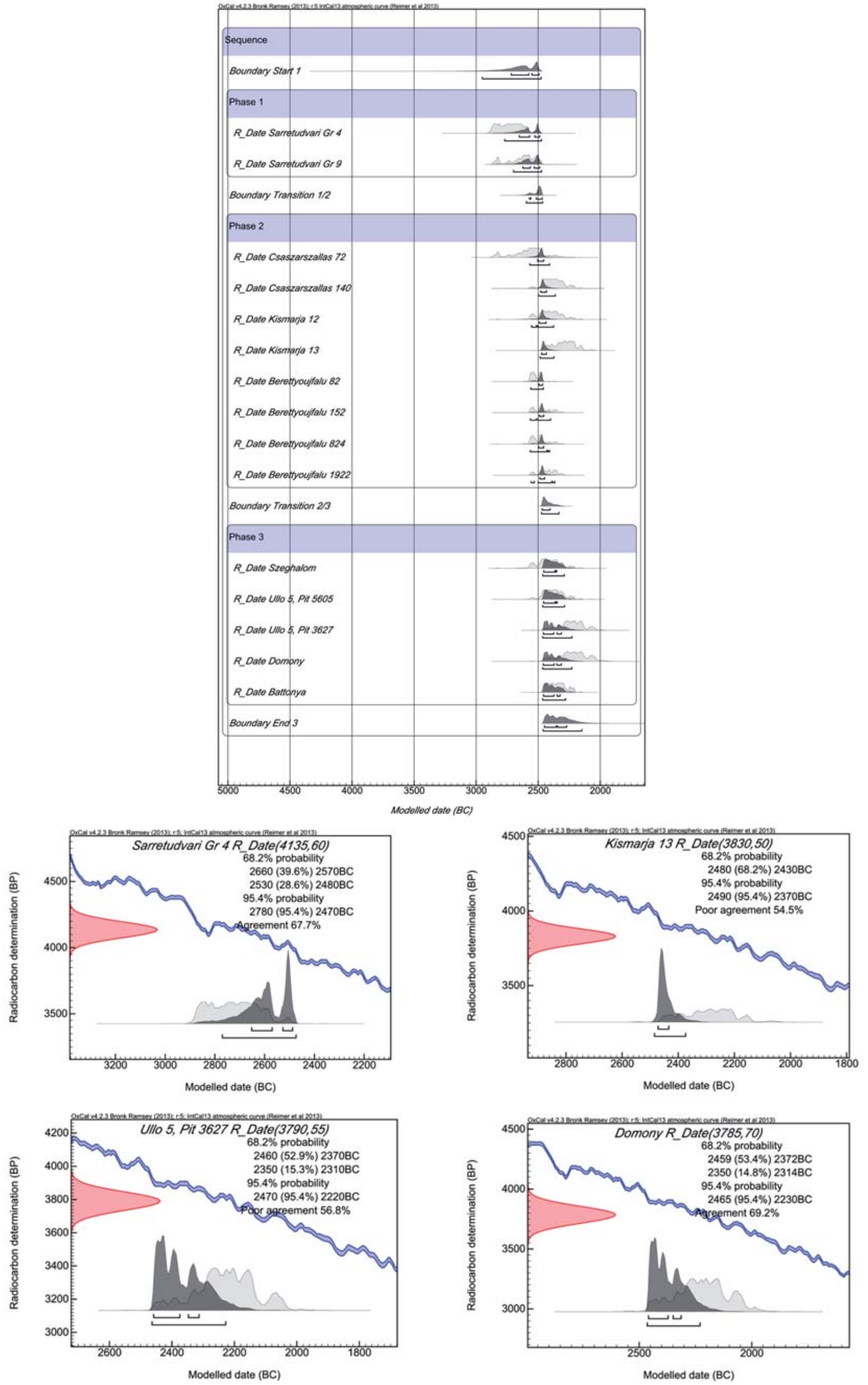


Fig. 3. Bayesian analysis of radiocarbon dates from Makó assemblages with dates poorly fitting the model (below)

Üllő, Site 5 yielded two radiocarbon dates from two features. The date from Pit 5605 is 2470–2300 BC, while the date from Pit 3627 is 2340–2130 BC. As we can see, their 1σ ranges hardly overlap. It has been suggested on typological grounds that the site belongs to the Makó 2 phase (EBA 2a). Based on these radiocarbon dates, however, we can also assume that the site was in use for a longer period, and Makó phases 1 and 2 cannot be distinguished that easily on typological grounds. If we assume, however, that the settlement features are contemporary, the combination of the two dates gives the rage 2450–2210 BC. Domony is assigned to phase 2 on typological grounds and has a later absolute date: 2340–2050 BC (Forenbaher 1993, 241, Fig. 3).

Most recently four dates have been published from the site of Berettyóújfalu-Nagy-Bócs-dűlő (Dani – Kisjuhász 2013), two from cremation graves and two from settlement features: 2570–2470 BC, 2570–2350 BC, 2570–2460 BC and 2550–2340 BC. Their combined date is 2550–2460 BC or 2560–2460 BC (2σ).

There are clear contradictions between the stylistic assessment and radiocarbon dates of some of these sites. If we carry out a Bayesian analysis on them, creating a sequence of three phases with Sárrétudvari representing the first, Makó 1 style assemblages the second, and Makó 2 style assemblages the third phase, this becomes even more apparent *(Fig. 3)*. In the case of at least two dates (Kismarja, Feature 13 and Üllő 5, Pit 3627) the "agreement value" is below 60%, which is considered poor. In two other cases (Sárrétudvari, Grave 4 and Domony) the "agreement value" is just above 60% *(Fig. 3)*. This indicates that these dates do not fit the "prior probability model", which has to be re-evaluated.

If we consider only the dates without the stylistic assessment of the sites, these fifteen dates seem to represent three phases that do not entirely confirm the expectations based on the typological analyses. Sárrétudvari-Őrhalom can be placed at the very beginning of the Early Bronze Age (*ca.* 2750–2600 BC), probably overlapping with the latest Final Copper Age assemblages. An earlier Makó phase – with assemblages including elements as well that previously had been assigned to phase 2 (see also Dani – Kisjuhász 2013) – can be dated to *ca.* 2550–2300 BC. The later phase can be placed to *ca.* 2300–2150 BC. Üllő 5 seems to lie on the border of these phases.

When we turn to Transdanubia, nine radiocarbon dates are known from seven sites with Somogyvár-Vinkovci style material (cp. Raczky – Hertelendi – Horváth 1992; Kulcsár 2013). The burial in the tumulus grave of Neusiedl am See has been assigned to Vučedol style material (Ruttkay 2002; 2003), although typologically it does not seem to be much different from other Somogyvár-Vinkovci assemblages. The assignment to an early phase is based mostly on the rather early radiocarbon date from the burial. Human bone from the grave was dated in two AMS laboratories, in Vienna and Zürich; the combined date is 2870–2620 BC (2σ). With the exception of Győrszemere-Tóth-tag, all the other sites are usually dated to the first Somogyvár-Vinkovci phase (EBA 1). It has been suggested that Győrszemere might be later (EBA 2a), although its material is typologically identical to the others. The argument is indirect: since EBA 1 in the northwestern part of the Carpathian Basin is "occupied" by the "Makó culture", Somogyvár-Vinkovci assemblages can be only later (Figler 1994, 23).

Szava and Győrszemere are dated to 2580–2470 BC and 2620–2460 BC, respectively (Raczky – Hertelendi – Horváth 1992, 43; Figler 1996). The grave from Šurany has a similar date: 2570–2340 BC, while all the others can be placed after 2500 BC (Novotná – Paulík 1989). The combination of the two dates from Pécs-Nagyárpád provides a date of 2460–2340 BC (Raczky – Hertelendi – Horváth 1992, 43; Forenbaher 1993, 241). While the two dates from Vinkovci-Hotel have a rather large standard deviation (Durman – Obelić 1989, 1003–1004), if we assume that the site is contemporary with the radiocarbon dated urn grave nearby, dated to 2450–2309 BC (Kalafatić 2006, 23–24, Tab. A), and use Bayesian statistics, the ranges become significantly shorter, *ca.* 2450–2300/2250 BC. A similar result is provided by the combination of all three dates from Vinkovci.

As a result we may establish that there seems to have been a short, *ca*. 200-year-long phase between 2800 and 2600 BC in the Carpathian Basin, when "Late Copper Age" material culture (late Baden, perhaps Kostolac?) was used contemporaneously with "Early Bronze Age" type material culture (earliest Makó and late Vučedol/earliest Somogyvár-Vinkovci). Currently, however, this phase is very difficult to fill with known archaeological material. In the next phase, the previously accepted twofold division of EBA pottery styles does not seem to hold against radiocarbon evidence. While these assemblages do belong to the EBA 1 and 2a phases, their typological differentiation seems impossible at the moment. In the light of this new chronological framework, our interpretations of the period have to be changed as well.

Continuities and discontinuities, interaction and transformation

The new chronological outline sketched above – even with its uncertainties – compels us to rethink the processes of transition from the Late Copper to the Early Bronze Age. Previously held opinions about a clean-cut division of the two periods and their material culture do not seem to hold up against new evidence. Here, first we would like to briefly review a few archaeological phenomena that show at least some continuity across this chronological border, and then we would like to demonstrate through a few examples the significant role of increased interregional interaction in the emergence of Early Bronze Age societies. These two aspects of the transition often go hand in hand.

In some areas of the Carpathian Basin, a degree of continuity can be observed in terms of settlement structure and location. In most of the Carpathian Basin, the settlements of the Late Copper Age were small and dispersed, probably with low population density (e.g., Horváth 2008, 164–168). There are two areas where larger fortified hilltop settlements emerged in the final phase, around 3000 BC: in the northeastern part of the Carpathian Basin, in present-day northeast Hungary and eastern Slovakia, along the Ipoly/Ipeľ and Sajó/Slaná rivers, where hilltop settlements with Late Baden and Kostolac style material have been discovered, surrounded by smaller settlements and cemeteries (most recently Patay 1999); and in southern Transdanubia, south of Lake Balaton, and especially in the south-Central part of the basin, along the Danube between Dunaszekcső in Hungary in the north and Belgrade in the south, a series of fortified hilltop sites are known with Vučedol style material (Tasić 1995), clearly controlling the route of the Danube from these strategic locations. Recent excavations at Vučedol itself have revealed a large number of well-preserved timber-framed houses with wattle-and-daub construction, measuring *ca*. 5.6–6.3 × 7.3–8.3 m (Forenbaher 1994; 1995). It remains to be seen, whether these formed part of a more hierarchical settlement network, since systematic settlement research in both regions remains sparse. Nevertheless, both are significant from our point of view as well, since in both areas, some of these settlements were continued in the Early Bronze Age as well.

Settlements dated to EBA 1 in the Carpathian Basin mostly continue the Late Copper Age pattern of fairly homogeneous, dispersed settlements throughout the area east of the Danube and in northern Transdanubia (for a review of settlements see Tóth 2001; Kulcsár 2009a, 58–70; Dani 2005, 63–72). In fact, most of the material of the phase is known from small settlements usually indicated only by pits dug into the subsoil. Remains of rectangular, above-ground, timber-structure houses of various sizes have rarely been found, e.g., at Csongrád-Vidre-sziget (7×37 m), Abda-Hármasok (5×15 m), Tatabánya-Dózsakert, and Hosszúpályi; other settlement features include hearths, ovens, wells and, rarely, ditches. We may distinguish between smaller farmsteads with a single cluster of pits, and larger hamlets with numerous discrete pit clusters perhaps indicating separate households, in a few cases reaching 50–70 features (e.g., Berettyóújfalu-Nagy-Bócs-dűlő, Csengele-Fecskés). However, even in the latter case archaeological features are scattered throughout fairly large areas, indicating low population density.

The pattern, however, is different in the above-mentioned two areas. In the northeast apparently at least some of the fortified hilltop sites were inhabited continuously into the Early Bronze Age, e.g., at Salgótarján-Pécskő (Korek 1968; Bóna 1992a, 11, 21; Patay 1999), where remains of a large, 13×19 m timber-framed house were discovered as well, although without proper stratigraphic observations (Gall – Tankó 2007). In southern Transdanubia, larger hilltop settlements were found as well, in many cases continuing the Late Copper Age occupation, but often in new locations as well (e.g., Somogyvár-Kupavárhegy, Zók-Várhegy, Dunaszekcső-Várhegy, Pécs-Nagyárpád, Batrovci-Gradac, etc.; Kulcsár 2009a, 263–266). Some of these were fortified as well: control excavations at Nagygörbő-Várhegy demonstrated the Early Bronze Age date of the rampart (Nováki 1965), while the recently excavated settlement at Kaposújlak-Várdomb-dűlő was apparently surrounded by a triple ditch (Somogyi 2002; Kulcsár 2012a). However, even in this area most of the settlements were smaller, open settlements, usually indicated only by a couple of pits, although some of these settlements can be larger as well, with 20–30 archaeological features (e.g., Börzönce-Temetői-dűlő: Bondár 1995; Szava: Ecsedy 1979b). Proper above-ground, timber-framed houses have not been identified yet. At a few sites (Pécs-Nagyárpád: Bándi 1981; 1984; Nagykanizsa-Inkey-kápolna: Bondár 2003; Csepreg-Kavicsbánya: Károlyi 1971–1972) larger, rectangular, semi-subterranean structures may have served as dwellings. In the case of Pécs-Nagyárpád these were apparently aligned along a street, and at least two size groups could be distinguished (10–15 m^2 and 30–40 m^2) (although no final report has been published from the site) (Bándi 1981; 1984; Bondár 1995, 232–233; Kulcsár 2009a, 266). It is possible that these settlements were already part of a two-tiered hierarchy with fortified central sites and smaller satellite settlements or temporarily used camp sites (Bondár 1995, 230–235; 2001). The latter range from a single excavated feature (pit) to *ca.* 30 features (Kulcsár 2009a, 266–268), indicating at least some differentiation in terms of settlement character or function.

Recent aerial reconnaissance and field survey in a smaller area south the city of Pécs and the Mecsek Mountains in southern Transdanubia revealed an interesting network of settlements, whose exact date, however, remains uncertain: both Final Copper Age and Early Bronze Age seem to be possible based on the surface finds. Apparently, in this microregion fortified hilltop sites can be found at the corners of triangles whose sides are about 4–6 km long. The use of the model was able to predict the existence of a few settlements that could be groundtruthed (Bertók – Gáti 2009). This shows a much greater density of such sites in a small region than previously expected and indicates that we have to expect more complex settlements networks at the beginning of the Early Bronze Age at least in some areas of the Carpathian Basin.

The above data indicate that beside the obvious differences the settlements of the Late Copper and the Early Bronze Ages do share some characteristics: a loosely scattered pattern of smaller, not too intensive settlements in most areas, but a more differentiated, two-tiered settlement hierarchy centred on fortified sites in the same two regions in both periods.

If we turn to material culture, a few ceramic forms also seem to be used continuously through the Copper Age-Bronze Age transition indicating some form of continuity. The most important of these are the interior decorated pedestalled or cross-footed bowls *(Fig. 4)*. These have been in the focus of research for a long time (see recently e.g., Burger 1980; Kulcsár 1998–1999; 2009a), but many uncertainties still remain regarding their origin and relationships with eastern analogies. It seems that the earliest exemplars appear in Vučedol contexts, around 3000–2800 BC (Dimitrijević 1977–1978, 14–16; Kulcsár 1998–1999, 117–118; 2009a, 308–310). A similarly early date can be assigned to cross-footed and pedestalled bowls with concentric cord-impressed decoration, e.g., Iža from Kostolac context (Němejcová-Pavúková 1968, Abb. 22), Branč (Vladár 1966, Abb. 33. 7) and Nagyhalász-Királyhalom, probably from a Late Copper Age kurgan in eastern Hungary (Dani 2011, 34, Fig. 13. 9). While the cross-footed stray bowl from Salgótarján-Zagyvapálfalva decorated both inside and outside

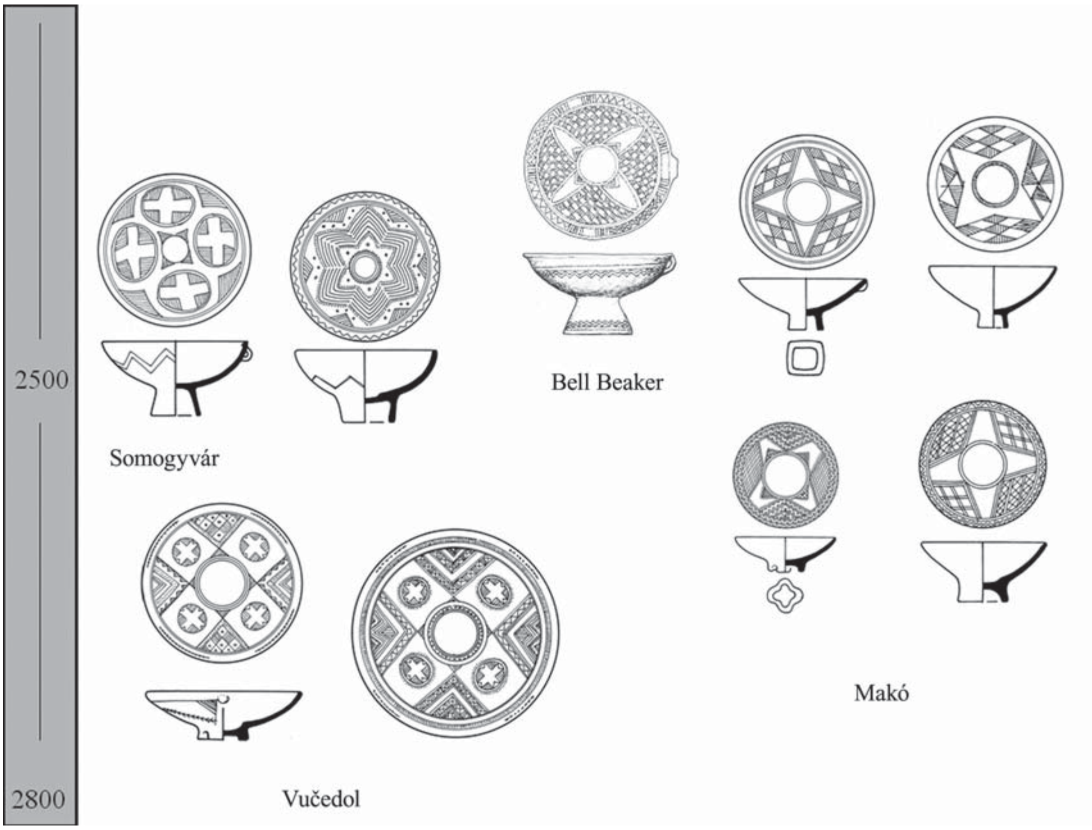


Fig. 4. Interior decorated pedestalled and cross-footed bowls – general chronology

(Kulcsár 2009b, 187, 1. kép; 2013, 644–645, Fig. 2. 2) has no context, its exact analogue from Vysočany in southeast Moravia belongs to Jevišovice type material (Medunová-Benešová 1977, Tab. VIII; Kulcsár 2013, Fig. 2. 1) *(Fig. 5. 1–2)*. A similar bowl has recently been published from Ordacsehi-Kécsimező on Lake Balaton (Kulcsár 2013, 649, Fig. 4c) *(Fig. 5. 3–5)*. This assemblage is rather difficult to date, but can be probably placed to the transitional period 2800–2600 BC. This is supported by the fact that the small globular amphora with perforated horizontal lug handles has a good analogue in form, proportions and handle form – although not in size – in the amphora from Grave 7 of the Sárrétudvari-Őrhalom mound (Dani – M. Nepper 2006, 34, Fig. 5. 2). The use and production of such interior decorated pedestalled bowls continued into the first phase of the Early Bronze Age in both the Makó-Kosihy-Čaka and Somogyvár-Vinkovci styles (Kulcsár 1998–1999; 2009a, 121–141, 308–319), and even further into the Bell Beaker period of the EBA 2a phase *(Fig. 4)*. This indicates a continuous development from *ca*. 2900 BC until after 2500 BC. The importance of these bowls is also shown by their probable connection with cross-footed bowls of the East European steppe and the North Caucasus in the mid-third millennium BC (e.g., Panasyuk 2009; 2010; Kaiser 2005; this volume). In the light of current evidence an origin in the Carpathian Basin and Central Europe seems more likely.

A few other vessel forms also indicate continuity between Late Copper Age and Early Bronze Age ceramic styles. Mugs (Kulcsár 2009a, 93–94, Fig. 18. I/6), flat bowls (Kulcsár 2009a, 111–112, Fig. 22. VII/7b), vessels with asymmetrical handles (Kulcsár 2009a, 98–101, Fig. 20. II/1, II/6), small conical bowls (Kulcsár 2009a, 119–121, Fig. 25. VIII) are attested in both the Vučedol and Makó pottery styles. Ovoid two-handled amphorae are general forms appearing both in Vučedol and the EBA 1 styles (Makó Type XIV/1 and Somogyvár Type XV/1–3; Kulcsár 2009a, 155–157, Fig. 35, 334–336, Fig. 67). Clay hooks also connect the Vučedol and Makó styles (Kulcsár 2009a, 164, 173, Fig. 38;

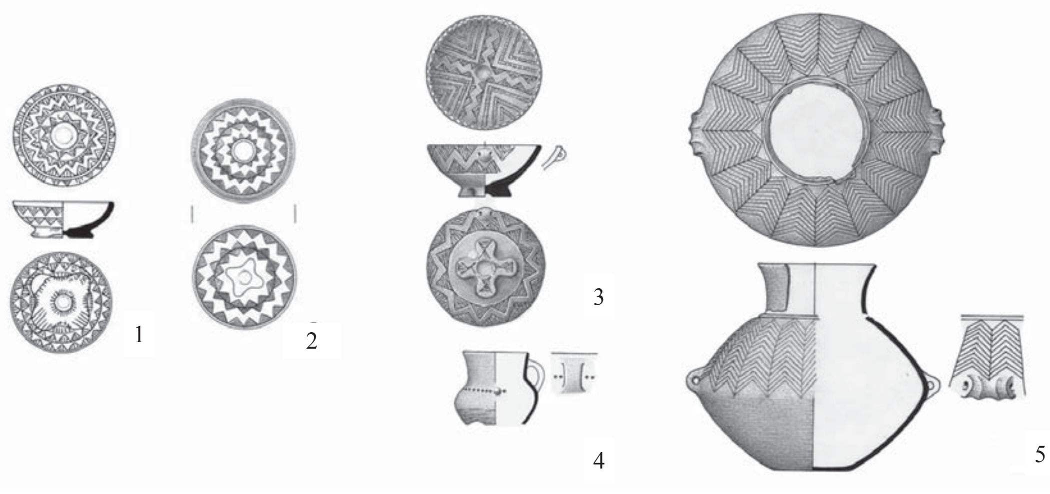
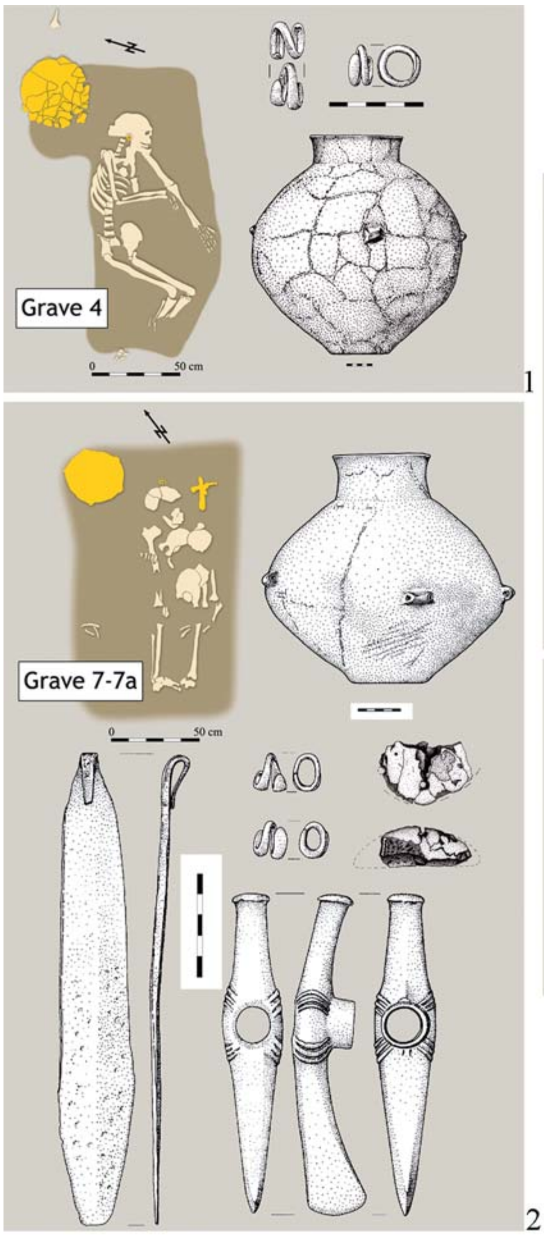


Fig. 5. Interior decorated cross-footed bowls – 1: Salgótarján-Zagyvapálfalva, 2: Vysočany, 3–5: Ordacsehi-Kécsimező

cp. SCHMIDT 1945, 102, Taf. 48, Abb. 14–15). Connections and continuities between the Vučedol and Somogyvár-Vinkovci styles are even more apparent. Pedestalled and small conical bowls and ovoid amphorae have already been mentioned. We may add wide-mouthed one-handled jugs, cooking pots and some of the small mugs as well (DIMITRIJEVIĆ 1982a; 1982b; KULCSÁR 2009a, 347).

Some continuity can be discovered in the area of metal production as well. For a long time, the late fourth millennium BC was seen as a period of diminished metallurgical activity due to various reasons (e.g., political upheavals due to migrations or the lack of easily accessible native copper). It was often juxtaposed with the developments of metallurgy in the early third millennium BC, characterized by innovations such as the bivalve mould. Recently, however, it has been suggested that some products of metallurgy, especially Bányabükk, Fajsz and Kozarac type shaft-hole axes can be dated to a period preceding the Early Bronze Age as traditionally defined (e.g., BÁTORA 2003; HANSEN 2009; SZEVERÉNYI 2013; DANI, this volume). The manufacture of these and related axes continues uninterrupted in the Early Bronze Age, indicating continuity in metallurgical production. The consumption of such axes in hoards – often as depositions of single items – is a pattern that will be a major characteristic of the European Bronze Age.

In terms of interregional interaction, the example of copper shaft-hole axes is evidence not only for the spread of a new type of metal weapon or tool, but also of a technological innovation. These objects were already cast in bivalve moulds, providing much greater control over the shape of the finished product and the process of casting. The first representatives of such shaft-hole axes in the Carpathian Basin are the Bányabükk type axes. These simple, single-edged, rectangular axes belong to a type that first appears in the Caucasus in the mid-fourth millennium BC, mostly in richly furnished burial mounds with Maikop style material. They can be found in somewhat later contexts on the south Russian steppes, also in rich male graves. The westernmost part of their distribution area is in the eastern part of the Carpathian Basin with outliers in Croatia on the Adriatic shore and in Albania (SZEVERÉNYI 2013). The date of the exemplars from the Caucasus and southern Russia indicate an earlier, pre-Bronze Age time-span in the second half of the fourth millennium BC and around 3000 BC. This date should be accepted for the exemplars in the Carpathian Basin as well, until new data suggests otherwise. This also means that in this case we are dealing with a Late Copper Age weapon – and Late Copper Age contacts that form the starting point of the long-lasting tradition of the use of copper and bronze shaft-hole axes as weapons, tools and prestige items throughout the Early and Middle Bronze Age.



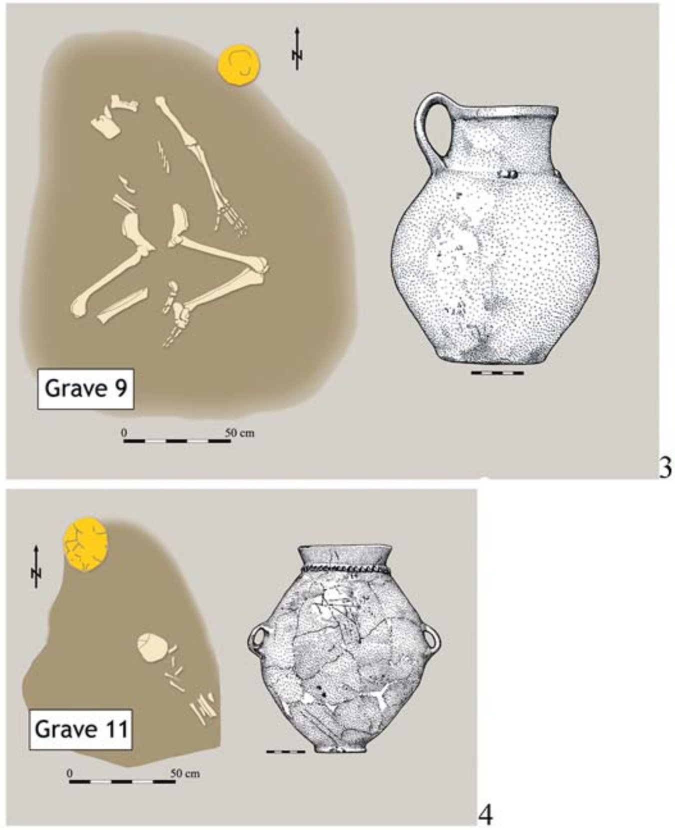
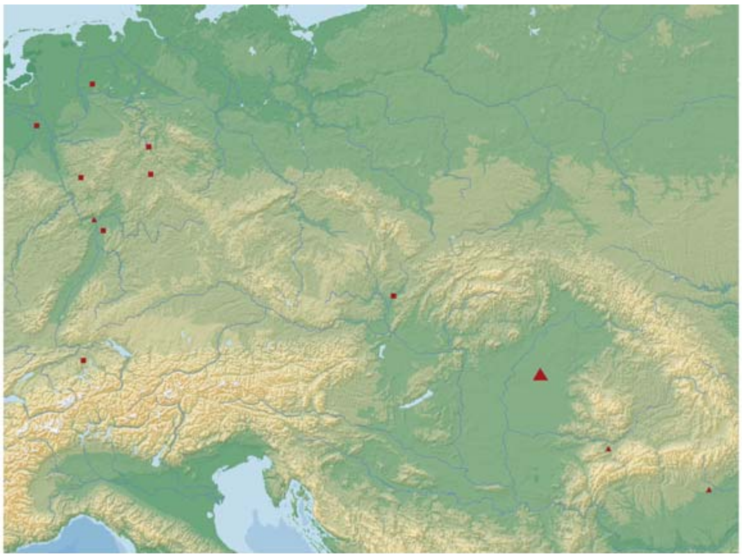


Fig. 6. Sárrétudvari-Őrhalom, graves from the mid-third millennium BC –1: grave 4, 2: graves 7/7a, 3: grave 9, 4: grave 11 (after G*ERLING et al. 2012, Fig. 5)*

When examining the context of these axes in the various parts of the distribution area, a number of differences can be observed. While in the Caucasus and southern Russia they are usually found in burial contexts, mostly furnishing the graves of rich males, in the Carpathian Basin they are mostly "stray finds" – probably "hoards" or deliberate depositions containing a single item – or, in the case of Bányabükk itself, parts of larger hoards that contain a single type of object. While the social and symbolic meanings attached to these axes may not have differed greatly in these areas, the differences in deposition and consumption do indicate a reinterpretation of the object type according to local cultural logic. It seems that in this phase, these axes were not yet used for the symbolic elaboration of various identities during burial practices, but were deposited in other ritual contexts (SZEVERÉNYI 2013).

The further development of this object class in the third millennium BC deserves a quick look, since these are the most significant metallurgical products of eastern and Central Europe in the Early Bronze Age. After the initial introduction of the form a large variety of axes began to be produced in the



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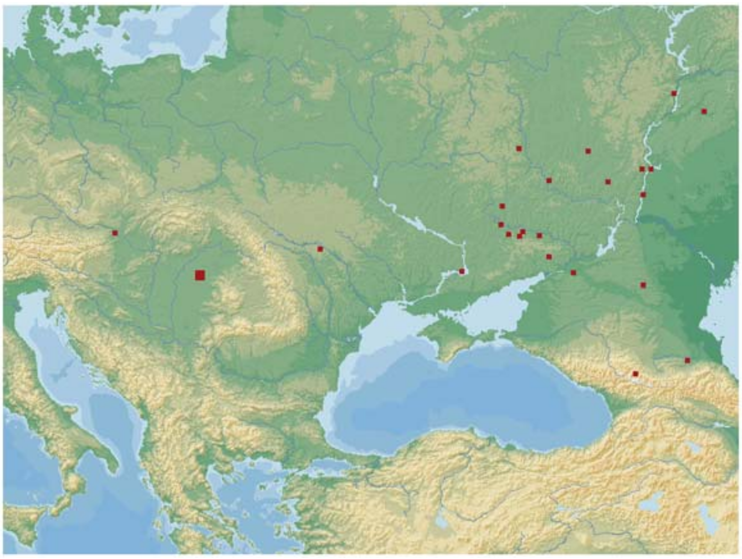

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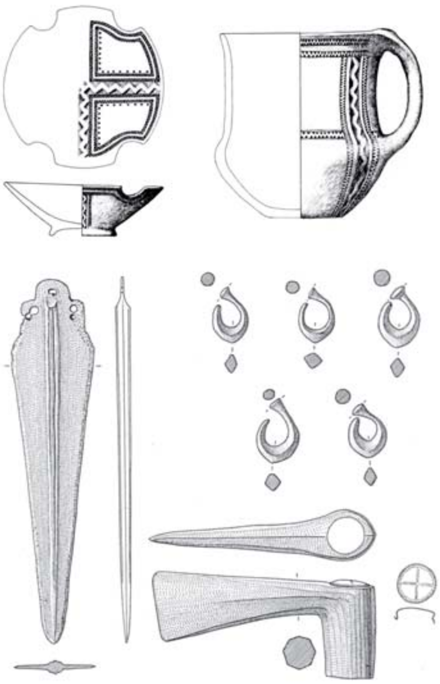
Fig. 7. Distribution of (a) Eschollbrücken type axes (square: classic, triangle: closely related) and (b) Manych type daggers (Sárrétudvari shown by enlarged sign)

Carpathian Basin and the northern Balkans. Local production is evidenced by the presence of moulds in larger settlements (see e.g. Dani, this volume).

Some of these axes now appear in rich male graves, often associated with a dagger and gold hair-rings. One such grave was excavated at the already mentioned Sárrétudvari-Őrhalom. Grave 4 contained only a vessel and two gold hair-rings, but Grave 7 yielded a special type of copper axe, a rare form of dagger and two hair-rings *(Fig. 6)*. Both weapons are foreign types: the axe is a variant of the so-called Eschollbrücken type, whose main distribution area is in Central and western Europe, and the exemplar from Sárrétudvari is one of the most easterly pieces (Dani – M. Nepper 2006; Maran 2008; Dani 2011) *(Fig. 7. 1)*. The dagger, on the other hand, belongs to the so-called Manych type and is known mostly from the Russian steppes, and the Sárrétudvari exemplar is one of the westernmost ones (Zimmerman 2003; Dani 2011) *(Fig. 7. 2)*. The gold hair-rings represent a simple type, which has a huge distribution



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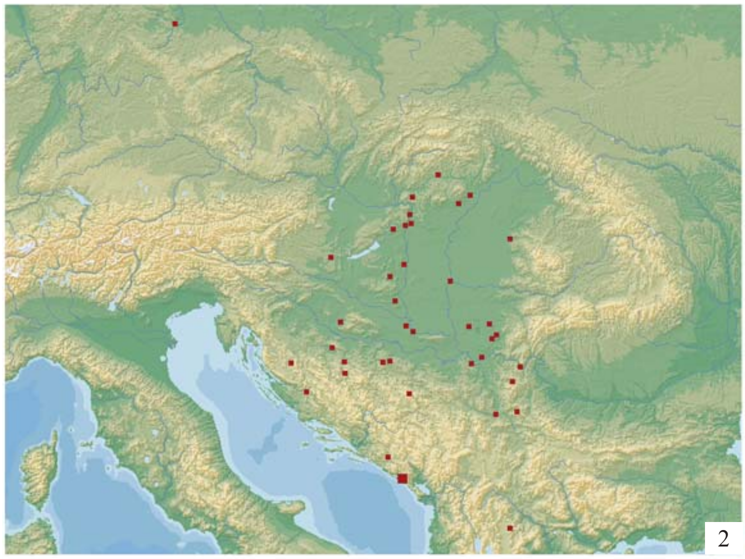

Fig. 8. 1: The finds of Mala Gruda, 2: distribution of Kozarac type axes, 3: distribution of "Anatolian 4a" type daggers (Mala Gruda shown with enlarged sign)

area from the Caucasus through the Russian steppes into the Carpathian Basin (see recently MOTZOI-CHICIDEANU – OLTEANU 2001).

Another such rich grave is known south of the Carpathian Basin, in the Balkans, in the large and richly furnished burial mound of Mala Gruda. Here a silver axe is associated with a gold dagger and a number of gold hair-rings (PRIMAS 1996) *(Fig. 8. 1)*. These axes are the earliest ones that have already been cast in closed bivalve moulds, again an important technological development, which was probably invented in the north Balkans or the southern part of the Carpathian Basin (e.g., PRIMAS 1996; 2007; DANI, this volume). Similar axes are known only from hoards, usually made of copper, but one such hoard from Bosnia yielded four silver exemplars as well (HANSEN 2001). The axe of Mala Gruda is the southernmost exemplar of the Kozarac type, distributed in the southern Carpathian Basin and the northwestern Balkans *(Fig. 8. 2)*. The dagger seems to represent a type that was in use in Anatolia, and is most probably an imported object here (MARAN 1998). A similar dagger made of arsenic copper is known from the Carpathian Basin as well, from Érpatak (KALICZ 1968 [mistakenly as "Balkány"]; DANI 2005; this volume) *(Fig. 8. 3)*. The hair-rings of the grave represent a local variant (Mala Gruda type) of a special type (Leukas type), which is known mostly from the eastern Carpathian Basin and the northern Balkans, although the southernmost exemplars were found already in the Aegean, on the island of Levkas (Kilian-Dirlmeier 2005).

Based on the above it seems that in the beginning of the third millennium BC, the distinguished status of a few individuals, mostly men, was emphasized by the deposition of rare, foreign weapon types, mostly axes and daggers, sometimes made of precious metals, in their graves. It seems that competition for leadership involved the demonstration of access to foreign objects and perhaps exotic knowledge, exchange and perhaps alliance with the leaders of distant communities.

The combination of these items, especially of axes and hair-rings, seems to have played a crucial role in the construction of new forms of masculinity in a narrow, powerful faction of Early Bronze Age society. The deposition of weapons in graves was important in the symbolic elaboration of a warrior status during burial rites, while the use of decorative hair-rings made of precious metals attest to the symbolic importance of hair, and generally grooming, in the creation of such identities. This tradition seems to continue well into the Middle Bronze Age in the Carpathian Basin, where gold hair-rings are often included in richly furnished warrior graves (in pairs or triples). This is the point in time when the notion of the "warrior's beauty" (Treherne 1995), which will be a very important aspect of social life throughout the European Bronze Age, seems to first manifest itself in the archaeological record.

The above examples show clearly that the transition to the Early Bronze Age in the Carpathian Basin had a dual character. A certain degree of continuity can be observed in a number of aspects, like settlement structures, pottery styles and forms and metal production and consumption. On the other hand, apparently some major transformations did take place that probably started during the crucial transitional period between 2800 and 2600 BC. Interregional interaction seems to have expanded considerably during this period and new networks were built in new directions that contributed significantly to the later developments of the Bronze Age in Hungary.

With regard to future research, this last concept – networks – should provide a new focus for our efforts. Research on complex networks has become a significant field of research on its own, and various methods of network analysis have already been very successfully implemented in archaeological research and interpretation (Knappett – Evans – Rivers 2008; Knappett 2011; [ed.] 2013; cp. Kulcsár 2012b). The existence, extent and orientation of prehistoric networks can be detected based on the analysis of various classes of archaeological remains from simple pottery forms to complex ideological structures. The background of these connections, an invisible world of concepts, ideas and innovations can, however, be revealed through thorough analyses, in which network analysis should play a key role in the future.

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View from the Northwest: Interactions Network in the Dnieper–Carpathian Area and People of the Globular Amphora Culture in the Third Millenium BC

MARZENA SZMYT

Abstract

This paper intends to discuss particular questions arising from the prehistory of regions situated between the Dnieper and the Carpathian Mountains, i.e. the western part of the East European forest-steppe and steppe zones. It shall focus on traces of interaction that could be dated to the end of the 4th and the first half of the 3rd millennium BC. At that time, despite many essential differences, the territories in question were covered by a network of multi-directional circulation of people and ideas. The cultural backdrop between the Dnieper and Carpathians has been most often raised in terms of the interaction along an east–west axis, less frequently north–south. In particular, this applies to the issue of steppe peoples and their interaction with the communities from the Balkans, the Carpathian Basin and the Caucasus, which is drawing attention from an increasing number of scholars. In this context archaeological traces pointing to the presence of a tradition related to the Globular Amphora culture between the Dnieper and Carpathians that have been raised, allow for identifying other axes of contacts (NW–SE) that linked north-Central European societies with the communities of the forest-steppe and the steppe. The relatively easy identification of Globular Amphora culture traits allows for detailed studies in a variety of contexts in which such traits appear as well as the tempo and course of changes that took place as a result of this interaction network. This, it is hoped, provides the opportunity to sketch a more informed picture of the complexity of these territories at the end of the 4th and first half of the 3rd millennium BC against the backdrop of cultural transformation and its effects, which had considerable importance for all of the continent at this period of prehistory.

Introduction

This paper discusses particular questions arising from the prehistory of regions situated between the Dnieper and the Carpathian Mountains, i.e. the western part of the East European forest-steppe and steppe zones. It shall focus on traces of interaction that could be dated to the end of the 4th and the first half of the 3rd millennium BC. At that time, despite many essential differences, the territories in question were covered by a network of multi-directional circulation of people and ideas. Unfortunately, at present we are only able to reconstruct some fragments of this network because of the relative lack of interest shown in this issue to date, as far as archaeological research and related studies are concerned. Accordingly, this study shall outline the presence of Central European patterns connected to the Globular Amphora culture (GAC) between the Dnieper and Carpathians. Furthermore, on account of the relative ease with which such patterns can be identified, it is possible to subject these traces to a particular contextual analysis, whose results bear out the complexity of culture in a given region.

1. The Dnieper–Carpathian area: a brief history of Globular Amphora culture traits identification

In what follows, a brief historical outline is given of research into the GAC in respect to the above mentioned area. Two issues will be discussed: (1.1) identification of “pure” GAC remains and (1.2) identification in other groups or cultures of such traits, which may have their origin in the GAC milieu.

In both cases the main aspect of enquiry lies in the relevant stages at which the main questions arise in respect to the role of the GAC in this context in a given region.

1.1. Identification of Globular Amphora culture between the Dnieper and Carpathians

The relics of the GAC in the area between the Dnieper River and the Carpathians *(Fig. 1)* have been documented since the 19th century (Sveshnikov 1983, 6; Burtănescu 2002, 119), but their precise cultural identification was established only at the beginning of the 20th century. The first outline of the southeastern (to be precise, Podolian) GAC concentration defined at the time as the "Megalithic Grave culture", was published in 1921 (Kozłowski 1921, 39; see also 1924). Several years later, materials of the eastern part of Volhynia were established as belonging to the "Megalithic culture" (Levitskiy 1929). Gradually more information concerning further discoveries appeared (e.g., Janusz 1918; Gerinovich 1926; Levitskiy 1930).

The issue of the southeastern branch of the GAC also had a place in broader works (e.g., Antoniewicz 1938; Kozłowski 1939; Kostrzewski 1948, 155–158; Bryusov 1952, 220–227; Gimbutas 1956, 140–152; Sulimirski 1959, 271–282) and on the margins of studies of other cultures (Äyräpäa 1933, 120–123; Passek 1949, 219–223). However, it was only with the monographic publication of Igor Kirillovich Sveshnikov (1957), and later with the studies of Marin Dinu (1959; 1960; 1961a) and Constantin Matasă (1959) concerning GAC funerary complexes in the Moldavian Upland that relatively precise identification was introduced. In particular, Sveshnikov's study, despite its misleading title, together with the later works of Alexander Häusler (1966) and Tadeusz Wiślański (1966, 83–90), finally put an end to the tradition of dual-naming for the materials in question: "Globular Amphora culture" and "Megalithic culture", the latter had been used to emphasise the distinct origins of Volhynian–Podolian finds.

The following years saw publications presenting new source assemblages (e.g., Spinei – Nistor 1968; Maleyev 1971; 1986; Berezanskaya – Pyasetskiy 1979; Foit 1983; Cucoş 1985 and many others). Further works of I. K. Sveshnikov (1971; 1974; and especially 1983) specified – in accordance with the standards then applied – the following questions: distribution area, spatial diversity and the relative chronology of Volhynian–Podolian materials of the GAC. A different perspective was presented by Tadeusz Sulimirski (1968; 1970, 162–170), whereas subsequent monographic publications reiterated older theses (Chernysh 1982; Sveshnikov 1983; 1990; Dumitroaia 2000).

Finally, in the 1990s a special project was undertaken into a new formulation of the distribution, chronology, periodisation and cultural significance of the GAC in eastern Europe (Szmyt 1996; 1998; 1999; 2000; 2001; 2002; 2003; 2004; 2009; Mihăilescu-Bîrliba – Szmyt 2003; Kośko – Szmyt 2009; Łysenko – Szmyt 2011). As a result of subsequent research, the absolute chronology of the eastern GAC group and its sub-groups could now be based on radiocarbon dating (Kadrow – Szmyt 1996; Szmyt 1998; 1999; 2009; Mihăilescu - Bîrliba – Szmyt 2003). The data available so far in the professional literature was then subjected to systematic analysis and a large cross-section of find assemblages was investigated (Szmyt 1999; 2009; Mihăilescu-Bîrliba – Szmyt 2003; Kośko – Szmyt 2009; Łysenko – Szmyt 2011).

A review of available finds (Szmyt 1999; 2009) revealed a significantly broader reach of GAC presence in the forest-steppe and a decidedly greater number of forest-steppe and steppe culture groups with the occasional element originating from the GAC than envisaged earlier. The first proposal of dating the Volhynian and Podolian sub-groups was undertaken, based on the changeability of vessel decorative traits (Szmyt 1999, 53–62). The eastern GAC branch was placed in the context of its two remaining territorial groups (Szmyt 1999, 42–85) as well as in relation to other cultural communities in eastern Europe, with a particular emphasis on the issue of inter-cultural contacts (Szmyt 1999, 86–188; cf. also Szmyt 2000; 2002; 2003; 2004; 2009).

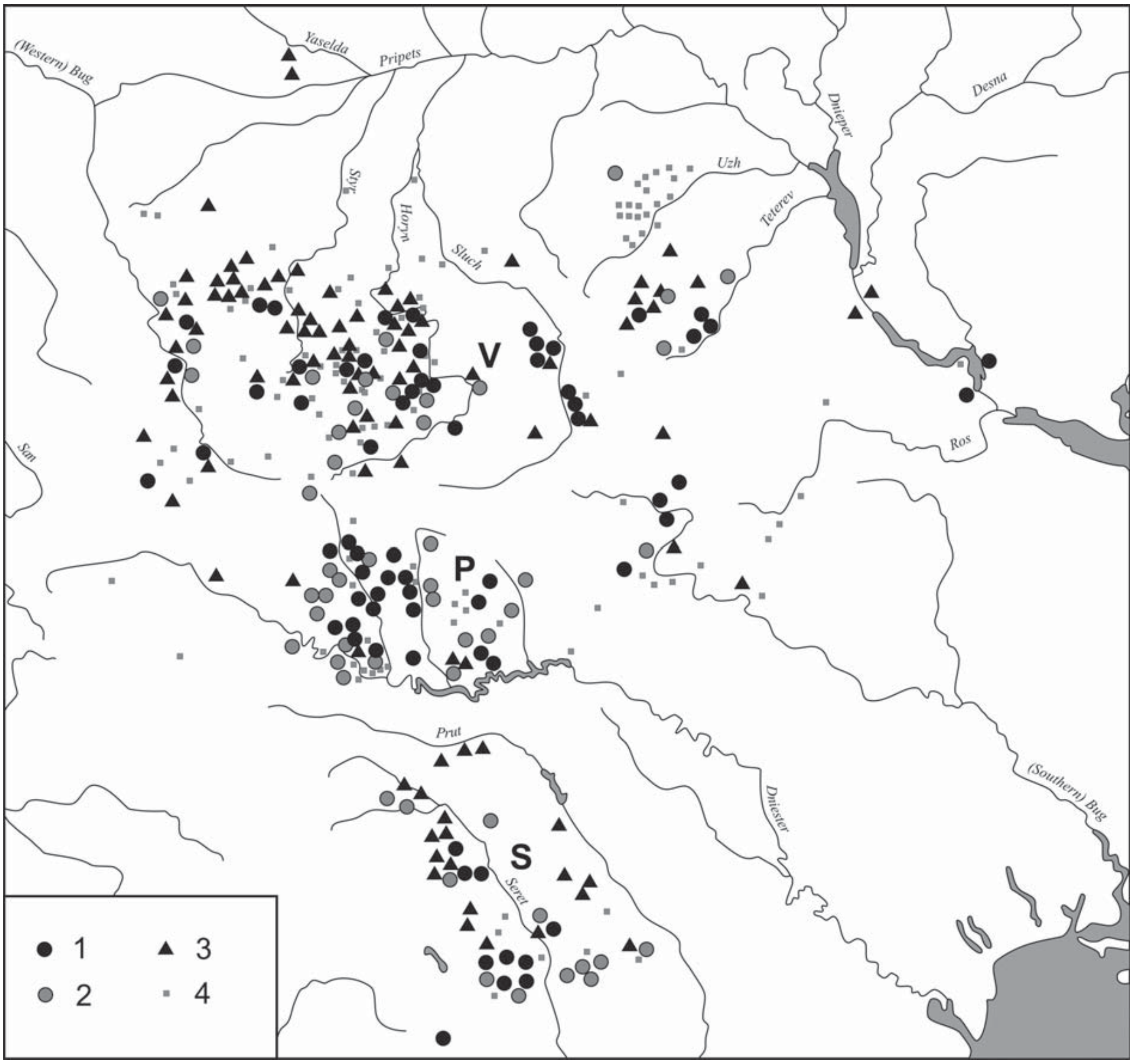

Fig. 1. The eastern group of the Globular Amphora culture, distribution of sites – 1: grave of the Globular Amphora culture, 2: possibly grave of the Globular Amphora culture, 3: other sites with pottery of the Globular Amphora culture, 4: flint artefacts (mainly axes or chisels) possibly linked to the Globular Amphora culture, V: Volhynian subgroup, P: Podolian subgroup, S: Siret (Moldavian) subgroup

The results of the above mentioned research programme were presented in several volumes of "Baltic-Pontic Studies" (Końko [ed.] 1996; 1999; Szmyt 1999; Kośko – Klochko [eds] 2003; 2009). This data is also taken into account in the more recent professional literature and summaries of research to date (e.g., Mihăilescu-Bîrliba 2001; 2005; Burtănescu 2002) and in studies outlining cultural transformation in more wide-ranging areas (e.g., Włodarczak 2008; 2010). Gradually, further articles are appearing, presenting newly discovered assemblages, most often that of graves (Malejev – Mazurik – Paniszko 2004; Rozdobudko – Yurchenko 2005; Pozikhovskiy – Samolyuk 2007; Łysenko – Szmyt 2011), including those regions where these have not been recorded before, for example in Transylvania (Székely 2002).

1.2. Identification of Globular Amphora culture traits in other cultural contexts

The presence of traits originating in the GAC as an issue shall be limited in this place to steppe cultures, to be precise, groups at the end of the steppe Eneolithic (pre-Yamnaya groups) and the Yamnaya culture. The discovery of grave assemblages that fused steppe and GAC traits started at the end of the 19th century (OSSOWSKI 1889, 12–15), though their cultural qualification has created a great deal of discussion. One example of this is the difference of views in respect to the grave from Łosiatyn (ukr. Losyatyn) in the Middle Dnieper area (cf. OSSOWSKI 1889, 15; SULIMIRSKI 1968, 183; HÄUSLER 1976, 92; SVESHNIKOV 1983, 36; 1985, 285; ARTEMENKO 1987, 8; SZMYT 2000, 443–445).

Further studies of assemblages featuring similar traits had to wait for another 90 years. They concerned in the main relics from Moldavia, in the basin of the upper reaches of the Seret and Prut rivers. In this context research was conducted at the following sites: Corpaci, kurgan 2/grave 7 (DERGACHEV 1982, 129; YAROVOY 1984, Fig. 4. 3), Ocniţa, kurgan 3/grave 14 (MANZURA − KLOCHKO − SAVVA 1992, Fig. 12. 6), Efimovka, kurgan 2/grave 14 (DERGACHEV 1986, Fig. 10. 4; ALEKSEEVA 1992, Fig. 19. 4), Novoselitsa, kurgan 19/grave 13 (SUBBOTIN − OSTROVERKHOV − DZIGOVSKIY 1995, Fig. 27. 12), Camenca, kurgan 445/grave 7 (KACHALOVA 1974, Fig. 7. 2) and others (cf. SZMYT 2000).

Further assemblages are gradually being added to the above list (e.g., Mocra; KASHUBA − KURCHATOV − SHCHERBAKOVA 2002, 214–215 and 221). On account of analogies in the construction of stone grave cists, some graves from the steppes between the lower Dniester and the Danube have also been linked to the GAC (e.g., Tatarbunary, grave 2; SUBBOTIN 1988).[1] In recent years the presence of similar assemblages has also been revealed between the Southern Bug and Sinyukha rivers (Kochubeivka; BIDZILYA − BUNYATYAN − NIKOLOVA 2005).

In turn, the issue of GAC traits in the context of materials of the “Pre-Yamnaya” stage representing the end of the steppe Eneolithic was raised by Yuri Ya. Rassamakin (1996), though earlier this was not taken into consideration (e.g., DERGACHEV − MANZURA 1991, 57–58). However, the record that may serve the basis of investigating the above question is still very limited (SZMYT 1999, 148–152) and even broader publications (e.g., a rich set of Eneolithic assemblages published by RASSAMAKIN 2004) have not supplied any new data in this respect. Our knowledge still relies basically on two grave assemblages from the Lower Dnieper region: Boguslav, Dnipropetrovsk region, kurgan group I, kurgan 23/grave 12 (ANDROSOV − MARINA − ZAVGORODNIY 1991; RASSAMAKIN 2004, 150–151) and Baratovka, Mykolaiv region, kurgan 1/grave 6 (RASSAMAKIN 1996, 120–128; 2004, 152–153). Both graves have been included in the so-called fourth burial tradition in the steppes represented by the Zhivotilovka-Volchansk group (RASSAMAKIN 2004, 208–209). In both cases only single elements of funerary rituals were recorded, the origins of which may be linked to the GAC. One was a vessel form (a small amphora with two handles) in Boguslav and the collective nature of the grave (six burials in a stone slab cist) in Baratovka. One enormous difficulty in this context is the lack of data pertaining to the absolute chronology of both graves, whose position is based solely on typological analysis.

The question of GAC participation in the history of steppe cultures has become the subject of a broad-ranging discussion during which completely opposing views were presented. The bone of contention would appear to lie in the proposed concept of the GAC having a strong influence on the Dolmen culture from the northwest Caucasus (NIKOLAEVA − SAFRONOV 1974), which was met with strong criticism (MALEYEV 1980; SVESHNIKOV 1983, 20; MARKOVIN 1990; HÄUSLER 1994, 195; MUNCHAEV 1994, 163).

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[1] However in my opinion, some graves have been incorrectly associated with the GAC (e.g., Baldovineshty, Bolgrad, Bursucheni, Gura Galbena, etc.; SUBBOTIN − SHMAGLIY 1970, 122; YAROVOY 1979; CHERNYAKOV − TOSHCHEV 1985); for more details see SZMYT 2000, 449.

An entirely different view in this context was put forward by Marija Gimbutas (1977; 1979; 1980), according to which the origins of the GAC (as one of "kurganized" cultures according to her) were linked to the influences of steppe groups. This view was also met with strong reservations (HÄUSLER 1981, 127–130; 1998) and at present is not being upheld.

GAC contacts with steppe and forest-steppe societies can also be viewed in a broader sense as one of the factors leading to the formation of a specific cultural structure known as the Corded Ware culture (WŁODARCZAK 2008, 561–569; cf. KOŚKO 2000 for an earlier concept regarding the possible role of Pre-Yamnaya impulses for Corded Ware culture origins).

2. The Dnieper–Carpathian area against the background of the general distribution of the Globular Amphora culture

Sources of the GAC culture have been identified across a wide area of central and eastern Europe, from the Elbe basin in the west to the upper and middle course of the Dnieper in the east, from the Baltic coast in the north to the Vltava basin, the Upper Vistula catchment, the middle courses of the Dniester and Southern Bug, Seret and Prut basins. Three territorial GAC groups are distinguished in this area: western, central (or Polish) and eastern (WIŚLAŃSKI 1966, 86–91; 1970, 183–221). For the purposes of this article and the discussion the last of these is the most important.

Taxonomic, chorological and chronological data advocate a Central European origin of the GAC peoples that moved to eastern Europe from the Vistula catchment area. It was not the first time that cultural patterns and people reached eastern Europe from the west. The movements of GAC populations to the east copied initially (in Volhynia and Podolia) earlier shifts by Funnel Beaker culture communities and, to a lesser degree, those by Linear Pottery culture populations (KOŚKO − SZMYT 2009). In addition, however, directions of new activity brought about a considerable widening of areas settled by GAC populations (including the Moldavian Upland and lands at the Middle Dnieper), and a broad dispersal of some of its cultural patterns across territories not covered by GAC settlement, partially in forest-steppe and steppe zones (KOŚKO − SZMYT 2009; SZMYT 2009; ŁYSENKO − SZMYT 2011).

The eastern group of the GAC was located south of the Pripets river, between the Western Bug and the Dnieper *(Fig. 1)*. Its southern borderline ran from the Middle Dnieper, through the middle section of the Southern Bug, to the Middle Dniester and upper section of the Western Bug, with an extreme southerly branch in the area between the Seret and the Prut rivers. In other words, the eastern group covered the territory of Volhynia, Podolia, the Moldavian Uplands and – in part – the Middle Dnieper basin. Three main concentrations of sites are located in this huge area and three separate sub-groups of the eastern GAC can be distinguished: Volhynian, Podolian and Moldavian (or Siret). Apart from these there are single, isolated sites known in an area between the Western Bug and the middle course of the Dnieper (SZMYT 1999; 2000; ŁYSENKO − SZMYT 2011) that reaches even the left bank of this river *(Fig. 2)*: Kiev-Nikolskaya Slobodka III and Bile Ozero 1 (SVESHNIKOV 1983, 36; SZMYT 1999, Cat. IC/26; 2009, 238; ROZDOBUDKO – YURCHENKO 2005). The presence of these scattered sites could indicate a form of control by the GAC over wider areas around territories permanently settled by these peoples. To the west of the area occupied by the Moldavian (Siret) sub-group, only an isolated GAC tomb has been indentified to date in Transylvania: in Sânmartin-Ciuc (*Fig. 3*; SZÉKELY 2002). This could be the sign of the cross-Carpathian movement of a small group, in the direction of the Carpathian Basin.

At present, with some caution, the eastern frontier of the area settled by GAC populations can be marked along a line drawn from the Teterev River to the upper drainage area of the Southern Bug since it is more or less there that the last concentrations of GAC sites end *(Fig. 1)*. Further east (as far as the middle course of the Dnieper) only dispersed finds are recorded (ŁYSENKO − SZMYT 2011). Likewise,

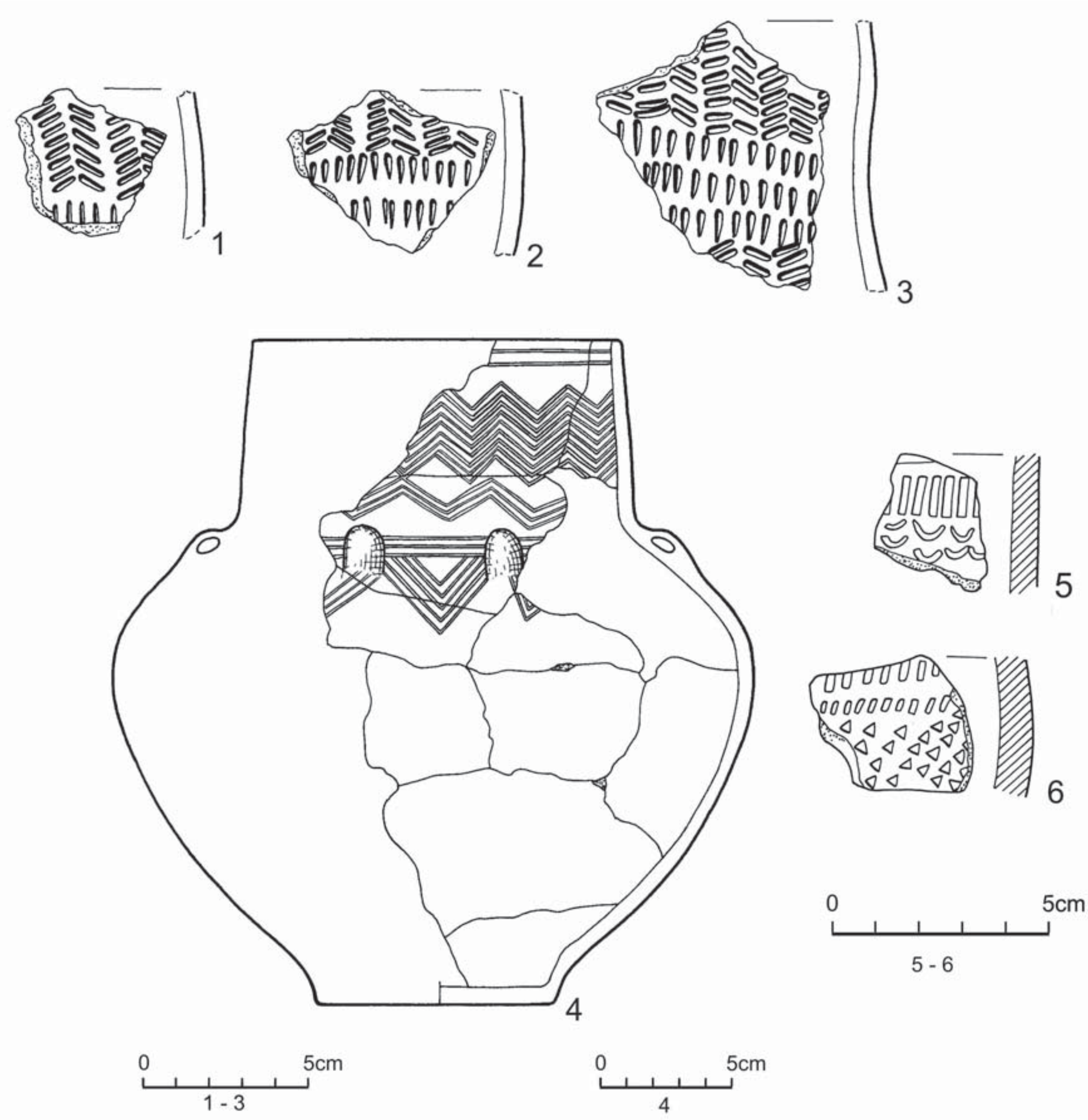

Fig. 2. Pottery of the Globular Amphora culture on the Middle Dnieper – 1–4: Bile Ozero 1, Kiev region, 5–6: Kiev-Nikolskaya Slobodka III, Kiev region (after Sveshnikov 1983; Rozdobudko – Yurchenko 2005)

the northern frontier can be delineated along the Uzh River and further west across the middle courses of Pripets tributaries (Sluch, Horyn and Styr rivers). The southern frontier is far more complex because it covers the interfluvial area between the middle sections of the Seret and Prut rivers. In turn in the west, the range of influence can be bounded by the Carpathians and a line drawn across the drainage of the Upper Dniester (between the Gnila Lipa and Zolota Lipa rivers; see Machnik 1998) as far as the upper course of the Western Bug river. Thus, the area from the Western Bug to the Southern Bug was settled by GAC communities, whereas lands lying immediately north, east and south of the indicated frontiers may have been occasionally penetrated by GAC societies on their own (the area between the upper part of the Southern Bug and middle section of the Dnieper) or in co-operation (of various kinds) with other cultural groups. The varied forms of co-operation are perceived today as evidence of GAC community participation, from the end of the 4th to the middle of the 3rd millennium BC, in both neighbouring and wide-ranging networks of cultural contacts.

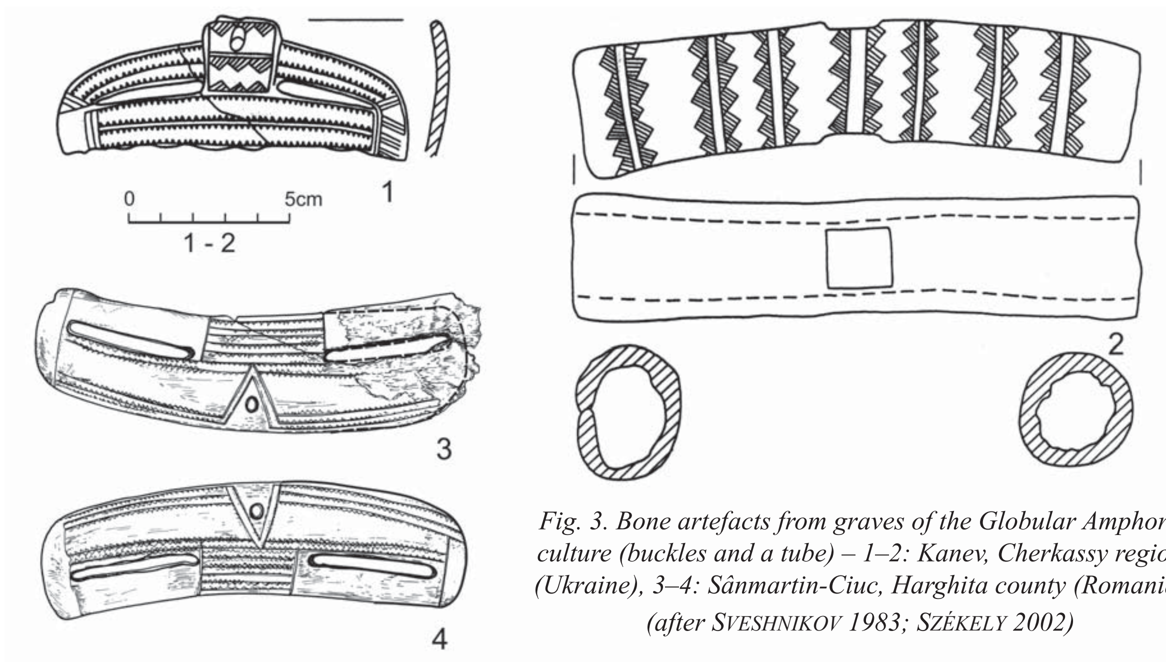

Fig. 3. Bone artefacts from graves of the Globular Amphora culture (buckles and a tube) – 1–2: Kanev, Cherkassy region (Ukraine), 3–4: Sânmartin-Ciuc, Harghita county (Romania) (after SVESHNIKOV *1983;* SZÉKELY *2002)*

The chronology of the eastern group is known at a general level *(Fig. 4)*, although many details are still subject to controversy (KADROW − SZMYT 1996; SZMYT 1999; MIHĂILESCU-BÎRLIBA − SZMYT 2003). Towards the end of the 4th millennium BC (in its final century?), GAC settlers must have arrived in Volhynia, moving from the Lublin Upland (SZMYT 1999; 2001). Their movement towards Podolia and the Moldavian Upland was rather quick as shown by the dates attributed to grave assemblages in Romania (MIHĂILESCU-BÎRLIBA − SZMYT 2003). In the west–east direction GAC populations entered the area lying further east, however, in the drainages of the Horyn, Sluch and Teterev rivers, such interaction could have differed greatly in dynamics, i.e. the eastern movement continued longer than that towards the south (SZMYT 2009, 245–246).[2] The first known grave of the GAC from Transylvania (Sânmartin-Ciuc; *Fig. 3. 3–4*) could be a sign of a small cross-Carpathian movement in the direction of the Carpathian Basin.

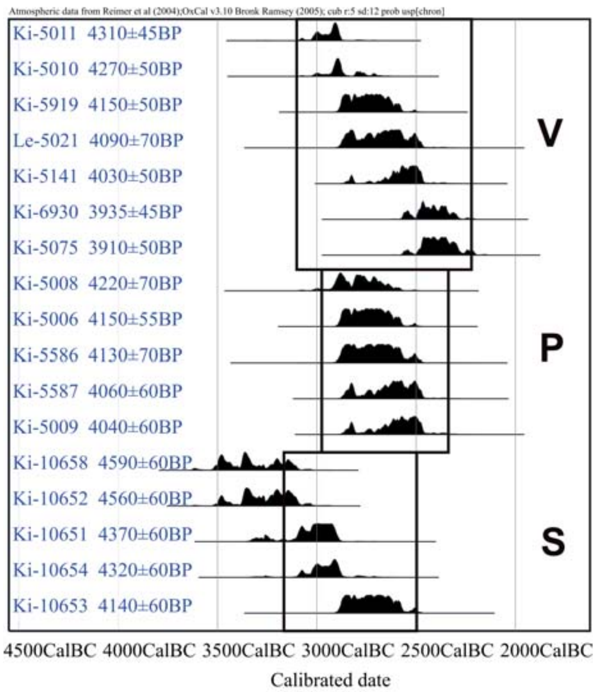

Fig. 4. Radiocarbon dates of the eastern Globular Amphora group – V: Volhynian subgroup, P: Podolian subgroup; S: Siret (Moldavian) subgroup (after SZMYT *1999;* MIHĂILESCU-BÎRLIBA *–* SZMYT *2003)*

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[2] In this case – due to insufficient radiocarbon data – arguments for a hypothesis are based on typochronological analyses (SZMYT 2009, 245–246).

In summary, the area between the Dnieper and Carpathians embracing the East European forest-steppe and steppe zone, is considered as the boundary of GAC expansion. In the northern and extreme western part it was settled by the eastern group. In the remaining part of the forest-steppe zone and in the steppe itself there were no GAC settlements, though occasional cultural elements are found, whose origins can be tied to this particular culture.

3. The Dnieper–Carpathian area: role of the Globular Amphora culture in the network of cultural contacts

On the basis of the available data from finds it is possible to maintain that the peoples of the eastern GAC sub-groups became an important participant in the network of cultural contacts that formed a link with the communities of the northern Black Sea area. Proof of this are the occasional traits recorded beyond the regions of settlement or those controlled by the GAC. Depending on the context, it is possible do define two structures of such contacts: (3.1) the Pre-Yamnaya culture stage (3.2) and that dominated by the Yamnaya culture.

3.1. The Pre-Yamnaya network of contacts and the Globular Amphora culture

As mentioned above (see part 1.2), the proposal that GAC peoples took part in the wide ranging geographic network of contacts linking the steppe communities relies basically on two grave assemblages from the Lower Dnieper region (Boguslav, Baratovka; *Fig. 5*) that have been included in the so-called fourth burial tradition on the steppes represented by the Zhivotilovka-Volchansk group (Rassamakin 2004, 208–209). Depending on the syncretic nature of this phenomenon where the adaptation of Late Tripolye patterns played an important role, mainly from the Kasperivtsy/Gordineşti (Horodiştea) group (Rassamakin 2004, 126, 170), widespread throughout the steppe zone (Movsha 1984; 1993; Manzura 1990), the hypothesis was developed that cultural elements of the GAC reached the steppe as a result of their interaction.

It is most plausible to discuss this against the background of a broader network of contacts between the societies of the forest-steppe and steppe zones. In this context, GAC traits can be viewed as an element in a set of heterogeneous cultural patterns characteristic of small mobile groups of varied ethno-cultural identification from the final stage of the steppe Eneolithic. “In general terms, forest-steppe patterns were probably disseminated in the form of a syncretic ‘package’, dominated by Tripolye culture elements” (Szmyt 1999, 185).

The issue of chronology is still an open one, in both hitherto mentioned graves as in the entire Zhivotilovka-Volchansk group (or the so-called fourth burial tradition, after Rassamakin 2004). In general terms, based on comparative chronology of Tripolye traits, the latter is placed in the period 3500–2900 BC (Rassamakin 2004, 179, 184–185). Taking into account, however, the chronology of GAC beginnings in the forest-steppe (Szmyt 2009, 245), groups from Baratovka and Boguslav ought to be placed at the later part of the above mentioned period.

3.2. The Yamnaya network of contacts and the Globular Amphora culture

There is a great deal more information on the role of GAC communities in the structure of contacts in the forest-steppe and steppe zone between the Dnieper and Carpathians controlled by the peoples of the Yamnaya culture. The latter, west of the Dnieper, appeared most likely *ca*. 3000–2900 BC, which is indicated by the latest radiocarbon dating of kurgans located between the Southern Bug and Sinyukha rivers (Kochubeivka; Bidzilya − Bunyatyan − Nikolova 2005, Table 1) and on the Ingul river

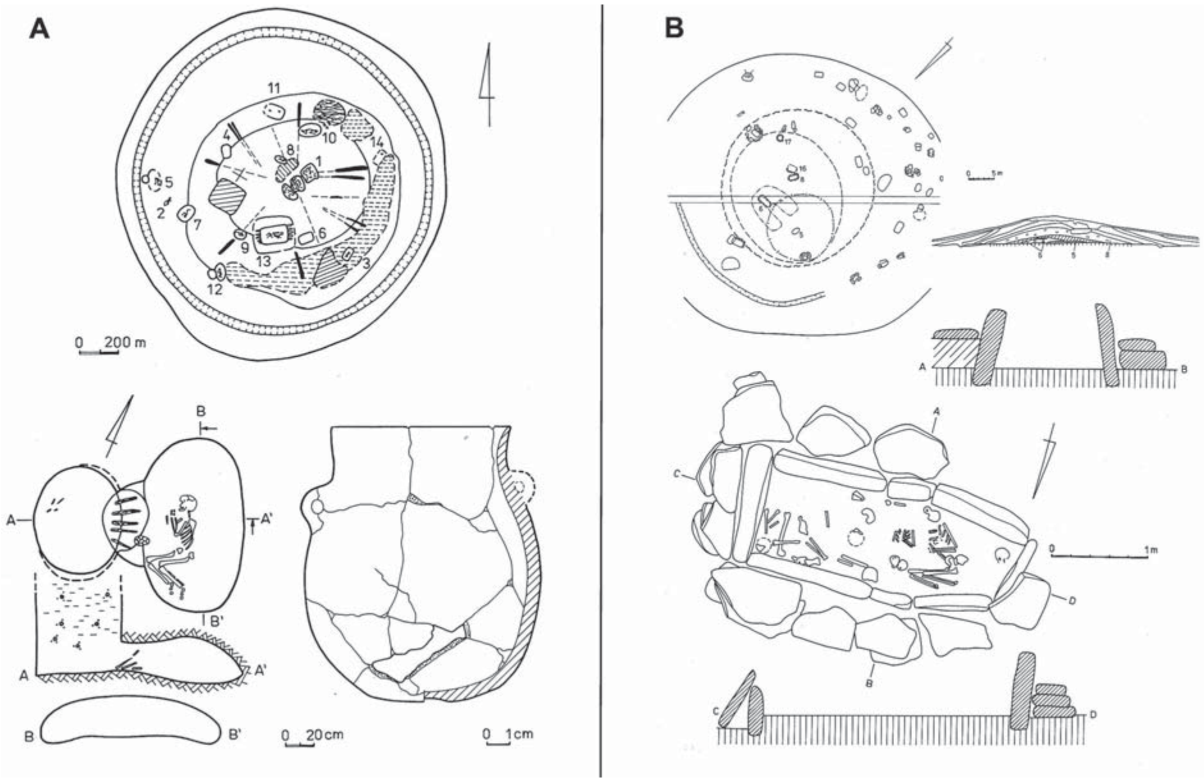

Fig. 5. Late Eneolithic (Pre-Yamnaya) graves with traits of the Globular Amphora culture in the steppe region – A: Boguslav, Dnipropetrovsk region, B: Baratovka, Mykolaiv region (after ANDROSOV – MARINA – ZAVGORODNIY *1991;* RASSAMAKIN *1996)*

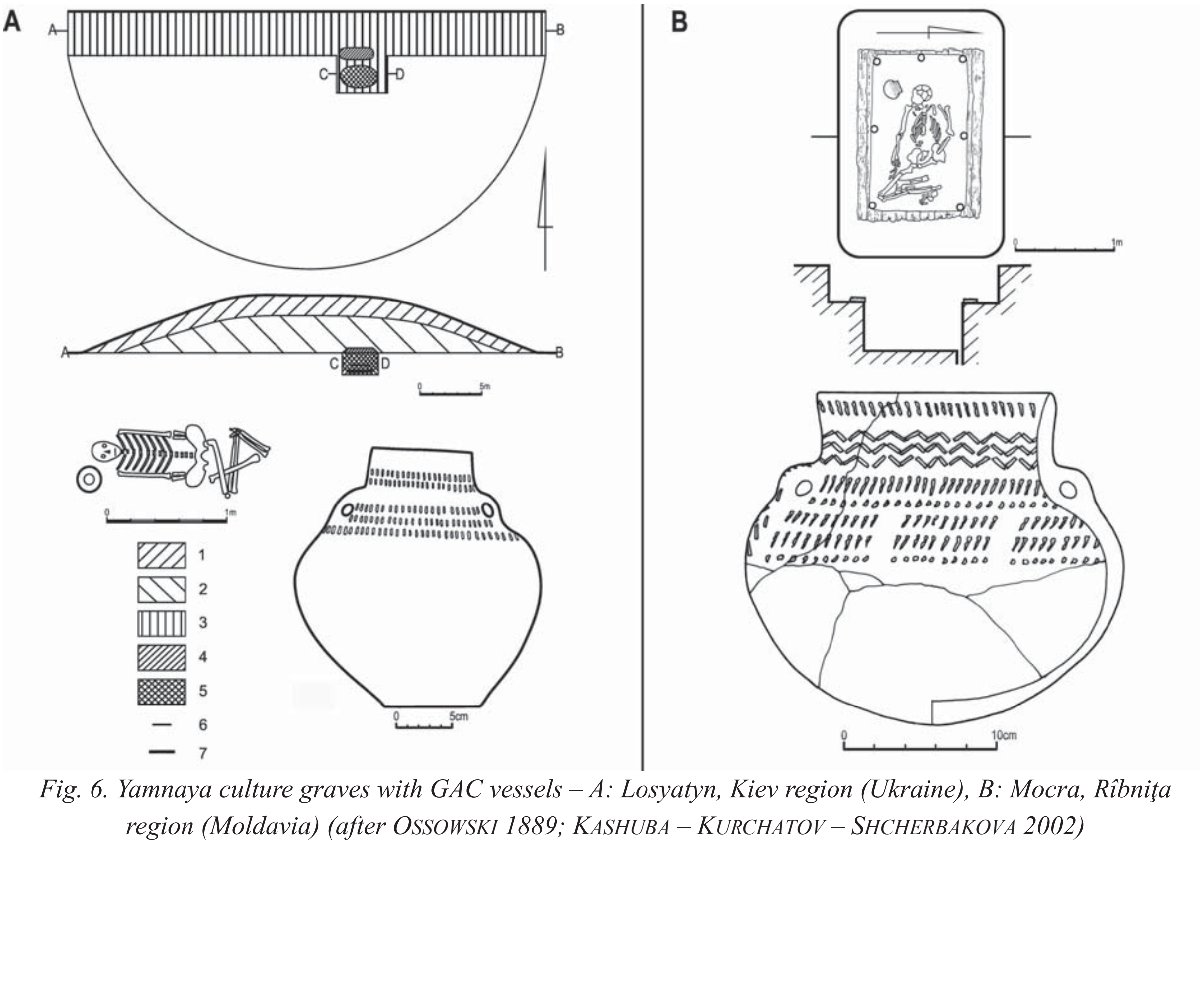

Fig. 6. Yamnaya culture graves with GAC vessels – A: Losyatyn, Kiev region (Ukraine), B: Mocra, Rîbniţa region (Moldavia) (after OSSOWSKI *1889;* KASHUBA – KURCHATOV – SHCHERBAKOVA *2002)*

(Sugokleya; NIKOLOVA – KAISER 2009, 233).[3] In the Dniester–Danube region its traces are dated and verified also to 3000–2900 BC (RASSAMAKIN – NIKOLOVA 2008, 65).[4]

In this context, of prime importance were relations between the respective GAC groups and that of the Yamnaya culture in the forest-steppe zone where geographically their relation could be said to be direct and synchronous. Evidence of such a direct contact are a series of graves typical for the Yamnaya culture but containing "alien" (i.e. atypical) objects: mostly these are clay vessels more or less corresponding to GAC style; much less frequently these are flint axes.

So far, such graves have been recorded in three areas of the forest-steppe *(Fig. 6)*, namely between the Prut and Dniester rivers (*Fig. 7. B*; SZMYT 2000, 459–460), on the right-bank section of the Middle Dnieper basin- between the confluences with the Desna and Ros rivers (*Fig. 7. A*; see SZMYT 2000, 457–459) and between the middle part of the Southern Bug and Sinyukha rivers (Kochubeivka kurgan 1, grave 9; BIDZILYA – BUNYATYAN – NIKOLOVA 2005; see SZMYT 2009, 238–240). These are the areas where the two societies must have come into direct contact with one another, taking even the form of migrations of individual people (e.g., in the form of matrimonial exchange).

On the Prut *(Fig. 7. B)* it is even possible to draw a line separating the distribution of synchronous settlements, with the GAC occupying territories west of the river, between the Prut and Seret rivers, while the Yamnaya culture settled its eastern bank, between the Prut and Dniester rivers (SZMYT 2003, 412–415). It would appear that between the Dniester, Prut and Seret we can observe traits of two phenomena: a quite clear cultural border and markers of cross-cultural (maybe cross-border?) contacts. Thus to the north of the Dniester the Podolian subgroup of the GAC can be found, to the west of the Prut the Moldavian subgroup and to the east of the Dniester the Yamnaya culture area. Moreover, between the Dniester and Prut rivers lies a territory occupied by the Yamnaya culture communities that incorporated some patterns (or customs) of the GAC, or even some peoples of the GAC.

Unfortunately, no similar records are in place in respect to mutual contacts in the steppe zone. Artefacts (vessels and axes), representing hypothetical GAC traits, have undergone more transformations here, i.e. they are less clear cut (SZMYT 2000, 460). They were identified in several graves of the Yamnaya culture on the lower Dniester and Dnieper (SZMYT 1999, Fig. 27). In turn, the origins of graves taking the form of stone cists, sporadically encountered in the steppe zone, are not known but do not necessarily have to refer to a single source (SZMYT 2009, 248). Due to the ambiguities in this context, the interpretation of "steppe" locations of hypothetical GAC patterns should refer to the situation in the forest-steppe zone as it must have been there that their reception took place.

It is most likely therefore that in respect to the above mentioned network of cultural contacts one ought to consider the issue of GAC relations with the so-called megalithic groups of the Black Sea area, which has long been a source of controversy[5] (see part 1.2). In the monograph devoted to the history of GAC societies in eastern Europe, I attempted to present the relevant concepts raised by the literature, and concluded that in order to resolve the as yet many unclear aspects in this context, new data is required (SZMYT 1999, 167–174). Since its publication, many articles on this issue have appeared and in part, added to our common store of knowledge in respect to GAC cultural networks.

Of particular note here are studies of materials of the so-called Kemi Oba culture that were published with considerable delay (SHCHEPINSKIY – TOSHCHEV 2001; SHCHEPINSKIY 2002). The study of hitherto proposed concepts relating to the above-mentioned group and the basis of their research has lead to

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3 On account of the controversy surrounding the radiocarbon dating for Yamnaya culture assemblages (KLOCHKO – KOŚKO – SZMYT 2003, 403–404; RASSAMAKIN – NIKOLOVA 2008, 60–67) I use here the newest data that were subjected to the critical analysis.

4 One ought to consider, however, older (up to 3300–3100 BC) dates from steppe graves beyond the Carpathians (Bulgaria, Hungary, Serbia). See e.g., DANI – M. NEPPER 2006, 44.

5 This also applies to the question of the dolmens from the Caucasus (SZMYT 1999, 167–174).

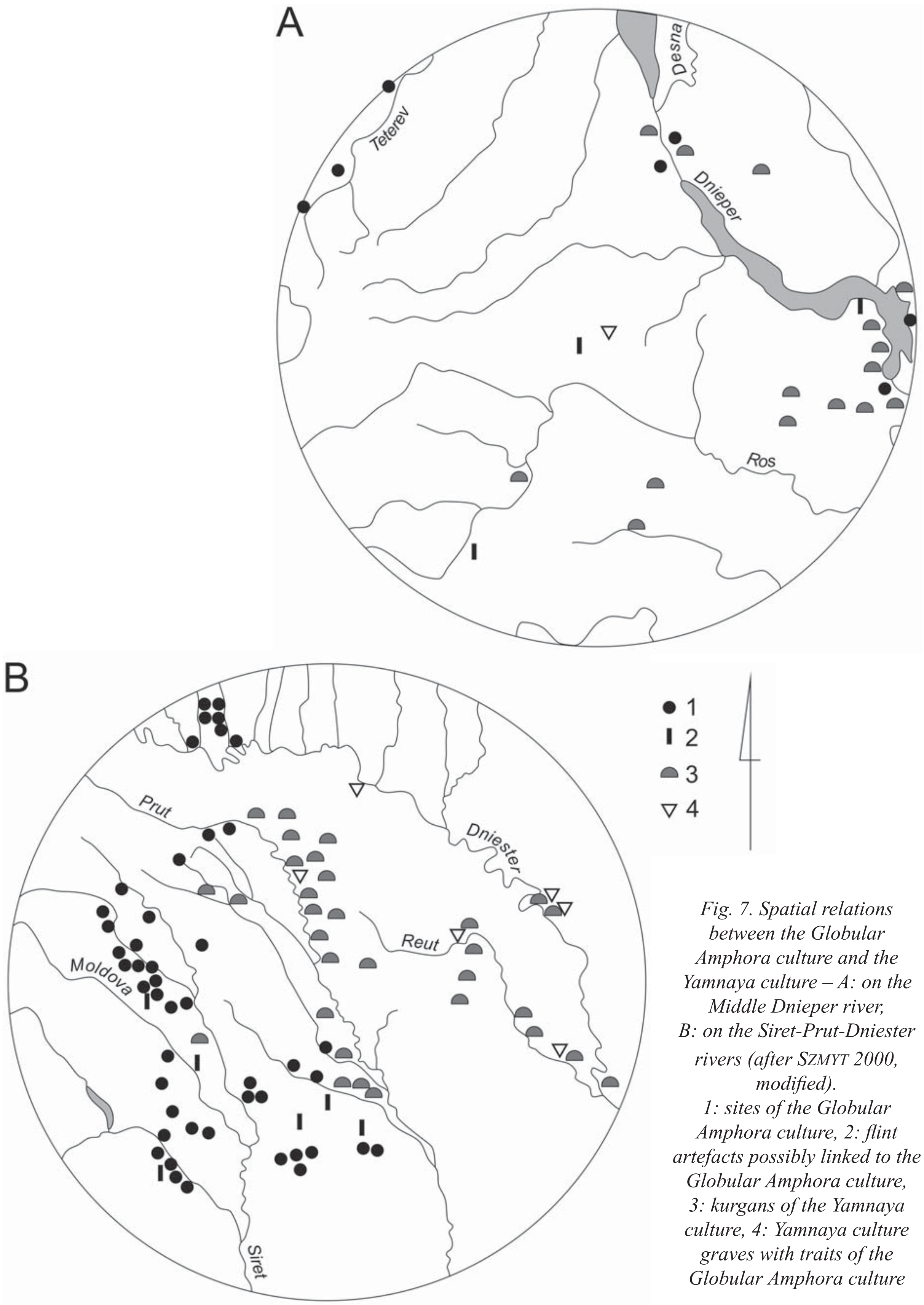

Fig. 7. Spatial relations between the Globular Amphora culture and the Yamnaya culture – A: on the Middle Dnieper river, B: on the Siret-Prut-Dniester rivers (after SZMYT *2000, modified). 1: sites of the Globular Amphora culture, 2: flint artefacts possibly linked to the Globular Amphora culture, 3: kurgans of the Yamnaya culture, 4: Yamnaya culture graves with traits of the Globular Amphora culture*

the proposition of incorporating the Kemi Oba to the Yamnaya culture (Toshchev 2007, 59–93). New empirical data are still lacking, however, that would allow for a precise contextualisation of this Crimean cultural phenomenon in the prehistoric timeline. This observation also applies to stone cist graves from other Black Sea areas that are associated with the Yamnaya culture (e.g., Shaposhnikova − Fomenko − Dovzhenko 1977).

4. Conclusion

The cultural backdrop between the Dnieper and Carpathians has been most often raised in terms of the interaction along an E–W axis, less frequently N–S. In particular, this applies to the issue of steppe peoples and their interaction with the communities from the Balkans, the Carpathian Basin and the Caucasus, which is drawing attention from an increasing number of scholars. In this context archaeological traces pointing to the presence of a tradition related to the GAC between the Dnieper and Carpathians that have been raised, allow for identifying other axes of contacts (NW–SE) that linked north-Central European societies with the communities of the forest-steppe and the steppe.

Moreover, the relatively easy identification of GAC traits allows for detailed studies in a variety of contexts in which such traits appear as well as, potentially, the dynamic and course of changes that took place as a result of this network of interaction. This, it is hoped, provides the opportunity for a more informed picture of the complexities taking place on these territories at the end of the 4th and first half of the 3rd millennium BC against the backdrop of cultural transformation and its effects, which had considerable importance for all of the continent at this period of prehistory (cf. Harrison − Heyd 2007).

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From the Late Eneolithic Period to the Early Bronze Age in the Black Sea Steppe: What is the Pit Grave Culture (Late Fourth to Mid-Third Millennium BC)?

YURI RASSAMAKIN

Abstract

This article includes the conceptual view of the author on the problems of transition between the Late Eneolithic and the Early Bronze Age, without a detailed comparative analysis of the archaeological sources. The stratigraphy of the kurgans and changes in the material culture between the Eneolithic and Early Bronze Age in the Black Sea steppe demonstrate that the transition process was rather "leaping" and not of evolutionary character. Absolute dates for the transition period (so called "leap") between the Late Eneolithic and the beginning of the Early Bronze Age (Pit Grave culture) are inconsistent in comparison with the archaeological data.

The regional and general periodization of the Pit Grave culture was developed on the basis of the stratigraphical positions of graves in kurgans. But the author does not see the evidence for the development of a reliable periodization of the Pit Grave culture and, accordingly, a clear chronological division of the graves of both traditions into separated stages during the Early Bronze Age. In other words, unlike the Eneolithic, the Pit Grave cultural-historical region of the Early Bronze Age appears as a cultural horizon that organically united the graves of the two burial traditions. Herewith, during the existence of the Pit Grave cultural-historical region that lasted approximately 500 years a certain evolution of burial rite and material assemblage took place. This evolution ended in the Black Sea steppe with the appearance of the graves of the so-called Early Catacomb culture.

Introduction

During the last years, the transition period from the Eneolithic to the Early Bronze Age in the Black Sea Steppe area has been a topic of active debates. The transformation of the Late Eneolithic cultural system and the formation of the Pit Grave cultural-historical region, defined by Nikolai Yakovlevich Merpert (MERPERT 1968, 6–8) as a new system of the Early Bronze Age (3000/2900–2500/2400 BC) is not clear yet. According to N. Ya. Merpert, the formation of the Pit Grave cultural-historical region was influenced by three main factors (MERPERT 1974, 128–133):

1. territory: the steppe zone appeared as a complex factor during the development of mobile cattle-breeding;
2. economic factor: new forms of mobile cattle-breeding formed the basis for the economic system;
3. social factor: the development of patriarchal relationships, symbolized by the kurgan burial rite took the major place in the new environment.

N. Ya. Merpert defined nine different variants of the Pit Grave region between the Urals and the Danube river (MERPERT 1968, 14–15; 1974, 14–15) *(Figs 1–2)*. After intensive excavations of kurgans in the different steppe and forest steppe areas during the last three decades of the twentieth century, this picture seems more complicated and includes an interpretation of cultural-historical and economic system, and structures of old and new local variants or groups. In this case, the main problem is the nature of the Pit Grave culture in the Pit Grave cultural-historical region itself.

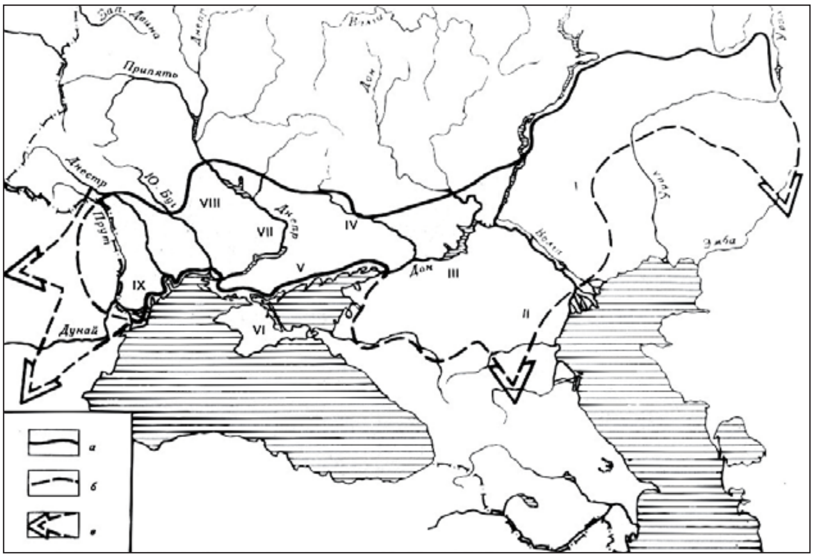

Fig. 1. Map of nine local variants of the Pit Grave cultural-historical region (after MERPERT *1974)*

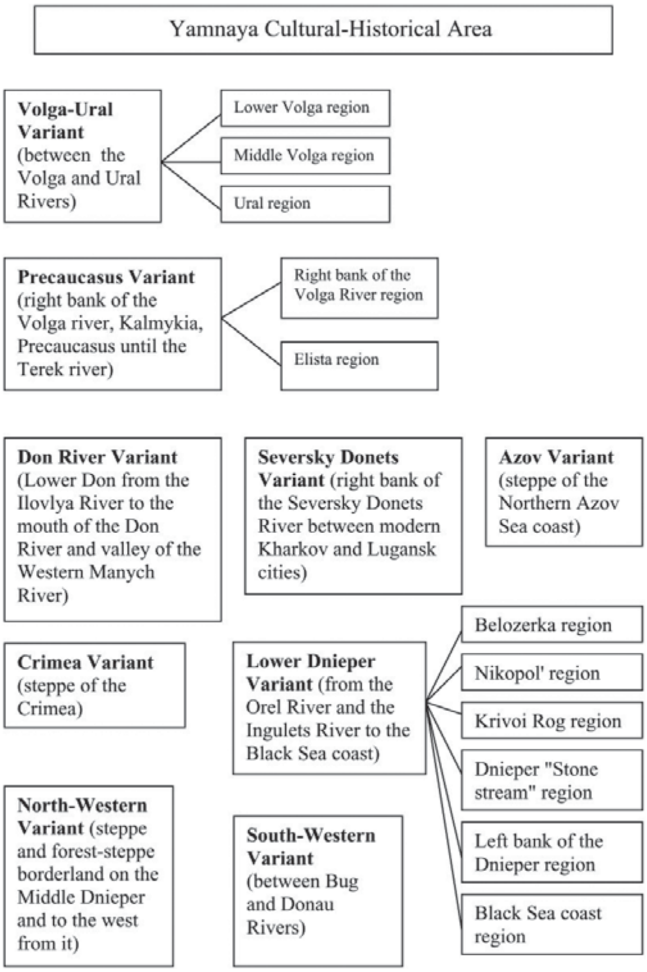

Fig. 2. Nine local variants of the Pit Grave cultural-historical region (after MERPERT *1968, 14–39)*

In the last decades, Ukrainian archaeologists have suggested different approaches to the solution of this issue. Some scholars do not accept the existence of the Pit Grave cultural-historical region at all. For example, Svitlana Volodimirivna Ivanova believes that only ideological factors influenced the formation of similar rituals practiced by territorially different groups of the Early Bronze Age (IVANOVA 2004; 2005; 2006a; 2006b). However, she does not explain clearly enough which factors underlay the formation of this common ideology in different regions of the vast steppe area. Dmitro Leonidovich Teslenko supports the idea of the existence of the Pit Grave cultural-historical region, although the essence of this definition has changed significantly recently (TESLENKO 2006, 30).[1]

In his works, the author already suggested to view the formation of the Pit Grave cultural-historical region as a "leap" in cultural development that occurred at the time of transition from the Eneolithic period to the Early Bronze Age. This change was stimulated by a number of factors, for example by ecological changes and degradation of the Eneolithic farming cultures. It resulted in the development of more mobile forms of cattle-breeding, as compared with the previous Eneolithic period, and in the change of the material complexes of archaeological cultures (RASSAMAKIN 1995). The author also analyzed this issue emphasizing economic questions (RASSAMAKIN 1999, 125–127, 129–132, 151–154; 2006a, 448–458).

In general, it is possible to assume the following changes happened as a result such a transformation (the economic aspect):

1. the Late and Final Eneolithic: various forms of a complex or mixed economy between a settled and semi-settled life; development of the initial forms of local pastoral systems. Crisis and disintegration of agricultural societies (Cucuteni-Trypillia and Maikop-Novosvobodnaia) are among the main aspects of the formation of more unified pastoral economy in the Early Bronze Age;
2. the Pit Grave Culture (Early Bronze Age): pastoral economy on the basis of cattle- and sheep-breeding; development of systems of short- and long-distance movement based upon seasonal changes within different local ecological zones, and connections between different local societies. Wheeled transport became very significant in the structure of society and in funeral rite. But can we define different steppe societies of the Pit Grave cultural-historical region as semi-nomads or even as earliest nomads? This problem remains rather disputable.

From the archaeological point of view, the author regards the transition from the Eneolithic to the Early Bronze Age in the Black Sea steppe zone as a system transformation of local cultures or groups of the Late Eneolithic period to the formation of more or less unified and steady phenomenon termed the "Pit Grave cultural-historical region" *(Fig. 3)*.

Can we trace this transformation in the archaeological evidence? In this context, the following basic changes can be considered as the results of this transformation process:

1. transition from the Eneolithic mounds with complex constructions (combinations of black earth and yellow clay with different additional elements, such as cairns, stone circles, ditches, and separate sacred places) to the simple mounds of the Pit Grave culture constructed of black earth blocks;
2. existence of the highly differentiated burial groups in the Eneolithic, and much more unified funeral rite in the Pit Grave culture;
3. continuation of the main, long-term steppe tradition in the making of round-bottom pottery, but: a) the use of more "primitive" technology; b) the appearance of new additional details, such as different handles on vessels; c) the existence of a new spectrum of pottery, atypical for the Eneolithic period.

[1] D. L. Teslenko provides a detailed historiographical overview of the present meaning of the term "Pit Grave cultural-historical region" (TESLENKO 2006).

