Raiko Krauss and Harald Floss (Eds.)

SOUTHEAST EUROPE BEFORE NEOLITHISATION

Proceedings of the International Workshop within the Collaborative Research Centres SFB 1070 "RessourcenKulturen", Schloss Hohentübingen, 9th of May 2014

RessourcenKulturen Band 1

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River Danube at the Iron Gates the 'Small Cauldrons' at Dubova, seen from the Serbian shore (see the contribution by Ciocani, 168).

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Vorwort der Herausgeber

Mit der Buchreihe „RessourcenKulturen“ entsteht ein Publikationsmedium für die Ergebnisse der Forschungen des von der Deutschen Forschungsgemeinschaft geförderten Sonderforschungsbereiches 1070 RessourcenKulturen an der Eberhard Karls Universität Tübingen. Vorrangig wird dies Dissertationen, andere monographische Schriften und Tagungsbände umfassen. Zur Gewährleistung der Einhaltung allgemeiner Standards der Qualitätssicherung werden alle Bände einem internationalen Peer-Review-Verfahren unterzogen.

Mit ihren Bänden spiegelt die Reihe die Fachbreite und interdisziplinäre Kooperation des SFB wider, die aus Archäologien (Ur- und Frühgeschichte, Archäologie des Mittelalters, Vorderasiatische Archäologie, Biblische Archäologie, Klassische Archäologie und Naturwissenschaftliche Archäologie), Empirischer Kulturwissenschaft, Ethnologie, Geographie, Geschichtswissenschaften und Historischen Philologien (Klassische Philologie, Vorderasiatische Philologie) besteht.

Um eine möglichst weite Verbreitung der Ergebnisse des SFB zu gewährleisten, ist neben dem Druck der Werke bewusst auch die Publikationsform des OpenAccess gewählt worden. Die Bände sind über die Homepage des SFB (http://www.uni-tuebingen.de/forschung/forschungsschwerpunkte/sonderforschungsbereiche/sfb-1070.html) sowie über die Website der Tübinger Universitätsbibliothek (https://publikationen.uni-tuebingen.de/) einzusehen.

Es ist unser Anliegen, die Publikationsreihe zu einem wichtigen Werkzeug der Verbreitung der Forschungserkenntnisse des SFB zu machen und damit zu einer lebendigen wissenschaftlichen Diskussion beizutragen.

Die Sprecher des Sonderforschungsbereiches 1070
RessourcenKulturen
Martin Bartelheim
Roland Hardenberg
Jörn Staecker

Publishers' Foreword

This is the first volume in the series 'RESSOURCEN-KULTUREN', a medium for the publication of the results of SFB 1070 ResourceCultures, a collaborative research centre located at Tübingen University and funded by the German Research Foundation (DFG). Primarily the series will include dissertations, monographs and conference publications. In order to ensure compliance with common standards of quality control all volumes are subject to an international peer review procedure.

The series will reflect the wide range and the interdisciplinary cooperation of the research centre, including several archaeological disciplines (Prehistoric Archaeology, Medieval Archaeology, Near Eastern Archaeology, Biblical Archaeology, Classical Archaeology and Scientific Archaeology) as well as Social and Cultural Anthropology, Geography (Human Geography, Physical Geography and Pedology), philologies (Classic Studies, Ancient Near Eastern Studies), and historical sciences (Ancient History, Medieval History, Economic History).

To guarantee widespread distribution we chose to publish in OpenAccess as well as producing printed copies. All volumes will be available on the homepage of SFB 1070 (http://www.uni-tuebingen.de/forschung/forschungsschwerpunkte/son-derforschungsbereiche/sfb-1070.html) and on the homepage of the University Library (https://publikationen.uni-tuebingen.de/).

With this series of publications we aim to create a tool for the circulation of findings attained by the work of the collaborative research centre in order to stimulate a lively scientific discussion.

The spokespersons of SFB 1070 'RESOURCECULTURES'
Martin Bartelheim
Roland Hardenberg
Jörn Staecker

RAIKO KRAUSS AND HARALD FLOSS

Southeast Europe on the Eve of Neolithisation – a Great Upheaval in the Use of Resources?

The transition to a sedentary way of life is one of the most decisive turns in human history. The Mesolithic is perceived as the period of Post-Ice Age hunters and gatherers. Depending on different scientific approaches, either the economic change from food procurement to food production, or technological changes – like the appearance of pottery and polished stone tools – herald the advent of a new age, the Neolithic. These changes were considered to be revolutionary, first by Gabriel de Mortillet and later by Vere Gordon Childe (Mortillet 1897, 326; Childe 1928, 1f.). Today we are aware of the fact that the process of Neolithisation – the shift from hunting and gathering to farming and stockbreeding – in Europe lasted for several millennia and is still continuing today in several parts of the world. Even so, representing the starting point of a radically different interaction with the natural environment, the sum of changes may still be considered as revolutionary. They are associated with an equally radically different approach of human beings towards their natural environment. While humans always made use of it, until relatively recently in their history they were still dependent on its ever-changing conditions. With the start of the Neolithic we observe a growing tendency to shape the environment according to human ideas and requirements. The breeding of domestic animals and the cultivation of plants represent merely the first steps in a process of 'civilising', leading towards our modern way of life, with all its dramatic effects on nature. It is evident that a turn from a hunting-gathering economy towards an agricultural lifestyle in permanent settlements has to result in a radically different handling of resources. On closer inspection, archaeological evidence in Europe reveals some intriguing traces of continuity, reaching from Mesolithic well into Neolithic. This rather gives the impression of a successive replacement of the old 'Mesolithic' resource culture by a new one, than that of a radical break with the Mesolithic ways to use resources. The mental change seems more radical, because life in larger communities and permanent settlements calls for a very different social mindset from the one needed for roaming in small groups of variable composition. But if we continue to examine the process of Neolithisation from the perspective of early agriculturists only, we will never be able to really understand the changes in the ways to use resources. Here a shortcoming of previous research in our region of interest becomes visible: while the Neolithic of Southeast Europe is one of the most intensively studied periods of human history, the times immediately preceding are much less well-known in comparison.

The Tübingen based Collaborative Research Centre 1070 ResourceCultures is sponsored by the German Research Foundation (DFG). It investigates the socio-cultural dynamics in the use of resources, applying a global perspective with an extraordinary chronological depth. The projects A01 and B01 cover the most ancient phases studied within the Research Centre, thus providing the basis for the analysis of some essential turning points in the history of human culture, including the ways to use resources. In particular, the focus of research of project B01 is the change of resource use by late Neanderthals and the first anatomical modern humans arriving in Europe. The project conducts two case studies, one in Burgundy, France; the other in Southwest Germany's Swabian Jura, in order to explore the use of lithic raw materials for the production of chipped stone artefacts by these different variants of *homo.* Continuities and breaks in the use of the environment will thus become visible, allowing us to draw conclusions about the range of mobility of Palaeolithic hunters. Especially the role of major water networks like the Danube, Rhône and Rhine as routes for migrations will be scrutinised.

Project A01 conducts a comparative analysis of resource use in two different parts of Southeast Europe with fundamentally dissimilar ecological conditions. On one hand the focus is on the region of the southern Bulgarian Black Sea coast, rich in mineral raw materials. Here the abundance of gold, copper, mineral salt and high-quality flint, as well as the easy access to maritime resources via the Black Sea, is considered responsible for the early emergence of complex societies. The development of the very first metallurgy, structured settlements of long duration and complex rites of burial are evidence of this process.

On the other hand, the cultural development of the Banat is presented, a landscape without mineral resources and far away from the sea. The availability of fertile soil alone provided a basis for the emergence of early agricultural societies. The open, park-like landscape that may be assumed for the beginning of the Neolithic allowed for an easy development of the economic foundation of an agrarian society.

The settlements of Mesolithic and Epi-Palaeolithic in both regions were neglected by previous research. For the understanding of the emergence of Neolithic societies we must also understand how resources were handled in the previous period. Only if we have firm knowledge of how both regions were used by humans during the long periods before the appearance of permanent settlements, will we be able to acknowledge what is really new in the Neolithic. Intriguingly, in the few places where we have information about both, Mesolithic/Epi-Palaeolithic and earliest Neolithic, for example on the Peloponnese or in the region of the Iron Gates, continuities in the use of resources seem more pronounced than disruptions. It seems the Neolithic expanded the use of existing resources, instead of exchanging old resources for new ones.

We start our evaluation of the current state of research in Southeast Europe with a study by Harald Floss, Simon Fröhle and Stefan Wettengl of the corridor of the Danube, one of the most important routes of communication during the earlier periods of European prehistory. Different major geographical regions of South Europe, presented by some of the most respected specialists for early Holocene cultures, are in the focus of the next contributions to this anthology. Dima Kiosak and Paolo Biagi examine the steppe region north of the Black Sea, adjacent to the Balkans. Research about the transition from Epi-Palaeolithic to Neolithic in the eastern Balkans and north-western Anatolia is summarised by Ivan Gatsov and Petranka Nedelcheva. Janusz Kozłowski deals with regions further to the South, mainland Greece, the Aegean and southern Anatolia. The lands around the Adriatic Sea, including Dalmatia, Montenegro, the Apennine Peninsula and even parts of the Alps, are studied by Dušan Borić and Emanuela Cristiani. Three papers highlight the region of the Iron Gates, where the Lower Danube cuts through the barrier of the Balkan and Carpathian Mountains, since long a spot of special interest for researchers of European Mesolithic. Finally, Raiko Krauss provides a short synthesis of the available information on the Mesolithic of the Carpathian Basin and some ideas about the passing down of several aspects of the way of life from Mesolithic to Neolithic.

This volume represents a fruitful cross-linking of the projects A01 and B01 within the Collabora-

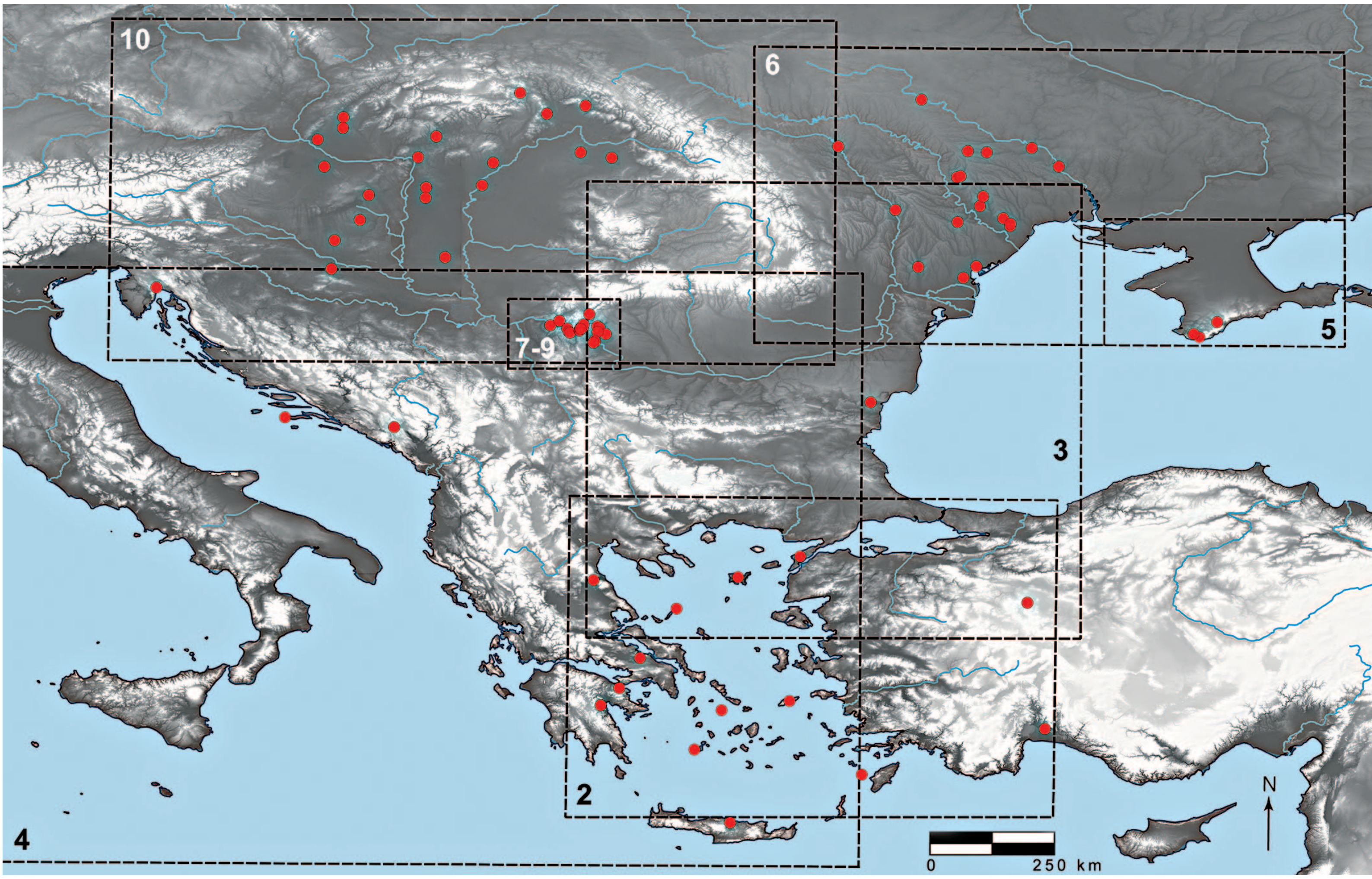

Fig. 1. Main Mesolithic sites in Southeast Europe and geographical foci of the contributions in this volume: 2 Kozłowski, 3 Gatsov/Nedelcheva, 4 Borić/Cristiani, 5 Biagi, 6 Kiosak, 7 Bonsall/Boroneanţ, 8 Ciocani, 9 Rusu, 10 Krauss (map by S. Fröhle and S. Wettengl).

tive Research Centre 1070 ResourceCultures and is one of the first publications resulting from its work, which seems even more appropriate because these projects are those dealing with the earliest periods. Southeast Europe is distinguished by its very good state of research on the Neolithic, while Mesolithic, in comparison to adjacent regions, was much neglected, with the notable exception of the Iron Gates. By attempting to approach the problems in our understanding of the transition from hunting and gathering to a food-producing economy from the Mesolithic perspective, we hope to help bridge this gap in our knowledge.

Acknowledgements

First, we like to express our thanks to the German Research Foundation for funding our work as a part of the Collaborative Research Centre. This volume presents results achieved in a workshop conducted in April 2014 at Schloss Hohentübingen. Our thanks go to all participants and helpers. Editorial assistance was provided by Marion Etzel and Uwe Müller.

Bibliography

Mortillet 1897: G. de Mortillet, Formation de la Nation Française (Paris 1997).
Childe 1928: V. G. Childe, New Light on the Most Ancient East (London 1928).

HARALD FLOSS, SIMON FRÖHLE AND STEFAN WETTENGL

The Aurignacian along the Danube
Its Two-Fold Role as a Transalpine and Cisalpine Passageway of *Early Homo Sapiens* into Europe

Keywords: Aurignacian, transalpine and cisalpine passageway, Human dispersal, Danubian Bottleneck

Acknowledgements

We thank Kurt Rademaker for the revision of the English manuscript. We also thank D. Borić and Z. Mester for providing additional information on the Pannonian Basin.

Introduction

In recent years, river systems as routes for migrations and human dispersal have been a focus of Palaeolithic research in Europe (Floss 2000; 2002; 2014; Terberger et al. 2013). These insights for instance could be manifested in the case of the Rhine-Rhône system (Hussain/Floss 2014). Regarding hypotheses concerning the dispersal of *Homo sapiens* into Europe, the Danube is of high importance. Aside from an assumed spread along the Mediterranean coastal regions, the Danube is regarded as a central focal point (Mellars 2006; 2011). Terms like the so called Danube-corridor hypothesis (Conard/Floss 2000, 478; Floss/Kieselbach 2004) emphasise this circumstance. However, evidence supporting these hypotheses remains quite fragmentary, both in terms of sites and of radiometric ages indicating a continuous diffusion of human populations from the Near East via the Balkans into Central Europe. The aim of our contribution as a kind of basic research is to assemble the entirety of Aurignacian sites situated along or near the Danube. Thereby we try to determine to what extent the Danube constituted a focal point for Early Upper Palaeolithic humans migrating into Europe. In general, we mapped not only Aurignacian sites in immediate proximity to the Danube, but in some exceptional cases, outstanding sites in a larger distance to the contemporary Danube were considered as well. We are aware of the fact that our approach can only partially reflect the concrete geographical conditions of the Upper Pleistocene Danube river course and of local geological specifics of the involved regions. Neither did we consider radiometric data in a large-scale manner for this study, given that many of the available dates are flawed due to contamination and proximity to datation limits (Higham et al. 2012). Further information dealing with radiocarbon chronology along the Danube is given by Mellars (2006) and Jöris et al. (2010). In European Palaeolithic archaeology, expecting that simplistic diffusionist hypotheses could be supported by the radiometric record almost always leads to disappointing results. Nevertheless, *Homo sapiens* appears at several places in Central and East Europe at about 40.000 BP. Given the Levantine record, for now it is the most probable hypothesis that *Homo sapiens* spread from there into Europe. During our extensive literature research, we decided to consider the Aurignacian as an entity and did not differentiate between assumed Aurignacian stages, as these subdivisions are highly questionable. This point applies particularly to a pretended differentiation between Aurignacien Ancien and Protoaurignacian sites, as in the light of recent research, the validity of the Protoaurignacian as an independent and chronologically distinctive phase of the Aurignacian has been rightly called into question (Conard/Bolus 2015; Tafelmaier 2015). Nonetheless, we think that at least via the simplicity of our approach, we can add some valuable basic information concerning the presence or absence of Early Upper Palaeolithic humans in the vicinity of the Danube and thereby contribute a test of the Danube-corridor hypothesis.

Methods

The geographical coordinates of the sites were extracted from maps or descriptions of the site locations as well as from coordinates given directly by the literature (see: list of sites). Some information can also be acquired from various sources available online, e.g. the Radiocarbon Palaeolithic Europe Database (http://ees.kuleuven.be/geography/projects/14c-palaeolithic/ [last access 14.05.2015]) or the Archaeology Database available from the Stage Three Project (http://www.esc.cam.ac.uk/research/research-groups/oistage3/stage-three-project-database-downloads [last access 23.05.2015]). We can assume a precision of 10 km for our position data. To plot the sites, we used QGIS 2.8. A base map was created from GTOPO30 (https://lta.cr.usgs.gov/GTOPO30 [last access 09.01.2015]) provided by the United States Geological Survey, and Natural Earth (http://www.naturalearthdata.com [last access 09.01.2015]) raster images. WGS 84 was applied as the reference coordinate system. The density map was created with PAST (PAleontological STatistics) 3.06, using the kernel density estimation (KDE) tool. The result of a KDE is not a probability density, but an estimation of the number of points within an area. The KDE was created with the Gaussian kernel with the underlying function

$$f(x,y) = \frac{1}{\pi r^2} \sum_i \exp\left(-\frac{d_i^2}{2r^2}\right) \text{ with}$$

$$d_i = \sqrt{(x - x_i)^2 + (y - y_i)^2}$$

A wider radius r – or band with parameter – has significant influence on the result of a KDE. If a wide radius is set, the KDE's result will be much smoother. A small radius will produce a more detailed density estimation which is most suitable for small-scale issues (for extended, more detailed information see: Nigst 2006b). For our purposes, the grid in PAST was set to 100 columns and 100 rows and the radius to 1000. The results afterwards were geo-referenced and imported into QGIS.

The Mapping Record

In total, 159 Aurignacian sites (see list of sites; *fig. 1*) could be considered in this study. Based on the available literature, we addressed those sites as Aurignacian that featured typical associations of stone and bone tools, ornaments and portable art (e.g. *fig. 2*) and/or can be put into the period from 43.000 to 28.000 BP by radiometric data. Following up, we will schedule all Aurignacian sites from the source of the Danube at the margins of the Black Forest to its outlet at the Black Sea. Due to the density of the sites, six detailed maps in boxes A to F (*fig. 3*) give further information and a higher geographical resolution. They have not been defined in order to reinforce any chronological or cultural affinities. The numbering of the sites was done by sorting according to the value of their longitudinal position.

The mapping of the whole area (see *fig. 1*) shows a clear orientation of Aurignacian sites along the Danube. Nevertheless, this observation is not correct for every sub-region. A heterogeneous distribution of sites, showing concentrations, as well as 'empty' areas, is visible. The latter is especially

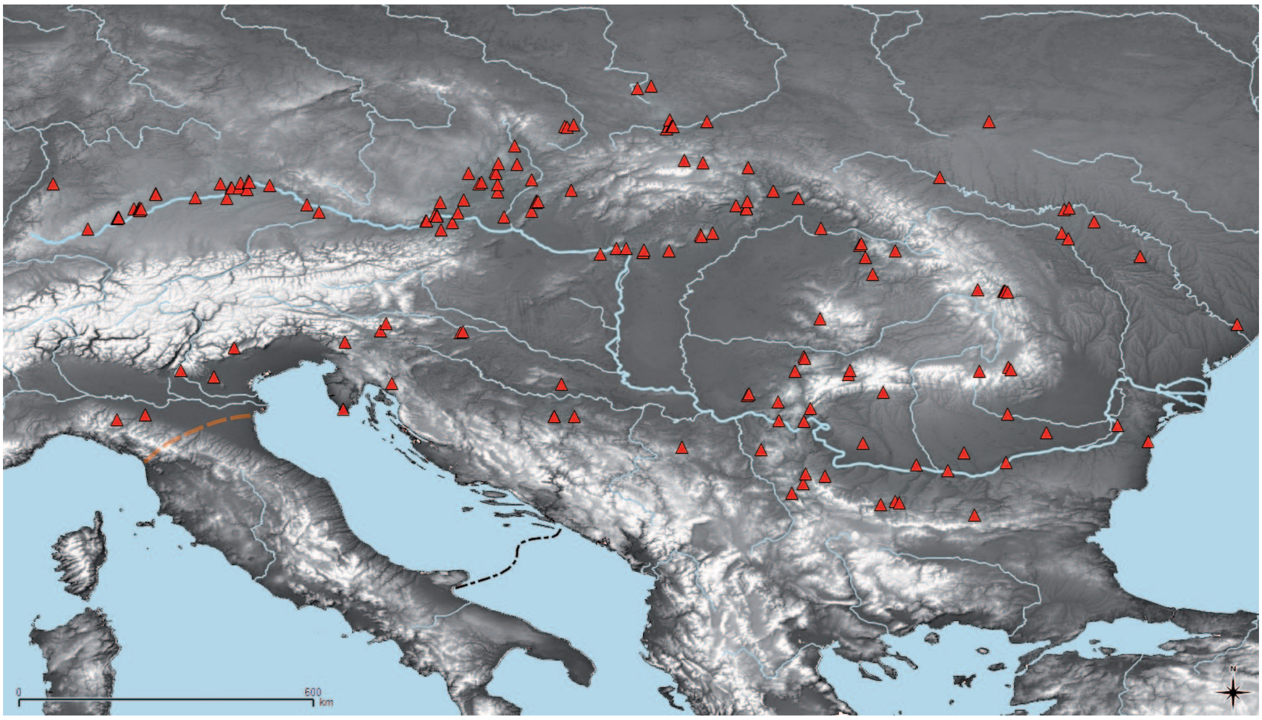

Fig. 1. Map of Aurignacian sites underlying this study. The orange line indicates the limit of our working-area. The dotted line indicates the extent of the landmass during the MIS 3 (see Jöris et al. 2010).

true for the Pannonian Basin. This observation in our opinion can hardly be explained as a pattern of research intensity. Interpretations for these patterns are given below.

Seen from the Danube's source in the Black Forest, the first important region (*fig. 4*) rich in Aurignacian sites is the Swabian Jura, which is crossed by several tributaries of the Danube (Schmiech, Hürbe, Ach, Blau, Brenz, Lone, etc.), forming valleys with cave sites of international reputation (e.g. Vogelherd, Hohlenstein-Stadel, Geißenklösterle and Hohle Fels) (Schmidt 1912; Hahn 1977; Conard/Bolus 2008; etc.). These sites represent a centre for the emergence of figurative art and yield the earliest known musical instruments (flutes). Following the ^{14}C-record available for the Swabian Jura, at Geißenklösterle Cave the Aurignacian occupation starts at about 42.500 cal BP (Higham et al. 2012).

Oriented in a north–east direction along the southern edge of the southern German Jurassic massif, the Danube flows to Bavaria with its famous outcrops of tabular chert in the region of Kelheim. These cherts were primarily exploited in the Neolithic period but were used since the late Middle Palaeolithic (Binsteiner 2006). In terms of the Aurignacian occupation, the Ofnet caves near the Nördlinger Ries (Schmidt 1912) earn an intermediate position between the Swabian and the Franconian Jura. Beyond the Swabian Jura, the Danube-Altmühl region (Bavaria) forms a second Aurignacian concentration. In the area of the city of Regensburg, Uthmeier (2004) compiled a total of 14 Aurignacian sites, e.g. Oberneder Cave and the open air site of Keilberg-Kirche.

Between the Regensburg region and Lower Austria (*fig. 4*), the Danube valley narrows, limited by the Bavarian Forest in the North and the Alps in the South. Along a stretch of almost 200 km, no Aurignacian site has been recorded. The next cluster is located in Lower Austria in the area between the cities of Krems and Vienna, with its very famous sites of Willendorf, Krems-Galgenberg and Langmannersdorf (Angeli 1952/1953). The Willendorf Aurignacian recently provided a ^{14}C-age of ca. 43.500 BP (Nigst et al. 2014). The March valley links the Lower Austrian area in a northern direction with Moravia, which also yields famous Aurignacian sites, e.g. Mladeč and Stránská Skálá (Neruda/Nerudova 2013).

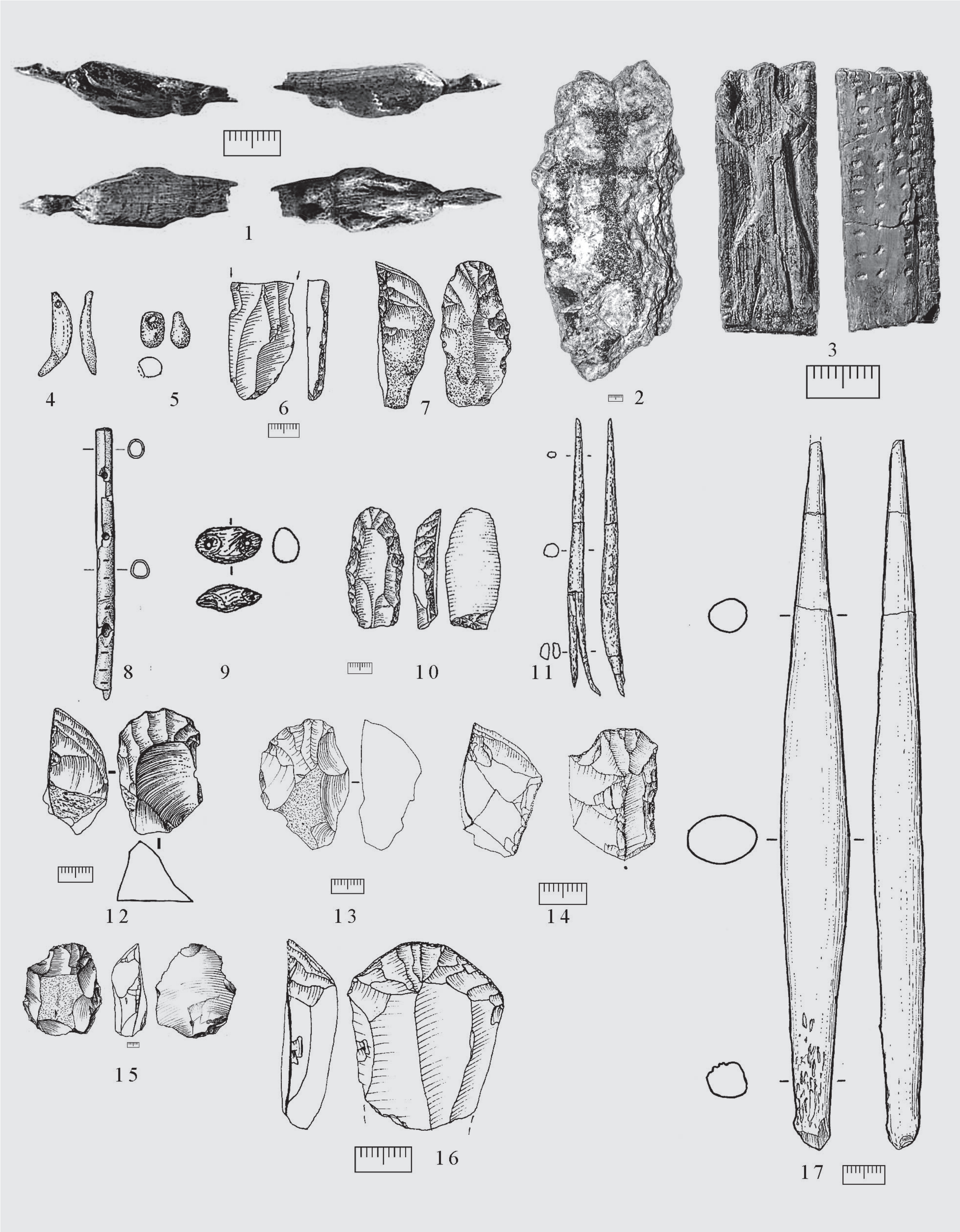

Fig. 2. Overview of Aurignacian artifacts: 1 – Waterbird, Hohle Fels (Conard 2003, fig. 1); 2 – Painted hybrid being, Grotta di Fumane (Conard/Bolus 2015, fig. 2); 3 – Adorant, Geißenklösterle (Conard/Bolus 2015, fig. 2); 4 – Perforated tooth; 5 – Drop-shaped pendant; 6 – Burin; 7 – Carinated piece; 8 – Flute; 9 – Double perforated bead; 10 – Carinated piece; 11 – Split-based point (4–11, Geißenklösterle: Bolus 2003, fig. 2.3); 12–16 – Carinated pieces (12: Remetea-Somos [Anghelinu/Niţă 2014, fig. 8.5]; 13: Nagyrede [Lengyel et al. 2006, fig. 2.1]; 14: Willendorf II [Hahn 1977, tab. 98.2]; 15: Cosava I [Sitlivy et al. 2014, fig. 8.1]; 16: Langmannersdorf [Hahn 1977, tab. 104.1]); 17 – Bone point, Willendorf II (Hahn 1977, tab. 99.1. M=1cm) (4–7 and 8–11 share their scale positioned in the middle).

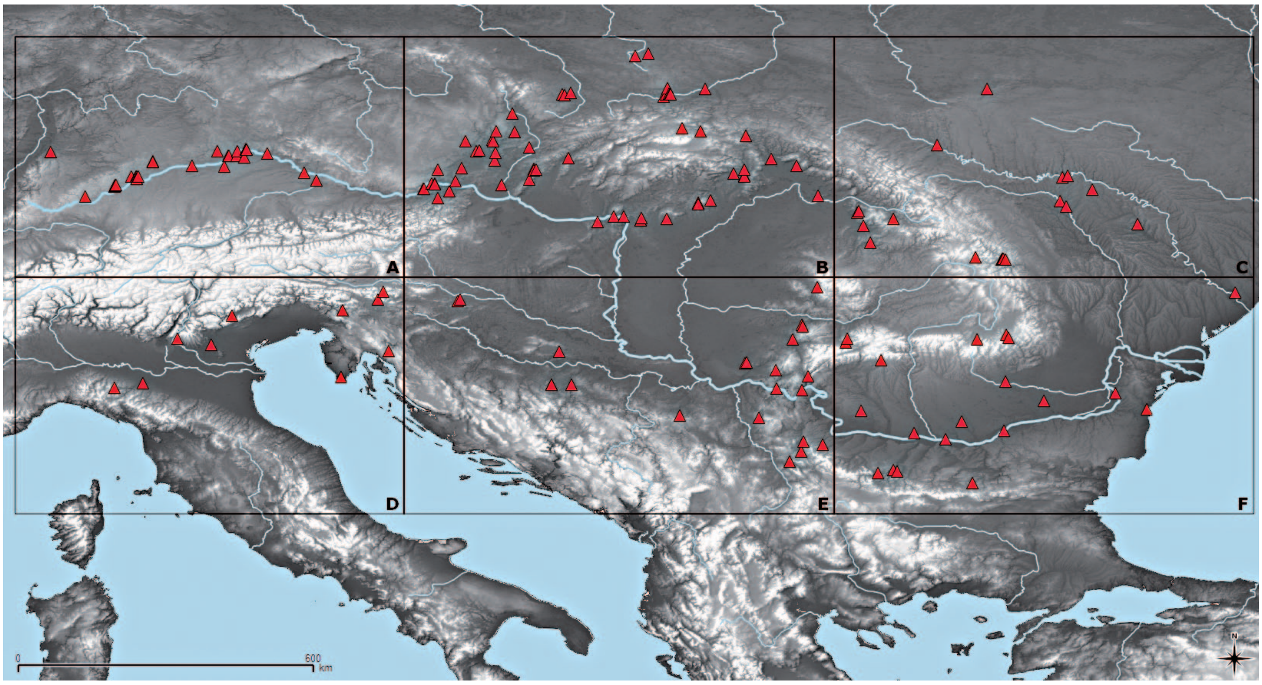

Fig. 3. For a better overview, we subdivided our basic map into the six sectors A to F. The detailed maps are given below.

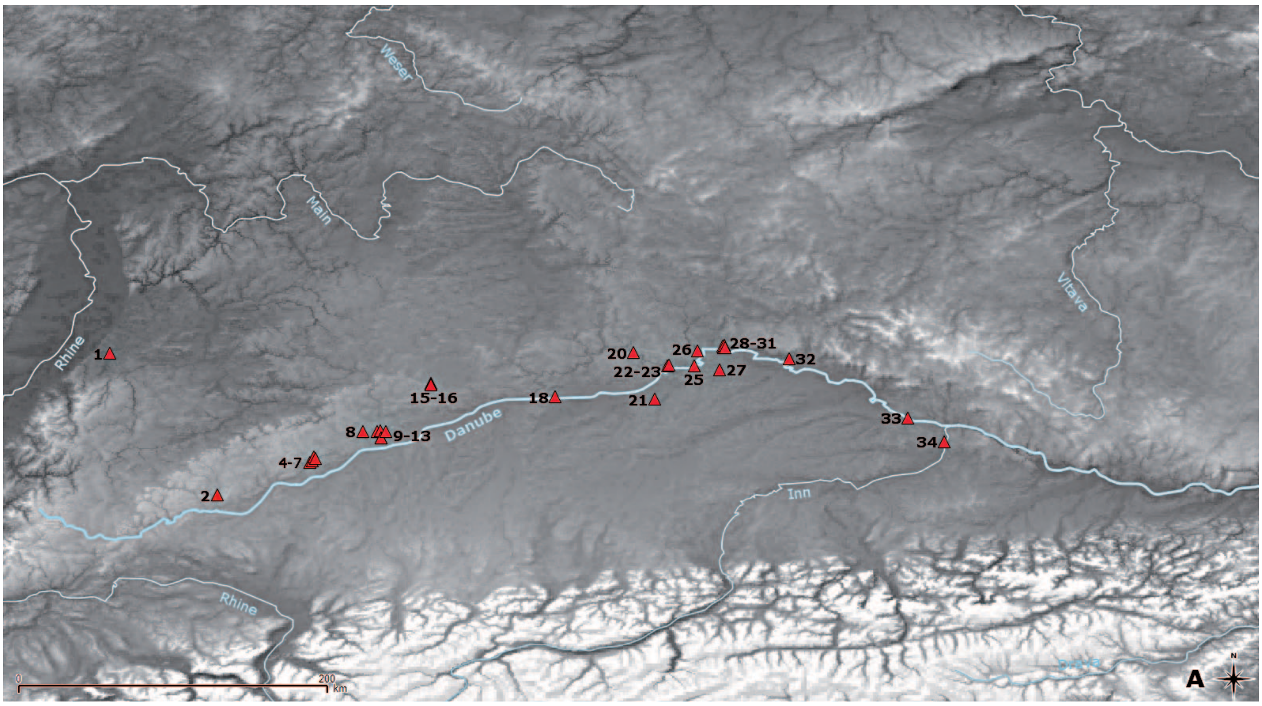

Fig. 4. Sector A comprises sites in the region from the source of the Danube to Lower Austria, such as Hohle Fels, Geißenklösterle or Willendorf. The Danube as a focal point for the Aurignacian settlement is clearly visible.

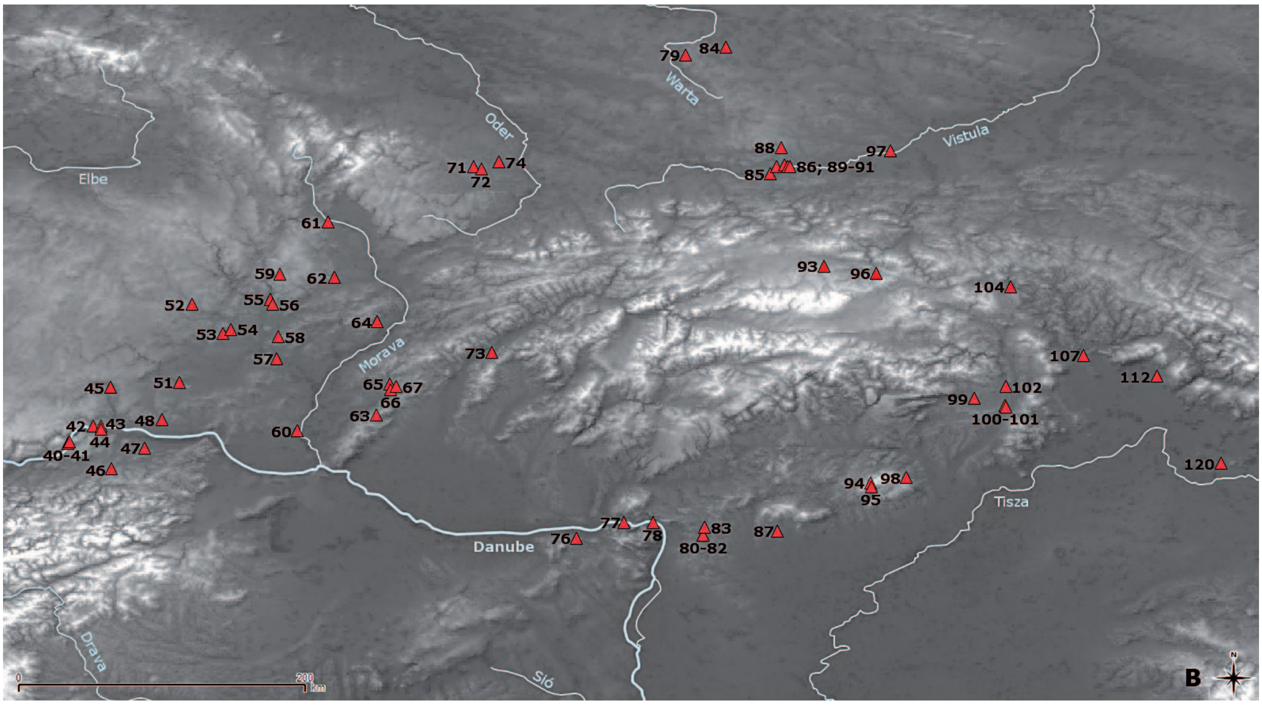

Fig. 5. Sector B depicts the Moravian region, as well as the western Carpathian Mountains and the Danube Bend.

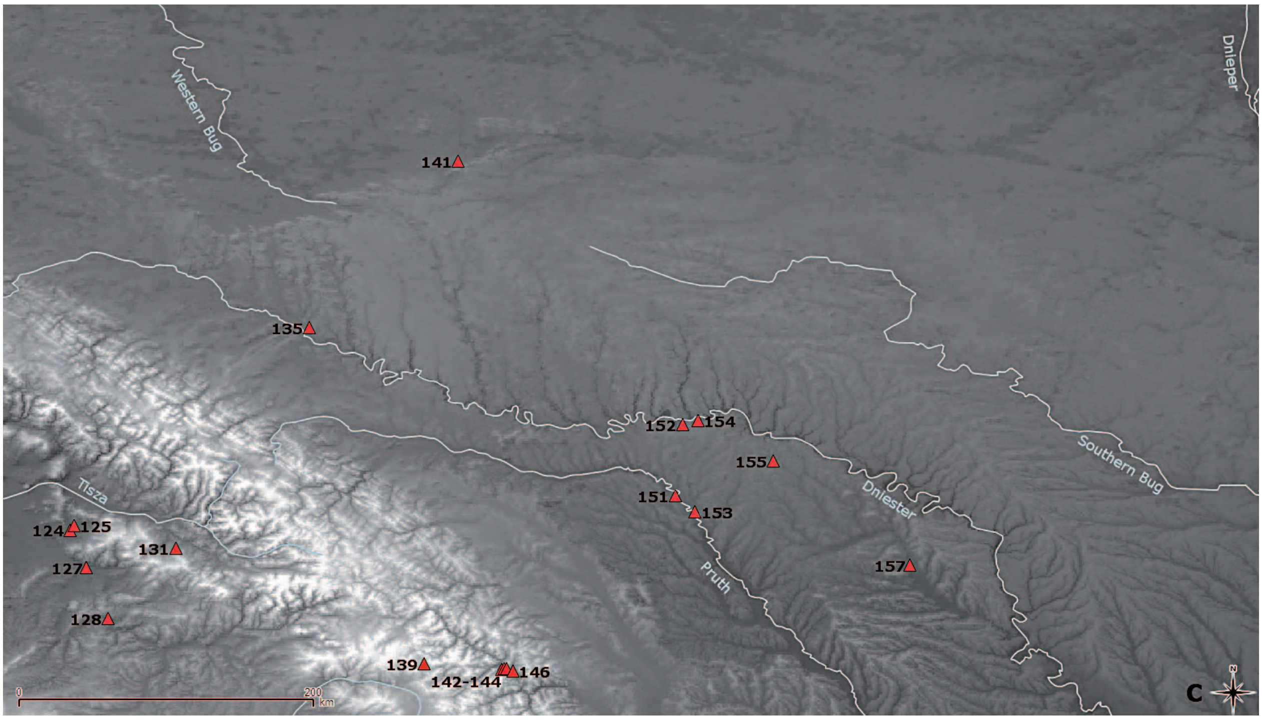

Fig. 6. Sector C shows Aurignacian sites in and east of the Carpathians. Rivers like the Pruth or the Dniester seem to have played a role for Aurignacian settlement in this region.

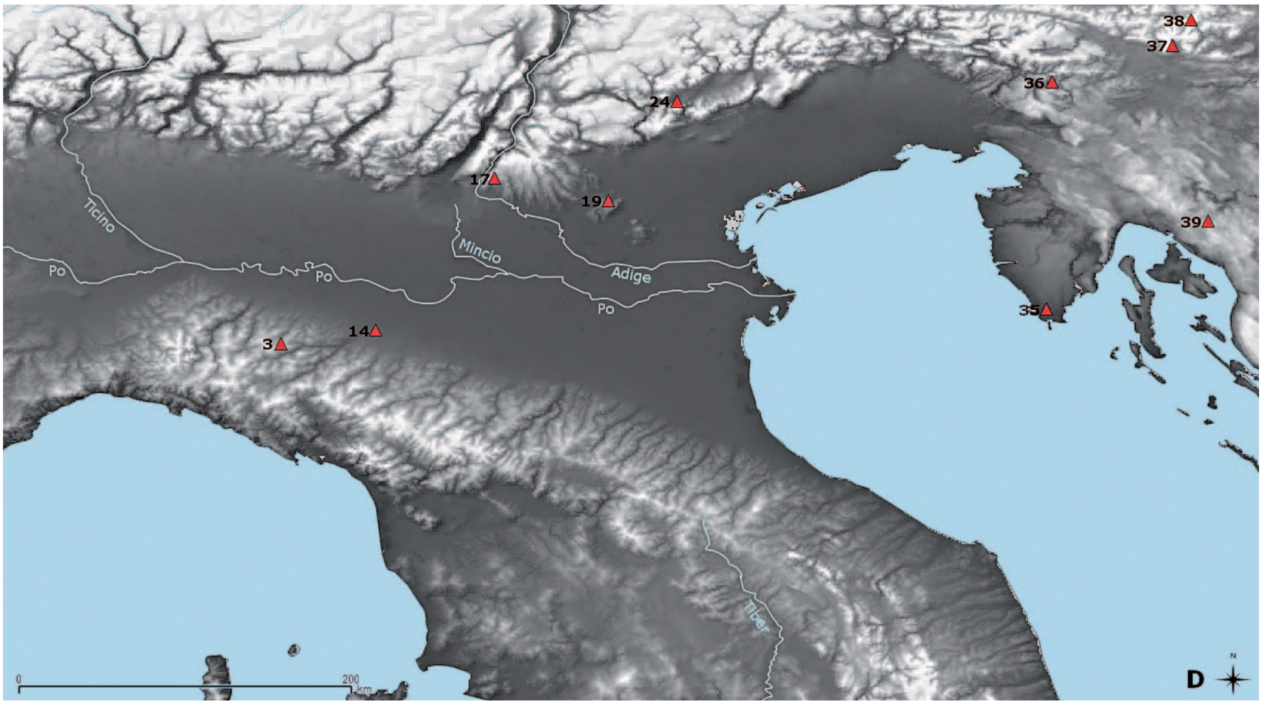

Fig. 7. Sector D depicts the Aurignacian sites of northern Italy, Slovenia and Croatia.

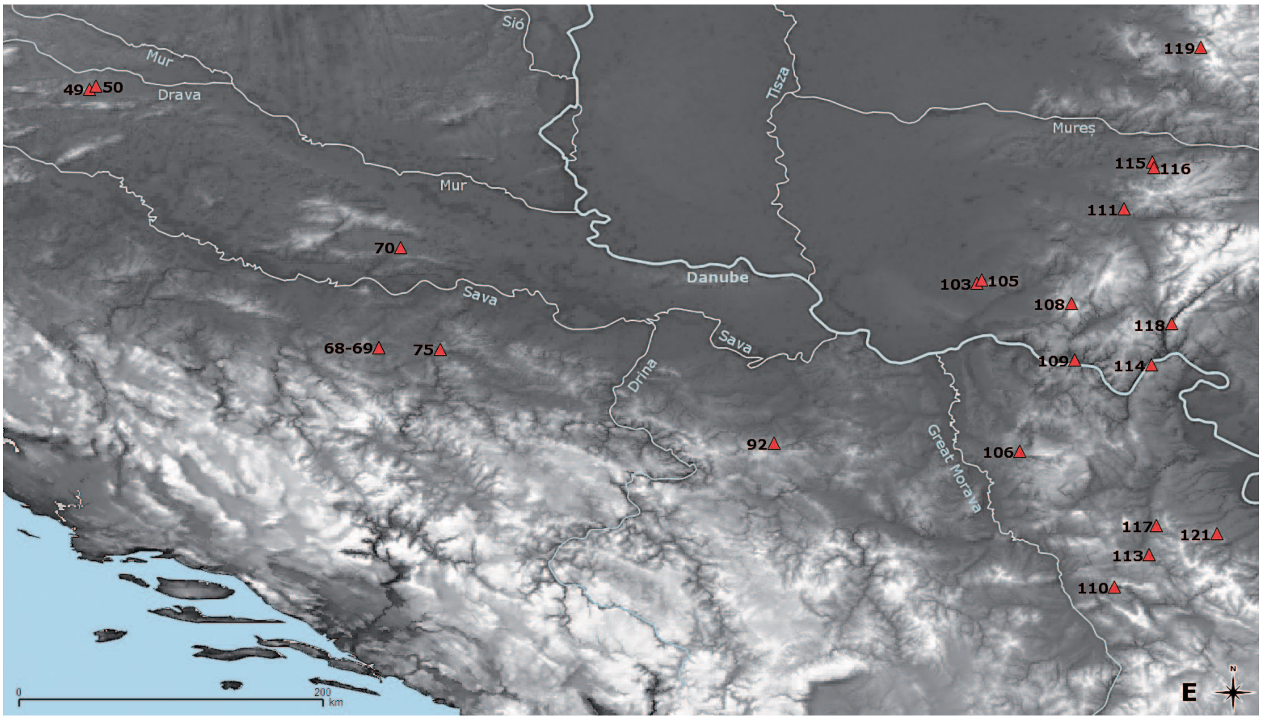

Fig. 8. Sector E clearly shows the lack of sites in the Pannonian Basin but also a high number of sites in the regions around the Iron Gate. Note the sites in proximity of the rivers Sava, Drava and Mur.

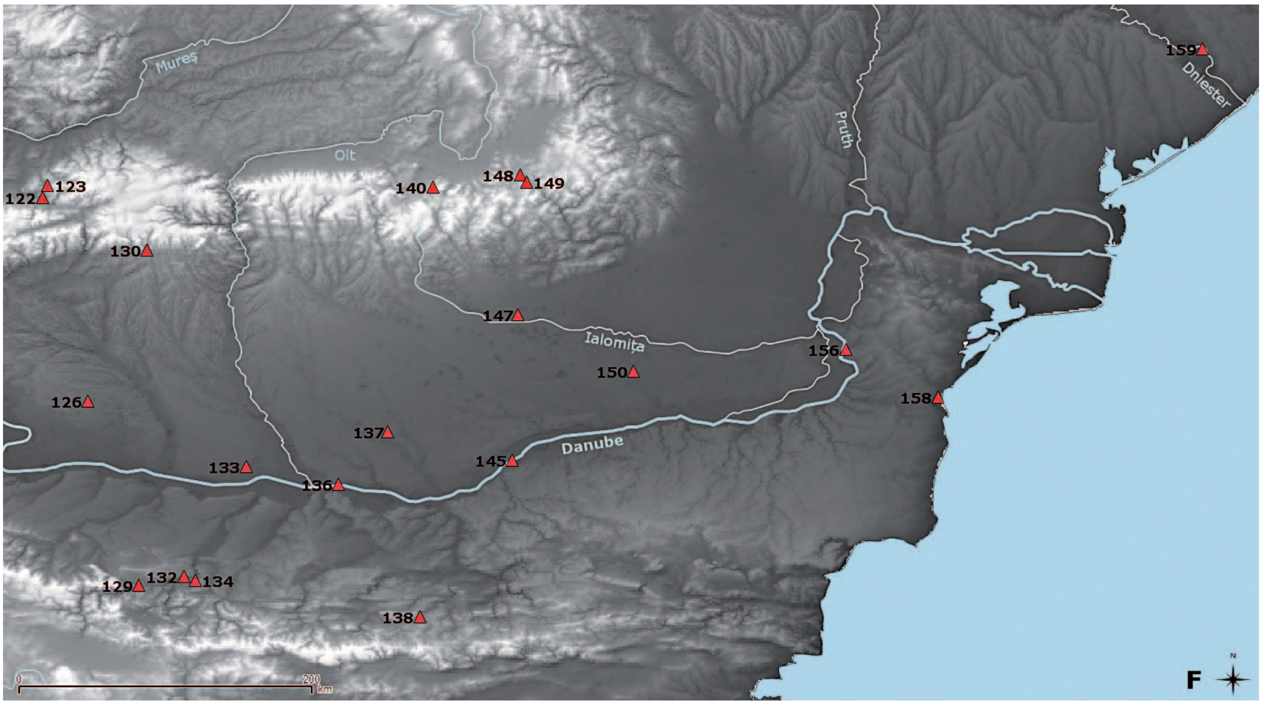

Fig. 9. Sector F shows the lower course of the Danube east of the Iron Gate. The density of Aurignacian sites is low; they are situated near the Danube as well as close to the mountain ranges of the Carpathians and the Balkans.

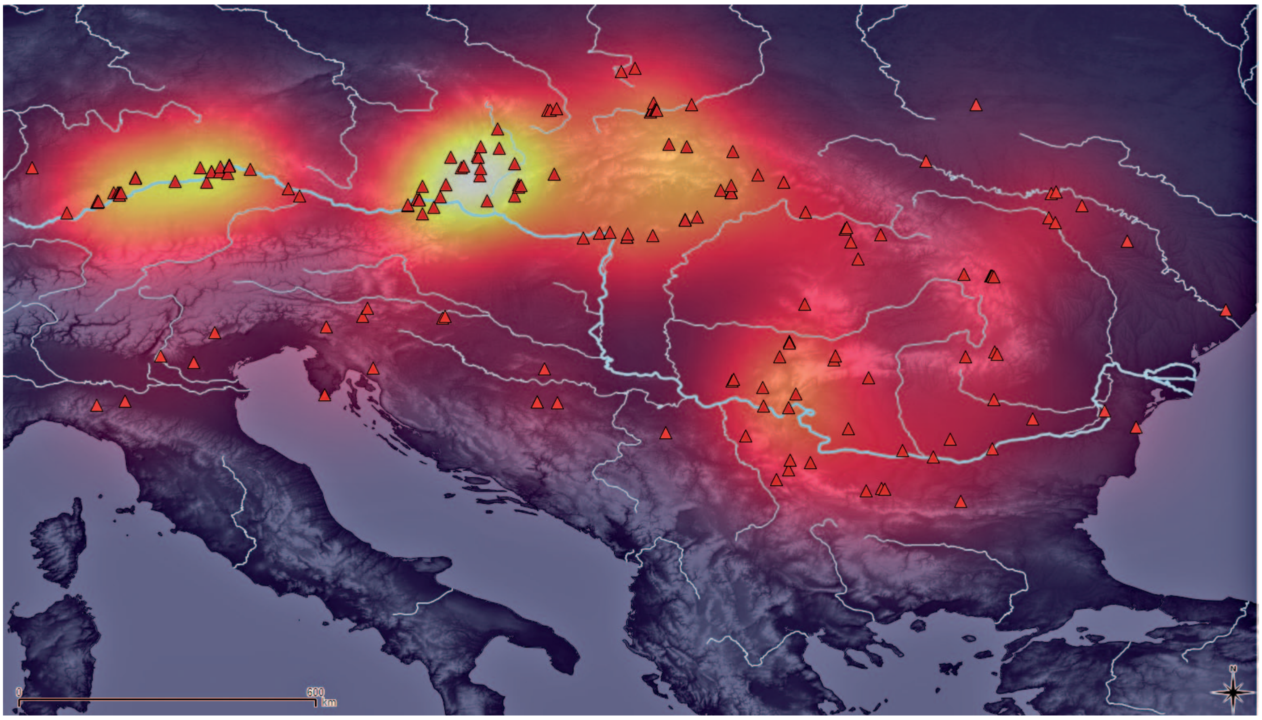

Fig. 10. Result of the kernel density estimation (KDE). Note the four centres of high site-density in descending order: the region of Moravia, the Swabian Jura and Lower Austria, the western Carpathians and the area around the Iron Gate. A small concentration of sites is also visible east of the Carpathians.

In Slovakia, in the western Carpathian Mountains north to Bratislava, additional sites are registered (*fig. 5*). In northern Hungary, near the Danube Bend, a smaller concentration is visible near the western Carpathian Mountains and the Bükk massif. Important sites here are Istállóskó and Peskö Cave (Mottl 1942; Vértes 1960).

For the following 300 km, the Danube runs straight southwards and divides the Slavonian landscape in the west from the Pannonian lowlands in the east, to continue through Serbia (*fig. 8*). In the flat Pannonian Basin, absolutely no Aurignacian site within a 100 km radius to the Danube has been observed. There is no record at all for a Palaeolithic occupation dating to a period earlier than the Gravettian in this region (Vértes 1960). In our state of information, the lack of Aurignacian sites in the Pannonian Basin could relate to several possibilities. One option states, that late Pleistocene archaeological sites could be covered by loess-deposits (Fitzsimmons et al. 2012; personal communication Z. Mester) of the Pannonian Basin. These constitute some of the mightiest loess-layers on the whole European continent and are often the basis of geological research in this area (e.g. Antoine et al. 2009; Iovita et al. 2014; Marković et al. 2006; 2008; 2009). Said loess-deposits originated in relation to the withdrawal of the primordial Paratethys sea and the following formation of mega-lakes and river-systems, especially the Danube and the Tisza around 700.000 years ago (Iovita et al. 2014). Due to those rivers, alluvial materials were deposited that served as the substrate for the following deposition of loess. The assumption, that the lack of sites may be related to research activity within the Pannonian Basin seems unlikely, because sites from the mid-Upper Palaeolithic or more recent times and even Pleistocene faunal remains (e.g. Marković et al. 2006) are present and research on loess-profiles was and is extensive in this area. We do not believe that especially Early Upper Palaeolithic sites were missed during research activities.

Second, it is possible, that the Pannonian Basin was not suitable for human settlement during the late Pleistocene due to the occurrence of vast floodplains. This also seems less probable, as during the timespan of the migration of the first *Homo sapiens* in the Marine Isotope Stage 3 (MIS 3), the Middle and Upper Danube basins represented open steppe-like environments with reliable sources of water and relatively warm climate; the floodplains never reached an extent that would have made the area totally inaccessible (Fitzsimmons et al. 2012; Kiss et al. 2014). In this case, it is more conceivable to us, that the people of the Aurignacian favoured the foothills of the Carpathians with their rich raw material outcrops instead of the Pannonian Basin (personal communication Z. Mester). Farther away, just a few sites near the Dinarian massif in Serbia and Bosnia-Herzegovina complete the impression of a very scarce Aurignacian occupation in this area. East of Belgrade, near the Iron Gates, which is the narrow Danube gorge between the Balkans and the Carpathian mountains, Aurignacian sites farther along the Danube are recorded.

East of the Iron Gates, Aurignacian sites are quite widespread but characteristically are situated mostly at the rim of the Balkan and the Carpathian Mountains (*fig. 9*). In this area, some exceptional sites are present in a very small distance from the current Danube channel (Ciuperceni, Giurgu Malu Rosu). In Romania there is a very important site that is included in the discussion of the dispersal of *Homo sapiens* into Europe: Peştera cu Oase (Anghelinu et al. 2012). Bacho Kiro (Mellars 2006; Tsanova/Bordes 2003) and Temnata (Mellars 2006; Teyssandier 2007), both in Bulgaria, also have contributed important information about the Early Upper Palaeolithic occupation of the area. Although not Aurignacian, Peştera cu Oase yielded the remains of one of the oldest anatomically modern humans in Europe, dating to 40.450±1020 cal BP (Trinkaus et al. 2003a; 2003b; Zilhão et al. 2007). Bacho Kiro, another site with human remains, is the eponymous site for the Bacho-Kirian transitional industry that is dating between 43.000 and 37000 BP at this site and between 45.000 and 37.000 BP at Temnata Cave (Kozłowski/Otte 2000; Mellars 2006). The farther to the east, in the lowlands near to the Danube Delta, the scarcer Aurignacian sites become. In the zones north of the Delta, other river systems, e.g. those of Dnjepr and Dniester, could have replaced the Danube (with its inaccessible delta) as focal points for human dispersals.

Results and Interpretations

The Aurignacian Mosaic

Whereas traditional research stressed a Pan-European Aurignacian unity, in recent years, more and more regional entities have been recognized within the overall Aurignacian distribution. A good illustration of this new view is given by Le Brun-Ricalens and Bordes (2007, fig. 1). Related to our Danubian investigation area, they stress as dense occupation zones the Swabian Jura, Lower Austria, Moravia, Slovakia, the Bükk Mountains, Venetia, Slovenia, Bosnia, Transylvania and Ukraine. In many aspects our mapping confirms their results but additionally suggests new patterns: some new areas, e.g. Bavaria and the Carpathian Mountains, come more into focus, whereas the Transylvanian Lowland in the area of the Lower Danube Valley is in fact much less important than the surrounding mountainous massifs. Another major difference to earlier mapping lies in the visualisation of differentiated densities. Now it becomes clear that southern Germany (Swabian Jura and Bavaria) and the Lower Austrian/Moravian complex possess by far the highest density of sites (*fig. 4 and 5*), whereas the other areas show less intense densities. Regardless of any possible preservation bias and differential intensity of research, the Aurignacian world seems to constitute distinctive settlement clusters with defined ranges and territories, which can be linked with each other by residential moves. In some cases, these contacts can be confirmed by the identification of raw material transport, e.g. between Bavaria and the Swabian Jura, or the Bükk Mountains and the Aurignacian at the Danube Bend.

The Danubian Bottleneck

The farther to the west, the more the Danube becomes a focal point for Aurignacian occupations (*fig. 4*). As the Lower Austrian basin is reached, the Danube plays an undoubted role as axis of orientation for human migrations. In contrast, in the lower course of the Danube, the direct relationship between sites and the river is less pronounced. This is most obvious if one compares the close proximity of the sites in south-western Germany and Lower Austria to the Danube's upper course with the sites in the regions of the lower reach of the Danube. The latter are situated in an average distance of ca. 40 km to the Danube. These observations lead us to the formulation of the 'Danube bottleneck hypothesis'.

The Aurignacian along the Danube and the Two-Fold Trans- and Cisalpine Human Dispersal

Mellars (2006; 2011) proposes two separate routes of the dispersal of anatomically modern humans via the Aurignacian and the Protoaurignacian into Europe (*fig. 13*). According to his hypothesis, the Protoaurignacian spread from the Near East to the regions south of the Black Sea and farther along the coastal regions of the northern Mediterranean Sea into the Iberian Peninsula. In contrast, for Mellars the classical Aurignacian expanded from the Near East into Central Europe along the northern banks of the Danube, traversing the Pannonian Basin.

Our results, based on a meticulous mapping of the sites, suggest a contradicting view. The Danube probably held a role as a two-fold passageway for the dispersal of *Homo sapiens* into Europe:

Its southern cisalpine passage followed the lower course of the Danube, traversing the Iron Gate, and continued along the northern edge of the Dinarian Mountains up to a point where the Danube, coming from the north, branches off into the huge Pannonian Basin. At that point, our mapping favours a possible continuation of human movements to the west, perfectly following a possible passageway along the Danubian tributaries Save and Drau (*fig. 8*), leading straight ahead into the hinterlands of Croatia or into Slovenia, where sites like Vindija, Velika Pećina (Karavanić 1998; 2003) or Divje Babe (Moreau 2015) are situated (*fig. 7*).

Farther to the west, the classical 'Protoaurignacian' centres in northern Italy are reached. On the contrary to existing claims, it seems that Aurignacian sites do not exist near the current shoreline of Croatia (*fig. 8*) (Karavanić 1998). Therefore, we cannot support the hypothesis of a spread of the (Proto) Aurignacian along the coastal regions of the Mediterranean Sea. This is even more apparent if we take into consideration that the extension of the Mediterranean Sea was much smaller 40 or 30 thousand years ago (Jöris et al.

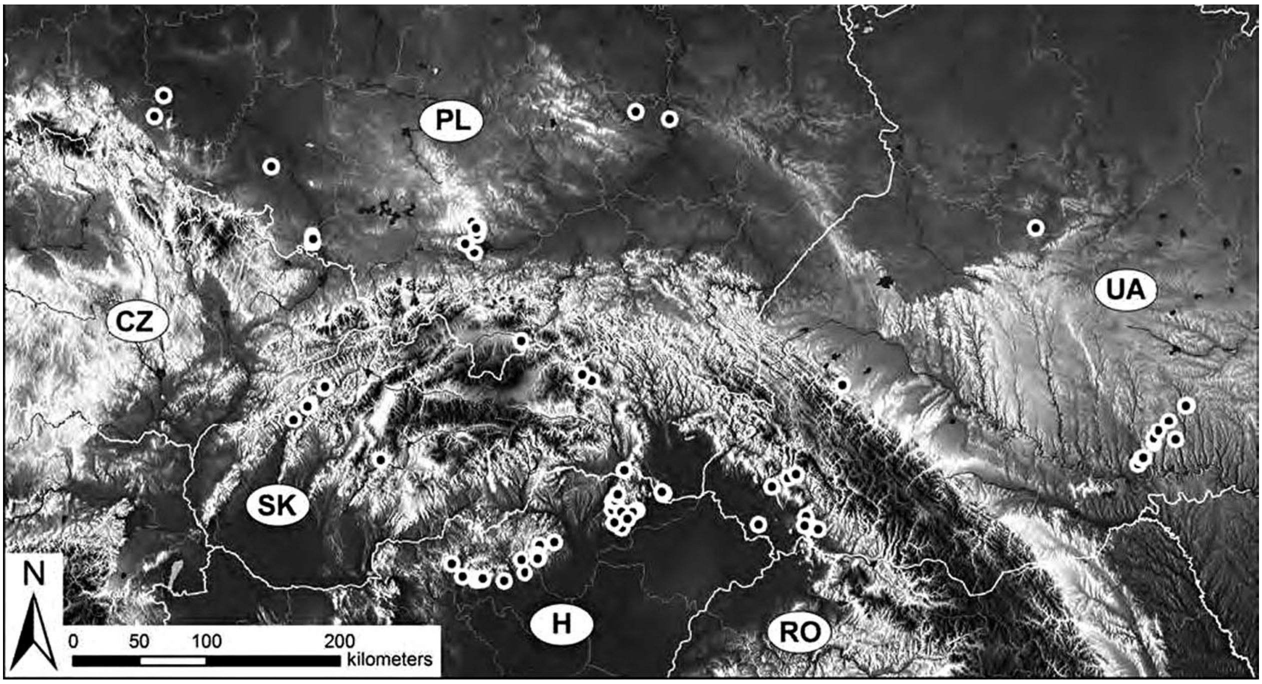

Fig. 11. Raw material sources in the Carpathians. Note the striking accordance of locations of raw material sources and Aurignacian sites (source: Mester et al. 2012, fig. 1).

2010, fig. 1). The Adriatic bay ended much farther to the South, and current coastal zones of northern Italy were situated far in the hinterland in Palaeolithic times. Instead of a coastal migration, a move along the lower Danube and the northern foothills of the Balkans, continuing by the rivers Mur, Drava and Sava, and finally arriving into northern Italy, seems to us more likely at this point.

Coming back to the Pannonian Basin itself, in upper Pleistocene times it probably was some kind of a barrier for early Upper Palaeolithic people, due to an inhospitable environment and probably a lack of certain raw materials, too. In fact, a huge area of more than 60.000 square-kilometres, from the Balkans in the South, the foothills of the Alps in the West, the Danube Bend in the North and the Banat in the East, is totally free of Aurignacian sites. We do not think that this absence is exclusively caused by worse preservation conditions or an inexistent state of research.

Consequently, in our view the Danube does probably not represent a continuous passageway of early *Homo sapiens* into Central Europe. At this moment, we can neither exclude nor confirm early human movement through the Pannonian Basin. This case is taken into account by the hatching in fig. 14.

On the contrary, beyond the cisalpine passage described above, a second independent transalpine passage can be hypothesised:

This northern passage played a significant role regarding the spread of *Homo sapiens* into Central Europe. This passage began in its first European steps independently of the Danube. Starting probably along the Dniester and two northern tributaries of the Danube, the Pruth and the southern Bug, the eastern and northern Carpathian Mountains seem to have played an important role for the implantation of Aurignacian societies (*fig. 6*). These circumstances are probably linked with rich outcrops of high-quality raw materials, e.g. in the Bükk Mountains in the western Carpathians, including several obsidian sources (Biró 2014; Mester et al. 2012). The locations of Aurignacian sites in that area associate perfectly with lithic raw material sources (see Mester et al. 2012, fig. 1). In addition, Aurignacian sites situated near the Danube Bend indicate procurement of Bükk Mountain obsidian (Biró 2014) (*fig. 12*). This observation strongly supports the idea of an east-to-

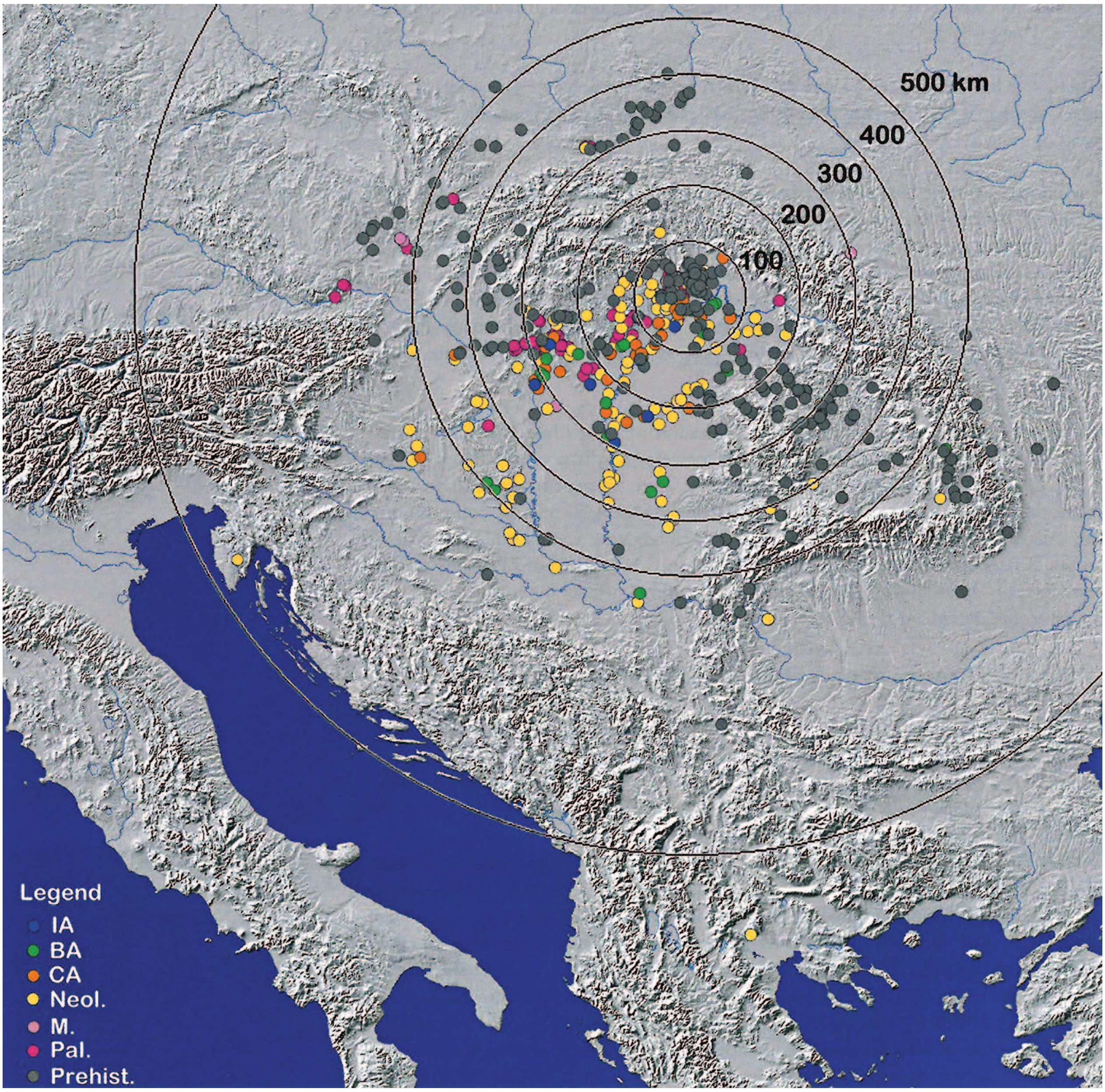

Fig. 12. Transport distances of obsidian procured in the Carpathians during different periods (source: Biro 2014).

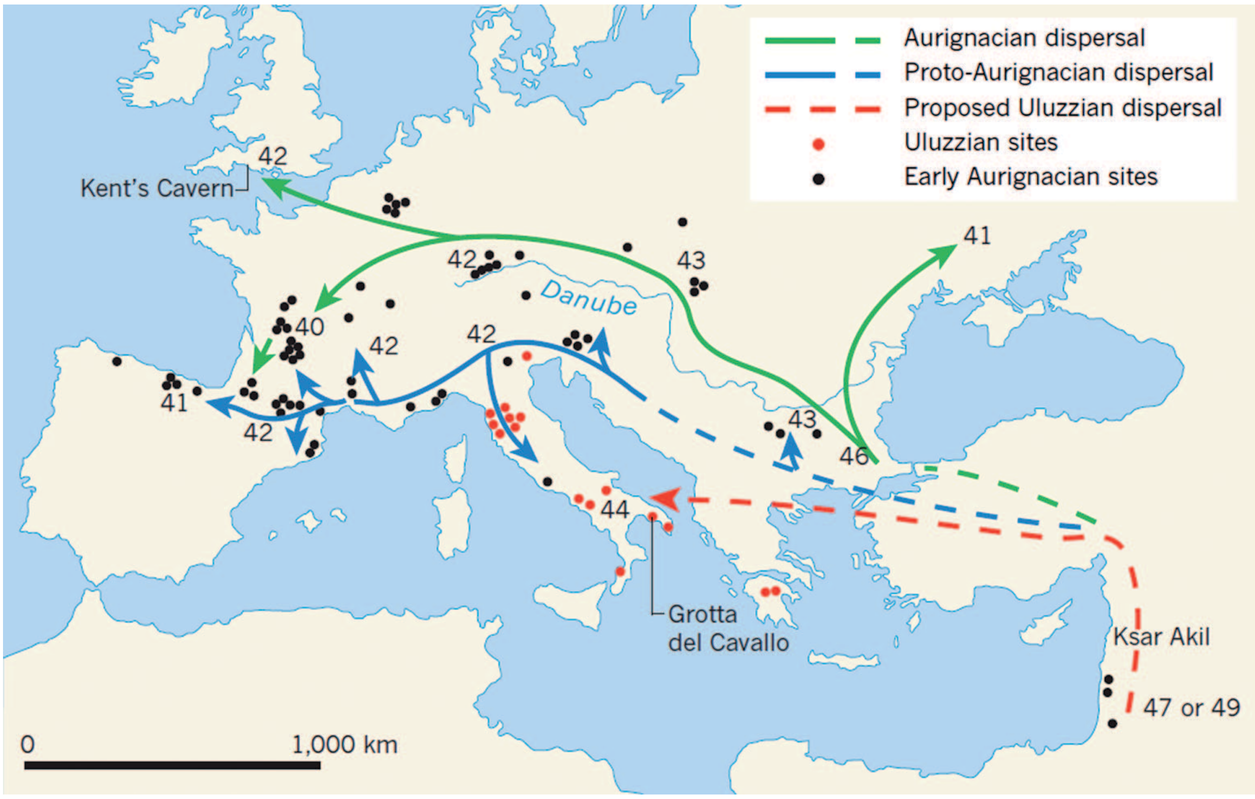

Fig. 13. Passageways of modern human dispersal as proposed by Mellars (2011, fig. 2).

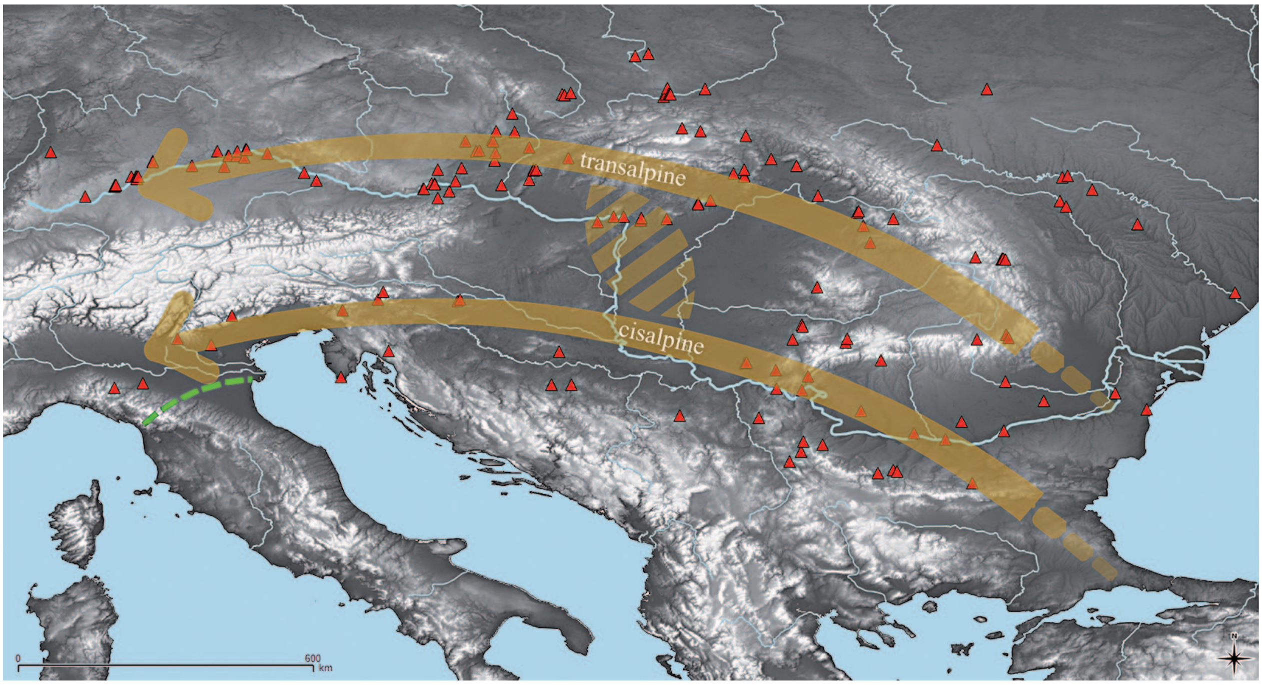

Fig. 14. Our model with possible trans- and cisalpine passageways of early modern human dispersal.

west connection and explains the lack of Aurignacian sites in the Pannonian Basin further south, as well. From the Danube Bend, Moravia and Austria are proximal. Once the Lower Austrian area is reached, the association between the distribution of Aurignacian sites and the course of the Danube is undeniable. The next steps then are current Bavaria and the famous Swabian Jura. The presence of Bavarian tabular chert in the Aurignacian sites of Swabia (Burkert/Floss 2005) is another striking argument that the assumed passageways of human movements and dispersal are not just a chimera but really did exist.

In summary, our study, though simplified, supports the central role of the Danube as a focal point for early *Homo sapiens* dispersals into Europe. But from our point of view, this happened differently than was previously assumed. The Danube holds a two-fold role as an orientation axis for a cisalpine and a transalpine movement. The cisalpine move happened principally following the lower Danube and its right tributaries Save and Drau. The transalpine move followed probably along the Dniester and the Carpathian Mountains. Here the Danube does not come into play before the Danube Bend. But beyond this point, the Danube is a much stronger focal point for Aurignacian settlement than it was ever the case before.

Harald Floss
Simon Fröhle
Stefan Wettengl
Eberhard Karls Universität Tübingen
Institut für Ur- und Frühgeschichte und
Archäologie des Mittelalters
Abteilung Ältere Urgeschichte und
Quartärökologie
D-72070 Tübingen
harald.floss@uni-tuebingen.de
simon.froehle@uni-tuebingen.de
stefan.wettengl@uni-tuebingen.de

Bibliography

Adams/Ringer 2004: B. Adams/Á Ringer, New C14 Dates for the Hungarian Early Upper Paleolithic. Current Anthropology 45.4, 2004, 541–551.

Alexandrescu et al. 2004: E. Alexandrescu/S. Balescu/A. Tuffreau, Nouvelles données chronologiques, technologiques et typologiques sur le Paléolithique supérieur ancien de la Plaine roumaine du Danube. Le gisement de Giurgiu-Malu Rosu. L'anthropologie 108, 2004, 407–423.

Alexandrescu et al. 2010: E. Alexandrescu/A. Olarui/G. Skog/K. Stenström/R. Hellborg, Human Fossil Bones from the Muierii Cave and the Cioclovina Cave, Romania. L'Anthropologie 114.3, 2010, 341–353.

Angeli 1952/1953: W. Angeli, Der Mammutjägerhalt von Langmannersdorf an der Perschling. Mitteilungen der Prähistorischen Kommission der Austriaischen Akademie der Wissenschaften 4, 1952/1953, 3–118.

Anghelinu/Niţă 2014: M. Anghelinu/L. Niţă, What's in a Name. The Aurignacian in Romania. Quaternary International 351, 2014, 172–192.

Anghelinu et al. 2012: M. Anghelinu/L. Niţă/L. Sitlivy/Th. Uthmeier/I. Balteăn, Looking around Peştera Cu Oase. The Beginnings of Upper Paleolithic in Romania. Quaternary International 274, 2012, 136–157.

Antoine et al. 2009: P. Antoine/D.-D. Rosseau/M. Fuchs/C. Hatté/C. Gauthier/S. B. Marković/M. Jovanović/T. Gaudenyo/O. Moine/J. Rossignol, High-Resolution of the Last Climatic Cycle in the Southern Carpathian Basin (Surduk, Vojvodina, Serbia). Quaternary International 198, 2009, 19–36.

Binsteiner 2006: A. Binsteiner, Die Lagerstätten und der Abbau bayerischer Jurahornsteine sowie deren Distribution im Neolithikum Mittel- und Osteuropas. Jahrbuch des Römisch-Germanischen Zentralmuseums Mainz 52.1, 2005, 44–155.

Biró 2014: K. T. Biró, Carpathian Obsidian. State of Art. In: M. Yamada/A. Ono (eds.), Lithic Raw Material Exploitation and Circulation in Préhistory. A Comparative Perspective in Diverse Palaeoenvironments. ERAUL 138 (Liège 2014) 47–69.

Bolus 2011: M. Bolus, The Late Middle Paleolithic and the Aurignacian of the Swabian Jura, Southwestern Germany. In: A. P. Derevianko/M. V. Shunkov, Characteristic Features of the Middle to Upper Paleolithic Transition in Eurasia (Novosibirsk 2011) 3–10.

Bolus 2012: M. Bolus, Flake Production in the Aurignacian of Southwestern Germany. Some Examples from the Swabian Jura. In: A. Pastoors/M. Peresani, Flakes not Blades. The Role of Flake Production at the Onset of the Upper Palaeolithic in Europe. Wissenschaftliche Schriften des Neanderthal Museums 5 (Mettmann 2012) 153–164.

Borić et al. 2012: D. Borić/V. Dimitrijević/D. White/C. Lane/C. A. I. French/E. Cristiani, Early Modern Human Settling of the 'Danube Corridor'. The Middle to Upper Palaeolithic Site of Tabula Traiana Cave in the Danube Gorges (Serbia). Antiquity 86.334, 2012 (http://www.antiquity.ac.uk/projgall/boric334/).

Burkert/Floss 2005: W. Burkert/H. Floss, Lithic Exploitation Areas in the Upper Palaeolithic of West and Southwest Germany. A Comparative Study. In: G. Weisgerber/G. Körlin (eds.), Stone Age – Mining Age. Der Anschnitt, Beiheft 19 = Veröffentlichungen aus dem Deutschen Bergbau-Museum Bochum 148 (Bochum 2005) 35–49.

Chu et al. 2014: W. Chu/Th. Hauck/D. Mihailović, Crvenka-At. Preliminary Results from a Lowland Aurignacian Site in the Middle Danube Catchment. In: D. Mihailović (ed.), Palaeolithic and Mesolithic Research in the Central Balkan (Belgrad 2014) 69–76.

Churchill/Smith 2000: S. E. Churchill/F. H. Smith, Makers of the Early Aurignacian of Europe. Yearbook of Physical Anthropology 43, 2000, 61–115.

Conard 2003: N. J. Conard, Palaeolithic Ivory Sculptures from Southwestern Germany and the Origins of Figurative Art. Nature 426, 2003, 830–832.

Conard/Bolus 2008: N. J. Conard/M. Bolus, Radiocarbon Dating the Late Middle Paleolithic and the Aurignacian of the Swabian Jura. Journal of Human Evolution 55, 2008, 886–897.

Conard/Bolus 2015: N. J. Conard/M. Bolus, Chronicling Modern Human's Arrival in Europe. Science 348.6236, 2015, 754–756. doi:10.1126/science.aab0234.

Conard/Floss 2000: N. J. Conard/H. Floss, Eine Elfenbeinplastik vom Hohle Fels bei Schelklingen und ihre Bedeutung für die Entwicklung des Jungpaläolithikums in Südwestdeutschland. Archäologisches Korrespondenzblatt 30, 2000, 473–480.

Davies 2003: W. Davies, The Human Presence in Europe during the Last Glacial Period III. Site Clusters, Regional Climates and Resource Attractions. In: T. H. Van Andel/W. Davies (eds.), Neanderthals and Modern Humans in the European Landscape during the Last Glaciation. Archaeological Results of the Stage 3 Project (Cambridge 2003) 191–220.