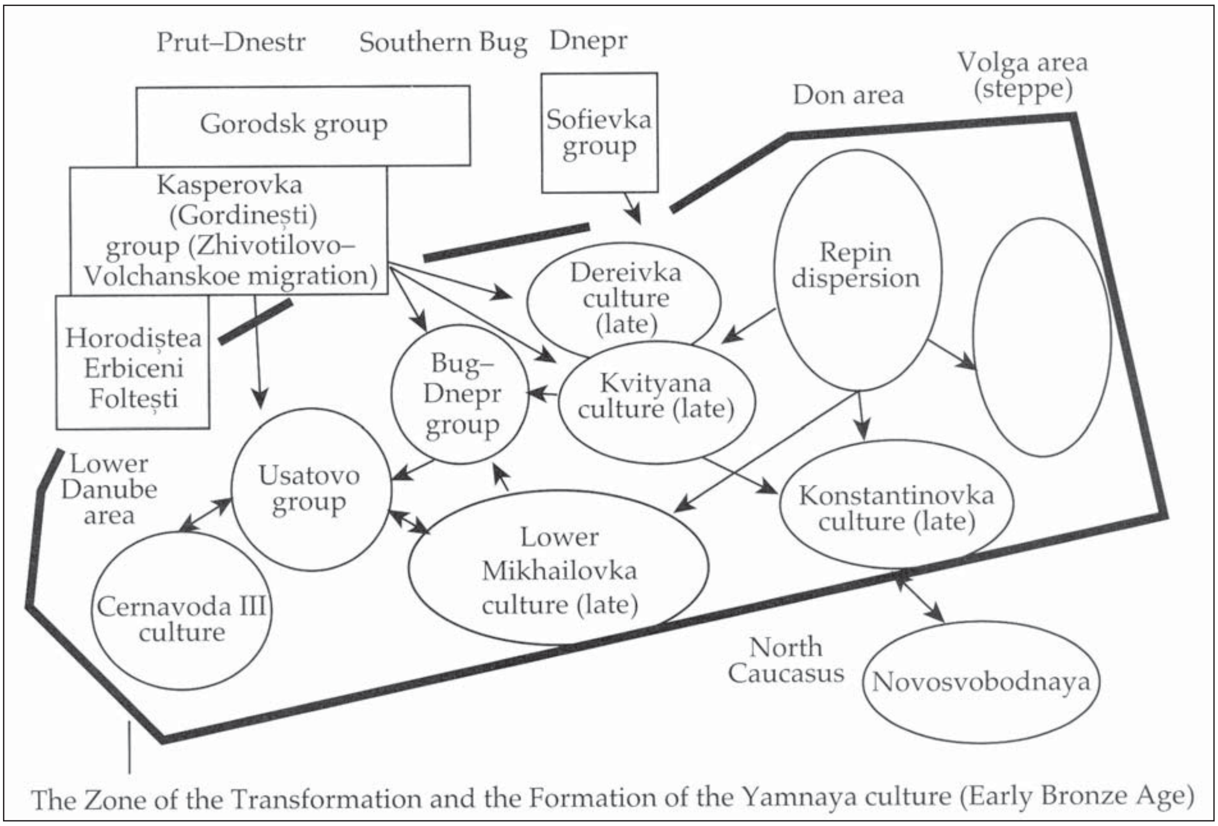

Fig. 3. Connections between the Late Eneolithic local groups (after R*ASSAMAKIN 1999, Fig. 3. 39)*

Burial rite – The Eneolithic period

Four main burial rite traditions existed in the steppe Black Sea region during the Eneolithic period: 1. in extended supine position *(Figs 4–5)*; 2. supine, with flexed legs *(Figs 6–7)*; 3. flexed position on the side, with one arm bent and the other extended or with both arms extended to the knees *(Figs 8–9)*; 4. side flexed position with bent arms and hands in front of the face *(Fig. 10)*. These traditions were defined on the basis of the analysis of four groups of the Eneolithic burials and grave goods (RASSAMAKIN 1999, 73, Fig. 3. 4–5; 2004, Teil I, 12–15, 141–142, Abb. 111). Each of these four groups had its own specific spatial distribution and chronological development (RASSAMAKIN 2004, 16–141).

The first burial tradition had a clearly marked center of concentration during the mid- and late Eneolithic (RASSAMAKIN 2004, Teil I, 16–17, 143–151, Abb. 4). But this tradition disappears in the Early Bronze Age. The fourth burial tradition appears only in the late Eneolithic, but also vanishes in the Early Bronze Age.

The earliest and long-lived tradition is the second one *(Fig. 11)*. We can trace its development through the Early, Middle, and Late Eneolithic. Gradual evolution of burial practices falls in this period. Moreover, it is possible to detect local characteristics in the development of the tradition and the change of the material assemblage in different regions, particularly in the Dnieper and the Lower Don regions (RASSAMAKIN 2004, Teil I, 151–168).

The author defined two vast distributional areas in the Black Sea steppe region, conventionally termed western and eastern as seen from the Dnieper river, where burials of the second traditions existed during the Middle and Late Eneolithic (RASSAMAKIN – EVDOKIMOV 2001, 84–85, Fig. 8) *(Figs 12–13)*.

The graves of the western area were combined into the so-called "post-Stog" group (Rassamakin – Evdokimov 2001, 84–85; Rassamakin 2004, 207–208). This term underlines the succession of burial rite with the earlier period of existence of the Sredny Stog II type sites.

Burials with pottery of the Repin type has already been known in the eastern area of distribution. Some scholars treated them as an independent Eneolithic Repin culture, whereas others considered them as an early phase of the Pit Grave culture (Sinyuk 1981, 15; Marina 1992; 2001; Trifonov 1996; Rassamakin 1999, 125; Barynkin 2000; Nikolova 2002).[2]

Although the positions of skeletons are identical in both groups, burials with Repin type pottery are characterized by rectangular pits, whereas in graves of the "post-Stog" group oval pits prevail *(Fig. 13)*. The pottery assemblage in the burials of the "post-Stog" group is more manifold than the uniform ceramics of the Repin type in the eastern area of distribution *(Fig. 13)*.

On one hand, the "local" pottery is specific for the "post-Stog" group, and therefore is compared by some scholars regarding its

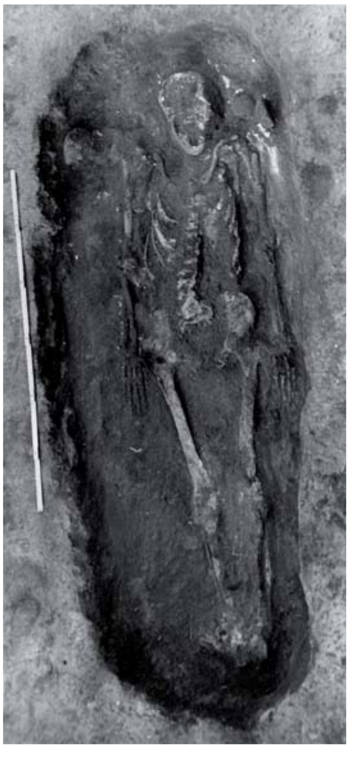

Fig. 4. Middle/Late Eneolithic graves of the first burial tradition covered by mound – Dnieper right bank, Sadovoe village, mound 101, gr. 12 (photo by Yu. Rassamakin)

Fig. 5. Middle/Late Eneolithic graves of the first burial tradition covered by mound – Molochnaia river, Zhovtneve village, mound 11, gr. 25 (photo by Yu. Rassamakin)

[2] Alla V. Nikolova provided overview of the latest detailed historiographical the term "Repin Culture" (Nikolova 2002).

Fig. 6. Early/Middle Eneolithic grave of the second burial tradition covered by mound – Molochnaia river, Vinogradnoe village, mound 3, gr. 15 (photo by Yu. Rassamakin)

Fig. 7. Late Eneolithic grave of the second burial tradition accompanied by a painted vessel of the Tripolye culture – Ingulets river, former Dubovoe village, mound "Dubova Mogyla", gr. 10 (after KOVALEVA *et al. 2003, 87, Fig. 30) (photo from the field report, Archive of Institute of Archaeology of NASU)*

Fig. 8. Middle Eneolithic grave of the third burial tradition covered by mound – Dnieper left bank, Balki village, mound "Vysoka Mogyla", gr. 7 (photo from the field report, Archive of Institute of Archaeology of NASU)

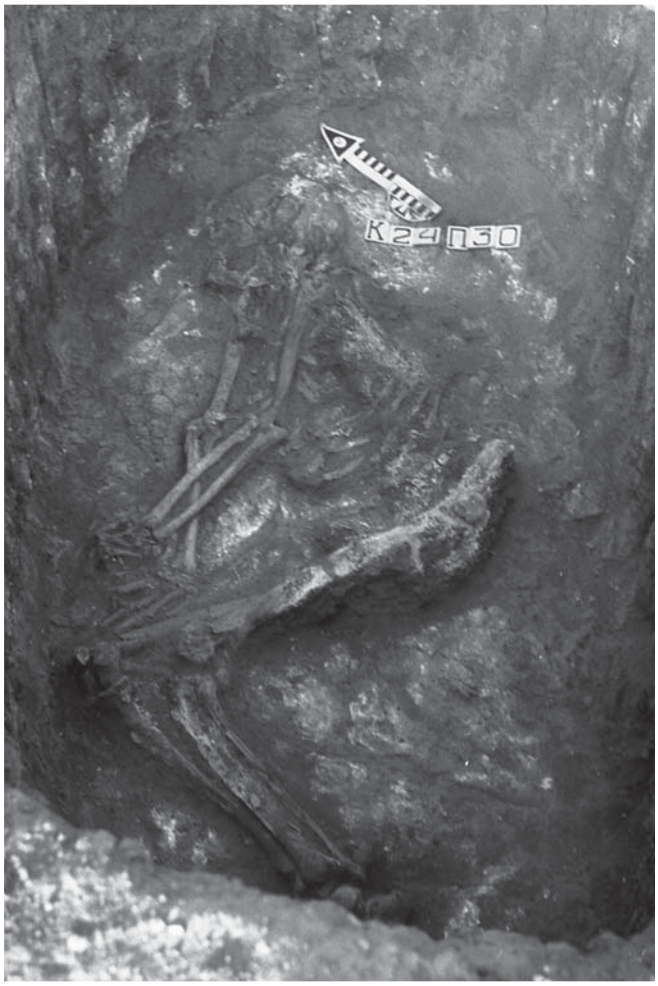

Fig. 9. Middle Eneolithic grave of the third burial tradition covered by mound – Molochnaia river, Vinogradnoe village, mound 24, gr. 30 (photo by Yu. Rassamakin)

Fig. 10. Late Eneolithic grave of the fourth burial tradition covered by mound — Molochnaia river, Vinogradnoe village, mound 24, gr. 27 (photo by Yu. Rassamakin)

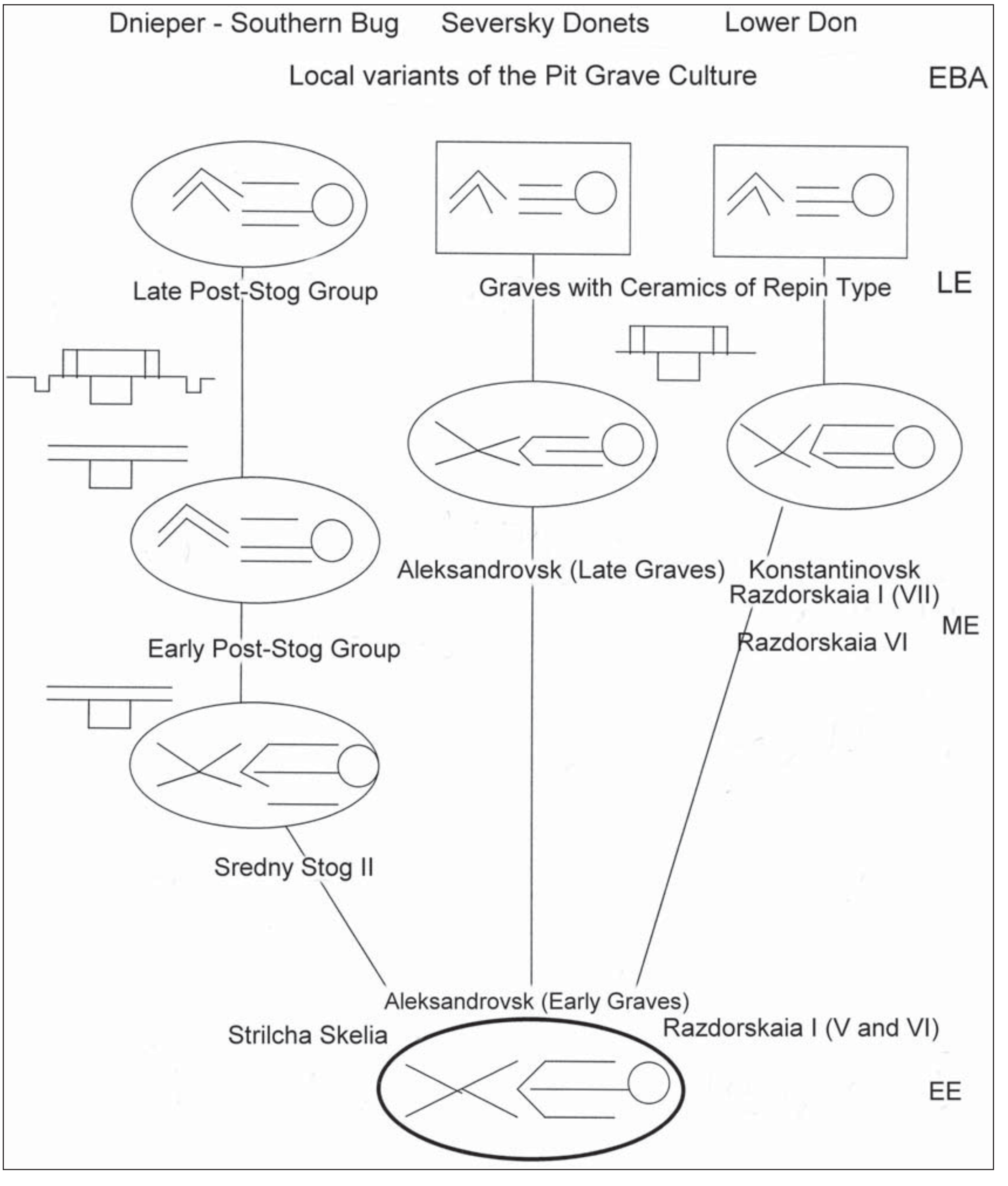

Fig. 11. Development of the second burial tradition from the Early to the Late Eneolithic

technological characteristics and forms with the pottery from the lower stratum of the Mikhailovka settlement at the Lower Dnieper. On the other hand "post-Stog" burials sometimes contain vessels of the Tripolye culture of the periods C/1 and C/2 *(Figs 14–18)*. Consequently, the Tripolye vessels form the basis for the relative chronology of the graves of the "post-Stog" group, and enable us to define two periods of the existence of this group in accordance with the periodization of the Tripolye culture.

Some scholars explain the appearance of graves with Repin type pottery by the migration processes during the Late Eneolithic. However, the question concerning the formation of this group remains open.

Arsen Tigranovich Sinyuk regarded the Neolithic Lower Don culture and the early phase of the Sredny Stog culture (after Dmitriy Ya. Telegin) to form the basis for the emergence of the Repin culture

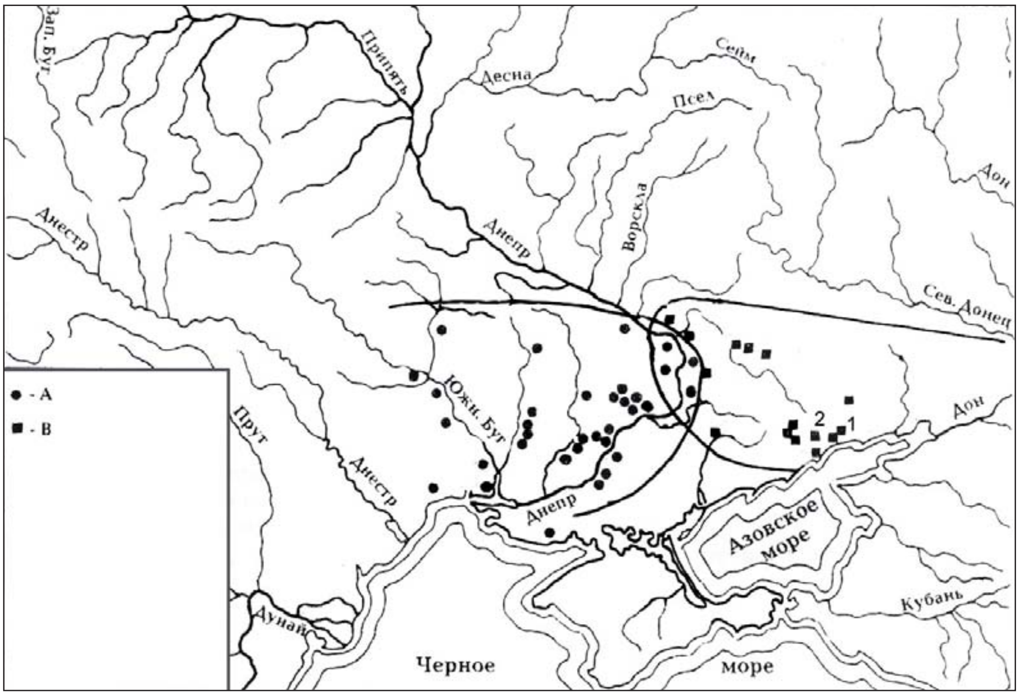

Fig. 12. Distribution of the graves of the "post-Stog group" (A) and graves with Repin type ceramics (B) – 1: Volonterovka; 2: Kremenevka

Fig. 13. Burial forms and ceramics of the "post-Stog" group and the Repin culture

and its typical pottery assemblage in the Middle Don region (SINYUK 1981, 14). Moreover, Sinyuk suggested that the extended supine position of the dead in burials without mounds were typical for the Repin culture (SINYUK 1981, 15).

D. Ya. Telegin considered the vessels of the Repin type as one of the three pottery types of the early stage of the Pit Grave culture. He suggested that the type A1 vessels originated from the traditions of the Sredny Stog culture (TELEGIN 1998; 2001), but he did not specify what was meant by the term "pottery traditions of the Srednij Stog culture". In his publication he illustrated vessels types as Srednij Stog 2 dated to the early phase of the Srednij Stog culture. On the bases of newly obtained materials some scholars consider that the Repin culture with its typical ceramic spectrum emerged from the pottery of the Dereivka type (late phase of the Sredny Stog culture after D. Ya. Telegin) as well as from the Pit-Comb Ware culture (SANZHAROV *et al.* 2000, 92–97).

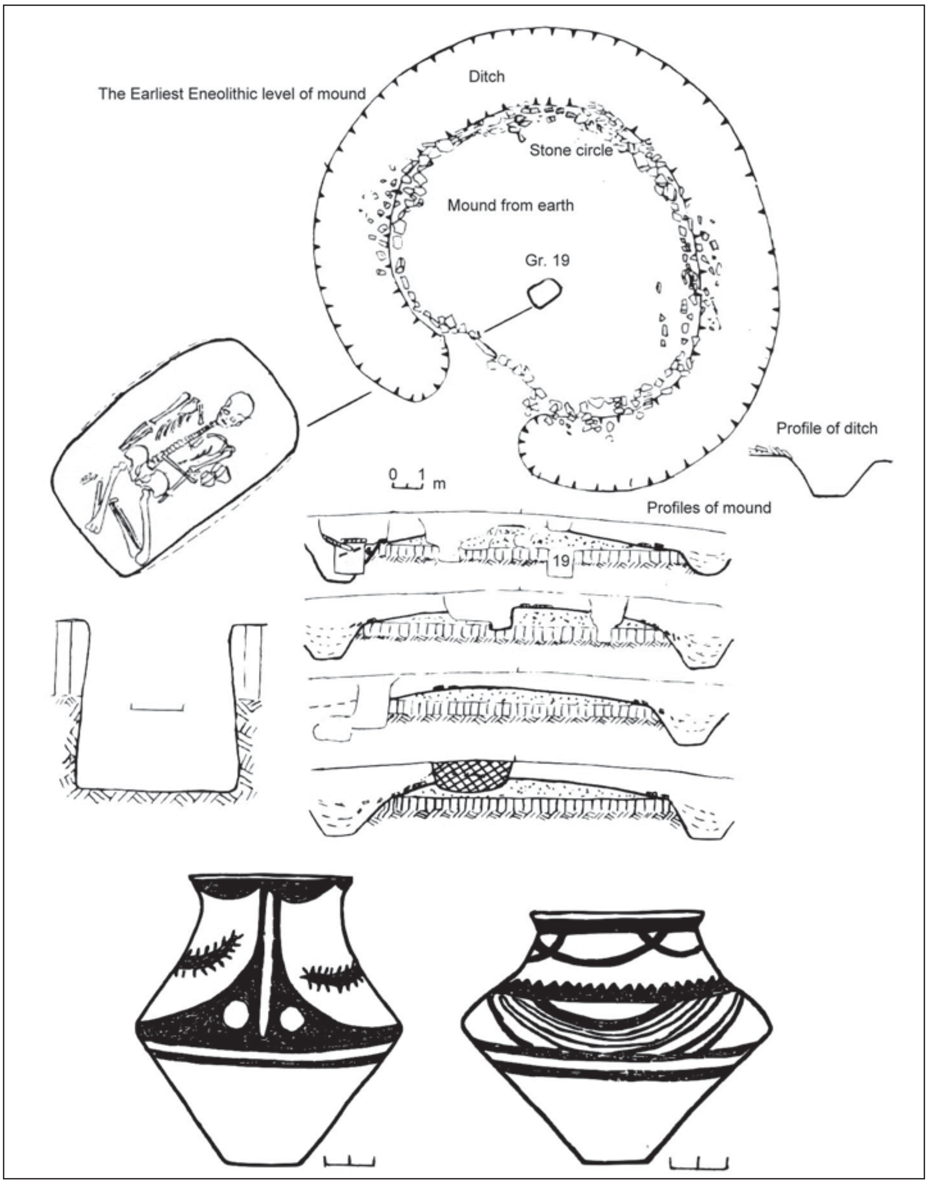

Fig. 14. Mound construction and vessels of the Tripolye culture – Southern Bug Region, Pribuzhany village, mound 4, gr. 19 (excavation by O. G. Shaposhnikova in 1982)

Fig. 15. Painted vessel from the a grave in Pribuzhany (photos by Yu. Rassamakin)

Fig. 16. The second painted vessel from the grave in Pribuzhany (photos by Yu. Rassamakin)

Fig. 17. Late Eneolithic grave of the second burial tradition and the painted vessel of the Tripolye culture from this grave – Ingulets river, former Dubovoe village, mound "Dubova Mogyla", gr. 10 (after K*OVALEVA et al. 2003, 87, Fig. 30) (photo from the field report, Archive of Institute of Archaeology of NASU)*

In general, the concept of the formation of Repin type pottery within the forest-steppe area is currently prevailing. After its emergence it started to spread into the steppe zone of the Dnieper, Lower Don, and Volga rivers. In these regions, Repin type pottery is scarcely known from settlement layers with generally a low concentration of artifacts. The settlement of Repin Khutor in the Middle Don region is an exception (SINYUK 1981).

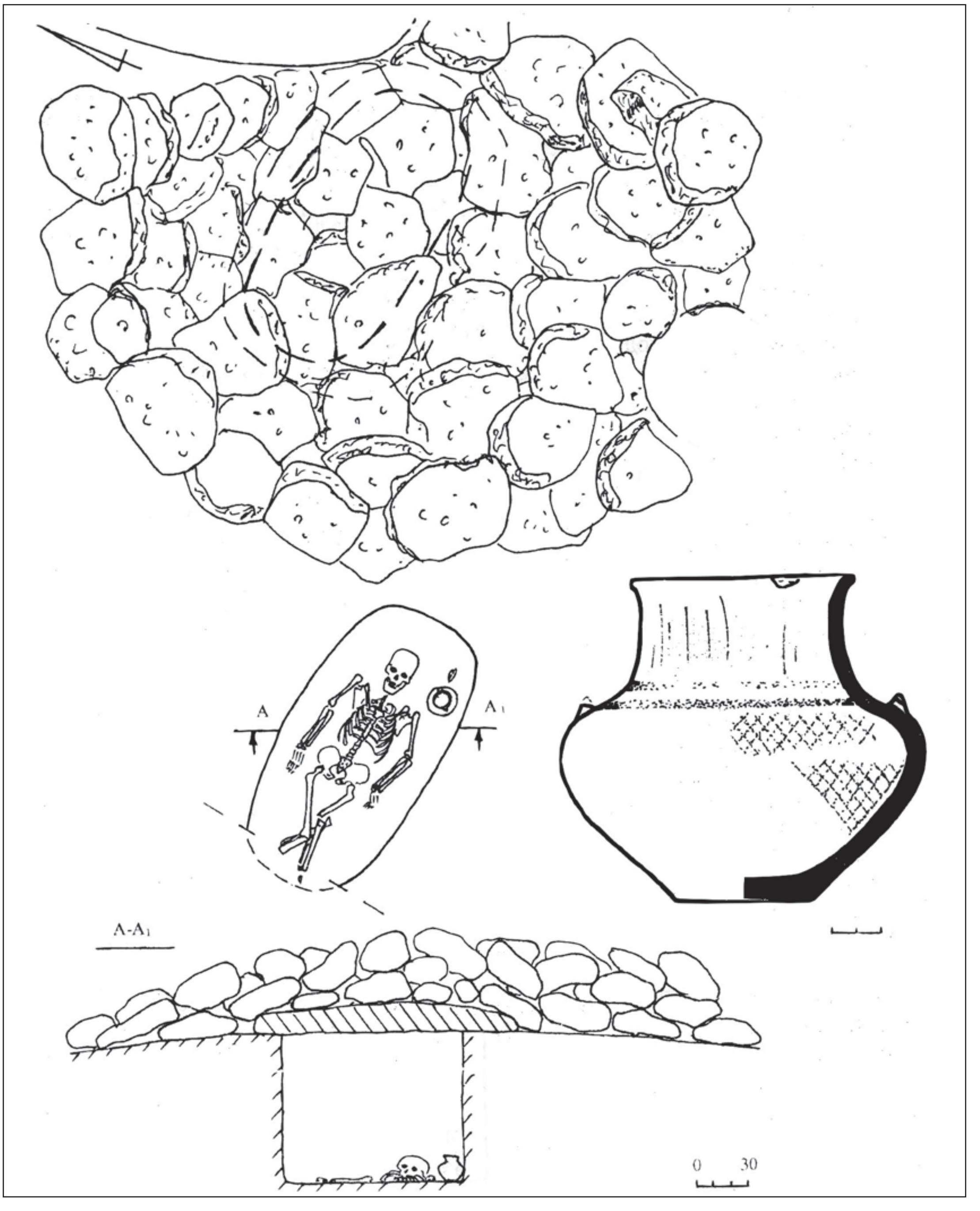

Fig. 18. Drawings of the Late Eneolithic grave of the second burial tradition and painted vessel of the Tripolye culture from this grave – Ingulets river, former Dubovoe village, mound "Dubova Mogyla", gr. 10 (after K*OVALEVA et al. 2003, 87, Fig. 30)*

Therefore two important issues remain under discussion:

1. Why do Repin type ceramics occur in burials of the second tradition?
2. How can we correlate this group of burials with the synchronous late "post-Stog" burials in the context of the emergence of the Early Bronze Age Pit Grave culture?

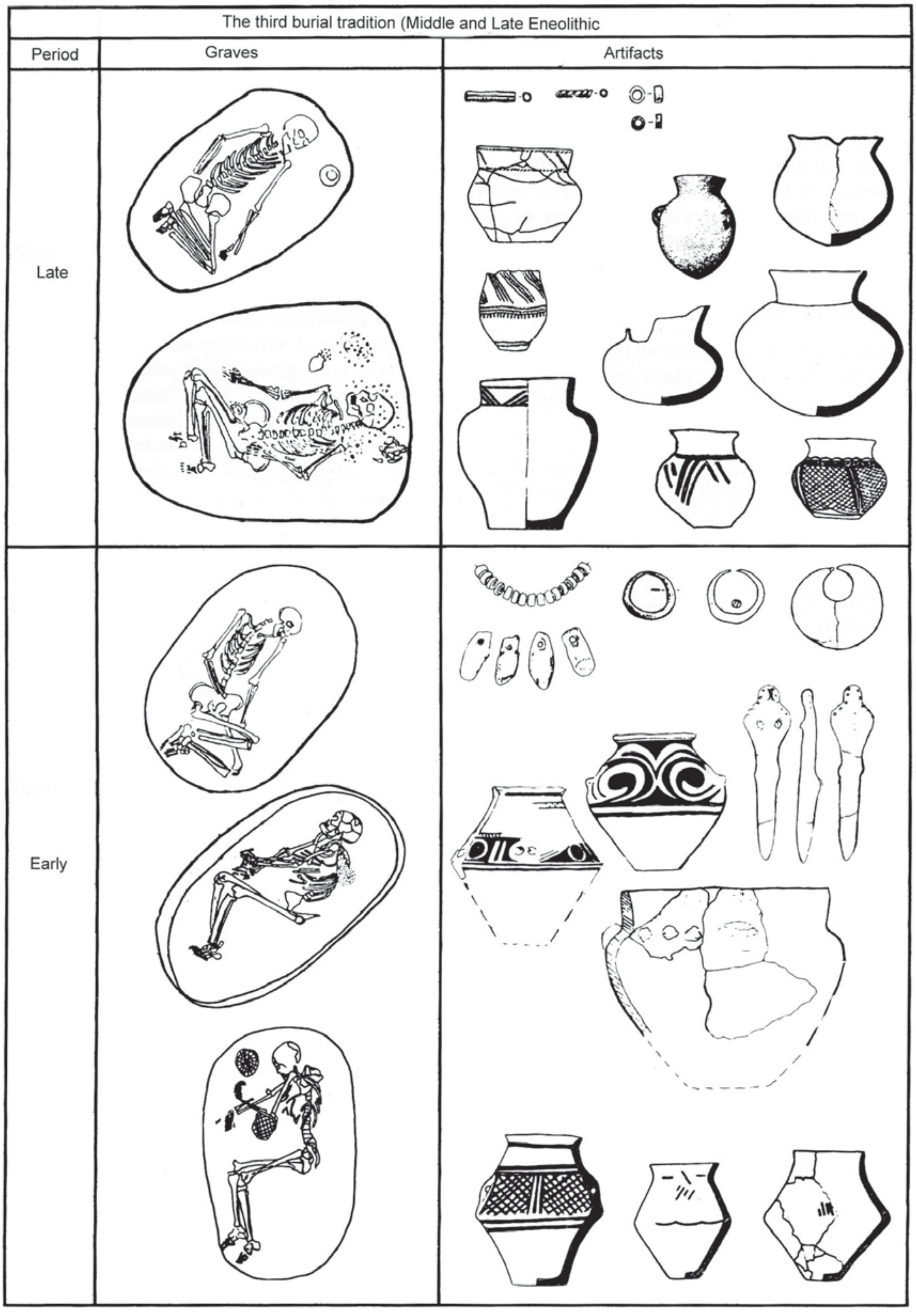

Fig. 19. The early and late periods of the development of the third burial tradition (after RASSAMAKIN 2004, Teil I, Abb. 124)

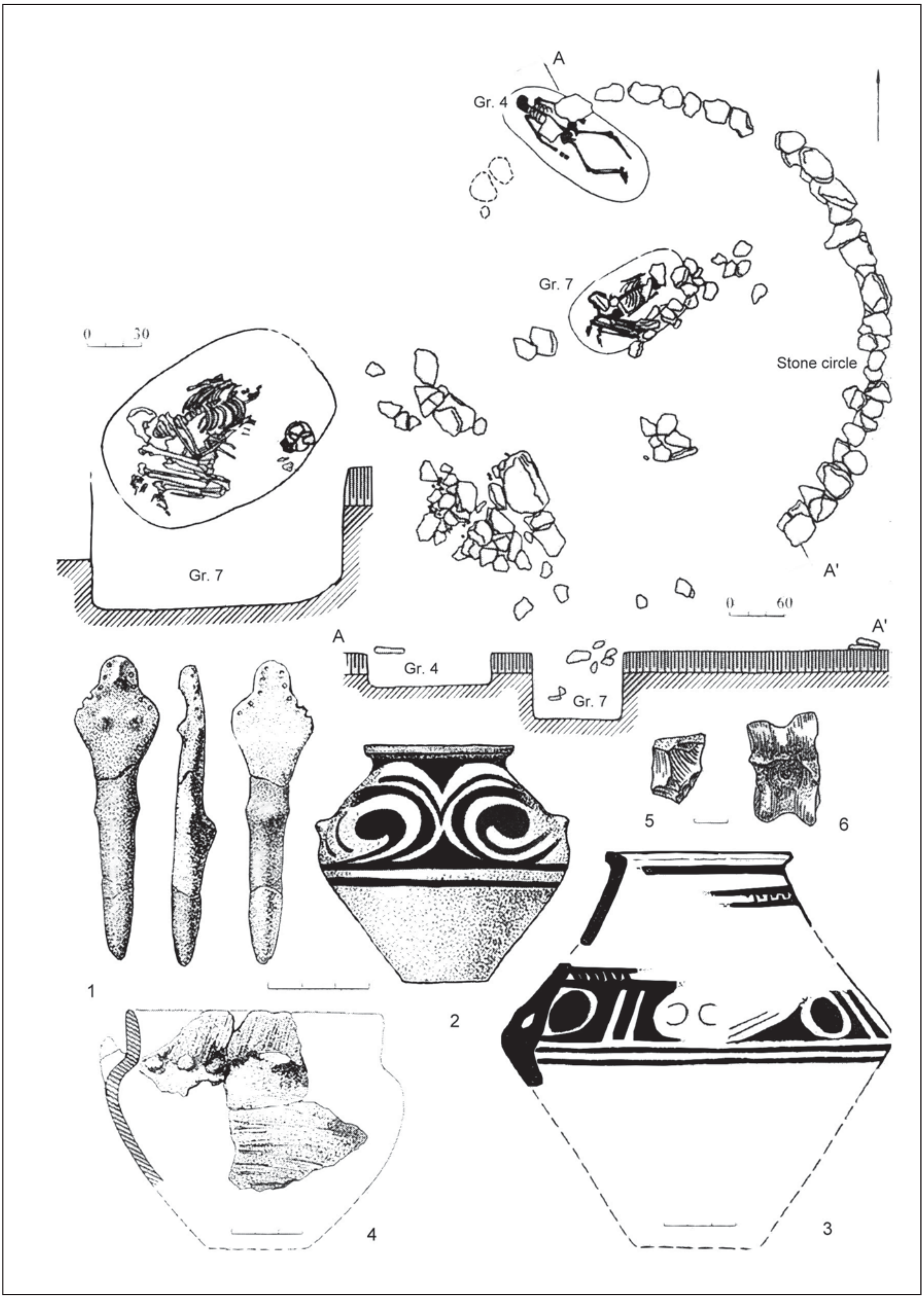

Fig. 20. Middle Eneolithic grave of the third burial tradition, accompanied by a clay female statuette (1), painted (2–3) and kitchen (4) ceramics of the Tripolye culture, flint (5) and bone (6) artefacts – Southern Bug region, Vinogradny Sad village, mound 2, gr. 7 (after Fomenko *2007, 445–446, Fig. 3)*

Previously, the author of this article considered the so-called Repin culture as a component in the formation of the Pit Grave cultural-historical region, being the compositional element of its "local" variants only (Rassamakin 1999, 125). As a matter of fact, and regarding burials with Repin type pottery as a separate Repin culture of the Late Eneolithic, this type of ceramics is missing in the graves of the Pit Grave cultural-historical region of the Early Bronze Age.

As for the "post-Stog" group, it possibly played the same role in the formation of the Pit Grave cultural-historical region, but only in the western distribution area.

The third burial tradition during the Eneolithic, where the deceased lay in a flexed position on his/her side (groups III-A and III-B), should be regarded as a new phenomenon as compared to the second burial tradition in the steppe zone (Rassamakin 2004, Teil I, 168–170).

Earlier, such flexed position of the dead was not typical for this territory. Their relative chronology and periodization were also determined based on the Tripolye ware from the graves, dated to the C/1 and C/2 periods (Rassamakin 2004, Teil I, 168–170, Abb. 124) *(Figs 19–20)*. The author of this article suggested that the farming component played an important role in the formation of this tradition and treated it in the context of the development of the Lower Mikhailovka culture (Rassamakin 1999, 91–92; 2004, Teil I, 168–170, 183–185). Igor V. Manzura considers the graves of this burial rite tradition from the region between the Danube and Dniester rivers as the Basarabian variant of the Chernavoda I culture (Manzura 1993, 26–30). V. G. Petrenko defines burials of this tradition in the Khadzhider type, named after an excavated kurgan with a Tripolye vessel of the C/1 period as a grave good (Petrenko 1993). It should be noted that the majority of the burials of the third tradition (group III-A and III-B) has been distributed in kurgans of the steppe zone between the Dnieper and Dniester rivers. They are also known to the east of the Dnieper river in the Molochnaya river region (Rassamakin 2004, Teil I, 20–22, Abb. 9–10).

Burial rite – The Early Bronze Age

Judging from their formal criteria, the burial rite of the Pit Grave culture includes only two funeral traditions of the Eneolithic of the Black Sea steppe: the second one (group II-A and II-C) *(Figs 21–23)* and the third one (III-A and rarely III-B) *(Figs 24–27)*. The quantitative ratio of graves of both traditions differs in different territories of the distribution of the Pit Grave cultural-historical region. Scholars use this index to allocate various local variants of the Pit Grave culture.

The regional and general periodization of the Pit Grave culture was developed on the basis of the stratigraphical positions of graves in kurgans. But the author does not see the evidence for the development of a reliable periodization of the Pit Grave culture and, accordingly, a clear chronological division of the graves of both traditions into separated stages during the Early Bronze Age. In other words and unlike the Eneolithic, the Pit Grave cultural-historical region of the Early Bronze Age appears as a single cultural horizon that organically united the graves of the two burial traditions. Herewith, during the existence of the Pit Grave cultural-historical region that lasted approximately 500 years (Rassamakin – Nikolova 2008, 60–67), a certain evolution of burial rite and material assemblage took place. This evolution ended in the Black Sea steppe with the appearance of graves of the so-called Early Catacomb culture.

To a certain degree, the appearance of different local steppe groups with mixed cultural traditions in the Late Eneolithic can be regarded as the beginning of a transformation process resulting in the formation of the unified burial rite in the Early Bronze Age (Rassamakin 1999, 122–125, Fig. 3. 49; 2004, Teil I, 184–185, 208–209; Rassamakin – Evdokimov 2009–2010, 23–28) *(Fig. 3)*. However, it is not clear why the first and the forth burial traditions of the Late Eneolithic are not reflected in the Early Bronze Age of the Black Sea steppes. If the graves of the fourth burial tradition (so-called Zhivotilovka-

Fig. 21. Early Bronze Age grave of the Pit Grave culture of the second burial tradition – Gnyly Tikich river, Kolodyste village, mound 1, gr. 10 (photo by Yu. Rassamakin)

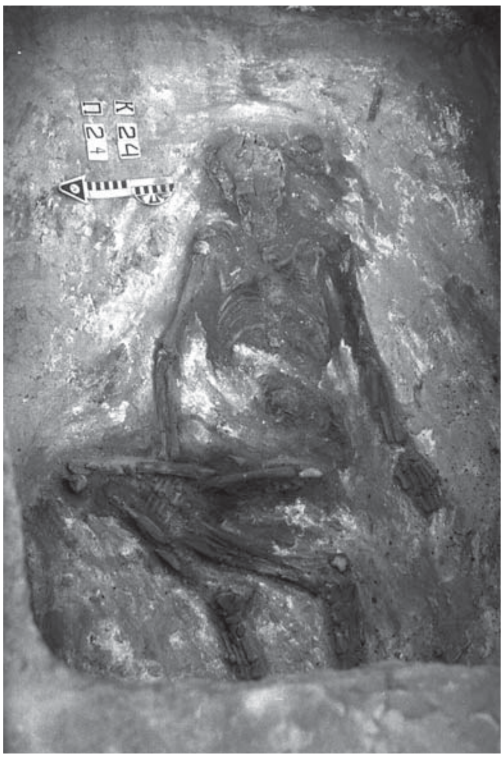

Fig. 22. Early Bronze Age grave of the Pit Grave culture of the second burial tradition – Molochnaia river, Vinogradnoe village, mound 24, gr. 24 (photo by Yu. Rassamakin)

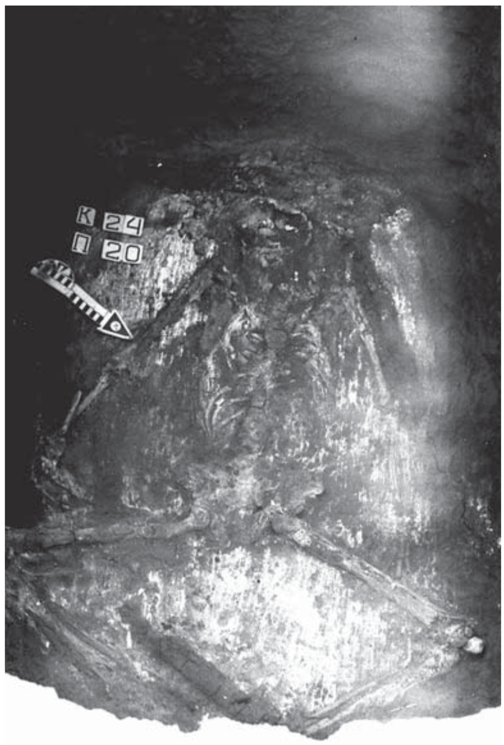

Fig. 23. Early Bronze Age grave of the Pit Grave culture of the second burial tradition – Molochnaia river, Vinogradnoe village, mound 24, gr. 20 (photo by Yu. Rassamakin)

Fig. 24. Early Bronze Age grave of the Pit Grave culture of the third burial tradition – Gnyly Tikich river, Kolodyste village, mound 1, gr. 9 (photo by Yu. Rassamakin)

Fig. 25. Early Bronze Age grave of the Pit Grave culture of the third burial tradition – Molochnaia river, Vinogradnoe village, mound 24, gr. 8 (photo by Yu. Rassamakin)

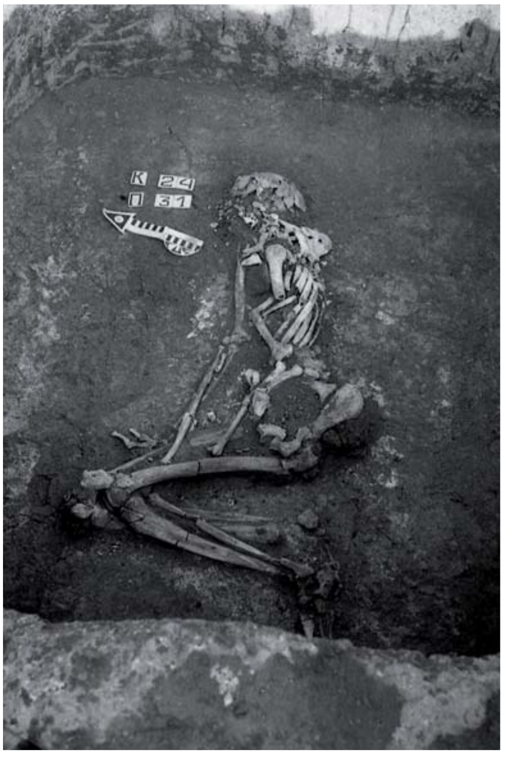

Fig. 26. Early Bronze Age grave of the Pit Grave culture of the third burial tradition – Molochnaia river, Vinogradnoe village, mound 24, gr. 31 (photo by Yu. Rassamakin)

Fig. 27. Early Bronze Age grave of the Pit Grave culture of the third burial tradition – Molochnaia river, Vinogradnoe village, mound 29, gr. 2 (photo by Yu. Rassamakin)

Volchansk group) were associated with migrants in the Late Eneolithic, and hence atypical for the steppe region (Rassamakin 1996; 1999, 122–125; 2004, Teil I, 55–59, 126–134, 184–185, 208–209), the destiny of the population attached to the first burial tradition, its numerous graves known on the waste territory, remains a puzzle.

In general, the burial rite of the Pit Grave culture seems more simplified then the one practiced during the Eneolithic period. In particular, we do not see complex constructions over the graves, while the Eneolithic burials, especially of the second and third burial traditions, typically had the complex cultic architecture. Eneolithic graves were covered with constructions made out of black humus and yellow clay, often circled by ditches and slab cromlechs *(Fig. 14, Fig. 20)* (Rassamakin 1999, Fig. 3. 27; 2002, 63–66; 2004, Teil I, 59–61). Also typical were the remains of funeral feasts left on the level of the ancient surface or in ditches (bonfire places, ceramics, animal bones and cult beam constructions beyond the territory of the mounds).

Graves of the Pit Grave cultural-historical region were covered, in most cases, with constructions built of blocks of black humus. Perhaps these constructions were formed as a truncated cone, but in a short time they lost their original forms.

Material culture – The Eneolithic period

The Eneolithic period in the Black Sea steppe differs from the Early Bronze Age by the presence of pottery that is clearly differentiated by its shape and ornamentation. Based on data from the settlements, scholars define Skelia, Stog, Dereivka, Kvitiana, and Repin types of clay ware (Rassamakin 2003, 68–69). Each type of pottery outlines the characteristics of separate Eneolithic cultures or groups. The wider spectrum of finds, with bowls and flat-bottom vessels as, for example, from the Dereivka settlement, can be explained by external influences. In such, the ceramic complex at the Dereivka settlement was influenced by the Tripolye culture. The main problem is the correlation of separate types of pottery from the Eneolithic settlements with the burial complexes.

In this regard the pottery used at funeral feasts found close to the burials is of great importance. Vessels from the graves often bear characteristic features. This pottery spectrum is represented by imported vessels as, for example, by painted vessels of the Tripolye culture or by imitations, especially of Maikop-Novosvobodnaia pottery of the Northern Caucasus. It is especially apparent in the Late Eneolithic *(Fig. 28)*. A new set of pottery (cups, small "amphorae", beakers) for the steppe region is known in the graves of the Zhivotilovka-Volchansk group (RASSAMAKIN 1996; 1999, 92–97; 2004, Teil I, 126–130). Against this background, the burials of the Repin culture with vessels analogous to the vessels from the settlements are viewed as exceptions.

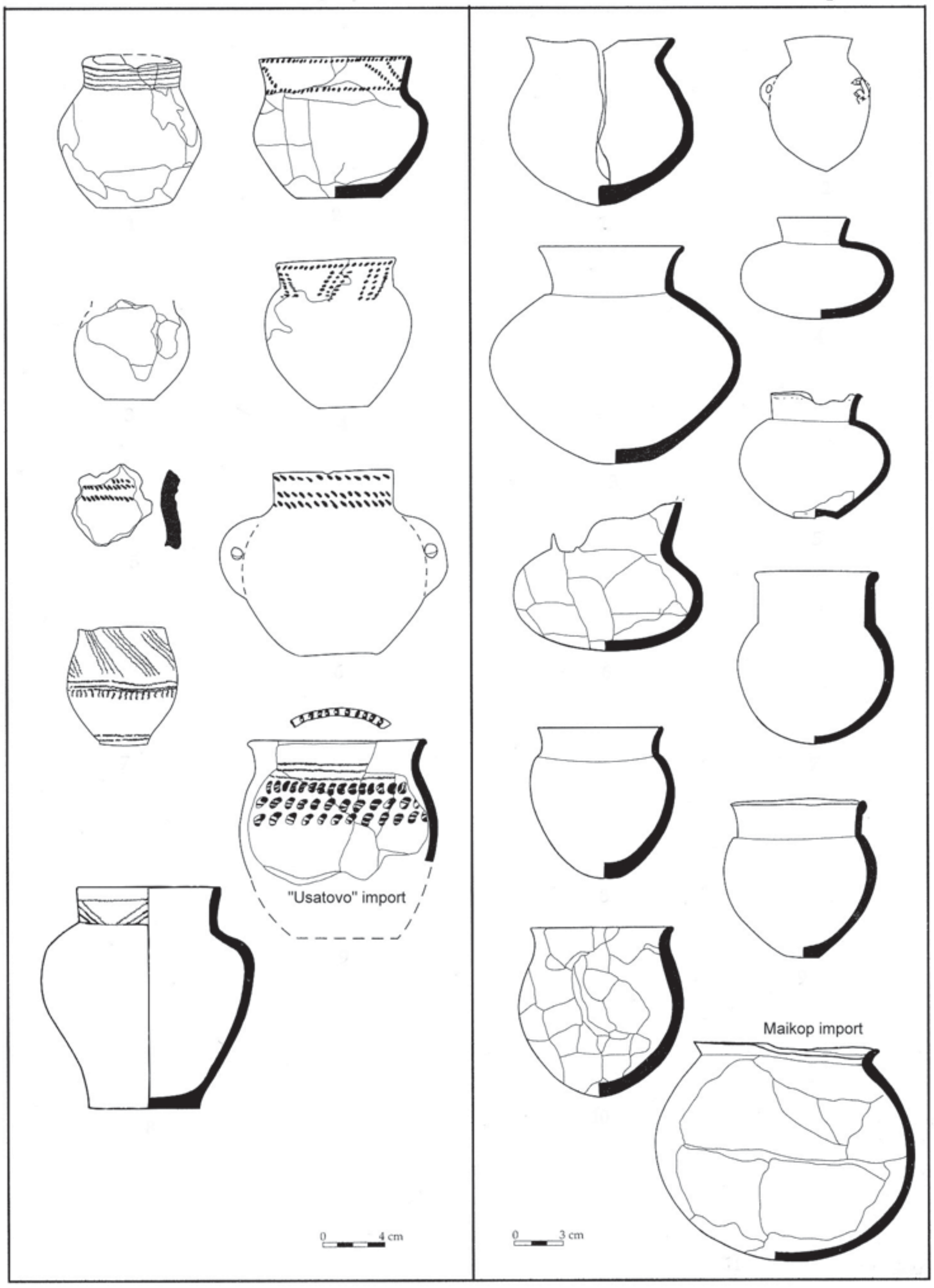

Fig. 28. Typical vessels from Late Eneolithic graves representing two different ceramic traditions (after RASSAMAKIN 2002, Fig. 4. 4)

Material culture – The Early Bronze Age

In contrast to the Eneolithic, the ceramic assemblage of the Early Bronze Age becomes more variable in shapes; their technology changed, and shells as an ingredient of the clay mass disappear. Ukrainian scholars define 25 clusters or groups of pottery (Nikolova – Manchich 1997, 104). It reflects the process of the formation of the Pit Grave cultural-historical region as a transformation of different traditions of the Late Eneolithic local cultural groups, and the appearance of completely new types of pottery. In this connection, a question arises: is it possible to single out a group of pottery from different clusters, which we can see as a reflection of the long-term "local" development of ceramic traditions, and conventionally define it as the "classic" pottery of the Pit Grave culture?

Such group of pottery from the graves of the Pit Grave culture can be represented by only a special group of vessels with rounded base and egg-shaped bodies. But at the same time, these vessels bear new elements – handles, small relief handles and a flat bottom *(Fig. 29)*. The majority of such vessels, for example, in the region between the Dnieper and the Don rivers could be considered as the "core" of the culture.

D. Ya. Telegin suggested one variant of the formation of the "classic" pottery of the Pit Grave culture in the Black Sea steppe region. But this scholar defined the pottery of the Repin type as dated to the early stage of the Pit Grave culture (Telegin 1998; 2001). This contradicts the hypothesis of the local formation of Repin pottery in the forest-steppe region (see above). Generally, ceramics of the Repin type are, indeed, homogeneous in terms of its formal characteristics, but, as mentioned above, are not represented in the graves of the Pit Grave culture.

The author of this article does not reject traditions of the Late Eneolithic in the formation of the "classic" pottery type of the Pit Grave culture *(Fig. 28)*. Precisely the Late Eneolithic period was the period when such additional characteristics as handles, small relief handles and the flat base appeared. The groove at the bottom of the vessels' neck is also an interesting feature. It is typical for a series of Late Eneolithic pottery and is also present on the "classic" vessel types of the Pit Grave. However, although the succession of traditions conceived in the transformation of forms is clearly visible, we cannot draw a straight line of evolution for the pottery.

Chronology

The chronological division of the Late Eneolithic and the Early Bronze Age is very well traceable due to the stratigraphy of burial mounds. Moreover, during the study of the stratigraphical sequence of layers of Eneolithic and Early Bronze Age periods, scholars often notice a formation of a soil layer (about 2–3 cm thick) prior to the time when the first Pit Grave culture graves were inserted into Eneolithic mounds.

On the basis of the available radiocarbon dates, we can talk about the existence of a certain gap on the uncalibrated scale between the burials with Repin type pottery and those of the Pit Grave culture, as shown by dates from graves with Repin type vessels from the kurgans of Volonterovka (kurgan 1, burials 3, 4, 5) and Kremenevka (kurgan 6, burials 8, 9, 7) in the Azov Sea steppe (Konstantinesku 1984; Kovalyukh – Nazarov 1999, 17, Table 1; Telegin – Pustovalov – Kovalyukh 2003, 143–144). Moreover, radiocarbon dates were also obtained from the graves of the Pit Grave culture (Volonterovka, kurgan 1, burials 11, 6, 9; Kremenevka, kurgan 6, burials 6, 4) inserted in the same two kurgans after burials with Repin ceramics (Konstantinesku 1988, 99–103; Telegin – Pustovalov – Kovalyukh 2003, 143–144) *(Figs 30–31)*.

The radiocarbon dates for the Late Eneolithic graves of the Zhivotilovka-Volchansk group in the Dniestr-Prut region (5 dates) correlate with the dates from graves with Repin type pottery in the Azov

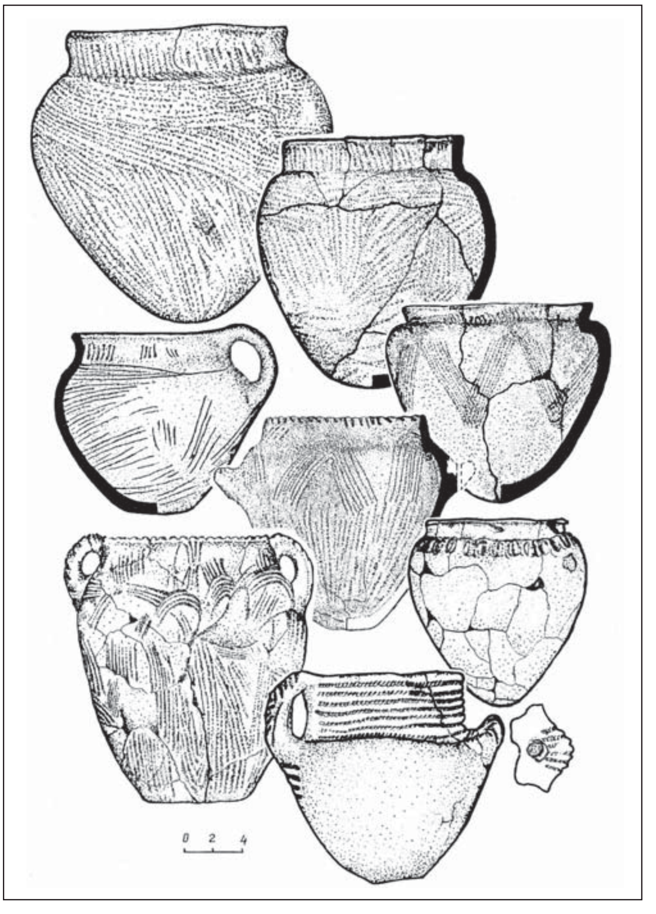

Fig. 29. "Classical" ceramics from graves of the Pit Grave culture

Sea region. They are placed between 4548 ± 28 BP and 4434 ± 23 BP (Petrenko – Kovaliukh 2003, 109, Table 7; Rassamakin 2011, 92, Abb. 12a–b).

Three close dates are also known for the middle layer of the Mikhailovka settlement at the Dnieper river (Kotova–Spitsyna 2003, 126, Table 1). However, the radiocarbon dating is not clear for the solution of the issue about the chronological division of these periods.

Generally, radiocarbon dates allow us to date the Pit Grave culture between 3000/2900–2500/2400 BC (Telegin – Pustovalov – Kovalyukh 2003, 142–148; Görsdorf – Rassamakin – Häusler 2004; Govedarica *et al.* 2006, 96–107; Rassamakin 2006b, 131–153; Rassamakin – Nikolova 2008, 60–67, Table 1; Nikolova – Kaiser 2009, 231–237). At the same time, Late Eneolithic burials, including the ones with Repin type pottery, suggest an earlier date approximately from the middle to the last century of the 4th millennium BC. This span is confirmed by the stratigraphy of the kurgans in Volonterovka and Kremenevka.

Conclusion

This article includes the conceptual view of the author on the problems of transition between the Late Eneolithic and the Early Bronze Age, without a detailed comparative analysis of the archaeological sources. At present we do not have sufficient data for an absolute chronology. The stratigraphy of the kurgans and changes in the material culture between the Eneolithic and Early Bronze Age in the Black Sea steppe demonstrate that the transition process was rather gradual and not of evolutionary character.

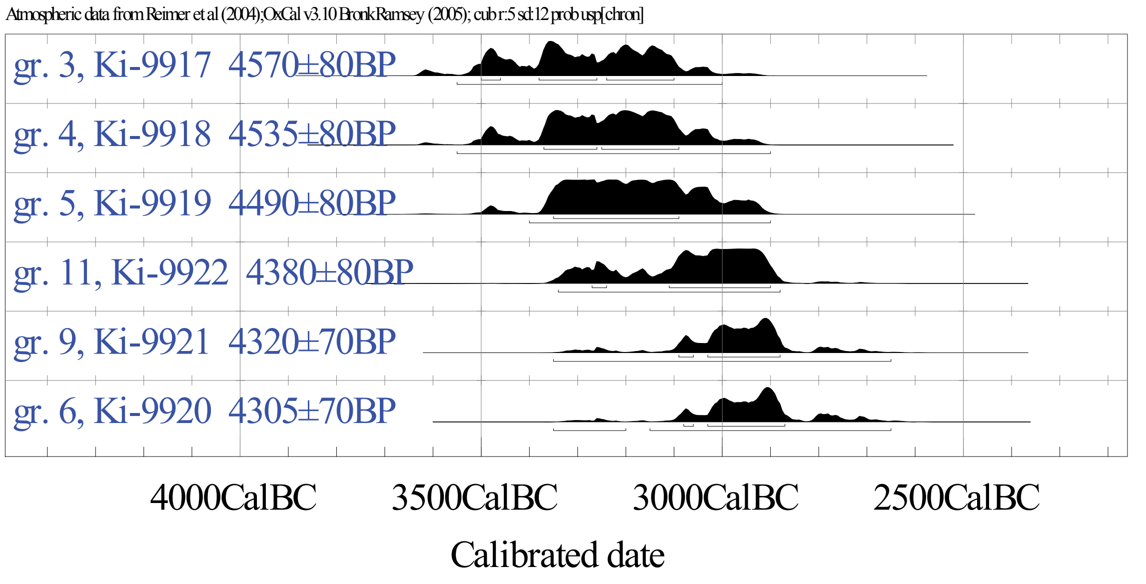

Fig. 30. Radiocarbon dates from the graves in mound 1 near Volonterovka village – gr. 3, 4 and 5 with Repin type ceramics; the later gr. 11, 9 and 6 of the Pit Grave culture according to mound stratigraphy

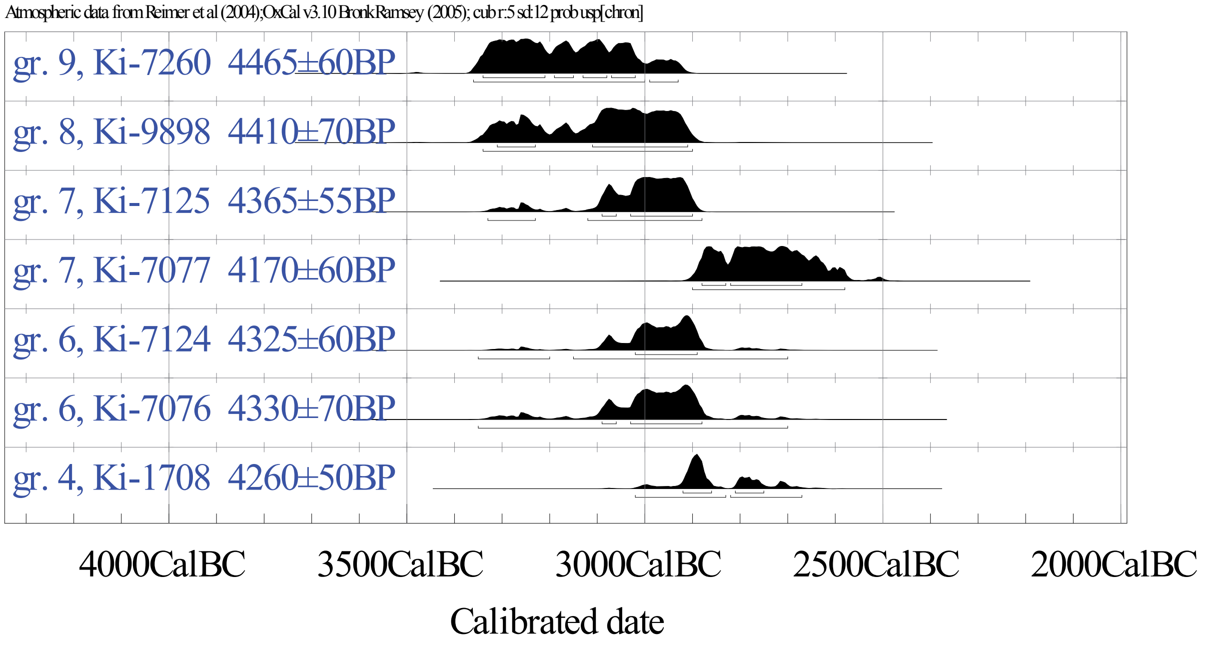

Fig. 31. Radiocarbon dates from the graves in mound 6 near Kremenevka village – gr. 9, 8 and 7 (?) with Repin type ceramics; the later gr. 6 and 4 of the Pit Grave culture according to mound stratigraphy

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Import, Imitation and Interaction
A Critical Review of the Chronology and Significance of Cross Footed Bowls of the Third Millennium BC in Southeastern and Eastern Europe

ELKE KAISER

Abstract

Bowls standing on a cross-shaped foot have frequently been seen by researchers as an indicator of interaction between the archaeological cultures in southeastern Europe and in the eastern European steppe region during the 3rd millennium BC. The type of vessel called the cross footed bowl, also known as the interior decorated bowl, comprises a Leitform *in the Vučedol culture of southeastern Europe. In the burials of various regional groups of the Catacomb culture, and particularly in those distributed across eastern Ukraine and southern Russia, researchers have found bowls, called censers, which are also often characterized by a cross-shaped foot.*

This article offers a critical assessment of both the interior decorated bowls of southeastern Europe and the censers of the Catacomb culture. It also presents the somewhat lesser-known censers of the Yamnaya culture, found principally in the Dnieper region. The article discusses whether the latter can be considered to represent a missing link between the interior decorated bowls of southeastern Europe and the censers of the Catacomb culture. The new absolute dating of the culture groups relevant in this context is of great significance for this discussion.

The evidence compiled here suggest that the interior decorated bowls of the Vučedol culture and synchronous cultures of southeastern Europe served as a model in the construction of the censers of the Yamnaya culture in the Dnieper region. Thus far, however, only locally made imitations of the vessel type interior decorated bowl have been found in the monuments of the Yamnaya culture. The focus in the transfer to the steppe may have been on the symbolic meaning of the bowl rather than its actual function. It should be emphasized that the transfer of interior decorated bowls from southeastern Europe to the Yamnaya culture represents an important indicator of a west-to-east vector of exchange, while the research literature highlights primarily exchange in the opposite direction (east-to-west transfer). It is not, at present, possible to ascertain the extent to which the production of censers in the Catacomb culture in east Ukraine and south Russia can be traced to an influence from the southeastern European cultures, in which the cross footed, or interior decorated bowls comprised a Leitform.

Introduction

Migration in the sense of the movement of entire populations (demic diffusion) has had a renaissance in the last decade and has been used to explain changes in material culture. In several recent publications the beginning of the Early Bronze Age in southeastern Europe has been connected to migration movements from the North Pontic steppe region (ANTHONY 2007; HARRISON – HEYD 2007). The infiltration and impact of so-called steppe tribes, in particular the Yamnaya (or Pit Grave) culture, on the cultural situation in the Balkans and the Carpathian Basin during the first half of the 3rd millennium BC is once again a focal point in research.

One of the significant material culture elements used to describe this infiltration and impact are cross footed bowls. These are ceramic bowls standing on a cross-shaped foot, and are a characteristic element of certain archaeological cultures in the Carpathian Basin and in the steppe region of eastern Europe *(Fig. 1, Fig. 3)*. From the 1960s the relative and absolute chronology of these cultures led them

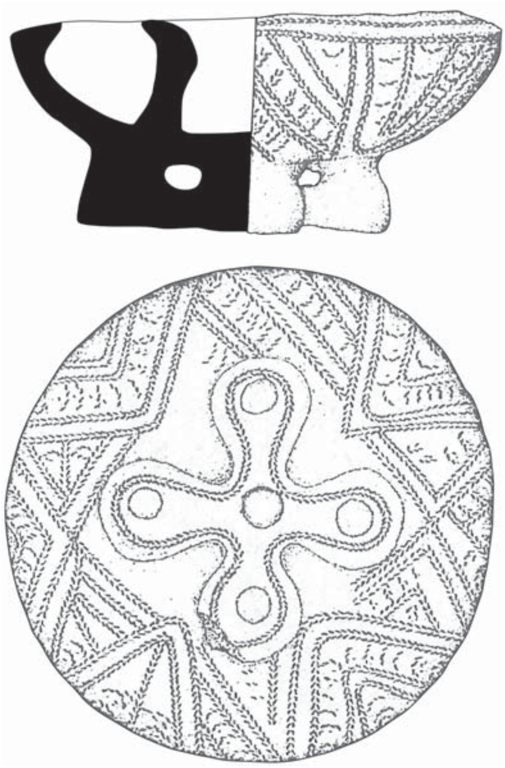

Fig. 1. Censer of the Eastern Catacomb culture from grave 1, tumulus 9, Zunda-Tolga, Kalmykia, southern Russia (after SHISHLINA *2002, 98, Ris. 4. 1)*

to be regarded as more or less contemporary, and formed part of a discussion about mutual cultural influence, in which cross footed bowls were transferred either from east to west or west to east (KLEIN 1966; BURGER 1980). Recently, Richard Harrison and Volker Heyd (2007, 197) have regarded them as a sign of innovation which population groups of the Yamnaya culture brought with them while migrating to southeastern Europe. Many of the innovations mentioned by R. Harrison and V. Heyd, which they describe as the 'Yamnaya package', can be dated to the 4th millennium BC and are therefore older than the Yamnaya culture (HANSEN 2011). However, there are connections that need explanation, such as the contemporary use of graves in barrow mounds in the Yamnaya culture of the eastern European steppe (first half of the 3rd millennium BC) and in regions of southeastern Europe. These burials bear many features of construction and ritual, which are considered characteristic for the Yamnaya culture (HEYD 2011). In the material culture, cross footed bowls seem to be a common vessel type appearing both in southeastern and eastern Europe. Their emergence in completely different cultural areas has often been considered as an indication for interactions between the aforementioned regions.

In this paper I will present the critical review of the archaeological evidence and chronology of cross footed bowls in two cultural regions: the Vučedol culture in southeastern Europe and the Catacomb culture of southern Russia. A similar vessel type is found in graves of the Yamnaya culture of the North Pontic region, and gave rise to this reexamination of the interregional relations of cultures in southeastern and eastern Europe during the 3rd millennium BC. The basis for this review is the recent publication of the earliest cross footed bowls of eastern Europe and the new absolute dating for the archaeological cultures. The discussion of absolute dating is particularly significant when viewed within the framework of migrations and influence. However, despite the new evidence, it is apparent that the situation is far from being non-ambiguous.

Terminology

Before outlining the research background, it is necessary to add a few words about the terminology used in this paper, because a number of bowls with similar form have different names across the geographical area of this study. In early publication they were called cross footed bowls (*Kreuzfußschalen*; for example HANČAR 1949), but as research has developed the names have changed. In southeastern Europe, which includes the Carpathian Basin, they were called either cross footed bowls or, on the basis of their decoration, interior decorated bowls. In eastern Europe, which is used to include southern Russia and the North Pontic region, they are called censers *(Räucherschalen)* because it is thought the contents were burnt inside the vessel. In this paper I will maintain the regional terminology to avoid assuming they are all from the same tradition: interior decorated bowls for the southeastern European specimens and censers for those in eastern Europe.

Research background of censers and interior decorated bowls

In the first decades of research the discussion focused on the Eastern Catacomb culture and the cultures in southeastern Europe, especially the Vučedol culture. The simplified chronological scheme of these archaeological cultures is outlined in *Table 1*. The censers in eastern Europe stand on a cross-shaped foot or on several small round feet; they are found in the graves of the Eastern Catacomb culture *(Fig. 1)*. The Catacomb culture is divided into two chronological phases. In its early phase (2800–2500 BC) burial constructions and rites are relatively homogeneous over its whole distribution area. After 2500 BC, when the developed phase of Catacomb culture begins, grave constructions and burial rites become heterogeneous in different regions. All regional groups of southern Russia and eastern Ukraine are summarized here under the term Eastern Catacomb culture, while the regional groups situated in central and western Ukraine are called Western Catacomb culture *(Table 1)*.

In the steppe area of south Russia censers are a common element among the inventory of catacomb graves, which are situated in barrows *(kurgans)*. These bowls were only ornamented on their outside wall; in addition, they occasionally contained the remains of burned organic materials and charcoal, and for this reason they were given the name censers (Hančar 1949, 72; Ierusalimskaya 1957, 45).

The first detailed research on censers from regions of eastern Europe and from the collections held at the Hermitage was published by Franz Hančar (1949), Anna A. Ierusalimskaya (1957) and Tatyana B. Popova (1957). T. B. Popova (1957, 162, Ris. 1) asserted that the dissemination of censers was limited to the Eastern Catacomb culture between the river Don in the west, the river Volga in the east and the Caucasian mountains in the south. However, no comprehensive work of the greater part of this vessel type was published. In 1970 Valeri G. Yegorov published his analysis of approximately 200 censers from the entire eastern European steppe region, but he only presented his table of morphological and ornamental classification, including information of relative chronology and a drawing which represented his idea of their evolutionary scheme *(Fig. 2)*. In this scheme he included the fragments of censers from the Dnieper region in nowadays south Ukraine, as found in the settlement of Mikhailovka. This scheme

<table>
<tr><th>BC</th><th>Carpathian Basin</th><th>Northwestern Pontic region</th><th>Northeastern Pontic region</th><th>South Russia</th><th>Northern Caucasus</th></tr>
<tr><td rowspan="3">2000</td><td colspan="2"></td><td colspan="2">Babino culture</td><td>Lola culture</td></tr>
<tr><td rowspan="2">Post-Vučedol culture groups (e.g., Makó, Somogyvár–Vinkovci)</td><td rowspan="2">Western Catacomb culture (regional group of Ingul)</td><td rowspan="2">Eastern Catacomb culture (several regional groups)</td><td rowspan="2">Eastern Catacomb culture (several regional groups)</td><td>Eastern Catacomb culture (Precaucasian regional group)</td></tr>
<tr><td rowspan="2">Northcaucasian culture</td></tr>
<tr><td rowspan="3">2500</td><td rowspan="2">Vučedol culture</td><td rowspan="4">Yamnaya culture (Pit Grave culture)</td><td colspan="2">Yamnaya / Early Catacomb culture</td></tr>
<tr><td colspan="2" rowspan="3">Yamnaya culture (Pit Grave culture)</td><td rowspan="3">Yamnaya / Novotitarovskaya culture</td></tr>
<tr><td>Kostolac culture</td></tr>
<tr><td>3000</td><td>Baden culture</td></tr>
</table>

Table 1. Simplified chronological scheme of archaeological cultures in eastern Europe and in the Carpathian Basin

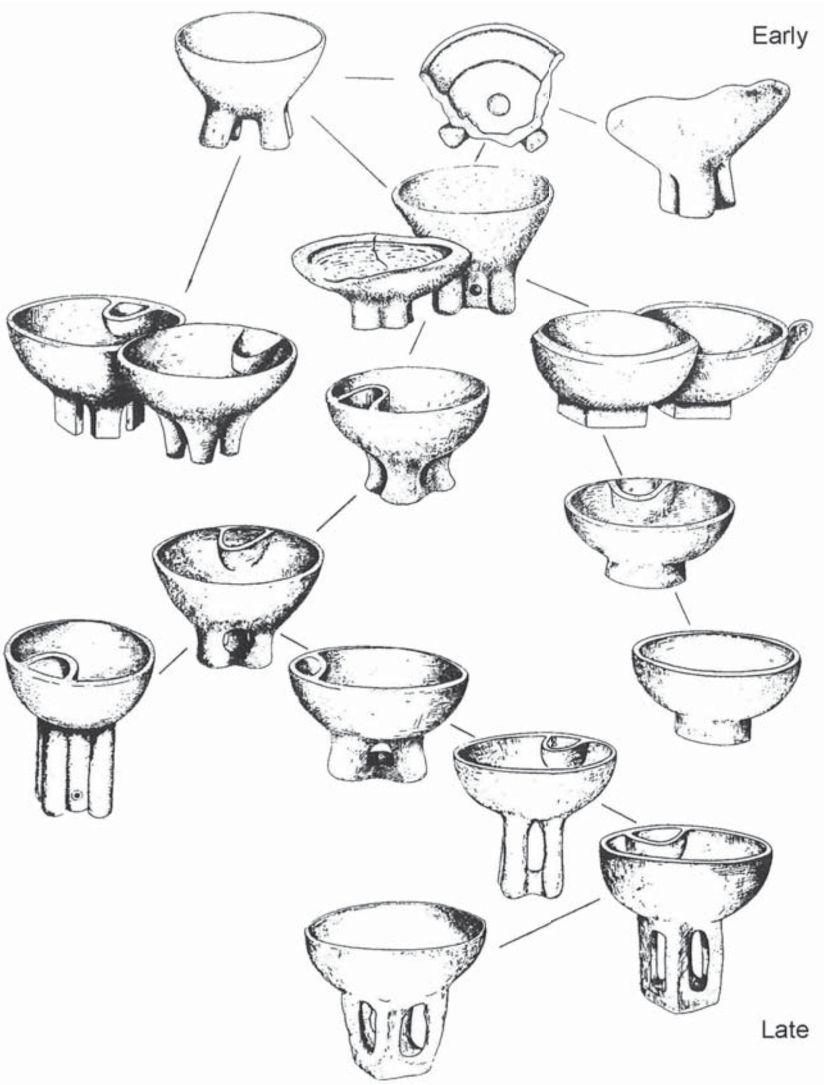

Fig. 2. Scheme of typological evolution of censers of the Eastern Catacomb culture (after Yegorov *1970, 162, Ris. 2)*

will be returned to later, here it is only important to emphasise that V. G. Yegorov assumed the examples from the Mikhailovka settlement represented the oldest type, which are characterized by three, four or more small unconnected feet *(Fig. 2, Fig. 10)*. According to V. G. Yegorov's scheme, censers with a cross-shaped foot represent a later phase in the development of this vessel type *(Fig. 2)*. Some of them show the shape of a cross, but this feature is only typical of a percentage of the censers *(Figs 1–2)*.

Before V. G. Yegorov's research, Lev S. Klein (1966) attempted to establish a much broader scheme of the development of censers and interior decorated bowls, which crossed several completely different geographical regions. L. S. Klein supposed that such bowls, belonging to the Baden and Vučedol cultures in southeastern Europe formed an impetus for the emergence of censers in the Catacomb culture.

More recently Natalya V. Panasyuk has collated the censers of south Russia (pers. comm.) and published her first results in several papers (Panasyuk 2005a; 2005b; 2006). In one of this she describes the problems of establishing a censer typology using those found only in the Eastern Catacomb culture (Panasyuk 2005b, 63). In the graves of this region, censers represent a typical element of the inventory.

Unfortunately no total number of the findings is given. As a result, using the published materials it is only possible to make a very rough assumption of the total number of finds; presumably, to the present day hundreds of censers have been discovered in southern Russia.

In southeastern Europe, notably in the Carpathian Basin, a large number of interior decorated bowls have been found. Like the censers the form of their foot can vary, but among others styles the cross-shaped foot is common *(Fig. 3)*. A very distinct feature is the decoration on the inside of the vessel. Detailed research of the southeastern European bowls only began with Ingrid Burger's research published in 1980, although a number of specimens had been published earlier. I. Burger compiled the late eneolithic evidence from the eastern areas of Central Europe and the Carpathian Basin. In this research, she asserts that the interior decorated bowls are a typical *Leitform* of the Vučedol culture and other contemporary cultures in the Carpathian Basin. No comprehensive work on the bowls in the entire Vučedol culture exists. Recently, Gabriella Kulcsár collated the interior decorated bowls of the Makó-Kosihy-Čaka culture in the Carpathian Basin, which is partly contemporary with the late Vučedol culture (Kulcsár 1999). While such bowls are abundant in this time, in the following period their number and their quality decrease significantly (Kulcsár 2009, 308–314). Interior decorated bowls are often discovered in settlements. As G. Kulcsár (2009, 124–128) has recently pointed out, the bowls discovered in settlements were in a fragmentary state, while those in graves are intact. Hence, non-fragmented bowls found accidentally can often be interpreted as originally belonging to the inventory of graves.

Absolute chronology of the 3rd millennium BC in southeastern and eastern Europe

Before discussing the details of influence and mutual interaction, it is first necessary to be certain of the absolute chronology of these cultures, the knowledge of which has changed radically in the last few years. Without absolute dating it was unclear whether these cultures were contemporary. On the basis of appearance, it was often assumed that the interior decorated bowls of southeastern Europe and the censers of the Catacomb culture in southern Russian and eastern Ukraine were more or less contemporary and related, despite the fact that they show a great variety and direct parallels are not known. Through relative dating the cross-shaped foot represented the main feature on which influences between a ceramic form in completely different archaeological cultures were presumed (Klein 1966; Burger 1980; Harrison – Heyd 2007). Hence, a matter of debate in earlier research was always the relative chronology and later also the absolute chronology of the cultures in which these bowls represent a *Leitform*.

For example, based on the known chronology at the time I. Burger (1980, 15, Abb. 3) presented a typology in which the bowls of Mikhailovka, a settlement of the Yamnaya culture situated on the Lower Dnieper, were suggested to be amongst the oldest bowls in southeast Europe. I. Burger

Fig. 3. Interior decorated bowl of Abraham, found without context (after Novotný 1955, obr. 11)

dated her early horizon of interior decorated bowls in southeastern Europe to a pre-Vučedol phase, while the mass of bowls belonged to the second horizon of the Vučedol culture. As already mentioned, this vessel types continued to be produced in archaeological cultures after the end of the Vučedol culture in southeastern Europe. In the framework provided by I. Burger, the emergence of cross footed bowls was explained as the impact of the steppe territory because she assumed the settlement layers of Mikhailovka to be earlier than the oldest find of interior decorated bowls from the site of Iža in Slovakia (Burger, 1980, 24; for Iža see Němejcová-Pavúková 1968, Abb. 22). The latter was discovered in a cultural layer of the Kostolac culture, dating to the transition from the Baden to the Vučedol culture in the Carpathian Basin *(Table 1)*. Typologically similar bowls from Abraham (Slovakia; *Fig. 3*) and Melk (Austria) are stray finds without context (Novotný 1955, 31, obr. 11; Ruttkay 1975, Table 7. 4).

The basis for the absolute chronology of southeast Europe changed since the contribution of I. Burger. Roughly fifteen years ago Joseph Maran (1998) established an absolute chronology based upon archaeological–historical comparisons between the western Balkans, the Carpathian Basin and the Aegean chronology and their correlation with radiocarbon dates. His scheme finds increasing support from new absolute dates, not only radiocarbon but also dendrochronology. He dated the Kostolac phase of the early Vučedol culture at the transition from the 4th to 3rd millennium BC (Maran 1998, Taf. 82). Hence, it seems likely that the first interior decorated bowls were produced around 3000 cal BC. Soon they became one of the most abundant ceramic forms in the following classic and late Vučedol culture, i.e. 2800 to 2500 cal BC *(Table 1)*. Its production still continued after the mid-3rd millennium BC, for example in the Somogyvár-Vinkovci culture (Kulcsár 2009, 308–314). Parallel to the classic and late Vučedol culture interior decorated bowls are present at many sites of archaeological cultures in southeastern Europe (Burger 1980, Abb. 1; Kulcsár 1999; 2009).

Therefore, according to absolute chronology, the Vučedol culture would be earlier than the Eastern Catacomb culture. This would mean that the interior decorated bowls of southeastern Europe were older than the censers of eastern Europe. However, new evidence of censers published in 2010 by N. V. Panasyuk show another picture.

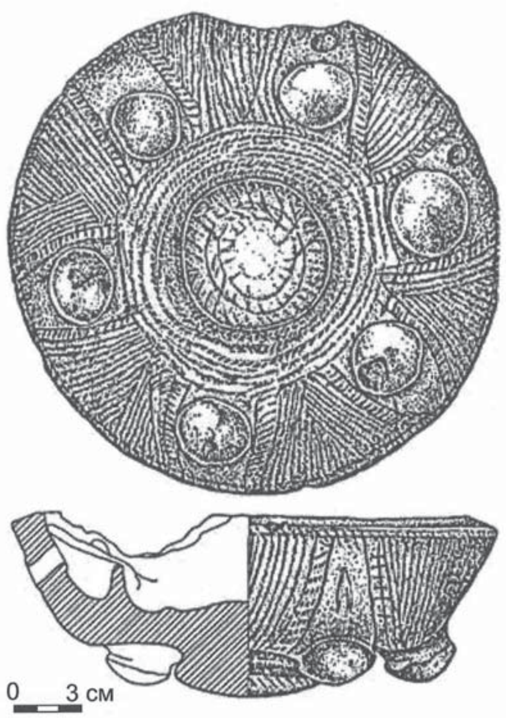

Fig. 4. Censer of the Early Catacomb culture, primary grave, tumulus 1, Temrta, Kalmykia, southern Russia (after Shishlina 2007, 165, Ris. 79. 5)

The earliest censers of eastern Europe

Recently, N. V. Panasyuk presented censers from 21 graves of the early phase of Catacomb culture in the steppe area of the Precaucasus (Panasyuk 2010), dated in absolute terms between 2800 and 2500 cal BC *(Fig. 4, Table 1)*. Five radiocarbon dates from graves of the Early Catacomb culture with censers are available *(Fig. 5)*. Three of them fall in the 1st half of the 3rd millennium BC, while one shows a slightly younger time period of the 27th to 24th centuries BC (Temrta III, kurgan 1, grave 1). One of the two dates for the catacomb grave 168 in the kurgan Ipatovo (district of Stavropol) should be disregarded due to a wide standard deviation *(Fig. 5)*. Hence, the first three dates go well with the absolute chronology of the Early Catacomb culture. N. V. Panasyuk's research

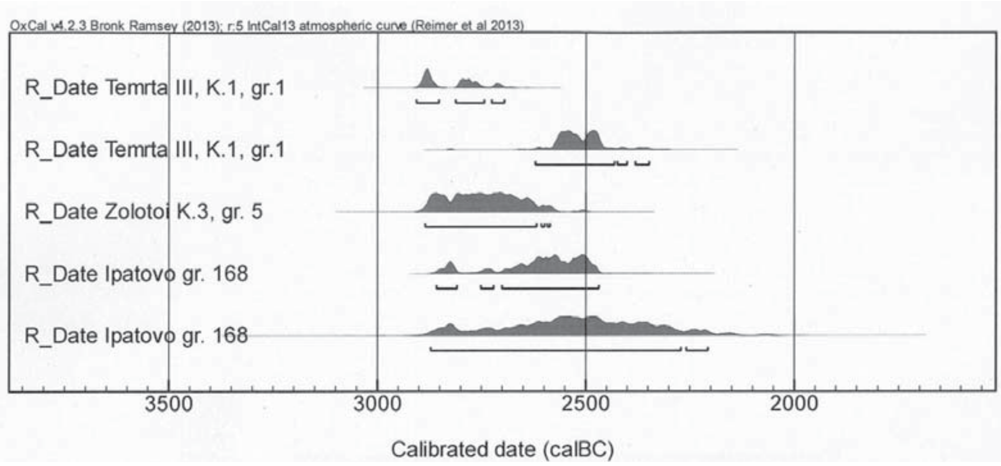

Fig. 5. Radiocarbon datings for graves with censers of the Early Catacomb culture in southern Russia (dates were published by KORENEVSKII *et al. 2007;* SHISHLINA *2007;* MIMOKHOD *2011)*

and these dates provide evidence that there are censers contemporary with the interior decorated bowls of the Vučedol culture.

However, only 21 censers are known from the Early Catacomb culture. In the developed phases of the Eastern Catacomb culture the censers are considered a *Leitform*, in some regions they are found in every second burial and sometimes multiple examples are found in one grave.

Already in the Early Catacomb culture censers vary in morphology and ornamentation, but they are always decorated on the outside like the censers of the later phases (see *Fig. 1*; PANASYUK 2005b, Table 2). The foot shape of the censers of the Early Catacomb culture can be formed in different ways and may not take the form of a cross, as is typical for the Eastern Catacomb culture *(Fig. 4)*. The inside of the vessel is often characterized by a small dividing ridge, whose function is unclear. In the early censers this particular feature is mostly missing. Basing on these 21 vessels N. V. Panasyuk presents a scheme of chronological development of the censers in southern Russia (PANASYUK 2010, 36–37). According to her most of their morphological and ornamental features already existed when the first censers were produced, which suggest an autonomous evolution of this vessel type. Her conclusions were substantiated by Roman Mimokhod (2009, 147–158), whose book was published nearly contemporaneously with the contribution of N. V. Panasyuk.

The censers in the North Pontic region

Following this discovery that the earliest censer of the Early Catacomb culture are dated before 2500 BC a similar occurrence is found in the graves of the Yamnaya culture in the North Pontic region. From this area today bowls similar to censers are known from eighteen burials in kurgans and from six settlements *(Fig. 6)*. Four more examples are stray finds. Most of the examples which were discovered in closed archaeological contexts can be attributed to the Yamnaya culture, which can be dated to the first half of 3rd millennium BC (*Table 1*; for the absolute chronology of Yamnaya culture see RASSAMAKIN – NIKOLOVA 2008, 60–67; NIKOLOVA – KAISER 2009). Unfortunately, none of the graves or settlements in which censers were found have been directly radiocarbon dated.

The censers were not only discovered in graves but also in settlements of the North Pontic region. As already mentioned, fragments of 40 censers were found in the upper layer of the Mikhailovka settlement in the Lower Dnieper region (*Fig. 10*; LAGODOVS'KA – SHAPOSHNIKOVA – MAKAREVICH 1962). This

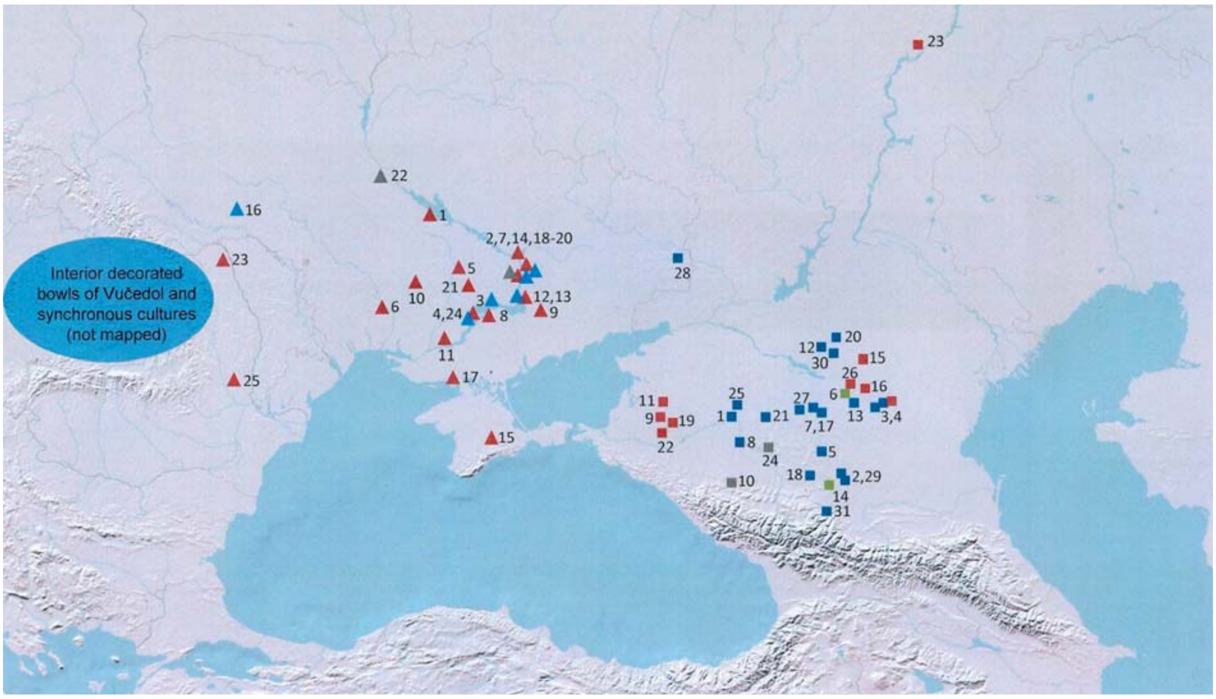

Fig. 6. Distribution of the censers of the Early Catacomb culture and the censers of the Yamnaya culture

Sites with censers in the region between Dnieper and Carpathian Mountains
Triangles (▲): Yamnaya culture: red=burial; blue=settlement; grey=archaeological context unknown – 1: Dereivka, 2: Fedorovka, 3: Kapulovka, 4: Michailovka, 5: Moiseevka, 6: Mostovoe, 7: Nikolskoe, 8: Nizhnyi Rogachik, 9: Novogrigorevka, 10: Novopetrovka, 11: Olgovka, 12: Ostrov Chortitsa, 13: Malaya Chortitsa, 14: Perun, 15: Simferopol, 16: Shchebutyntsi-Kulina, 17: Skadovsk, 18: Skelya Kamenolomnya, 19: Voiskovoe, 20: Vorona, 21: Zelenyi Gai, 22: Zlodievka, 23: Corlăteni, 24: Leontaevka, 25 Măcişeni

Burial sites of Early Catacomb, Novotitarovskaya, Yamnaya and Northcaucasian culture with censers (according to Panasyuk 2010, Ris. 1 with additions)
Squares (■): censers: blue=Early Catacomb culture; red=Novotitarovskaya and Yamnaya culture; green=North Caucasian culture – 1: Rasshevatskii I, 2: Veselaya Roshcha II, 3: Vostochnyi Manych (right bank, 1967), 4: Vostochnyi Manych (left bank, 1965), 5: Svetlograd, 6: Zunda-Tolga-6, 7: Ipatovo, 8: Novokubansk, 9: Proletarskii, 10: Ippodromni I, 11: Bryukhovetskii, 12: Lysnyanskii II, 13: Sharakhalsun 2, 14: Krasnoe Znamya II, 15: Tri Brata I, 16: Chograiskii V, 17: Barkhanchak 2, 18: Inozemtsevo I, 19: Stanitsa Novokorsunskaya, 20: Temrta III, 21: Ptichye I, 22: Stanitsa Novovelichkovskaya, 23: Zolotoi Kurgan, 24: Tonnelnyi-6, 25: Uspenskii, 26: Tsagan-Usn VII, 27: Zolotarevka-7, 28: Lugansk, VSGI, 29: Kitaevka, 30: Peschanyi V, 31: Gora Rakitnaya

settlement layer is usually dated to the final phase of the Yamnaya culture or to the transition to the Catacomb culture. Often even the bowl fragments themselves served as an argument for this proposal. However, still today it is not possible to date the upper layer of the Mikhailovka settlement in a narrow time span. The other ceramic types found in this layer only confirm a general attribution to the Yamnaya culture.

The question remains, do the censers of the Yamnaya culture in the North Pontic region represent the missing link between the censers of the Early Catacomb graves in south Russia and the interior decorated bowls in the Carpathian Basin? Morphologically the censers of the Yamnaya culture are extremely varied, the decoration is on the inside or on the outside of the vessel or even both and the decorative motifs also differ *(Figs 7–10)*. The foot is shaped in various ways, but this is also common to

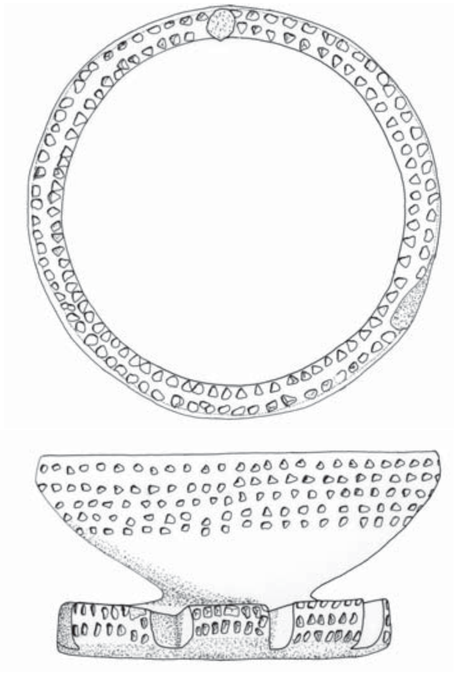

Fig. 7. Censer of the Yamnaya culture, Ukraine, without context, in the courtesy of National Historical Museum Kiev (drawing by the author)

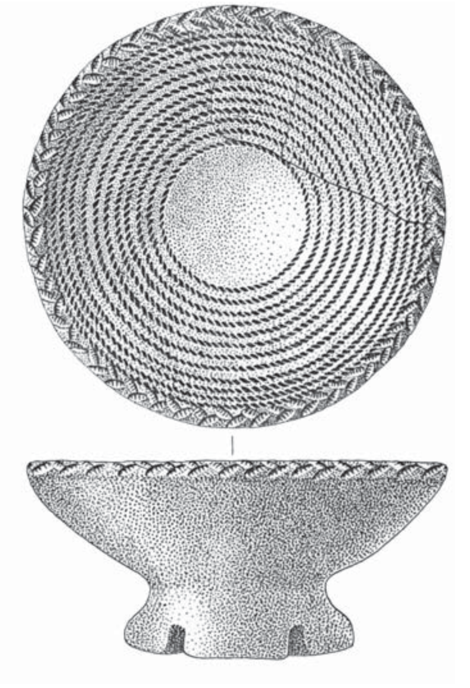

Fig. 8. Censer of the Yamnaya culture, grave 5, tumulus 1, Skadovsk, Region of Kherson, Ukraine (unpublished material)

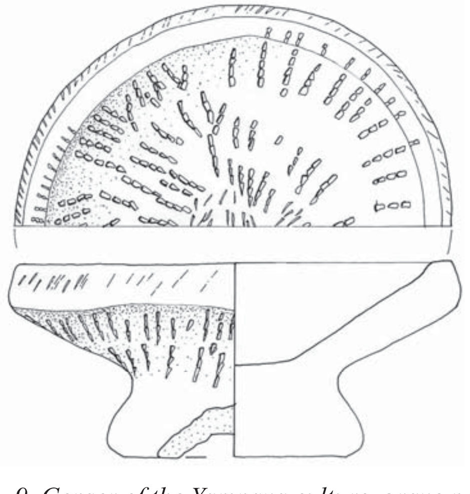

Fig. 9. Censer of the Yamnaya culture, grave near Dereivka (drawing by the author)

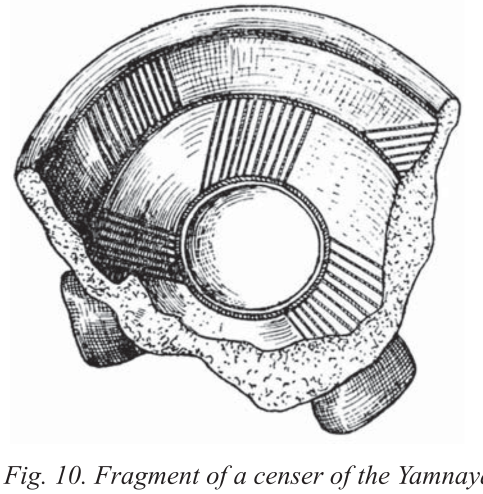

Fig. 10. Fragment of a censer of the Yamnaya culture, settlement of Mikhailovka at the Lower Dnieper (after LAGODOVS'KA – SHAPOSHNIKOVA – MAKAREVICH *1962, Ris. 33. 5a)*

the censers in the Early Catacomb culture as well to the interior decorated bowls in southeastern Europe. In both the latter region and in the North Pontic area the censers or interior decorated bowls were found in graves as well as in settlements. Their number in settlements is higher, probably because fragments of more than one bowl are often found. As for southeastern Europe it can be assumed that intact specimens, discovered without any archaeological context would originally have stood in graves. In the Russian and Ukrainian literature the bowls found in the Yamnaya culture in the North Pontic steppe are also named censers, although they are not very similar to the censers proper of the Eastern Catacomb culture. From the area between the Dnieper and the Carpathian Mountains there are no examples with the characteristic feature of censers, that is the small ridge dividing the inner part of the bowl.

Discussion

The archaeological information concerning the censers and the interior decorated bowls can be summarized as follows:

1. In southeastern Europe this vessel type appeared in the first half of 3rd millennium BC in the Vučedol and other cultures. The common feature of all bowls found in this vast territory is the decoration on the inside, while the form of the vessel including the foot varies *(Fig. 3)*. Cross shaped foots are present only on particular bowls. The interior decorated bowls are widely disseminated in the first half of 3rd millennium BC (especially in sites which are designated to, or are contemporary with, the Vučedol culture). The number of bowls is decreasing after 2500/2400 cal BC. They were predominantly found in settlements, but this evidence might be biased by the fact that mainly settlements are preserved.
2. In the steppe area of southern Russia and partly eastern Ukraine the earliest censers can be dated to 2800–2500 cal BC. The ritual deposition of censers in graves mainly took part in the Eastern Catacomb culture, e.g. after 2500 cal BC. These censers are decorated only on their outside *(Fig. 1)*. In this part of the eastern European steppe no settlements are known, so censers are assumed to have their main function in the burial rite. For the sake of brevity and clearness I am not going to discuss the complex regional groups of Eastern Catacomb culture in the middle course of the river Don, because it is not relevant here.
3. Both regions where interior decorated bowls and censers were found may be linked with the findings of a similar ceramic type in the North Pontic region. Interestingly, here the censers were found in settlements and in graves. All datable archaeological contexts can be designated to the Yamnaya culture, which precedes the Eastern Catacomb culture. With the exception of one fragment from the settlement Perun, situated on an island in the Dnieper *(Fig. 6. 14)*, none of the bowls in this region can be dated later than 2500 cal BC.

In my argument I have emphasized the regional differences of this specific vessel type. But despite all differences censers and interior decorated bowls also show some similarities, although these are difficult to describe concretely. The similar visual appearance of both types leads to a more or less intuitive comparison. It is mainly the cross shaped foot, which represent a characteristic feature of these pottery types in both cultural areas. This was the basis for the earlier assumption that the emergence of censers and interior decorated bowls cannot be regarded as a pure convergent phenomenon.

Unfortunately, little is known about the function of this vessel type. Although the term censer suggests that burnt material remains were found inside the vessel, in reality few excavators describe the bowl content. F. Hančar (1945, 72), for example, mentioned that one censer found in the kurgans of *Tri brata* (Three brothers) was filled with charcoal and ashes. A. A. Ierusalimskaya (1957, 45) pointed out that inside the bowl ochre was found along with charcoal. A paleobotanical analysis of the burnt organic materials from the censer has only been conducted in one case with the results revealing phytolyths of cannabis and wild cereal species (Shishlina 2007, 337, Table 38). In particular regional groups of the Catacomb culture the censers were deposited upside down and there is no evidence of the original content.

Even less information is available for the censers of the Yamnaya culture in the North Pontic region. The fact of placing the decoration on the inside of the vessel may lead to the assumption that they were used for purposes other than burning materials or using ochre.

If we argue that the morphological and formal similarities of this vessel type and their contemporaneity cannot be explained by chance, than we need to question their relationship. Despite this we should bear in mind that this vessel type was disseminated in two completely different regions and probably had different functions. We can discuss three possibilities concerning interregional interaction.

The first hypothesis proposes that the censers of the Yamnaya culture in the North Pontic region reflect the influence of the Vučedol and contemporary cultures in southeastern Europe. In the Vučedol culture the interior decorated bowls represent a *Leitform*. Only sixty specimen from twenty four sites are known from the Yamnaya culture in the North Pontic region. Unfortunately, the censers of the Yamnaya culture vary substantially in shape and decoration, so it is impossible to link them with one or several bowl types of the cultures in southeastern Europe. If the Yamnaya types actually represent an impact from the west, they seem to represent only imitations of the southeast European bowls. The fact that they were found not only in graves but also in settlements of the Yamnaya culture is, in my opinion, a further indication for an influence coming from the Carpathian Basin, where significantly more bowls with inner decoration were found in settlement layers than in graves.

The Yamnaya culture was present in the vast territory from the Cis-Urals to the Lower Danube at a time when interior decorated bowls were abundant in southeastern Europe. However, censers were found only in the Yamnaya graves of the most western area, which connects the steppe region with southeastern Europe. Furthermore, there is scarce evidence of direct ceramic imports and imitations from the Makó-Kosihy-Čaka culture in nowadays Hungary or in the Yamnaya graves in the Dnieper region (Rassamakin – Nikolova 2008). Without any mineralogical analysis it is not possible to prove an import proper of interior decorated bowls to the steppe region, but a comparison of morphological similitaries provided G. Kulcsár (2009, 139) with the basis to link an example from the grave at Corlăteni (northwestern Pontic region) directly with a specimen found in the inner part of the Carpathian Basin.

In my opinion the aforementioned facts indicate that the censers of the Yamnaya culture emerged as the result of an impact from the Vučedol culture in southeastern Europe. However, the scarce evidence does not allow to answer further questions, for example, whether and how the specific symbolic meaning of the interior decorated bowls was also transfered to the North Pontic region

It is also impossible to argue whether or not the emergence of censers in the Early Catacomb culture is connected to the Yamnaya culture in the North Pontic region. In eastern European literature most researchers were convinced and most remain convinced that a tradition deriving from the northern Caucasus gave rise to the censers of the Catacomb culture. Only L. S. Klein (1966) argued in favour of a western origin of the Catacomb culture, also based upon the similarities of interior decorated bowls and censers.

The direction of influence can also be thought to go from the east to the west, which would be the second hypothesis: in this scenario the censers of the Yamnaya culture were produced more or less contemporaneously with the censers in the Early Catacomb culture between 2800 and 2500 cal BC. In parallel a few specimen were discovered in graves of the Yamnaya culture and the Novotitarovskaya culture of southern Russia *(Fig. 6. 4, 9, 11, 15–16, 19, 22, 26)*. The latter is a regional group of the Yamnaya culture with very distinct features, so it is often understood as an independent archaeological culture (Gei 2000). But to connect the emergence of the censers in sites of the Yamnaya culture in the North Pontic region with an infiltration from the Early Catacomb culture seems unlikely, because only a small number of censers was discovered in both cultures. Indeed, the censers only became numerous in the Eastern Catacomb culture after 2500 cal BC. Only then did the censers become a *Leitform* in eastern Europe. By contrast, in the Vučedol culture a great number of interior decorated bowls are already represented before the middle of the 3rd millennium BC. Therefore, it seems highly unlikely that the censers represent an archetype for the interior decorated bowls in southeastern Europe.

Finally, we cannot exclude a third hypothesis that proposes an autonomous development of censers in eastern Europe and interior decorated bowls in southeastern Europe. Even for the examples in the North

Pontic region an autonomous development cannot be completely denied. Importantly, in some cases bowls standing on small feet may even date to the 4th millennium BC bowls. However, an independent development of censers in all three regions also seems unlikely, especially as censer production and usage started without a significant time gap.

Conclusion

In concluding I would like to maintain that the censers of the Yamnaya culture can be seen as an indication of mutual contacts between cultures in the Carpathian Basin and the North Pontic region, although the evidence is relatively scarce and the absolute dating is still problematic. It seems most likely that it was the idea behind the symbolic meaning of bowls standing on a foot that was brought to the steppe, rather than the interior decorated bowls themselves. In this case, the inhabitants of the North Pontic region started to produce their own types and used them in settlements and sporadically also as grave goods. This diversity in production and usage might be the reason why the types of these bowls differ so essentially that it is hard to establish a detailed typological classification.

Interior decorated bowls are not the only ceramic form that was brought from the Carpathian Basin to the North Pontic steppe. Recently a real import of a vessel with asymmetric handles, typical for the Post-Vučedol cultures in the Carpathian Basin was published. It was discovered in a grave of the Yamnaya culture in southern Ukraine. Besides this example several imitations of vessels with asymmetric handles are known in the North Pontic region (Rassamakin – Nikolova 2008). Therefore, this specific vessel type and the interior decorated bowls confirm that it was not only the steppe inhabitants who exerted influence upon cultures in southeast Europe, but this influence was also exerted in the other direction. Although a number of aspects remain problematic, this conclusion can be drawn from the detailed examination of censers and interior decorated bowls as outlined in this article. Hence, interior decorated bowls can no longer be understood as an element of the so-called Yamnaya package, as described by R. Harrison and V. Heyd (2007, 197). It is more likely that the censers found in the Yamnaya graves of the North Pontic region are a result of an influence of the Vučedol culture.

Whether or not further influence stretched as far as the eastern Ukraine and southern Russia, which would lead to the argument that the production of the first censers in the Early Catacomb culture was evolved by an impulse from the cultures in southeastern Europe, cannot be suggested with the current archaeological evidence. An autonomous development or a transfer of an idea from the northern Caucasus to the adjacent steppe zone in present-day southern Russia seems more likely (Panasyuk 2010). However, this would be an issue for another paper. In this paper my main aim was to point out the importance of a critical review of one piece of archaeological evidence of mutual relationships between the inhabitants of the North Pontic steppe and the Carpathian Basin during the 3rd millennium BC.

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Multidisciplinary Contributions to the Study of Pit Grave Culture Kurgans of the Great Hungarian Plain[1]

TÜNDE HORVÁTH – JÁNOS DANI – ÁKOS PETŐ – ŁUKASZ POSPIESZNY – ÉVA SVINGOR

Abstract

The aim of our paper is to provide analytical data to the multidisciplinary research of Pit Grave culture kurgans of the Carpathian Basin. The data presented in the following have chronological, cultural, environmental and anthropological implications. People of the Pit Grave culture inhabited the Carpathian Basin during the Late Copper and Early Bronze Age. Radiocarbon dates of Pit Grave culture kurgans and other contemporary cultures help to integrate this cultural complex in the prehistory of the Carpathian Basin. Environmental data – from two archaeological sites – provide detailed information on the environmental setting this culture lived in, and information on nutritional habits as well as burial rituals.

Introduction

After having seen the groundbreaking publication of István Ecsedy's book about the theme ("The People of the Pit Grave kurgans in Eastern Hungary") in 1979, new excavations were made and new research methods and results have emerged in the last 30 years. These facts, and a new approach concerning to the formation of the European Early Bronze Age, have led us to a new summary of the topic. The short case studies presented here complement previously published, more extended summaries on the topic (e.g., Dani 2011; Horváth 2011a; Pető – Barczi [eds] 2011; Barczi *et al.* 2012).

The first part of the paper gives an overview on the environmental and burial reconstruction of the Hajdúnánás-Tedej-Lyukashalom kurgan *(Fig. 4)*. Based on these, we formulate a preliminary hypothesis on the possible annual migration patterns of the Pit Grave culture populations of the Carpathian Basin.

The second part of this contribution presents the stable isotope data gained from the primary burial of the Tiszavasvári-Deákhalom kurgan *(Fig. 5)*.

The third part gives an overview on the new magnetometric survey of Hajdúnánás-Tedej-Szálláshalom, which is situated to the south of the Lyukashalom *(Fig. 9)*.

In the fourth part, we aim give an overview on the absolute chronology of the kurgan burials and compare these to the contemporary cultures (Baden, Makó and Nyírség) of the Carpathian Basin. An attempt is made to integrate the radiocarbon dates in the relative chronological system of the prehistoric Carpathian Basin. Suggestions are made on possible changes based on the result of this integration. Besides, we attempt to harmonise the radiocarbon dates of kurgan burials of the Carpathian Basin with the chronology of the North Pontic steppes and the spread of the Pit Grave culture to the Balkans and to Central Europe.

Finally, a cultural and chronological system of the earliest steppe cultures of the Carpathian Basin is developed on the basis of the new radiocarbon dates and archaeological finds, which is synchronized with the existing chronological system.

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1 This paper was an oral presentation at the EAA 2010 in The Hague, in the session "Transition to the Bronze Age: Interregional Interaction and Socio-Cultural Change at the Beginning of the Third Millennium BC in the Carpathian Basin and Surrounding Regions". The presentation is available from the official website: http://www.academia.edu/2155452/EAA_2010_Hague_2010._szeptember_2-4_J._Dani_-_T._Horvath_Yamnaya_Intrusion_in_Northeastern_Hungary_and_the_Transition_from_the_Late_Copper_to_the_Early_Bronze_Age.

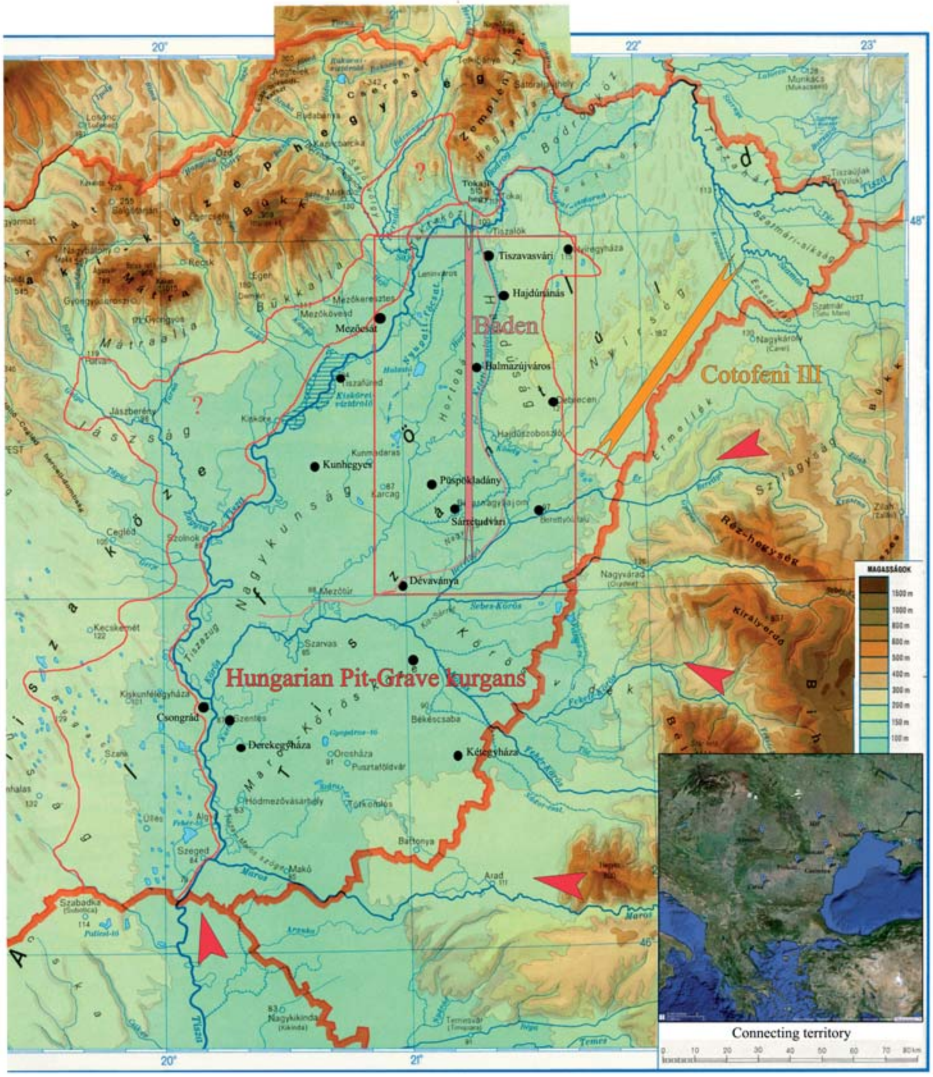


Fig. 1. The territory of Pit Grave culture in Hungary (by T. Horváth)

A short summary of the environmental and burial reconstruction of Hajdúnánás-Tedej-Lyukashalom

The Hajdúnánás-Tedej-Lyukashalom kurgan was subjected to broad spectra of environmental analyses (for details see Pető – Barczi [eds] 2011), among them palaeobotanical ones. The palaeobotanical analysis, which included phytolith and pollen recovery from the buried soil, the cultural layers of the kurgan, as well as the primary burial aimed at reconstructing the environmental setting of the Pit Grave population and the ritual of the primary burial. The results of the environmental reconstruction have been discussed in detail earlier by Ákos Pető and Linda Scott Cummings (2011), Attila Barczi and Katalin Joó (2011), Attila Csanádi and Tivadar M. Tóth (2011) and recently by A. Barczi and his colleagues (2012). The detailed reconstruction of the primary burial is not entirely finished, thus preliminary data show resemblance with the details of the environmental reconstruction.

The phytolith analysis of the Hajdúnánás-Tedej-Lyukashalom yielded data that reflect a steppe-dominated environment. Data derived from samples taken from the surface of the buried palaeosoil undoubtedly support this theory, as its microfossil composition is dominated by steppeland indicators

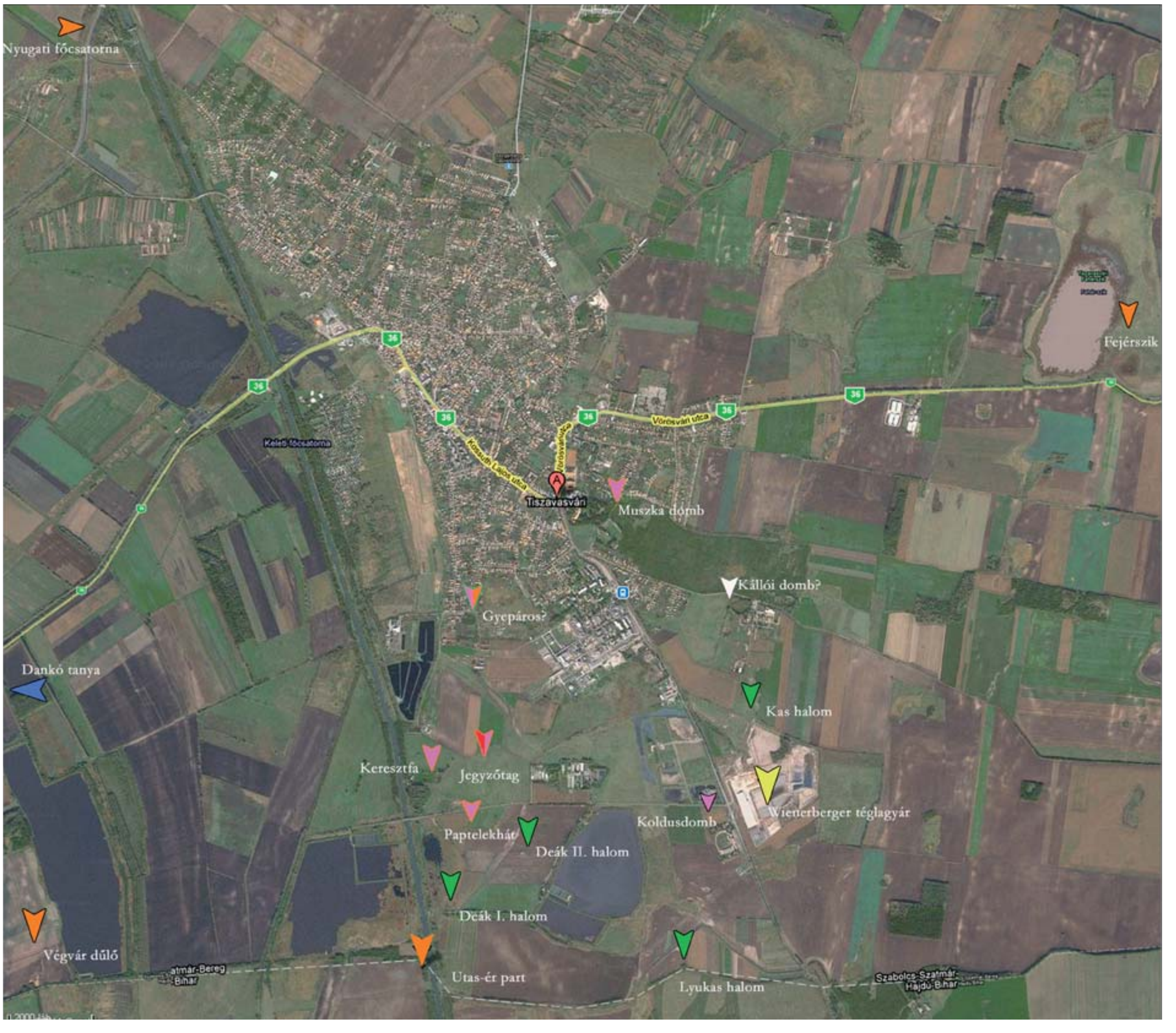


Fig. 2. Environment of the Tiszavasvári and Hajdúnánás microregion in the Late Copper Age and Early Bronze Age 1–3 periods (by T. Horváth) — Boleraz/Baden settlement: Wienerberger téglagyár; Baden settlements: Kásaföld, Koldusdomb, Muszkadomb; Baden graves: Keresztfal, Paptelekhát; Baden (?) and Yamnaya graves: Gyepáros; Yamnaya graves: Deákhalom I–II, Kashalom, Lyukashalom; Coţofeni find: Lyukashalom; find with cord decoration: Koldusdomb; Makó settlement: Városföldje-Jegyzőtag; Nyírség settlements: Betepart, Fejérszik, Gyepáros, Keresztfal, Muszkadomb, Nyugati főcsatorna, Paptelekhát, Utasér-part, Városföldje-Jegyzőtag, Sanislău/Szaniszló: Dankó tanya, Végvár

(PETŐ – CUMMINGS 2011, Fig. 3). The amount of arboreal detritus correlated with the total biomorph content, and the occasional appearance (low percentage values) of phytolith morphotypes indicating arboreal vegetation refer to a former grove, grassland vegetation with discrete tree species that may have inhabited this part of the surrounding area, but did not form closed forest habitats (BARCZI – GOLYEVA – PETŐ 2009). Both the existence of closed forest vegetation and an open steppe land lacking any arboreal species can be rejected. Palynological data give more precise insight to possible arboreal appearance in the vicinity of the kurgan and its wider environment.

Arboreal species identified by pollen grains surviving in the buried soil can be grouped in order to interpret their ecological information. *Pinus sylvestris* L., *Picea abies* L. Karsten, and *Fagus sylvatica* L. are

Fig. 3. Location of Pit Grave culture kurgans on the territory of Hungary, Romania, Moldova, Serbia and Bulgaria. Within the territory of Hungary doubtful kurgan sites are marked with grey dots (by T. Horváth)

Fig. 4. Visual reconstruction of the primary burial (Feature 2, Grave 1) of the Hajdúnánás-Tedej-Lyukashalom kurgan (graphics by Viktor Szinyei)

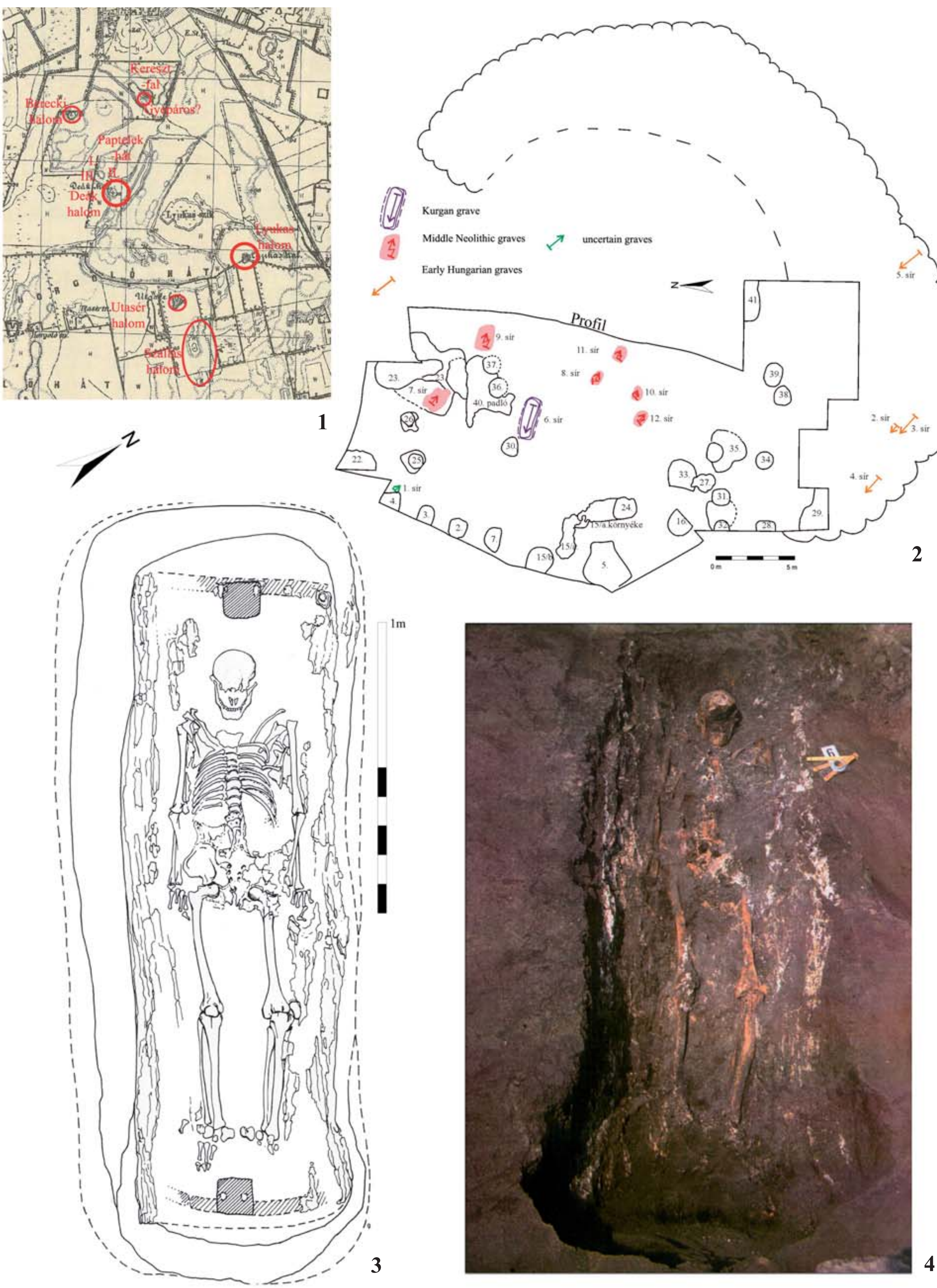


Fig. 5. Tiszavasvári-Deákhalom, Kurgan II — 1: the site on the map of the Third Ordinance Survey, 2: groundplan of the kurgan, 3: drawing and 4: photo of Grave 6

all representatives of mountainous areas. As their pollen is distributed by aeolian process to long distances, the appearance of these pollen grains are considered external, and give neither a local, nor a regional signal. Furthermore, *Pinus* species can only be considered local if their pollen rate in the signal exceeds 25% (Huntley – Birks 1983), which was not met in this case (Pető – Cummings 2011, Fig. 4). A better interpretation of regional flora can be made based on the appearance of *Salix*, *Tilia*, *Ulmus*, *Moraceae* and *Alnus* genera. As the study site is, and has always been, in the closer environment of, although not next to, the Tisza River, these taxa reflect grove forests that inhabited the higher flood plain of lowland river valleys. Plant associations, such as *Fraxino pannonicae–Ulmetum, Senecio fluviatilis–Populetum* or *Leucojo aestivo–Salicetum* can all be characterised to a greater or lesser extent by the identified taxa. The amount of *Quercus* pollen exceeds 2.0% identifying it as a local element of the closer vicinity. In this case, *Quercus* represents a transition between groves and forest steppes as it may be part of both. The so-called shrub-effect in the samples is represented by the appearance of low amounts of *Juniperus* (typical of sandy territories, such as the neighbouring Nyírség region), *Berberidaceae* and *Corylus* pollens.

Although the interpretation of arboreal taxa draws diverse scenery, it must be taken into account that arboreal pollens are underrepresented in all of the samples. The examined samples were dominated by non-arboreal herbaceous plants. Therefore, the local vegetational patterns should be interpreted based on the phytolith and non-arboreal record.

The primary pattern of the territory is influenced by the *Gramineae* and *Asteraceae* plant families (Pető – Cummings 2011, Fig. 5). While arboreal pollen gave a good overview of the tree species possibly inhabiting the kurgan's wider surroundings, herbaceous pollens – combined with the phytolith analytical results – may give an insight of the local flora. Microterritorial vegetation differences can be adjusted based on the rate of the *Liguliflorae* sub-family and *Gramineae* family. Phytolith analysis showed that the central territory of the kurgan was dominated by *Gramineae* species of (semi)arid steppe vegetation, so *Gramineae* pollen can be accepted as an indicator of a former steppe, probably located on a micro loess ridge. *Liguliflorea* sub-family is considered as an indicator of a – probably periodically – water-effected meadow mosaic. Based on the distribution of the above-mentioned indicators we may reconstruct the territory of the kurgan as described below: the central part of the kurgan's base was probably inhabited by steppe vegetation *(Gramineae)*, located on an arid loess ridge, whilst the ring, that is the external skirt of the formation, was inhabited by species more likely to be related to water-effected vegetation *(Liguliflorea)* (see Pető – Cummings 2011, Fig. 6).

Besides the external arboreal pollens, there is one observation, which opens up questions related to the reconstruction of the landscape. The presence of *Nymphaea* pollen (Pető – Cummings 2011, Table 3) suggests the closeness of standing water either in the form of an abandoned meander of the river Tisza or as a flatland lake.

Possible evidence of plant cultivation in the closer environment of the kurgan is shown by cereal and plough weed pollens found in most of the samples. The typical species of cereal cultivation of the Late Copper and Early Bronze Age are *Triticum*, *Hordeum* and *Pannicum* (Gyulai 2001).

Samples from the primary burial were subjected to pollen and phytolith analysis, whilst FT-IR was applied in order to gain data on the circumstances and the possible date of the burial ritual.[2]

Samples taken from the ground surface of the primary burial are dominated by steppeland species. We aimed at placing the time of burial in a calendar year by compiling a pollen calendar of the predominant species recovered from the samples of the primary burial, based upon the theory that species that spread their pollen grains later during the vegetational period will mark the possible date of the ritual. Since the samples are dominated by *Gramineae* and *Asteraceae* pollen grains, the relative time of the burial

[2] The Fourier Transform Infrared Spectroscopy (FT-IR) and the pollen analysis were conducted by Melissa Logan and Linda Scott Cummings at the PaleoResearch Institute, Golden, Colorado, USA.

	February	March	April	May	June	July	August	September	October
Alnus sp.									
Picea sp.									
Pinus sp.									
Quercus sp.									
Salix sp.									
Artemisia sp.									
Corylus avellana L.									
Gramineae									

Table 1. Pollen calendar compiled based upon the pollen record of samples collected from the base burial at Hajdúnánás-Tedej-Lyukashalom kurgan — dark gray fields indicate the main flowering, whilst the light gray fields the pre- and post-flowering periods of the taxa listed in the pollen calendar

can be placed between May and July (see red frame on *Table 1*). The only taxon that broadens this time interval is the *Artemisia* genus, which starts to distribute its pollens at the turn of June/July. These results however are only accepted as preliminary data, since we are aware that the method of identifying annual burial time based on pollen distribution of the ground surface of the burial might have different interpretations as well. At this point of the research, it is not possible to undoubtedly rely on the time interval given by the pollen spectra, but we accept this outcome as guideline for a possible burial date.

FT-IR analyses were performed on soil samples collected from different locations from the base of the grave (burial) and on a sample taken from the mat with red and black stripes (see also Horváth 2011a, 108, Fig. 6). Samples collected from the side of the grave gave signals of galactoglucomannan and rhamnogalacturonan. Galactoglucomannan is a primary component of the woody tissue of coniferous plants (Gymnosperms) (Bochicchio – Reicher 2003). Rhamnogalacturonans are specific pectic polysaccharides that reside in the cell walls of all land plants, and result from the degradation of pectin (Willats *et al.* 2001). These peaks indicate the possible presence of wood in this area, however it is difficult to assess, whether these signals are the result of secondary contamination, or they truly represent wood material used for constructing the burial/grave.

Organic residues extracted from the mat decorated with red paint were tested for protein and organic residues. Protein residue analysis yielded a weak positive to human on the leather fragment recovered (Cummings – Logan 2009). This is possibly the result of association with the burial and decay of bodily fluids and tissues, rather than suggesting the origin of the leather. No other positive reactions were noted, so it was not possible to identify the origin of the leather conclusively. The position of this leather or skin within the burial might be crucial to answering this question. The organic residue signature for the leather fragment included peaks representing the presence of absorbed water, fats/oils/lipids and/or plant waxes, aromatic esters, aromatic rings, pectin, proteins including nucleic acids, and the amino acid valine (Cummings – Logan 2009). Valine, an essential amino acid, is represented in this sample by a peak at 1451 wave numbers. Common dietary sources of valine include fish, poultry, and some legumes. Matches with this signature were made with bird blood and humates. The presence of bird blood, which is interpreted at a general level indicating animals, rather than at the specific level, indicates the presence of animal proteins in the sample, which would be expected for leather. The FT-IR signatures for animal bloods, including humans, are nearly identical, which makes it impossible to identify the specific species or type of animal leather. Finding a match with animal blood does seem to support the possibility that the sample represents a piece of leather; however, identification of raw protein using protein residue analysis, which is based on immunological techniques, is the only method to identify specific animal proteins, and confirm that the sample is a piece of leather. The match with humates probably indicates the presence of the local environmental signature representing the deterioration of plant materials in the sediments in which the leather fragment was buried.

Based on the archaeological finds recovered at the Hajdúnánás-Tedej-Lyukashalom kurgan, the site can be linked to the Pit Grave culture. Since the skeleton in the primary burial was disturbed, it is difficult to identify more precisely the cultural affiliation of the kurgan. Based on the way the skeleton was lying, Pre-Pit Grave communities cannot be excluded, the radiocarbon dates, however, seem to exclude this (younger than 3000 BC).

The kurgan was constructed in multiple steps (see also BARCZI – JOÓ 2011; CSANÁDI – M. TÓTH 2011 for details). The feature – probably a grave – associated with the third cultural layer of the construction was almost entirely robbed, we can only rely on radiocarbon dates gained from the layers and the construction of the grave itself. Since the construction differs from the primary burial, we might conclude that these belonged to different Pit Grave populations, however the radiocarbon dates suggest that these populations appeared very close in time to each other at the location. The primary burial and the one in the third cultural layer can be identified as either Pre-Pit Grave and Early Pit Grave or Early Pit Grave and Late Pit Grave. The later concept is underlined by the absolute chronological dates. Ceramic sherd fragments of Coţofeni III and Early Bronze Age cultures were recovered from the third cultural layer. Moreover, the phenomenon of the burial process, namely that the person was rolled in a mat composed of plant material and laid on the kurgan without any pit dug into the already existing kurgan body, is a typical characteristic of Early Bronze Age cultures influenced by Pit Grave effects (CIUGUDEAN 2011, 24).

Based on what we already know about the time of burial and the environment of the kurgan, it might be concluded that the Hajdúság and the archaeological site could have been part of the summer occupation and settling area of one of the westernmost Pit Grave populations of the Eurasian steppe belt.

Tiszavasvári-Deákhalom, Kurgan II

The Tiszavasvári-Deákhalom (II) kurgan is situated approximately 150 meters north-west of Hajdúnánás-Tedej-Lyukashalom *(Fig. 2)*. Several mounds and burials have been excavated here *(Fig. 5)* by the archaeologists of the Jósa András Museum (Nyíregyháza, Hungary) (DANI 2011, 27–28).

Altogether six graves were found in kurgan II at Tiszavasvári-Deákhalom. The two most interesting ones were selected for radiocarbon dating and stable isotope measurements. Grave 3 was a secondary grave intersecting the original mound, and was dated generally to the Late Copper/Early Bronze Age. It contained remains of an adult male, placed in a straight position on his back. The skeleton was equipped with a hair-ring made of bronze wire. Grave 6 was dug in the palaeosoil buried under the formation. However, it is not certain whether it was the primary burial of the mound or not, since it was located 14 meters from the geometric centre of the kurgan. An adult male was buried in straight position on his back in a log “coffin”, and probably covered with animal skin or fur. No other grave goods were preserved.

Collagen samples were taken from single bones of both individuals, and have been subjected to AMS ^{14}C dating at the Poznań Radiocarbon Laboratory. The sample taken from a bone from Grave 6 was dated twice and sent to the Polish Geological Institute (National Research Institute in Warsaw) for stable isotope analysis (δ^{15}N and δ^{13}C).

C:N values of both samples indicate a rather low degree of preservation of collagen. In case of collagen from Grave 6 it significantly exceeds the recommended interval (VAN KLINKEN 1999; BRONK RAMSEY 2004). The result of the dating from Grave 3 undermines its initial dating to the Early Bronze Age, placing it between 11th and 12th century AD *(Table 2, Fig. 6)*. For the human collagen sample from Grave 6 two radiocarbon determinations were obtained. As they relate to the same event they were combined together for calibration. At 95.4% probability from the Bayesian model the burial dates to 3091–2926 cal BC, with the mean age of 3011 cal BC *(Table 2, Fig. 7)*.

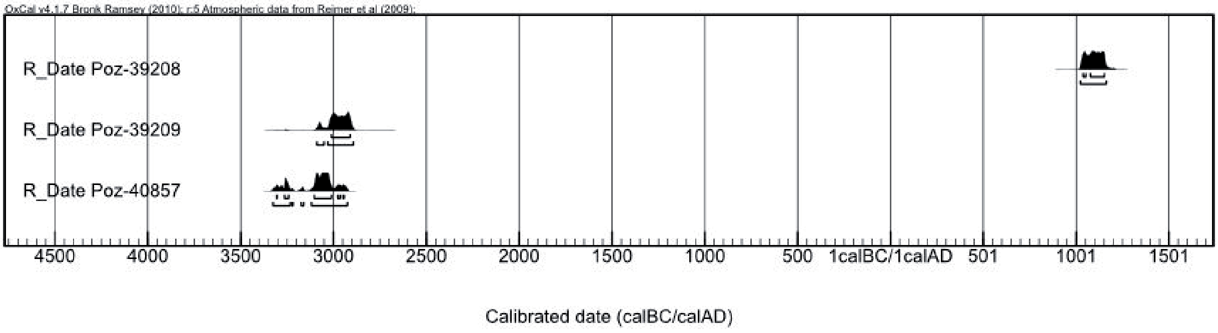


Fig. 6. Calibrated age probability distributions for the individuals from Tiszavasvári-Deákhalom II kurgan

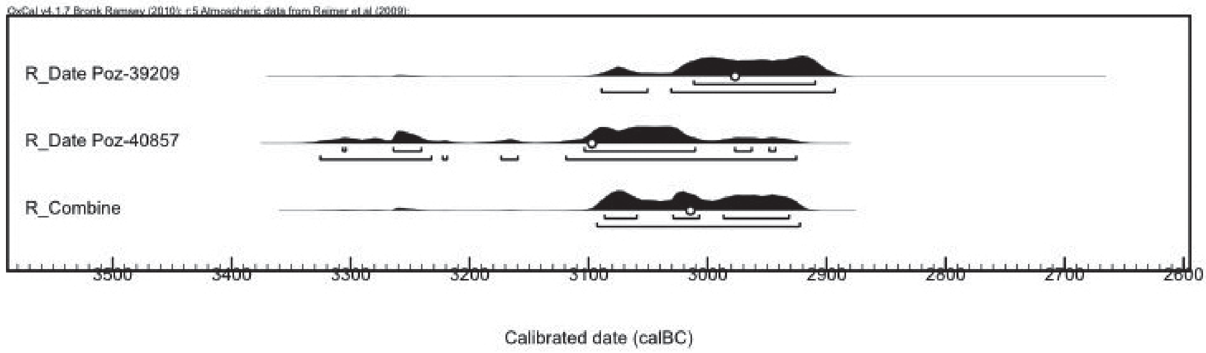
Grave No.	Lab. ID	BP	SD	Sample	68.2% (1σ)	95.4% (2σ)	μ	C %	N %	C:N	δ¹³C ‰	δ¹⁵N ‰
3	Poz-39208	935	30	metacarpal bone	1038–1153	1025–1164	1098	9.6	2.5	3.84	–	–
6	Poz-39209	4350	40	frontal bone	3012–2910	3090–2894	2977	4.2	0.9	4.67	–20.4	12.7
	Poz-40857	4430	30		3307–2944	3326–2926	3098					

Table 2. Radiocarbon and stable isotopes results for the individuals from Tiszavasvári-Deákhalom II kurgan

Stable isotopes ratios in humans' bone collagen are related to the protein part of their diet (AMBROSE 1993). The $\delta^{13}C$ value in a consumer's bone collagen is approximately 5‰ more positive than the dietary source. The $\delta^{15}N$ value expresses the trophic level of the consumer and is enriched by approximately 3‰. For a better understanding of the results received for Grave 6 of Tiszavasvári-Deákhalom II, they were compared with the published data set obtained for human and animal bones from the Early and Middle Chalcolithic of the Great Hungarian Plain. These reference samples were obtained from the cemetery of Tiszapolgár-Basatanya, from Phase I of the Tiszapolgár culture and from Phase II, which is related to the Bodrogkeresztúr culture, and from the Bodrogkeresztúr culture cemetery at Magyarhomorog (GIBLIN 2011, Appendix A).

Julia Giblin concluded earlier in her study that the investigated Chalcolithic populations consumed terrestrial plants and animals. Fish and millet (or other type of C4 plants) did not constitute a substantial part of their diet (GIBLIN 2011, 272). Relatively high $\delta^{15}N$ values indicate that a significant portion of the protein in their diet came from animals (meat and dairy products). The $\delta^{15}N$ value of the sample of Tiszavasvári-Deákhalom was higher in relation to the comparative series. It is plausible, therefore that, the diet of the investigated individual relied largely on animal derived protein (HEDGES – REYNARD 2007, 1248) excluding fish (see BONSALL *et al.* 1997, 77, Fig. 8). Hence, the assumed offset of the radiocarbon age due to freshwater reservoir effect (LANTING – VAN DER PLICHT 1998) is insignificant. The isotopic signal possibly reflects a subsistence strategy similar to pastoralism *(Fig. 8)*.

The evaluation of the analytical dates connects Grave 6 of Tiszavasvári-Deákhalom II with its particular burial rite and relatively early radiocarbon dates to the Pre-Pit Grave Kvityana culture.



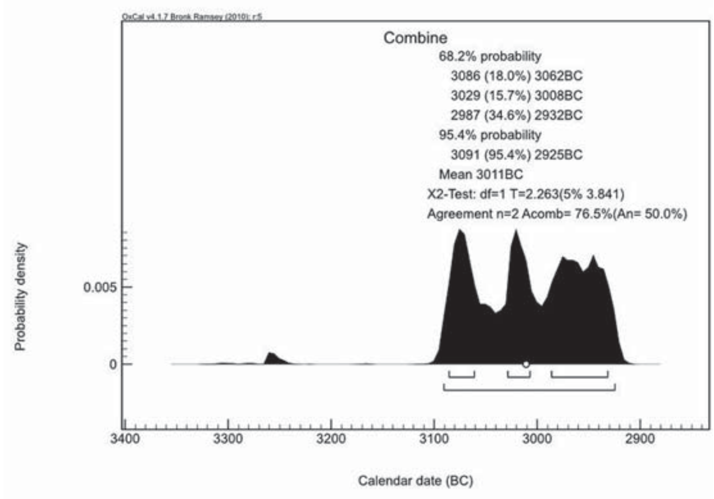


Fig. 7. Calibrated probability distributions of the combined radiocarbon dates of Grave 6 from Tiszavasvári-Deákhalom II kurgan

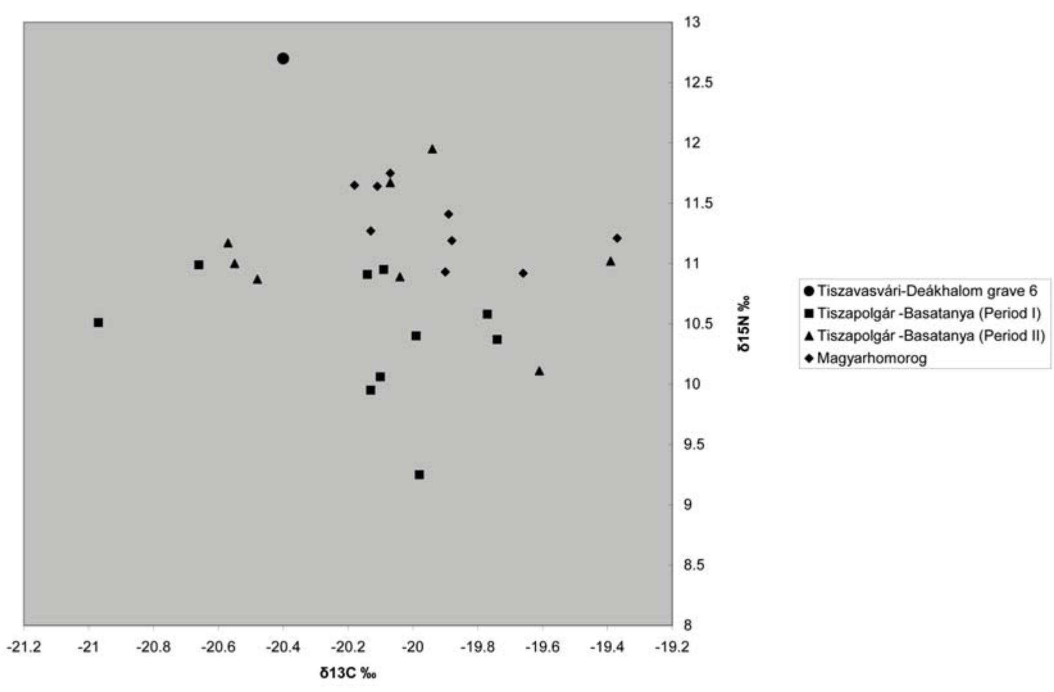


Fig. 8. Isotopic ratios in human bone collagen of the individuals from the Early and Middle Chalcolithic cemeteries on the Great Hungarian Plain (after GIBLIN 2011) and Grave 6 from Tiszavasvári-Deákhalom II kurgan

Hajdúnánás-Tedej-Szálláshalmi dűlő

1500 meter south-west from Hajdúnánás-Tedej-Lyukashalom, in the Hajdúnánás-Tedej-Szálláshalmi dűlő, a field survey was conducted in 2010. Two natural and/or artificial mounds were identified in the close vicinity of each other. At the so-called Kis-Szálláshalom a geophysical survey was conducted in order to identify if it is a destroyed kurgan or not *(Fig. 9)*.

The Hajdúnánás–Tiszavasvári microregion was densely inhabited in the Late Copper Age (3600–2800 BC) and during the transitional period between Late Copper Age and Early Bronze Age (2800–2600 BC). In the Early Bronze Age 1–3 periods (2600–2000/1900 BC), a dense network of sites existed here *(Fig. 2)*. Baden-Viss type sites (settlement traces and extramural or intramural graves) were noticed in seven cases; Coţofeni sherds as stray finds in one; Pre-Pit Grave/Pit-Grave kurgan sites in approximately 50 (many were destroyed by modern agricultural practice); a cord decorated sherd as stray find in one; a Makó site in one; Nyírség sites (burials and settlement traces) in nine and Sanislău settlements in two cases.

The potential kurgan at Kis-Szálláshalom is marked on the topographical map and has been confirmed by a field survey in the spring of 2010. Precise elevation measurements and geophysical survey were applied on a selected part of the site to identify burial pits, as well as the size and the state of preservation of the mound.

Magnetometry was chosen for the geophysical survey (Aspinall – Gaffney – Schmidt 2008). This method is designed to measure the anomalies in the Earth's magnetic field, caused by near-surface layers and archaeological features of enhanced magnetic susceptibility. The anomalies are initiated by remnant and induced magnetisation. These processes relate to objects made of metal, bricks, decaying or burnt organic materials (humus, wood, plants, bodies of animals and humans), ferromagnetic rocks, etc. The measurements were made with a Bartington Fluxgate Grad 601-1 magnetometer, in a parallel mode. Twenty-five data grids (20.0×20.0 m each), covering an area of 10,000 m^2, were surveyed. The data was processed in the Geoplot 3.0 application.

No clear magnetic anomalies related to the kurgan burial mound were registered. However, a complex structure of settlement or causewayed enclosure features (ditch, palisade?) were discovered (on the basis of the material found on the surface it is identified as a multi-component Middle and Late Neolithic, and Early Copper Age tell(?)/enclosed-settlement with LBK, Esztár and Tiszapolgár potsherds).

In the Upper Tisza region, there are some sites, where antecedent Neolithic and Early Copper Age cultures are connected to the Pit Grave kurgan sites in the same time interval. This phenomenon can probably be seen at the Kis-Szálláshalom site as well: all detected prehistoric cultures need high places close to water for settling. Neolithic traces were excavated under the kurgan sites of Hajdúnánás-Tedej-Lyukashalom (Mesolithic animal bones and uncharacteristic Neolithic potsherds, Tiszavasvári-Deákhalom II (Tiszadob culture, Middle Neolithic), in the palaeosoil of Tiszavasvári-Gyepáros, and at the field survey at Hajdúnánás-Zöldhalom and Nagy-Vidi halom. Such phenomena also occurred at some of the kurgan sites in the Hortobágy region as well (Hortobágy-Halászlaponyag, -Papegyháza: old excavations).

Absolute and relative chronology

According to the Hungarian chronology, nomads of the Eurasian steppes reached the eastern part of the Carpathian Basin between the Middle/Late Copper Age and the Early Bronze Age. The following tables give a summary of the radiocarbon dates that were obtained from finds of steppe and contemporary cultures inhabiting the Carpathian Basin. Based on the radiocarbon dates, the steppe cultures could be divided on a chronological and cultural basis. This division was harmonised with the Hungarian prehistoric terminology *(Tables 3–4, 6)*.

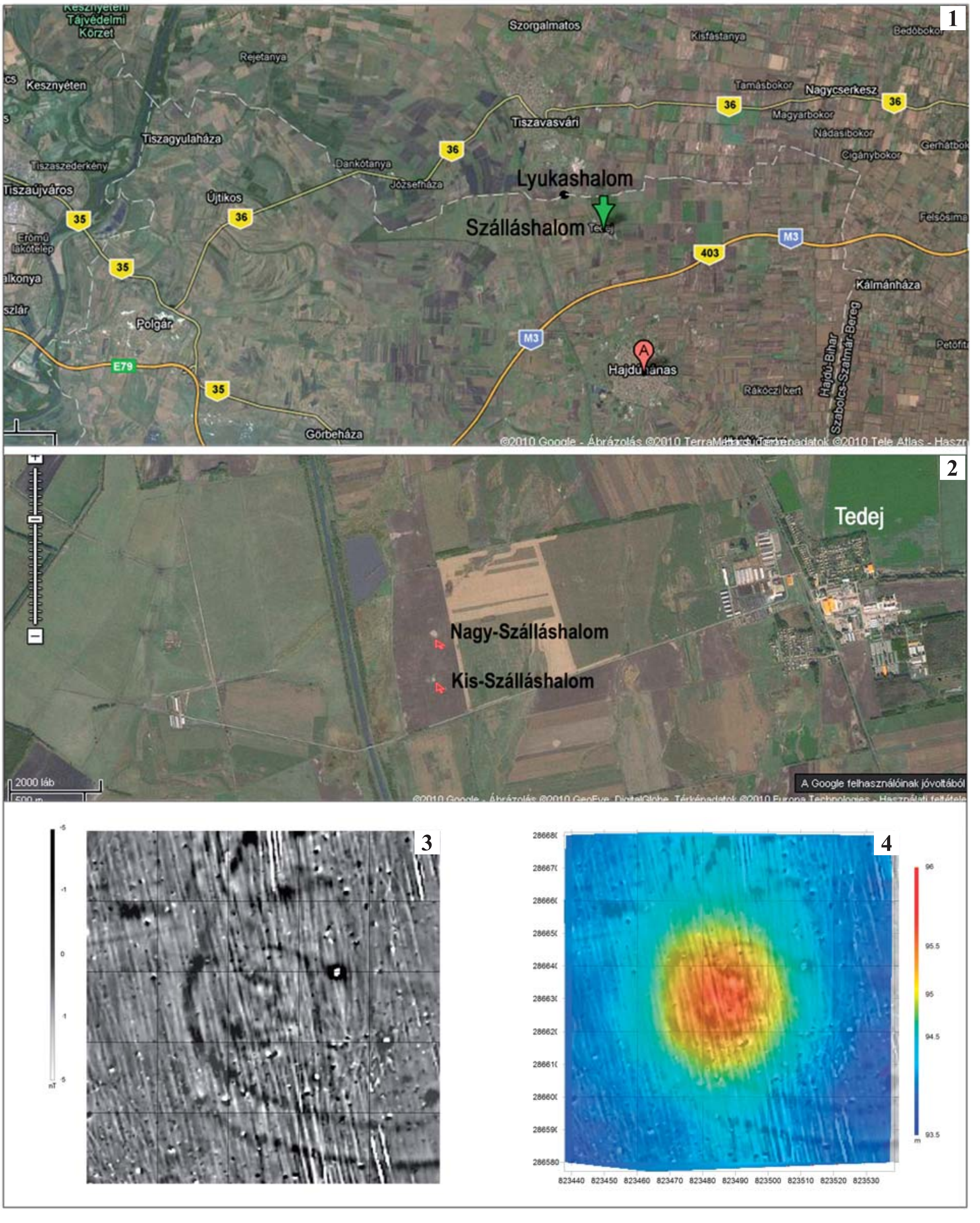


Fig. 9. Hajdúnánás-Tedej-Kis-Szálláshalom and Nagy-Szálláshalom — 1–2: location of the sites, 3: plot of results of magnetometric prospection, 4: plot of results of magnetometric survey overimposed on digital elevation model

Labor ID	Name of the archaeological site	Cultural affiliation	Type of the sample	BP	calibrated BC (1 σ, 68.2%)
OCHRE GRAVE CULTURE					
Poz-41865	Csongrád-Kettőshalom	Steppe Ochre Graves Period I	human bone Grave 1	5470 ± 40	4370–4239
PIT GRAVE CULTURE KURGANS					
Poz-39466	Tiszavasvári-Gyepáros	Early Pit Grave Period III	human bone Grave 6	4355 ± 35	3020–2910
Poz-39209 Poz-40857	Tiszavasvári-Deákhalom	Pre-Pit Grave/Kvityana Period II	human bone Grave 6	4350 ± 40 4430 ± 30	3020–2910 3307–2944
Poz-31637	*Hajdúnánás-Tedej-Lyukashalom*	*Pre/Early Pit Grave Period II/III?*	*charred plant material Feature 1*	*4270 ± 40*	*2920–2870*
Poz-31405	Hajdúnánás-Tedej-Lyukashalom	Early/Late Pit Grave Period III/IV	human bone Grave 1, Feature 2	4210 ± 35	2900–2700
Poz-39464	Hajdúszoboszló-Árkushalom	Early Pit Grave Period III	animal bone sacrificial feasting, O. 331	4385 ± 35	3080–2920
Poz-39461	Balmazújváros-Hortobágy-Árkus-Kettőshalom	Early Pit Grave Period III	human bone kurgan grave	4320 ± 35	3010–2890
Poz-39561	Hortobágy-Ohat-Dunahalom	Early Pit Grave Period III	human bone kurgan grave	4030 ± 35	2580–2480
Poz-42726	*Püspökladány-Kincsesdomb*	*Pre-Pit Grave/Lower Mikhailovka Period II*	*soil material from double burial of Grave 3*	*7340 ± 40*	*6250–6100*
Poz-42724	Püspökladány-Kincsesdomb	Early Pit Grave Period III	human bone Grave 1	4215 ± 35	2900–2710
Poz-42725	*Püspökladány-Kincsesdomb*	*Late Pit Grave Period IV/V?*	*human bone Grave 2, Carbonate contant measurement!*	*3730 ± 35*	*2200–2040*
Poz-39454	Kunhegyes-Nagyálláshalom	Early Pit Grave Period III	human bone Grave 14	4075 ± 35	2840–2490
Poz-39456	Kunhegyes-Nagyálláshalom	Early Pit Grave Period III	human bone Grave 18	4195 ± 35	2890–2700
Bln-609	Kétegyháza-Törökhalom Kurgan 3	Early Pit Grave Period III	human bone Grave 4	4265 ± 80	3020–2690
deb-6869	Sárrétudvari-Őrhalom	Pre/Early Pit Grave Period II/III?	human bone Grave 12	4520 ± 40	3350–3110
Poz-39563	*Sárrétudvari-Őrhalom*	*Early Pit Grave Period III*	*charred plant material Grave 8*	*4530 ± 60*	*3360–3100*
deb-6639	Sárrétudvari-Őrhalom	Early Pit Grave Period III	human bone Grave 10	4350 ± 40	3020–2910
deb-7182	Sárrétudvari-Őrhalom	Late Pit Grave Period IV	human bone Grave 4	4135 ± 60	2870–2520
deb-6871	Sárrétudvari-Őrhalom	Late Pit Grave Period IV	human bone Grave 9	4060 ± 50	2840–2490
BADEN CULTURE					
Poz-39467	Tiszavasvári-Wienerberger Téglagyár	Baden-Viss surviving in the EBA	animal bone from pit Feature 459	3860 ± 50	2457–2235
Poz-39470	Tiszavasvári-Wienerberger Téglagyár	Baden-Viss	animal bone from pit Feature 501	4450 ± 35	3322–3025
Poz-39562	Tiszavasvári-Wienerberger Téglagyár	Baden-Viss	animal bone from pit Feature 502	4405 ± 35	3091–2933
Poz-31799	Berettyóújfalu-Nagy-Bócs dűlő	Baden	animal bone from pit Feature 2006/Str.4251	4480 ± 40	3332–3096
Poz-31805	Berettyóújfalu-Nagy-Bócs dűlő	Baden	animal bone from pit Feature 1989/4234	4505 ± 35	3338–3106
MAKÓ CULTURE					
Poz-31798	Berettyóújfalu-Nagy-Bócs dűlő	Makó	animal bone from pit Feature 82/353	3990 ± 30	2566–2473
Poz-31800	Berettyóújfalu-Nagy-Bócs dűlő	Makó	animal bone from pit Feature 152/603	3955 ± 35	2566–2351
Poz-31803	Berettyóújfalu-Nagy-Bócs dűlő	Makó	animal bone from pit Feature 824/1889	3970 ± 40	2570–2461
Poz-31804	Berettyóújfalu-Nagy-Bócs dűlő	Makó	animal bone from pit Feature 1922/4212	3940 ± 35	2548–2348
Poz-31801	Debrecen-Szennyvíztelep	Makó	human bone Grave 479/617	3955 ± 35	2566–2351
NYÍRSÉG CULTURE					
Poz-39462	Hajdúnánás-Feketehalom	Nyírség	human bone Grave 32/51	3710 ± 30	2190–2037
Poz-39463	Hajdúnánás-Feketehalom	Nyírség	human bone Grave 36/62	3740 ± 30	2201–2053

*Table 3. Radiocarbon dates of Pit Grave culture (Pit Grave) kurgans from the territory of Hungary and new radiocarbon dates of contemporary cultures – * dates typeset with italic yielded younger or older dates and probably need correction*

Unfortunately, not too much is known about the life and economy of the steppe cultures that inhabited the Carpathian Basin in the examined time interval.

Differences in nutrition and nutrition sources (e.g. the ratio of terrestrial and aquatic species), the use of space along rivers and their tributaries all play an important role in the interpretation and correctness of the radiocarbon dates. These circumstances make it difficult to assess the effects that might have altered the archaeological finds that were subjected to radiocarbon dating (Shishlina *et al.* 2007). These environmental effects multiply each other in case of group calibration, and may result in a 300 to 500 years variation. To avoid these alternations, we have been using raw data *(Table 4, Fig. 10)*.

Sample code	**cal BC 1σ** 68.2%	**cal BC 2σ** 95.4%	μ
R_Date Poz-39563	3360–3100	3500–3020	3225
R_Date deb-6869	3350–3110	3370–3090	3220
R_Date Poz-39464	3080–2920	3100–2900	3005
R_Date Poz-39466	3020–2910	3090–2890	2975
R_Date Poz-39209	3020–2910	3090–2890	2975
R_Date deb-6639	3020–2910	3090–2890	2975
R_Date Poz-39461	3010–2890	3030–2880	2945
R_Date Poz-31637	2920–2870	3020–2700	2885
R_Date Bln-609	3020–2690	3100–2580	2865
R_Date Poz-42724	2900–2710	2910–2670	2800
R_Date Poz-31405	2900–2700	2910–2670	2795
R_Date Poz-39456	2890–2700	2900–2660	2780
R_Date deb-7182	2870–2620	2890–2500	2720
R_Date Poz-39454	2840–2500	2860–2490	2645
R_Date deb-6871	2840–2490	2870–2470	2630
R_Date Poz-39561	2580–2480	2840–2470	2555

Table 4. Calibrated radiocarbon age of Pit Grave culture kurgans

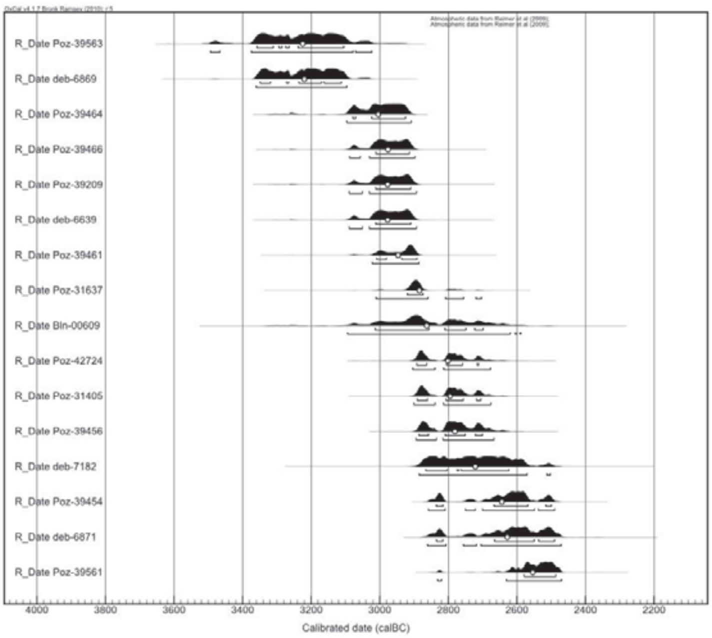
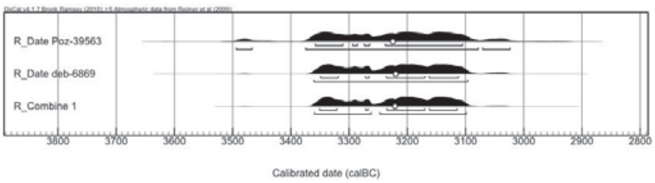


Fig. 10. Calibrated age probability distributions for the individuals from Pit Grave culture kurgans

The widest time interval was detected for the Sárrétudvari-Őrhalom kurgan. The two oldest radiocarbon dates derive from this kurgan as well: sample deb-6869 from Grave 12 and sample Poz-39563 from Grave 8. The age of these are basically the same, so they can be combined *(Fig. 11)*.



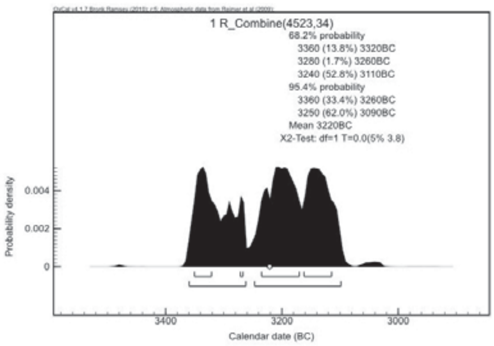


Fig. 11. Calibrated probability distributions of the radiocarbon dates of Grave 8 and 12 from Sárrétudvari-Őrhalom and their combined calibration

The age of two bone samples collected from two different sites in the vicinity of Tiszavasvári (Tiszavasvári-Gyepáros and Tiszavasvári-Deákhalom II, Grave 6), were found to be identical, although they derive from different cultural contexts (Tiszavasvári-Deákhalom II: Pre-Pit Grave/Kvityana, Tiszavasvári-Gyepáros: Pit Grave). The same age interval was measured for a sample collected from Grave 10 at Sárrétudvari-Őrhalom, therefore the combined calibration of the three samples seems logical *(Fig. 12)*.

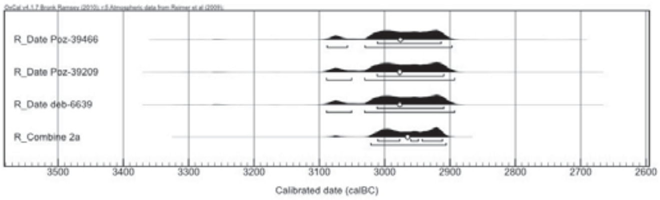
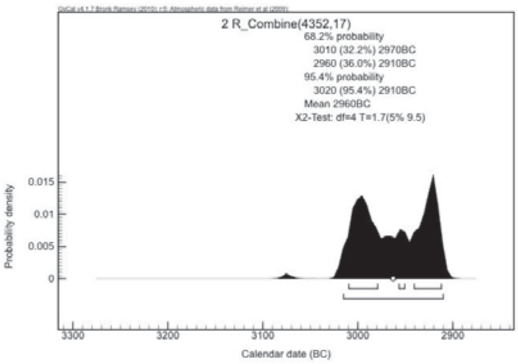


Fig. 12. Calibrated probability distributions of the radiocarbon dates of Grave 6 from Tiszavasvári-Deákhalom and Grave 10 from Sárrétudvari-Őrhalom and their combined calibration

Samples from Hajdúszoboszló-Árkushalom (Poz-39464) and Balmazújváros-Hortobágy-Árkus-Kettőshalom (Poz-39461) gave similar distribution curves *(Fig. 13)*.

The above listed 5 samples can be combined, because statistically their age is the same at a probability of 95% (Student's test), and they can be dated to 3010–2910 cal BC at 1σ probability, to 3020–2910 cal BC at 2σ probability.



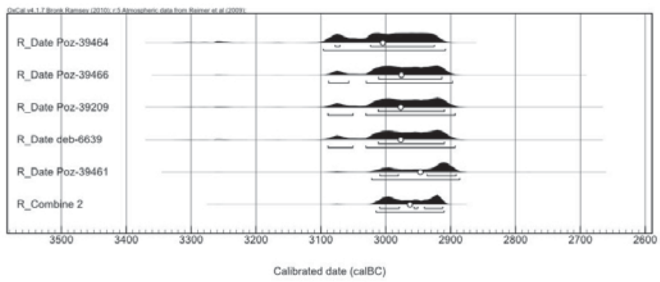


Fig. 13. Calibrated probability distributions of the radiocarbon dates of Grave 6 from Tiszavasvári-Deákhalom, Grave 10 from Sárrétudvari-Őrhalom, Balmazújváros-Hortobágy-Árkus-Kettőshalom and Hajdúszoboszló-Árkushalom kurgans and a possible combined calibration

Similar probability distributions were gained for the following samples: plant material of the secondary burial (Poz-31637) and human bone (Poz-31405) found at Hajdúnánás-Tedej-Lyukashalom; human bones excavated from Grave 4 in Kurgan 3 at Kétegyháza-Törökhalom (Bln-609), Püspökladány-Kincsesdomb (Poz-42724) and Grave 18 at Kunhegyes-Nagyálláshalom (Poz-39456). Therefore, their combination can be done as well *(Fig. 14)*.

These 5 samples can be combined, because statistically their age is the same at a probability of 95% (Student's test), and they can be dated to 2900–2770 cal BC at 1σ probability, to 2900–2710 cal BC at 2σ probability.

The youngest sample (Poz-39561) derives from Hortobágy-Ohat-Dunahalom. The two relatively young samples come from Sárrétudvari-Őrhalom (deb-6871 from Grave 9) and from Kunhegyes-Nagyálláshalom (Poz-39454 from Grave 14). The forth sample from Sárrétudvari-Őrhalom Grave 4 (deb-7182), is a bit older but because of its larger SD, the difference is irrelevant. The four samples can

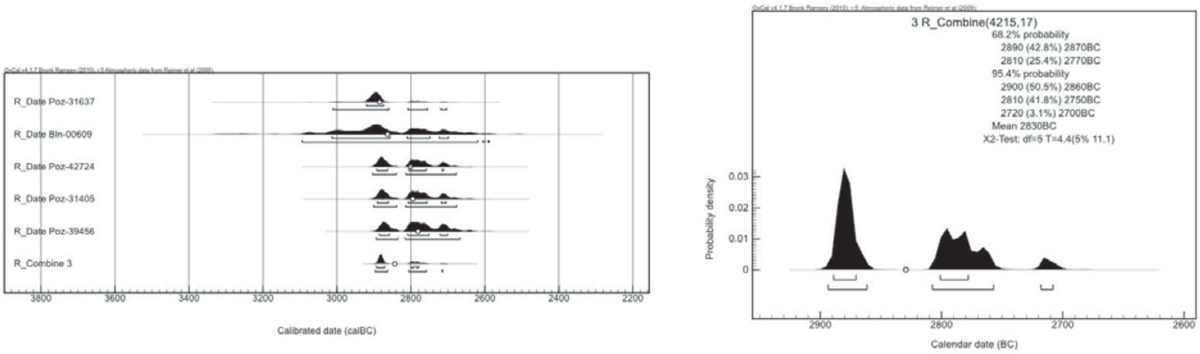
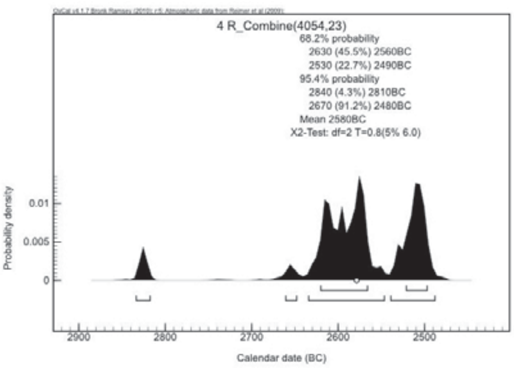


Fig. 14. Calibrated probability distributions of the radiocarbon dates of the samples from Hajdúnánás-Tedej-Lyukashalom, Kétegyháza-Törökhalom, Püspökladány-Kincsesdomb and Kunhegyes-Nagyálláshalom kurgans and a possible combined calibration

be combined, because statistically their age is the same at a probability of 95% (Student's test), and they can be dated to 2630–2490 cal BC at 1σ probability, to 2840–2480 cal BC at 2σ probability *(Fig. 15)*.



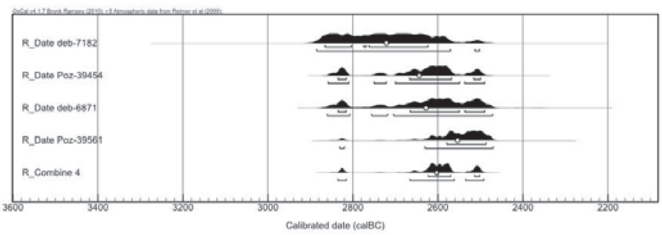


Fig. 15. Calibrated probability distributions of the radiocarbon dates of the samples from Hortobágy-Ohat-Dunahalom, Sárrétudvari-Őrhalom and Grave 14 of Kunhegyes-Nagyálláshalom and a possible combined calibration

The last two sample groups cannot be separated at 2σ level (2900–2710 cal BC and 2840–2480 cal BC respectively). At the same time – based on Student's test – the nine samples are not identical, so they cannot be combined.

We must stress, however, that the above presented clustering was only based on the statistical evaluation of the radiocarbon dates. The grouping does not reflect the cultural context of the samples in every case. These anomalies were dissolved by the overlapping of the periods and the partial co-appearance of different steppe cultures in space and time in the Carpathian Basin. Moreover, we are aware that the consistent and rigorous insistence to the radiocarbon dates themselves would be a similar mistake like a preconception that would neglect scientific measurements. The groups that are shown in *Table 5* and *Fig. 16* therefore only represent a working hypothesis that was formulated on the basis of our current knowledge and data.

Next to the determined T test values the numbers in brackets indicate the maximum T test values for the conformity of data at a probability of 95%. The combinations are *(Fig. 16)*:
R_Combine 1: Poz-39563, deb-6869
R_Combine 2: Poz-39464, Poz-39466, Poz-39461, Poz-39209, deb-6639
R_Combine 3: Poz-31631, Bln-609, Poz-42724, Poz-31405, Poz-39456
R_Combine 4: deb-7182, Poz-39454, deb-6871, Poz-39561

Group	cal BC 1σ, 68.2%	cal BC 2σ, 95.4%	μ	T test
R_Combine 1	3360–3110	3360–3090	3220	0 (3.8)
R_Combine 2	3010–2910	3020–2910	2960	1.7 (9.5)
R_Combine 3	2890–2770	2900–2700	2830	2.5 (9.5)
R_Combine 4	2630–2490	2840–2480	2580	2.5 (7.8)

Table 5. Combined radiocarbon age of Pit Grave kurgans

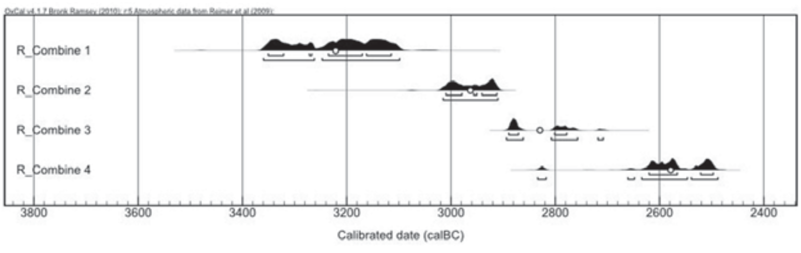


Fig. 16. Combine group-calibration of Pit Grave kurgans

Periods for the steppe cultures

Period I – Steppe Ochre Grave, until 4000 BC

On Great Hungarian Plain the single burial at Csongrád-Kettőshalom – n.b. not a kurgan burial! –should be rather identified as Steppe Ochre Grave culture. Its estimated date is based on the contemporary Marosdécse burials: 4200–4100 cal BC (Govedarica 2004, 71), parallel with the Middle Copper Age Bodrogkeresztúr culture (Ecsedy 1979, 12).

The recently obtained radiocarbon data of the Csongrád-Kettőshalom grave is 4370–4240 cal BC, in good correlation with other Steppe Ochre Grave data (Govedarica 2004), but a little bit earlier then the Middle Copper Age.

In Eastern Europe this is the period of the Early Eneolithic (4550–4100/4000 BC) of the Eurasian steppe region. The period of the Khvalynsk and Skelya cultures is contemporaneous with the Cucuteni A-Tripolye B1 phase (which populations played a significant role in the mediation between the steppe and agricultural communities). Moreover, it is analogous with the Romanian Aldeni-Bolgrad and Bulgarian Varna cultures (Higham *et al.* 2007), whose prosperity is identified with the elite of the Skelya culture.

There is a so-called steppe-hiatus between the early and middle phase of the Eneolithic between 4100/4000–3800/3700 BC (Rassamakin 1999, Table 3. 2).

The Middle Eneolithic Period of the Eurasian steppes (3800/3700–3500/3400 BC) can be characterized by the Cucuteni B-Tripolye B2-C1 Phase (Tomashevo, Zhvanetsk, Kosenovo groups, and the so-called *Scheibenhenkel* horizon, and in the east by the Lower Mikhailovka, Kvityana, Dereivka, Pivikha, Repin and Maikop cultures.

In the Carpathian Basin, the Early Eneolithic, the steppe-hiatus and the Middle Eneolithic Period is identified as the Early and Middle Copper Age, with the Tiszapolgár, Bodrogkeresztúr, Hunyadihalom, Lažňany, Ludanice, Balaton-Lasinja and *Furchenstich* cultures.

Csongrád-Kettőshalom fits rather to the beginning of the Middle Copper Age horizon, and most probably arrived into the Carpathian Basin as an early wave of the eastern Early Eneolithic populations, which can be described as the transition period of the Early and Middle Copper Age (see Bodrogkeresztúr cemetery at Rákóczifalva-Bagi föld: 4334–4075 cal BC; Csányi – Tárnoki – Raczky 2008).

Time period	**Name of the Age or Period** (Hungarian and *neighbouring territory: Maran 1998; Todorova 2002*)	**Cultures**	
		in Transdanubia	**east of the Danube**
4000–3600 BC	End of the Middle Copper Age *Aenolithikum/Eneolith* *Chalcolithicum* *Jungneolithikum/End-neolithikum* *Postäneolithikum*	Ludanice and Balaton-Lasinja, mixed with *Furchenstich* dates: Balatonőszöd-Temetői dűlő: Horváth 2011b; and 3980–3800 cal BC, Vörs-Máriaasszonysziget, deb-12188: Medzihradszky *et al.* 2009, 24, Table 1	Ludanice, Lažňany, Bodrogkeresztúr, Hunyadihalom, and Balaton-Lasinja, mixed with *Furchenstich* dates: Abony 49: Rajna 2011; Szihalom (Ludanice): Wild *et al.* 2001, Table 1
3600–2800 BC	Late Copper Age *Jungsteinzeit* *Jung- und Spätkupferzeit* *Late Neolithic* *Protobronzezeit* *Bronzezeit (from 3100 BC after Durankulak)* *Early Helladic and ETh (from 3100 BC)*	Boleráz (3600–3400 BC) Boleráz/Baden (3400–3000 BC) Baden (3400–2800 BC) Kostolac (3350–2800 BC) Early Vučedol? (3500?–2900/2800 BC) dates: Balatonőszöd-Temetői dűlő, and Benkő *et al.* 1989; Petrović–Jovanović 2002; Balen 2005, 2011	Boleraz (3600–3400 BC) Boleraz/Baden? (3400–3000 BC) Baden (3400–2800 BC) Coţofeni III (3000–2800 BC) Kostolac? (3350–2700 BC) Pre-Pit Grave/Pit Grave (3350–2800 BC) dates: Balatonőszöd-Temetői dűlő, Benkő *et al.* 1989; Forenbaher 1993; Ciugudean 2000; Stadler *et al.* 2001
2800–2600 BC	Transition between LCA and EBA *Frühbronzezeit* *Early Bronze Age* *Early Helladic I* *Early Helladic II from 2700/2600 BC*	Baden (2800–2600 BC) Vučedol? (2800–2600 BC) Early Makó? Late Kostolac (2880–2670 cal BC, Vörs-Máriaaszonysziget, deb-12763, unpublished, pers. comm. of K. T. Biró) Somogyvár-Vinkovci (2750–2580 cal BC, Vörs-Máriaasszonysziget, deb-12180, Medzihradszky *et al.* 2009, 24, Table 1)	Baden (2800–2600 BC) Pit Grave (2800–2600 BC) Early Makó?
2600–2500 BC	Early Bronze Age 1 *Early Helladic II* *Early Bronze Age*	Baden (2600–2500 BC) Early Makó? Late Vučedol? (2600–2500 BC) Somogyvár-Vinkovci (2750–2580 cal BC, Vörs-Máriaasszonysziget, deb-12180, Medzihradszky *et al.* 2009, 24, Table 1: the date is uncertain, it may belong to the Kostolac period)	Baden (2600–2500 BC) Early Makó (2600–2500 BC) Pit Grave (2600–2500 BC)
2500–2300 BC	Early Bronze Age 2a *Reinecke Bz A0-1* *Early Helladic II*	Baden (2500–2300 BC) Makó (2470–2300 BC; Kővári–Patay 2005) Proto-Nagyrév/Early Nagyrév? (2570–2340 cal BC, e.g. Bln-1649: Bölcske-Vörösgyír) Somogyvár-Vinkovci (Kalafatić 2006; Vinkovci, KIA-29563) Bell Beaker (2500–2300 BC)	Baden (2500–2300 BC) Makó (2500–2300 BC) Pit Grave (2500–2470 BC) Nyírség? Maros? Gyula-Roşia?
2300–2200 BC	Early Bronze Age 2b *Reinecke Bz A0-2 or transition between A0/A1* *Early Helladic II* *EBA/MBA transition*	Late Makó (2300–2200 BC; Kővári–Patay 2005) Bell Beaker (2300–2200 BC) Early Nagyrév? Somogyvár-Vinkovci?	Baden (2300–2200 BC) Maros (from 2270 BC, P. Fischl–Kulcsár 2011, Table 3) Early Nagyrév (2290–2050 cal BC, e.g., Bln-1987: Tószeg-Laposhalom) Late Makó? Nyírség? Gyula-Roşia?
2200–2000 BC	Early Bronze Age 3 *Reinecke Bz A1* *Early Helladic III* *Middle Bronze Age*	Makó (2200–2130 BC; Kővári–Patay 2005) Bell Beaker (2200–2000 BC) Classic Nagyrév? Somogyvár-Vinkovci – Proto-Kisapostag (2100–2000 BC; Medzihradszky *et al.* 2009, Table 1: deb-11965, 12542, 12388, 12390, 12547)	Nyírség (2200–2030 BC) Classic Nagyrév (Raczky–Hertelendi–Veres 1994) Early Hatvan (Raczky–Hertelendi–Veres 1994) Early Maros (P. Fischl–Kulcsár 2011, Table 3) Early Ottomány (2025–1910 cal BC e.g., Bln-1642: Gáborján-Csapszékpart)
2000–1900 BC	Transition between EBA and MBA *Reinecke Bz A2* *Middle Bronze Age* *Middle Helladic*	Bell Beaker (2000–1900 BC) Proto-Nagyrév (2010–1910 cal BC; deb-10117, Endrődi–Pásztor 2006) Somogyvár-Vinkovci (2000–1900 BC; Dirjec 1991, Z-1934: Blatna Brezovica) Kisapostag? Nagyrév/Vatya? (2035–1925 cal BC; e.g., Bln-1646: Bölcske-Vörögyír)	Late Nagyrév? Hatvan (1925–1770 cal BC, e.g., Bln-1844: Jászdózsa-Kápolnahalom) Maros? Ottomány? Proto-Füzesabony?

Table 6. Relative and absolute chronology of the Late Copper Age and Early Bronze Age of the Carpathian Basin ("?" means sites, cultures and periods/ages are in uncertain chronological position, with uncertain absolute dates, or without correct, modern ^{14}C dates. Hungarian Bronze Age dates are from Raczky – Hertelendi – Veres 1994: conventional radiocarbon dates)

Period II – Pre-Pit Grave, 3400/3350–3300/3000–2750 cal BC

The cultures of the Late Eneolithic Period in the Eurasian steppe belt (3500/3400–3000/2900 cal BC) are late Repin, late Konstantinovka, Novosvobodnaja, late Kvityana, late Dereivka and late Lower Mikhailovka cultures, Tripolye C2 (with the Sofievka, Kasperovo/Gordinesti, Gorodsk, Usatovo groups), and with the "Badenization process", together with the local groups at the Dnieper-South-Bug region, Kemi-Oba communities. The emergence of the Pit Grave culture can be dated in this period, which is partly contemporaneous with the Boleráz, respectively the Cernavodă III, and the classical Baden, dating to a bit thereafter. More or less it is the Late Copper Age in the Hungarian prehistory.

The earliest kurgan graves of the Great Hungarian Plain can be classified as Pre-Pit Grave (*syn.* Pre-Yamnaya) horizons (Sárrétudvari-Őrhalom, Grave 12; Dani – M. Nepper 2006; K. Zoffmann 2006; Tiszavasvári-Deákhalom, Grave 6/Kvityana; Püspökladány-Kincsesdomb, Grave 3/Lower Mikhailovka, and perhaps Hajdúnánás-Tedej-Lyukashalom, Grave 1).

An overlap with this period appears with the earliest Pit Grave: the earliest, primary phase of Pit Grave kurgans with multiple depositions (Kétegyháza-Törökhalom, Kurgan 3, Grave 6, some Pit Grave ochre-graves in the Hortobágy region, e.g. Hortobágy-Árkus, which all lack grave deposits, and also those burials with grave chambers lined with some organic material). Differentiated from Period I, this phase might be identified as a Pre-Pit Grave horizon, and dated on the basis of the burials at Sárrétudvari and Tiszavasvári between: 3400/3350–3300/3000–2750 cal BC.

Period III – Early Pit Grave, 3300/3100–2900/2600 cal BC

In the Eurasian steppe region this is the period of the Early Bronze Age, which corresponds with the Early Pit Grave horizon, with the surviving Pre-Pit Grave groups (Usatovo), and dates from 3300/3100–3000/2600 cal BC.

At the Great Hungarian Plain the youngest period of multi-phase kurgans, moreover, the burials with timber-construction, but no or poor grave deposits can be linked to this period. This horizon can be identified and with the end of the Late Copper Age–Early Bronze Age transitional period, including the Late (and surviving) Baden/Coţofeni IIIa, b culture. This might be called Early Pit Grave Horizon. This period can be dated between 3300/3100 and 2900/2600 cal BC, overlapping with Period II. Our opinion is that Hajdúnánás-Tedej-Lyukashalom, Tiszavasvári-Gyepáros, Sárrétudvari-Őrhalom Graves 8 and 10, Kétegyháza-Törökhalom, Kurgan 3, Grave 4 and some graves from the Hortobágy region (Balmazújváros-Kárhozotthalom) are part of this time span.

Period IV – Late Pit Grave with strong Catacomb influences, 2900/2800–2500/2400 cal BC

The Early Bronze Age in the Eurasian steppes, which is the Late Pit Grave horizon, and simultaneous with the Catacomb entity, can be dated between 2800/2700–2100/2000 cal BC.

On the Great Hungarian Plain the latest, third construction phase of the kurgans, and, this is the time frame when rich metal depositions and Early Bronze Age ceramic sets appear in kurgan burials. It is contemporary with the Period I of the Early Bronze Age, and includes the surviving Baden, Vučedol, Makó-Kosihy-Čaka, early Somogyvár-Vinkovci, Glina-Schneckenbeg A, Coţofeni IIIc-Livezile cultures, and can be dated to 2900/2800–2500/2400 cal BC, according to the radiocarbon dates of Nezsider/Neusiedl am See, Velika Gruda, and the second building phase of the Sárrétudvari kurgan.

In contrast to former theories, we assume that the Catacomb culture – one of the later waves from the Eurasian steppes – did not exist as a discrete tribe on the territory of the Carpathian Basin. Although the late Pit Grave horizon shows similarities with the graves of the Polish Corded Ware culture that are found under mounds as well, it cannot be classified as Catacomb culture.[3]

The affluent arsenic bronze and gold grave goods, the secondary burials in the kurgans, and the arrangement along the outer circle can be a Catacomb influence; however, all these features are represented in the late Pit Grave culture as well. Besides, the contemporaneity as well as the combination of the two cultures has earlier been proved in the northwest Pontic area. Because of this phenomenon we might denominate this fourth phase as Late Pit Grave horizon with strong Catacomb influence.

On the basis of the AMS dates, the graves of Ohat-Dunahalom and Kunhegyes-Nagyálláshalom can be dated to this period, despite the conservative outlook of the burial rite.

Period V – Late Pit Grave effect, 2500/2400–2200/2000 cal BC

It can be presumed that this period enters into the second phase of the Early Bronze Age: Nyírség skeleton graves beside Hajdúnánás-Feketehalom, Somogyvár-Vinkovci type barrow burials, Eastern Slovakian mounds with Nyírség type pottery, all dated to the same period as the emergence of the Bell Beaker culture and the Proto-Nagyrév culture (see Bóna 1994), without the real ethnic presence of the Pit Grave peoples.[4] The study period is an excellent example to illustrate how contemporary cultures unite: in the Budapest region it is nearly impossible to differentiate the Bell Beaker-Early Nagyrév-Makó cultures: both settlements and burials are documented as a special mixture (Kalicz-Schreiber – Kalicz 1998–2000).[5]

The settling steppe communities in Period II and III can be identified with mixed cultural entities of the Pit Grave culture, and the strongly Tripolye C2-Usatovo stimulated Pre-Pit Grave Kvityana and Lower Mikhailovka groups, arriving from the Pontic area to the territory of the Great Hungarian Plain. The direction of the migration led from Moldova,[6] through the passes of the Carpathian Mountains and along the main waterways such as the valleys of the Berettyó, Maros/Mureş, and stopped at the line of the Tisza River.[7]

In Period IV(/V) intercultural connections with local cultures inside the Carpathian Basin strengthened and extended in a way that the original cultural identity of the Catacomb-influenced Late Pit Grave groups diluted, thus it is even more problematic to reconstruct their route than in the earlier periods. The direct route, which this even more far-away group followed when it arrived to Central Europe, has probably changed as compared to the previous periods: another road along the Danube seems to be a dominating one for the whole Carpathian Basin; with the use of the wheel and the wagon (Plačidol) and a developed metal production based on arsenic-bronze raw materials.

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3 In Little Poland, where the presence of niche graves was previously seen as a result of influences from the steppes, there is currently no clear evidence for direct connections with the Catacomb culture (Włodarczak 2006, 135).

4 The beginning of the Reinecke A Bronze Age is identical with the Phase 3 of the Hungarian Early Bronze Age. Thus, when discussing the Phase I or Phase II of the Hungarian Bronze Age this corresponds with the Final Eneolithic, Late Neolithic periods and cultures in Europe, see Horváth 2004, 43; 2012.

5 It was not only proved in the central part of the country, see for instance the paper given by János Dani and Katalin Tóth at the ΜΩΜΟΣ VI conference on the burial at Panyola.

6 The strongest anthropological similarity to Carpathian Basin kurgans can be detected with the ones in Moldova, see Marcsik 1979; K. Zoffmann 2011.

7 Populations of the autochthonous cultures of the Great Hungarian Plain (e.g. Boleráz, Baden, Makó) and the people of the kurgans were presumably mixing between 3350–2400 BC.

Most probably the main reason for this large-scale migration was the drastic change in the ecological circumstances caused by a drier climate and the over-grazing of the meadows (GOLYEVA 2000; SHISHLINA [ed.] 2000).[8]

David W. Anthony (2007, 362–364) recommended that the steppe populations arriving to the Great Hungarian Plain got there east from the Usatovo settlement area, from the South-Bug-Ingul-Dnieper region: the earliest Pit Grave kurgans are situated there (for example Bal'ki, with a deposited wagon, and one wooden plough-tooth: RASSAMAKIN 1999, Fig 3. 58). The steppe along the Lower Dniester were occupied by the Usatovo culture between 3400/3300–2800 BC, but the majority of the Pit Grave kurgans there (from 2800–2400 BC) are dated later than the migration to the Great Hungarian Plain. Thus, D. W. Anthony supposed that the Dniester variant is a sign of a return migration from the Danube valley and the Great Hungarian Plain to that region. Although this is a very pleasant theory, it cannot be verified in the study area: without much more excavation results and radiocarbon dates, and moreover, the overall revision of the Usatovo culture, this debate cannot be resolved (for this see also RASSAMAKIN – NIKOLOVA 2008, 13).

The migrating route sketched by Richard Harrison and Volker Heyd (2007, 194, Fig. 43) cannot be accepted for the whole period. This would lead from the mouth of the Dnieper River, around the Carpathian Mountains and reach the Great Hungarian Plain not just from the southern direction (through the Lower Danube), but through the passes of the northeastern and eastern Carpathians. The radiocarbon dates of some kurgans in Serbia, and Bulgaria are later or can be correlated with Period IV/V (e.g. in case of the kurgan at Jabuka in Serbia, an individual layer of soil formation was documented after a Kostolac stratum, upon which the kurgan was built; in Bulgaria in Kurgan 1 at Trnava, Coţofeni and Pit Grave ceramics with corded decoration were excavated: ANTHONY 2007, 363, Fig. 14. 6).

The hypothesis regarding the so called "Pit Grave package" is similarly not entirely applicable to this problem (HARRISON – HEYD 2007, 196–197). In accordance with the literature of Russian scholars (SAPOSNIKOVA *et al.* 1988; LEVINE *et al.* 1999; SHISHLINA [ed.] 2000; TSUTHKIN – SHISHLINA [eds] 2001; MORGUNOVA *et al.* 2003; MORGUNOVA 2004; RASSAMAKIN 2004; MERPERT *et al.* 2006), the third (social status and sex is markedly expressed),[9] and eighth characteristics (the importance of the horse) are not confirmed. At the same time we should be clarifying the fourth component ("The creation of a special status for craftsman..." in HARRISON – HEYD 2007, 196): the metalworkers had formed a specialized group or layer in the Early Bronze Age society; but this doesn't mean necessarily their highest social status. Irrespectively of this, the complex influence of the Eurasian steppe populations in the investigated period in the geographical area under examination cannot be neglected.

At last, it is anticipated that the excavation results and the series of new ^{14}C dates discussed in this study from the westernmost ethnic presence as well as expansion of these cultures further enhance this extremely complex and problematic jigsaw-puzzle with some new mosaic stones.

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8 According to A. Golyeva, in Kalmykia in most of the kurgans the buried soil was degraded and eroded. This phenomenon was further deteriorated in the Pit Grave/Catacomb transformation period by the drier climate and overgrazing. See GOLYEVA 2000.

9 See also IVANOVA 2003. It should be considered that kurgan burial was a kind of privilege for a not in every detail perfectly identified social group, thus kurgan burials cannot be taken as a mirror for the whole contemporary society. The social differences reflected in the Pit Grave graves are rather outlining local differences or territorial accessibility of raw materials and resources (for example the valley of the River Manych in Kalmykia; see SHISHLINA [ed.] 2000), and not just on the basis of the status or the gender.

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Insights into the Transylvanian Early Bronze Age Using Strontium and Oxygen Isotope Analyses: A Pilot Study

CLAUDIA GERLING – HORIA CIUGUDEAN

Abstract

Burial mounds are a widespread phenomenon in Early Bronze Age Europe. They are also one of the characteristics of the Early Bronze Age burial ritual in Transylvania and are associated with the so-called Livezile Group. In the framework of a large-scale study focussing on the investigation of mobility patterns of the Eneolithic and Early Bronze Age communities of the West Eurasian steppes[1] *a series of pilot studies were undertaken in the steppe-like environments of eastern Europe. One such pilot study investigated Early Bronze Age burials on the Great Hungarian Plain associated with foreign burial elements that point towards cultural connections to the southeast and east.*[2] *Inter alia the results of the isotope analysis of the present pilot study were obtained in order to potentially verify the conclusions based on previously obtained data from the Great Hungarian Plain.*

Six human individuals from four Transylvanian sites were selected for $^{87}Sr/^{86}Sr$ and $\delta^{18}O$ isotopic analyses. Although the data set is far too small to gain answers on a statistically significant basis, a number of conclusions can be suggested. It is likely that the consistency in the isotope data is the result of the mixture of $^{87}Sr/^{86}Sr$ and $\delta^{18}O$ values of uplands and lowlands, which may point towards relatively restricted movement patterns rather than wide-ranging mobility or migration.

Introduction

The tradition of erecting burial mounds is a widespread phenomenon in southeast Europe during the Early Bronze Age that is not restricted to one archaeological culture (Dani 2011, with further literature). In eastern Europe burial mounds are associated with different cultural contexts. They are also present in Transylvania, where they are seen in association with the Livezile group (e.g., Ciugudean 1996; 2011) and date to the post-Coţofeni period (Roman 1976, 31; 1986, 41; Ciugudean 1996, 80–81; Popa *et al.* 2006, 183–184; Rișcuța – Popa – Ferencz 2009, 278–279).

Claudia Gerling and her colleagues (2012a; 2012b) employed $^{87}Sr/^{86}Sr$ and $\delta^{18}O$ isotope analysis to investigate twenty human skeletons from Late Copper Age/Early Bronze Age burial mounds in the Great Hungarian Plain. Some of the individuals in the Hungarian tumuli graves identified as isotopic outliers showed archaeological affinities to the Transylvanian Livezile group, thus in order to verify this potential association six humans and two animals from the four Transylvanian sites of Ampoița-Peret, Ampoița-Dostior, Livezile and Meteş-La Meteşel were selected for further $^{87}Sr/^{86}Sr$ and $\delta^{18}O$ isotope analyses.

All sites are located in the eastern belt of the Apuseni Mountains within the Transylvanian Basin *(Fig. 1)*. This region is encircled by the Carpathian Mountains and offers good preconditions for the

[1] Research project by Claudia Gerling within the Cluster of Excellence Topoi at Freie Universität Berlin, Research Group of Wolfram Schier and Elke Kaiser in collaboration with the University of Bristol (Volker Heyd and Alistair Pike).

[2] Research project by the University of Bristol (V. Heyd and A. Pike) with the Institute of Archaeology of the Hungarian Academy of Sciences in Budapest (Eszter Bánffy, Kitti Köhler, Gabriella Kulcsár, Vajk Szeverényi), and Déri Múzeum in Debrecen (János Dani), isotope analysis was conducted as part of C. Gerling's PhD research.

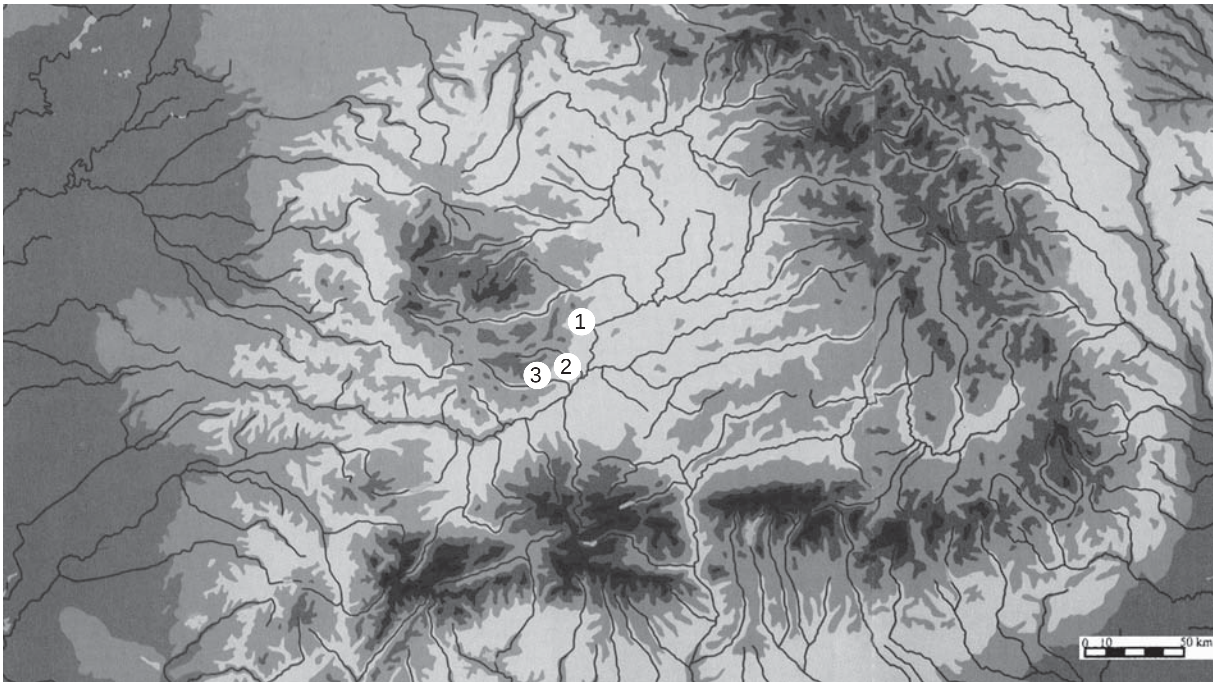

Fig. 1. Map of Transylvania with the location of the sites – 1: Livezile, 2: Ampoiţa, 3: Meteş

conduction of stable isotope analysis based on geological diversity and minor temperature differences between lowlands and mountains.

The Early Bronze Age in Transylvania

The erection of burial mounds with stone coverings is the dominating Early Bronze Age funeral pattern in the highlands of western Transylvania including the eastern and southern parts of the Apuseni Mountains (Ciugudean 1996, 128–134; 2011, 23–27; Rişcuţa – Popa – Ferencz 2009, 270–281). The archaeological investigation of the burial mounds started as early as at the turn of the 19th century (Fenichel 1891a; 1891b; Herepey 1901, 18–22), with another intense research period in the late decades of the 20th century (Vlassa – Takács – Lazarovici 1987; Ciugudean 1991) and some very recent contributions on the topic (e.g., Ciugudean 2011; Motzoi-Chicideanu 2011, 305–315).

In respect to their cultural affiliation, the tradition can be connected to the Livezile group (Ciugudean 1996, 79–80; 2011, 26), which also includes Copăceni type finds (e.g., Rotea 1993, 73, 84; 2003, 67–70; Rişcuţa – Popa – Ferencz 2009, 281) in its later phase of evolution (for a critique of the so-called Copăceni group see Dietrich – Rotea 2009; Motzoi-Chicideanu 2011, 305, 321).

The Livezile group (as defined by Horia Ciugudean, cf. characterisation of the group in Ciugudean 1996, 78–95; Motzoi-Chicideanu 2011, 305–315) dates to the beginning of the Early Bronze Age and is distributed in the eastern fringe of the Apuseni Mountains *(Fig. 1)*. The burial tradition includes the inhumation of articulated and disarticulated skeletons in contracted positions. They lay directly on the surface and were covered by stone mounds. Settlements are mainly located in dominant positions such as hilltops but there are also remains of temporary sites in rock shelters and even caves (Ciugudean 1996, 150).

Ceramic finds consist of characteristic Livezile cups with handles rising over the rim *(Fig. 2. 2, 8, 11)*, small conical beakers *(Fig. 2. 1)*, jugs *(Fig. 2. 14)*, funnel-necked bowls with outturned rims, conical bowls with thickened rims, amphorae with globular body and tubular handles *(Fig. 2. 3)*, sack-shaped

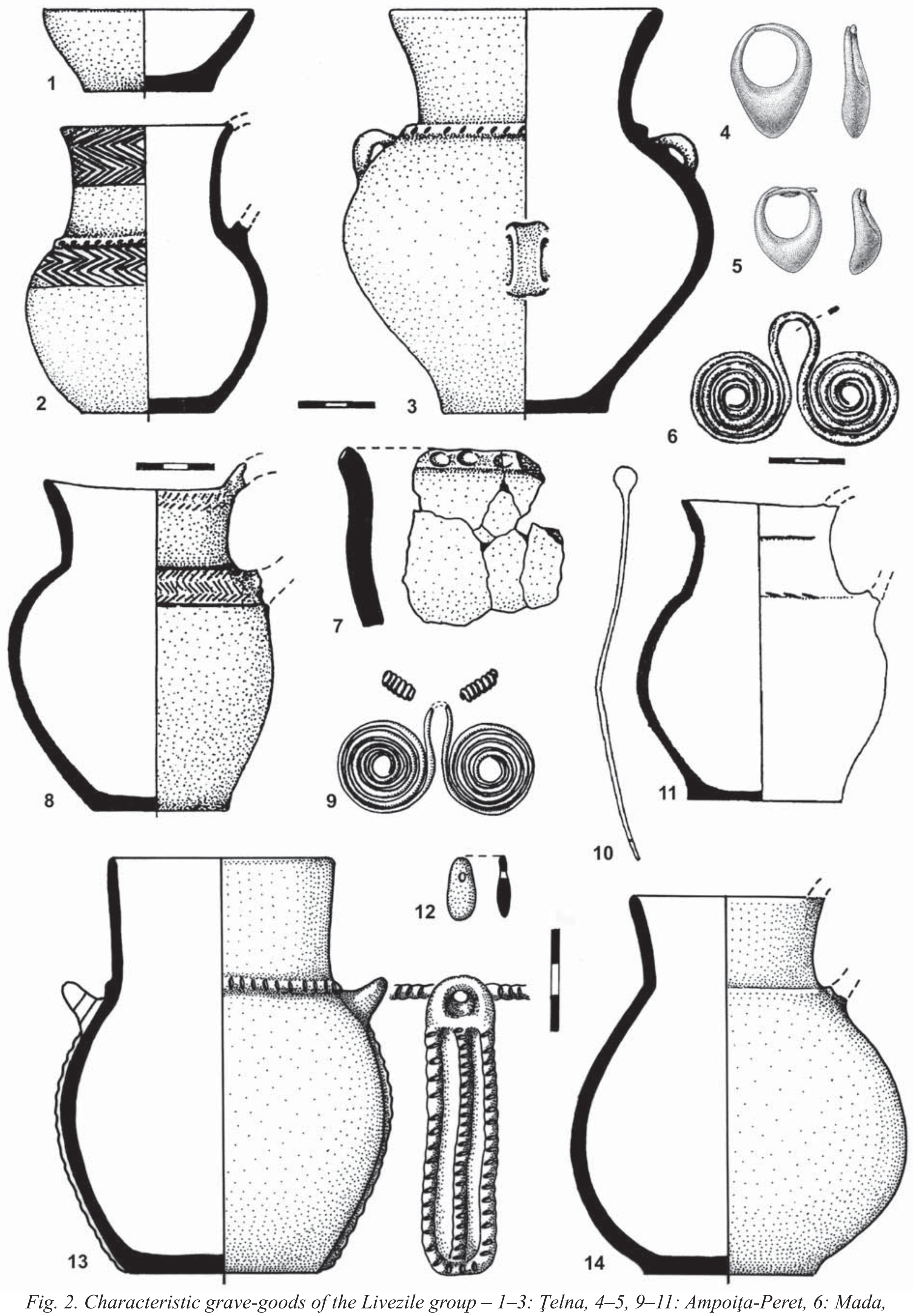

Fig. 2. Characteristic grave-goods of the Livezile group – 1–3: Ţelna, 4–5, 9–11: Ampoiţa-Peret, 6: Mada, 7–8: Meteş, 12–14: Livezile-Baia (4–5: gold, 6, 9–10: copper, 12: bone)

vessels, and hanging vessels *(Fig. 2. 13)*. Characteristic ornaments are the *Fischgrätenverzierung*, hatched horizontal bands and rhombs and incisions on rims and shoulders, plastic applications, and sometimes, superficial channelling (Ciugudean 1996, 150). The pottery shapes and ornaments are linked to other contemporaneous cultural groups such as Folteşti (-Cernavodă II) and Schneckenberg (Ciugudean 1996, 150), but Corded Ware and Globular Amphora patterns can be detected too.

Furthermore, bone tools are common whereas stone tools, e.g., made of quartzite and flint, are less frequent; metal objects include copper and arsenical copper spectacle-shaped pendants and spiral beads *(Fig. 2. 6, 9)*, pins *(Fig. 2. 10)*, but also gold and silver hair rings (Ciugudean 1996, 151). The gold hair rings from Ampoiţa *(Fig. 2. 4–5)* highlight long distance connections with the southern Balkans (Ciugudean 1991, 94; 1996, 127–128, 143; Primas 1996, 85).

For the dating and the chronology of the Livezile group, we have at our disposal a variety of absolute and relative data. As we have already underlined, there are several sites where the Livezile-type tumuli were erected over late Coţofeni settlements (Ciugudean 2011, 24), supporting the widespread opinion that most of them, if not all, can be dated to the post-Coţofeni/Baden period (Roman 1986, 41; Ciugudean 1996, 80–81; 2011, 26; Rişcuţa – Popa – Ferencz 2009, 278–279). However, the recent excavation of an earthen mound at Silivaşu de Jos (County Hunedoara) delivered a rich pottery offering with typical Coţofeni III shapes and ornaments (Luca *et al.* 2011), which might indicate that tumulus burials were already used by late Coţofeni communities.