Demidenko/Noiret 2012: Y. E. Demidenko/P. Noiret, The Siuren-I Aurignacian of Krems-Dufour Type Industries in the Context of the European Aurignacian. In: Y. E. Demidenko/M. Otte/P. Noiret/I. Siuren, Rockshelter. From the Late Middle Paleolithic and Early Upper Paleolithic to Epi-Paleolithic in Crimea. ERAUL 129 (Liège 2012) 343–357.

Dobosi 2005: V. T. Dobosi, Cadastre of Palaeolithic Finds in Hungary. State of Art 2005. Communicationes Archaeologicae Hungariae 2005, 49–81.

Dobrescu 1999: R. Dobrescu, Présence de l'Aurignacien du Nord-Ouest de la Romanie. Living Past 1, 1999. <http://www.cimec.ro/arheologie/livingpast/nr1/dobrescu/aurignacien.htm> (last access 10.07.2015).

Dobrescu 2008: R. Dobrescu, Aurignacianul din Transilvania. Asociaţia Română de Arheologie Studii de Preistorie Supplementum 3 (Bukarest 2008).

Dogandžić et al. 2014: T. Dogandžić/S. McPherron/D. Mihailović, Middle and Upper Paleolithic in the Balkans. Continuities and Discontinuities of Human Occupations. In: D. Mihailović (ed.), Palaeolithic and Mesolithic Research in the Central Balkan (Belgrad 2014) 83–96.

Fitzsimmons et al. 2012: K. E. Fitzsimmons/S. B. Marković/U. Hambach, Pleistocene Environmental Dynamics Recorded in the Loess of the Middle and Lower Danube Basin. Quaternary Science Reviews 41, 2012, 104–118.

Floss 2000: H. Floss, Le couloir Rhin-Saône-Rhône. Axe de communication au tardiglaciaire? In: C. Coupillard/A. Richard (eds.), Les derniers chasseurs-cueilleurs d'Europe occidentale (13000–5500 av. J.-C.). Actes du Colloque de Besançon, 23.–25. octobre 1998. Collection annales littéraires, Presses Universitaires Franc-comtoises (Paris 2000) 313–321.

Floss 2002: H. Floss, La Saône – Lien ou limite de l'occupation humaine au Paléolithique. In: Institut de Recherche du Val de Saône-Mâconnais (ed.), La Saône: axe de civilisation, Congrès International, Mâcon, 26.–27.1.2001 (Lyon 2002) 113–125.

Floss 2014: H. Floss, Rivers as Orientation Axes for Migrations, Exchange Networks and Transmission of Cultural Traditions in the Upper Palaeolithic of Central Europe. In: M. Yamada/A. Ono (eds.), Lithic Raw Material Exploitation and Circulation in Préhistory. A Comparative Perspective in Diverse Palaeoenvironments. ERAUL 138 (Liège 2014) 11–22.

Floss/Kieselbach 2004: H. Floss/P. Kieselbach, The Danube Corridor after 29,000 BP. New Results on Raw Material Procurement Patterns in the Gravettian of Southwestern Germany. Mitteilungen der Gesellschaft für Urgeschichte 13, 2004, 61–78.

Floss/Poenicke 2006: H. Floss/H.-W. Poenicke, Jungpaläolithische Oberflächenfunde aus Königsbach-Stein (Enzkreis) oder: Was macht ein Aurignacien zum Aurignacien? Quartär 53/54, 2006, 115–146.

Floss et al. 2012: H. Floss/Ch. Hoyer/E. Dutkiewicz/J. Frick/H.-W. Poenicke, Eine neu entdeckte paläolithische Freilandfundstelle auf der Schwäbischen Alb. Sondagegrabungen in Börslingen. Archäologische Ausgrabungen in Baden-Württemberg 2011, 71–73.

Ghemiş et al. 2011: C. Ghemiş/J. Clottes/B. Gely/F. Prud Homme, An Exceptional Archaeological Discovery. The 'Art Gallery' in Coliboaia Cave, Apuseni Mountains, Romania. Acta Archaeologica Carpathica 46, 2011, 5–18.

Hahn 1977: J. Hahn, Aurignacien. Das ältere Jungpaläolithikum in Mittel- und Osteuropa (Köln 1977).

Higham et al. 2012: Th. Higham/L. Basell/R. Jacob/R. Wood/C. B. Ramsey/N. J. Conard, Testing Models for the Beginnings of the Aurignacian and the Advent of Figurative Art and Music. The Radiocarbon Chronology of Geißenklösterle. Journal of Human Evolution 62.6, 2012, 664–676.

Hussain/Floss 2014: S. T. Hussain/H. Floss, The Role of River Courses in Organizing the Cultural Space of the Upper Paleolithic. Examples from the Rhine, Rhône, Danube and Garonne. In: M. Otte (ed.), Modes de contact et déplacements au Paléolithique eurasiatique, colloque UISPP, Liège 2012 (Liège 2014) 307–320.

Iovita et al. 2014: R. Iovita/A. Doboş/K. E. Fitzsimmons/M. Probst/U. Hambach/M. Robu/M. Vlaicu/A. Petculescu, Geoarchaeological Prospection in the Loess Steppe. Preliminary Results from the Lower Danube Survey for Paleolithic Sites (LoDanS). Quaternary International 351, 2014, 98–114.

Jöris et al. 2010: O. Jöris/C. Neugebauer-Maresch/B. Weninger/M. Street, The Radiocarbon Chronology of the Aurignacian to Mid-Upper Palaeolithic Transition along the Upper and Middle Danube. In: C. Neugebauer-Maresch/L. R. Owen (eds.), New Aspects of the Central and Eastern European Upper Palaeolithic. Methods, Chronology, Technology and Subsistence. Symposium by the Prehistoric Commission of the Austrian Academy of Sciences; Vienna, November 9–11, 2005. Mitteilungen der Prähistorischen Kommission 72, 2010, 101–137.

Kaminská 2001: L. Kaminská, Die Nutzung von Steinrohmaterialien im Paläolithikum der Slovakia. Quartär 51/52, 2001, 81–106.

Karavanić 1995: I. Karavanić, Upper Palaeolithic Occupation Levels and Late-Occuring Neandertals at Vindija Cave (Croatia) in the Context of Central Europe and the Balkans. Journal of Anthropological Research 51, 1995, 9–35.

Karavanić 1998: I. Karavanić, The Early Upper Palaeolithic of Croatia. In: F. Alhaique (ed.), Proceedings of the XIII International Congress of Prehistoric and Protohistoric Sciences (Forlì, Italy), 8–14 September 1996, Vol. 2. Lithic technology. From Raw Material Procurement to Tool Production (Forlì 1998) 659–665.

Karavanić 2003: I. Karavanić, L'industrie aurignacienne de la grotte de Šandalja II (Istrie, Croatie) dans le contexte de la région de l'Est de l'Adriatique. L'anthropologie 107, 2003, 577–602.

Kiss et al. 2014: T. Kiss/P. Hernesz/B. Sümeghy/K. Györgyövics/G. Sipos, The Evolution of the Great Hungarian Plain Fluvial System. Fluvial Processes in a Subsiding Area from the Beginning of the Weichselian. Quaternary International 30, 2014, 1–14.

Kozłowski/Otte 2000: J. K. Kozłowski/M. Otte, La formation de l'Aurignacien en Europe. L'anthropologie 104, 2000, 3–15.

Kuhn et al. 2014: S. Kuhn/D. Mihailovic/V. Dimitrijevic, The Southeast Serbia Paleaolithic Project. An Interim Report. In: D. Mihailović (ed.), Palaeolithic and Mesolithic Research in the Central Balkan (Belgrade 2014) 97–106.

Le Bruns-Ricalens/Bordes 2007: F. Le Bruns-Ricalens/J.-G. Bordes, Les débuts de l'Aurignacien en Europe occidentale. Unité ou diversité? Du territoire de subsistance au territoire culturel. Die Anfänge des Aurignacien in Westeuropa. Einheit oder Diversität? Vom Subsistenzraum zur Kulturlandschaft. In: H. Floss/N. Rouquerol (eds.), Les chemins de l'art Aurignacien en Europe. Das Aurignacien und die Anfänge der Kunst in Europa (Aurignac 2007) 37–62.

Lengyel et al. 2007: G. Lengyel/S. Béres/L. Fodor, New Lithic Evidence of the Aurignacian in Hungary. Eurasion Prehistory 4.1/2, 2007, 79–85.

Leroi-Gourhan et al. 1967: A. Leroi-Gourhan/C. N. Mateesco/Em. Protopopesco-Pake, Contribution a l'etude du climat de la station de Vadastra du Paleolithique supérieur a la fin du Neolithique. Bulletin de l'Association française pour l'etude du Quaternaire 4, 1967, 271–279.

Marković et al. 2006: S. B. Marković/E. Oches/P. Sümegi/M. Jovanović/T. Gaudenyi, An Introduction to the Middle and Upper Pleistocene Loess-Paleosol Sequence at Ruma Brickyard, Vojvodina, Serbia. Quaternary International 149, 2006, 80–86.

Marković et al. 2008: S. B. Marković/M. Bokhorst/J. Vandenberghe/W. D. McCoy/E. A. Oches/U. Hambach/T. Gaudenyi/M. Jovanović/L. Zöller/T. Stevens/B. Machalett, Late Pleistocene Loess-Palaeosol Sequences in the Vojvodina Region, North Serbia. Journal of Quaternary Science 23.1, 2008, 73–84.

Marković et al. 2009: S. B. Marković/U. Hambach/N. Catto/M. Jovanović/B. Buggle/B. Machalett/L. Zöller/B. Glaser/M. Frechen, Middle and Late Pleistocene Loess Sequences at Batajnica, Vojvodina, Serbia. Quaternary International 198, 2009, 255–266.

Masojć/Bronowicki 2003: M. Masojć/J. Bronowicki, The Chełm Massif Area. An Aurignacian Settlement Enclave in the South-Wester Poland. Przegląd Archeologiczny 51, 2003, 49–76.

Mellars 2006: P. Mellars, Archaeology and the Dispersal of Modern Humans in Europe. Deconstructing the 'Aurignacian'. Evolutionary Anthropology 15, 2006, 167–182.

Mellars 2011: P. Mellars, The Earliest Modern Humans in Europe. Nature 479, 2011, 483–484.

Mester 2014: Z. Mester, Hongrie. Tendances et Problemes. In: P. Noiret/D. Leesch (eds.), Le Paléolithique supérieur d'Eurasie (Liège 2014) 65–77.

Mester et al. 2012: Z. Mester/N. Faragó/G. Lengyel, The Lithic Raw Material Sources and Interregional Human Contacts in the Northern Carpathian Regions. A Research Program. Anthropologie L/3, 2012, 275–293.

Mlejnek 2010: O. Mlejnek, Tvarožná I, stanice vyvinutého aurignacienu na Moravé. Acta Musei Moraviae Scientiae Sociales 95.1, 2010, 17–50.

Mlejnek 2013: O. Mlejnek, Interdisciplinary Research on the Moravian Upper Palaeolithic in the New Millenium (2001–2013). Interdisciplinaria Archaeologica 4.2, 2013, 193–204.

Mlejnek et al. 2012: O. Mlejnek/P. Škrdla/A. Přychistal/I. Ondratice/Želeč. An Early Upper Palaeolithic Site in Central Moravia. Archäologisches Korrespondenzblatt 42.3, 2012, 295–314.

Montet-White 1994: A. Montet-White, Palaeolithic Settlement Patterns in Northern Bosnia. Preistoria Alpina – Museuo Tridentio di Scienze Naturali 28, 1992, 91–102.

Moreau 2015: L. Moreau, Reasessing the Aurignacian of Slovenia. Techno-Economic Behaviour and Direct Dating of Osseus Projectile Points. Journal of Human Evolution 78, 2015, 158–180.

Mottl 1942: M. Mottl, Das Aurignacien in Ungarn. Quartär 4, 1942, 82–108.

Mussi et al. 2006: M. Mussi/P. Gioia/F. Negrino, Ten Small Sites. The Diversity of the Italian Aurignacian. In: O. Bar-Yosef/J. Zilhão (eds.), Towards a Definition of the Aurignacian. Proceedings of the Symposium Held in Lisbon, Portugal, June 25–30, 2002. Trabalhos de Arqueologia 45 (Lisbon 2006) 189–209.

Neruda/Nerudová 2013: P. Neruda/Z. Nerudová, The Middle-Upper Palaeolithic Transition in Moravia in the Context of the Middle Danube Region. Quaternary International 294, 2013, 3–19.

Neugebauer-Maresch 2007: Ch. Neugebauer-Maresch, La statuette de Stratzing et l'Aurignacien en Basse Autriche. In: H. Floss/N. Rouquerol (eds.), Les chemins de l'art Aurignacien en Europe. Das Aurignacien und die Anfänge der Kunst in Europa (Aurignac 2007) 148–156.

Nigst 2006a: P. R. Nigst, The First Modern Humans in the Middle Danube Area? New Evidence from Willendorf II (Eastern Austria). In: N. J. Conard (ed.), When Neanderthals and Modern Humans Met (Tübingen 2006) 269–304.

Nigst 2006b: P. R. Nigst, Eine Behausung aus dem Gravettien? Vorläufige Ergebnisse der GIS-basierten Analyse der räumlichen Verteilung der Fundobjekte in Grub/Kranawetberg (Lower Austria). Archaeologica Austriaca 88, 2004, 29–66.

Nigst/Haesaerts 2012: P. R. Nigst/P. Haesaerts, L'Aurignacien en Basse Autriche. Résultats préliminaires de l'analyse technologique de la couche culturelle 3 de Willendorf II et ses implicatioins pour la chronologie du Paléolithique supérieur ancien en Europe centrale. L'anthropologie 116, 2012, 575–608.

Nigst et al. 2014: P. R. Nigst/P. Haesaerts/F. Damblon/C. Frank-Fellner/C. Mallol/B. Viola/M. Götzinger/L. Niven/G. Trnka/J.-J. Hublin, Early Modern Human Settlement of Europe North of the Alps Occured 43,500 Years Ago in a Cold Steppe-Type Environment. Proceedings of the National Academy of Sciences of the United States of America, Early Edition 111.7, 2014, 14394–14399. http://www.pnas.org/cgi/doi/10.1073/pnas.1412201111.

Noiret 2004: P. Noiret, Le Paléolithique supérieur de la Moldavie. L'anthropologie 108, 2004, 425–470.

Noiret 2009: P. Noiret, Le Paléolithique supérieur de Moldavie. ERAUL 124 (Liège 2009).

Richter 1987: J. Richter, Jungpaläolithische Funde aus Breitenbach/Kr. Zeitz im Germanischen Nationalmuseum Nürnberg. Quartär 37/38, 1987, 63–69.

Schmidt 1912: R. R. Schmidt, Die diluviale Vorzeit Deutschlands (Stuttgart 1912).

Sitlivy et al. 2014: V. Sitlivy/V. Chabai/M. Anghelinu/Th. Uthmeier/H. Kels/L. Niţă/I. Băltean/A. Veselsky/C. Ţuţu, Preliminary Reassessment of the Aurignacian in Banat (South-Western Romania). Quaternary International 351, 2014, 193–212.

Škrdla et al. 2011: P. Škrdla/F. Havlíček/T. Rychtaříková, Křepice (okr. Břeclav). 'Domovní kopce'. Aurignacien. Sídliště. Povrchový pruzkům. Přehled výzkumů 51, 2010, 282–283.

Soficaru et al. 2007: A. Soficaru/C. Petrea/A. Doboş/E. Trinkaus, The Human Cranium from the Peştera Cioclovina Uscată, Romania. Context, Age, Taphonomy, Morphology, and Paleopathology. Current Anthropology 48.4, 2007, 611–619.

Steguweit 2007/2008: L. Steguweit, Retuschierte Lamellen im Inventar der Aurignacien-Station Alberndorf (Lower Austria). Acta Archaeologica Carpathica 42/43, 2007/2008, 7–25.

Steguweit 2009a: L. Steguweit, Investigating the Aurginacian/Gravettian Transition in the Bistriţa Valley (NE-Romania). In: M. Camps/P. Chauhan, Sourcebook of Paleolithic Transitions (Washington 2009) 465–478.

Steguweit 2009b: L. Steguweit, Long Upper Palaeolithic Sequences from the Sites of Poiana Ciresului, Bistricioara and Ceahlau-Dartu (NE Romania). Preistoria Alpina 44, 2009, 33–38.

Steguweit 2010: L. Steguweit, New Insights into the Inventory of Alberndorf (Lower Austria) and some Remarks on the 'Epi-Aurignacian' Controversy. In: C. Neugebauer-Maresch/L. R. Owen, New Aspects of the Central and Eastern European Upper Palaeolithic. Methods, Chronology, Technology and Subsistence. Mitteilungen der Prähistorischen Kommission 72, 2010, 221–229.

Steguweit 2011: L. Steguweit, Neue paläolithische Funde aus Bayern. Fines Transire 20, 2011, 43–52.

Stepanchuk et al. 2009: V. Stepanchuk/I. V. Spozhnikov/M. Gladkikh/H. S. Ryzhov, Ukrainian Upper Palaeolithic between 40/10.000 BP. Current Insights into Environmental-Climatic Change and Cultural Development. In: F. Djindjian/J. Kozłowski/N. Bicho (eds.), Le concept de territoires dans le Paléolithique supérieur européen. BAR International Series 1938 (Oxford 2009) 63–74.

Svoboda 1987: J. Svoboda, Výzkum aurignacké stanice Stránská skála II. Archeologické rozhledy 39, 1987, 376–383.

Svoboda 2001: J. Svoboda, Mladec and Other Caves in the Middle Danube Region. Early Modern Humans, Late Neandertals, and Projectiles. In: J. Zilhão/T. Aubry/A. F. Carvalho (eds.), Les premiers hommes modernes de la péninsule ibérique. Actes du colloque de la commission VIII de l'UISPP (Vila nova de Foy Côa, 22–24 octobre 1998) (Lisbon 2001) 45–60.

Svoboda 2003: J. Svoboda, The Bohunician and the Aurignacian. In: J. Zilhão/F. d'Errico (eds.), The Chronology of the Aurignacian and the Transitional Technocomplexes. Dating, Stratigraphies, Cultural Implications (Lisbon 2003) 123–131.

Svoboda 2006: J. Svoboda, The Aurignacian and After. Chronology, Geography and Cultural Taxonomy in the Middle Danube Region. In: O. Bar-Yosef/J. Zilhão (eds.), Towards a Definition of the Aurignacian. Trabalhoes de Arqeologia 45, 2006, 259–274.

Tafelmaier 2015: Y. Tafelmaier, 'Trapped in Terms'. The Proto-Aurignacian and Early Aurignacian of Northern Spain. In: A. Maier (ed.), Abstracts 57th Annual Meeting of the Obermaier Society at Heidenheim 2015. Special Session on 'Symbolic Communication and Modern Culture' (Erlangen 2015) 68–69.

Terberger et al. 2013: Th. Terberger/H. Floss/Ph. Heinzelmann/A. Kotula/J. Serangeli, Down the River Rhine ca. 16,000 Years Ago. New Evidence from the Site Dreieich-Götzenhain, Hessen. In: A. Pastoors/B. Auffermann (eds.), Pleistocene Foragers. Their Culture and Environment, Festschrift in Honour of Gerd-Christian Weniger for his Sixtieth Birthday, Wissenschaftliche Schriften des Neanderthal Museums (Mettmann 2013) 101–115.

Teyssandier 2003: N. Teyssandier, Les débuts de l'Aurignacien en Europe. Discussion à partir des sites de Geissenklösterle, Willendorf II, Krems-Hundssteig et Bacho Kiro (unpublished PhD-Thesis Université Paris X-Nanterre 2003).

Teyssandier 2005: N. Teyssandier, Neue Perspektiven zu den Anfängen des Aurignacien. Mitteilungen der Gesellschaft für Urgeschichte 14, 2006, 11–24.

Teyssandier 2007: N. Teyssandier, En route vers l'Ouest? Les debuts de l'Aurignacien en Europe centrale et dans les Balkans. In: H. Floss/N. Rouquerol (eds.), Les chemins de l'art Aurignacien en Europe. Das Aurignacien und die Anfänge der Kunst in Europa (Aurignac 2007) 117–130.

Trinkaus et al. 2003a: E. Trinkaus/O. Moldovan/S. Milota/A. Bilgăr/L. Sarcina/S. Athreya/S. E. Bailey/R. Rodrigo/G. Mircea/T. Higham/C. B. Ramsey/J. van der Plicht, An Early Modern Human from the Peștera cu Oase. Proceedings of the National Academy of Sciences of the United States of America 100.20, 2003, 11231–11236.

Trinkaus et al. 2003b: E. Trinkaus/S. Milota/R. Rodrigo/G. Mircea/O. Moldovan, Early Modern Human Cranial Remains from the Peştera cu Oase, Romania. Journal of Human Evolution 45, 2003, 245–253.

Tsanova/Bordes 2003: T. Tsanoca/J-G. Bordes, Contribution au débat sur l'origine de l'aurignacien: principaux résultats d'une étude technologique de l'industrie lithique de la couche 11 de Bacho Kiro. In: Ts. Tsonev/E. Montagnari Kokelj (eds.) The Humanized Mineral World. Towards Social and Symbolic Evaluation of Prehistoric Technologies in South Eastern Europe Proceedings of the ESF Workshop, Sofia – 3–6 September 2003. ERAUL 103, 2003, 41–50.

Uthmeier 2004: Th. Uthmeier, Micoquien, Aurignacien und Gravettien in Bayern. Eine regionale Studie zum Übergang vom Mittel- zum Jungpaläolithikum in Bayern. Archäologische Berichte 18 (Bonn 2004).

Valde-Nowak et al. 2013: P. Valde-Nowak/R. Nadachowski/T. Madeyska (eds.), Obłazowa Cave. Human Activity, Stratigraphy and Palaeoenviroment (Krakow 2003).

Valoch 1996: K. Valoch, Das Mittelwürm in den Lössen Südmährens und seine paläolithischen Kulturen. Eiszeitalter und Gegenwart 46, 1996, 54–64.

Valoch 2010: K. Valoch, Paläolithische Archäologie in der ehemaligen Tschechoslovakei und ihr Beitrag zur mitteleuropäischen Forschung. Mitteilungen der Gesellschaft für Urgeschichte 19, 2010, 71–115.

Vértes 1960: L. Vértes, Die Altsteinzeit der südlichen Donaugebiete. Quartär 12, 1960, 53–105.

Vishniatsky/Nehoroshev 2004: L. B. Vishniatsky/P. E. Nehoroshev, The Beginning of the Upper Paleolithic on the Russian Plain. In: P. J. Brantingham/S. L. Kuhn/K. W. Kerry, The Early Upper Paleolithic Beyond Western Europe (Berkeley 2004) 80–96.

Zilhão et al. 2007: J. Zilhão/E. Trinkaus/S. Constantin/S. Milota/M. Gherase/L. Sarcina/A. Danciu/H. Rougier/J. Quilès/R. Rodrigo, The Peștera cu Oase People, Europe‘s Earliest Modern Humans. In: P. Mellars/K. Boyle/O. Bar-Yosef/C. Stringer (eds.), Rethinking the Human Revolution. New Beahvioral and Biological Perspectives on the Origin and Dispersal of Modern Humans (Cambridge 2007) 249–262.

List of sites

No.	Site	Country	Longitude	Latitude	Reference
1	Königsbach-Stein	Germany	08.58324	49.00263	Floss/Poenicke 2006
2	Göpfelstein-höhle	Germany	09.20967	48.17976	Bolus 2012
3	Ronco del Gatto	Italy	09.74933	44.69602	Mussi et al. 2006
4	Hohle Fels	Germany	09.75000	48.36999	Conard/Bolus 2008; Bolus 2012; 2011
5	Sirgenstein	Germany	09.76000	48.38000	Hahn 1977, 92–94; Conard/Bolus 2008; Bolus 2012; Schmidt 1912
6	Brillenhöhle	Germany	09.77000	48.39999	Hahn 1977, 92; Conard/Bolus 2008; Bolus 2012; 2011
7	Geissenklösterle	Germany	09.77999	48.39000	Hahn 1977; Teyssandier 2003; 2005; Conard/Bolus 2008; Bolus 2011
8	Börslingen	Germany	10.05788	48.54623	Floss et al. 2012
9	Bockstein-Törle	Germany	10.14000	48.54999	Hahn 1977, 83–85; Conard/Bolus 2008; Bolus 2012
10	Bockstein-Höhle	Germany	10.15822	48.55439	Hahn 1977, 82; Bolus 2011
11	Hohlenstein-Bärenhöhle	Germany	10.16000	48.50999	Hahn 1977; Conard/Bolus 2008
12	Hohlenstein-Stadel	Germany	10.16000	48.50999	Hahn 1977
13	Vogelherd	Germany	10.19000	48.54999	Hahn 1977, 87–92; Conard/Bolus 2008; Bolus 2012
14	Lemignano	Italy	10.26312	44.77266	Mussi et al. 2006
15	Kleine Ofnet	Germany	10.44999	48.82999	Schmidt 1912
16	Große Ofnet	Germany	10.45031	48.81850	Uthmeier 2004; Schmidt 1912
17	Grotta di Fumane	Italy	10.90518	45.59181	Mussi et al. 2006
18	Laisäcker	Germany	11.17183	48.75105	Uthmeier 2004
19	Grotta di Paina	Italy	11.51766	45.47174	Mussi et al. 2006
20	Fischleitenhöhle	Germany	11.62838	49.00992	Uthmeier 2004
21	Irnsing	Germany	11.75050	48.73868	Uthmeier 2004
22	Großes Schulerloch	Germany	11.82635	48.92766	Uthmeier 2004

No.	Site	Country	Longitude	Latitude	Reference
23	Obernedern-Höhle	Germany	11.83606	48.93280	Uthmeier 2004
24	Monte Avena	Italy	11.89087	46.00777	Mussi et al. 2006
25	Kapfelberg	Germany	11.98081	48.93130	Uthmeier 2004
26	Sinzing - Räuberhöhle	Germany	12.00161	49.01860	Uthmeier 2004
27	Westerberg	Germany	12.12882	48.90653	Uthmeier 2004
28	Keilberg - Zur hohen Linie	Germany	12.14899	49.04352	Uthmeier 2004
29	Keilberg - Zur hohen Linie-Ost	Germany	12.15359	49.03688	Uthmeier 2004
30	Keilberg - Kirche	Germany	12.15929	49.04797	Uthmeier 2004
31	Keilberg - Silberbrunn	Germany	12.16276	49.03604	Uthmeier 2004
32	Kirchroth-Keller	Germany	12.53676	48.97208	Uthmeier 2004
33	Windorf	Germany	13.22278	48.62444	Steguweit 2011
34	Vornbach im Inntal	Germany	13.43637	48.48581	Steguweit 2011
35	Šandalja II	Croatia	13.88931	44.88390	Karavanić 2003
36	Divje-Babe I	Slovakia	13.91568	46.11249	Moreau et al. 2015
37	Mokriška jama	Slovakia	14.56803	46.30848	Moreau et al. 2015
38	Potočka zijalka	Slovakia	14.66908	46.44928	Moreau et al. 2015
39	Lokve	Croatia	14.76222	45.36055	Vértes 1960
40	Willendorf II	Austria	15.39000	48.32000	Nigst 2006a; Nigst/Haesaerts 2012; Nigst et al. 2014; Svoboda 2006
41	Schwallenbach	Austria	15.40000	48.32999	Svoboda 2003; Nigst/Haesaerts 2012
42	Senftenberg	Austria	15.55000	48.43000	Neruda/Nerudová 2013
43	Krems-Galgenberg	Austria	15.6000	48.43000	Neugebauer-Maresch 2007; Neruda/Nerudová 2013
44	Krems-Hundssteig	Austria	15.60000	48.40999	Teyssandier 2003; 2005; Neruda/Nerudová 2013
45	Horn, Raabserstraße	Austria	15.66000	48.67000	Svoboda 2006

No.	Site	Country	Longitude	Latitude	Reference
46	Getzersdorf	Austria	15.66443	48.16094	Nigst 2006a
47	Langmanners-dorf	Austria	15.86999	48.28999	Angeli 1952/1953; Richter 1987
48	Großweikers-dorf	Austria	15.98300	48.47000	Neruda/Nerudová 2013
49	Velika Pećina	Croatia	16.03000	46.28000	Karavanić 2003
50	Vindija	Croatia	16.07056	46.29944	Moreau et al. 2015
51	Alberndorf	Austria	16.09162	48.70205	Steguweit 2007/2008; Neruda/Nerudová 2013; Steguweit 2010
52	Tvarožná I	Czech Republic	16.16774	49.19111	Mlejnek 2010
53	Vedrovice	Czech Republic	16.35999	49.00999	Valoch 1996
54	Marsovice	Czech Republic	16.41000	49.03000	Valoch 2010
55	Obciny	Czech Republic	16.66000	49.21999	Richter 1987
56	Stránská Skálá II	Czech Republic	16.67583	49.19056	Svoboda 1987; Svoboda 2003; Neruda/Nerudová 2013
57	Milovice I	Czech Republic	16.69900	48.85100	Davies 2003
58	Krepice	Czech Republic	16.71000	48.99000	Škrdla et al. 2011
59	Pod hradem	Czech Republic	16.71999	49.38000	Valoch 1996
60	Stillfried B	Austria	16.82999	48.39999	Valoch 1996
61	Mladeč	Czech Republic	17.01861	49.70694	Svoboda 2001
62	Ondratice	Czech Republic	17.05944	49.35917	Masojć/Bronowicki 2003; Mlejnek et al. 2012
63	Dzerava Skála	Slovakia	17.32472	48.49694	Hahn 1977; Neruda/Nerudová 2013
64	Poviná	Czech Republic	17.32999	49.07999	Mlejnek 2013
65	Kunov	Slovakia	17.40718	48.69240	Kaminská 2001
66	Hlboké	Slovakia	17.41010	48.65760	Kaminská 2001
67	Prietrž	Slovakia	17.44889	48.67489	Kaminská 2001
68	Luscic	Bosnia	17.74194	44.75364	Montet-White 1994

No.	Site	Country	Longitude	Latitude	Reference
69	Mala Gradina	Bosnia	17.74194	44.75364	Montet-White 1994
70	Zarilac	Croatia	17.87134	45.34655	Karavanić 1995
71	Lubotyń	Poland	17.93000	50.04999	Masojć/Bronowicki 2003
72	Dzierżysław 8	Poland	17.98000	50.03999	Masojć/Bronowicki 2003
73	Trenčín	Slovakia	18.04779	48.89023	Kaminská 2001
74	Pietrowice Wielkie 4B	Poland	18.09000	50.07999	Masojć/Bronowicki 2003
75	Londza	Bosnia	18.10287	44.74290	Montet-White 1994
76	Jankovich	Hungary	18.57562	47.72308	Dobosi 2005
77	Szob Komar-földek	Hungary	18.87453	47.82308	Dobosi 2005
78	Veröce - Fehérhegy	Hungary	19.05460	47.82639	Dobosi 2005
79	Zamkowa Dolna	Poland	19.26000	50.75000	Masojć/Bronowicki 2003
80	Galgagkyörk-Májóka	Hungary	19.36762	47.74433	Dobosi 2005
81	Galgagyörk-Komárka	Hungary	19.36762	47.74433	Dobosi 2005
82	Galgagyörk-Szárhegy	Hungary	19.36762	47.74433	Dobosi 2005
83	Acsa	Hungary	19.37640	47.79523	Mester 2014
84	Deszczowa	Poland	19.51000	50.79999	Masojć/Bronowicki 2003
85	Piekary II	Poland	19.78999	50.00999	Masojć/Bronowicki 2003
86	Kraków-Sowiniec	Poland	19.82999	50.04999	Masojć/Bronowicki 2003
87	Nagyréde	Hungary	19.83545	47.77143	Mester 2014
88	Mamutowa	Poland	19.85701	50.17038	Masojć/Bronowicki 2003
89	Kraków-Zwierzyniec	Poland	19.87999	50.06000	Masojć/Bronowicki 2003
90	Kraków-Spadzista	Poland	19.89999	50.04999	Masojć/Bronowicki 2003
91	Kraków-St. Bronisława	Poland	19.91000	50.04999	Masojć/Bronowicki 2003

No.	Site	Country	Longitude	Latitude	Reference
92	Salitrena	Serbia	20.07839	44.19052	Borić et al. 2012; Chu et al. 2014
93	Obłazowa	Poland	20.12588	49.42862	Walde-Nowak et al. 2003
94	Istállóskó	Hungary	20.41890	48.07167	Lengyel et al. 2007; Mottl 1942; Neruda/Nerudová 2013
95	Peskö	Hungary	20.42315	48.04725	Borić et al. 2012
96	Haligovce	Slovakia	20.45275	49.38320	Vértes 1960
97	Jaksice	Poland	20.53999	50.14999	Masojć/Bronowicki 2003
98	Szeleta	Hungary	20.63886	48.10844	Adams/Ringer 2004
99	Čečejovce	Slovakia	21.06667	48.60000	Kaminská 2001
100	Seňa	Slovakia	21.25730	48.55890	Kaminská 2001
101	Kechnec	Slovakia	21.26444	48.54917	Kaminská 2001
102	Barca	Slovakia	21.26500	48.67778	Vértes 1960
103	At	Romania	21.27779	45.13629	Chu et al. 2014
104	Bardejov	Slovakia	21.29260	49.30006	Kaminská 2001
105	Crvenka I + II	Romania	21.30506	45.15512	Chu et al. 2014; Dogandžić et al. 2014
106	Orlovača	Serbia	21.52868	44.13846	Dogandžić et al. 2014
107	Kučín	Slovakia	21.75085	48.86662	Kaminská 2001
108	Peștera cu Oase	Romania	21.83333	45.01666	Trinkaus et al. 2003a; Zilhão et al. 2007; Anghelinu et al. 2012
109	Gornea	Romania	21.85230	44.67957	Chu et al. 2014; Dogandžić et al. 2014
110	Donja Pećina	Serbia	22.08774	43.33729	Kuhn et al. 2014
111	Tincova	Romania	22.14509	45.57180	Anghelinu/Niţă 2014; Sitlivy et al. 2014
112	Tibava	Slovakia	22.20930	48.74120	Kaminská 2001; Valoch 2010
113	Baranica	Serbia	22.29405	43.52689	Borić et al. 2012
114	Tabula Traiana	Serbia	22.30604	44.65309	Borić et al. 2012

No.	Site	Country	Longitude	Latitude	Reference
115	Coşava	Romania	22.31200	45.84830	Anghelinu/Niţă 2014; Sitlivy et al. 2014
116	Româneşti Dumbraviţă	Romania	22.32086	45.81733	Anghelinu/Niţă 2014; Sitlivy et al. 2014
117	Selačka	Serbia	22.33549	43.70237	Kuhn et al. 2014
118	Hotilor	Romania	22.42839	44.89648	Anghelinu et al. 2012; Anghelinu/Niţă 2014
119	Coliboaia	Romania	22.59733	46.53082	Ghemiş et al. 2011
120	Beregovo	Ukraine	22.61275	48.19505	Demidenko/Noiret 2012
121	Kozarnika	Bulgaria	22.69535	43.65284	Borić et al. 2012
122	Bordul Mare	Romania	23.11667	45.51667	Anghelinu/Niţă 2014
123	Cioclovina	Romania	23.14417	45.59028	Anghelinu/Niţă 2014; Soficaru 2007
124	Remetea Şomoş	Romania	23.32833	47.88805	Anghelinu/Niţă 2014
125	Boineşti	Romania	23.35120	47.91570	Anghelinu/Niţă 2014
126	Suharu	Romania	23.39218	44.26718	Vértes 1960
127	Buşag	Romania	23.42780	47.65870	Anghelinu/Niţă 2014
128	Perii Vadului	Romania	23.55999	47.35000	Dobrescu 2008
129	Pešt	Bulgaria	23.70456	43.13843	Vértes 1960
130	Peștera Muierilor	Romania	23.75390	45.19221	Vértes 1960; Anghelinu et al. 2012
131	Călineşti	Romania	23.97495	47.77991	Anghelinu/Niţă 2014
132	Samuilica	Bulgaria	23.98000	43.18999	Churchill/Smith 2000
133	Vădastra	Romania	24,36555	43.86791	Leroi-Gourhan et al. 1967; Hahn 1977; Anghelinu/Niţă 2014
134	Temnata	Bulgaria	24.05010	43.16677	Teyssandier 2007
135	Mezhigirtsi	Ukraine	24.78726	49.12408	Stepanchuk et al. 2009
136	Ciuperceni	Romania	24.93037	43.75629	Anghelinu/Niţă 2014
137	Calinesti	Romania	25.23000	44.07999	Dobrescu 1999

No.	Site	Country	Longitude	Latitude	Reference
138	Bacho-Kiro	Bulgaria	25.43028	42.94666	Teyssandier 2003; 2005; 2007
139	Bistricioara-Lutărie I	Romania	25.48631	47.07339	Anghelinu/Niţă 2014
140	Gura Cheii Râşnov	Romania	25.51000	45.57999	Dobrescu 2008
141	Koulychivka	Ukraine	25.69522	50.14410	Vishniatsky/Nehoroshev 2004
142	Ceahlau	Slovakia	25.96202	47.04032	Vértes 1960; Steguweit 2009b
143	Dârţu	Romania	25.97502	47.04339	Steguweit 2009b; Anghelinu/Niţă 2014
144	Podiş	Romania	25.99090	47.04345	Steguweit 2009a; Anghelinu/Niţă 2014
145	Giurgiu-Malu Rosu	Romania	25.99576	43.90622	Alexandrescu et al. 2004; Anghelinu et al. 2012
146	Cetăţica I	Romania	26.02884	47.02953	Steguweit 2009a; Anghelinu/Niţă 2014
147	Lapos	Romania	26.03000	44.79999	Anghelinu/Niţă 2014
148	Cremenea-Poieniţă	Romania	26.04177	45.65420	Anghelinu/Niţă 2014
149	Cremenea-Malu Dinu Buzea	Romania	26.08334	45.60959	Anghelinu/Niţă 2014
150	Nicolae Balcescu	Romania	26.73540	44.44928	Alexandrescu et al. 2010
151	Mitoc - Malu Galben	Moldova	27.02383	48.09772	Noiret 2004; 2009
152	Molodovar	Ukraine	27.06649	48.53223	Vishniatsky/Nehoroshev 2004
153	Corpaci-Mâs	Moldova	27.13946	48.00259	Noiret 2004; 2009
154	Korman	Ukraine	27.16082	48.56027	Vishniatsky/Nehoroshev 2004
155	Climăuţi II	Moldova	27.61944	48.31253	Noiret 2004; 2009
156	Topalu	Romania	28.04063	44.58587	Vértes 1960
157	Brynzeny	Moldova	28.45000	47.67390	Vishniatsky/Nehoroshev 2004
158	Mamaia-Sat	Romania	28.60820	44.29156	Anghelinu/Niţă 2014
159	Zeleny Khutor	Ukraine	30.22693	46.42783	Stepanchuk et al. 2009

JANUSZ K. KOZŁOWSKI

The Mesolithic of the Aegean Basin
Cultural Variability, Subsistence Economy, Interregional Links and Seafaring

Keywords: Mesolithic, Aegean basin, taxonomic units, raw materials, subsistence economy.

Abstract

The evolution of the Mesolithic in the Aegean basin is analysed in respect of cultural evolution, with particular emphasis on the issue of taxonomy and economy in the context of the development of the entire Mediterranean basin. Our analysis has allowed to distinguish a specific unit that formed in the Aegean islands when they were settled at the Pleistocene/Holocene transition. The factor that facilitated this colonization was seafaring. The 'Aegean Mesolithic' demonstrates, on the one hand, the adaptation of Mesolithic sailors to ecological conditions on the Aegean islands, on the other hand, the isolation of the islands from the mainland. At the same time, contact over the sea with Anatolia and Cyprus provided an incentive for the early appearance (as early as the first half of the 9th mill. calBC) of some elements of the 'Neolithic package' among the Mesolithic foragers/fishers groups on the Aegean islands. This process had been completed by the adoption of the full Neolithic package before the appearance of ceramics on the coast of the Peloponnese and in Crete.

Introduction

The cultural variability in the Terminal Palaeolithic of the Balkans, the Danube basin and the western coast of the Black Sea had been, first of all, the consequence of continuing evolution of Gravettian traditions. In the time interval between 12.000 and 9600 calBC three cultural provinces can be distinguished: the Balkan Epigravettian (Mihajlović 1999; Mihajlović/Mihajlović 2007; Kozłowski 1999), the Epigravettian of the Middle and the Lower Danube basin (Lengyel 2008/2009), and the Gravettian of the Pontic zone (Olenkovski 2008). These units were contemporaneous with the Antalyan in southern Anatolia (Kozłowski 1994), the Trialetian and the Zarzian in the territory of eastern Anatolia, in Transcaucasia and Iraq (Gebel/Kozłowski 1994) and also with the Natufian in the Near East (*fig. 1*). Although the Aegean basin separates these two territories, the development of seafaring, documented by the distribution of obsidian from the island of Melos (Perlès 1987), caused that the entire Aegean Sea basin became a single cultural unit i.e. the Aegean Mesolithic (Sampson et al. 2002; Kozłowski 2005).

In effect, at the beginning of the Holocene, in the Early Mesolithic, a contrast is observable between the cultural units in eastern Greece, repre-

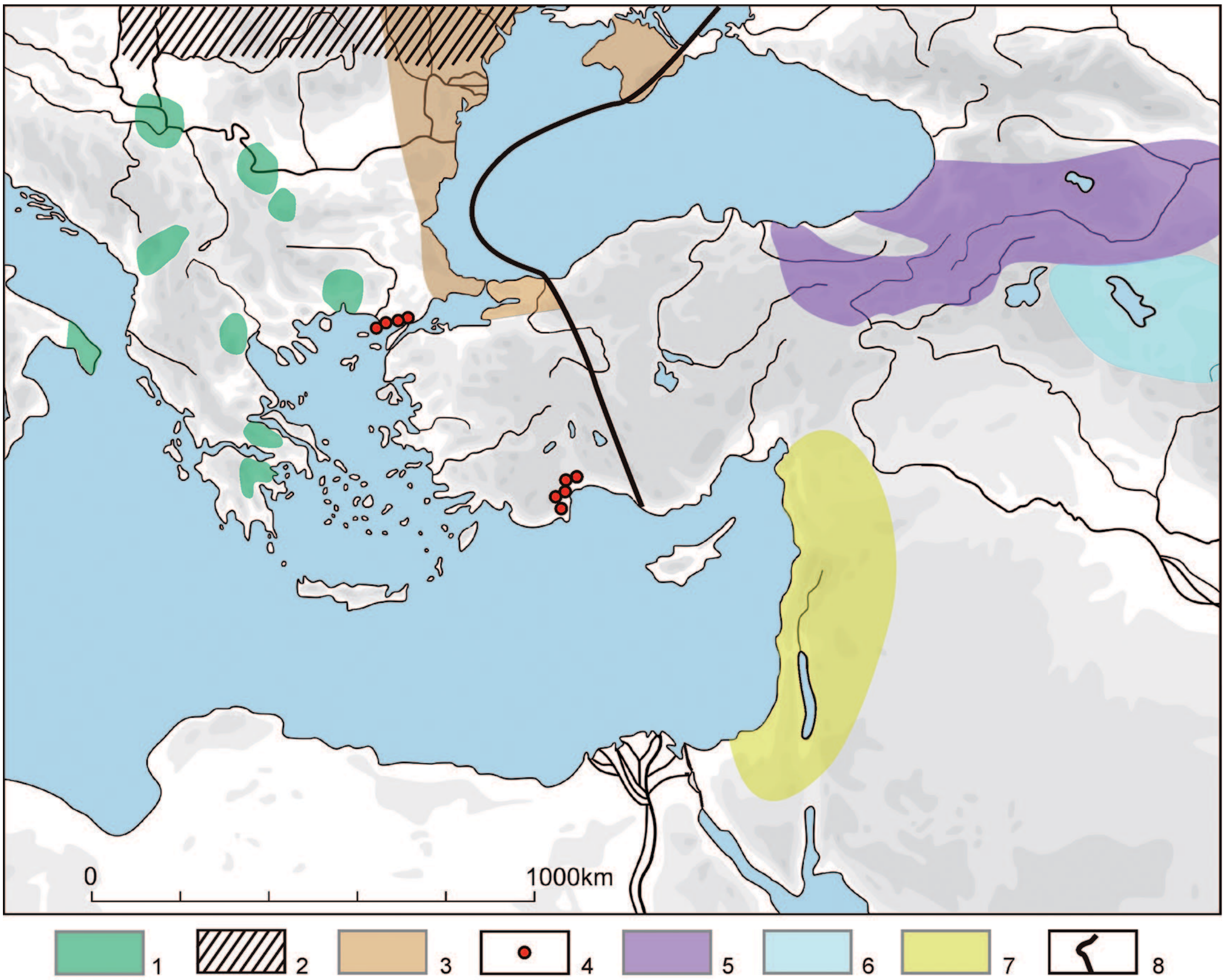

Fig. 1. Final Palaeolithic of the Eastern Mediterranean and the Black Sea Basin (12.000 – 10.000 BP). Culture units: 1. Balkan Epigravettian; 2. Carpathian Epigravettian; 3. Pontic Epigravettian; 4. Antalyan; 5. Trialetian; 6. Zarzian; 7. Natufian; 8. Eastern Limit of the Epigravettian Tradition (Graph by author).

sented by multilevel sites such as the Franchthi and the Klissoura Caves, and the 'Aegean Mesolithic' sites in the Aegean islands such as, most importantly, Gioura, Kythnos, Ikaria, Naxos (Sampson et al. 2010). At the same time the northern, marginal, zone of the Aegean basin (the sites on the island of Lemnos, Gokceada, and on the Gallipoli Peninsula) and south-western Anatolia (the Öküzini sequence – layers Ia1 and Ib1) diverge from the typical Aegean Mesolithic (*fig. 2*).

The Mesolithic of Eastern Continental Greece – Taxonomic Issues

In the north-eastern Peloponnese there are two sequences: The Franchthi Cave (Perlès 1987, 199) and Cave 1 in the Klissoura Gorge (Kozłowski/Stiner 2010; Kaczanowska et al. 2010) provided assemblages of the time-span from the Pleistocene/Holocene transition to the Late Mesolithic (Franchthi, layers VII–IX: 8700 – 7170 calBC; Klissoura Cave 1 layer 5a – 8290 calBC; for layers 5 and 3 radiometric determinations are not available) (*fig. 3*). In the Franchthi Cave, layer X appear even the first harbingers of the pre-ceramic neolithisation in the sphere of subsistence economy (Perlès 1995).

In Cave 1 in the Klissora Gorge (*fig. 4*) three Mesolithic layers were registered; layers 5a, 5 and 3 provided assemblages that represent blade industries, strongly linked with the local Epigravettian traditions. Amongst the distinctive features of these industries are a high index of microliths and notably backed pieces with a straight or

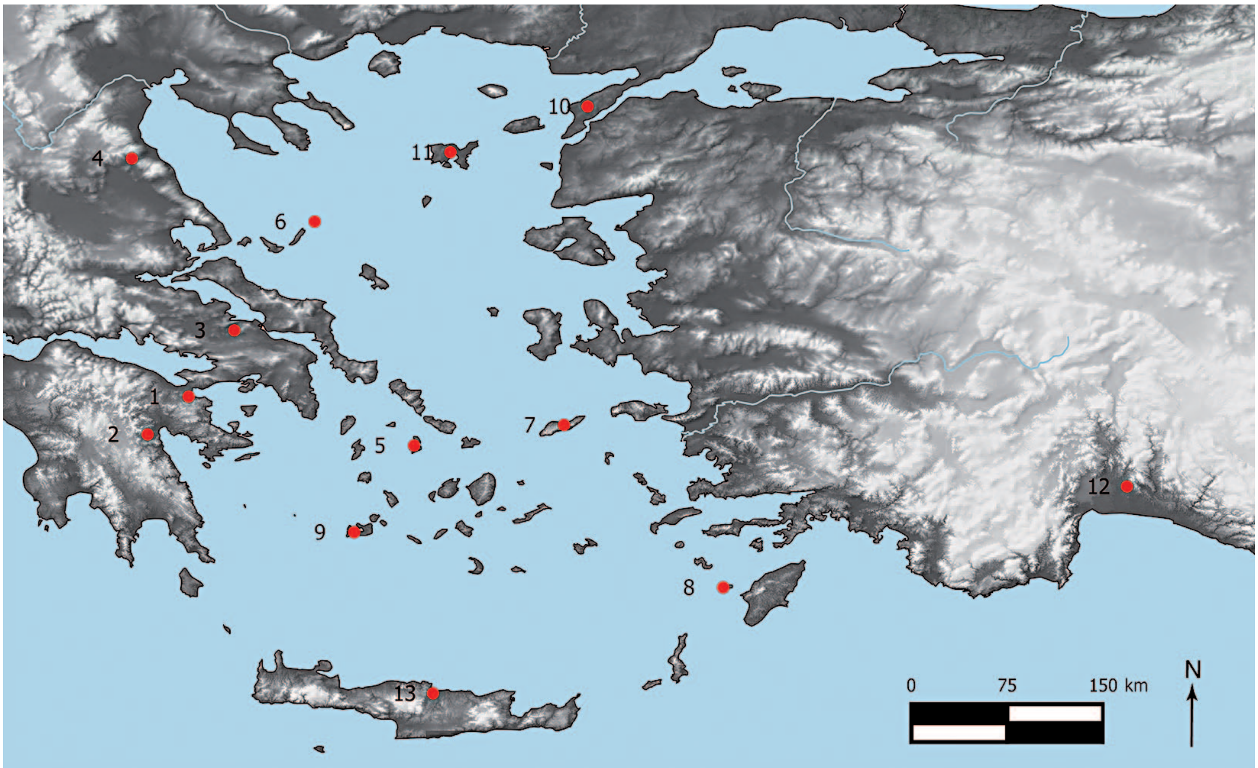

Fig. 2. Map of the Mesolithic multi-layer and multi-occupational sites: 1. Klissoura Cave 1; 2. Franchthi Cave; 3. Sarakenos Cave; 4. Theopetra Cave; 5. Kythnos-Maroulas; 6. Gioura – Cyclope Cave; 7. Ikaria-Kerame; 8. Chalki; 9. Naxos; 10. Ucdutlar; 11. Lemnos; 12. Öküzini; 13. Knossos (map by S. Fröhle and S. Wettengl).

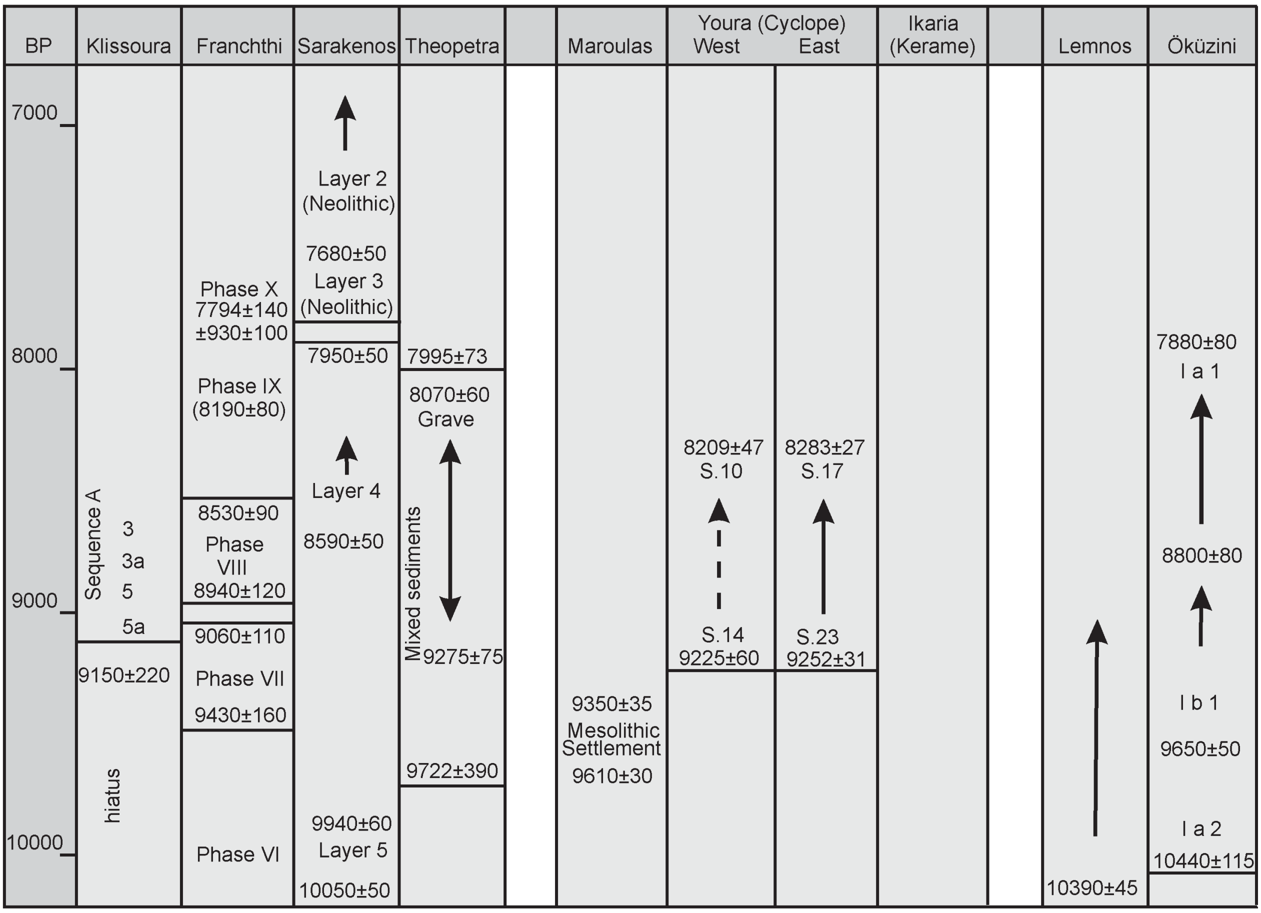

Fig. 3. Radiocarbon dates for the Mesolithic sequences in the Aegean Basin: Continental Greece, Aegean Islands and Northern Aegean (with reference to the Öküzini sequence, after Yalcinkaya et al. 2002). Timescale: Uncalibrated BP (Graph by author).

Fig. 4. Klissoura, Cave 1. View of the site. Photograph by author.

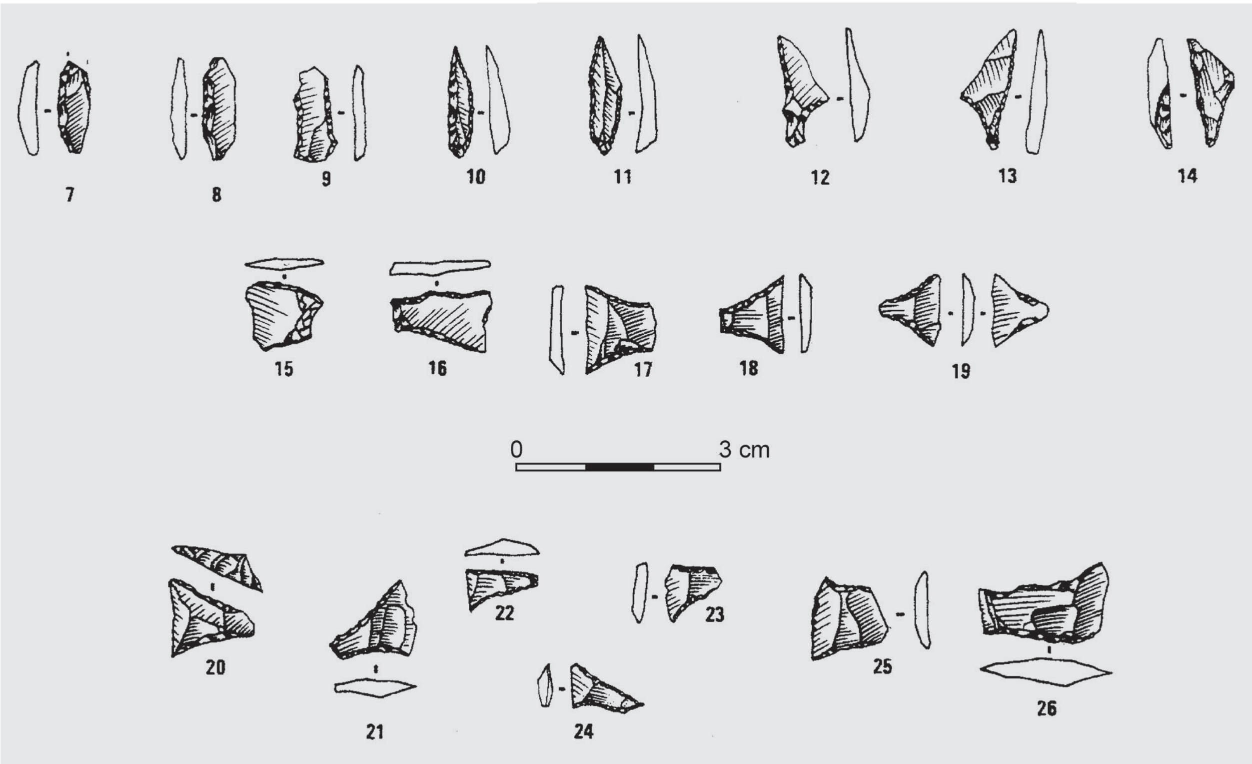

Fig. 6. Franchthi Cave, phase VIII. Backed bladelets, backed bladelets with a proximal concave truncation, double truncations, trapezes (acc. to Pèrles 2001).

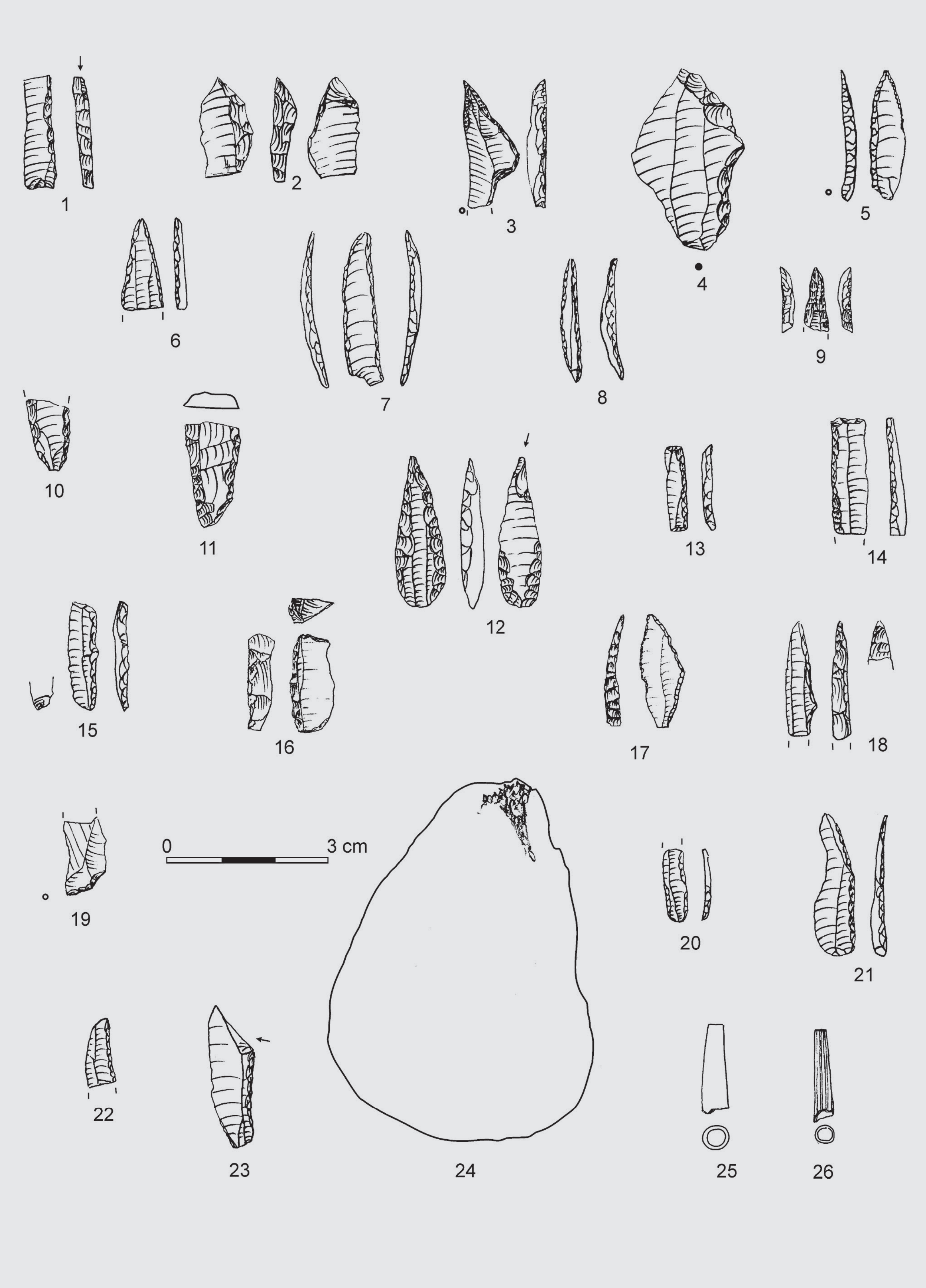

Fig. 5. Klissoura Cave 1. Sequence A, layer 5a: Sauveterrian points, triangles, rectangles, microretouched bladelets (acc. to Kaczanowska et al. 2010).

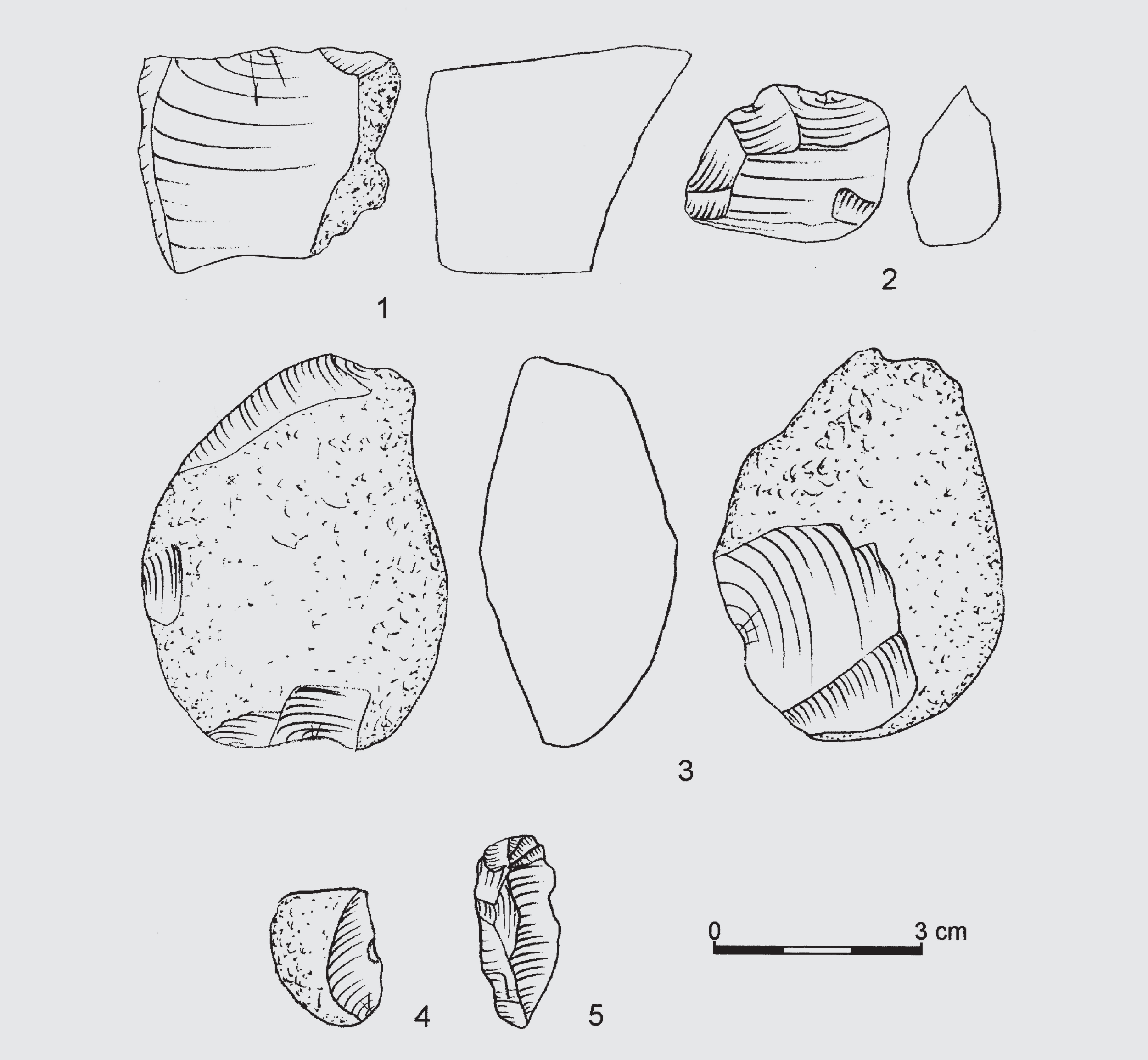

Fig. 7. Sarakenos Cave, layer 4. Limestone and sandstone cores and flakes. Drawings by author.

weakly convex blunted back. Moreover, geometrical forms occur such as rectangles and obtuse triangles. The manifestation of western traditions is only the presence of small, very thin Sauvetarrian microliths produced without the use of microburin technique (*fig. 5*). It can be assumed that in the Early Holocene the cave was inhabited by isolated, conservative groups, who used a flint industry rooted in the local traditions.

In the case of the Franchthi Cave phase VII the beginning of the Mesolithic is characterized by a dramatic drop in the frequency of microliths (backed pieces, geometrics) in comparison with the Late Palaeolithic Epigravettian level VI, namely from 60% to merely 8%. The frequency of microburins shows a similar, sharp decrease. Simultaneously, the proportion of flake tools with marginal retouch and denticulated-notched tools increased (Perlès 1995, fig. 6). Such a drastic change at the boundary between the Pleistocene and the Holocene can be the result of changes in the subsistence economy (growing importance of snail and mollusc gathering) or the fact that good quality raw materials were unavailable. In the Late Mesolithic layer VIII, in contrary the pattern is reversed: the frequency of microliths is higher, both backed pieces, including specimens with proximal concave truncations, as well as geometric forms, such as truncations and trapezes (*fig. 6*). Considering the presence of regular blade technique the changes observable in the contact zone between layers VII and VIII can be ascribed to impulses from the milieu of the central and western Mediterranean Castelnovian. Although in layer IX flake tools (with marginal and notched retouch) re-appear, strong links with the western Mediterranean are evidenced by the presence of *armatures à tranchant transversal* (Perlès 1995, fig. 9). In level X elements of Neolithic economy appear but the regular blade technique is employed again (Perlès 2001, fig. 3.1–2).

Thus, the variability of the Mesolithic of Continental Greece has its source in the western impulses from the Sauveterroid and the Castelnovian units, but – moreover – in the isolation of some Mesolithic groups. Besides layer VII from the Franchthi Cave, the best example of this phenomenon are the Late Mesolithic inventories from layer 4 in the Sarakenos Cave in Boeotia (Sampson et al. 2009). In this layer the sole exploited raw materials were limestone and sandstone, worked by means of flaking technique (*fig. 7*) – which is unlike the Late Palaeolithic and the Neolithic, when extralocal raw materials such as obsidian, flint and radiolarite were used.

The Mesolithic of the Aegean Islands – Chronology and Cultural Taxonomy

Unlike in continental Greece the inhabitants of the islands in the Aegean Sea elaborated broad networks of contacts. The settling of the islands must have taken place in several migration waves from the continent, and repeated contacts in between the various islands. The sequence of dates from the site of Maroulas on Kythnos (Facorellis et al. 2010) points to a relatively early settling of the Cyclades (the first half of the 9th mill. calBC) (*fig. 8*).

The lithic industry at Maroulas is mainly based on local quartz (56%), but shows also a high proportion of extralocal, Melian, obsidian (31.1%). The presence of flint (10.8%) can in turn evidence contacts with Continental Greece.

Among the tools, the most frequent are denticulated-notched forms, end-scrapers, perforators and arched backed pieces (*fig. 9*).

Fig. 8. Kythnos Island: view of the Maroulas site. Photograph by author.

The dates from the western trench in the Cyclope Cave on the island of Gioura are only slightly younger than from Maroulas (the middle of the 9th mill. calBC). The small lithic inventory from this site are mainly flakes and flake tools, end-scrapers, retouched flakes and notched tools (Sampson et al. 1998; Sampson 2008).

Remains of Mesolithic occupation were also found in other islands in the Aegean Sea. For example, groups of sailors reached Ikaria. Analysis of the inventory from the site of Kerame I in Ikaria (Sampson et al. 2012) showed its similarity to the industry from Maroulas in Kythnos (*fig. 10*). Thus, it can be assumed that fairly early groups of sailors reached Ikaria and settled the island. Regretfully, radiocarbon dates could not be obtained, while dates from hydratation of obsidian are not sufficiently precise. Artefacts from Kerame I, made from extralocal raw materials, notably obsidian from Melos and Ghiali confirm contacts with zones of the Aegean about 170km away to the southwest (Melos) and about 130km to the southeast (Ghiali).

The Early Mesolithic occupation of the Aegean islands and raw material circulation between the islands confirm that the inhabitants of the Aegean islands mastered seafaring, and were adapt at taking advantage of local currents and favourable winds.

Sites ascribed to the Late Phase of the Mesolithic on the Aegean islands have been relatively poorly recognized. The most complete sequence was discovered in the Cyclope Cave on the island of Gioura (Sampson 2008; Kaczanowska/Kozłowski 2008) (*fig. 11*). The Late Mesolithic layers, dated to

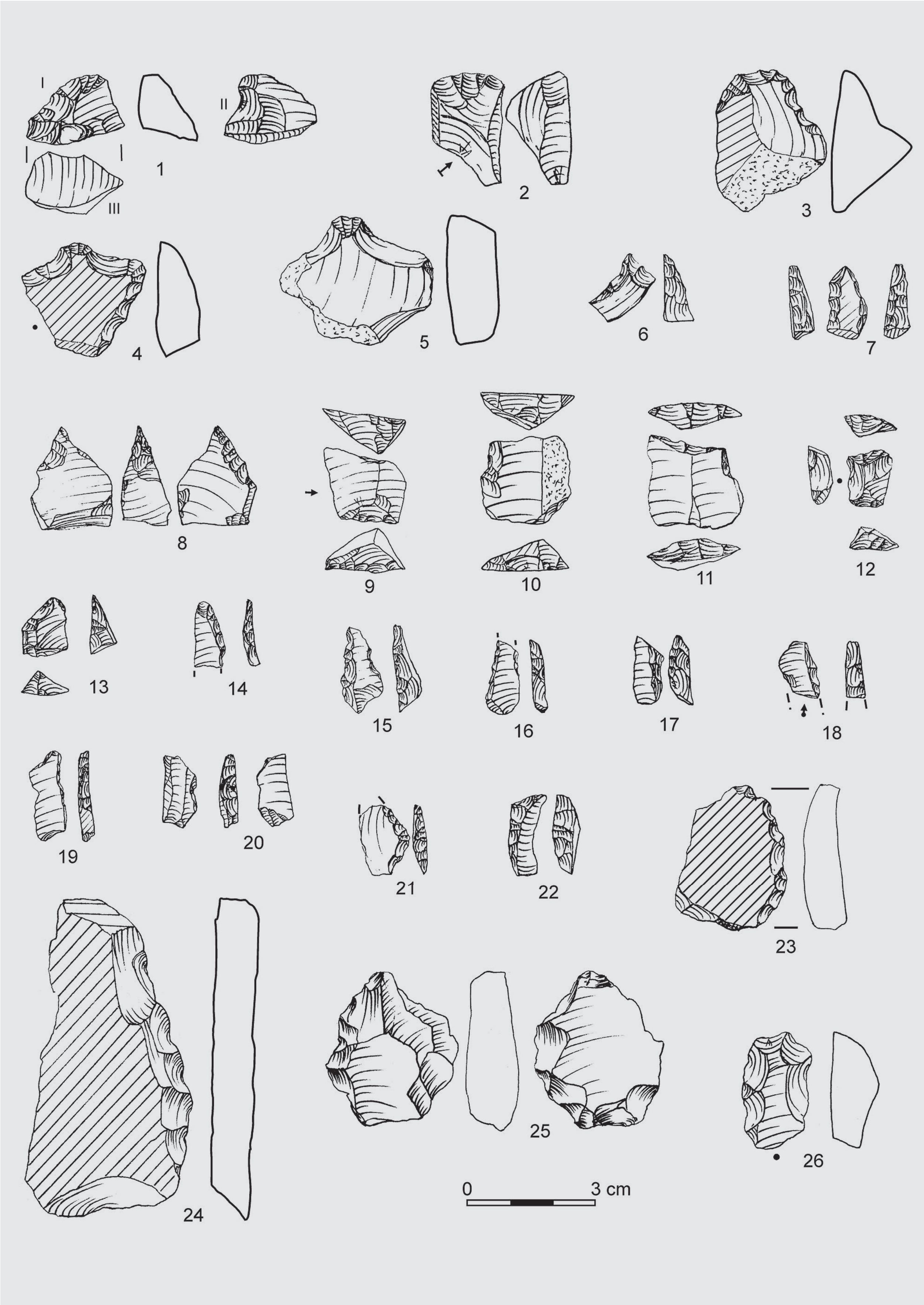

Fig. 9. Maroulas. Selection of chipped stone industry (acc. to Sampson et al. 2010).

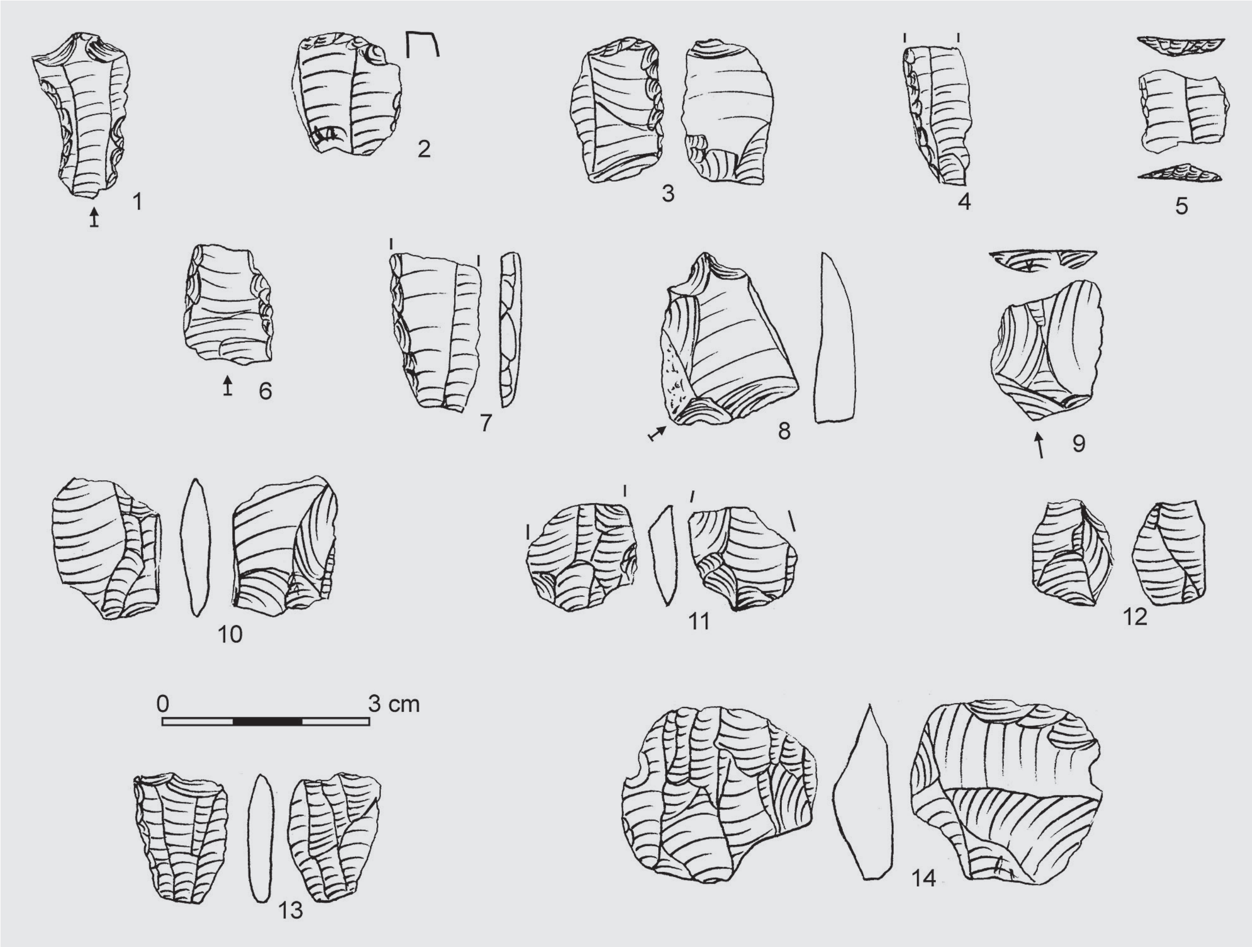

Fig. 10. Kerame-Ikaria. Selection of chipped stone industry (acc. to Sampson et al. 2012).

the second half of the 8th mill. calBC, provided an industry with mainly flake technology and splintered technique, with retouched tools (up to 25% of all artefacts) such as end-scrapers, retouched flakes and denticulated-notched tools. Two fairly large backed blades, one with bipolar retouch, confirm that this industry belongs to the Epigravettian tradition (*fig. 12*). Most of the inventory was made of flint (possibly obtained from primary deposits, which is indicated by striations on flake cortex), whereas the simultaneous use of Melian obsidian is uncertain. Assuming the few obsidian artefacts indeed come from the Late Mesolithic layers, then they would indicate the use of microblade technique and the production of backed inserts: trapezes and arched backed pieces.

The Late Mesolithic settlement on other islands of the Aegean Sea has not been documented by absolute dating. Nevertheless, the techno-morphological evidence ascribes the finds from the surface collection of A. Sampson (2010) on the islands of Naxos (Cyclades) and Chalki (Dodecanese) to the Late Mesolithic. Artefacts from Roos on Naxos, made from white-patinated flint and Melian obsidian, represent mainly the splintered and flake technique. Sporadic blades were used for the production of end-scrapers, backed pieces and some trapezes. Some trapezes, all the truncations, notched tools, and atypical perforators were made on flakes. The inventory from Naxos, although not without some Neolithic admixtures (a macroblade with bilateral retouch used as a sickle), belongs in its main bulk to the flake tradition of the Aegean Mesolithic, while the presence of typical trapezes points to its Late Phase.

Similar evidence has dated the surface finds from the island of Chalki to the Late Mesolithic. This inventory was made mainly of obsidian from Melos, also from Ghiali and of some, less frequent siliceous rocks. The specific feature of this inven-

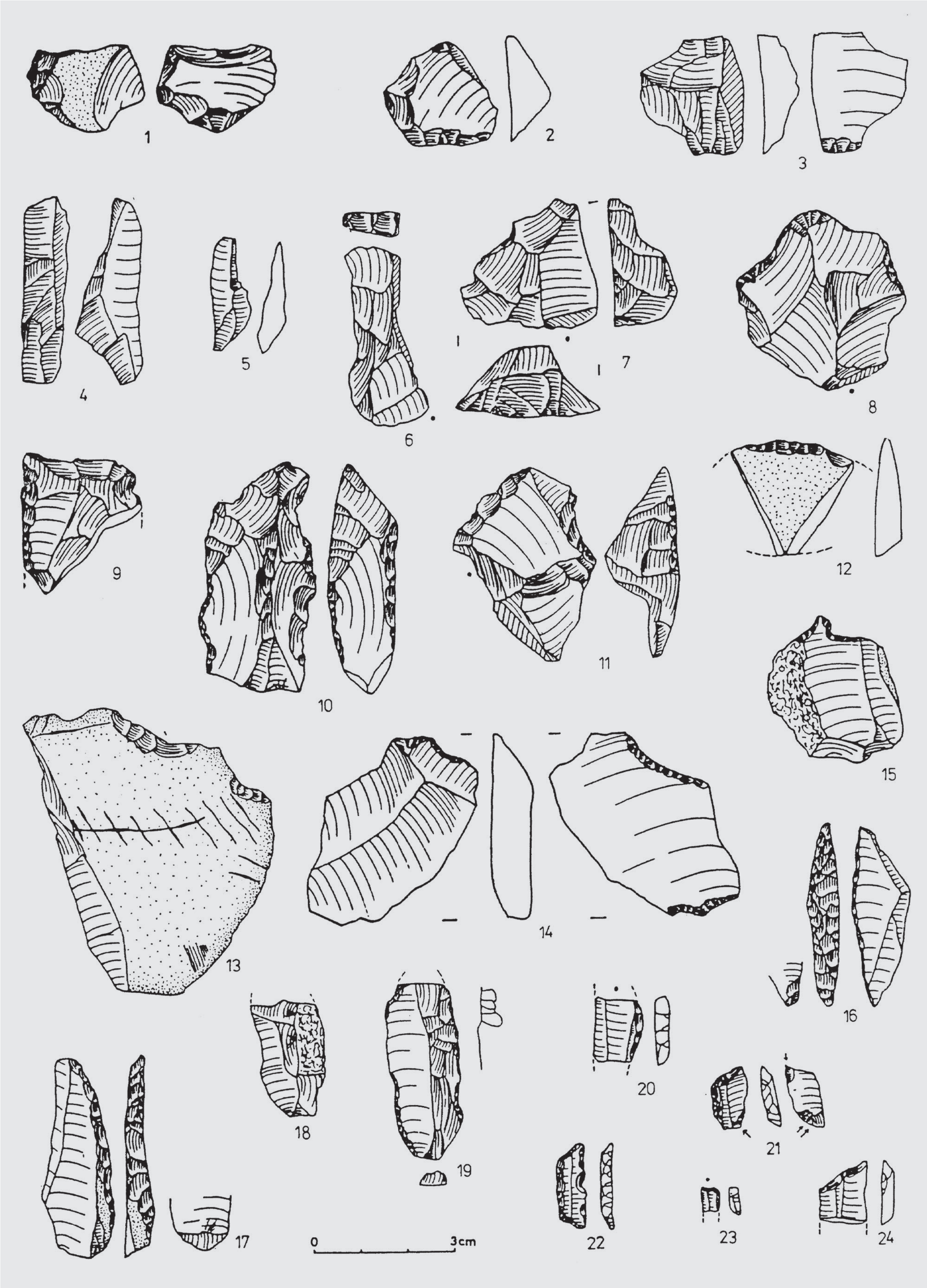

Fig. 12. Cyclope Cave, Gioura Island, Northern Sporades. Mesolithic chipped stone artefacts (retouched flakes, splintered pieces, end-scrapers on flakes, backed blades, and obsidian microliths) (acc. to Kaczanowska/Kozłowski 2008).

Fig. 11. Cyclope Cave, Gioura Island, Northern Sporades. Photograph by author.

Fig. 13. Lemnos Island. View of the site of Ouriakos. Photograph by author.

tory is the presence of flake cores and hypermicrolithic, microblade cores: single-platform sub-conical and double-platform specimens. Splintered technique is less frequent than on Naxos. Among tools microlithic backed pieces are much more numerous (segments, backed pieces with a straight and with an angulated blunted back), typical trapezes (some with three retouched sides) and truncations. Other tool groups are: end-scrapers, notched and denticulated tools, retouched flakes and becs. Although the industry from the island of Chalki shows the impact of the Aegean Mesolithic tradition, yet – at the same time – the presence of microblade technology and a more numerous group of geometric and parageometric microliths makes this industry different from the Cycladic tradition, and may point to contacts with south-western Anatolia.

Analyses of lithic raw materials used in the Aegean Mesolithic confirm the existence of systematic networks of marine contacts between islands. The Cyclades and the northern Sporades were supplied with Melian obsidian whose proportion could be as much as half of an inventory; in the eastern part of the Aegean basin, besides Melian obsidian, also poorer quality obsidian from Ghiali was brought to islands. Both on Ghiali and on Melos, obsidian was obtained from secondary sediments on the beaches – as the size of concretions and rolled cortex suggest. Melian obsidian was also brought to the mainland. Artefacts from Melian obsidian occur at Mesolithic sites in the eastern Peloponnese, but they are less numerous than on the islands. Much less is known about the provenance of siliceous rocks.