The absolute dating is based on two ^{14}C dates coming from the Livezile-Baia site *(Figs 3–4)*. A fragment of an animal bone from the settlement was radiocarbon dated to 4109 ± 44 BP (Bln-4624), i.e. 2873–2502 cal BC (95.4% probability), while the tooth of an individual from grave 2 in tumulus 2 was dated to 4015 ± 35 BP (Poz-42712), i.e. 2621–2468 cal BC (95.4% probability). Both results can be well correlated with the radiocarbon datings of grave 4 and 9 in the tumulus from Sárrétudvari-Őrhalom, where Livezile-type vessels were part of the grave-goods (Dani 2011, 31, Table 2). Accordingly, the beginnings of the Livezile group can be put in the first half of the 3rd millennium BC, most likely after 2700 BC. This chronological position is in accordance with the absolute dating of the Coţofeni culture too (Ciugudean 2000, 57–59, Pl. 154).

So far, nothing can be said regarding the end of the Livezile group, which might have a longer evolution than it was generally admitted so far. The radiocarbon date from grave 3 at Meteş *(Fig. 5)* is quite late, 3660 ± 50 BP, i.e. 2196–1903 cal BC (95.4% probability) and it shows that burials were made intermittently for several centuries in the barrows of the Apuseni Mountains. By that time, the

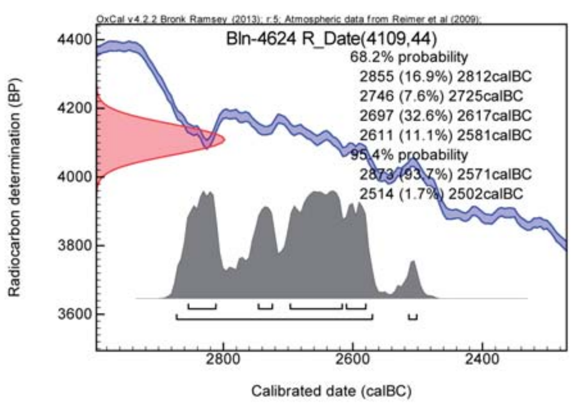

Fig. 3. Livezile-Baia (County Alba) – radiocarbon dating of the animal bone from the settlement. Plot made using OxCal v.4.2.2 computer program, Bronk Ramsey 2013

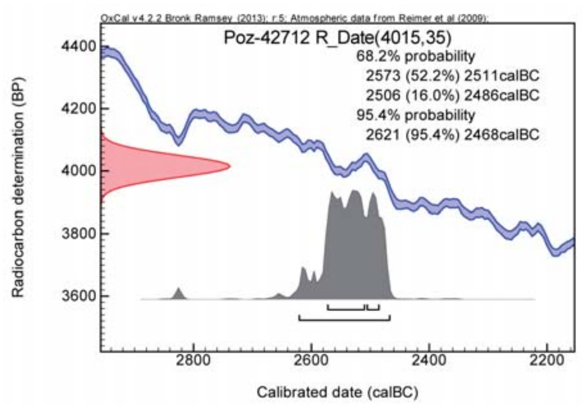

Fig. 4. Livezile-Baia (County Alba) – radiocarbon dating of burial 2 in tumulus 2. Plot made using OxCal v.4.2.2 computer program, Bronk Ramsey 2013

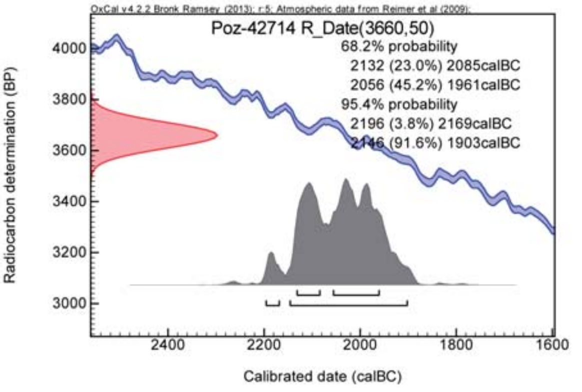

Fig. 5. Meteş-La Meteşel (County Alba) – radiocarbon dating of burial 3 in tumulus 1. Plot made using OxCal v.4.2.2 computer program, Bronk Ramsey 2013

Transylvanian lowlands were already occupied by the Early Bronze Age III groups, characterized by the *Besenstrich- und Textilmuster-Keramik*, a pottery style still missing in the highlands (CIUGUDEAN 1996, 110–112).

The visibility of the monuments is a feature that burial mounds of the Apuseni Mountains have in common, the tumuli being always placed in dominant positions, usually on the watershed between two valleys *(Fig. 6)*. So far, tumuli with stone coverings have not been reported on river meadows, which seems to be the case of the Yamnaya type earthen mounds. The mounds are usually erected not very far from rocky areas, especially limestone outcrops, where stones can be easily collected. A close connection between the limestone rocks and Late Eneolithic/Early Bronze Age settlements and barrows has been clearly observed along the Ampoi valley. The best documented site is Ampoiţa-Peret, where both settlement and cemetery were excavated (CIUGUDEAN 1991; 2011, 24, Pl. 10. 3).

At several sites settlements and cemetery areas overlapped, e.g., at Livezile-Baia, where several mounds were built over part of a former Coţofeni III settlement. The recent excavations in tumulus I at Cetea-Picuiata have revealed the presence of two fireplaces belonging to the Coţofeni III habitation, covered by the EBA burial mound (POPA *et al.* 2006, 183, Fig. 5). Outside Transylvania, similar observations were made in Moldavia, Serbia and Hungary, where Yamnaya mounds were often built over late Cucuteni/Horodiştea or Baden/Kostolac settlements (BUKVIĆ 1987; BURTĂNESCU 2002, 224–225). The great number of such situations raises the question whether these super-positions were

Fig. 6. Livezile-Baia – settlement on the lower terrace and tumuli on the top (photograph taken by H. Ciugudean)

really accidental or if there was an intention behind them. According to Volker Heyd (2011, 542), this might be seen as a symbolic connection to potential or claimed ancestors, or as an act of actively taking previous remains and territory into one's possession.

The burial tradition is characterised as follows (see CIUGUDEAN 2011, 23–25 for a description, including further literature): cemeteries are rather small with mainly less than 10 mounds and are often arranged in lines. In some cases the mounds were probably arranged in association with routes of communication crossing the mountains. The mounds have a round or, less frequently, ellipsoid shape and an average size of 10 to 12 m, most of them quite flat (less than l m high). Further characteristics of the Early Bronze Age burial mounds in the Apuseni Mountains are the inhumations in contracted positions placed directly on the surface and covered by a thin layer of soil, several layers of stones and a final soil cover, largely destroyed by erosion. Occasionally, rings of bigger stones were integrated in the burial structures. There were mainly single burials, but also burials of several individuals occur. The deceased were placed in supine positions with flexed legs or in crouched positions on the side. Also disarticulated skeletons occur, in primary, secondary burials and in the peripheries of the mounds. Articulated skeletons result from the interment of corpses, while assemblages of completely or partly disarticulated skeletons point to disintegration prior to burial, so the excarnation before interment seems likely (CIUGUDEAN 1991, 91; 1996, 132–133; LAZAROVICI – MEŞTER 1995, 88; RIŞCUŢA – POPA – FERENCZ 2009, 275). Cremation graves were also observed, mainly as secondary burials. Infrequently there are mounds without skeletal remains, regarded as symbolic funerary monuments (CIUGUDEAN 2011, 25). Grave inventory is generally very poor or not evident at all. Primary graves usually contain more funeral goods than secondary ones, and also metal objects count as characteristics for primary graves, while ceramic objects were placed in primary as well as secondary graves (CIUGUDEAN 2011, 26). Multiple parallels to other cultural groups can be identified (cf. CIUGUDEAN 2011, 23). The tradition of the inhumation under burial mounds is very common in the Early Bronze Age (cf. HARDING 2011). Burials on the ground, without pit graves, are known south to the Carpathians in the Folteşti tumulus at Blejoi (PAVELEŢ 2007), in the cemetery with cord decorated vessels at Milostea (POPESCU – VULPE 1966), as well as in the Eastern Slovakian tumulus group (NOVOTNÁ 1987, 89). The arrangement of the burial mounds in lines is a feature that can be compared to the Corded Ware groups from the northern Carpathians (MACHNIK 1998, 257–262, Fig. 2, Fig. 4) and eastern Slovakia (BUDINSKÝ-KRIČKA 1967, 278–322) or in the Belotić-Bela Crkva group in Serbia (GAVELA [ed.] 1968, Fig. 5, Fig. 11–11a, Fig. 19a). A similar preference could be detected in the Yamnaya culture (DERGAČEV 1994, 124; AGULNIKOV 1995, 81). The deposition of disarticulated skeletons is attested for Yamnaya as well (HÄUSLER 1976, Pl. 6. 10a, Pl. 12. 2, Pl. 25. 9, Pl. 27. 22; KORYAKOVA – EPIMAKHOV 2007, 48, Fig. 2. 3-A), although it is mainly a common practice in central and western Europe during the Late Neolithic and Early Bronze Age, e.g., in the Funnel Beaker (MIDGLEY 1992, 443–458) and Globular Amphora cultures (NOSEK 1967, Fig. 42–43, Fig. 156, Fig. 166; HENSEL – WIŚLAŃSKI [eds] 1979, Fig. 178). Horia Ciugudean (2011, 29) regards the Yamnaya influence as a catalyst for the transformation of the funerary rites and rituals of late Coţofeni communities, e.g., expressed in the Early Bronze Age Livezile group of west Transylvania. Despite a number of congruities with the Yamnaya cultural communities, there are also important contradictions, for example the lack of the pit-graves under the mounds and the absence of the ritual powdering with red ochre. The spectacle-shaped pendants that accompany the dead have no parallels in the typical Yamnaya package (CIUGUDEAN 2011, 30), and they belong to the local Coţofeni heritage, as proven by the representations of such ornaments on Coţofeni vessels (CIUGUDEAN 2000, Pl. 141; POPA 2010, Pl. 10). Nevertheless, a possible scenario sees Yamnaya cultural groups inhabiting the lowlands of the Transylvanian Mureş valley and being involved in interregional exchange towards the Tisza Plain and the Lower Danube (CIUGUDEAN 2011, 30). This might offer one possible explanation for the presence of a broken Yamnaya pot in tumulus 1 at Meteş *(Fig. 2. 7)*, as well as for the Livezile-type vessels in the tumulus at Sárrétudvari-Őrhalom (DANI 2011, 31).

Methodology

The application of strontium and oxygen isotope analysis to archaeological material allows us to differentiate between human individuals that lived in geologically and climatically variable regions. Over the past 25 years, the potential of strontium and to a lesser extent oxygen isotope analysis to identify human and faunal mobility in archaeological assemblages has been demonstrated in innumerable studies that investigated material from various temporal periods and geographical regions (e.g., GRUPE *et al.* 1997; HOOGEWERFF *et al.* 2001; EVANS – CHENERY – FRITZPATRICK 2006; EVANS – STOODLEY – CHENERY 2006; ECKARDT *et al.* 2009; KNUDSON 2009; PRICE *et al.* 2010).

Strontium (Sr) has four stable isotopes. One of these isotopes, ^{87}Sr, is radiogenic and the product of the radioactive decay of rubidium (^{87}Rb), whereas the remainder, including ^{86}Sr, are not. Due to differing ages and compositions of rocks, Sr and Sr ratios vary across the globe and thus strontium isotope ratios and concentrations in bedrock and soil vary according to the local geology (FAURE 1986). The strontium isotopic ratio of the bedrock, soil and groundwater is incorporated by plants, animals and humans through water and particularly food uptake, and importantly there is no significant change or fractionation in the isotopic composition of strontium up the food chain (ERICSON 1985). Strontium can substitute for calcium in an individual's hard tissues such as tooth and bone (SCHWEISSING 2004, 13), therefore the ^{87}Sr/^{86}Sr composition of an individual's hard tissue reflects the ^{87}Sr/^{86}Sr composition of its diet. Tooth enamel mineralises during childhood and is resistant to later recrystallisation processes (HILLSON 1996), therefore by applying ^{87}Sr/^{86}Sr analysis to enamel, information regarding the isotopic composition of an individual's diet and consequently the environment and geology of its surrounding during childhood can be gained (early studies e.g., SEALY *et al.* 1991; PRICE *et al.* 1994). A good basis of comparison to determine if a person changed locations later in life is provided by archaeological and modern faunal remains, soil and plant samples from the closer surrounding of the place of the individual's death.

Conversely, the oxygen isotope composition (δ^{18}O values) of a human's tooth enamel, or mammalian body tissue in general, is directly related to the composition of ingested water (e.g., LONGINELLI 1984; LUZ – KOLODNY – HOROWITZ 1984; IACUMIN *et al.* 1996). The oxygen isotope composition of precipitation water depends on temperature, latitude, altitude and distance from the ocean (DANSGAARD 1964; LONGINELLI 1984). With due regard to fractionation processes the δ^{18}O composition of drinking water is conveyed to body water mainly through water uptake. For most large mammals, the composition of ingested water reflects local meteoric water. There are numerous equations providing a conversion from the δ^{18}O in structural carbonate and phosphate into the δ^{18}O of drinking or precipitation water (LONGINELLI 1984; LUZ – KOLODNY – HOROWITZ 1984; LEVINSON – LUZ – KOLODNY 1987; IACUMIN *et al.* 1996; DAUX *et al.* 2008). The most recent equation by Carolyn Chenery and her colleagues (CHENERY *et al.* 2012) provides a direct conversion from $\delta^{18}O_{carbonate}$ into $\delta^{18}O_{drinking\ water}$. Nevertheless, all of these equations were established on relatively small data sets and in relation to particular climatic conditions, consequently resulting $\delta^{18}O_{drinking\ water}$ values can only be considered as estimations (POLLARD – PELLEGRINI – LEE-THORP 2011). Because the causes of δ^{18}O and ^{87}Sr/^{86}Sr variation are independent of each other, the combined application of both analytical techniques provides a particularly useful tool to help reconstruct past movements of humans and animals (e.g., BENTLEY – PRICE – STEPHAN 2004; BUDD *et al.* 2004; PRICE *et al.* 2010; MÜLDNER – CHENERY – ECKHARDT 2011).

Geography, geology and climate of the study region

The sample sites are located in the Inner Carpathian or Transylvanian Basin at the southeastern edge of the Apuseni Mountains and within a distance to 30 km of each other *(Fig. 1)*. The Transylvanian Basin is encircled by the Carpathian Mountains, which are approximately 1300 km long and 50 to 150 km wide. While the climate of the Carpathians is characterised by hot summers and cold winters with an average annual precipitation rate of 650 mm, temperatures in the Inner Carpathian Basin are slightly more moderate and the precipitation rate is lower (BREU 1989).

The basin is geologically homogeneous and built of Cenozoic sediments, while the Carpathian Mountains are geologically variable and include Proterozoic metamorphic as well as Palaeozoic and Mesozoic bedrock (ASCH 2005; *Fig. 7*). The Apuseni Mountains include the same wide range of lithologies, and due to this geological variability, we can expect varying $^{87}Sr/^{86}Sr$ isotope ratios for the mountains. Ioan Seghedi and his colleagues found bedrock $^{87}Sr/^{86}Sr$ values ranging from 0.7040 to 0.7083 (SEGHEDI *et al.* 2004, 122–126, Table 1). The local geology at the study sites in

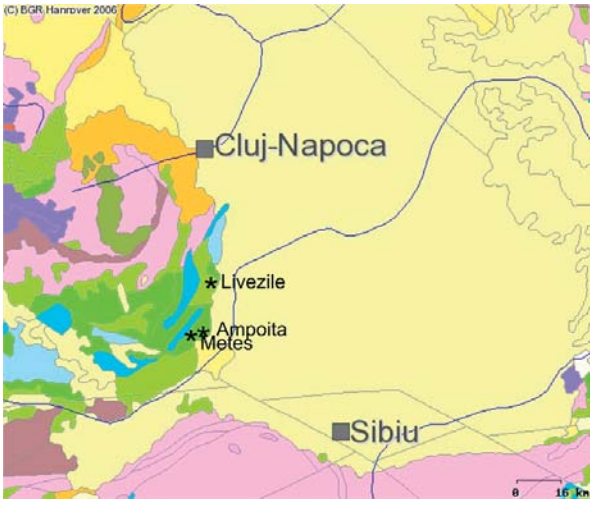

Fig. 7. Bedrock geology (based on the geological map by ASCH 2005) in the Apuseni Mountains area with sampling locations. Palaeozoic (pink, rust), Mesozoic (green, blue, purple), Cenozoic (yellow)

ID	Site	Burial mound	Grave	Anthropology Age (years)	Sex	Item	$^{87}Sr/^{86}Sr$ enamel	Sr enamel (ppm)	$^{87}Sr/^{86}Sr$ dentine	Sr dentine (ppm)	$\delta^{18}O_{carbonate}$ (V-PDB) in ‰	$\delta^{18}O_{drinking\ water}$ in ‰
Li 2/2	Livezile	2	2	25–35	male	M2 maxilla	0.70941	53	0.70903	70	–5.82	–9.02
AmD 1/4	Ampoiţa-Dostior	1	4	14–15	male (?)	M1 mandibula	0.70990	250	0.70972	301	–5.46	–8.43
AmP 1/1	Ampoiţa-Peret	1	1	6–7	–	M2 mandibula	0.70941	183	0.70952	268	–5.95	–9.24
AmP 1/2	Ampoiţa-Peret	1	2	18–24	male (?)	M2 maxilla	0.70976	139	–	–	–6.18	–9.61
Me 1/3	Meteş-La Meteşel	1	3	25–35	female	M1 maxilla	0.71048	121	–	–	–6.13	–9.53
Me 1/7	Meteş-La Meteşel	1	7	17–25	male (?)	M1 mandibula	0.70913	97	–	–	–5.71	–8.84
Am Ref1	Ampoiţa-La Pietri, Coţofeni settlement, complex 5	–	–	–	–	Cattle, premolares	0.70754 (PM 1) 0.70777 (PM 2)	369 (PM 1) 338 (PM 2)	– 0.70898 (PM 2)	– 470 (PM 2)	– –5.54 (PM 2)	–8.62 (D'ANGELA–LONGINELLI 1990) (PM 2)
Am Ref2	Ampoiţa-La Pietri, Petreşti settlement, complex 6	–	–	–	–	Cattle, M3 mandibula	0.70980	175	0.71037	570	–7.46	–10.54 (D'ANGELA–LONGINELLI 1990)

Table 1. Basic anthropological information (based on the preliminary report by K. McSweeney) and results of strontium and oxygen ($\delta^{18}O_{drinking\ water}$ as calculated by C. Chenery equation, see CHENERY et al. 2012) isotope analyses. M1: first permanent molar; M2: second permanent molar; PM: premolares. Typical one standard deviation analytical precisions for strontium are < 0.00001 and for oxygen < 0.2‰

the southern and eastern parts of the Apuseni Mountains range is dominated by Jurassic and Cretaceous material, therefore a 'local' $^{87}Sr/^{86}Sr$ range of approximately 0.707 to 0.710 can be expected.

The IAEA (International Atomic Energy Agency; www.iaea.org) gives weighted $\delta^{18}O$ values between –11‰ and –8‰ for most of Europe including the area of modern Romania (Voerkelius *et al.* 2010). The Online Isotopes in Precipitation Calculator (Bowen – Revenaugh 2003; Bowen – Wassenaar – Hobson 2005) gives $\delta^{18}O$ of approximately –8.5‰ for all sites where samples were selected. For areas of higher altitudes in the same region more depleted $\delta^{18}O$ values of approximately –9‰ or even lower can be expected.

Sample set and laboratory procedures

We sampled one human individual from Livezile (burial mound 2, burial 2), two humans from Meteş-La Meteşel (burial mound 1, burials 3 and 7), two human skeletons from Ampoiţa-Peret (burial mound 1, burials 1 and 2) and one from Ampoiţa-Dostior (burial mound 1, burial 4) for $^{87}Sr/^{86}Sr$ and $\delta^{18}O$ analyses *(Table 1)*. Li 2/2 is a secondary burial, which was placed in the stone covering in the centre of the burial mound, without any grave goods. Me 1/7 is one of the three burials of the primary grave, located in the central part of the barrow. The skeleton was dismembered and superposed by two further skeletons in contracted positions. The grave also contained a ceramic cup. Me 1/3 is a secondary burial in the same mound, placed between the inner ring and the central stone packing. The skeleton laid contracted on the left side, and the grave did not contain any grave goods. The two skeletons from Ampoiţa-Peret were secondary burials, one (burial 1) being deposited in no anatomical order and the other (burial 2) in a contracted position on the right. Neither graves contained any goods. AmD 1/4 is part of a secondary grave that contained two humans. The skeleton was placed in contracted position on the left side, and the grave did not contain any grave goods.

First and second permanent molars were selected, which represent the first years of the individual's lifetime, i.e. 0 to 3 years (first molar) and 2.5 to 8 years (second molars) respectively (Hillson 1996, 118–125; Schweissing 2004, 16, Table 2). In addition the enamel and the dentine of two faunal teeth were analysed to gain insight into the local biologically available $^{87}Sr/^{86}Sr$.

Sample preparation for $^{87}Sr/^{86}Sr$ and $\delta^{18}O$ analyses was conducted in the laboratory facilities of the Department of Archaeology and Anthropology at the University of Bristol. Strontium isotope analysis was performed in the laboratory facilities of the Department of Earth Sciences at the University of Bristol, and oxygen isotope analysis was performed in the Research Laboratory for Archaeology and History of Arts at the University of Oxford. Sample preparation followed the methodology as outlined in Gerling 2012, which includes minor adjustments to the method described in Haak *et al.* 2008 and Cahill Wilson *et al.* 2012.

Results of $^{87}Sr/^{86}Sr$ and $\delta^{18}O$ analyses

To identify immigration to, or mobility at a site, the $^{87}Sr/^{86}Sr$ ratio of a human individual is compared with a 'local' or 'regional' $^{87}Sr/^{86}Sr$ range based on comparative data (Price – Burton – Bentley 2002; Bentley – Price – stephan 2004; Tütken – Vennemann – Pfretzschner 2011; Maurer *et al.* 2012). Ideally, these 'local' proxies include modern and archaeological, locally restricted living fauna, plant, water and soil.

Strontium isotope analysis of tooth enamel and dentine of two animals from a Coţofeni settlement and of one animal from a Petreşti settlement at the site of Ampoiţa-La Pietri were also undertaken in this study *(Table 1, Fig. 8)*. The Petreşti cattle gave $^{87}Sr/^{86}Sr$ values of 0.7098 in its enamel and 0.7104 in the dentine, which correspond

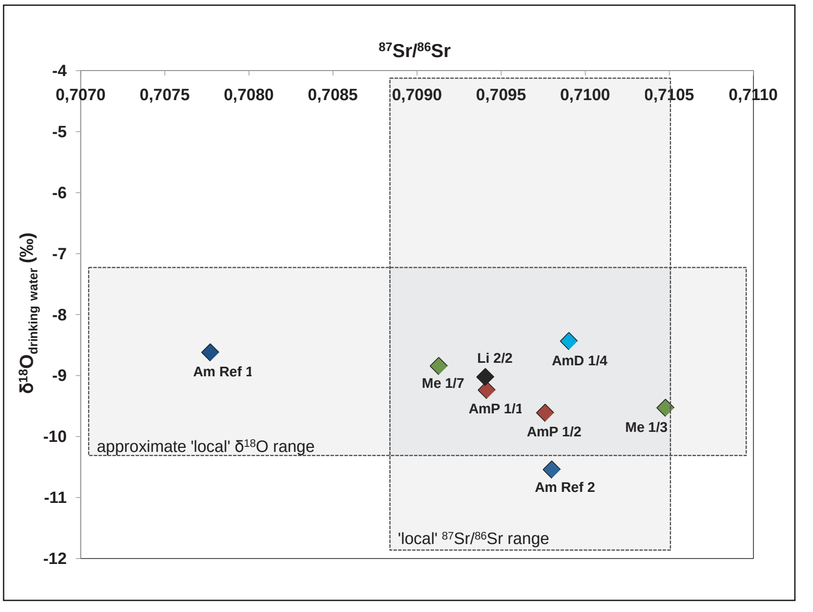

Fig. 8. ^{87}*Sr/*^{86}*Sr and* $\delta^{18}O_{drinking\ water}$ *(*CHENERY *et al. 2012) values of the analysed humans and cattle. The 'local' strontium and oxygen ranges are displayed in dashed grey frames*

well with the Sr isotopic range of the human individuals (see below) and are consistent with the geological regions of the environment. The ^{87}Sr/^{86}Sr values of the Coțofeni cattle were 0.7075 (enamel PM 1), 0.7078 (enamel PM 2) and 0.7090 (dentine in PM 2). The results of the two enamel samples are consistent with the surrounding Mesozoic rocks which should result in a ^{87}Sr/^{86}Sr range between 0.707 and 0.709. There is no consistency between the signatures of the two enamel samples and the signature of the dentine sample from tooth 2, which plots at the lower end of the human data set. Furthermore, three samples of underlying crown dentine from the human teeth were selected for the establishment of the bioavailable ^{87}Sr/^{86}Sr range, and these exhibit a range of 0.7090 to 0.7097. Given the fact that all sample sites are located within a small radius and are located on similar geology, the results of all proxies, i.e. the dentine ^{87}Sr/^{86}Sr values of animals and humans, were combined. This resulted in a mean of 0.7095 ± 0.0011 (2σ) and a range of 0.7084 to 0.7107 for the 'local' biologically available strontium. The Coțofeni cattle enamel samples fall outside this range thus suggesting they may not be representative of the local biologically available strontium. If this is the case, it would not be relevant to use them in the calculation of the local range, and if excluded a more precise local range of 0.7088 to 0.7105 with a mean of 0.7097 ± 0.0009 (2σ) can be proposed.

The six human individuals from Ampoiţa-Doştior, Ampoiţa-Peret, Meteş-La Meteşel and Livezile share similar ^{87}Sr/^{86}Sr values with a strontium isotope range of 0.7091 to 0.7105 and a mean equal to 0.7097 ± 0.0005 (1σ) *(Table 1, Fig. 8)*. Considering that four different sites were sampled, the human individuals form a relatively tight cluster. One individual, burial 3 in burial mound 1 at Meteş-La Meteşel has a strontium isotope value higher than the majority of the others but still within the limits of what can be considered the 'local' bioavailable strontium range. The only exceptions are the very low strontium isotope enamel values of the Coțofeni cattle, which is far off this range.

Strontium concentrations *(Table 1)* ranged between 53 and 250 ppm in human tooth enamel and from 70 to 301 ppm in human tooth dentine, which is considerably lower than for the faunal teeth analysed. In fauna, strontium concentration ranges were 175 to 338 ppm in enamel and 470 to 580 ppm in dentine. With the exception of the very low strontium concentration of the human skeleton's dentine in Livezile burial 2 tumulus 2, the results are in line with expectations.

The oxygen stable isotope composition of meteoric or rain water varies according to geographic location. An approximate idea of expected δ^{18}O values in the eastern belt of the Apuseni Mountains was gained using the Online Isotopes in Precipitation Calculator (OIPC; BOWEN – REVENAUGH 2003; BOWEN – WASSENAAR – HOBSON 2005), which is based on data primarily derived from the International Atomic Energy Association (IAEA) and the Global Network for Isotopes in Precipitation (GNIP). The

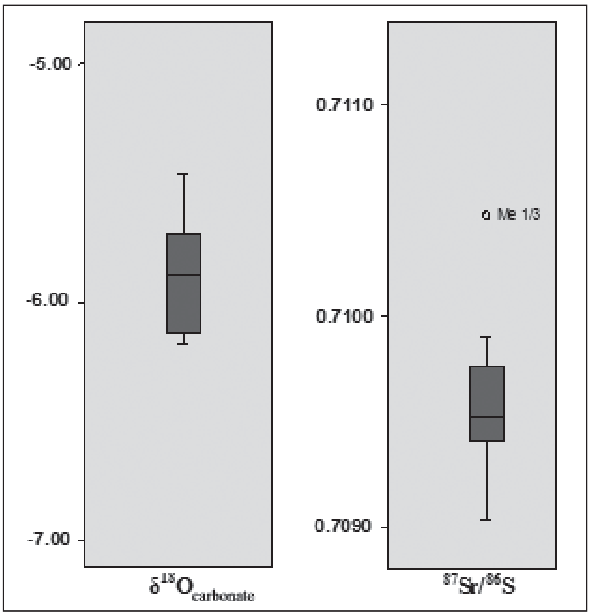

Fig. 9. Box plots of $^{87}Sr/^{86}Sr$ and $\delta^{18}O_{carbonate}$ data of the human tooth enamel. The box plots divide a distribution according to the inter-quartile range, with the box containing 50% of the values. Possible outliers are marked by circles

calculation of the estimated mean annual oxygen isotope composition in modern precipitation results in $\delta^{18}O$ values of approximately –8.2‰ given an altitude of 500 m NN. Mountain peaks in the vicinity of the sites, where drinking water sources originated, can reach much higher altitudes (DIERCKE 1988, 110–111). When altitudes of 1000 m are taken as a basis, OIPC-$\delta^{18}O$ values average at –9.2‰.

The human tooth enamel $\delta^{18}O_{carbonate}$ values range between –6.18 and –5.46‰ (V-PDB; 24.54 to 25.28‰ V-SMOW). It can be assumed that modern rain water is roughly representative of past values (CHENERY *et al.* 2010) and to enable a comparison with the meteoric water the regression equation of CHENERY *et al.* 2012 was applied. Calculated $\delta^{18}O_{drinking\ water}$ values cluster between –9.61 and –8.43‰ *(Table 1, Fig. 8)*. This is a narrow range, even when considering the minimum 1‰ uncertainty created when converting $\delta^{18}O_{carbonate}$ into $\delta^{18}O_{drinking\ water}$ values (POLLARD – PELLEGRINI – LEE-THORP 2011).

The cattle from the Petreşti settlement from Ampoiţa gave a $\delta^{18}O_{carbonate}$ value of –7.46‰ (V-PDB; 23.22‰ V-SMOW) and –10.54‰ using the drinking water equation by D. D'Angela and A. Longinelli 1990. The cattle from the Coţofeni settlement at the same site resulted in an oxygen isotope value of –5.54‰ (V-PDB; 25.20‰ V-SMOW) and –8.62‰ (using D'ANGELA – LONGINELLI 1990), respectively.

The combination of $\delta^{18}O$ and $^{87}Sr/^{86}Sr$ values creates a relatively clustered data set, and all oxygen isotope ratios are more or less consistent with the estimated 'regional' $\delta^{18}O$ range *(Figs 8–9)*. However since strontium isotope ratios can be more informative than oxygen isotopes for tracing mobility on a small spatial scale, the cattle from the Ampoiţa Coţofeni settlement can be considered a true outlier due to their distinct $^{87}Sr/^{86}Sr$ signature. Furthermore, the skeleton Meteş 1/3 is a potential human outlier although it does plot at the margin of the 'local' bioavailable Sr range.

Data interpretation and discussion

The majority of the selected samples (Meteş burial 7 mound 1, Livezile burial 2 mound 2 and Ampoiţa-Peret burial 1 mound 1) cluster between $^{87}Sr/^{86}Sr$ 0.7090 and 0.7100 and $\delta^{18}O$ –10 to –8‰ *(Fig. 8)*. These isotopic values are probably the results of mixing signatures between Cenozoic and Mesozoic derived strontium and water sources deriving from different altitudes. Both can be found within the close surroundings and do not necessarily indicate movements on a larger scale. It is more probable, however, that mobility patterns were small-scale only and included movements between different geographic regions and varying altitudes, e.g. in association with mobile herding, the use of different pastures or the exploitation of mineral resources in the mountains whilst mainly living in the river valleys. Nevertheless, these results can also be the product of settled lifeways in connection with various food resources and water sources.

There is one probable outlier only, Meteş burial 3 in mound 1, which gave the highest $^{87}Sr/^{86}Sr$ value of the date set in combination with one of the most depleted $\delta^{18}O$ values. The values are however

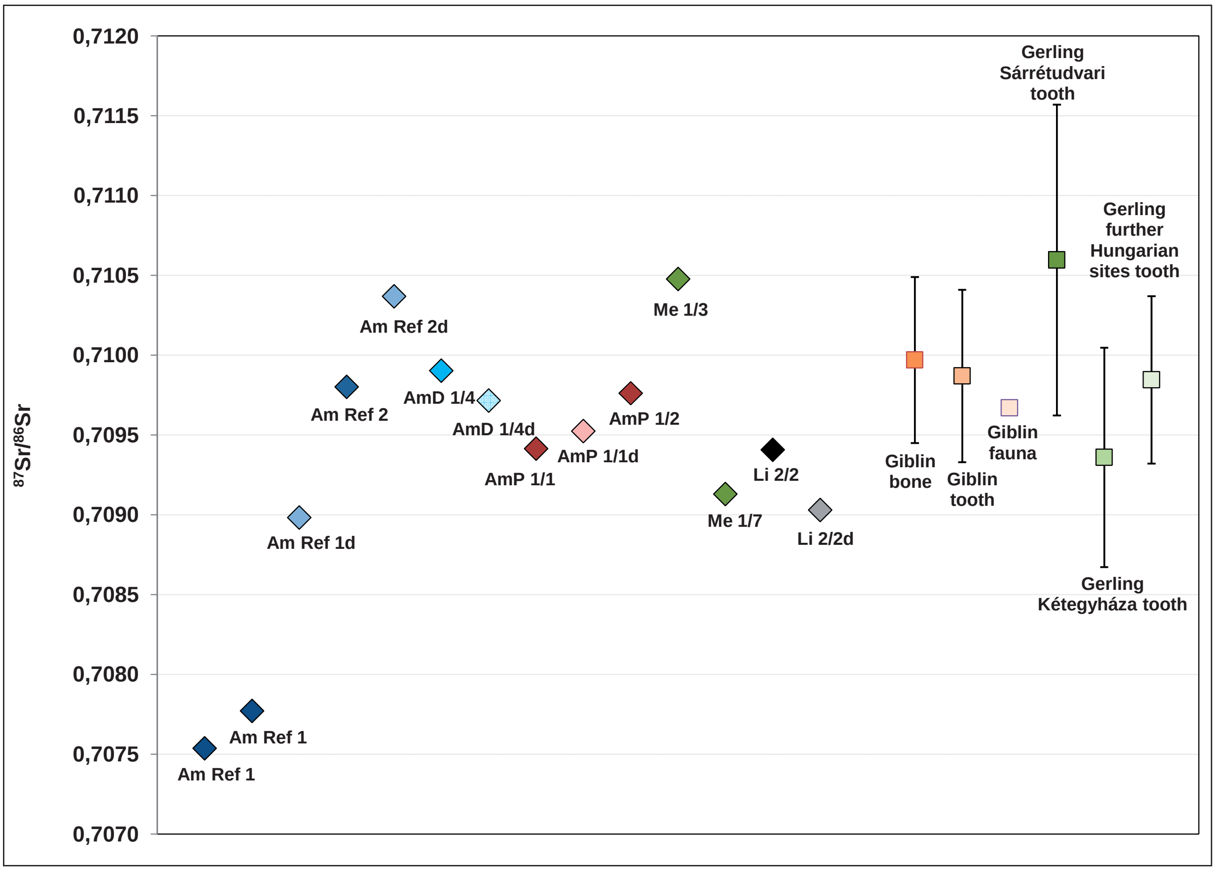

Fig. 10. Comparison of the Transylvanian $^{87}Sr/^{86}Sr$ data to the data set from eastern Hungary (GERLING et al. 2012a; 2012b; GIBLIN et al. 2013). Gerling: n $^{87}Sr/^{86}Sr_{human\ dental\ enamel}$ = 24; Giblin: n $^{87}Sr/^{86}Sr_{human\ dental\ enamel}$ = 123, n $^{87}Sr/^{86}Sr_{human\ bone}$ = 45, n $^{87}Sr/^{86}Sr_{fauna}$ = 60. Given are mean $^{87}Sr/^{86}Sr$ values with 2σ standard deviations

still within the broad 'local' isotopic ranges. The skeleton belongs to a secondary grave, which did not contain any burial objects. Therefore, it is difficult to decide if the burial is also an outlier regarding the archaeology.

One of the key aims of this study was to produce further comparative isotope data for Late Copper Age/Early Bronze Age sites from the Eastern Hungarian Plain, for which – based on former archaeological and isotopic evidence – a connection to this region was suggested (GERLING *et al.* 2012a; 2012b).

Claudia Gerling and her colleagues applied strontium and oxygen isotope analyses on 20 Copper Age and Early Bronze Age human skeletons from eastern Hungarian burial mounds. Ratios of $^{87}Sr/^{86}Sr$ ranged between 0.70916 and 0.71157 and ratios of $^{18}O/^{16}O$ fell in the range of –6.98 to –4.02‰ (V-PDB; 23.72 to 26.76‰ V-SMOW; –10.83 to –5.98‰ using the conversion by CHENERY *et al.* 2012). They argued for a potential connection between the outlier human individuals from the east Hungarian Sárrétudvari-Őrhalom mound and the archaeological cultural remains of Early Bronze Age Transylvania and the Livezile group (GERLING *et al.* 2012a). These assumptions were based on the combination of the archaeological evidence, alongside the more radiogenic $^{87}Sr/^{86}Sr$ and more depleted $\delta^{18}O$ values that were seen as indicators for a region of origin which is more mountainous and built of older geology further to the east. The authors argued for a potential connection to the sites under discussion in the present study, in the knowledge that no comparative skeletal remains from Romanian Transylvania were available at that time.

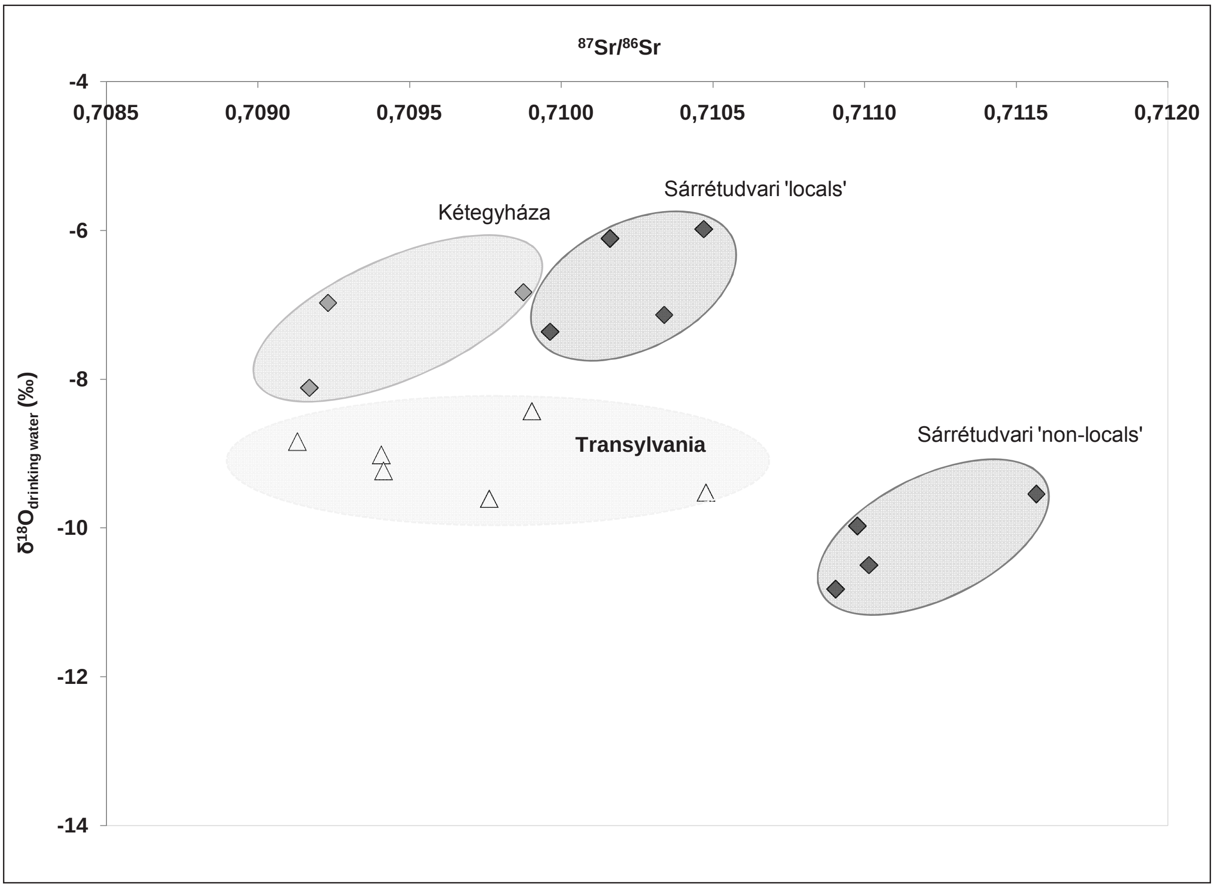

Fig. 11. Comparison of the Transylvanian $^{87}Sr/^{86}Sr$ *and* $\delta^{18}O_{drinking\ water}$ *(*CHENERY *et al. 2012) data to the data set from eastern Hungary: Sárrétudvari-Őrhalom (n=8) and Kétegyháza-Kétegyházi tanyák (n=3;* GERLING *et al. 2012a; 2012b)*

Previous major stable isotope work in the Eastern Hungarian Plain was conducted by Julia Giblin (GIBLIN 2009; GIBLIN *et al.* 2013), who applied strontium isotope analysis to investigate human mobility during the Neolithic and Early Copper Age. Based on more variable $^{87}Sr/^{86}Sr$ ratios of the Copper Age human individuals it was concluded that a shift to a more mobile lifestyle, including the acquisition of resources from a wider geographic radius, occurred. They found this being in parallel with increased social interaction. The restricted $^{87}Sr/^{86}Sr$ variability led the authors to conclude that although a change towards pastoralism based on cattle herding was suggested by different authors (e.g., BÖKÖNYI 1988; BÁNFFY 1994), there was limited movement within the Great Hungarian Plain without an extensive use of the eastern uplands' resources (GIBLIN *et al.* 2013, 227–237).

A comparison between the Transylvanian $^{87}Sr/^{86}Sr$ data and the sample set obtained from burial sites in eastern Hungary (study J. Giblin and her colleagues) reveals a considerably good correlation *(Fig. 10)*. Comparing the data to the burial mounds in eastern Hungary in the studies of C. Gerling and her colleagues, it is found that the Transylvanian data sit approximately in the middle of what can be reconstructed a triangle of the $^{87}Sr/^{86}Sr$ samples from Sárrétudvari-Őrhalom and Kétegyháza-Kétegyházi tanyák *(Fig. 11)*. Furthermore, they take an intermediate position between the much depleted $\delta^{18}O$ values from Sárrétudvari-Őrhalom and the less depleted ones from the same site and from Kétegyháza-Kétegyházi tanyák. In the light of this complemented data set it can be assumed that the isotopic outliers from Sárrétudvari-Őrhalom do not agree with the results from the selected Transylvanian sample sites. They exhibit much more radiogenic $^{87}Sr/^{86}Sr$ and marginally more depleted $\delta^{18}O$ values.

On the basis of the archaeological evidence a close connection between eastern Hungarian burial mounds like Sárrétudvari-Őrhalom, the Transylvanian Livezile group and the Early Bronze Age cultural communities of the East European steppes has been suggested (e.g., Dani – M. Nepper 2006, 41–44; Dani 2011, 29–33 with further literature). The burial rite combines elements of non-local origin, e.g. the erection of burial mounds and foreign ceramic inventories, with local traditions like the absence of pit graves and the building of stone coverings in the burial mounds. Copper and gold ornaments give hints to the exploitation of mineral resources of the Carpathian Mountains region and can be regarded as characteristics of an emerging Early Bronze Age elite (Ciugudean 2011, 29). Both the mixed $^{87}Sr/^{86}Sr$ values of this sample set and the marginally too depleted $\delta^{18}O$ might be interpreted as indicators of a comprehensive use of lowland and upland at the foothill of the Apuseni Mountains.

The two animals, one cattle from a Petreşti settlement and one cattle from a Coțofeni settlement resulted in highly variable $^{87}Sr/^{86}Sr$ and $\delta^{18}O$ values. In addition, the Coțofeni cattle differed from the calculated 'local' biologically available $^{87}Sr/^{86}Sr$ and 'regional' $\delta^{18}O$ ranges.

The question why the cattle is an isotopic outlier can be approached by considering various aspects of the economy of the Coțofeni cultural communities, whose cultural remains are distributed in Transylvania and adjacent regions (e.g., Roman 1976; 1977; Ciugudean 2000). The diversity of site locations, the lowland, altitudes up to 1000 m and even rock shelters and caves, can be understood as hints to the presence of transhumant pastoralism (Ciugudean 2000, 114). Although thorough zooarchaeological research for the 3rd and 2nd millennia BC in Romania is missing, Cornelia Becker (Becker 2000) was able to draw significant conclusions about the Copper Age–Early Bronze Age economy in Transylvania based on the faunal material from the sites Poiana-Ampoiului and Livezile; the predominant sources of meat at the settlement of Poiana-Ampoiului 'Piatra Corbului' were domestic animals, in particular sheep/goat and cattle, whereas wild animals were of minor importance (Becker 2000, 71–73). The predominance of ovicaprine herding in comparison to wild animal hunting was also attested for Livezile (Becker 2000, 74–76).

Even though no sequential $^{87}Sr/^{86}Sr$ and $\delta^{18}O$ sampling was applied to the two animals of the present study, the distinct isotopic signature of the Coţofeni cattle might be regarded as another indicator for transhumant herding alongside the predominance of small ruminants and the presence of small and potentially seasonal settlements and burial sites at higher altitudes. Transhumant pastoralism can be defined as "an animal and land use strategy involving the movement of herds of domestic herbivores between altitudinally differentiated and complementary seasonal pastures" (Geddes 1982; Bartosiewicz – Greenfield [eds] 1999, 15). In the Carpathian Mountains transhumance follows a long tradition, and transhumant sheep herding is evidenced until the 19th century (Avram 1992; Becker 2000, 87–88), where herding routes attest regular movements between the highlands like the Apuseni Mountains and the surrounding lowlands (Irmie 1965, 14; Zöbl 1982, Fig. 22).

Conclusions

In total, the data set is relatively consistent without large variability. The geographic locations of this series investigated suggest that most of the samples are the result of mixed signals from variations in the local geology and between water sources from the mountain water sheds and the mid-uplands or lowlands. The isotopic results point to small-range movements including the exploitation of different water and food sources within a specific distance from the sites. A human skeleton, burial 3 in burial mound 1 from Meteș-La Meteșel, and the cattle from the Coţofeni settlement in Ampoiţa-La pietri, can be considered the only isotopic outliers. A hint at the use of various pastures and/or different herding practices is given by the clear variation between the two animals analysed from Ampoiţa-La pietri despite both animals belonging to two different cultural settlements. Furthermore, the isotopic outlier samples from Sárrétudvari-Őrhalom on the Eastern Hungarian Plain are in no clear accordance with the Transylvanian sample set.

This investigation served as a pilot study to test the conclusions derived from the sample set in the Eastern Hungarian Plain (GERLING 2012; GERLING *et al.* 2012a; 2012b) as well as to gain first insights into Livezile mobility patterns and economy. The data suggests there was restricted or small-range mobility in the highlands of western Transylvania during the Early Bronze Age, and that different pastures or herding practices were used by chronologically similar cultural groups.

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The Significance of the Metallurgy at the Beginning of the Third Millennium BC in the Carpathian Basin

JÁNOS DANI

Abstract

This article is dealing with the first series and significance of the copper shaft-hole axes, no doubt the most important metallurgical product of its era, used throughout the third millennium BC in the Carpathian Basin. Besides discussing the typo-chronology of the major axe groupings, i.e. Bányabükk, Fajsz, Corbasca, Kömlőd-Kozarac, Nyírtass, Dumbrăvioara, etc., it is made an attempt to the cultural attribution of the various types. However also the social and economic, and technological points of view are being discussed for the beginnings of the Bronze Age. The technology of copper shaft-hole axe production (processing of ores, casting, use of bivalve or tri-partite moulds) was probably known from the first quarter of the third millennium BC, while the use of real tin-bronzes began just at the end of the Early Bronze Age, approximately around 2000 BC. There was thus a relative long period, which we can call an 'experimental period'. During this time span several metal sorts were used in the alloying process. Based on analyses of the earliest Bronze Age metals, we can identify various added metals (first of all arsenic, gold and silver, bismuth, etc.), consequently the existence of various copper alloys and some knowledge about properties. Summarising the currently available data, an eastern European origin of this weapon and symbol of power is assured. However concurrently certain local features can be detected making it a multicultural phenomenon of the local Late Copper and Early Bronze Age. The Carpathian Basin was not only a passive adaptive zone, but it was an innovative secondary centre (as it was earlier in the Early and Middle Copper Age) with newly developed metal types and metallurgical methods. With the intensive exploitation of local ore sources, and the flourishing of the production of shaft-hole axes, the Carpathian zone played an important role in the further distribution of Early Bronze Age metallurgy to western and southern Europe.

Introduction

The definition of the beginnings of the Early Bronze Age in eastern-Central Europe is a hard and – to my mind – a rather impossible task, already dealt with by some scholars (VULPE 2001; KIENLIN 2010, 118–121; 2013, 415–419). However, the latest contribution by Volker Heyd shows most expressively the conflict between archaeological theories, chronological systems and terminologies (HEYD, this volume). Whatever a future conclusion can be, surely the most significant items of the Early Bronze Age metallurgy are the copper shaft-hole axes. The collection and the separated mapping of the various types of shaft-hole axes is therefore an important contribution and can show an interesting, and perhaps more nuanced picture not just about their distribution but also the wider chronological relationship of these objects.

The shaft-hole axes in the wider Carpathian Basin

The horizon of the Bányabükk/Vâlcele shaft-hole axes made of copper dates to the very end of the Copper Age (Baden culture) as recently highligthed by some scholars (HANSEN 2010, 305; 2011, 142–144; SZEVERÉNYI 2013, 666; HEYD, this volume), which concurrently means that a "...'metal crisis' of the second half of the fourth millennium did not exist" (HANSEN 2011, 146). It is for sure that the first metallurgical innovation and maybe inspiration (in this case the metallurgical technology and the

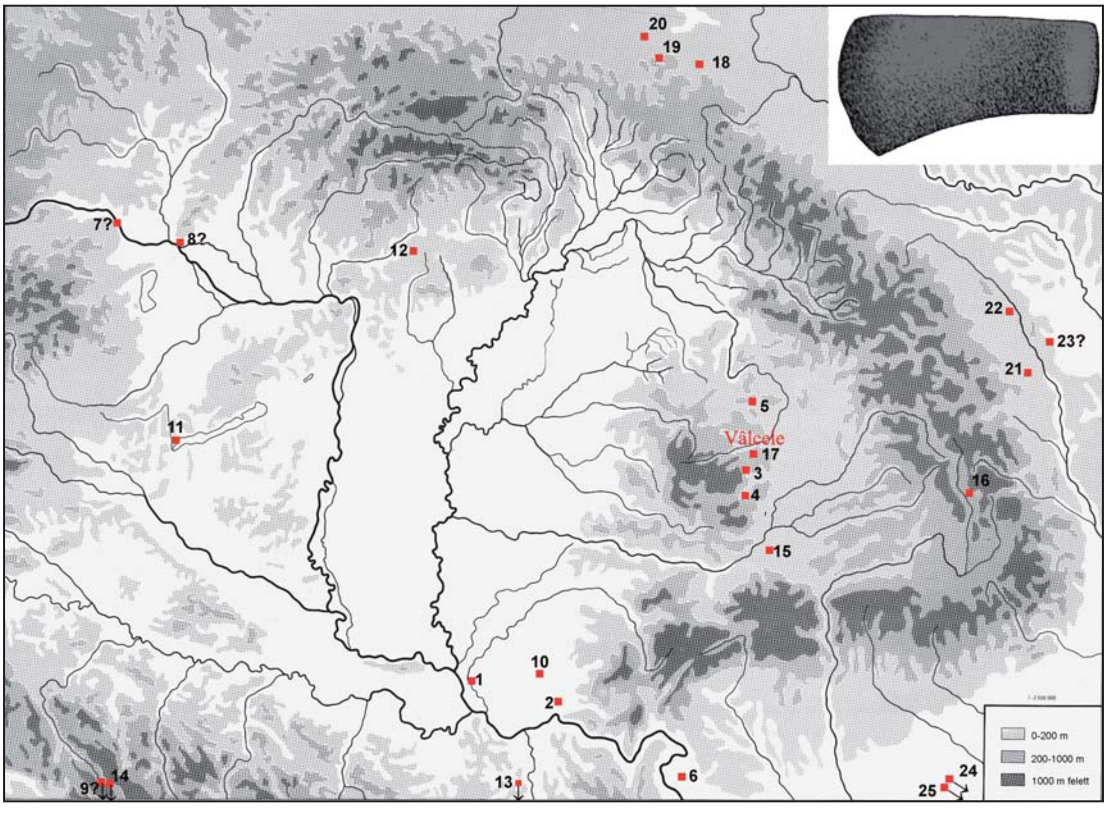


Fig. 1. Distribution of the Bányabükk type shaft-hole axes in the Carpathian Basin (cp. the Appendix 1)

production of the Bányabükk type axes) arrived from eastern Europe and the Caucasus region (BÁTORA 2003; KAISER 2005; CHERNYKH 2008, 79–82; HANSEN 2009a, 36; 2009b 145–149; 2011, 143–145) at the end of the fourth millennium BC. This is the same period than the east-Central European Late Copper Age *(Fig. 1, Appendix 1).* Based on the overall distribution of this type, it is obvious that the production of the Bányabükk/Vâlcele axes must be seen as an "international phenomenon" and connected to the wider "Baden Complex" comprising also contemporaneous cultures and groups such as Coţofeni, Nakovani, Jevišovice, late Funnel Beaker, Globular Amphora Culture, etc.

After this above outlined prelude, some time in the first quarter of the third millennium, a new age, namely the Early Bronze Age, dawns and with it come new types of shaft-hole axes. One of these new types are the so-called Fajsz type axes. Unfortunately, the far majority of these axes are found as scattered items and single finds, so that we must be content to get for most of them at least their provenance right. From the point of view of the dating of these Fajsz type axes, the Brno-Lišeň (Staré Zámky) metal depot (BENEŠOVÁ 1956; ŘÍHOVSKÝ 1992, 36, Taf. 85A) is thus of cardinal importance, as this depot securely turned up in the Jevišovice B-Řivnač layer. The age of this Eneolithic layer of Staré Zámky is well-specified with the contemporaneous Starý Lískovec site's calibrated radiocarbon dates, which are between 3090–2470 BC (in a 2σ calibration) (JOHN 2010, Tab. 9).[1] The samples classified as Fajsz type are spread all over the Carpathian Basin, except for the southern and southwestern parts of Transdanubia (DANI – KIS-VARGA 2000, 28, Fig. 2). Probably, they did not gain ground here, because firstly the Vučedol and later the Somogyvár-Vinkovci cultures living here were primarily characterised with manufacturing and using first of all the so-called Kömlőd-Kozarac type axes.

[1] According to Jozef Bátora and Jochen Görsdorf it is 2890–2770 BC (BÁTORA 2003, 33). After Maximilian O. Baldia and his colleagues the sequence falls between 3100/3000 and 2850 BC (BALDIA – FRINK – BOULANGER 2008, 43, Fig. 18).

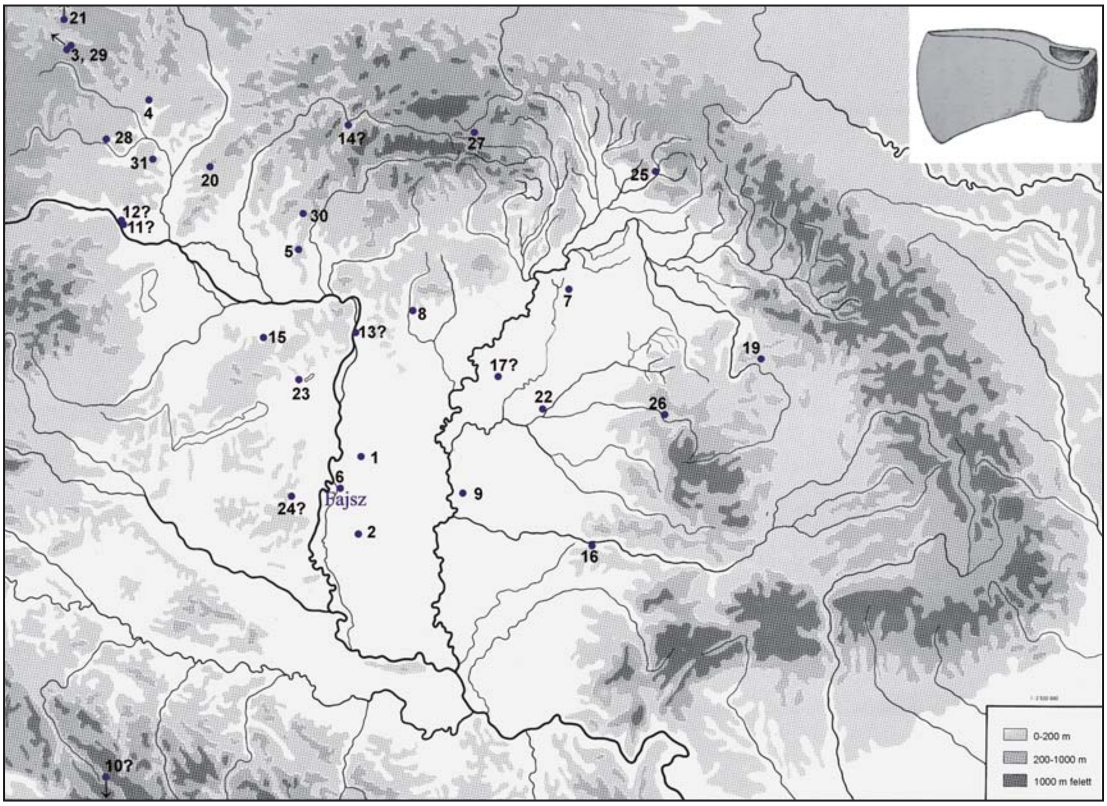


Fig. 2. Distribution of the Fajsz type shaft-hole axes in the Carpathian Basin (cp. the Appendix 2)

Taking a look at the geographical distribution, we can conclude that the Fajsz axe is the only type of shaft-hole axe whose distribution more or less concurs with the distribution territory of the Makó culture *(Fig. 2, Appendix 2)*. Based on this observation, we can at first sight assume that the Fajsz axes are to be considered as the true legacy of the Makó metallurgy, and that of its neighbouring and partly contemporary cultures. However, the only absolutely dated find of Brno-Líšeň refers to the earlier Final Eneolithic period defined by Jevišovice B/Mödling-Zöbing, Řivnač, Cham, etc. At the same time it means more than that and both the Bányabükk and Fajsz types – previously considered to be contemporaneous – indicate at least partly consecutive chronological horizons. We can thus define the Fajsz type as a local axe type unambiguously developed in the Carpathian Basin.

Metallurgy of the first Early Bronze Age culture, the so-called Makó culture, however, cannot be considered as uniplanar. Apart from applying here the Fajsz type axes due to the mould-depots found in the Vel'ký Meder/Nagymegyer site (Hromada – Varsik 1994) and the recently excavated Site 5 of Üllő (Kővári – Patay 2005), also the Kömlőd-Kozarac type axes must be placed here. Their technological advance in production, when compared to the Bányabükk and Fajsz types, can be verified by the existence of some intact three-piece-moulds.[2] Pit no. 5605 of the Üllő site with the metalworking debris deposition is well dated to 2470–2340 BC (in a 1σ calibration), meaning that the settlement was also in use during the later phase of the Makó culture (Kővári – Patay 2005, 124).

Taking a look at the finds which are indicative for the production of axes in the Early Bronze Age, one gets a startling picture: there are hardly any other types of axe-moulds found in the territory of

[2] This contradicts to the ideas of David Liversage, according to which a Lišen-Fajsz – Kozarac-Zók – Kömlőd-Stubło chronological sequence exists. In his opinion the Fajsz type can still be connected to the Baden culture, while the Kozarac type belongs to the Zók-Vučedol culture; the treasures from Dunakömlőd and Stubło can then be dated to the beginnings of the Reinecke A1-period (Liversage 1994, Table I. 95–96).

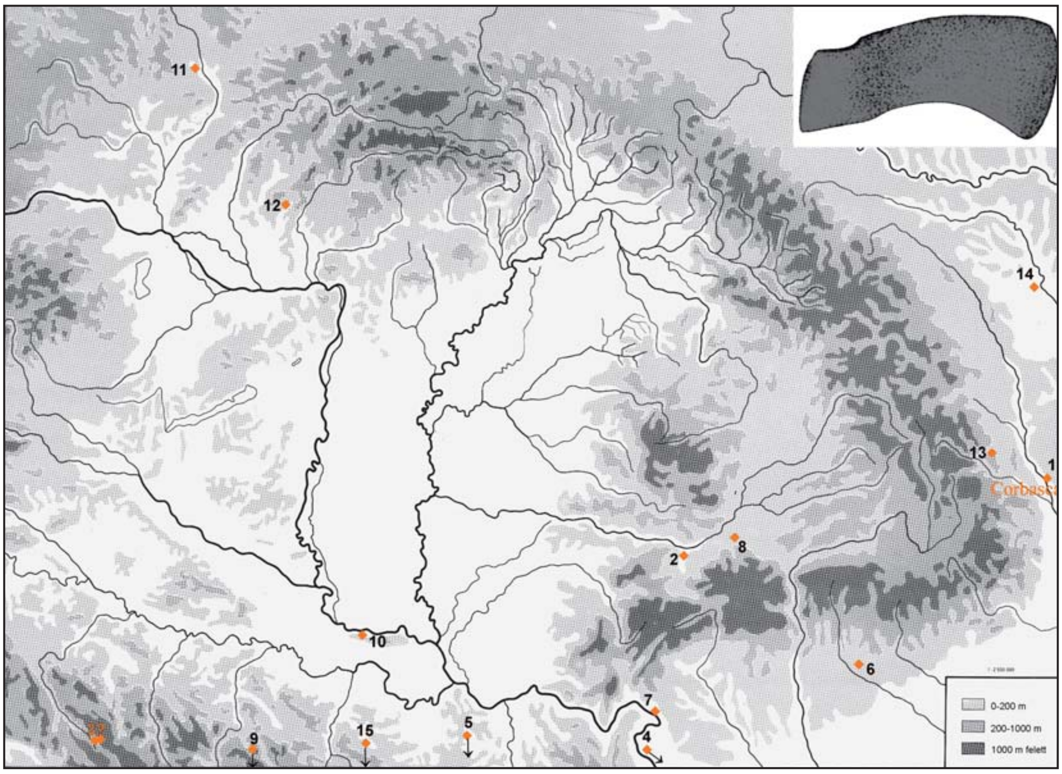


Fig. 3. Distribution of the Corbasca type shaft-hole axes in the Carpathian Basin (cp. the Appendix 3)

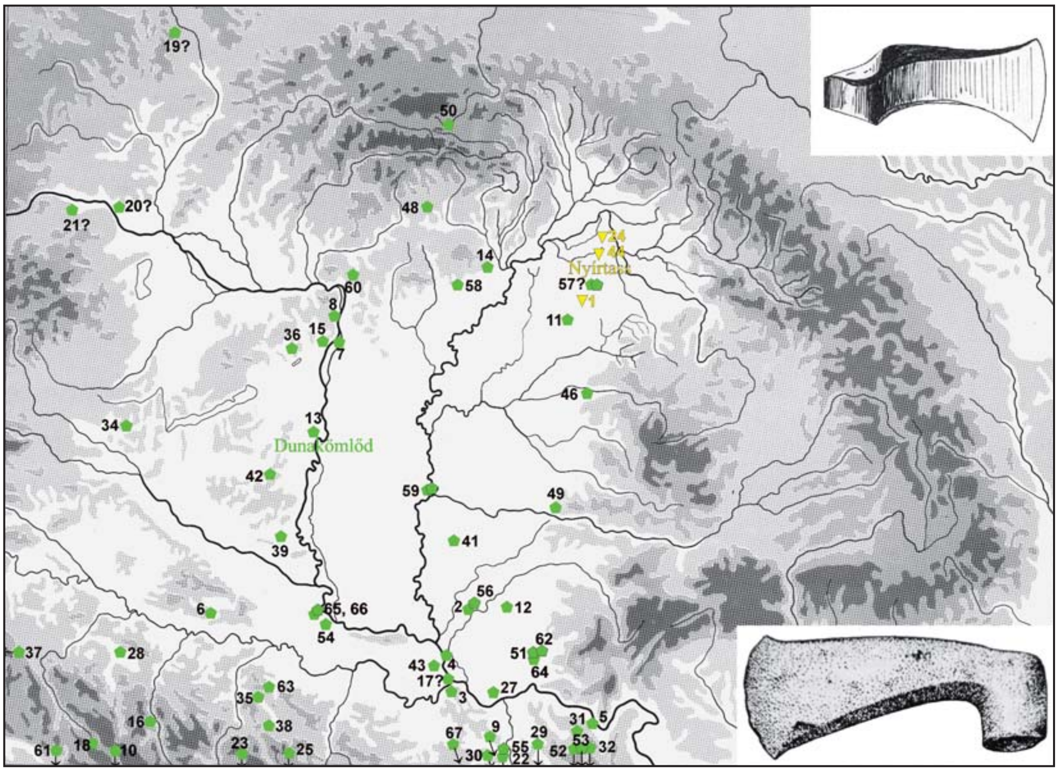


Fig. 4. Distribution of the Kömlőd-Kozarac (⬟)and Nyírtass (▼) type shaft-hole axes in the Carpathian Basin (cp. the Appendix 4)

the Carpathian Basin than the Kömlőd-Kozarac type *(Fig. 6, Appendix 6)*. The only exception are the moulds that turned up in the Zók-Várhegy site. Here a piece of archaic type (Corbasca or Bányabükk?) axe mould were also found and not just those of Kömlőd-Kozarac-type axe moulds (ECSEDY 1983, Pl. XIII. 2, Pl. XIV. 5). Consequently, this hillfort settlement is of cardinal importance because it verifies the contemporaneous production of two different types of axes (ECSEDY 1983, 84).

The Corbasca type axes are in a close typological connection to the Fajsz axes based upon the system of Alexandru Vulpe (VULPE 1970, 29–30, Abb. 1). The Ostrovul Corbului I hoard, which was found in a clay-vessel in a there settlement of the Glina III-period, renders help to date this axe type (VULPE 1970, 30, Taf. 65. E), although one has to remark that the dating of this depot does not seem to be so univocal because Coţofeni-Kostolac and late Vučedol finds were also excavated at this site. Furthermore, in the Ostrovul Corbului I hoard the Corbasca axes are accompanied by two other axes, very similar to the Fajsz type (VULPE 1970, 30, Taf. 65. E). On the basis of this combination, it may be presumed that the production of the Corbasca type copper axes can be dated to the end of the Late Copper Age or to the beginnings of the Early Bronze Age (VULPE 1970, 28, Abb. 1; GOGÂLTAN 2000, 232) *(Fig. 3, Appendix 3)*.

When comparing the distribution of the Fajsz and the Corbasca types, it is an interesting fact to see the Corbasca type axes' distribution to fits very well with that of the first one. However, the Fajsz type seems to be a pure Central Carpathian axe, whilst the Corbasca axes more link to the southern part of the Carpathian Basin and to the Lower Danube region. But, no doubt, they must have been in use at the same time. The Žitavany hoard in Slovakia, which yielded a Fajsz and a Corbasca axe, also confirms this contemporaneity (NOVOTNÁ 1957, 309–310, Tab. II. 1ab, 2ab; 1970, 27, Taf. 8. 137–138).

The main research insufficiency when classifying the Early Bronze Age shaft-hole axes into various types lies in the typological systems and denominations divided into countries. This statement is particularly valid in the cases of Dunakömlőd, Kozarac, Dumbrăvioara/Sáromberke, Stubło type axes. I agree with those scholars (e.g., Aleksandar Durman, Florin Gogâltan, Tibor Kovács) who already realized some time ago that these axe types are basically the same, or – in a better description – that they can be ranked into the same type. Perhaps it is the best statement to say that they all can be regarded as local variants of a type that spread over a greater area (DURMAN 1983, 64–65; KOVÁCS 1996, 115; GOGÂLTAN 2000, 233–234; HORVÁTH 2001, 53).

When looking at these distribution maps it becomes obvious that this (Dunakömlőd–Kozarac–Dumbrăvioara/Sáromberke–Stubło) type is of a southern Carpathian Basin / northern Balkanic origin whose production began – proofed by the moulds discovered so far – in the classical period of the Vučedol culture (ECSEDY 1983, 84–85). This is supported by the fact that most of the hoards and depositions containing these types of axes have come to light in the eastern parts of Croatia, in Serbia, in Montenegro and in Bosnia-Herzegovina. Their production proceeded into the late phase of the Vučedol culture and their metallurgical legacy is still to be seen in the local post-Vučedol cultures *(Fig. 4, Appendix 4)*. This also includes the Makó as well as the Somogyvár-Vinkovci culture. Based on the spatial distribution of both axes and moulds it might well do that the Makó and Somogyvár-Vinkovci cultures play an important role in the spreading of these Kömlőd-Kozarac type axes (KALICZ-SCHREIBER 1991; KOVÁCS 1996, 119). The sheer volume of metalwork now, and of course the production of exactly this type had reached a real "boom". This is not only visible by the overall number of axes per hoard, but also by the occasional use of precious metals (silver, electron) as well as by a relatively larger number of moulds. Nevertheless, this axe type and its improved variants were used for quite a long time. Based on the axes excavated for instance in Mokrin Grave 208,[3] or particularly the one from the Emőd-Nagyhalom site,[4]

[3] Based on the calibrated radiocarbon results for the Grave 208 of the Mokrin cemetery (*ca*. 2200–2020 BC), it could be dated to the Early Bronze Age III-period (GIRIĆ 1971; GOGÂLTAN 2000, 233, Taf. 3. 2).

[4] The site in which this shaft-hole axe was discovered solely belongs to the Hatvan culture (KOÓS 1993, 5–6, Taf. 1. 2).

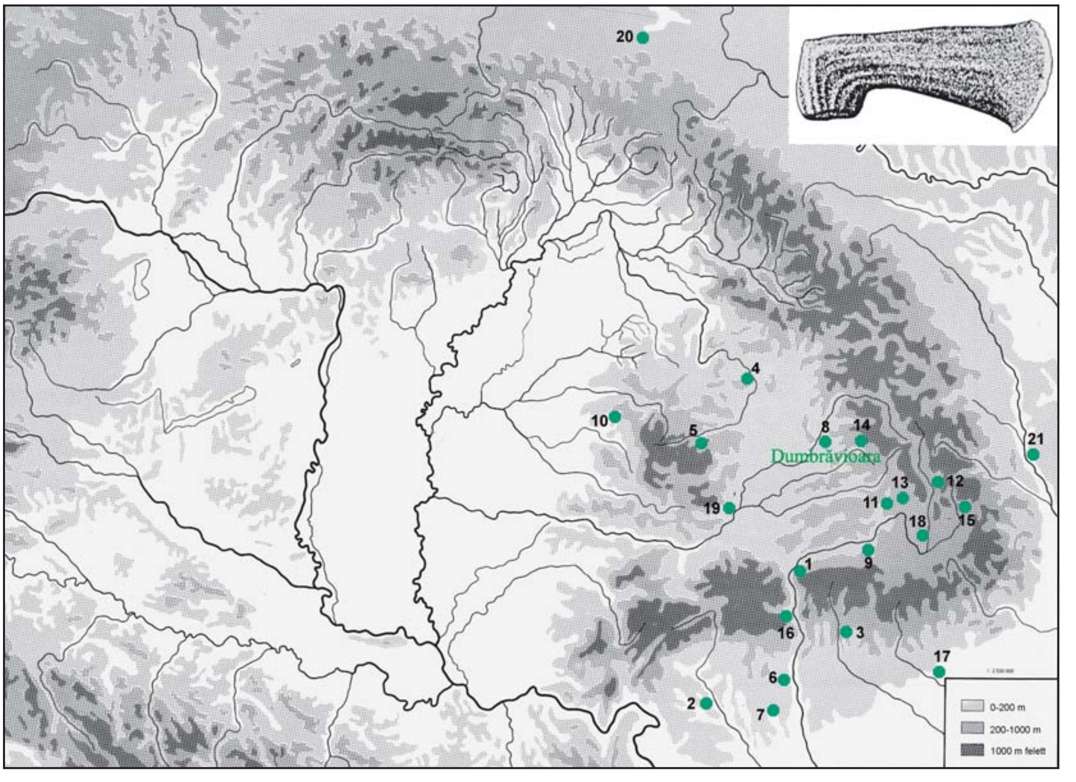


Fig. 5. Distribution of the Dumbrăvioara/Sáromberke type shaft-hole axes in the Carpathian Basin (cp. the Appendix 5)

their production must have continued into the period of the Early Bronze Age III – Middle Bronze Age I of the Hungarian chrono-terminological system. In the territory of Romanian Moldavia, the closest relative of the Kozarac type are the so-called Mărăşti type axes. These are said to have been produced by people of the Târpeşti and Aldeşti archaeological groups and are thus hypothetically dated by Florin Burtănescu to between *ca*. 2700 BC and the 25/24th century BC (Burtănescu 2002, 180–182, Pl. I. 6–9). Later specimens of the Kozarac type family, named Izvoarele and Darabani types respectively,[5] came also to light not only in the well-known Stubło hoard (Antoniewicz 1929; Vulpe 1970, Taf. 70A) but also in the recently published Meżihirci hoard (or perhaps grave furniture?). The latter was assigned to the early phase of the Mierzanowice culture (Machnik – Tkaczuk 2003, 484–486, Fig. 2. 2, Photos 1–2).

The production of the Dumbrăvioara/Sáromberke type axes, being a later but more improved relative to the wider Kömlőd type, can be dated to the period of the Schneckenberg B and Jigodin cultures in Transylvania, as well as of the Roşia group. In the territory of Oltenia it is dated to the Runcuri phase of the Glina culture (Roman – Németi 1986, 230; Vulpe 1988, 210–212; Dénes – V. Szabó 1998, 95–99; Burtănescu 2002, 187) *(Fig. 5, Appendix 5)*. From the point of view of their relative chronology, the axe specimen combined with Schneckenberg B pottery found in Őrkő, and the moulds that turned up together with the Jigodin assemblage at Leliceni/Csíkszentlélek, can be credited to be the most important. This type is also in use in Moldavia – based on the axe found in the site of Răcătău-Cetăţuie – and dates to the there Monteoru Ic3–Ic2 phase, respectively at the beginning of the local Middle Bronze Age (Burtănescu 2002, 187–188, Pl. II. 7).

5 The differences between the three types mentioned above can best be expressed as nuances.

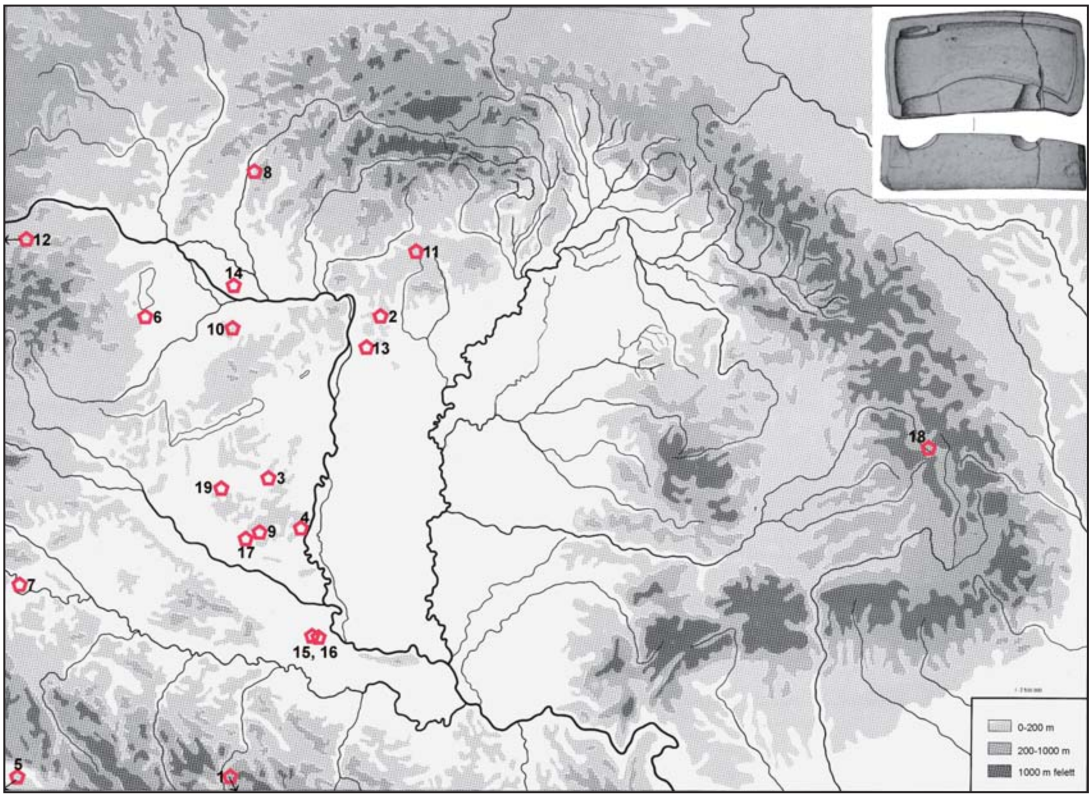


Fig. 6. Distribution of the moulds for shaft-hole axes in the Carpathian Basin (cp. the Appendix 6)

This chronological background has most recently been confirmed by the discovery of a copper shaft-hole axe, which has its best parallels in the Dumbrăvioara/Sáromberke type of Transylvania, in a lavishly furnished grave of the Corded Ware culture at the site of Szczytna, a village in the Rzeszów Voivodeship of the most southeastern part of Poland. This Grave no. 4 (Czopek [ed.] 2011, Fot. 96, 249, 64.15) *(Fig. 5. 20, Appendix 5. 20)*[6] is of a special importance not only from the chronological point of view, and the correlation of the there developed Corded Ware with the Schneckenberg B and Jigodin cultures, but also perhaps in the context of the origins of the rather alien cord decoration known from pots of the eastern Transylvanian Early Bronze Age groups. There is an interesting coincidence when looking at this link between southeastern Poland (its sub-Carpathian part) and eastern Transylvania but a chronological horizon earlier when Globular Amphorae culture graves seem to follow the same trajectory.

Shaft-hole axe contexts and metal analyses in the Upper Tisza region

Among the bulk of early shaft hole axes, only three axes are found in the Upper Tisza region from the territory of the Nyírség culture which is dated to the Early Bronze Age II-period.[7] They represent a specific sub-type in as much as the upper and lower parts of their shaft hole is cut in a slanting direction contrary to the Kömlőd-Kozarac type axes. Also, they do not have a stretched shaft tube. Such examples were found in Kisvárda and its surroundings *(Fig. 8. 1)*, the sites of Balkány-Abapuszta and Nyírtass.

[6] Many thanks to Volker Heyd for this important information.

[7] Other two (till now already lost) pieces of shaft hole axes representing the Kömlőd-Kozarac form are without exact provenance ("Szabolcs county"). They are known only from the original description sheets of András Jósa *(Fig. 9)*.

The latter one *(Fig. 7. 2, Fig. 8. 2)* was made of a very specific “alloy”: besides the copper as its main component (88.2%) it also contains 2.5% silver and, surprisingly, 9.1% gold (!) *(Table 1. 27)*. So far such an alloy has no counterparts in the Bronze Age metallurgy of the Carpathian Basin.

Looking at the parish of Balkány, besides a shaft-hole copper axe *(Fig. 7. 1, Fig. 8. 3)* a narrow and triangular, 5-riveted copper(?) dagger (*Fig. 7. 4*; Kemenczei 1988, Taf. 1. 3) with a triangular grip plaque was also found. It is not clear whether the two belong together, if there is indeed a connection, these two pieces of weapons might be seen as the panoply of a warrior (Kalicz 1968, 46) and thus be regarded as funerary equipments. However, there is also the possibility that they belonged to a – originally perhaps even larger – metal hoard. Finally, it can of course also not be excluded that these two artefacts are not at all connected with each other.[8] This axe could be labelled to be made of a so-called “arsenic copper” as it contained 2.7% arsenic (As), 1.2% lead (Pb) and 1.1% bismuth (Bi) apart from overall 94.3% copper (Cu) *(Table 1. 26)*.

A second dagger with a stretched triangular blade with a mid rip *(Fig. 7. 1, 3)*[9] is also known from the territory of Nyírség (northeastern Hungary), namely from the Hugyaj-Érpatak findspot. Its best parallel is the famous electron dagger (Durman 1988, 59; Vučedol 1988, Kat. 232) found in the Mala Gruda princely burial in Montenegro. Another Hungarian specimen, published by Tibor Kemenczei in the late 1980s (Kemenczei 1988, 9, Taf. 1. 5), is well comparable too although its exact provenance is unknown. According to its metal composition *(Table 1. 25),* this Hugyaj-Érpatak dagger could also be regarded as one of arsenic copper (95.5% Cu and 2.3% As) although the rate of iron in the alloy is surprisingly high (2.0%).

As a summary, it can be concluded that the metallurgy of the Nyírség culture, as far as those few examples can tell, is evidently derived from the south and it ultimately seems to stem from the Late Vučedol in conjunction with some local features. The usage of both the Kömlőd-Kozarac type axes and the triangular shaped daggers give hints to this, whereas the Nyírtass axe could perhaps be better grouped into a specific sub-type, probably of an eastern origin *(Fig. 4)*.

Emerging metallurgical centres in the Carpathian Basin

In terms of producing Early Bronze Age shaft-hole axes, it therefore seems that the Carpathian Basin did not function as a primary, innovative centre at the beginnings of the Early Bronze Age. Rather, the production of these axe types – due to the effect taken by the eastern European (and so indirectly linking the eastern Carpathian Basin to the metallurgical centres in the Caucasus region) steppe Pit Grave/Yamnaya culture (so-called “Yamnaya package” by Richard Harrison and Volker Heyd [2007]) – already began at the end of the Copper Age by using the copper ores available here. I am inclined to think that, due to this aspect, the Carpathian Basin filled the part of an adaptive, secondary centre. As the most western part and gradually the most developing and flourishing region of the “Circumpontic Metallurgical Province” (= CMP) outlined by Evgeny N. Chernykh many years ago (Chernykh 1992; 2008; Chernykh – Avilova – Orlovskaya 2002), it nevertheless played a significant role in further disseminating this Early Bronze Age metallurgy towards the west.

Within this wider secondary centre, the respective copper-ore distributions of the Carpathian Basin facilitated the development of a handful of local manufacturing centres. We are therefore able to reconstruct an Early Bronze Age northern Transylvanian and Upper Tisza region metallurgical centre primarily

8 Both of them come from Balkány-Abapuszta: the dagger, however, is deposited in the collections of Jenő Péchy (Hampel 1886, XVIII. t. 1), while the axe was donated to András Jósa by Albert Darvas.

9 Tibor Kemenczei mentions that a shaft-hole axe was also discovered together with this dagger. In the case of the axe he might have had in mind of the one found at Balkány whose place was, however, not correctly identified. This would mean that it was not discovered at Érpatak.

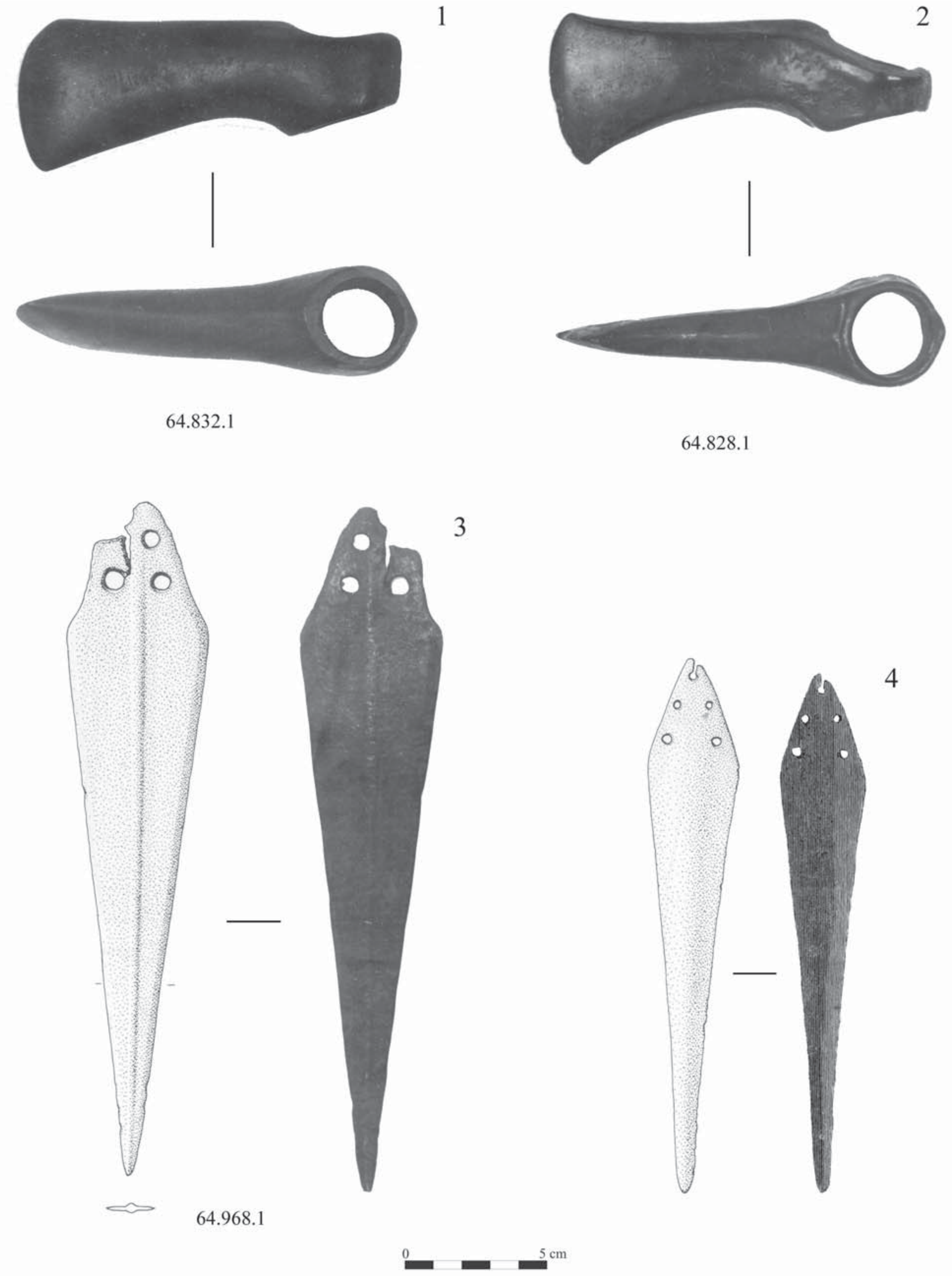
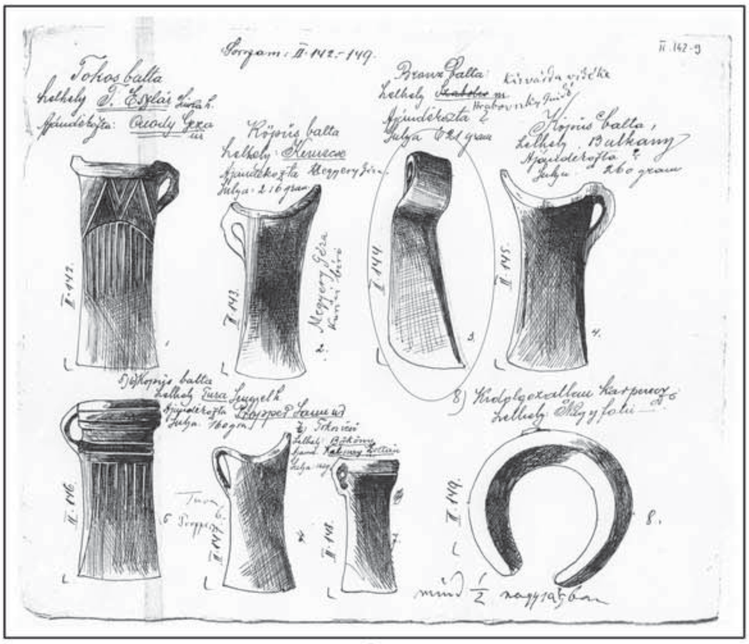


Fig. 7. 1, 4: Balkány-Abapuszta, 2: Nyírtass, 3: Érpatak, Hugyaj (3–4: after HAMPEL 1886, XVIII. t. 1; KEMENCZEI 1988, Taf. I. 3–4)



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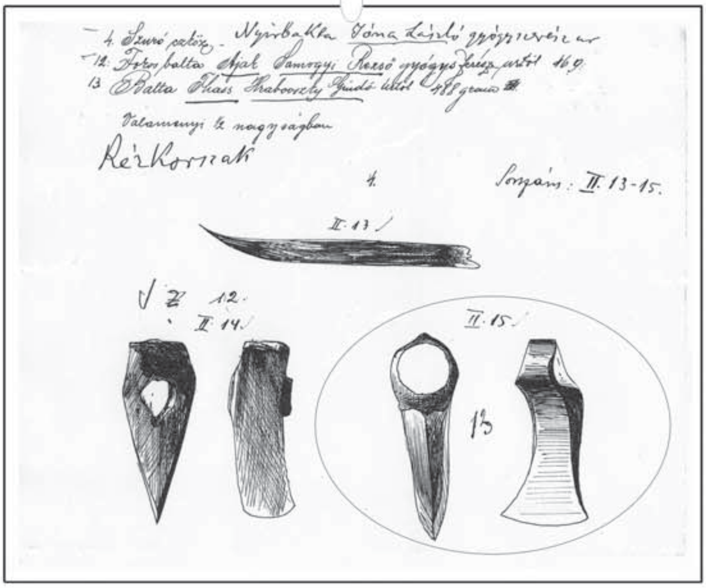

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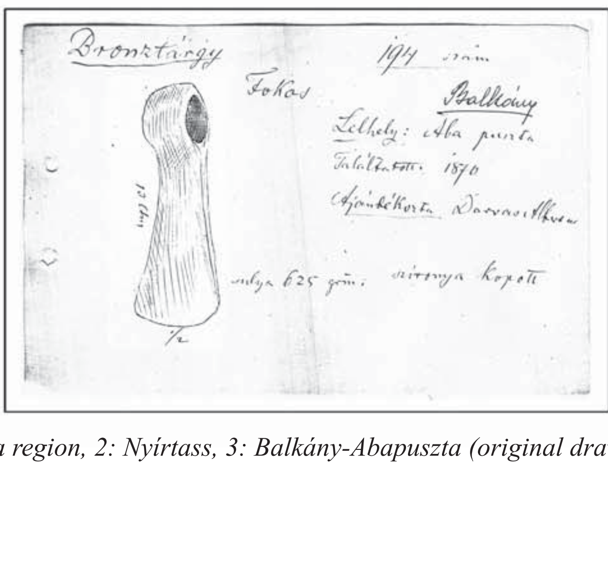

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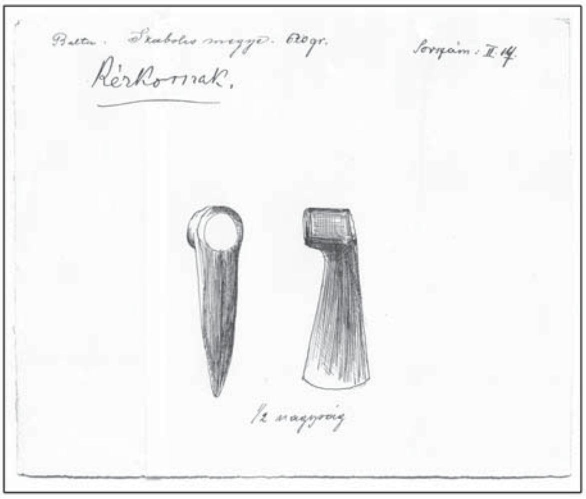
Fig. 8. 1: Kisvárda region, 2: Nyírtass, 3: Balkány-Abapuszta (original drawings of András Jósa)



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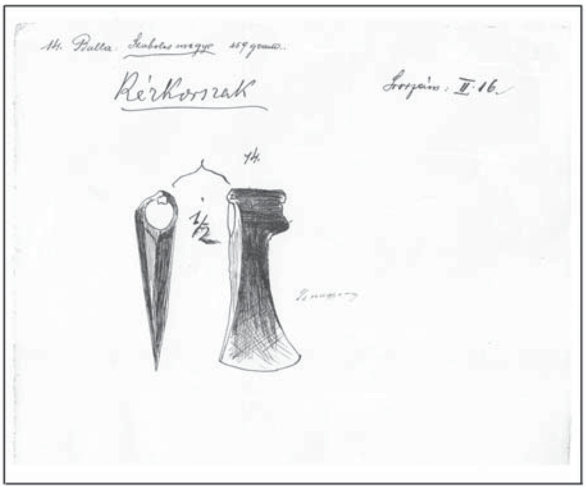

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Fig. 9. 1–2: Shaft-hole axes from unknown sites ("Szabolcs county", northeastern Hungary; original drawings by András Jósa)

producing the Bányabükk and Kömlőd-Kozarac-Săromberke types of axes by using the copper ores available in the nearby *Muntii Metaliferi* (Erdélyi-érchegység). However, the exploration of the relation/connection between the Transylvanian prehistoric copper mines and the Early Bronze Age metal varieties and their ore provenances is still at an early stage. In all probability copper ore mining zones already known in the Early and Middle Copper Age were exploited again (Beşliu – Lazarovici 1995, 113–117; Lazarovici *et al.* 1995, 218–222, Fig. 11; Kadar 2002, 12–14).

According to latest research it is possible that the ores of the western part of the Carpathian Mountains abounding in non-ferrous metals as well as precious metals (mainly the Slovenské Rudohorie/Slovakian Ore Mountains/Szlovák Érchegység)[10] were already exploited in this period (Schalk 1998, 21–24, Abb. 3). Fieldwork made at the, e.g., Špania Dolina-Piesky site (Žebrák 1995, 13–15, Fig. 1. 6) also indicate this when seeking the correlation with the Early Bronze Age axes (again scattered items for the far majority) axes found in the territory of Slovakia.

Another likewise significant metallurgical centre is probably to be seen in relation to the eastern Serbian copper ore outcrops of Rudna Glava and Rudnik (Pernicka *et al.* 1993, 38). Although the Bronze Age exploitation of these mining areas can be considered as certified, there are however still no infallible data that would indicate that these mines were in use in the beginning of the Early Bronze Age. But this possibility cannot be excluded either.[11] The exploitation of the Rudna Glava mining area has undoubtedly stopped at some point in the Copper Age, although work in the Rudnik copper ore strata, such as at Prljuša Šturac, likely seems to have been taken up again in the Early Bronze Age (Jovanović 1995, 32–34). However, for the largest copper ore outcrop zones in eastern Serbia, the mining areas of Bor and Majdanpek, we do unfortunately not have data regarding their prehistoric exploitation. This is partly owed to the waste destructions due to the modern, large-scale exploitation. However, a considerable part of the analysed Copper Age metals correlates well with the Majdanpek ores (Begemann – Pernicka – Schmitt-Strecker 1995, Fig. 4. 146–147; Krajnović *et al.* 1995, 65–66).

[10] We might also mention the Fátra, lower Tatra and Vihorlat mountains, as well as the mountains around Kassa, at Hernád, Poprád, Rozsnyó, etc.

[11] Unfortunately, there is no correlation between the composition of metals coming from the area of Rudna Glava and dating to the Early Bronze Age and the copper ores excavated from the so far known ancient mine (Pernicka *et al.* 1993, 25–37; Begemann – Pernicka – Schmitt-Strecker 1995, Figs 5–6, 147–148).

No.	Site Inv.No. No. of SAM	Type of the sample Cultural association	Composition (in weight %)										
			Fe	Ni	Cu	As	Ag	Sn	Sb	Pb	Bi	Au	Zn
1	**Hódmezővásárhely** 62/921 SAM 13 258	**Fajsz type axe** ? (strayfind)	T	<0.01	99.3	0.58	<0.01	T	0.05	0.04	0.011	–	–
2	**Nagyvejke-Réti szántók (Borsó-hegy)** Private collection of A.Csiszér, 85/169	**Narrow chisel** Somogyvár-Vinkovci	0.18	–	96.6	0.4	2.1	–	0.5	–	–	–	–
3	**Nagyvejke-Réti szántók (Borsó-hegy)** Private collection of A.Csiszér	**Dameged/fragmented chisel** Somogyvár-Vinkovci	–	–	90.2	0.95	0.65	7.3	0.7	0.07	–	–	–
4	**Nagyvejke-Réti szántók (Borsó-hegy)** Private collection of A.Csiszér, 96/122	**Flat chisel** Somogyvár-Vinkovci	0.4	–	99.5	–	–	–	–	–	–	–	–
5	**Nagyvejke-Réti szántók (Borsó-hegy)** Private collection of A.Csiszér, 90/81	**Kömlőd-Kozarac type axe** Somogyvár-Vinkovci	0.1	–	95.1	2.7	0.11	–	–	1.9	–	–	–
6	**Dunakömlőd** B.12.933.1 SAM 13 402	**Kömlőd-Kozarac type axe** Hoard	0.2	–	99.2	–	0.10	–	–	0.45	–	–	–
7	**Dunakömlőd** B.12.933.2 SAM 13 403	**Kömlőd-Kozarac type axe** Hoard	–	–	99.0	–	0.46	–	–	0.42	–	–	–
8	**Dunakömlőd** B.12.933.3 SAM 13 404	**Kömlőd-Kozarac type axe** Hoard	–	–	99.7	–	0.18	–	–	–	–	–	–
9	**Dunakömlőd** B.12.933.4 SAM 13 405	**Axe (Caucasian type)** Hoard	0.2	–	95.2	2.20	0.20	–	1.30	0.81	–	–	–
10	**Dunakömlőd** B.12.933.5 SAM 13 406	**Axe** Hoard	0.1	–	94.3	2.34	0.23	–	–	1.78	1.12	–	–
11	**Dunakömlőd** B.12.933.6 SAM 13 407	**Flat chisel** Hoard	–	–	99.5	–	0.10	–	–	0.33	–	–	–
12	**Dunakömlőd** B.12.933.7 SAM 13 408	**Flat chisel** Hoard	–	–	98.9	0.61	0.20	–	–	0.27	–	–	–
13	**Dunakömlőd** B.12.933.8 SAM 13 409	**Chisel** Hoard	–	–	99.6	–	0.35	–	–	–	–	–	–
14	**Kopáncs, Grave 2** MFM 93.1.14	**Armring** Maros	–	–	96.0	0.16	0.24	3.45	–	–	–	–	–
15	**Lublinit Cave (Vargyas-valley, Transylvania, Romania)**	**Dumbrăvioara(Sáromberke) type axe** Hoard, Schneckenberg culture	0.09	–	98.2	1.27	0.03	–	–	0.32	–	–	–
16	**Emőd-Nagyhalom** HOM	**Kömlőd-Kozarac type axe** Hatvan (?), strayfind	–	–	99.6	–	0.18	–	–	0.11	–	–	–
17	**Unknown site (Borsod-Abaúj-Zemplén county)** HOM 53.932.1	**Chisel** ?, strayfind	–	–	99.1	–	0.64	–	–	0.3	–	–	–
18	**Unknown site (Borsod-Abaúj-Zemplén county)** HOM 53.931.1	**Chisel** ?, strayfind	0.04	–	99.9	–	–	–	–	–	–	–	–
19	**Szihalom** HOM 53.468.1	**Kömlőd-Kozarac type axe** ?, strayfind	–	–	96.6	0.87	0.38	–	0.29	0.9	1.1	–	–
20	**Felsővadász-Várdomb** HOM	**Awl** Hatvan	–	–	96.3	3.6	0.02	–	–	–	–	–	–
21	**Unknown Site (Borsod-Abaúj-Zemplén county)** HOM 53.1044.1	**Dagger** ?, strayfind	0.12	–	89.1	0.17	1.0	9.2	0.38	–	–	–	–
22	**Demecser-Roffaj-dűlő Feature 16** JAM 2000.16.01	**Perforated disc** Szaniszló	–	–	99.9	–	0.08	–	–	–	–	T	–

Table 1. Results of the ED XRF analysis of some Early Bronze Age copper base metals. The metalanalyses was carried out by Miklós Kis-Varga in the Institute for Nuclear Research of the Hungarian Academy of Sciences, Debrecen, Hungary (T.: only in traces; grey color: copper)

No.	Site Inv.No. No. of SAM	Type of the sample Cultural association	Composition (in weight %)										
			Fe	Ni	Cu	As	Ag	Sn	Sb	Pb	Bi	Au	Zn
23	**Nagyrév-Zsidóhalom Grave C/6** DJM 91.8.33	**Armring** Nagyrév	1.0	1.24	95.2	0.48	0.009	1.9	–	–	–	–	–
24	**Nagyrév-Zsidóhalom Grave B/8** DJM 91.8.32	**Dagger** Nagyrév	0.1	0.4	97.3	0.56	0.7	0.09	0.46	0.2	–	–	–
25	**Hugyaj, Érpatak** JAM 64.968.1	**Triangular dagger** Nyírség (?), strayfind	2.0	–	95.5	2.3	0.02	–	–	0.09	–	–	–
26	**Balkány-Abapuszta** JAM 64.832.1	**Shaft hole axe with slantwise cut tube** Nyírség (?), strayfind	–	–	94.3	2.7	0.15	–	0.3	1.2	1.1	–	–
27	**Nyírtass** JAM 64.828.1	**Shaft hole axe with slantwise cut tube** Nyírség (?), strayfind	0.04	–	88.2	–	2.5	–	–	–	–	9.1	–
28	**Hajdúdorog-Szállásföldek** HM 61.80.23	**Fajsz type axe** ?, strayfind	–	–	99.1	0.79	0.02	–	–	–	–	–	–
29	**Budapest-Óbuda** MNM 24/a/1883	**Kömlőd-Kozarac type axe (shaft-hole)** ?, strayfind	–	–	92.68	4.6	0.62	–	–	0.68	1.42	–	–
30	**Budapest-Óbuda** MNM 24/a/1883	**Kömlőd-Kozarac type axe (edge)** ?, strayfind	–	–	94.55	1.5	0.82	–	–	0.96	2.17	–	–
31	**Érd** MNM 12/1946	**Kömlőd-Kozarac type axe** ?, strayfind	–	–	99.79	–	0.21	–	–	–	–	–	–
32	**Lippik jódfürdő** MNM 41/1877	**Kömlőd-Kozarac type axe** ?, strayfind	–	–	99.33	–	0.67	–	–	–	–	–	–
33	**Budapest-Kis-Duna (Csepel)** MNM 209/1874	**Kömlőd-Kozarac type axe** ?, strayfind	1.97	–	97.18	0.3	0.02	–	–	0.53	–	–	–
34	**Balaton (unknown site)** MNM 3/1865	**MBA axe, Hajdúsámson type** ?, strayfind	–	2.87	93.67	0.56	2.9	–	–	–	–	–	–
35	**Erdély (unknown site)** MNM 82/1883	**MBA axe, Pădureni type** ?, strayfind	–	–	97.94	0.86	1.2	–	–	–	–	–	–
37	**Erdély (unknown site)** MNM 30/1886	**Izvoarele type axe** ?, strayfind	–	–	99.29	0.68	0.03	–	–	–	–	–	–
38	**Eger** MNM 51/1893.5	**MBA axe, Pădureni type** ?, strayfind	–	–	95.04	0.33	0.85	3.26	0.52	–	–	–	–
39	**Tolmács** MNM 85.7.1	**Kömlőd-Kozarac type axe** ?, strayfind	0.47	–	98.97	0.49	0.07	–	–	–	–	–	–
40	**Pianul de Sus/Oláhpián** MNM 301/1876.55	**Corbasca type axe** ?, strayfind	–	–	99.72	0.1	0.02	–	–	0.16	–	–	–
41	**Sárrétudvari-Őrhalom, Grave 7** DM IV.92.59.2	**Dagger** Late Yamnaya	–	–	99.9	–	0.02	–	–	–	–	–	–
42	**Sárrétudvari-Őrhalom, Grave 7** DM IV.92.59.3	**Pickaxe** Late Yamnaya	0.43	–	99.2	–	0.01	–	–	0.35	–	–	–

Table 1. Continued

Based on the SAM project (Junghans – Sangmeister – Schröder 1960; 1968; 1974) and the metal analysis made since then (see e.g., Krause 2003), we can come the following technological conclusions:

1. the series of the first shaft-hole axes are not made of bronze but from pure copper;
2. during the Early Bronze Age III-period (the Reinecke A1-phase) the Early Bronze Age metallurgy got to the point to be able to produce and use classical tin-bronze through a gradual and continuous development. This process, also to be called a "experimental period/phase", signifies experiments with the alloying materials and a better knowledge of the material's properties. At the same time this also means the continuous development of the metallurgic technology and its gradual improvement (Vulpe 2001, 422). This "experimental period" is well illustrated during the Early Bronze Age I–II in northeastern Hungary *(Table 1)*. While during the Early Bronze Age I the majority of shaft-hole axes is made of pure copper (which can of course contain small amounts of contamination with other trace elements), during the Early Bronze Age II-period, and to some extent already parallel to the earlier period, there are attempts to intentionally alloy

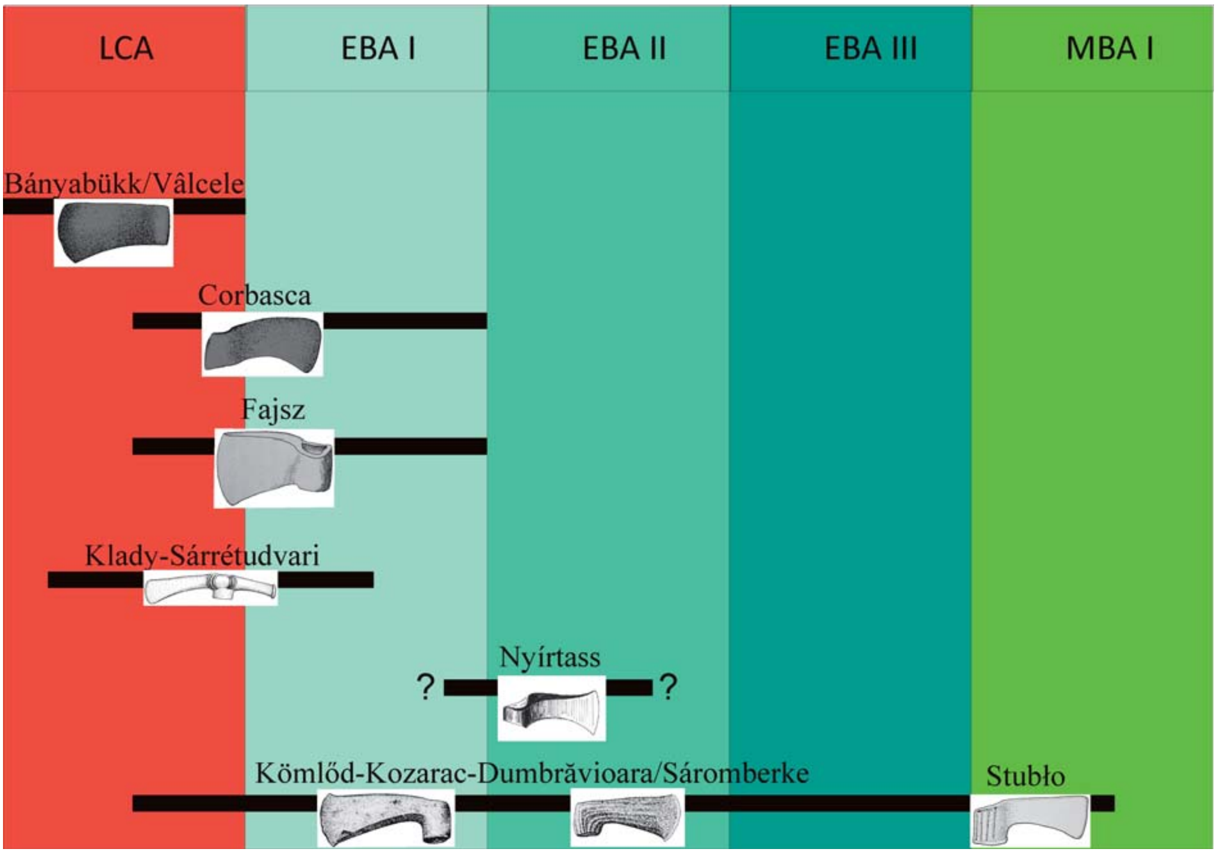

Fig. 10. Chronological table of the shaft-hole axes in the Carpathian Basin

copper with arsenic (As). Such could be considered as a transition state ("arsenic copper" or "arsenic bronze" / *Arsenkupfer* or *Arsenbronze*).[12] Apart from the arsenic, there is occasionally to notice a higher concentration of other metals in the artefacts. These include lead (Pb) as in the cases of Balkány-Abapuszta, Dunakömlőd, Nagyvejke-Réti szántók and Tiszavasvári-Deákhalom; nickel (Ni) as from Balaton and Nagyrév-Zsidóhalom; iron (Fe) from Budapest-Kis Duna and Hugyaj-Érpatak; and finally bismuth (Bi) from Budapest-Óbuda. In some cases these can be regarded as simple contaminants, but in other cases, and when having a percentage of above 1.5–2, they no doubt function as intentional alloying materials. Regarding certain other metals (iron, nickel and bismuth) there is an off-chance that they were added deliberately to the metals. The occurrence of silver (Ag) and gold (Au) in a higher amount in some of the artefacts (such as from Balaton, Nagyvejke and Nyírtass) can be regarded as unique. Very rarely Antimony (Sb) is also found (Dunakömlőd);

3. the use of closed moulds consisting of three parts in comparison with the open bivalve moulds used some time earlier in eastern Europe;
4. evolution/development of new local and technologically much more sophisticated axe types and other metal objects (such as e.g., the various types of hair-rings as of Mala Gruda, Leukas, Zimnicea etc.);

[12] For a detailed description of the use of arsenic in copper objects' production see Durman 2006, 30–34.

5. based on scholarly research made in the past decades, the previous chronological system developed for the shaft-hole axes of the Carpathian Basin can be modified as shown the in the following figure *(Fig. 10)*.

A special social background

No doubt this all must have also had far-reaching social implications. We see these particularly in the graves and hoards of this period. But also depositions within settlement sites need to be mentioned. Altogether, four categories of social changes in the Carpathian Basin at the beginning of the third millennium BC can be summarized:

1. The more intensive metal production caused serious changes in the society. The now available metal weaponry, consisting of the shaft-hole axes and the tanged, triangularly formed daggers, indicates a rich empowered *elite* (HARRISON – HEYD 2007, 193–203; HEYD 2011, 546).
2. At the same time a special societal layer/profession was formed in certain communities: a manufacturing specialist or craftsman, the *smith* (HARRISON – HEYD 2007, 196). From this moment – for the first time in eastern-Central Europe – we can observe graves of these smiths. The first metalworker's graves are known from the Yamnaya and Katacombnaya cultures of the Pontic steppes (BÁTORA 2002; KAISER 2005; KOLEDIN 2004, 82–84, Sl. 18–24; DURMAN 2006, 35–53). Unfortunately, we do not know such interments from the Pit Grave/Yamnaya west of the Black Sea and in Hungary. In the Carpathian Basin, the first similar graves are known from the Early Bronze Age IIa-period (see PATAY, this volume) and then the Middle Bronze Age (e.g., Nižná Myšľa – OLEXA 1987; 2002, 84, Fot. 100). We can assume that in the beginnings these craftsmen were some kind of wandering smiths. Later – for the end of Middle Bronze Age – this profession had become more stationary and permanent metallurgical workshops were formed. Great value was bequeathed on this profession and it also had an enhanced prestige. The best example for this is that the most beautiful Greek goddess – Aphrodite – was married to Hephaestus, the crippled Greek god of metallurgy (see the detailed mythological background of the metalworking in DURMAN 2006).
3. The emergence of a special hoarding tradition and here particularly hoards with a large number of axes[13] (see HARRISON – HEYD 2007, 196; HANSEN 2009a, 36, Abb. 35; 2009b, 149–155, Abb. 18; 2011, 145–147, Fig. 14; SZEVERÉNYI 2013, 666–667); hoards/depositions of metallurgical stone tools, moulds, crucibles, *tuyères*/blowers (ECSEDY 1983; 1990; KŐVÁRI – PATAY 2005). As Elke Kaiser has already pointed out, this tradition also come from the Circumpontic Metallurgical Province, namely to the Katacombnaya culture (KAISER 2005).
4. The interest of procuring the ores serving as the raw material of metals; areas abounding in raw materials (i.e. the mining places) were connected with "areas poor in metals" by the means of exchange and intense trade relations. The societies supervising these exploitation zones obtained strategic advantages and their elite organising and supervising the trade was able to acquire a great fortune.

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[13] See especially the Early Bronze Age hoards with axes made of noble metals from the collection of Axel Guttmann (HANSEN 2001).

Conclusions

Recent research has demonstrated beyond doubt that the idea to the production of the first shaft-hole axes was not local in the Carpathian Basin. It were the Late Copper Age people living in the wider northern and northeastern Pontus region that adopted this invention from the Maykop and Kura-Arax cultures somewhen during the second half of the 4th millennium BC. Among these, most assuredly the people of the Pit Grave kurgans (Yamnaya culture) mediated the knowledge regarding the production of this artefact type and transmitted it to regions further to the west, along their own migration westwards.

In a very analogy to Colin Renfrew's model regarding the Early/Middle Copper Age metallurgy of the Carpathian Basin and the eastern Balkans ("independence of southeast European Copper Age") we can establish the conclusion that the Carpathian Basin is not just simply an adaptive region, but it also plays a crucial role as an innovative, secondary centre developing new artefact types and technological advances. This is particularly evident for the closed tri-partite moulds. Making use of local copper ores, not infrequent in many parts of particularly the eastern Carpathian Basin and the Balkans, the production of the shaft-hole axes has been accomplished here. It is also from this area that it spread further towards western and southern Europe.

According to the above-mentioned facts the title of this paper could thus also be modified as "The Significance of the Carpathian Basin in the Distribution of Bronze Age Metallurgy at the Beginning and in the Mid-Third Millennium BC".

Appendices 1–6

Appendix 1

Bányabükk/Vâlcele type axes in the Carpathian Basin (see Fig. 1*)*

1. Baranda (SRB) (Kuna 1981, 66–67).
2. Bela Crkva/Fehértemplom (SRB) (Kuna 1981, 66, Taf. XXVI. 6; Durman 1983, Tab. 12. 2).
3. Cheile Turului/Tordatúr, Túri hasadék (RO) (Téglás 1914, 57, 3. kép; Vulpe 1970, 27, no. 34, Taf. 3. 34; Ferenczi 1997, I. t. 3).
4. Colţeşti/Torockószentgyörgy (RO) (Téglás 1914, 55, 1. kép; Vulpe 1970, 27, no. 37, Taf. 3. 37).
5. Cubleşul Someşan/Magyarköblös (RO) (Vulpe 1970, 27, no. 35, Taf. 3. 35).
6. Dănceu (RO) (Crăciunescu 1998, 146, Pl. III. 1).
7. Unknown provenance/site (Naturhistorisches Museum, Wien, Austria) (Mayer1977, 19, Taf. 4. 36).
8. Unknown provenance/site (Slovakia, Museum of Bratislava) (Novotná 1970, 27, Taf. 8. 139).
9. Unknown provenance/site (Museum of Split, Croatia) (Žeravica 1993, 20, Taf. 5. 43).
10. Izbište /Izbiste (SRB) (Kuna 1981, 66, Taf. XXVI. 8; Durman 1983, Tab. 12. 4).
11. Keszthely-Alsódobogó (H) (MRT 1, 77, 7. t. 13; Kovács 1996, 116).
12. Karancslapujtő (H) (Kőszegi 1957, 47, 6. t. 6).
13. Leskovac-Hisar (SRB) (Garašanin 1954, 69–70).
14. Otok (HR) (Žeravica 1993, 20, Taf. 5. 44).
15. Sebeş/Szászsebes (RO) (Vulpe 1970, 27, no. 36).
16. Topliţa/Csíktapolca (RO) (Vulpe 1970, 27, no. 33, Taf. 3. 33).
17. Vîlcele or Baniabic/Bányabükk (RO) (Roska 1933; Vulpe 1970, 27, no. 1–32, Taf. 1, Taf. 2, Taf. 3. 25–32).
18. Munina (PL) (Żaki 1961, 89–90, Fig. 1b; Gedl 2004, 26, Nr. 20, Taf. 3. 20).
19. Rudna Mała (PL) (Żaki 1961, 88, Fig. 1a, Fig. 2; Gedl 2004, 25, Nr. 19, Taf. 3. 19).
20. Pistyń (PL) (Żaki 1961, 89–90, Fig. 1c).
21. Rădeni (RO) (Dumitroaia 1985, 465–466, Fig. 4a; Burtănescu 2002, 172, Pl. 1. 1).
22. Rotunda (RO) (Burtănescu 2002, 172, Pl. 1. 2).
23. Moldavia (unknown provenance) (RO) (Irmia 1998, 41, note 6).
24. Mahmudia (RO) (Vasiliu 1996, 27–30; Irimia 1998, 39).
25. Izvoarele (RO) (Irimia 1998, 37, 39, Fig. 2–3).

Appendix 2

Fajsz type axes in the Carpathian Basin (see Fig. 2*)*

1. Akasztó (H) (Kovács 1996, 116, Abb. 1).
2. Bácsalmás (H) (Kürti 1974, 45, 23. kép).
3. Brachwitz (D) (Mildenberger 1950, 27, Abb. 1; Kaufmann 2001).
4. Brno-Líšeň (CZ) (Benešová 1956, Obr. 1–2; Řihovský 1992, 37, Taf. 5. 36).
5. Dolný Pial/Alsópél (SK) (Vladár 1970, 5–6, Obr. 1–2).
6. Fajsz (H) (Hampel 1903, 426–427; Nagy 1913, 309, V. kép 21–23; Kalicz 1968, Taf. I. 16–17, 19–21).
7. Hajdúdorog-Szállásföldek (H) (Dani – Kis-Varga 2000).
8. Hatvan (H) (Hampel 1877, VIII. t. 26; Nagy 1913, 309; Roska 1956, 43).
9. Hódmezővásárhely (H) (Szeremlei 1900, 212, 12. sz. 1; Kovács 1996, 116, Abb. 1; V. Szabó 1999, 1. kép 1).
10. Unknown provenance/site from Dalmatia (Museum of Split, Croatia) (Kuna 1981, 66, Taf. XXVI. 7; Durman 1983, Tab. 12. 3).
11. Unknown provenance/site (Urgeschichte Institut, Wien, Austria; from the territory of Hungarian-Austrian Monarchy, Hungary?) (Mayer 1977, 20, Taf. 4. 37).
12. Unknown provenance/site (Naturhistorisches Museum, Wien, Austria; from the territory of Hungarian-Austrian Monarchy, Hungary?) (Hoernes 1892, 372, 379, Abb. 57–57a; Mayer 1977, 20, Taf. 4. 38).
13 Unknown provenance/site (Hungary, from the collection of Ferenc Kiss and György Ráth, HNM) (Pulszky 1883, 61, 14. ábra 4–5; Nagy 1913, 309; Roska 1956, 43, 15. ábra 1–2).
14. Unknown provenance/site (Museum of Martin, Slovakia) (Novotná 1955, 74, Obr. 5; 1957, 310, Tab. I. 3ab; 1970, 27, Taf. 8. 136).
15. Kisbér (H) (Novotná 1957, 310, Tab. I. 1ab, 2ab).
16. Lipova/Lippa (RO) (Roska 1956, 44, 17. ábra; Vulpe 1970, 28, no. 38, Taf. 3. 38).
17. Nagykunság (Mirha-Gád) (Kőszegi 1957, 47, VI. t. 5).
18. Ottilienkogel bei Glantscbach (A) (Mayer 1977, 22, Taf. 5. 41).
19. Şasa/Sasfalu (RO) (Kadar 2002, 11, 13).
20. Senica/Szenice (SK) (Kőszegi 1957, 47; Novotná 1970, 27).
21. Strehlen (PL) (Mildenberger 1950, Abb. 3; Roska 1956, 44).
22. Szeghalom-Varjas-major (Site 11/61) (H) (MRT 6, 152, 63. t. 13).
23. Székesfehérvár (H) (Roska 1933, 354; Dullo 1936, 149, Abb. 17. 14).
24. Tolna megye (H) (Kovács 1996, 116, Abb. 1).
25. Užhorod/Ungvár (UA) (Jankovich 1931, 20–21, III. t. 3).
26. Vadul Crişului/Rév (RO) (Nagy 1913, 309; Vulpe 1970, 28, no. 39).
27. Veľký Slavkov/Nagyszalók (SK) (Novotná 1957, 310, Tab. II. 3ab; Novotná 1970, 29, Taf. 8. 141).
28. Vevčice (CZ) (Benešová 1956, Obr. 3; Řihovský 1992, 37, Taf. 5. 35).
29. Zscheiplitz (D) (Mildenberger 1950, 28, Abb. 2; Kaufmann 2001).
30. Žitavany (Opatovce)-"Na vrškoch"/Zsitvaapáti (SK) (Novotná 1957, 309–310, Tab. II. 1ab, 2ab; 1970, 27, Taf. 8. 138).
31. Hauskirchen, VB Gänserndorf (A) (Huysza 1990, Abb. 184; Ruttkay 1995, Abb. 30. 18).

Appendix 3

Corbasca type axes in the Carpathian Basin (see Fig. 3*)*

1. Corbasca/Korbászka (RO) (Vulpe 1970, 30, No. 40, Taf. 3. 40, Taf. 65C; Burtănescu 2002, 177, Pl. 1. 3).
2. Călan/Pusztakalán (RO) (Vulpe 1970, 30, No. 42, Taf. 3. 42).
3. Unknown provenance/site (Museum of Split, Croatia) (Kuna 1981, 66; Žeravica 1993, 21–22, Taf. 5. 446–447).
4. Izvoarele (RO) (Vulpe 1970, 30, Taf. 3. 43).
5. Lozane, Pusta Reka (SRB) (Pernicka *et al.* 1993, Pl. 7. 5).
6. Olăneşti (RO) (Petre-Govora 1983, 289, Fig. 2. 2).
7. Ostrovul Corbului (Depot I) (RO) (Vulpe 1970, 30, Nos 44–47, Taf. 3. 44–47, Taf. 65. E).
8. Pianul de Sus/Oláhpián (RO) (Kőszegi 1957, 47, VI. t. 3; Vulpe 1970, 30, No. 41, Taf. 3. 41).
9. Podi (SRB) (Žeravica 1993, 21, Taf. 5. 45).
10. Šarengrad (HR) (Garašanin 1954, 70, Abb. 1. 7).

11. Vlčnov (Museum of Mohelnice, Bohemia) (Řihovský1992, 37, Taf. 5. 37).
12. Žitavany (Opatovce)-“Na vrškoch”/Zsitvaapáti (SK) (Novotná 1957, 309–310, Tab. II. 1ab, 2ab; 1970, 27, Taf. 8. 137).
13. Poduri (RO) (Burtănescu 2002, 179, Pl. 1. 4).
14. Osoi (RO) (Burtănescu 2002, 179, Pl. 1. 5).
15. Rëmbec (AL) (Prendi 1988, 188–189, Nr. 26).

Appendix 4

Kömlőd-Kozarac type and Nyírtass subtype axes in the Carpathian Basin (see Fig. 4*)*

1. Balkány (H) (Kalicz 1968, 46, Taf. I. 3).
2. Banatski Despotovac/Ernőháza (SRB) (Kuna 1981, 66).
3. Begaljica or Boleč (SRB) (Garašanin 1954, 70, Abb. 1. 15; Kuna 1981, 66).
4. Bočac, Tijesno Vrbasa (BIH) (Durman 1983, T. 13. 2; Žeravica 1993, 25, Taf. 7. 68).
5. Boljetin (SRB) (Jovanović 1971, Tab. VII. 7; Pernicka *et al.* 1993, Pl. 7. 4).
6. Brekinjska (Pakrac; HR) (Kuna 1981, 66; Vučedol 1988, Kat. 221; Durman 2006, 65–66, Cat. 32).
7. Budapest-Csepel (H) (Kőszegi 1957, 48, Taf. 7. 4).
8. Budapest-Óbuda (H) (Kőszegi 1957, 48, 60).
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12. Deta/Detta (RO) (Vulpe 1970, 40, No. 109, Taf. 8. 109; Kuna 1981, 66).
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20. Unknown site (Urgeschichte Institut, Wien, Austria) (Mayer 1977, 20, Taf. 5. 39).
21. Unknown site (?, Austria) (Mayer 1977, 22, Taf. 5. 42).
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23. Kapova jama, Brani Do (BIH) (Kuna 1981, 66; Žeravica 1993, 26, Taf. 7. 74).
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30. Kruševac/Krusevác (SRB) (Kuna 1981, 66).
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37. Lukovo (HR) (Kuna 1981, 66; Žeravica 1993, 26).
38. Mačkovac (BIH) (Kuna 1981, 66).
39. Majs (H) (Ecsedy 1983, 79, Pl. IX. 4; 1990, 228, Fig. 11).
40. Mala Gruda (MNE) (Vučedol 1988, 58–59, Kat. 232; Žeravica 1993, 26, Taf. 8. 81; Durman 2006, 85, Cat. 38).
41. Mokrin (SRB) (Girić 1971; Gogâltan 2000, 233, Taf. 3. 2).
42. Nagyvejke-Réti szántók (Borsó-hegy) (H) (Kulcsár 1999, 20–21, 1. kép; 2009, 345, 377, Pl. 47. 5).
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49. Păuliş/Ópálos (RO) (GOGÂLTAN 2000, 233, Taf. 3. 1).
50. Poprad/Poprád region (SK) (NOVOTNÁ 1970, 29, Taf. 8. 142).
51. Potporanj/Porány (SRB) (KUNA 1981, 66).
52. Prilep (MK) (KUNA 1981, 66; DURMAN 1983, T. 13. 9).
53. Soko Banja (SRB) (KUNA 1981, 66).
54. Sotin/Szata (Vukovar) (HR) (KUNA 1981, 66; VUČEDOL 1988, Kat. 220; DURMAN 2006, 125, Cat. 31).
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56. Sutjeska (SRB) (KUNA 1981, 66).
57. "Szabolcs county" (H) (they were lost and known only from the description sheet of András Jósa under old inv. no. II. 14 and II. 16) *(Fig. 9).*
58. Szihalom (H) (KALICZ 1968, 46, Taf. I. 2).
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60. Tolmács (H) (KOVÁCS 1996, 116–117, Abb. 1).
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65. Vukovar-Dobra voda (HR) (KUNA 1981, 66; DURMAN 1983, T. 12. 6).
66. Vukovar-Vinograd Vuić (HR) (KUNA 1981, 66; DURMAN 1983, T. 12. 5).
67. Zakuta (SRB) (KUNA 1981, 66).

Appendix 5

Dumbrăvioara/Sáromberke type axes in the Carpathian Basin (see Fig. 5*)*

1. Blănoi, Racoviţa/Oltrákovica (RO) (PETRE-GOVORA 1983, 288–289, Fig. 2. 1).
2. Bolboşi (RO) (VULPE 1970, 31, No. 55, Taf. 4. 55).
3. Brădetu, Brăduleţ (RO) (VULPE 1988, 210, Fig. 1. 4).
4. Căprioara/Kecskeháta (RO) (VULPE 1970, 31, No. 49, Taf. 4. 49).
5. Corneşti/Sövényfalva (RO) (VULPE 1970, 31, No. 50, Taf. 4. 50).
6. Creţeni (RO) (VULPE 1970, 31, No. 56, Taf. 4. 56).
7. Dobriceni (RO) (VULPE 1970, 31, No. 57, Taf. 4. 57).
8. Dumbrăvioara/Sáromberke (RO) (VULPE 1970, 31, No. 48, Taf. 4. 48).
9. Găujani, Boişoara-Vîlcea/Valcsa (RO) (PETRE 1976, 262–264, Fig. 1. 2).
10. Izbucul Topliţei (RO) (EMŐDI – HALASI 1985, 232, Fig. 5a).
11. Jimbor/Szászzsombor (RO) (VULPE 1970, 31, No. 53, Taf. 4. 53).
12. Leliceni/Csíkszentlélek (RO) (ROMAN – JÁNOS – HORVÁTH 1973, 562, Fig. 3; ROMAN – DODD-OPRIŢESCU – JÁNOS 1992, Taf. 78, Taf. 79. 2, 5–8).
13. Lublinit cave, Vargyas patak (RO) (DÉNES – V. SZABÓ 1998, Abb. 4–5).
14. Mura Mare/Nagyszederjes (RO) (VULPE 1970, 31, No. 54, Taf. 4. 54).
15. Ojdula/Ozsdola (RO) (VULPE 1970, 31, No. 51, Taf. 4. 51).
16. Pietreni (RO) (VULPE 1970, 31, No. 58, Taf. 4. 58).
17. "Ploieşti" (RO) (VULPE 1988, 210, Fig. 1. 5).
18. Sfîntu Gheorghe/Sepsiszentgyörgy (RO) (VULPE 1970, 31, No. 52, Taf. 4. 52).
19. Sîntimbru/Marosszentimre (RO) (ALDEA – CIUGUDEAN 1989, 71, Pl. I. 2).
20. Szczytna (PL) (CZOPEK [ed.] 2011, Fot 96, 249, 64.15).
21. Răcătău-Cetăţuie (RO) (BURTĂNESCU 2002, 187–188, Pl. II. 7).

Appendix 6

Moulds for Early Bronze Age axes in the Carpathian Basin (see Fig. 6*)*

No.	Site	Find association	Type of the mould	References
1	Debelo Brdo	Settlement Vučedol layer	Fragmented mould for Kömlőd-Kozarac type axe and 3 broken moulds for a dagger, a pin and an awl	Durman 1983, 32, T. 5. 7; Žeravica 1993, 27, Taf. 8. 84–86.
2	Domony-János Roob’s garden	Settlement, Pit 2 Makó culture	Fragmented mould (Kömlőd-Kozarac type ?)	Kalicz 1968, 48, 79, Taf. X. 1; Durman 1983, 33, T. 6. 8.
3	Döbrököz-Tűzköves	Settlement, stray find Late Vučedol/Somogyvár-Vinkovci culture	Kömlőd-Kozarac type axe	Kulcsár 2002, 115. t. 13; 2009, 345, 365, Pl. 43. 2.
4	Dunaszekcső-Várhegy	Settlement, stray find Vučedol (?)	? Fragmented mould	Ecsedy 1990, 228, Fig. 9.
5	Gradina Alihodže	Vučedol layer	? Fragmented mould for a shaft-hole axe and a flat axe	Durman 1983, 32, Sl. 2; Žeravica 1993, 27, Taf. 8. 87–88.
6	Hidegség-Templom-domb	?	Kömlőd-Kozarac type axe	Gömöri 1992, 14.
7	Ljubljansko Barje/Laibacher Moor-Ig	Settlement Vučedol C	Moulds for Kömlőd-Kozarac and Corbasca (?) types	Durman 1983, 23–28, 32–33, T. 6. 6–7.
8	Nevidzany/Nevigyén	Settlement Makó culture	Kömlőd-Kozarac type axe	Bátora 1982, 258, Obr. 3. 4.
9	Pécs-Nagyárpád-Dióstető	Settlement, pit Somogyvár-Vinkovci culture	? Fragmented	Bándi 1981, 22, Pl. 11; Ecsedy 1983, 79, Fig. 45, Pl. IX. 5.
10	Ravazd-Villibald domb	Settlement Somogyvár-Vinkovci culture	Kömlőd-Kozarac type axe	Figler 1985; Kalicz-Schreiber 1991, 10.
11	Salgótarján-Pécskő	Stray find from the Trench 3 Baden, Makó and Hatvan features on the site	?	Korek 1968, 55–56, Taf. XII. 1–3.
12	Salzburg-Rainberg	Settlement feature	Kömlőd-Kozarac type axe	Pittioni 1954, Abb. 251. 1ab; Durman 1983, 33, T. 6. 9; Mayer 1977, 20, Taf. 5. 40.
13	Üllő, Site 5	Feature 5605 Makó culture	Bivalve mould for Kömlőd-Kozarac type axe, 5 moulds for flat chisels, 2 moulds for pointed chisels, 2 moulds for socketed chisels and a cruicible	Kővári – Patay 2005.
14	Vel’ký Meder/Nagymegyer	Feature 26/89 Makó culture	Kömlőd-Kozarac type axe	Hromada – Varsik 1994, 50, 54–55, Obr. 1, Obr. 2. 6; Bátora 2003, Abb. 17. 7.
15	Vinkovci-Tržnica, Hotel	Settlement Vučedol B2	4 bivalve moulds for Kömlőd-Kozarac type axe, fragmented mould for wire; one sided chisel mould; a fragmented mould (undefinable); 2 core inserts	Durman 1983, 23–28, T. 1–3; 2006, 64; Vučedol 1988, Cat. 210–213; Bátora 2003, Abb. 15. 1–3, 7–8.
16	Vinkovci-Ervenica	Settlement, pit Vučedol B2	Fragmented, probably mould for Kömlőd-Kozarac type axe	Gale 2002, 57, T. 5. 5.
17	Zók-Várhegy	Settlement, pit 1977/36 Late Vučedol	Moulds for Kömlőd-Kozarac and Corbasca (?) type axes and cruicibles	Ecsedy 1983, 71–85, 88–91, Fig. 41, Fig. 45, Pl. IX. 1–3, 5, Pls X–XIV; 1990, 227, Fig. 8. 2.
18	Leliceni/Csíkszentlélek	Settlement Jigodin culture	Dumbrăvioara/Sáromberke type axe	Roman – János –Horváth 1973, 562, Fig. 3; Roman – Dodd-Oprițescu – János 1992, Taf. 78, Taf. 79. 2, 5–8.
19	Kaposújlak-Várdomb	Settlement, features 144, 191, 702 Somogyvár-Vinkovci culture	3 fragmented moulds for Kömlőd-Kozarac-type axes	Somogyi 2004, 167, Figs 14–16.

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Uivar and Its Significance for the Beginning of the Early Bronze Age in the Romanian Banat

MANFRED WOIDICH – ALEXANDRU SZENTMIKLÓSI

Abstract

The paper summarizes the Makó finds that were made during the excavations at the Late Neolithic and Early Copper Age tell site of Uivar in the Romanian Banat region. Found mostly at the southwestern part of the tell, they consist of settlement features (pits), pottery single finds, and three urn-graves and one un-urned cremation burial forming a small necropole. An unequipped inhumation found in Trench II and dated to between 2850 and 2700 cal BC likely predates the beginnings of the Makó occupation of the site. This occupation seems to have lasted for longer, covering not only the Hungarian Early Bronze Age I-period but also reaching into the next (IIa-) horizon. To here should belong the graves. Although being located at the southeastern limits of the Makó distribution in the Carpathian Basin, the pottery inventory demonstrates a wide range of connections, from the Kosihy-Čaka Group in the north, over Somogyvár-Vinkovci in the west and the Şoimuş Group in the Middle Mureş region, to finally the Glina III-Schneckenberg B of Wallachia. These links are being discussed.

Until recently, the beginning of the Bronze Age in the Romanian Banat was unclear. On distribution maps of the Early Bronze Age published until the 1990s this area was either left blank or filled with a question mark (Bándi 1981, Taf. 12; Kalicz 1982, 128, Abb. 6; Bóna 1992, 16, Frühe Bronzezeit I; Koós 1999, 1. kép). Later on from 1991, Horia Ciugudean recognised in his research into the Early Bronze Age in Transylvania the presence of a Makó-Kosihy-Čaka population in the Romanian Banat (Ciugudean 1991, 108, 110, Abb. 35; until then classified as Vučedol C). Florin Gogâltan (1993; 1995; 1996; 1998; 1999) and Marian Gumă (Gumă 1997) managed to increase the number of Makó-Kosihy-Čaka sites in this region. Based on the geographical position of the Banat region, they established for this part of Romania a chronological system following the Hungarian chronology. Consequently, the Early Bronze Age starts with the Makó-Kosihy-Čaka culture.

The excavations at the tell settlement of Uivar-Gomila undertaken by Wolfram Schier and Florin Draşovean focused on the Late Neolithic and Early Copper Age (Schier – Draşovean 2004; Schier 2006; 2008), but they also discovered the most prolific site of the Makó-Kosihy-Čaka culture in this region (Woidich 2007; 2008; 2009).

Traces of the Early Bronze Age settlement are limited to the southwestern part of the tell. Any statements about the settlement structure are restricted due to the relatively small percentage of the excavated areas as well as to the enormous surface erosion in the central part of the hill. During the campaign of 2007 a small necropolis in the northern vicinity of the tell settlement was uncovered *(Fig. 1)*. The base of the tell revealed the best preservation conditions, where the Early Bronze Age features were protected by colluvia against modern agricultural soil intrusions. Unfortunately, the colluvia combined with the humidity of the soil hindered the visibility of the features. On that account most of the features could be documented only in the lower area. Consequently, a high percentage of the material could not directly be connected to Early Bronze Age features.

Amongst others two enormous truncated conical pits have been excavated in the settlement area *(Fig. 2)* (Woidich 2008, 119, Abb. 2). Therefore two interpretations were discussed: pit-house or a pit with a special function, probably a storage pit.

Most of the local ceramic range can be defined as belonging to the classical ware of the Makó-Kosihy-Čaka culture *(Fig. 3)*. The predominant pottery types in Uivar are bowls and pots. Jars and footed

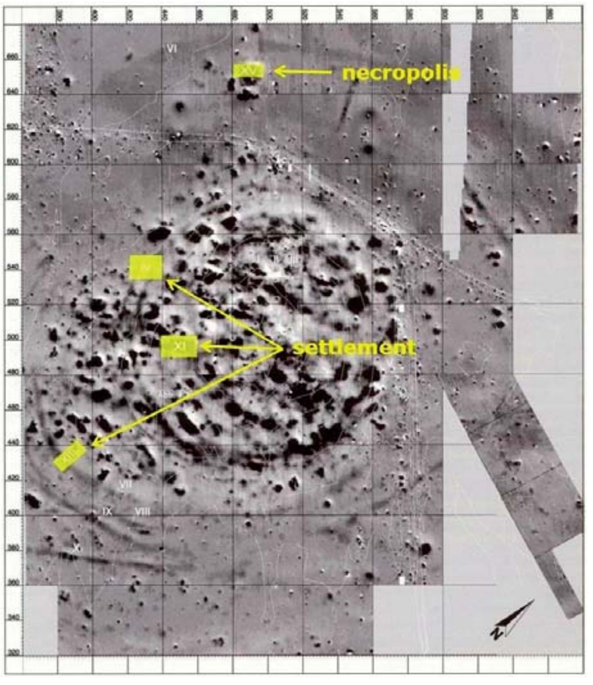

Fig. 1. Uivar-Gomila – position of the trenches with EBA ceramic marked on a magnetic prospection map (after SCHIER – DRAŞOVEAN *2004)*

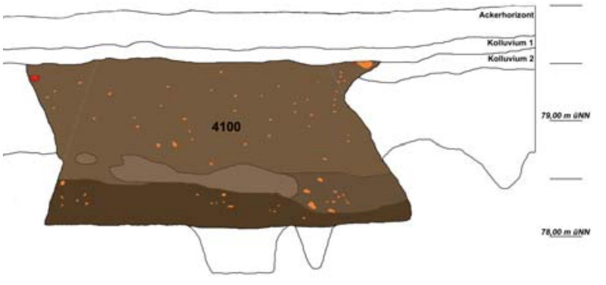

Fig. 2. Uivar-Gomila – profile drawing of the truncated conical Pit 4100

bowls are also present but in smaller quantities. The ceramic repertoire is completed by flat bowls, bottles and miniature vessels. Even though Uivar is located at the southeastern periphery of the Makó-Kosihy-Čaka culture the material might be easily integrated in the ceramic inventory of other prolific settlements.

Particularly Uivar's position in the periphery turned out to be very interesting. There are several pottery sherds which indicate connections to the neighbouring cultures. Two vessels, a pot with a triangular rim and the footed bowl with exterior and rim decoration (WOIDICH 2008, 120, 122, Abb. 4) are representing the influence of the northwestern territory of the Makó-Kosihy-Čaka culture,[1] probably the so-called Kosihy-Čaka subgroup, or rather even of the Somogyvár-Vinkovci culture.[2] Pots with complex plastic ornamentation, X-shaped handles, the so-called cuffed rims *(Manschettenränder)* and T-shaped rims discovered in Uivar testify intensive contacts to the Şoimuş group of the Middle Mureş region (WOIDICH 2008, 121, 123–124, Abb. 6–7).[3]

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[1] Pots with triangular rim: TÓTH 2001, 137, 158, Fig. 21. 1. Footed bowl with exterior and/or rim decoration: Aspern-Sandgrube Weber (KASTNER 1939, Abb. 3. 1, 2a–b, Abb. 4. 1); Aspern-Gärtnerei Binder (KASTNER 1939, Abb. 4. 2–3); Dunaszentpál-Bolgányi úti kavicsbánya (FIGLER 1996, 16, Pl. I. 1); Grub an der March-Unterhaspel (LEEB 1991, 31); Kamenín-Kiskukoricás (NEVIZÁNSKY 2001, 31, Pl. I. 4, 8); Obersulz-Wartberg (SCHWAMMENHÖFER 2002, 568, Abb. 183); Sládkovičovo (VLADÁR 1969, 106, Fig. 8, Fig. 7. 15); see also VOLLMANN 2005, 73.

[2] Pots with triangular rim: Börzönce-Temetői dűlő (BONDÁR 1995, 265, 267, Fig. 13. H/4, Fig. 15. EF/5, Pl. 122, Pl. 131. 67, Pl. 133. 78, Pl. 134. 79–80, Pl. 141. 136); Csepreg-Kavicsbánya (KALICZ-SCHREIBER 1989, 250, Abb. 1, Abb. 10, Abb. 12. 14); Győrszemere-Tóth tag (FIGLER 1994, 35–36, Abb. 7. 2, 4, Abb. 8. 3–4, 7); Nagykanizsa-Inkey kápolna (BONDÁR 2003, 69, 72–73, Fig. 8. 3, Fig. 11. 6, Fig. 12. 6); Rajka-Modrovich puszta (FIGLER 1994, 37, Fig. 9. 1); Szava (ECSEDY 1979, 120, 132, Taf. I. 7, Taf. XIII. 4). Footed bowl with exterior and/or rim decoration: Beltinci-Behind Raščica near Krog (ŠAVEL 2006, 144–145, 148, Fig. 2. 2–5, Fig. 3. 1–3, 6–7, Fig. 6. 5); Börzönce-Temetői dűlő (BONDÁR 1995, Pl. 149); Csepreg-Kavicsbánya (KALICZ-SCHREIBER 1989, 250, Abb. 1); Dunaszekcső-Várhegy (ECSEDY 1985, Fig. 10. 1–3); Győrszemere-Tóth tag (FIGLER 1994, 35, Abb. 7. 1); Gyulaj-Banyahegy (BÁNDI 1982, Abb. 2. 6–8); Nagykanizsa-Inkey kápolna (KALICZ-SCHREIBER 1989, 251, Abb. 3. 8–9); Nagyvejke-Réti szántók (KULCSÁR 1999, 134, Pl. 1. 26); Pécs-Nagyárpád (BÁNDI 1981, 232, Taf. 8. 21); Szava (ECSEDY 1979, 121, 125–128, Taf. II. 12, Taf. VI. 9, Taf. VII. 8, Taf. VIII. 4, Taf. IX. 12–13); Vinkovci-Tržnica (DURMAN 2000, 158, 165); Založnica (VELUŠČEK – ČUFAR 2003, 151, Pl. 10. 6); Zók-Várhegy (ECSEDY 1983, Abb. 25); see also KULCSÁR 1999, 132.

[3] Pots with complex plastic ornamentation: Deva-Magna Curia (RIŞCUŢA 1998, 132–133, Fig. 12. 7, Fig. 13. 9); Soimuş (ANDRIŢOIU 1989, 46–47, 50–51, Fig. 3. 1, Fig. 4. 11, Fig. 7. 1, Fig. 8. 2–3); Ţebea-Ruşti (ANDRIŢOIU

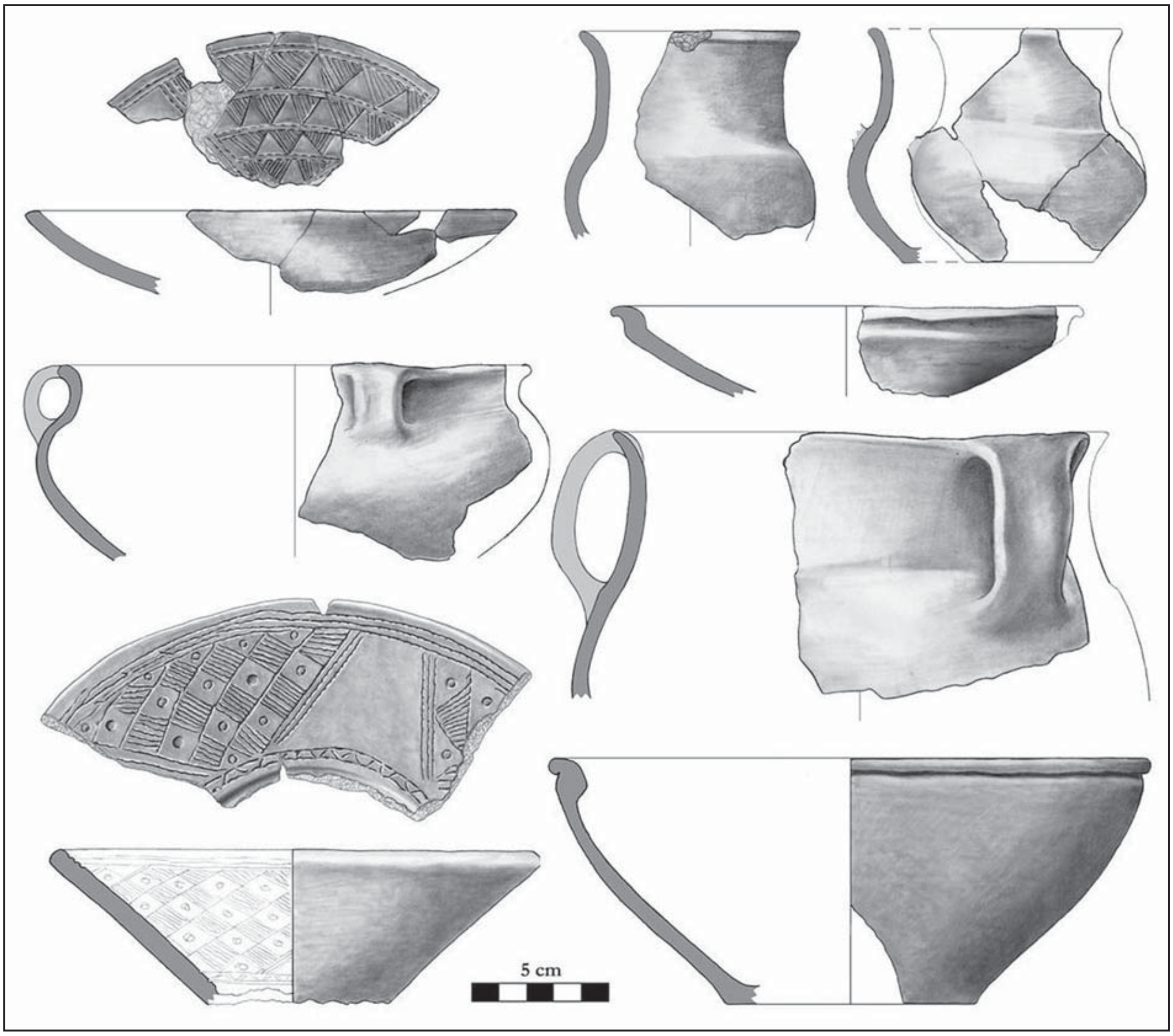

Fig. 3. Classical ware of the Makó-Kosihy-Čaka culture from Uivar-Gomila

Two sherds with a line of wrought knobs under the rim belong to the Glina III-Schneckenberg B cultural complex of Wallachia and southeastern Transylvania (Woidich 2008, 121–122, Abb. 5. 1–2; 2009, 359).[4] Unfortunately they cannot be allocated to an archaeological feature. Albeit they possess

1989, 47, 50, Fig. 4. 13, Fig. 7. 13); Temeşesti (Gogâltan – Apai 2005, 43, Pl. III. 1); Zlatna-Măgura Dudaşului (Ciugudean 1996, 263, Fig. 67. 1, 4). X-shaped handles: Deva-Magna Curia (Rişcuţa 1998, 131, 134, Fig. 11. 6, Fig. 14. 6); Temeşesti (Gogâltan – Apai 2005, 46, Pl. VI. 2). Cuffed rim: Corbeşti (Gogâltan – Apai 2005, 49, Pl. IX. 1); Deva-Magna Curia (Rişcuţa 1998, 128, 130, 134, Fig. 8. 3, Fig. 10. 5, Fig. 14. 2); Roşia Nouă (Gogâltan – Apai 2005, 49, Pl. IX. 2. 4); Soimuş (Andriţoiu 1989, 46, Fig. 3. 10); Ţebea-Ruşti (Andriţoiu 1989, 46–47, Fig. 3. 13, 15, Fig. 4, 3, 6); Temeşesti (Gogâltan – Apai 2005, 41, 43–45, Pl. I. 1–7, Pl. III. 5, Pl. IV. 1–9, 11, Pl. V. 3–4, 6). T-shaped rims: Alba Julia-str. Sinaia (Ciugudean 1988, 16, Fig. 2. 1); Balomir-Săteşti (Popa 1998, 57, Fig. 2. 3); Deva-Magna Curia (Rişcuţa 1998, 126–127, 131, Fig. 6. 3–4, Fig. 7. 2–3, 5, Fig. 11. 7); Soimuş (Andriţoiu 1989, 49–50, Fig. 6. 7, Fig. 7. 8); Ţebea-Ruşti (Andriţoiu 1989, 49–50, Fig. 6. 4–6, 14, Fig. 7. 6); Temeşesti (Gogâltan – Apai 2005, 44–45, Pl. IV. 10, Pl. V. 1–2).

4 Line of wrought knobs: Braneţ (Roman 1976, 35, Abb. 9. 5); Braşov-Schneckenberg (Băjenaru 2003, 146); Bukarest-Ciurel (Schuster 2004, 91, Abb. 2. 3, 5); Bukarest-Rosu (Roman 1976, 31–32, Abb. 4. 11, Abb. 5. 1–4, 9–10; Schuster 2004, 91, Abb. 2. 6); Cuciulata (Bichir 1962, 95, 102, Abb. 5. 6/10, 7/11, Abb. 10. 6);

Fig. 4. Uivar-Gomila – inhumation burial in Trench II

chronological relevance and they might indirectly mark the beginning of the Early Bronze Age in Uivar. A second direct evidence for a possible Pre-Makó-Kosihy-Čaka population is provided by an inhumation burial in Trench II *(Fig. 4)*. According to the radiocarbon date the person was buried approximately between 2850–2700 cal BC (Hd-22711: 4164 ± 24 BP; Schier – Drașovean 2004, 202). The stratigraphy of the Early Bronze Age settlement of Odaia Turcului has shown that the three lower settlement layers, which belong to the Glina III culture, hold pots with wrought knobs. In contrast, bowls with T-shaped rims, also found in Uivar, appear only in the younger stratum 4 of the Glina IV culture or in the so-called Odaia Turcului or Năeni group (Tudor 1982, 61; Băjenaru 2003, 127, 130–132, Abb. 2. 2, 11, Abb. 3. 4–5, Abb. 4. 11).

Beside the T-shaped rims other hints appearing in Uivar suggest the continuity of the settlement into the second phase of the Early Bronze Age (EBA IIa). Without any doubt, the fragments of vessels with a moustache rib below the handle and the sherds with vertical ribs (Woidich 2008, 125, Abb. 8), rarely known from Makó-Kosihy-Čaka sites,[5] should be regarded in a more complex spatial and chronological context, but they already imply a development, which unfolds in the second stage of the Early Bronze Age, especially in the Nagyrév culture.[6] Furthermore they are also found as a part of the ceramic range of the Somogyvár-Vinkovci culture,[7] the Bell Beaker–Csepel group[8] as well as the Austrian Oggau-Wipfing Horizon.[9]

So far the correlation between the Makó-Kosihy-Čaka culture and the Şoimuş group as well as the Glina IV culture panned out to be problematic. According to the local chronological systems of

Leliceni (Băjenaru 2003, 146); Odaia Turcului (Tudor 1982, 62–64, Abb. 2. 5, 7, Abb. 3. 7–8, Abb. 4. 2, 11; Băjenaru 2002, 130–132, Fig. 2–4); Ostruvul Corbului (Roman 1998, 26, Abb. 4. 2); Prundu (Roman 1976, 35, Abb. 9. 1, 3–4, 6–7); Sf. Gheorghe-Örkö (Băjenaru 2003, 146); Tutrakan (Băjenaru 2002, 136, Fig. 8. 8); Vădastra (Roman 1976, 35, Abb. 9. 2).

5 Moustache rib below the handle: Battonya-Georgievics tanya (Bondár – D. Matuz – Szabó 1998, 42–43, Fig. 13. 1, Fig. 14. 2). Vertical ribs: Budapest, III-Aranyhegyi út (Kalicz-Schreiber 1994, 55, Abb. 10. 16); Sládkovičovo (Vladár 1969, 103, Fig. 6. 15); Tiszalúc-Sarkadpuszta (Szathmári 1999, 90, Taf. 9. 15).

6 Moustache rib below the handle: Mezőkomárom (Bándi 1982, Abb. 8. 17); Nagykőrös (Kalicz-Schreiber 1984, 180, Taf. 42. 5, 11); Rákóczifalva (Kalicz-Schreiber 1984, 180, Taf. 42. 8). Vertical ribs: Adony (Kalicz-Schreiber 1984, 180, Taf. 42. 9); Igar-Vámpuszta (Kovács 1982, 172, Abb. 6. 5); Mezőkomárom (Bándi 1982, Abb. 8. 5, 9); Rákóczifalva (Kalicz-Schreiber 1984, 180, Taf. 42. 10); Szőreg (Kalicz-Schreiber 1984, 180, Taf. 42. 1–2); Sövényháza (Kalicz-Schreiber 1982, 145, Abb. 6. 3); Tószeg (Kalicz-Schreiber 1984, Abb. 46. 8, 10); see also Vollmann 2005, 117, 353, Taf. 50.

7 Moustache rib below the handle: Börzönce-Temetői dűlő (Bondár 1995, Pl. 158. 247); Založnica (Velušček – Čufar 2003, 154, Pl. 13. 7).

8 Moustache rib below the handle: Budapest, III-Békásmegyer (Kalicz-Schreiber 1984, 174, Taf. 36. 3); Szentendre (Kalicz-Schreiber 1984, 173, Taf. 35. 19); Szigetszentmiklós-Üdülősor (Endrődi 2005, 29; Vollmann 2009, 287, Taf. 5. 10–11). Vertical ribs: Budapest, III-Békásmegyer (Kalicz-Schreiber 1984, 174 Taf. 36. 3); Budapest, XXI-Csepel (Kalicz-Schreiber 1984, 176, Taf. 38. 8).

9 Moustache rib below the handle: Oggau-Seegasse (Neugebauer – Neugebauer 1998, 322, Abb. 8. 1); see also Bertemes 2000, 29, 33; Vollmann 2005, 186–189.

Fig. 5. Uivar-Gomila – three urn graves (1–3) and one un-urned cremation burial (4) embedded in a burned neolithic floor

the Romanian Banat (Gumă 1997, 99, 101–102; Gogâltan 1999, 366, Fig. 54), the finds of the so-called Sânpetru German-Pančevo type bridged the gap between the Makó-Kosihy-Čaka and the Early Mureş culture. Since the pottery of the eponymous site Sânpetru German can easily be integrated into Uivar´s ceramic range, the finds of the Sânpetru German-Pančevo type, which consist solely of these two eponymous sites and an unpublished site in Cenad, should be incorporated into a later phase of Makó-Kosihy-Čaka (Woidich 2008, 128–131, Abb. 10–11, Tab. 1; 2009, 359).

As already mentioned, in 2007 a small Early Bronze Age necropolis was localized. Three urn graves *(Fig. 5. 1–3)* and one un-urned cremation burial *(Fig. 5. 4)* were embedded in a burned Neolithic floor. Urn Grave 1 contained amongst other things a mug with divided handle *(Fig. 6)*, characteristic for the Somogyvár-Vinkovci culture.[10] The mug and a pot were covered by two bowls and used as containers for the cremation remains.

Beside the cremation remains the two-handled pot of Urn Grave 2 contained also a small cup *(Fig. 7)*. The knobs situated next to the cup's handle connect this vessel to a similar cup unearthed in Pančevo.[11] A second similar fragment of this kind of handle decoration was found in Uivar in a settlement feature

[10] Divided handles: Ada (Horváth 1984, 11, Pl. 1. 1); Battonya (G. Szénászky 1987–88, 145, Abb. 5. 1); Nagyárpád (Bándi 1981, 234, Taf. 10. 5); Radanovac (Horváth 1984, 11, Pl. 1. 2); Zók (Ecsedy 1983, Fig. 26).

[11] Pančevo-Donja Varoš (Grčki-Stanimirov 1996, 78, Taf. III. 4).

Fig. 6. Uivar-Gomila – mug with divided handle of Grave 1

Fig. 7. Uivar-Gomila – small cup with knobs situated next to the handle of urn grave 2

of Trench IV together with classical Makó-Kosihy-Čaka ware.[12] These two vessels might reflect the growing influence of Somogyvár-Vinkovci elements eastwards on the southeastern territory of the Makó-Kosihy-Čaka culture in the Early Bronze Age stage IIa. This phenomenon led Ferenc Horváth to the formation of the so-called Ada group.[13] This influence can be traced even further to the east in the Apuseni Mountains, in the Roşia Group.[14]

Remains from three stages of the Early Bronze Age can be distinguished at the tell of Uivar. A Pre-Makó-Kosihy-Čaka phase[15] is indicated by the ^{14}C date of the unfurnished inhumation burial. The Glina-III/Schneckenberg B fragments might be connected to this early horizon, too. The classical Makó-Kosihy-Čaka phase is represented by the characteristic ceramic range from the settlement features. The result of a radiocarbon sample falls into the expected chronological range of this phase.[16] There are multiple ceramic elements (moustache rib below the handle, vertical ribs, T-shaped rims and knobs situated next to the handle) which point to the continuation of the settlement of Uivar into the second stage of the Early Bronze Age. The small necropolis might be linked to this younger stage, too. Furthermore, we would like to suggest a late Makó-Kosihy-Čaka phase for the Romanian Banat which replaces the Sânpetru German-Pančevo horizon. This creation is no longer needed to explain the phenomena at the transition of the first to the second stage of the Early Bronze Age.

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12 Woidich 2008, 125, Abb. 8. 4.

13 Horváth 1984; 1985; Bóna 1992, 15; Vollmann 2005, 172–173.

14 Bóna 1992, 15.

15 Proto Early Bronze Age (?) or Transition Period.

16 Hd-27787: 3938 ± 32 BP (2426 ± 56 [68%] cal BC).

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"Nagyrév Jugs" and Their Archaeological Context

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Abstract

The main aim of our study was to compute a contextual seriation of grave goods from the Late Eneolithic and the Early Bronze Age in the Middle Danube region (mostly in Moravia, Czech Republic, and the Carpathian Basin) on various hierarchical levels, to then compare the sequence of objects in seriation sets with absolute dates, and finally to infer the possible role of so-called Nagyrév jugs in the relative chronology of that period.

Incidences of 95 variables (types of grave goods) on 832 cases (mainly graves) from 11 archaeological cultures were recorded from the literature. In sum, the matrix contained 2163 incidences. These data were subjected to a contextual seriation on various levels from individual burial sites, through aggregates of several sites, to the entire region. Subsequently, 86 available calibrated ^{14}C dates (CalPal 2007 HULU) were compared with these relative orders.

The relative sequences from various hierarchical levels of the same culture/cultural sphere (e.g., the Bell Beaker culture) correlate with each other variously. The relative sequences of identical variables from separate seriations for the individual cultures have very little relationship to each other. Therefore, the similarities between cultures are much less pronounced than those within each of them.Within individual cultures, or cultural spheres, correlations between absolute dates and the sequences from individual seriations for a hierarchical level are often strong, but sometimes not statistically significant due to the small number of cases. This suggests that relative chronologies created within individual cultures are valid to a certain degree. We should thus seek an optimum compromise in the composition of the seriation aggregates where a sufficient number of absolute dates but restrictions for the "non-chronological" sources of variability exist.

Some types of Nagyrév jugs occur in more than one archaeological culture during a particular time span, other types are confined to a specific region or time period. For these reasons, we suggest that the concept of the "Nagyrév jug" needs to be re-evaluated.

Introduction

Chronology is an important method for investigating past cultures. It is particularly vital to have a temporal grasp of socially dynamic periods, such as the end stages of the Early and Late Eneolithic periods (3800/3700–2800/2600 BC). A timeline for temporal successions and new developments can be formed on the basis of the results of absolute dating, as well as relative chronologies. Both of these methods have their advantages, as well as limitations.

Most absolute dating methods are based on the principle of radioactive decay of unstable isotopes. In late prehistory, the most often utilized method is ^{14}C (radiocarbon) and its improved version AMS-Dating. This measurement allows us to determine an age estimate of the dated material. Another advantage of obtaining a series of absolute dates is identifying time gaps between cultural episodes. The accuracy and reliability of the age estimates is also contingent on other factors (type of material dated, its relationship to the targeted event, amount of charcoal in the sample/degree of diagenesis, recent contamination, etc.). The precision of each date is also compromised by the statistical error, which presents the result with a standard deviation. Following calibration of raw dates, the resulting information consists of probability distributions which are somewhat difficult to compare. This method is also considerably expensive, which is one reason why we do not yet have a sufficient number of ^{14}C age estimates.

Relative chronology is based on the presence of chronologically diagnostic finds which are diagnostic for a particular period, culture, or one of its phases (so-called typology dating). More comprehensive approaches are based on creating successions comprising of initial occurrence, its dominance and subsequent decline; in particular, combinations of several indicators with computationally advanced methods (seriation, Correspondence Analysis, etc.). Relative chronology can be used to categorize most assemblages, where sufficient data is available. The disadvantage of relative chronology is not being able to detect the time gaps between artifact groups. The use of relative indicators is also often complicated by the fact that cultures evolve within themselves, as well as through culture contact. Apart from chronologically diagnostic artifacts, we also have artifacts which indicate inter-cultural contact. "Nagyrév jugs" are an example of a cultural contact artifact at the end of the Eneolithic period. Employing Miroslav Buchvaldek's definition (1978a; 1978b; 1981; 1997; 2002), Nagyrév jugs belong to ceramic finds indicating cultural contact that appear in Europe (there are several types and variants) as part of a particular aggregate of cultural components coming from several regions in a short period of time during the Final Eneolithic/Early Bronze Age (2700/2600–2300/2200 BC).

Contextual seriation is often used for reconstructing the chronological sequence of graves as only the presence or absence of a design style or type is important. The results of contextual seriation always depend on the extent to which the range of variables reflects temporal variation and other factors. When seriation is applied at a particular burial site restricting the intra-regional and inter-regional spatial variability, as well as other factors (age, sex, social and other differences), the similarities and differences in age estimates can determine succession (using seriation), which corresponds to relative chronology. The results are directly dependent on the choice of variables. That is why it is recommended that all non-temporal factors are controlled when developing the relative chronology.

Relative chronology significantly correlates with the choice of variables. For instance, if weapons are used as a variable, seriation can present a succession strongly influenced by the sex of the buried individual (Neustupný 2007, 136). The sex of the individual may not influence seriation just through gender-specific artifacts. Analysis of the jugs of the Corded Ware culture (CWC) in Bohemia has shown that in this cultural context, there is a statistical difference in jugs between individuals buried on their right and left sides (based on sex), in the type of decoration and jug volume – male jugs had a distinctly higher volume (mean value >2 liters) than female jugs (mean value 1 liter). The succession of decoration types on CWC jugs (represented by succession on Correspondence axis 1) constructed separately for right-side burials and left-side burials did not correspond exactly (Krištuf 2005). It is highly probable that similar patterns will also be present in the Moravian Corded Ware culture (MCWC) when using different variables (artifacts, decorations) and seriation types.

The chronology could theoretically be verified by the application of different dating methods. Relative chronology was developed using the principle of seriation based on occurrence of temporally diagnostic patterns (e.g., the presence of specific artifacts) and should correspond to the sequence of absolute ^{14}C estimates. With regards to the relative dating methods, decisions need to be made about (a) which relative dating methods/calculations to use, (b) which variables to employ, (c) for which aggregates (hierarchical levels) should relative chronologies be developed given necessary compromises that need to be made (1) to limit the sources of non-temporal variability (space/region, sex, social differences) and, at the same time (2) to consider temporal-spatial relationships between various archaeological cultures (entities).

Goals of the study

The pilot version of this study presented in Den Haag (2010) represented preliminary conclusions for evaluating the Late Eneolithic using contextual seriation.[1] The approach and analysis in 2010 were based on the idea that there are three major cultures in Moravia during the Late Eneolithic, which were in contact with each other, they probably coexisted for some time and mutually influenced each other. This idea led us to presume that the relative succession of the shared contextual seriation could reflect chronological relationships. We attempted to follow the classification of Nagyrév jugs in this order and the possibility of their use as "contact" artifacts. Seriation permitted an unequivocal relative sequence of these three cultures with small zones of overlap in peripheral sequences. There was uncertainty, however, whether relative chronology (contextual proximity of aggregate finds) reflects temporal patterns. The sequences could also reflect social, gender, regional and other factors. Although the relative sequences of dated aggregates from all three cultures correlate at a statistically significant level with mean values of absolute age estimates, in the case of individual cultures the relative sequences were unrelated to absolute age estimates. Therefore, it was unclear whether the overall relative sequence represents the actual temporal succession of artifacts and cases in individual cultures. The interpretation of the relative order was even more problematic when surrounding regions were also considered (including the Carpathian Basin). Given this situation, we decided to add new data to the database, including limited data about the sex of buried individuals, and further develop the relative chronology by incorporating aspects of regional aggregate hierarchy.

The main idea remains the same: the criterion for correctness is the relationship of the relative sequence in contextual seriation to the sequence of independently determined absolute dates. Strong correlation indicates that a significant number of contextual connections is influenced by time so relative sequences can be understood as the presence of a succession of individual artifacts in a culture.

The goal of our new study is:

1. on the basis of the available data, create a contextual seriation of objects from the Late Eneolithic in the Middle Danube region (mostly in Moravia and the Carpathian Basin) at various hierarchical levels, from individual burial sites to the entire region. When possible, specify the possible effect of the sex of the individuals manifested in grave goods on the resultant sequence;
2. compare the results of different hierarchical levels and follow the occurrence of Nagyrév jugs in the proposed relative chronologies;
3. compare the sequence of objects in seriation sets with absolute dates, where they are available;
4. form interpretations about the main archaeological cultures in the terminal Eneolithic in the Middle Danube region and infer the possible role of Nagyrév jugs in the relative chronology of that period.

Material and methods

Sources of data

We recorded evidence for the presence of Nagyrév jugs, other artifacts (ceramics, ceramic elements, ceramic plastic applications, stone industry, bone and antler artifacts, glass and metals) from Late Eneolithic/Early Bronze Age localities in Central Europe, in published literature and unpublished sources. All variables used are listed in *Table 1*. The Nagyrév jugs were classified according to the

[1] This article is a reworked version of the pilot study. The first version was presented in 2010 at the 16th Annual Meeting of the European Association of Archaeologists in Den Haag, Netherlands.

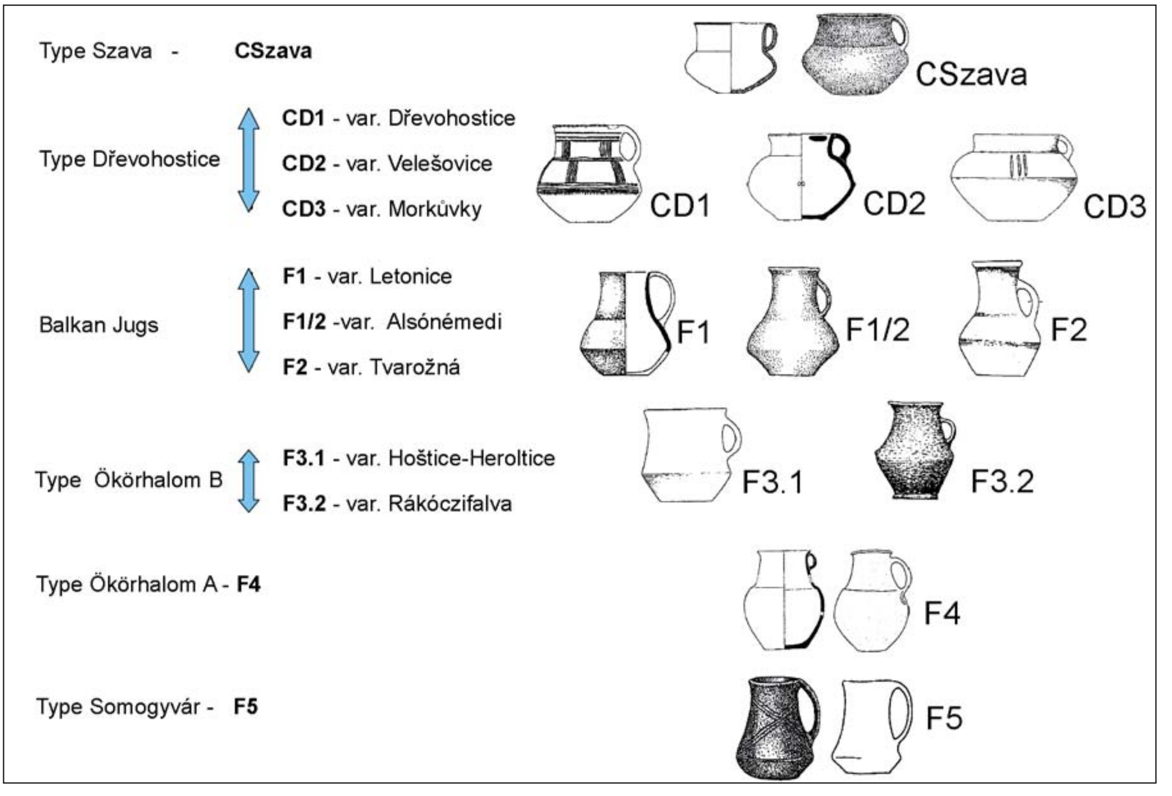

Fig. 1. Typology of Nagyrév jugs (after PEŠKA 2008)

typology published by Jaroslav Peška (2008) described below. "Nagyrév jugs" or "jugs with one handle" are represented by biconical forms with a higher cylindrical neck and a handle at or below the rim (cf. ENDRŐDI 1992; KALICZ-SCHREIBER – KALICZ 1998; 1998–2000; 1999; KULCSÁR 2002; 2009; VOLLMANN 2005; ENDRŐDI – PÁSZTOR 2006). There is consensus that they arrive in Central Europe from regions to the south or southeast, but the terminology and chronology of these jugs is far from unified or clear. In his doctoral thesis, J. Peška (2008) distinguished four types of jugs (labeled here with F), defined by a combination of shape and characteristic features, but mainly by the position of the handle *(Fig. 1)*. The first type is the "Balkan jug", with Letonice (F1), Tvarožná (F2) and Alsónémedi (F1/2) subtypes. Other types include the Ökörhalom B (F3) with the Hoštice-Heroltice (F3.1) and Rákoczifalva (F3.2) subtypes, Ökörhalom A (F4) and Somogyvár (F5). Furthermore, incidence of these jugs is tightly connected to Dřevohostice jugs with Dřevohostice *sensu stricto* (CD1), Velešovice (CD2), and Morkůvky (CD3) subtypes, and also with the Szava type (CSza).

On the whole we recorded 95 variables *(Table 1)* that were coded into the form of incidence (absence/presence) matrix (0 – absence, 1 – presence). Frequencies of the same items/goods in graves were disregarded. The following archaeological cultures/cultural traditions were then included in the analysis: Moravian Corded Ware culture (MCWC), Corded Ware culture (CWC), Bell Beaker culture (BBC), Protoúnětice culture (PÚC), Csepel group of Bell Beaker culture (CSE), Makó/Kosihy-Čaka culture (MKC), Somogyvár-Vinkovci culture (SOV), Late Vučedol culture (LVU), Nagyrév culture Phase I (NgC 1), Nagyrév culture Phase II (NgC 2), and Pitvaros culture (PIT). Overall, the matrix contained 832 cases – archaeological contexts that were represented mainly by graves originating from 11 traditionally recognized archaeological cultures in 13 geographic micro-regions *(Fig. 2)*. In sum, the matrix contained 2163 incidences.

Description	Abbreviation	Sum of incidences
Ceramics		
Amphora-shaped jug	AC	38
Amphora-like vessel	AG	10
Corded beaker	B1	43
"Fish bone" decorated beaker	B2	7
Jug of the Dřevohostice type, var. Dřevohostice	CD1	69
Jug of the Dřevohostice type, var. Velešovice	CD2	85
Jug of the Dřevohostice type, var. Morkůvky	CD3	21
Jug of the Szava type	CSza	11
Globular jug	Ck	52
S-shaped jug (slender)	Cs1	18
S-shaped jug (broad)	Cs2	15
Jug of the Bedřichovice type	CBe1	15
Jug of the Bedřichovice type, var. Pavlov	CBe2	5
Jug of the Bedřicovice type, var. Syrovice	CSyr	5
Jug of the Bedřichovice type, var. Šardičky	CSar	7
Pot	D	30
Handled pot	Dh	12
Storied jar	EN	3
Jug of the Balkan type, var. Letonice	F1	110
Jug of the Balkan type, var. Alsónémedi (F1/2)	F12	19
Jug of the Balkan type, var. Tvarožná	F2	14
Jug of the Ökörhalom B type, var. Hoštice-Heroltice (F3.1)	F31	16
Jug of the Ökörhalom B type, var. Rákóczifalva (F3.2)	F32	10
Jug of the Ökörhalom A type	F4	13
Jug of the Somogyvár type	F5	32
One handled cylindrical cup	G1	13
High two handled cylindrical cup	G2	11
Decorated bell beaker (high, slender)	GB1	40
Decorated bell beaker (low, broad)	GB2	90
Polypood bowl on legs	Hf	18
The Moravian type bowl	Hm	44
Bowl of the Makó/Kosihy-Čaka	HMK	10
Bowl with the Palmela type rim	Hr	70
Sharp profiled bowl with neck and handles	H3	47
The Schönfeld type bowl	H5	9
Bowl of Gemeinlebarn type	HGe	21
Handled pot with curved neck	K1	21
Handled pot with cylindrical/conical neck	K2	49
Two handled vessel	L	28
Inside decorated footed bowl, Ljubljana type	LH1	5
Inside decorated footed bowl, Čaka type	LH2	18
Inside decorated footed bowl, Sotin/Ig II	LH3	4
Three-part mug	Ndg	30
S-shaped mug	Ns	80
Sharply S-profilled mug	Ng	11
Globular mug	Nk	67
Mug of the Oggau type	NOg	27
Mug of the Trausdorf-Leithaprodersdorf type (high)	NTrL1	17
Mug of the Trausdorf-Leithaprodersdorf type (low)	NTrL2	45

Table 1. List of variables used in the analysis – Description: specification of particular variable; Abbreviation: short name used in tables; Sum of incidences: the number of recorded objects with the presence of the variable in the overall incidence matrix

Description	Abbreviation	Sum of incidences
Jug like mug	N3	9
Egg-shaped pot	P	146
One handled egg-shaped pot with handles	Ph	14
Wide opened mug	SN	15
Handleless vessel	U	8
Handleless amphora	UA	41
Parts of ceramics		
Asymmetrical handle	asH	7
Storied handle	etH	3
Horizontal handle	horH	12
Double handle	dopH	18
Blank handle	blinH	30
Ribbed handle	ripH	11
Framed stand	DbF	4
Soul hole	Seeloch	6
Plastic decorations of ceramics		
Protrusions on the upper base of handle	PA1	7
“Small wings”, extension of one or both bases of handle	PA2	11
Mustache below the bottom of handle	PA3	16
Plastic “horseshoe”	PA4	16
“Nipple-like” protrusion	PA6	17
Other plastic applications	PA7	17
Stone industry		
Faceted battle-axe	FHA	8
Silesian type battle-axe	SHA	3
Simple shape battle-axe	OHA	34
Silicite dagger	SDg	15
Whetstone	SSt	5
Stone wristguard (wide, 4 holes)	ND1	44
Stone wristguard (narrow, 4 holes)	ND2	12
Stone wristguard (narrow, 2 holes)	ND3	14
Bone and antler industry		
Cylindrical bone beads	KPI3	7
Pin with perforated head	KN2	15
Bone V-perforated button	KnoV	41
Glass		
Glass, faience beads	Glass	3
Metals		
Copper awl	CuA	30
Copper torq	CuHr	9
Lockenringe	CuO	13
Hair ornament made of simple wire	HaS1	29
Hair ornament made of double wire	HaS2	12
Oar-shaped pin with back hook	RkN1	5
Oar-shaped pin with simple hook	RkN2	5
Copper knife/razor	CuM	14
Copper dagger type I	CuDg1	5
Copper dagger type II	CuDg2	4
Copper dagger type III	CuDg3	10
Copper dagger type IV	CuDg4	14
Riveted copper dagger type	CuDg5	8
Cu/Au sheet plate with twisted ends	Cu/Au Platte	10

Table 1. Continued

The majority of our data comes from Moravia. The Carpathian Basin data came only from the literature available to us and, moreover, the Carpathian Basin contexts with Nagyrév jugs were preferentially included, which could be influencing the comparison. While published and unpublished material could be accessed for the Moravian sites, access to literature regarding the Carpathian Basin was more limited (including access to published material). This is also reflected in the number of analyzed assemblages. Another difficulty was the varying quality and quantity (level of detail, structuring, etc.) of the information made available (particularly in older investigations) and classification of identical contexts into different cultures by different authors. All these circumstances certainly influenced the character of the compared datasets so this needs to be taken into account when considering the results and interpretations.

In the Moravian burials we also monitored the sex of the individual at selected sites. Archaeological sexing was based on the position of the skeleton and anthropological sexing was based on the anthropological assessment of the skeleton. These two pieces of data were used to create a variable in which males (M) and females (F) were those cases where the archaeological and anthropological assessments of sex concurred. In cases where only one type of assessment was available (usually based on position of the skeleton), it was used. For remaining cases (i.e. sex not available or archaeological and anthropological identifications in contradiction), the case was labeled “N”.

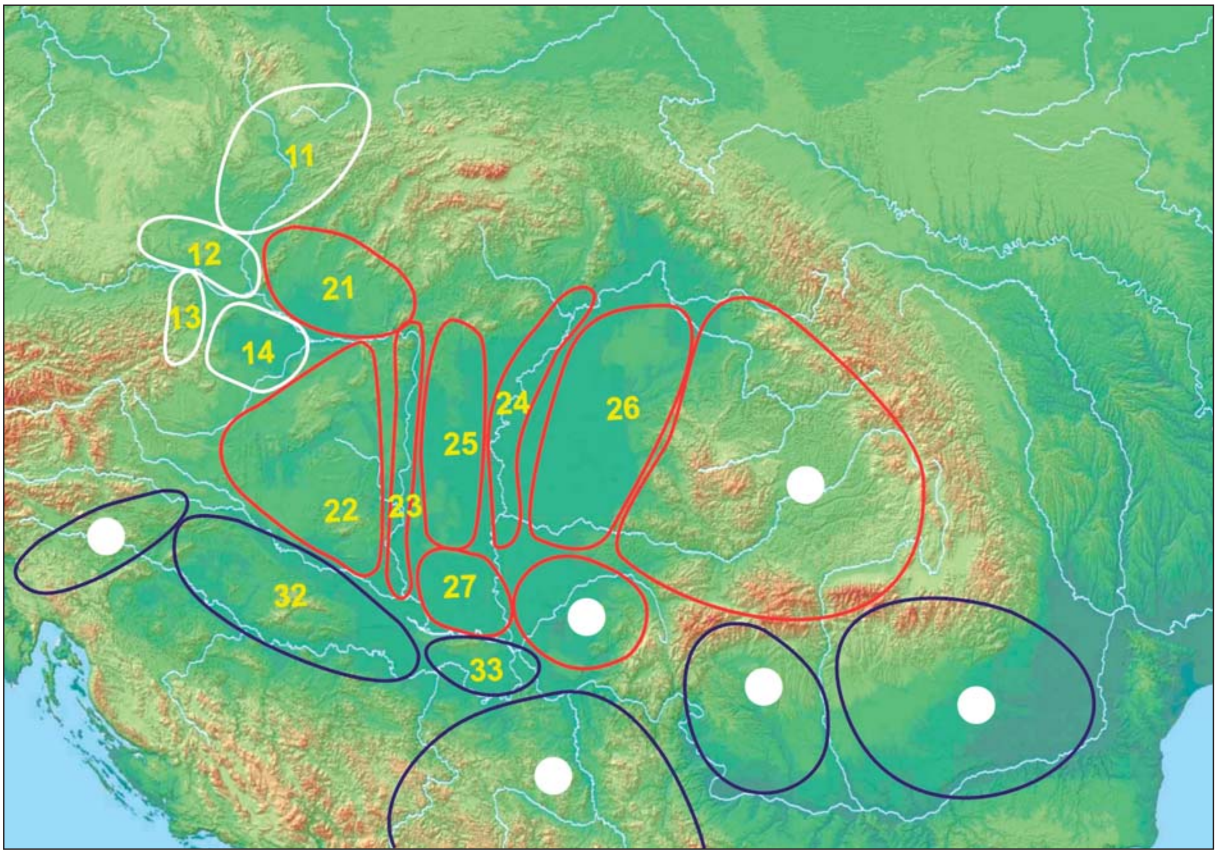

Fig. 2. Map of geographic areas covered in the study – 11: Moravia; 12: Lower Austria north of the Danube; 13: Traisental (southern Lower Austrian Danube region); 14: Burgenland and western Hungary; 21: southwestern Slovakia; 22: Transdanubia; 23: Danube region; 24: Tisza region; 25: Central Hungary; 26: eastern Hungary (east of the Tisza); 27: Vojvodina; 32: Slavonia; 33: Syrmia

Ordination/seriation methods

The data matrix was analyzed using two different methods. Both methods are means of searching for similar (association by similarity) cases. One of the methods was originally developed by James C. Brower and Kenneth M. Kile (1988; BK from here on) and is currently implemented in the software PAST 1.81 (Hammer – Harper – Ryan 2001). The BK algorithm is iterative and consists of repeating series of four (I–IV) steps. (I) Columns are labeled by consecutive numbers from left to right (*1* to *m*) and a mean value is calculated for each row, where presence occurs in a given row (in the matrix labeled 1). (II) The rows are arranged from top to bottom according to the mean value. (III) The rows are labeled from *1* to *n* and the obtained mean values of presences are calculated for each column. (IV) Columns are arranged from right to left on the basis of obtained mean values. Steps I–IV are repeated for so long until the sequence stabilizes. The process is constrained with a limitation on alterations in row sequences – cases (when the variable sequence is known), or complete with common seriation of rows and columns. As the relative chronology was not clearly specified for cases or variables, we use an unconstrained version. The result is ordering of presences near the diagonal from upper left to bottom right in the matrix and the resultant sequence of cases and variables. Authors (Brower – Kile 1988) used a simple test criterion. It is based on a case of ideal seriation when all presences (1) are directly on the diagonal and absence (0) is not embedded in any presences block in a given column. Embedded absence represents any absence which occurs between the highest and the lowest presence in a given column. The calculation of the criterion:

$$criterion = 1 - \left[\sum_{j=1}^{m} A_j \Big/ \sum_{j=1}^{m} R_j \right]$$

where A_j is the number of embedded absences in column *j*, R_j is the range of presences in the column *j*. In a perfect seriation the criterion is equal to 1.

The second ordination method applied was Correspondence Analysis (CA) which is a traditional multivariate technique based on decomposition of Chi-square statistics of the contingency table into new orthogonal factors. We computed CA using the program PAST 1.81 (Hammer – Harper – Ryan 2001). Correspondence Axis 1 (CA1) represents a matrix of chronologically distinctive objects which tends to indicate a relative time axis, but not all authors agree with this assertion (cf. Krištuf 2005, 109). In the first step of the analysis, both methods (CA1, BK) were used in seriation. We also confirmed the original finding (Brower – Kile 1988) that seriation yields results similar to those of the first axis of multivariate ordination methods. As the sequences generated by both methods strongly correlated *(Fig. 3)*, only the BK method was used for all analyses. We present these results here. We are aware however, that other axes of multidimensional space (CA2, CA3 etc.) can be a source of important information which the one-dimensional sequence (BK) does not provide.

Approaches to comparison

Hierarchical aspect of the data

We focused on the hierarchical aspect of the obtained data, which includes aggregates of differing regional extent. Given that we had data for large burial sites, we could proceed hierarchically and compare the results generated by seriations of various hierarchical levels and aggregates. We analyzed the data at the following levels:

(a) individual burial sites, where we could expect minimum influence of regional diversity and burials from a single community for a period of time;

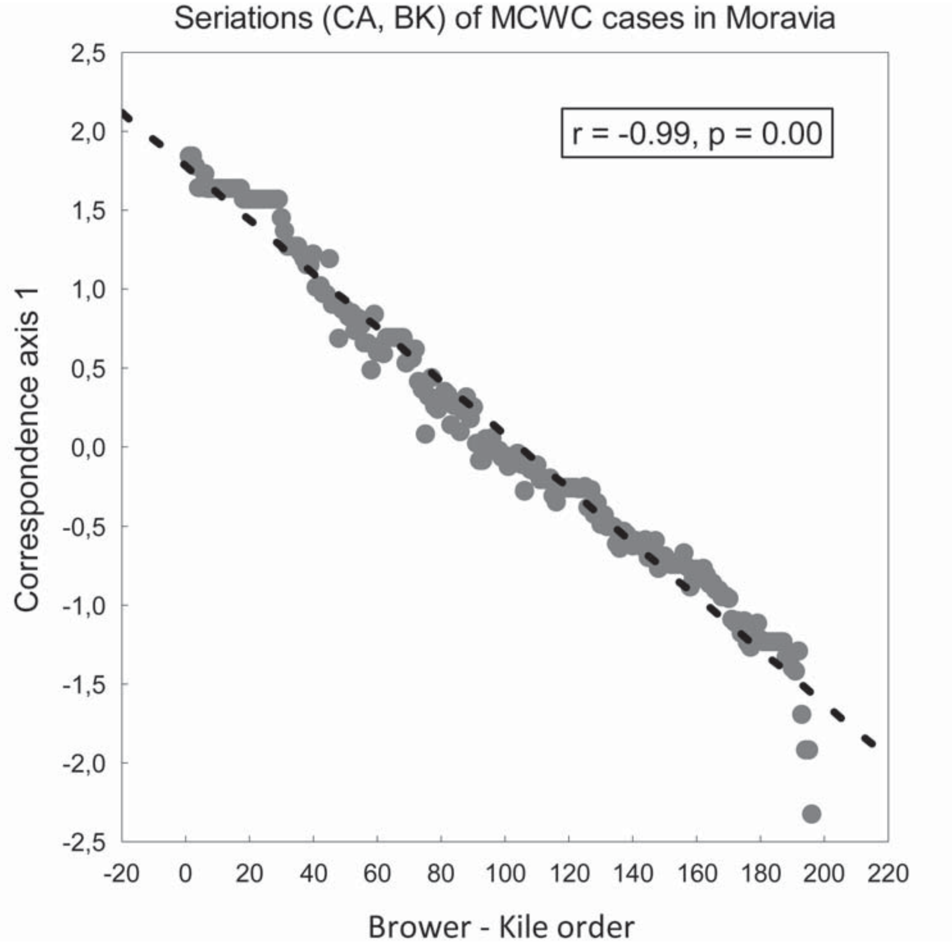

Fig. 3. Scatter plot visualizing relationship between the order of Moravian MCWC cases obtained from BROWER – KILE *1988 seriation method and values of Correspondence axis 1 for the same sample*

(b) a single archaeological culture/cultural tradition in a defined micro-region (i.e. Moravia), where we could expect the same tradition, but also some differences between geographical regions;
(c) a single archaeological culture/cultural tradition in a broader region (in Moravia and the Carpathian Basin), where a similar tradition can be expected, but a greater influence of geographical differences;
(d) several cultural traditions of the Late Eneolithic period in a defined micro-region (i.e. Moravia), where we are possibly starting to see not only distinct regional variability, but also fundamental differences in artifact sequences;
(e) a broader approach with several Late Eneolithic cultural traditions in the wider region (in Moravia and the Carpathian Basin, where we are possibly starting to see not only distinct regional variability, but also fundamental differences in artifact sequences.

First we selected two Moravian MCWC sites, Olomouc-Nemilany 3, Pravá a Levá k Nedvězí (ACO project, unpublished data) and Olomouc-Řepčín 1, Horní nivy (ACO project, unpublished data), then only Nemilany 3 and Řepčín 1, where we analyzed each site separately and also male burials separately. We followed the same procedure at the BBC site Hoštice 1-Za Hanou (MATĚJÍČKOVÁ – DVOŘÁK [eds] 2012) (Hoštice 1 from here on), where we could analyze both sexes independently. In the Protoúnětice culture (PÚC) we analyzed Pavlov-Horní pole (PEŠKA 2009) separately.

In the second step, we performed seriation of all MCWC cases in Moravia. We included the other cases from this region with the two mentioned above. We did the same with BBC and PÚC in Moravia.

In the third step, we incorporated chronologically corresponding periods from Bohemia, the Carpathian Basin and Lower Austria into the three independent seriation sequences from the three Moravian cultures. MCWC, CWC from Bohemia, SOV and MKC were categorized with the "CWC sphere". The Moravian BBC sites were combined with CSE from the Carpathian Basin and BBC sites from other regions were all combined into the "BBC sphere". The PÚC Moravian sites were grouped with NgC 1, NgC 2 and PIT into the "PÚC sphere". These working "spheres" are understood as working tools created for broader spatial-temporal comparisons of three Moravian cultures and not a statement about genetic relationships (excepting the BBC sphere).

In the next step, we analyzed all three Moravian cultures (MCWC, BBC, PÚC) together. We analyzed Carpathian Basin cultures in a similar fashion.

In the last step, we combined all of the cultures in Moravia and the Carpathian Basin (MCWC, BBC, PÚC, SOV, MKC, CSE, NGC1, NGC2 and PIT) together.

Comparison of the variable order

We recorded the order of individual objects (variables) after each seriation. Given that each seriation has a different number of cases, we converted these sequences (whole numbers) into decimal places expressing the percentual position of a given object in relation to the overall number of objects. As an example, if an object was fifth out of a total of 10 objects, it would be given a value of 50 (after conversion). We compared the standardized sequence of variables from individual seriations using the Spearman correlation coefficient *(rho)*. When comparing the results of the various seriations we paid attention to differences in placement of Nagyrév jugs between different analyses.

Comparison with absolute dates

The succession of cases (burials) from individual seriations were compared using the Spearman correlation coefficient *(rho)* with middle values of calibrated (CalPal 2007 HULU) radiocarbon dates. We had 86 calibrated ^{14}C dates available to us *(Table 2)*. The available absolute dates were obtained from published literature or unpublished data from the Archaeological Centre, Olomouc. One date from Franzhausen II was kindly made available to us by Daniela Kern from Vienna and we are grateful for this. Absolute dates all originate from evaluated find assemblages, sometimes directly from Nagyrév jugs contexts. Only at Szava, Nagyárpád and Vinkovci-Tržnica, a single absolute date was used which was not associated with a specific context. In cases where a case (grave) had more than one date available, it was used multiple times in the sequence.

Results

Comparisons within individual sites

Olomouc-Nemilany 3, Pravá a Levá k Nedvězí

The sample includes graves from MCWC burial site Olomouc-Nemilany 3 and one case from Olomouc-Nemilany 1. Calibrated age estimates range from 2560 ± 50 BC to 2270 ± 50 BC. There are 22 graves in the database which contain 16 types of objects (variables): AC, B1, B2, CD1, CD2, Ck, G1, L, P, PA1, FHA, OHA, Pf, CuA, CuHr and HaS1. There are 55 recorded presences in the matrix. Sex was determined on the basis of the position of the skeleton (males – right side, females – left side). Anthropological sexing was not available. Ten cases were identified as males, 4 cases as females and in the remaining 8 cases, the position of the skeleton (and thus the sex) could not be determined.

Case No	Culture	Case	^{14}Ccal	SD	Source
108	MCWC	Olomouc-Nemilany 3, Pravá k Nedvězí, H 36	2560	50	unpublished
89	MCWC	Olomouc-Nemilany 3, Pravá k Nedvězí, H 2	2540	40	unpublished
579	MCWC	Stříbrnice 1, Lopaty, H 65	2530	40	unpublished
100	MCWC	Olomouc-Nemilany 3, Pravá k Nedvězí, H 18	2510	40	unpublished
106	MCWC	Olomouc-Nemilany 3, Pravá k Nedvězí, H 28	2540	40	unpublished
98	MCWC	Olomouc-Nemilany 3, Pravá k Nedvězí, H 16	2410	50	unpublished
84	MCWC	Olomouc-Slavonín 1, U hvězdárny, H 19	2840	60	unpublished
34	MCWC	Pavlov, H 780/II	1860	80	Peška 2009
33	MCWC	Pavlov, H 780/I	1860	80	Peška 2009
691	SOV	Vinkovci - Tržnica/Hotel, horizont C-2	2300	120	Durman – Obelić 1989
691	SOV	Vinkovci - Tržnica/Hotel, horizont C-2	2270	130	Durman – Obelić 1989
377	CWC	Franzhausen II, H 3419	2760	80	unpublished
90	MCWC	Olomouc-Nemilany 3, Pravá k Nedvězí, H 3	2270	50	unpublished
107	MCWC	Olomouc-Nemilany 3, Pravá k Nedvězí, H 31	2530	40	unpublished
441	SOV	Szava, Pit 15	2531	51	Raczky *et al.* 1992
451	SOV	Nagyárpád, Pit CXX/α	2375	65	Raczky *et al.* 1992
451	SOV	Nagyárpád, Pit CXX/α	2378	82	Raczky *et al.* 1992
609	MCWC	Olomouc-Řepčín 1, Horní nivy, H 18	2380	60	Peška 2010
581	MCWC	Stříbrnice 1, Lopaty, H 74	2430	60	unpublished
437	SOV	Szava, Pit 1	2531	51	Raczky *et al.* 1992
442	SOV	Szava, Pit 19	2531	51	Raczky *et al.* 1992
438	SOV	Szava, Pit 2	2531	51	Raczky *et al.* 1992
440	SOV	Szava, Pit 8	2531	51	Raczky *et al.* 1992
31	MCWC	Pavlov, H 5	2430	90	Peška 2009
444	PVU	Zók-Várhegy, Pit 1977/36	2720	110	Primas 1996
444	PVU	Zók-Várhegy, Pit 1977/36	2750	90	Primas 1996
85	MCWC	Olomouc-Slavonín 1, U hvězdárny, H 68	2550	50	unpublished
85	MCWC	Olomouc-Slavonín 1, U hvězdárny, H 68	2610	70	unpublished
460	MKC	Üllő, Pit 3627	2240	90	Kővári – Patay 2005
439	SOV	Szava, Pit 3	2531	51	Raczky *et al.* 1992
443	SOV	Szava, Pit 20	2531	51	Raczky *et al.* 1992
690	SOV	Vinkovci - Tržnica/Hotel, horizont C-1	2300	120	Durman – Obelić 1989
690	SOV	Vinkovci - Tržnica/Hotel, horizont C-1	2270	130	Durman – Obelić 1989
401	SOV	Neusiedl am See	2750	90	Ruttkay 2002
883	MCWC	Olomouc-Nemilany 3, Pravá k Nedvězí, H 21	2564	51	unpublished
448	SOV	Nagyárpád, Pit CII/α	2375	65	Raczky *et al.* 1992
448	SOV	Nagyárpád, Pit CII/α	2378	82	Raczky *et al.* 1992
504	MKC	Battonya-Georgievics-tanya, Pit 1	2360	70	Bondár *et al.* 1998
183	BBC	Tvořihráz I, H 2/91	2360	70	Bálek *et al.* 1999
183	BBC	Tvořihráz I, H 2/91	2160	90	Bálek *et al.* 1999
183	BBC	Tvořihráz I, H 2/91	2200	70	Bálek *et al.* 1999
183	BBC	Tvořihráz I, H 2/91	2550	60	Bálek *et al.* 1999
183	BBC	Tvořihráz I, H 2/91	2320	90	Bálek *et al.* 1999
447	SOV	Nagyárpád, Pit C/β	2375	65	Raczky *et al.* 1992

Table 2. List of calibrated ^{14}C data available and used in the analysis – Case No: number of the case (grave or object) in the database (incidence matrix); Culture: archaeological culture or culture sphere; Case: identification of grave/object; ^{14}Ccal: average ^{14}C value; SD: standard deviation; Source: source of the date/reference

Case No	Culture	Case	^{14}Ccal	SD	Source
447	SOV	Nagyárpád, Pit C/β	2378	82	Raczky *et al.* 1992
450	SOV	Nagyárpád, Pit CXII/α	2375	65	Raczky *et al.* 1992
450	SOV	Nagyárpád, Pit CXII/α	2378	82	Raczky *et al.* 1992
449	SOV	Nagyárpád, Pit CIII/α	2380	70	Raczky *et al.* 1992
449	SOV	Nagyárpád, Pit CIII/α	2380	80	Raczky *et al.* 1992
144	BBC	Záhlinice I, H 47/89	2326	85	Peška 2012
760	BBC	Hoštice 1, H 863	2350	70	Peška 2012
145	BBC	Záhlinice I, H 48/89	2423	63	Peška 2012
138	BBC	Pavlov, Horní pole, H 570/84	2260	60	Peška 2009
138	BBC	Pavlov, Horní pole, H 570/84	2390	80	Peška 2009
138	BBC	Pavlov, Horní pole, H 570/84	2270	100	Peška 2009
723	BBC	Hoštice 1, H 826	2280	70	Peška 2012
137	BBC	Pavlov, Horní pole, H 501/83	1460	30	Peška 2009
137	BBC	Pavlov, Horní pole, H 501/83	2520	70	Peška 2009
845	BBC	Hoštice 1, H 947	2330	80	Peška 2012
227	PUC	Pavlov, Horní pole, H 7	2120	70	Peška 2009
227	PUC	Pavlov, Horní pole, H 7	2310	100	Peška 2009
834	BBC	Hoštice 1, H 937	2390	60	Peška 2012
734	BBC	Hoštice 1, H 837	2380	60	Peška 2012
235	PUC	Pavlov, Horní pole, H 346	1960	40	Peška 2009
235	PUC	Pavlov, Horní pole, H 346	2160	90	Peška 2009
136	BBC	Pavlov, Horní pole, H 500/83	2300	70	Peška 2009
136	BBC	Pavlov, Horní pole, H 500/83	2390	80	Peška 2009
496	PIT	Kiskundorozsma, H 56	2170	40	Bende – Lőrinczy 2002
717	BBC	Hoštice 1, H 820	2240	60	Peška 2012
238	PUC	Pavlov, Horní pole, H 353	2120	60	Peška 2009
238	PUC	Pavlov, Horní pole, H 353	2280	100	Peška 2009
494	PIT	Kiskundorozsma, H 15	1940	70	Bende – Lőrinczy 2002
494	PIT	Kiskundorozsma, H 15	1815	5	Bende – Lőrinczy 2002
495	PIT	Kiskundorozsma, H 55	2060	70	Bende – Lőrinczy 2002
224	PUC	Pavlov, Horní pole, H 2	2210	60	Peška 2009
224	PUC	Pavlov, Horní pole, H 2	2310	90	Peška 2009
241	PUC	Pavlov, Horní pole, H 489	2100	50	Peška 2009
241	PUC	Pavlov, Horní pole, H 489	2050	80	Peška 2009
226	PUC	Pavlov, Horní pole, H 6	2090	50	Peška 2009
226	PUC	Pavlov, Horní pole, H 6	1800	70	Peška 2009
226	PUC	Pavlov, Horní pole, H 6	2140	70	Peška 2009
768	BBC	Hoštice 1, H 871	2340	80	Peška 2012
225	PUC	Pavlov, Horní pole, H 4	2250	70	Peška 2009
225	PUC	Pavlov, Horní pole, H 4	2330	90	Peška 2009
236	PUC	Pavlov, Horní pole, H 350	2060	60	Peška 2009
236	PUC	Pavlov, Horní pole, H 350	2180	90	Peška 2009

Table 2. Continued

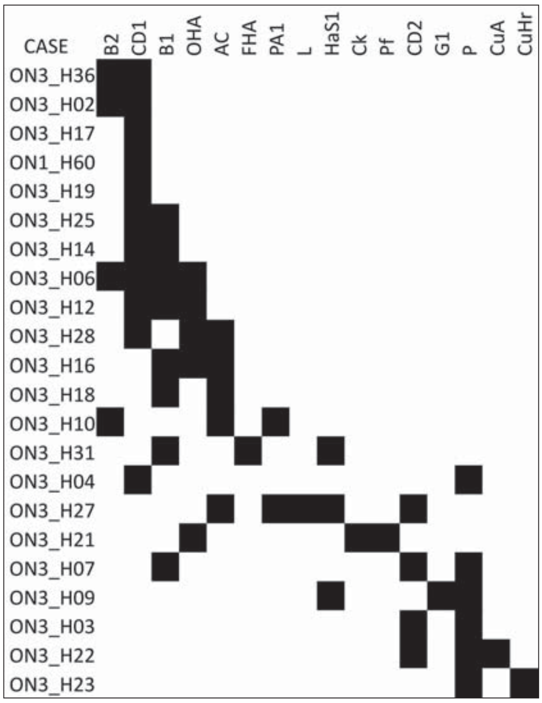

Fig. 4. Order obtained from BK seriation of all cases from the site Nemilany 3 – ON3: Olomouc-Nemilany 3, H: grave no.