Recent discoveries of flint extraction points on the island of Naxos (Carter et al. 2014) do not resolve the question of the provenance of flint on the island of Gioura, in view of the fact that the macroscopic characteristic features of flints from Naxos are different from those of flints from Gioura.

As regards the flint that occurs at Maroulas the presence of artefacts exhibiting Middle Palaeolithic traits suggests that this raw material could have been brought from the deposits in the eastern Peloponnese, exploited in this period.

The islands of the southern and the central zones of the Aegean were visited or even permanently settled only in the very beginning of the Holocene, the islands of the northern zone – on the other hand – first of all Lemnos, provide numerous traces of occupation at the boundary of the Pleistocene and the Holocene. Moreover, while the Early Holocene settlement in the Cyclades, Dodecanese and the Sporades has its roots in eastern Greece, the settlement of the northern Aegean basin shows links with south-western Anatolia.

The investigations conducted by N. Efstratiou on Lemnos, especially at a large complex of sites at Ouriakos (*fig. 13*) uncovered a sequence of assemblages basing on microblade technology and using subconical, single-platform and double platform cores. Typical tools are mainly microliths, predominantly segments and bladelets with angulated

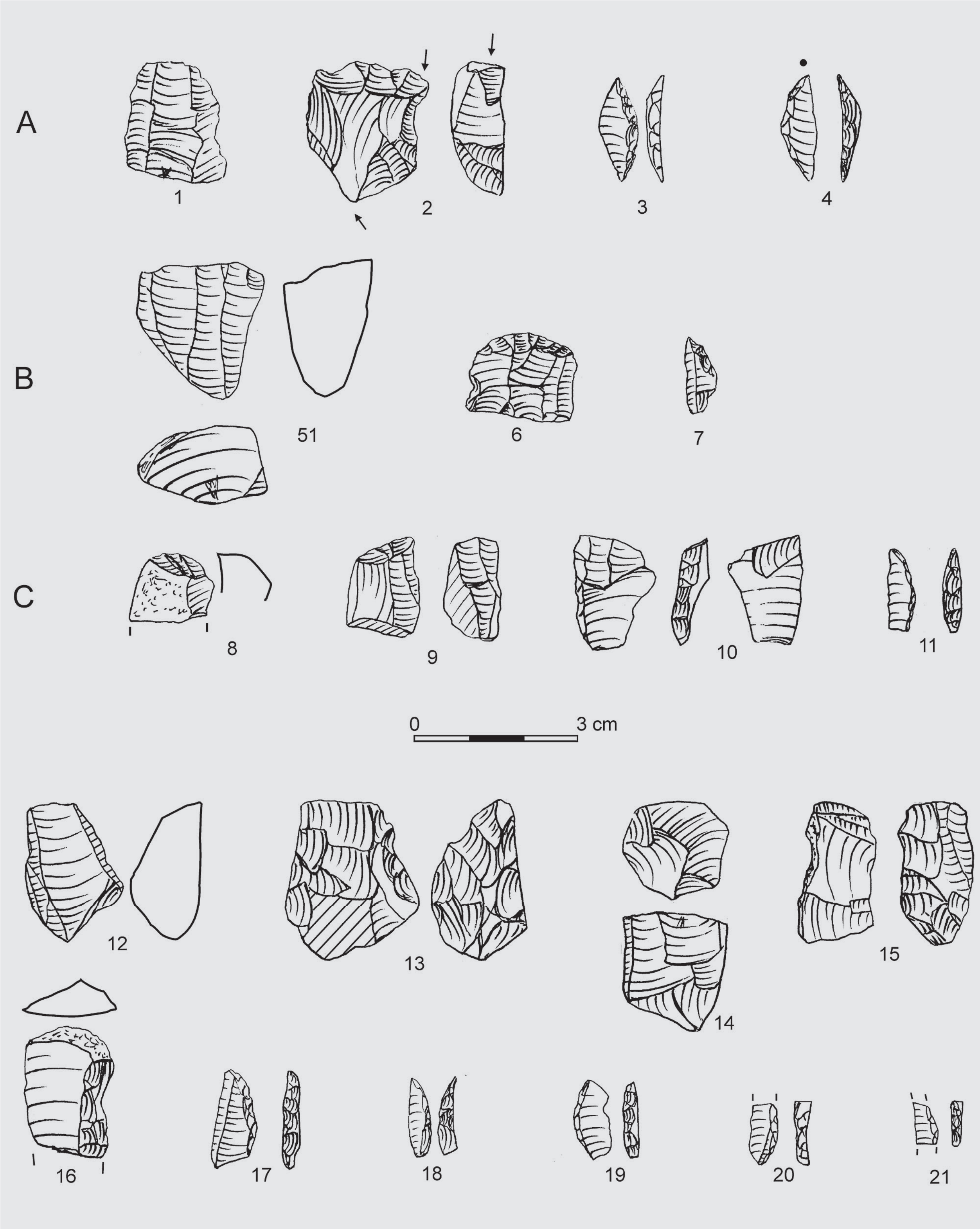

Fig. 14. Ouriakos, Lemnos. Chipped stone industry (excavations by N. Efstratiou). Drawings by author.

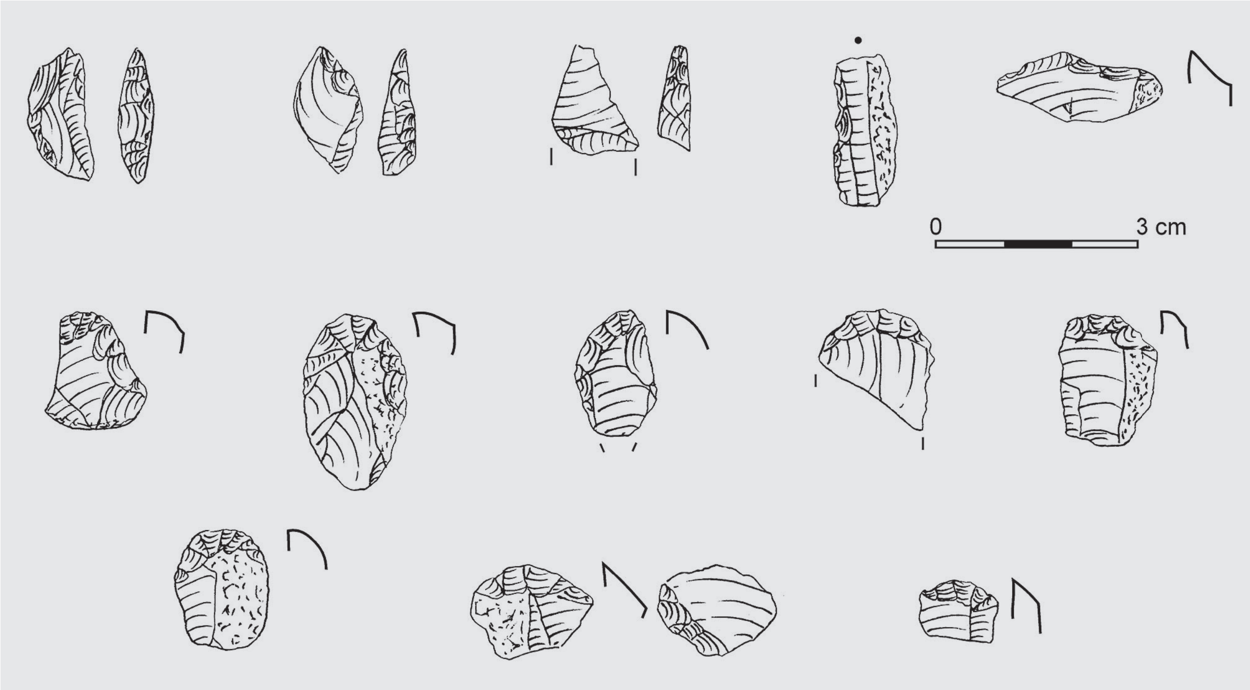

Fig. 15. Ucdütlar, Gallipoli Peninsula. Chipped stone industry (excavations by O. Özbek). Drawings by author.

back, shaped by steep, often bipolar, retouch but without the use of microburin technique (*fig. 14*). Among other tools are end-scrapers, mostly short, and atypical burins (Efstratiou et al. 2014). Surface sites with similar inventories are very frequent on Lemnos, notably in the region of Fyssini. All the sites used local flint, opalites and jasper.

A similar lithic tradition in the southern promontory of the Gallipoli Peninsula was recorded at the surface site of Ucdütlar (excavations by O. Özbek), represented by surface finds mixed with the Middle-Upper Palaeolithic artefacts. The industry from the Pleistocene/Holocene boundary at Ucdütlar is based on microlithisation and the production of bladelets or flakes from single-platform or change-of-orientation cores. Tools are predominantly short end-scrapers; backed microlithis – straight or segmentolidal – are much less numerous, and truncations are few (*fig. 15*).

We have only one radiometric determination for northern Aegean industries (Ouriakos – lowermost part 10.457–10.198 calBC), but close analogies can be pointed out with dated sites in south-western Anatolia, most importantly with the sequence in the Ökuzini Cave (Efstratiou et al. 2014; Yalcinkaya et al. 2002). In the upper part of this sequence similar assemblages referred to as Antalyan (Kozłowski 1994), occur in the Terminal Pleistocene between layers VI (about 12.000 calBC) and layer Ia1 (10.000–9000 calBC). The Early Holocene layer 0 yielded an assemblage deriving from the Antalyan. Moreover, the continuation of this microblade technological tradition is supported by the sequence of the Beldibi Cave where geometric microliths – albeit produced in the microburin technique – were recovered in the Early Holocene layer C, and in layer B – even in association with pottery (Bostanci 1965). Thus, analogies with the region of Antalya indicate that the sites in Lemnos and at Gallipoli could be placed at the Pleistocene/Holocene boundary. It is likely, however, that in Dryas III the island of Lemnos could have been connected by a land bridge with Anatolia (Perissoriatis/Conispoliatis 2003).

In the northern Balkans and the Circum-Pontic territory the continuity of Epipalaeolithic blade/bladelet industries with conical or pencil-like cores can be seen. They co-occur with backed bladelets, microlithic end-scrapers and perforators. To the same province a few surface sites registered on the Black Sea coast of European Turkey can be ascribed (Ağaçlı, Gümüşdere, Domali) (Gatsov/Özdogan 1994).

We should be aware of the fact that the picture of the coastal settlement in the Early Holocene (both on the continent and on the islands) is incomplete because the post-Pleistocene sea transgression was lower than the present day sea level. In the Mesolithic the shoreline was about 35m lower than today, and therefore a number of sites situated on the Mesolithic beaches are now submerged. The subaquatic observations in the vicinity of Mesolithic sites, e.g. near the site of Maroulas on Kythnos (burial places cut out in the rock) and in the vicinity of the Cyclope Cave on the island of Gioura have confirmed the existence of such sites.

Subsistence Economy of the Mesolithic and the Aegean Basin

The tendencies in the exploitation of the environment in the Early Mesolithic of the Aegean basin reveal differences between inland and island sites.

Detailed studies of the sequence of the Late Palaeolithic (layers III' – II) and the Mesolithic (layers 5a, 5, 3) in the Klissoura Cave 1 (Starkovich 2012; 2014) have shown that the expansion of the present-day Mediterranean forest environment at the beginning of the Holocene (Tzedakis 1994; 1999) induced modifications in the tendencies in the subsistence economy that had operated up until then. Generally, the most productive small prey (i.e. hare and partridge) was heavily used – as evidenced by the higher NISP index of small game as compared to large game in Mesolithic layers (Starkovich 2014, tab. I). This tendency is also registered at other Mesolithic sites in Greece (e.g. in the Franchthi Cave) where low rank animals as hare, birds, and especially fish were favored by Mesolithic hunter-foragers (Payne 1975b; Stiner/Monro 2011).

In the Franchthi Cave the Mesolithic phases show a variability of subsistence economy (Sampson et al. 2010). Phase VII (8971–7924 calBC) is dominated by hunting large mammals such as cervids, caprids, suids and smaller game such as fox and hare. Game was supplemented with birds, marine molluscs (*Cyclope neritea*) whereas snails (*Helix figulina*) played a relatively small role. Plant gathering (Pistacia nuts, *Prunus*) is evidenced by macroremains. In phase VIII (8023–7424 calBC) this diet changes conspicuously as tuna fishing became most important (20–40% of all bones), also cervids and wild boar were important game. Simultaneously, concentrations of land snails were registered; plant macroremains are fewer. In phase IX (7429–6829 calBC), in turn, large quantities of shells of *Carithium vulgatum* evidence that molluscs were collected, while tuna fishing is less important. Finally, beginnings of food-producing economy appear in phase X – the last phase of the Mesolithic sequence from Franchthi (see below).

In respect of subsistence economy the Sarakenos Cave in Boeotia, where the entire Mesolithic layer 4 (7651–7028 calBC) shows bird (pigeon, starling) and small mammals and also occasionally hare hunting, is completely different from the Franchthi Cave.

The economy of Mesolithic populations in the Aegean islands was determined by the environment differing from that on the continent, first of all by the absence of large mammals. The subsistence economy of the inhabitants of the Mesolithic settlement at Maroulas (Sampson et al. 2010), dated to the first half of the 9th mill. calBC (Facorellis et al. 2010), has been most fully reconstructed.

In the diet of the inhabitants of Maroulas foraging played an important role, especially the gathering of snails of *Helix figulina* species. Fishing was also practiced, both the species that migrated seasonally (tuna) as well as inshore fish such as morays/conger eels, groupers and scorpion fish (Mylona 2010). The presence of numerous grinding stones indicate that plant foods were also of considerable importance. The evidence for the domestication of pigs is still controversial, but the presence of pigs on the island is best explained by anthropogenic factors (Trantalidou 2010).

A similar structure of subsistence is evidenced by remains from Mesolithic layers in the Cyclope Cave on the island of Gioura, dated 8550–7200 calBC (Sampson et al. 2003). Fishing was the staple diet (*Sparidae*, *Scombridae*, *Serranidae*) (Powell 2003); animal domestication (semi-wild goats) (Trantalidou 2003), also the presence of suids, and bird hunting (Shearwater Manx, bustard) (Mylona 2003) are also evidenced.

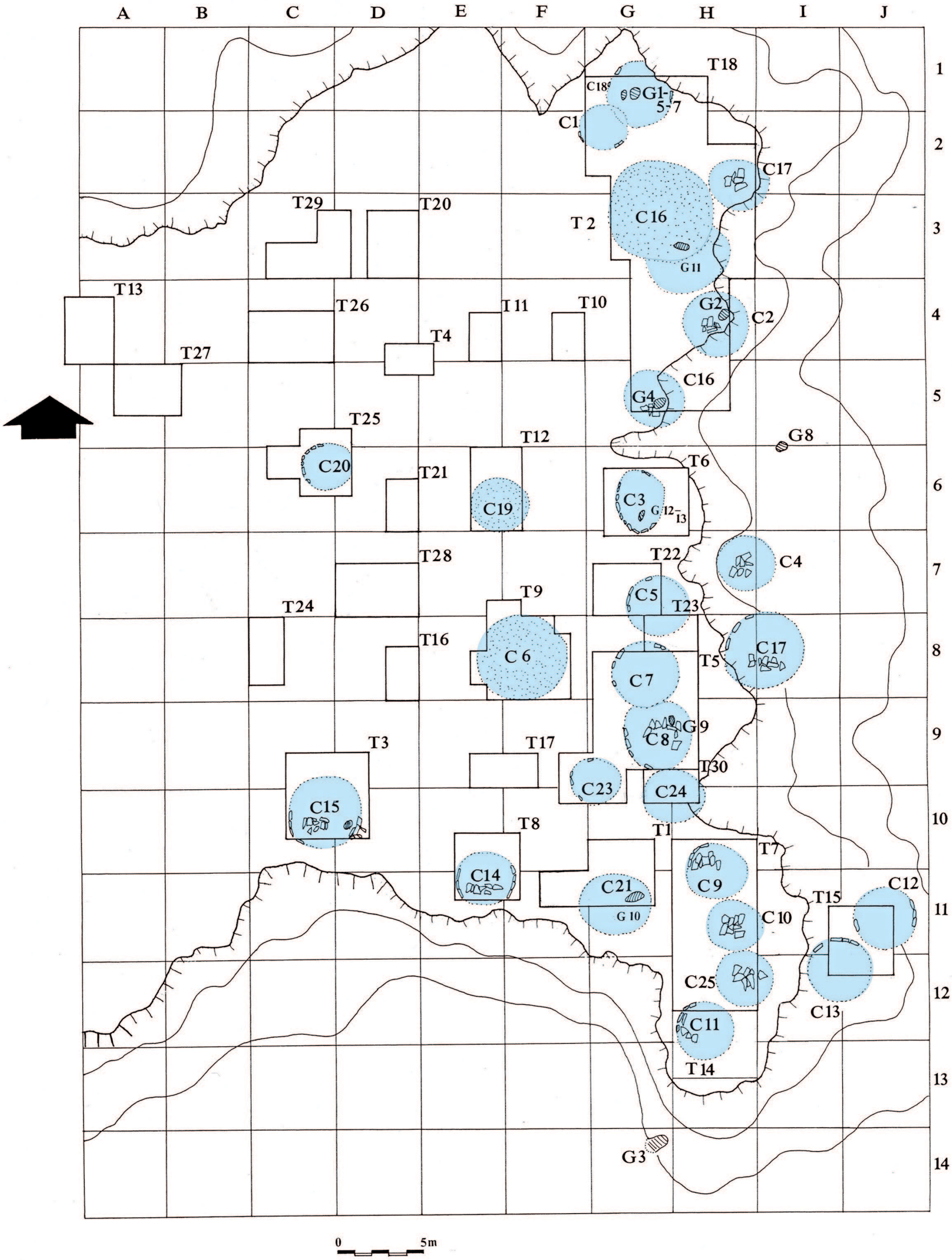

Fig. 16. Maroulas, Kythnos. Map of the excavated area with stone structures (after Sampson et al. 2010).

Fig. 17. Maroulas, Kythnos. Round stone house (acc. to Sampson et al. 2010).

Fig. 18. Maroulas, Kythnos. Burials under stone pavement (acc. to Sampson et al. 2010).

Fig. 19. Maroulas, Kythnos. Ground stone artefacts. 1,2 – fragments of stone vessels (metamorphic shale), 3 – cylindrical pestle (metamorphic shale), 4 – handstone (quartzite) (acc. to Sampson et al. 2010).

Innovations in the Mesolithic of the Aegean Basin and their Origins

As we have already said, in the Early Mesolithic of the Aegean basin (second half of the 9th mill. calBC) economic innovations appear that can be regarded as elements of the Neolithic package. There are:

- a semi-settled way of life documented by the durability of occupation of settlement locations e.g. at Maroulas on Kythnos (*fig. 16*). Regretfully, seasonality indicators for these sites are uncertain, and we are unable to determine the duration of particular episodes of site occupation. Seasonality of fishing, e.g. at Maroulas, may possibly indicate spring or early summer (Trantalidou 2010), but occupation in other periods of the year e.g. throughout summer, is also likely,
- architecture on a round plan, with stone foundations and floors from stone tiles sometimes carefully fitted (by hammering along the tile edges) (*fig. 17*),
- sequences of floors which is indicative of re-utilization of dwelling structures and durability of building sites; in the intervals in the occupation of a location the dwellings functioned as shell middens,
- burials underneath floors and next to dwellings (*fig. 18*),
- the presence of a variety of ground stone implements used for crushing mineral dyes and plant foods. Besides grinding stones also stone vessels occurred (*fig. 19*).

A controversial issue is the evidence for pig domestication, although it is highly likely – in the case of the Cyclades – that semi-domesticated pigs were imported to islands (Trantalidou 2010).

Early Mesolithic elements in the 'Neolithic package' may have persisted in the Aegean islands until the Late Mesolithic. For example, the younger layers of the sequence in the Cyclope Cave on the island of Gioura (Sampson 2008; Kaczanow-

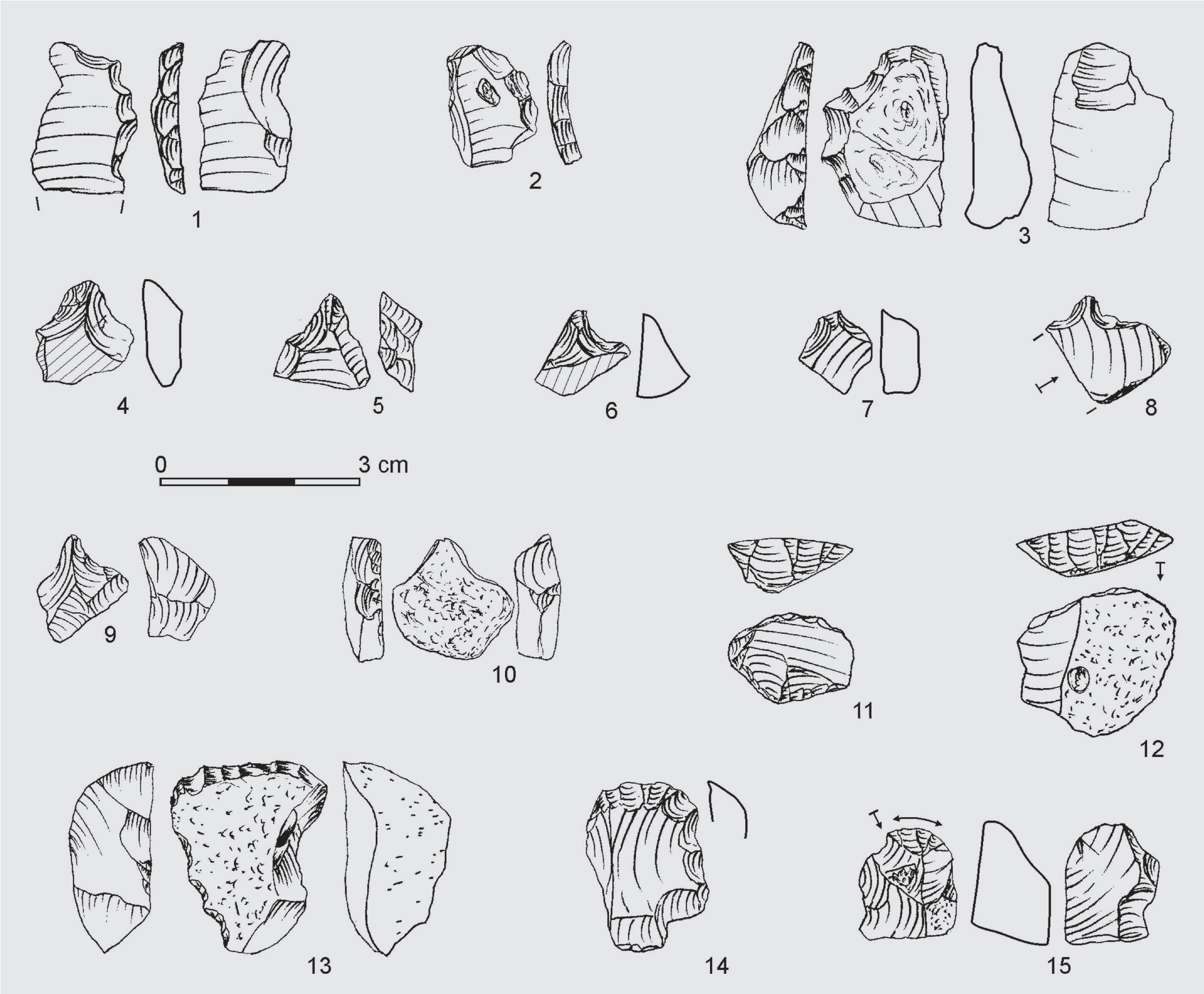

Fig. 20. Nissi Beach, Cyprus. Lithic artefacts from reconstructed pebble-flake assemblage (Kaczanowska/Kozłowski 2014).

ska/Kozłowski 2008) have been dated to the end of the 9th mill. calBC and the 9th/8th mill. calBC transition yielded bones of pigs that lived – just as in the Early Mesolithic – in a semi-free state (Trantalidou 2003). We can say with all certainty that they had been imported to the island by its Mesolithic inhabitants, probably as early as in the Early Mesolithic (the first half of the 9th mill. calBC).

C. Trantalidou (2003, 150) assumes that 'suids, having no animal predators, were attracted to the settlement by rotting fish, thereby making themselves more accessible to hunters'. It should be stressed that the size of pigs both at Maroulas and in the Cyclope Cave sequence diminished in time, although within a single population variability can be considerable. So far palaeogenetic analyses of the population of Aegean swine have not been done. Thus we are unable to determine their origins and relation to the population of swine that – most probably – were brought from the Near East along the route north of the Black Sea (Larson et al. 2007).

Even more controversial is the presence of semi-domesticated caprids in the Mesolithic layers in the Cyclope Cave. We should bear in mind that the quantity of caprid bones in the Mesolithic layers is very small, while individual animals are larger than those in the Neolithic layers. Moreover, the stratigraphy of the interface between the Mesolithic and the Neolithic layers causes some controversies. Thus, C. Trantalidou's (2003) hypothesis

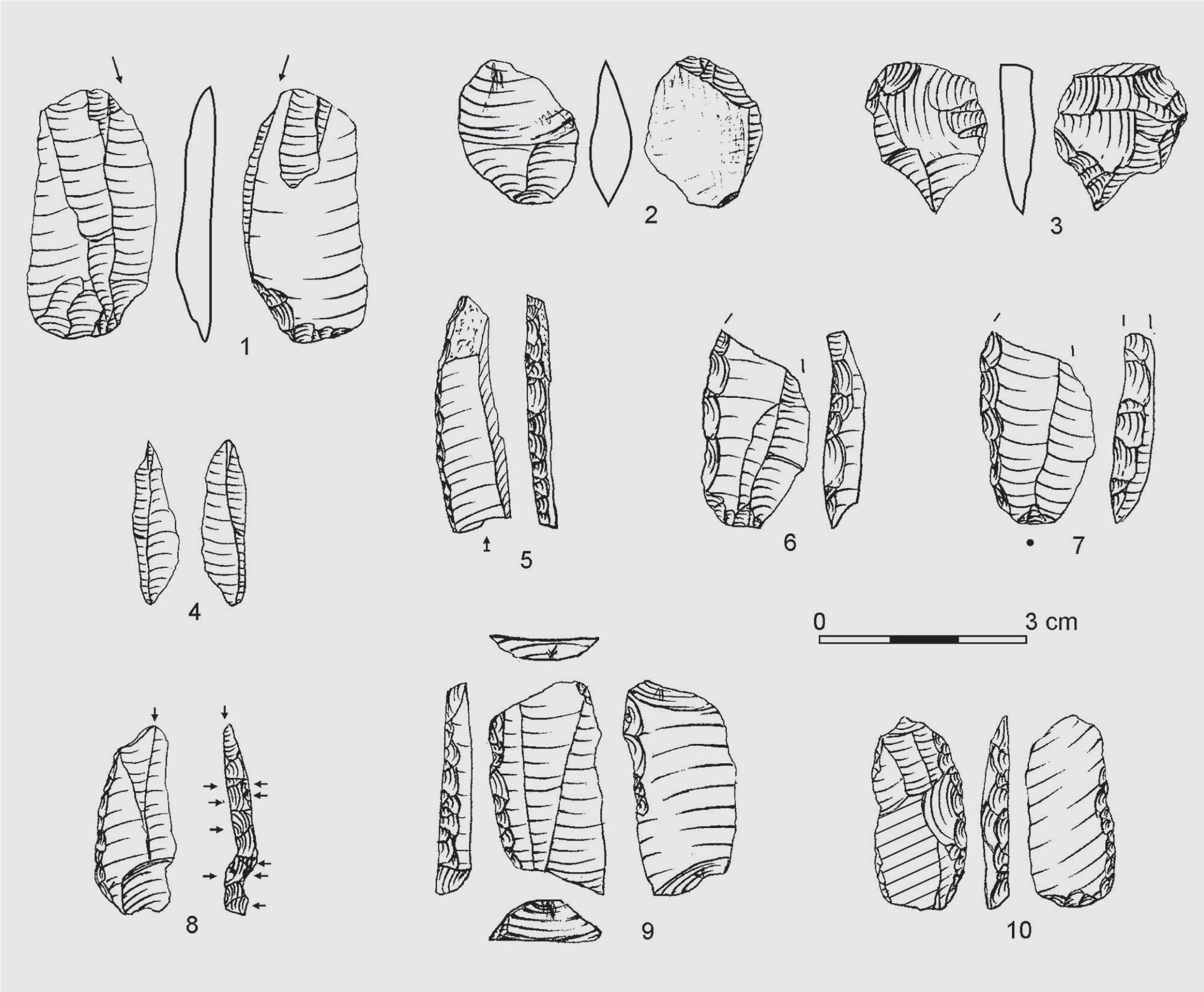

Fig. 21. Knossos, Crete. Lithic artefacts from layer X (Kaczanowska/Kozłowski 2011).

about selective cross-breeding to achieve domestication must be approached with caution.

The presence of elements of the 'Neolithic package' in the Mesolithic communities in the Aegean islands (Cyclades, northern Sporades) already in the first half of the 9th mill. calBC allows to take early contacts between the Aegean and the Near East for granted. Particularly strong links existed between Anatolia and Cyprus where in the second half of the 9th mill. calBC Pre-Pottery Neolithic A (PPNA) units were replaced by Pre-Pottery Neolithic B (PPNB). The PPNA on Cyprus exhibits a number of features of the 'Neolithic package', although not all. For example, domestication of cereals was absent. A number of progressive components of the Aegean Mesolithic (e.g. stone architecture, ground stone implements) could be the effect of contacts with Cyprus and the Near East. Moreover, the occurrence of a 'western episode' on Cyprus between the Aspros type Epipalaeolithic (Ammerman 2010; Ammerman et al. 2007; Ammerman et al. 2008) and the PPNA, for example from Klimonas (Knapp 2010), probably in the middle of the 9th mill. calBC, confirms the hypothesis about Near East–Aegean contacts. The 'western episode' is documented by the pebble-flake industry from Nissi Beach (Ammerman 2010; Kaczanowska/Kozłowski 2014). This industry shows a number of similarities with assemblages of the Aegean Mesolithic such as the presence of arched backed pieces, denticulated and notched tools, side-scrapers, and splintered technique (*fig. 20*).

The 'Full Package' of the Neolithic Subsistence in the Aegean Basin

Investigations so far have not confirmed the hypothesis of the existence of a Pre-Ceramic Neolithic in the Aegean basin, which is claimed to have derived directly from technological and economic traditions of the eastern Mediterranean Pre-Ceramic Neolithic. C. Perlès (2001) has correctly ascribed these sites to the Initial Phase of the Ceramic Neolithic.

Only two sites, both in the Aegean basin, belong to 'Aceramic' assemblages with the full 'Neolithic package' namely: the Franchthi Cave ('grey clay' level – described sometimes as the 'Preceramic Neolithic' or the 'Franchthi Ceramic Interphase 0/1', possibly as 'Initial Neolithic') (Perlès 2001), and Knossos (level X) (Evans 1971; Conolly 2008; Kaczanowska/Kozłowski 2012; Efstratiou 2005).

In the Franchthi Cave the 'Aceramic' level is stratified in between the series of the Early to Late Mesolithic (dated from the 9th to the middle of the 8th mill. calBC) and the Early Neolithic occupation (Franchthi Ceramic Phase dated to the middle of 7th mill. calBC) (Perlès 1990; 2001). Additionally, the continuity with the Mesolithic is indicated by the occupation of the same space within the Cave (while the Ceramic Neolithic was found at the neighbouring site of Paralia on the coast of the sea), the same wild plants that were gathered in the Mesolithic (Hansen 1991) and the same marine molluscs species (Shackelton 1987). Among the important indicators of the 'Neolithic package' in the grey clay layer is first of all, a dramatic increase in the proportion of domesticated caprids (Payne 1975a). Pig bones also occur, but they are not numerous and the status of pigs is uncertain. Emmer wheat (*Triticum turgidum* ssp. *Dicoccum*) and two-row barley (*Hordeum vulgare* ssp. *Distichum*) grain occurs documenting either cultivation or possibly, exchange (Hansen 1991) of these species that had not been the result of local domestication of wild cereals. We can thus assume that in the 'Aceramic Neolithic' the inhabitants of the Franchthi Cave were acquainted with all the elements of the farming-breeding economy, although the frequency of cereals points, rather, to selective 'adoption through exchange' (Perlès 2001, 48). For these reasons, the 'Aceramic Neolithic' from Franchthi cannot be regarded as a proof of a local evolution of Mesolithic foraging economy into a fully fledged Neolithic.

The issue of the 'Aceramic Neolithic' is also pertinent on Crete, notably in layer X from Knossos, dated at the second half of the 8th mill. calBC (Evans 1994). The assemblage from layer X has no clear Mesolithic antecedents on Crete. For example, the sites in the Plakias region, believed to be Mesolithic (Strasser et al. 2010) display no techno-morphological features in common with the 'Aceramic Neolithic' from Knossos. On the other hand, the assemblage from layer X shares a number of characteristic features with the 'Aegean Mesolithic' (Kaczanowska/Kozłowski 2011) which, despite the chronological hiatus, continue into the Ceramic Neolithic (Early Neolithic I) from layer IX. Links of the 'Aceramic Neolithic' from Knossos with the Aegean Mesolithic are documented by the high frequency of Melian obsidian at Knossos (69.7%) accompanied by local siliceous rocks. A trait in common with the Aegean Mesolithic is the major role of splintered technique and the presence of, predominantly, flake tools such as notched-denticulated and backed implements (*fig. 21*).

The elements of food-producing economy in the 'Aceramic Neolithic' at Knossos have been attested by finds from layer X (investigations by Evans) (Evans 1994) and from spits 38, 39 (investigations by N. Efstratiou) (Efstratiou 2005; Efstratiou et al. 2004). Domesticated livestock (domesticated elsewhere – not on Crete: ovicaprids, pigs, dogs), also cultivated cereals (*Triticum* sp.) and legumes (*Pisium* sp.), were imported from the Near East. Moreover, almonds (*Amagdylus communis*) and figs (*Ficus carica*) were collected.

Conclusions

In this paper we have contrasted the evolution of the Early Holocene Mesolithic units in the territory of eastern Greece, that were rooted in the Epigravettian tradition with influences from the central and western Mediterranean, and the appearance of Mesolithic units in the Aegean islands as the consequence of early voyaging in the Mediterranean. The 'Aegean Mesolithic' exhibits a number of differences in comparison with the continental Mesolithic such as a major role of flake technique, the importance of denticulated-notched tools, limited production of geometric microliths, also from flakes, mainly arched backed pieces, and a greater role of splintered technique.

In all the sites of the Aegean Mesolithic Melian obsidian and obsidian from Ghiali were used. Their presence documents systematic contacts in between islands. As early as the first half of the 9th mill. calBC the diet of Mesolithic foragers/fishers/small game hunters was enriched by a greater component of plant foods (the presence of grinding implements in the equipment of inhabitants) and the import of animals (goat and swine) to the islands probably in a proto-domestication stage. In consequence, the premises of a semi-sedentary way of life can be seen with stone architecture and burials beneath house floors. These innovations are interpreted as the effect of over-sea contacts with the Pre-Pottery-Neolithic communities on Cyprus. The final outcome of these contacts was the appearance of the full Neolithic package in some groups of the Aegean Mesolithic population (Franchthi, phase X, Knossos layer X) which had taken place before the beginnings of the Ceramic Neolithic. In conclusion, we can assert that the neolithisation in the Aegean basin is associated with marine contacts: this was a multi-phase phenomenon much earlier than the initials of the Ceramic Neolithic in continental Greece.

Janusz K. Kozłowski
Institute of Archaeology
Jagiellonian University
ul. Gołębia 24
PL-31-007 Kraków
Janusz.kozlowski@uj.edu.pl

Bibliography

Ammerman 2010: A. J. Ammerman, The First Argonauts. Towards the Study of the Earlier Seafaring in the Mediterranean. In: A. Anderson/J. H. Barrett/K. V. Boyle (eds.), The Global Origins and Development of Seafaring (Cambridge 2010) 81–92.

Ammerman et al. 2007: A. J. Ammerman/P. Flourentzos/R. Gabrielli/C. McCartney/J. Noller/D. Peloso/D. Sorabji, More on the New Early Sites on Cyprus. Report of the Department of Antiquities, Cyprus, 2007, 1–26.

Ammerman et al. 2008: A. J. Ammerman/P. Flourentzos/R. Gabrielli/T. Higham/C. McCartney/T. Turnbull, Third Report on Early Sites in Cyprus. Report of the Department of Antiquities, Cyprus, 2010, 1–32.

Bostanci 1965: E. Bostanci, The Mesolithic of Beldibi and Belbasi and their Relation with the Other Findings in Anatolia. Antropoloji 3, 1965, 91–149.

Carter et al. 2014: T. Carter/D. Contreras/S. Doyle/D. Mihajlović/T. Moutsiou/N. Skarpelis, The Stelida Naxos Archaeological Project. New Data on the Middle Palaeolithic and Mesolithic Cyclades. Antiquity 34, 2014, 1–4.

Conolly 2008: J. Conolly, The Knapped Stone Technology of the First Occupants at Knossos. In: V. Isaakidou/P. Tomkis (eds.), Escaping the Labyrinth. The Cretan Neolithic in Context. Sheffield Studies in Aegean Archaeology (Sheffield 2008) 73–89.

Efstratiou 2005: N. Efstratiou, Tracing the Story of the First Farmers in Greece. A Long and Widening Road. In: C. Lichter/R. Meric (eds.), How did Farming Reach Europe? Anatolian-European Relations from the Second Half of the Seventh through the First Half of the Sixth Millennium calBC. International Workshop, Istanbul, 20–22 May 2004. Byzas 2 (Istanbul 2005) 141–155.

Efstratiou et al. 2004: N. Efstratiou/A. Karestou/E. Nanou/D. Morgomenou, The Neolithic Settlement of Knossos. New Light on an Old Picture. In: G. Cadogan/E. Hatzaki/A. Vasiliakis (eds.), Knossos, Palace, City, State. The British School of Athens, Supplements 12 (London 2004) 39–49.

Efstratiou et al. 2014: N. Efstratiou/P. Biagi/E. Starnini, The Epipaleolithic Site of Ouriakos in the Island of Lemnos and its Place in the Late Pleistocene Peopling of the East Mediterranean. Adalya 17, 2014, 1–23.

Evans 1971: J. Evans, Neolithic Knossos. The Growth of the Settlement. Proceedings of the Prehistoric Society 37, 1971, 95–117.

Evans 1994: J. Evans, The Early Millennia, Continuity and Change in the Farming Settlement. In: D. Evely/H. Hughes-Brock/M. Momigliano (eds.), Knossos. A Labyrinth of History. British School of Athens 1994, 1–20.

Facorellis et al. 2010: Y. Facorellis/B. N. Damiata/E. Vardala-Theodorou/M. Ntinou/J. Southon, AMS Radiocarbon Dating of the Mesolithic Site Maroulas on Kythnos and Calculation of the Regional Marine Reservoir Effect. In: A. Sampson/J. K. Kozłowski/M. Kaczanowska (eds.), The Prehistory of Kythnos (Cyclades, Greece) and the Mesolithic Settlement at Maroulas (Krakow 2010) 127–136.

Gatsov/Özdogan 1994: I. Gatsov/M. Özdogan, Some Epi-Palaeolithic Sites from NW Turkey. Ağaçlı, Domali, Gümüşdere. Anatolicum 20, 1994, 97–120.

Gebel/Kozłowski 1994: H. G. Gebel/S. K. Kozłowski (eds.), Neolithic Chipped Stone Industries of the Fertile Crescent. Ex Oriente (Berlin 1994).

Hansen 1991: J. M. Hansen, The Palaeoethnobotany of Franchthi Cave. Excavations at Franchthi Cave, Greece 7 (Bloomington 1991).

Kaczanowska/Kozłowski 2008: M. Kaczanowska/J. K. Kozłowski, Chipped Stone Artefacts. In: A. Sampson (ed.), The Cave of the Cyclops 1. Intra-Site Analysis, Local Industries, and Regional Site Distribution. Prehistory Monographs 21 (Philadelphia 2008) 169–178.

Kaczanowska/Kozłowski 2011: M. Kaczanowska/J. K. Kozłowski, Lithic Industry from the Aceramic Levels at Knossos (Crete, Grece). An Alternative Approach. Eurasian Prehistory 1/2.8, 2011, 67–89.

Kaczanowska/Kozłowski 2014: M. Kaczanowska/J. K. Kozłowski, Reconstruction of the Lithic Assemblages from Nissi Beach (Cyprus). In: Contributions to the Archaeology of Early Cyprus (Krakow 2014) 67–106.

Kaczanowska et al. 2010: M. Kaczanowska/J. K. Kozłowski/K. Sobczyk, Upper Palaeolithic Human Occupations and Material Culture at Klissoura Cave 1. Eurasian Prehistory 7.2, 2010, 133–286.

Knapp 2010: A. B. Knapp, Cyprus's Earliest Prehistory. Seafarers, Foragers and Settlers. Journal of World Prehistory 23, 2010, 79–120.

Kozłowski 1994: S. K. Kozłowski, Chipped Stone Neolithic Industries at the Eastern Wing of the Fertile Crescent (Synthesis Contribution). In: H. G. Gebel/S. K. Kozłowski (eds.), Neolithic Chipped Stone Industries of the Fertile Crescent. Ex Oriente (Berlin 1994) 73–89.

Kozłowski 1999: J. K. Kozłowski, Gravettian/Epigravettian Sequences in the Balkans. Environment, Technologies, Hunting Strategies and Raw Material Procurement. In: G. N. Bailey/E. Adam/E. Panagpolou/C. Perlès/K. Zachos (eds.), The Palaeolithic Archaeology of Greece and Adjacent Areas. British School at Athens (Athens 1999) 319–329.

Kozłowski 2005: J. K. Kozłowski, Paléolithique supérieur et Mésolithique en Mediterranée. Cadre culturel. L' Anthropologie 3.109, 2005, 520–540.

Kozłowski/Stiner 2010: J. K. Kozłowski/M. C. Stiner (eds.), Klissoura Cave1, Argolid, Greece. The Upper Palaeolithic Sequence. Eurasian Prehistory 2.7, 2010, 1–321.

Larson et al. 2007: G. Larson/U. Albarella/K. Dobney/P. Rowley-Conwy/J. Schibler/A. Tresset/J.-D. Vigne/C. J. Edwards/A. Schlumbaum/A. Dinu/A. Balaeascu/G. Dolman/A. Tagliacozzo/N. Mamaseryan/P. Miracle/I. Van Wijngarden-Bakker/M. Masseti/D. G. Bradley/A. Cooper, Ancient DNA, Pig Domestication, and the Spread of the Neolithic in Europe. Proceedings of the National Academy of Sciences of the United States of America 104.39, 2007, 15376–15281.

Lengyel 2008/2009: G. Lengyel, Radiocarbon Dates of the 'Gravettian Entity' in Hungary. Praehistoria 9/10, 2008/2009, 241–263.

Mihajlović 1999: D. Mihajlović, The Upper Palaeolithic and Mesolithic Industries of Montenegro. In: G. N.

Bailey/E. Adam/E. Panagpolou/C. Perlès/K. Zachos (eds.), The Palaeolithic Archaeology of Greece and Adjacent Areas. British School at Athens (Athens 1999) 357–360.

Mihajlović/Mihajlović 2007: D. Mihajlović/B. Mihajlović, Considérations sur le Gravettien et l'Epigravettien ancien des Balkans de l'Ouest. Paléo 19, 2007, 115–130.

Mylona 2003: D. Mylona, A Review of the Research of Fish Remains in the Aegean. In: C. Gamble/ P. Halstead/Y. Hamilakis (eds.), Zooarchaeology in Greece. Recent Advances. British School at Athens (London 2003) 187–190.

Mylona 2010: D. Mylona, Mesolithic Fishers at Maroulas, Kythnos. The Fish Bones. In: A. Sampson/ J. K. Kozłowski/M. Kaczanowska (eds.), The Prehistory of Kythnos (Cayclades, Greece) and the Mesolithic Settlement at Maroulas (Krakow 2010) 127–136.

Olenkovski 2008: N. Olenkovski, Epigravett Vostochnoy Evropy. Kulturno-istoricheskiye aspeky (Kherson 2008).

Payne 1975a: S. Payne, Animal Bones. In: T. H. Jacobsen (ed.), Excavations in the Franchthi Cave 1969–1971. Hesperia 42, 1975, 59–66.

Payne 1975b: J. Payne, Faunal Changes at Franchthi Cave from 20000 BC to 3000 BC. Archaeological Studies 1975, 120–131.

Perissoriatis/Conispoliatis 2003: C. Perissoriatis/N. Conispoliatis, The Impacts of Sea-Level Changes during Latest Pleistocene and Holocene Times on the Morphology of the Ionian and Aegean Seas (SE Alpine Europe). Marine Geology 196, 2003, 145–156.

Perlès 1987: C. Perlès, Les industries lithiques taillées de Franchthi (Argolide, Grèce) 1. Présentation générale des industries paléolithiques. Excavations at Franchthi Cave 3 (Bloomington 1987).

Perlès 1990: C. Perlès, Les industries lithiques taillées de Franchthi (Argolide, Grèce) 2. Les industries du Mésolithique et du Néolithique initial. Excavations at Franchthi Cave 5 (Bloomington 1990).

Perlès 1995: C. Perlès, La transition Pleistocène/Holocène et le problème du Mésolithique en Grèce. In: V. Villaverdo Bonilla (ed.), Los ultimos cazadores (Alicante 1995) 170–209.

Perlès 2001: C. Perlès, The Early Neolithic in Greece (Cambridge 2001).

Powell 2003: J. Powell, The Fish Bone Assemblages from the Cave of Cyclope, Youra. Evidence for Continuity and Change. In: N. Galanidou/C. Perlès (eds.), The Greek Mesolithic. Problems and Perspectives. British School of Athens, Studies 10 (London 2003) 172–179.

Sampson 2008: A. Sampson (ed.), The Cave of the Cyclops 1. Intra-Site Analysis, Local Industries, and Regional Site Distribution. Prehistory Monographs 21 (Philadelphia 2008).

Sampson 2010: A. Sampson, Mesolithic Greece 9000–6500 BC. Palaeoenvironment-Paleaoeconomy-Technology (Athens 2010).

Sampson et al. 1998: A. Sampson/J. K. Kozłowski/M. Kaczanowska, Entre l'Anatolie et les Balkans. Une sequence Mésolithique-Néolithique de l'ile de Youra. In: M. Otte (ed.), Préhistoire de l'Anatolie. Genèse des deux mondes. Actes du colloque international, Liège 28 avril – 3 mai 1997 (Liège 1998) 125–141.

Sampson et al. 2002: A. Sampson/J. K. Kozłowski/M. Kaczanowska/A. Giannouli, The Mesolithic Settlement at Maroulas, Kythnos. Mediterranean Archaeology and Archaeometry 2, 2002, 45–60.

Sampson et al. 2003: A. Sampson/J. K. Kozłowski/M. Kaczanowska, Mesolithic Chipped Stone Industries from the Cave of Cyclope on the Island of Youra (Northern Sporades). In: N. Galanidou/C. Perlès (eds.), The Greek Mesolithic. Problems and Perspectives. British School of Athens, Studies 10 (London 2003) 145–172.

Sampson et al. 2009: A. Sampson/J. K. Kozłowski/M. Kaczanowska/T. Budek/A. Nadachowski/T. Tomek/B. Miekinia, Sarakenos Cave in Boeotia, from Palaeolithic to the Early Bronze Age. Eurasian Prehistory 1/2.6, 2009, 199–231.

Sampson et al. 2010: A. Sampson/M. Kaczanowska/J. K. Kozłowski, The Prehistory of the Island of Kythnos (Cyclades, Greece) and the Mesolithic Settlement of Maroulas (Krakow 2010).

Sampson et al. 2012: A. Sampson/M. Kaczanowska/J. K. Kozłowski, Mesolithic Occupations and Environments on the Island of Ikaria, Aegean. Folia Quaternaria 80 (Krakow 2012).

Shackelton 1987: N. J. Shackelton, Oxygen Isotopes, Ice Volume and Sea Level. Quaternary Science Review 5, 1987, 183–190.

Starkovich 2012: B. Starkovich, Intensification of Small Game Resource at Klissoura Cave 1 (Peloponnese, Greece) from the Middle Palaeolithic to the Mesolithic. Quaternary International 264, 2012, 17–31.

Starkovich 2014: B. Starkovich, Optimal Foraging, Dietary Change and Site Use during the Palaeolithic at Klissoura Cave 1 (Southern Greece). Journal of Archaeological Science 52, 2014, 20–55.

Stiner/Monro 2011: M. Stiner/N. D. Munro, The Evolution of Diet and Landscape during the Upper Palaeolithic through Mesolithic at Franchthi Cave (Peloponnese, Greece). Journal of Human Evolution 60, 2011, 618–636.

Strasser et al. 2010: T. Strasser/E. Panagopolou/C. Runnels/P. Murray/N. Thompson/P. Karkanas/F. McCoy/K. W. Wegmann, Stone Age Seafaring in the Mediterranean. Evidence from Plakian Region for Lower Palaeolithic and Mesolithic Habitation of Crete. Hesperia 79, 2010, 105–195.

Trantalidou 2003: K. Trantalidou, Faunal Remains from the Earliest Strata of Cave of Cyclope, Youra. In: N. Galanidou/C. Perlès (eds.), The Greek Mesolithic. Problems and Perspectives. British School of Athens, Studies 10 (London 2003) 145–172.

Trantalidou 2010: K. Trantalidou, Dietary Adaptations of Coastal People in the Aegean Archipelago during the Mesolithic Period. The Macrofauna Assemblages of Maroulas on Kythnos. In: A. Sampson/ J. K. Kozłowski/M. Kaczanowska (eds.), The Prehistory of Kythnos (Cyclades, Greece) and the Mesolithic Settlement at Maroulas (Krakow 2010) 127–136.

Tzedakis 1994: P. C. Tzedakis, Vegetation Changes through Glacial-Interglacial Cycles. A Long Pollen Sequence Perspective. Philosophical Transactions: Biological Sciences 1314.345, 1994, 403–432.

Tzedakis 1999: P. C. Tzedakis, Last Climatic Cycle at Kopais, Central Greece. Journal of Geological Society of London 156, 1999, 425–434.

Yalcinkaya et al. 2002: I. Yalcinkaya/M. Otte/J. Kozłowski/O. Bar-Yosef, Öküzini. Final Palaeolithic Evolution of Southwest Anatolia. ERAUL 96 (Liege 2002).

IVAN GATSOV AND PETRANKA NEDELCHEVA

The Mesolithic/Neolithic Transition in Bulgaria and Western Anatolia – An Overview

Keywords: Neolithic, Mesolithic, bullet core technology, Marmara Sea

Problems of the Transition from Mesolithic to Neolithic in Bulgaria

The lack of archaeological evidence from the period between the 9th and the 7th mill. BC poses a problem for the understanding of the transition from Mesolithic to Neolithic in this region. At present the youngest available absolute date for the Palaeolithic comes from the Kozarnika cave in northwestern Bulgaria. 'Les dates 14 C sur charbon de bois ont donné pour la couche 3a: 11.490±120 BP (Gif-109911/GifA-98346) et 11.550±100 BP (Gif-10990/GifA-98345)' (Sirakov et al. 2007, 131–144).

The earliest radiometric dates for the Neolithic are at the end of the 7th mill. BC, leaving a gap of about 2000 years for archaeological and paleo environmental research. Up to now, there is only one lithic collection, albeit without reliable stratigraphic context, which was obtained in the sand dune area in the reserve 'Dikilitash' not far from the shore of the Black Sea. Only this material from Dikilitash can be related to the period of the transition from Mesolithic/Epipalaeolithic to the Neolithic. Based on this collection's technology and typology it has been related to the Iron Gate Epi-Tardigravettien assemblages (Gatsov 2009).

As for Early Neolithic finds, they all lay in virgin soil and no traces connected to the Mesolithic/Neolithic transition have been recorded anywhere. The Early Neolithic chipped stone assemblages display totally different characteristics concerning detachment techniques, typology and systems of supply and procurement. In our opinion, the main reason for the lack of Mesolithic sites is the lack of research.

The Earliest Neolithic Assemblages in Central North-Western Anatolia

In recent years, due to the salvage excavations conducted by Turan Efe, lithic artefacts from the settlement of Keçiçayırı in the Eskişehir region have been excavated. According to the excavator the finds date into the Pre-and Early Neolithic and Late Chalcolithic periods, while some Roman settlement remains were unearthed as well (Gatsov/Nedelcheva 2011, 89–96; Efe et al. 2012, 227–236). Amongst the material from this site some pieces deserve attention, such as a core with two opposite platforms (*fig. 1.1*), chipped disks of tabular flint (*fig. 1.3*) and fragments of leaf points (*fig. 1.2*).

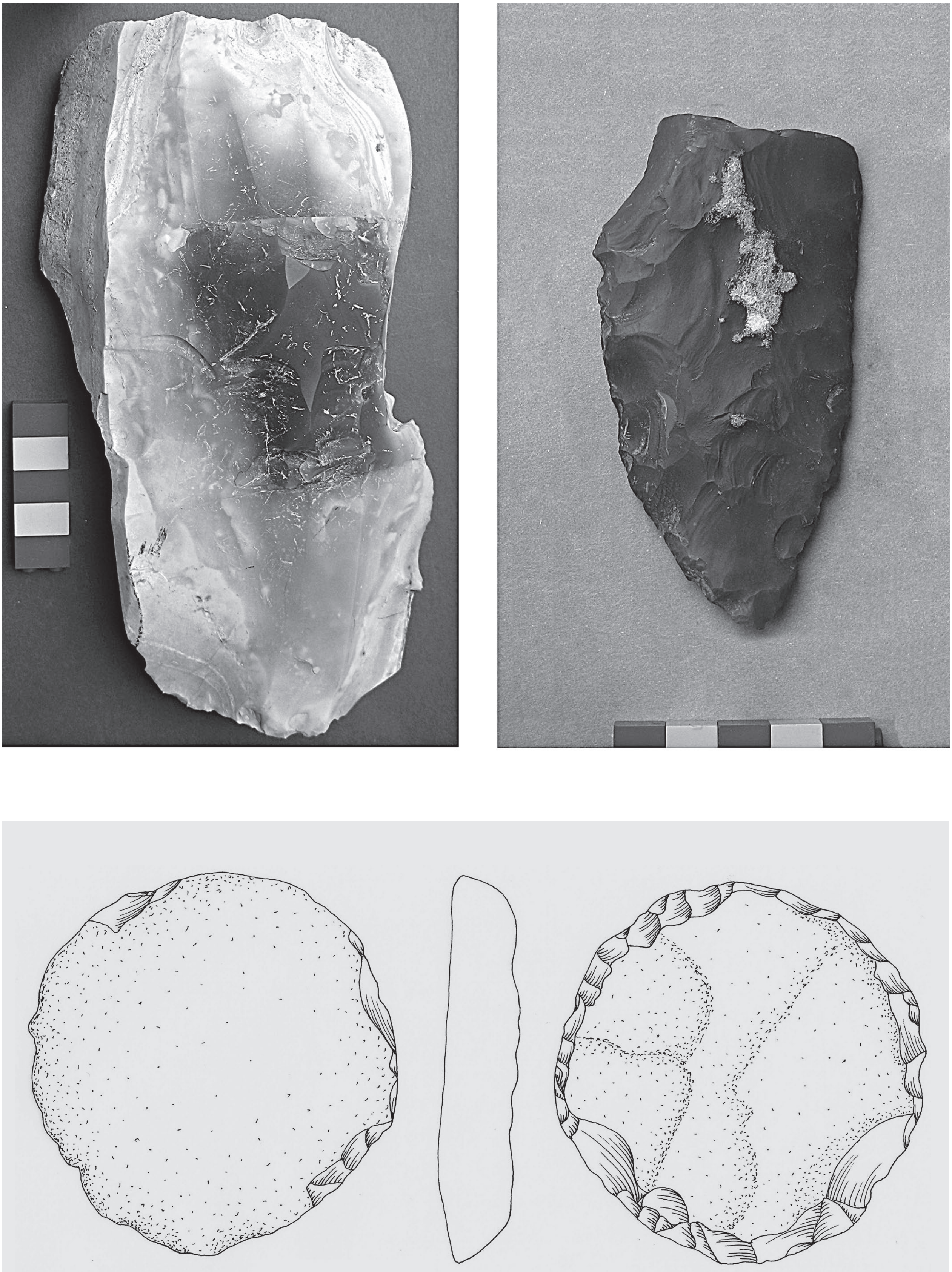

Fig. 1. Keçiçayırı: 1- core specimen with two opposite platform; 2- fragment of leaf points; 3- chipped disks on tabular flint.

At this stage of the study, in the absence of a wider basis for comparison, it can only be stated that these artefacts are completely different from the bullet core technology recorded to the south and east of the Marmara Sea. Up to now it is very difficult to clearly distinguish between Pre-Pottery and Pottery Neolithic assemblages at Keçiçayırı. More information would be needed in order to formulate better defined borders between Pre-Pottery and Pottery Neolithic at Keçiçayırı. As a preliminary hypothesis, it may be assumed that the lithics from Keçiçayırı may eventually be dated to the time before the appearance of the first Pottery Neolithic.

Lithic Assemblages from 7th – 5th mill. BC in Eastern Thrace and in the Area South and East of the Marmara Sea – The Earliest Evidence

In the South and East Marmara regions the earliest evidence of human occupation is dated to the time between the first half of the 7th mill. BC and the very beginning of the 5th mill. BC. The beginning of Pottery Neolithic in this area seems to be connected with a very characteristic bullet core technology that has been recorded at different sites, such as Çukuriçi Höyük, (Horejs 2012, 117–131), Ilıpınar, Fikirtepe, Pendik (Gatsov 2009), Barcın Höyük (Gatsov et. al. 2012, 129–137), (*fig. 2.1*), Aktopraklık (Karul 2011, 57–65), (*fig. 2.5*), Menteşe and Gülpinar (Gatsov/Nedelcheva 2014, 416; Gatsov et al. 2012, 129–137). With this technological complex a number of problems, concerning for example its origin, its range of distribution, its technological stability and the reasons for its disappearance, still remain unsolved.

Primarily bullet core technology can be considered as a supra regional phenomenon. Core reduction was performed mainly by pressure and punching. The pressure technique itself includes using a long crutch, hand-held baguette and holding the core with a grooved device, or a shoulder crutch with the core held in a grooved piece (Pelegrin 2012, 467; 470 fig. 18.2; 471 fig. 18.3–4; 472 fig. 18.5; 473 fig. 18.6; 474 fig. 18.7; 476 fig. 18.8; 479 fig. 18.11–12). These detachment techniques were applied to single platform conical cores for the production of blades and bladelets, resulting in the final stages of production in relatively small bullet cores. Detachment with a use of levers is rarely detectable instead. The typological repertoire seems rather uniform, featuring mainly flat circular and semicircular ended scrapers (*fig. 2.3*), thick and macroscrapers (*fig. 2.6b*), characteristic blade perforators and drills (*fig. 2.4; 2.6a*) and trapezes (*fig. 2.2*).

Last but not least, the problem of the origin and distribution of bullet core technology has to be addressed. In Northwest Anatolia this technology is spreading to the south and east of the Marmara See, while it is interesting that it does not extend to the north to Eastern Thrace and Bulgaria. To the east this technology has been recorded in Central Anatolia and in the eastern half of the Fertile Crescent, at Nemerik, Upper or Northern Mesopotamia (Kozłowski/Aurenche 2005; Gatsov/Nedelcheva 2011, 92). Up to now, examples of bullet cores were not found on Cyprus, Crete or in mainland Greece and Macedonia (Naumov et al. 2009, 81 f.; Kaczanowska/Kozłowski 2011, 67–87). The question, whether a specific region of origin for this technical tradition can be identified must remain unsolved.

At present only the lithic collections of the Ağaçlı group from the Turkish Black Sea shore could be considered as an indicator for an Epipalaeolithic/Mesolithic substratum (Gatsov/Özdoğan 1994, 97–120). The information about other kinds of finds provided recently by Mehmet Özdoğan (2014, 33–49) will certainly shed new light on this problem.

In the last years additional information was made available from the north-western Pontic region (Stanko 2009, 8–11; Stanko/Kiosak 2010, 27–100; Gatsov 2013, 85–89). Bullet core technology is a distinguished feature of two Mesolithic cultural units at Kukrek and Grebenyky.[1] The first dates to the end of the Palaeolithic period and is characterised by the cores in question and 'Kukrek inserts' and 'Kukrek burins', burins on flakes. Retouched points, adjacent to an oblique truncation (Biagi/Kiosak 2010, 24) are another part of Kukrek microlithic industry. Typical for Grebenyky are, besides the conical and bullet cores, blade and flake end-scrapers, notched blades, isosceles trapezes, missing in the lithic assemblages of the regions to the

1 See also the contribution of Kiosak in this volume.

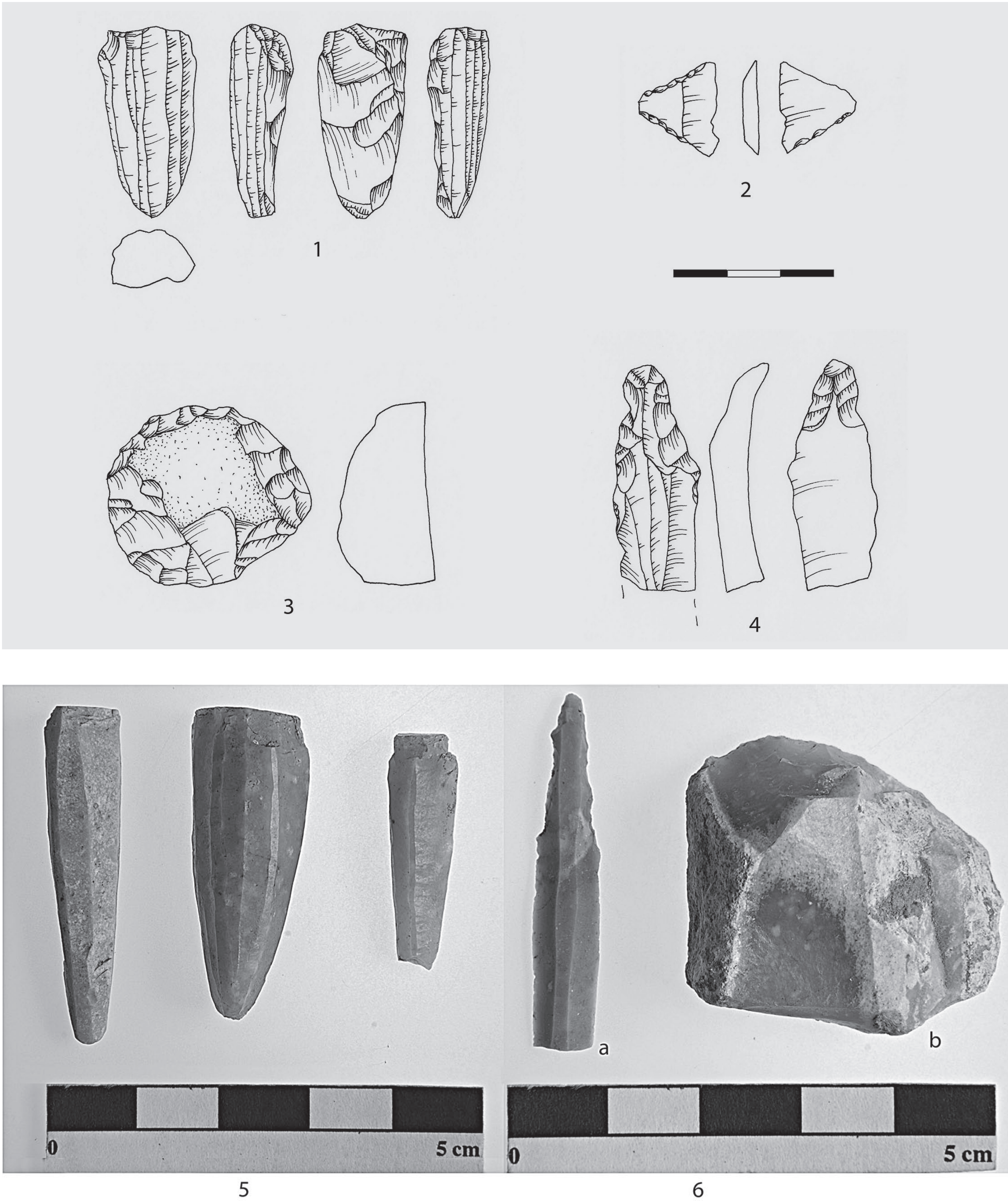

Fig. 2. Barcin Höyük: 1- bullet core; 2- trapez; 3- semi-circular end-scraper; 4- drill; Aktopraklık: 5- bullet cores; 6a- drill; 6b- macro end-scraper.

Fig. 3. Map of the sites mentioned in the text (map by S. Fröhle and S. Wettengl).

south and east of the Marmara Sea (Biagi/Kiosak 2010, 27) (*fig. 3*).

This new information about Mesolithic groups in the north-western Pontic region, including the new radiometric dates from Grebenyky, dates the beginning of this period to the second half of the 8th mill. BC (Біаджі et al. 2008, 35). In conclusion, the presently available results point to rather weak contacts among the Mesolithic groups from the north-western Pontic area and those in the regions south and east of the Marmara Sea during the 7th and 6th mill. BC.

Ivan Gatsov
Petranka Nedelcheva
New Bulgarian University
BG-1618 Sofia
21 Montevideo Str.
igatsov@yahoo.com
pnedelcheva@nbu.bg

Bibliography

Biagi/Kiosak 2010: P. Biagi/D. Kiosak, The Mesolithic of the Northwestern Pontic Region. New AMS Dates for the Origin and Spread of the Blade and Trapeze Industries in Southeastern Europe. Eurasia Antiqua 16, 2010, 21–41.

Efe et al. 2012: T. Efe/I. Gatsov/P. Nedelcheva, The Neolithic Settlement of Keçiçayırı Near Seyitgazi, Eskişehir. In: M. Özdoğan/N. Başgelen/P. Kuniholm (eds.), The Neolithic in Turkey. New Excavations and New Developments 4. Western Turkey (İstanbul 2012) 227–236.

Gatsov 2009: I. Gatsov, Prehistoric Chipped Stone Assemblages from Eastern Thrace and the South Marmara Region 7th–5th mill. B.C. BAR International Series 1904 (Oxford 2009).

Gatsov 2013: I. Gatsov, Lithic Assemblages from the Area of NW Pontic 9–7 mill BC. In: A. Anders/G. Kulcsár (eds.), Moments in Time. Papers Presented to Pál Racky on his 60th Birthday (Budapest 2013) 85–89.

Gatsov/Özdoğan1994: I. Gatsov/M. Ozdogan, Some Epi – Palaeolithic Sites in NW Turkey. Ağaçlı, Domali, Gümüşdere. Anatolica 20, 1994, 97–120.

Gatsov/Nedelcheva 2011: I. Gatsov/P. Nedelcheva, Neolithic Chipped Stone Assemblages in Northwestern Anatolia. Eurasian Prehistory 8.1/2, 2011, 89–96.

Gatsov/Nedelcheva 2014: I. Gatsov/ P. Nedelcheva, Lithic Production Before and After the 4th Millennium BC in the Lower Danube, South East Bulgaria, Marmara Region and Eastern Aegean. In: B. Horejs/M. Mehofer, Western Anatolia before Troy. Proto-Urbanization in the 4th Millennium BC? Proceedings of the International Symposium Held at the Kunsthistorisches Museum Wien Vienna, Austria, 21–24 November, 2012. Oriental and European Archaeology 1 (Vienna 2014) 413–420.

Gatsov et al. 2012: I. Gatsov/P. Nedelcheva/M. Kay, Lithic Assemblages from Prehistoric Settlement at Barcin Höyük, Anatolia. New Results. Eurasian Prehistory 9.1/2, 2012, 129–137.

Horejs 2012: B. Horejs, Cukurici Hoyuk, A Neolithic and Bronze Age Settlement in the Region of Ephesos. In: M. Özdoğan/N. Başgelen/P. Kuniholm (eds.), The Neolithic in Turkey. New Excavations and New Developments 4. Western Turkey (İstanbul 2012) 117–131.

Kaczanowska/Kozłowski 2011: M. Kaczanowska/J. K. Kozłowski, Lithic Industry from the Aceramic Levels of Knossos (Crete, Greece). An Alternative Approach. Eurasian Prehistory 8.1/2, 2011, 67–89.

Karul 2011: N. Karul, The Emergence of Neolithic Life in South and Eastern Marmara Region. In: R. Krauss (ed.), Beginnings. New Research in the Appearance of the Neolithic between Northwest Anatolia and the Carpatian Basin. Papers of the International Workshop 8th–9th April 2009, Istanbul. Menschen – Kulturen – Traditionen; ForschungsCluster 1.1 (Rahden/Westfalen 2011) 57–65.

Kozłowski/Aurenche 2005: S. Kozłowski/O. Aurenche, Territories, Boundaries and Cultures in the Neolithic Near East. BAR International Series 1362 (Oxford 2005).

Naumov et al. 2009: G. Naumov/Lj. Fidanovski/A. Ivkovska, Neolithic Communities in the Republic of Macedonia (Skopje 2009).

Özdoğan 2014: M. Özdoğan, A New Look at the Introduction of the Neolithic Way of Life in Southeastern Europe. Changing Paradigms of the Expansion of the Neolithic Way of Life. Documenta Praehistorica 41, 2014, 33–49.

Pelegrin 2012: J. Pelegrin, New Experimental Observations for the Characterization of Pressure Blade Production Techniques. In: P. Desrosiers (ed.), The Emergence of Pressure Blade Making. From Origin to Modern Experimentation (New York 2012) 465–500.

Sirakov et al. 2007: N. Sirakov/Ts. Tsanova/S. Sirakova/S. Taneva/I. Krumov/I. Dimitrova/N. Kovacheva, Un nouveau faciès lamellaire du début de Paléolithique supérieur dans les Balkans. Paléo, revue d'archéologie préhistorique 19, 2007, 131–144.

Stanko 2009: V. N. Stanko, Formation Dynamics of the Population of the Northwestern Pryčernomorja Steppe in the Upper Palaeolithic and Mesolithic. Quaternary International 197, 2009, 8–11.

Stanko/Kiosak 2010: V. Stanko/D. Kiosak, The Late Mesolithic Settlement of South-Western Ukraine. Atti Società per la Preistoriae Protostoria della regione Friuli-Venezia Giulia, 17 2010, 27–100.
Біаджі *et al. 2008*: П. Біаджі/В. Станко/Д. Кіосак, Нові радіовуглецеві дати поселення Мирне. Серія Історичні науки Спецвипуск 83.96, 2008, 33–37.

DUŠAN BORIĆ AND EMANUELA CRISTIANI

Social Networks and Connectivity among the Palaeolithic and Mesolithic Foragers of the Balkans and Italy

Keywords: hunter-gatherers, social networks, shouldered pieces, personal ornaments, decorated portable art

'For a number of reasons, including reproduction, the behavior of humans and their nonhuman primate relatives needs to be broadly circumscribed in space. Humans (and primates) are always in webs of interaction with their conspecific neighbors and their neighbors' neighbors.' (Wobst 2000, 221).

'Along the Pacific coast where lived small nations that, even though speaking mutually unintelligible languages (numbering several dozens), were trading with each other. (...) dentalia shells gathered only in the Puget Sound and north of it were much in demand in California. In the other direction, the mother-of-pearl, from abalone shells that came from southern California was traded all the way up to the British Columbia and Alaska, where it was used in making jewellery and other precious objects. I have cited in The Naked Man *(...) a long text from Teit on the intertribal fairs held on the lower Columbia as well as inland, a text that draws startling picture of commercial exchange among peoples sometimes very far removed from one another…'* (Lévi-Strauss 1995, 179 f).

Abstract

Major environmental perturbations over the last glacial period, with considerable changes in sea levels, have significantly affected the spatial organization of Palaeolithic and Mesolithic hunter-gatherer communities between the Balkans and Italy.[1] For this reason, these regions are an ideal case for studying how different environmental factors could affect connectivity among human groups and rates of innovation.

Italy and the Balkans are also key transitory regions for various dispersal events in the evolutionary history of the European continent that brought different hominin taxa into Europe from the areas of Africa and south-western Asia. Yet, compared to various well-researched regional hotspots in central and western Europe, the picture of the Palaeolithic and Mesolithic adaptations re-

1 We thank Dimitrij Mlekuž for the base map of the Balkans and Italy used in this article, Paola Ucelli Gnesutta for her help with evidence from Settecanelle, and Robert Whallon for the permission to adapt his drawing in our fig. 15. Dušan Borić thanks Raiko Krauss and Harald Floss for organizing intellectually stimulating and enjoyable workshop in Tübingen in May 2014 where a version of this text was presented.

mains coarse-grained in particular in the Balkans as a result of a historical research bias followed by unsettled recent history preventing the application of new research methodologies. In this paper, we aim to highlight particular examples of connectivity across large tracks of land during the Palaeolithic and Mesolithic and to point out the potential that social network thinking has in the study of the Balkans and Italy.

Social Analysis in Hunter-Gatherers Studies: A Theoretical Context

Traditionally, in the scholarship dedicated to the study of early prehistoric periods, and in particular the Palaeolithic, interest has primarily been focused on taxonomic ordering of diagnostic artefact types, ecological/environmental aspects of the evidence and/or explanations that prefer broad evolutionary trends. Culture-historical, evolutionary behavioural ecology, or Neo-Darwinian approaches (cf. Bettinger 1995) are the backdrop to such dominant agendas in this research field. The interest strongly remains to uncover decisive breaks or 'missing links', focusing on origins and revolutions as the main currency of invested debates (Gamble 2007).

Similarly, the study of social organization of forager communities has often been limited to the preconceived umbrella concept of band-level societies that are applied uniformly to most if not all forager societies worldwide and throughout human history, despite ethnographic evidence for a much larger array of organizational forms, which also must have characterised foraging societies of the past (Binford 2006). Group-centred approaches in anthropological and sociological analysis of hunter-gatherer social contexts see human societies through an architectural metaphor of a given edifice with little space for individual agency to make a difference and within a stadial view of social evolution (Gamble 1999). Wobst argues, 'researchers of quite contrasting paradigms tend to perpetuate the same "environmental" bias in their presentation of forager data' (Wobst 2011, 269). These deeply rooted ways of looking at hunter-gatherer societies in early prehistory hamper any potential for developing more nuanced approaches that would open up the study of these early periods to new conceptual horizons.

Going beyond the focus on environmental constraints and social institutions in forager studies one could usefully utilize various paths provided by network theory and social network analysis (SNA), which allow us to sidestep the dichotomy between the structure and agency, society and individual through a multi-scalar approach to social reality (Gamble 1999). The focus on SNA in social sciences has proved useful in conceptualizing and analysing the increasing complexity of personal and institutional relationships in the present-day context. Recent research emphasizes the antiquity and uniqueness of the social networking faculty in humans, singling out the aspect of co-operation in establishing ties with both kin and non-kin as a feature that must have been present in early humans (Apicella et al. 2012). The core properties of social networks bridge past and present, simple and complex social contexts.

Regarding the development of hominin sociality, anthropological research has shown that by 300.000 BC the neocortex of the brain was developed enough to maintain social relations with networks of around 120 and up to 150 people (Aiello/Dunbar 1993; Dunbar 1996). In this context, the question emerges about the type of communication mechanisms for the maintenance of such social networks, with the importance of rudimentary forms of language in order to transcend physical aspects of social 'grooming' through a kind of 'vocal grooming' (Gamble 1999, 261). The latter is also based on the antiquity of FOXP2 language gene (Krause et al. 2007). Moreover, the Social Brain Hypothesis predicates that novel cultural and biological mechanisms were evolutionary responses to the increasing need to integrate more individuals and other social units (some of which are only infrequently encountered) into social networks that encompassed wider communities and dispersed social systems as the consequence of social complexity (Gamble et al. 2011). The expensive tissue hypothesis links these various strands of evidence for the evolutionary development of human (and generally primate) brains and suggests that the process of encephalization, i.e. the development of larger brains, seen as physiologically expensive tissue, required higher protein intake derived from largely carnivorous and generally higher quality dietary habits (Aiello/Wheeler 1995; Powell et al. 2010). Concomitant changes must have ensued in patterns of resource procurement and life strategies in order to maintain these bigger brains (Foley/Lee 1996).

Gamble (1999) has suggested three main levels of personal networks that would apply to hominin species in order to conceptualize the structure of hunter-gatherer social life: (a) intimate networks (~five individuals that can be equated with a nuclear family or any 'significant others') relying primarily on emotional resources in maintaining relations; (b) effective networks (~20–25 individuals that in the context of hunter-gather societies can be equated with minimal bands, thus corresponding to lineage and village groups) mobilizing emotional but also material and to a lesser extent symbolic/stylistic resources; and (c) extended networks (100–400 individuals that would correspond to effective breeding units or tribal groups of a maximum band comprising up to 500 individuals), which, while to lesser extent relying on emotional resources, often mobilize material and in particular symbolic/stylistic resources. While in this way defined levels of social networks bear resemblance to the so-called magic numbers often used in understanding the demography and defining institutions of hunter-gatherer studies grounded in various ethnographic examples around the world (Birdsell 1973; Kelly 1995; 2013; Wobst 1974), Gamble's approach calls for questioning of a group-based model of society as such, emphasizing the need to refocus our attention to the key role of individuals within social networks. Network theory analysis, which views social relationships in terms of nodes (individual actors within networks) and ties (representing relationships between the individuals), provides a methodological framework for a much needed novel approach to the study of social agency in Palaeolithic and Mesolithic archaeologies. Apart from Gamble's (1999) pioneering works in advocating this type of approach, there has been little dedicated attempt to apply network theory analysis in the study of Palaeolithic and Mesolithic periods with some notable exceptions (Coward 2010; 2013; Whallon 2006).

Environmental Changes, Population Size and Social Networks

Binford (1980) suggested archetypical movement strategies for foragers, splitting them into 'collectors', i.e. logistically organized groups that move infrequently within a tethered pattern of mobility in contrast to 'foragers', i.e. groups characterised by a high degree of residential mobility who frequently relocate their camps. This dichotomy of ideal types rarely works as such and should be seen as a range, whereas a much wider spectrum of types and commitments to mobility should be envisaged. For example, there are documented forager groups that are residentially stable at the locus of concentrated and predictable resources (e.g., Heffley 1981; Kelly 1995; 2013) and network (social) mobility and informational mobility have recently been stressed by Whallon et al. (2011; cf. Whallon 2006). While Binford emphasized the movement across landscapes as part of embedded procurement, i.e. primarily as part of subsistence-oriented movements, one should also account with 'non-utilitarian' movements, such as those related to exchange, as in Bushmen's *!hxaro* (Wiessner 1982; cf. Whallon 2006; Whallon et al. 2011). Subsequently, Whallon (2006, 262 f.) distinguished four types of mobility: residential mobility, logistical mobility, 'network mobility' (visiting kin and other socially significant others) and 'information mobility' (e.g., visiting sacred sites, ritual and ceremonial movements), but stresses that one should not expect sharp boundaries between the character of these theoretically differentiated types of mobility.

It seems reasonable to assume that among prehistoric hunter-gatherer societies, beyond intimate networks of ~five individuals (family unit) and effective networks of ~20–25 individuals (band), extended networks of up to 500 individuals corresponded to effective breeding units or tribal groups of a maximal band (Gamble 1999). Within such maximal bands cultural practices were transmitted, learned and shared, resulting in similarities of technological know-hows and material culture styles. For instance, in such maximal bands exchanges of flint raw material at distances of up to 150 km were common. In these small-world-like societies strong ties depended on frequent face-to-face encounters. Yet, around ~45.000 BC, with the start of the Upper Palaeolithic in Europe, and possibly related to the spread of Anatomically Modern Humans (AMH), the archaeological record indicates an increasing importance of long distance connections beyond the territories of adjacent maximal bands (see below). Evidence of exotic marine shells found over 200 km and up to 800 km from their place of origin, as well as similarities in cultural practices and forms of artefacts over large territories suggest movements of people, objects, and innovations. Why were such connections among distant communities established? One answer to this question could be that it became important to establish regional networks as 'safety nets' in unpredictable and changing climates and environments (Whallon 2006). In harsher landscapes we could assume larger hunter-gatherer territories. Through gift-giving, exchanges, ceremonies and rituals, people might have relied on what is in network theory (Borgatti/Halgin 2011) referred to as the strength of weak ties of mutual rights and obligations among individuals who are not frequently encountered and who do not share the same cultural traditions and styles.

But the argument about 'safety nets' might appear overly utilitarian, providing a retrospective understanding and justification of social and cultural practices in terms of practical reason. In this tradition of anthropological thought culture is understood as 'constructed out of practical action and interest, as guided by a kind of super-rationality' (Sahlins 1976, 73). According to this view, cultural practices, which govern exchanges of 'exotic' items as well as patterns of resource procurement and mobility, are reduced to 'adaptive advantages'. Yet, collective forms of experience with shared representations often remain grounded in unreflected thought (Descola 2013, 74 f.) with the sociality of the human world always already being symbolically constituted along the grid of invariants that universally structure human mind (e.g., Lévi-Strauss 1987).

An alternative explanation is that offered by Gamble (2012) who, taking a much longer evolutionary view and building on the Social Brain Hypothesis (e.g., Dunbar 1996; Gamble et al. 2011), suggests the critical role of emotions in the creation and maintenance of larger social groupings and social networks among large-brained hominins. This author in particular emphasizes social emotions in dealing with others, such as shame, envy, jealousy and pride, which are the basic prerequirements for the existence of social institutions. In his view, emotions are used 'as a resource that can be amplified to strengthen social bonds' (Gamble 2012, 19).

A hypothesis could also be proposed that the establishment of extensive ('global') social networks and their maintenance since the start of the Upper Palaeolithic in Europe not only related to the rates at which novel behaviours spread, were adopted and developed, but also, more critically, to a widespread adoption and retention of certain innovations (cf. Davies 2012). Evolutionary, population-based models suggest that innovations are less likely to be selected and retained when population levels decline, which is often due to environmental/climatic deteriorations (*tab. 1*). In such models, a density of social networks is an important factor in the spread of innovations (Shennan 2001; Kuhn 2012; for a critique see Gamble 2012). This population size, 'too-few-trees/minds-in-the-forest' argument (Gamble 2012, 20), suggests that demographic effects of expansion and shrinking affect rates at which new and beneficial innovations appear and spread regarding the accumulation and retention of cultural skills. For instance, it is argued that cold phases caused the contraction of cultural diversity due to population decline and loss of cultural knowledge (e.g., Shennan 2001; Powell et al. 2009). These different factors are possibly linked but we often lack systematically collected and analysed data of sufficient magnitude and diachronic depth to examine these different factors together.

Three more specific hypotheses can be suggested taking into account demography, environmental/climatic factors, rates of innovations, and social networks:

- Rates of innovation and culture change are random, and were directly dependent on population size: high innovation rates are linked to periods of high population growth and vice versa;
- Even when population levels grew due to high resource availability, innovation rates declined;
- Despite low population size and/or environmental constraints, the strength of weak ties, which

	Environmental/ Archaeological proxies	High innovation rates	Low innovation rates
Climate/ Environment	Sea-level changes; pollen diagrams; speleothems	High resource availability in different biotopes	Concentrated and patchy resources in harsh environments
Population size/ density	Numbers of radiocarbon dates; site densities; thickness of arch. layers and artefact densities; diet breadth	Increase/high	Decline/low
Material culture and land use strategies	Techno-morphological properties of artefacts; techniques of hafting and use; faunal and plant remains	High diversity in tool forms and modalities of use; new ways of exploiting resources	Low diversity in tool forms and land use strategies (conservatism) over long periods of time
Social network properties	Movement of flint raw materials; movement of shells and other 'exotica'	High density networks of strong and weak ties	Isolated populations or connected beyond maximal band territories primarily through weak ties

Tab. 1. Summary of expectations regarding high and low innovation rates linked to parameters measurable for the Palaeolithic and Mesolithic along with specific environmental and archaeological indicators.

served as 'safety nets', in social networks allowed the spread of innovations due to high mobility.

The methodological challenge remains how best to estimate population parameters in Early Prehistory or measure rates of change and the diversification of material culture forms (e.g., through the development of stone artefacts typological categories) due to the low level of compatibility among different analysts. Hence, SNA is rarely applied in the study of network structures among foragers (but see Coward 2013). It is outside the scope of this paper to provide an analysis within a formal framework of SNA in relation to a particular empirical case study. Instead, we aim to highlight particular examples of connectivity across large tracks of land during early prehistory and to point out the potential that social network thinking has in the study of two related areas of south-eastern Europe: the Balkans and Italy.

Early Balkan and Italian Prehistory: Archaeological Context

Major environmental perturbations over the last glacial period, with considerable changes in sea levels, must have significantly affected the spatial organization of hunter-gatherer communities between the Balkans and Italy. It makes these regions an ideal case for studying how different environmental factors could affect connectivity among human groups and rates of innovation. The Balkans and Italy are also key transitory regions for various dispersal events in the evolutionary history of the European continent that brought different hominin taxa into Europe from the areas of Africa and south-western Asia. These southern European provinces yielded the first evidence of cultural and cognitive novelties and human fossil remains that mark the emergence of Upper Palaeolithic social contexts and behavioural and cultural complexity on the European soil. Compared to various well-researched regional hotspots in central and western Europe, the picture of the Palaeolithic and Mesolithic remains coarse-grained in particular in the Balkans as a result of historical research bias followed by unsettled recent history preventing the application of new research methodologies.

Both the Balkans and Italy are characterized by Lower Palaeolithic records with both human remains and artefacts dated to more than half a million years ago (e.g., Guadelli et al. 2005;

Kuhn 1995; Mussi 2002; Rink et al. 2013; Roksandic et al. 2009; Sirakov et al. 2010; Stiner 1994). There are also considerable Middle Palaeolithic records spread across both regions (e.g., Darlas/Mihailoviće 2008; Mussi 2002; Mihailović 2009; Peresani 2012; Richards et al. 2000; Rink et al. 2002). With regard to social networks in the Middle Palaeolithic of Italy and the Balkans, despite occasional evidence for longer stone raw material transfers, up to 100 km as shown by case studies from southern Italy (Spinapolice 2012) and Hungary (Kozłowski 1994), and often related to the use of Levallois technique in the course of the later phases of the Middle Palaeolithic (Gamble 1999, 265), local raw materials are the predominant component of knapped stone assemblages. Such local networks in raw material transfers did not often exceed distances of 15 – 20 km from the place of gathering/habitation/disposal. Mellars suggests that in the Middle Palaeolithic 'variable degrees of social distance maintained between human populations' led to 'separate patterns of technological development' (Mellars 1996, 355). Neandertal populations largely dwelt within their immediate landscape of habit, i.e. within what Gamble defines as intimate and effective networks (see above). In other words, Neandertal social life depended 'on co-presence and the reaffirmation of bonds through regular contacts instilled in the practices of everyday life' (Gamble 1999, 265). Yet, as with earlier hominins, fission and fusion process for raw materials transport or communal hunt might have created an awareness of belonging to larger communities. It also seems that any innovation and new behaviours might have been localized in particular regional zones due to the lack of 'global' networks (Davies 2012).

It is only with the start of the Upper Palaeolithic that the recovered artefacts indicate the existence of cultural/stylistic links over much wider regions, suggesting the establishment of the first extended, 'global' social networks in Europe. The start of the Upper Palaeolithic in the Balkans and Italy has been for some time the matter of intense debate regarding the nature of the Middle to Upper Palaeolithic transition. In both regions, just before ~40.000 cal BP, several so-called transitional lithic industries are known based on the largely Levallois-derived reduction sequences – in the Balkans the best known is Bachokirian after the site of Bacho Kiro in Bulgaria (Kozłowski 2007) and in Italy Uluzzian, after the site of Grotta di Uluzzo, spread in the southcentral parts of the Peninsula and southern Greece. Associated with these assemblages are items of personal decoration in the form of perforated shells, teeth as well as tools made on osseous materials, seen as key elements of cognitive and behavioural modernity (Benazzi et al. 2011; Mussi 2002; Stiner 2010). It has been argued that in the absence of affinities between these traditional industries and the preceding local Mousterian Middle Palaeolithic traditions in the Balkans and Italy, the origin of these Levallois-derived assemblages must be sought in the Near East where comparable examples can be found (Kozłowski 2004; 2007). While it is not easy to assign straightforwardly a taxon to technological traits, the assumption was made that AMH could be associated with these transitional industries, also suggested by the most recent re-evaluation of human remains associated with Uluzzian levels from Grotta del Cavallo, dated to ~45.000 – 43.000 cal BP (Benazzi et al. 2011). It seems that these transitional industries are then followed by the further spread of the typical early Upper Palaeolithic traditions of material culture traits known as Proto-Aurignacian and evolved Aurignacan. One of the typical Aurignacian traits is the appearance of split-base points on antler, which are very abundant at some of the sites, and attest to the innovations in hafting technology (Knecht 1993), which likely related to changes in hunting techniques. Yet, based on recently obtained direct radiocarbon accelerator mass spectrometry (henceforth AMS) dates on Neandertal human remains from Vindija in Croatia, redated to ~33.000 – 32.000 cal BP (Higham et al. 2006), there is an overlap between these dates and those of the Initial/Early Upper Palaeolithic elsewhere (Jöris et al. 2008) raising the possibility for the co-existence of Neandertal and AMH populations in south-eastern Europe.

Further, the importance of the Danube River Basin in the dispersal of AMH across Europe is supported by both early dates for the start of the Upper Palaeolithic in central Europe (from ~42.000 cal BP [Conard/Bolus 2003; Higham et al. 2012]), as well as a number of AMH fossils with early radiocarbon dates along the Danube in the south-western Carpathian Mountains (Soficaru et al. 2006; Soficaru 2007). The earliest dated fossils comprise cranial remains of two individuals from Peștera cu Oase (in the Romanian hinterland of the Danube), which are among the oldest directly dated AMH remains from Europe (Trinkaus et al. 2013; Zilhão et al. 2007; cf. Higham et al. 2011; 2012). In addition, the first traces of Initial/Early Upper Palaeolithic human occupation contemporaneous with the Oase fossils have been found at Tabula Traiana Cave within the Danube Gorges region (Borić et al. 2012). This newly available chronological framework is also supported by the stratigraphic position of tephra levels or the presence of shards from the widespread Campanian Ignimbrite (CI) volcanic eruption dated to ~40.000 cal BP, which originated in the Phlegrean Fields near present-day Naples, representing an important chronostratigraphic marker for various sites across Italy, south-eastern and eastern Europe (Lowe et al. 2012).

Recently re-evaluated evidence for the Palaeolithic occupation of the Danube Basin in the north-central Balkans (Baltean 2011; Bonsall et al. 2012) along with newly discovered and excavated sites (e.g., the site of Šalitrena Cave [Mihailović 2008; Mihailović et al. 2011]) suggests clustering of key Upper Palaeolithic sites in the Sava-Danube River corridors, as important transitory zones where the pace of cultural innovations might have been accelerated due to the intensity of contact and communication that over time resulted in the creation of extended social networks. The assumed rapid spread of Aurignacian industries across Europe suggests that probably natural corridors along river valleys and coasts must have been used. It has been suggested that one of the main Aurignacian routes reaching Italy was along the Sava River valley through the present-day territories of Serbia, Bosnia and Croatia, into the territory of Slovenia, then along the northern Adriatic rim and farther westward along the Po Valley en route to western Europe. Along the route there are important concentrations of sites in the wider catchment of these transitory zones in south-eastern Europe (e.g., Slovenia [Brodar/Osole 1979] and Istria [Balbo 2008; Malez 1979]), farther westwards in coastal Liguria, and generally along the coasts of the Tyrrhenian and Adriatic Seas in Italy (Higham et al. 2009; Mussi 2002). One could see these Aurignacian groups as the earliest examples of extended social networks in Europe.

The evolved Aurignacian industries are generally followed by the Gravettian industries with backed blades and bladelets from ~28.000 cal BP, although in Istria, Croatia (Šandalja II) and the Argolid, Greece (Klisoura Cave 1) the layers with Aurignacian type material might have endured up to ~28.000 BC (Karavanić 2003; Kozłowski 2008; Kuhn et al. 2010). In the eastern Balkans, important sequences documenting these time spans were found in Bulgaria at the sites of Bacho Kiro (Kozłowski 2004 and references therein), Temnata (Kozłowski et al. 1992; Tsanova 2008) and Kozarnika (Guadelli et al. 2008; Tsanova 2008) caves, with indications of gaps between the Aurignacian and Gravettian levels. Stratified Aurignacian and Gravettian levels were also found at the newly discovered site of Šalitrena Cave in the central Balkans, dated to ~24.000 – 25.000 cal BP (Mihailović 2008; Mihailović et al. 2011). With regard to the changing climatic conditions around this time, there were several short interstadial events between 28.000 and 21.000 cal BP while the ice advance accelerated after 25.000 BC, leading to the Last Glacial Maximum (henceforth LGM) (22.000 BP±2000) (Alley et al. 2005). These changes also led to the shrinking of the Adriatic Sea, opening a large land bridge, known as the Great Adriatic Plain, between Italy and the Balkans. It has been argued that the northern Adriatic Plain might have been a zone of high resource productivity (Miracle 2007; but see Mussi 2002, 312). This newly gained territory and the worsening of environmental conditions leading to the LGM might have prompted, at the peak of glacial conditions, actual movements of human populations from the Middle Danube Basin, where well-established Gravettian communities are known (e.g., at Willendorf II, Pavlovian sites), to the areas of southern Europe, with certain parts of the Balkans and Italy, and in particular the Great Adriatic Plain, serving as refugia for both animal, plant and human communities.

While it remains difficult to substantiate the claim about the actual population movement during this period it seems that important influences from the Middle Danube Basin reached both the

Balkans and Italy relating to the spread of techno-morphological traits in lithic types characteristic of the central European Gravettian traditions (Willendorf II layer 9 – Moravany – Banka – Nitra Čerman) (Kozłowski 2008). In particular, in the period following the LGM, from around 23.000 cal BP if not earlier (see below), across the Balkans and Italy one finds a specific typological category known as shouldered piece, which might have related to the development of new hafting techniques, prompted by changes in hunting practices. Shouldered pieces represent an unmistakable techno-functional and stylistic trait that defines the typical early phase of Epigravettian industries, with similarities across the Balkans and Italy (Whallon 1999).

Our research at the site of Vrbička Cave (950 masl) also suggests that in terms of land use strategies, higher altitude locations in the Dinaric Alps started being utilized since the start of the LGM with the documented specialized marmot hunting sites (Borić et al. 2014a; Cristiani 2013; 2014). This is one of the earliest documented examples that testifies to the existence of a long-term evolutionary innovation in land use strategies referred to as broad spectrum economy, i.e. a move from exclusive focus on large game hunting to small game species and in general a wider resource base.

During the Gravettian period, there are examples of raw material transfers over considerable distances. In the eastern Balkans, small quantities of non-local limnoquartzites were transported from the northern parts of the Carpathian Basin to Temnata Cave (Pawlikowski 1992), while possibly similar examples can be found in southern Apulia in Italy (Bietti/Cancellieri 2007). Apart from lithic raw materials, the circulation of marine molluscs, such as *Dentalia*, *Cyclope neritea*, etc., is also attested (Mussi 2002). Such examples may indicate a significant degree of connectivity across these regions over long distances. We will later come back to more detailed examples of these transfers.

The evidence for such connections further increases in the Late Epigravettian phase with general tendencies for the spread of Azilian characteristics and microlithisation in the production of backed points for composite tools. There are further examples of the links between the Danube Gorges Epipalaeolithic sites and various contemporaneous Late Epigravettian sites in Italy (e.g., Cancellieri 2010), which we also explore in some detail below. The presence of Late Epigravettian clay figurines in the Adriatic Basin also suggests possible connections with the tradition found in central Europe (Farbstein et al. 2012). These examples suggest long-distance connectivity across these adjacent regions of southern Europe and beyond at the end of the Pleistocene. The interstadial conditions (Bølling/Allerød oscillations) leading to the melting of glaciers in the Alpine region, prompted a re-colonization of higher altitude locations by human groups in the Italian Alps from ~15.000 cal BP. At this time in the Prealps, similarly to earlier examples from the Balkans, some of these groups start focusing on marmot hunting, with several specialized sites identified to date (Romandini et al. 2012).

The start of the Holocene along with the amelioration of environmental conditions after ~11.600 cal BP, brought about the recovery of plant communities across these regions, fostering the growth of dense vegetation coverage (Willis 1994). The inundation of the Great Adriatic Plain and various other coastal regions took place due to the onset of rapid late glacial warming from ~15.000 cal BP, causing the rise of sea levels. It has been argued that these developments significantly affected long distance connections across the Balkans and Italy and led to a relative insularity of foraging communities in both regions in the course of the Early Mesolithic (~11.600–9200 cal BP). Such changes must have considerably affected the territorial organization of Late Epigravettian groups (Whallon 2007a). Evidence of Early Holocene adaptations have been found in the Danube Gorges (Bonsall 2008; Borić 2011), Montenegro (Mihailović 2007), southern Greece (Kozłowski/Kaczanowska 2009), Thessaly (Kyparissi-Apostolika 2003), Istria (Miracle 1997) and on Adriatic islands, while the period is much better researched and known in Italy (Mussi 2002 and references therein). Some have suggested a process of regionalization, with little evidence of long distance contacts, leading to socially ‘closed’ societies in the Early Mesolithic (Mihailović 2007). It also seems that distinct cultural/stylistic territories were established, on the one hand, in Italy and along the eastern Adriatic coast with the chronological succession of the Sauveterrian (Early Mesolithic) and Castelnovian (Late Mesolithic) techno-complexes, and, on the other, the hinterland regions of the Balkans characterized by the continuation of Epigravettian traditions (Kozłowski/Kaczanowska 2009). Yet, there are well-documented examples of long-distance exchanges of symbolic items, such as marine shells, between the deep hinterland areas such as the Danube Gorges and various coastal regions along the Adriatic (Cristiani/Borić 2012), re-emphasizing the importance of riparian corridors (e.g., Borić 2011; Floss 2014). There is also evidence for a considerable increase in the use of osseous materials and the development of specific artefact forms, such as harpoons, across both regions.

This short overview has highlighted key developments across the Balkans and Italy in the course of early prehistory and it reveals the potential of the proposed undertaking, which aims to explore two adjacent regions of southern Europe in which both climatic/environmental and sociocultural factors might have affected patterns of social organization of hunter-gatherer groups over millennia. This represents a largely untapped resource, as our current knowledge of these periods remains hampered by various preservation and research biases (especially in the Balkans). In the following, we provide more specific examples of connectivity between the Balkans and Italy in the course of the Upper Palaeolithic and Mesolithic.

Shouldered Pieces

As previously mentioned, one particular technological innovation in knapped stone assemblages that appeared in the course of the Upper Palaeolithic of both the Balkans and Italy are shouldered pieces (*fig. 1*). These are most frequently points (*pointes à cran*), but other tool morphologies (e.g., blades) are also found with recognizably tapered and retouched bases used for hafting. The appearance of this innovation has often been associated with the Early Epigravettian period in the Balkans and Italy. It has been assumed that this innovation spread from Gravettian cultures of central Europe, possibly even as part of actual population movements from central Europe into southern European refugia at the time of the worsening of climatic conditions in the course of the LGM. Such processes might have led to the patterning of archaeological evidence that is referred to as 'the shouldered point horizon' (Kozłowski 2008, 9). This tool type represents an important fossil directeur for the period in these regions (*fig. 2*). Importantly, this innovation is linked to changes in hunting practices, with the introduction of different hafting technological solutions for fixing arrows on thinner shafts and allow for lighter and well balanced projectiles, arguably easier to produce than those with centrally placed stems, which are more fragile. Such projectiles, used either with bows or spear-throwers, allowed for the targeting of prey at larger distances (Plisson/Geneste 1989).

In northern Italy, industries with *à cran* pieces have been found at Grotta delle Arene Candide and Grotta dei Fanciulli in Liguria (Laplace 1964; 1966) and at Grotta Paina in Veneto (Broglio et al. 1993). In the south-eastern part of the peninsula the key sequence is the site of Grotta Paglicci in Puglia, which has yielded the most complete Epigravettian stratigraphic sequence for the wider Adriatic region (Mezzena/Palma di Cesnola 1967). At Grotta Paglicci, shouldered pieces are found in Early Epigravettian layers (from layer 18 to 10). The presence of shouldered pieces is also attested in the caves of Taurisano (Bietti 1979), Mura and Cipolliane in Salento, Grotta Niscemi and Canicattini Bagni in Sicily, and Riparo del Romito in Calabria. This widespread distribution suggests that shouldered pieces are well established in all southern regions of Italy. Early Epigravettian cave settlements are known also in the Apennine Mountains, in Marche and Abruzzo regions. Shouldered pieces are also found at the sites of Cavernette Falische (Mussi/Zampetti 1985), Grotta del Sambuco (Barra Incardona 1969), Cenciano Diruto (Pennacchioni/Tozzi 1984), and Grotta delle Settecannelle (Ucelli Gnesutta/Cristiani 2014 and references therein) in Lazio.

Some of the earliest sites with shouldered points in the Balkans are found in Istria, Croatia (Šandalja II with a date of 21.740±450 BP, Malez 1979), Ovčja Jama in Slovenia (layers 3 and 4 with the date of 19.540±500 BP, Osole 1962/1963) and Kastritsa in western Greece (level 19 with the date of 19.900±370 BP, Bailey/Gamble 1990). Recent research at Vrbička Cave in western Monte-

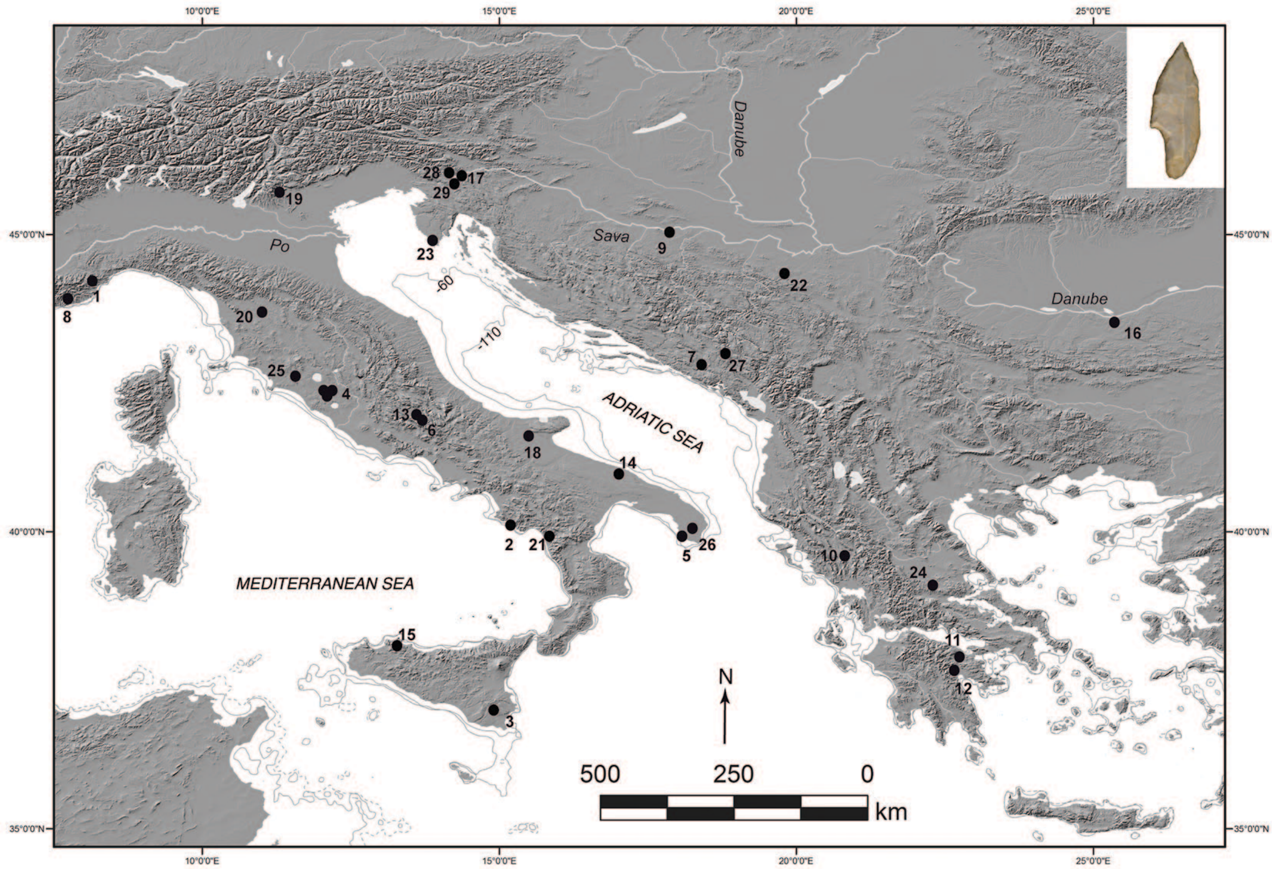

Fig. 1. Map showing the distribution of sites with shouldered points in the Balkans and Italy. Bathymetric contours show the drop of sea levels –110m during the LGM climax and –60m by the end of the Pleistocene.
1. Arene Candide; 2. Cala della Ossa; 3. Canicattini Bagni; 4. Cavernette Falische (Cenciano Diruto, Lattanzi, Sambuco); 5. Cipolliane C; 6. Clemente Tronci; 7. Crvena Stijena, layer IX; 8. Fanciulli; 9. Kadar; 10. Kastritsa; 11. Kephalari; 12. Klissoura 1, layer IIb; 13. Maurizio; 14. Mura; 15. Niscemi; 16. Orphei (Tchoutchoura); 17. Ovčja Jama; 18. Paglicci; 19. Paina; 20. Poggio alla Malva; 21. Romito; 22. Šalitrena; 23. Šandalja II; 24. Seidi; 25. Settecannelle; 26. Taurisano; 27. Vrbička; 28. Zakajeni spodmol; 29. Županov spodmol.

negro reports one shouldered blade piece. This might currently be the earliest dated occurrence of shouldered pieces in the Balkans as the layer in which it was found is AMS-dated to 23.120±160 BP (OxA-27861), which calibrates to around 28.000–27.000 cal BP (Borić et al. 2014a; Cristiani 2013; 2014), pushing the occurrence of this tool type in the Balkans to the Gravettian period in the context of the earliest backed industries of the region. Two shouldered pieces have also been found in the Gravettian levels of Šalitrena Cave in western Serbia and are said to date to the period 25.000–24.000 cal BP (Mihailović 2008; Mihailović et al. 2011, 89) but the actual dates from this site have not been published yet.

Currently, there remains a need to better understand the occurrence of the 'horizon with shouldered points' across the Balkans and Italy along with a need to establish a more accurate chronological scale for the appearance of this *fossil directeur* in these two regions and determine likely links with the industries in the Middle Danube Basin. It has been suggested that it was the actual population movement into southern European refugia during the LGM that allowed for the spread of innovations in the form of shouldered pieces. An alternative or complementary explanation could be that the spread of this particular hafting innovation as a possible improvement in hunting techniques was part of knowledge transfers that were enabled by the existence of well-connected social networks that might have in part been prompted by the worsening of the climatic conditions with the onset of the LGM. One could envisage that the frequency of 'arrhythmic' processes of population contraction and disper-

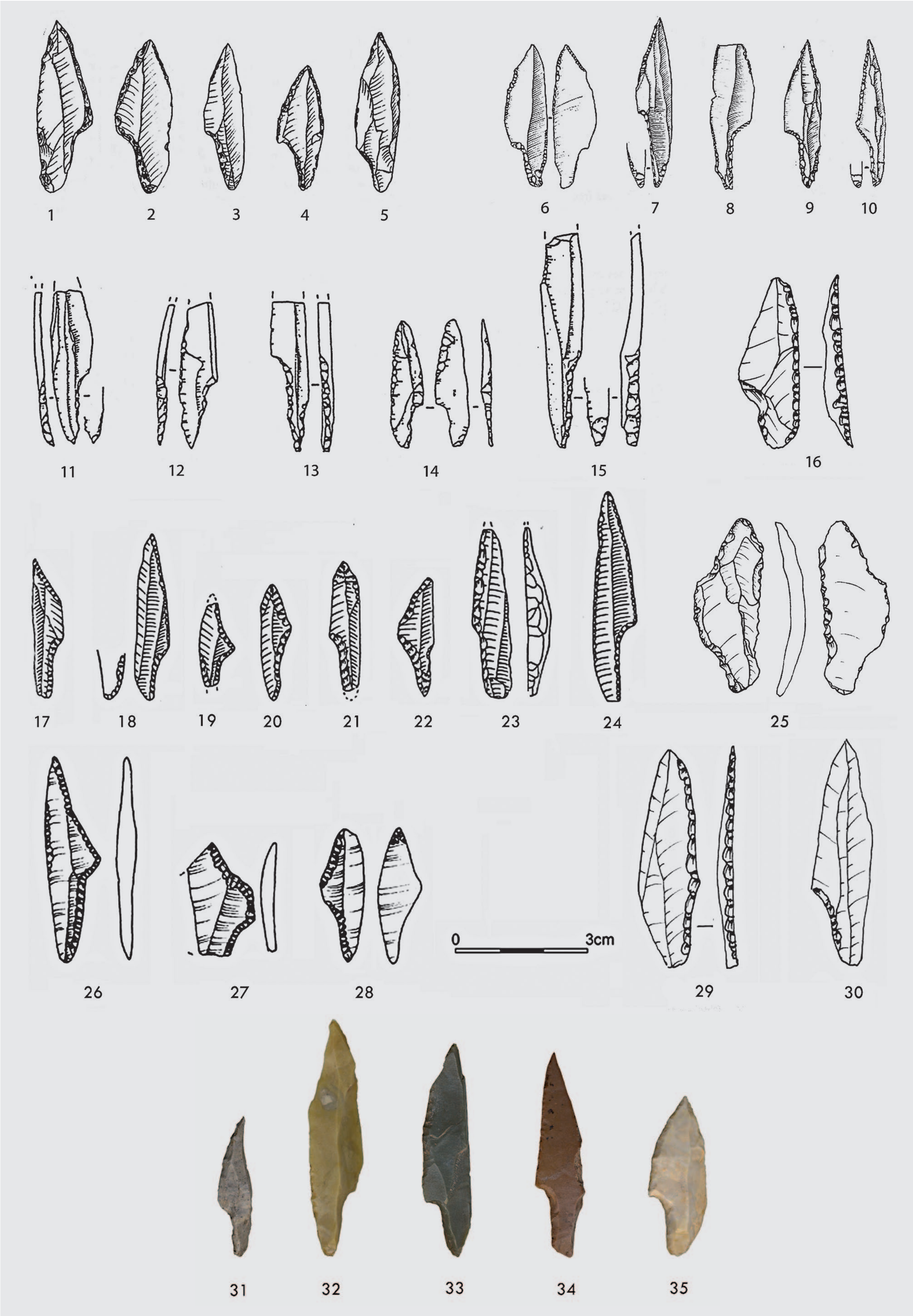

Fig. 2. A selection of shouldered points from various Gravettian/Epigravettian sites in Italy and the Balkans.
1 – 5. Settecannelle; 6 – 10. Paglicci; 11 – 15. Paina; 16. Crvena Stijena; 17 – 18. Šandalja; 19 – 22. Kadar; 23 – 24. Kastritsa; 25. Vrbička; 26 – 28. Orphei; 29 – 30. Šalitrena; 31 – 35. Settecannelle.

sal across these regions during the Gravettian and Early Epigravettian periods might have in part contributed to the need for reliable social networks across long distances with transferability of knowledge and know-hows between forager groups. In this context, the emergence and spread of a particular technological innovation is only an epiphenomenon of social arrangements that were at this time already in place beyond the territories of the adjacent regional bands.

Decorative Motifs

In the Late Epigravettian period, very similar geometric decorative motifs occur contemporaneously at sites separated by hundreds of kilometres in the Balkans and Italy (*fig. 3*). In Italy, the Epigravettian layers of Grotta delle Settecannelle in Lazio have yielded a rich assemblage of portable art, comprising more than 50 incised objects of stone, bone, and antler, some of which are tools. The stratigraphy of Settecannelle spans the period from the Early Epigravettian, characterised by the presence of an *à cran* phase to the Final Epigravettian characterized by an industry dominated by short thumbnail-shaped scrapers of the Romanellian type (Boschian/Ucelli Gnesutta 1995). The chronology of the human occupation at the cave has been based on dates on charcoal from a sequence of hearths. There are seven charcoal dates that cover the Epigravettian period (*tab. 2*). In *fig. 4*, calibrated ranges of these dates are compared to North Greenland (NGRIP) $\delta^{18}O_{ice}$ record and event stratigraphy. Despite a necessary caution regarding the limited number of dates and relatively imprecise conventional charcoal measurements, it is probable that the occupation of layer 10 dated with three radiocarbon measurements relates to the early phase of the Bølling/Allerød interstadial, i.e. the period between ca. 15.650 and 13.490 cal BP (95% confidence). Layer 8 is dated with one charcoal date only that calibrates to the range 13.030 to 11.760 cal BP (95% confidence), which falls into the duration of the Younger Dryas cold spell.

Examples of portable art come from two Final Epigravettian levels: layers 10 and 8. Stone pebbles were in a number of instances incised with 'naturalistic' depictions of aurochs. These layers also yielded incised bones with 'structured geometric style' and artefacts with 'repetitive incisions'. One black-burnt bone object bore parallel rectilinear incisions in combination with a zig-zag motif (*fig. 5*). The decoration extends on the whole surface leaving free only the central part. In this zone, a microscopic examination revealed that a grid of straight lines was traced at first in order to follow a preconceived decorative pattern for the rectilinear motif. Three abstract motives are represented on the bone: a meander, an angular band, and a broken line. The meander is developed along the fractured edge and is incomplete. The preserved part is constituted of five parallel lines each very close to the other. The external line is deep and we can hypothesize that another similar line would have completed the drawing in the missing part. The angular band is a band of six lines, which form a 90-degree angle. Below this, the four central lines close in pairs of two while the two external lines open on the left and the right and frame a segment of the broken line (Ucelli Gnesutta/Cristiani 2002).

Comparisons regarding the style of both naturalistic and geometric depictions can be made with other contemporaneous Palaeolithic sites in Italy, such as meandric motives found in Grotta Polesini

Layer	Context	Lab ID	Material	^{14}C (uncal. BP)
8	hearth	GrN-15977	Charcoal	10570±260
10	hearth	OZC-164	Charcoal	12050±150
10	hearth	GrN-21847	Charcoal	12540±100
10	hearth	OZC-163	Charcoal	12700±170
14–12	hearth	OZC-165	Charcoal	15700±180
16	hearth	OZC-166	Charcoal	16200±200
17	hearth	GrN-21848	Charcoal	16620±210

Tab. 2. Existing charcoal dates from Grotta delle Settecannelle (after Ucelli Gnesutta/Cristiani 2002, footnote 1).

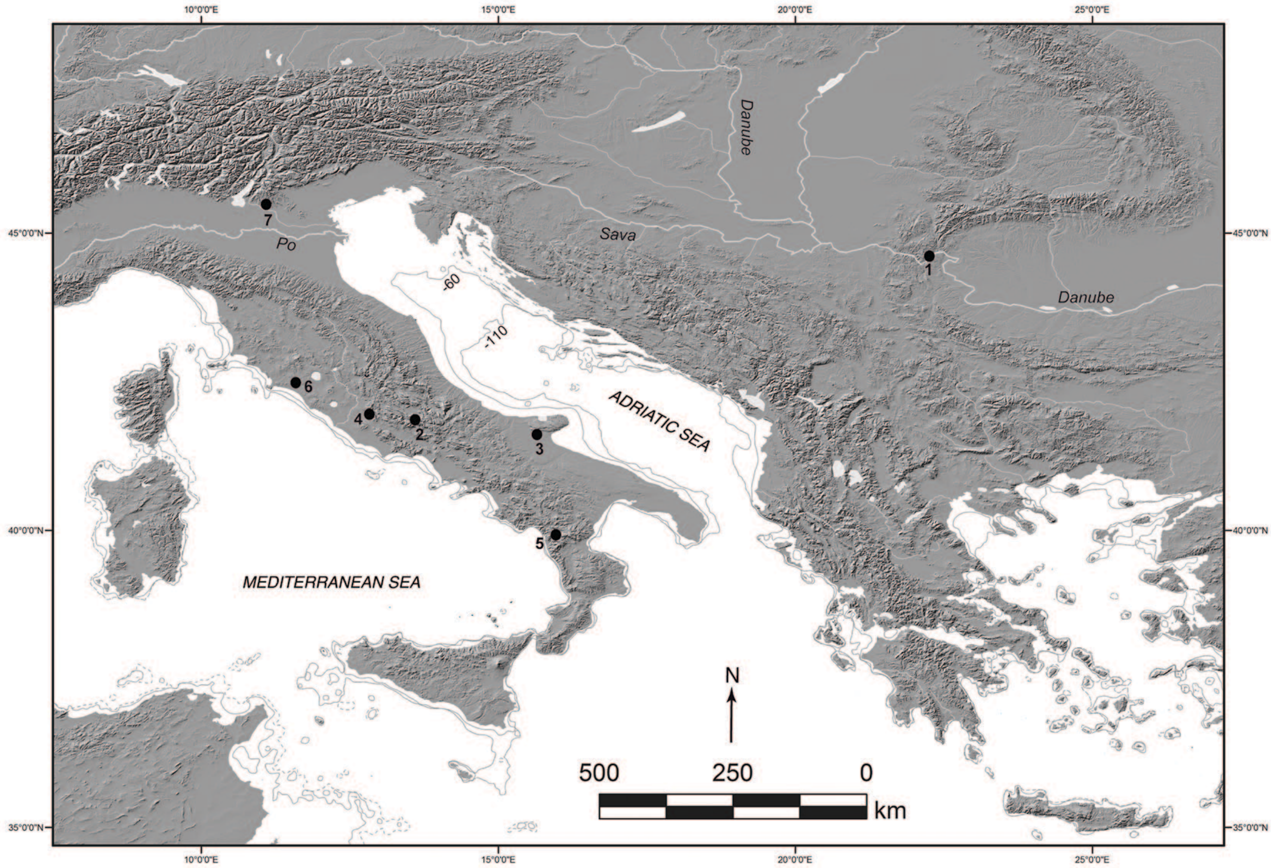

Fig. 3. Map showing the distribution of sites with Epigravettian engraved motifs in the Balkans and Italy. Bathymetric contours show the drop of sea levels –110m during the LGM climax and –60m by the end of the Pleistocene.
1. Cuina Turcului; 2. Fucino caves; 3. Paglicci; 4. Polesini; 5. Romito; 6. Settecannelle; 7. Tagliente.

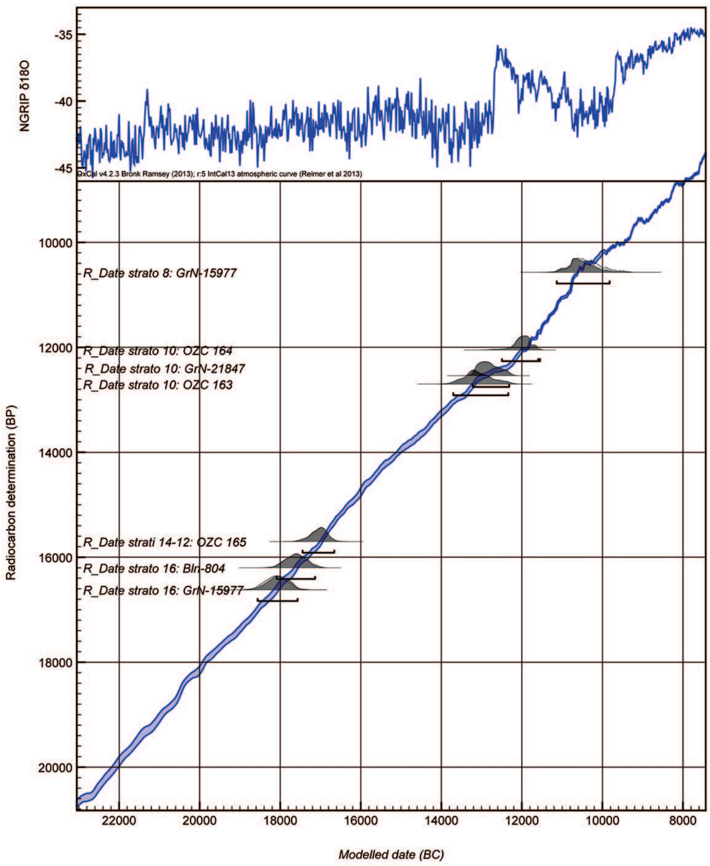

Fig. 4. Calibrated radiocarbon ranges from Epigravettian levels of Grotta delle Settecannelle. Dates are calibrated using OxCal v4.2.3 (Bronk Ramsey et al. 2013) and the IntCal09 dataset (Reimer et al. 2013); compared to North Greenland (NGRIP) $\delta^{18}O_{ice}$ record and event stratigraphy.

1

2

3

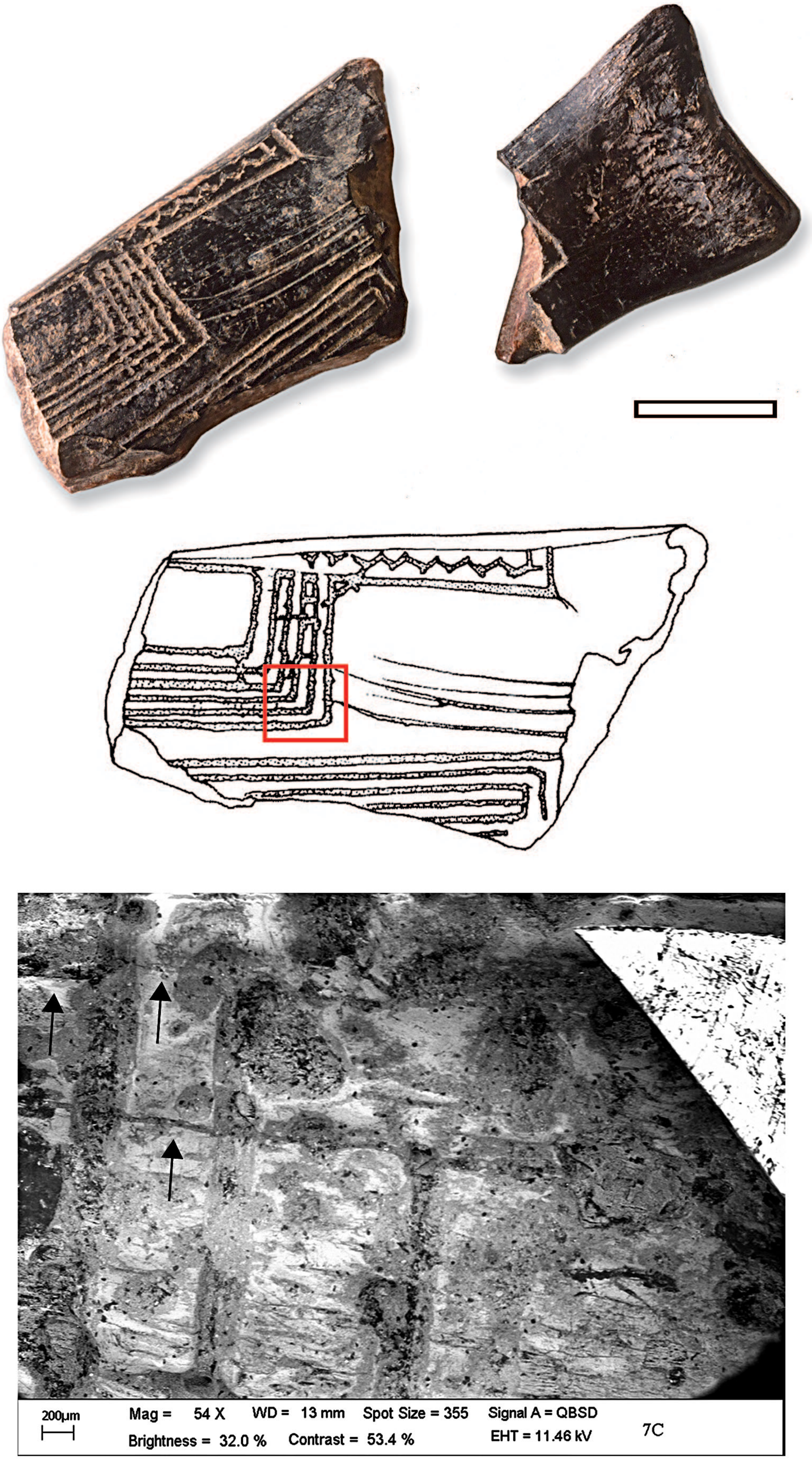

Fig. 5. Decorated bone from Settecannelle, layer 8, Lazio, Italy (after Ucelli Gnesutta/Cristiani 2002).

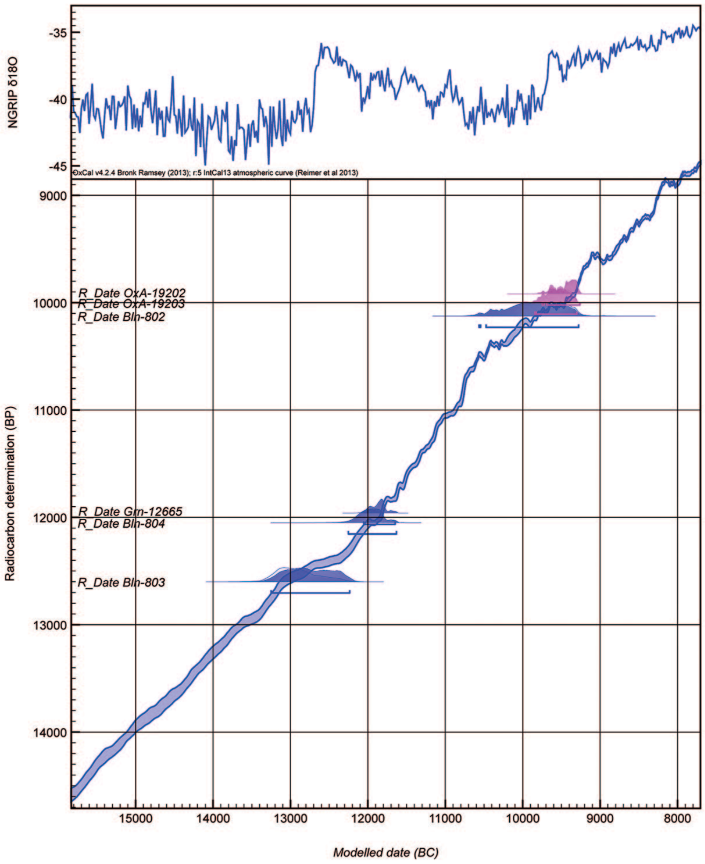

Fig. 6. Calibrated radiocarbon ranges from Epigravettian levels of Cuina Turcului. Dates are calibrated using OxCal v4.2.3 (Bronk Ramsey et al. 2013) and the IntCal09 dataset (Reimer et al. 2013); compared to North Greenland (NGRIP) $\delta^{18}O_{ice}$ record and event stratigraphy.

in Lazio, Riparo Tagliente in Veneto, Fucino caves in Abruzzo, Grotta Paglicci in Apulia (Arrighi et al. 2008; Arrighi 2012), Riparo del Romito in Calabria (Graziosi 1973; Grifoni Cremonesi 1998). At these sites, both naturalistic incised animal depictions and geometric designs on portable objects are found, and both categories of ornamented objects are similar to those found at Settecannelle.

Farther afield, the style of incisions found at Settecannelle can also be associated with the iconography found at the site of Cuina Turcului in the Danube Gorges area of present-day Romania (Mărgărit 2008; Păunescu 1970). Four charcoal dates come from Cuina Turcului layers I and II and the more recent AMS dates from layer II date human remains (*tab. 3; fig. 6*). A similar caution expressed about a limited number of charcoal dates from Settecannelle must apply here too. Layer I is dated with three dates that fall into the early phase of the Bølling/Allerød interstadial. The calibrated ranges of these three measurements are between 15.280 and 13.590 cal BP (95% confidence). Compared to the dates from Settecannelle, there is contemporaneity between the occupations of these Final Epigravettian layers where decorative motifs appear at the two sites.

Epipaleolithic layers I and II at Cuina Turcului yielded several art objects with geometric motives (*fig. 7*) very similar to those found in the Final Epigravettian layers of Settecannelle. Apart from zig-zag lines found on a number of incised osseous objects, one bone object from layer I bears similar identical parallel meander-like lines to those found at Settecannelle.

Similarities between the Epigravettian levels of Cuina Turcului and Climente II in the Danube Gorges and Settecannelle are also found in their respective lithic industries, and include the presence of backed curved points and numerous circular thumbnail scrapers, backed blades and double backed blades with inverse proximal retouch (Chirica 1999). These techno-morphological traits are common for the Tardiglacial lithic industries across the central-eastern Mediterranean regions: southern France, Italy, and the Balkans (Broglio/Kozłowski 1987; Kozłowski 1999). In addition, a similar range of ornamental beads made of marine gastropods, in particular *Cyclope neritea* (see

Layer	Context	Lab ID	Material, species	δ13C	δ15N	14C (uncal. BP)
II	"Individual 1," adult female, left humerus	OxA-19203	Bone, *Homo sapiens*	−19.4	15.2	10.435±45 (uncorrected) 10.003±71 (corrected)
II	"Individual 2" (687), adult male?, 25-35 yr, left ulna	OxA-19202	Bone, *Homo sapiens*	−19.3	15.2	10.350±45 (uncorrected) 9918±71 (corrected)
II	depth 3.68–3.85 m, hearth at the base of the layer	Bln-802	Charcoal, Pinus sp.	–	–	10.125±200
I	depth 6.2–6.4 m, hearth at the base of the layer	GrN-12665	Charcoal, Pinus sp.	–	–	11.960±60
I	depth 6.2–6.4 m, hearth at the base of the layer	Bln-804	Charcoal, Pinus sp.	–	–	12.050±120
I	depth 5.9 – 5.95 m	Bln-803	Charcoal, Pinus sp.	–	–	12.600±120

Tab. 3. Charcoal and AMS dates from Cuina Turcului (corrected and uncorrected values are given for the OxA- AMS dates after Bonsall et al. 2015, tab. 2; Bln- and GrN- dates after Păunescu 2000, 342).

below), as well as red deer canines were used at these two distant and broadly contemporaneous Late Epigravettian sites.

While some of these similarities between these regions must have stemmed from older shared cultural repertoires and can be interpreted as a consequence of branching cultural processes, striking similarities in decorative motifs used around the same time can hardly be explained by convergent and independent innovations in these two distant regions. The distance between Settecannelle and Cuina Turcului is around 900 km as the crow flies and certainly longer taking into account geographic and other limitations and difficulties in traveling. In our opinion, the observed similarities could better be explained by long-distance connections along established social networks beyond adjacent maximal/regional band territories. During the periods in question, either during the Bølling/Allerød interstadial or in the course of the Younger Dryas, one should envisage relatively open and in places sparsely forested landscapes. It should be noted, however, that based on more recent syntheses of the pollen data, and additional direct dating of macro-charcoal remains of identified tree species, during the glacial periods, south-eastern European landscapes were not steppe lands as previously thought. Around 40% of the total pollen comes from coniferous, needle-leaved tree types, such as pine (*Pinus*). But there is also good evidence of the refugial survival of deciduous, broad-leaved species of trees, such as oak (*Quercus*) and hazel (*Corylus*), as small pockets in predominantly coniferous forests. In addition, south-facing slopes might have also preserved deciduous tree species. In particular, mid-altitude, mountainous locations with higher levels of precipitation might have been favourable for the survival of forests, with low altitude locations being too dry and high altitude locations being too cold (Willis 1994; 1996; Willis/van Andel 2004). All the same, traversing long distances across Tardiglacial landscapes of southern Europe might have been a considerably easier task than during the Early Holocene.

In addition, the lower sea levels in the Adriatic might have still allowed a short-cut communicative route from the Balkan hinterland when traversing across the northern half of the Great Adriatic Plain into Italy. These environmental and geographic factors, coupled with the need to maintain long-distance contacts, perhaps partly as safe-

Fig. 7. Decorated bones from Epigravettian levels at Cuina Turcului, the Danube Gorges, Romania (after Mărgărit 2008, fig. 81; Păunescu 1970).
1. ornamented equid phalanx, layer II; 2 – 4. ornamented bones, layer I.

ty nets in unpredictable and harsh climatic conditions among small-world societies (see above), could be a possible way to explain the existence of such long-distance connections during this period. But, as previously emphasized, connectivity need not be interpreted as stemming out of utilitarian and rational motivations only. Admittedly, the chronological scale and relatively crude palaeoenvironmental proxies when comparing the temporal placement of decorative motifs from the two sites, Settecannelle and Cuina Turcului, remain coarse-grained, with a number of uncertainties regarding a detailed reconstruction of the context of the assumed interactions between the two distant regions. Future improvements of the chronological and palaeoenvironmental frameworks would allow one to make firmer conclusions when attempting to reconstruct the shape and density of late Epigravettian social networks across Italy and the Balkans.

Ornamental Beads

For a good reason, ornamental beads often play an important role in discussions about long-distance exchanges between different communities. Ornamental beads can be understood both as a powerful material objectification with symbolic connotations and an important element of visual information technologies due to their easy transferability and standardisation qualities (e.g., Kuhn/Stiner 2007; d'Errico/Vanhaeren 2007; Vanhaeren/d'Errico 2006; White 2007). Based on the long and continuous Palaeolithic to Mesolithic sequence at Franchthi Cave in Greece, recently Perlès (2013, 296) has argued that ornamental traditions could be understood as reflections of long-term regional continuities rather than a reflection of changes related to population replacements or social boundaries, and may operate on different scales of change from other categories of material culture (e.g., lithics). For instance, at Franchthi, ornaments show a remarkable stability over the long-term and, different from lithics, a limited spectrum of types was selected, with the predominance of *Cyclope* sp., *Columbella rustica* and *Dentalium* sp. shells, while perforated teeth and bone ornaments are absent. Yet, on the medium-term scale and at a more detailed typological level, Perlès defines different phases in the ornamental assemblage, with *Homalopoma sanguineum* characterizing both the Aurignacian and Gravettian ornamental phases, *C. rustica* being common in the Epigravettian phase and the appearance of perforated pebbles in association with the Mesolithic (Perlès 2013, 287). Remarkably, no changes in the repertoire of ornaments used are recognized in the transition from the Aurignacian to the Gravettian and, later, from the Epigravettian to the Mesolithic, although a replacement of population was suggested in both cases based on changes in the characteristics of lithic assemblages.

Beads made of *Cyclope neritea* gastropods represent one of the oldest types of ornamental beads used since the beginnings of the Upper Palaeolithic in both the Balkans and Italy (*figs. 8–9*). Examples from Franchthi (Douka et al. 2011) and Klissoura (Stiner 2010) caves in Greece show that *C. neritea* ornamental beads were found starting from the transitional (Uluzzian) and the earliest Upper Palaeolithic levels first in costal zones that were in the relative vicinity of the natural habitats of this species. Similarly, a relative proximity of archaeological *C. neritea* beads to the natural habitat of the species can be claimed in the case of a small number of ornaments made of this gastropod associated with the late Upper Palaeolithic levels at the sites of Vela Spila on the island of Korčula (Cristiani et al. 2014a) and Vlakno Cave on the Dugi Otok island (Vujević/Parica 2009/2010), both in Croatia. At these two sites, several *C. rustica* beads appeared at this time too while their popularity peaks in the course of the Mesolithic (see below). On the other hand, in the Balkans, the earliest currently known example of the spread of this type of beads into the hinterland over a considerable distance of more than 400 km relates to their appearance in the previously discussed Epigravettian levels at the site of Cuina Turculi in the Danube Gorges region of Romania (Mărgărit 2008, fig. 81; Păunescu 1970). As the crow flies, the distance of the Danube Gorges region to the Black Sea along the Danube is ca. 500 km, the shortest route to the southern Adriatic Sea is ca. 400 km, and to the northern Aegean Sea ca. 500 km.

In Italy, *C. neritea* beads were found, among other sites, in occupation deposits of Riparo Mochi

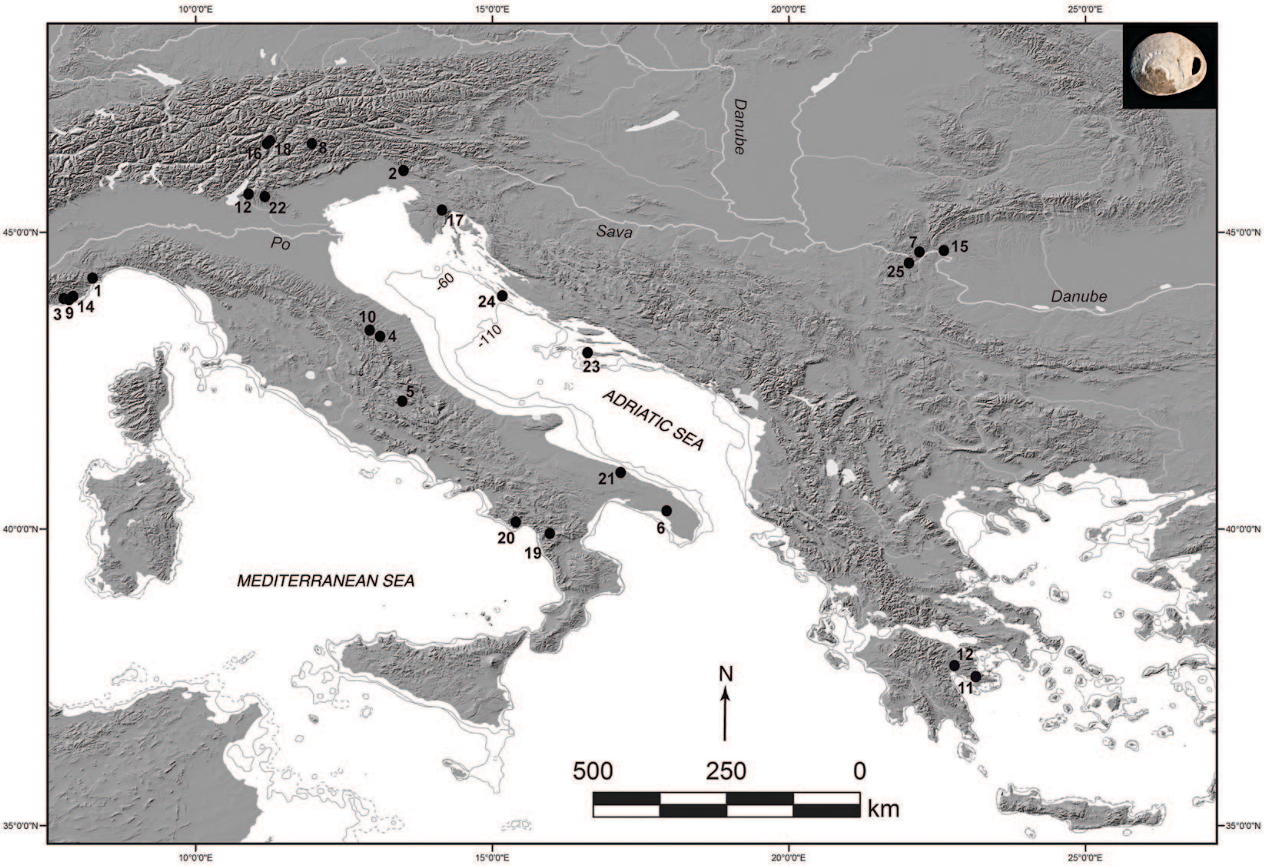

Fig. 8. Map showing the distribution of Upper Palaeolithic and Mesolithic sites with *Cyclope neritea*, ornamental beads in the Balkans and Italy. Bathymetric contours show the drop of sea levels –110m during the LGM climax and –60m by the end of the Pleistocene.
1. Arene Candide; 2. Biarzo; 3. Bombrini; 4. Continentza; 5. Continenza; 6. Cavallo; 7. Cuina Turcului; 8. Dalmeri; 9. Fanciulli; 10. Ferrovia; 11. Franchthi; 12. Fumane; 13. Klissoura 1; 14. Mochi; 15. Ostrovul Banului; 16. Pradestel; 17. Pupićina; 18. Romagnano III; 19. Romito; 20. Serratura; 21. S. Maria di Agnano; 22. Tagliente; 23. Vela Spila; 24. Vlakno; 25. Vlasac.

in the Balzi Rossi (Stiner 1999a), Grotta di Fumane (Fiocchi 1997), Riparo Tagliente (Gurioli 2006), and Biarzo (Cristiani 2013). At S. Maria di Agnano in Puglia, *C. neritea* ornaments were found associated with a Gravettian female burial (Giacobini 2006, 173; Vacca/Coppola 1993). The most notable examples are Late Epigravettian burials of two children (two and four years old) from Grotta dei Fanciulli, Liguria, with more than 1426 *C. neritea* shell ornaments found on the back of the deceased, underneath the pelvic bones (Vanhaeren/d'Errico 2003). These burials are dated to a late phase of the Epigravettian (Henry-Gambier et al. 2001). In the same region, at Arene Candide, the Gravettian burial Prince and several other Epigravettian burials were adorned by different marine shell beads, among which were also very numerous *C. neritea* (Cardini 1980). At La Madeleine, in the Dordogne region, France, an infant was buried with hundreds of Dentalium and several *C. neritea* shell beads, and is dated to the Epipalaeolithic (Azilian) (Vanhaeren/d'Errico 2001; 2003).

This apparent popularity of *C. neritea* beads seems to have peaked primarily in Italy but also in the Balkans around the same time in the course of the Epigravettian period. This corresponds well with the previous discussion of decorative motifs that suggested long-distance connections between certain regions of Italy and the Balkans in the Late Upper Palaeolithic. On the other hand, some other Upper Palaeolithic sites in the Balkan hinterlands yielded only evidence of Dentalium shell ornaments, such as Gravettian levels at the site of Šalitrena Cave in Serbia (Mihailović 2007) and Badanj Rockshelter in Herzegowina (Whallon 2007b). Differently, at Mališina Stijena Rockshelter in northern Montenegro, two perforated specimens of *Nassarius gibbosulus* were found in Late

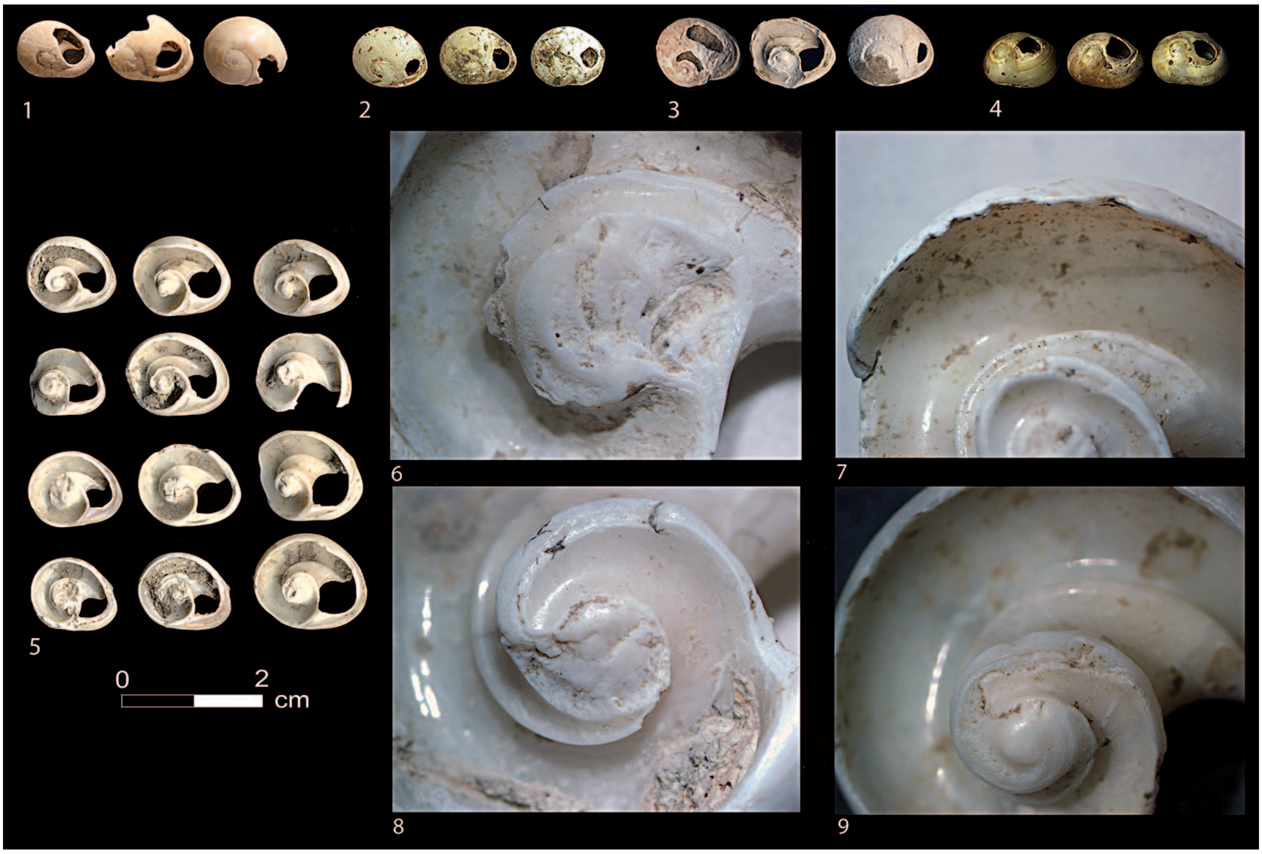

Fig. 9. A selection of *Cyclope neritea* ornamental beads found in Italy and the Balkans.
1. Biarzo; 2. Tagliente; 3. Vela Spila; 4. Mochi; 5 – 9. Vlasac.

Epigravettian layer 2 (Bogićević/Dimitrijević 2004; Radovanović 1986). *Nassarius* was also found at Vela Spila (Cristiani et al. 2014a). Closer to the Adriatic coastal zone, one also finds Glycimeris shells in Gravettian/Epigravettian levels at Crvena Stijena Rockshelter in Montenegro and Vlakno Cave on Dugi Otok island in Croatia (Vujević/Parica 2009/2010). In addition, beads made from red deer vestigial canines remain popular for the most of this period and were found at a number of sites.

During the Early and Middle Mesolithic (ca. 11.500–9300 cal BP), *C. neritea* beads disappeared from the archaeological record of the Mesolithic sites in the Danube Gorges region of the Balkans (Borić 2011) and Italy (Mussi 2002). In this region, ornamental beads have neither been associated with burials dated to these earlier Mesolithic phases nor with Early-Middle Mesolithic occupation levels. While this could be a reflection of a relatively patchy preservation and devastation of these levels at sites that were repeatedly used in later Mesolithic and Neolithic phases, it could also be a genuine pattern of evidence that points to diachronic changes in connectivity and consumption of ornamental beads. Similarly, major changes in the circulation of good quality flint raw materials coupled with concomitant technological choices in the Balkans with the onset of the Holocene have been interpreted as the consequence of 'the increasing forestation which blocked the access to some primary deposits, and … the increasing isolation of human groups in the Early Holocene' (Kozłowski/Kozłowski 1982, 100; cf. Mihailović 2007). Indeed, at the start of the Holocene across the Balkans mixed deciduous woodland expanded quickly, showing overall similarities across the region in tree species composition, dominated by oak (*Quercus*), hazel (*Corylus*), lime (*Tilia*), and elm (*Ulmus*) (Willis 1994). At present, available data for these earlier Mesolithic phases in the Danube Gorges and other hinterland regions in the Balkans remain too limited for a more unequivocal answer regarding the character of connectivity between coastal and inland foragers.

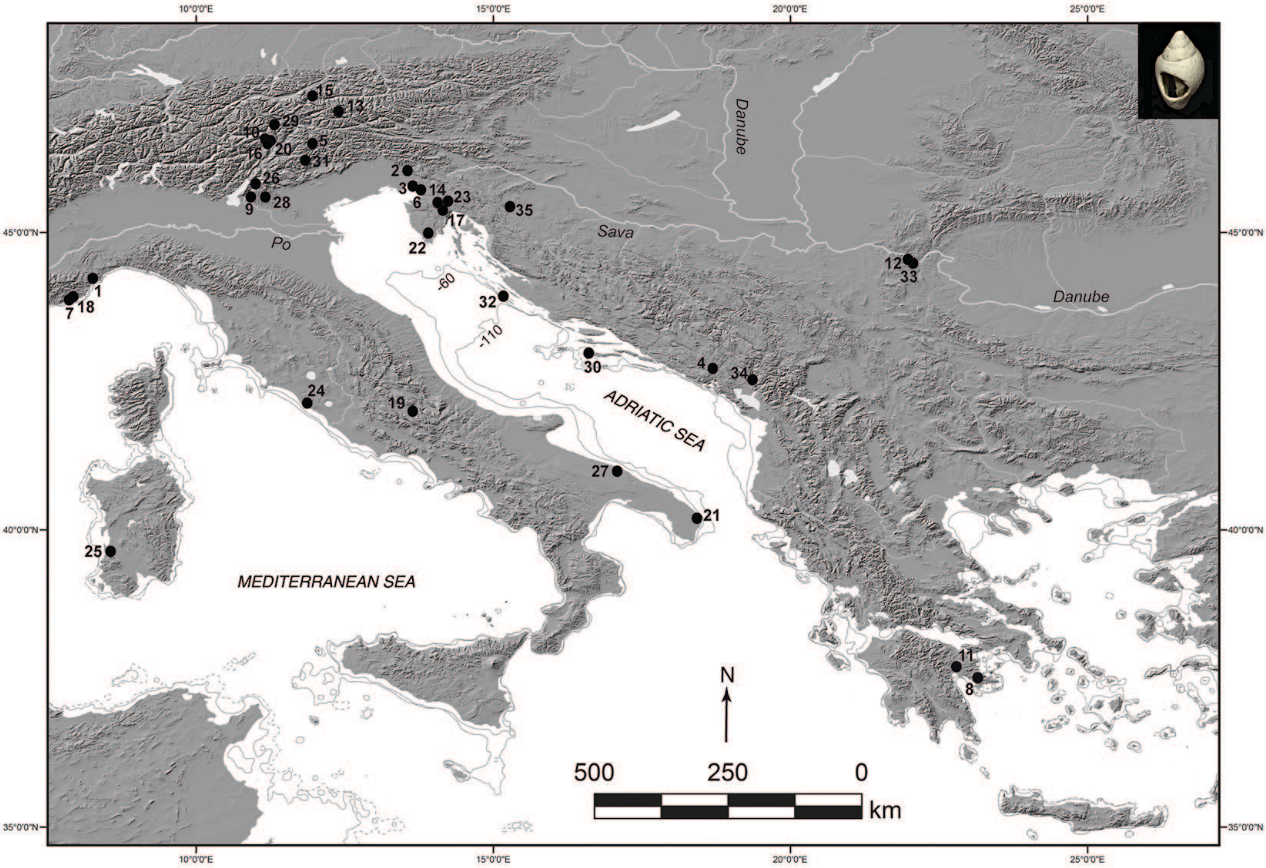

Fig. 10. Map showing the distribution of Epigravettian and Mesolithic sites with *Columbella rustica* ornamental beads in the Balkans and Italy. Bathymetric contours show the drop of sea levels –110m during the LGM climax and –60m by the end of the Pleistocene.
1. Arene Candide; 2. Biarzo; 3. Ciclami; 4. Crvena stijena; 5. Dalmeri; 6. Edera; 7. Fanciulli; 8. Franchthi; 9. Fumane; 10. Gaban; 11. Klissoura1; 12. Lepenski Vir; 13. Mondeval de Sora; 14. Ovčja; 15. Plan de Frea; 16. Pradestel; 17. Pupićina; 18. Mochi; 19. Pozzo; 20. Romagnano III; 21. Romanelli; 22. Šandalja II; 23. Šebrn; 24. Settecennelle; 25. S'Omu e S'Orku; 26. Soman; 27. S. Maria di Agnano; 28. Tagliente; 29. Vatte di Zambana; 30. Vela Spila; 31. Villabruna; 32. Vlakno; 33. Vlasac; 34. Vruća; 35. Zala.

There seems to have been an important change with the start of the Late Mesolithic in the Balkans, from around 9300 cal BP. The extent of long-distance connectivity is perhaps again best inferred on the basis of the presence of 'exotic' ornaments in the Danube Gorges region. The Late Mesolithic deposits at the site of Vlasac yielded evidence of *C. rustica* beads in association with inhumation Burial 49 (Borić 2011, 171 and references therein). In this context, it is particularly significant that Burial 49, one of only two nonlocal individuals at this site on the basis of strontium isotope analysis (Borić/Price 2013), is the only Late Mesolithic individual at Vlasac that was associated with eleven *C. rustica* beads, and may suggest that this possible female originated in areas outside the Danube Gorges, perhaps even from one of the mentioned coastal regions. At Vlasac, *C. rustica* beads were also found in the occupation deposits dated to ca. 9000–8800 cal BP (Borić et al. 2014b). This may be a direct reflection of the rise in popularity of *C. rustica* beads in coastal regions of the Adriatic Sea and a wider Circum-Adriatic region (e.g., Cristiani 2012; Cristiani et al. 2014a) (*figs. 10–11*). Around the same time, or somewhat later, towards the mid-9th mill. BP, several burials at the site of Vlasac yielded evidence of *C. neritea* beads that were attached to the clothing of the deceased (Cristiani/Borić 2012). In another, currently undated but possibly Late Mesolithic, context at the site of Ostrovul Banului a number of such beads were also found together as a set (Mărgărit 2008, fig. 104). Both at Vlasac and Ostovul Banului, *C. neritea* specimens indicate a Late Mesolithic technological tradition

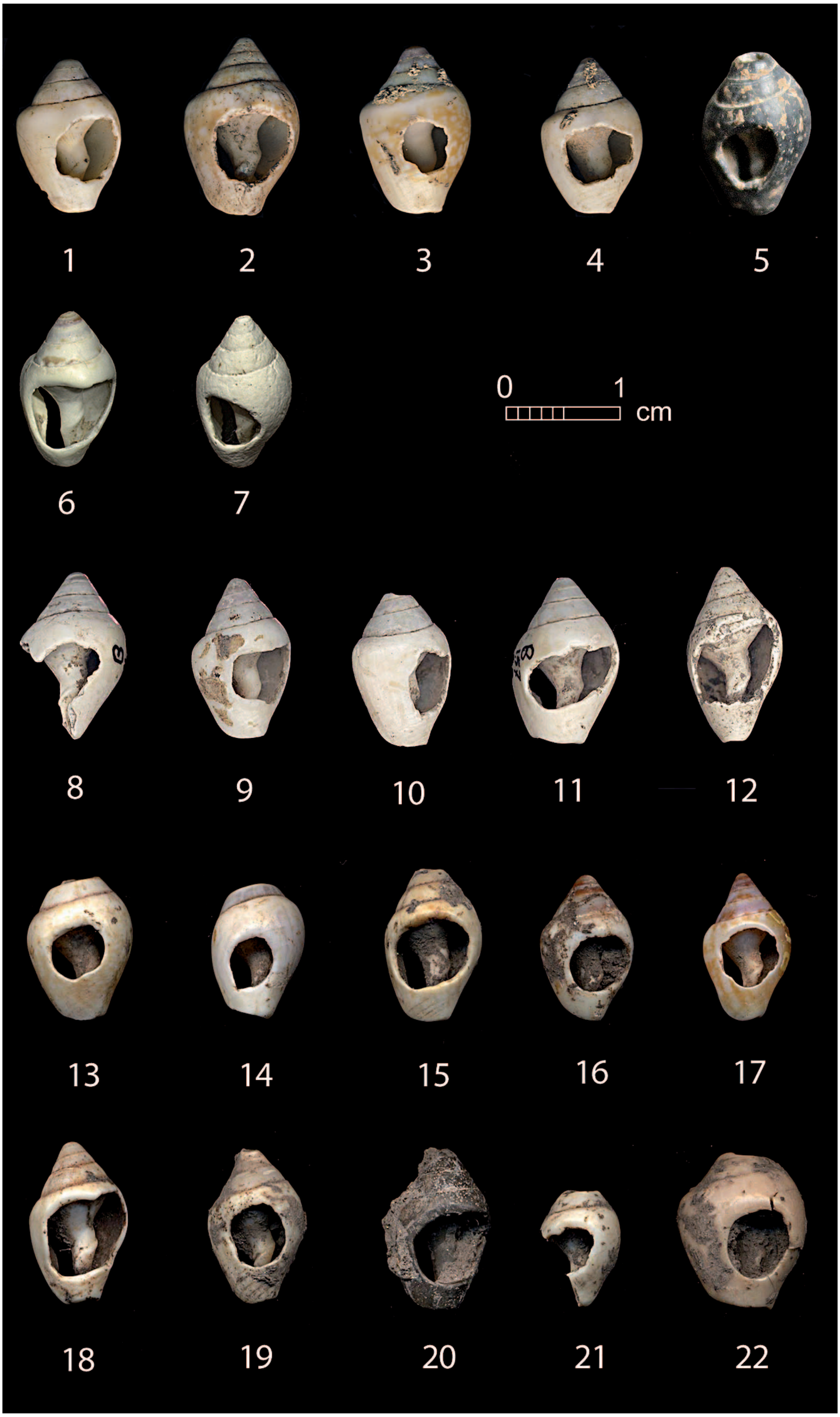

Fig. 11. A selection of *Columbella rustica* ornamental beads found in Italy and the Balkans.
1 – 4. Vela Spila; 5. Vruća; 6 – 7. Vlasac; 8 – 12. Biarzo; 13 – 22. Pradestel.

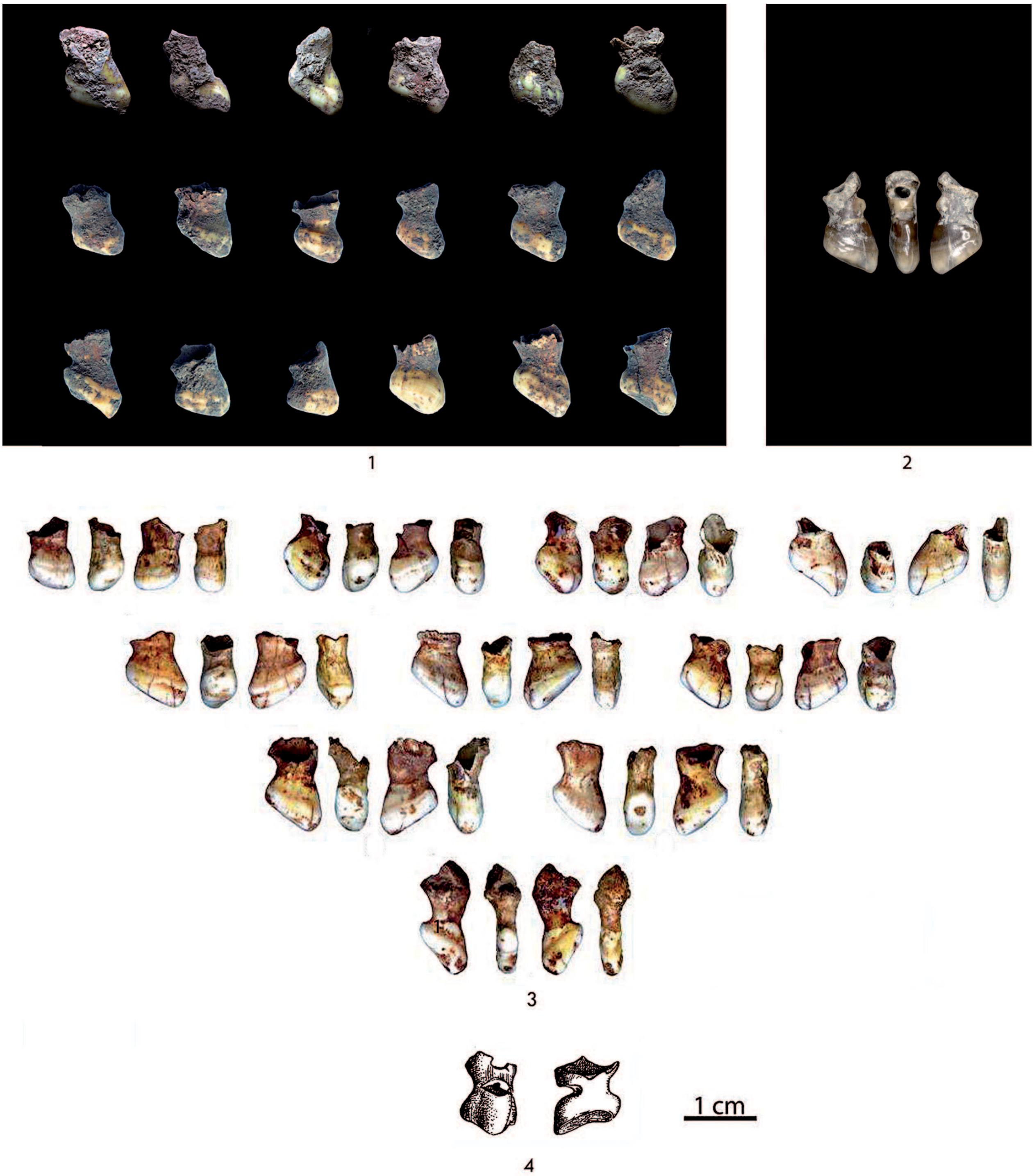

Fig. 12. Types of cyprinid teeth ornamental beads found in the Danube Gorges region, Montenegro, Crimea and the Upper Danube region.
1. Vlasac; 2. Vrbička; 3. Hohlenstein-Stadel (after Rigaud 2013); 4. Zamil-Koba I (after Kraynov 1940).

Fig. 13. A reconstruction of cloak-type embroidered garment worn by adult females and children at Late Mesolithic Vlasac on the basis of ornaments' distributions in Burials H2 and H297 (drawing: Mauro Cutrona).

of shell modifications specific to the Danube Gorges area that removed the body whorls of the shell in order to facilitate their fastening to garments (*fig. 9*), which is different from the pattern of perforation seen on Epipalaeolithic Cuina Turcului specimens (Cristiani/Borić 2012).

It seems that *C. neritea* remained popular in both Franchthi (Perlès/Vanhaeren 2010) and Klissoura 1 (Stiner 2010) caves throughout the Mesolithic. However, no primary burials from Franchthi are associated with ornaments, and possible association of *C. neritea* and Dentalium beads is only assumed for disarticulated remains of an infant (Fr 401) and a three-to-six-year-old child (Fr 414) (Cullen 1995, 277). On the other hand, no *C. neritea* beads have been found in the Mesolithic levels of Vela Spila in Croatia where *C. rustica* are the absolutely dominant gastropod species used for ornamental beads in the Mesolithic (Cristiani et al. 2014a) while there is only one *C. neritea* bead found in an assemblage again dominated by *C. rustica* beads in the Mesolithic levels of Pupićina Cave in Croatia (Komšo 2006; Komšo/Vukosavljević 2011, tab. 1).

But it was not only 'exotic' marine bead ornaments that travelled over long distances. There is documented evidence of exchanges in ornaments at the distance of over 100 km between the coastal site of Pupićina Cave in Istria and the hinterland site of Zala Cave in Croatia. While *C. rustica* beads, abundant in the Mesolithic levels of Pupićina Cave (n=90), were found in the Mesolithic levels of Zala Cave (n=nine), freshwater *Lithoglyphus naticoides* gastropods found in larger numbers at Zala Cave (n=35) were also reported at Pupićina Cave (n=six), possibly suggesting exchanges of ornaments and regular communication between coastal and inland foragers (Komšo/Vukosavljević 2011). In this particular case, it is likely that such exchanges and communication were taking place within the regional ('tribal') territories that might have corresponded to the territories of ethnographic cultures (see below).

Another example on non-marine ornamental beads that also seems to have traversed long distances relates to one particular type of ornament found in large quantities in the Danube Gorges region, where it appears with the start of the Late Mesolithic period. Cyprinid (carp species) pharyngeal teeth turned into ornamental beads either by cuts/perforations made on the neck of the tooth or by unmodified suspension using red ochre stained treads (*fig. 12*) and resin are found sometimes in hundreds in association with Late Mesolithic burials of both adults and children at the sites of Vlasac (Borić et al. 2014b; Cristiani/Borić 2012; Cristiani et al. 2014b) and Schela Cladovei (Bonsall 2008; Boroneanţ 1990). At Vlasac, these ornaments were found either on their own or in combination with *C. neritea* and in one case with *C. rustica* ornamental beads. These beads were sewn onto attires that covered the deceased and based on their distribution in burials such embroidery was in particular attached to the piece of clothing (a cloak?) that was lying beneath the deceased, i.e. the one that covered the back of the deceased or that served to wrap the body of the deceased (*fig. 13*).

We have previously noted the curious absence of red deer vestigial canine ornaments in the Danube Gorges and the fact that this is perhaps related to the rise in popularity of carp teeth beads (Cristiani/Borić 2012, 3463). Red deer canine beads were widespread among Upper Palaeolithic and Mesolithic foragers of Eurasia and beyond and were also found in the Late Epipalaeolithic levels at Cuina Turcului and Climente II in the Danube Gorges but are completely absent for the duration of the Mesolithic in this region. There is a possibility that the same range of meanings held in relation to red deer teeth ornaments by various Mesolithic communities became 'delegated' to cyprinid teeth in this regional context. That a river animal's body element was chosen as a source of material for ornaments for communities living along the big river should not be surprising. But it is also that to some extent cyprinid teeth can be seen to resemble red deer canines in shape regarding their appearance when sewed onto items of clothing. In addition, their anatomical position in the animal's body, being 'hidden' within the body, i.e. invisible before opening the body of each respective animal might have been imbued with particular significance.

An enigma regarding the distribution of this type of ornaments becomes apparent by the existence of a suite of sites in southern Germany, found in the Upper Danube region, where cyprinid teeth were also found used as ornaments, albeit

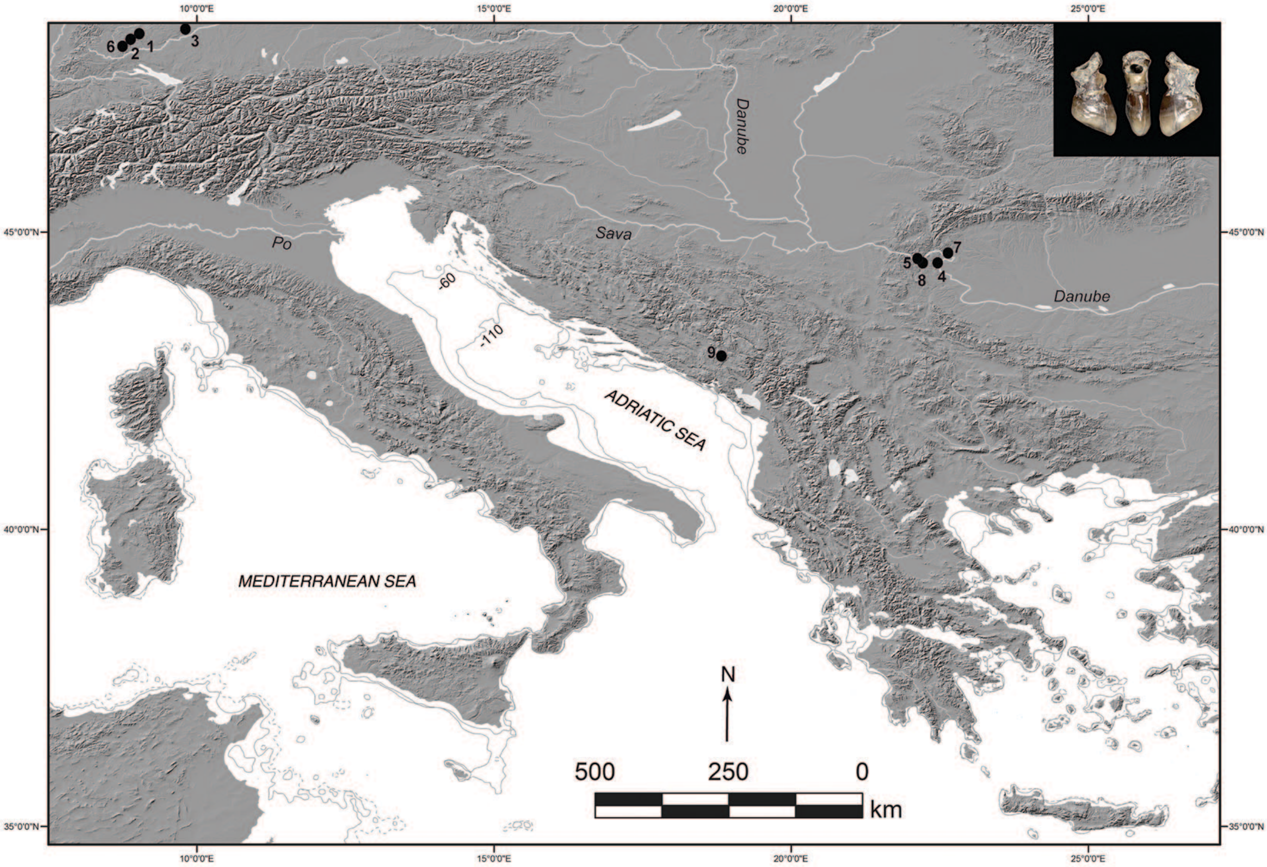

Fig. 14. Map showing the distribution of Late Mesolithic sites with cyprinid pharyngeal ornamental beads in the Balkans and the Upper Danube region. Bathymetric contours show the drop of sea levels –110m during the LGM climax and –60m by the end of the Pleistocene.
1. Burghöhle von Dietfurt; 2. Falkenstein Höhle; 3. Hohlenstein-Stadel; 4. Kula; 5. Lepenski Vir; 6. Probstfeld; 7. Schela Cladovei; 8. Vlasac; 9. Vrbička.

in smaller quantities than in the Danube Gorges area. Such ornaments were reported at the sites of Burghöhle von Dietfurt (Baden-Württemberg, Germany), Falkenstein Höhle (Bavaria, Germany), Probstfels (Baden-Württemberg, Germany), and Hohlenstein-Stadel (Baden-Württemberg, Germany) (Rigaud, 2011; Rigaud et al. 2014; see also Rähle 1978; Völzing 1938; Wetzel 1938) (*fig. 14*). At the site of Hohlenstein-Stadel these ornaments were associated with a secondary burial containing several disarticulated skulls, and might have been attached to some sort of headdress worn by the deceased who possibly suffered violent deaths. It is worth mentioning that use-wear and residue traces from both regions suggest that suspension techniques might have been similar despite different technological choices/know-hows in creating perforations (Cristiani et al. 2014b). These two regions are some 1000 km apart as the crow flies and even more distant if one is to travel along the Danube course. Moreover, there are no other known Mesolithic sites between these two regions with cyprinid teeth ornaments. Finally, existing dates suggest that the use of these ornaments in the two regions was broadly contemporaneous.