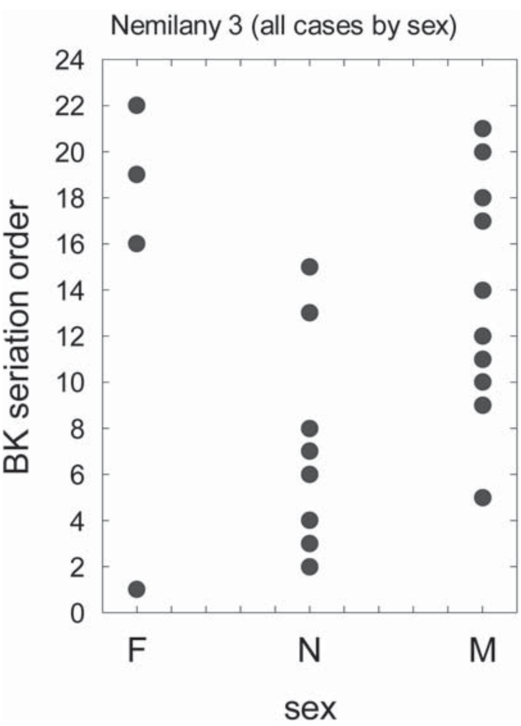

Fig. 5. Order of all cases from the site Nemilany 3 by sex – F: females; N: unknown sex; M: males (sex was determined on the basis of the position of the skeleton; males: right side, females: left side)

The result of the BK seriation method was a sequence with the criterion 0.555, which means that after seriation the column of presences (i.e. positions labeled as 1), blank spaces near the diagonal are filled with ca. 45% of zeroes, i.e. it is relatively inhomogeneous, especially in the lower part *(Fig. 4)*. Jug CD1 is at the left end of the sequence, while CD2 is in the right half of the sequence. All copper decorations are clustered at one end of the sequence. The left half of the sequence is more compact than the right half. The correlation coefficient of the numerically expressed sequence with middle values of calibrated absolute ^{14}C dates have resulted in *rho* = –0.40, but the correlation is not statistically significant ($p > 0.05$).

Males are distributed relatively regularly in the sample *(Fig. 5)*, but 3 out of 4 females are clustered at the end of the sequence (association with decorations) and the remaining female is at the beginning of the sequence. More of the indeterminable individuals are in the first half of the sequence.

In the next step we repeated the procedure, but only with cases identified as males. The result of the BK seriation *(Fig. 6)* is a sequence with criterion 0.703, which means that the proportion of zeroes replacing the blank spaces around the diagonal are reduced to *ca*. 30%, especially in the lower section. Jugs CD1 and CD2 are in the first half of the sequence. The correlation coefficient of the numerically expressed sequence with middle values of calibrated absolute ^{14}C dates (only 6 values) is almost zero (*rho* = 0.2, $p > 0.05$).

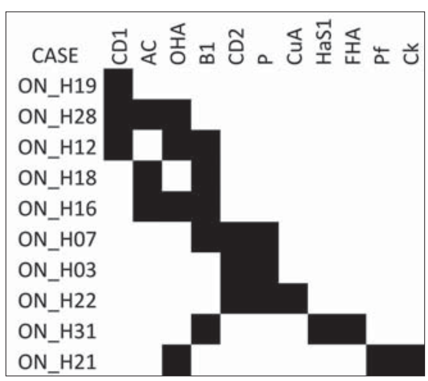

Fig. 6. Seriation BK order of male graves from the site Nemilany 3 – ON3: Olomouc-Nemilany 3; H: grave no.

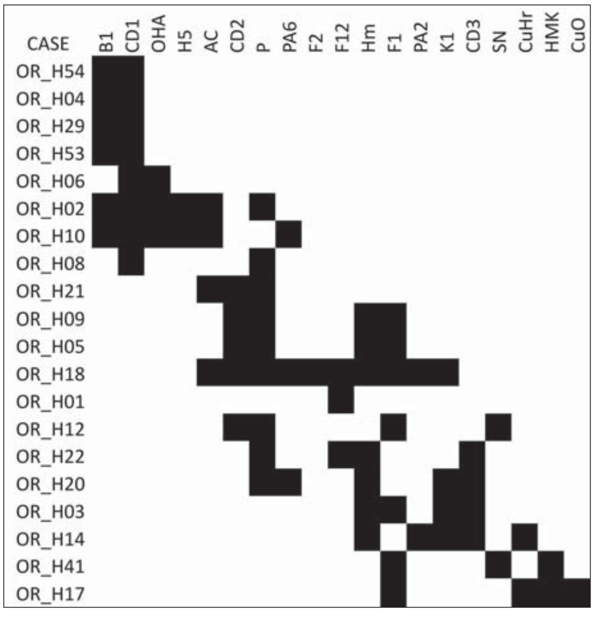

Fig. 7. Order obtained from BK seriation of all cases from the site Olomouc-Řepčín 1 – OR: Olomouc-Řepčín 1; H: grave no.

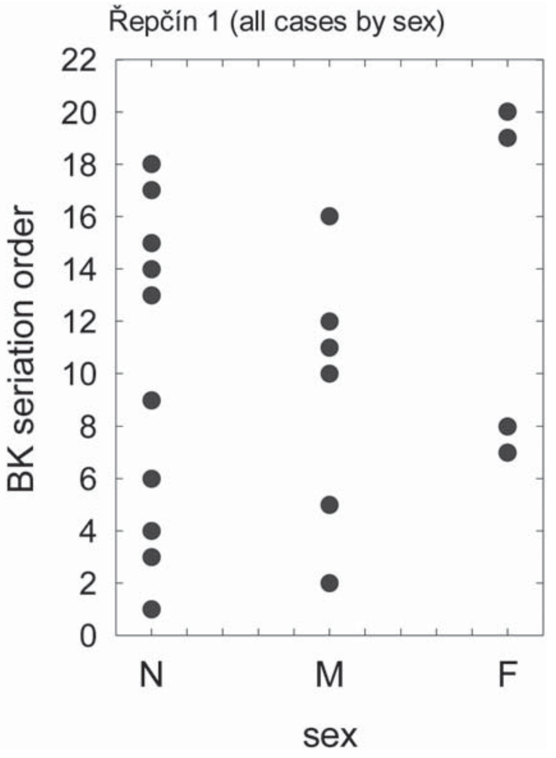

Fig. 8. Order of all cases from the site Olomouc-Řepčín 1 divided by sex – F: females; N: unknown sex; M: males (sex was determined on the basis of the position of the skeleton; males: right side; females: left side)

Olomouc-Řepčín 1, Horní nivy

The sample includes graves from MCWC burial site Olomouc-Řepčín 1, Horní nivy. There are 20 graves in the database which contain 16 types of objects (descriptors): AC, B1, CD1, CD2, CD3, F1, F2, F12, Hm, HMK, H5, K1, P, SN, PA2, PA6, OHA, CuHr, and CuO. There are 75 recorded presences (numerals 1 in the matrix).

The test criterion in this case is 0.652, which means that after seriation, another ca. 35% of zeroes were inserted into the blank spaces around the diagonal forming a relatively wide, black-and-white chequered band *(Fig. 7)*. Distribution by sex is depicted in *Figure 8*.

CD1 and CD2 again occur in the first half of the sequence, F2, F12 and F1 around the halfway mark and CD3 closer to the right end. Copper objects are at the end of the sequence again, in association with two females at the end of the sequence. This sequence cannot be compared to absolute dates because these are not available.

Seriation criterion for six independently assessed male graves is 0.871, but with such a small number, chance can have a major effect (similarly to the previous burial site). The position of jugs CD1, CD2 and CD3 remained the same, but F1 has moved in front of F2 *(Fig. 9)*. (Note: Since cases OR_H04 and OR_H06 have with the remaining four cases no artifact in common, they might be equally ordered in the opposite side of the sequence.)

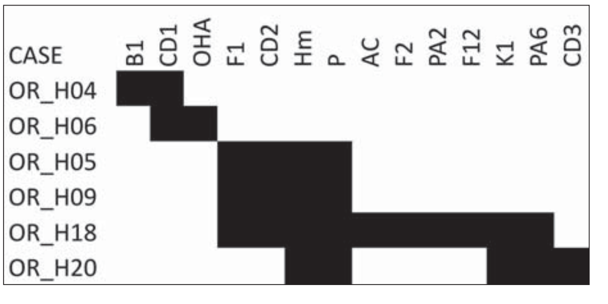

Fig. 9. Order obtained from BK seriation of male graves from the site Olomouc-Řepčín 1 – OR: Olomouc-Řepčín 1; H: grave no.

Comparison of the two sites

We presented the position of individual variables in their (horizontal) numerical sequence in each seriation and the correlation coefficient was used to correlate the sequences of both sites (Nemilany 3 vs. Řepčín 1). The relative sequences of whole samples correlate at a statistically significant level ($rho = 0.96$, $p < 0.001$), while male-only sequences do not correlate ($rho = -0.03$, $p > 0.05$). At individual sites, the overall seriation correlates with the seriation for males at Nemilany 3 ($rho = 0.83$, $p < 0.05$), but not at Řepčín ($rho = 0.31$, $p > 0.05$).

The seriation sequences for both burial sites concur in battle axes being on one side and metal decorations on the other. It is very likely that the seriation is affected by sex to a certain extent, which is more apparent at Nemilany 3.

Assessment of MCWC in the Moravian context

In the next step we combined all Moravian cases classified as MCWC. This sample includes 199 graves from MCWC burial sites. The total number of object types (variables) in these graves is 55: AC, B1, B2, CD1, CD2, CD3, Ck, D, Dh, EN, F1, F2, F12, F31, F5, G1, GB2, Hf, Hm, HMK, H3, H5, HGe, K1, K2, L, LH1, LH2, P, Ph, SN, U, UA, dopH, ripH, PA1, PA2, PA3, PA4, PA6, PA7, FHA, SHA, OHA, Pf, KPI3, EZ, Cu/Auplate, CuA, CuHr, CuO, HaS1, HaS2, CuM, and CuDg3. A total of 621 presences were recorded in the matrix.

Sixty-nine cases were identified as males, 39 cases as females, 93 were unidentified or unidentifiable and in the remaining 3 cases, the anthropological and archaeological assessments were in contradiction.

The seriation criterion is only 0.227, which means that after seriation another ca. 77% of absences were inserted into the blank spaces around the diagonal, which applies to the entire sequence from beginning to end. It follows from the sex category graphs (red – females, blue – males, grey – other) in the first column of the seriation scatterplot (see above), that the sexes occur throughout the whole sequence, but the sequence is distributed unevenly for each sex *(Figs 10–11)*.[2]

In regards to the Nagyrév jugs in question, CDs are on one side of the sequence:
CD1 is at the left end of the sequence (position 3);
CD2 is approximately in the middle (position 27);
CD3 is even further along (position 40).

Then follow jugs F:
F1 (position 41 – immediately beside CD3)
F31 (position 42);
F2 (position 47);
F12 (position 48).

Calibrated dates range from 2840 ± 60 BC to 1860 ± 80 BC. The sequence of the seriation correlates at a significant level with absolute dates and the correlation coefficient ($rho = -0.83$, $p < 0.05$) is greater than at Nemilany 3 separately. When we remove apparent outliers (2 dates 1860 ± 80 BC, Pavlov, H 780/I and H 780/II, case 33 and 34), which are younger by a whole range of the remaining MCWC values,

[2] In this graph *(Fig. 10)* (and several others in this article), the number of cases reached the point at which markings of rows (graves) and columns (artefacts) cease to be easily legible. If any reader is interested in the detailed position of particular cases and variables in relative sequences, please do not hesitate to contact the authors: we are happy to send on request the charts in full resolution.

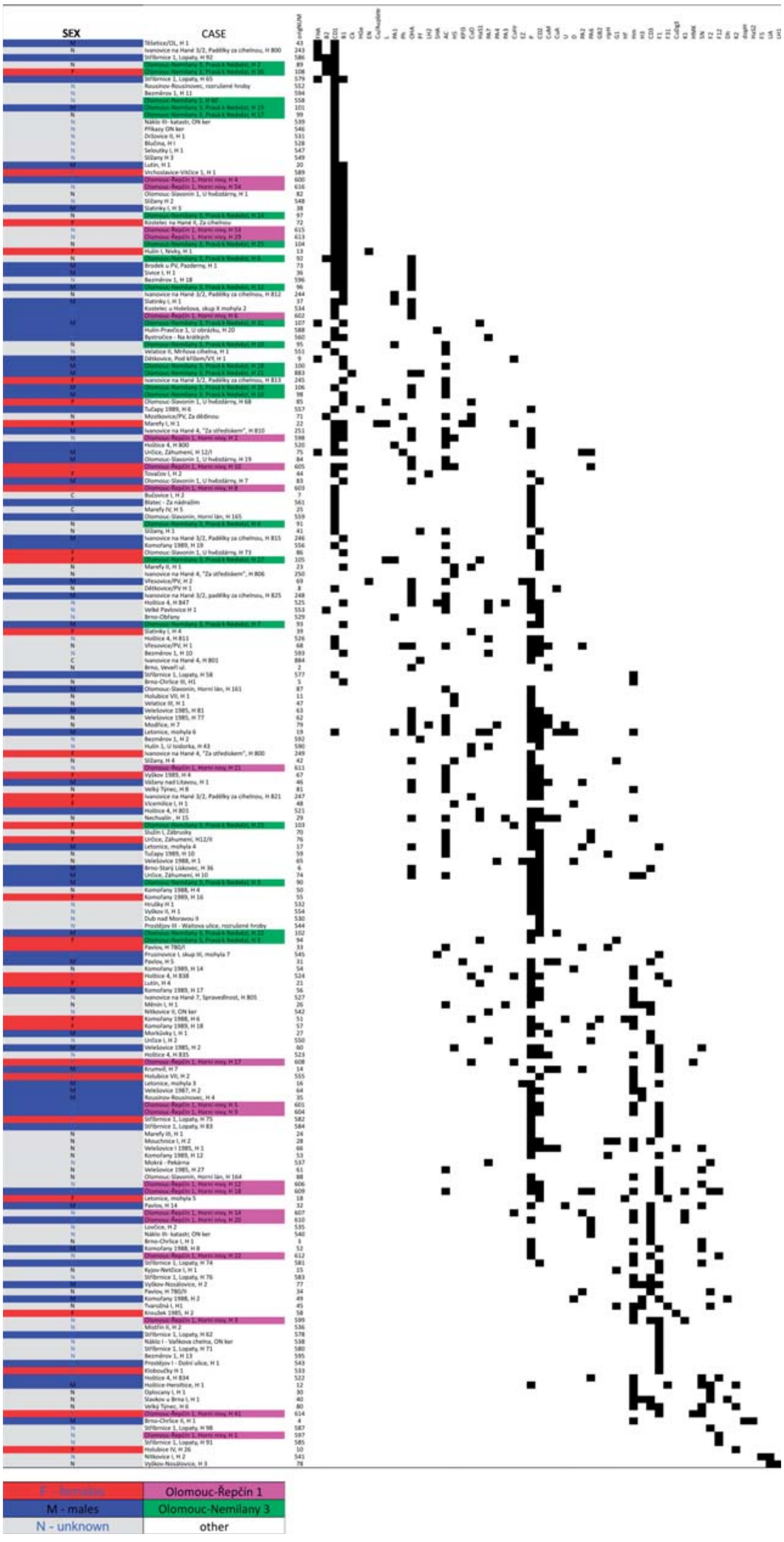

Fig. 10. Order obtained from BK seriation of all MCWC cases from Moravia. The two leftmost columns indicate sex (red: females; blue: males; grey: unknown) and position of cases from Olomouc-Nemilany 3 and Olomouc-Řepčín 1

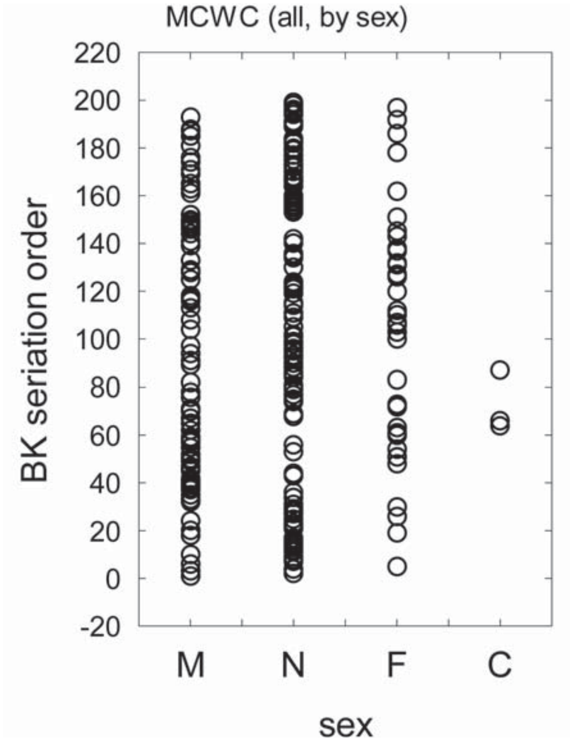

Fig. 11. Order of all MCWC cases from Moravia divided by sex – M: males; N: unknown sex; F: females; C: contradictory (C – position of skeleton in contradiction with morphologically estimated sex according to the skeleton)

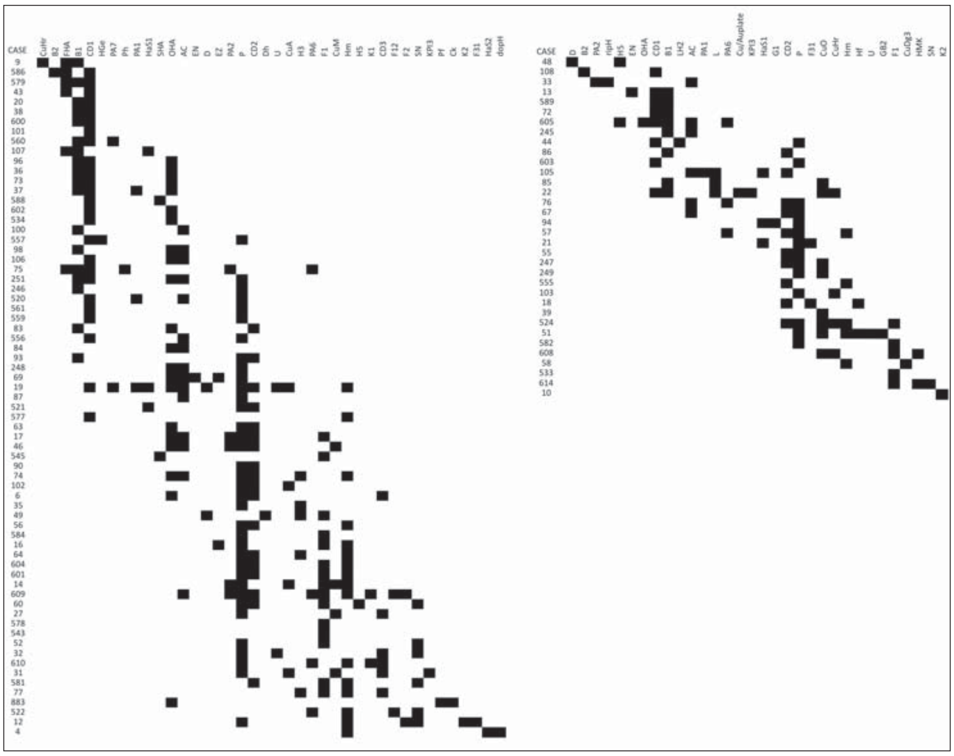

Fig. 12. Orders obtained from BK seriation of MCWC sample from Moravia for males (left) and females (right) separately

the correlation BK seriation sequence becomes weaker and loses statistical significance (*rho* = –0.49, p > 0.05).

When we included only male graves in the seriation *(Fig. 12)*, we categorized 69 cases and 40 variables and there were 239 presences in the matrix. The seriation criterion increased to 0.323, which is not a major change to seriation with all cases included and can be a result of a smaller number of cases and variables. Eleven cases remained in the matrix and its relationship with the seriation sequence was weak and not statistically significant (*rho* = –0.13, p > 0.05).

The sequence of the Nagyrév jugs is the following (out of 40):
CD1 is at the left end (position 5);
CD2 is approx. in the middle (position 19);
F1 (position 25);
CD3 (position 30) switched position with F1;
F12 (position 31);
F2 (position 32);
F31 (position 38).

We followed the same procedure for female graves *(Fig. 12)*. There was a total of 34 cases with 32 variables and 101 presences. The seriation criterion was greater than for the male graves with a value of 0.433, but the number is still low. In regards to the Nagyrév jugs, they are in the following sequence (out of 32):

CD1 is at the left end of the sequence (position 8);
CD2 is approximately in the middle (position 19);
F31 (position 21);
F1 (position 28);
CD jugs remain in a similar position (they moved further relative to males), but F31 and F1 switched their positions. Only three absolute dates remained in the matrix so calculating the correlation coefficient would be meaningless.

Combined seriation of MCWC assemblages and chronologically corresponding cultures in the Carpathian Basin

After the preceding analysis we performed a new BK seriation using a sequence of all the above-mentioned cultures (MCWC-CWC-MKC-SOV) as a representation of a broader Late Eneolithic/Early Bronze complex in the Middle Danube region. The data contained 303 cases, 64 variables and a total of 879 presences.

In the multicoloured distribution plot of values *(Fig. 13)*, we can see that MCWC dominates in the upper/left part of the sequence and the Carpathian Basin cultures are at the opposite end, although both categories overlap considerably. Making a judgment based on the relative chronology, the two groups systematically differ in their mean relative sequences. Sex is probably not having a major effect (although it may be causing the unevenness), so it may be social differences (?). The two most likely factors are regional differences (in space) and time.

Calibrated dates (a total of 24 values) range from 2840 ± 60 BC to 1860 ± 80 BC (the range is defined by the Moravian dates because it is the same dates used for seriation in Moravia). The seriation sequence shows a relatively strong association with absolute dates, but the correlation is not statistically significant (*rho* = –0.47, *p* > 0.05). If we remove the apparent outliers (2 dates 1860 ± 80 BC, Pavlov, H 780/I and H 780/II), then the values range from 2840 ± 60 BC to 2240 ± 90 BC and the correlation with BK seriation sequence becomes statistically significant (*rho* = –0.50, *p* < 0.05). Nonparametric

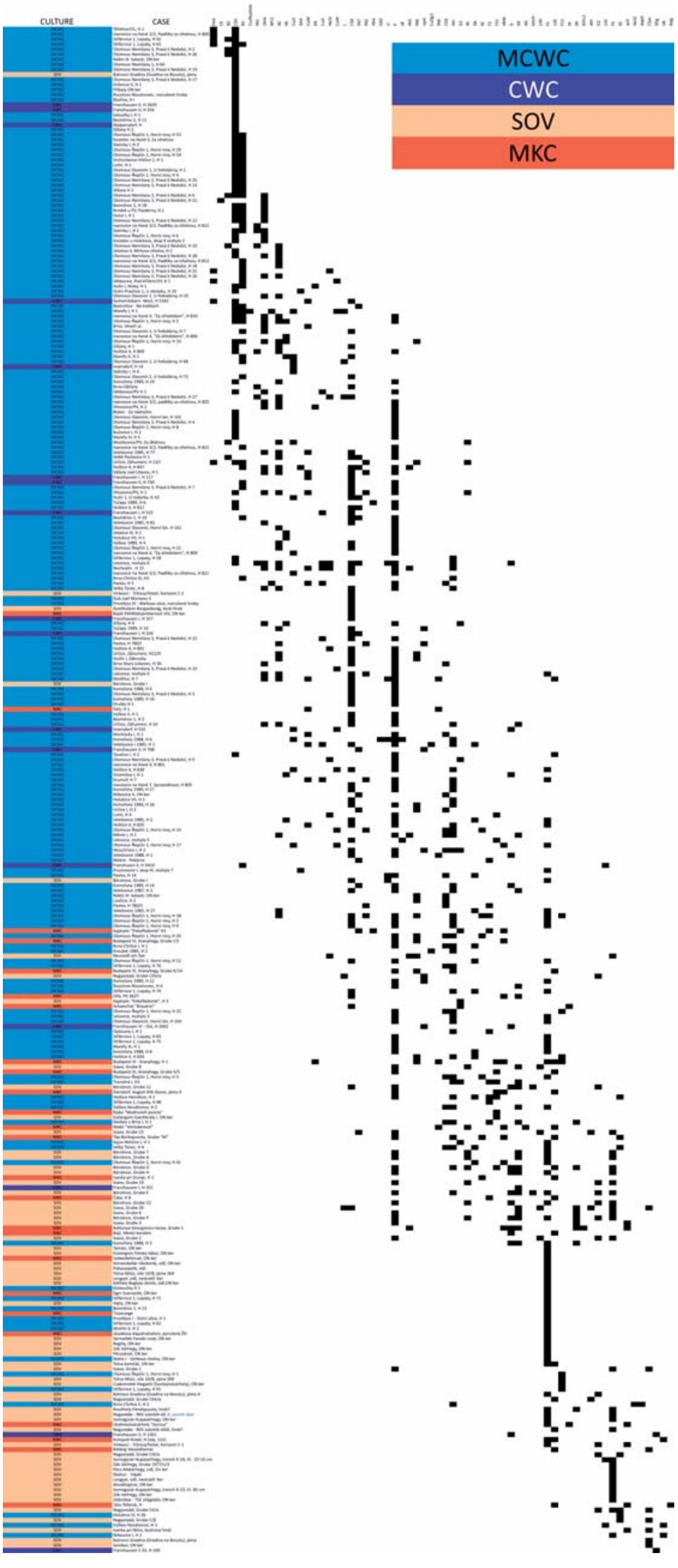

Fig. 13. Combined BK seriation of MCWC assemblages and chronologically corresponding cultures in the Carpathian Basin (CWC sphere)

Mann-Whitney U-test of differences rejected the null hypothesis of equality of middle values (*n1* = 15, *n2* = 7, exact *p* = 0.048) of absolute dates in Bohemia and Moravia (CWC combined with MCWC) and absolute dates in the Carpathian Basin (MKC combined with SOV). Absolute dates (means from calibrations) from the Carpathian Basin, which were available to us, are systematically younger than Moravian and Bohemian dates. Overall, it appears that approximately a half of the seriation sequence variance can be explained by absolute dates, i.e. time. A substantial part of the variance still remains to be explained by other factors. Part of the sequence may also be explained by regional differences.

In regards to the incidence of Nagyrév jugs, there is a following sequence (out of 64):
CD1 is in the left/upper section (position 4);
CD2 is near the beginning in the second half (position 20);
CD3 (position 33);
F2 (position 39);
F31 immediately after F2 (position 40);
F1 (position 47);
F12 (position 49).

Bell Beaker culture

Sites in the Hoštice cadaster

The largest sample with dates is a group of sites in the cadaster of Hoštice, district Vyškov (Matějíčková – Dvořák 2012). Hoštice 1-Za Hanou site and Hoštice 4-Sečné louky site were included in the database. There is a total of 142 cases (65 males, 52 females and 25 indetermined) with 36 variables, and a total of 393 presences in the matrix.

The seriation criterion is 0.319, the distribution of presences gradually widens until it covers most of the lower section with object presences *(Fig. 14)*. Males and females appear throughout the sequence, but males dominate in the first half and females dominate in the second half. Thus it can be surmised that the sequence is partly influenced by sex differences. Nonparametric Mann-Whitney test has not rejected the equality of means for males (median order = 66) and females (median order = 88.5).

Calibrated dates (7 values) range from 2390 ± 80 BC to 2240 ± 60 BC (range of ca. 150 years). The correlation between seriation sequence and absolute dates is not statistically significant (*rho* = 0.07, *p* > 0.05).

In regards to the occurrence of Nagyrév jugs, the only type present is F1 (position 4, one presence in the matrix – Hoštice 1, H 937).

After selecting males *(Fig. 15)* the assemblage numbered 65 cases, 28 variables and 176 presences. The seriation criterion was 0.417. The F1 type case (position 8) was still in the first half of the sequence. There were only 3 absolute dates (maximum range of the means is 40 years), which we did not correlate with the relative sequence.

After selecting females *(Fig. 15)* the assemblage numbered 52 cases, 26 variables and 167 presences. The seriation criterion was 0.448. There were only 4 absolute dates (maximum range of the means is 40 years), which we did not correlate with the relative sequence.

BBC in the entire Moravian territory

The next step was the seriation of BBC cases from all of Moravia. The database numbered 287 cases (106 males, 97 females and 84 undetermined) with 54 variables and 740 presences in the matrix.

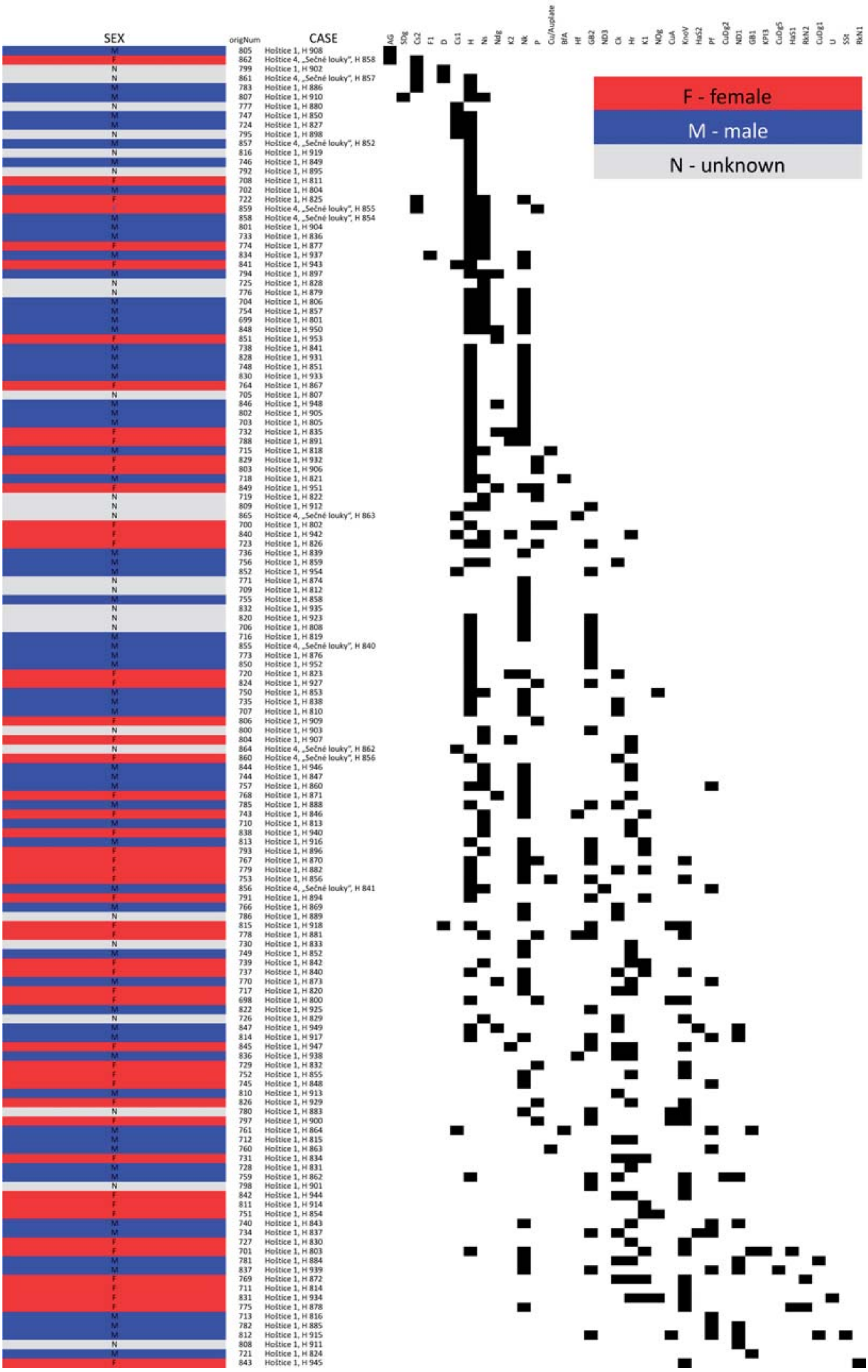

Fig. 14. Order of cases from the cadaster of Hoštice (Hoštice 1-Za Hanou site and Hoštice 4-Sečné louky (sex highlighted: females: red; males: blue; unknown sex: grey)

Fig. 15. Orders obtained from BK seriation of BBC sample from Hoštice sites for males (left) and females (right) separately

The seriation criterion was 0.228 and the seriation distribution of presences around the diagonal is very wide *(Fig. 16)*. In the depiction by sex, there is an apparent imbalance in sex representation in every part of the graph. Although the nonparametric Mann-Whitney test did not reject the equality of sequence means in the entire seriation, after dividing into sections, the differences are significant. For example, after the first 90 cases in the first half, males dominate at a statistically significant level and females dominate in the second half; overall, males are more on the edges and females dominate in the middle. Thus sex has a major influence on the sequencing in BBC.

Nagyrév jugs have the following sequence: CD3 (position 2), CD2 (position 31), F1 (position 38), F4 (position 51) a F5 (position 53).

There was a total of 19 dates available, ranging from 2550 ± 60 BC to 1460 ± 30 BC (range *ca.* 1090 years). Some cases have several dates and have been used more than once (i.e. more than one absolute date for a particular position). The youngest date is evidently an outlier (1460 ± 30 BC, No. 137, site Pavlov, Horní pole, H 501/83; Dvořák *et al.* 1996), because it is almost 900 years younger than the median of the other values and it is about two maximum ranges away from all the other values. It appears to be an anomaly so we excluded it. Even after this value was excluded (as well as before the exclusion of this outlier), the seriation sequence does not correlate (*rho* = –0.063, *p* > 0.05) with the absolute dates.

After a separate seriation *(Fig. 17)* of male cases (39 variables, 106 cases, a total of 270 presences) two areas of overlap appeared, the criterion was 0.290, which is a slight improvement compared to the overall seriation. In regards to the jugs in question, CD3 (position 8) is closer to the beginning of the sequence, F1 is approximately in the middle (position 23) and CD2 is almost at the end (position 34).

Position 8 of absolute dates correlates with the BK sequence negatively, but not at a statistically significant level (*rho* = –0.48, p > 0.05).

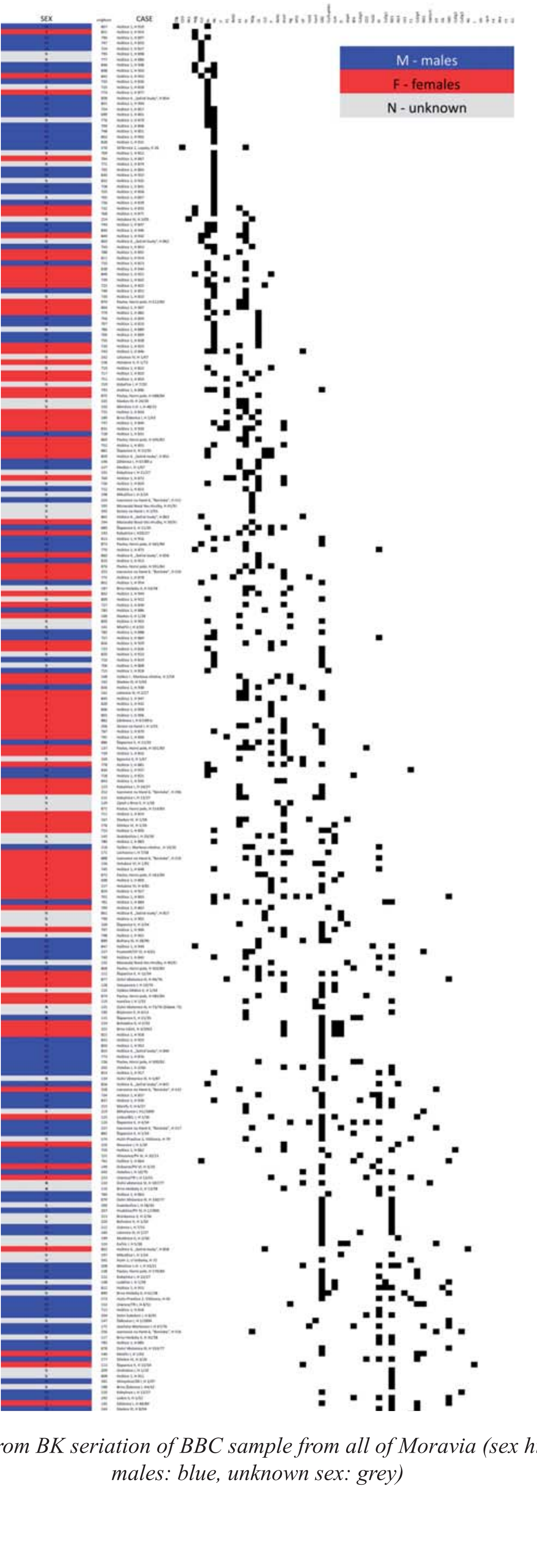

Fig. 16. Orders obtained from BK seriation of BBC sample from all of Moravia (sex highlighted: females: red, males: blue, unknown sex: grey)

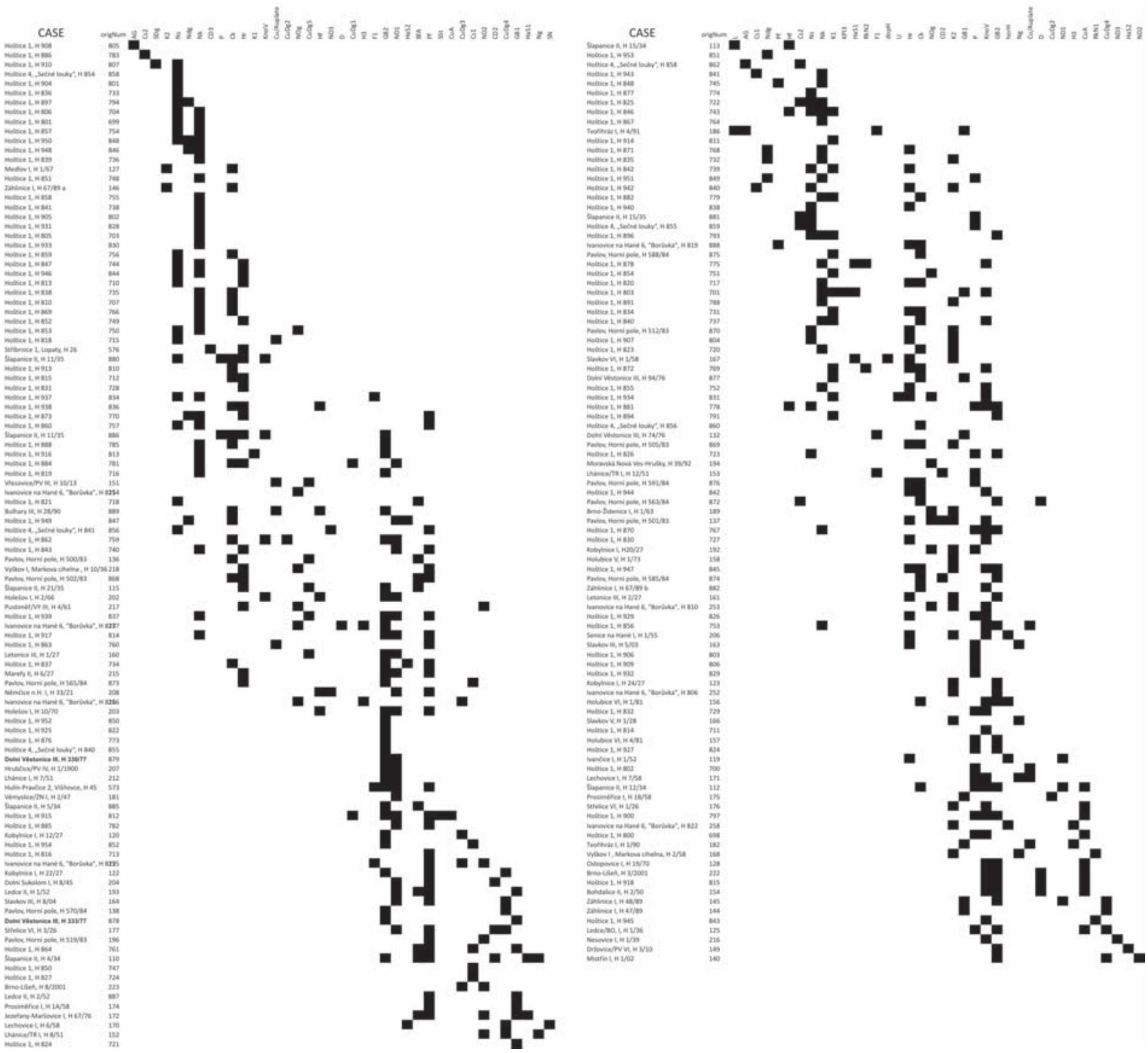

Fig. 17. Orders obtained from BK seriation of BBC sample from all of Moravia for males (left) and females (right) separately

After a separate seriation *(Fig. 17)* of female cases (38 variables, 97 cases, a total of 280 presences) two areas of overlap appeared, the criterion was 0.286, which is similar to males. In regards to the jugs in question, F1 is in the first half closer to the middle (position 14) and CD2 is approximately at the beginning of the second half of the sequence (position 20), so the pattern is opposite to males (provided that the time direction of the seriation is the same).

A sequence of 8 absolute dates (7 after the exclusion of the outlier) correlates slightly positively with the BK sequence, but not at a statistically significant level (*rho* = 0.21, $p > 0.05$). The female sequence cannot be simply reversed (the direction of seriation is arbitrary). It is different in several respects, but not simply the opposite.

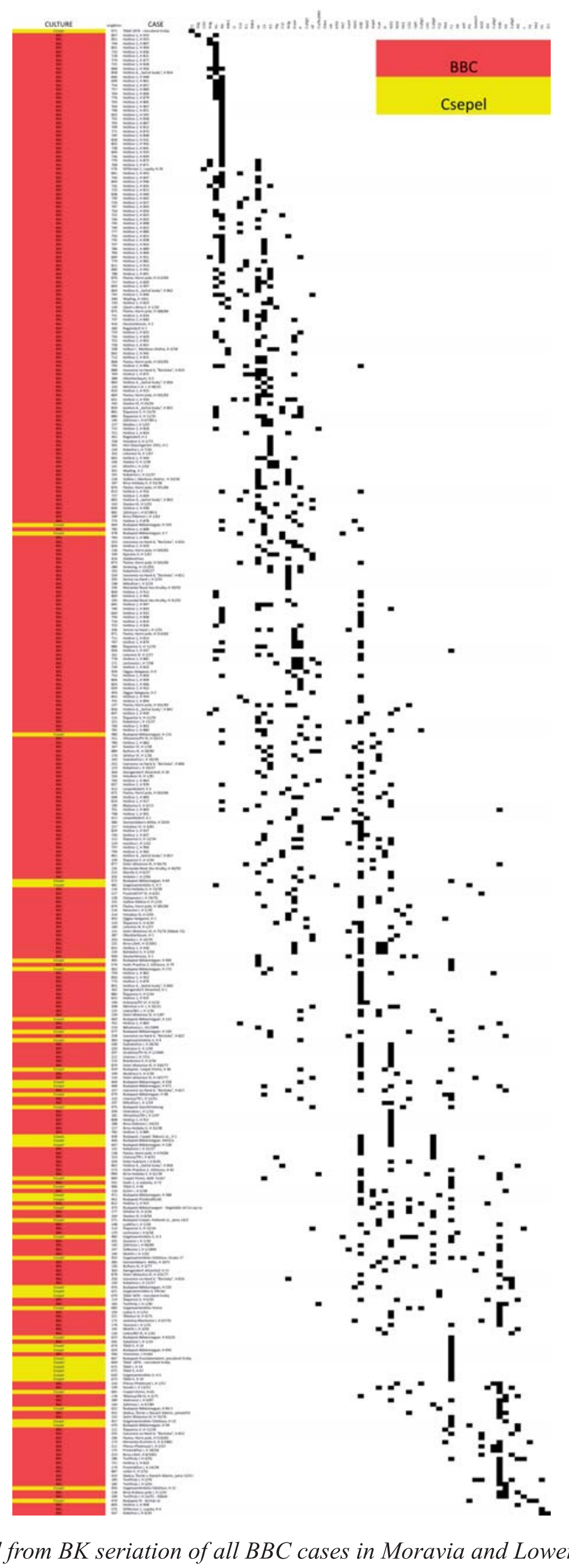

Fig. 18. Orders obtained from BK seriation of all BBC cases in Moravia and Lower Austria and the Csepel group in the Carpathian Basin (BBC sphere), BBC and Csepel groups are highlighted

BBC sphere seriation in the Middle Danube region

The last seriation *(Fig. 18)* represents all BBC cases in Moravia and Lower Austria and the BBC Csepel group in the Carpathian Basin. There was a total of 60 variables and 355 cases, which represents 855 presences. The seriation criterion decreased to 0.194.

The Nagyrév jugs sequence is as follows (out of 60): F2 (position 1, but it can be at the opposite end because it is not associated with any other case), CD3 (position 3), CD2 (position 37), F12 (position 43), F1 (position 44), F4 (position 57), F5 (position 59).

Case sequence with absolute dates constitutes the same aggregate as the aggregate of absolute dates from Moravia only. After seriation of the entire BBC sphere, the sequence becomes very similar to the BBC Moravian sequence (*rho* = 0.95, $p < 0.00001$). As in Moravia, the obtained BK sequence for the entire set of data for the Middle Danube region does not correlate whatsoever with absolute dates (*rho* = –0.05, $p > 0.05$).

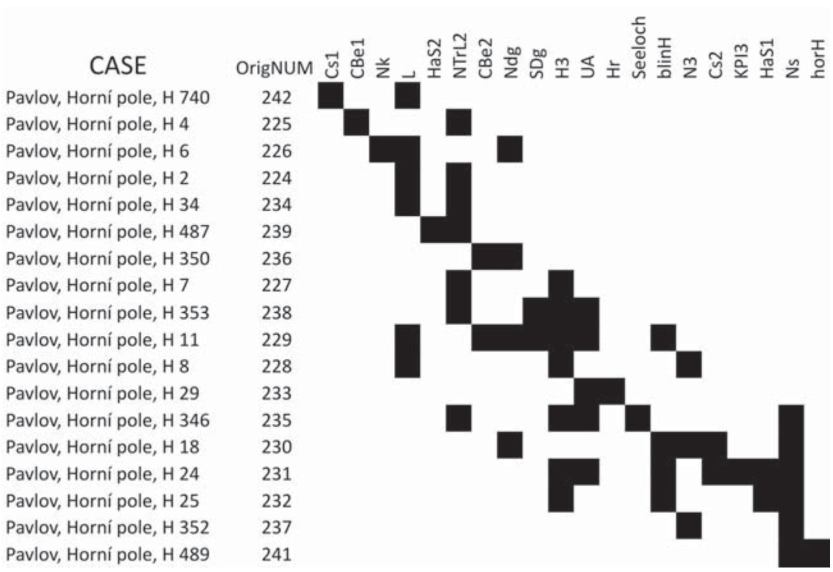

Fig. 19. Order obtained from BK seriation of all cases from the site Pavlov-Horní Pole

Protoúnětice culture

The data for the sex of individuals in the Protoúnětice culture was inadequate so we did not differentiate between the sexes.

Pavlov-Horní pole

The first seriation we completed was for the burial site Pavlov-Horní Pole. There were 20 variables, 18 cases and 58 presences. The seriation criterion was 0.509 *(Fig. 19)*.

The Nagyrév jug sequence cannot be stipulated because none of the defined types were present.

The sequence of cases with absolute dates contains 17 values and some of the presences have more than one date attached, with 8 graves having been dated. After excluding outliers (1800 BC, H2) we obtained a relatively high correlation coefficient, which is not statistically significant (*rho* = –0.49, $p > 0.05$), but there is a tendency for older cases to be ranked lower.

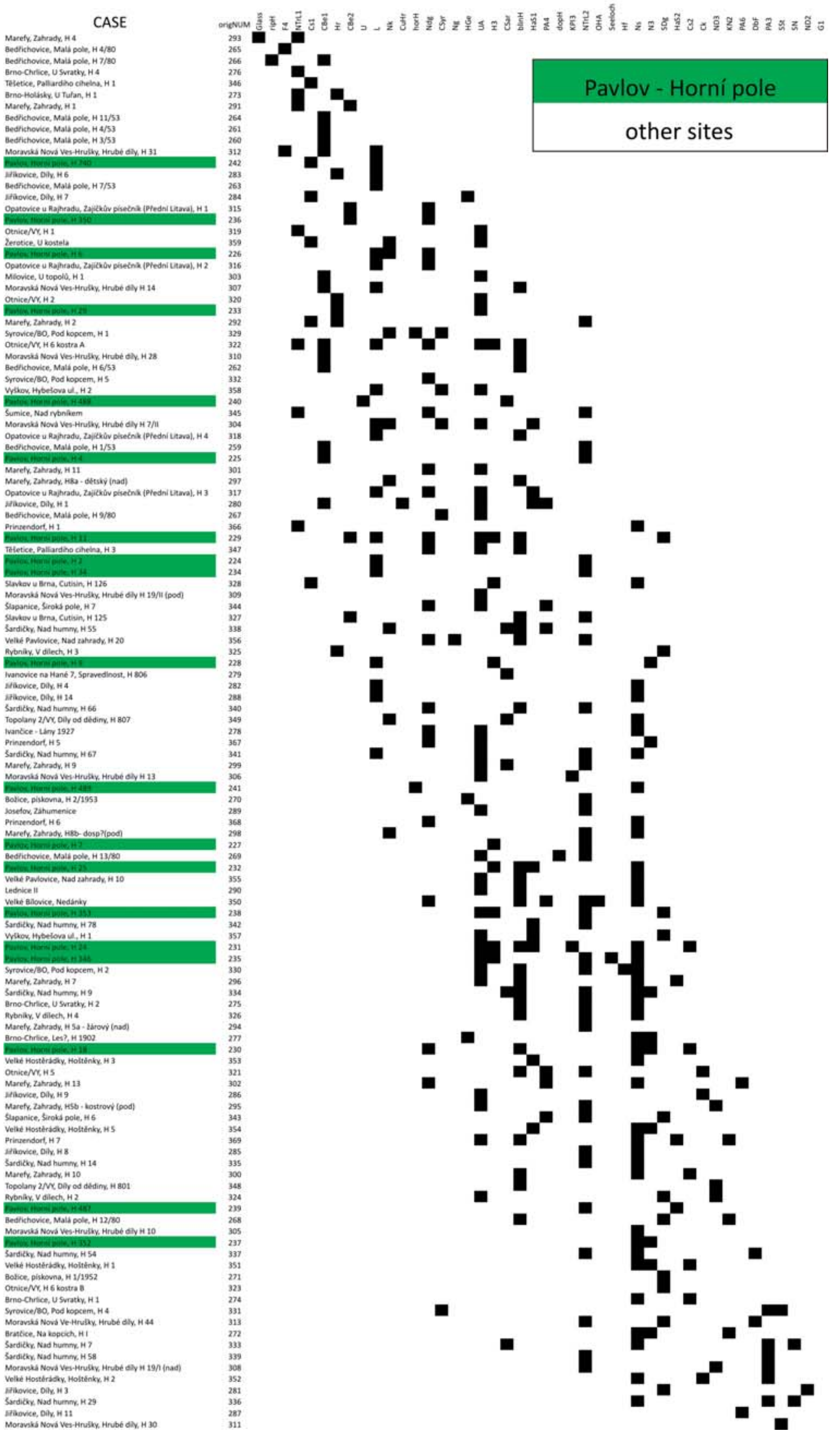

Fig. 20. Order obtained from BK seriation of all PÚC cases in Moravia, Pavlov-Horní Pole highlighted

Protoúnětice culture seriation in Moravia

We also computed seriation of all PÚC cases in Moravia and adjacent regions in Lower Austria. There were 44 variables, 123 cases and 330 presences. The seriation criterion was 0.226 *(Fig. 20)*.

Burial site Pavlov-Horní Pole is distributed throughout the sequence, except for the beginning and the end. The sequence of Nagyrév jugs cannot be stipulated because the sequence contains only F4 near the end of one sequence.

Absolute dates were available only for Pavlov-Horní Pole, so the absolute dates are the same but are being applied to a different sequence. The correlation coefficient is almost zero (*rho* = –0.07, $p > 0.05$). If the chronological sequence does possess a chronological dimension, it is not possible to determine its direction.

Seriation of Protoúnětice culture and Early Bronze Age cultures in the Carpathian Basin

We also computed a seriation of all Late Eneolithic/Early Bronze Age cultures in the Middle Danube region. Included cultures were PÚC, NGC1, NGC2 and PIT. There were 50 variables, 158 cases and 409 presences. The seriation criterion was 0.237 *(Fig. 21)*.

Nagyrév culture cases 1 and 2 are clustered mostly at one end of the sequence (they are clearly associated with F4, F32, F2, F12), PIT cultures and cases appear at the opposite end with PÚC also present.

Twenty absolute dates were available (after excluding outliers H2 from H2 Pavlov-Horní Pole). The correlation coefficient of the absolute date sequence was almost zero (*rho* = –0.06, $p > 0.05$). If the chronological sequence does possess a chronological dimension, it is not possible to determine its direction.

Seriation of all cultures in Moravia

We computed the seriation of all Moravian cultures together. Included cultures were MCWC, BBC and PÚC. There were 89 variables, 605 cases and 1628 presences. The seriation criterion was 0.175 *(Fig. 22)*.

Nagyrév jugs are ordered in the following sequence (out of 89): CD1 (position 4), F12 (position 13), CD2 (position 18), F2 (position 20), CD3 (position 21), F1 (position 26), F31 (position 29), F5 (position 63) and F4 (position 81).

There were 55 absolute dates available. After excluding three outliers mentioned above in the context of individual cultures, 52 absolute dates remained. The correlation coefficient for the absolute date sequence is high (*rho* = –0.74, $p < 0.00001$). It is evident that seriation sequenced these three cultures in the only possible way with BBC in the middle and as the mean values of the absolute dates (in individual cultures) differ, a strong dependence between the values in the relative sequence and absolute date values has developed. Within the individual cultures separately, the sequences do not correlate with the absolute dates.

Seriation of all Carpathian Basin cultures

We computed the seriation of all cultures in the Carpathian Basin. The cultures included are LVU, MKC, SOV, CSE, BBC, NGC I, NGC II, PIT. There were 68 variables, 173 cases and 424 presences. The seriation criterion was 0.2327 *(Fig. 23)*.

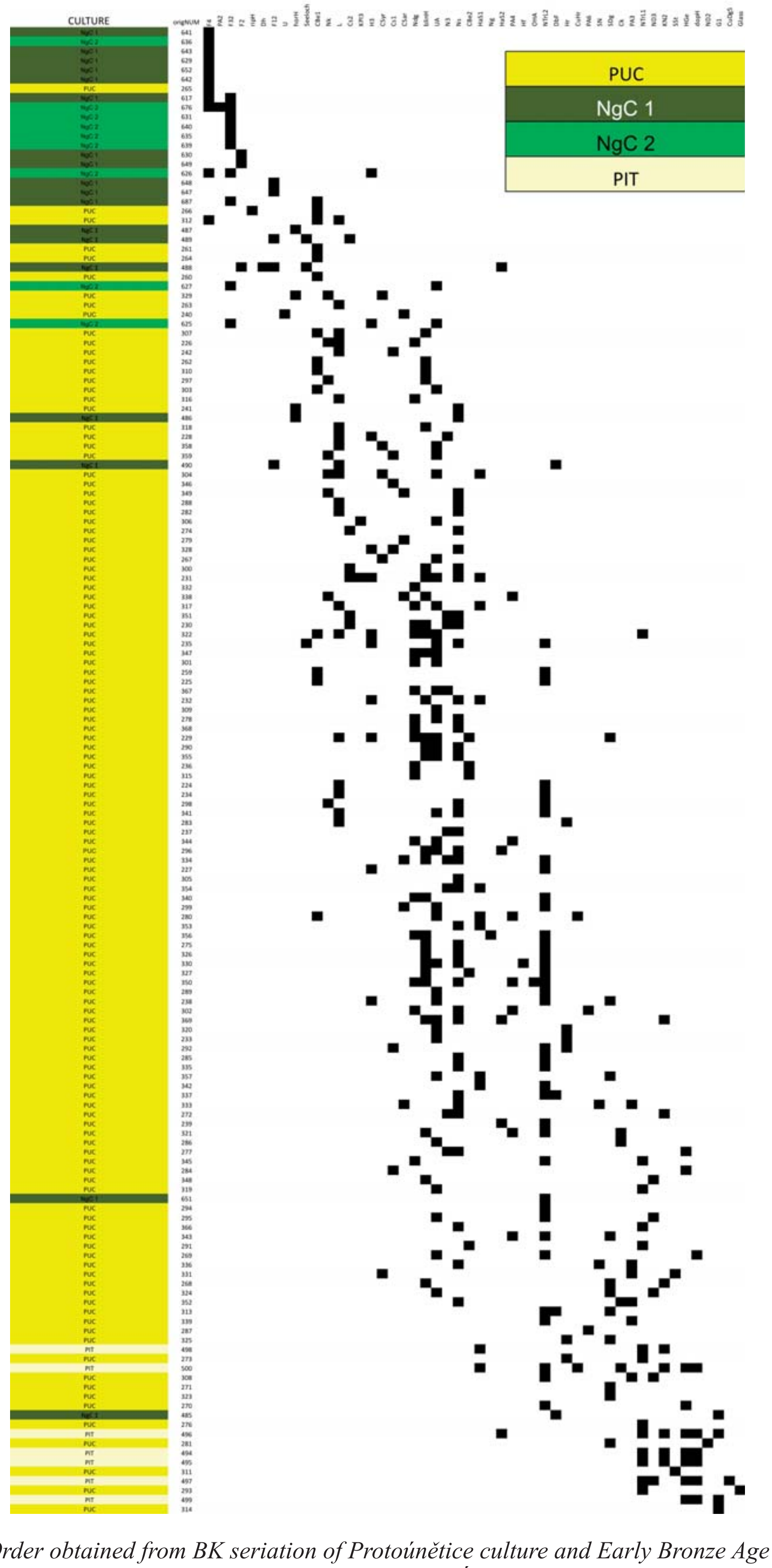

Fig. 21. Order obtained from BK seriation of Protoúnětice culture and Early Bronze Age cultures in the Carpathian Basin (PÚC sphere)

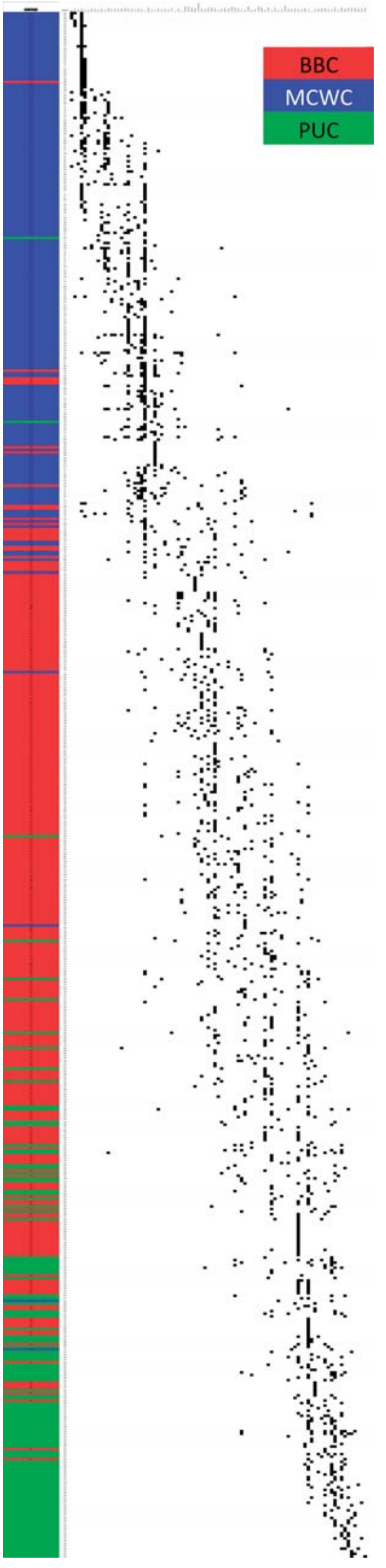

Fig. 22. Order obtained from BK seriation of three Late Eneolithic cultures from Moravia: MCWC, BBC and PÚC

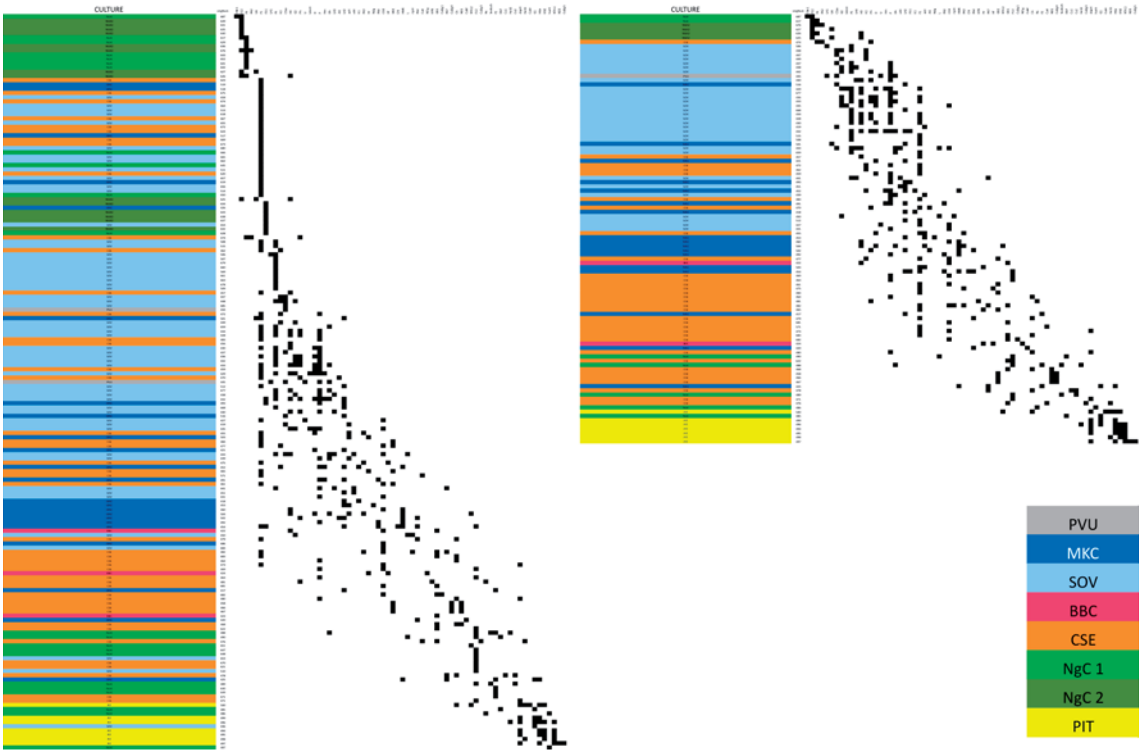

Fig. 23. Order obtained from BK seriation of cases from Carpathian Basin – all available cases (left); cases with two or more presences only (right)

The relationships between the three main cultural spheres (CWC, BBC, Early Bronze Age) appear to be far more complex than in Moravia. A similar trend appears: in the first half of the seriation, CWC dominates; in the second half, the BBC dominates, PIT at the end, but there is much more overlap between CWC and BBC spheres, and NGC2 appears at the very beginning. Nagyrév jugs occur only in the first part of the sequence (68): F32 (position 2), F4 (position 3), F1 (position 6), F31 (position 7), F5 (position 9).

Twenty-five absolute dates were available and the sequence correlation coefficient with middle values of the absolute dates is relatively high (*rho* = –0.57, *p* = 0.0032).

The pilot date sequence could have been influenced by a greater number of cases with one presence and the focus on cases with Nagyrév jugs (compared to Moravia), so we also conducted the seriation only with cases that had two or more presences. There were 68 variables, 101 cases and 532 presences. The seriation criterion was 0.2338 *(Fig. 23)*. This step has simplified the situation. NGC2 is still positioned at the beginning of the sequence and the overlap of CWC and BBC spheres still remains. It appears that MKC is mostly positioned in the contact area of the CWC and BBC spheres.

Combined seriation of all Moravian and Carpathian Basin cultures

We computed a seriation of all Moravian and Carpathian Basin cultures. The cultures included are LVU, MCWC, CWC, BBC, PÚC, SOV, MKC, NgC 1, NgC 2 and PIT. There was a total of 95 variables, 832 cases and 2163 presences. The seriation criterion was 0.1513 *(Fig. 24)*.

Nagyrév jugs are ordered in this sequence (out of 95): CD1 (position 2), F31 (position 12), F2 (position 17), CD3 (position 18), CD2 (position 18), F4 (position 26), F1 (position 34), F12 (position 37) and F32 (position 46).

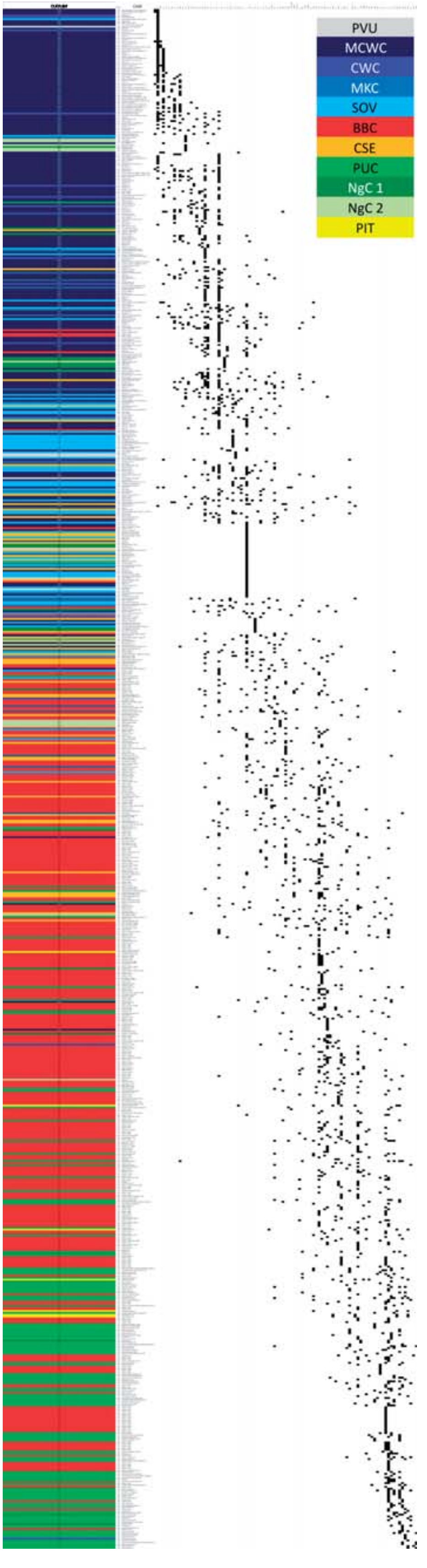

Fig. 24. Order obtained from BK seriation of all cases from Moravia and Carpathian Basin combined

Eighty-six absolute dates were available *(Fig. 22)* and after excluding three outliers (Pavlov, H 780/I, 1860 BC; Pavlov H 780/II 1860 BC, and Pavlov-Horní pole, H 501/83, 1460 BC), which were mentioned above in the context of individual cultures, 83 absolute dates remained. The correlation coefficient for the sequence of middle values of absolute dates was high (*rho* = –0.69, $p < 0.00001$). It is noteworthy that even with a greater number of cases in the seriation and greater numbers of absolute dates (than in Moravia only), the overall correlation is lower.

Comparison of individual seriation sequences

The resultant table *(Table 3* and *4)* shows correlations in sequences of variables (objects) between all seriations. Some correlations could not be calculated because the aggregates being compared did not share common objects (e.g., Řepčín and Hoštice after separating the sexes), others (grey in the table) are based on less than five cases (objects) so they are very susceptible to chance. Most strong correlations were recorded in the context of specific cultural spheres. Correlations are not strong between the various cultural spheres. For example, of all BBC sphere seriation sequences and all CWC sphere seriation

Spearman correlation coefficients	MCWC_Nemilany_all	MCWC_Nemilany_males	MCWC_Repcin_all	MCWC_Repcin_males	MCWC_Moravia_all	MCWC_Moravia_males	MCWC_Moravia_females	CWC_sphere_Central_Europe_all	BBC_Hostice_all	BBC_Hostice_males	BBC_Hostice_females	BBC_Moravia_all	BBC_Moravia_males	BBC_Moravia_females	BBC_sphere_Central Europe_all	PUC_Pavlov_all	PUC_Moravia_all	PUC_sphere_Central_Europe_all	Late_Eneolithic_Moravia_all	Late_Eneolithic_Carpathian_Basin_all	Late_Eneolithic_Carpathian_Basin_selection	Late_Eneolithic_Central_Europe_all
MCWC_Nemilany_all																						
MCWC_Nemilany_males	0,56																					
MCWC_Repcin_all	**0,96**	0,60																				
MCWC_Repcin_males	0,31	0,43	0,31																			
MCWC_Moravia_all	**0,80**	0,05	**0,58**	0,23																		
MCWC_Moravia_males	0,42	0,45	0,44	0,18	**0,69**																	
MCWC_Moravia_females	**0,97**	0,71	**0,66**	-0,13	**0,63**	0,43																
„CWC_sphere“_Central_Europe_all	**0,66**	-0,12	**0,56**	0,25	**0,86**	**0,57**	**0,42**															
BBC_Hostice_all	-0,50	0,30	0,50	0,50	-0,29	-0,06	0,20	**-0,49**														
BBC_Hostice_males	0,50	-0,50	---	---	-0,30	0,03	-0,80	-0,35	**0,62**													
BBC_Hostice_females	-0,10	0,00	---	---	-0,43	-0,35	-0,36	**-0,59**	**0,74**	0,32												
BBC_Moravia_all	-0,07	-0,26	0,03	-0,10	0,22	0,07	-0,10	0,03	0,26	0,15	**0,49**											
BBC_Moravia_males	-0,31	-0,20	0,03	-0,40	0,00	-0,25	0,49	-0,42	**0,59**	0,21	**0,71**	**0,54**										
BBC_Moravia_females	**0,89**	-0,60	-0,80	0,20	0,25	-0,10	-0,07	-0,07	**0,37**	**0,43**	**0,54**	**0,38**	**0,42**									
BBC_sphere_all	-0,07	-0,70	0,22	0,29	0,06	-0,28	-0,13	-0,01	0,18	0,18	0,34	**0,93**	**0,54**	**0,35**								
PUC_Pavlov_all	---	---	---	---	0,09	-0,80	---	-0,44	0,24	-0,07	0,45	0,14	-0,26	0,36	0,10							
PUC_Moravia_all	0,20	0,50	-0,20	---	0,15	**0,59**	0,23	-0,02	0,06	0,17	0,07	0,10	0,16	0,42	0,26	**0,47**						
„PUC_sphere“_all	0,66	0,50	0,14	0,60	-0,23	0,05	0,26	-0,03	0,23	0,54	-0,04	0,03	0,24	0,42	0,01	0,01	**0,50**					
Late_Eneolithic_Moravia_all	**0,71**	0,53	**0,76**	0,33	**0,46**	**0,56**	**0,53**	**0,57**	-0,34	-0,29	**-0,73**	-0,07	**-0,44**	**-0,44**	-0,11	-0,40	-0,28	0,12				
Late_Eneolithic_Carpathian_Basin_all	0,14	0,80	0,08	-0,37	-0,28	-0,04	0,20	**-0,41**	0,30	0,05	0,03	-0,02	0,26	0,10	-0,23	0,40	0,27	**0,57**	0,16			
Late_Eneolithic_Carpathian_Basin_selection	0,17	0,60	0,08	-0,53	-0,26	0,02	0,37	**-0,43**	0,27	0,15	-0,04	-0,04	0,35	0,17	-0,20	0,37	0,31	**0,63**	0,14	**0,97**		
Late_Eneolithic_Central_Europe_all	**0,71**	0,62	**0,64**	0,30	**0,39**	**0,51**	**0,51**	**0,51**	-0,17	-0,10	**-0,49**	**-0,44**	**-0,34**	-0,24	**-0,45**	-0,24	-0,21	**0,28**	**0,89**	**0,41**	**0,41**	

Table 3. Spearman correlations between all analysed BK relative orders— ---: insufficient numerical conditions (less than 3 cases); grey: insufficient numerical conditions (less than 5 cases); red bold: statistically significant correlation (at 0.05 level)

	CWC	BBC	PUC
CWC	0,48	-0,10	0,13
BBC	-0,10	0,44	0,17
PUC	0,13	0,17	0,32

Table 4. Average Spearman correlations between all analysed BK relative orders, simplification (through averaging all correlation coefficients) of the Table 3

sequences (a total of 49), only one statistically significant correlation was recorded (MCWC_Nemilany_all vs. BBC_Moravia_females), but it was based on only 7 cases. This means that sequences for the same objects in different cultural spheres do not relate to each other. The following table presents middle values of correlation coefficients within and between spheres.

In every cultural sphere the relations between objects (relative orders) are completely different. It is interesting that Moravian only sequences and the overall sequences (Moravia together with the Carpathian Basin) correlate strongly, in particular the BBC and PÚC, whereas the constituent sequences at individual sites do not always correlate with sequences of larger aggregates. For example, the Pavlov sequence correlates with the Moravian PÚC sequence, but there is very little correlation with the PÚC sphere (on the basis of available data) from the entire region including the Carpathian Basin (groups PÚC, NgC 1, NgC 2, PIT). A similar situation exists between sequences from Hoštice and the BBC sphere sequence. In the CWC we do not observe this at either of the two burial sites (Nemilany 3 and Řepčín 1 strongly correlate with the CWC sphere sequence). We can see from the correlations of the CWC group aggregates that major differences exist between the whole group sequence and selected male burials. Male sequences from both burial sites do not correlate with any other groups, and in all of Moravia correlating the male sequence with the overall CWC group sequence produces a correlation coefficient smaller by one-third, than in sequences where sexes are not analyzed separately.

The size of the aggregate and sex have a major effect on the overall sequence. In smaller aggregates with a smaller number of cases and artifacts, the criterion value is distinctly higher, but there is also a greater likelihood of chance for locally specific factors influencing the result. In larger aggregates we have a larger number of cases in the seriation (the situation is described more completely and comprehensively so nothing significant is likely to be missed) and a larger number of absolute dates (and usually a greater time range), but, probably, also a more considerable blurring effect of regional, social and other sources of variability.

There are large differences in how universally the individual Nagyrév jugs occur throughout the entire time period and in the different cultural spheres. From the 22 seriations conducted at various levels, the most universal were CD2 and F1 (actual contact artifacts), which were present in 16 seriations. F1 and F2 were present in 11 seriations, CD1 and CD3 in 10 seriations, F4 and F5 in 8 seriations and F32 in only 3 seriations. In terms of the three cultural spheres, CD2 and F1 are the best candidates for being contact artifacts. Other Nagyrév jugs are contact artifacts to a smaller extent. Jugs F4, F5 a F32 should be considered as either regional or temporally limited types. Thus the concept of Nagyrév jugs as contact artifacts may be due for re-evaluation and due to the great heterogeneity of their occurrence; some types – F4, F5, F32 – should be removed from this category.

In all CWC seriations, the CD1 is oldest, CD2 relatively younger and CD3 the youngest. Only CD1 and CD2 are always relatively older than all jugs in the F category. Sequence CD3 in all F jugs is generally always in the second half of the sequence and their position changes in the various MCWC seriations. The period in question can therefore be roughly divided into "CD1 and CD2 periods" and a "period of other jugs". Sequences F12 and F2 are almost identical. Identical jug types are arranged differently in the BBC compared to the MCWC: CD3 position is reversed to the beginning, CD2 and F1 are near each other at the beginning of the second half of the sequence, but in a different BBC seriation and in a jumbled order, and finally F5 at the end of the sequence, which is consistent with the MCWC. So even the positions of Nagyrév jugs express differing sequences of identical objects in the MCWC and BBC, which follows from the overall correlations between seriations. In the PÚC, all jugs (F1, F2, F31, and F4) occur near the beginning of the sequence.

It is also apparent that Nagyrév jugs occur in different parts of the overall sequence of all objects. The most striking comparison is the seriation of the entire Late Eneolithic in Moravia and in the entire Middle Danube region *(Fig. 25)*, where Nagyrév jugs occur throughout the entire sequence range, while

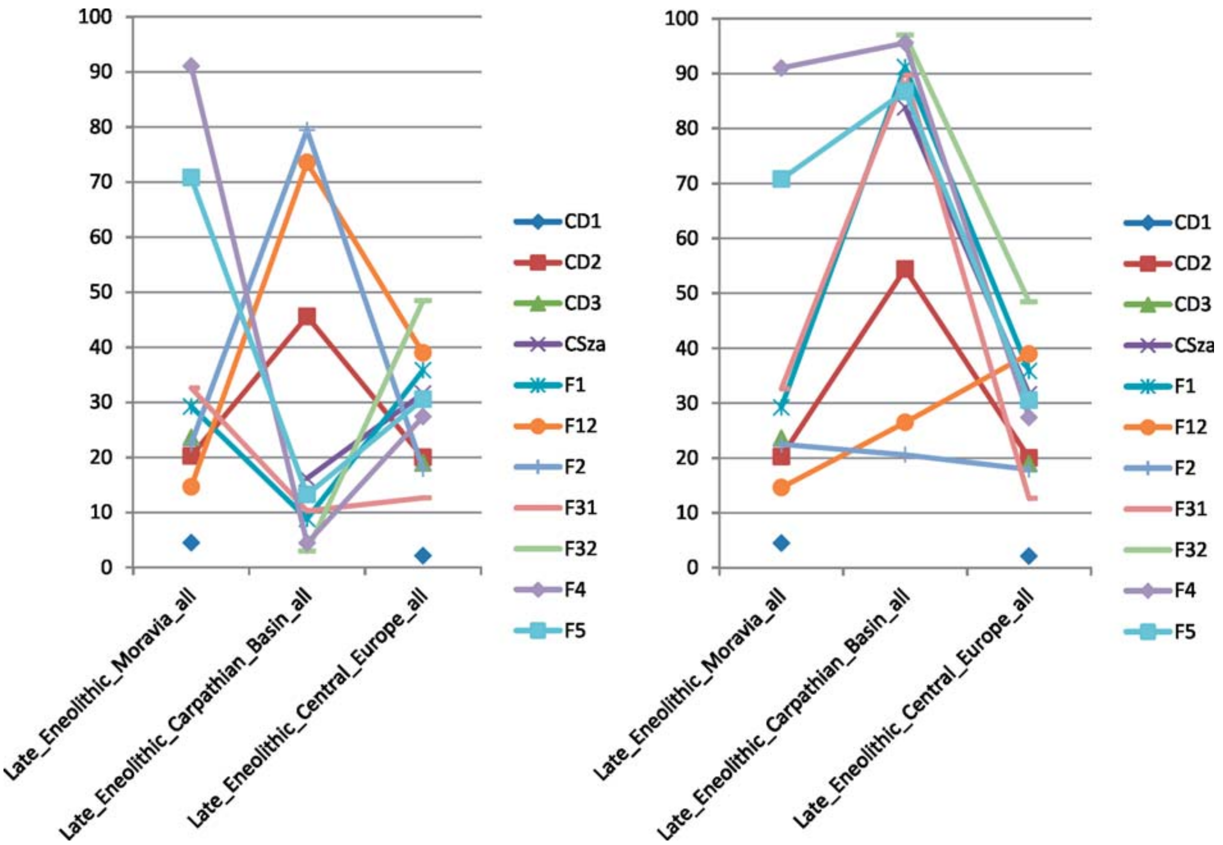

Fig. 25. Comparison of relative orders (BK seriation) for Nagyrév jugs in Moravia and Carpathian Basin separately and combined (Central Europe all), seriation order for Carpathian Basin is original (left) and reversed (right)

in the entire assemblage (incl. Carpathian Basin) they only occur in the first half of the sequence. If this really reflects relative temporal relationships between Moravia and the Carpathian Basin, then the Moravian aggregates MCWC and BBC would be chronologically present in only some sections in the development of the Carpathian Basin aggregates. That could mean that Moravia represents the older part of the period, which later spread into the Carpathian Basin. This would mean that the concepts accounting for their genesis, which is usually thought to be in the Carpathian Basin, would need to be re-evaluted. At this stage, it is not clear how this result could be influenced by the differing structure and quantity of data from Moravia and the Carpathian Basin.

Correlating the relative order with absolute data

The correlation coefficients between absolute dates and seriations from the entire time period and all cultures are high and statistically significant *(Table 5, Fig. 26)*. In theory, the conditions are conducive for this to occur: significant time range (more than 1000 years), that is, small amount of error for the range of values, and the total number of dates is the highest for all correlations. It is apparent that the correlation is contingent on the arrangement order of the three main cultural spheres. As the mean values of absolute dates differ by several hundred years, the whole sequence then also correlates with absolute dates. Within the individual culture spheres (as well as cultures in Moravia) the absolute dates do not correlate with the overall sequence (that is, when we attempt to correlate the entire relative sequence

Sample	Culture	Sex	Total variables	Total cases	Presences	Criterion		N abs data	Max-Min	rho	p (rho)
Corded Ware culture											
Nemilany 3	MCWC	all	16	22	55	0.555		8	294	–0.40	>0.05
Nemilany 3	MCWC	males	11	10	26	0.703		6	294	0.2	>0.05
Řepčín 1	MCWC	all	19	20	75	0.652		n.a.	n.a.	n.a.	n.a.
Řepčín 1	MCWC	males	14	6	27	0.871		n.a.	n.a.	n.a.	n.a.
Moravia	MCWC	all	55	199	621	0.227		14*	570*	**–0.49***	>0.05*
Moravia	MCWC	males	40	69	239	0.323		11*	570*	–0.13*	>0.05*
Moravia	MCWC	females	34	32	101	0.433		3	n.a.	n.a.	n.a.
Central Europe	CWC sphere	all	64	303	879	0.198		22*	600*	**–0.50***	**<0.05***
Bell Beaker culture											
Hoštice	BBC	all	36	142	393	0.319		7	150	0.071	>0.05
Hoštice	BBC	males	28	65	176	0.417		3	40	n.a.	n.a.
Hoštice	BBC	females	26	52	167	0.448		4	100	**–0.40**	>0.05
Moravia	BBC	all	54	287	740	0.228		20*	390*	–0.06*	>0.05*
Moravia	BBC	males	39	106	270	0.290		8	130	**–0.48**	>0.05
Moravia	BBC	females	38	97	280	0.286		7*	280*	0.21*	>0.05*
Central Europe	BBC sphere	all	60	355	855	0.194		20*	390*	–0.05*	>0.05*
Protoúnětice culture											
Pavlov HP	PÚC	all	20	18	58	0.509		16*	370*	**–0.49***	>0.05*
Moravia, Lower Austria	PÚC	all	44	123	330	0.226		17*	370*	–0.07*	>0.05*
Central Europe	PÚC sphere	all	50	158	409	0.237		20*	515*	–0.06*	>0.05*
Late Eneolithic/ Early Bronze Age											
Moravia	CWC, BBC, PÚC	all	89	605	1628	0.175		52*	1040	**–0.74***	**<0.00001***
Carpathian Basin	All available data, all cultures**	all	68	173	424	0.234		25	935	**–0.55**	**<0.01***
Carpathian Basin	2 and more pres-ences, all cultures**	all	68	101	352	0.234		23	716	**–0.53**	**<0.01***
Central Europe	All available data, all cultures***	all	95	832	2163	0.151		83*	1040	**–0.69***	**<0.00001***

*Table 5. Spearman rank order correlations between relative orders in all tested hierarchical levels (seriation method BK) and calibrated ^{14}C data – Legend: sample: origin of the data; culture: archaeological culture/entity or group of cultures; total variables: number of descriptors/variables in seriation; total cases: number of cases (graves, contexts) in seriation; presences: total number of presences of variables in incidence matrix; sex: sex of human in grave; criterion: criterion of seriation using BK method; N abs data: number of calibrated ^{14}C data available; Min-Max: time span (difference between maximum and minimum average value for a given sample); rho: Spearman correlation coefficient (bold: relatively high, red: statistically significant); p (rho): probability level for rho (H0 = no relationship); *: after discarding outliers; CWC sphere: CWC (Bohemia), MCWC, SOV and MKC; BBC sphere: BBC and CSE; PÚC sphere: PÚC, PIT, NgC 1 and NgC 2; n.a.: not applied or not available; **: CWC, BBC, MCWC, PÚC, LVU, NgC 1, NgC 2, PIT; ***: whole database, all cultures*

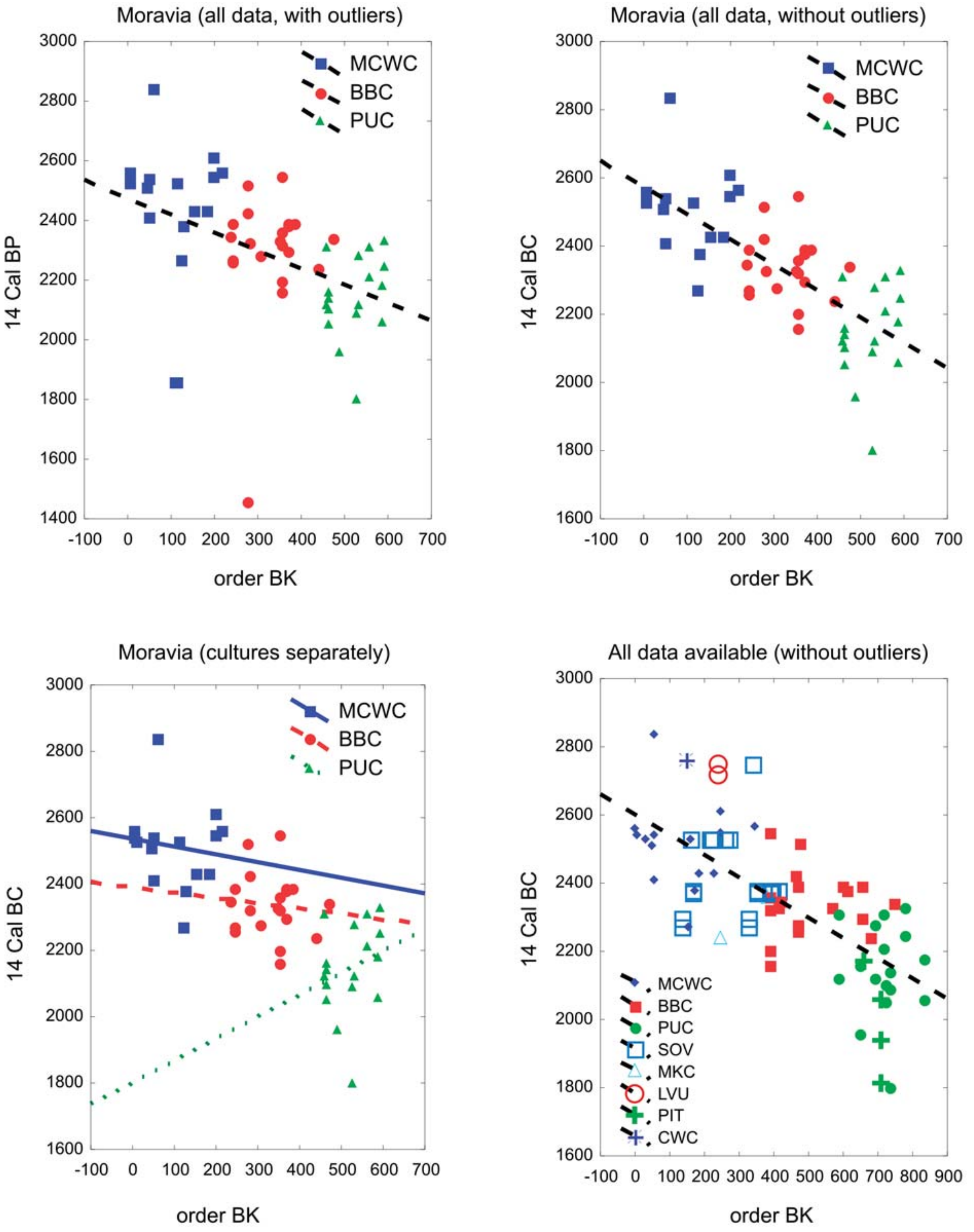

Fig. 26. Relationship between relative order (BK method) and average values of calibrated ^{14}C data – Moravia with outliers (upper left plot); Moravia without outliers (upper right plot); Moravia with trends for each culture separately (lower left plot); all data available from Moravia and other regions without outliers (lower right plot)

with absolute dates in each cultural sphere separately). These results are not included in the correlation table *(Table 5)*, but depicted in *Fig. 26* (linear models in lower left plot).

The individual seriations of smaller aggregates (localities, micro-regions) within the cultural spheres also do not correlate significantly with the absolute dates, except for the CWC sphere sequence. Despite this fact, some values of Spearman correlation coefficient (though insignificant) are numerically comparable to those for the whole sample (aggregates: MCWC Nemilany 3, MCWC Moravia, BBC Hoštice females, BBC Moravia males, PÚC Pavlov). So, here the lack of statistical significance might be just due to relatively smaller sample sizes (number of absolute data) and not due to lack of true relationship. If we were able to acquire additional data in the future and the relatively high correlations would be classified as statistically significant (in the above mentioned aggregates) we could conclude that the relative chronologies (temporal orders of artifacts) from the smaller aggregates are more valid than from the entire time period (i.e. all cultures combined).

Seriation of smaller aggregates (of individual sites and Moravia) has not resulted in high correlations with absolute dates, which could be because the time range for a specific period is shorter and/or the number of dates is lower. Our data originated from more burial sites and regions, did not include status, and for most sites it did not include the sex of the buried individuals. Therefore, the seriation sequence reflects not only relative temporal relationships, but it also reflects (to an unknown extent) social, sex and regional factors. These factors could not be controlled in our raw data. This is partly due to the burial customs in these cultures, e.g., in PÚC the sex of the buried individuals cannot be easily determined on the basis of which body side they were buried on and anthropological assessments are also disputable. When we consider an evaluation based only on the magnitude of the correlation coefficient, a relatively high correlation coefficient (but not statistically significant) in the MCWC was recorded in Nemilany 3 without sex assessments (and without sex assessment in all of Moravia). Seriation sequence for males performed separately for both cases produced a weaker correlation. Contrastingly, in the BBC, seriation for Hoštice 1 as well as for all of Moravia produced the strongest (but still not statistically significant) relationship with absolute dates after analyzing each sex separately. So far, this indirectly indicates that sex assessment is more relevant in BBC than in the MCWC.

The relationship between Moravia and the Carpathian Basin

Overall, the results indicate that three Moravian cultures (MCWC, BBC and PÚC) are relatively distinct in relation to each other. Although there is a degree of overlap on the boundaries of the sequences, the overall pattern resembles a situation where one culture ends and another begins. The cultures follow on from each other in a chronological sense and although they share some of their material culture, the artifact context (relationship between different artifacts) is different in each culture. After adding the Carpathian Basin cases (CWC, BBC and PÚC, i.e. Early Bronze Age Carpathian Basin cultures), or the seriation of all Carpathian Basin cultures separately, the inter-cultural boundaries are not as clear and unequivocal as in Moravia (this could be partly because, in comparison to Moravia, it is a larger territory with a smaller number of cases). Comparing Moravia and Carpathian Basin, SOV and MKC have a tendency to be relatively younger than MCWC. At the same time, both SOV and MKC have on average, slightly younger absolute dates in our database than the MCWC, but we are aware of the limited number of absolute dates from the Carpathian Basin. Provided that in the combined seriations (i.e. Moravia and the Carpathian Basin), the Carpathian Basin objects are placed at the end of the CWC group sequence (in seriations with a comparable number of cases from each of the two regions), the differences in the distributions of Nagyrév jugs (in Moravia and the Carpathian Basin) are real, and the detected tendencies (middle values of MKC and SOV absolute dates in the Carpathian Basin are roughly equivalent to those in the Moravian BBC), a possible interpretation is as follows: The MCWC developed in Moravia, where it was strongly influenced by the incoming BBC. It was either pushed out into the Carpathian Basin, or it ceased to exist and the SOV and MKC concurrently developed in the Carpathian Basin. The NgC appears in this territory at the same time. The origin of the NgC is closely associated with the origin of the PÚC and its reoccupation of Moravia. The Únětice culture then immediately follows (no absolute dates were included in this study). Relatively sharp boundaries between the three Late Eneolithic cultures in Moravia create the impression of a discontinuity in the local development. The association between MCWC and PÚC should be sought in the Carpathian Basin.

Conclusion

Contextual seriation of finds (including Nagyrév jugs) from the Late Eneolithic/Early Bronze Age time period are mostly originating in Moravia and the Carpathian Basin while comparing the relative sequencing of individual variables with absolute dates indicate that:

1. The relative sequences of identical artifacts from separate seriations for the individual cultures in Moravia have very little relationship to each other. The correlations of relative sequences from various hierarchical levels (site, region, several regions) of the same culture or cultural sphere correlate with each other to varying degrees. In terms of the relative closeness (context) of the artifacts present, the cultures are relatively discrete units and similarities between them are much less pronounced than those inside the cultures. The question is to what extent these results reflect circular reasoning (culture = type, dominance of a particular type = proof for existence of a particular culture).
2. Significant correlation of the relative sequence in the seriation of all cultures combined with absolute dates is provided only by the overall arrangement order of cultures and the large time range. Within the individual cultures, this sequence is totally unrelated to the absolute dates. Thus the results indicate that the relative artifact sequence is not correct (i.e. the time sequence in which the artifacts actually appeared). Contrastingly, the correlations are often strong (but often not at a statistically significant level due to the small number of cases) between absolute dates of the sequences from individual seriations for specific sites, regions and multiple regions, in individual cultures or cultural spheres. While the numbers of absolute dates are limited, we see a potential in seeking an optimum compromise in the composition of the seriation aggregates, where a sufficient number of absolute dates exists, but the "non-chronological" sources of variability (sex, regional influences, social differences) are restricted.
3. Some types of Nagyrév jugs have a "contact potential", i.e. they occur in more than one culture (even more than one region) in a particular time period. This is most relevant only to CD2 and F1 (in terms of inter-cultural contact between MCWC and BBC). Other types are confined to a specific region or time period and can be considered as specific for a particular chrono-cultural segment (CD1, F32, F4, F5). For these reasons we suggest that the concept of Nagyrév jugs needs to be re-evaluated in such a way where the heterogeneous objects are not unequivocally considered as contact objects (probably just in a regional sense).

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Bell Beaker Cemetery and Settlement at Szigetszentmiklós
First Results

Róbert Patay

Abstract

This paper is a preliminary report on the excavation and evaluation of the Bell Beaker cemetery investigated in the outskirts of Szigetszentmiklós. A total of 219 Bell Beaker burials were uncovered. The cemetery contained a surprisingly high proportion of inhumation burials compared to the burial grounds earlier investigated in the Budapest area. The burial rites and the grave goods show strong ties with the Central European cemeteries of the culture, with the Bell Beaker East Group. The finds from the cemetery also bespeak the cultural impact of the local Early Bronze Age cultures. The halberd from one of the burials is a unique find in the Bell Beaker heritage of the Carpathian Basin. The radiocarbon dates indicate that the cemetery was used between 2500–2200 cal BC.

In this study, I shall offer a brief overview of the finds and findings of the excavation of the Bell Beaker cemetery and settlement at Szigetszentmiklós-Felső Ürge-hegyi dűlő, lying in the northwestern part of the Csepel Island near Budapest *(Fig. 1)*. Previously, a few Bell Beaker cemeteries have already been located on the northern part of the Csepel Island and in the area of Szigetszentmiklós (Endrődi 1992, 106–107, Fig. 1; Kalicz-Schreiber 1997, Fig. 1; Kulcsár 2011, Fig. 4. B): Szigetszentmiklós-Alsóbucka (Kalicz-Schreiber 1997, 178, Fig. 2, Fig. 5); Szigetszentmiklós-Teleki út 45 (Kalicz-Schreiber 1997, 178, Fig. 6. 1–2); Szigetszentmiklós-II. Vízcsőárok (Kalicz-Schreiber 1997, 179–181, Figs 3–4, Fig. 6. 3–9, Figs 7–8); Szigetszentmiklós-Üdülősor (Endrődi 1992; 2012; Endrődi – Horváth 2009). The cemetery of Felső Ürge-hegyi dűlő is a new site, unrelated to these. Its archaeological investigation was carried out between 2006 and 2007 (Patay 2008a, 285–287; 2008b).[1] The investigated area covers some 5 hectares; we uncovered a total of 716 features, among them three graves of the Early Bronze Age Nagyrév culture (Patay 2009), a grave of the Late Bronze Age Urnfield culture, Late Bronze Age and medieval settlement features (pits and ditches), as well as 219 burials and a few pits and ditches of the Bell Beaker culture *(Fig. 2)*. The Early Bronze Age site lies some 250–280 m from the current Danube bank. Some of the graves lay on a heavily eroded ridge running from the northeast to the southwest. The cemetery map indicates that the enclosed burials lay on the ridge. A depression, most likely the remain of a former watercourse, runs in a northeast to southwest direction in the eastern and southern part of the area, beyond which we did not find any Early Bronze Age features, suggesting that the depression marked the edge of the burial ground. Even though the cemetery probably extends beyond the investigated area in the west and northwest, it cannot be excavated since that area is constructed upon.

Similarly to the other burial grounds of the period in the Carpathian Basin, this cemetery too can be assigned to the mixed rite type with its inhumation, scattered cremation and inurned burials (*Fig. 3*; Kalicz-Schreiber 1984, 137; Kalicz-Schreiber – Kalicz 1998–2000, 47–48). The form of the grave pits could most often be observed in the case of the inhumation and the scattered cremation burials: most were oblong or oval. Several scattered cremation burials did not have a grave pit. No more

[1] I shall here present a preliminary overview of the finds and their evaluation, the latter no more than working hypotheses at the moment, which will undoubtedly be modified and refined as the assessment the finds continues.

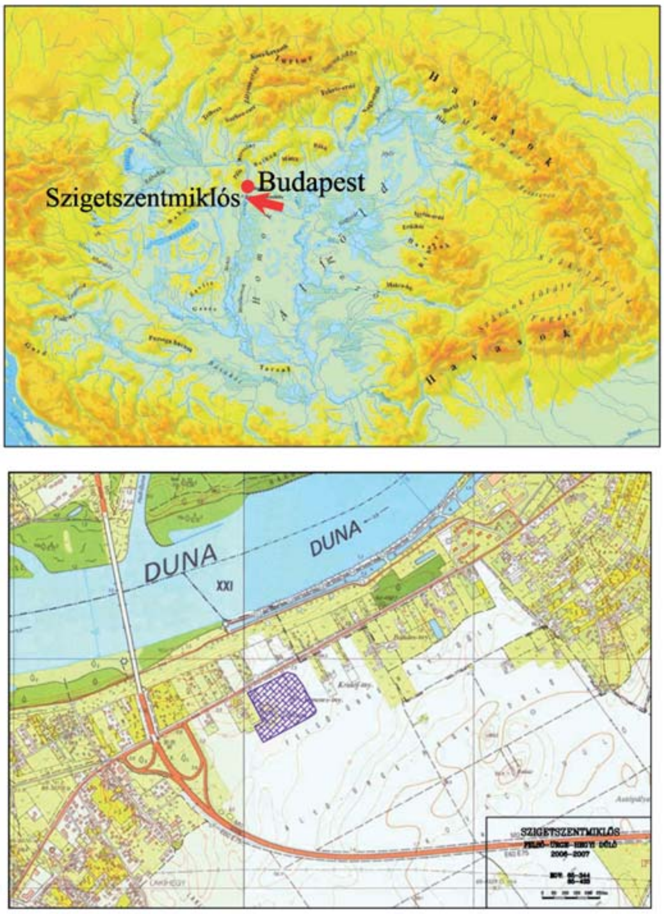


Fig. 1. Szigetszentmiklós-Felső Ürge-hegyi dűlő – 1–2: location of the site

than a few oval grave pits could be observed in the case of inurned burials because they had been simply dug into the humus. The grave pits were northeast to southwest oriented.

One remarkable feature of this burial ground is the unusually high proportion of inhumation burials: 102 graves of the 219 excavated graves were inhumations (47%) *(Fig. 4)*. A glance at the table reveals that such a high proportion of inhumation burials has not been documented in any other Bell Beaker cemetery of the Carpathian Basin (Kalicz-Schreiber 1984, 137; Kalicz-Schreiber – Kalicz 1998–2000, 47–48). Inhumation is more typical for the Central European, southern German, Austrian and Bohemian-Moravian groups of the culture (Havel 1978, 114; Neugebauer 1994, 38; Bálek *et al.* 1999, 34; Krut'ová 2003; Heyd 2007, 332).

Another element of the Central European funerary tradition could also be documented in the Szigetszentmiklós cemetery, namely inhumation performed according to strict rites. The proportion of deceased laid on the right and the left side was roughly equal and they were oriented either northeast to southwest or southwest to northeast. The anthropological material is fairly well preserved. The analysis of the skeletal remains indicated that men were always interred on their left side, while women were laid to rest on their right side (Köhler 2011), with their face looking to the east in the case of both male and female burials. A comparable burial rite was observed in the cemeteries of the Bell Beaker East Group in Central Europe (Neugebauer 1994, 38; Heyd 2001, 398; 2007, 332; Dornheim *et al.* 2005, 36–38). The funerary rite of the inhumation burials shares many similarities with the rites practiced in regions west of the Carpathian Basin.