The picture about the distribution of cyprinid teeth ornaments is further complicated by the existence of two other distant regions where cyprinid teeth ornaments have also been found. First, at the cave site of Zamil-Koba I in the Crimean Peninsula, two modified cyprinid teeth ornaments were associated with a skull burial found in a pit (62cm in diameter and 30cm deep) together with other human or animal postcranial bones, charcoal and flint artefacts, indicating a Mesolithic context (Kraynov 1940, 14) (*figs. 12, 14*). Unfortunately, this context has not been dated directly so we could not be certain about the contemporaneity of this and other Mesolithic contexts where such ornaments appear (cf. Biagi/Kiosk 2010). The published drawing of one of the ornamental cyprinid teeth shows the shape of a cyprinid pharyngeal tooth and a clearly visible cut on the root of the tooth (Kraynov 1940, 23, T. V, 4–5), with the modification made in the same way as on the modified specimens found in the Danube Gorges, suggesting a shared technological gesture if not direct contact between the two regions. This site is more than 900 km away from the Danube Gorges region as the crow flies and still farther away from the Upper Danube region. One could possibly envisage contacts along the Lower Danube and farther along the north-eastern coast of the Black Sea. Possible links between Early Holocene flint-stone industries and the Black Sea coastal sites within the Cuina Turcului-Belolesye-Shan Koba complex have previously been suggested (Radovanović 1981; Kozłowski 1989).

The second example comes from the Mesolithic levels of the site of Vrbička Cave in western Montenegro (*figs. 12, 14*). Here, only one modified carp tooth ornamental bead was found. The modification made on the root of the tooth is identical to the ones made in the Danube Gorges area and may again hint at direct contacts between the two regions, which are some 400 km apart. The bead is found in the Late Mesolithic layer of the cave, currently AMS-dated to the beginning of the 9th mill. BP (Cristiani 2014), thus being broadly contemporaneous to the contexts in which ornamental cyprinid teeth beads appear in the Danube Gorges.

The last two examples suggest that in the Mesolithic of the Balkans even 'non-exotic' beads seem to have been transferred at very long distances that certainly went beyond the maximal territories of adjacent regional bands. In this context, ornamental beads' double character as highly charged symbolic tokens and transferable material items with relational properties becomes fully apparent. Ornamental beads enchained relationships at both individual and group levels, helping to maintain social networks and to keep distant communities abreast of the existence of others (cf. Gamble 2007; 2013). Narratives that travelled along with material objects must have also enchained mythical realities in a complex web of transformational logics, which might have been similar to those described by structural analyses of mythical motives among neighbouring groups, often subject to the rules of inversion and symmetry (cf. Lévi-Strauss 1987; 1995).

Discussion and conclusions

'Regionality is not inscribed in any straightforward way into archaeological data. It needs to be imagined before it can be perceived or measured.' (Wobst 2000, 221)

Whallon (2006) suggested a heuristic model of hunter-gatherer spatial organization in relation to the assumed hexagonal packing of spatial units (ideal model over a perfect uniform plane, cf. Haggett 1965). As he observes, one should expect 'distortions of the ideal, hexagonal territories [to] occur as they are "fitted" over specific geographical features or topography' (Whallon 2006, 266). Based on the survey of ethnographic evidence and archaeological case studies for Late Pleistocene and Early Holocene foragers in central and western Europe (e.g., Eriksen 2002; Floss 1994; 2014), this model suggests three main ranges of human mobility:

– Ranges < 200 km: movements of lithic raw materials (mostly up to 130 km).
– Ranges between 200 and 300 km range that are primarily related to social and gift-giving exchanges.
– Ranges beyond 300 km are seen as involving ceremonial and ritual exchanges (e.g., circulation of shells as personal adornment and other 'exotica').

These types of human mobility further correspond to three spatial organizational units among forager groups with corresponding estimates of territory size (*fig. 15*):

– Minimal band (25–30 people, 28 km radius, 2500 km²).
– Maximal regional band territory consisting of seven (175–210) or 19 minimal bands (475–570 people, 123 km radius, 47.500 km²).
– Adjacent maximal or regional bands (325 km radius, 332.500 km²).

Based on this general model of the spatial organization of forager groups, fig. 16 proposes a model

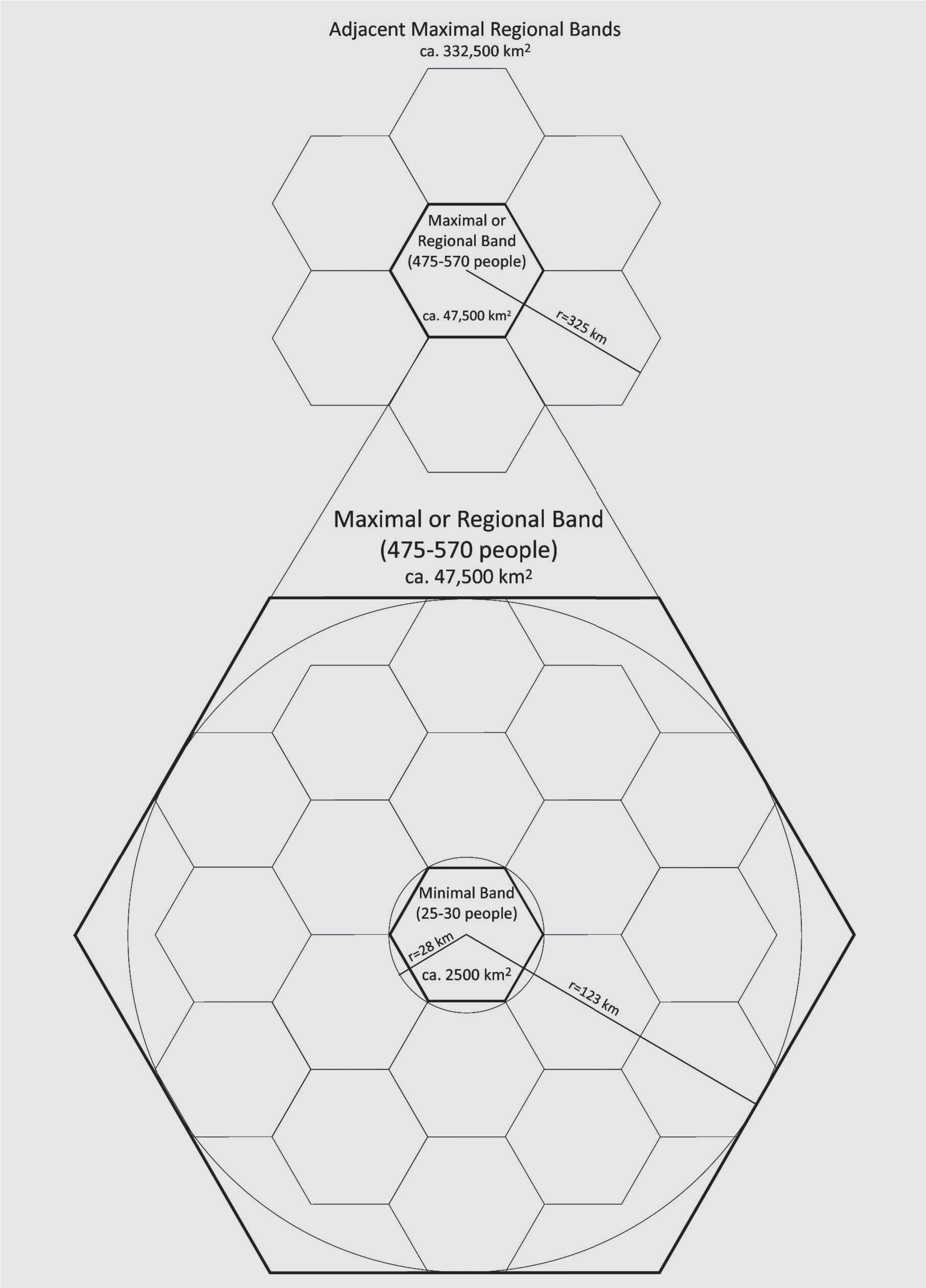

Fig. 15. Heuristic model of spatial organization of hunter-gatherer bands and their territories: hexagonal packing of spatial units over a perfect uniform plane (after Whallon 2006, fig. 4).

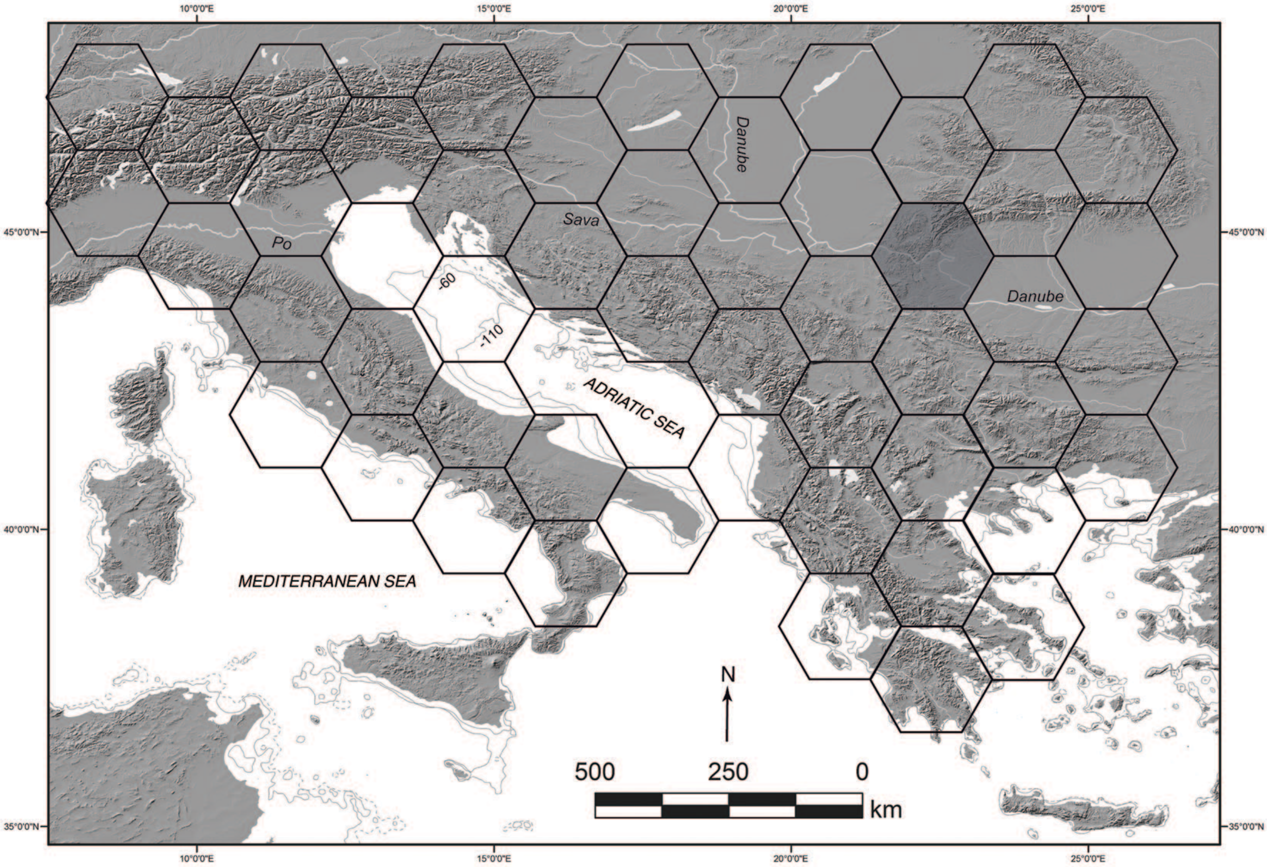

Fig. 16. An ideal heuristic model of the spatial organization of hunter-gatherers during the early prehistory of the Balkans and Italy with hexagonal packing of maximal or regional band territories with the radius of ~125 km. The starting point for the distribution of spatial packing units in real-space is the documented regional case of the long-lasting concentration of forager sites in the Danube Gorges region (darker shaded). Bathymetric contours show the drop of sea levels –110m during the LGM climax and –60m by the end of the Pleistocene.

of spatial organization of Upper Palaeolithic and Mesolithic hunter-gatherers in the Balkans and Italy with hexagonal packing of maximal or regional band territories, each with the assumed radius of ~125 km. The starting point for the given distribution of forager spatial packing units across real geographic space is the documented regional case of the long-lasting concentration of forager sites in the Danube Gorges region. In the Balkans, this is the best regional example that documents the extent of an assumed 'tribal' or maximal regional band territory. While this kind of exercise must remain highly provisional and should allow for variations in the arrangement of spatial units that must have been affected by geographical constraints to the distribution of both human groups and resources, it is here used as a heuristic model that may help us to

1) better envisage the structure of and relationships among different spatial units that structured forager social networks in these regions, and
2) focus our empirical research efforts in testing the theoretical proposal about forager spatial packing arrangements.

Yet, that tribal territories would not have been affected by either the efficiency of technology or population density is suggested by Birdsell (1968, 232) who claims that 'the size of dialectical tribal unit is insensitive to regional variations in both climate and biotic factors. Its primary determinants are competence in speech, and mobility on foot.'

There is an expectation that hunter-gatherer exchange networks for non-local raw material transfers were largely confined to distances of up to ca. 125–130 km, i.e. staying within the assumed hexagonal territories of maximal bands ('tribal' territories), whereas the distances for the distribution of decorative shells and other symbolically meaningful items often travelled across the territories of adjacent maximal bands, from ca. 200 km up to 800 km, serving to maintain long distance connections (Whallon 2006).

Evidence of long distance connections at distances beyond 1000 km throughout late Upper Palaeolithic and Mesolithic south-eastern Europe beyond adjacent maximal band territories might have been part of movements that enabled the spread of particular technological innovations related to curated weaponry, such as shouldered points and other tool types. At the same time, the spread of non-'utilitarian', symbolically-charged items or ideas, such as geometric motifs and ornaments, possibly along with mythical narratives, is also evident on the basis of the presented data. Elements of symbolic repertoires and axes of connectivity might have been established in the course of the late Upper Palaeolithic if not earlier and might have remained in place throughout the Early Holocene. Mesolithic flint raw material transfers were likely confined to the limits of maximal band territories. There are only rare examples of obsidian transfers from the Carpathian Mountains found in the Danube Gorges area in the course of the Epigravettian (Băile Herculane, Cuina Turcului: Dinan 1996a; 1996b) and Early/Middle Mesolithic (Padina: Radovanović 1981). But more work is needed in the future in order to understand knapped stone raw material transfers better.

The current data may suggest that there were some disruptions to long-distance connectivity across the Balkans and Italy at the start of the Holocene when major environmental changes ensued with the inundation of the Great Adriatic Plain and the growth of dense forests that might have obliterated partly certain communication corridors, making forager communities relatively isolated within their regional or maximal band territories. This could be reflected both in the absence of 'exotic' ornaments in the course of the Early/Middle Mesolithic at inland forager sites, as well as the primary reliance on locally available flint raw materials. However, at present, this must remain a conjecture that is based on relatively limited datasets. Interestingly, an opposite trend in the circulation of 'exotic' shells is documented in south-western Germany, with the rise in the abundance of such items in Early Mesolithic when compared to the late Upper Palaeolithic (Eriksen 2002; Whallon 2006, 268).

In the Balkans, significant changes seem to have been in place by the start of the Late Mesolithic towards the end of the 10th mill. BP. While patterns in exploitation of primarily locally available stone raw materials did not alter from the preceding earlier Mesolithic phases, ornamental beads made of local materials at both coastal and inland forager sites became widespread over significant distances in the course of the 9th mill. BP. Some of the marine shells, such as *C. neritea*, which were favourite items of decorative consumption in the Epigravettian period, now again started traversing long distances between coastal and inland forager communities as evidenced in Late Mesolithic burials at Vlasac in the Danube Gorges region. This re-emergence of *C. neritea* beads points to the long-term continuity of ornamental traditions that might have been linked to mythical narratives, which could have enabled the reinvented potency of cultural symbols of significant antiquity. However, certain marine gastropod species that only sporadically occurred as ornamental beads in the Upper Palaeolithic now became dominant and widespread, such as *C. rustica*.

New types of ornamental beads, such as cyprinid pharyngeal teeth ornaments, were also introduced in the Late Mesolithic. While it is likely that this type of ornamental bead innovation first appeared somewhere along the Danube, it is difficult to suggest the exact area of its origin as both in the Lower and Upper Danube regions the appearance of these beads was broadly contemporaneous. However, judging by similarities of perforation modifications to teeth roots on specimens from the Danube Gorges, Montenegro and Crimea, and the abundance of these beads in the Danube Gorges area, it is very likely that the place of origin for cyprinid teeth ornaments found in Montenegro and Crimea was the Danube Gorges area.

Previous examples aimed to show the potential of social network thinking for the study of Upper Palaeolithic and Mesolithic forager collectives of the Balkans and Italy. It is argued that we should expect significant long-distance mobility throughout these periods, despite possible diachronic oscillations and disruptions brought about by climatic and environmental changes. It seems that communication axis beyond maximal band territories were maintained for considerable periods of time, with the reinvention as well as remodeling of supra-regional contacts between forager groups. The evidence of these contacts attests to the importance of 'weak links' in small-world like societies.

In the course of the 9th mill. BP, if not earlier, such a vibrant world of forager contacts over considerable distances across southeastern Europe, Italy, and beyond might have also included those territories of Anatolia with already established first Neolithic, farming communities. In the second half of the mill., certain aspects of these Neolithic milieus might have influenced social and cultural practices of southeastern European foragers as previously argued for the case of the Danube Gorges foragers (Borić 2007; Borić/Stefanović 2004) and the Aegean (Reingruber 2011). Based on the evidence from the former region, in the last two centuries of the 9th mill. BP there was a clearcut departure from the previous taste for certain 'exotic' ornamental choices, such as *C. neritea* and *C. rustica* beads. While cyprinid teeth beads were still used during this transitional period, Neolithic-like disc-and barrel-shaped beads made of Spondylus and limestone/stone became dominant in Lepenski Vir and Vlasac burials (Borić 2011; Borić/Price 2013; Borić et al. 2014b; cf. Rigaud et al. 2015). Such ornamental choices, among other strands of evidence, reflect a fundamental transformation of previously existent forager social networks in the wider region. Our ability to reconstruct and analyse social networks that characterised foragers as well as the first agro-pastoralist communities, drawing conclusions about the functioning of 'weak links' among these different small-world like societies, remains an exciting and potent future research venture in this and other regional contexts.

Dušan Borić
Department of Archaeology and Conservation
SHARE, Cardiff University
Colum Drive
UK-Cardiff CF10 3EU
boricd@cardiff.ac.uk

Emanuela Cristiani
McDonald Institute
for Archaeological Research
University of Cambridge
Downing Street
UK-Cambridge CB1 3ER
ec484@cam.ac.uk

Bibliography

Aiello/Dunbar 1993: L. C. Aiello/R. I. M. Dunbar, Neocortex Size, Group Size, and the Evolution of Language. Current Anthropology 34.2, 1993, 184–193.

Aiello/Wheeler 1995: L. Aiello/P. Wheeler, The Expensive-Tissue Hypothesis.The Brain and the Digestive System in Human and Primate Evolution. Current Anthropology 36.2, 1995, 199–221.

Alley et al. 2005: R. B. Alley/P. U. Clark/Ph. Huybrechts/I. Joughin, Ice-Sheet and Sea-Level Changes. Science 310, 2005, 456–460.

Apicella et al. 2012: C. Apicella/F. W. Marlowe/J. H. Fowler/N. A. Christakis, Social Networks and Cooperation in Hunter-Gatherers. Nature 481, 2012, 497–501.

Arrighi et al. 2008: S. Arrighi/V. Borgia/F. d'Errico/A. Ronchitelli, I ciottoli decorati di Paglicci. Raffigurazioni e utilizzo. Rivista di Scienze Preistoriche 58, 2008, 39–58.

Arrighi et al. 2012: S. Arrighi/V. Borgia/F. d'Errico/S. Ricci/A. Ronchitelli, Manifestazioni d'arte inedite e analisi tecnologica dell'arte mobiliare di Grotta Paglicci (Rignano Garganico – Foggia). Preistoria Alpina, 46.1, 2012, 49–58.

Bailey/Gamble 1990: G. Bailey/C. Gamble, The Balkans at 18,000 BP. The View from Epirus. In: C. S. Gamble/O. Soffer (eds.), The World at 18,000 BP: 1. High Altitudes (London 1990) 148–167.

Balbo 2008: A. L. Balbo, Human Adaptation to Mediterranean Wetlands. The Geoarchaeology of Polje Ćepić (Istria, Croatia) in the Late Pleistocene and Holocene (Saarbrücken 2008).

Baltean 2011: I. C. Baltean, The Palaeolithic in Banat. In: N. Tasić/F. Drașovean (eds.), The Prehistory of Banat (Bucharest 2011) 21–76.

Barra Incardona 1969: A. Barra Incardona, Le nuove ricerche nelle cavernette e nei ripari dell'agro Falisco. Atti della Società Toscana de Scienze Naturali di Pisa 76, 1969, 102–124.

Benazzi et al. 2011: S. Benazzi/K. Douka/C. Fornai/C. C. Bauer/O. Kullmer/J. Svoboda/I. Pap/F. Mallegni/P. Bayle/M. Coquerelle/S. Condemi/A. Ronchitelli/K. Harvati/G. W. Weber, Early Dispersal of Modern Humans in Europe and Implications for Neanderthal Behaviour. Nature 479, 2011, 525–528.

Bettinger 1995: R. L. Bettinger, Hunter-Gatherers. Archaeological and Evolutionary Theory (New York 1995).

Biagi/Kiosk 2010: P. Biagi/D. Kiosk,The Mesolithic of the Northwestern Pontic Region. New AMS Dates for the Origin and Spread of the Blade and Trapeze Industries in Southeastern Europe. Eurasia Antiqua 16, 2010, 21–41.

Bietti 1979: A. Bietti, Le gisement paléolithique supérieur de Taurisano (Lecce, Italie) et sa position chronologique et culturelle dans l'Epigravettien italien. In: D. de Sonneville Bordes (ed.), La Fin de Temps Glaciaires en Europe (Paris 1979) 333–344.

Bietti/Cancellieri 2007: A. Bietti/E. Cancellieri, New Data from the Late Upper Palaeolithic Site of Fondo Focone (Ugento, Southern Apulia, Italy). The Lithic Industry of the B Trench. In: R. Whallon (ed.), Late Paleolithic Environments and Cultural Relations around the Adriatic. BAR International Series 1716 (Oxford 2007) 1–14.

Binford 1980: L. R. Binford, Willow Smoke and Dogs' Tails. Hunter-Gatherer Settlement Systems and Archaeological Site Formation. American Antiquity 45, 1980, 4–20.

Binford 2006: I. Binford, Bands as Characteristic of 'Mobile Hunter-Gatherers' May Exist Only in the History of Anthropology. In: F. Sellet/R. Greaves/ P.-L. Yu (eds.), Archaeology and Ethnoarchaeology of Mobility (Gainesville 2006) 3–22.

Birdsell 1973: J. B. Birdsell, A Basic Demographic Unit. Current Anthropology 14, 1973, 337–356.

Birdsell 1968: J. B. Birdsell, Some Predictions for the Pleistocene Based on Equilibrium Systems Among Recent Hunter-Gatherers. In: R. Lee/I. DeVore (eds.), Man the Hunter (Chicago 1968) 229–240.

Bogićević/Dimitrijević 2004: K. Bogićević/V. Dimitrijević, Quaternary Fauna from Mališina Stijena Near Pljevlja (Monetenegro). Zbornik radova Odbora za kras i speleologiju SANU 8, 2004, 119–131.

Bonsall 2008: C. Bonsall,The Mesolithic of the Iron Gates. In: G. N. Bailey/P. Spikins (eds.), Mesolithic Europe (Cambridge 2008) 238–279.

Bonsall et al. 2012: C. Bonsall/A. Boroneanţ/A. Soficaru/K. McSweeney/T. Higham/N. Miritoiu/C. Pickard/G. Cook, Interrelationship of Age and Diet in Romania's Oldest Human Burial. Naturwissenschaften 99, 2012, 321–325.

Bonsall et al. 2015: C. Bonsall/R. Vasić/A. Boroneanţ/M. Roksandić/A. Soficaru/K. McSweeney/A. Evatt/Ü. Aguraiuja/C. Pickard/V. Dimitrijević/T. Higham/D. Hamilton/G. Cook, New AMS ^{14}C Dates for Human Remains from Stone Age Sites in the Iron Gates Reach of the Danube, Southeast Europe. Radiocarbon 57.1, 33–46.

Borgatti/Halgin 2011: S. P. Borgatti/D. S. Halgin, On Network Theory. Organization Science 22.5, 2011, 1168–1181.

Borić 2007: D. Borić, The House between Grand Narratives and Microhistories. A House Society in the Balkans. In: R. A. Beck Jr. (ed.), The Durable House. House Society Models in Archaeology. Center For Archaeological Investigations, Occasional Paper 35 (Carbondale 2007) 97–129.

Borić 2011: D. Borić, Adaptations and Transformations of the Danube Gorges Foragers (c. 13,000–5500 cal. BC). An Overview. In: R. Krauss (ed.), Beginnings – New Research in the Appearance of the Neolithic between Northwest Anatolia and the Carpathian Basin. Papers of the International Workshop 8th–9th April 2009, Istanbul. Menschen – Kulturen – Traditionen 1 (Rahden/Westfalen 2011) 157–203.

Borić/Price 2013: D. Borić/T. D. Price, Strontium Isotopes Document Greater Human Mobility at the Start of the Balkan Neolithic. Proceedings of the National Academy of Sciences 110.9, 2013, 3298–3303.

Borić/Stefanović 2004: D. Borić/S. Stefanović, Birth and Death. Infant Burials from Vlasac and Lepenski Vir. Antiquity 78.301, 2004, 526–546.

Borić et al. 2012: D. Borić/V. Dimitrijević/D. White/C. Lane/C. A. I. French/E. Cristiani, Early Modern Human Settling of the 'Danube Corridor'. The Middle to Upper Palaeolithic Site of Tabula Traiana Cave in the Danube Gorges (Serbia). Antiquity, 86.334, 2012 (http://www.antiquity.ac.uk/projgall/boric334/).

Borić et al. 2014a: D. Borić/E. Cristiani/Z. Vušović-Lučić/N. Borovinić/D. Mihailović, LGM Marmot Hunting at Vrbička Cave in the Dinaric Alps. Poster Presented at the Conference 'Where the Wild Things Are', University of Durham, January 8th to 9th, 2014.

Borić et al. 2014b: D. Borić/C. A. I. French/S. Stefanović/V. Dimitrijević/E. Cristiani/M. Gurova/D. Antonović/E. A. Allué/D. Filipović, Late Mesolithic Lifeways and Deathways at Vlasac (Serbia). Journal of Field Archaeology 39.1, 2014, 4–31.

Boroneanţ 1990: V. Boroneanţ, Les enterrements de Schela Cladovei. Nouvelles données. In: P. Vermeersch/P. V. Van Peer (eds.), Contributions to the Mesolithic in Europe (Leuven 1990) 121–125.

Boschian/Ucelli Gnesutta 1995: G. Boschian/P. Ucelli Gnesutta, Osservazioni geo-arceologiche sui livelli pleolitici dell Grotta delle Settecannelle (ischia di Castro, VT). Preistoria e Protostoria in Etruria. Atti del II Incontro studi (Milano 1995) 45–51.

Brodar/Osole 1979: M. Brodar/F. Osole, Paleolitske i mezolitske regije i kulture u Sloveniji. In: A. Benac (ed.), Praistorija jugoslavenskih zemalja. Paleolitsko i mezolitsko doba: 1 (Sarajevo 1979) 159–194.

Broglio/Kozłowski 1987: A. Broglio/J. K. Kozłowski, Il paleolitico. Uomo, ambiente e culture (Milano 1987).

Broglio et al. 1993: A. Broglio/G. Chelidonio/L. Longo, Analyse morphologique et fonctionnelle des pointes à cran de l'Épigravettien ancien. In: P. C. Anderson/S. Beyries/M. Otte/H. Plisson (eds.), Traces et fonction. Les gestes retrouvés. Eraul 50 (Liège 1993) 31–39.

Bronk Ramsey et al. 2013: C. Bronk Ramsey/M. Scott/H. van der Plicht, Calibration for Archaeological and Environmental Terrestrial Samples in the Time Range 26–50 ka cal BP. Radiocarbon 55.4, 2013, 2021–2027.

Cancellieri 2010: E. Cancellieri, From the Watershed to the Great Adriatic Plain. An Investigation on Human and Landscape Ecology during the Late Upper Paleolithic. The Significance of Lithic Technology (Unpublished PhD thesis, University of Ferrara 2010).

Cardini 1980: L. Cardini, La necropoli mesolitica delle Arene Candide. Memorie Istituto Italiano di Paleontologia Umana 3, 1980, 9–31.

Chirica 1999: V. Chirica, Influences circum-méditerranéens dan l'épipaléolithique du sud-est de la Romanie. In: D. Sacchi (ed.), Les faciès leptolithiques du nord-ouest méditerranéen: milieux naturels et culturels. Paris: Société Préhistorique Française, XXIVème Congrès Préhistorique de France (Carcassonne 1999) 79–89.

Conard/Bolus 2003: N. J. Conard/M. Bolus, Radiocarbon Dating the Appearance of Modern Humans and Timing of Cultural Innovations in Europe. New Results and New Challenges. Journal of Human Evolution 44, 2003, 331–371.

Coward 2010: F. Coward, Small Worlds, Material Culture and Ancient Near Eastern Social Networks. In: R. Dunbar/C. Gamble/J. A. J. Gowlett (eds.), Social Brain and Distributed Mind (Oxford 2010) 449–479.

Coward 2013: F. Coward, Grounding the Net. Networks, Environments and Material Culture in the Epipalaeolithic and Early Neolithic of the Near East. In: K. Knappett (ed.), Network Analysis in Archaeology. New Approaches to Regional Interaction (Oxford 2013) 247–280.

Cristiani 2012: E. Cristiani, Ornamental Traditions of the Late Pleistocene and Early Holocene Foragers in the Eastern Alps. The Case of Riparo Biarzo. Gortania 34, 2012, 89–102.

Cristiani 2013: E. Cristiani, Prehistoric Foragers of Montenegro. Archaeology at Cambridge 2011–2012, 27.

Cristiani 2014: E. Cristiani, Late Pleistocene and Early Holocene Foragers of Montenegro. Archaeology at Cambridge 2012–2013, 41.

Cristiani/Borić 2012: E. Cristiani/D. Borić, 8500-Year-Old Garment Embroidery from the Late Mesolithic Site of Vlasac (Serbia). Technological, Use-Wear and Residue Analyses. Journal of Archaeological Science 39, 2012, 3450–3469.

Cristiani et al. 2014a: E. Cristiani/R. Farbstein/P. Miracle, Late Pleistocene and Early Holocene Personal Ornaments from the Eastern Adriatic. The Evidence from Vela Spila (Croatia). Journal of Anthropological Archaeology 36, 2014, 21–31.

Cristiani et al. 2014b: E. Cristiani/I. Živaljević/D. Borić, Residue Analysis and Ornament Suspension Techniques in Prehistory. Cyprinid Pharyngeal Teeth Beads from Late Mesolithic Burials at Vlasac (Serbia). Journal of Archaeological Science 46, 2014, 292–310.

Cullen 1995: T. Cullen, Mesolithic Mortuary Ritual at Franchthi Cave, Greece. Antiquity 69, 1995, 270–289.

Darlas/Mihailović 2008: A. Darlas/D. Mihailović (eds.), The Palaeolithic of the Balkans. BAR International Series 1819 (Oxford 2008).

Davies 2012: W. Davies, Climate, Creativity and Competition. Evaluating the Neanderthal 'Glass Ceiling'. In: S. Elias (ed.), Origins of Human Innovation and Creativity (Amsterdam 2012) 103–128.

Descola 2013: Ph. Descola, The Ecology of Others (Chicago 2013).

Dinan 1996a: E. H. Dinan, A Preliminary Report on the Lithic Assemblages from the Early Holocene Level at the Iron Gates Site of Băile Herculane. Mesolithic Miscellany 17.2, 1996, 15–24.

Dinan 1996b: E. H. Dinan, Preliminary Lithic Analysis of the Epigravettian Levels from the Iron Gates Site of Cuina Turcului. Mesolithic Miscellany 17.2, 1996, 25–40.

Douka et al. 2011: K. Douka/C. Perlès/H. Valladas/M. Vanhaeren/R. E. M. Hedges, Franchthi Cave Revisited. The Age of the Aurignacian in South-Eastern Europe. Antiquity 85.330, 2011, 1131–1150.

Dunbar 1996: R. I. M. Dunbar, Grooming, Gossip and the Evolution of Language (London 1996).

Eriksen 2002: B. V. Eriksen, Fossil Mollusks and Exotic Raw Materials in Late Glacial and Early Postglacial Find Contexts – a Complement to Lithic Studies. In: L. E. Fischer/B. V. Eriksen (eds.), Lithic Raw Material Economy in Late Glacial and Early Postglacial Western Europe. BAR International Series 1093 (Oxford 2002) 27–52.

d'Errico/Vanhaeren 2007: F. d'Errico/M. Vanhaeren, Evolution or Revolution? New Evidence for the Origin of Symbolic Behaviour In and Out of Africa. In: P. Mellars (ed.), Rethinking the Human Revolution. New Behavioural and Biological Perspectives on the Origin and Dispersal of Modern Humans (Cambridge 2007) 275–286.

Farbstein et al. 2012: B. Farbstein/D. Radić/D. Brajković/P. Miracle, First Epigravettian Ceramic Figurines from Europe (Vela Spila, Croatia). PLOS ONE 7.7, 2012, 1–15.

Fiocchi 1997: C. Fiocchi, Le conchiglie marine provenienti dalla Grotta di Fumane (Monti Lessini-Verona). Atti dell'lstituto Veneto di Scienze, Lettere ed Arti 155, 1996/1997, 1–22.

Floss 1994: H. Floss, Rohmaterialversorgung im Paläolithikum des Mittelrheingebietes. Monographien Römisch-Germanisches Zentralmuseum zu Mainz, RGZM 21 (Bonn 1994).

Floss 2014: H. Floss, Rivers as Orientation Axes for Migrations, Exchange Networks and Transmission of Cultural Traditions in the Upper Palaeolithic of Central Europe. In: M. Yamada/A. Ono (eds.), Lithic Raw Material Exploitation and Circulation in Préhistory. A Comparative Perspective in Diverse Palaeoenvironments. ERAUL 138 (Liège 2014) 11–22.

Foley/Lee 1996: R. A. Foley/P. C. Lee, Finite Social Space and the Evolution of Human Social Behaviour. In: J. Steele/S. Shennan (eds.), The Archaeology of Human Ancestry. Power, Sex and Tradition (London 1996) 47–66.

Gamble 1999: C. Gamble, The Palaeolithic Societies of Europe (Cambridge 1999).

Gamble 2007: C. Gamble, Origins and Revolutions (Cambridge 2007).

Gamble 2012: C. Gamble, Creativity and Complex Society before the Upper Palaeolithic Transition. In: S. Elias (ed.), Origins of Human Innovation and Creativity (Amsterdam 2012) 15–21.

Gamble 2013: C. Gamble, Settling the Earth. The Archaeology of Deep Human History (Cambridge 2013).
Gamble et al. 2011: C. Gamble/J. Gowlett/R. Dunbar,The Social Brain and the Shape of the Palaeolithic. Cambridge Archaeological Journal 21, 2011, 115–135.
Giacobini 2006: G. Giacobini, Les sépultures du Paléolithique supérieur. La documentation italienne. C. R. Palevol 5, 2006, 169–176.
Graziosi 1973: P. Graziosi, L'arte preistorica in Italia (Firenze 1973).
Grifoni Cremonesi 1998: R. Grifoni Cremonesi, Alcune osservazioni sul rituale funeario del paleolitico superior della Grotta Continenza. Rivista di Scienze Preistoriche 49, 1998, 395–407.
Guadelli et al. 2005: J. L. Guadelli/N. Sirakov/St. Ivanova/Sv. Sirakov/E. Anastassova/P. Courtaud/ I. Dimitrova/N. Djabarska/Ph. Fernandez/C. Ferrier/M. Fontugne/D. Gambier/A. Guadelli/ D. Iordanova/N. Iordanova/M. Kovatcheva/I. Krumov/J.-Cl. Leblanc/J.-B. Mallye/M. Marinska/ V. Miteva/V. Popov/R. Spassov/St. Taneva/N. Tisterat-Laborde/Ts. Tsanova, Une sequence du Paleolithique Inferieur au Paleolithique Recent dans les Balkans. La grotte Kozarnika a orechets (nord-ouest de la Bulgarie). In: N. Molines/M.-H. Moncel/J.-L. Monnier (eds.), Les Premiers Peuplements en Europe. BAR International Series 1364 (Oxford 2005) 87–103.
Gurioli 2006: F. Gurioli, Il trattamento delle materie dure animali nel Paleolitico superiore dell'Italia nord-orientale. Sfruttamento a fini alimentari, tecnologici e simbolici (Unpublished PhD thesis, Scienze Antropologiche, Consorzio Universitario di Bologna-Ferrara-Parma 2006).
Haggett 1965: P. Haggett, Locational Analysis in Human Geography (London 1965).
Heffley 1981: S. Heffley, The Relationship between Northern Athapaskan Settlement Patterns and Resource Distribution. An Application of Horn's Model. In: B. Winterhalder/E. A. Smith (eds.), Hunter-Gatherer Foraging Strategies. Ethnographic and Archaeological Analyses (Chicago 1981) 126–147.
Henry-Gambier et al. 2001: D. Henry-Gambier/M. Courty/É Crubézy/B. Kervazo, La sépulture des enfants de Grimaldi (Baoussé-Roussé, Italie). Anthropologie et Palethnologie funéraire des populations de la fin du Paléolithique supérieur (Paris 2001).
Higham et al. 2006: T. Higham/C. Bronk Ramsey/I. Karavanić/F. H. Smith/E. Trinkaus, Revised Direct Radiocarbon Dating of the Vindija G1 Upper Paleolithic Neandertals. Proceedings of the National Academy of Sciences 103.3, 2006, 553–557.
Higham et al. 2009: T. Higham/F. Brock/M. Peresani/A. Broglio/R. Wood/K. Douka, Problems with Radiocarbon Dating the Middle to Upper Palaeolithic Transition in Italy. Quaternary Science Review 28, 2009, 1257–1267.
Higham et al. 2011: T. Higham/T. Compton/C. Stringer/R. Jacobi/B. Shapiro/E. Trinkaus/B. Chandler/ F. Gröning/C. Collins/S. Hillson/P. O'Higgins/C. FitzGerald/M. Fagan, The Earliest Evidence for Anatomically Modern Humans in Northwestern Europe. Nature 479, 2011, 521–524.
Higham et al. 2012: Th. Higham/L. Basell/R. Jacobi/R. Wood/C. Bronk Ramsey/N. J. Conard, Testing Models for the Beginnings of the Aurignacian and the Advent of Figurative Art and Music. The Radiocarbon Chronology of Geißenklösterle. Journal of Human Evolution 62, 2012, 664–676.
Jöris/Street 2008: O. Jöris/M. Street, At the End of the 14C Time Scale – the Middle to Upper Paleolithic Record of Western Eurasia. Journal of Human Evolution 55, 2008, 782–802.
Karavanić 2003: I. Karavanić, L'industrie aurignacienne de la grotte de Šandalja II (Istrie, Croatie) dans le context de la région de l'Est de l'Adriatique. L'Anthropologie 107, 2003, 577–602.
Kelly 1995: R. L. Kelly, The Foraging Spectrum. Diversity in Hunter-Gatherer Lifeways (Washington 1995).
Kelly 2013: R. Kelly, The Lifeways of Hunter-Gatherers. The Foraging Spectrum (Cambridge 2013).
Knecht 1993: H. Knecht, Early Upper Paleolithic Approaches to Bone and Antler Projectile Technology. In: G. L. Peterkine/H. M. Bricker/P. Mellars (eds.), Hunting and Animal Exploitation in the Later Palaeolithic and Mesolithic of Eurasia. Archaeological Papers of the American Anthropological Association 4 (Washington 1993) 33–47.
Komšo 2006: D. Komšo,The Mesolithic in Croatia. Opuscula Archaeologica 30, 2006, 55–91.

Komšo/Vukosavljević 2011: D. Komšo/N. Vukosavljević, Connecting Coast and Inland. Perforated Marine and Freshwater Snail Shells in the Croatian Mesolithic. Quaternary International 244.1, 2011, 117–125.

Kozłowski 1989: S. K. Kozłowski, A Survey of Early Holocene Cultures of the Western Part of the Russian Plain. In: C. Bonsall (ed.), The Mesolithic in Europe (Edinburgh 1989) 424–441.

Kozłowski 1994: J. Kozłowski, Le Paléolithique des Carpathes occidentales. Preistoria Alpina 28, 1994, 113–126.

Kozłowski 1999: J. K. Kozłowski, Gravettian/Epigravettian Sequences in the Balkans. Environment, Technologies, Hunting Strategies and Raw Material Procurement. In: G. N. Bailey/E. Adam/C. Perlès/E. Panagopoulou/K. Zachos (eds.), The Palaeolithic Archaeology of Greece and Adjacent Areas (London 1999) 319–329.

Kozłowski 2004: J. K. Kozłowski, Early Upper Palaeolithic Levallois-Derived Industries in the Balkans and in the Middle Danube Basin. Anthropologie 42.3, 2004, 263–280.

Kozłowski 2007: J. Kozłowski, The Significance of Blade Technologies in the Period 50–35 kya BP for the Middle-Upper Palaeolithic Transition in Central Europe. In: P. Mellars/K. Boyle/O. Bar-Yosef/C. Stringer (eds.), Rethinking the Human Revolution. New Behavioural and Biological Perspectives on the Origin and Dispersal of Modern Humans (Cambridge 2007) 317–328.

Kozłowski 2008: J. Kozłowski, End of the Aurignacian and the Beginning of the Gravettian in the Balkans. In: A. Darlas/D. Mihailović (eds.), The Palaeolithic of the Balkans. BAR International Series 1819 (Oxford 2008) 3–14.

Kozłowski/Kaczanowska 2009: J. K. Kozłowski/M. Kaczanowska, The Mesolithic in the Aegean Basin. How to Interpret the Pre-Neolithic Settlement of the Aegean Islands and its Role in the Neolithization of Southeastern Europe. In: J. J. Shea/D. E. Liberman (eds.), Transitions in Prehistory. Papers in Honor of Ofer Bar-Yosef (Cambridge 2009) 357–383.

Kozłowski/Kozłowski 1982: J. K. Kozłowski/S. K. Kozłowski, Lithic Industries from the Multi-Layer Mesolithic Site, Vlasac, in Yugoslavia. In: J. K. Kozłowski (ed.), Origin of the Chipped Stone Industries of the Early Farming Cultures in the Balkans. Prace archeologiczne 33 (Warsaw 1982) 11–109.

Kozłowski et al. 1992: J. Kozłowski/H. Laville/B. Ginter, Temnata Cave, Excavations in Karlukovo Karst Area, Bulgaria: I.1 (Krakow 1992).

Krause et al. 2007: J. Krause/C. Lalueza-Fox/L. Orlando/W. Enard/R. E. Green/H. A. Burbano/J.-J. Hublin/C. Hänni/J. Fortea/M. de la Rasilla/J. Bertranpetit/A. Rosas/S. Pääbo, The Derived FOXP2 Variant of Modern Humans was Shared with Neanderthals. Current Biology 17.21, 2007, 1908–1912.

Kraynov 1940: D. A. Kraynov, Peschernaya stoyanka Zamil-Koba 1. Sbornik statey po arheologii SSSR. Trudy Gosudarstvennogo istoricheskogo muzeja 8, 1938, 7–32.

Kuhn 1995: S. Kuhn, Mousterian Lithic Technology. An Ecological Perspective (Princeton 1995).

Kuhn 2012: S. Kuhn, Emergent Patterns of Creativity and Innovation in Early Technologies. In: S. Elias (ed.), Origins of Human Innovation and Creativity (Amsterdam 2012) 69–87.

Kuhn/Stiner 2007: S. Kuhn/M. Stiner, Body Ornamentation as Information Technology. Towards an Understanding of the Significance of Early Beads. In: P. Mellars/K. Boyle/O. Bar-Yosef/C. Stringer (eds.), Rethinking the Human Revolution. New Behavioural and Biological Perspectives on the Origin and Dispersal of Modern Humans (Cambridge 2007) 45–54.

Kuhn et al. 2010: S. L. Kuhn/J. Pigati/P. Karkanas/M. Koumouzelis/J. K. Kozłowski/M. Ntinou/M. C. Stiner, Radiocarbon Dating Results for the Early Upper Palaeolithic of Klissoura Cave 1. Eurasian Prehistory 7.2, 2010, 37–46.

Kyparissi-Apostolika 2003: N. Kyparissi-Apostolika, The Mesolithic in Theopetra Cave. Data on a Debated Period of Greek Prehistory. In: N. Galanidou/C. Perlès (eds.), The Greek Mesolithic. Problems and Perspectives (London 2003) 189–198.

Laplace 1964: G. Laplace, Les subdivisions du Leptolithique italien. Etude de typologie analytique. Bullettino di Paletnologia Italiano 73, 1964, 25–63.

Laplace 1966: G. Laplace, Recherches sur l'origine et l'évolution des complexes leptolithiques. Melanges d'Archéologie et d'Histoire, Suppl. 4 (Paris 1966).

Lévi-Strauss 1987: C. Lévi-Strauss, Structural Anthropology II (London 1987).

Lévi-Strauss 1995: C. Lévi-Strauss, The Story of Lynx (Chicago 1995).

Lowe et al. 2012: J. Lowe/N. Barton/S. Blockley/C. Bronk Ramsey/V. L.Cullen/W. Davies/C. Gamble/K. Grant/M. Hardiman/R. Housley/C. S. Lane/Sh. Lee/M. Lewis/A. MacLeod/M. Menzies/W. Mueller/M. Pollard/C. Price/A. P. Roberts/E. J. Rohling/C. Satow/V. Smith/C. B. Stringer/E. Tomlinson/ D. White/P. Albert/I. Arienzo/G. Barker/D. Borić/A. Carandante/L. Civetta/C. Ferrier/J.-L. Guadelli/P. Karkanas/M. Koumouzelis/U. Muller/G. Orsi/J. Pross/M. Rosi/L. Shalamanov-Korobar/N. Sirakov/P. Tzedakis, Volcanic Ash Layers Illuminate the Resilience of Neanderthals and Early Modern Humans to Natural Hazards. Proceedings of the National Academy of Sciences 109.34, 2012, 13532–13537.

Malez 1979: M. Malez, Nalazišta paleolitskog i mezolitskog doba u Hrvatskoj. In: A. Benac (ed.), Praistorija jugoslavenskih zemalja. Paleolitsko i mezolitsko doba:1 (Sarajevo 1979) 227–276.

Mărgărit 2008: M. Mărgărit, L'Art mobilier paléolithique et mésolithique de Roumanie et de la République Moldova en contexte central et est-europeen (Târgoviște 2008).

Mellars 1996: P. Mellars, The Neanderthal Legacy. An Archaeological Perspective from Western Europe (Princeton 1996).

Mezzena/Palma di Cesnola 1967: A. Mezzena/A. Palma di Cesnola, L'Epigravettiano della Grotta Paglicci nel Gargano (scavi F. Zorzi 1961–1963). Rivista di Scienze Preistoriche 22.1, 1967, 23–156.

Mihailović 2007: D. Mihailović, Social Aspects of the Transition to Farming in the Balkans. Documenta Praehistorica 34, 2007, 73–88.

Mihailović 2008: B. Mihailović, The Gravettian Site Šalitrena pećina near Mionica (Western Serbia). In: A. Darlas/D. Mihailović (eds.), The Palaeolithic of the Balkans. BAR International Series 1891 (Oxford 2008) 101–106.

Mihailović 2009: D. Mihailović, Middle Palaeolithic Settlement at Petrovaradin Fortress (Novi Sad 2009).

Mihailović et al. 2011: D. Mihailović/B. Mihailović/M. Lopičić, The Palaeolithic in Northern Serbia. In: N. Tasić/F. Drașovean (eds.), The Prehistory of Banat 1. The Paleolithic and Mesolithic (Bucharest 2011) 78–101.

Miracle 1997: P. T. Miracle, Early Holocene Foragers in the Karst of Northern Istria. Poročilo o raziskovanju paleolita, neolita in eneolita v Sloveniji 24, 1997, 43–61.

Miracle 2007: P. Miracle, The Late Glacial 'Great Adriatic Plain'. 'Garden of Eden' or 'No Man's Land' during the Epipalaeolithic? A View from Istria (Croatia). In: R. Whallon (ed.), Late Paleolithic Environments and Cultural Relations around the Adriatic. BAR International Series 1716 (Oxford 2007) 41–51.

Mussi 2002: M. Mussi, The Earliest Italy. An Overview of the Italian Palaeolithic and Mesolithic (New York 2002).

Mussi/Zampetti 1985: M. Mussi/D. Zampetti, Il Paleolitico delle Caverne Falische. Una messa a punto. In: M. Liverani/A. Palmieri/R. Peroni (eds.), Studi di paletnologia in onore di S. M. Puglisi (Roma 1985) 627–645.

Osole 1962/1963: R. Osole, Mlajši paleolitik iz Ovčje jame. Arheološki vestnik 13/14, 1962/1963, 129–144.

Păunescu 1970: A. Păunescu, Epipaleoliticul de la Cuina Turcului-Dubova. Studii şi Cercetări Istorie Veche şi Archeologice 21.1, 3–29.

Păunescu 2000: A. Păunescu, Paleoliticul şi mezoliticul din spaţiul cuprins între Carpaţi şi Dunăre (Bucharest 2000).

Pawlikowski 1992: M. Pawlikowski, The Origins of Lithic Raw Materials. In: J. Kozłowski/H. Laville/B. Ginter (eds.), Temnata Cave, Excavations in Karlukovo Karst Area, Bulgaria: I.1 (Krakow 1992) 241–288.

Pennacchioni/Tozzi 1984: M. Pennacchioni/C. Tozzi, L'Epigravettiano di Cenciano Diruto (Vignanello, Viterbo). Atti della XXIV Riunione Scientifica dell'lstituto Italiano di Preistoria e Protostoria 24, 1984, 183–193.

Peresani 2012: M. Peresani, Fifty Thousand Years of Flint Knapping and Tool Shaping Across the Mousterian and Uluzzian Sequence of Fumane Cave. Quaternary International 247, 2012, 125–150.

Perlès 2013: C. Perlès, Tempi of Change. When Soloists don't Play Together. Arrhythmia in 'Continuous' Change. Journal of Archaeological Method and Theory 20, 2013, 281–299.

Perlès/Vanhaeren 2010: C. Perlès/M. Vanhaeren, Black Cyclope Neritea Marine Shell Ornaments in the Upper Palaeolithic and Mesolithic of Franchthi Cave, Greece. Arguments for Intentional Heat Treatment. Journal of Field Archaeology 35.3, 2010, 298–309.

Plisson/Geneste 1989: H. Plisson/J. M. Geneste, Analyse technologique des pointes à cran solutréennes du Placard (Charente), du Fourneau du Diable, du Pech de la Boissiere et de Combe Saunière (Dordogne). Paléo 1, 1989, 65–105.

Powell et al. 2009: A. Powell/D. Shennan/M. Thomas, Late Pleistocene Demography and the Appearance of Modern Human Behavior. Science 324, 2009, 1298–1301.

Powell et al. 2010: J. L. Powell/P. A. Lewis/R. I. M. Dunbar/M. García-Fiñana/N. Roberts, Orbital Prefrontal Cortex Volume Correlates with Social Cognitive Competence. Neuropsychologia 48.12, 2010, 3554–3562.

Radovanović 1981: I. Radovanović, Ranoholocenska kremena industrija sa lokaliteta Padina u Djerdapu (Beograd 1981).

Radovanović 1986: I. Radovanović, Novija istraživanja paleolita i mezolita u Crnoj Gori. Glasnik Srpskog arheološkog društva 3, 1986, 63–77.

Rähle 1978: W. Rähle, Schmuckschnecken aus mesolithischen Kulturschichten Süddeutschlands und ihre Herkunft (Probstfeld, Falkensteinhöhle, Burghöhle Dietfurt, Zigeunerfels, Große Ofnet). In: W. Taute (ed.), Das Mesolithikum in Süddeutschland: 2. Tübinger Monographien zur Urgeschichte (Tübingen 1978) 163–268.

Reimer et al. 2013: P. J. Reimer/E. Bard/A. Bayliss/J. W. Beck/P. G. Blackwell/C. Bronk Ramsey/P. M. Grootes/T. P. Guilderson/H. Haflidason/I. Hajdas/C. Hatt/T. J. Heaton/D. L. Hoffmann/A. G. Hogg/K. A. Hughen/K. F. Kaiser/B. Kromer/S. W. Manning/M. Niu/R. W. Reimer/D. A. Richards/E. M. Scott/J. R. Southon/R. A. Staff/C. S. M. Turney/J. van der Plicht, IntCal13 and Marine13 Radiocarbon Age Calibration Curves 0–50,000 Years cal BP. Radiocarbon 55.4, 2013, 1869–1887.

Reingruber 2011: A. Reingruber, Early Neolithic Settlement Patterns and Exchange Networks in the Aegean. Documenta Prehistorica 38, 2011, 291–305.

Richards et al. 2000: M. P. Richards/P. B. Pettitt/E. Trinkaus/F. H. Smith/M. Paunović/I. Karavanić, Neanderthal Diet at Vindija and Neanderthal Predation. The Evidence from Stable Isotopes. Proceedings of the National Academy of Sciences 97, 2000, 7663–7666.

Rigaud 2011: S. Rigaud, La parure. Traceur de la géographie culturelle et des dynamiques de peuplement au passage Mésolithique-Néolithique en Europe (Unpublished PhD thesis, University of Bordeaux 2011), http://tel.archives-ouvertes.fr/tel-00668694 (last access July 20, 2015).

Rigaud et al. 2014: S. Rigaud/M. Vanhaeren/A. Queffelec/G. Le Bourdon/F. d'Errico, The Way we Wear Makes the Difference. Residue Analysis Applied to Mesolithic Personal Ornaments from Hohlenstein-Stadel (Germany). Archaeological and Anthropological Sciences 6.2, 2014, 133–144.

Rigaud et al. 2015: S. Rigaud/F. d'Errico/M. Vanhaeren, Ornaments Reveal Resistance of North European Cultures to the Spread of Farming. PLOS One. DOI:10.1371/journal.pone.0121166.

Rink et al. 2002: W. J. Rink/I. Karavanić/P. B. Pettitt/J. van der Plicht/F. H. Smith/J. Bartoll, ESR and AMS-Based 14C Dating of Mousterian Levels at Mujina Pećina, Dalmatia, Croatia. Journal of Archaeological Science 29, 2002, 943–952.

Rink et al. 2013: W. J. Rink/N. Mercier/D. Mihailović/M. W. Morley/J. W. Thompson/M. Roksandic, New Radiometric Ages for the BH-1 Hominin from Balanica (Serbia). Implications for Understanding the Role of the Balkans in Middle Pleistocene Human Evolution. PLOS ONE 8.2, 2013, 54608.

Roksandic et al. 2009: M. Roksandic/D. Mihailović/N. Mercier/V. Dimitrijević/M. W. Morley/Z. Rakocevic/B. Mihailović/B. Guibert/J. Babb, A Human Mandible BH-1 from the Pleistocene Deposits of Mala

Balanica Cave (Sićevo Gorge, Serbia). Journal of Human Evolution 61, 2009, 186–196.

Romandini et al. 2012: M. Romandini/M. Peresani/F. Gurioli/B. Sala, Marmota Marmota, the Most Common Prey Species at Grotta del Clusantin. Insights from an Unusual Case-Study in the Italian Alps. Quaternary International 252, 2012, 184–194.

Sahlins 1976: M. Sahlins, Culture and Practical Reason (Chicago 1976).

Shennan 2001: S. Shennan, Demography and Cultural Innovation. A Model and its Implications for the Emergence of Modern Human Culture. Cambridge Archaeological Journal 11, 2001, 5–16.

Sirakov et al. 2010: N. Sirakov/J.-L. Guadelli/S. Ivanova/S. Sirakova/M. Boudadi-Maligne/Ph. Dimitrova Fernandez/C. Ferrier/A. Guadelli/D. Iordanova/N. Iordanova/M. Kovatcheva/I. Krumov/J.-Cl. Leblanc/V. Miteva/V. Popov/R. Spassov/S. Taneva/T. Tsanova, An Ancient Continuous Human Presence in the Balkans and the Beginnings of Human Settlement in Western Eurasia. A Lower Pleistocene Example of the Lower Palaeolithic Levels in Kozarnika Cave (North-Western Bulgaria). Quaternary International 223/224, 2010, 94–106.

Soficaru et al. 2006: A. Soficaru/A. Doboș/E. Trinkaus, Early Modern Humans from the Peștera Muierii, Baia de Fier, Romania. Proceedings of the National Academy of Sciences 103.46, 2006, 17196–17201.

Soficaru et al. 2007: A. Soficaru/C. Petrea/A. Dobos/E. Trinkaus, The Human Cranium from the Peștera Cioclovina Uscata, Romania. Context, Age, Taphonomy, Morphology, and Paleopathology. Current Anthropology 48.4, 2007, 611–619.

Spinapolice 2012: E. E. Spinapolice, Raw Material Economy in Salento (Apulia, Italy). New Perspectives on Neanderthal Mobility Patterns. Journal of Archaeological Science 39, 2012, 680–689.

Stiner 1994: M. C. Stiner, Honor Among Thieves. A Zooarchaeological Study of Neandertal Ecology (Princeton 1994).

Stiner 1999a: M. C. Stiner, Palaeolithic Mollusc Exploitation at Riparo Mochi (Balzi Rossi, Italy). Food and Ornaments from the Aurignacian through Epigravettian. Antiquity 73, 1999, 735–754.

Stiner 1999b: M. C. Stiner, Shell Ornaments from the Upper Paleolithic through Mesolithic Layers of Klissoura Cave 1 by Prosymna (Peloponese, Greece). Eurasian Prehistory 7.2, 1999, 287–308.

Stiner 2010: M. C. Stiner, Shell Ornaments from the Upper Palaeolithic through Mesolithic Layers of Klissoura Cave 1 by Prosymna (Peloponnese, Greece). Eurasian Prehistory 7.2, 2010, 287–308.

Trinkaus/Constantin/Zilhão: E. Trinkaus/S. Constantin/J. Zilhão (eds.) Life and Death at the Peştera cu Oase. A Setting for Modern Human Emergence in Europe (New York 2013).

Tsanova 2008: Ts. Tsanova, Les débuts du Paléolithique supérieur dans l'Est des Balkans. Réflexion à partir des études taphonomique et techno-économique des ensembles lithiques des grottes Bacho Kiro (couche 11), Temnata (couche VI et 4) et Kozarnika (niveau VII). BAR International Series 1752 (Oxford 2008).

Ucelli Gnesutta/Cristiani 2002: P. Ucelli Gnesutta/E. Cristiani, Analisi stilistica e tecnologica di frammenti di osso decorato dai livelli epigravettiani della Grotta di Settecannelle (Viterbo). Rivista di Scienze Preistoriche 52, 2002, 143–160.

Ucelli Gnesutta/Cristiani 2014: P. Ucelli Gnesutta/E. Cristiani, Analisi tipologica e funzionale delle punte à cran epigravettiane della Grotta delle Settecannelle (Viterbo). In: N. Negroni Catacchio (ed.), Atti dell'Undicesimo Incontro di Studi Valentano (VT) – Pitigliano (GR), 14–16 Settembre 2012 (Milano 2014) 595–614.

Vacca/Coppola 1993: E. Vacca/D. Coppola, The Upper Palaeolithic Burial at the Cave of Santa Maria di Agnano (Ostuni, Brindisi). Preliminary Report. Rivista di Antropologia 71, 1993, 275–284.

Vanhaeren/d'Errico 2001: M. Vanhaeren/F. d'Errico, La Parure de l'enfant de la Madeleine (Fouilles Peyrony). Un nouveau regard sur l'enfance au Paléolithique supérieur. Paléo 13, 2001, 201–240.

Vanhaeren/d'Errico 2003: M. Vanhaeren/F. d'Errico, Childhood in the Epipaleolithic. What do Personal Ornaments Associated to Burials Tell Us? In: L. Larsson/H. Kindgren/K. Knutsson/D. Leoffler/E. Akerlund (eds.), Mesolithic on the Move. Papers Presented at the Sixth International Conference on the Mesolithic in Europe, Stockholm 2000 (Oxford 2003) 494–505.

Vanhaeren/d'Errico 2006: M. Vanhaeren/F. d'Errico, Aurignacian Ethno-Linguistic Geography of Europe Revealed by Personal Ornaments. Journal of Archaeological Science 33, 2006, 1105–1128.

Völzing 1938: O. Völzing, Die Grabungen 1937 am Hohlestein im Lonetal, Fundberichte aus Schwaben, N.F. 9, 1938, 1–7.

Vujević/Parica 2009/2010: D. Vujević/M. Parica, Nakit i umjetnost pećine Vlakno. Archaeologia Adriatica 3/4, 2009/2010, 23–34.

Wetzel 1938: R. Wetzel, Die Kopfbestattung und die Knochentrümmerstätte des Hohlensteins im Rahmen der Urgeschichte des Lonetals. Verhandlungen der Deutschen Gesellschaft für Rassenforschung 9, 1938, 13–212.

Whallon 1999: R. Whallon, The Lithic Tool Assemblages at Badanj within their Regional Context. In: G. N. Bailey/E. Adam/C. Perlès/E. Panagopoulou/K. Zachos (eds.), The Palaeolithic Archaeology of Greece and Adjacent Areas (London 1999) 330–342.

Whallon 2006: R. Whallon, Social Networks and Information. Non-'Utilitarian'Mobility Among Hunter-Gatherers. Journal of Anthropological Archaeology 25, 2006, 259–270.

Whallon 2007a: R. Whallon, Social Territories Around the Adriatic in the Late Pleistocene. In: R. Whallon (ed.), Late Palaeolithic Environments and Cultural Relations Around the Adriatic. BAR International Series 1716 (Oxford 2007) 61–65.

Whallon 2007b: R. Whallon, Spatial Distributions and Activities in Epigravettian Level 6 at the Site of Badanj, Bosnia and Herzegovina. Glasnik Srpskog arheološkog društva 23, 2007, 9–26.

Whallon et al. 2011: R. Whallon/W. Lovis/R. K. Hitchcock (eds.), Information and its Role in Hunter-Gatherer Bands (Los Angeles 2011).

White 2007: R. White, Systems of Personal Ornamentation in the Early Upper Palaeolithic. Methodological Challenges and New Observations. In: P. Mellars/K. Boyle/O. Bar-Yosef/C. Stringer (eds.), Rethinking the Human Revolution (Cambridge 2007) 287–302.

Wiessner 1982: P. Wiessner, Risk, Reciprocity and Social Influences on !Kung San Economics. In: E. Leacock/R. B. Lee (eds.), Politics and History in Band Societies (Cambridge 1982) 61–84.

Willis 1994: K. J. Willis, The Vegetational History of the Balkans. Quaternary Science Reviews 13, 1994, 769–788.

Willis 1996: K. J. Willis, Where did all the Flowers Go? The Fate of Temperate European Flora During the Glacial Periods. Endeavour 20, 1996, 110–114.

Willis/Van Andel 2004: K. J. Willis/T. H. Van Andel, Trees or no Trees? The Environment of Central and Eastern Europe during the Last Glaciation. Quaternary Science Reviews 23, 2004, 2369–2387.

Wobst 1974: M. Wobst, Boundary Conditions for Palaeolithic Social Systems. A Simulation Approach. American Antiquity 39, 1974, 147–178.

Wobst 2000: M. Wobst, Regions and Late Pleistocene Hunter-Gatherers. In: G. Larsen Peterkin/ H. A. Price (eds.), Regional Approaches to Adaptation in Late Pleistocene Western Europe. BAR International Series (Oxford 2000) 221–229.

Wobst 2011: M. H. Wobst, Foraging for Information among Foragers – an Afterword. In: R. Whallon/W. Lovis/R. K. Hitchcock (eds.), Information and its Role in Hunter-Gatherer Bands (Los Angeles 2011), 267–280.

Zilhão et al. 2007: J. Zilhão/E. Trinkaus/S. Constantin/Ș. Milota/M. Gherase/L. Sarcina/A. Danciu/H. Rougier/J. Quilès/R. Rodrigo, The Peștera cu Oase People, Europe's Earliest Modern Humans. In: P. Mellars/K. Boyle/O. Bar-Yosef/C. Stringer (eds.), Rethinking the Human Revolution. New Behavioural and Biological Perspectives on the Origin and Dispersal of Modern Humans (Cambridge 2007) 249–262.

PAOLO BIAGI

The Last Hunter-Gatherers of the Northern Coast of the Black Sea and their Role in the Mesolithic of Europe

A View from Crimea

Keywords: Crimea, Late Palaeolithic and Mesolithic, Shan-Koba, Radiocarbon chronology, Chipped stone assemblages

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In this paper the calibrations diagrams of *figs. 5*, *7* and *8* have been developed according to OxCal 4.2 (Bronk Ramsey/Lee 2013), while the dates of *tables 1* and *2* have been calibrated according to CalPal 2014 (Danzeglocke et al. 2014).

Introduction

The Late Palaeolithic and Mesolithic sequences brought to light during the excavations carried out in the rock-shelters of Crimea are among the most important and complete in south-eastern Europe (Воеводский 1950; Телегін 1982; Gimbutas 1956, 14 – 17; Демиденко 2003; Demidenko 2014a). The data obtained from these sites helps us follow the cultural and environmental changes that took place along the northern coast of the Black Sea between the end of the Pleistocene and the beginning of the Holocene (Громова/Громов 1937; Бибиков 1941; Antony 2007; Stanko 2007; 2009; Yanevich et al. 2009; Dolukhanov et al. 2009; Demidenko 2014b).

In particular the rock-shelters of Shan-Koba (Бибиков 1946; Бибиков et al. 1994; Schen et al. 2012), Murzak-Koba (Бибиков 1940a; Бибиков et al. 1994; Yanevich 1998, fig. 2; Zaliznyak 1998), Fat'ma-Koba (Бибиков 1959; 1966; Бибиков et al. 1994), and Grot Skalist'iy (Коен 1994; Манько 2010), situated along the south-eastern slopes of the Crimean mountains (*fig. 1*), have yielded long sequences showing different periods of habitation that constitute the main topic of the present paper. Although most of the sites were excavated during the Soviet period, thanks to the prompt and

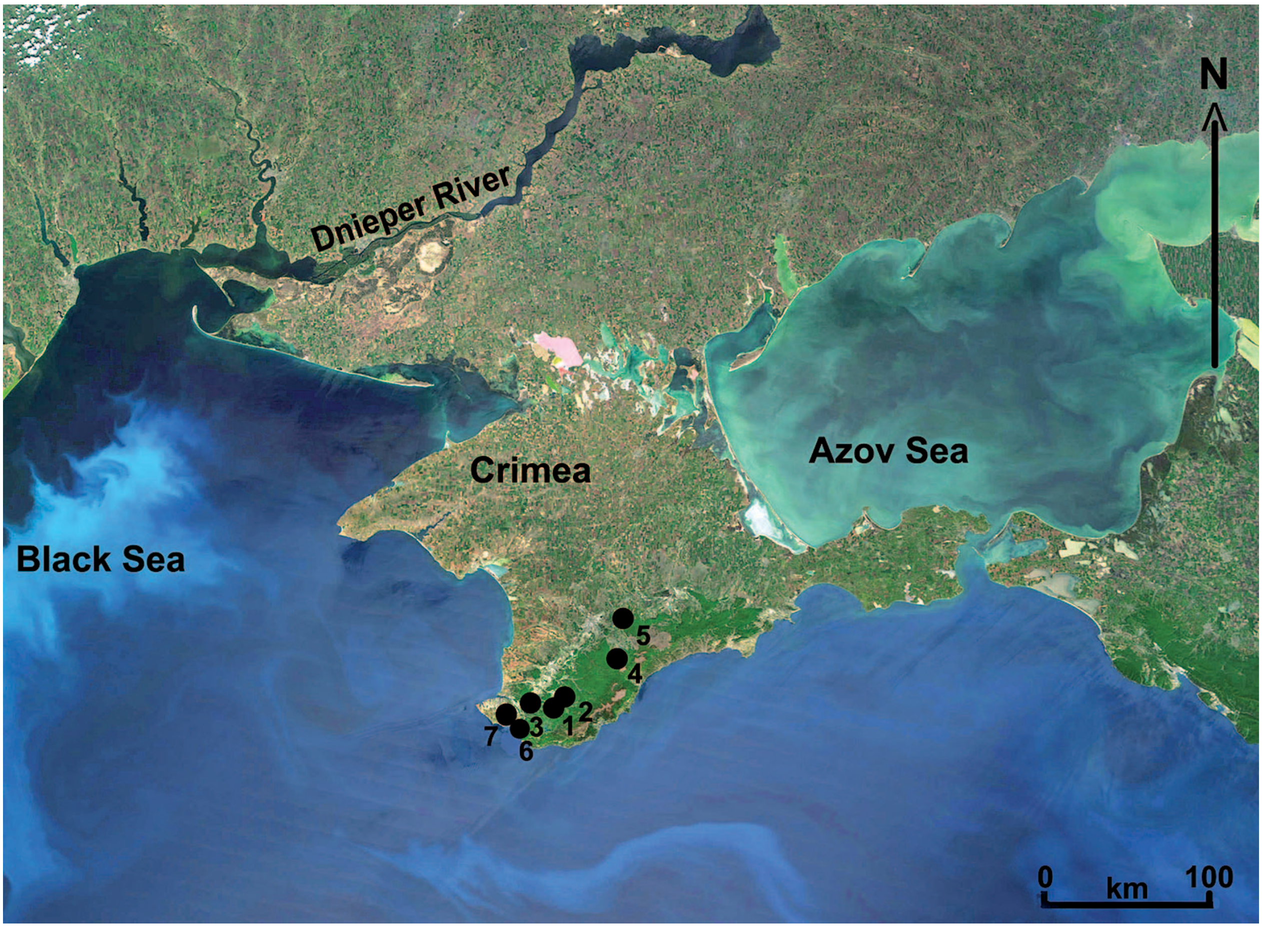

Fig. 1. Approximate location of the most important sites mentioned in the text. Shan-Koba (1), Murzak-Koba (2), Fat'ma-Koba (3), Grot Skalist'iy (4), Shpan-Koba (5), Laspi 7 (6), BBBP-2 and MM-2 (7) (drawing by P. Biagi).

detailed publication of the results (Бибиков et al. 1994), they still constitute the backbone of the North Pontic prehistory. Moreover they represent a fundamental resource for us to follow the events that took place in the region between the end of the Palaeolithic (Stepanchuk et al. 2009) and the beginning of the Neolithic (Бадер 1961).

It is unfortunate that, apart from a few exceptions (Телегiн 1982, 46; Телегин 1985; Манько 2010, 250), the excavated sequences were not correlated with a good series of absolute dates. In effect just a few radiocarbon results were obtained from the Crimean rock-shelters and caves during the Soviet period (Телегин 1989). Most of the Late Palaeolithic and Mesolithic dates from the sites of the northern coast of the Black Sea were obtained later, mainly during the last two decades, in a few cases following specific programmes of investigation (Зализняк 1995; Biagi et al. 2007; Біаджі et al. 2008; Dolukhanov 2008; Biagi/Kiosak 2010).

As recently published (Benecke 2006; Biagi et al. 2014), the AMS dates from Shan-Koba in particular, helped reconstruct with better approximation the periods during which the site was settled, redefine the Late Palaeolithic and Mesolithic time-span covered by the cultural sequences of the entire region, and improve the sequential chronology of the Crimean chipped stone assemblages, mainly between the Allerød interstadial and the Early Atlantic period.

The history of research at the above rock-shelter and the varying interpretation of the cultural sequences suggested by different authors (Бонч-Осмоловский 1934; Мацкевой 1977; Коен 1991; Манько 2010) have already been discussed in a previous paper (Biagi et al. 2014). Nevertheless, Shan-Koba was considered to be the reference site for the Late Palaeolithic and Mesolithic cultural sequence of southern Ukraine for a long time. The site, eponymous of the same culture, was considered a typical case of the so-called 'single culture interpretation'. According to this theory, suggested by D. Ya. Telegin (Телегин 1966) one single community of hunter-gatherers exploited a restricted territory almost without interruption throughout the Late Palaeolithic and the entire Mesolithic. The Soviet archaeologists called this phenomenon Mountain-Crimean Culture (Gornokrimskaya).

More recently D. Telegin proposed a new subdivision for the Mesolithic cultures of southern Ukraine, and its neighbouring territories. According to the above author three 'cultural-ethnographic entities' (Telegin 1998, fig. 1), defined on the basis of typological characteristics of chipped stone tools, are represented in the region.

D. Ya. Telegin attributed the Mountain-Crimean Culture to the first of his 'entities', which he called Crimea-Belyi Les, the expansion of which covers four different well-defined spots, distributed between the Romanian course of the Danube (Cuina Turcului [Păunescu 1979]) and the Caucasus (Sosruko [Бадер/Церетели 1989]); the second Kukrek (Великова 1951), and the third Rogalik-Grebeniki (Станко 1972; Телегін 1982, 79; Stanko/Kiosak 2008/2009; Залізняк 2005, fig. 9). These 'entities' were defined independently from their chronology. They all were believed to have lasted for a long time, from the Late Palaeolithic onward and during the entire Mesolithic, with typological characteristics still present in the lithic assemblages at the beginning of the Early Neolithic (Telegin 1998, 96).

Describing the typology of the chipped stone tools of the above 'entities', D. Ya. Telegin pointed out the high percentage of microlithic lunates and notched bladelets in the Crimea-Belyi Les 'entity', of Kukrek inserts and truncated bladelets in the Kukrek, and trapezes in the Rogalik-Grebeniki (Telegin 1998, fig. 2; see also Нужный 1992, fig. 23 for Grebeniki).

The reason for the remarkable differences between the three complexes in the chipped stone tool repertoire was seen in the different territories exploited by the inhabitants of the three 'entities'. Nevertheless the basic chrono-typological subdivisions already suggested by other authors for the Late Palaeolithic and Mesolithic of the Crimean mountains (Телегин 1989; Бибиков et al. 1994), were re-proposed for the Crimea-Belyi Les 'entity'. The most characteristic are the systematic recurrence of lunates during the early stages of the Shan-Koba Late Palaeolithic and Mesolithic sequence, as represented in layers 6–4 of the same sequence (Нужный 1992, figs. 10–11) (Shan-Koba Culture [Бонч-Осмоловский 1934; Воеводский 1950]) and the appearance of trapezes in the upper layer 3 of the same series (Murzak-Koba Culture), Murzak-Koba (Коен 1994; Yanevich 1998, fig. 2; Нужный 1992, fig. 21), and other sites in the north-western Pontic region (Станко 1976), amongst which Laspi 7 (Zaliznyak 1998, fig. 3) is thought to have played an important role.

The Late Palaeolithic and Mesolithic Sequence of the Crimean Mountains

As mentioned above, the sequence of the Late Palaeolithic/Mesolithic of Crimea was defined mainly on the remains of material culture and the radiometric results from four sites: Shan-Koba, Murzak-Koba, Fat'ma-Koba, and Grot Skalist'iy, although the sequences recently brought to light from the rock-shelters of Buran-Kaya III (Janevich 1998; Yanevich et al. 2009; Péan et al. 2013), Shpan-Koba (Benecke 1999; Nuzhniy 1998, fig. 1), Vishennoe (Демиденко 2003) and Sy-At III (Nuzhniy 1998, fig. 2) introduced very important changes, especially regarding the final stages of the Crimean Late Palaeolithic and the Preboreal Early Mesolithic. It is important to point out the key role played by the detailed study of the geometric microliths in the interpretation of the above sequences, the definition of the territories covered by the different cultural aspects, the hunting methods adopted by the last hunter-gatherers, and the techniques used for shafting many types of geometric microliths (Нужный 1992).

The Late Palaeolithic sequence of Grot Skalist'iy (Манько 2010; 2013, 15–43) has been radiocarbon-dated between 13.500±150 BP (Ki-13.152) and 11.200±120 BP (Ki-13153) on unidentified animal bones. Although the six dates available from the site are not in stratigraphic sequence, we can suggest that the rock-shelter was inhabited roughly between the Bølling and Allerød interstadials (Hoek 2008). The most characteristic geometric microliths from layer III consist of lunates obtained by abrupt, bipolar retouch with the microburin technique.

The Shpan-Koba Culture, represented from layer II of the homonymous rock-shelter, yielded a basically microlithic chipped stone assemblage consisting of 'specific asymmetrical triangles processed with abrupt or semi-abrupt retouch on the longer part and abrupt or bipolar ones on the base. Sometimes these triangles were manufactured in the microburin technique' (Nuzhniy 1998, 107). All the five radiocarbon dates reported by V. O. Man'ko (Манько 2013, tab. 2) from the Shpan-Koba Culture layer II of the same site, fall between 9730±50 BP (KIA-3687) and 9150±150 BP (Gin-6276). Layer II is stratified between layer III, attributed to the Shan-Koba Culture, radiocarbon-dated between 10.210±80 BP (Ki-5823) and 9760±60 BP (KIA-3686), and layer I, attributed to the Murzak-Koba Culture, dated between 7600±45 BP (Ki-5821) and 6780±40 BP (Ki-5822). All the results above are from unidentified animal bones.

The Shpan-Koba sequence is of primary importance because it yielded a cultural aspect, first defined by A. A. Yanevich (Яневич 1993), never recognized by the earlier excavators of the Crimean rock-shelters. This aspect is considered to represent at least part of the Preboreal Early Mesolithic of Crimea. Most authors agree that its origin is to be sought in the Final Epigravettian of the steppe zone of southern Ukraine (Яневич 1993; Nuzhniy 1998, 107 contra Манько 2013, 242).

The Shan-Koba Sequence

Shan-Koba is a 25 m long and 6m wide rock-shelter that opens in the Kubalar-Dere valley, a small tributary of the Baidar River that flows from the mountain slopes of south-eastern Crimea. It was discovered by S. A. Trusova and S. N. Bibikov in 1927, and excavated by G. A. Bonch-Osmolovskiy in 1928, and S. N. Bibikov in 1935–1936 (Бибиков et al. 1994).

The sequence recorded by A. Bonch-Osmolovskiy (Бонч-Осмоловский 1934) consists of six layers, three of which (6, 4 and 3) were 'ashy', rich in material culture remains and archaeological structures, separated by the 'intermediate' layers 5 and 2. According to the typological charac-

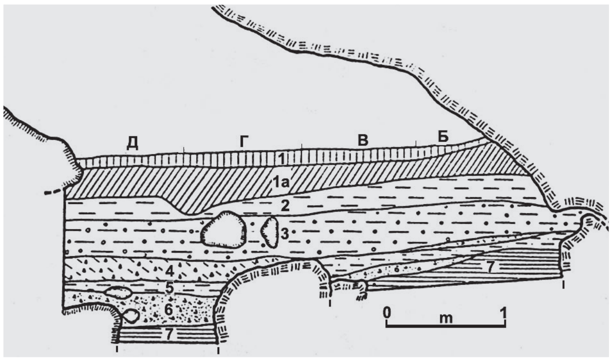

Fig. 2. Shan-Koba: Section through the deposits excavated in 1936 (from Бибиков et al. 1994, fig. 11) (redrawn by P. Biagi).

teristics of the chipped stone assemblages, Layers 6–4, were attributed to the 'Azilian', Layer 3 to the 'Tardenoisian with trapezes', following the French terminology in use at that time (see also Gimbutas 1956, 14). A few years later a Neolithic layer (1a) was discovered in the western part of the shelter (Бибиков 1940b), while layer 1 was attributed to the Bronze Age (*fig. 2*).

The excavators subdivided Layer 3 into four spits, the uppermost of which yielded a few structures, a thick fireplace, Helix middens (Бибиков 1941), and a pit filled with Helix fragments close to a flint knapping area. Spits 3 and 4 showed evidence for a few habitation structures, among which are a clay-surfaced fireplace delimited by a semi-circle of pebbles, around which five large stones were placed, and a pit for baking Helix.

Layer 4 did not yield archaeological features. The chipped stone artefacts were recovered from a sub-rectangular surface of some 34m². The microliths consist of lunates, seven scalene triangles and one trapeze produced in microburin technique. As reported above, following the French terminology in fashion at that time (see for instance Станко 1966 for the use of the term Tardenoisian in the North Pontic region), they were attributed to the Azilian, as well as those from lower-lying Layer 6.

Layer 5 as well did not yield any structures. The chipped assemblage from this 'intermediate' horizon consists of 102 artefacts, among which are mainly lunates, although a few trapezes and triangles were also recovered.