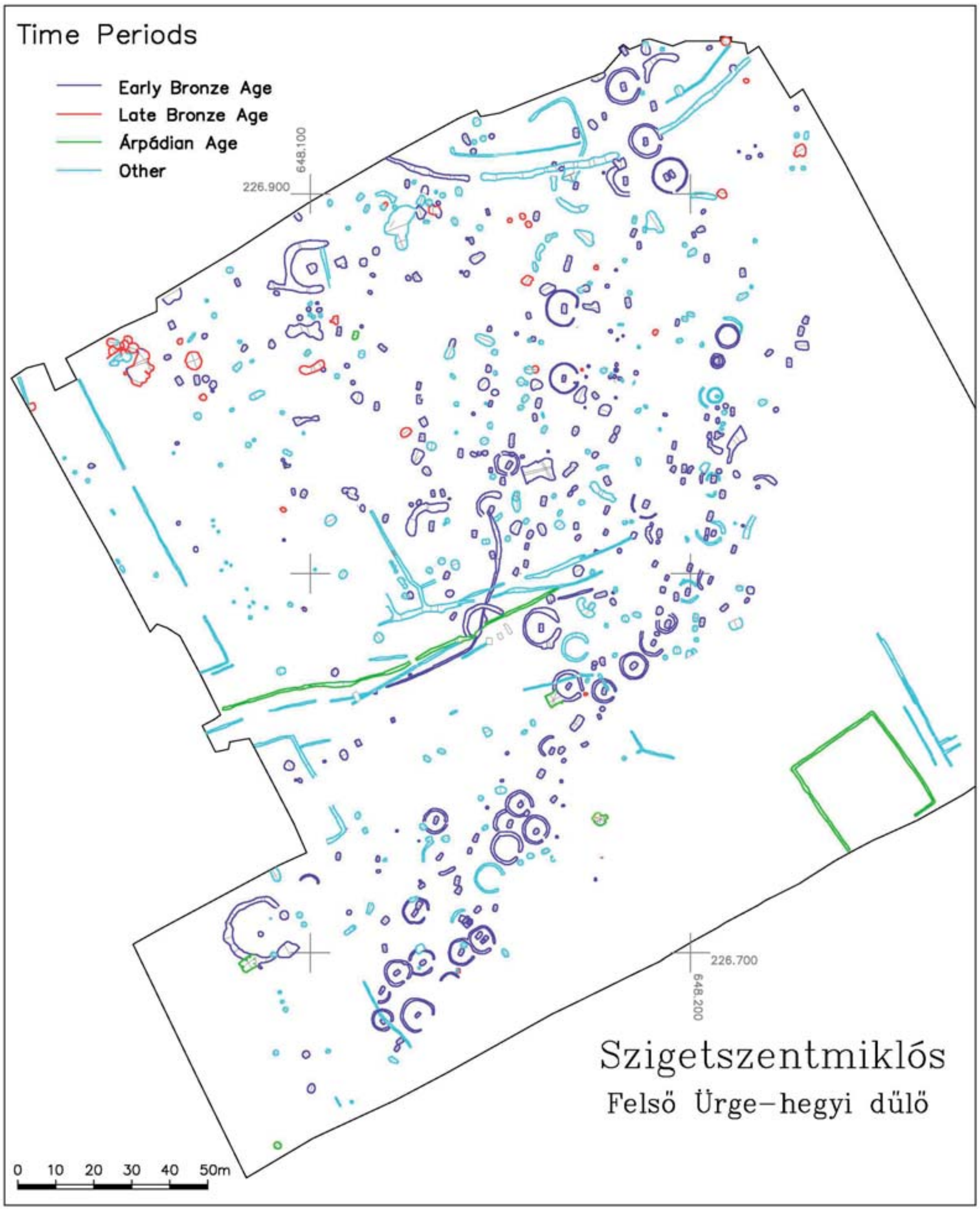


Fig. 2. Szigetszentmiklós-Felső Ürge-hegyi dűlő – phases of the site

In the case of scattered cremation burials, accounting for 50 of the 219 Bell Beaker graves (23%), the ashes were generally strewn in the middle of the grave pit, conforming to the practice observed in other Bell Beaker cemeteries *(Fig. 5)*. Four graves contained several small heaps of ashes, suggesting that the remains of several individuals had been interred in the grave *(Fig. 6)*. We noted the remains of a funerary structure in one cremation grave ringed by a ditch *(Fig. 7)*. Similar structures have been identified in Austrian (NEUGEBAUER 1994, 37), Bohemian, Moravian and Hungarian Late Eneolithic and Early Bronze Age cemeteries (KYTLICOVÁ 1960, 472, Abb. 3–4; STUCHLÍK – STUCHLÍKOVÁ 1996, 76–78, obr. 42–43; BÁLEK *et al.* 1999, 33, Tab. 10; BÁTORA 1999a; GOGÂLTAN 1999, 171, Fig. 23). We found several cremation burials without a grave pit, with the ashes simply strewn over the prehistoric occupation level.

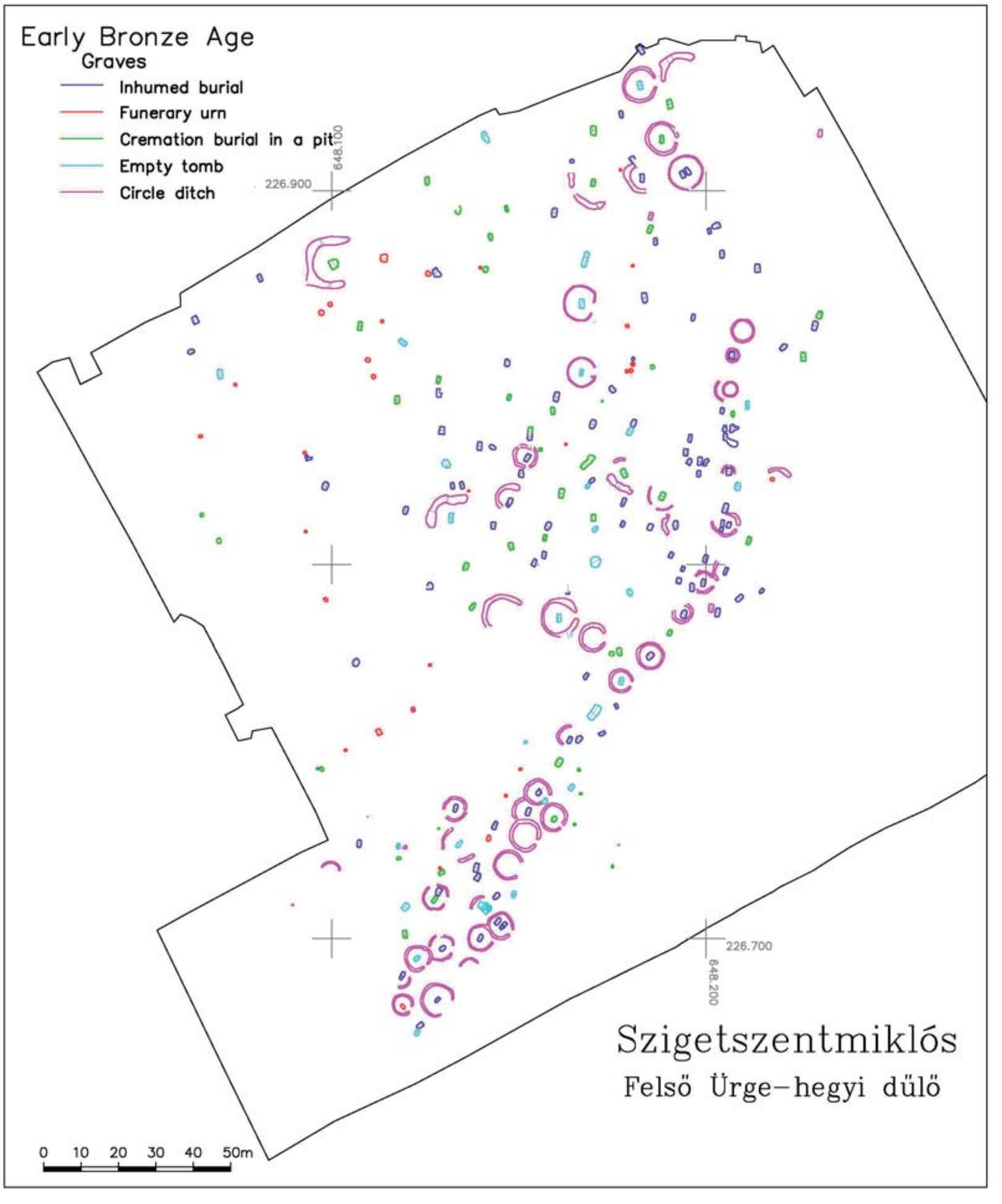


Fig. 3. Szigetszentmiklós-Felső Ürge-hegyi dűlő – funerary rites of the Bell Beaker burials

Very few inurned burials were found, 36 in all (16%) *(Fig. 8)*. Most were simply dug into the humus; only in a few cases could an oval grave pit be observed. Inurned burials generally contained a large urn for the ashes and one-handled jugs. Beakers proper of the usual Bell Beaker "package" were deposited only in two of the inurned burials.

Mention must be made of the so-called symbolic graves. We uncovered 29 burials, which contained various grave goods, but no human skeletal remains (13%) *(Fig. 9)*. Each of these graves was excavated with great care and it is therefore unlikely that we had missed any bones. It is also unlikely that the skeletal bones had perhaps perished owing to the nature of the soil since the human remains from the other burials survived in good condition. These symbolic graves contained a proportionately high

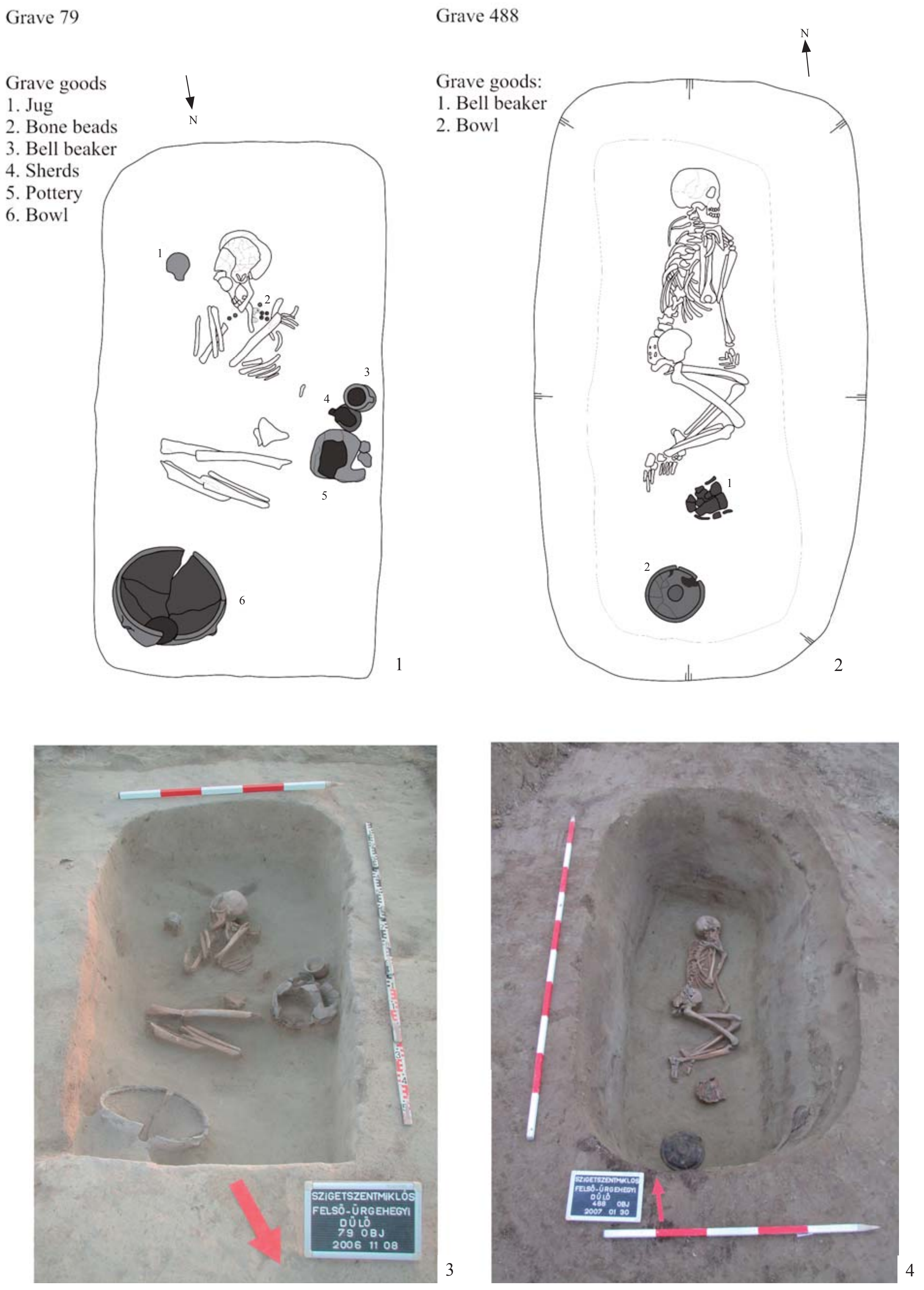


Fig. 4. Inhumation burials in the cemetery – 1, 3: Grave 79, 2, 4: Grave 488

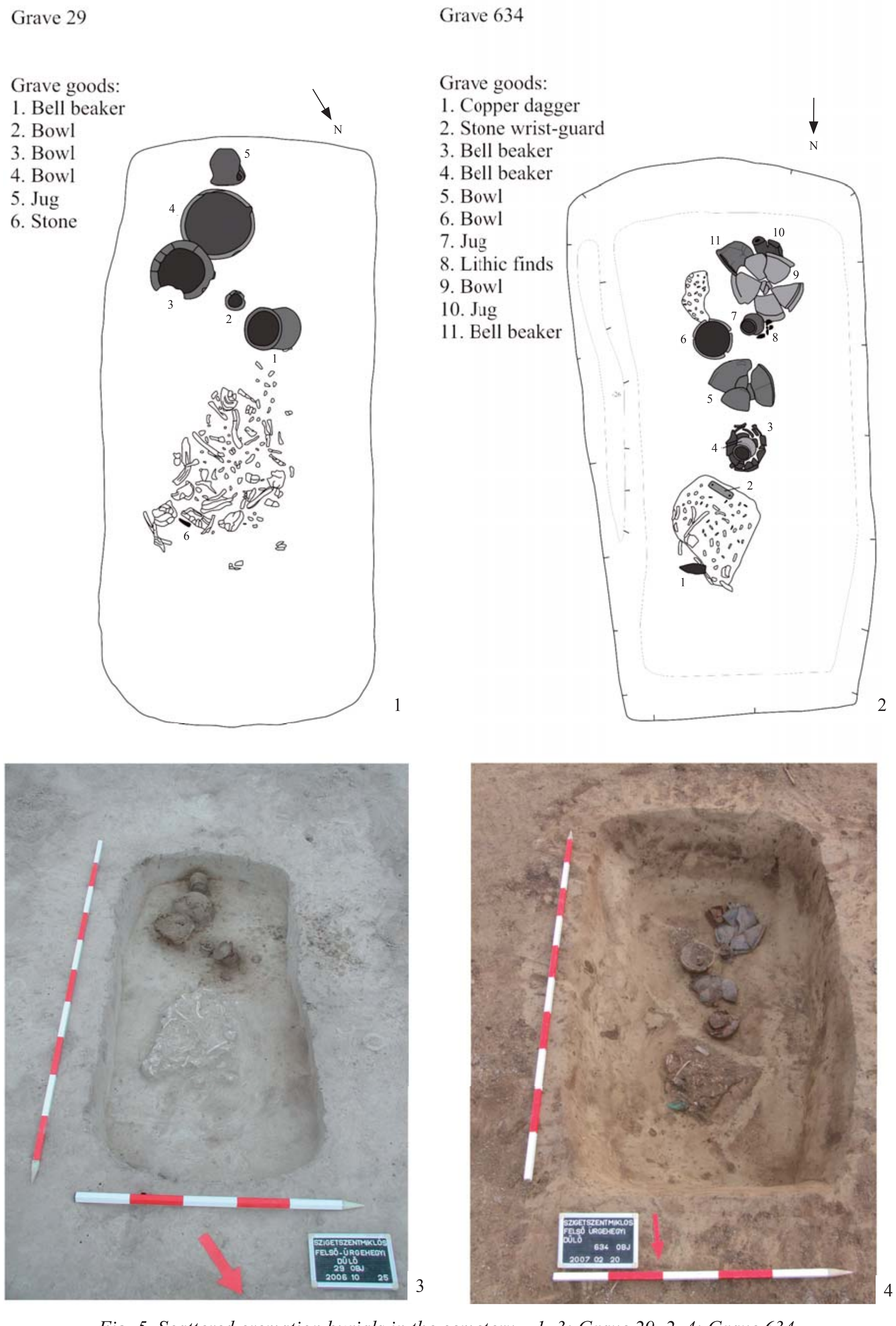


Fig. 5. Scattered cremation burials in the cemetery – 1, 3: Grave 29, 2, 4: Grave 634

number of weapons, daggers, wrist guards and arrow points, suggesting that they were perhaps the burials of hunters or warriors, who had died in areas lying far from the community's burial ground. Similar symbolic graves were noted in the Bell Beaker cemeteries at Budakalász (Ottományi – Czene 2006, 69–71; Czene 2008, 32) and Szigetszentmiklós-Üdülősor (Endrődi 2012, 18–20, Fig. 9). Symbolic graves have been reported from other Early Bronze Age contexts as well (Bátora 1999b; Kulcsár 2009, 85–86).

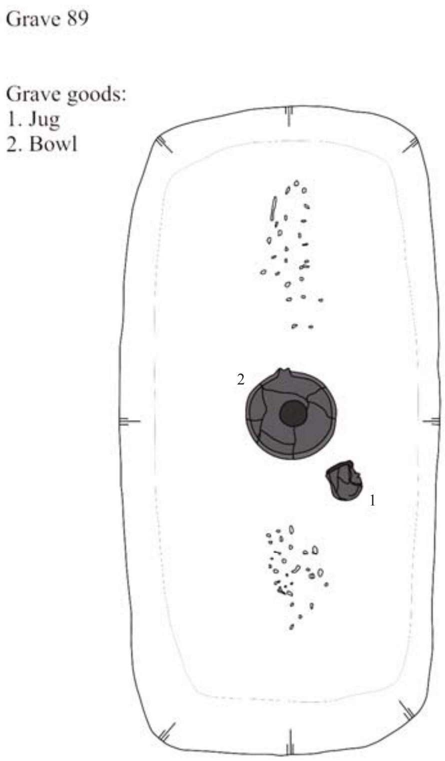
Some graves were enclosed within a round ditch. The Szigetszentmiklós cemetery is the second burial ground, where this feature could be observed; graves encircled by a ditch were first noted in the Budakalász cemetery (Ottományi 2006). We found 45 graves of this type *(Fig. 10)*. The 30 to 40 cm wide ditches had a diameter of 4 to 5 meters. Enclosed graves could be noted in the case of all three burial rites (25 inhumation, 8 scattered cremation, 1 inurned and 10 symbolic graves with round ditches), although most of these graves contained inhumation burials. In some cases, the ditch enclosed two or three burials. Some of these grave ditches contained broken vessels, which may be linked to the funerary ceremony *(Fig. 11)*. Similar phenomena were also observed in the cemetery of Szigetszentmiklós-Üdülősor (Endrődi 2012, 10, Fig. 2. 2–3). The ring-shaped ditches could be the only remains of burial mounds destroyed by modern agriculture (Krut'ová 2003, 211; Dornheim *et al.* 2005, 59).

Most burials contained a rich assortment of grave goods. The various elements of the Bell Beaker "package" – bell beakers, flat copper daggers, stone wrist-guards, triangular arrowheads, bone buttons with a V-shaped perforation – are represented by 46% of all the grave goods. Altogether 40% of the inhumation burials and 30% of the enclosed graves contained artefacts of this type. In contrast to other Bell Beaker cemeteries in the Budapest area (Kalicz-Schreiber 1997, 184) a strong correlation could be noted between inhumation rite and the deposition of various elements of the Bell Beaker "package" as grave goods in the Szigetszentmiklós cemetery.

A part of the ceramic finds represents widespread Early Bronze Age pottery types *(Begleitkeramik)*, such as handled jugs, pots, bowls and urns (*Fig. 12*; Ecsedy 1988, 16–17). Wares typical for the Bell Beaker culture were also quite frequent, and the high number of bell beakers was also striking. 43% of the burials yielded bell beakers (132 in 97 burials) with or without a handle and a decorative pattern arranged in bands or zones *(Fig. 13)*. We sought a possible correlation between the funerary rite and the presence of beakers in the grave inventory and found that inhumation burials also contained quite a high number of beakers (50 bell beakers in 43 inhumation burials). Other pottery wares included bowls with a straight, occasionally decorated rim *(Fig. 14. 1–4)*, pots and urns. One-handled jugs, another frequent type among the grave goods, betray cultural impacts from the Somogyvár-Vinkovci culture *(Fig. 14. 5–8)*. One variety of deep hemispherical bowls with steep side and horizontal rim evokes a type frequent in more westerly regions (*Fig. 12. 2*; Dvořák – Hájek 1990, Taf. 4. 6, Taf. 8. A4, B3, Taf. 9. B1, Taf. 22. B1, C1, G3, etc.).

A fairly large amount of metal artefacts came to light. Flat copper daggers (12 pieces in 11 graves: *Fig. 15. 1*), awls (7 pieces in 7 graves) and a halberd *(Fig. 21. 1)*, to be described at somewhat greater length below, were recovered from eleven graves. Seven burials yielded a total of twelve gold rings and gold plaques *(Fig. 15. 3–4)*. Two gold rings laid in a symbolic burial, the other gold finds all came from inhumation graves, where they were found beside the skull. Two burials contained silver artefacts: small silver tubes and perforated silver plaques with a *repoussé* decoration *(Fig. 15. 2)*. Gold and silver plaques are known, for example, from Bohemian Bell Beaker cemeteries (Havel 1978, Obr. 9. 18; Bálek *et al.* 1999, 32, Tab. 3, 5–6).

Aside from the pottery, the grave goods included the distinctive stone wrist-guards of the culture (33 pieces in 31 graves), representing well-known types (Sangmeister's Types B, D and G) (*Fig. 16. 1–3*; Sangmeister 1974, 115–118).



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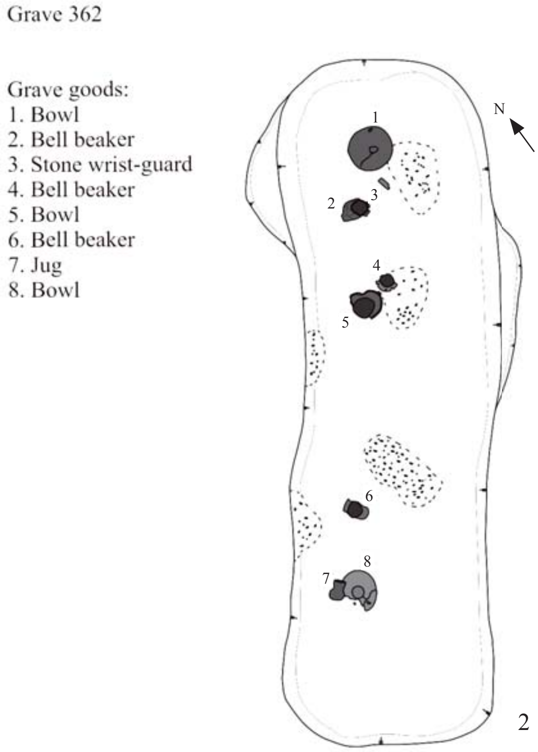

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Fig. 6. Scattered cremation burials in the cemetery: several small heaps of ashes – 1, 3: Grave 89, 2, 4: Grave 362

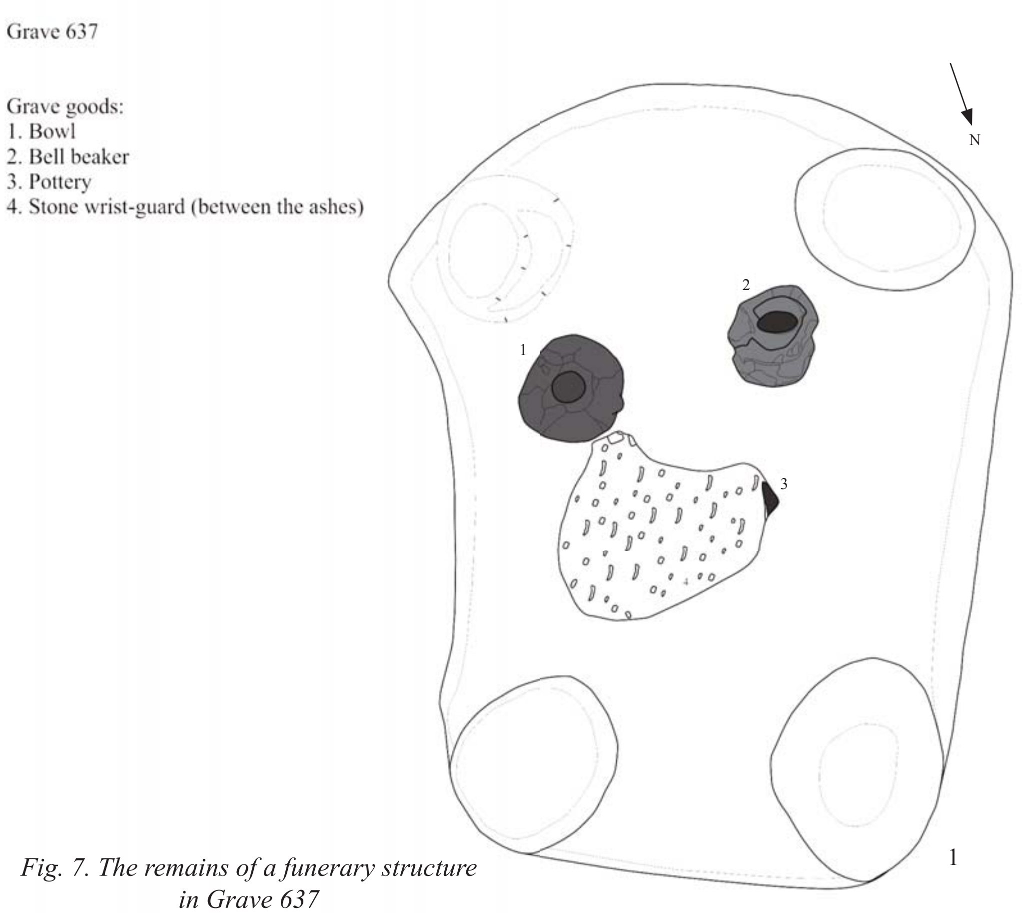

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Fig. 7. The remains of a funerary structure in Grave 637

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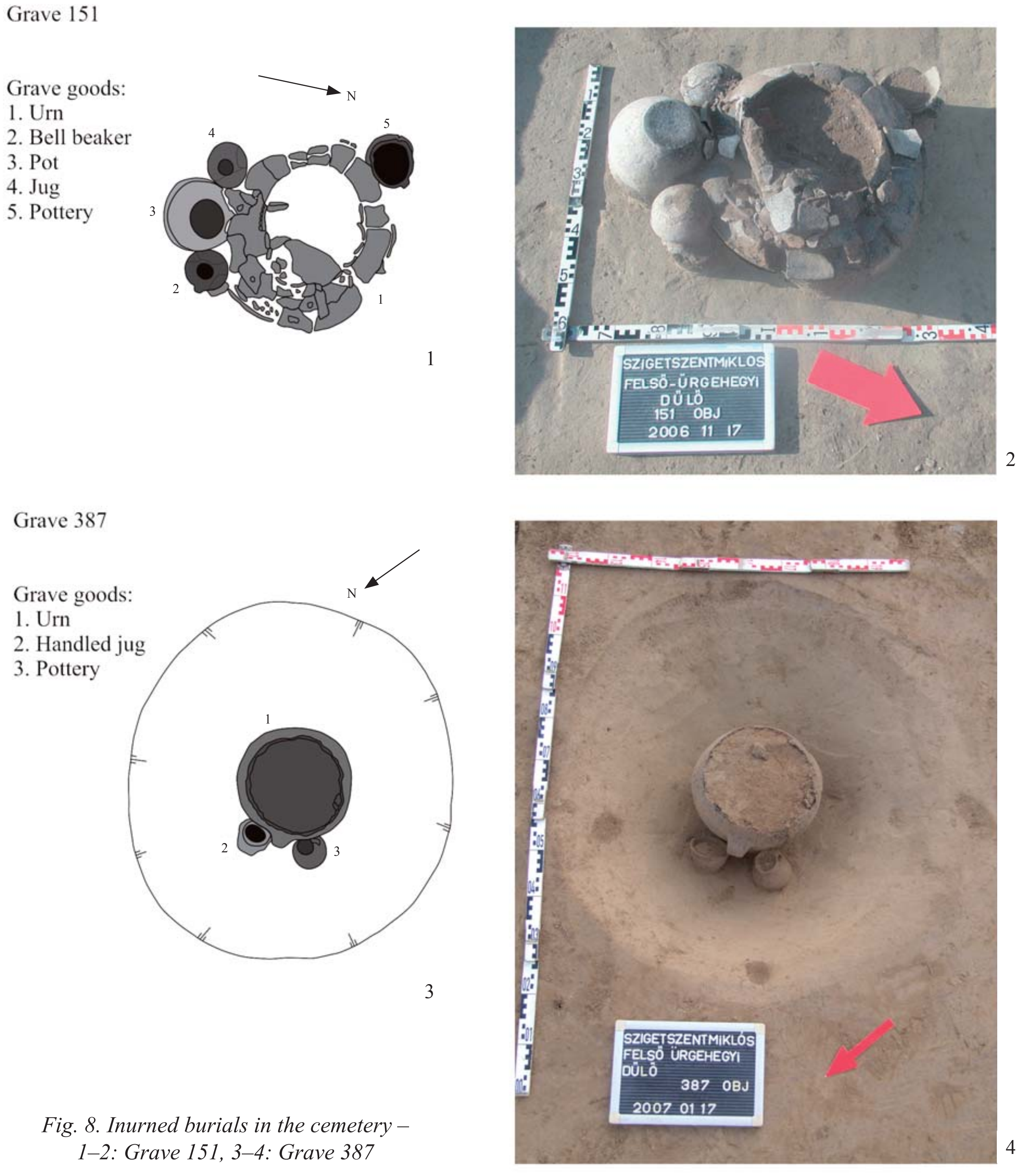

Fig. 8. Inurned burials in the cemetery – 1–2: Grave 151, 3–4: Grave 387

The lithic finds are made up of the typical triangular arrowheads of the culture and a wide range of blades, various flakes and scrapers, which were predominantly manufactured from hornstone obtained in the Buda Mountains (T. BIRÓ 2002) and radiolarite from Szentgál and the Gerecse Mountains. Tools and implements fashioned from obsidian, hydroquartzite, quartzite pebbles, flint and chert also occurred among the lithics *(Fig. 16. 4)*.[2]

[2] I am indebted to Krisztián Zandler (Kubinyi Ferenc Museum, Szécsény) for the evaluation of the chipped stone implements.

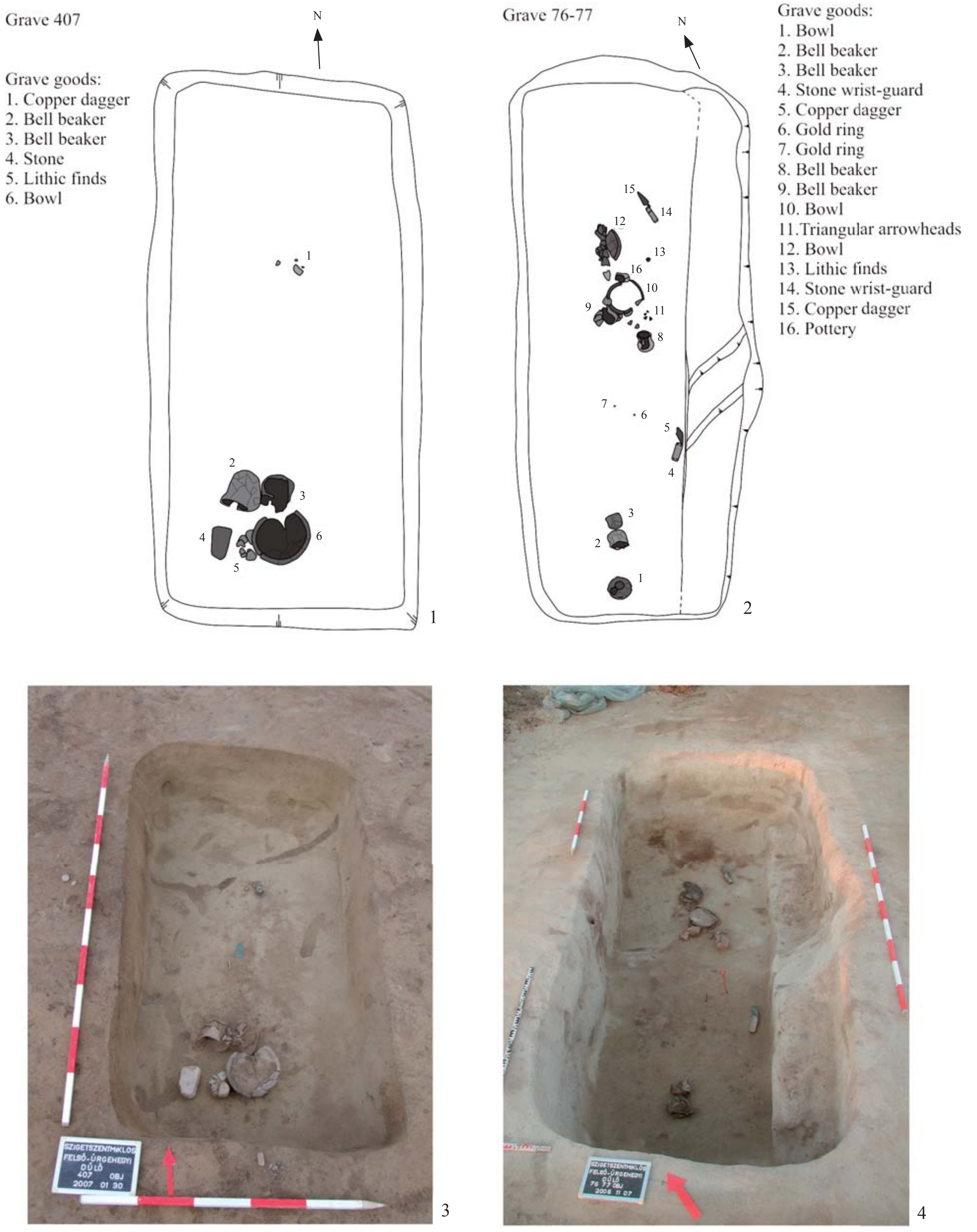

Fig. 9. Symbolic burials in the cemetery – 1, 3: Grave 407, 2, 4: Grave 76–77

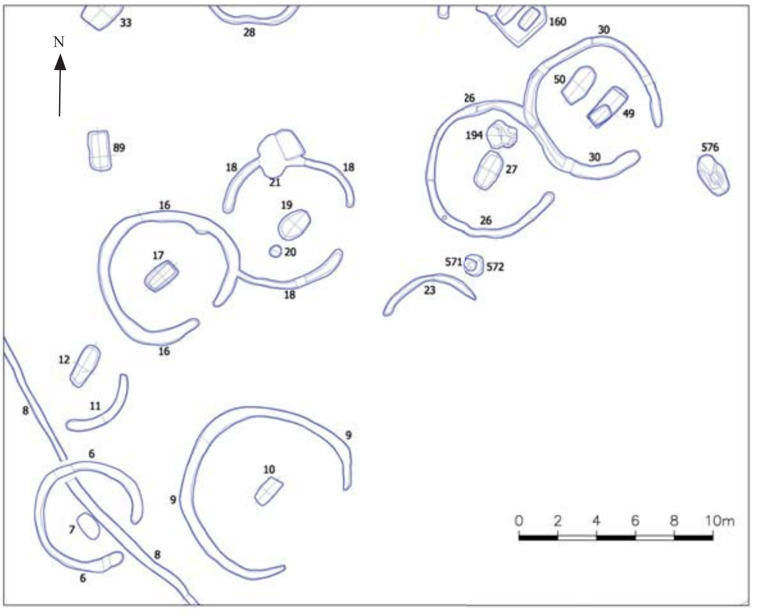

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Fig. 10. Szigetszentmiklós-Felső Ürge-hegyi dűlő – 1–3: round ditches and graves in the cemetery

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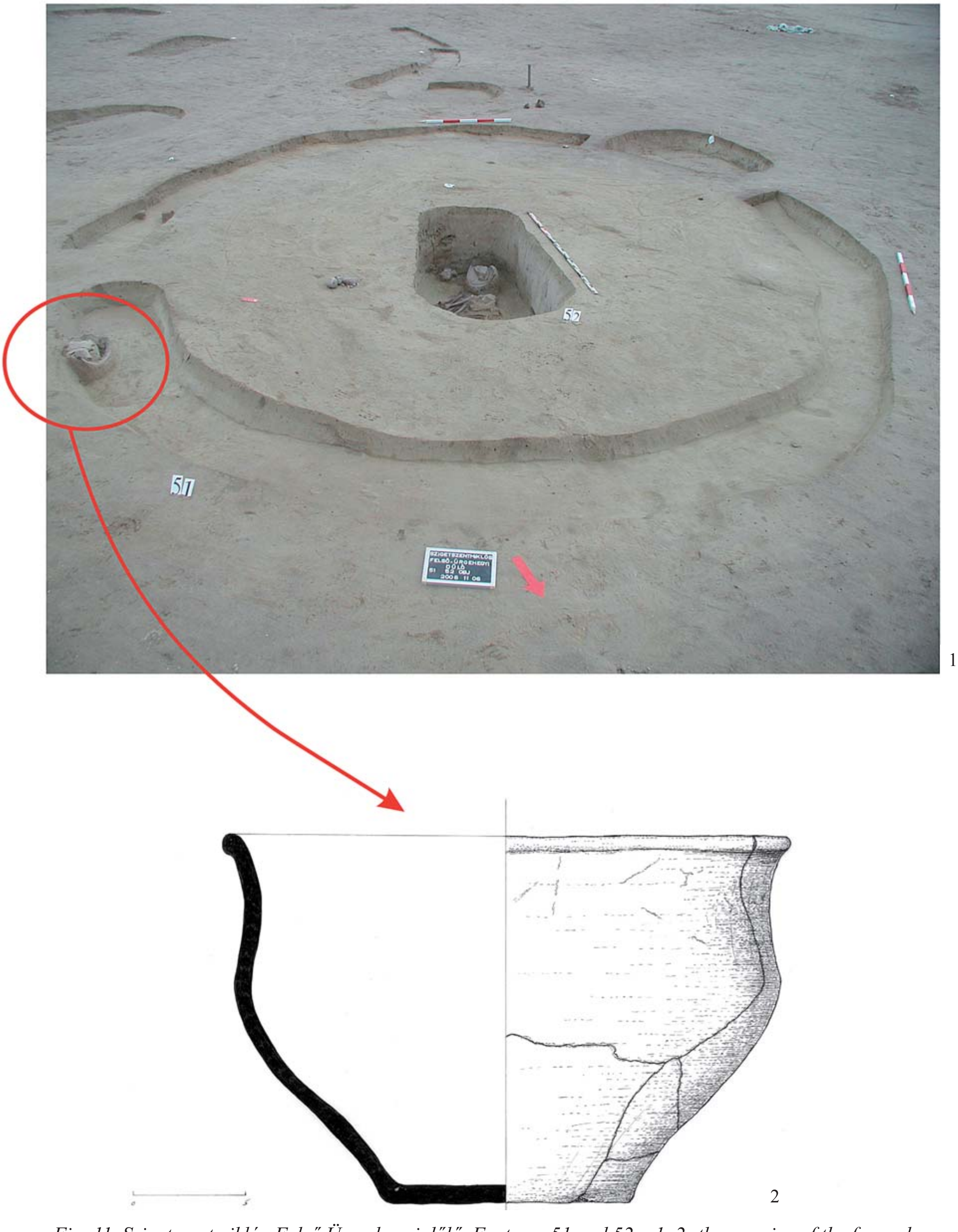

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Fig. 11. Szigetszentmiklós-Felső Ürge-hegyi dűlő, Features 51 and 52 – 1–2: the remains of the funeral ceremony

The bone artefacts included decorated lunular amulets *(Fig. 17. 1–3)* and bone buttons with a V-shaped perforation *(Fig. 16. 4–7)*. The best analogies to the lunular amulets came to light at the Budapest-Rákóczi Ferenc út site (Endrődi – Horváth 1999, 31, Fig. 3. 1) and comparable pieces have been published from Austria (Willvonseder 1936, 8; Neugebauer 1994, 37, Abb. 17. 6–7, Abb. 18. 2), Bohemia and Moravia (Willvonseder 1936, 7–8; Hájek 1939, obr. 1. 2–3, obr. 2–3; Geisler 1990, obr. 2. 12; Růžičková 2009) and Little Poland as well, indicating that this artefact type originated in the west.

Several burials contained beads and other jewellery articles made of amber. Unfortunately, these survived in a very poor condition and perished after they were lifted.

Limestone and bone beads, as well as various other bone ornaments *(Fig. 20. 5)* were found near the cervical vertebrae in several burials. One grave yielded bone plaques and other bone ornaments. Comparable pieces are known from Moravian Bell Beaker cemeteries (Kalousek 1956, 96, T. XIV. 1).

Several graves of the cemetery yielded finds and implements that can be contacted with metalworking. Grave 346 is of great importance in this regard. It was a scattered cremation burial with a ring-shaped ditch. The grave goods included a one-handled jug, Bell Beakers without decoration, a bowl, a stone implement, a *tuyère (Fig. 18)* and slag (?) remains. In some graves were found polished stone tools, which may indicate the relationship of the deceased with metalworking (Bátora 2002, 179–207; Bertemes – Heyd 2002, 215–218). Grave 433, a symbolic burial (grave goods: five bell beakers, bowls, stone wrist-guard, chipped stone implements) must also be mentioned in this respect, as it yielded boar tusks.[3] Bell Beaker graves into which boar tusks were deposited are known from the Czech-Moravian Basin and Lower Austria (Hájek 1966, 236, Abb. 1. 14–15; Dvořák 1992, 30, Taf. 58. A3; Neugebauer 1994, 36–37; Dvorák *et al.* 1996, 19, Taf. 20. B1–4; Bálek *et al.* 1999, 14, Tab. 8. 18–19). Boar tusks had perhaps been used in metalworking as they have often been found together with stone tools used in metalworking, for example in a grave uncovered at Künzing-Bruck (Bertemes – Schmotz – Thiele 2000; Bertemes – Heyd 2002, 216–217).

Human bone samples from five burials were submitted to the Vienna Environmental Research Accelerator Laboratory for radiocarbon measurements. The radiocarbon dates indicate that the cemetery was used between 2500–2200 cal BC *(Fig. 19)*. The radiocarbon dates indicate that the cemetery had been used over a longer period of time (Heyd 2007, 332–334).

Two graves are especially noteworthy since their finds are important for determining the chronological position and cultural contacts of the cemetery.

The earliest date was obtained for the sample from Grave 50 *(Fig. 20)*. This grave is an inhumation burial that yielded a copper awl *(Fig. 20. 4)*, bone costume ornaments *(Fig. 20. 5)*, a one-handled jug *(Fig. 20. 2)*, a small amphora-like vessel decorated with Bell Beaker patterns *(Fig. 20. 3)* and a footed bowl decorated with Bell Beaker design on the exterior and a pattern recalling the ornamentation of the pedestalled bowls of the Makó-Kosihy-Čaka culture in its interior *(Fig. 20. 1)*. A pedestalled bowl decorated with a similar design was found in the Tököl cemetery (Schreiber 1975, 200, Abb. 9. 1a–b, 3a–c). These finds suggest that the intensive interaction between the bell beaker users and the local population, and the adoption of local traditions had lasted longer than earlier assumed.

Grave 128 is a scattered cremation burial with a large round ditch *(Fig. 21)*. It may have been the grave of a leader with high prestige, a man aged between 23 and 59 years. In addition to his halberd *(Fig. 21. 1)*, his dagger *(Fig. 21. 2)*, and his stone wrist-guard *(Fig. 21. 3)*, two bell beakers *(Fig. 21. 4–5)*, a bowl *(Fig. 21. 7)*, a pot *(Fig. 21. 6)*, one decorated lunular amulet *(Fig. 21. 8)* and a wide range of blades had been placed in the grave.

[3] I would here like to thank Andrea Kőrösi (Museum of Hungarian Agriculture) for the evaluation of the animal bone material.

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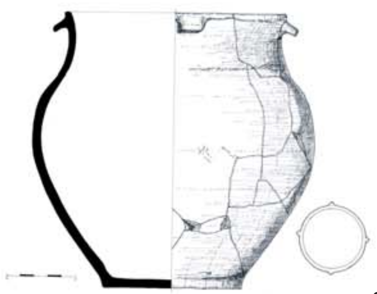

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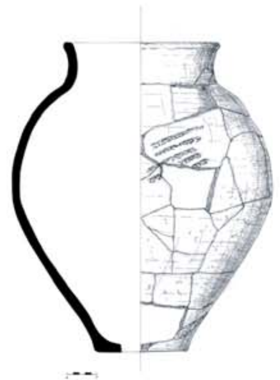

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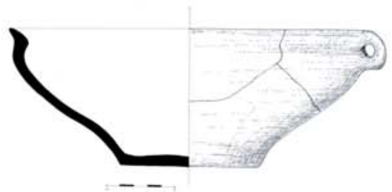

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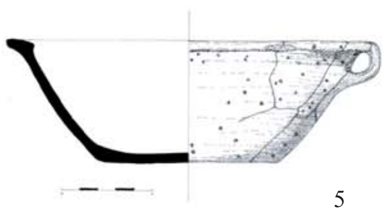

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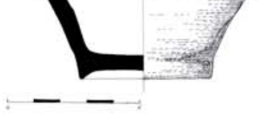

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Fig. 12. Szigetszentmiklós-Felső Ürge-hegyi dűlő – 1–7: Early Bronze Age pottery types (Begleitkeramik) *in the cemetery*

Fig. 13. Szigetszentmiklós-Felső Ürge-hegyi dűlő – 1–6: bell beaker examples in the cemetery

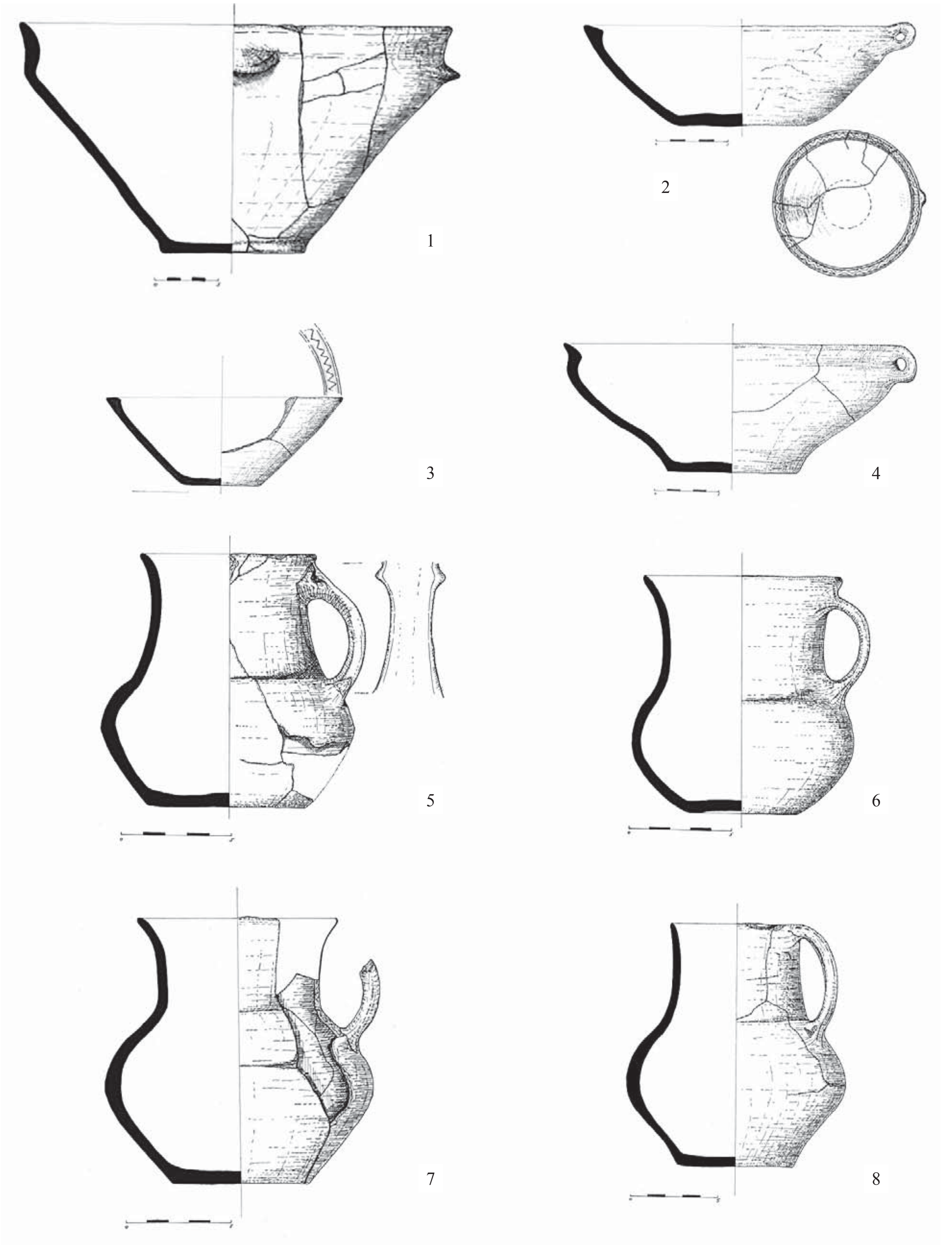

Fig. 14. Szigetszentmiklós-Felső Ürge-hegyi dűlő – 1–8: bowls and jugs in the cemetery

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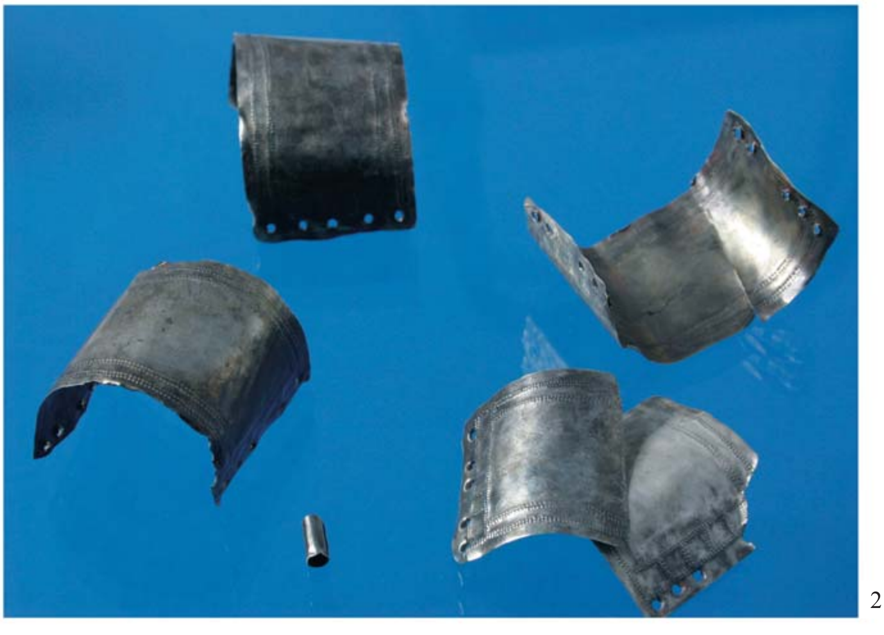

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Fig. 15. Metal artefacts in the cemetery – 1: flat copper daggers, 2: small silver tubes and perforated silver plaques with repoussé *decoration, 3: gold rings, 4: gold plaques*

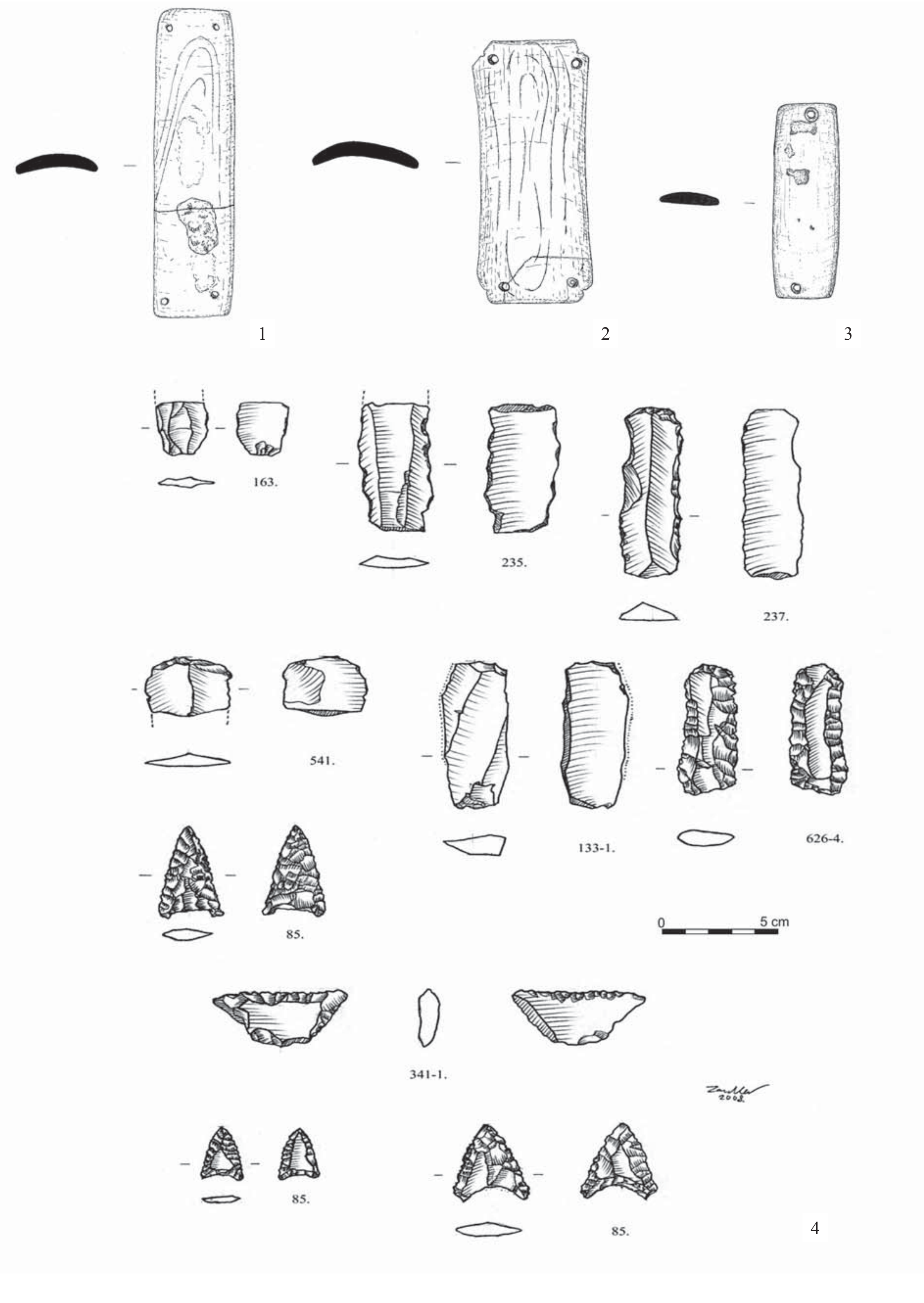


Fig. 16. Stone wrist-guards (1–3) and lithic finds (4) in the cemetery

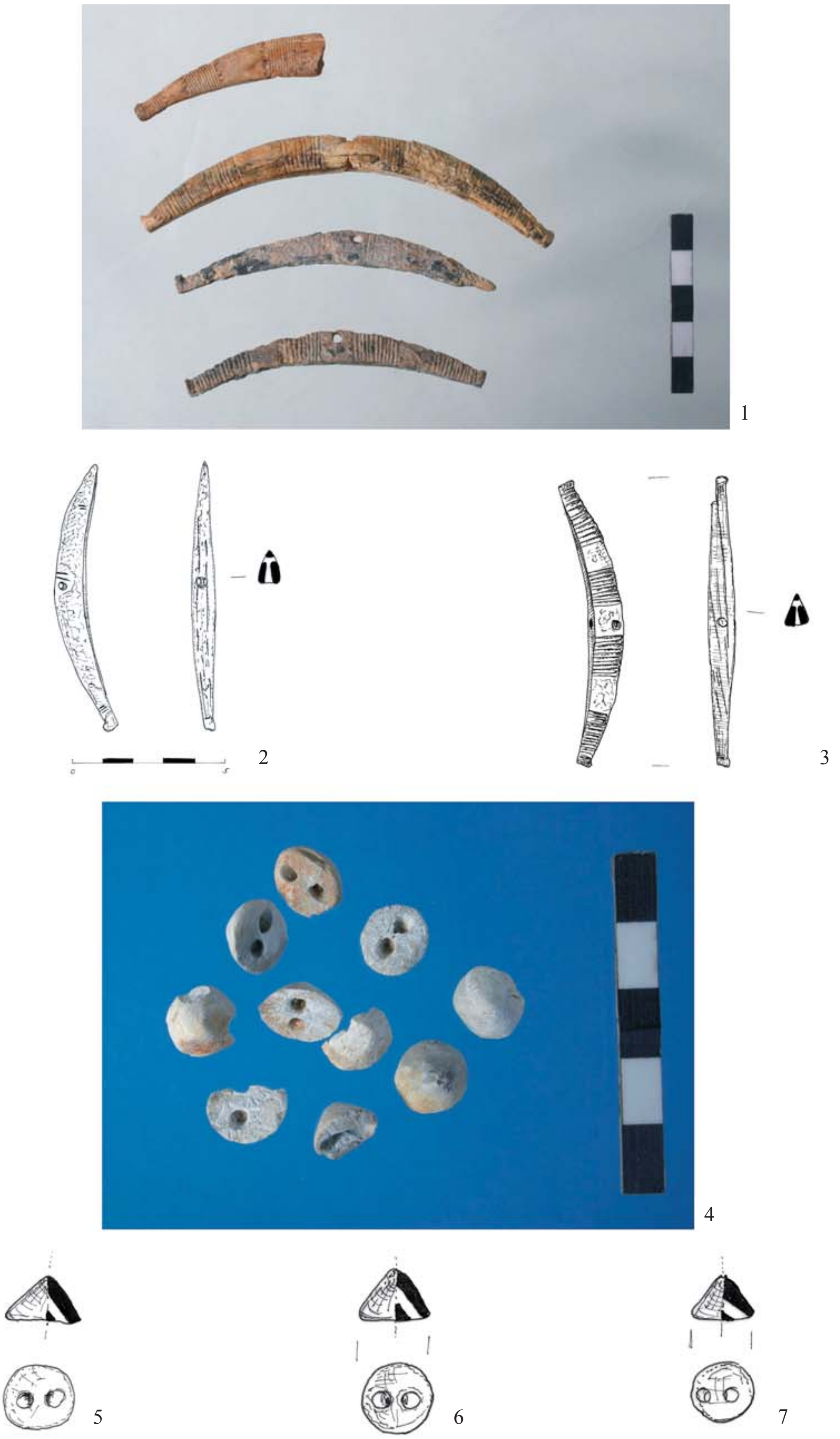


Fig. 17. Bone artefacts in the cemetery – 1–3: decorated lunular amulets, 4–7: bone buttons with a V shaped perforation

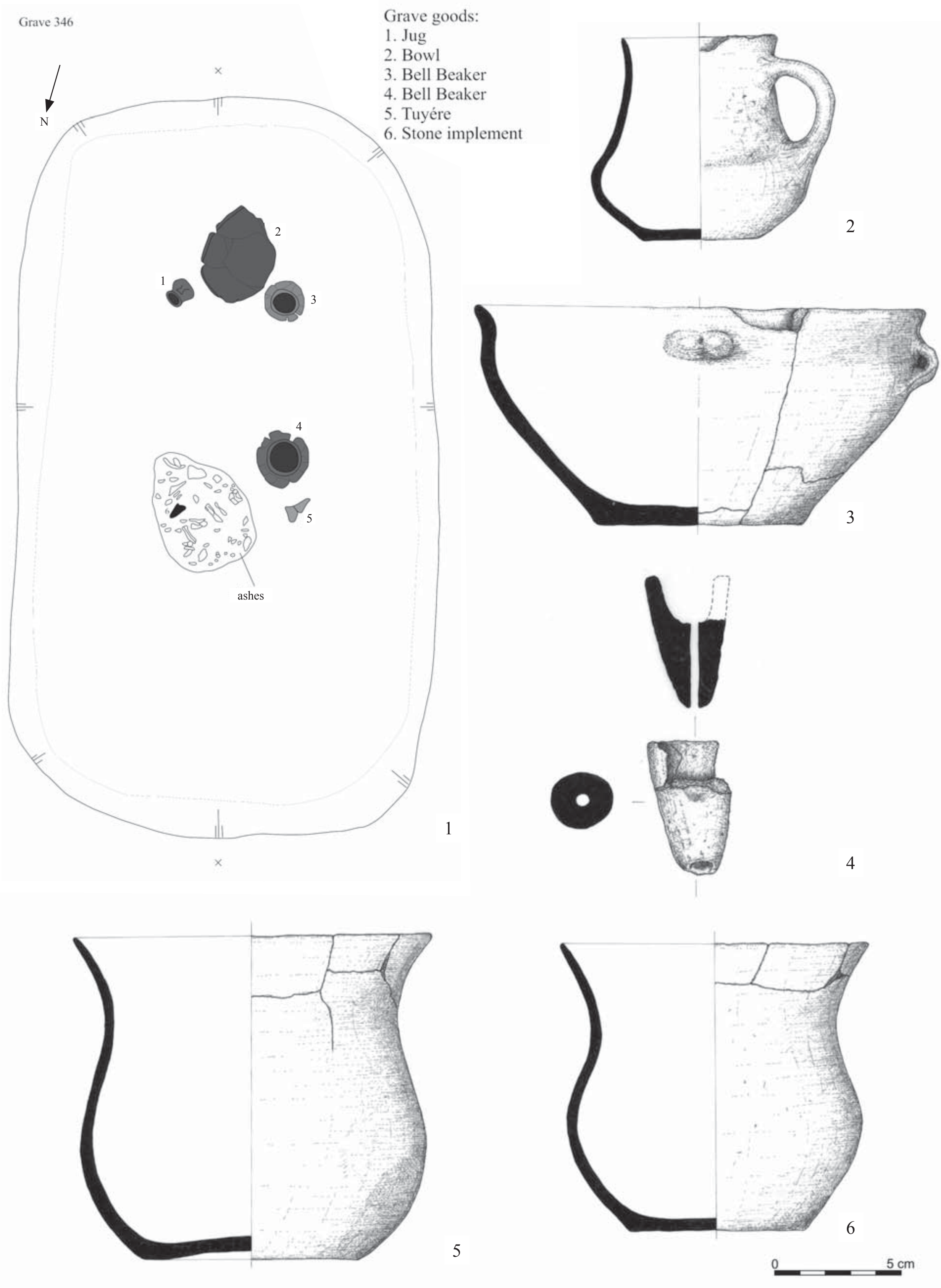
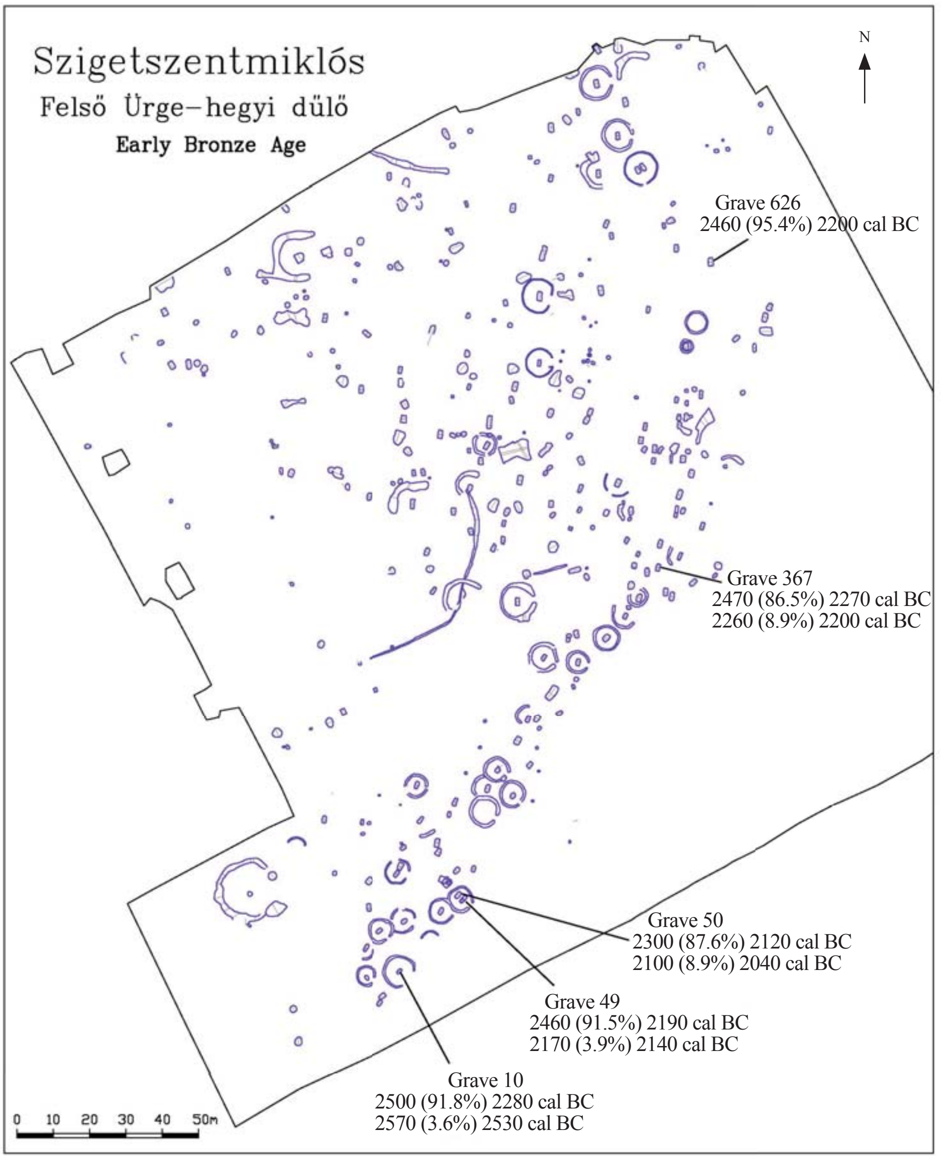


Fig. 18. Szigetszentmiklós-Felső Ürge-hegyi dűlő – Grave 346 (1) and its finds (2–6)

The study of the contacts between southeastern Moravia and the Carpathian Basin during the Late Eneolithic (Late Copper Age) and the Early Bronze Age has always been one of the main fields of Czech and Moravian prehistoric studies. Contacts between the two regions are well documented for the Makó-Kosihy-Čaka/Somogyvár-Vinkovci/Bell Beaker/Early Nagyrév period. A few vessel types appearing in the Carpathian Basin, such as amphorae and cups with ribbed decoration and biconical and globular cups with funnel-shaped neck, can generally been linked to the Corded Ware culture of Moravia. Several variants of the one-handled jugs current in the Carpathian Basin have been reported from Corded Ware sites in Bohemia and Moravia. These include Dřevohostice type jugs, the one-handled biconical jugs of the Balcanic type, and Somogyvár and Ökörhalom type jugs. Several scholars (Ondráček 1965; 1967; Pleslová-Štiková 1976; Vladár 1976; Buchvaldek 1981; 2002; Moucha 1981) believe that contacts with the southeast and the Carpathian Basin played an important role in the Protoaunjetitz period, the formative phase of the Aunjetitz culture. The prototypes of various pottery wares, principally of the one-handled jugs and of the footed bowls with fenestrated foot, are generally sought in the Makó-Kosihy-Čaka/Somogyvár/Glina III-Schneckenberg/Bell Beaker, and especially in the Early Nagyrév and Nagyrév cultures. These cultural impacts reflect intensive contacts over a long period of time between the Carpathian Basin, the Czech-Moravian Basin and Lower Silesia. It seems to me that the halberd from Grave 128 of the Szigetszentmiklós cemetery provides yet another piece of evidence for the contacts between the two regions. The halberd from Szigetszentmiklós can be regarded as the earliest piece in the Carpathian Basin. Three comparable halberds are known from the Carpathian Basin; unfortunately, all three are stray finds. One was found in the Szigetszentmiklós area, the other in the Pápa area (Kovács 1996), while the third one was found in the Danube near Dunaújváros (B. Horváth – Keszi 2004, 63, Pl. 284). The best analogies to these halberds can be quoted from the west (Harbison 1969, 35–55, Pls 8–21; Gallay 1981, 125–126, Pl. 33. 505) and from the Aunjetitz culture (Bartelheim 1998, 39–47, Taf. 44). The halberds of the Aunjetitz culture must certainly be mentioned in this respect. Even though halberds are not known from Protoaunjetitz contexts, I am nonetheless convinced that the appearance of this artefact type in the Carpathian Basin can be attributed to the contacts with the Czech-Moravian Basin and, also, that these contacts can be dated to the later half of the Early Bronze Age II, as used in Hungarian Bronze Age studies, corresponding to the Late Bell Beaker period and the appearance of Early Nagyrév assemblages. According to the chronological framework introduced by François Bertemes and Volker Heyd, this can be correlated with the Reinecke A0 period, dating to roughly 2350–2250 cal BC, when the region was settled by the Late Corded Ware culture, the Late Bell Beaker culture and the Protoaunjetitz culture (Bertemes – Heyd 2002, 190–204). The radiocarbon dates indicate that the late phase of the Szigetszentmiklós cemetery can be assigned to this period. It would then seem that halberds appeared in the Carpathian Basin without any apparent antecedents. The halberd from Szigetszentmiklós can be regarded as the earliest piece in the Carpathian Basin and its presence is proof for the intensive and dynamic contacts between the Carpathian Basin and the Czech-Moravian Basin during the Early Bronze Age, reflected by the flow of information and the spread of new innovations between these two regions.

In addition to the burials, we also uncovered the refuse pits and ditches of a prehistoric settlement, which lay scattered among the graves. With the exception of the Late Bronze Age and medieval features, these pits and ditches contained very few finds, principally animal bones (cattle, horse, sheep, red deer) and a few atypical, non-joining prehistoric sherds, making their dating difficult. No more than eight pits could be assigned to the Bell Beaker culture based on the finds recovered from them, which included beakers and bowls with decorated rim. One noteworthy vessel in the ceramic inventory is a bowl with decorated rim set on a cylindrical foot. Similar bowls were recovered from the burials at Szigetszentmiklós and on various sites in the Budapest area (Kalicz-Schreiber 1997, 184–185, Abb. 9. 5–6). Knowing that this bowl type is one of the typical wares of the Bell Beaker sites in the



Lab.-No.	Sample name	$\delta^{13}C^{1,2)}$ [‰]	^{14}C age$^{1)}$ [BP]	Calibrated age$^{3)}$ [cal BC]
VERA-4748	Grave 10	–17.6 ± 0.7	3920 ± 40	2500 (91.8%) 2280, 2570 (3.6%) 2530
VERA-4749	Grave 49	–20.1 ± 1.2	3830 ± 40	2460 (91.5%) 2190, 2170 (3.9%) 2140
VERA-4750	Grave 50	–20.3 ± 0.6	3775 ± 35	2300 (87.6%) 2120, 2100 (8.9%) 2040
VERA-4755	Grave 367	–19.7 ± 1.1	3875 ± 40	2470 (86.5%) 2270, 2260 (8.9%) 2200
VERA-4757	Grave 626	–21.4 ± 1.4	3845 ± 35	2460 (95.4%) 2200

1) 1σ –error

2) $\delta^{13}C$ determined with the AMS-system

3) determined with the calibration program OxCal and the calibration curve INTCAL04,
data correspond to the 2σ-confidence level, probability of the individual time periods in brackets

Fig. 19. Szigetszentmiklós-Felső Ürge-hegyi dűlő – ^{14}C dates from the cemetery

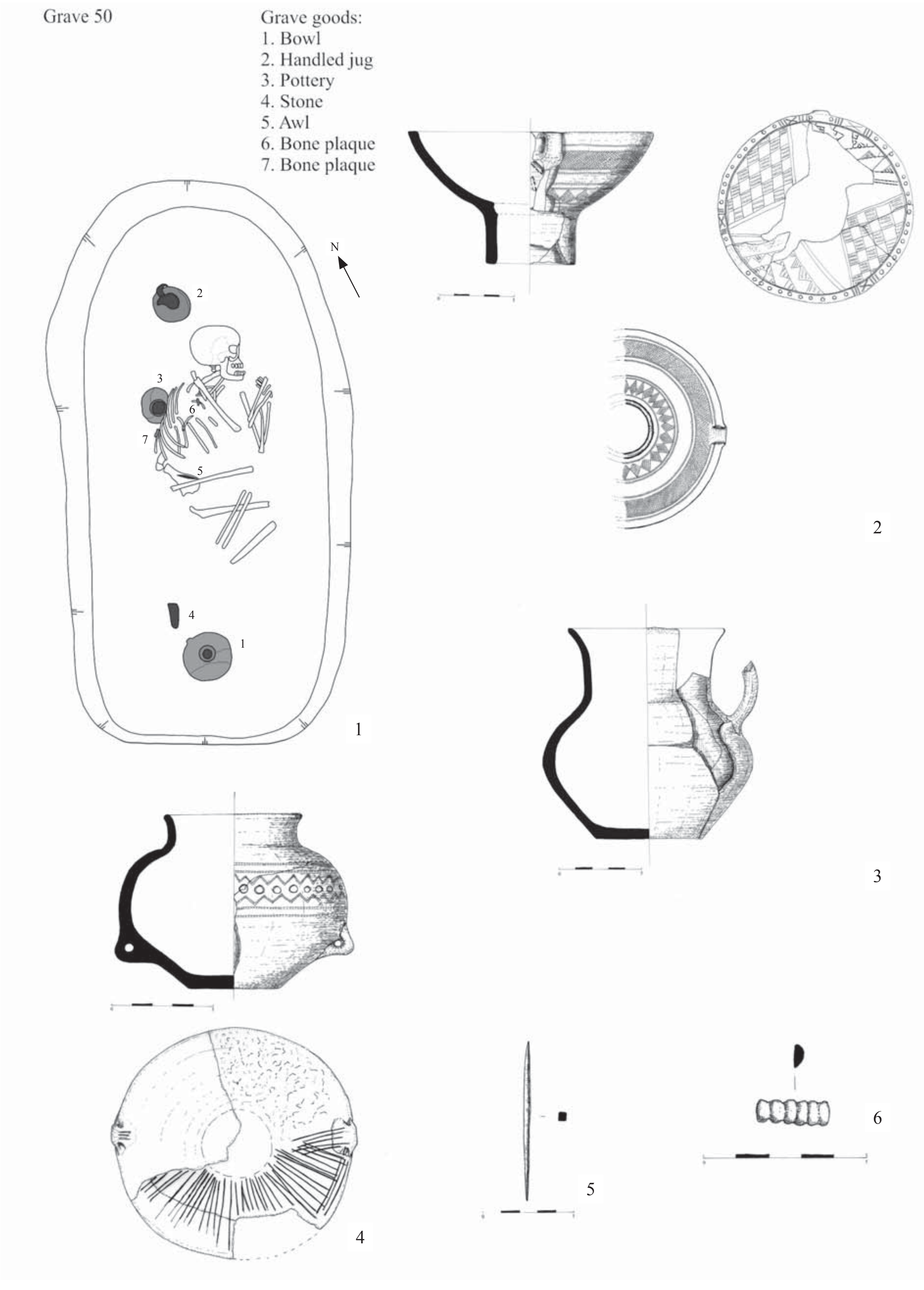


Fig. 20. Szigetszentmiklós-Felső Ürge-hegyi dűlő – Grave 50 (1) and its finds (2–6)

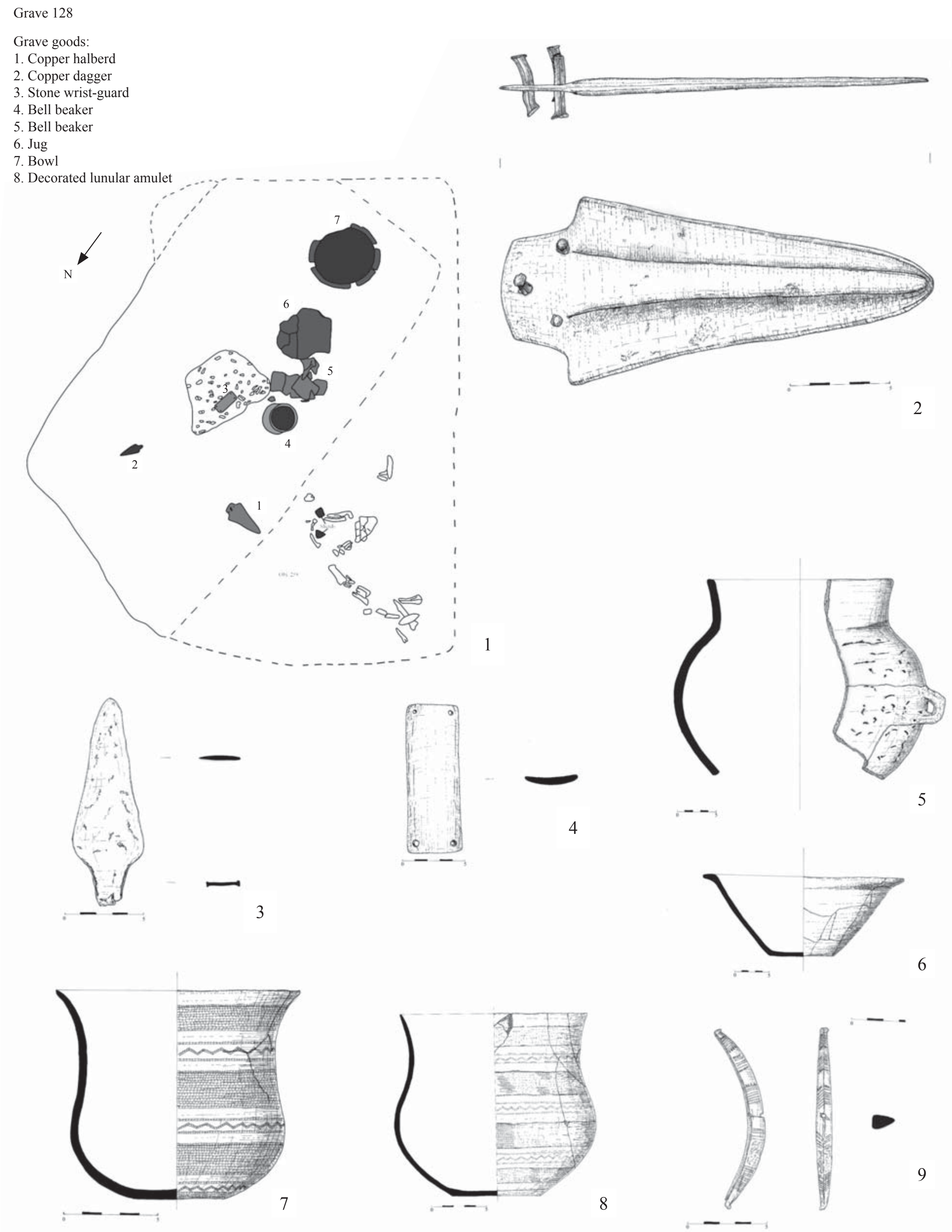


Fig. 21. Szigetszentmiklós-Felső Urge-hegyi dűlő – Grave 128 (1) and its finds (2–9)

Czech-Moravian Basin and in southern Germany (Dvořák – Hájek 1990, Taf. VI. 7; Dvořák *et al.* 1996, Taf. 10. 84, Taf. 15. 6) it seems likely that its origins can be sought in the west.

Most Bell Beaker cemeteries in the Budapest area lie some 200–300 m from the Danube, while the settlements were established closer to the river (Kalicz-Schreiber 1997, 183; 2001, 168–169). At Szigetszentmiklós, however, the pits containing Bell Beaker pottery were uncovered among and beside the burials. The graves and the settlement features often bordered on each other. In one case, a ditch containing Bell Beaker pottery cut through a Bell Beaker burial. However, the pottery recovered from the pits is very scanty, fragmented and contains few typical Bell Beaker wares, and thus a comparison with the pottery deposited in the graves will hardly contribute to clarifying the chronological relation between the settlement and the cemetery.

The Szigetszentmiklós cemetery will undoubtedly furnish new, and important evidence for the Bell Beaker research in Hungary and in Europe. This is the second largest known cemetery after Budakalász (Ottományi – Czene 2006; Czene 2008) in Hungary. Some burials, yielding finds with a resemblance to the Early Bell Beaker find horizon as defined by V. Heyd (2001) can be dated to the initial Bell Beaker period, while others date to a later period marked by the integration with the Late Makó-Kosihy-Čaka and Early Nagyrév cultures. The burial customs, various artefact types occurring among the grave goods and the halberd from Grave 128 indicate contacts with the west, while the decorated footed bowl and amphora-like small vessel from Grave 50 is a reflection of contact with the other Early Bronze Age cultures of the Carpathian Basin.

In sum, we may say, that the burial rites noted in the Szigetszentmiklós cemetery were introduced from Central Europe. The burials from the later period of the cemetery reflect strong, intensive ties with other regions of Central Europe, as well as strong connections with neighbouring cultures.[4]

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[4] This study is an extended version of the paper read at the conference entitled "Bell-Beakers. Symbols of a 5000-Year-Old Cultural Community in Europe", held in Torres Vedras (Portugal) in 2008 and "Bell Beaker Days along the Riverside", held in Budapest (Hungary) in 2009. I am grateful for the grant from the National Cultural Fund enabling my participation at the conference in Portugal. The photos were made by Linda Szászvári and the author, the drawing by Zoltán Farkas, the maps by Benedek Érdi, whom I would here like to thank for their work. I am especially grateful to István Ecsedy for his help in preparing this study.

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Cultural Change and Animal Keeping
Case Study of a Neolithic, Copper Age and Bronze Age Site near Budapest, Hungary

PÉTER CSIPPÁN

Abstract

People and their closest environment have a special interaction with each other through feedbacks. Human culture, the natural environment and domestic animals live in a special ecosystem that depends on these entities. The most important economic animals lived in a special multidimensional cultural and niche-like place, similar to ecological niches. These places determined the social status and the exploitation of these animals. Through the household activities the other important aspect of the systemic approach employed here is contact with the natural environment, and the identification of the catchment area and the resource management of these cultures. From the bone specimens of wild animals we can draw conclusions on the available animal resources and activities (e.g. hunting, fishing, gathering, etc.), which exploit them in some form or another. The technology of this exploitation can be observed in archaeological finds through butchering marks and body part distributions. It also has an important cultural meaning; however, we can observe them only through the screen of the taphonomic processes.

This paper considers a case study of animal bone finds from the prehistoric (Neolithic, Eneolithic, Early and Late Bronze Age) settlements of Dunakeszi-Székesdűlő. More than 7000 animal bone specimens came to light from these excavations. At all of these settlements the most important animals were cattle (Bos taurus L.)*, small ruminants (*Ovis aries L. *and* Capra hircus L.*) and pig* (Sus domesticus Erxl.). *The interpretation and possibilities of the method of ecological anthropology give new results, through animal husbandry in the research of archaeological cultures.*

Introduction

Between 2000 and 2004, archaeologists of the Budapest History Museum (BTM) excavated a site in Dunakeszi near Budapest, Hungary *(Fig. 1)*. During the excavations features representing different archaeological periods came to light. The excavations yielded Neolithic (Bicske-Bíňa phase), Copper Age (Protoboleraz phase), Early Bronze Age (Bell Beaker, Bell Beaker Csepel-group) and Late Bronze Age (Tumulus culture) artefacts (HORVÁTH *et al.* 2004, 209). This multiperiodicity and continuity lend importance to the site. The analysis of animal bones from different periods offers a great possibility for making a comprehensive review of animal exploitation – through the mirror of meat consumption – over these periods in a more-or-less constant natural environment providing comparable resources.

Fig. 1. Map of Hungary with the location of the site of Dunakeszi-Székesdűlő

Method

The ecological approach has its own history in the social sciences following the pioneering work by Julian H. Steward titled "The Theory of Culture Change" in 1955 (Steward 1955). J. H. Steward's basic idea is that people and their own environment (biotic and abiotic) have some contiguous interactions and this contact can be analysed by integrating ecological methods within cultural research.

In his essay J. H. Steward introduced a special, empirical research method, representing a basic step for analysing culture types. J. H. Steward named this method cultural ecology (Steward 1955, 450). The steps of this research method after J. H. Steward are as follows (Steward 1955, 450–453):

1. circumstantial description of human cultures and their own natural environment;
2. identification of the exploitation technics of the natural environment and the adaptation of the human population. Description of the relationship between the adaptation to the natural environment and special patterns of behaviour;
3. the leading of adaptation and the technology for the different parts of the culture.

J. H. Steward pointed out, that societies of differing social complexity also represent different forms of adaptation, while cultures have developed various adaptation technics for a broad range of environments. Following these analytical steps, comparisons between adaptation techniques become possible (Steward 1977, 52). We have reservations concerning Steward's idea, because adaptations themselves represent very complex, multi-layered phenomena (Hardesty 1977, 23) including:

1. behavioural adaptation;
2. physiological adaptation;
3. genetic and demographic adaptation.

Changes of behaviour are the most rapid response to environmental change. Two kinds of behaviour may be adaptive (Hardesty 1977, 23–26):

1. idiosyncratic behaviour: includes all special types of behaviour developed by people in an effort to answer environmental problems. This form of cultural behaviour has three layers: technological, social and ideological;
2. increasing effectiveness behaviour: members of the population strive to exploit the maximum of resources by investing minimum.

J. H. Steward's cultural ecology was the basis of Roy A. Rappaport's systematic thinking and the beginning of ecological anthropology. Rappaport's work, "Pigs for the Ancestors", described an ecological-systemic method of research in anthropology (Rappaport 1968). In his scheme the human population and the natural environment were strongly connected in a special ecosystem. He referred to and used ecological terminology consistently and he interpreted cultural behaviour as tools for the caveat of the ecosystem's equilibrium (Rappaport 1971, 64).

Probably one of the first papers to use the ecological point of view was published by John G. D. Clark in his work titled "Prehistoric Europe: The Economic Basis" in 1952 (Clark 1952). J. G. D. Clark noticed the importance of equilibrium in ecological systems – whom the human population is a part –, in close connection with the economic and cultural stability of society (Clark 1952, 7).

Following J. H. Steward's ground-laying work its adaptation gained major importance in archaeological research. Environmental adaptation was a flagship concept in processualist "New Archaeology". In Lewis R. Binford's paper "Archaeology as Anthropology" the author recognized the importance of J. H. Steward's cultural ecology (Binford 1962, 218).

Notwithstanding that the processualist approach provoked a lot of criticism, the importance of environmental factors or the viewpoint of cultural ecology has never been questioned. Later Michael D. Coe and Kent V. Flannery presented a model of microenvironmental analysis, which pointed to the significance of research into human-environment relationship (Coe – Flannery 1968).

The first archaeological application of the system-ecological approach is connected to L. R. Binford, who wanted to build a systemic ecological model for the domestication of plants and animals. In L. R. Binford's view this process was a special adaptive answer to changes in the natural environment (Binford 1965, 205).

It is important to note, that in system-ecological applications relationships may be considered those of a special closed system, because our knowledge of all contemporaneous interactions and natural/human factors is limited. In reality, however, these systems were open like all systems related to the natural environment. The idea of a closed system – characterized by limited interactions and factors – is more flexible, that is useable for the analysis above.

Although the idea of this system originated from ecology, the precision of interpretations concerning methods and concepts is questionable. Using these concepts, it is very important to notice, that not all phenomena are up to their ecological ones (e.g. ecosystem, niche, population). Human societies display a more complex behaviour that is pointing beyond the frames of a closed system. Hypothetical modelling of the relationships, however, has the potential of exposing the hidden connections between different factors in the everyday lives of people thousands of years ago.

Although useful information is limited, a large number of finds came to light from different periods at the site. Animal bones represent an adequate group of materials for gathering information. Meat consumption in everyday life characterizes animal keeping, while the remains of hunted animals are indicative of the natural environment.

Material

Altogether 7149 pcs of animal bones (NISP) came to light. Unfortunately the fragmentation of the bones was high, so a large number of bones could not be identified *(Appendices 1–2)*.

Cattle *(Bos taurus L.)*

Cattle were best represented among the animal bones. On the basis of the numbers of identifiable specimens (NISP), cattle bones made up 57.8 % of bone finds from domestic species. Unfortunately, these finds were heavily fragmented; the body size and sex of cattle could be calculated only in 8 cases on the basis of metapodials (Nobis 1954; Matolcsi 1970). The measurements were taken in millimetres following the protocol by Angela von den Driesch (1976). Trunk lengths were calculated using the estimated withers heights (Matolcsi 1968, 29) *(Table 1)*. Trunk lengths of the animals – similarly to withers heights –

Sex	Copper Age	Early Bronze Age	Late Bronze Age
Cow		***metacarpus sin.*** GL=**214.1**; BP=**45.1** WH=**1285.06** ***metacarpus dex.*** GL=**200.8**; BP=**52.2** WH=**1210.82**	
Bull		***metacarpus sin.*** GL=**200.9**; BP=**66.0** WH=**1271.7** ***metacarpus sin.*** GL=**180.3**; BP=**59.5** WH=**1141.3**	
?	***metatarsus sin.*** GL=**247.0**; BP=**59.2** WH=**1351.1**	***metatarsus dex.*** GL=**219.2**; BP=**51.8** WH=**1199.02**	***metatarsus dex.*** GL=**223.0**; BP=**50.6** WH=**1219.81** ***metacarpus dex.**** GL=**222.0**; BP=**67.2** WH=**1371.96**

* - on the basis of size it was almost an aurochs

Table 1. Dunakeszi-Székesdűlő – calculated withers heights of cattle (mm)

concur with the averages expected for different periods. On the basic of calculated body sizes large-middle size cattle were characteristic of these periods *(Table 2)*.

	Copper Age	Early Bronze Age	Late Bronze Age
Cow		1472.0 1386.96	
?	1547.65	1373.44	1397.26 1557.38
Bull		1456.7 1307.33	

Table 2. Dunakeszi-Székesdűlő – calculated trunk length of cattle (mm)

Small ruminants (sheep/goat) (*Ovis aries* L. and *Capra hircus* L.)

The species-level identification of bones from small ruminants is difficult, because they have very similar osteomorphology. Only a few elements of the skeleton can be recognized with sufficient certainty.

Unfortunately, the fragmentation of bones was very high at the site, therefore the separation of the two small ruminant species was largely impossible. The estimation of body sizes was also impossible.

However, according to the NISP, the importance of small ruminants, sheep and goat, was significant throughout the periods. The ratio of their bones among domestic animal bones reached 24.63%.

Domestic pig (*Sus domesticus* Erxl.)

The importance of pig intensified during the Copper Age, and stagnated thereafter. The number of their bone fragments contributed 10.86% to the overall NISP of the domestic animals. The withers heights of two individuals were calculated from the Early Bronze Age settlement using astragalus measurement (Teichert 1969) *(Table 3)*.

Bone	GL (mm)	Withers height (mm)
astragalus sin.	42.9	767.9
astragalus sin.	41.8	748.2

Table 3. Dunakeszi-Székesdűlő – calculated withers heights of pigs

Horse (*Equus caballus* L.)

The role of horses in the domestic fauna was minimal, with the exception of the Early Bronze Age when horse keeping culminated, then subsided toward the Late Bronze Age period. The contribution of horse bones to the domestic fauna ranged between 5.19% of NISP. The aforementioned culmination in the Early Bronze Age period was important, because this was a possible sign of intensive horse keeping in the area, which was noticed by Sándor Bökönyi in 1978 (Bökönyi 1978, 30, 35; Kalicz-Schreiber – Kalicz 1998–2000, 49). The withers heights of only four individuals could be calculated (Vitt 1952) *(Table 4)*.

Bone	GL (mm)	Withers height (mm)
metatarsus III. sin.	239.0	1247.7
metatarsus III. sin.	254.9	1332.4
metacarpus III. sin.	213.6	1332.5
radius dex.	331.9	1527.6

Table 4. Dunakeszi-Székesdűlő – calculated withers heights of horses

Domestic dog (Canis familiaris L.)

The presence of dogs in the Neolithic settlement was represented by only a single coprolite. Subsequently they were represented by numerous bone fragments in the Copper Age as well as in the Early and Late Bronze Ages. No body size could be calculated due to the high degree of fragmentation. The proportion of dog remains was 1.46 % among domestic animals.

Hunted game and the natural environment

The habitats of the hunted animals give basic information on the macro-environment aiding paleoecological reconstruction of prehistoric settlements.

On the basis of this knowledge, there were closed woods as well as parkland forests near the prehistoric settlements of Dunakeszi-Székesdűlő. This statement is strengthened by the considerable proportion of bones from wild mammals such as red deer (*Cervus elaphus* L.), roe deer (*Capreolus capreolus* L.), aurochs (*Bos primigenius* Boj.), wild boar (*Sus scrofa* L.), wolf (*Canis lupus* L.) and red fox (*Vulpes vulpes* L.) (Vörös 1994, 180; 2000).

Although these species often show environmental flexibility, their common presence is determined by habitat type. Based on its percentual ratio within the wild animal NISP red deer was the most important and most hunted game during the Copper Age, the Early Bronze Age and Late Bronze Age. This trend is unsurprising, because this animal provides a multitude of goods (meat, skin, bone, antler) (Bökönyi 1979–1980, 112).

Evidence of the contemporaneous vicinity of waters is provided by the numerous riverine shell *(Unio sp.)* fragments, two pieces of fishscale, and three bone fragments from a beaver (*Castor fiber* L.). A few species imply the marshy character of the microenvironment of the site, e.g. the pond tortoise (*Emys orbicularis* L.) and two species of water snails.

Forty-three specimens of great ramshorn (*Planorbarius corneus* L.) and one specimen came to light from a single feature from the Late Bronze Age period. The large number of these snails and shells was the evidence for the consumption of these animals.

Concerning the tortoise bones we have to surmise that they were a taphonomic rather than a cultural phenomenon as no marks of processing or cut marks were present on these bones. It is possible that these animals burrowed into the softer layers of the archaeological features for the purpose of hibernation.

Several wells (dated to the Late Bronze Age) were excavated at the site (Szilas 2002, 292). The archaeobotanical analysis of samples from these wells verifies the marshy micro-environment of the prehistoric settlements (Gyulai 2002, 305).

Reconstruction of the paleoenvironment

A submediterrane-like weather that was typical of the Late Atlantic climatic phase of the Late Neolithic (Kordos 1977, 226), turned cooler and rainier during the Bronze Age in the Carpathian Basin.

During the Subboreal climatic phase, extensive beech woods, parkland forests, and swampy meadows flourished in the studied area (Járainé Komlódi 2000, 47). The natural flora and fauna also responded to the general climatic changes. On the basis of the “vole-thermometer” and “Arvicola” humiditas monitoring, László Kordos inferred the climatic changes in the vertebrate microfauna. These conclusions rely on the biostratigraphical analysis of rodents based on the strong connection between the vegetation and these micromammal species (Kordos 1977, 227). Although to a lesser extent, domestic animals also responded to these climatic changes (Choyke – Bartosiewicz 1999, 246).

The paleohydrogeology of the site indicates that it was once positioned on a deposit of the Danube (KOROM – REMÉNYI 2005, 198). Paleopedological, paleobotanical and malacological analyses show, that the eastern part of the site was a swampy, humid area, rich in different types of weeds (HORVÁTH *et al.* 2003, 5; KOROM – REMÉNYI 2005, 198). Finally, parkland areas and woods were identified in the proximity of the site on the basis of the macromammals identified.

Palaeoecosystem with cultural aspects

The goal of ecological approaches is the analysis of interactions and feedbacks between the natural environment and the human population, using ecological methods and identifying a special ecological system (ecosystem) with cultural aspects. Analysing an ecosystem is possible through its dynamic aspects (BORSOS 2001, 23).

All activities are dynamic aspects, with their own continuity and/or regularity perpetually affecting the entire system thereby determining it. From the archaeozoological point of view we can define the fact of meat consumption as a dynamic aspect, because this activity involves definite interactions between animals and the human population.

Determining dynamic aspects does not require the complete reconstruction of the contemporaneous environment, albeit these reconstructions provide more information for research making them more complex.

The archaeological populations of humans and the animal species they interacted with may be conceived like two distinct biological populations: a group of individuals with similarly definable properties, represented by suitable numbers and interactions. These groups are independent of each other (MAJER 2004, 33).

In this case, however, archaeological human populations may be seen in a wider sense than biological populations, because they are not "only" reproductive groups, but they were also defined by cultural aspects. The domestic animals were controlled and selected by the human population. Along a different dimension, bone finds are also selected by cultural aspects, e.g. customs of butchering, meat consumption and garbage disposal.

Based on the interpretation of meat consumption as a dynamic aspect, a special ecosystem can be sketched *(Fig. 2)*. In this case CULTURE, the NATURAL ENVIRONMENT and DOMESTIC ANIMALS were the main entities (taken as constant substances), which operated the system with their own interactions.

In order to analyze the dynamic aspect we have to define variables, which depended on the entities of the ecosystem and were available in all of the discussed archaeological periods. These variables were not the elements of the system, because the stationary nature of these elements is the main axiome of the ecosystem. These variables can only be specific dimensions of the entities, but not the entities themselves (RAPPAPORT 1968, 4). Possible is a specific attribute of the populations, or the variability of the population, but not the population itself (RAPPAPORT 1968, 4). From the viewpoint of animal bones this variable

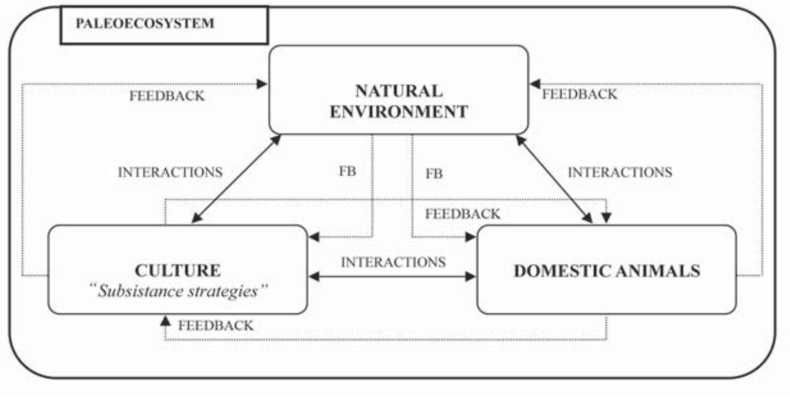


Fig. 2. Paleoecosystem built around the natural environment, domestic animals and culture

may be the rate of meat consumption, the type of animal keeping, the technology of consumption or the techniques of the exploitation of the environment.

Natural environment as an entity included all biotic and abiotic factors around the settlement *(Table 5)* where the human population once lived. Moreover, other human populations living at nearby settlements were also included in this entity.

Culture as an ecological entity is restricted, because through the mirror of animal bones, we can only analyse meat consumption, animal keeping, hunting, fishing, that is, subsistence strategies connected to the direct evidence of animal remains. This entity also includes techniques of animal exploitation.

The entity of domestic animals included all domestic species, which produced the primary and liminal (transitional) environment between the natural environment and the human population.

Interactions between human culture and the natural environment

Effects of the natural environment for the human culture

Biotic factors		**Abiotic factors**
Intraspecific	*Interspecific*	
- trade +	- possibility of fishing +	- climate ±
- cultural pressure ±	- possibility of hunting +	- topography ±
	- gathering +	- water ±
		- soil type ±
		- raw materials (clay, wood, ore, stone, salt etc.) +

Effects of the human culture for the natural environment
- gathering ±
- hunting ±
- fishing ±
- animal keeping –
- logging –
- mining –

Interactions between the human culture and the domestic animals

Effects of the human culture for the domestic animals
- cultural effects of keeping +
- exploitation type and rate ±
- processing and product making –
- control of breeding, protection +

Effects of the domestic animals for the human culture
- socio-economic roles: "living meat-can", workpower (draught etc.), mate +
- usage of resource continuum +
- breeding possibilities ±
- cultural value +

Interactions between the natural environment and the domestic animals

Effects of the domestic animals for the natural environment
- exploitation of the resources –
- overpopulation –
- adaptivity 0
- meat-resource for the carnivores +

Effects of the natural environment for the domestic animals
- keeping habit +
- resources +
- possibility of "bloodfreshing" +
- source of dangers –

Table 5. The possible types of interactions between the entities – +: profitable; –: harmful; 0: indifferent; ±: both profitable and harmful

Self-regulatory systems and feedback

This type of ecological systems is self-regulated by the interactions between the entities and the dynamic aspects. In such systems all actions provoke a response. If any of the value(s) of the variables change, process(es) are generated which can change other variables in order to maintain the equilibrium of the whole system (Rappaport 1968, 4). This process, called feedback, can be either positive or negative from the viewpoint of the populations.

Herding and control can also regulate the numbers of animals. The abridgement of the possibility of overpopulation of the species may be perceived as a positive feedback for the human population and the natural environment, but it has negative bearing on controlled domestic animal population.

The catchment area and resource management

On the basis of the presence of wild and domestic animals as an indicator of the natural habitats, it is possible to determine the contemporaneous catchment area once exploited by the archaeological populations.

The liminal zones between different habitat types were the most productive areas from the viewpoint of natural resources. Therefore, the catchment areas of settlements usually included several liminal zones (Sutton – Anderson 2004, 5), because the productivity of the catchment area depended on the numbers of liminal zones incorporated.

The cadence of exploitation for animal resources concerns the resource management practices of the human population. There were two ways for this management (Sutton – Anderson 2004, 111): active and passive.

All types of exploitation are active, which require the death of the animal, because the entire animal is used (meat, skin, bone etc.). On the other hand, this means the conscious control, butchering or hunting and eating of the animal species in question (Sutton – Anderson 2004, 115).

The passive type of exploitation includes all animal utilization techniques, which do not require the killing of animals. These types of exploitation also include spiritual activities, offerings etc., which do not serve the common utilities, the merely utilitarian forms of exploitation, but are put to the service of higher levels of ideologies (Sutton – Anderson 2004, 115). It is important to note, that neither intensive animal keeping, nor intensive agricultural activities excluded the exploitation of natural resources (hunting, fishing, gathering, etc.), although the importance of these activities was much smaller.

In this case study the active resource exploitation of the animals – as mirrored by animal bones – showed some growth during the Early Bronze Age and Late Bronze Age, although the number of bones and the concomitant diversity of species was less in the earlier periods, which may influence the results.

Cultural niches of the main domestic species

In classical ecology, the different animal species are perceived as living in a special multidimensional space within the ecosystem. This is called a niche. The niche includes all interactions of the species with its own natural environment (Majer 2004, 37). The axes of this multidimensional space provide the natural factors, which similarly influence the everyday life of human populations (Majer 2004, 41). The different factors are comparable in terms of the interdependence with each other.

If the niches of two species overlap with each other (similar activity-time, similar food preferences, similar habits, etc.), a competition begins between the two species concerned, which finally leads to the disappearance of one of them (Géczy 1984, 65).

S. Bökönyi noticed in his work, that the improvement of the domestic animal species was influenced by the following factors (BÖKÖNYI 1974, 88):

– geographical and climatic factors (resource-continuum);
– factors connected to zoogeography and domestication;
– factors connected to the use of domestic animals;
– ethnic reasons;
– factors associated with class-structure and types of the settlement;
– factors connected with the techniques of husbandry;
– religious causes.

Adapting the concept of niche for the factors listed above, special socio-ecological niches can be defined for domestic species. These spaces determine the whole life of animals, their life spans, their foraging, as well as their socio-economical position within the settlement.

In the case of the main domestic animals (cattle, sheep/goat, pig) the niches can be determined relatively easily by the number of the utilization techniques and the natural resource exploitation skills of the species. The life of the animal population and the mere fact of keeping a particular species mostly depend on these niches *(Fig. 3)*.

Cattle have much more utilization possibilities than other domestic species, but they have the least resource-using ability. Small ruminants have less utilization possibilities, but they are more tolerant toward the environment. Pigs have only a single utilization possibility, meat, but they possess the widest resource-using ability and their rate of reproduction is the highest among livestock. The niches of the main domestic species are thus more-or-less culturally and biologically separated, therefore these species do not compete with each other. This is one possible answer, to the question why these animals became the main domestic ones in many parts of the world (GÉCZY 1984, 65).

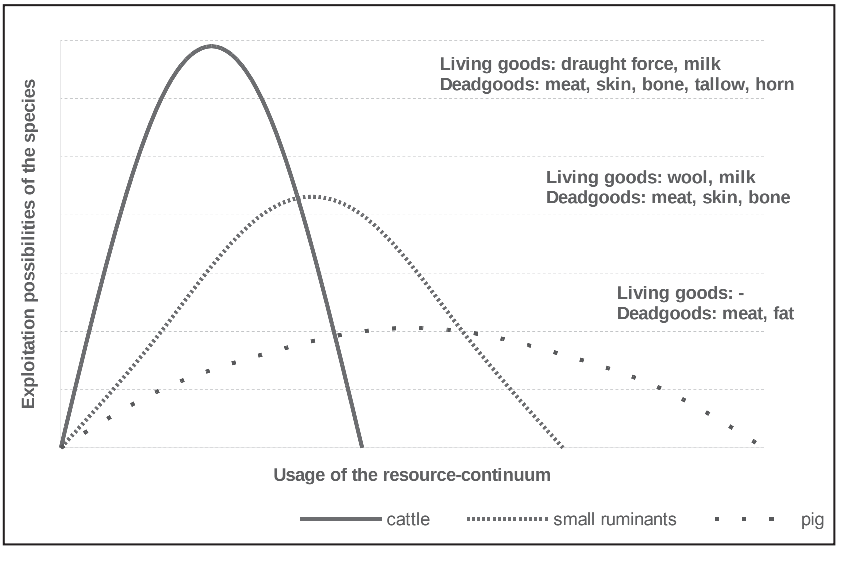


Fig. 3. Niche-like spaces of the most important domestic animals

Mortality and feedback

After the analysis of the identifiable bones, it became apparent that the majority of domestic animals were butchered in their adult ages. It is important to notice, that the "bone-eater" taphonomic factors tend to more easily destroy the bones of young animals. All results in this paper are interpreted in the mirror of taphonomic laws.

In the case of cattle, culling the young seems to be more frequent in the Late Bronze Age. This trend is possibly linked with high scale utilization possibilities. Diachronic swings in kill-off ages exerts a positive feedback on the cattle population. A cultural process indicates a biological one.

In the case of small ruminants, the kill-off ages show a different situation from those of cattle. The young-age killings are also decreasing until the Early Bronze Age, but this trend is slipping into the Late Bronze Age. This phenomenon possibly depends on the number of animals in the stock. The supply of young meat is higher in a sufficiently large stock, because the killing of a young animals does not threaten the replenishment of the whole stock.

On the other hand the mode of utilization for these animals may have changed during different archaeological periods. Cultural change therefore also indicates a biological difference in this case as well. The phenomenon had a negative feedback effect on the population of small ruminants.

In the case of pigs the highest ratio of the remains originated from young animals. This phenomenon faded away by the Early Bronze Age period, but increased again in the Late Bronze Age. The small utilities determine the lifetime of these animals, so cultural decisions influence the population of pigs through a negative feedback *(Fig. 4)*.

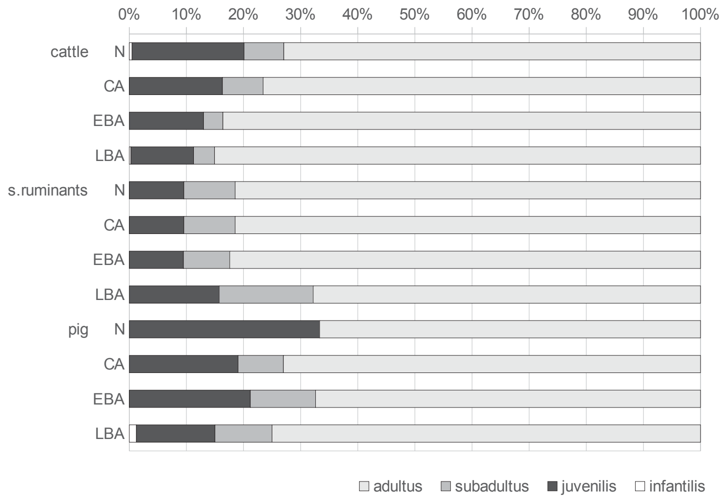


Fig. 4. Dunakeszi-Székesdűlő – kill-off patterns of the main domestic species

The technology of meat processing and body part distributions

Following the steps of J. H. Steward's cultural ecology, the next step is determining the techniques of the exploitation of the natural environment. In our case this technique is – in the mirror of meat consumption as a dynamic aspect – meat processing.

The identification of butchering or cut-marks in prehistoric materials is difficult and not always clean-cut, but the process of butchering is traceable by the differential representation of body parts of various animal species. The over- and underrepresentation observed may have different importance, which is mirrored in the quantity and quality of the representation.

For this analysis we have to compare the real representation of the bone finds with the theoretical ratios of the bones in each body part in a whole skeleton (*Table 6*; Reitz – Wing 1999, 212; Csippán 2007, 92–93). Using this method there is a possibility to understand differences between meat processing in different archaeological periods *(Fig. 5)*.

In order to make the different numbers of bone finds more comparable, the natural logarithm of the calculated percentages was used following the method of Elizabeth J. Reitz and Elizabeth S. Wing (1999, 212).

head	*neuro- et viscerocranium, mandibles, hyoideum, horncores*
trunk	*vertebras (c, th, l, s, cd), ribs*
cranial part	*scapula, humerus, radius, ulna*
caudali part	*pelvis, femur, tibia, patella*
front leg	*carpals, metacarpals*
rear leg	*tarsals, metatarsals, astragalus, calcaneus*
feet	*phalanges, sesamoids*

Table 6. Distribution of bones in the different body parts

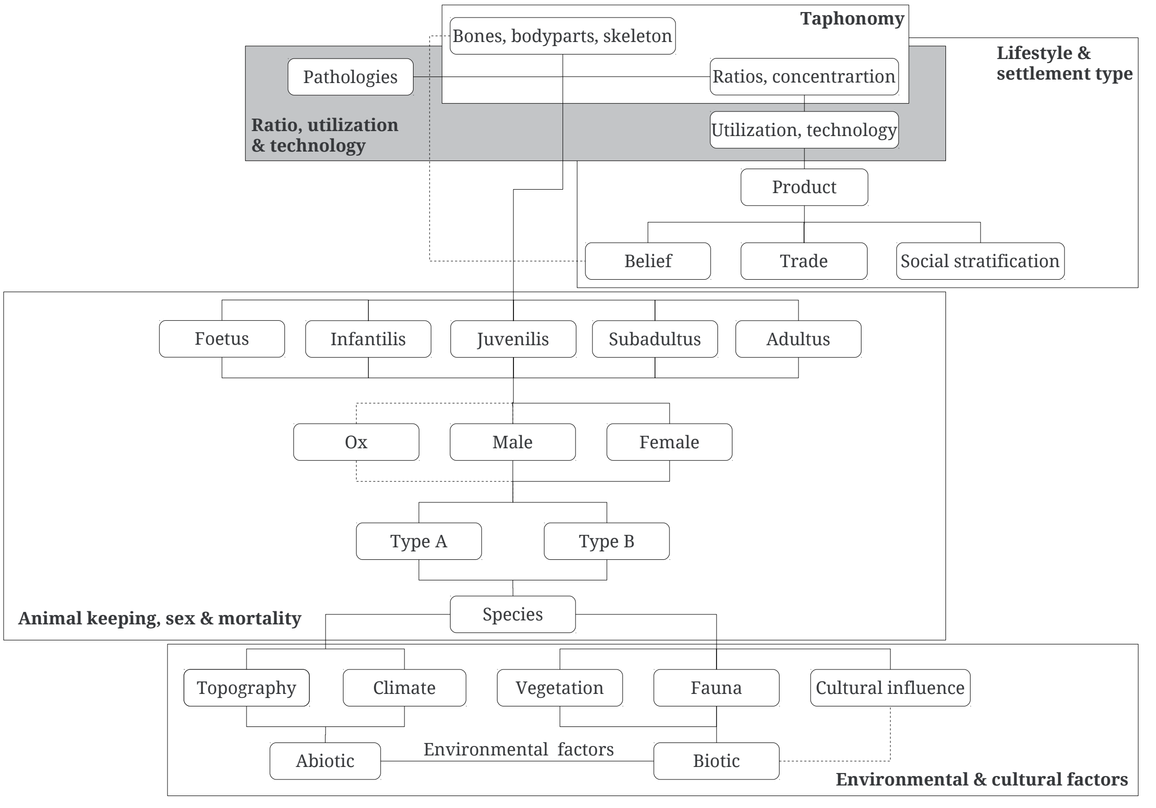


Fig. 5. Interpretation of the archeozoological data and their connections with the different parts of culture

In the case of cattle the under- and overrepresentation of the body parts is more or less equal in all periods. This observation may have two possible interpretations:

1. similar utilization and similar butchering processes;
2. similar site and similar taphonomic effects.

The head, the cranial, the caudal part and the rear leg are overrepresented in each period, but the others are underrepresented. In the case of the head region, the fragility of the skull may have influenced the high numbers. The cranial and caudal parts unequivocally represent preferences for the meat-rich body regions. The differences between the representation of the front and rear legs is also interesting. The interpretation of this phenomenon needs more evidence and further analyses.

The ratios of body parts among small ruminant remains are very similar to those of cattle. Only the metapodials and other bones of the feet show some differences. On the one hand, this may be interpreted as the outcome of taphonomic processes, because these bones are small enough to be lost with greater probability. On the other hand, this phenomenon may also be explained by skinning, because during that process the same bones usually remain in the raw skin and may be deposited elsewhere. No diachronic differences were seen in the deposition of small ruminant remains.

In the case of pigs, the underrepresentation of metapodials and the rest of the foot bones is the same or even higher than was the case with small ruminants. The arch of the diagram possibly shows differences in meat processing and relevant techniques. Only the Neolithic and Copper Age samples are different, although the number of bones in these samples is very low.

Conclusions

This paper is an essay on the application of classical steps of cultural ecology in a small area of archaeology: archaeozoology. Hopefully it could be made clear how possibilities of the cultural ecological approach can be used in archaeozoology. This solution is important as natural factors played a key role in the lives of prehistoric cultures.

The case study of Dunakeszi-Székesdűlő was considered suitable for demonstrating these possibilities, because this site is characterized by multi-periodicity and a continuity of prehistoric occupation.

Cattle were the most prominent domestic animal in all periods at the site, followed by small ruminants (sheep/goat) and pig. The number of pig remains grew until the beginning of the Late Bronze Age (Bökönyi 1979–1980, 112). This phenomenon is possibly connected to the change to the Subboreal climatic phase, which favoured pig-keeping in riverine geographical environments.

The hunting of game was confined to meat-games such as red deer (*Cervus elaphus* L.) and aurochs (*Bos primigenius* Boj.). A rare faunal element identified in the Neolithic assemblage was horse, possibly representing the wild form *(Equus ferus gmelini)*.

The importance of hunting was increasing by the Bronze Age. The repertoire of hunted wild ungulates was completed by two other meat purpose wild animals, roe deer (*Capreolus capreolus* L.) and wild boar (*Sus scrofa* L.). Remains of small, fur-bearing game also occurred.

The exploitation of natural resources, that is, resource management was strongly dependent on the cultural aspects of the human population. The method considered in this paper followed J. Steward' approach to cultural ecology in three steps:

1. circumstantial description of human cultures and their own natural environment;
2. identification of the exploitation techniques of the natural environment and the adaptation of the human population. Description of the relationship between the adaptation to the natural environment and the special behaviour patterns;
3. the leading roles of adaptation and technology in different parts of the culture.

Following J. Steward's method the observed results were set in a special cultural ecosystem. This system was studied based on the bone finds – through the mirror of meat consumption. So in this case the dynamic aspect, which is a propulsive force in the system, is the fact of meat consumption itself.

This special ecosystem is based on three different entities: CULTURE (Subsistence strategies) – NATURAL ENVIRONMENT – DOMESTIC ANIMALS. In this system, the main entities communicate with each other through special interactions, which have positive or negative feedback effects on the different elements of the entities.

Using this approach based on archaeozoological analysis, ancient lifestyles and animal keeping were interpreted. The faunal diversity show the arrangement of possible natural resources in the proximity of settlements and help outline the resource management of prehistoric populations (Reményi 2003, 269).

The analysis clarified the special niches (a concept borrowed from ecology) of the main domestic species. These topological spaces determined the life and utilization of the animals. Finally the technology of animal exploitation differed and this diversity was recognizable in the ratios of the various bones and body parts of the animals recovered. Using this method outlined a complex picture of the paleoecological system near the settlements, animal keeping and hunting – through the aspect of meat consumption.

Appendix 1

List of animal remains from the excavations

Period	Neolithic	Copper Age	Bronze Age		Total
			EBA	LBA	
Number of features	29	11	122	88	
Species					
Cattle (*Bos taurus* L.)	467	297	790	383	1937
Small ruminants *(Caprinidae sp.)*	57	216	388	164	825
Pig (*Sus domesticus* Erxl.)	11	75	195	83	364
Horse (*Equus caballus* L.)		2	153	19	174
Dog (*Canis familiaris* L.)	*	12	34	3	49
Domestic mammals	**535**	**602**	**1560**	**652**	**3349**
Wild horse *(Equus ferus gmelini)*	1				1
Aurochs (*Bos primigenius* Boj.)	5	11	13	6	35
Red deer (*Cervus elaphus* L.)	3	20	84	22	129
Roe deer (*Capreolus capreolus* L.)		2	5	9	16
Wild boar (*Sus scrofa* L.)		4	34	9	47
Wolf (*Canis lupus* L.)				1	1
Red fox (*Vulpes vulpes* L.)			4		4
Beaver (*Castor fiber* L.)		1			1
Wild hare (*Lepus europaeus* L.)			5		5
Rodent *(Rodentia)*			9		9
Wild mammals	**9**	**38**	**154**	**47**	**248**
Bird *(Aves)*			4		4
Pond tortoise (*Emys orbicularis* L.)			2	8	10
Fish *(Pisces)*			5	2	7
Riverine shell (*Unio* sp.)	6	13	24	5	48
Great ramshorn (*Planorbarius corneus* L.)		6		43	49
Great pond snail (*Lymnaea stagnalis* L.)				1	1
Snail *(Gastropoda)*	1		2	9	12
Other	**7**	**19**	**37**	**68**	**131**
Middle size mammal *(Mammalia indet.)*			8		8
Small ungulate *(Ungulata indet.)*	27	98	455	164	744
Large ungulate *(Ungulata indet.)*	735	232	1236	466	2669
	762	**330**	**1699**	**630**	**3421**
Total	**1313**	**989**	**3450**	**1397**	**7149**

* - coprolite

Expected and observed quantities of the body parts of the main domestic species in the Neolithic period

Cattle	Expected			Observed			
	NISP	NISP%	Lnx	NISP	NISP%	lny	lny-lnx
Head	6	4.2	1.435	70	23.9	3.173	1.738
Trunk	72	50.0	3.91	70	23.9	3.173	–0.737
Cranial part	8	5.55	1.713	46	15.7	2.754	1.041
Caudal part	8	5.55	1.713	31	10.6	2.359	0.646
Front leg	14	9.7	2.272	21	7.2	1.970	–0.302
Rear leg	12	8.3	2.116	26	8.9	2.183	0.067
Feet	24	16.7	2.815	29	9.9	2.292	–0.523
Total	**144**	**100**		**293**	**100.0**		

Small ruminants	Expected			Observed			
	NISP	NISP%	Lnx	NISP	NISP%	lny	lny-lnx
Head	6	4.5	1.504	52	27.8	3.325	1.821
Trunk	61	45.9	3.826	25	13.4	2.593	–1.233
Cranial part	8	6.0	1.791	37	19.8	2.985	1.194
Caudal part	8	6.0	1.791	37	19.8	2.985	1.194
Front leg	14	10.6	2.36	18	9.6	2.264	–0.096
Rear leg	12	9.0	2.197	18	9.6	2.264	0.067
Feet	24	18.0	2.89	—	—	—	—
Total	**133**	**100**		**187**	**100.0**		

Pig	Expected			Observed			
	NISP	NISP%	Lnx	NISP	NISP%	lny	lny-lnx
Head	4	2.2	0.788	37	50.0	3.912	3.124
Trunk	76	40.4	3.698	7	9.5	2.247	–1.451
Cranial part	8	4.3	1.458	18	24.3	3.191	1.733
Caudal part	10	5.3	1.667	8	10.8	2.381	0.714
Front leg	24	12.7	2.541	—	—	—	—
Rear leg	18	9.6	2.261	3	4.1	1.400	–0.861
Feet	48	25.5	3.238	1	1.4	0.301	–2.937
Total	**188**	**100**		**74**	**100.0**		

Expected and observed quantities of the body parts of the main domestic species in the Copper Age period

Cattle	Expected			Observed			
	NISP	NISP%	Lnx	NISP	NISP%	lny	lny-lnx
Head	6	4.2	1.435	70	23.9	3.173	1.738
Trunk	72	50.0	3.91	70	23.9	3.173	–0.737
Cranial part	8	5.55	1.713	46	15.7	2.754	1.041
Caudal part	8	5.55	1.713	31	10.6	2.359	0.646
Front leg	14	9.7	2.272	21	7.2	1.970	–0.302
Rear leg	12	8.3	2.116	26	8.9	2.183	0.067
Feet	24	16.7	2.815	29	9.9	2.292	–0.523
Total	**144**	**100**		**293**	**100.0**		

Small ruminants	Expected			Observed			
	NISP	NISP%	Lnx	NISP	NISP%	lny	lny-lnx
Head	6	4.5	1.504	52	27.8	3.325	1.821
Trunk	61	45.9	3.826	25	13.4	2.593	–1.233
Cranial part	8	6.0	1.791	37	19.8	2.985	1.194
Caudal part	8	6.0	1.791	37	19.8	2.985	1.194
Front leg	14	10.6	2.36	18	9.6	2.264	–0.096
Rear leg	12	9.0	2.197	18	9.6	2.264	0.067
Feet	24	18.0	2.89	—	—	—	—
Total	**133**	**100**		**187**	**100.0**		

Pig	Expected			Observed			
	NISP	NISP%	Lnx	NISP	NISP%	lny	lny-lnx
Head	4	2.2	0.788	37	50.0	3.912	3.124
Trunk	76	40.4	3.698	7	9.5	2.247	–1.451
Cranial part	8	4.3	1.458	18	24.3	3.191	1.733
Caudal part	10	5.3	1.667	8	10.8	2.381	0.714
Front leg	24	12.7	2.541	—	—	—	—
Rear leg	18	9.6	2.261	3	4.1	1.400	–0.861
Feet	48	25.5	3.238	1	1.4	0.301	–2.937
Total	**188**	**100**		**74**	**100.0**		

Expected and observed quantities of the body parts of the main domestic species in the Early Bronze Age period

Cattle	Expected			Observed			
	NISP	NISP%	lnx	NISP	NISP%	lny	lny-lnx
Head	6	4.2	1.435	231	28.7	3.356	1.921
Trunk	72	50.0	3.91	149	18.5	2.917	–0.993
Cranial part	8	5.55	1.713	87	10.8	2.379	0.666
Caudal part	8	5.55	1.713	94	11.7	2.459	0.746
Front leg	14	9.7	2.272	52	6.5	1.871	–0.401
Rear leg	12	8.3	2.116	92	11.4	2.433	0.317
Feet	24	16.7	2.815	99	12.3	2.509	–0.306
Total	**144**	**100**		**804**	**100**		

Small ruminants	Expected			Observed			
	NISP	NISP%	lnx	NISP	NISP%	lny	lny-lnx
Head	6	4.5	1.504	128	42.7	3.754	2.25
Trunk	61	45.9	3.826	17	5.7	1.74	–2.086
Cranial part	8	6.0	1.791	51	17.0	2.833	1.042
Caudal part	8	6.0	1.791	56	18.7	2.928	1.137
Front leg	14	10.6	2.36	13	4.3	1.458	–0.902
Rear leg	12	9.0	2.197	31	10.3	2.332	0.135
Feet	24	18.0	2.89	4	1.3	0.22	–2.67
Total	**133**	**100**		**300**	**100**		

Pig	Expected			Observed			
	NISP	NISP%	lnx	NISP	NISP%	lny	lnx-lny
Head	4	2.2	0.788	75	38.7	3.655	2.867
Trunk	76	40.4	3.698	14	7.2	1.974	–1.724
Cranial part	8	4.3	1.458	38	19.6	2.975	1.517
Caudal part	10	5.3	1.667	31	15.9	2.766	1.099
Front leg	24	12.7	2.541	6	3.1	1.131	–1.41
Rear leg	18	9.6	2.261	16	8.2	2.104	–0.157
Feet	48	25.5	3.238	14	7.2	1.974	–1.264
Total	**188**	**100**		**194**	**100**		

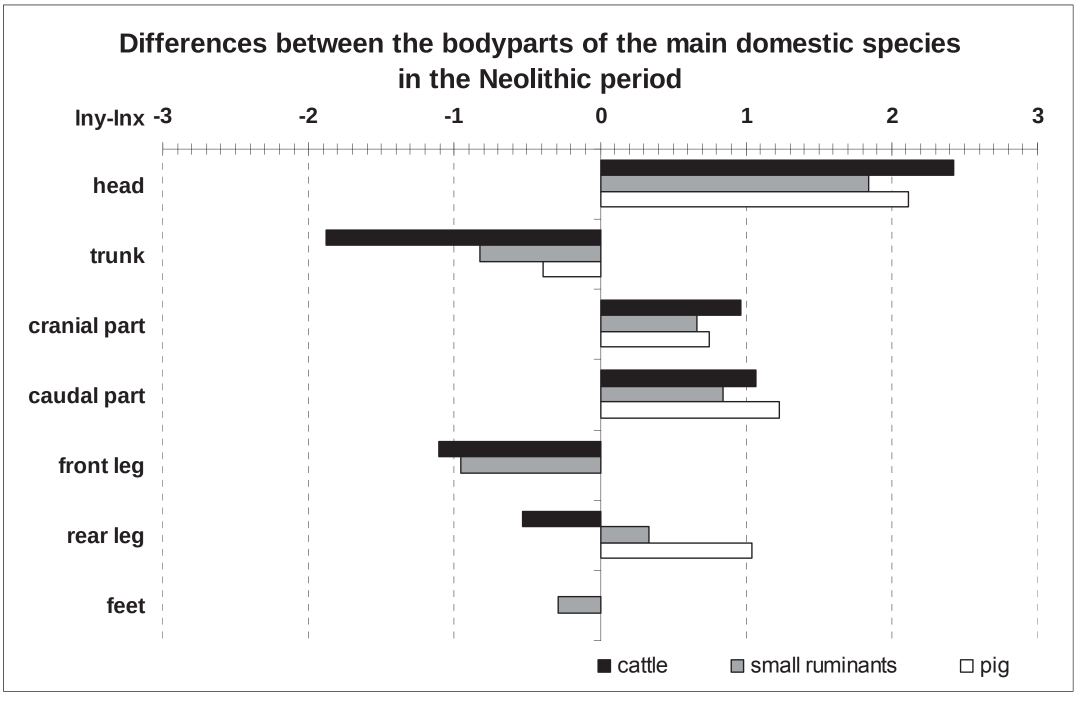
Expected and observed quantities of the body parts of the main domestic species in the Late Bronze Age period

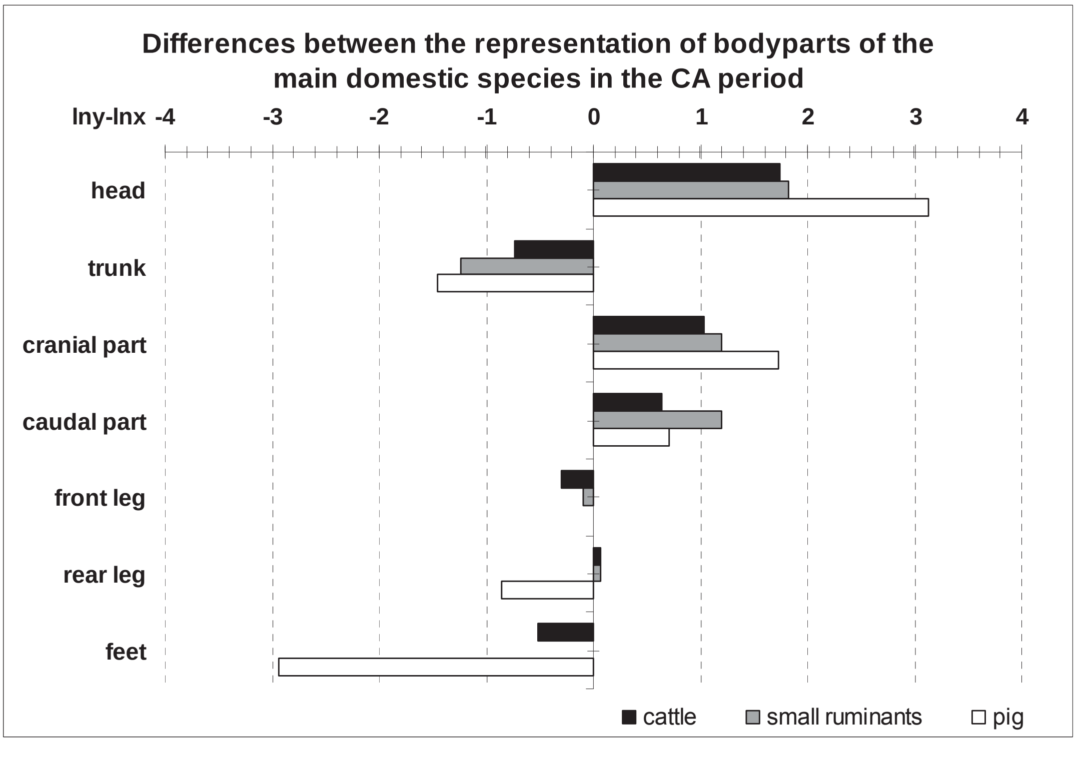
Cattle	Expected			Observed			
	NISP	NISP%	lnx	NISP	NISP%	lny	lny-lnx
Head	6	4.2	1.435	87	23.2	3.144	1.709
Trunk	72	50.0	3.91	78	20.8	3.034	–0.876
Cranial part	8	5.55	1.713	53	14.1	2.646	0.933
Caudal part	8	5.55	1.713	41	10.9	2.388	0.675
Front leg	14	9.7	2.272	24	6.4	1.856	–0.416
Rear leg	12	8.3	2.116	60	16.0	2.772	0.656
Feet	24	16.7	2.815	32	8.5	2.14	–0.675
Total	**144**	**100**		**375**	**100**		

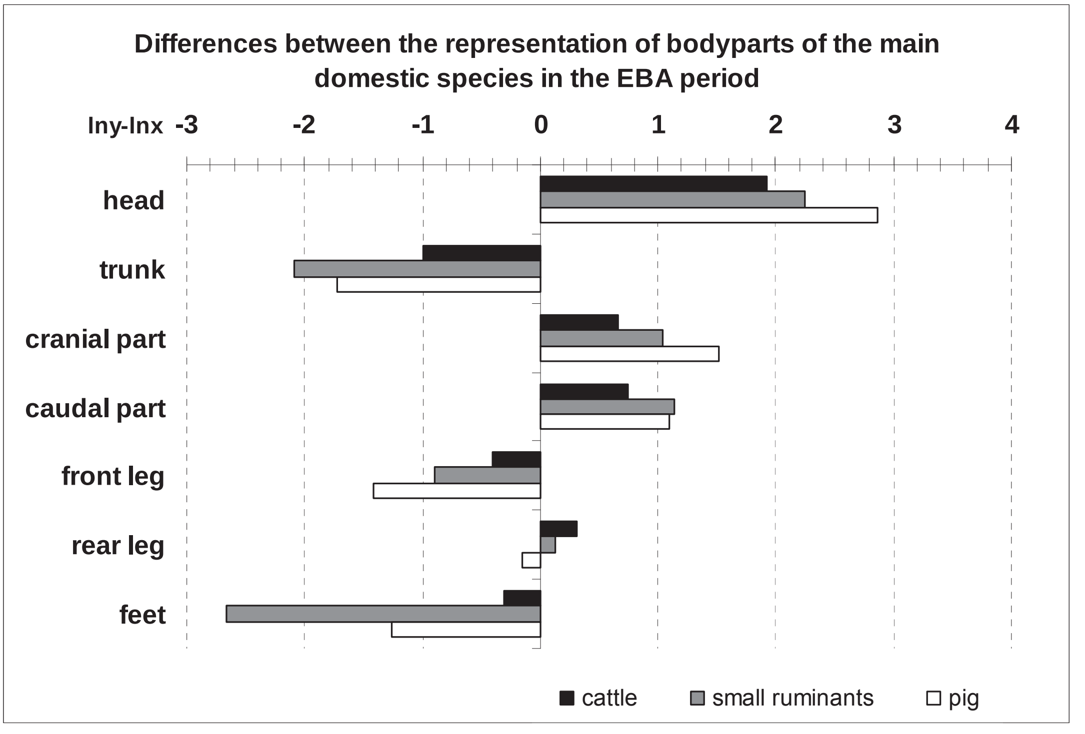
Small ruminants	Expected			Observed			
	NISP	NISP%	lnx	NISP	NISP%	lny	lny-lnx
Head	6	4.5	1.504	71	46.1	3.83	2.326
Trunk	61	45.9	3.826	8	5.2	1.648	–2.178
Cranial part	8	6.0	1.791	21	13.6	2.61	0.819
Caudal part	8	6.0	1.791	33	21.4	3.063	1.272
Front leg	14	10.6	2.36	7	4.5	1.504	–0.856
Rear leg	12	9.0	2.197	14	9.1	2.208	0.011
Feet	24	18.0	2.89	—	—	—	—
Total	**133**	**100**		**154**	**100**		

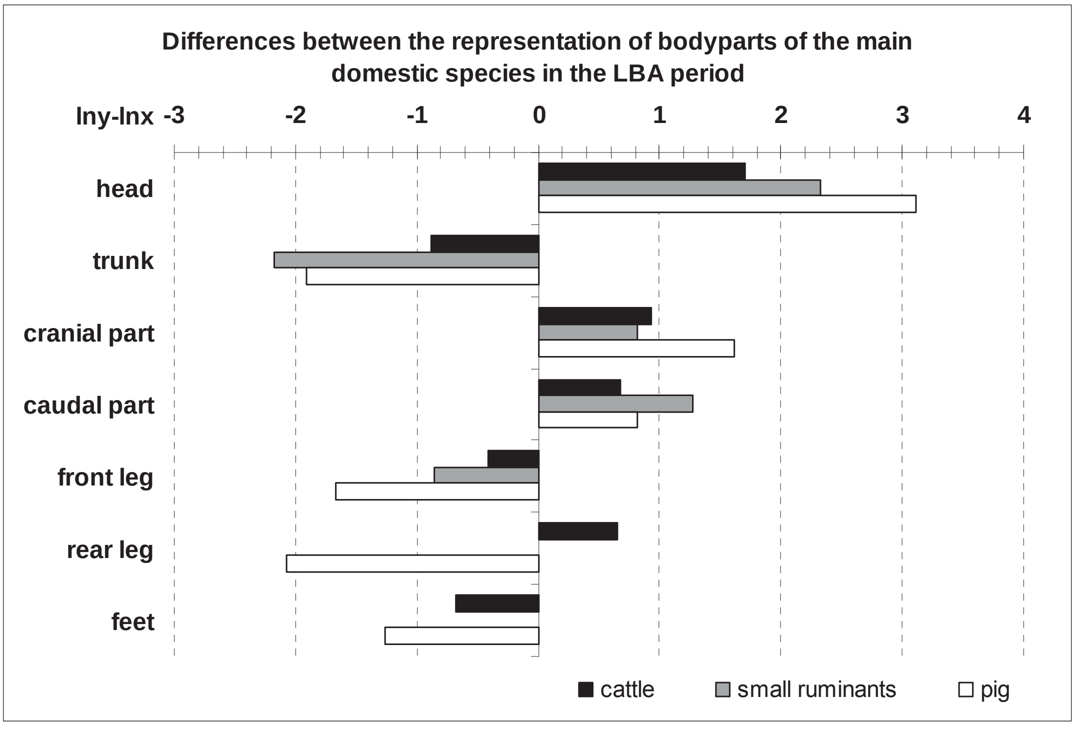
Pig	Expected			Observed			
	NISP	NISP%	lnx	NISP	NISP%	lny	lny-lnx
Head	4	2.2	0.788	41	49.4	3.899	3.111
Trunk	76	40.4	3.698	5	6.0	1.791	–1.907
Cranial part	8	4.3	1.458	18	21.7	3.077	1.619
Caudal part	10	5.3	1.667	10	12.0	2.484	0.817
Front leg	24	12.7	2.541	2	2.4	0.875	–1.666
Rear leg	18	9.6	2.261	1	1.2	0.182	–2.079
Feet	48	25.5	3.238	6	7.2	1.974	–1.264
Total	**188**	**100**		**83**	**100**		

Appendix 2


Differences between the bodyparts of the main domestic species in the Neolithic period
lny-lnx
-3
-2
-1
0
1
2
3
head
trunk
cranial part
caudal part
front leg
rear leg
feet
cattle
small ruminants
pig


Differences between the representation of bodyparts of the main domestic species in the CA period
lny-lnx
-4
-3
-2
-1
0
1
2
3
4
head
trunk
cranial part
caudal part
front leg
rear leg
feet
cattle
small ruminants
pig


Differences between the representation of bodyparts of the main domestic species in the EBA period
lny-lnx
-3
-2
-1
0
1
2
3
4
head
trunk
cranial part
caudal part
front leg
rear leg
feet
cattle
small ruminants
pig


Differences between the representation of bodyparts of the main domestic species in the LBA period
lny-lnx
-3
-2
-1
0
1
2
3
4
head
trunk
cranial part
caudal part
front leg
rear leg
feet
cattle
small ruminants
pig

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Middle Bronze Age Beyond the Eastern Fringe of the Carpathian Basin[1]

NECULAI BOLOHAN – ANDREI ASĂNDULESEI

Abstract

The current investigations allowed us to set forth some assumptions or conclusions, which concern the evolution of the Costişa community in the context of the passage from Early Bronze Age to Middle Bronze Age and in the Middle Bronze Age within the eastern Carpathians area. On the account of the precious research it can be established that there existed some interference between Monteoru Ic4 and the beginning of the Costişa communities, and contacts intensified during the Monteoru Ic3–Ic2 phases.

There is enough evidence to place the beginning of the Costişa culture at the very end of the 3rd millennium BC. The idea of a Central European contribution in defining Costişa features became an established truth. If we look back in time, a similar phenomenon occurred in the case of the Globular Amphora culture that penetrated through Volhynia and western Podolia to the northern half of Moldavia. Accepting this scenario, these communities in the northern half of Moldavia might represent an extremely southern extension of the Komariw-Bialyi Potik groups blended in the area by some Carpathian Basin features. Nevertheless, the newly created identity might represent in some extent the result of negotiating places, artefacts, strategies and multilateral relationships.

By bringing together the archaeological data, we can conclude that during the final stage of the Early Bronze Age and the beginning of the Middle Bronze Age the communities in the foothills of the eastern Carpathians could act together with other contemporary communities (Mnogovalikovaya culture, Monteoru culture) as a mediator between areas of the Carpathian Basin and neighbouring areas. In this scenario, salt may have played an important role. The hilltop settlement of Siliştea seems to have had all the necessary characteristics (location, altitude, orientation, visibility) in a close spatial relation to the salt springs in the Cracău-Bistriţa catchments.

Introductory notes

We have witnessed lately a raising need to reassess the data concerning the end of the Early Bronze Age (EBA) and the beginning of the Middle Bronze Age (MBA) for the area stretching east of the Carpathian Basin. In my case, this reassessment was imposed by the discovery, in the aforementioned area, of some artefacts linked to the region of Central Europe. Moreover, the usual discourse regarding this area has to be altered given the new achievements in the fields of structural analyses and non-invasive investigations. Furthermore, the development of the database, a changing discourse regarding the area and the period under study, in terms of both theory and methodology, led to a more active approach and comprehension of the characteristic phenomena. The new framework of analysis and the new theoretical and methodological approach allowed taking into consideration unused data which made possible a holistic understanding of the analyzed phenomena.

Apparently, the eastern Carpathian area during the MBA seems to be characterized by "well-defined" cultural communities (archaeological cultures), occupying two distinct areas within the same region. Thus, the southern part belongs to the Monteoru *culture* and the north to the Costişa *culture*. In between these two distinct areas, in the Sub-Carpathian region and in the proximity of the Carpathian Mountain passes, there is a buffer territory with some artefacts, which do not resemble those found in the surrounding areas. This buffer territory was settled and enabled to function because of its location in the

[1] A first abridged draft of this contribution was published as Bolohan 2010.

proximity of the mountain passes and the connection to the most important means of communication in the area, namely the Siret river which crosses the eastern Carpathian area from north up to the Danube Delta.

Up to now, archaeological research in the area led to the discovery of some major archaeological sites, which were analyzed within the cultural-historical framework. The accidental similarities or differences were explained by the *movement* of communities or resulting from *imports.* These analyses led to establishing prototypes for the artefacts discovered in the area, which can be traced across several generations. Nonetheless, up to now, we do not have an assessment concerning different patterns of relations, the dynamics of settlements, the individuals or the elites in the area.

The fragmented picture of the research done in the area is the consequence of several factors: some areas received more attention, while others were neglected following the distinct interests of the archaeologists who preferred to focus on their areas of interest and expertise. Thus, for the EBA in eastern Romania, there is only one monographic study (Burtănescu 2002). The rest is reserved to possible surprises as was recently stated (Vulpe 2010, 220–232, Figs 30–31). Up to recently we saw only a few data reported concerning the period of the MBA. Nevertheless, the image started to be completed thanks to the research done since the year 2000 (Munteanu 2010 and most of the recent bibliography concerning the topic in the area). On the other hand, the period of the LBA has been the focus of research done in the area, which resulted in numerous studies dedicated to this particular segment (Dascălu 2007 with bibliography).

These introductory note are meant to stress the lack of national or regional purposes, which could have established patterns of research and prioritize areas of interest. Moreover, it is important to stress the urgency of connecting the traditional approach to the analytical approach in order to create a new research paradigm.

On local theory and methodology

For a few years, local archaeology has been trying to re-evaluate its theoretical and methodological background (Anghelinu 2003; Palincaș 2010 and the bibliography) and to reassess some of the data concerning the area of study (Popescu – Băjenaru 2008). The current approach re-evaluates some of the archaeological literature, field observations, "excavations" in some museum deposits and the possibility to include some non-invasive and invasive research methods. On this occasion, I paid attention to the data issued by archaeologists of different periods in the attempt to appraise my research concerning the transition from the EBA to MBA and the content of these chronological sequences.

In the last few years we had the possibility of extending the observations by including non-invasive and non-destructive research techniques (topographical mapping, intensive grid survey, drilling, as well as geomagnetic and geoelectric field measurments and radiocarbon dating). They have allowed a re-evaluation and the identification of new strategies of field research.

This study aims to change the parochial and "canonical" view on *material culture* and to find a way to construct the materiality of cultures in the need to permanently re-evaluate the potentials of archaeology. On account of these inferences the next step might unveil the inner dynamic, the interactions and the conditions for understanding the way of mixing cultures and creating cultural *buffer territories* in Central and eastern European prehistory.

Despite a long and very important bulk of discoveries, archaeology in eastern Europe has mainly worked with a traditional culture-historical approach or from a neo-evolutionist viewpoint when assessing the equation between culture, history, material culture and identity. Archaeologists have focused mainly on identifying *archaeological cultures* and throwing bridges in a very complicate and bushy relative chronology and artefact typology. Scholars have tried to map the geographical distribution through differences and similarities in artefacts as well. These analogies have constantly been explained by diffusion and migration. In this respect, the task is to set up a long distribution system from prehistory to historical times for building the history of known ancient people according to interwar archaeological thought (for an up to date critique see Kristiansen 2000, 19–21).

Thus, different types of classificatory rules produce *archaeological cultures* as the expression of the relation between a body of common features and a social group charted within an area. The *archaeological culture* became rather a group or an artifactual style, resulting from a hierarchy of artefact types indicating morphological or functional similitudes. Noteworthy is the review of the notion of "archaeological culture" in all its components according to the western school of archaeology. It is needless to explain here the struggle for reassessing the meanings of the words: *artefacts*, *cultures, material cultures* (Van der Waals 1984, 2–5; Shanks – Tilley 1987, 117–119, 130–134). Unfortunately, there are no references concerning Far East European archaeology (Shennan 1994, 5–14, 17–22). In contemporary times we may talk about a long history concerning the notion of "archaeological culture" from Gustaf Kossina to Vere Gordon Childe up to Ian Hodder (Hides 1996, 25–27). Most of the scholars in western Europe and North America are against the approach that portrayed "cultural groups as monolithic, bounded, objective identities" (Jones – Graves-Brown 1996, 5). To some extent, archaeological cultures or cultural groups may indicate an entity or an individual with its own life circle, from birth until their death. The study of *material culture* has been done by concentrating on typologies and taxonomies and not on the complexity and diversity of decrypting the grammar of material culture (Tilley 1991, 15–17) or the *history* masked by materiality or by the artefacts, avoiding to deal with the "communicative qualities of material culture" (Lucy 2005, 99). Furthermore, this simplified inquiry is skirting the topic of "the active role of material culture in constituting, rather than merely reflecting social realities" (Lucy 2005, 99).

Those efforts did not have a theoretic frame and an up-to-date methodology, which would have facilitated a relinquishment of the older and confusing modes of interpretation of materiality, which paid tribute to a *mechanical* cultural evolutionism or neo-evolutionism. By means of this model, older periods were divided into cultural units, defined through a set of common features (so close to the identity sameness!) to be found within fixed or fluctuant boundaries. Thus, the main task and result consist of finding regional groups through stylistic variations. From this standpoint to the involvement and decryption of social facts, institutions, ideologies, codes of transmitting knowledge or models of mobility for tracking past identities, there was and still is a long way to go.

At the moment, I propose to reinforce the concept of *cultural identity* in local archaeology, with aspects of stylistic change and artefact variability, which is traditionally based on the relationships between people and objects, people and places and objects and places. It is not my intention to avoid the artefactual taxonomies or to simply find analogies. I intend to push further on the way of searching and seeing material culture in order to set up a multivariate methodological consensus (Wells 1998). The analysis of cultural identities in this area of study has not been a priority given the fact that the goal has been the need for defining archaeological units (cultures, groups), which led to a fragmentation of the discourse. Alternatively, even worst, this race to become the "godfather" for a cultural unit may express a powerful archaeological ego.

Lately, starting in 2000, the issue of understanding the EBA and the beginning of MBA east of the Carpathians in almost all of its components, but in a regional context became a main task.

Environment and area of study

The area of study is located in the west-Central parts of Moldavia, in Romania, and is represented by a region stretching from the eastern Carpathian Mountains in the west to the western banks of the

Siret river in the east. Particularly, I will refer to the middle part of the Moldavian Sub-Carpathians, which comprises three distinct depressions: Ozana-Topolița, Cracău-Bistrița and Tazlău-Cașin (Velcea – Savu 1982, 236–247). The area consists of mountainous regions, hills and highlands on the western edges, and two main alluvial plains and watersheds, Cracău and Bistrița. Although, there is no available data on the paleohydrography of the area during the Bronze Age, one can say that it was not totally different from the modern age. For Moldavia, the Siret represented the main catchment and way of access, which passed through different regions. In this sense, the river played the role of mediating contacts. For the Cracău-Bistrița depression, the Bistrița river was the main axis of communication and catchments area. The middle terraces offered, due to alluvial deposits, proper conditions for settlement and agriculture. The left bank, after the Cracău flows into the Bistrița, is a little bit higher than the right bank, with some steep slopes. The smaller tributaries, which branch the left terraces of Bistrița, affected the landscape. The main archaeological sites with traces of habitation from the Bronze Age similar to Costişa are located on the top of the terraces *(Fig. 1).*

The goal of this contribution is to focus upon the Cracău-Bistrița geographical depression very well marked to the west, north, east, and rather open to the south. In such conditions, the depression was an important *buffer territory* between the northern and Central parts of Moldavia, along the outer piedmonts of the eastern Carpathians and between east and west; in other words, due to its geographical position and cultural dynamic a *buffer territory* between western Moldavia and the eastern Carpathian Basin. Communication between these areas was facilitated by the use of the ridge roads and alpine passes, as well as the use of natural transportation routes located in the valleys of watercourses.

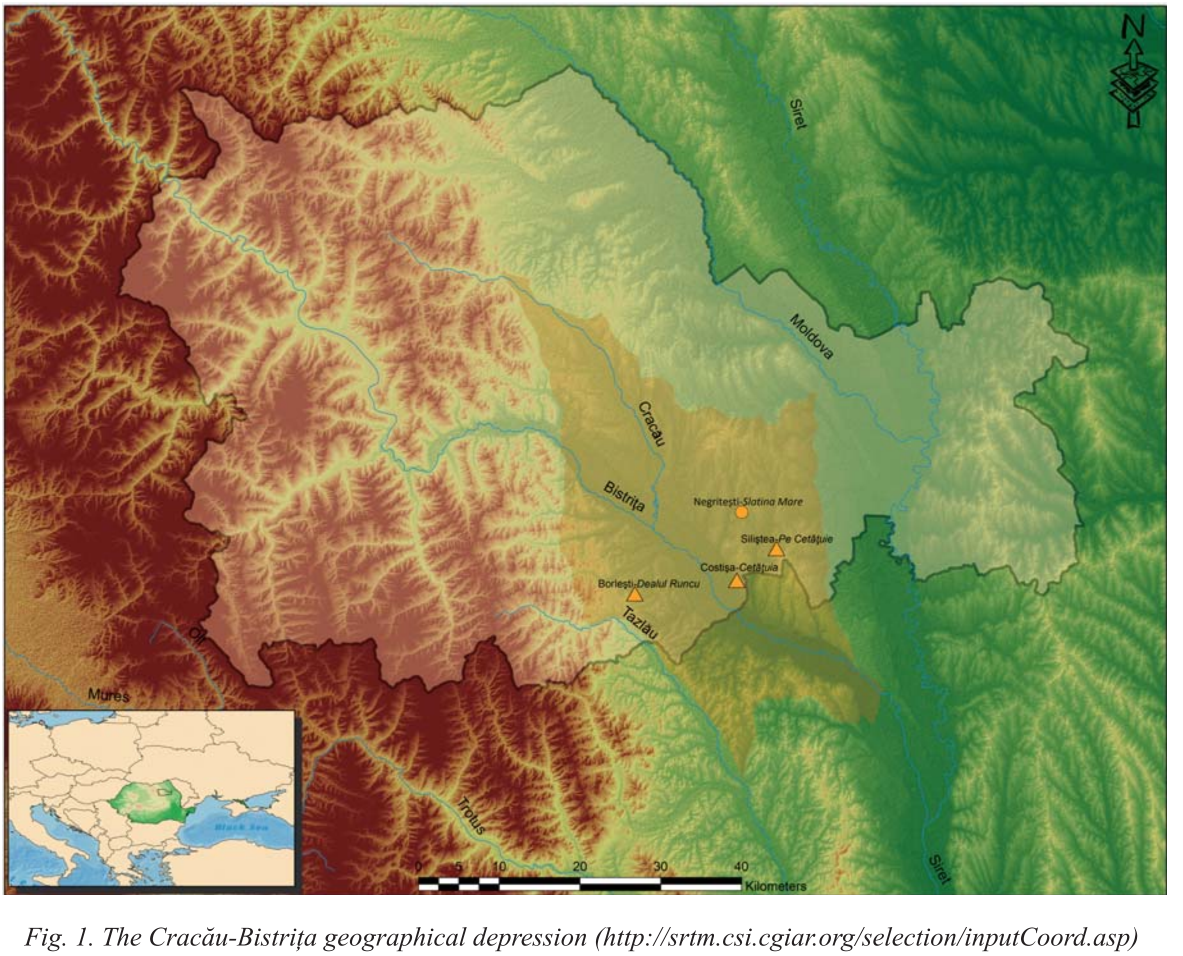

Fig. 1. The Cracău-Bistrița geographical depression (http://srtm.csi.cgiar.org/selection/inputCoord.asp)

Local and regional periodization and chronologies

The first tripartite sequencing of the Bronze Age in Romania was developed in 1960, when the existence of the Costişa-Bilîi Potik cultural complex or the Costişa culture was first mentioned, and was placed in the early stage of the MBA in the northern part of Moldavia (Nestor 1960, 98, 102–103, Pl. IX). At that time, the period in question was dated between the 18th and 14th centuries BC.

Further research into the site of Costişa allowed the definition of specific artefacts and the cultural background that contributed to the emergence of this ceramic group. Thus, some "survivals" from the Corded Ware cultural background have been discovered and some functional analogies in the Komarovo and Bialîi-Potik ceramic groups have also been established (Vulpe 1961, 113–121).

One can notice for the next two decades, that there have been scarce local contributions to the knowledge of the MBA period in the northern half of Moldavia and especially the Cracău-Bistriţa depression. For this period we have to mention the archaeological research conducted by Marilena Florescu at Borleşti (Neamţ County) in the western side of the depression. Although there was little reliable information concerning the area of study, she was able to correctly identify at that time new data concerning the beginning and the chronological and cultural definition of this period and of the cultural identity as well as its relationships with other contemporary phenomena. M. Florescu's opinion is based on stratigraphic analysis, pottery analysis from different contemporary sites and research results from the surrounding areas, like those from western Ukraine and southern Poland. The researcher noted that the Costişa archaeological culture is located between two large and well-defined cultural phenomena: Monteoru in the south and Trzcienec in the northeast. Thus, according to the data from Borleşti, she managed to establish two phases in the evolution of the Costişa culture. The first phase is represented by the settlement of Borleşti and other similar discoveries, like those from Kostianetz, Zatoka. The second phase is represented by the discoveries in the settlement of Costişa and similar finds, for instance those at Komarow-Zazawa and Bialy-Potock. These stages belonged to the Middle Bronze Age and they were placed in the 17th–14th centuries BC (Florescu 1970, 70–81).

In the same context, the contributions of Marija Gimbutas are also worth mentioning, which benefited from direct access to the sources of documentation and managed to achieve, by corroborating the data, a supraregional picture of the Bronze Age in Central and eastern Europe. She discussed the Costişa culture in relation with the Monteoru culture from southern Moldavia and contemporary Bilopotok (Bilyi Potok in Ukrainian and Bialy Potok in Polish) from the Upper Dniester basin in the northern Carpathian area. Based on some artefactual analogies, Costişa was divided into two phases. The older one, Costişa I is related to Bilopotok and Costişa II, which is related to a northward Monteoru expansion (Gimbutas 1965, 221–224). M. Gimbutas dated this "Early Bronze Age Complex" to *ca*. 1800–1450/1400 BC (Gimbutas 1965, 456–459, Table IV, Figs 299–300). This image, formed in the mid-1960s, has remained valid until the resumption of research at Costişa and the onset of research at Siliştea (Bolohan 2004).

Now there is a good effort for setting an up-to-date chronological system for eastern Romania. The area of study is in a very tangled situation and far away from certainty. Thus, when working with metallic finds, the Central European chronological system is the reference; while when looking for defining *material cultures* to which the researched area is more or less related, the Aegean chronology is the pillar.

Unfortunately, it is still very hard to identify and date the beginning of the Bronze Age for the research area. The EBA is represented by a series of dissimilar discoveries as the Corded Ware, Ochre Graves, Yamnaya, Katakombnaya, Usatovo-Horodistea-Folteşti I, Folteşti II, Răcăciuni, Dolheşti, Tîrpeşti, the beginnings of Monteoru and Costişa cultures and so on (Burtănescu 2002). Lately, there is a proposal to concentrate and organize these discoveries according to *material cultural* features, the relations between the discoveries and the ^{14}C data. In this respect, the EBA at the periphery of the eastern

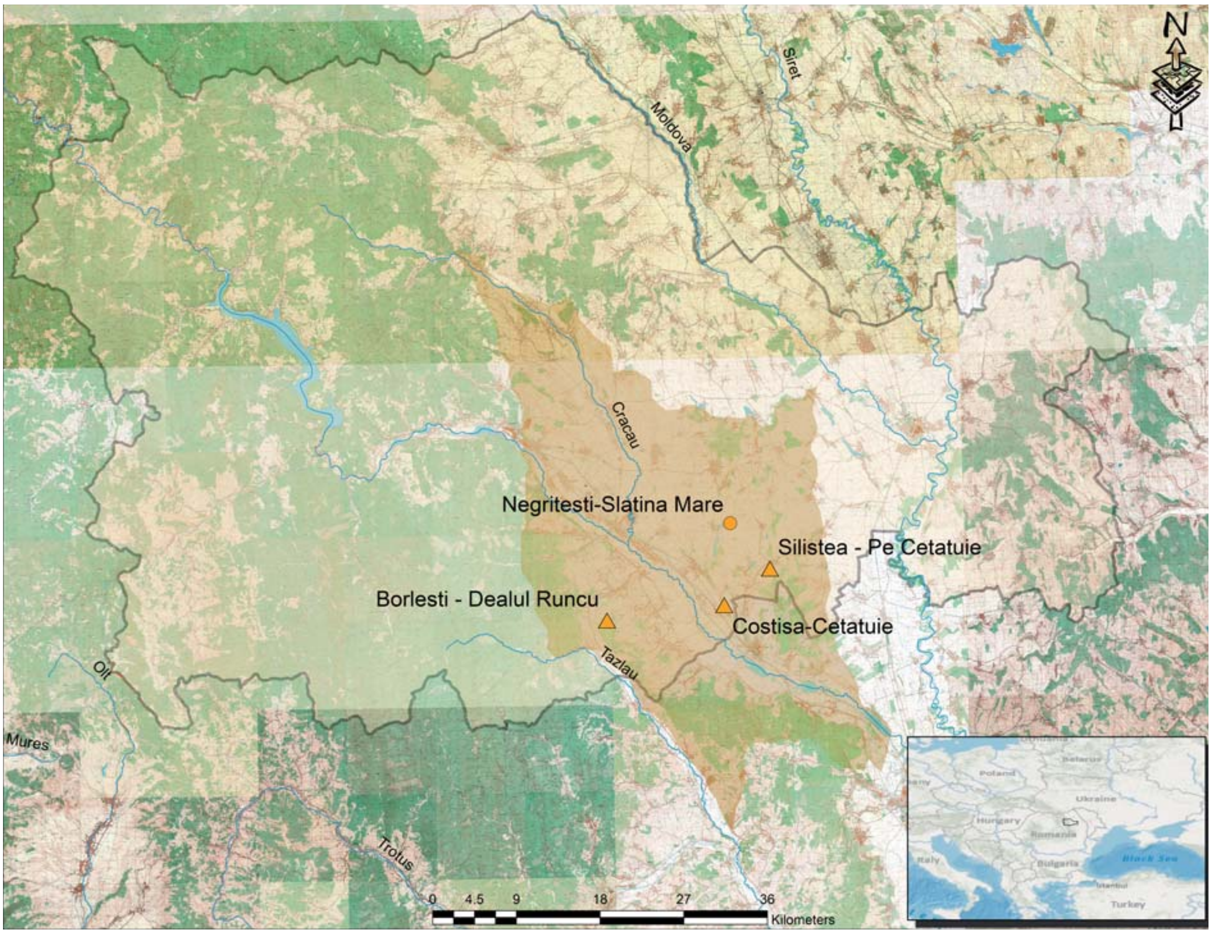

Fig. 2. Northwestern corner of Central Moldavia – EBA and MBA sites at Borleşti, Costişa, Negriteşti and Siliştea (Directia Topografica Militara)

Carpathian Basin is divided into two major phases: EBA I (2900/2800–2600/2500 BC) and EBA II (2600/2500–2100/2000 ± 100 BC) (Burtănescu 2002, 305–309). At least the beginning of the EBA I is estimated for a far earlier period than that considered for the southwestern Carpathian Basin, where the middle of the 3rd millennium BC is a very convenient data (Gogâltan 1999, 72–74, Fig. 1/fourth table). As for the final stage of the EBA and the dawn of the MBA in the area, recent ^{14}C data from Costișa and Siliștea (Neamț County) in western Moldavia give room for new dialogues.[2]

Early and Middle Bronze Age in western Moldavia

When Central European societies went into a slight decline at the end of the Early Bronze Age, the eastern Carpathian Basin became a centre for mining, high quality bronze working, salt exploitation and an area of the redistribution and consumption of goods. Systematically, during the MBA, bronze producing societies emerged, which supplied large areas with their products through long distance exchange and networks of buffer territories (Sherratt 1993; Kristiansen 2000; Uhnér 2010). These

[2] This is the time and opportunity to warmly express my thanks and gratitude to Dr. Vlad Vintilă Zirra, Dr. Radu Băjenaru and Dr. Anca Diana Popescu (Institute of Archaeology "Vasile Pârvan", Bucharest). They helped in collecting my samples and kindly supported the radiocarbon analyses.

societies, at the eastern fringe of the Carpathian Basin and in the Sub-Carpathians, were organized around chiefly, fortified hilltop settlements. Currently, we presume the existence of a hinterland peopled by smaller villages surrounding these strongholds. They are very specific for the Monteoru and Costișa communities, although we have scarce information about them. The history of these communities starts at the end of the EBA and continues until the beginning of the LBA in eastern Romania.

In 1961 and 1962, Alexandru Vulpe described the features, emergence, inner evolution and cultural destiny of the EBA/MBA in eastern Romania, when he firstly talked about the *Costişa culture* (VULPE 1961; VULPE – ZĂMOȘTEANU 1962). From then onwards, there have been some attempts of explaining the place of Costișa discoveries within the eastern European Bronze Age. It was asserted from the beginning, according to the pottery analogies, that the new *culture* was part of a bigger *complex*, named Bialy-Potik-Komariw, which stretches from northern Bessarabia, western Ukraine and the southern Poland. The Romanian alternative of this *cultural complex* is known from that moment under the name of *Costişa culture* which, through its southern extensions, entered into contact with the earlier phases of the Monteoru culture (for a bibliography concerning the topic see MUNTEANU 2010).

For a couple of decades, the horizontal stratigraphy at Costişa and Borleşti and the artefacts unearthed at a few other sites from northern and Central Moldavia represented the only reliable data for the periodization and chronology of this type of material; so far, the Costişa level was overlapped by a Monteoru Ic2–Ib level, according to the specialists. Thus, the ancientness of the *Costişa culture* in relation to the *Monteoru culture* in the northern part of the Central Moldavia was admitted, just like the idea of mutual cultural contacts between Costişa-Monteoru along a southnorth axis and Costişa and Wietenberg across the eastern Carpathians. In other words, Costişa type finds filled the MBA (Classical Bronze Age cultures) sequence in the northern part of Moldavia until the beginning of the Late Bronze Age, according to most archaeologists.

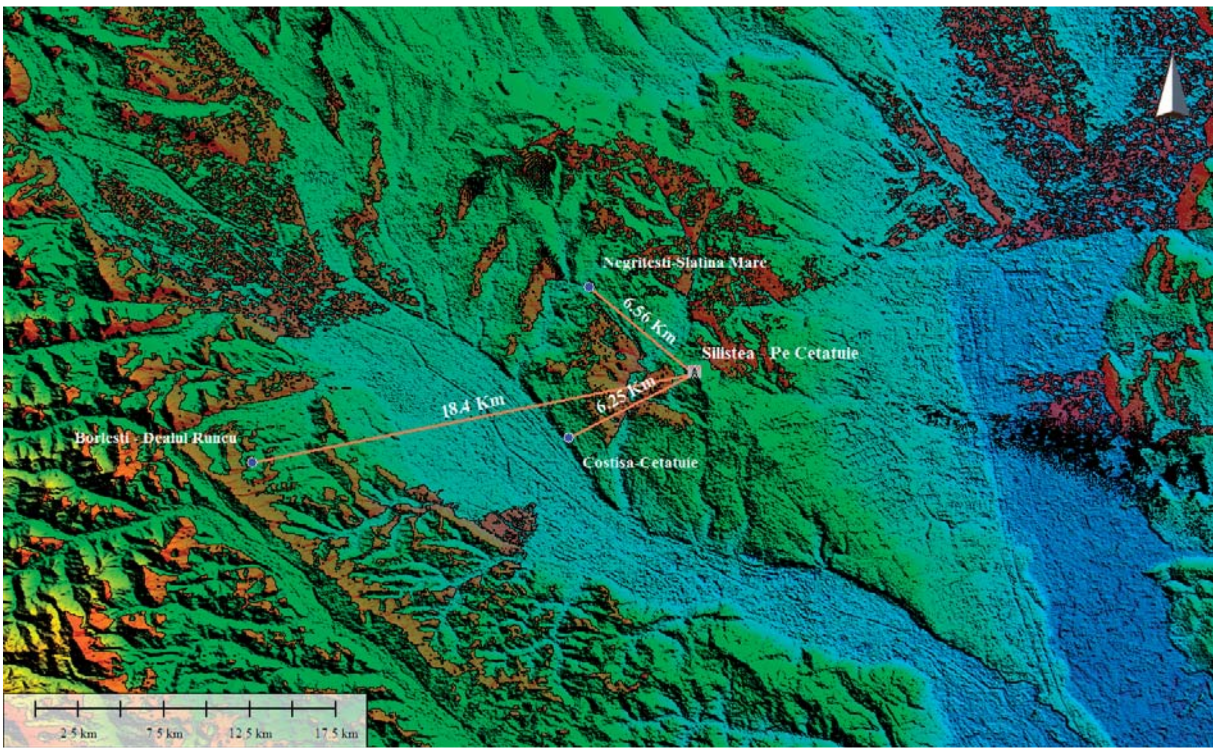

Fig. 3. Distances between Siliştea and Borleşti, Costişa, Negriteşti. Viewshed map (http://srtm.csi.cgiar.org/selection/inputCoord.asp)

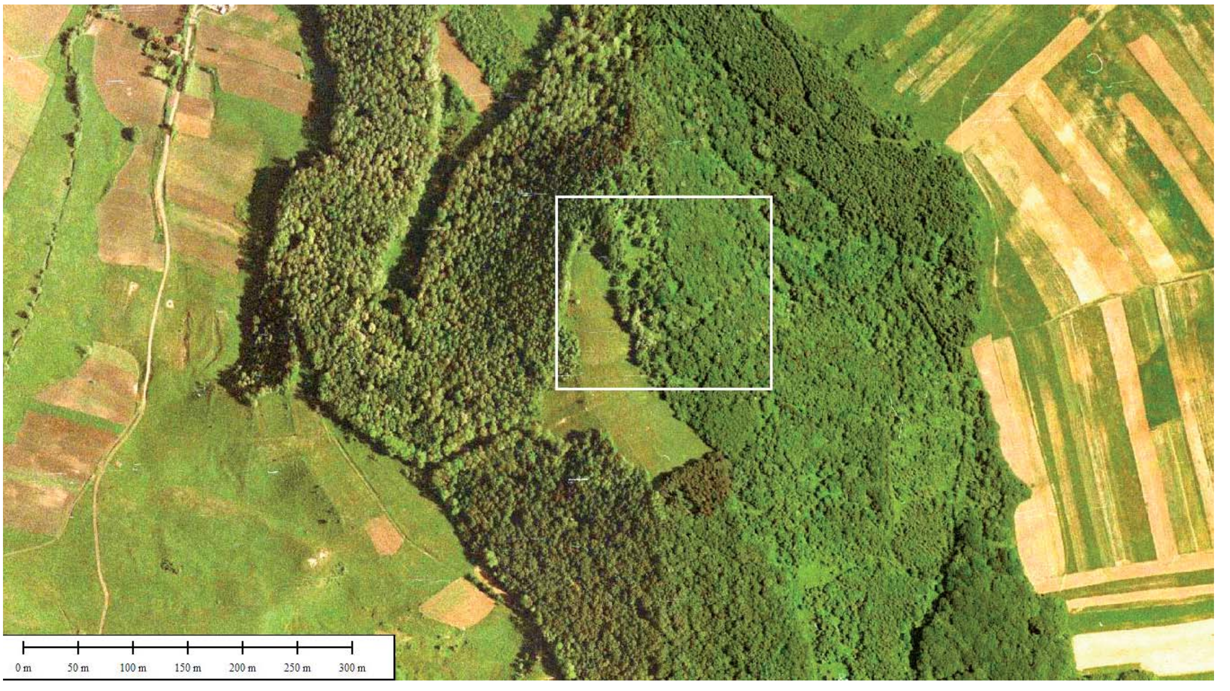

Fig. 4. The situation of the site Silişţea-Pe Cetăţuie (www.ancpi.ro)

Until recently, few information has been added in the attempt of understanding the evolution, destiny and multidimensional type of relations developed at the passage between the EBA and MBA and to the question, which elements of Central and eastern Europe (Costişa-Bialy Potik-Komariw, Monteoru, Wietenberg etc.) took part in the process.

But lately, due to research in eastern and southeastern Transylvania (e.g., at Păuleni-Ciomortan, Harghita County) and in the northwestern corner of Central Moldavia (for instance at Lunca, Costişa, Siliştea – Neamț County; Poduri – Bacău County and Adâncata – Suceava County; *Fig. 2*) new data have come to light on the EBA and MBA in this part of Europe.

Case study: Siliştea, Neamţ County

The site is situated in Central Moldavia (eastern Romania), at the southern extremity of the Cracău-Bistriţa geographic depression and in the hillocks area between the Bistriţa and Siret rivers (at approximate 12 km east from the first and approximate 10 km west from the second). The eponymous settlement is located 6.25 km to the west-southwest while the Borleşti site 18.4 km to the east *(Fig. 3)*. This fortified hilltop settlement is located on the "border" between the Monteoru and Costişa communities, in the proximity of some important routes of access from southern to northern Moldavia and to Transylvania.

Although up to the moment only a small area from the entire fortified settlement has been investigated, some observations can be made regarding the topography and internal structure of the settlement and the archaeological material.

The inhabited area occupies the northern end of a triangular plateau *(Fig. 4)*. The connection with the rest of the plateau was blocked by a moat with a depth of up to –3.2 m. The western and eastern sides are represented by steep slopes that did not require fortification. Landslides and anthropogenic interference affected the northern edge. Thus, the inhabited area and the fortified settlement were greater than what is now visible.

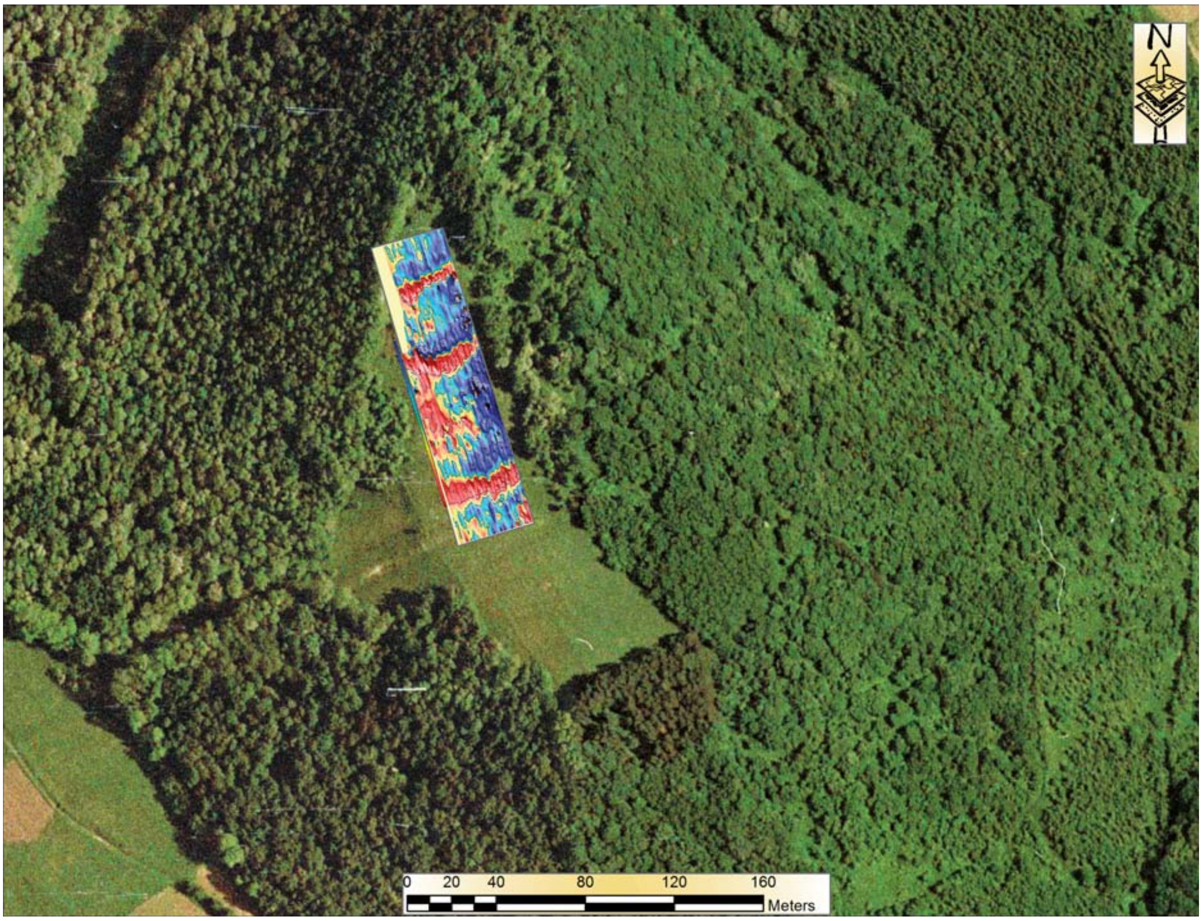

Fig. 5. Geomagnetic prospection at Siliştea-Pe Cetăţuie

Recent archaeomagnetic research[3] confirms the archaeological data obtained in the field. Non-invasive methods were used to search the inhabited area for inner structures and other remains. Geomagnetic prospection was used to identify traces of human activity below the surface. In the present study, the interdisciplinary approach, by resorting to non-invasive technology, aims to correlate several prospection techniques (magnetometric mapping and GPR technology) to allow for the development of accurate interpretations based on the existing hypotheses based on previous systematic archaeological excavations.

The measurements were performed using a Geometrics G858 Caesium vapour magnetometer. During the data collecting sessions the instrument was installed on a dedicated mobile platform supplied by the producer, in horizontal gradiometer position, with two sensors at a distance of 1 m from each-other and 0.3 m above ground. To accelerate the acquisition process, the data strings were bi-directionally correlated using the *mapped survey* function, with a distance of 1 m between profiles and approximately 11 readings per metre, in straight line, thus making possible to cover the 36-metre-wide and 140-metre-long surface area. This approach is particularly useful, since it offers the possibility to visualise, verify, and edit the information concurrently with the actual data registering process; therefore, any potential

[3] Investigations undertook by Andrei Asăndulesei from the Arheoinvest Research Platform, "Alexandru Ioan Cuza" University of Iaşi, Romania. This work was partially supported by the by the European Social Fund in Romania, under the responsibility of the Managing Authority for the Sectoral Operational Programme for Human Resources Development 2007–2013 (grant POSDRU/88/1.5/S/47646).

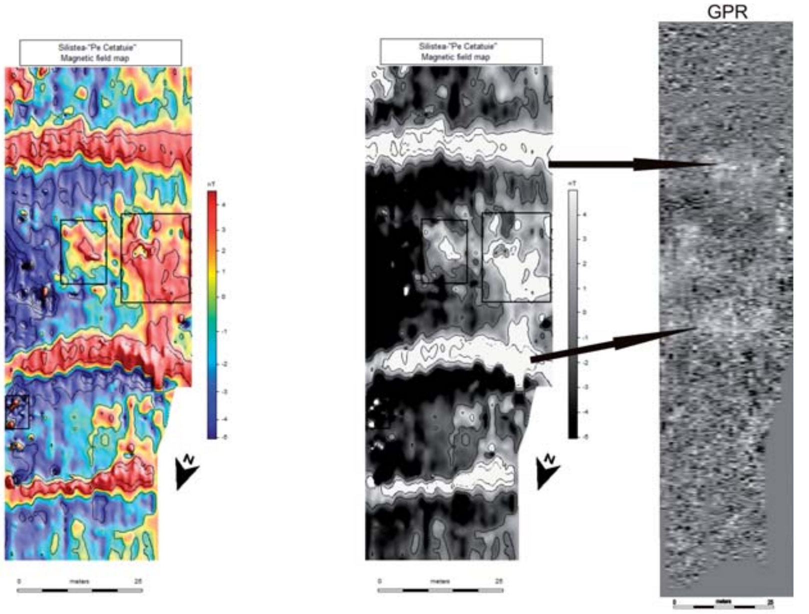

Fig. 6. Geomagnetic and GPR prospections at Siliştea-Pe Cetăţuie

positioning issues can be quickly addressed and managed. An apparently insignificant, yet particularly important stage of the research is the removal from the investigated area of any objects that can generate magnetic perturbations (e.g., scattered magnetic fragments); this is performed prior to the commencement of the actual operations.

The data-processing stage did not rely heavily on excessive filtering of the information, since, as it is well known, this inherently renders a distorted view of the underground evidence. Accordingly, the first stage consisted of the analysis of the raw-data and the mitigation of the issues caused by the presence of metallic fragments using the *despike* function and their levelling using the *destripe* function; this was followed by the georeferencing of the dataset in the national geodetic system. The use of specific software programs (MagMap and MagPick), as well as their processing in a GIS software program (ArcGIS), made possible the visual rendering of the data and the export of high-quality images.

The system used in our case-study was a Malå Geoscience Ramac X3M GPR, with a 250 MHz antenna; the surface covered was 35 metres in width and 150 metres in length. The distance between the lines was set to 1 m, producing 35 GPR profiles, and the data acquisition was unidirectional. The length of the profiles varied because of the topography and vegetation present on the plateau on which the settlement is found. The processing was performed using the RadExplorer and Easy 3D software suites.

The seamless integration of the two methods of non-destructive investigation and their analysis in a GIS environment constituted the main focus of this research endeavour. The results obtained from these two non-invasive methods were reciprocally checked, correlated, and interpreted; concurrently, constant reference was made to the information provided by the archaeological digging.

One noteworthy result concerns the fortification works of the settlement. On account of the extremely powerful magnetic signal detected in the investigated area, we could identify two defensive ditches situated at the northern end of the settlement, in addition to the one already confirmed by archaeological excavation. The two newly discovered ditches are parallel to and of similar shape as the latter *(Fig. 6)*. They may be the indicators for two other trenches whose utility will be verified through archaeological excavation *(Fig. 5)*. The agglomerations of material with strong magnetic signal, probably subjected to fires, from within the fortifications could be identified as archaeological features *(Fig. 6)*. They are predominantly found around the Central part of the scanned area, and are of considerable sizes (sometimes up to 10×10 m or larger). The magnetic anomalies and zones of rectangular shape elements occurring in the investigated area prove the existence of dwellings. Some magnetic perturbations could even indicate the presence of ancient metallic objects in the soil *(Fig. 6)*.

The joint use of the two methods proved to be adequate and effective, contributing to the precise interpretation of the data, with increased accuracy compared to the scenario in which only one of the methods was used. A definitive correspondence was found between the anomalies detected by the

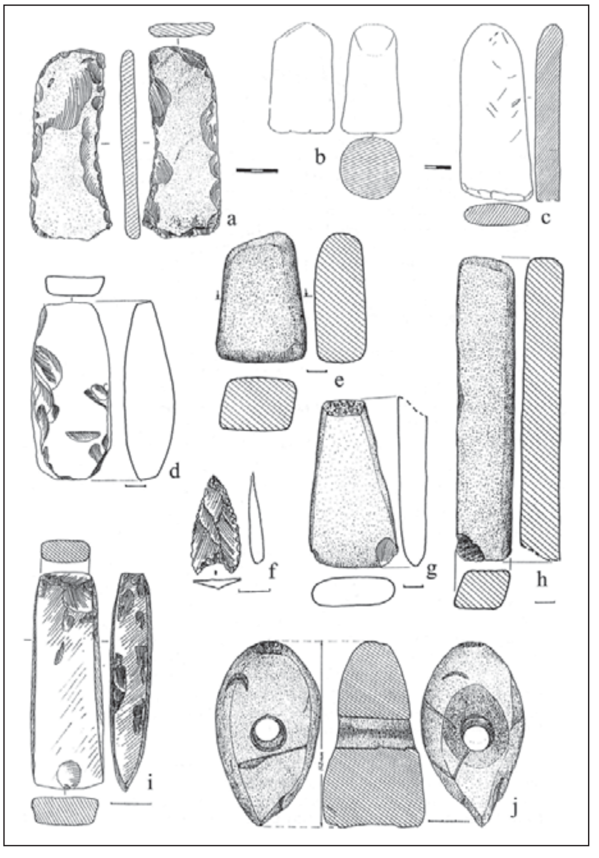

Fig. 7. Siliştea-Pe Cetăţuie – a–j: stone tools (after BOLOHAN – CREŢU 2004, Pl. 12)

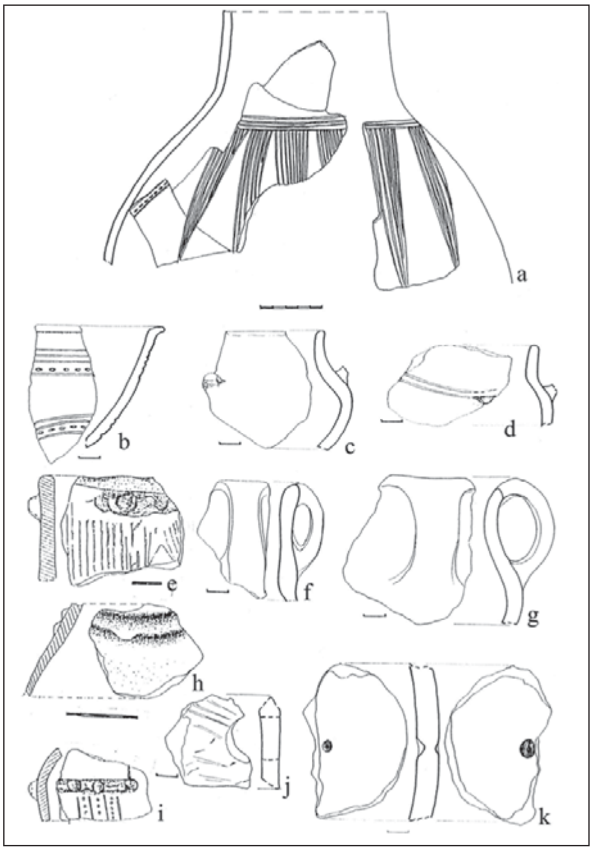

Fig. 8. Siliştea-Pe Cetăţuie – a–k: vessel fragments (after BOLOHAN – CREŢU 2004, Pl. 10)

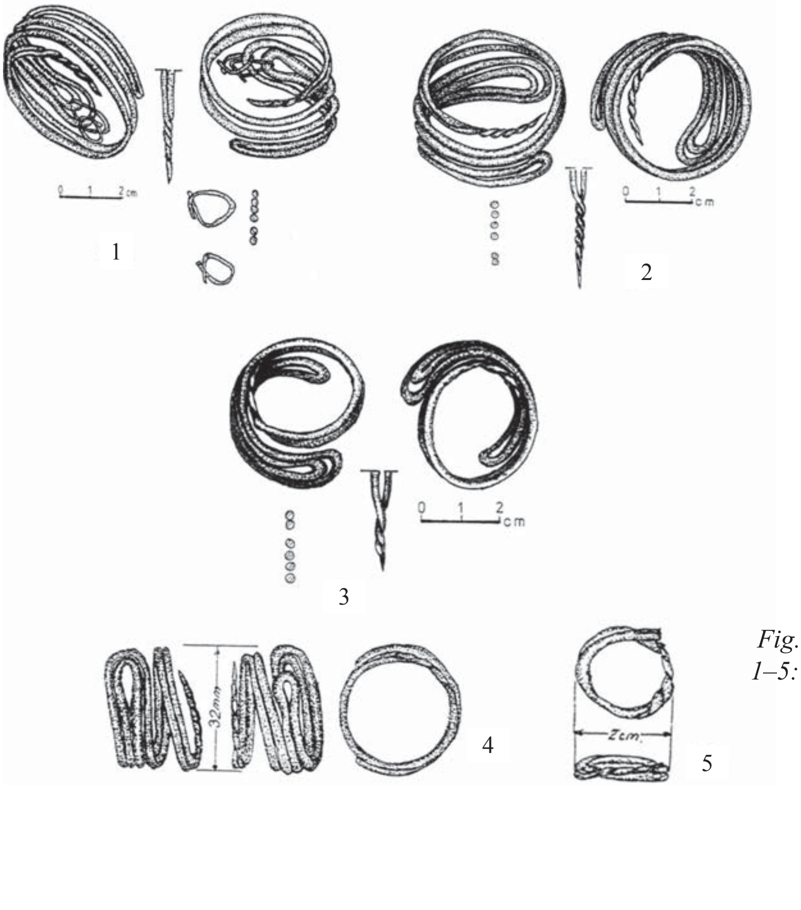

*Fig. 9. Siliştea-Pe Cetăţuie – 1–5: lock rings (*Noppenring*s)*

magnetometer and those identified by the GPR, to the degree that specific details could be extracted: position, shape, depth, etc.

With some exceptions, the artefacts (tools, pottery) unearthed at Siliştea *(Figs 7–8)* belong to the MBA horizon in Moldavia. There are some exceptions represented by two types of artefacts: a special kind of metallic adornment and a specific type of pottery. The presence of these artefacts raises some questions concerning the chronological framework, the cultural relations with contemporary and neighbouring and distant areas.

Among some metal finds five lock rings *(Noppenringe/aus Doppeldraht gedrehte Haaringe/ spiralförmige Haarsmuckstücke)* of Central European type have to be mentioned *(Fig. 9)*. These adornments are similar to those of the Aunjetitz area in Central Europe, found especially in graves or small metal deposits. Lately, three other such *Noppenringe* have been reported from Central Moldavia (Costișa, Piatra Șoimului and Răcăciuni). Four other *Noppenringe* made of gold wire come from Beba Veche, in the Banat (southwestern Romania), where they are dated to the end of the EBA, around 2200 BC (Gogâltan 1999, 187–188, Pl. 40. 6–10). Three other gold *Noppenringe* were reported from an EBA site at the Izbucu Topliţei Cave (Bihor County) together with pottery types dated to the regional EBA IIb–III (Molnár – Călin 2003, 22, 36, Pls 1–2). Noteworthy is the presence of golden *Noppenringe* in western Transylvania close to the Central European EBA and MBA cultural regions.

The *Noppenring* is a typical copper or bronze wire adornment spread in Central Europe and east-Central Europe starting in the final stage of the EBA and the MBA in the following phases: Nitra, Mierzanowice, Aunjetitz and Mad'arovce groups. Even the artefacts from Siliştea were scattered across the unearthed area and there are no superposed archaeological layers for separating a local chronology. One can notice the similitude with items from Central Europe. As analogy, see the hair rings with a single or double spiral from the cemetery of Niederrussbach, Lower Austria, Early Aunjetitz (Gimbutas 1965, 253, Pl. 162B), from a grave at Straubing-Alburger Hochweg (Gimbutas 1965, 253, Pl. 163. 32–46), Neudorf bei Staatz, north of Vienna, Franzhausen I, the finds from the cemetery of Únětice/Aunjetitz itself (Gimbutas 1965, 268, Pl. 176. 6–8); finds in Bohemia from Kostelec, okr. Jičin; Milošice, okr. Louny; Slany-Slanská horá, okr. Kladno; Očihov, okr. Louny; Vrany, Čertovka, okr. Kladno; the pieces from a tomb at Uherský Brod-U Bajovského mlýna, in southeastern Moravia (Podborský 2004, Abb. 3. 7–14); those from the Early Aunjetitz necropolis at Abrahám in western Slovakia, the seven *Noppenringe* from the royal tomb at Trsteniče (Znojmo district), the fragmentary pieces found in Grave 268 at Jelsovče (Nitra district), those from Grave 61 at Mýtna Nová Ves (Topol'čany district), in Grave 82 at Branč (Nitra district), two exemplars in Matúškovo, southern Slovakia (Gimbutas 1965, 271, Pl. 178. 8–9).

In Central Europe, most of these kinds of items (*Noppenringe*) belong to the funerary inventory or to small metal deposits and represent a very common fashion of the period; some are part of the princely grave inventory and mark together with other items the status of the individual within the community.

Despite the presence of the metal artefacts, there is no source of copper, tin or traces of metallurgical activity in the area. Instead, there are many other natural sources among which liquid or crystallized salt sources have been in use from ancient times until the present. Numerous traces of liquid salt exploitation (special pots, charcoal, ash, wood artefacts) indicate seasonal and recurrent work from prehistory up to our days (Alexianu *et al.* 2011, 9–20). According to archaeological and ethnographical data, these liquid salt sources might indicate a long chain of exchanges along the eastern Carpathians towards north to a contact zone, in this case Transcarpathia. The presence of these *Noppenringe* in western Moldavia in the area of the Costişa culture (only one belong to Monteoru, but in the close proximity of Costişa) might indicate the existence of some contacts between the Middle Danube area and the eastern Carpathians, at the transition between EBA/MBA. These data can be assigned to an earlier phase of the Costişa culture and the existence of a system in which local hierarchies were negotiated through artefacts.

The second type of finds are the so-called *Besenstrich* (brushed, scored) pottery, which represents, in the area of study, approximately 15% of the whole material *(Fig. 10)*. This kind of pottery has no relation with the local pottery and testifies, looking across the eastern Carpathians, to strong relations with the same kind of pottery in the EBA and MBA in Transylvania and the Middle Danube area. Recently, Cristian Ioan Popa surveyed thoroughly the cultural background and cultural interferences of the final EBA and MBA in Transylvania. The analysis of pottery with the *Besenstrich* decoration allowed the identification of a Central European and even north Carpathian origin for it (Popa 2005, 65–69). This decoration occurred in the final EBA level in southeastern Transylvania at Zoltan (Covasna County) on approximately 36% of the pottery. The excavator suggested a Central European origin for this decoration (Cavruc 2001, 55, 71). Since, based on the artefacts, Zoltan is contemporary with Ciomortan and Costișa (Popa 2005, 129), to some extent there is a pottery "connection" among these groups.

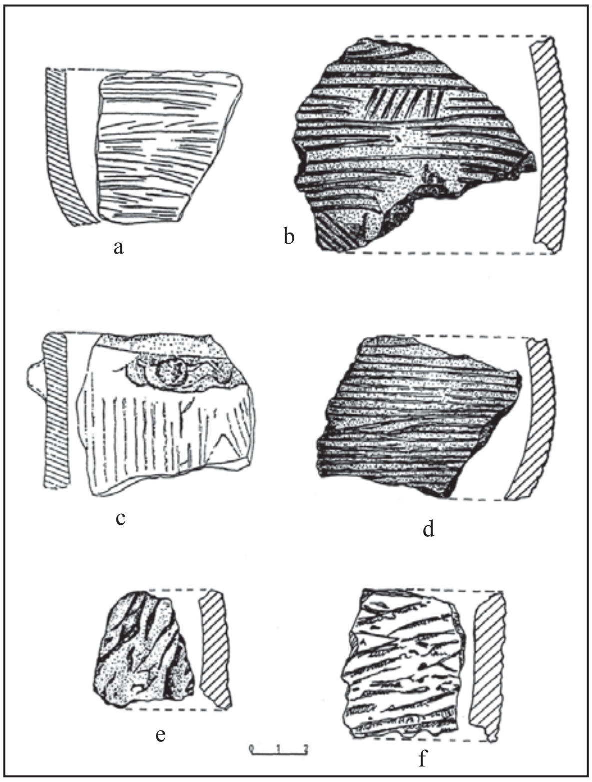

Fig. 10. Siliştea-Pe Cetăţuie – a–f: vessel fragments of Besenstrich *type*

On this account, I presume a bilateral type of exchange between western Moldavia, and eastern and Central Transylvania through the mountain passes (see, for example, the early Wietenberg pottery type in western Moldavia or Costişa type pottery in southeastern and eastern Transylvania) and northwards along the eastern Sub-Carpathians.

Radiocarbon dating

Based on recent radiocarbon analyses, we could reach at least some conclusions concerning local absolute chronology. For the first time 15 calibrated data (from closed contexts) were obtained from two fortified settlements situated in the northwestern part of Central Moldavia. These data fit very well with some hypotheses concerning the transition from the EBA to the MBA and the MBA in the area. Up till now there were no absolute dates for the transitional period from the EBA to the MBA and the beginning of the MBA in eastern Romania.

Radiocarbon dates from Siliștea were obtained through the analysis of four animal osteological remains found in secure archaeological context, which were dated through the typology of the artefacts and their stratigraphy. Of these, we have received only three set of dates until now.

The radiocarbon dates from Siliștea correspond to a time span represented by 3546 ± 26 BP (1937–1785 and 1955–1773 cal BC) and 3371 ± 22 BP (1689–1631 and 1739–1614 cal BC), which are comparable to the dates of contemporary forms in Central Europe *(Fig. 11)*.

As for the calibrated radiocarbon dates we have to take into account the following probabilities. These dates stretch from 1937–1785 cal BC (1σ) and 1955–1773 cal BC (2σ) to 1689–1631 cal BC (1σ) and 1739–1614 cal BC (2σ). In accordance with these data, the settlement seems to have been occupied from the mid-20th century to the mid-18th century BC (Bolohan 2010, 237–240). Therefore, the dates

Lab. Code	Sample name	BP	δ^{13}C ‰	cal BC, 1σ	cal BC, 2σ
Hd-29247	Silistea, 54 sect.B/’03	3546 ± 26	–21.6	1937–1785	1955–1773
Hd-29027	Silistea, 57 sect.a/’04	3455 ± 30	–21.9	1873–1695	1879–1691
Hd-29377	Silistea, 56 sect.B/’04	3371 ± 22	–21.6	1689–1631	1739–1614

Table 1. Radiocarbon dates from Siliştea-Pe Cetăţuie (after B*OLOHAN 2010, Table 1)*

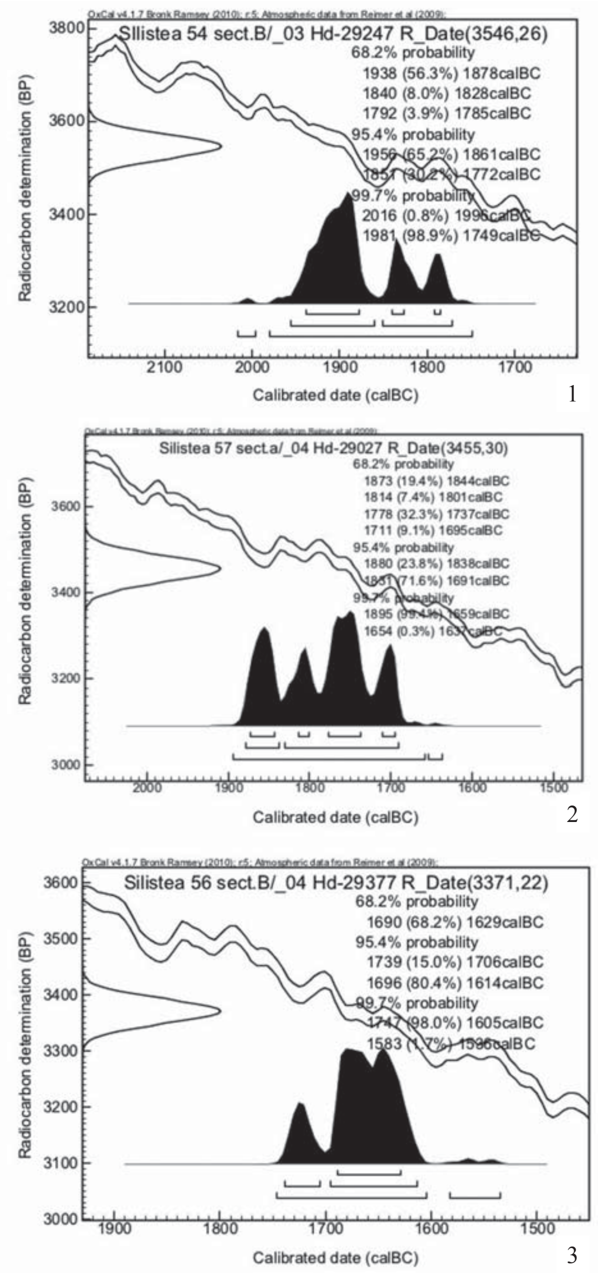

Fig. 11. Siliştea-Pe Cetăţuie – 1–3: radiocarbon dates from the site (after B*OLOHAN 2010, 239–240)*

show that the discoveries at Siliștea correspond to the period of the beginning of the Middle Bronze Age in the area *(Table 1)*. With no exceptions, the same dates, although unpublished, are available for Costișa as well.[4]

Therefore, the archaeological chronology is confirmed by radiocarbon data. In this respect, at the “Far Eastern” boundary of the eastern Carpathians, these data testify the chronological and cultural parallel with phenomena in the Carpathian Basin (Hatvan, Otomani-Füzesabony or Koszider horizon). A good example for this are the value of the samples from the layers IV–III from Včelince in the southern part of Central Slovakia which range from 3518 ± 37 BP (1890–1750 cal BC) to 3328 ± 30 BP (1690–1650, 1640–1580, 1570–1520 cal BC) (GÖRSDORF – MARKOVÁ – FURMÁNEK 2004, 88–90, Table 1–2, Fig. 8). Even a cluster of ^{14}C data (Bln 771: 1620–1680 BC; M 2169: 1680–1740 BC; GrN 7522: 1609–1720/1730–1740 BC; M 2327: 1740–1750 BC and Gd 5571: 1890–1900 BC) from Iwanowice, Babia Gora, dating from the final phase of the Mierzanowice culture, fits very well with the ^{14}C data from Siliștea (KADROW 1991, Table 1). To this chronological framework, we may add the data from the eastern neighbouring area. According to other radiocarbon data, Costișa might be contemporary with the final phase of the Mnogovalikovaya group, developed between 2300–1800 BC (MOTZOI-CHICIDEANU 2003).

The emergence of Costișa communities and their expansion along the eastern Carpathians towards Central Moldavia is still a controversial

[4] Kind personal communication with dr. Anca Popescu from the Institute of Archaeology “Vasile Pârvan” in Bucharest.

issue. To understand these permanent shifts should be considered the possible influence of the Danube Carpathian centre in individualizing the specific transition from EBA to MBA within the neighbouring Trzciniec centre. In this respect one can say about a Carpathian Danubian print in the field of metallurgy (Kośko – Klochko 1998, 197–201). Certainly, these communities belong to a huge "Epicorded Ware Carpathian Cultural Circle" characterizing Central and eastern Europe in EBA.

Conclusion

These preliminary data allowed us to put forward some assumptions or conclusions, which concern the evolution of the Costişa community in the context of the transition from the EBA to the MBA and in the MBA within the eastern Carpathian area. Therefore, we can admit the existence of some connections between Monteoru Ic4 and the beginning of the Costişa communities, while contacts intensified during the Monteoru Ic3–Ic2 phases. Certainly, in the area unearthed up to now, there is no evidence of a stratigraphic superposition of Costişa and Monteoru communities. They lived together a while until they interblended.

There is enough evidence that place the beginning of the Costişa culture at the very end of the 3rd millennium BC. The idea of a Central European contribution in defining the Costişa features became an established truth. If we look back in time, a similar phenomenon occurred in the case of the Globular Amphora culture that penetrated through Volhynia and western Podolia into the northern half of Moldavia. Accepting this *scenario,* these communities in the northern half of Moldavia might represent an extremely southern extension of the Komariw-Bialyi Potik groups, blended in the area by some traits from the Carpathian Basin. Nevertheless, the newly created identity might represent in some extent the result of negotiating places, artefacts, strategies and multilateral relationships. Thus, *culture* can be used by individuals or by groups to communicate inside a pattern-group or with outsiders. Material culture represents the way they report to the internal cohesion and the way they interact with neighbouring areas or newcomers.

On the other hand, as shown by recent multivariate investigations in the Cracău-Bistriţa depression, we could ask questions about the purpose of such a place situated in a position that dominates visually, to the north, the whole Cracău-Bistriţa area. What is the significance of the site uncovered at Silistea? Was it just a hilltop fortification, as the actual toponym of the place seems to indicate (*Cetăţuie*, meaning "fortress" in Romanian), or did it have a multiple function as the headquarter of a local chiefdom. Although research at the site is still ongoing, we have all the needed data from this hilltop settlement to consider it a place of exercising control over a network of supraregional contacts.

Crystallized salt from salty springs seems to have played a key role (at Negritești, 6.56 km north of Siliștea there is an important salty water source for the eastern side of the Cracău-Bistriţa depression; *Fig. 3*). The dominating role is also supported by the control exerted on an important agricultural area favoured by the soil types in the southern extremity of the depression.

Another hypothesis advances the idea that the site at Siliştea could have been an *emporion* placed at the centre of a buffer territory. The latter hypothesis is supported by the lack of overlapping cultural layers, but the presence of the mixed pottery or foreign metal artefacts. Moreover, research has shown that Siliștea was the scene of elaborate rituals (ceremonial meat offerings, pottery depositions and foundation rituals).

By bringing together the archaeological data, we can conclude that during the final stage of the EBA and the beginning of the MBA the communities at the foothills of the eastern Carpathians could act together with other contemporary communities (Mnogovalikovaya culture, Monteoru culture) as mediators between areas of the Carpathian Basin and the neighbouring regions. In this scenario, salt may have played an important role too. The hilltop settlement of Siliştea seems to be given all the characteristics (location, altitude, orientation, visibility) to have a close spatial relationship to the salt springs in the Cracău-Bistriţa catchments. Thus both centres, Siliştea and Costişa, were multifunctional, situated in a buffer territory, which mediated contact between communities settling in the area and the different patterns of regional interactions.

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