Layer 6 was excavated into six spits. Two fireplaces were found in spits 2 and 3 near a wide, elongated heap of bones, close to a flint-knapping

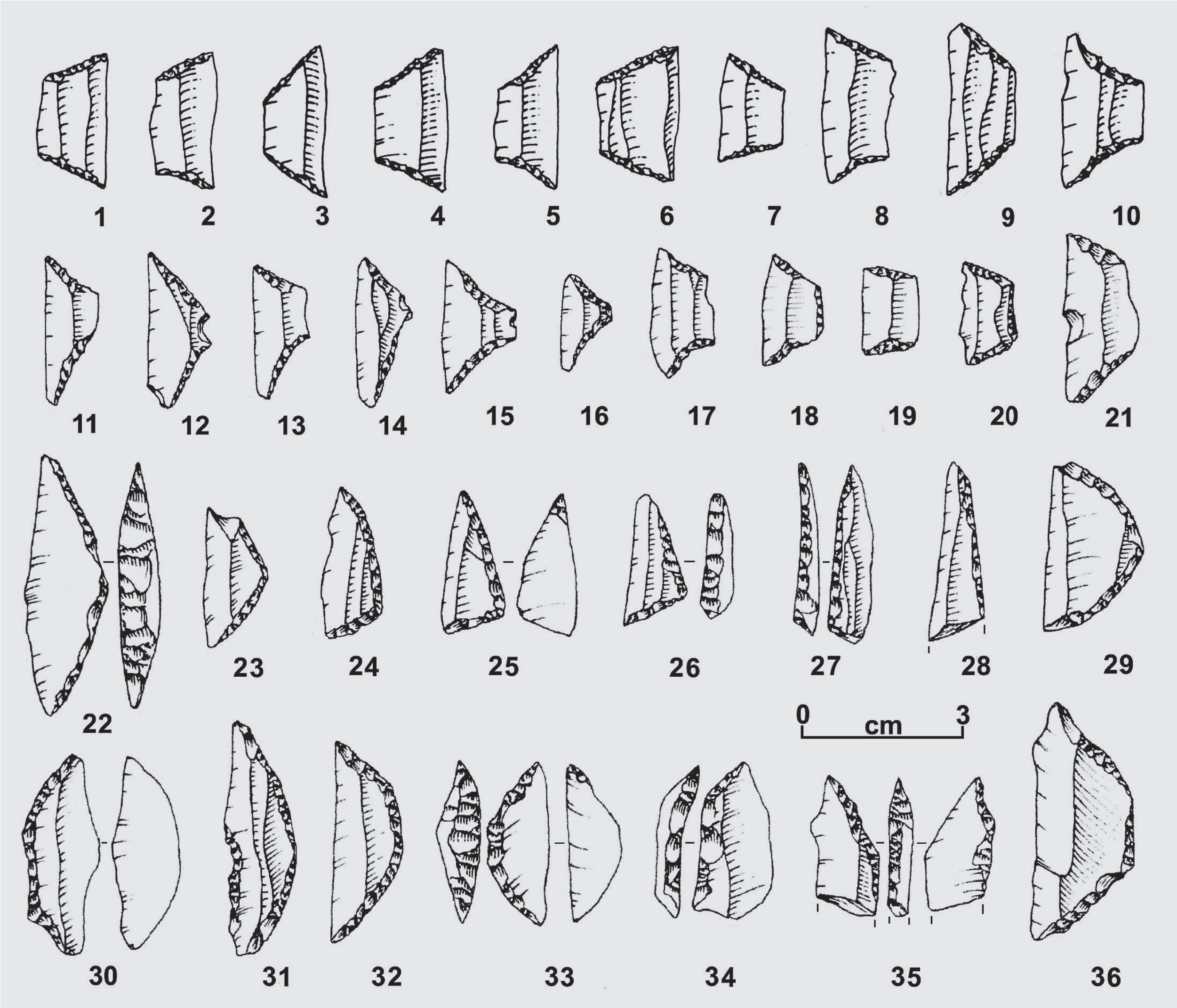

Fig. 3. Characteristic geometric microlithic types from Mirnoe (no. 1 – 10), and Shan-Koba Layer 3 (no. 11 – 21), Layer 4 (22 – 29) and Layer 6 (30 – 36) (from Biagi/Kiosak 2010, fig. 6, and Biagi et al. 2014, figs. 4 – 6) (drawings by P. Biagi, inking by G. Almerigogna).

area. A Helix midden, charcoals, bone fragments and flints were found below a 'cover' of large stones in spit 4. This layer yielded a very rich chipped stone assemblage (*fig. 3*), represented by different types of abrupt retouched points, geometric lunates and triangles (Бибиков et al. 1994).

Two contrasting radiocarbon results were first obtained from unidentified bones from spit 1 of Layer 6: 9910±180 BP (Ki-11805) and 11.260±190 BP (Ki-11806) (Манько 2010, tab. 2).

Shan-Koba AMS Chronology

During the last decade 16 samples were submitted for AMS dating to Kiel (KIA: 12 tooth samples) and Groningen (GrA: four bone samples) radiocarbon laboratories.

The results from both series are presented together in *table 1*. Given that the scope of this paper is the Late Palaeolithic and Mesolithic sequence, comments on the samples from Layers 1 (Bronze Age?) to 2 (Neolithic?) are not discussed.

The results obtained from both laboratories show that Layer 6 was settled between the end of the Bølling and the end of the Allerød oscillations. The five AMS dates from this layer, some 1.20 m thick, are not in a sequence. This makes the attribution of the finds to the Bølling or older Dryas problematic. The samples were collected from a well-defined area of the shelter, some 3 × 3 m wide (*fig. 4D and 4E*).

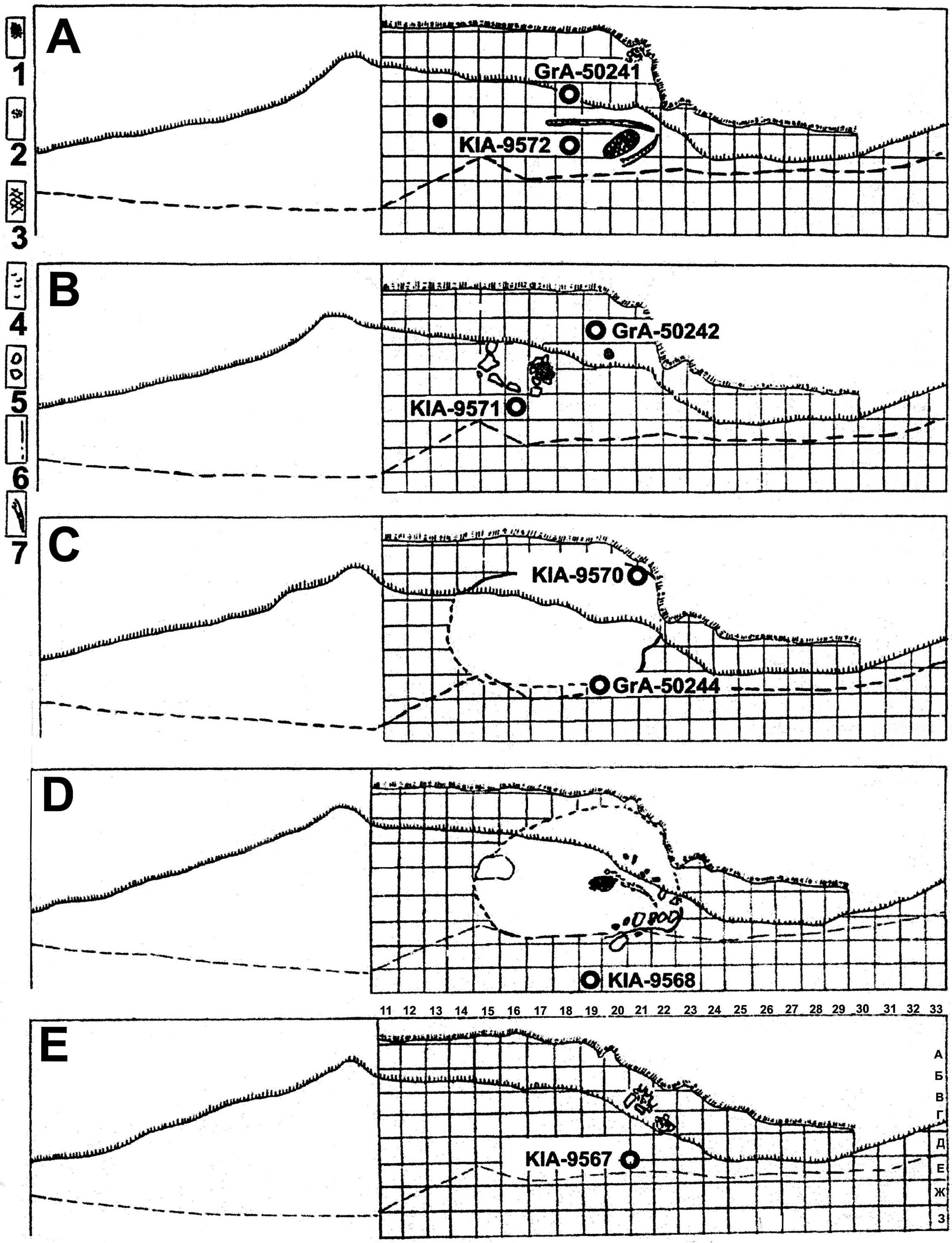

Fig. 4. Shan-Koba: Horizontal distribution of the AMS-dated samples from Layer 3, spit 2 (A), Layer 3, spit 3 (B), Layer 4 (C), Layer 6, spit 2 (D) and Layer 6, spit 3 (E). Hearths (1 and 2), hearth pit (3), land snails (4), stones (5), limit of the cultural layer (6), heap of land snails (7) (excavation plans from Бибиков et al. 1994, figs. 23 and 24; redrawn by P. Biagi).

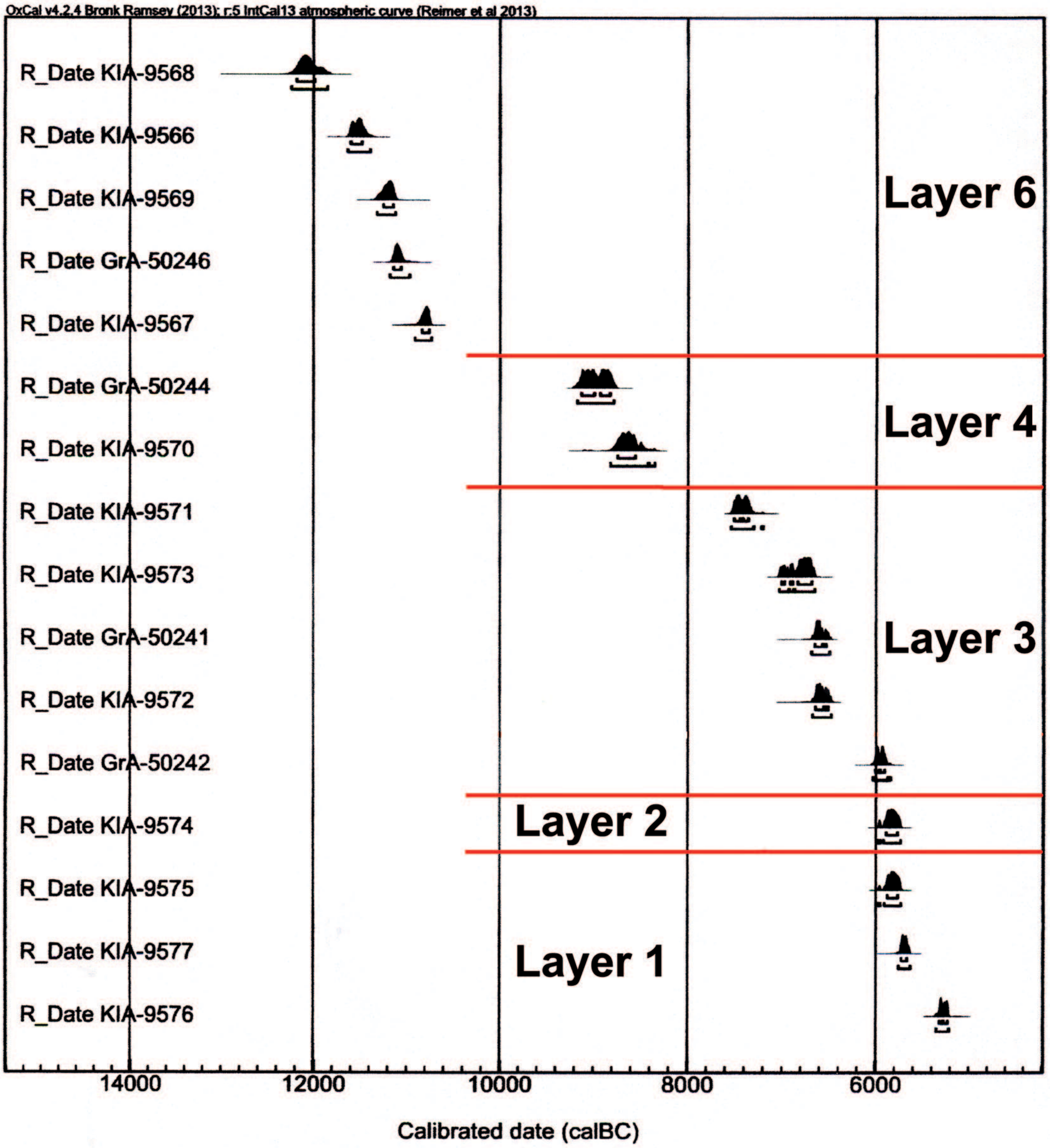

Fig. 5. Shan-Koba: cumulative diagram of the calibrated KIA and GrA AMS dates.

Two samples from two distinct squares of Layer 4 yielded similar Late Preboreal results (Bos et al. 2007). The spit provenance of one of the specimen is unknown (*fig. 4C*).

Four samples from Layer 3 are to be attributed to the Atlantic period, while KIA-9571 to the Boreal. They come from five squares, and different spits, of the central part of the shelter (*fig. 4A* and *4B*). Also in this case they are not in accordance with the sequence described by the excavators.

The cumulative diagram of the calibrated dates (*fig. 5*) shows evident gaps between the first (Layer 6), second (Layer 4) and third group of dates (Layer 3). They suggest that at least this part of the shelter was not settled for very long periods (Biagi et al. 2014). This evidence contrasts with the data obtained from the study of the chipped stone assemblages from layer 4 and the 'lower part' of Layer 3, which, according to D. Nuzhniy, were disturbed and contained also typical Shpan-Koba types (Nuzhniy 1998, 105).

The Pollen Cores from South-West Crimea

A series of pollen cores made in south-western Crimea, yielded important results not only for the study of the vegetation changes that took place in the region from the end of the Pleistocene to the present (Cordova et al. 2001; Cordova/Lehman 2003; Cordova 2007), but also for the human impact on the landscape during the Boreal, Mesolithic period (Cordova/Lehman 2005).

Pollen cores of major archaeological interest were extracted from Balka Bermala and Balka Yukarina, at some 150m of altitude. The two dry valleys are located in the Heraklean peninsula, east of Sevastopol, some 2km from the present coastline, 40 to 100km south-west of the rock-shelters discussed in this paper.

Chernozem soils were recorded at different depths from cores BBBP-2 and MM2 (*fig. 6*). The bottom of BBBP-2 chernozem, AMS-dated to 8550±40 BP (Beta-156479?) and 8070±40 BP (Beta-127551), and MM2, dated to 8342±70 BP (T-16421), yielded typical Murzak-Koba chipped stone implements (Cordova/Lehman 2005, 267).

The pollen diagram BBBP-2, shows that during the above period chernozem soils began to accumulate (pollen zone 4), and a steppe-like landscape started to establish, indicating the beginning of 'a continental cool and dry climate' that led to environmental conditions similar to those of the present (Cordova/Lehman 2005, 270). The data provided by the two cores allow us to correlate the presence of Murzak-Koba Mesolithic hunter-gatherers with the second half of the Boreal, when important climatic/environmental changes were taking place and affected the way of life of the last hunter-gatherers.

Discussion

AMS dates comparable to those from the lowermost chernozem soils containing Murzak-Koba artefacts at BBBP-2 and MM-2 were obtained from other archaeological sites of Crimea and the north-western Pontic region (*tab. 2*). The two new AMS dates from the rock-shelter of Laspi 7 in Crimea, and those from Mirnoe, west of Odessa (Станко 1982), are indicative in this respect (*fig. 7*). They clearly show that different types of trapezoidal arrowheads started to be produced by Late Boreal hunter-gatherers of different cultural traditions, Murzak-Koba and Grebeniki for example (Biagi/Kiosak 2010, 34).

The three groups of dates mentioned above partly fill a long gap within the Mesolithic sequence of Shan-Koba shelter (*fig. 8*). They demonstrate that the Murzak-Koba hunter-gatherers, who settled in Shan-Koba layer 3, where undoubtedly not the first to produce innovative types of trapezoidal arrowheads in the Crimean peninsula. This fact opens new questions regarding the possible sediment mixing observed by D. Nuzhniy (see above) from the Mesolithic layers 4 and 3 of Shan-Koba, and the chronology of the earliest Atlantic occupation of the same site. The available radiocarbon assays show that trapezoidal geometrics made their earliest appearance in Crimea at Laspi 7, layer D (Biagi/Kiosak 2010, tab. 1 and 3), suggesting that the Murzak-Koba Culture developed in subsequent stages in a way similar to that suggested by A. A. Yanevich (Yanevich 1998, fig. 2).

The question of the origin of the Mesolithic cultures with trapezes has already been taken into consideration by different authors in recent

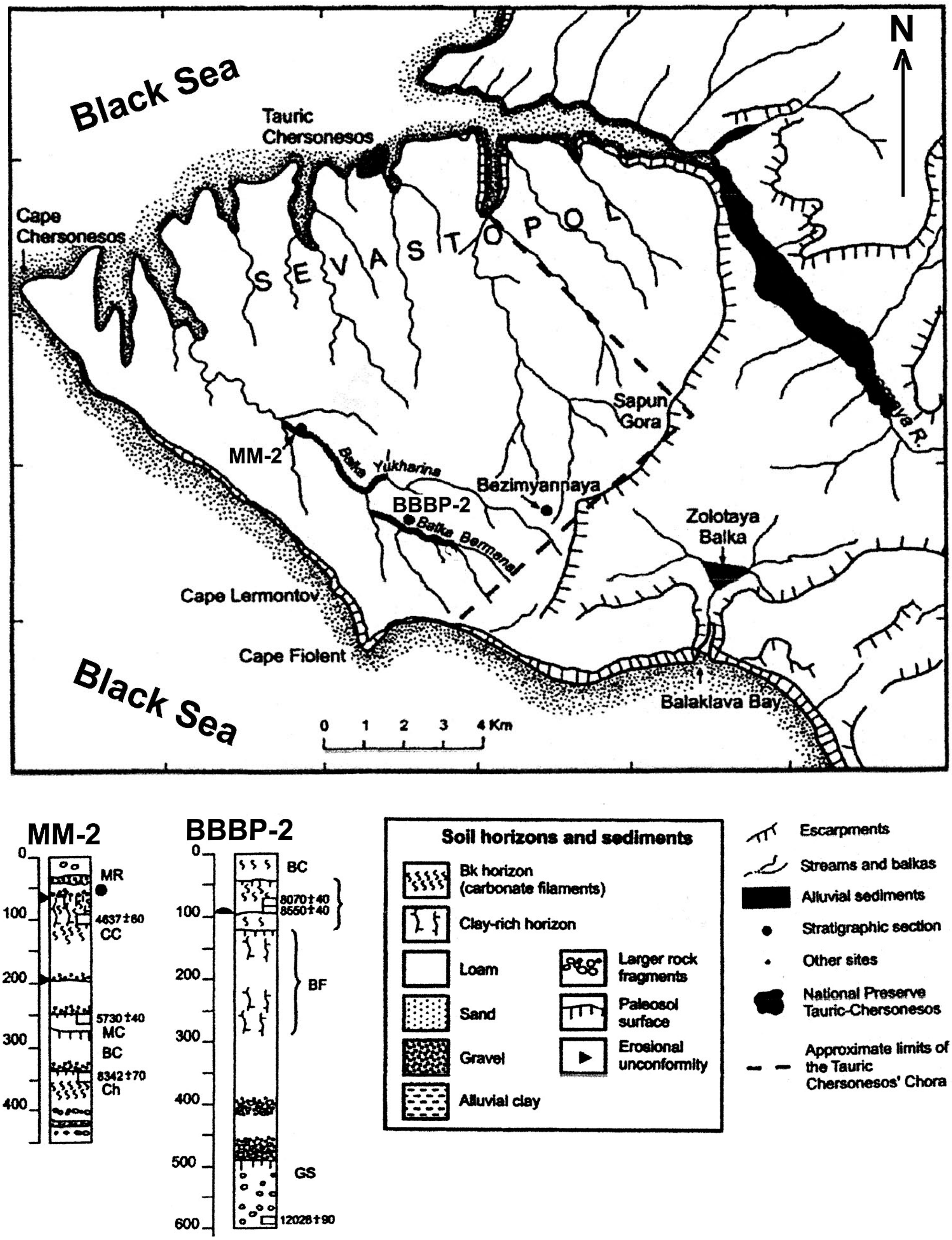

Fig. 6. Heraklean peninsula: schematic representation of the BBBP-2 and MM-2 pollen profiles with the indication of the most important radiocarbon dates. Soil characteristics: Maedow rendzina (MR), Calcic cinnamon (CC), Meadow cinnamon (MC), Brown cinnamon (BC), Meadow chernozem (Ch), Alluvial brown forest (BF), and Alluvial grey soil (GS) (from Cordova/Lehman 2005, figs. 2, 4 and tab. 4) (redrawn by P. Biagi, with variations).

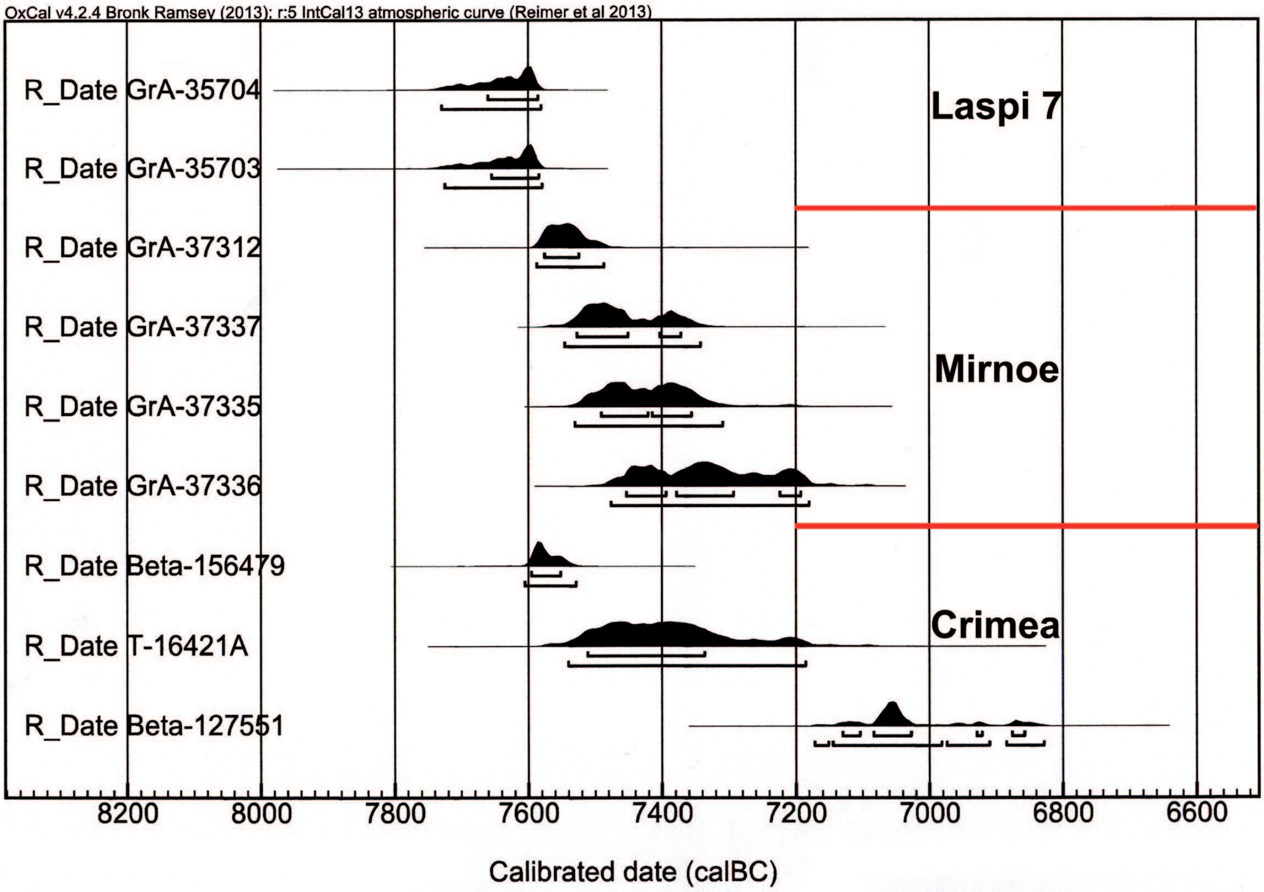

Fig. 7. Calibrated dates from Laspi 7, Mirnoe, and BBBP-2 and MM-2 pollen cores.

years (Clark 1958; 1980; Galimova 2006; Antony 2007). It is now clear that the problem cannot be solved without the support of good sets of AMS dates, even from those sites from which Mesolithic trapezes have been recovered from well-stratified complexes in important geographical regions, among which is the rock-shelter of Chokh in Daghestan (Амирханов 1987).

According to the dates presented above the invention of trapezoidal arrowheads for hunting purposes during the Boreal period should be re-proposed from the Crimean and north-western Pontic hunter-gatherer sites. The rate of spread of the sites with trapezoidal geometric hunting weapons across the Balkan peninsula is difficult to follow, because of the scarcity of Mesolithic sites in some areas, and the very limited number of dates (Perrin et al. 2009; Bonsall 2008, 263), a situation that does not seem to have improved during the last years (Merkyte 2003; Boroneanţ 2005).

Furthermore the results presented in this paper contradict the hypothesis put forward by L. Zaliznyak (1998, 139; Залізняк 2005, 119), according to which the Grebeniki Culture 'developed under the strong influence' of the Early Neolithic Criş Culture of the Carpathian basin and its related regions. The neolithisation of the Balkan peninsula took place during the last two centuries of the 8th mill. BP (Biagi et al. 2005; Krauss et al. 2014), as the available AMS dates indicate, some fifteen centuries later than the earliest appearance of Mesolithic trapeze industries along the northern coast of the Black Sea.

Summary

This paper discusses the AMS chronology of Shan-Koba, a rock-shelter excavated in Soviet times in the mountains of Crimea. The new results show that the Late Palaeolithic/Mesolithic sequence is not 'continuous' as previously suggested. The site was settled during specific periods of the end of the Palaeolithic, Boreal and Atlantic. The gap ob-

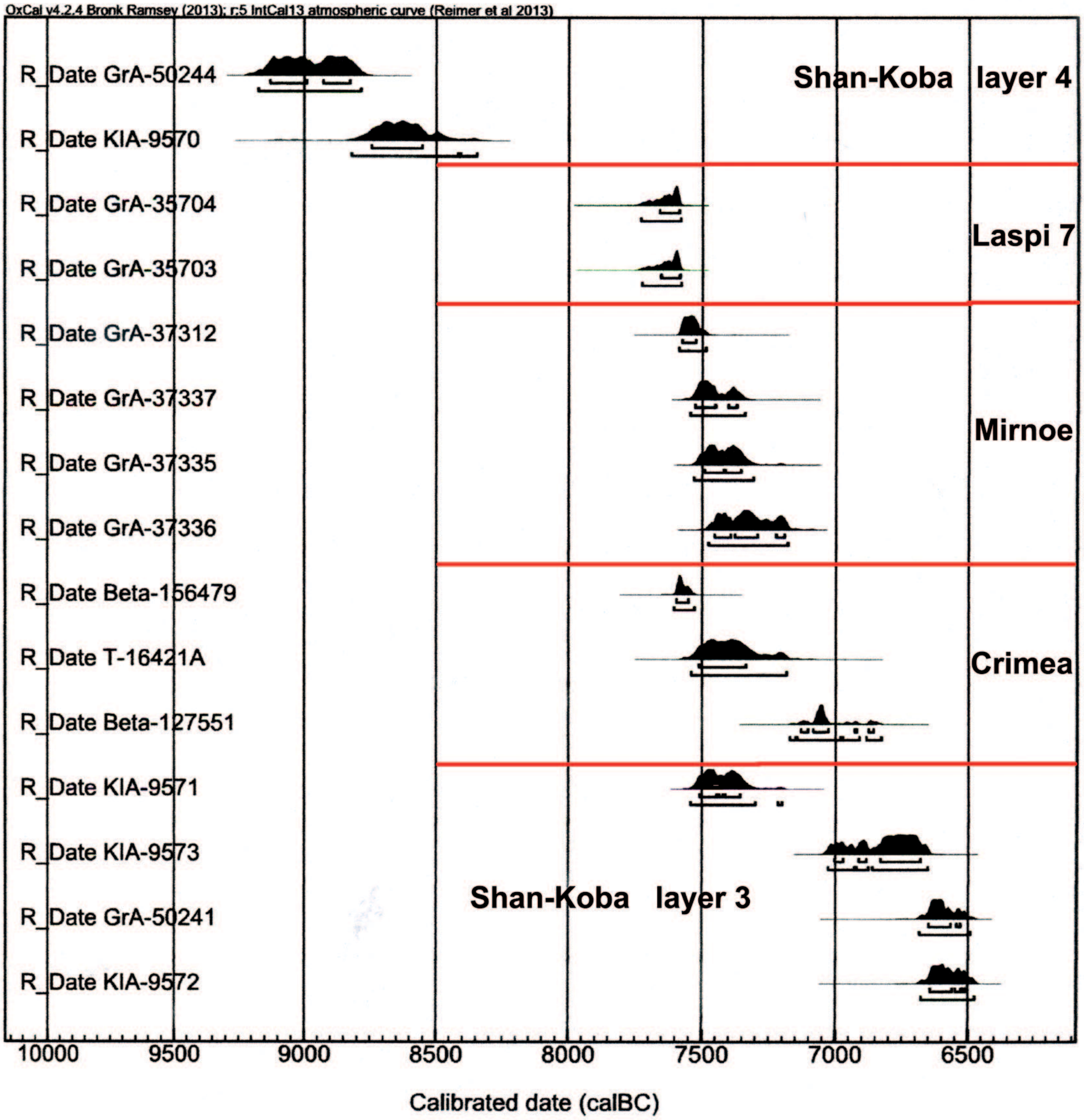

Fig. 8. Cumulative diagram of the calibrated dates from Shan-Koba, Layers 3 and 4, and those from Laspi 7, Mirnoe, BBBP-2 and MM-2 pollen cores.

served in the Mesolithic chronology of the shelter is filled with other radiometric results recently obtained from both north-western Pontic sites, and two pollen cores extracted from the Heraklean peninsula. It is during the second half of the Boreal that Mesolithic assemblages with trapezoidal arrowheads make their first appearance in the region, during a period of climatic variations that led to the formation of chernozem soils and a steppe-like landscape. The above data contribute to the study of the Late Mesolithic blade and trapeze assemblage in south-eastern Europe.

Paolo Biagi
Ca' Foscari University
Department of Asian and North African Studies
Ca' Cappello, San Polo 2035
I-30125 Venezia
pavelius@unive.it

Lab number	Layer	Spit	Square	Depth	Material	$\Delta^{13}C$	Uncal BP	Cal BC	Reference
KIA-9576	1a	Unkn.	?	Unkn.	Boar tooth	Unpubl.	6301±36	5277±37	Benecke 2006
KIA-9577	1	Unkn	19/б	Unkn.	Boar tooth	Unpubl.	6811±40	5698±29	Benecke 2006
KIA-9575	1a	Unkn.	15/б	Unkn.	Red deer tooth	Unpubl.	6944±44	5827±53	Benecke 2006
KIA-9574	2	Unkn.	14/а	Unkn.	Red deer tooth	Unpubl.	6954±46	5837±56	Benecke 2006
GrA-50242	3	3–3	19/б	90–100	Unident. bone	-20.19	7075±45	5958±41	Biagi et al. 2014
KIA-9572	3	2	18/д	Unkn.	Boar tooth	Unpubl.	7760±52	6581±56	Benecke 2006
GrA-50241	3	3–2	18/в	80–90	Unident. bone	-20.07	7775±45	6593±51	Biagi et al. 2014
KIA-9573	3	1	19/в	Unkn.	Boar tooth	Unpubl.	7915±45	6838±124	Benecke 2006
KIA-9571	3	3	16/д	Unkn.	Red deer tooth	Unpubl.	8357±52	7431±64	Benecke 2006
KIA-9570	4	Unkn.	20-21/а-б	Unkn.	Red deer tooth	Unpubl.	9366±73	8637±93	Benecke 2006
GrA-50244	4	4–4	19/е	100–110	Bone tool	-20.42	9575±45	8982±124	Biagi et al. 2014
KIA-9567	6	3	20-21/д-е	Unkn.	Red deer tooth	Unpubl.	10871±58	10889±84	Benecke 2006
GrA-50246	6	Unkn.	18/е	170–180	Bone tool	-20.12	11170±45	11127±116	Biagi et al. 2014
KIA-9569	6	1	19/ж	Unkn.	Boar tooth	Unpubl.	11299±53	11247±100	Benecke 2006
KIA-9566	6	4	20-21/д-е	Unkn.	Red deer tooth	Unpubl.	11645±59	11584±137	Benecke 2006
KIA-9568	6	2	19/з	Unkn.	Boar tooth	Unpubl.	12148±61	12229±237	Benecke 2006

Tab. 1. Shan-Koba: List of the recent KIA and GrA AMS dates. Calibrations at 1σ according to Danzeglocke et al. 2014.

Lab number	Site	Layer	Square	Depth	Material	$\Delta^{13}C$	Uncal BP	Cal BC	Reference
GrA-35704	Laspi 7	D	18	cm 170	Ulmus	-24.51	8625±40	7643±42	Biagi/Kiosak 2010
GrA-35703	Laspi 7	D	18	cm 170	Pomoideae	-26.52	8620±40	7639±40	Biagi/Kiosak 2010
GrA-37312	Mirnoe	PII	Д22	—	Wild horse	-21.36	8475±45	7547±25	Біаджі et al. 2008
GrA-37337	Mirnoe	PI	Б5	—	Wild horse	-21.13	8385±45	7453±62	Біаджі et al. 2008
GrA-37335	Mirnoe	PIII	B1	—	Ungulate	-19.93	8350±45	7428±58	Біаджі et al. 2008
GrA-37336	Mirnoe	PI	Г24	—	Aurochs	-19.39	8280±45	7332±99	Біаджі et al. 2008
Beta-156479	BBBP-2	—	—	cm 90	Sediment	-27.1	8550±40	7576±18	Cordova/Lehman 2005
T-16421A	MM-2	—	—	cm 350	Sediment	-17.2	8342±70	7399±89	Cordova/Lehman 2005
Beta-127551	BBBP-2	—	—	cm 90	Sediment	-26.7	8070±40	7009±77	Cordova/Lehman 2005

Tab. 2. List of the AMS dates from Laspi 7, Mirnoe, and BBBP-2 and MM-2 pollen cores. Calibrations at 1σ according to Danzeglocke et al. 2014.

Bibliography

Antony 2007: D. W. Antony, Pontic-Caspian Mesolithic and Early Neolithic Societies at the Time of the Black Sea Flood. A Small Audience and Small Effect. In: V. Yanko-Hombach/A. S. Gilbert/N. Panin/P. M. Dolukhanov (eds.), The Black Sea Flood Question Changes in Coastline, Climate and Human Settlement (Berlin 2007) 345–370.

Benecke 1999: N. Benecke, Die Tierreste aus dem mesolithischen Abri Špan'-Koba in Krimgebirge. Beiträge zur Archäozoologie und Prähistorischen Anthropologie 2, 1999, 71–90.

Benecke 2006: N. Benecke, Zur Datierung der Faunensequenz am Abri Šan-Koba (Krim, Ukraine). Beiträge zur Archäozoologie und Prähistorischen Anthropologie 5, 2006, 12–15.

Biagi/Kiosak 2010: P. Biagi/D. Kiosak, The Mesolithic of the Northwestern Pontic Region. New AMS Dates for the Origin and Spread of the Blade and Trapeze Industries in Southeastern Europe. Eurasia Antiqua 16, 2010, 21–41.

Biagi et al. 2005: P. Biagi/S. Shennan/M. Spataro, Rapid Rivers and Slow Seas? New Data for the Radiocarbon Chronology of the Balkan Peninsula. Prehistoric Archaeology and Anthropological Theory and Education 6/7, 2005, 43–51.

Biagi et al. 2007: P. Biagi/S. K. Kozłowski/L. L. Zaliznyak, Old Problems and New Perspectives for the Radiocarbon Chronology of the Ukrainian Mesolithic? In: V. Yanko-Hombach (ed.), Extended Abstracts IGPC 521-481 Joint Meeting Field Trip IGPC 521 'Black Sea Mediterranean Corridor during the Last 30ky: Sea-Level Change and Human Adaptation' (2005–2009), IGPC 481 'Dating Caspian Sea-Level Change' (2003–2007) (Moscow 2007) 27–30.

Biagi et al. 2014: P. Biagi/A. G. Khlopachev/D. M. Kiosak, The Radiocarbon Chronology of the Shan-Koba Rock-Shelter. A Late Palaeolithic and Mesolithic Sequence in the Crimean Mountains (Ukraine). Diadora 28, 2014, 7–20.

Bonsall 2008: C. Bonsall, The Mesolithic of the Iron Gates. In: G. Bailey/S. Spiniks (eds.), Mesolithic Europe (Cambridge 2008) 238–279.

Boroneanţ 2005: A. Boroneanţ, The Tardenosian in Romania – a False Problem? Studii de Preistoire 2, 2005, 17–46.

Bos et al. 2007: J. A. A. Bos/B. van Geel/J. van der Plicht/S. J. P. Bohncke, Preboreal Climate Oscillations in Europe. Wiggle-Match Dating and Synthesis of Dutch High-Resolution Multi-Proxy Records. Quaternary Science Reviews 26, 2005, 1927–1950.

Bronk Ramsey/Lee 2013: C. Bronk Ramsey/S. Lee, Recent and Planned Development of the Program OxCal. Radiocarbon 55.2/3, 2013, 720–730.

Clark 1958: J. G. D. Clark, Blade and Trapeze Industries of the European Stone Age. Proceedings of the Prehistoric Society 24, 1958, 24–42.

Clark 1980: G. Clark, Mesolithic Prelude (Edinburgh 1980).

Cordova 2007: C. E. Cordova, The Holocene Mediterranization of the Southern Crimean Vegetation. Palaeoecological Records, Regional Climate Change, and Possible Non-Climatic Influences. In: V. Yanko-Hombach/A. S. Gilbert/N. Panin/P. M. Dolukhanov (eds.),The Black Sea Flood Question. Changes in the Coastline, Climate and Human Settlement (Berlin 2007) 319–344.

Cordova/Lehman 2003: C. E. Cordova/P. H. Lehman, Archaeopalynology of Synanthropic Vegetation in the Chora of Chersonesos, Crimea, Ukraine. Journal of Archaeological Science 30, 2003, 1483–1501.

Cordova/Lehman 2005: C. E. Cordova/P. H. Lehman, Holocene Environmental Change in Southwestern Crimea (Ukraine) in Pollen and Soil Records. The Holocene 15.2, 2005, 263–277.

Cordova et al. 2001: C. E. Cordova/A. R. Rybak/P. H. Lehman, Vegetation Patterns and Conservation Issues in Southern Crimea. Post-Soviet Geography and Economics 42.5, 2001, 362–385.

Danzeglocke et al. 2014: U. Danzeglocke/O. Jöris/B. Weninger, CalPal 2014 Cologne Radiocarbon Calibrations and Paleoclimate Research Package. Radiocarbon Laboratory, Cologne University, Cologne.

Demidenko 2014a: Yu. E. Demidenko, Crimean Upper Palaeolithic. In: C. Smith (ed.), Encyclopedia of Global Archaeology (New York 2014) 1782–1791.

Demidenko 2014b: Yu. E. Demidenko, Siuren I Rockshelter. From the Late Middle Paleolithic and Early Upper Paleolithic to the Epipaleolithic in Crimea. In: C. Smith (ed.), Encyclopedia of Global Archaeology (New York 2014) 6711–6721. doi: 10.1007/978-1-4419-0465-2_1867.

Dolukhanov 2008: P. Dolukhanov, The Mesolithic of European Russia, Belarus, and the Ukraine. In: G. Bailey/P. Spiniks (eds.), Mesolithic Europe (Cambridge 2008) 280–301.

Dolukhanov et al. 2009: P. M. Dolukhanov/S. V. Kadurin/E. P. Larchenkov, Dynamics of the Coastal North Black Sea Area in Late Pleistocene and Holocene and Early Human Dispersal. Quaternary International 197.1/2, 2009, 27–34. doi:10.1016/j.quaint.2008.04.002.

Galimova 2006: M. Galimova, Final Palaeolithic-Early Mesolithic Cultures with Trapezia in the Volga and Dnieper Basins. The Question of Origin. Archaeologia Baltica 7, 2006, 136–147.

Gimbutas 1956: M. Gimbutas, The Prehistory of Eastern Europe Part I. Neolithic, Neolithic and Copper Age Cultures in Russia and the Baltic Area. American School of Prehistoric Research, Bulletin 20 (Cambridge 1956).

Hoek 2008: W. Z. Hoek, The Last Glacial-Interglacial Transition. Episodes 31.2, 2008, 226–229.

Janevich 1998: A. A. Janevich, Buran-Kaya 3. Neue Angaben zur Kulturgliederung des Jungpaläolithikums der Krim. Préhistoire Européenne 13, 1998, 133–148.

Krauss et al. 2014: R. Krauss/N. Elenski/B. Weninger/L. Clare/C. Çakırlar/P. Zidarov, Beginnings of the Neolithic in Southeast Europe. The Early Neolithic Sequence and Absolute Dates from Džuljunica-Smărdeš (Bulgaria). Documenta Praehistorica 41, 2014, 51–77.

Merkyte 2003: I. Merkyte, The Mesolithic Syndrome in Southeastern Europe. Acta Archaeologica 74, 2003, 307–317.

Nuzhniy 1998: D. Nuzhniy, The Ukrainian Steppe as a Region of Intercultural Contacts Between Atlantic and Mediterranean Zones of European Mesolithic. Baltic-Pontic Studies 5, 1998, 102–119.

Păunescu 1979: A. Păunescu, Cercetările Archeologice de la Cuina Turcului-Dubova (Jud. Mehedinţi). Tibiscus 5, 1979, 11–56.

Péan et al. 2013: S. Péan/S. Puaud/L. Crépin/S. Prat/A. Quiles/J. van der Plicht/H. Valladas/A. J. Stuart/D. G. Drucker/M. Patou-Mathis/F. Lanoë/A. Yanevich, The Middle to Upper Palaeolithic Sequence of Buran-Kaya III (Crimea, Ukraine). New Stratigraphic, Palaeoenvironmental, and Chronological Results. Radiocarbon 55.2/3, 2013, 1454–1469.

Perrin et al. 2009: T. Perrin/G. Marchand/P. Allard/D. Binder/C. Collina/O. G. Punchol/N. Valdeyron, Le second Mésolithique d'Europe occidentale.Origines et gradient chronologique. Annales de la Fondation Fyssen 24, 2009, 160–176.

Schen et al. 2012: A. Schen/C. Geörg/A. Schulz/J. Burger/N. Benecke, The Arrival of Domestic Animals in South-East Europe as Seen from Ancient DNA. In: E. Kaiser/J. Berger/W. Schier (eds.), Population Dynamics in Prehistory and Ancient History. New Approaches by Using Stable Isotopes and Genetics. Berlin Studies of the Ancient World 5 (Berlin 2012) 45–54.

Stanko 2007: V. N. Stanko, Fluctuations in the Level of the Black Sea and Mesolithic Settlement of the Northern Pontic Area. In: V. Yanko-Hombach/A. S. Gilbert/N. Panin/P. M. Dolukhanov (eds.), The Black Sea Flood Question Changes in Coastline, Climate and Human Settlement (Berlin 2007) 371–385.

Stanko 2009: N. V. Stanko, Formation Dynamics of the Population of the Northwestern Pryčornomorja Steppe in the Upper Paleolithic and Mesolithic. Quaternary International 197, 2009, 8–11.

Stanko/Kiosak 2008/2009: V. N. Stanko/D. Diosak, The Late Mesolithic Settlement of South-Western Ukraine. Attidella Società per la Preistoria e Protostoria della Regione Friuli-Venezia Giulia 17, 2008/2009, 27–100.

Stepanchuk et al. 2009: V. N. Stepanchuk/I. V. Sapozhnikov/M. I. Gladkikh/H. S. Ryzhov, Ukrainian Upper Palaeolithic Between 40/10.000 BP. Current Insights into Environmental-Climatic Change and Cultural Development. In: F. Djindjian/J. Kozłowski/N. Bicho (eds.), Le concept de territoires dans le Paléolithique supérieur européen. BAR International Series 1938 (Oxford 2009) 63–74.

Telegin 1998: D. Telegin, Mesolithic Cultural-Ethnographic Entities in Southern Ukraine. Genesis and Role in Neolithization of the Region. Baltic-Pontic Studies 5, 1998, 85–101.

Yanevich 1998: A. A. Yanevich, The Neolithic of Mountainous Crimea. Baltic-Pontic Studies 5, 1998, 146–159.

Yanevich et al. 2009: A. Yanevich/S. Péan/M. Créoin/M. Lázničkova-Galetova/S. Prat/V. Prysyajnuk, Upper Palaeolithic Settlements in Buran-Kaya 3 (Crimea, Ukraine). New Interdisciplinary Researches of the Layers 5–2, 6–1 and 6–2. Archaeological Almanac 20, 2009, 187–2002.

Zaliznyak 1998: L. Zaliznyak, The Late Mesolithic Subbase of the Ukrainian Neolithic. Baltic-Pontic Studies 5, 1998, 120–145.

Амирханов 1987: Х. А. Амирханов, Чохское поселение. Человек и его Култура в Мезолите и Неолите Горного Дагестана (Москва 1987).

Бадер 1961: Н. О. Бадер, О соотношении культуры верхнего Палеолита и Мезолита Крыма и Кавказа. Советская Археология 4, 1961, 9–25.

Бадер/Церетели 1989: Н. О. Бадер/Л. Д. Церетели, Мезолит Кавказа. In: Л. В. Кольцов (ed.), Мезолит СССР (Москва 1989) 93–105.

Бибиков 1940a: С. Н. Бибиков, Грот Мурзак-Коба. Новая позднепалеолитическая стоянка в Крыму. Советская Археология 5, 1940, 159–178.

Бибиков 1940b: С. Н. Бибиков, К вопросу о Неолите в Крыму. Краткие сообщения Института истории материалной културы 4, 1940, 26–31.

Бибиков 1941: С. Н. Бибиков, Об использованни улиток Helix в позднепалеолитическое время. Материялы исследования по археологии 2, 1941, 141–142.

Бибиков 1946: С. Н. Бибиков, Позднепалеолитическое поселение в навесе Шан-Коба и гроте Мурзак-Коба в Крыму. Краткие сообщения Института истории материалной културы 13, 1946, 126–130.

Бибиков 1959: С. Н. Бибиков, Раскопки в навесе Фатма-Коба в 1959 г. Краткие сообщения института археологии АН УССР 8, 1959, 114–121.

Бибиков 1966: С. Н. Бибиков, Раскопки в навесе Фатма-Коба и некоторые вопросы изучения Мезолита Крыма. У истоков древних култур (эпоха Мезолита) (Москва 1966) 138–143.

Бибиков et al. 1994: С. Н. Бибиков/В. Н. Станко/В. Ю. Коен, Финальный Палеолит и Мезолит Горного Крыма (Одесса 1994).

Біаджі et al. 2008: П. Біаджі/В. Н. Станко/Д. В. Кіосак, Нові радіовуглецеві даті поселленя Мирне. Наукові праці, серія історичні наукі спецвитук 83, 2008, 33–37.

Бонч-Осмоловский 1934: Г. А. Бонч-Осмоловский, Итоги изучения Крымского палеолита. Труды междуиародной конференции Ассоциаций по изученню Четвертичново периода Европы (Ленинград 1934) 114–173.

Великова 1951: Е. А. Великова, Эпипалеолитическая стоянка Кукрек в Крыму. Краткие сообщения о докладах и полевых исслеованиях Института истории материалной культуры 36, 1951, 87–95.

Воеводский 1950: М. В. Воеводский, Мезолитические культуры Восточной Европы. Краткие сообщения Института истории материалной културы 31, 1950, 110–119.

Демиденко 2003: Ю. Э. Демиденко, Верхний Палеолит Крыма. Индустриально-хронологическая вариабельност. Археологически записки 3, 2003, 36–50.

Громова/Громов 1937: В. И. Громова/В. И. Громов, Материалы к изучению палеолитической фауны Крыма в связи с некоторыми вопросами стратиграфии. Труды советской секции ассоциации по изучению Четвертичного периода 1, 1937, 52–93.

Залізняк 2005: Л. Залізняк, Фіналний Палеоліт і Мезоліт континенталиої України. Кам’яна доба України 8 (Київ 2005).

Зализняк 1995: Л. Л. Зализняк, Фінальний палеоліт України. Археологія (Київ) 1, 1995, 3–21.

Коен 1991: В. Ю. Коен, Фінальний палеоліт Горного Крыма. Автореферат дисертації кандидата історичних наук (Київ 1991).

Коен 1994: В. Ю. Коен, Шан-Кобинская култура (к проблеме хронологии и периодизации финального Палеолита горного Крыма). Археологический алманах 3, 1994, 245–260.

Манько 2010: В. А. Манько, Случаи интерстратификации в слоях пачки 3 стоянки Грот Скалистый и вопрос о происхождении крымского финального Палеолита. Stratum plus 1, 2010, 245–262.

Манько 2013: В. О. Манько, Фінальний Палеоліт – Неолит Криму. Културно-історичний процес (Київ 2013).

Мацкевой 1977: Л. Г. Мацкевой, Мезолит и Неолит Восточного Крыма (Київ 1977).

Нужный 1992: Д. Ю. Нужный, Розвиток мікролітичної техніки в кам'яному віці (Київ 1992).

Станко 1966: В. Н. Станко, Мезолитическая стоянка Гиржево в Одесской области. Советская археолоия 2, 1966, 96–103.

Станко 1972: В. Н. Станко, Типы памятников и локалные культуры в Мезолите северного причерномрья. Материалы и Исследования по Археологии СССР 198 = Палеолит и Мезолит СССР 7, 1972, 252–261.

Станко 1976: В. Н. Станко, Периодизация памятников Мезолита Северново Причерномория. Материалы по археологии Северново Причерномория 8, 1976, 15–21.

Станко 1982: В. Н. Станко, Мирное. Проблема Мезолита степей Северного Причерноморья (Kiyv 1982).

Телегин 1966: Д. Я. Телегин, Мезолит Левобережной Украины и его место в сложении днепровско-донецкой неолитческой културы. Материялы и исследования по археологии 126, 1966, 99–107.

Телегін 1982: Д. Я. Телегін, Мезолітичні пам'ятки України (Київ 1982).

Телегин 1985: Д. Я. Телегин, Памятники эпохи Мезолита на территории Украинской ССР (Карта местонахождений) (Київ 1985).

Телегин 1989: Д. Я. Телегин, Мезолит Юго-Запада СССР (Украина и Молдавия). In: Л. В. Кольцов (ed.), Мезолит СССР (Москва 1989) 106–124.

Яневич 1993: О. О. Яневич, Шпанська мезолітична култура. Археологія (Київ) 1, 1993, 3–15.

DMYTRO KIOSAK

Mesolithic 'Heritage' and Neolithic in Southwest Ukraine

Keywords: Mesolithic, Neolithic, lithic industry, taphonomy

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Introduction

While migration and diffusion have always been in the centre of the discussion of neolithisation, the great debate in the past thirty years has been to estimate the role of the 'Mesolithic heritage' in the newly established Neolithic societies throughout Europe. There were several major points of criticism to purely migrationist explanations for the victorious march of the Neolithic way of life into Southern and Central Europe, amongst them the 'frontier' model of M. Zvelebil (Zvelebil/Rowley-Conwy 1984) and many others (Gronenborn 1998; Thorpe 1999; Whittle 1996).

At present, the neolithisation of Europe is generally seen as a phenomenon of propagation of societies of a particular type that first appeared in Greek Thessaly and subsequently spread out. These societies were so different from the preceding hunter-gatherers groups that shorthand interaction seems questionable between them (Cauvin 1994; Hodder 1990). New archaeological data and our growing understanding helped to discard most regional claims for the existence of enclaves of direct descendants of Mesolithic population amongst Neolithic societies, apart from the Pan-Balkanian neolithisation process.

Vast territories of Eastern Europe are still not considered in this process. While they are immediately adjacent to the Eastern Balkans and the Carpathian Basin in a geographical sense, these regions are effectively excluded of the modern theoretical discussion about neolithisation. One of the aims of this paper is to include them into the discussion of neolithisation in the same way as it is done for the adjacent regions. Another aim is to underline the variety of local non-Neolithic societies that were radically distinct, not only from Neolithic newcomers, but also from one another.

Recent Mesolithic is represented by two cultures in the Southwest Ukraine – Grebenyky and

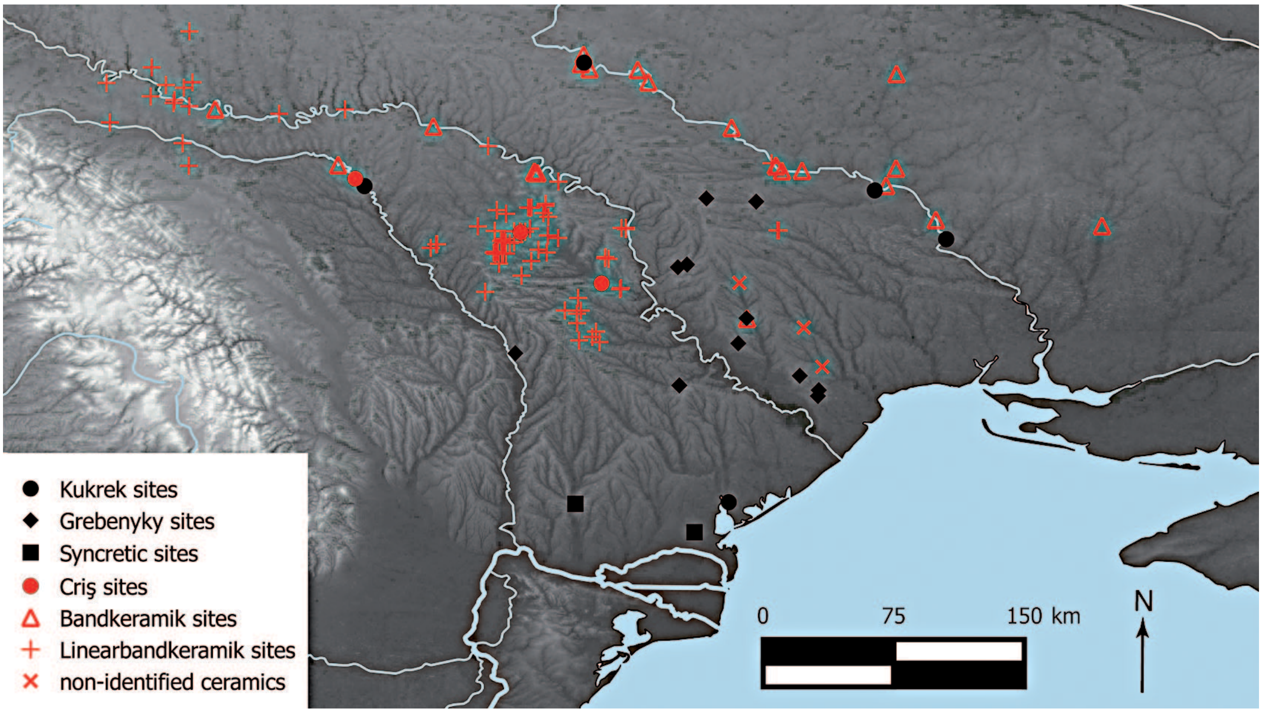

Fig. 1. Recent Mesolithic and Neolithic sites in Southwest Ukraine. A – region under study in Europe; B – site distribution: 1 – Sacarovca 1, 2 – Kamyane-Zavallia, 3 – Melnychna Krucha, 4 – Pechera 1, 5 – Dobryanka 3, 6 – Gyrzheve, 7 – Grebenyky, 8 – Mainova Balka, 9 – Abuzova Balka, 10 – Viişoara 1 (map by S. Fröhle and S. Wettengl).

Kukrek (Станко 1967). Grebenyky Culture comprises over 60 sites mostly on the shores of small rivers and gullies between Prut and Ingulets rivers (*fig. 1*). It is characterised by flat prismatic cores, geometric microliths (isosceles trapezes), a few burins and mostly circular and semi-circular end-scrapers (*fig. 2A*). Kukrek Culture assemblages include bullet or conical cores for the production of parallel-sided bladelets (*fig. 2B.26–30*), polyhedrical flake cores and end-scrapers on flakes (*fig. 2B.18–25*). The burins are more numerous than the end-scrapers: they are often multifaceted on a flake ('Kukrek burins', *fig. 2B.14*). The microliths consist of backed points adjacent to an oblique truncation ('Abuzova Balka points', *fig. 2B.1–6*); 'Kukrek inserts' are also abundant (medium, wide blade fragments with trimming facets on their ventral surface, and a partial, dorsal retouch along their proximal or distal sides, *fig. 2B.11–13*). Chronological and territorial relations of both cultures are still unclear (Залізняк 2005; Biagi/Kiosak 2010; Stanko/Kiosak 2010; Сапожников/Сапожникова 2011). Several sites (*fig. 1*) yielded characteristic tools of both Grebenyky and Kukrek Culture in approximately equal proportions. They were classified as 'syncretic' (Stanko/Kiosak 2010, 85). There were small Neolithic potsherds (Stanko/Kiosak 2010; Kiosak 2011; Сапожников/Сапожникова 2011) in some other sites (*fig. 1*).

The Neolithic of Southwest Ukraine consists of two different groups of cultures: 'external or ecdemic' and 'local' ones (Larina 1994; Zvelebil/Lillie 2000; Kotova 2003; 2004; Larina 2010). Both labels are fully conventional because a 'local' origin for the second group of cultures has still to be proved. The ecdemic group of cultures includes Criş and Linear Pottery cultures (LBK), while the 'local' Neolithic is represented by the Bug-Dniester Culture (BDK). The new-coming cultures are well-defined entities with village-like settlements, huge amounts of characteristic pottery, similar expressions of sacral beliefs and ways of group identity manifestation (Kotova 2003; Larina 2010). The 'local' cultures have camp-like settlements with only few permanent houses, usually dug-outs, and definitely no elaborated clay architecture (Даниленко 1969; Larina 1994; 2010). Potsherds are less numerous than lithics on such sites. Pottery deco-

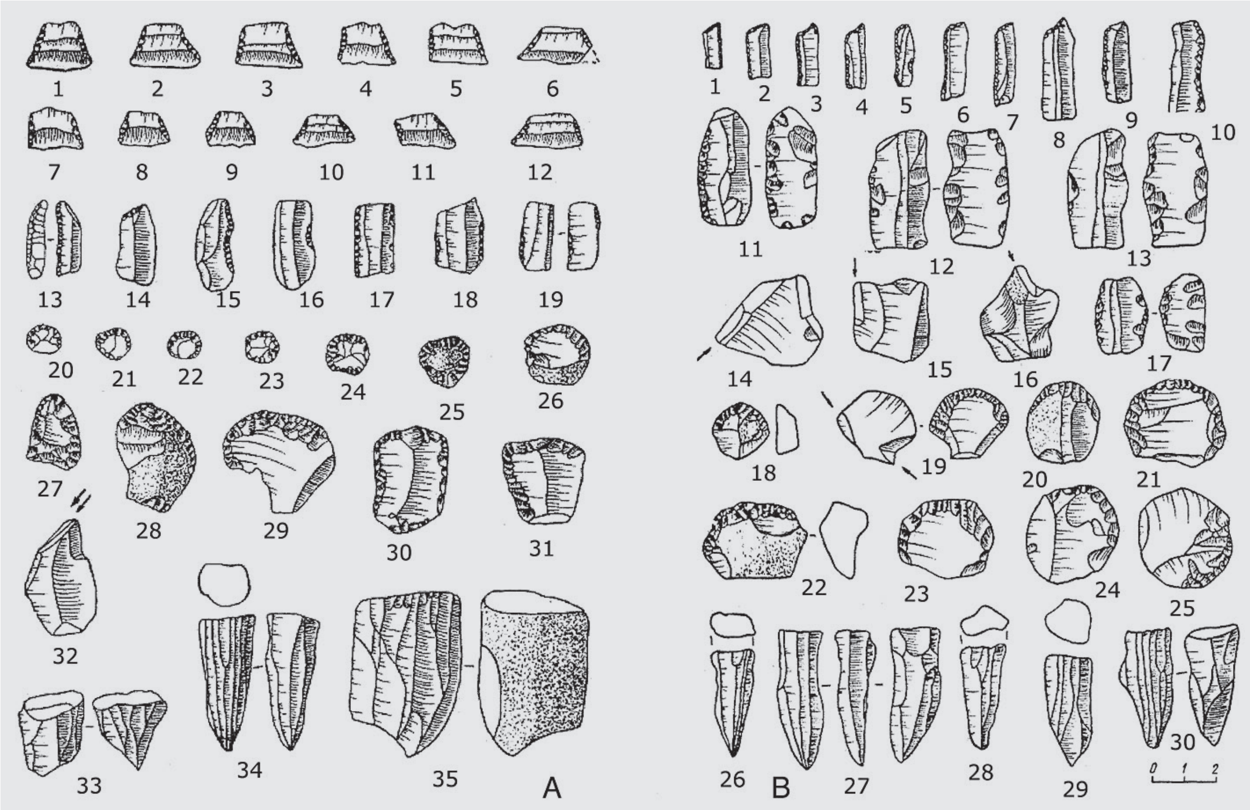

Fig. 2. Grebenyky (A) *versus* Kukrek (B) industries as illustrated by selected lithics from sites of Abuzova Balka (B) and Grebenyky (A) (after Stanko/Kiosak 2010).

rations styles are unstable and subject to quick changes. There is no clear division between fine- and coarse-ware. Thus, we can suspect that pottery played a different social role in these cultures. Expressions of sacral beliefs are not standardised, rare and really individual as compared to ecdemic cultures (Даниленко 1969, 83–84, 112, 129–144, 170; Larina 2010, 196). In most cases this distinction is valid for the Neolithic of the whole Ukraine and its neighbouring lands.

Thus, apart from the question of Mesolithic-Neolithic interaction, also the nature of interaction between two different sets of Neolithic cultures has to be treated.

Linear Pottery Culture in Central Ukraine and the Kamyane-Zavallia Settlement

The brightest example for an 'external' Neolithic culture is the Linear Pottery Culture. It is well-known in Moldova and the Western Ukraine with just a few finds scattered to the east (Дворянінов 1982; Ларина 1999; Kotova 2003; Залізняк et al. 2013; Товкайло 2014). Recently a new site of this culture, Kamyane-Zavallia, was discovered in the Southern Bug Valley – the traditional domain of the Bug-Dniester Culture.[1] The site is situated on the first terrace of the Southern Bug river around 10m above water level and some 400m away from the actual river shore. The general area of the site covers 450m along the river shore and some 200m perpendicular to it.

The occupational layer was found in the greyish subsoil underneath a quite dense layer of chernozem. Pit or Object 1 is the first and only intra-site structure found so far. The pit is 2.4m wide and at least 7m long. It continues into the western and northern walls of the trench. It had an irregular shape of edges and bottom. Most of the finds are coming from the pit – over 1500 potsherds, 2000 bone fragments, four grinding stones and 65 lithic implements (by summer 2014).

1 Odessa Archaeological Museum expedition, together with I. V. Bruyako and V. L. Denisuk in 2011. In 2012 and 2014 it was excavated by the author. In 2013 the site was investigated by the author together with Thomas Saile (Regensburg) and Maciej Dębiec (Rzeszów).

The set of finds is typical for LBK residential sites. It includes a fine pottery with 'notes' and incised lines, a polished stone adze ('*Schuhleistenkeil*' type), sickle inserts, ceramic weights and grinding stones. The pottery is characteristic for the later stage of LBK east of the Carpathians, the *Notenkopf* phase.

There are over 400 lithic implements found on the surface and in the trenches (in 2011–2014, also by O. S. Peresunchak, history teacher in Zavallia secondary school). 95% of the stone artefacts were made from grey and dark-grey fine-grained flint, transparent when thin. Outcrops of this raw material were never described in the vicinity of the site. A flint with similar macroscopic characteristics is found in 180km to the northwest in the Middle Dniester valley. Another variety of flint is a pebble flint with whitish inclusions. Macroscopically similar flints were reported from gravels of the Southern Bug river (Станко et al. 1981).

The assemblage comprises debitage from complete or almost complete blade reduction sequence.

Blade cores were mostly exploited at least around 2/3 of the perimeter of flaking platform. Their shape is prismatic and subconical. There is a certain amount of residual flake cores. Some cores were re-used as hammerstones. Blades and bladelets are more numerous than microblades. They evidently are made by a quite effective technology aimed at producing regular, symmetrical, parallel-sided prismatic laminar products that are often rather thick. Their butts are usually quite thick and large. The removal of overhang was optional before detachment. The angle of percussion is around 85–95°. Sometimes the sides and arrises of blades are a little bit wavy. These observations are consistent with the technical traces of punch technique rather than with blade detachment by pressure or soft organic percussion (Pelegrin 2000; 2006; 2012).

Retouched flakes and blades have various shapes and are numerous and obviously served varied functions. Side-scrapers and endscrapers on bladelets are quite characteristic, alongside with microscrapers. There are points, as well as typical perforators. Simple burins on a spall of a blade are the common type of burin. Two asymmetrical trapezes are very different from the scalene trapezes, widely spread both in Recent Mesolithic and local Neolithic. There are several blade parts with characteristic 'sickle gloss' (*fig. 3*).

A local Mesolithic 'heritage' is difficult to find in the lithic inventory of Kamyane-Zavallia. First of all, the majority of raw material was imported to the site from a distance much larger than the distances of Mesolithic raw material transportation. In certain cases Mesolithic people have used exotic flint varieties (Петрунь 1971; Станко et al. 1981); however these always constitute just a small portion of the assemblage. The absolute predominance of high quality imported flint suggests a system of flint acquisition and provenance that is radically different from the Mesolithic precursors (Zimmermann 1995).

From the technological point of view the Recent Mesolithic of the adjacent regions is characterised by a fine, regular bladelet knapping technique. Pencil-like (bullet) cores are commonly interpreted as products of the standing pressure technique. The end-products of their reduction were microblades (laminar flakes less than 8mm wide). None of these features is found in the Kamyane-Zavallia assemblage.

Most of the geometric microliths consist of trapezes of varying shapes in the Recent Mesolithic collections. Although the isosceles types predominate, the scalene specimens are also numerous. A small percentage of microburins is also known (Нужний 2008, 64). However asymmetrical trapezes that were discovered in Kamyane-Zavallia find no analogies in the quite rich geometric complexes of the Recent Mesolithic of Southwest Ukraine.

The presence of typical blades with 'sickle gloss' contrasts with the tool-sets of Recent Mesolithic. There were 'reaping knives' described for the Upper Palaeolithic and Mesolithic sites of the region (Сапожников/Сапожникова 2011), but their morphology is different.

More specifically the Southern Bug valley Mesolithic is thought to be represented by the Kukrek Culture (Даниленко 1969, 61–62; Станко et al. 1981; Телегiн 1982). Kukrek sites yielded a distinctive set of tools and cores (bullet cores, 'Abuzova Balka' points, Kukrek inserts, Kukrek burins). There are no similar types of cores and tools in the lithic collection of Kamyane-Zavallia.

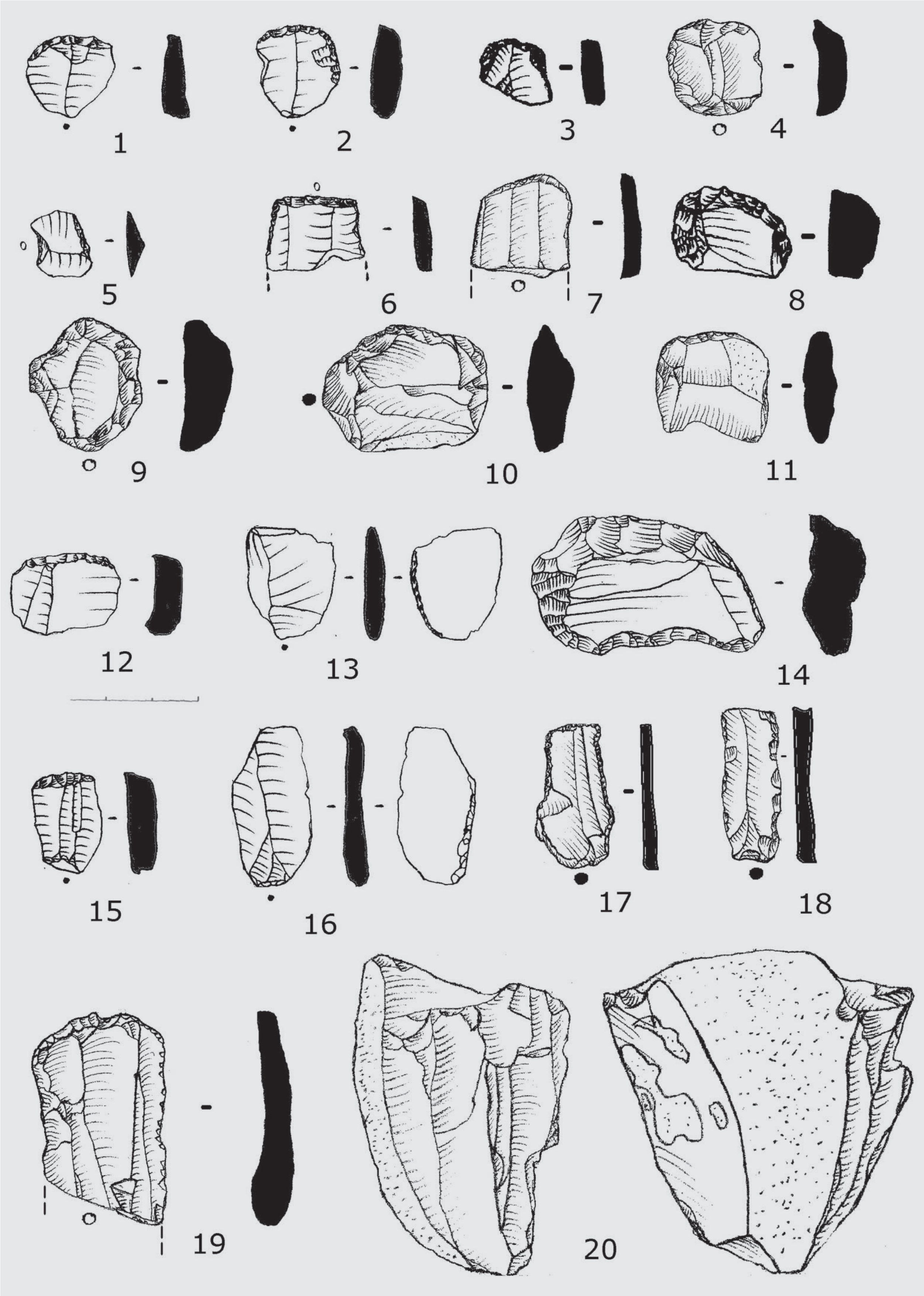

Fig. 3. Kamyane-Zavallia. Selected chipped stone tools. Drawing by D. Kiosak.

What is the Bug-Dniester Culture?

The Bug-Dniester culture is a classic example of a Neolithic culture for the Ukraine and large parts of former USSR. It was the first Neolithic culture defined in the Southwest Ukraine mostly by V. M. Danilenko (1969).

According to V. M. Danilenko, the Bug-Dniester Culture covers the whole of the Neolithic in the region of Bug and Dniester rivers until the arrival of the Chalcolithic Precucuteni-Trypillia A tribes. In Soviet and post-Soviet tradition Neolithic means pottery and vice versa. Contrary to this opinion V. M. Danilenko saw the main characteristic of Neolithic in the presence of domesticated animals and plants. Thus, his Bug-Dniester Culture started already during the Pre-Pottery Neolithic phase (Zan'kivtsi) (Danilenko 1969, 90).

Bug-Dniester sites are situated directly on the river shores and they consist of scatters of river shells, fragmented bones, lithics and some potsherds. Dwellings are mostly reconstructed due to the distribution of finds, by planigraphical considerations; they are usually without certain constructive elements. There are some dugout dwellings mostly in the Dniester river valley. Other on-site structures are hearths and dug-in large vessels. Pottery had undergone several important changes reflected in the ceramic styles or phases defined by V. M. Danilenko (1969, 46–147).

Mesolithic heritage is traditionally estimated as quite notable in the Bug-Dniester Culture by almost every author that ever described its lithic industry. V. M. Danilenko was the first to note the Grebenyky substratum in the Bug-Dniester flintworking, influenced also by Kukrek tradition at the early phases of the culture (Danilenko 1969, 150). This opinion is commonly accepted at present. D. L. Gaskevych proposed to specify this concept. He found that the lithic industry of BDK resembles the cultural group Radelychi 4 – Mshana 10 from the Upper Dniester valley. The latter was treated as closely related to the Mesolithic Grebenyky Culture. Thus, the Grebenyky 'heritage' was transmitted to BDK not directly but rather through Radelychi 4 – Mshana 10 agency (Gaskevych 2003, 6 f.). Some sites of Early BDK (Pechera phase) have lithic complexes with strong Kukrek influence while others are devoid of Kukrek characteristic artefacts (Gaskevych 2005).

Bug-Dniester Culture is defined by its spatial limits (the valleys of Southern Bug and Dniester) and the time interval (from Mesolithic until Chalcolithic) (Danilenko 1969, 149). It is composed of six very different ceramic phases or styles according to V. M. Danilenko, five according to V. I. Markevich and three according to D. Ja. Telegin and R. Tringham (Danilenko 1969; Tringham 1973; Markevich 1974; Телегін 1977). Some of them have their own range, which only partly corresponds with the area of the Bug-Dniester Culture (Gaskevych 2011). The lithic inventory also underwent at least one radical change – at the transition between the Early and Recent periods (Gaskevych 2005). This mixed character leaves little space for the interpretation of the Bug-Dniester Culture as material remains of a certain homogenous culturally unified group (tribe, group of tribes or group of communities), as is common in the Soviet and Post-Soviet tradition. 'Bug-Dniester Culture' more likely is an economic entity – an entity of a specific way of life. The 'Bug-Dniestrians' shared a common way of life despite the differences in the pottery ornamentation. V. M. Danilenko often referred to features of the way of living when he argued that a certain site belonged to BDK. According to him such features are the location of sites near favourable places for communal fishing, similar structures and intra-site spatial patterning, similarities in the lithic tool-kits etc. He draws a picture of a riverine way of life (Danilenko 1969, 90, 150).

According to the current state of research, there are several issues about the Bug-Dniester Culture that need to be addressed:

1) the BDK chronology;
2) are there domesticates?
3) is it a single culture?

During the 1960's and 70's the chronology of BDK was built on the basis of 'imports'. There were potsherds of other cultures found in Bug-Dniestrean contexts and vice versa. The Early Bug-Dniester was thought to be at least partially (Pechera phase) contemporaneous with the Criş Culture in a broad sense and Recent Bug-Dniester was treated as synchronous with LBK (Samchyntsi phase) and Precucuteni-Trypillia A (Savran phase).

A number of radiocarbon dates seemed to conform to this chronology. During the 1990's a massive programme of radiocarbon dating was carried out by Kyiv specialists (Бурдо 2003; Kotova 2003). The dates were obtained in the Kyiv laboratory and the results were surprising. It appeared that Early BDK existed around 6400–6000 calBC (1σ) and Recent BDK – around 6000–5300 calBC (1σ). The new chronology was accepted and interpreted by N. S. Kotova. According to her opinion, BDK can be divided into two phases, based on the stratigraphy of Baz'kiv Ostriv (excavations of V. M. Danilenko, 1959). The Early BDK has some traits in common with the earliest phases of Criş or Proto-Starcevo, the Recent BDK probably interacted with Linear Pottery Culture and later phases of Criş (Kotova 2003).

L. Zaliznyak and M. Tovkailo disagreed with the 'new chronology' on grounds of 'imports' and typological comparisons. They believed BDK should date much later and be a product of Balkan impulses (Товкайло 2004; 2014) or 'waves of migration' (Залізняк/Панченко 2007; Залізняк/Товкайло 2007; Залізняк et al. 2013) in a 'barbarian periphery' of hunters and gatherers in the valleys of Southern Bug and Middle Dniester (Залізняк 1998, 232).

In 2007 D. L. Gaskevych proposed to distinguish firmly 'new' and 'old' chronologies (Гаскевич 2007). The former was based on the Kyiv radiocarbon laboratory dates that were obtained in 1998–2008; the latter was constituted by a smaller set of Berlin, Kiel and Leningrad dates obtained before 1998. The time-span of the 'new chronology' was described above. According to the 'old chronology' the Early BDK existed between 5880–5550 calBC (1σ) and the Recent Bug-Dniester 5610–4710 calBC (1σ). Neither of the chronologies is preferable at the moment and each of them has its own voids and contradicts in some way to the typological seriations of complexes. A solution is sought in the essential revision of our ideas on the very nature of Bug-Dniester Culture (Гаскевич 2014).

The presence of domesticates (both plants and animals) in the BDK was also the subject of a vivid discussion. While Ukrainian and Moldavian archaeozoologists defined a part of faunal assemblages from Bug-Dniester sites as remains of domestic animals: cattle, sheep and/or goat and swine (David 1996; Журавлев/Котова 1996; Давид 1997), their colleagues tend to doubt this opinion on biometrical grounds. During the 1990's N. Benecke partially re-examined collections from 1960's' excavations and studied the faunal remains that were gathered in the course of excavations on the sites Soroki III, Tătărăuca Nouă XIV and XV in 1996–1997. He found that no bones of definitely domesticated animals were present in the old collections and that some domesticates were revealed in newly excavated sites. However, the site formation history appeared to be complex. The presence of Aeneolithic admixtures cannot be excluded in the general faunal assemblage (Wechler 2001, 73). So there is no certain evidence for the use of domesticated animals by the BDK population.[2]

Domesticated plants were not attested in BDK contexts by floatation. However, there were not many attempts to carry out floatation on the BDK settlements. Some species were identified by the analysis of imprints of grains and pericarps on the potsherds of BDK by G. Pashkevich and Z. Yanushevich (1989; Котова/Пашкевич 2002). A detailed re-analysis of their results gives some reasons for doubts. The greatest variety of species comes from the site Sacarovca (Sakharovka) I (Moldova). It was previously attributed to BDK (Yanushevich 1989, 609). Recently, this site appeared to belong to Criş Culture (Larina 1994). Some potsherds with notable organic admixture traditionally are defined as Criş imports or as a result of Criş influence in the BDK contexts (Даниленко 1969; Товкайло 2014). Thus, imprints of parts of domesticated plants on potsherds are no decisive evidence to prove that BDK practiced agriculture or at least used grains and seeds of wheat and barley as food supply. In order to have firmer grounds for the consideration of imprints it would be necessary to have the potsherds with imprints defined and described typologically and technologically. Direct radiocarbon dating of these organic-rich potsherds could also give an additional line of evidence.

And the last but not the least question: is BDK a single culture? Despite the common and long held opinion there are some facts that contradict the idea about a stable and non-interrupted devel-

2 The author thanks Prof. N. Benecke for personal comments on BDK archaeozoological assemblages.

opment of a homogeneous culture in the valleys of Bug and Dniester during Neolithic. Bug-Dniester sites often have 'non-ceramic' layers underneath. The 'ceramic' phases of Bug-Dniester Culture appear to be rather styles instead of phases. There are 3 to 6 such styles according to different authors (Даниленко 1969; Tringham 1973; Телегін 1977; Гаскевич 2013). Each of these styles of pottery making and decoration had its own chronology and distribution that only partially intersects with the timing and areas of the others (Гаскевич 2007; 2011; 2014). The styles are quite distinctive and there are no obvious interrelations between them. So both the homogeneity and the gradual development of BDK culture can be questioned on several quite reasonable grounds.

The problems of BDK cannot be solved only by re-analysis of old collections but require new fieldwork.

Melnychna Krucha

In 2011–2012 the author initiated small-scale excavations at the Melnychna Krucha BDK site. Melnychna Krucha was one of the first Neolithic sites discovered in Southern Ukraine (*fig. 1.3*). It was discovered around 1931 by the local resident S. I. Chub. It was surveyed by K. P. Polikarpovich, V. I. Selinov, F. Kharlampovich, A. V. Dobrovolsky (Гаскевич/Кіосак 2011). In 1949 V. M. Danilenko excavated the biggest part of the site. It became a stepping stone for his classification of the Bug-Dniester Neolithic. It was presented as a site with a 'long stratigraphy'. It contained layers of the Aeneolithic Trypillian Culture, Recent Bug-Dniester and Early Bug Dniester Culture (Даниленко 1969).

Recently the author (together with D. L. Gaskevich, Kyiv-Institute of Archaeology) located the site and opened a small trench (4x4 m) in order to re-examine issues of its stratigraphy and taphonomy.

Melnychna Krucha is situated on the northern bank of the Southern Bug on a meadow floodplain that is separated by a shallow depression (maybe an old riverbed) from plateau.

The trench reached 300 cm in depth (*fig. 4A*). 1. topsoil (20–25 cm); 2. dark grey humic mellow soil with numerous root-marks (62–75 cm); 3. grey, light grey sandy sub-soil (denser than the upper layer) (110–127 cm); 4. transitional grey-yellowish layer with multiple animal burrows (krotovinas); 5. yellow and light yellow sandy loam with numerous shells; it gets notably darker in the lower part and gradually contacts the underlying layer (170–175 cm); 6. grey and dark grey soft loam with carbonate inclusions, pebbles and reddish spots (185–200 cm); 7. dense, grey-greenish layer with numerous conglomerates, pebbles and spots of gleying (traced down to 300 cm).

During the excavations in 1949 V. M. Danilenko observed that there was a yellowish silty layer (B) with broken bones and Trypillian potsherds (0,5–0,9m) under archaeologically sterile modern soil (A). The third horizon was a grey loam (C) with an Early Neolithic layer in it. Early Neolithic layer was attributed to the Pechera phase of BDK. It yielded potsherds with incised decoration and organic admixture and numerous lithics of 'Kukrek' tradition. The bottom of the sequence was represented by grey-greenish silt (D). In 1969 V. M. Danilenko situated a layer of Recent Neolithic in the layer B (Даниленко 1969). Thus, we can suggest that there is a certain correspondence between the sequence of 1949 and the stratigraphy of 2012.

There were seven potsherds in the 2012 trench. None of them can be connected to the lowest archaeological horizons of the site.

Chipped stone tools (105 items with known depth) are numerous down the sequence. If we plot the depths of lithics (*fig. 4B solid columns*), the histogram has two maxima. The first corresponds to a contact between the yellow sandy layer and the grey loam (170–180 cm). The second is detected inside the grey loam (185–200 cm depth). Some finds (mostly bone shatter) were revealed at a depth of 90–120 cm – in the lower part of the grey subsoil of the modern soil profile.

Thus, the 2012 trench contained three archaeological horizons:

I – some chipped stones and broken bones in the lower part of the grey subsoil (-90–120 cm);
II – a thick and saturated horizon in yellow silty soil; it's base is marked by massive bones (jaws, big antler fragments, hips) at 172–175 cm, however there are finds starting at least from -130 cm;
III – 'suspended' layer in grey loam at 185–200 cm.

There is no sterile interlayer between the ho-

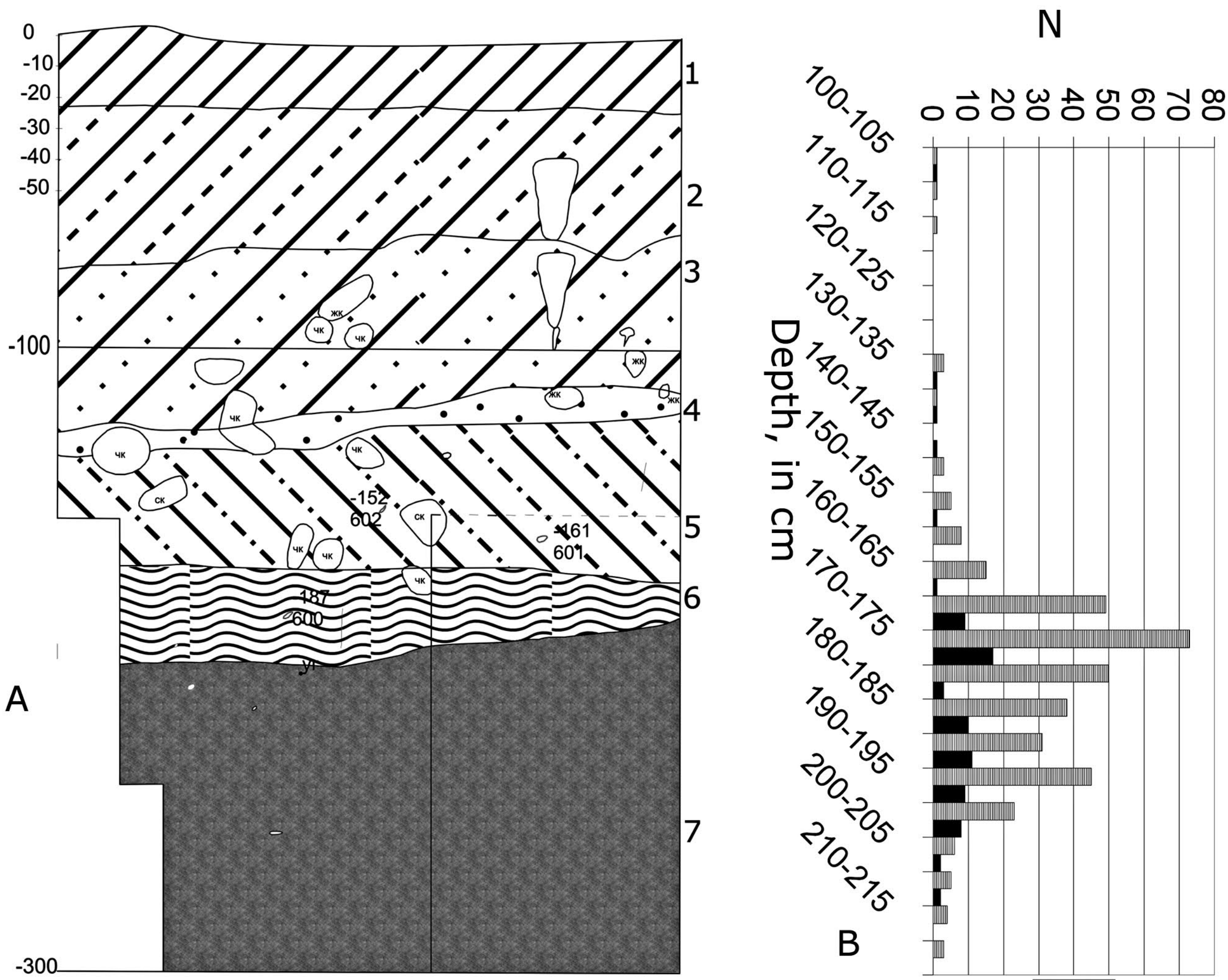

Fig. 4. Melnychna Krucha. Stratigraphy (A, 1-7 layers described in text, -152.601 – finds [depth and number on planum]) and vertical distribution of finds (B, solid – chipped flints, hatched – total amount of finds). Drawing by D. Kiosak.

rizons II and III. However, they are clearly different. Horizon II is a dense scatter of faunal remains with some chipped flints, mostly decortification and primary knapping by-products. Horizon III is a layer of dispersed lithics with some small bone fragments and burnt bone shatters. We conclude that these two horizons are two cultural layers disturbed by burrowing animals' activity and soil formation processes. Horizons II and III share several common characteristics with the cultural layers described by V. M. Danilenko. Horizon II corresponds to layer B and horizon III to the Early Neolithic cultural layer in layer C.

In horizon II chipped stone artefacts mostly result from decortification and primary knapping of 1–2 concretions of honey-coloured flint with white-reddish cortex.

There are flakes, chips, shatters and a fragment of a flat one-sided core for bladelets. There is also a sub-conical core for bladelets and flakes. Retouched items are few: bladelets and microblades with partial marginal retouch, two end-scrapers are done on sides of flakes (*fig. 5.11–12*). There are no culturally distinctive tools. Knapping technique was aimed on the production of regular parallel-sided blades and bladelets from one-polar cores of various shapes.

Horizon III contained bones of red deer and pig.[3] Several non-identified fish bones were found in the floatation samples. The lithic inventory includes end-scrapers (double and semi-circular on flakes) (*fig. 5.2, 9*), backed bladelet (*fig. 5.1*), subconical microcores with regular dorsal scars (*fig. 5.10–16*), dihedral burins, burins on a flake

3 The author is extremely grateful to O. P. Sekerska ('K.D. Ushinsky' South Ukrainian Pedagogical University) for the analysis of faunal remains.

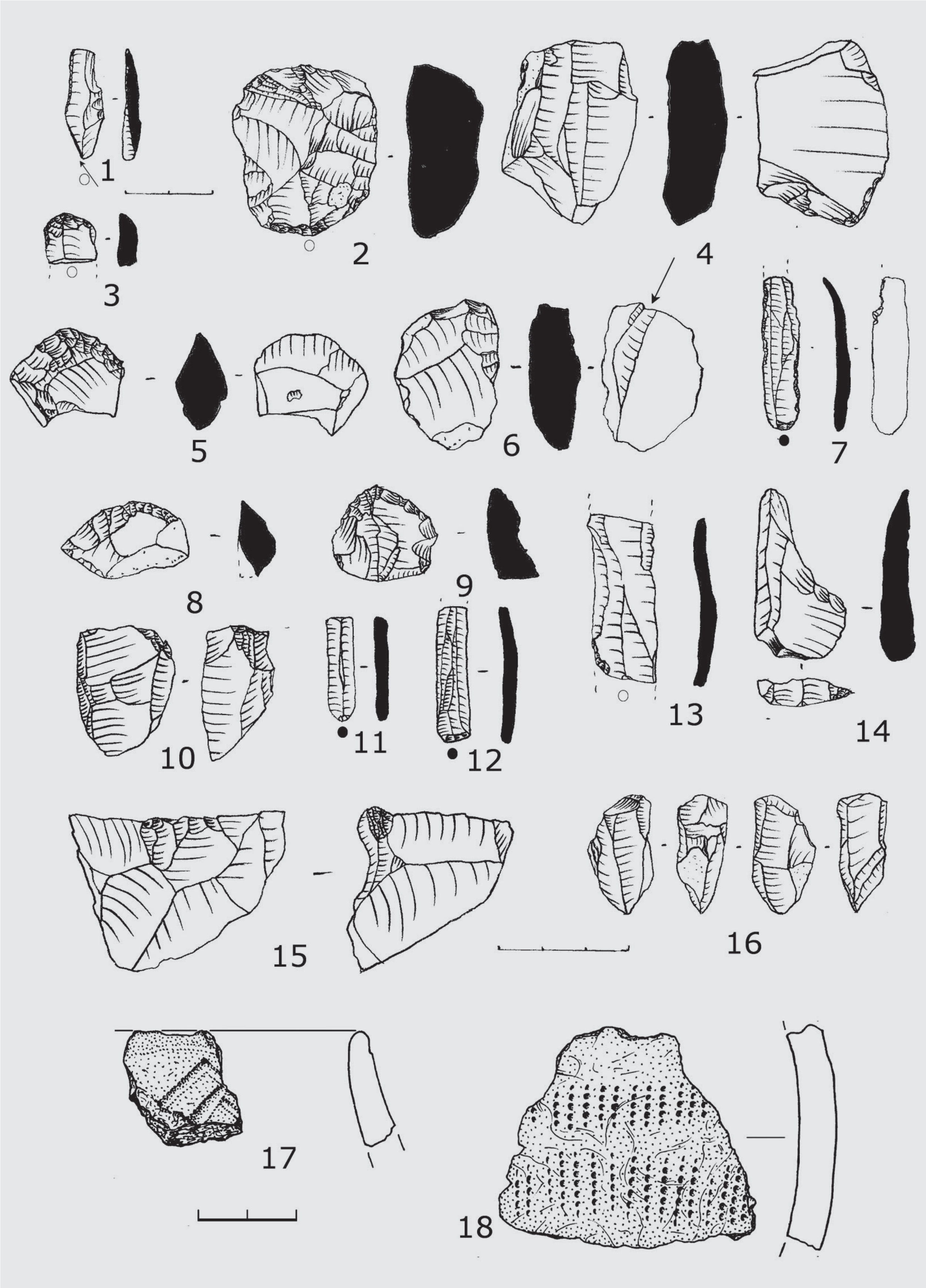

Fig. 5. Melnychna Krucha. Finds. 1-16 – lithic tools (excavations, 2012), 17-18 –potsherds (surface material, 1938). Drawing by D. L. Gaskevych (after Гаскевич/Кіосак 2011).

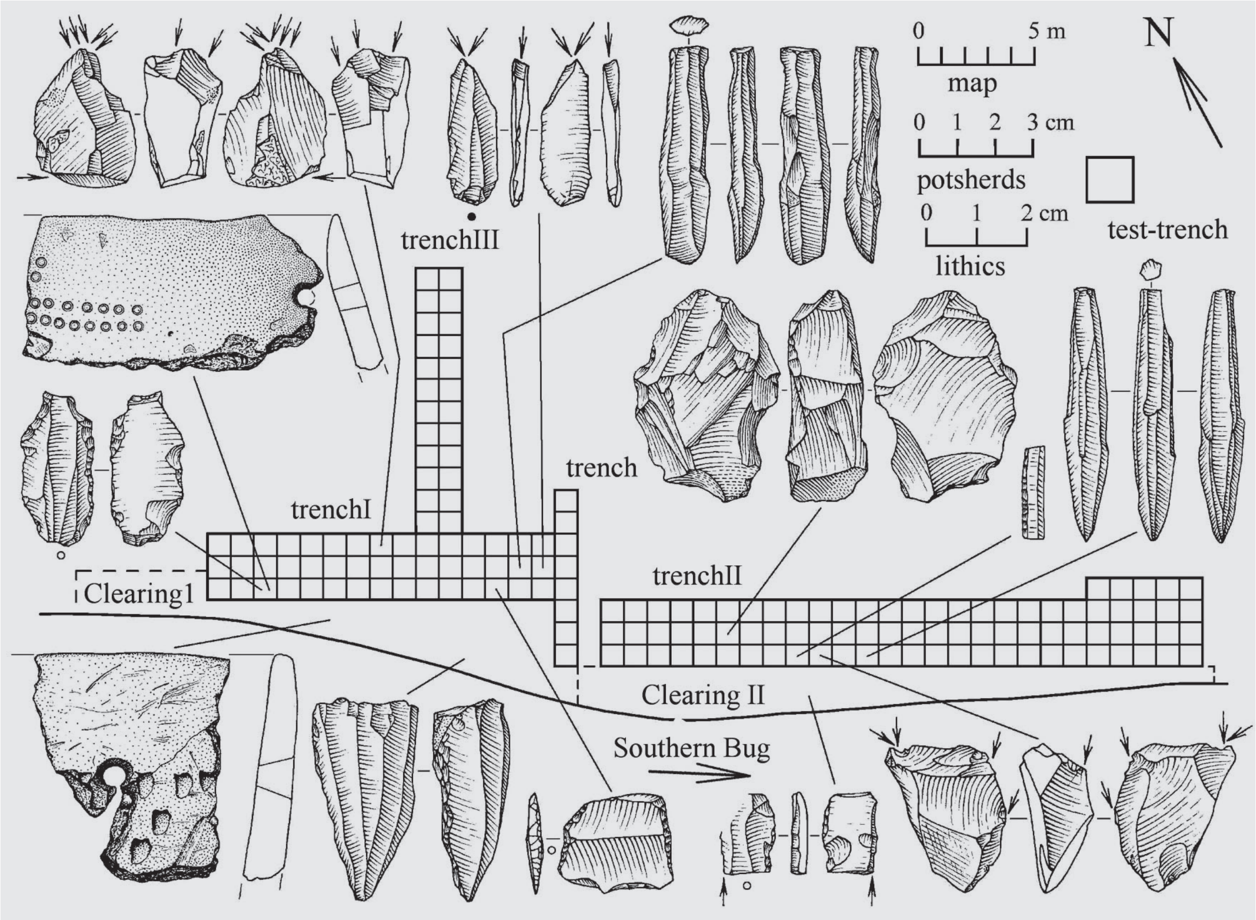

Fig. 6. Melnychna Krucha 1949. Distribution of finds. Drawing by D.L. Gaskevych (after Гаскевич/Кіосак 2011).

(*fig. 5.6*) and numerous microblades. The general composition of assemblage and knapping style are consistent with the Kukrek complexes structure (Гаскевич/Кіосак 2011).[4]

Thus, the new sequence of Melnychna Krucha provides several reasons to doubt the attribution to 'Neolithic' of the lower layer. It yielded a lithic collection that is very similar with Mesolithic Kukrek complexes, no potsherds and no definite domestic animals' bones. Moreover, D. L. Gaskevych has recently reconstructed the spatial distribution of finds in the1949 excavation trenches (*fig. 6*). It appeared that Kukrek-looking lithics (bullet cores, backed bladelets, multi-faceted burins on flakes, massive circular and sub-circular end-scrapers) were spatially separated from 'Neolithic' potsherds and non-Kukrek lithics (trapezes, burins and end-scrapers on blades). The former were found in the eastern part of the site, while the latter concentrated in the western part (Гаскевич/Кіосак 2011). So, one could argue that two different habitations were partially superimposed in the lower layer of Melnychna Krucha.

Interpretation

Two sets of cultures were labelled 'Neolithic' in the southwest of the Ukraine. While Criş and LBK conform to the structural characteristics of Neolithic societies, BDK is distinctively different. It has no settlements of village type, no elaborated architecture, no distinctive fine-ware vessels, and no figurines. Let us assume that remains of domesticates are found in the Bug-Dniester contexts. Even then, domestication of the valleys of Bug and Dniester did not occur in the sense of Ian Hodder's domestication of Europe (Hodder 1990). BDK is not a 'Hodderian' Neolithic society.

4 Some of the results presented here were obtained together with D. L. Gaskevych.

There are several theoretical models, which were proposed to explain this incongruence. None of them is completely satisfactory. M. Lillie and M. Zvelebil proposed to treat BDK as a transitional society – foragers in the availability phase. They adopted pottery technology from contact with Criş communities in the west between 7000–6800 BP. Later they turned to agricultural ways of life completely, until their incorporation into the Trypillia-Cucuteni cultural tradition (Zvelebil/Lillie 2000, 72–76).

This concept can be criticized in several ways. First, there are components of material culture in the BDK which cannot be explained by the adoption of certain elements from their Neolithic neighbours and cannot be traced back to Recent Mesolithic – for example, pots with comb decoration (Gaskevych 2011; 2014). L. L. Zaliznyak names pointed bottom of vessels as evidently 'local trait' (Залізняк 1998, 232). Second, the 'new' and even 'old' chronologies place the early BDK sites (for example in Soroki II, layer I (5880–5560 calBC [1σ]) earlier or roughly statistically synchronous with the arrival of the Balkan farmers in the region. The earliest evidence of their presence is Viişoara I site in the Prut valley (*fig. 1.10*) which belongs to Criş III. This phase is dated between 5800–5500 calBC in Romania (Biagi et al. 2005, 43–47; Biagi/Spataro 2005). The radiocarbon date of the largest Criş settlement in the region, Sacarovca (Sakharovka) I (Criş IV) is 5640–5480 (1σ) calBC (*fig. 1.1*). So, there is not much time left for an interaction between Early BDK and Criş communities.

Here the author suggests an explanatory model on the nature of BDK society. Obviously it requires additional empirical support. However, it seems at least fruitful as a tool to define lines and directions of future research, which will eventually support or falsify it.

There are several indications that BDK is not a culture. It is rather an entity of a specific way of life – some groups from different cultures united by similar ways of subsistence production in similar ecological setting. They utilized the resources of Southern Bug and Dniester valleys in the same pattern. The latter resulted in numerous re-uses of the same particularly favourable places. This process created not just multiple stratified sites with several archaeological layers but also a notable degree of superimposition and mechanical admixtures of different habitations inside these layers. This unified way of life was river-oriented. Fishing played an important role. The sites are usually found close to the water, near rapids, islands, river crossings, shallow channels and so on. There are numerous finds of fish-bones and some finds of fishing implements in the BDK contexts (Даниленко 1969; Маркевич 1974). Hunting and gathering could also be practised in the river valleys (Даниленко 1969, 178 f.; Журавлев/Котова 1996). This adaptation was quite successful and even a (hypothetical) acquaintance with domestic animals and plants did not change its foundations. This economic orientation was different both from the mobile ways of life of hunter-gatherers and the sedentary life of the first farmers. In contrast with the local Mesolithic, the BDK population had more elaborated structures on sites, a different settlement pattern, more extensive tool-sets, some evidence of art and sacral beliefs. That is why it would be rather simplistic to call BDK a 'ceramic Mesolithic'. L. L. Zaliznyak attributed the pottery-bearing sites of Surs'ka Culture (influenced by BDK) to an economic type of river shores' fishers-hunters-gatherers (Залізняк 1998, 98). It is quite probable that this definition can be extended to BDK too, maybe with the additional use of domestic animals and plants.

Thus, the issue of the probable interaction of economically different societies is more complicated than just a 'Meso-Neo interface' in the South-west Ukraine. Here in fact, several 'interfaces' should be investigated: Mesolithic with Criş and LBK, Mesolithic with BDK and finally, Criş and LBK with BDK.

The lithic collection of the Kamyane-Zavallia settlement indicated that little if any interaction with the local Mesolithic affected the knapping style and typological composition of its assemblage. LBK appears as a completely migratory phenomenon in this part of the Ukraine. This opinion is supported by the observations on LBK lithic inventories of adjacent regions (Larina et al. 1997; Larina 1999).

In 2005 D. L. Gaskevych demonstrated that Early Bug-Dniester sites bear either 'Kukrek' or 'geometric' lithic assemblages (Гаскевич 2005, 28). The 'Kukrek tradition' sites comprise Baz'kiv

Ostriv, Pechera, Gaivoron-Polizhok, Melnychna Krucha. Another group is best evidenced by Sokiltsi VI site. Later, a very rich and very characteristic Kukrek assemblage was found associated with Early BDK potsherds in Dobryanka 3 site by a team led by L. L. Zaliznyak (IA NASU, Kyiv) (Залізняк/Манько 2005; Залізняк/Панченко 2007; Залізняк/Товкайло 2007). These observations were the basis of hypotheses either on the 'Kukrek factor' in the origin of BDK (Kotova 2003), or even the 'Kukrek factor' in the neolithisation of Western and Central Ukraine (Залізняк/Панченко 2007). I. V. Sapozhnikov and G. V. Sapozhnikova defined Mesolithic Kukrek sites (such as Abuzova Balka, Kinetspil and so on) as belonging already to the Neolithic ('Pre-Ceramic Neolithic') (Сапожников/Сапожникова 2011, 24) based on the results of use-wear analysis. They defined a group of tools as 'reaping knives' or 'sickle inserts' in the abundant surface material collection of Abuzova Balka. According to the Sapozhnikovs this suggests already a 'presence of agriculture' (Сапожников/Сапожникова 2011, 122).

Contrary to these opinions, there is a certain amount of evidence that pottery-bearing Early BDK sites could obtain 'Kukrek'-looking lithic inventories due to a superimposition of Mesolithic 'Kukrek' and 'ceramic' BDK habitations. In 2008 D. L. Gaskevych (together with a Polish team) excavated Pechera I site (*fig. 1.4*). Their excavation trench was opened right next to the 1958 trench of V. M. Danilenko. There were no clearly defined Neolithic layers in the 2008 trench. Potsherds of different BDK styles or phases (Pechera, Samchyntsi, Savran) were encountered throughout the lower part of the sequence together with some pieces of Criş ceramics (Гаскевич 2013). Thus, the stratigraphy from the V. M. Danilenko excavations may be doubted. There are no reasons to suppose that the bearers of Early BDK pottery were the makers of Kukrek tools in the Pechera 1 assemblage (Гаскевич 2014, 10 f., 14).

Dobryanka 3 site yielded an abundant Kukrek lithic assemblage and some potsherds of Early BDK (*fig. 1.5*). There were also potsherds of LBK and a human burial (Залізняк et al. 2013). While the burial, some potsherds with organic admixtures and some animal bones were dated to the late 7th – early 6th mill. BC, there are also Early Mesolithic dates and at least two dates that are indicative for a Bronze Age occupation of the site (Biagi et al. 2007; Lillie et al. 2009). Because of this, one can reasonably doubt the relation between Kukrek lithic inventory and Early BDK pottery.

The site of Melnychna Krucha can also be put on this list of doubts. In 2012 re-excavations yielded no traces of pottery and domesticated animals in the lower layer of the site. Moreover, re-analysis of the spatial distribution of potsherds and Kukrek characteristic tools demonstrated that they were found in different parts of the site in 1949. It seems that the association of Early BDK and Kukrek lithics still has to be proved here by new refined data.

The presented data is obviously not enough to deny completely a certain 'Kukrek' presence on the Early BDK sites. However, the role of the 'Kukrek factor' in the neolithisation of the region is evidently overestimated.

The third 'interface' (Criş and LBK with BDK) is particularly intriguing and requires additional research. There are around ten reported cases of BDK potsherds found in LBK settlements and vice versa (Даниленко 1969; Ларина 1999; 2006). However, chronological and (sometimes) stratigraphic discrepancies could indicate that these ceramic vessels were not really in use simultaneously, but rather were mixed in a single layer due to post-depositional processes. A new promising direction of research is a microregional approach to groups of sites in some particular settings, where LBK sites are situated close to BDK sites. A region of this type is known in the vicinity of Tătărăuca Nouă in Moldova near the Dniester river (Wechler et al. 1998; Ларина 2006). Recently, a microregion of LBK and BDK 'interface' was found at the southern Bug river where the LBK site of Kamyane-Zavallia is situated at 5km distance from the BDK sites Zavallia and Zhakchik (Кіосак 2015).

Conclusion

Recent finds demonstrate that previous views on the Mesolithic-Neolithic transition in the Southwest Ukraine need to be revised. We can no longer view Bug-Dniester culture as a 'normal' Neolithic culture either developed by local Mesolithic hunters or resulting from 'waves of migrants' from elsewhere. Despite the (probable) acquaintance of BDK population with domestic animals and plants, they conducted their way of life radically different from the ways of life of the first farmers.

We need to distinguish firmly the 'normal' ('external' or 'Hodderian') Neolithic represented in the Southwest Ukraine by Criş and LBK cultures and 'riverine' societies like BDK. The former are a migratory phenomenon in the Southwest Ukraine and so far there is little if any indication of a local 'Mesolithic heritage' in their lithic inventories. The latter seems to be deeply rooted in the Recent Mesolithic of the region. However, a detailed re-analysis of 'old' (mostly 1949–1961) data and new small-scale excavations with refined stratigraphical controls gave reason to doubt a traditional view of a pronounced 'Kukrek factor' in the formation of Early BDK. It appears that in certain cases tools characteristic for Kukrek could get into BDK layers by post-depositional processes. Thus, the question of a Mesolithic cultural aspect that gave rise for BDK lithic technology (together with Grebenyky-type aspects) seems to be open at the moment.

Dmytro Kiosak
4, Lanzheronivska
UA-65000-Odessa
dkiosak@ukr.net

Bibliography

Biagi/Kiosak 2010: P. Biagi/D. Kiosak, The Mesolithic of the Northwestern Pontic Region. New AMS Dates for the Origin and Spread of the Blade and Trapeze Industries in Southeastern Europe. Eurasia Antiqua 16, 2010, 21–41.

Biagi/Spataro 2005: P. Biagi/M. P. Spataro, New Observations on the Radiocarbon Chronology of the Starćevo-Cris and Körös Cultures. In: L. Nikolova/J. Higgins (eds.), Prehistoric Archaeology & Anthropological Theory and Education. Reports of Prehistoric Research Projects 6/7 (Salt Lake City 2005) 35–40.

Biagi et al. 2005: P. Biagi/S. Shennan/M. P. Spataro, Rapid Rivers and Slow Seas? New Data for the Radiocarbon Chronology of the Balkan Peninsula. In: L. Nikolova/J. Higgins (eds.), Prehistoric Archaeology and Anthropological Theory and Education. Reports of Prehistoric Research Projects 6/7 (Salt Lake City 2005) 43–51.

Biagi et al. 2007: P. Biagi/S. K. Kozłowski/L. L. Zaliznyak, Old Problems and New Perspectives for the Radiocarbon Chronology of the Ukrainian Mesolithic? In: V. Yanko-Hombach (ed.), Extended Abstracts IGPC 521-481 Joint Meeting Field Trip IGPC 521 'Black Sea Mediterranean Corridor during the Last 30ky: Sea-Level Change and Human Adaptation' (2005–2009), IGPC 481 'Dating Caspian Sea-Level Change' (2003–2007) (Moscow 2007) 27–30.

David 1996: A. David, The Mammalian Fauna from Mesolithic and Neolithic Settlements from Moldova. In: R. Kertész/J. Makkay (eds.), From the Mesolithic to the Neolithic. Proceedings of the International Archaeological Conference Held in the Damjanich Museum of Szolnok, September 22–27, 1996 (Szolnok 1996) 167–175.

Gaskevych 2011: D. Gaskevych, A New Approach to the Problem of the Neolithisation of the North-Pontic Area. Is there a North-Eastern Kind of Mediterranean Impresso Pottery? Documenta Praehistorica 38, 2011, 275–290.

Gronenborn 1998: D. Gronenborn, Ältestbandkeramische Kultur, La Hoguette, Limburg, and ... what else? Contemplating the Mesolithic-Neolithic Transition in the Southern Central Europe. Documenta Praehistorica 25, 1998, 189–202.

Hodder 1990: I. Hodder, The Domestication of Europe. Structure and Contingency in Neolithic Societies (Oxford 1990).

Kiosak 2011: D. Kiosak, The Issue of the 'Steppe Neolithic' in the North-Western Black Sea Area. In: V. Yanko-Hombach (ed.), INQUA 501 VII Meeting. 21–28 August, 2011 (Odessa 2011) 116–118.
Kotova 2003: N. S. Kotova, Neolithization in Ukraine (Oxford 2003).
Kotova 2004: N. S. Kotova, First Cattle-Breeders of the Steppe Ukraine. The Mesolithic-Early Eneolithic. In: A. Kośko (ed.), Nomadism and Pastoralism Between Vistula and Dnieper. Neolithic, Eneolithic and Bronze Age (Poznan 2004) 55–66.
Larina 1994: O. V. Larina, Neoliticul pe teritoriul Republicii Moldova. Thraco-Dacica 15, 1994, 41–66.
Larina 2010: O. V. Larina, Inceputurile Economiei Productive. Neoliticul. Oranduirea Gentlico-Tribala. In: V. Dergaciov (ed.), Istoria Moldovei. Epoca preistorica si antica. Pana in sec. V (Chisinau 2010) 177–218.
Lillie et al. 2009: M. Lillie/C. Budd/I. D. Potekhina/R. E. M. Hedges, The Radiocarbon Reservoir Effect. New Evidence from the Cemeteries of the Middle and Lower Dnieper Basin, Ukraine. Journal of Archaeological Science 36, 2009, 256–264.
Pelegrin 2000: J. Pelegrin, Les techniques de debitage laminaire au Tardiglaciaire. Critères de diagnose et quelque réflexions. In: B. Valentin (ed.), L'Europe Centrale et Septentrionale au Tardiglaciaire. Confrontation des modèles régionaux de peuplement. Table ronde de Nemours 13–16 mai, 1997. Mémoires du Musée de Préhistoire d'Ile de France 7 (Nemours 2000) 73–86.
Pelegrin 2006: J. Pelegrin, Long Blade Technology in the Old World. An Experimental Approach and Some Archaeological Results. In: J. Apel/K. Knutsson (ed.), Skilled Production and Social Reproduction. Aspects on Traditional Stone-Tool Technologies. Proceedings of a Symposium in Uppsala, August 20–24, 2003 (Uppsala 2006) 37–68.
Pelegrin 2012: J. Pelegrin, New Experimental Observations for the Characterization of Pressure Blade Production Techniques. In: P. Desrosiers (ed.), The Emergence of Pressure Blade Making. From Origin to Modern Experimentation (New York 2012) 465–500.
Stanko/Kiosak 2010: V. N. Stanko/D. Kiosak, The Late Mesolithic Settlement of South-Western Ukraine. Atti Societa Preistoria e Protostoria, Friuli-Venezia-Giulia 17, 2010, 24–100.
Thorpe 1999: I. J. Thorpe, The Origins of Agriculture in Europe (London 1999).
Tringham 1973: R. Tringham, The Mesolithic of Southeastern Europe. In: S. Kozłowski (ed.), The Mesolithic in Europe (Warsaw 1973) 531–550.
Wechler 2001: K.-P. Wechler, Studien zum Neolithikum der osteuropäischen Steppe (Mainz 2001).
Wechler et al. 1998: K.-P. Wechler/V. A. Dergačev/O. V. Larina, Neue Forschungen zum Neolithikum Osteuropas. Ergebnisse der moldawisch-deutschen Geländearbeiten 1996 und 1997. Prähistorische Zeitschrift 73.2, 1998, 151–166.
Whittle 1996: A. Whittle, Europe in the Neolithic. The Creation of New Worlds (Cambridge 1996).
Yanushevich 1989: Z. V. Yanushevich, Agricultural Evolution North of the Black Sea from the Neolithic to the Iron Age. In: D. R. Harris/G. C. Hillman (ed.), Foraging and Farming. The Evolution of Plant Exploitation (London 1989) 607–619.
Zimmermann 1995: A. Zimmermann, Austauschsysteme von Silexartefakten in der Bandkeramik Mitteleuropas (Bonn 1995).
Zvelebil/Lillie 2000: M. Zvelebil/M. Lillie, Transition to Agriculture in Eastern Europe. In: T. D. Price (ed.), Europe's First Farmers (Cambridge 2000) 47–92.
Zvelebil/Rowley-Conwy 1984: M. Zvelebil/P. Rowley-Conwy, Transition to Farming in Northern Europe. A Hunter-Gatherer Perspective. Norwegian Archaeological Review 17, 1984, 104–128.

Бурдо 2003: Н. Б. Бурдо, Новые данные для абсолютной датировки неолита и раннего энеолита на территории Украины. Stratum plus 2003, 431–446.
Гаскевич 2003: Д. Л. Гаскевич, Крем'яний інвентар неолітичних культур України (Київ 2003).
Гаскевич 2005: Д. Л. Гаскевич, Крем'яні вироби кукрекської культурної традиції в інвентарі буго-дністровських пам'яток Побужжя. Археологія (Київ) 3, 2005, 24–37.

Гаскевич 2007: Д. Л. Гаскевич, Синхронізація буго-дністровського неоліту і неоліту Центральної Європи. Проблема радіовуглецевих дат. In: M. Gierlach (ed.), Wspolnota dziedzictwa archeologicznego ziem Ukrainy i Polski. Materialy z konferencji zorganizowanej przez Osrodek Ochrony Dziedzictwa Archeologicznego Lancut (26–28 October 2005) (Warsawa 2007) 115–147.

Гаскевич 2013: Д. Л. Гаскевич, В. М. Даниленко та періодизація неоліту Південного Бугу. Нові запитання до старих джерел. Археологія (Київ) 4, 2013, 3–17.

Гаскевич 2014: Д. Л. Гаскевич, Проблеми радіовуглецевого датування буго-дністровської неолітичної культури. Археологія (Київ) 4, 2014, 3–17.

Гаскевич/Кіосак 2011: Д. Л. Гаскевич/Д. Кіосак, Неолітичні знахідки Мельничної Кручі з досліджень А.В. Добровольського та культурно-хронологічна інтерпретація пам'ятки. Кам'яна доба України 14, 2011, 198–207.

Даниленко 1969: В. Н. Даниленко, Неолит Украины. Главы древнейшей истории Юго-Восточной Европы (Київ 1969).

Давид 1997: А. И. Давид, Фауна млекопитающих мезолитических и неолитических поселений Республики Молдова. In: V. Dergaciov (ed.), Vestigii Arheologice din Moldova (Chişinău 1997) 111–120.

Дворянінов 1982: С. О. Дворянінов, Поселення культури лінійно-стрічкової кераміки Майнова Балка на Одесщині. Археологія (Київ) 38, 1982, 93–95.

Журавлев/Котова 1996: О. П. Журавлев/Н. С. Котова, Тваринництво неолітичного населення України. Археологія (Київ) 2, 1996, 3–17.

Залізняк 1998: Л. Л. Залізняк, Передісторія України X–V тис. до н.е. (Київ 1998).

Залізняк 2005: Л. Залізняк, Фінальний палеоліт і мезоліт континентальної України. Кам'яна доба України 8 (Київ 2005).

Залізняк/Манько 2005: Л. Л. Залізняк/В. О. Манько, Стоянки біля с. Добрянка на р. Тікич та деякі проблеми неолітизації Середнього Побужжя. Кам'яна доба України 4, 2005, 137–168.

Залізняк/Панченко 2007: Л. Л. Залізняк/Ю. В. Панченко, Неолітизація Правобережної України. Балкани чи 'східний імпульс'? Матеріали та дослідження з археології Східної України. Від неоліту до кіммерійців 7, 2007, 6–14.

Залізняк/Товкайло 2007: Л. Л. Залізняк/М. Т. Товкайло, Проблеми неолітизації Правобережної України за матеріалами розкопок стоянки Добрянка 3. Кам'яна доба України 10, 2007, 148–167.

Залізняк et al. 2013: Л. Л. Залізняк/М. Т. Товкайло/В. О. Манько/А. А. Сорокун, Стоянки біля хутора Добрянка та проблема неолітизації Буго-Дністровського межиріччя. Кам'яна доба України 15, 2013, 194–257.

Кіосак 2015: Д. В. Кіосак, Південне Побужжя – частина ареалу культури лінійно-стрічкової кераміки. In: Л. О. Поддубна (ed.), IX Миколаївська обласна краєзнавча конференція. Історіографія. Етнографія. Культура. Нові дослідження, грудень 2013, Миколаїв (Миколаїв 2015) 48–50.

Котова/Пашкевич 2002: Н. С. Котова/Г. А. Пашкевич, Каталог отпечатков культурных растений на керамике неолитических культур Украины. In: Н. С. Котова, Неолитизация Украины (Київ 2002) 106–108.

Ларина 1999: О. В. Ларина, Культура линейно-ленточной керамики Пруто-Днестровского региона. Stratum plus 2, 1999, 10–140.

Ларина 2006: О. Ларина, Неолитическая керамика поселения Тэтэрэука Ноуэ XV. Revista arheologică 2.1/2, 2006, 35–55.

Ларина et al. 1997: О. Ларина/К.-П. Вехлер/В. А. Дергачев/С. Коваленко/В. М. Бикбаев, Новые полевые исследования памятников мезолита и неолита Молдовы. In: V. Dergaciov (ed.), Vestigii arheologice din Moldova (Chişinău 1997) 62–110.

Маркевич 1974: В. И. Маркевич, Буго-днестровская культура на территории Молдавии (Кишинев 1974).

Нужний 2008: Д. Нужний, Розвиток мікролітичної техніки в кам’яному віці. Удосконалення зброї первісних мисливців (Київ 2008).

Петрунь 1971: В. Ф. Петрунь, О геологической позиции и обработанном кремне мезолитической стоянки Белолесье. Материалы по археологии Северного Причерноморья 7, 1971, 110–117.

Сапожников/Сапожникова 2011: И. В. Сапожников/Г. В. Сапожникова, Каменный век Северо-Западного Причерноморья. Stratum Plus 1, 2011, 15–149.

Станко 1967: В. Н. Станко, Мезолит Северо-Западного Причерноморья (Київ 1967).

Станко et al. 1981: В. Н. Станко/В. Ф. Петрунь/Т. И. Максимюк, Позднемезолитическое местонахождение кукрекского типа на Южном Буге. In: П. О. Карышковский (ed.), Памятники древних культур Северо-Западного Причерноморья (Київ 1981) 5–12.

Телегін 1977: Д. Я. Телегін, Маркевич В.И. Буго-днестровская культура на территории Молдавии. Археологія (Київ) 23, 1977, 89–91.

Телегін 1982: Д. Я. Телегін, Мезолітичні пам’ятки України (Київ 1982).

Товкайло 2004: М. Т. Товкайло, До проблеми датування буго-дністровського неоліту. Кам’яна доба України 5, 2004, 236–246.

Товкайло 2014: М. Т. Товкайло, Неолитизация Юго-Западной Украины в свете нових исследований поселения Гард. Stratum Plus 2, 2014, 183–245.

CLIVE BONSALL AND ADINA BORONEANȚ

Lateglacial Hunter-Gatherers in the Iron Gates

A Brief Review of the Archaeological and Chronological Evidence

Keywords: Lateglacial, Epigravettian, hunter-gatherers, Iron Gates

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Abstract

This paper provides an overview of the evidence for human occupation of the Iron Gates section of the lower Danube Valley during the Lateglacial period, between ca. 14.700 and 11.700 cal BP. Late or Final Epigravettian assemblages of chipped stone and bone artefacts were recovered in excavations in the 1950s and 1960s at three cave sites in the Romanian sector of the Iron Gates: Hoților, Climente II and Cuina Turcului. Radiometric and AMS ^{14}C dates from the sites fall mainly in the Bølling-Allerød interstadial. However, direct dates on human remains from Cuina Turcului raise the possibility of a continuation of the Epigravettian into the Holocene. The absence of ^{14}C dates for the Younger Dryas may be a function of the radiocarbon sampling strategy. Previous claims for the existence of Epigravettian occupations at open-air sites in the Iron Gates have yet to be substantiated.

Introduction

The Lateglacial period was part of a major global climate change event (Termination 1) that marked the end of the Last Glaciation. It began with an abrupt warming (the Bølling-Allerød) at 14.700 cal BP, followed by a return to colder conditions ca. 12.900 cal BP (the Younger Dryas) and a final rapid warming ca. 11.700 cal BP leading to the Holocene and the establishment of full interglacial conditions.

Several sites in the Iron Gates have produced evidence of hunter-gatherer occupation during the Lateglacial period (*fig. 1*). In this paper we provide a brief overview of the archaeological evidence and comment on the significance of new AMS ^{14}C dates on animal bones and human remains. We also reflect upon two important questions: (i) was settlement of the Iron Gates continuous through-

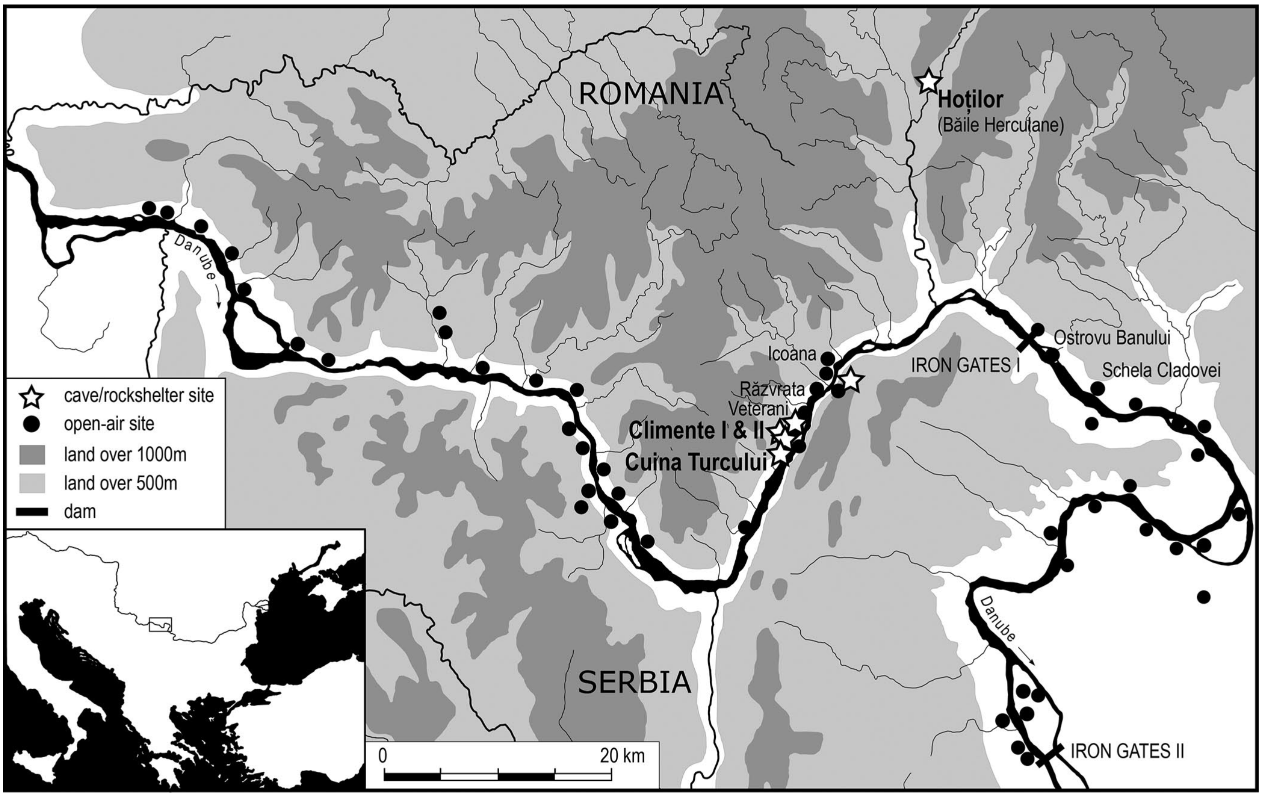

Fig. 1. Iron Gates sites with evidence of later Stone Age occupation. Named sites have a documented or presumed Epigravettian component.

out the period, (ii) are the archaeological remains that have been assigned to this period part of a unitary cultural entity?

Final Palaeolithic, Epipalaeolithic or Early Mesolithic?

Any discussion of the archaeology of the Iron Gates is made more difficult by inconsistent use of terminology (*fig. 2*).

Some authors have applied the terms 'Epipalaeolithic' to the Lateglacial hunter-gatherers of the Iron Gates and 'Mesolithic' to those of the Early Holocene (e.g. Păunescu 2000; Borić 2011). Others have tended to regard 'Epipalaeolithic' and 'Mesolithic' as synonyms and applied these terms either to the whole of the time-range from c. 15.000 – 8100 cal BP (e.g. Boroneanț 2000; Bonsall 2008), or restricted them to the Early Holocene denoting Lateglacial finds as 'Final Palaeolithic' (e.g. Mihailović 2008).

Inter-regional comparisons with better documented sequences in Italy and southwest France resulted in the introduction of cultural labels such as 'Azilian', 'Romanellian', 'Romanello-Azilian' and 'Tardigravettian' to characterize the Lateglacial finds from the Iron Gates, although these terms were largely abandoned elsewhere following Bartolomei et al.'s (1979) revision of the Late Upper Palaeolithic sequence in Italy and their use of the term 'Epigravettian' in place of Tardigravettian. For example, in their review of the European Upper Palaeolithic, Djindjian et al. (1999, 302 – 309) treat the Iron Gates sites as part of their 'Mediterranean Final Epigravettian' technocomplex.

Some Romanian archaeologists, whilst acknowledging the external parallels, have preferred to differentiate the Lateglacial assemblages from the Iron Gates by the use of the cultural label 'Clisurean', derived from a local name (Clisura Dunării) for the Romanian part of the Iron Gates gorge (e.g. Nicolăescu-Plopşor et al. 1965; Boroneanț 2000).

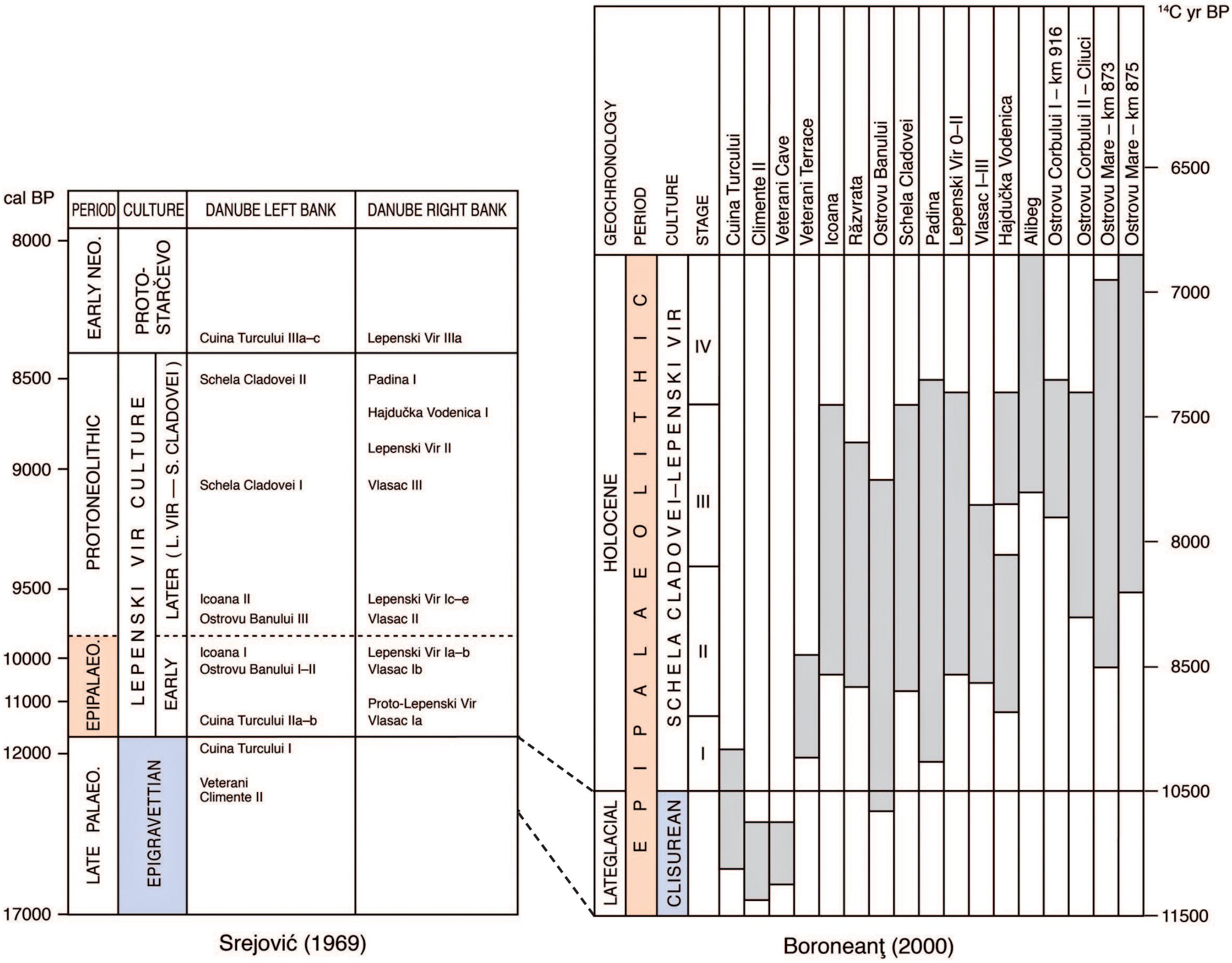

Fig. 2. Periodization, chronology and terminology of the later Stone Age in the Iron Gates, according to Srejović (1969) and Boroneanț (2000).

Site	Hor.	Original cultural designation	Formal tools	Debitage	Total	References
Cuina Turcului	I	'Romanello-Azilian'	1340	27,012	28,352	Păunescu 1970; 1978; 2000
Cuina Turcului	II	'Romanello-Azilian'	2022	42,240	44,262	Păunescu 1970; 1978; 2000
Climente II		'Late Epigravettian to Early Romanellian'	514	5864	6378	Boroneanț 1970
Ostrovul Banului	I–II	'Romanellian'	256	3337	3593	Boroneanț 1970
Hoților		'Azilian' / 'Clisurean'	86	978	1064	Nicolăescu-Plopşor/ Păunescu 1961; Nicolăescu-Plopşor et al. 1965; Păunescu 2002
Climente I		'Proto-Clisurean'	94	230	324	Boroneanț 1973

Tab. 1. Lithic artefact inventories from Epigravettian horizons (artefact totals after Păunescu 2000; 2002).

Epigravettian ('Clisurean') in the Iron Gates

Research undertaken in the second half of the twentieth century led to the recognition (or presumption) of Lateglacial occupations in a number of sites in the Iron Gates region (*fig. 1*). The first finds were made in the 1950s at Peștera Hoților (Thieves' Cave) at Băile Herculane in the valley of the river Cerna (Nicolăescu-Plopşor/Păunescu 1961). Most finds, however, were made at sites along the Romanian bank of the Danube between 1964 and 1969 during rescue excavations linked to the construction of the Iron Gates I dam. Epigravettian 'layers' were recognized in the rockshelter of Cuina Turcului and the cave sites of Climente I and II, as well as in the open-air site of Ostrovu Banului (Boroneanț 1970; 1973; Păunescu 1970; 1978). In several other sites, Epigravettian occupations were posited on the basis of artefact typology – at Veterani Cave by Boroneanț (1973; 2000), and at the open-air sites of Răzvrata, Veterani Terasă, Icoana and Schela Cladovei by Păunescu (1989; 2000). At none of these sites, however, is there supporting evidence of Lateglacial occupation from stratigraphy or radiocarbon dating (see Discussion).

Of the five 'main' sites, the most productive archaeologically was Cuina Turcului rockshelter where two 'Tardigravettian' horizons were distinguished (Cuina Turcului levels I and II) separated by sterile deposits. In at least one part of the cave the younger of these horizons (II) was subdivided into two levels (IIa and IIb), again separated by supposedly sterile deposits (Păunescu 1970; 1978; 2000). Above the Epigravettian deposits was another allegedly sterile horizon, overlain by deposits containing Early Neolithic (Starčevo-Criș culture) remains.

Finds attributed to the Epigravettian layers included more than 70.000 chipped stone artefacts, coarse stone tools, fragments of ochre and graphite, and abundant faunal remains including numerous artefacts made from bone, antler, tooth and shell. The chipped stone assemblage was predominantly of flint (96.8%) although other rock types (jasper, quartz/quartzite and obsidian) are represented. Some of the coarse stone tools were stained or 'painted' with red ochre. Among the bone tools are forms identified by Păunescu (2000) as awls, projectile points, chisels and a harpoon fragment. A significant number of bone tools were decorated with incisions forming abstract patterns including repetitive geometric designs (parallel lines, zig-zags, triangles and lozenges), short irregular lines (isolated or in groups) and simple hatching and cross-hatching sometimes framed between two parallel lines. Such decorations were applied mainly to bone; only two antler fragments with incised decoration were found. Also attributed to the Epigravettian horizons were 15 pierced animal teeth (deer, wolf and wild boar), two pierced fish vertebrae, and pierced shells of freshwater and marine molluscs. According to Păunescu (2000, 344) no consistent typological differences could be observed between the bone artefact assemblages from the two main Epigravettian horizons, although Srejović (1969, 14) argued that the geometric motifs belonged to an earlier phase than the hatched motifs.

Excavations in Climente II cave identified a layer up to 70cm thick, interpreted as belonging to the period 'from the end of the Epigravettian to the beginning of the Romanellian' (Boroneanț 1970, 2). From this layer were recovered nearly 6000 chipped stone artefacts, over 40 bone and antler artefacts (including a broken harpoon head and two decorated pieces), four pierced animal teeth (deer, wolf), a *Dentalium* shell, a number of river pebbles some of which were described as 'painted' with red ochre, and several lumps of red ochre and haematite (Boroneanț 1979, 176; Păunescu 2000, 368–372). Faunal remains from the same layer comprised those of large mammals (red deer, wild boar, brown bear), small mammals (beaver, fox, hedgehog), birds and fish (Păunescu 2000, 373).

The other sites where Epigravettian horizons were recognized produced much smaller amounts of material (*tab. 1*). At Climente I a 'proto-Clisurean' horizon (Boroneanț 1973) was identified in a 5.7 m thick sequence of deposits that also contained 'Mousterian', 'Aurignacian' and 'post-Palaeolithic' layers. A similar sequence was recorded in Peștera Hoților where a 10–15 cm thick 'Azilian' ('Clisurean') layer, within which were hearths and areas of darker soil containing charcoal and ash, occurred directly above an Aurignacian level (Nicolăescu-Plopşor/Păunescu 1961; Nicolăescu-

Plopşor et al. 1965). At Ostrovul Banului two 'Romanellian' levels were identified below deposits assigned to the Mesolithic 'Schela Cladovei culture' (Boroneanț 1970).

Human remains occurred in the Epigravettian deposits at Cuina Turcului and Climente II. At Cuina Turcului disarticulated remains were recovered from both the Epigravettian and Early Neolithic parts of the sequence. The 'Tardigravettian I' horizon produced two permanent molars, while bones from four individuals (three adults and a foetus) were attributed to the 'Tardigravettian IIa' horizon (Păunescu 1970; 1978). At Climente II bones of at least two individuals were recovered from different parts of the cave. They comprised (i) the articulated skeleton of an adult male lying on the left side with the legs tightly flexed and lacking the cranium, many of the bones being stained with red ochre; and (ii) some teeth and fragments of bones that 'seem to be from a child's skeleton' (Boroneanț 1979, 176).

In previous studies of these sites most attention was focused on the lithic assemblages, which were used both as a means of dating the sites and of establishing intra- and extra-regional comparisons. The most detailed accounts of the lithic assemblages from the Iron Gates Epigravettian sites were provided by Păunescu (2000; 2002) who inventoried the formal tools using the Upper Palaeolithic type list of Sonneville-Bordes and Perrot (1953; 1954; 1955; 1956a; 1956b). The results of his analyses for the eight largest assemblages are presented in tab. 2.

Păunescu also obtained radiometric radiocarbon dates from two sites (*tab. 3*). At Cuina Turcului the 'Tardigravettian I' horizon was dated by three radiometric ^{14}C measurements on pine charcoal ranging between 12.600±120 and 11.960±60 BP, while a radiometric date of 10.125±200 BP was obtained on a mixed sample of charcoal and burnt bone fragments from the 'Tardigravettian IIa' horizon (Păunescu 1970; 1978; 2000). From Peștera Hoților a radiometric date of 11.490±75 BP was obtained for burnt bones from a hearth (Păunescu 2002).

The present authors obtained new single-entity AMS radiocarbon dates as part of an ongoing re-evaluation of the pre-Holocene settlement of the Iron Gates. Tables 4–5 present results for human remains and humanly modified animal bones from Epigravettian levels at Climente II cave and Cuina Turcului. Dating of material from Climente II has proved especially difficult because of low collagen yield. Of a total of 13 samples submitted to the Oxford Radiocarbon Accelerator Unit, only six (two human, four ungulate) yielded sufficient collagen for dating.

Lab ID	Site	Context	Material	^{14}C age (BP)	Calibrated age (95% confidence)
Bln-803	Cuina Turcului	Layer I (Trench B 5.90–5.95m; hearth at base of layer.	Pine charcoal	12600±120	15290–14280 cal BP
Bln-804	Cuina Turcului	Layer I (Trench A 6.20–6.40m; hearth at base of layer.	Pine charcoal	12050±120	14205–13575 cal BP
GrN-12665	Cuina Turcului	Layer I (Trench S 5.70–5.88m; hearth at base of layer.	Pine charcoal	11960±60	14005–13595 cal BP
Bln-802	Cuina Turcului	Layer IIa (Intermediate A, 3.68-3.85m; hearth)	Charcoal, burnt bones	10125±200	12520–11210 cal BP
GrN-16987	Peștera Hoților	Sq. 3-4, 1.07–1.19m, S slope, hearth no. 3	Burnt bones	11490±75	13425–13160 cal BP

Tab. 3. Radiometric ^{14}C dates for Epigravettian levels at Cuina Turcului and Peștera Hoților.

SB-P no.	Tool type	Cuina Turcului level I		Cuina Turcului level II		Climente I		Climente II		Peștera Hoților		Ostrovul Banului		Icoana		Schela Cladovei	
		∑	%	∑	%	∑	%	∑	%	∑	%	∑	%	∑	%	∑	%
1	Simple endscraper	230	17.16	129	6.37			77	13.73	7	8.14	28	10.94	12	11.88	3	3.19
2	Atypical endscraper	66	4.93	58	2.87	2	2.12	21	3.74	2	2.33	8	3.13	16	15.84	3	3.19
3	Double endscraper	18	1.34	32	1.58			3	0.53			3	1.17				
4	Ogival endscraper	10	0.75	11	0.54			4	0.71	1	1.17	1	0.39				
5	Endscraper on retouched flake	20	1.49	28	1.38			18	3.21	5	5.82	2	0.78				
6	Endscraper on Aurignacian blade																
7	Fan-shaped endscraper	6	0.45	7	0.35			3	0.53			1	0.39	1	0.99		
8	Endscraper on flake	39	2.91	462	22.85	1	1.06	11	1.96			6	2.34	4	3.96		
9	Circular endscraper	111	8.28	195	9.64			23	4.10			16	6.25	6	5.94	12	12.77
10	Thumbnail endscraper	100	7.46	231	11.42			21	3.74	2	2.33	14	5.47	1	0.99		
11	Carinated endscraper	10	0.75	11	0.54			6	1.07	1	1.17	4	1.56	2	1.98		
12	Atypical carinated endscraper	15	1.11	4	0.2			3	0.53							2	2.13
13	Thick-nosed endscraper	4	0.3	3	0.15			5	0.89	1	1.17						
14	Flat-nosed (or shouldered) endscraper	7	0.52	4	0.2			6	1.07	2	2.33	2	0.78	1	0.99	1	1.06
15	Nucleiform endscraper	6	0.45	—	—			1	0.18								
16	Rabot																
17	Endscraper-burin	6	0.45	3	0.15												
18	Endscraper-truncated blade	4	0.3	2	0.1												
19	Burin-truncated blade	1	0.08	2	0.1					1	1.17	1	0.39				
20	Piercer-truncated blade	2	0.15	1	0.05												

SB-P no.	Tool type	Cuina Turcului level I		Cuina Turcului level II		Climente I		Climente II		Peștera Hoților		Ostrovul Banului		Icoana		Schela Cladovei	
		∑	%	∑	%	∑	%	∑	%	∑	%	∑	%	∑	%	∑	%
21	Piercer-endscraper	1	0.08	—	—											2	2.13
22	Piercer-burin	1	0.08	—	—												
23	Perforator	3	0.22	5	0.25			3	0.53	1	1.17						
24	Atypical perforator (bec)	7	0.52	9	0.44			8	1.43	1	1.17	2	0.78			3	3.19
25	Multiple piercer or bec	1	0.08	—	—					1	1.17						
26	Micro-perforator	4	0.3	1	0.05	1	1.06					1	0.39				
27	Dihedral straight burin	2	0.15	7	0.35	1	1.06	2	0.36	3	3.49	3	1.17	4	3.96	7	7.45
28	Offset dihedral burin	2	0.15	6	0.3												
29	Dihedral angle burin	3	0.22	8	0.39			2	0.36	3	3.49	2	0.78	2	1.98		
30	Angle burin on break	5	0.37	22	1.09			3	0.53	5	5.82	5	1.95	1	0.99		
31	Mulitple dihedral burin	1	0.08	3	0.15							1	0.39				
32	Burin busqué																
33	Parrot-beak burin																
34	Burin on straight re-touched truncation	1	0.08	4	0.2			1	0.18	1	1.17	1	0.39				
35	Burin on oblique re-touched truncation	2	0.15	3	0.15												
36	Burin on a concave truncation	1	0.08	1	0.05												
37	Burin on convex truncation							1	0.18								
38	Transverse burin on lateral reotuch							1	0.18								
39	Transverse burin on lateral preparation																

SB-P no.	Tool type	Cuina Turcului level I		Cuina Turcului level II		Climente I		Climente II		Peștera Hoților		Ostrovul Banului		Icoana		Schela Cladovei	
		∑	%	∑	%	∑	%	∑	%	∑	%	∑	%	∑	%	∑	%
40	Multiple truncation burin	1	0.08	3	0.15												
41	Multiple mixed burin	—	—	1	0.05												
42	Noailles burin																
43	Core-like burin	1	0.08	1	0.05												
44	Flat-faced burin																
45	Abri Audi type backed knife																
46	Chatelperron knife or point																
47	Atypical Chatelperron point																
48	Gravette point	3	0.22	11	0.54	5	5.33	4	0.71			2	0.78				
49	Atypical Gravette point	—	—	1	0.05												
50	Micro-gravette	20	1.49	59	2.92	3	3.19	12	2.14			14	5.47				
50a	Lamellar leaf point with bilateral retouch					5	5.33										
51	Truncated element															1	1.06
52	Font-Yves point																
53	Backed gibbous piece	4	0.3	4	0.2			3	0.53	1	1.17						
54	Fléchette																
55	Tanged point																
56	Perigordian shouldered point	—	—	1	0.05												
57	Shouldered piece	5	0.37	10	0.49			1	0.18			1	0.39				
58	Complete backed blade	13	0.97	14	0.69	2	2.12	4	0.71	1	1.17	1	0.39				
59	Partly backed blade	4	0.3	11	0.54	1	1.06	3	0.53								

SB-P no.	Tool type	Cuina Turcului level I		Cuina Turcului level II		Climente I		Climente II		Peștera Hoților		Ostrovul Banului		Icoana		Schela Cladovei	
		∑	%	∑	%	∑	%	∑	%	∑	%	∑	%	∑	%	∑	%
60	Piece with straight truncation	8	0.6	6	0.3			5	0.89	2	2.33	5	1.95	3	2.97		
61	Piece with oblique truncation	7	0.52	3	0.15							1	0.39				
62	Piece with a concave truncation	3	0.22	3	0.15			1	0.18								
63	Piece with convex truncation			3	0.15												
64	Double truncation							1	0.18								
65	Continuously retouched piece – one edge	52	3.88	13	0.64	2	2.12	9	1.60			2	0.78			7	7.45
66	Continuously retouched piece – two edges	10	0.75	3	0.15	3	3.19										
67	Aurignacian blade																
68	Notched or waisted Aurignacian blade																
69	Pointe à face plane																
70	Laurel leaf																
71	Willow leaf																
72	Solutrean shouldered point																
73	Pick																
74	Notched piece	25	1.86	33	1.63	5	5.33	22	3.92	2	2.33	8	3.13	2	1.98	3	3.19
75	Denticulated piece	8	0.6	23	1.14	3	3.19	15	2.67	1	1.17	2	0.78	3	2.97		
76	Splintered piece	46	3.43	60	2.97			18	3.21	3	3.49	22	8.59	19	18.81	25	26.60
77	Sidescraper	60	4.48	35	1.73	3	3.19	77	13.73	4	4.66	13	5.08	7	6.93	5	5.32
78	Raclette	76	5.67	38	1.88			25	4.46	5	5.82	21	8.20	17	16.83	3	3.19
79	Triangle	31	2.31	7	0.35			3	0.53	3	3.49	1	0.39				
80	Rectangle	1	0.08	5	0.25					1	1.17					1	1.06

SB-P no.	Tool type	Cuina Turcului level I		Cuina Turcului level II		Climente I		Climente II		Peștera Hoților		Ostrovul Banului		Icoana		Schela Cladovei	
		∑	%	∑	%	∑	%	∑	%	∑	%	∑	%	∑	%	∑	%
81	Trapeze	9	0.67	3	0.15			1	0.18	2	2.33	2	0.78				
82	Rhomb																
83	Lunate (segment of circle)	63	4.7	58	2.87			26	4.63	2	2.33	2	0.78				
84	Truncated bladelet	25	1.86	39	1.93			10	1.78	1	1.17	13	5.08			3	3.19
85	Backed bladelet	67	5	137	6.77	43	45.76	34	6.06	6	6.98	18	7.03			1	1.06
86	Truncated backed bladelet	20	1.49	32	1.58	1	1.06	4	0.71	2	2.33	2	0.78				
87	Denticulated backed bladelet	—	—	6	0.3			1	0.18							1	1.06
88	Denticulated blade-let	3	0.22	17	0.84			6	1.07			3	1.17				
89	Notched bladelet	35	2.61	57	2.82			7	1.25	2	2.33	9	3.52			1	1.06
90	Dufour bladelet	5	0.37	14	0.69	10	10.65	7	1.25	3	3.49	7	2.73			7	7.45
91	Azilian point	31	2.31	35	1.73	1	1.06	29	5.17	6	6.98	6	2.34			3	3.19
92	Divers	15	1.12	24	1.19	2	2.12	10	1.78	2	2.33						
	Totals:	**1340**		**2022**		**94**		**561**		**86**		**256**		**101**		**94**	

Tab. 2. Typological analysis of Epigravettian assemblages, based on Păunescu (2000; 2002). 'SB-P' refers to the type list of Sonneville-Bordes/Perrot (1953; 1954; 1955; 1956a; 1956b).

Site	Lab ID	Sample details	Context	Body position	^{14}C age (BP)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	C/N	Corrected age BP	Calibrated age (95% confidence)
Climente II:	OxA-22042/24990	Burial 1, adult, male, L femur	Trench IV, sq. 2	Flexed	12565±37	-18.5	13.8	3.3	12220±58	14375–13925 cal BP
Cuina Turcului:	OxA-19203	'Individual 1', adult, female, L humerus	Trench M, 'Tardi-gravettian' level II	?	10435±45	-19.4	15.2	3.3	10003±71	11795–11245 cal BP
Cuina Turcului:	OxA-19202	'Individual 2' (687), adult, male?, 25–35yr, L ulna	Trench B, 'Tardi-gravettian' level II	?	10350±45	-19.3	15.2	3.3	9918±71	11695–11200 cal BP

Tab. 4. AMS ^{14}C dates for human remains from Epigravettian levels at Climente II and Cuina Turcului.

Lab ID	Year of excavation	Sample details	Context	^{14}C age (BP)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	C/N	Calibrated age (95% confidence)
OxA-26310	1968	*C. elaphus*, bone (metatarsal), split	Trench I, 0.80m	11970±55	-20.3	6.3	3.2	14025–13625 cal BP
OxA-26199	1968	*C. elaphus*, bone (tibia), worked to a crude point	Trench III, sq. 1, 0.95m	11880±55	-19.0	2.5	3.2	13805–13555 cal BP
OxA-25735	1968	*C. elaphus*, antler, worked	Trench II, 0.65m	10900±50	-20.6	5.0	3.1	12875–12690 cal BP
OxA-26198	1968	*C. elaphus*, bone (metacarpal) with cutmarks	Trench II, 0.25m	10840±50	-20.6	5.4	3.2	12805–12680 cal BP

Tab. 5. AMS ^{14}C dates on humanly modified animal bones from Epigravettian deposits at Climente II.

Discussion

The Epigravettian evidence from the Iron Gates has some obvious limitations, arising partly from the 'rescue' nature of the original excavations. The work was often undertaken rapidly with limited resources and (in the case of the cave sites) without the benefit of artificial lighting. Consequently, recovery and recording methods were rather coarse grained. The problems have been compounded by the lack of detailed excavation reports for all sites except Cuina Turcului (Păunescu 1970; 1978).

Păunescu's typological analysis of the chipped stone assemblages (*tab. 2*) was accompanied by drawings of representative series of the formal tools from the various sites (Păunescu 2000, fig. 143–144, 146–148, 153, 156, 159, 161, 164, 165, 174, 211; 2002, 18). This dataset is used here for comparative purposes, but with some qualification. For example, Păunescu recognized 'carinated endscrapers' (SB-P #11–12) and 'Dufour bladelets' (SB-P #50) in many of the assemblages he assigned to the 'Tardigravettian'. Yet these types are rarely, if ever, present in Epigravettian assemblages elsewhere in Europe, being among the defining elements of Early Upper Palaeolithic Aurignacian industries. Most likely the 'carinated endscrapers' and 'Dufour bladelets' listed in tab. 2 are typological misidentifications, although stratigraphic mixing between Aurignacian and Epigravettian horizons at Peștera Hoților cannot be ruled out.

As will be evident from tab. 2, the three largest assemblages – from Cuina Turcului levels I and II and Climente II – share a number of specific tool types, including backed bladelets, Gravette points, microgravettes, curved backed pieces (Azilian points), geometric microliths (lunates, triangles, trapezes and rectangles) and short endscrapers (especially thumbnail endscrapers). Combination tools, particularly double endscrapers – which are rare in later ('Mesolithic') contexts in the Iron Gates – also occur in all three assemblages. Individually, these types are not diagnostic, but in combination they are typical of the Late or Final Epigravettian in Southeast Europe (cf. Karavanić et al. 2013).

Backed bladelets, Azilian points, geometric microliths and thumbnail endscrapers are also present in the much smaller assemblage from Peștera Hoților, which is dated to the Lateglacial by a single radiocarbon determination. Likewise, the assemblage from Ostrovul Banului levels I–II contains Azilian points, geometric microliths, thumbnail endscrapers and double endscrapers; but in this case there are no supporting ^{14}C dates, which has led some researchers (e.g. Borić 2011, 165) to question whether this site actually contained an Epigravettian component.

The small assemblage from Climente I differs from the other sites. There are no thumbnail endscrapers or lunates, and only one (atypical) Azilian point. The formal tools include backed bladelets, Gravette points and what Păunescu described as 'leaf points with bilateral retouch'. The last mentioned are conspicuously absent from the Epigravettian assemblages from Climente II, Cuina Turcului and Peștera Hoților. Păunescu found no equivalent in the SB-P typelist, and added them to the list as a new type (#50a). However, judging from the published illustrations (Păunescu 2000, fig. 153.17–20) they resemble fléchettes (SB-P #54) and generally the assemblage from Climente I has a Gravettian rather than Epigravettian aspect. It should be noted that initially V. Boroneanț (1968) and Păunescu (1973) interpreted the Climente I assemblage as 'Gravettian'. Both later revised their opinions, the latter describing it as 'Tardigravettian' (Păunescu 2000), and the former as 'Proto-Clisurean' (Boroneanț 2000) reflecting his view that it relates to an earlier period than the 'Clisurean' assemblages from Climente II, Cuina Turcului and Peștera Hoților.

The Epigravettian 'status' of the assemblages from Veterani Cave, Veterani Terasă, and the open-air sites of Răzvrata, Icoana and Schela Cladovei, which was based purely on artefact typology (Păunescu 2000), is equally insecure. The assemblages from these sites are small and lack many of the more definitive tool types found in the Epigravettian levels at Climente II, Cuina Turcului and Peștera Hoților. For example, from the presumed 'Tardigravettian horizon' at Icoana (cf. Păunescu 2000) there are no Gravette points, microgravettes, backed bladelets, Azilian points or geometric microliths, and only a single thumbnail endscraper, while among 94 'Tardigravettian' chipped stone tools from Schela Cladovei Păunescu identified just three Azilian points and one backed bladelet, but no Gravette points, microgravettes, geometric microliths or thumbnail endscrapers (*tab. 2*). More importantly, the large series of single-entity AMS ^{14}C dates on animal and human bones that have since been obtained for these two sites (25 from Icoana, and 58 from Schela Cladovei) provide no indication of hunter-gatherer occupation of either site in the Lateglacial or the very early Holocene (Bonsall 2008; Bonsall et al. 2015). A difference in age between Icoana and Cuina Turcului levels I–II had previously been suggested by Bolomey's (1973) comparative analysis of the faunal remains from the two sites summarized in fig. 3, the key features of which are: (i) the absence of ibex, moose and horse from Icoana; (ii) the preponderance of wild pig and red deer at Icoana and their relative scarcity at Cuina Turcului, and (iii) the absence from Cuina Turcului levels I and II of dog (*Canis familiaris*), which is thought to have been a Holocene ('Mesolithic') domesticate in the Iron Gates (Bökönyi 1975; Dimitrijević/Vuković 2015).

In their analysis of Late Epigravettian assemblages from the eastern Adriatic, Karavanić et al. (2013) observed a reduction in the frequencies of backed bladelets and microgravettes, and an increase in Azilian points and lunates through time. The evidence for temporal change in the Epigravettian of the Iron Gates is more limited, and not entirely consistent with that from the eastern Adriatic; the only stratigraphic sequence is from Cuina Turcului where the percentages of Azilian points, lunates and triangles decrease between levels I and II, but the frequency of backed bladelets actually increases.

Fig. 4 presents AMS and radiometric ^{14}C dates for Epigravettian levels in Iron Gates cave sites alongside the earliest dates for open-air sites. The dates for Climente II, Cuina Turcului level I, and Peștera Hoților all fall in the time range of the Bølling-Allerød interstadial, ca. 14.700–12.700 cal BP. The reservoir corrected ages of the human remains from level II at Cuina Turcului are significantly later and fall around the beginning of the Holocene. However, there is some doubt about the association of human remains and artefacts in level II (cf. Boroneanț 2011). If the human and other archaeological remains from level II were contemporaneous, then this would imply that the Epigravettian assemblage from this horizon dates wholly or in part to the initial Holocene rather than the terminal Pleistocene. If, on the other hand, the human bones were from burials inserted into pre-existing deposits, then the Epigravettian assemblage from level II could be largely or entirely pre-Holocene in age.

A continuation of Epigravettian techno-typological traits into the Holocene would not be surprising given the similarity of the chipped stone assemblage from Padina A1–A2 (e.g. the presence of Azilian points, geometric microliths, thumbnail endscrapers and occasional double endscrapers) with that from Cuina Turcului level II (Radovanović 1996, 238, fig. 5.5), and the radiocar-

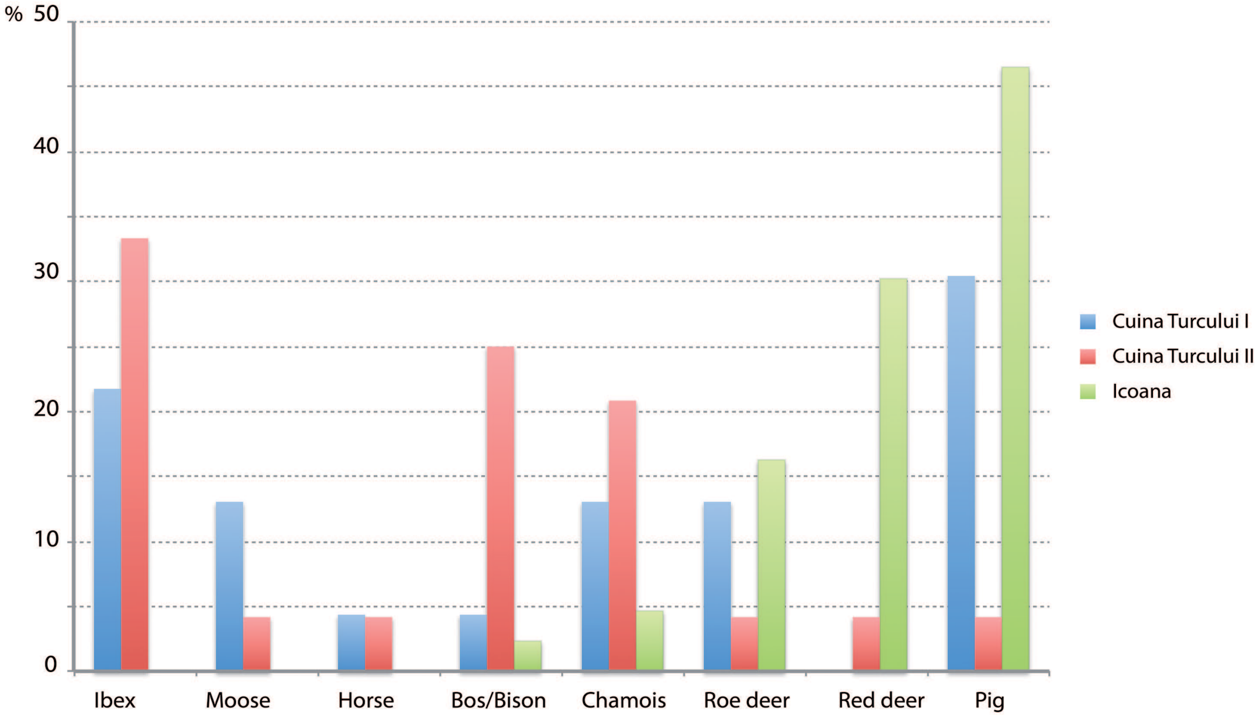

Fig. 3. Composition of the large-sized mammal assemblages from Cuina Turcului and Icoana (based on Bolomey 1973).

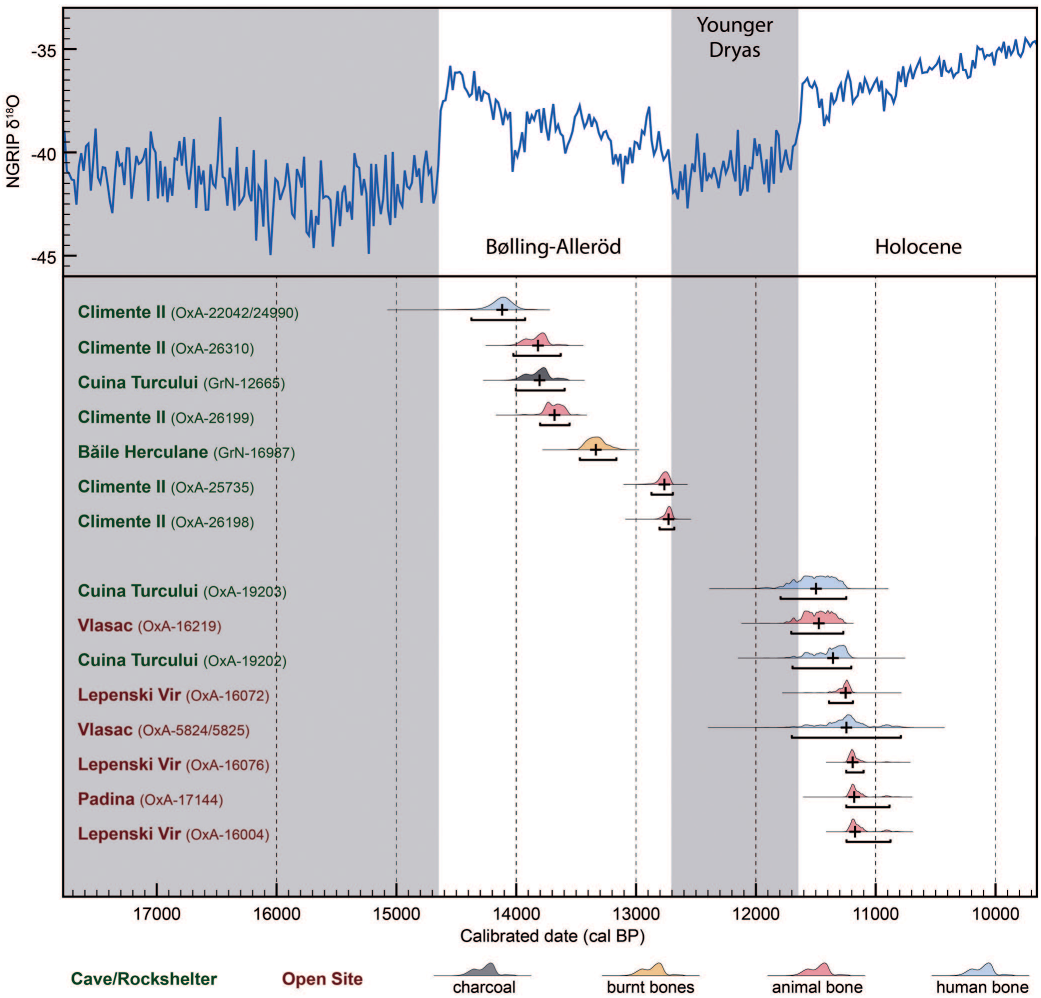

Fig. 4. Calibrated probability distributions of radiocarbon ages of archaeological samples from cave and open-air sites in the Iron Gates within the time range 15.000 to 11.000 cal BP, compared against the North Greenland (NGRIP) $\delta^{18}O$ ice record. Low precision dates (one-sigma errors greater than ±100 yr) have been omitted.

bon evidence of initial Holocene settlement at Padina (*fig. 4*; Borić/Miracle 2004). It should also be noted that some Final Epigravettian sites in Italy are radiocarbon dated to the early Holocene (Bietti 1990, 97).

A striking feature of fig. 4 is the absence of radiocarbon dates coinciding with the Younger Dryas cold event (ca. 12.700 – 11.700 cal BP). While this may represent a hiatus in the use of the rockshelter, such radiocarbon 'gaps' can also be the result of taphonomic factors or a function of the radiocarbon sampling strategy (cf. Mlekuž et al. 2008). It should be noted that all the animal bones dated from the cave sites (*tab. 5*) were red deer (*Cervus elaphus*), which was present in the Iron Gates region during the Bølling-Allerød interstadial and the Early Holocene but was likely rare or absent during the Younger Dryas. Ibex (*Capra ibex*), well represented in the faunal assemblages from levels I and II at Cuina Turcului (*fig. 3*), prefer more open habitats and are likely to have been more numerous than deer in the mountainous terrain surrounding the rockshelter during the Younger Dryas. Mihailović (2008, 15 f.) has even suggested that the survival of hunter-gatherers in the Iron Gates during the Younger Dryas would have been dependent on intensive hunting of ibex and chamois. Therefore, without AMS ^{14}C dates on ibex bones from the Epigravettian levels at Cuina Turcului it would be premature to conclude that there was no Younger Dryas occupation of the rockshelter.

Conclusions

Late or Final Epigravettian ('Tardigravettian') occupations were previously recognized in up to nine cave and open-air sites in the Iron Gates section of the lower Danube Valley. Our review of the typological, archaeofaunal, stratigraphic and radiocarbon evidence supports the existence of Lateglacial occupations in at least three sites: Hoților cave, Climente II cave and Cuina Turcului rockshelter. The 'proto-Clisurean' assemblage from Climente I cave may be Gravettian rather than Epigravettian, but this requires confirmation from radiocarbon dating. Likewise, the existence of an Epigravettian component in the open-air site on Ostrovul Banului, posited by V. Boroneanț and A. Păunescu on stratigraphic and typological evidence, requires support from radiocarbon dating. The case for Epigravettian occupations in Veterani Cave and at the open-air sites of Veterani Terasă, Răzvrata, Icoana and Schela Cladovei rested on ambiguous typological evidence, but has since been weakened by the acquisition of large series of AMS dates for Icoana and Schela Cladovei that suggest neither of these sites was occupied during the Lateglacial or very early Holocene.

Radiocarbon dates on animal and human bones from the Epigravettian levels in Hoților, Climente II and Cuina Turcului fall mainly in the Bølling-Allerød interstadial between 14.700 and 12.900 cal BP, although dates on human remains from the later of the two main Epigravettian levels at Cuina Turcului raise the possibility that the Epigravettian assemblages there are in part of Early Holocene age. The lack of ^{14}C dates corresponding to the Younger Dryas (12.900 – 11.700 cal BP) cold event may reflect a period when the cave sites were not used, or could be a function of the radiocarbon sampling strategy.

A striking feature of the Epigravettian assemblages from Cuina Turcului and Climente II is the presence of large numbers of bone tools, including many with incised decoration in various styles. Establishing a secure chronology for this material will be a priority in future research.

Clive Bonsall
University of Edinburgh
School of History, Classics and Archaeology
William Robertson Wing, Old Medical School
Teviot Place
UK-Edinburgh, EH89AG
C.Bonsall@ed.ac.uk

Adina Boroneanț
'Vasile Pârvan' Institute of Archaeology
Romanian Academy,
11 Henri Coanda St.
RO-010667 Bucharest
boro30@gmail.com

Bibliography

Bartolomei et al. 1979: G. Bartolomei/A. Broglio/A. Palma di Cesnola, Chronostratigraphie et écologie de l'Epigravettien en Italie. In: D. de Sonneville-Bordes (ed.), La Fin des Temps Glaciaires en Europe (Paris 1979) 297–324.

Bietti 1990: A. Bietti, The Late Upper Paleolithic in Italy. An Overview. Journal of World Prehistory 4, 1990, 95–155.

Bökönyi 1975: S. Bökönyi, Vlasac. An Early Site of Dog Domestication. In: A. T. Clason (ed.), Archaeozoological Studies. Papers at the Archaeozoological Conference 1974, Held at the Biologisch-Archaeologisch Instituut of the State University of Groningen (Amsterdam 1975) 167–178.

Bolomey 1973: A. Bolomey, An Outline of the Late Epipalaeolithic Economy at the Iron Gates. The Evidence on Bones. Dacia N.S. 17, 1973, 41–52.

Bonsall 2008: C. Bonsall, The Mesolithic of the Iron Gates. In: G. Bailey/P. Spikins (eds.), Mesolithic Europe (Cambridge 2008) 238–279.

Bonsall et al. 2015: C. Bonsall/R. Vasić/V. Boroneanț/M. Roksandic/A. Soficaru/K. McSweeney/A. Evatt/Ü. Aguraiuja/C. Pickard/V. Dimitrijević/T. Higham/D. Hamilton/G. Cook, New AMS ^{14}C Dates for Human Remains from Stone Age Sites in the Iron Gates Reach of the Danube, Southeast Europe. Radiocarbon 57.1, 33–46.

Borić 2011: D. Borić, Adaptations and Transformations of the Danube Gorges Foragers (c. 13,000–5500 cal. BC). An Overview. In: R. Krauss (ed.), Beginnings – New Research in the Appearance of the Neolithic between Northwest Anatolia and the Carpathian Basin. Papers of the International Workshop 8th–9th April 2009, Istanbul. Menschen – Kulturen – Traditionen 1 (Rahden/Westfalen 2011) 157–203.

Borić/Miracle 2004: D. Borić/P. Miracle, Mesolithic and Neolithic (Dis)Continuities in the Danube Gorges. New AMS Dates from Padina and Hajdučka Vodenica (Serbia). Oxford Journal of Archaeology 23.4, 2004, 341–371.

Boroneanț 1968: V. Boroneanț, Descoperiri gravettiene în Peștera lui Climente. Revista Muzeelor 5.6, 1968, 542–546.

Boroneanț 1970: V. Boroneanț, La période epipaléolithique sur la rive roumaine de Portes de Fer du Danube. Prähistorische Zeitschrift 45, 1970, 1–25.

Boroneanț 1973: V. Boroneanț, Recherches archéologiques sur la culture Schela Cladovei de la zone des Portes de Fer. Dacia N.S. 17, 1973, 5–39.

Boroneanț 1979: V. Boroneanț, Descoperiri arheologice în unele peșteri din defileul Dunării. Speologia. Serie Monografica 1979, 140–181.

Boroneanț 2000: V. Boroneanț, Paléolithique supérieur final et Epipaléolithique dans la zone des Portes de Fer (Bucarest 2000).

Boroneanț 2011: A. Boroneanț, The Mesolithic in Banat. In: F. Draşovean/B. Jovanović (eds.), The Prehistory of Banat 1. The Palaeolithic and Mesolithic (Bucharest 2011) 103–141.

Dimitrijević/Vuković 2015: V. Dimitrijević/S. Vuković, Was the Dog Locally Domesticated in the Danube Gorges? Morphometric Study of Dog Cranial Remains from four Mesolithic–Early Neolithic Archaeological Sites by Comparison with Contemporary Wolves. International Journal of Osteoarchaeology 25, 2015, 1–30.

Djindjian et al. 1999: F. Djindjian/J. Kozłowski/M. Otte, Le Paléolithique supérieur en Europe (Paris 1999).

Karavanić et al. 2013: I. Karavanić/N. Vukosavljević/R. Šošić Klindžić/D. Kurtanjek/J. Zupanič, The Lithic and Bone Industries of the Epigravettian Layers from Šandalja II Near Pula. Vjesnik za Arheologiju i Povijest Dalmatinsku 106, 2013, 7–73.

Mihailović 2008: D. Mihailović, Lithic Technology and Settlement Systems of the Final Palaeolithic and Early Mesolithic in the Iron Gates. In: C. Bonsall/V. Boroneanţ/I. Radovanović (eds.), The Iron Gates in Prehistory – New Perspectives. BAR International Series 1893 (Oxford 2008) 11–18.

Mlekuž et al. 2008: D. Mlekuž/M. Budja/R. W. Payton/C. Bonsall, 'Mind the Gap'. Caves, Radiocarbon Sequences, and the Mesolithic–Neolithic Transition in Europe – Lessons from the Mala Triglavca Rockshelter Site. Geoarchaeology: An International Journal 23, 2008, 398–416.

Nicolăescu-Plopşor/Păunescu 1961: C. S. Nicolăescu-Plopşor/A. Păunescu, Azilianul de la Băile Herculane în lumina noilor cercetări. Studii și Cercetari de Istorie Veche 12, 1961, 203–210.

Nicolăescu-Plopşor et al. 1965: C. S. Nicolăescu-Plopşor/M. Davidescu/S. Roman/V. Boroneanţ, Cercetările arheologice de la Cazane. Studii și Cercetări de Istorie Veche 16.2, 1965, 407–441.

Păunescu 1970: A. Păunescu, Epipaleoliticul de la Cuina Turcului-Dubova. Studii şi Cercetări Istorie Veche şi Archeologice 21.1, 3–29.

Păunescu 1973: A. Păunescu, Cercetări paleolitice în jud. Botoşani (1970). Materiale si Cercetari Arheologice 10, 1973, 9–14.

Păunescu 1978: A. Păunescu, Cercetările arheologice de la Cuina Turcului-Dubova (jud. Mehedinţi). Tibiscus 5, 1978, 11–56.

Păunescu 1989: A. Păunescu, Le paléolithique et mésolithique de Roumanie (un bref aperçu). L'Anthropologie 93, 1989, 123–158.

Păunescu 2000: A. Păunescu, Paleoliticul şi mezoliticul din spaţiul cuprins între Carpaţi şi Dunăre (Bucharest 2000).

Păunescu 2002: A. Păunescu, Paleoliticul şi mezoliticul din spaţiul transilvan (Bucureşti 2002).

Radovanović1996: I. Radovanović, The Iron Gates Mesolithic. International Monographs in Prehistory. Archaeological Series 11 (Ann Arbor 1996).

Sonneville-Bordes/Perrot 1953: D. de Sonneville-Bordes/J. Perrot, Essai d'adaptation des méthodes statistiques au Paléolithique supérieur: prémiers résultats. Bulletin de la Sociéte Préhistorique Française 50, 1953, 323–333.

Sonneville-Bordes/Perrot 1954: D. de Sonneville-Bordes/J. Perrot, Lexique typologique du Paléolithique supérieur. Bulletin de la Sociéte Préhistorique Française 51.7, 1954, 327–335.

Sonneville-Bordes/Perrot 1955: D. de Sonneville-Bordes/J. Perrot, Lexique typologique du Paléolithique supérieur. Bulletin de la Sociéte Préhistorique Française 52.1/2, 1955, 76–79.

Sonneville-Bordes/Perrot 1956a: D. de Sonneville-Bordes/J. Perrot, Lexique typologique du Paléolithique supérieur. Bulletin de la Sociéte Préhistorique Française 53, 1956, 408–412.

Sonneville-Bordes/Perrot 1956b: D. de Sonneville-Bordes/J. Perrot, Lexique typologique du Paléolithique supérieur. Bulletin de la Sociéte Préhistorique Française 53, 1956, 547–559.

Srejović 1969: D. Srejović, The Roots of the Lepenski Vir Culture. Archaeologia Iugoslavica 10, 1969, 13–21.

PETRU CIOCANI

The Mesolithic-Neolithic Transition in the Iron Gates Region

Keywords: transition, Mesolithic, Neolithic, Iron Gates, adaptive strategies

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Introduction

The Mesolithic-Neolithic transition represents on a large scale the transition between two fundamentally different economies and ways of living, with foraging on one and farming on the other side. On a smaller scale it represents a variety of complex transformational processes, ranging from the centres where it first occurred to the regions into which it was transmitted. This transition including social, cultural, ideological, economic and technological changes occurred in different regions at different times and in different ways.

The roots of these social changes were in the Pleistocene-Holocene transition, when the end of the last glacial period marked the beginning of the Mesolithic age in western Eurasia. This age represents, on one hand, a continuity of development from the previous period (Upper Palaeolithic), during which high achievements were reached and only one species of hominids survived. On the other hand, it is also marked by a series of changes and transformations. A trigger for these changes were the rising temperatures during the Early Postglacial period, affecting the environment leading to modifications of the biotope. Therefore, together with the retreat of the ice sheet, the glacial flora and fauna was displaced by new vegetation and animals, specific to the warmer climate. Thus, the steppes were replaced by deciduous forest and the glacial large fauna was replaced by forest fauna. All of the changes in the environment directly influenced the Mesolithic communities. In addition, the scale of these environmental changes was very high, a fact which can be observed in the global sea level rise, marked by an increase of more than 120 meters since the Last Glacial Maximum (Flemig et al. 1998). Therefore, the impact on Mesolithic communities, which had to adapt their way of life to these ecological transformations, was also high. These adaptive processes were very complex and different from region to region, consisting of a large range of reforms in the social, cultural, economic and technological spheres (Kozłowski 1996, 150 f.).

Given the fact that the existing flora and fauna constituted the nutritional resources of the communities, all the mentioned changes also in the biotope represented changes in the availability of these resources. Therefore, one of the most affected segments was the subsistence, requiring an adaptation of the economy to the newly available resources. When analysing the different Eurasian Mesolithic societies these innovations can be observed, and although they differ from region to region, it is possible to distinguish some general tendencies. The most common ones are the innovations in hunting practices and techniques, which were adjusted to the newly available forest fauna (Clark 1962, 100 f.). Beside these innovations two new adaptive strategies characteristic for the Mesolithic period can be identified:

1) The development of an economy based on aquatic resources, which became more accessible with the warming of the climate (Kozłowski 1996, 155; Merkyte 2003, 312; Bazzanella et al. 2007, 97). This new economy was convenient. Compared to hunting of the new available fauna it could yield larger caloric content at lower energy cost (Grupe et al. 2003, 180). In addition, fishing, was not exclusive, but usually was combined with other strategies, such as hunting and gathering. However, fishing could be applied only in the territories with large concentration of aquatic resources located in the vicinity of a large water supply such as a large river, lake, sea or ocean. Hence, a shift in the topography of the settlements can be observed (Merkyte 2003, 312). Different communities applied this strategy to different degrees of intensity, oscillating from minor to significant dependence on aquatic resources. In the cases where the dependence was intense over a long period of time it could lead to the formation of compact groups of sites in the vicinity of water, a decrease in mobility, an increase in the population density, activity specialization, as well as emergence of social stratification (Constandse-Westermann/Newell 1989).
2) The development of an economy based on management of wild resources with the aim of increasing the availability of certain wild plants and animals, and thus providing larger quantities of food (Zvelebil 1996, 164–167; Ronen/Winter 2001, 384). Similar to the first strategy, this one was always combined with others. In addition to this, in some cases the increased control over the wild resources over long periods of time led to their domestication (Diamond 1999, 106 f.; Riehl et al. 2013, 65).

The occurrence of the domestication process led step by step to the transition to food production, which produced a gradual transformation of the lifestyle. This transformation represents the transition from the Mesolithic to the Neolithic. Once the new way of life came about, it was transmitted to the surrounding territories and thus, most of the Mesolithic populations gradually adopted this new lifestyle (Diamond 1999, 108). The date at which the Mesolithic ended and the way in which the new lifestyle occurred varied from region to region. The closest region to Europe where the domestication and consequently the new way of life occurred was Southwest Asia. However, it took several thousand years until this new lifestyle was transferred to Southeast Europe.

The Iron Gates Area

One of the most important locations for investigating the Mesolithic-Neolithic transition in Southeast Europe is the region of the Iron Gates. Its importance is seen on one hand by the large concentration of sites (most of them with burials), and on the other hand by the long-term continuous occupation in the region. Although this region has a crucial role in our understanding of one of the most complex prehistoric processes, it has still not yet been adequately researched. The investigations in this region began in the early 1960s prior to the construction of the hydroelectric dam with a series of field surveys, which were followed by rescue excavations. The limited time allocated to the excavations and consequently the submergence of most of the sites led to a large loss of information (Boroneanț/Dinu 2006, 48 f.; Boroneanț 2011, 110–113). Despite that, a few settlements remained not submerged, where the excavations continue and new analyses are carried out on the materials from museum collections.

This region has a special geographical location, being situated where the river Danube cross-es the Carpathian Mountains, forming a landscape with alternating narrow gorges separated by depressionary basins (*fig. 1*). This section of the river, which carves the limestone massifs by its erosive activity, continuous change in its direction and collects a series of tributary rivers, marks the beginning of the Lower Danube (Bonsall et al. 2008a, 1). Thus, this particular geographical configuration forms a series of different micro-climates which had a crucial importance during the climate changes at the Pleistocene-Holocene transition, making the temperature oscillations less harsh (Radovanović 1996, 31; Boroneanț 2011, 107–109). Moreover, at the beginning of the Holocene, the new climatic conditions led to the spread of forest in the region together with its specific fauna, and thus, it was colonised by a large variety of terrestrial, arboreal and aerial animals representing an important nutritional resource. In addition to this, the second largest river in Europe provided a large amount of fish, with some species, like catfish and sturgeon, being able to reach impressive sizes. Since most of the sturgeon species migrated upstream twice per year to spawn, the gorges region with its strong currents, rocky bottom and well aerated nutrient rich water, provided an ideal habitat for these fishes and an excellent place for spawning. On the other hand, the natural topographic features, such as the high gradient of the river bed (falling 8m in 20km), the swift current slowing down the migration of fish, the water depth (reaching in some places 50m) and the narrowness of the river (only 170m in the Cazan gorges) offered special conditions for fishing and functioned as a natural trap (Bartosiewicz et al. 2008, 46; Dinu 2010, 299).

The special location at the intersection of the Danube and the Carpathian Mountains, the unique geographical conditions, particularly the presence of micro-climates, the abundant nutritional resources (terrestrial and aquatic) and the raw materials made the region very attractive especially during the Pleistocene-Holocene transition when it represented a refuge. This region was populated since the Upper Paleolithic (Băltean 2011, 50–55; Mihailović et al. 2011, 88), but during the Mesolithic it is the most densely inhabited region in Southeast Europe (Borić 2005, fig. 3.1), occupying a special place in European prehistory. Its ca. 20 Mesolithic sites are distributed unevenly in the territory, mostly concentrated in the gorge sector (*fig. 2*). Since the transition has its roots in the Epipaleolithic and its effects continue until the Late Neolithic, I will present here the cultural development covering this span of time.

Epipaleolithic (13.000 – 9500 BC) and Early Mesolithic (9500 – 7200 BC)

The following sites can be attributed to these periods: Cuina Turcului, Hoților Cave, Lepenski Vir, Padina, Vlasac, Climente II (?), Veterani Cave (?), Ostrovul Banului (?), Haidučka Vodenica (?) (Dinan 1996a; 1996b; Boroneanț 2012, 40 f.; Borić 2011, 166). During most of this time, the temperatures were much lower than today; however, the Iron Gates region with its special location, played a role as a refuge area for numerous plants creating a contrast between the flora inside and outside this region (Chapman 1989, 506). This island of vegetation surrounded by steppes attracted a large spectrum of animals creating good conditions for human populations.

These two periods have been insufficiently investigated and are thus inadequately understood. The assignation of most of the sites from the left side of the river to these periods is questionable and on the other side of the river only a certain number of burials can be definitely assigned to these periods. For this reason, the current study presents both periods together and includes only the most reliable and significant data. There is a tendency in the location of the settlements, which can be observed. During the first period, caves and rock shelter sites were preferred, while in the Early Mesolithic open-air sites became characteristic. From both periods, very few architectural remains have been discovered and studied, and those which have been found are mainly rounded hearths (Păunescu 1979, 14).

The lithic industry from both periods is characterised by microlithic assemblages consisting of retouched blades and bladelets, backed blades, endscrapers, geometric segments, points, burins and denticulated tools (Păunescu 1970, 13). During the Early Mesolithic most of these tools were manufactured out of local flint, being grey, brown,

Fig. 1. The Small Cauldrons in the Iron Gates region (photo taken on 07.09.2014).

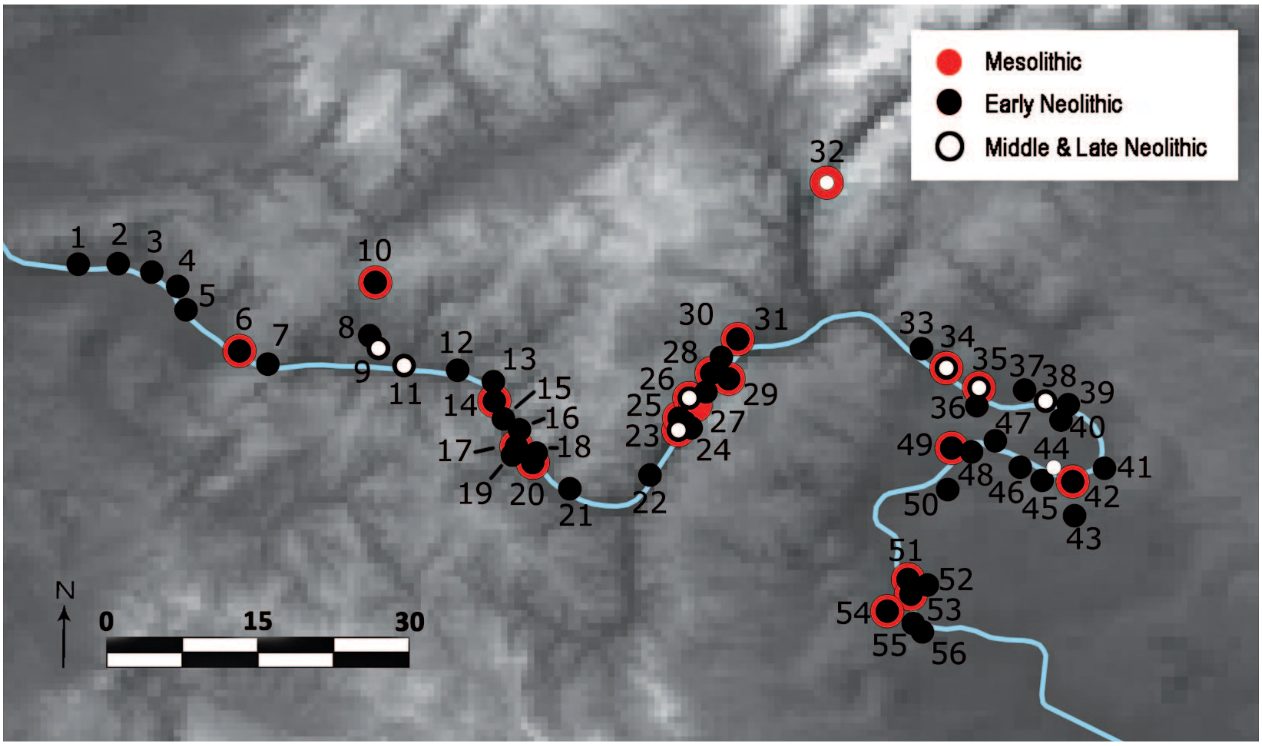

Fig. 2. The distribution of the Mesolithic and Neolithic sites in the Iron Gates region (after Boronenanț 2012, fig 1, modified). 1. Divici; 2. Șușca; 3. Pojejena; 4. Măcești; 5. Moldova Veche; 6. Alibeg; 7. Sf. Elena; 8. Sichevița; 9. Gornea; 10. La Hoțu Cave; 11. Liubcova; 12. Berzasca; 13. Cozla; 14. Padina; 15. Subica; 16. Ilișova; 17. Lepenski Vir; 18. Izlaz; 19. Aria Babi; 20. Vlasac; 21. Svinița; 22. Tișovica; 23. Cuina Turcului; 24. Gaura Ponicovei; 25. Climente I & II; 26. Veterani Cave & Terasă; 27. Sacoviștea Mare; 28. Răzvrata; 29. Haidučka Vodenica; 30. La Balon; 31. Icoana; 32. Băile Herculane; 33. Gura Văii – La Baraj; 34. Ostrovu Banului; 35. Schela Cladovei; 36. Donje Butorke; 37. Drobeta; 38. Ostrovu Șimian; 39. Șimian; 40. Ajmana; 41. Ostrovu Corbului I; 42. Ostrovu Corbului II; 43. Scăpău; 44. Korbovo – Zbradila; 45. Baoți; 46. Tismana; 47. Vajuga – Pesak; 48. Vrancea; 49. Velesnica; 50. Crivina; 51. Ostrovu Mare – Km 873; 52. Ostrovu Mare – Schela; 53. Ostrovu Mare – Km 875; 54. Kula; 55. Knjepište; 56. Ušće Kameničkog potoka (map by S. Fröhle and S. Wettengl).

yellowish, or greenish in colour. However, there is a small amount of tools made of obsidian, radiolarite, jasper, quartzite, rock crystal and shales. One general difference can be observed between the two periods: the common use of high quality raw materials during the first period (Dinan 1996a, 18; 1996b, 29 f.) and the lower quality during the second, indicating a higher degree of mobility during the first period (Mihailović 2008). The bone and antler tools were present in large quantities mostly represented by awls, projectile points and harpoons (Boroneanț 2011, 114–118).

The Epipaleolithic subsistence was based mainly on hunting and, to a somewhat lesser degree, by fishing and gathering. The animals hunted were mammals and birds (Păunescu 1979, 14 f.). The presence of large amounts of fish bones indicate that from this early period on fish already played an important role in the diet (Boroneanț 2011, 116). For the Early Mesolithic, the stable isotope analysis, taken from radiometric dated skeletons, indicates a diet based on aquatic resources, but less pronounced than in the Late Mesolithic. Moreover, these studies indicate consumption of aquatic resources throughout the year, which implies a certain degree of reduced mobility (Bonsall 2008, 254).

Art is represented by adornments (beads and pendants) and decorated osseous objects. Between the two periods an artistic continuity can be observed, as geometric zigzags and net motives remained in use. In addition, there are similarities in the decorative motives from certain contemporaneous sites in the Apennine Peninsula. These similarities, as well as the presence of the snail *Cyclope neritea* in the Iron Gates, indicate the existence of supra-regional networks (Borić 2011, 165).

While the burial practices from the Epipaleolithic have been little researched (Păunescu 1979, 14), the burials from the Early Mesolithic are well studied. They are placed within the settlements, the most frequent position of the skeletons is the extended supine position, with arms and legs stretched. They are orientated perpendicular to the river with the head pointing in the opposite direction (Bonsall et al. 2008b, 180). Other positions are also documented as lying on the back or sitting with flexed legs splayed on both sides and crossed (lotus position), as well as lying on one side with legs slightly flexed (Boroneanț 2011, 120; Borić 2011, 166).

Late Mesolithic (7200 – 6300 BC)

The following sites were inhabited during this period: Hajdučka Vodenica, Răzvrata, Icoana, Ostrovul Banului, Ostrovul Corbului, Schela Cladovei, Padina, Vlasac, Ostrovul Mare, Veterani Terasă, Lepenski Vir (?) (Boroneanț 2012, 42; Borić 2011, 170–173). The temperatures were reaching the climatic optimum, diminishing the vegetational contrast inside and outside the region.

The sites were located in the vicinity of the Danube, usually near locations where fishing was most efficiently undertaken (Dinu 2010, 300; Bartosiewicz et al. 2008, 44). Most of the sites were open air, which can be divided into permanent, semi-permanent and temporary sites, with some of the sites perhaps acting as fishing camps or ritual centres (Boroneanț 2012, 44). All the sites were included into a complex internal social network (Bonsall 2008, 263). During this period the intensity of occupation in the sites is high, except for Lepenski Vir, which probably was not inhabited or the deposits were destroyed by later occupations (Borić 2011, 168 f.).

The architectural structures are represented by single roomed semi-sunken huts that have an oval or trapeze shape, with the latter having the entrance on the wider side. The floors of the dwellings are marked by scattered bone, antler and lithic fragments, some with traces of burning. Part of the structures contain hearths or large stones, presumably altars, located in their centre. Hearths were present inside, as well as outside the dwellings and are represented by two types – simple circular shaped and rectangular. The latter were bordered with stones and their interior was plastered with battered clay. They were mostly present on the right side of the river (Boroneanț 2011, 129 f.). Postholes and storage pits were also uncovered. According to D. Borić, during this period at the site of Vlasac for the first time red floors appeared, constructed of limestone mixed with sand inside the trapezoidal buildings (Borić 2011, 170).

The chipped lithic tools are represented by endscrapers, side scrapers, burins, notched tools, geometric segments, retouched blades, bladelets and raclettes. The raw material was obtained locally and it consists mainly of quarts and quartzite. As in most cases, flint occurs only in an insignificant amount. This increase in the use of local raw materials is related to the decreased residential mobility (Voytek/Tringham 1989, 497; Merkyte 2003, 311). During this period, besides the chipped tools, locally developed ground stone tools also appeared, which are distinguishable from the Neolithic ones. They are represented by mallet-scepters, mallet-weights, hammerstones, anvils, pounders, grindstones/polishers, whetstones, working plates, querns, mortars, fishing weights, sling-balls and pebble-axes. For their production, the people used local stones, mainly pebbles (Antonović 2008, 33–37). Other tools are made of bones (awls, needles, chisels, perforated bone flakes daggers, spatulas, projectile points), antlers (adzes, hoes, mattocks, picks, awls and harpoons), and boar tusks (Boroneanț 2011, 121–128). We have also to consider a large variety of tools made of less durable materials (wood, reed, leather and other organic materials), which are not preserved.

The subsistence, similary to the Early Mesolithic one, was based on both terrestrial and aquatic resources, with an emphasis on the aquatic resources. The difference ist that in the late Mesolithic the dependence on the riverine resources was largely increased, reaching up to 60–80% of the diet (Bonsall 2008, 260; Boroneanț 2012, 43). The faunal remains in the settlements include a large variety of mammals (chamois, ibex, wild pig, elk, red deer, roe deer, hedgehog, wild horse, wolf, wild cat, brown bear, beaver, badger, pine marten, aurochs, wisent, European ass, elk, hare, fox), fishes (bream, barbel, sneep, European carp, European perch, asp, northern pike, zander, catfish, chub, Danube salmon, orfe, sterlet, Russian sturgeon, beluga and small cyprinidae), birds (grouse and jackdaw), molluscs (mussel and snail) and reptiles (turtle) (Boroneanț 2011, 121–128). Here it should also be mentioned that beside for their meat, the animals were also hunted for their fur, hide, feathers, as well as for their bones and antlers which were used for manufacturing most of the tools. The high amount of disarticulated and broken dog bones (the only domestic animal), with butchering marks on them present in the sites suggest that the dogs were consumed, probably during the cold period (Bonsall 2008, 262; Dimitriević 2008, 127). The region had a large variety of comestible wild plants (Radovanović 1996, 32); but when flotation was applied, their presence was scarce (Mason et al. 1996; Bonsall 2008, 260). As already mentioned, compared to the Early Mesolithic, there was an intensification in the use of the riverine resources, amongst which fish represent the largest amount. This intensification was possible due to the large amount of fish present in the river, and due to the good fishing conditions in this region. In addition, we have to take into account the size of the fish during the Mesolithic, when without pollution, over-exploitation and dams, some species could grow much larger than the modern ones (Bartosiewicz et al. 2008, 40). Most of the large fish were available only twice per year, during the spawning migrations (Bartosiewicz et al. 2008, 48). The increased reliability on fish consumption with an emphasis on the large seasonal species, required specialization, which included extensive knowledge of the behaviour of fish and sophisticated fishing techniques. In addition, the increased dependence on river resources influenced the location of the settlements in the immediate proximity to the river, the increase in the population density and the decrease in mobility (Chapman 1989, 508). Furthermore, together with the increase in the reliability on fish a new perception of fish was developed, reaching ideological significance and leading to its later sacralization, expressed in stone sculptures (Bartosiewicz et al. 2008, 51; Radovanović 1997, 88). The large quantity of captured fish, their size, as well as the seasonality of fishing suggests the presence of preserving and storage practices (Dinu 2010, 305); however very few traces of this activity have been preserved. Possible preserving and storage practices can be recognized in some small pits filled with fish bones and the rectangular stone-bordered pits (Boroneanț 2011, 131; Bonsall 2008, 261). In addition, the discovered parts of animal carcasses left in the houses could also be interpreted as evidence of preserving practices in the form of dried meat (Dimitriević 2008, 127). The presence of these practices further suggests a certain degree of sedentarisation, which could be supported by the easy availability of aquatic resources (Voytek/Tringham 1989, 494–496).

Artistic manifestations consist of adornments, stone sculptures and decorated osseous objects. The first group, include pendants and appliqués (pierced fish vertebras and Cyprinidae teeth), as well as beads (snail and mussel). Some of these shells are of maritime provenience. The second group consists of average-sized, carved river boulders with small circular depressions, including some that were painted with red ochre. The decorations on osseous and lithic objects show incised short lines, zigzagged lines, triangles, 'fishnet' pattern and hachures inside two parallel lines (Boroneanț 1996, fig. 1–12). Ochre and hematite chunks were also found separately in the sites. They had important symbolic value and were used primarily during funeral rituals for sprinkling or painting the body (Radovanović 1997, 87).

A large number of burials from this period have been excavated, most of them situated inside or within the periphery of the settlements. Sometimes the burial grounds show a long continuity – from the Early Mesolithic until the Late Mesolithic. The general burial rite was the single inhumation in rectangular graves. The most common position of the skeletons was stretched on the back with the hands on the pelvis or along the body. Most of the graves were oriented parallel to the river, with the heads of the skeletons pointing downstream. This burial position and orientation became characteristic for the period and continued into the following (Borić 2011, 174; Bonsall et al. 2008b, 180). It is also documented that parts of the skeletons, mainly skulls, were removed and subject to secondary burial either individually or together with parts of other individuals. This practice and the presence of cemeteries are another marker for a certain degree of sedentarisation. In some dwellings human mandibles were discovered on the floor, some of them showing traces of ochre. Additional burial rites include the practice of covering the body or the grave with stones, which might have served as markers. Beside human burials there is also one documented burial of dog. In some human graves bones of dogs were discovered as well. In a number of graves, ochre powdered skeletons, ochre fragments, tusk tools, arrow points on the chest, as well as teeth and shell beads were found. These elements can be interpreted as grave goods, however, they are not necessarily markers of social status differentiation (Bonsall 2008, 256–259; Boroneanț et al. 2001, 3 f.). In addition, in some of the graves arrow points embedded in the bones were discovered, sometimes presumably the cause of the death. Their presence suggests the existence of some internal or external conflicts (Bonsall 2008, 263 f.; Borić 2011, 171).

The small size of the settlements indicates a low number of inhabitants, while the dense settlement system suggests the existence of a wide internal social network, without which the communities would not have been viable. This network could have served for social intercourse, finding partners, exchanging goods and ideas, participating in social practices (e.g. fishing) as well as ritual practices and ceremonies (Bonsall 2008, 263). The visible uniformity in the material culture and particularly in the symbolic representations indicate an intensive ideological integration (Radovanović 1997, 89). The presence of marine shells, of Mediterranean origin (*Cyclope neritea*, *Columbella rustica*), also suggests the existence of a long-distance exchange network (Borić 2011, 170). These external relations indicate that the Mesolithic communities were not completely isolated and some goods, as well as ideas could circulate.

In conclusion, it can be seen that most of the features from earlier periods continued to exist, with very few changes. In addition to this, some processes that started earlier also continued. This was the case with the dependence on the aquatic resources, which continuously increased over time. Simultaneously with this increase, the focus was moved to larger fish, the sites were located closer to the fishing places, the communities became less mobile, and the use of the local raw materials increased. This long cultural development and the transmission of traditions with almost unobservable changes indicate a socio-cultural stability (Bonsall 2008, 276).

Final Mesolithic (6300 – 6000/5900 BC). The Transition

The following sites are assigned to this period: Lepenski Vir, Vlasac, Padina, Hajdučka Vodenica, Alibeg, Ostrovul Corbului and Ostrovul Mare (Boroneanț 2011, 132; Borić 2011, 176–179). This period partly coincides, on one hand with a short (ca. 200 year) period of intensive cooling known as the '8200 calBP event' (Weninger et al. 2007, 7 f.; Weninger et al. 2014, 8–13), and on the other hand with the emergence of the first Neolithic communities in the Central Balkans.

On the left side of the Danube this period has not been well studied. In addition, currently all the sites there are submerged, with the exception of Schela Cladovei, which was not inhabited during the Final Mesolithic. C. Bonsall interprets this period as a decrease in the activity of the sites caused by the 'Little Ice Age' suggesting the possibility of their relocation to the higher terraces (not surveyed) and the use of the riverbank sites as fishing camps only (Bonsall 2008, 264 f.). At the site of Alibeg, which was occupied during the end of this period, semi-sunken huts both oval and trapeze in shape continued to be used, having circular or rectangular hearths in their centre. The hearts were bordered with stones, with floors made of successive levels of a well-fired mixture of sand and limy clay. The lithic tools are made mainly from local quartz and quartzite, while flint, as during the Late Mesolithic, occurs only in a small percentage (5%). Artistic production is documented by large carved stone boulders situated on the floor of the house and personal adornments such as beads (Boroneanț 2011, 133 f.). By contrast, the sites on the right side of the Danube were intensively inhabited (Borić/Miracle 2004, 367). Trapezoidal buildings with rectangular stone-lined hearths in their centres are characteristic. Concerning the funeral traditions, as well as the use of the burial areas a continuity from the Late Mesolithic can be observed (Borić 2011, 176–179). The site of Lepenski Vir was flourishing during this period and probably became sacred and a ritual centre (Bonsall 2008, 265). New architectural elements like lime plastered reddish floors in the trapezoidal buildings and the large stone sculptures placed in the houses appeared (Borić 2011, 176). The graves were situated under the dwellings and around them. New elements of burial practices can be observed, such as the burials of neonates underneath house floors (Bonsall 2008, 274; Stefanović/Borić 2008, 158). In the site of Vlasac, during this period the dead were buried according to the Mesolithic rites. The diet was still aquatic based, while a new fashion of body decoration (Spondylus and limestone beads) is detectable (Borić 2007, 40 f.).

As mentioned above, during this time the first Neolithic settlements had already appeared in the Central Balkans. According to the radiometric analysis, the earliest Neolithic settlement is the site of Blagotin, dated to ca. 6200 BC, followed by the sites Kovačevo (Lichardus-Itten et al. 2006, 85), Anzabegovo and Grivac, dated to ca. 6100 BC (Manson 2008, 93). In addition, in the Iron Gates region ca. 6100 BC, the Neolithic settlement Ajmana, existed, where at least one of the analysed skeletons represents the first generation of migrants in the region (Borić 2011, 180). The isotope analysis (Borić/Price 2013, 3301) also show that among the burials in the site of Lepenski Vir several individuals dated to this period represent first-generation migrants in the region. The scarcity of Early Neolithic settlements can be explained as a consequence of the 8200 calBP cooling event, interpreted as a standstill in the Neolithic expansion (Bonsall 2008, 268 f.), but also by the state of research. Anyway, it is certain that during this period the first Neolithic settlements appeared in the Central Balkans and some even in close vicinity to the Mesolithic ones. With their presence in the region, the social interaction with the local Mesolithic communities began. It should be mentioned that unlike the Late Mesolithic, in this period there is no evidence of violence neither in the Mesolithic settlements, nor in the Neolithic ones. Societal interaction appears to have been expressed in exchange relationships, which were beneficial for both sides. Traces of this interaction particularly can be seen in the material culture of the Mesolithic settlements. Beside the occurrence of new elements in the architecture and burial practices mentioned above, which might be interpreted as Neolithic influence, in some of the Mesolithic sites appear unquestionably Neolithic elements, such as pottery sherds and crouched inhumation (Boroneanț 2011, 135). In addition, beside the local ground stone tools also those with cutting edges, characteristic for the Neolithic, appeared. There are axes, adzes and chisels used mainly for woodworking. For their production local and nonlocal stones were used (Antonović 2008, 35–37). Additionally, new types of adornments make their appearance (*Spondylus*, marble, nephrite and limestone beads) and along with them the body aesthetics was changed (Borić 2011, 179). The appearance of these imported materials suggest the presence of long-distance contacts. Moreover, in the Mesolithic site of Hajdučka Vodenica bones of domestic animals were discovered (Greenfield 2008b, 217) and the stable isotope analyses from Lepenski Vir, show that amongst the population (although depending mainly on an aquatic based diet), at least three adults lived from a terrestrial diet (Bonsall 2008, 274). Therefore, during this period the Mesolithic communities already had the knowledge of domesticates and food production, but their diet was still based on aquatic resources.

The large spectrum of external influences presented above in fact is the result of an intense interaction between the Mesolithic and Neolithic communities. It can be claimed that during the process of neolithisation the Mesolithic communities did not remain isolated, but actively participated in this process. Between the communities a social interaction network was established, which could have included the exchange of ideas, goods and possibly partners. Up to now research has been focused mainly on the Neolithic influences visible in the Mesolithic culture, however, the opposite also should be expected.

Even though the new elements mentioned above appear in Mesolithic communities, the main features of the culture are still obviously Mesolithic expressed in the most evident and conservative characteristics, such as diet, architecture, burial practices, raw materials and tool technology. Moreover, the analysis of the diet shows a continuation of the tendency towards an increasing importance on aquatic resources (Bonsall 2007, 59), detectable from the Early Mesolithic onwards.

In conclusion, this period represents the peak of the development of Mesolithic culture, probably stimulated by the interaction with Neolithic communities, at the same time it represents the period when old local traditions and values were slowly replaced by new ones. The appearance of these external elements in the Mesolithic culture after a long and smooth development of several millennia with no significant and sharp changes, justify the characterisation 'transitional' for this period. Now the region becomes gradually integrated into a wider Neolithic settlement network, in which the Mesolithic culture eventually is acculturated.

Early Neolithic (6000/5900 – 5500 BC). The Transformation

The beginning of this period coincided on the one hand with the end of the 'Little Ice Age', and was marked on the other hand by a major Neolithic expansion (Borić 2011, 183). During this expansion a large territory in Southeast Europe was settled by Neolithic communities, including extended territories north of the Danube. The earliest radiometric dated Neolithic settlements north of the Danube are Topole-Bać, Vinogradi-Bečej, Donja Branjevina, Foeni-Sălaș, Gura Baciului, Ocna Sibiului and Șeușa. These sites appeared ca. 6000 BC (Biagi et al. 2005, fig. 5 – 6). By typological comparison some other settlements such as Cîrcea-La hanuri (Nica 1977, 13 – 30) and Măgura-Buduiasca (Andreescu/ Mirea 2008) can also be assigned to this early period.

A consequence of this expansion was the consolidation of the Neolithic in Southeast Europe and the inclusion of the region of the Iron Gates into a much larger settlement network, leading to major transformations there. During this period the region became more densely inhabited and the Mesolithic way of living was replaced by the Neolithic one. First a large number of Neolithic settlements appeared in places which were not inhabited earlier, such as Gornea (Lazarovici 1977) and Liubcova (Luca 1998) (*fig. 2,9.11*). Second, most of the earlier abandoned sites were resettled by populations with Neolithic characteristics. A good example is the site of Schela Cladovei, which had a hiatus in the occupation during the Final Mesolithic, but was resettled around 6000 BC by a Neolithic community (Bonsall 2008, 267). The case of Cuina Turcului, which was abandoned for a long period of time but resettled at the beginning of the Early Neolithic is similar (Păunescu 1979, 28). Finally, the sites inhabited at the end of the Mesolithic continued to exist, but their inhabitants adopted the Neolithic lifestyle. This situation can be seen very well at Lepenski Vir where, without a temporal break, the site became inhabited by a population with Neolithic characteristics around 5900 BC (Borić

2011, 177 f.). A similar situation can be observed at the sites of Padina, Hajdučka Vodenica (Borić/Miracle 2004, 363) and Vlasac (Borić 2007, 39). During this period, the sites already had a different kind of occupational pattern and different architecture. The trapezoidal architecture with sculptures inside was replaced by rectangular dwellings constructed in wattle and daub technique with domed ovens on the interior. Some of the old trapezoidal buildings were used for burials (Borić 2011, 177 f.). In addition, some technological innovations in the bone and stone (chipped and ground) tool production were introduced and together with them new raw materials (non-local) appeared, such as obsidian, high quality Balkan flint, jadeite, nephrite, malachite (Borić 2011, 183; Antonović 2008, 25). Besides that, pottery became characteristic, being produced in large quantities, and the aesthetics of body decoration was also changed. The analysis of the faunal and floral remains show the adoption of domestic plants and animals in the region, although the wild animals still predominate (Greenfield 2008a, 110). Fish still contributed to the diet, but the stable isotope analysis in Lepenski Vir, shows that the population subsisted mainly on the terrestrial resources (Bonsall 2008, 271). Decrease in the use of fish during this period is observed also at the site of Schela Cladovei (Bartosiewicz et al. 2006, 39). The mortuary practices representing the most conservative element of the culture were changed with the appearance of the burial rite of inhumation in crouched position (Bonsall 2008, 267). The above mentioned isotope analyses show that during this period the tendency of arriving new migrants into the region continues (Borić/Price 2013, 3301). Paleo-demographic studies (Jackes et al. 2008, 86) indicate that, in contrast to the stable and stationary population of the Mesolithic, the Neolithic one was growing. In parallel with the changes in material culture mentioned above, we now also observe significant changes in religious, ideological and social aspects (Borić 2011, 182 f.).

Despite the fact that during this period major transformations occurred, some Mesolithic elements still continued to exist. First, the diachronic studies show evidence of human biological continuity, with very limited infiltrated external population (Roksandic 2008b, 73; 2008a, 248). Second, the locally developed ground stone technology from the Mesolithic continued to exist until the Late Neolithic (Antonović 2008, 37). Third, although the diet was diversified, the aquatic resources still played an important role (Grupe et al. 2003, 181 f.). Fourth, in the site of Padina a few trapezoidal buildings continued to be used (Borić 2011, 178). Finally, in the Neolithic layers of Velesnica, certain Mesolithic elements were discovered, such as large caved boulders, a high frequency of quartz tools and one burial in lotus position (Vasić 2008). Although the mechanisms of the transition are still not well understood (Boroneanț 2012, 198), the presented elements of continuity show on one hand that there was not a sharp separation between Mesolithic and Neolithic, and on the other hand that the transition did not occur uniformly in the whole region, but rather differently from site to site. Despite this issue, it is clear that during this transformational period the traditional elements are very limited in comparison to the Neolithic ones. The overwhelming prevalence of new elements indicates that the Mesolithic culture was gradually assimilated and transformed into the Neolithic one. Even the long lasting religious traditions, expressed in the mortuary practices, were assimilated indicating a transformation of the traditional Mesolithic ideology.

Middle and Late Neolithic (5500 – 4500 BC)

Characteristic for this period are further gradual changes in the way of life, but which now had negative consequences on the population density in the Iron Gates region. During this time in the Central Balkans, a new stage in the development of the Neolithic began, marked by the occurrence of a new technology in ceramic production, a process known as the formation of the Vinča Culture. At this stage of development the Neolithic economy became very effective, as can be detected from a large scale food production. These practices led to an increase of the population and to the appearance of large settlements in the areas with high agricultural and pastoral potential. Since the Iron Gates region, situated in the mountains, was not suitable for large scale agriculture and stockbreeding, it started to lose its importance. In turn, fishing became less important and the population started to migrate into the neighbouring regions, abandoning their settlements (Borić 2011, 183; Voytek/Tringham 1989, 498). Thus, in the Iron Gates region only a few settlements were inhabited for relatively short period of time. In the settlements Schela Cladovei and Ostrovul Banului (Golu) Middle Neolithic material was discovered together with Early Neolithic finds, marking the transition between these periods (Roman/Boroneanț 1974, 126 f.; Boroneanț 1990). Cultural strata indicating a short occupation were excavated in the sites Veterani Cave and Cuina Turcului (Nicolăescu-Plopșor et al. 1965). In addition to this, at the site of Ostrovu Șimian several potsherds from this period were discovered, which remained unpublished (A. Boroneanț, personal communication, 16.01.2015). The large sites of Gornea, Liubcova and Korbovo, which continue to be settled during this period, represent an exception as they are located in large valleys with fertile alluvial soils, where the new form of economy could be applied. None of them was inhabited during the Mesolithic, indicating that the places settled during the Mesolithic were not considered favourable in the Middle and Late Neolithic.

Discussion

Cultural development is a highly complex and rather unpredictable process, which is influenced by a large range of biological, environmental, social, cultural, ideological, and technological factors. The influence of this factors can vary from case to case. Still, in some situations certain factors are more dominant than others. This was the case with the environmental factors during the Pleistocene-Holocene transition, when the global climatic changes had a huge impact on the development of societies. The results of this impact are well documented in the development of all Eurasian Mesolithic communities.

When analysing the development of the Mesolithic culture in the Iron Gates region, cultural changes influenced by environmental factors can be easily observed. However, not all aspects of culture were equally influenced by these factors, those related to basic means of survival being mainly affected. The most affected aspects of the culture are illustrated by the following adaptations. First, the occupation of a region rich in resources and with special geographical conditions, where the climate changes were less rough. Second, the development of an economy based on both terrestrial and aquatic resources, with an emphasis on the latter, whose significance increased with time. Third, diachronic changes can be observed in the type of settlements. While during the earliest and colder periods caves were preferred, with the warming of the environment open-air sites became more common. Finally, the repertoire of tools characterised by microlithisation was also adapted to the postglacial environment. Beside these aspects, strongly affected by environmental changes, there are others less related to basic survival, which were affected to a lesser degree. Here the artistic expressions can be mentioned that are indirectly influenced by the new economy dependent on fish consumption. The dependence on this resource, the seasonal availability of the large fish and the difficult and dangerous work of catching these fish influenced the community's perception about them. In addition, the burials and the architectural constructions oriented in relation to the Danube might have also been indirectly influenced by the new aquatic based economy. Together with the new economy, the knowledge of the communities about fish behaviour was enhanced, new techniques and equipment were developed along with the need for coordinated activity. The seasonal abundance of large fish required storage techniques and a certain degree of sedentism. This demonstrates that one type of factors (in this case the environmental ones) can influence a large spectrum of societal features, as they are closely related to each other. Thus, when some of these features are directly influenced, the rest are indirectly affected.

The described features influenced by the environmental factors, show the way in which the Mesolithic communities in the Iron Gates region adapted to the changes in the environment. The long continuity of occupation during this period of intense change, along with the density of settlements, demonstrates that these adaptive reactions were efficient and sustainable. Amongst them, the new economy based on aquatic resources, which is the former adaptive strategy presented in the introduction, played a crucial role. The relatively dense settlement system in the Iron Gates region shows the significance of this economy. Therefore, when looking at the long cultural continuity and stability in the region, which can be seen over several millennia with very few observable and almost undetectable transformations in material culture, one can assume the new economy was the main factor in this long-term cultural stability. Then, at the end of the 7th mill. BC, during the zenith of Mesolithic development, the long cultural stability was apparently 'disturbed' by external factors. In the Central Balkans new settlements appeared, belonging to a new culture with different traditions and origins – the Neolithic culture. The appearance of this new culture might have had a positive effect for the Mesolithic communities in terms of enlarging their social network and offered access to new sorts of goods, technology and ideas, but for the preservation of their culture, values and traditions it had negative effect. At the time when the first Neolithic settlements appeared in the Central Balkans they had little influence, and therefore only a few specific elements were adopted by the Mesolithic people. After several hundred years of coexistence, the Mesolithic culture was completely transformed and even the most conservative traditions were assimilated into the Neolithic culture. In addition, after another few hundred years, the region lost its importance and its abundant aquatic resources were ignored. Even when the region was resettled later, it never again played such an important role in European prehistory.

This transformation of the Mesolithic culture plays crucial role in the understanding of further cultural developments and although it is the focus of many studies still, the mechanisms of this process remain rather unclear (Borić 2007, 42; Boroneanț 2012, 198 f.). Excluding the possibility that the 8200 calBP climate event did thoroughly affect the Mesolithic culture, but which deserves to be studied in more detail, the only significant reason for its transformation remains the appearance of a new cultural phenomenon. The emergence of this phenomenon, defined as neolithisation is another inadequately understood episode of European prehistory, although there are many different and often contradictory models trying to explain it (Budja 2010, 107 f.; Kind 2010, 449–451; Boroneanț/Dinu 2006, 51 f.). Common to all these models is, that once the new culture was introduced to Europe, most of the Mesolithic communities gradually were transformed (assimilated), as was the case of the Iron Gates region. Regarding the neolithisation of Southeast Europe, currently it is widely assumed that a new population from Anatolia settled an almost uninhabited territory, but this assumption strongly underestimates the contribution of the Mesolithic communities to the neolithisation process (Budja 2010, 109). This assumption derives from the absence of Mesolithic occupational evidence in the Central Balkans south of the Iron Gates region (Borić 2005, 20 fig. 3.1). But, despite this apparent lack of occupation, was this territory really not settled during the Mesolithic?

To answer this, two indicators can be analysed. First, the presence of 'exotic' finds with Mediterranean provenience, which, although they do not show a large-scale external influence, nevertheless indicate the presence of other Mesolithic groups between the Danube and the Mediterranean coast. Second, it should be considered that prior to the dam construction in the Iron Gates region, the Mesolithic was unknown and corresponding discoveries were made only during the resulting intensive surveys and rescue excavations (Nicolăescu-Plopșor et al. 1965, 407). Moreover, the exceptional natural conditions and the abundant aquatic resources allowing the dense and permanent inhabitation of this region have also contributed to the large accumulation of anthropogenic sediments (sometimes more than 3m) which has also concentrated artefacts in confined places making their discovery easier. On the other hand, in the inland of the Balkans, where locations with large concentrations of resources are not characteristic, the possibility of having sedentary populations during the Mesolithic is very low. If the territory was inhabited by small and mobile Mesolithic communities leaving scarce evidence the possibility of discovering them is reduced. In contrast to settlements in caves and under rock shelters, those located in the floodplains are rarely well preserved (Chapman 1989, 504). This is due to a combination of geomorphological factors on one hand, and of the destructive impact of modern agricultural work, on the other. If the cultural traces are near the surface and poorly preserved, their identification will require specific investigations to find Mesolithic sites (Sériadès 2006, 16). This was done in Hungary, where previous to the focused systematic research, it was assumed that during the Mesolithic this territory was not inhabited (hiatus) and a number of explanations were given. However, in recent years after systematic surveys were conducted, some Mesolithic sites were discovered, which raises questions about the relationship between Late Mesolithic and Early Neolithic communities (Kertész 2002; Eichmann et al. 2010). Similarly, therefore, future systematic investigations in the Central Balkans could also change the current assumptions, such as the (non-)existence of Mesolithic communities or their contribution to the process of neolithisation.

Regardless how many Mesolithic communities in the Balkans existed, which could have influenced neolithisation, it is certain that during this process all of them were assimilated into the Neolithic culture. This leads to the question, why the interaction between the Mesolithic and the Neolithic cultures led to the assimilation of the Mesolithic culture? When analysing the Mesolithic culture in the Iron Gates region, trying not to overestimate and idealize the discoveries, one can see a population with stable nutrition, demonstrated by the height of the individuals and by their good health status (Boroneanț et al. 2001, 5), having a flourishing culture, with long traditions well adapted to the local environment. When compared to the earliest Neolithic cultures in the Balkans, one can note that the differences are not great. With even a brief look at the dense Mesolithic settlement network, the impressive trapezoidal architecture, the high artistic achievements, the varied burial traditions, the specialized local environmental economy, the technology of lithic and bone industry, the level of sedentism and the stability over a long period of time, one can observe the high achievments of the Pre-Neolithic culture. Given the complexity of the Mesolithic culture in the process of interaction between both cultures, the following questions have to be asked: why were the local Mesolithic communities transformed into Neolithic ones and not vice versa? What was the reason for this relatively rapid assimilation? The Neolithic communities must have had some advantages. When comparing the material record of the Late Mesolithic and Early Neolithic in the Central Balkans two main differences can be observed – the ceramic technology and the new economy based on food production. The first one has a limited role, as ceramic technology is neither a Neolithic discovery, nor is the emergence of Neolithic lifestyle related to pottery production (Budja 2010, 116). Thus, the only remaining difference is the new economy based on domesticated plants and animals. Unlike the Mesolithic communities, that only had domesticated dogs, the Neolithic communities had additionally other domesticates such as emmer wheat, einkorn wheat, barley, lentils, peas, cattle, sheep, goat and pigs, which were all used for food production. These plants and animals were domesticated in Southwest Asia, where their wild progenitors were present. The domestication process occurred as a result of the intensive management of the resources by the local Epipaleolithic/Mesolithic communities. This process lasted thousands of years, when the populations were still dependent on non-domesticated food sources and only slowly shifted to a diet where it played a minor role (Riehl et al. 2013; Zohari et al. 2012, 1–4; Diamond 1999, 107). This management (the prerequisite for the domestication) in fact is the second adaptive strategy mentioned in the introduction, as a response to the changes in the environment. Hence, the Mesolithic communities from Southwest Asia adapted to the same climatic changes as the ones from the Iron Gates region, but using different strategies. This new economy based on domesticates was more efficient, as it could produce larger amounts of food from a smaller territory and could minimize the seasonal availability of food (Diamond 1999, 88). In addition to this, food production could always be combined with hunting, fishing and gathering. Therefore, when domesticated plants and animals were introduced into Europe they were an extension of the existent subsistence strategies and not surprising easily adopted by the local population. But, could this adoption have an impact on the Mesolithic communities strong enough to lead to the transformation of their culture? Was it impossible for these communities to adopt only the domesticates and to continue to stick to their traditions? Additionally, we have to consider that this adoption occurred during the 'Little Ice Age' (the 8200 calBP event), lasting a couple of hundred years and reducing the potential of the new economy, as well as the mountainous location of the Mesolithic sites that was not very suitable for these practices.

Since the new economy alone cannot completely explain the transformation of the Mesolithic culture there should be other reasons. Differences in social and cultural aspects are observable between the two cultures. First, when analysing the Early Neolithic social identity, we can observe that together with the new economy the range of social practices was increased (cereal cultivation, hoeing, ploughing, fence-making, ditch-digging, weeding, baking brewing, animal husbandry, dairy production, cooking, pottery-making, spinning and weaving, building and so forth), and together with them the spectrum of skills and competences was enlarged (Chapman/Gaydarska 2011, 28–34). Since most Early Neolithic people were not specialized only in one social practice, the increased variety of skills allowed new kinds of combinations, which led to the emergence of a wider diversity of identities and the increase of their individualisation. In addition, this individualisation led to the differentiation of the values for these different social practices and their products, reinforcing a new social system of values. The new and complex social practices, interconnected in long operational chains, intensified the interdependency between the individuals and increased the complexity of the social network in the settlements (Chapman/Gaydarska 2011, 34–37). Furthermore, the increased level of individualisation mentioned above, along with the increased sedentarisation and the possibility of storage in turn increased the possibility of unequal access to goods, determining changes in the social relations (Voytek/Tringham 1989, 496). Second, the Neolithic nonmaterial culture (values, beliefs, symbols, norms) was also different than the Mesolithic one. The differences in economy an social organisation suggest for a different belief system (Eliade 1959, 162). Finally, the advantages of the new economy, when introduced into the Balkans, led to a continuous increase in population and with the appearance of the Neolithic in Southeast Europe gradually a wide and dense settlement network was established keeping the communities interconnected. The uniformity of Early Neolithic material culture over a large territory and during a long period of time shows a strong interconnection between the settlements. Within the new network communication was improved, goods and ideas from larger distance could be transmitted and the population became more mobile. In the context of this intensively interconnected settlement system, in which the Iron Gates region was included, the new social and cultural values strongly influenced the Mesolithic communities and, as a consequence, lead to their acculturation. The most traditional elements of the Mesolithic culture, such as mortuary practices, the belief system and symbolic values were replaced with Neolithic ones. It can be stated, that the social and cultural factors have played a much more significant role in the transformation of the Mesolithic culture in the Danube Gorges region than the economy itself. In conclusion, one may say that a group of factors led to the adoption of the Neolithic way of life, among which the social and cultural ones played the most significant role.

Conclusions

The transition between the Mesolithic and Neolithic is a complex process of transformation, varying in different regions. In the region of the Iron Gates this transition was marked by the interference of the local Mesolithic culture with the foreign Neolithic culture.

Both, the local and the foreign culture, as a response to environmental changes, developed an adaptive strategy based on available resources. In the region of the Danube Gorges the use of aquatic resources (mainly fish) was increased leading to the development of an aquatic based economy. In Southwest Asia control and applied management over natural resources were increased, which led to the domestication of some plants and animals and as a consequence, a new economy based on food production was developed.

The Iron Gates region was inhabited since the Late Palaeolithic. Its special location and the favourable living conditions, and in particular the easy availability of resources, became very significant during the Pleistocene-Holocene environmental changes, when the region played the role of a refugium and the density of occupation increased.

The subsistence strategies were initially based on hunting and fishing, but the easy availability of aquatic resources and the good conditions for fishing led to a gradual development of an aquatic based economy, simultaneously with the warming of the climate. During the Epipaleolithic fish constituted a small percentage of the diet, but in the Early Mesolithic the use of aquatic resources intensified and this tendency continued until the Final Mesolithic, when such resources contributed to the diet with 60–80%.

Together with the intensification in the use of the riverine resources the mobility of the communities started to decrease, visible in the almost exclusive use of local raw materials. Along with this intensification the focus gradually moved to the large migratory fish and a new perception of fish was developed leading to their sacralisation.

During all Mesolithic periods very few changes can be observed. The first decisive changes appeared during the Final Mesolithic period. The transitional character of this period is visible on one hand, by the strong continuity of local cultural traditions and on the other hand by the emergence of new cultural elements related to the appearance of the first Neolithic settlements in the Central Balkans. During this period the climax of the Mesolithic development was reached, expressed particularly in architecture and art.

The way in which the new cultural phenomenon was introduced in the Balkans is still not fully understood. It is certain, however, that the first Neolithic settlements appeared in the Central Balkans contemporaneously with the Mesolithic communities. In the Iron Gates region both cultures coexisted for a few hundred years, all the while interacting with each other. The results of this interaction can be seen particularly in the material culture of the Mesolithic settlements. This coexistence did not last long and somewhere around 6000 BC, with the consolidation of Neolithic in the Central Balkans and its expansion north of the Danube, the Mesolithic communities transformed into Neolithic ones. Although in some settlements certain Mesolithic elements were still preserved, most of the cultural features appear to be Neolithic. The biological continuity in the population with a very limited immigration of foreigners and the apparent absence of aggression points to a process of acculturation. It seems that the local population adopted the new culture and in turn abandoned most of the Mesolithic traditions.

Usually, the reasons for this acculturation are seen in the new economy and technologies, which were introduced together with the new cultural phenomenon. Although these innovations were clearly more efficient, as follows from their rapid adoption, their adoption cannot explain the total transformation of the Mesolithic culture into a Neolithic one.

Simultaneously with the development of the new economy changes in social and cultural practices also appeared, leading to a wider diversity of social identities, a new ideology and new cultural values. In addition, with the consolidation of the Neolithic in Southeast Europe, the Iron Gates region was included into a wide and dense settlement network, in which the transfer of ideas and goods was intensified. The newly introduced social and cultural values influenced the Mesolithic communities and transformed their culture even including the most conservative elements. While numerous factors contributed to the assimilation of the Mesolithic culture, the social and cultural ones played the major role.

Although the new lifestyle had advantages for the region of the Danube Gorges specifically it had negative long-term consequences. Following the complete transformation of the Mesolithic communities into Neolithic ones, the new way of life appeared not very suitable for this region. During the Middle and Late Neolithic, when extensive agriculture became characteristic, the region was almost completely abandoned and its aquatic resources ignored.

Petru Ciocani
SFB 1070 "ResourceCultures"
Eberhard Karls University of Tübingen
Gartenstraße 29
D-72074 Tübingen
petru.ciocani@uni-tuebingen.de

Bibliography

Andreescu/Mirea 2008: R. R. Andreescu/P. Mirea, Teleorman Valley. The Beginning of the Neolithic in Southern Romania. In: S. A. Luca (ed.), Proceedings of the International Colloquium. The Carpathian Basin and its Role in the Neolithisation of the Balkan Peninsula. Acta Terrae Septemcastrensis 7 (Sibiu 2008) 57–75.

Antonović 2008: D. Antonović, The Development of the Ground Stone Industry in the Serbian Part of the Iron Gates. In: C. Bonsall/V. Boroneanț/I. Radovanović (eds.), The Iron Gates in Prehistory. New Perspectives. BAR International Series 1893 (Oxford 2008) 19–37.

Bartosiewicz et al. 2006: L. Bartosiewicz/V. Boroneanț/C. Bonsall/S. Stallibrass, Size of Prehistoric Cattle and Pig at Schela Cladovei (Iron Gates Region, Romania). Analele Banatului 14.1, 2006, 23–42.

Bartosiewicz et al. 2008: L. Bartosiewicz/C. Bonsall/V. Șișu, Sturgeon Fishing in the Middle and Lower Danube Region. In: C. Bonsall/V. Boroneanț/I. Radovanović (eds.), The Iron Gates in Prehistory. New Perspectives. BAR International Series 1893 (Oxford 2008) 39–54.

Bazzanella et al. 2007: M. Bazzanella/L. Betti/U. Wierer, Mesolithic Wetland Exploitation at Galgenbühel/Dos de la Forca Italy, Eastern Alps. The Fish Fauna. In: H. Plagmann (ed.), The Role of Fish in Ancient Time. Internationale Archäologie, Arbeitsgemeinschaft, Symposium, Tagung, Kongress 8 (Rahden/Westfalen 2007) 93–100.

Băltean 2011: I. C. Băltean, The Paleolithic in Banat. In: N. Tasić/Fl. Drașovean (eds.), The Prehistory of Banat: 1. The Paleolithic and Mesolithic (Bucharest 2011) 19–76.

Biagi et al. 2005: P. Biagi/S. Shennan/M. Spataro, Rapid Rivers and Slow Seas? New Data for the Radiocarbon Chronology of the Balkan Peninsula. In: L. Nikolova/J. Higgins (eds.), Prehistoric Archaeology and Anthropological Theory and Education. Reports of Prehistoric Research Projects 6/7 (Salt Lake City 2005) 41–51.

Bonsall 2007: C. Bonsall, When was the Neolithic Transition in the Iron Gates? In: M. Spataro/P. Biagi (eds.), A Short Walk through the Balkans. The First Farmers of the Carpathian Basin and Adjacent Regions. Attidella Società per la Preistoria e Protostoria della Regione Friuli-Venezia Giulia 12 (Trieste 2007) 53–66.

Bonsall 2008: C. Bonsall, The Mesolithic of the Iron Gates. In: G. Bailey/P. Spikins (eds.), Mesolithic Europe (Cambridge 2008) 238–179.

Bonsall et al. 2008a: C. Bonsall/V. Boronenaț/I. Radovanović, Introduction. In: C. Bonsall/V. Boroneanț/I. Radovanović (eds.), The Iron Gates in Prehistory. New Perspectives. BAR International Series 1893 (Oxford 2008) 1–7.

Bonsall et al. 2008b: C. Bonsall/I. Radovanović/M. Roksandic/G. Cook/T. Higham/C. Pickard, Dating Burial Practices and Architecture at Lepenski Vir. In: C. Bonsall/V. Boroneanț/I. Radovanović (eds.), The Iron Gates in Prehistory. New Perspectives. BAR International Series 1893 (Oxford 2008) 175–204.

Borić 2005: D. Borić, Deconstructing Essentialism. Unsettling Frontiers of the Mesolithic-Neolithic Balkans. In: D. Bailey/A. Whittle/V. Cummings (eds.), (Un)Settling the Neolithic (Oxford 2005) 16–31.

Borić 2007: D. Borić, Mesolithic-Neolithic Interactions in the Danube Gorges. In: J. I. Kozłowski/M. Nowak (eds.), Mesolithic/Neolithic Interactions in the Balkans and in the Middle Danube Basin. BAR International Series 1726 (Oxford 2007) 31–45.

Borić 2011: D. Borić, Adaptations and Transformations of the Danube Gorges Foragers (c. 13,000–5500 cal. BC). An Overview. In: R. Krauss (ed.), Beginnings – New Research in the Appearance of the Neolithic between Northwest Anatolia and the Carpathian Basin. Papers of the International Workshop 8th–9th April 2009, Istanbul. Menschen – Kulturen – Traditionen 1 (Rahden/Westfalen 2011) 157–203.

Borić/Miracle 2004: D. Borić/P. Miracle, Mesolithic and Neolithic (Dis)Continuities in the Danube Gorges. New AMS Dates from Padina and Haidučka Vodenica (Serbia). Oxford Journal of Archaeology 23.4, 2004, 341–371.

Borić/Price 2013: D. Borić/D. Price, Strontium Isotopes Document Greater Human Mobility at the Start of the Balkan Neolithic. Proceedings of the National Academy of Sciences 110.9, 2013, 3298–3303.

Boroneanț 1990: V. Boroneanț, Le site de Schela Cladovei. Problèmes poses par la transition de la culture Criș Starčevo a la culture Vinča. In: D. Srejović (ed.), Vinča and its World. International Symposium – The Danube Region from 6000 to 3000 BC (Belgrade 1990) 143–147.

Boroneanț 1996: V. Boroneanț, The Art of Epipaleolithic/Mesolithic in the South-West of Romania. In: A. Beltrán/A. Vigliardi (eds), The Colloquia of the XIII International Congress of Prehistoric and Protohistoric Sciences 8. Art in the Paleolithic and Mesolithic (Forlì 1996) 53–65.

Boroneanț et al. 2001: V. Boroneanț/C. Bonsall/K. McSweeney/R. Payton/M. Macklin, Mormintele mezolitice din aria III de la Schela Cladovei. Apulum 38.1, 2001, 1–7.

Boroneanț 2011: A. Boroneanț, Introduction – The Mesolithic in Banat. In: N. Tasić/F. Drașovean (eds.), The Prehistory of Banat 1. The Paleolithic and Mesolithic (Bucharest 2011) 103–141.

Boroneanț 2012: A. Boroneanț, Aspecte ale tranziției de la mezolitic la neoliticul timpuriu în zona Porțile de Fier (Cluj-Napoca 2012).

Boroneanț/Dinu 2006: A. Boroneanț/A. Dinu, The Romanian Mesolithic and the Transition to Farming. A Case Study. The Iron Gates. Studii de Preistorie 3, 2006, 41–76.

Budja 2010: M. Budja, The Neolithisation of South-Eastern Europe. From Y-Chromosome Dispersals to Ceramic Figurines. In: D. Gronenborn/J. Petrasch (eds.), Die Neolithisierung Mitteleuropas. Internationale Tagung, Mainz 24. bis 26. Juni 2005. The Spread of the Neolithic to Central Europe. International Symposium, Mainz 24 June – 26 June 2005: 1. RGZM Tagungen 4,1 (Mainz 2010) 107–139.

Chapman 1989: J. Chapman, Demographic Trends in Neothermal South-East Europe. In: C. Bonsall (ed.), The Mesolithic in Europe (Edinburgh 1989) 500–515.

Chapman/Gaydarska 2011: J. Chapman/B. Gaydarska, Can we Reconcile Individualisation with Relational Personhood? A Case Study from the Early Neolithic. Documenta Prehistorica 38, 2011, 21–43.

Clark 1962: J. G. D. Clark, A Survey of the Mesolithic Phase in the Prehistory of Europe and South-West Asia. In: G. C. Sansoni (ed.), Atti del VI Congresso Internationale delle Scienze Preistoriche e Protoistoriche I (Rom 1962) 97–111.

Constandse-Westermann/Newell 1989: T. S. Constandse-Westermann/R. R. Newell, Limb Lateralization and Social Stratification in Western European Mesolithic Societies. In: I. Hershkovitz (ed.), People and Culture in Change. BAR International Series 508.2 (Oxford 1989) 405–433.

Diamond 1999: J. Diamond, Guns, Germs and Steel. The Fates of Human Societies (New York 1999).

Dimitrievié 2008: V. Dimitrievié, Lepenski Vir Animal Bones. What was Left in the Houses? In: C. Bonsall/V. Boroneanț/I. Radovanović (eds.), The Iron Gates in Prehistory. New Perspectives. BAR International Series 1893 (Oxford 2008) 117–130.

Dinan 1996a: E. H. Dinan, A Preliminary Report on the Lithic Assemblage from the Early Holocene Level at the Iron Gates Site of Băile Herculane. Mesolithic Miscellany 17.2, 1996, 15–24.

Dinan 1996b: E. H. Dinan, Preliminary Lithic Analysis of the Epigravettian Levels form the Iron Gates Site of Cuina Turcului. Mesolithic Miscellany 17.2, 1996, 25–40.

Dinu 2010: A. Dinu, Mesolithic Fish and Fishermen of the Lower Danube (Iron Gates). Documenta Prehistorica 37, 2010, 299–310.

Eichmann et al. 2010: W. Eichmann/R. Kertész/T. Marton, Mesolithic in the LBK Heartland of Transdanubia, Western Hungary. In: D. Gronenborn/J. Petrasch (eds.), Die Neolithisierung Mitteleuropas. Internationale Tagung, Mainz 24. bis 26. Juni 2005. The Spread of the Neolithic to Central Europe. International Symposium, Mainz 24 June – 26 June 2005: 1. RGZM Tagungen 4,1 (Mainz 2010) 211–233.

Eliade 1959: M. Eliade, The Sacred and the Profane. The Nature of Religion (New York 1959).

Flemig et al. 1998: K. Fleming/P. Johnston/D. Zwartz/Y. Yokoyama/K. Lambeck/J. Chappell, Refining the Eustatic Sea-Level Curve since the Last Glacial Maximum Using Far- and Intermediate-Field Sites. Earth and Planetary Science Letters 163, 1998, 327–342.

Greenfield 2008a: H. J. Greenfield, Faunal Assemblages from the Early Neolithic of the Central Balkans. Methodological Issues in the Reconstruction of Subsistence and Land Use. In: C. Bonsall/V. Boroneanț/I. Radovanović (eds.), The Iron Gates in Prehistory. New Perspectives. BAR International Series 1893 (Oxford 2008) 103–114.

Greenfield 2008b: H. J. Greenfield, The Vertebrate Fauna from Hajdučka Vodenica in the Danubian Iron Gates. Subsistence and Taphonomy from the Early Neolithic and Mesolithic. In: C. Bonsall/V. Boroneanț/I. Radovanović (eds.), The Iron Gates in Prehistory. New Perspectives. BAR International Series 1893 (Oxford 2008) 205–226.

Grupe et al. 2003: G. Grupe/J. Peters/Z. Mikic, The Exploitation of Freshwater Food Resources by Meso- and Neolithic Populations of Central Europe. In: G. Brunenhult (ed.), Stones and Bones. Formal Disposal of the Dead in Atlantic Europe during the Mesolithic-Neolithic Interface 6000–3000 BC. BAR International Series 1201 (Oxford 2003) 177–187.

Jackes et al. 2008: M. Jackes/M. Roksandic/C. Meiklejohn, Demography of the Đerdap Mesolithic-Neolithic Transition. In: C. Bonsall/V. Boroneanț/I. Radovanović (eds.), The Iron Gates in Prehistory. New Perspectives. BAR International Series 1893 (Oxford 2008) 77–88.

Kertész 2002: R. Kertész, Mesolithic Hunter-Gatherers in the Northwestern Part of the Great Hungarian Plain. Praehistoria 3, 2002, 281–304.

Kind 2010: C.-J. Kind, Diversity at the Transition – a View from the Mesolithic. In: D. Gronenborn/J. Petrasch (eds.), Die Neolithisierung Mitteleuropas. Internationale Tagung, Mainz 24. bis 26. Juni 2005. The Spread of the Neolithic to Central Europe. International Symposium, Mainz 24 June – 26 June 2005: 2. RGZM Tagungen 4,2 (Mainz 2010) 449–460.

Kozłowski 1996: S. K. Kozłowski, Early Postglacial Adaptation in Poland and Central Europe (Mesolithic/Epipaleolithic). In: S. K. Kozłowski/C. Tozzi (eds.), The Colloquia of the XIII International Congress of Prehistoric and Protohistoric Sciences 7. The Mesolithic (Forlì 1996) 149–162.

Lazarovici 1977: Gh. Lazarovici, Gornea. Preistorie (Reșița 1977).

Lichardus-Itten et al. 2006: M. Lichardus-Itten/J.-P. Demoule/L. Pernicheva/M. Grebska-Kulova/I. Kulov, Kovačevo, an Early Neolithic Site in South-West Bulgaria and its Importance for European Neolithization. In: I. Gatsov/H. Schwarzberg (eds.), Aegean-Marmara-Black Sea. The Present State of Research on the Early Neolithic (Langenweissbach 2006) 83–94.

Luca 1998: S. A. Luca, Liubcova-Ornița. Monografie Arheologică (Târgoviște 1998).

Manson 2008: J. L. Manson, Approaches to Starčevo Culture Chronology. In: C. Bonsall/V. Boroneanț/I. Adovanović (eds.), The Iron Gates in Prehistory. New Perspectives. BAR International Series 1893 (Oxford 2008) 89–101.

Mason et al. 1996: S. Mason/V. Boroneanț/C. Bonasll, Plant Remains from Schela Cladovei, Romania. A Preliminary Note. Mesolithic Miscellany 17.2, 1996, 11–14.

Merkyte 2003: I. Merkyte, The Mesolithic Syndrome in Southeastern Europe. Acta Archaeologica 74, 2003, 307–317.

Mihailović 2008: D. Mihailović, Lithic Technology and Settlement System of the Final Paleolithic and Early Mesolithic in the Iron Gates. In C. Bonsall/V. Boroneanț/I. Radovanović (eds.), The Iron Gates in Prehistory. New Perspectives. BAR International Series 1893 (Oxford 2008) 11–18.

Mihailović et al. 2011: D. Mihailović/B. Mihailović/M. Lopičić, The Paleolithic in Northern Serbia. In: N. Tasić/Fl. Drașovean (eds.), The Prehistory of Banat 1. The Paleolithic and Mesolithic (Bucharest 2011) 77–101.

Nica 1977: M. Nica, Nouvelles données sur le Néolithique Ancient d'Oltenie. Dacia 21, 1977, 13–53.

Nicolăescu-Plopșor et al. 1965: C. S. Nicolăescu-Plopșor/M. Davidescu/S. Roman/V. Boroneanț, Cercetările arheologice de la cazane. Studii și cercetări de istorie veche 16.2, 1965, 407–411.

Păunescu 1970: A. Păunescu, Epipaleoliticul de la Cuina Turcului – Dubova. Studii și cercetări de istorie veche 21.1, 1970, 3–29.

Păunescu 1979: A. Păunescu, Cercetările arheologice de la Cuina Turcului – Dubova (jud. Mehedinți). Tibiscus 5, 1979, 11–56.

Radovanović 1996: I. Radovanović, The Iron Gates Mesolithic. International Monographs in Prehistory. Archaeological Series 11 (Ann Arbor 1996).

Radovanović 1997: I. Radovanović, 'The Culture of Lepenski Vir' . A Contribution to Interpretation of its Ideological Aspects. In: M. Lazic (ed.), Antidoron Dragoslavo Srejović completis LXV annis ab amicis collegis discipulis oblatum (Belgrade 1997) 85–93.

Riehl et al. 2013: S. Riehl/M. Zeidi/J. Conard, Emergence of Agriculture in the Foothills of the Zagros Mountains of Iran. Science 341.65, 2013, 65–67.

Roksandic 2008a: M. Roksandic, The Human Osteological Material from Velesnica. In: C. Bonsall/V. Boroneanț/I. Radovanović (eds.), The Iron Gates in Prehistory. New Perspectives. BAR International Series 1893 (Oxford 2008) 243–249.

Roksandic 2008b: M. Roksandic, The Mesolithic-Neolithic Transition in the Đerdap as Evidenced by Non-Metric Anatomical Variants. In: C. Bonsall/V. Boroneanț/I. Radovanović (eds.), The Iron Gates in Prehistory. New Perspectives. BAR International Series 1893 (Oxford 2008) 55–76.

Roman/Boroneanț 1974: P. Roman/V. Boronenaț, Locuirea Neolitică din Ostrovul Banului de la Gura Văii. Drobeta 1974, 117–128.

Ronen/Winter 2001: A. Ronen/H. Winter, Pre-Pottery Neolithic A and the 'Agricultural Revolution'. In: R. Kertesz/J. Makkay (eds.), From the Mesolithic to the Neolithic (Budapest 2001) 379–388.

Sėfėriadès 2006: M. L. Séfériadès, Some Reflections on the Mesolithic Substratum and the Neolithisation Processes in the Aegean, Danubian and Black Sea Areas. In: I. Gatsov/H. Schwarzberg (eds.), Aegean – Marmara – Black Sea. The Present State of the Research on the Early Neolithic (Langenweissbach 2006) 15–20.

Stefanović/Borić 2008: S. Stefanović/D. Borić, New-Born Infant Burials Underneath House Floors at Lepenski Vir. In Pursuit of Contextual Meanings. In: C. Bonsall/V. Boroneanț/I. Radovanović (eds.), The Iron Gates in Prehistory. New Perspectives. BAR International Series 1893 (Oxford 2008) 131–169.

Vasić 2008: R. Vasić, Velesnica and the Lepenski Vir Culture. In: C. Bonsall/V. Boroneanț/I. Radovanović (eds.), The Iron Gates in Prehistory. New Perspectives. BAR International Series 1893 (Oxford 2008) 227–241.

Voytek/Tringham 1989: B. A. Voytek/R. Tringham, Rethinking the Mesolithic. The Case of South-East Europe. In: C. Bonsall (ed.), The Mesolithic in Europe (Edinburgh 1989) 492–499.

Weninger et al. 2007: B. Weninger/E. Alram-Stern/E. Bauer/L. Clare/U. Danzeglocke/O. Jöris/C. Kubatzki/G. Rollefson/H. Todorova/T. Van Andel, Abrupt Climate Forcing Observed at Early Neolithic Sites in South-East Europe and the Near East. In: H. Todorova/M. Stefanovich/G. Ivanov (eds.), The Struma/Strymon River Valley in Prehistory. In The Steps of James Harvey Gaul 2 (Sofia 2007) 7–28.

Weninger et al. 2014: B. Weninger/L. Clare/F. Gerritsen/B. Horejs/R. Krauss/J. Linstädter/L. Özbal/E. Rohling, Neolithisation of the Aegean and Southeast Europe during the 6600–6000 calBC Period of Rapid Climate Change. Documenta Praehistorica 41, 2014, 1–31.

Zohari et al. 2012: D. Zohari/M. Hopf/E. Weiss, Domestication of Plants in the Old World. The Origin and Spread of Domesticated Plants in South-West Asia, Europe, and the Mediterranean Basin (Oxford 2012).

Zvelebil 1996: M. Zvelebil. Subsistence and Social Organization of the Mesolithic Communities in Temperate and Northern Europe. In: S. K. Kozłowski/C. Tozzi (eds.), The Colloquia of the XIII International Congress of Prehistoric and Protohistoric Sciences 7. The Mesolithic (Forlì 1996) 163–174.

AURELIAN RUSU

'Lepenski Vir – Schela Cladovei Culture', a Paradigm Paralysis?

Keywords: Lepenski Vir – Schela Cladovei Culture, archaeological paradigm, archaeological interpretation, archaeological process, Mesolithic

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Abstract

This paper examines the state of the archaeological paradigm 'Lepenski Vir – Schela Cladovei Culture' using a 'Kuhnian' framework. It follows the process of archaeological discoveries of human remains in the geographical region now called 'Iron Gates' at the Danube River in Europe, the first archaeological interpretations of those discoveries and the archaeological re/actions that followed up to the present state of research. This 'paradigm' 'Lepenski Vir – Schela Cladovei Culture' is viewed by the author as a 'tool' in understanding the human past. Therefore this paper focuses on the question, whether this 'tool' has reached the point where it can be called a paradigm and as such be useful for further archaeological research of other 'new paradigmatic archaeological horizons', or if it is still in the process of becoming one.

Research on the Archaeological Record of 'Lepenski Vir-Schela Cladovei Culture'

The remains of Lepenski Vir – Schela Cladovei Culture's give the impression that something is missing, or more precisely that something is being missed. This prompted the implied question in the title of this paper. It is not meant as a rhetorical artifice in order to keep the reader interested, but instead it is just a more accurate expression of one researcher's line of thought after he went through the published archaeological record. There is a sense of indefinable.

To understand and clarify the 'Lepenski Vir – Schela Cladovei Culture's' published archaeological record I found it necessary to study the work of Thomas S. Kuhn (1996), which proved to be very useful. Thus, his definition of paradigms being 'universally recognised scientific achievements that for a time provide model problems and solutions to a community of practitioners' (Kuhn 1996, X) will be the guiding line for my endeavour. Applying this perspective, a clear question cannot be stated. Because the paralysis is not within a paradigm as it is with the archaeological published record (and the archaeologists who handle it) that could form the 'Lepenski Vir – Schela Cladovei Culture' paradigm.

'Lepenski Vir – Schela Cladovei Culture'

I use the term 'Lepenski Vir – Schela Cladovei culture' because scientifically this is the order of appearance in archaeology of the two parts that constitute it: Lepenski Vir Culture (Srejović 1966) and Schela Cladovei Culture (Boroneanţ 1969), each of them coined after eponymous sites that were excavated by the researchers quoted respectively. And also, to stress the fact that each one of them was used to refer to certain discoveries, which in fact were parts of the same 'paradigm'. That is an archaeological interpretation of material and spiritual manifestations of some human groups (17 sites located so far) in a certain chronological period (c. 9500 – c. 6000 calBC), in a certain environment – in this case what is known today as the Danube's Iron Gates area/region.

As with any terminology, the one is being used for this paper is an entirely arbitrary choice of words, which are supported historiographically. And this should matter most, while addressing knowledge about the past. If indeed the terminology is misleading, then of course, this fact should be addressed and improved. However, as currently 'farmers' is used so freely in archaeology to label people from Neolithic times, perhaps using 'Lepenski Vir – Schela Cladovei Culture' is not that altogether incorrect or misguiding. Especially if one understands this label to be just what it is – a name for archaeological discoveries, made when they were made and done by the archaeologists who made them, and who choose a form of labelling that was at hand to them at this point of time. Considering the time of the discoveries and their publications and the fact that this terminology – whether Lepenski Vir Culture, Schela Cladovei Culture, Lepenski Vir – Schela Cladovei Culture or Schela Cladovei – Lepenski Vir Culture – found its way into archaeological records (has been used since then and is known for what it stands for) then it is just convenient for future researchers to continue to use it.

In fact, following the arguments above, out of the list of suggestions:

Lepenski Vir Culture, Schela Cladovei Culture, Lepenski Vir – Schela Cladovei Culture, Schela Cladovei – Lepenski Vir Culture, Iron Gates Mesolithic or Vlasac – Schela Cladovei Culture (Srejović 1966; 1972a; 1972b; Boroneanţ 1969; 1980; 2000; Radovanović 1996; Borić et al. 2014), 'Lepenski Vir – Schela Cladovei Culture' is the most correct one. Considering archaeological and historiographic factors that stand behind a semantic construction in archaeology, this should be the one most accurate.

Its Paradigmatic Formation

As with any conceptualisation at first, there is a stage that can be called pre-paradigm. For the archaeological culture in case, this would have to do with the researchers who excavated its sites. And as such, with the schools of archaeology that each of them where formed at, as well as their own type of specialisation in archaeology. The importance of this is found in the way they carried out their excavations and the way that they were prepared to perceive the discoveries that they were to uncover.

It is well known that the researchers were Yugoslavians and Romanians that were formed as archaeologists in the first half of the last century, a time when archaeology in itself was in a process of scientific formation. One could say even at its scientific beginnings.

For now let us just name the researchers that carried out the excavations on the Iron Gates archaeological project.

The Yugoslavian team was formed by B.

Jovanović, Z. Letica, M. Sladić, D. Srejović, R. Vasić, B. Stalio (Radovanović 1996, 3).

The Romanian team was formed by Al. Bolomey, V. Boroneanţ, M. Davidescu, Fl. Mogoşanu, C. S. Nicolăescu-Plopşor, Al. Păunescu, St. Roman, P. Roman (Boroneanţ 2000, 11).

A biographic study of each of the researchers involved in the discoveries of said cultural remains would provide fundamental insight on their personal archaeological formation.

This and the understanding of what archaeology was scientifically at the time, would produce the foundation for the way that archaeologically 'Lepenski Vir – Schela Cladovei culture' was forming towards a paradigm.

But this goes beyond the purpose of this paper and I consider it sufficient to point out, for now, the means for understanding the pre-paradigmatic phase. Later on perhaps, it will constitute a subject of future research.

The second phase within the paradigm formation, as already mentioned before, would be the excavations themselves. And concerning this, not only how the excavators were prepared for their tasks, but even more external factors that made the excavations possible. Those were economic and political factors (a joined project of the socialist states Yugoslavia and Romania for constructing hydroelectric dams at the Iron Gates on the Danube) and the physical manifestations of these factors, transposed in the construction process of the dams. All these factors without doubt created a pressure upon the archaeologists, a pressure that influenced the way the excavations were carried out. This is a fact not to be taken lightly, because archaeologically it is of highest importance. On top of these factors, additionally there were environmental factors, present at all excavations.

Out of all these factors, the one that is most decisive for the formation of a new paradigm is the first one, the so-called pre-paradigm phase. This is something that we always have to be aware of when trying to understand a paradigm (because, as in any human activity, the human subject is the main factor for its development).

As the second phase unfolds, a new stage of the creation of the paradigm is forming, and that would be the discovery of the remains of what would later be labelled 'Lepenski Vir – Schela Cladovei Culture'. These discoveries would confront the archaeologists involved in the excavation process with something that they had not encountered before. Nor had they had any previous (learned) knowledge of such specific types of discoveries (the reference here is to those that defined this particular culture).

So, much of what would happen from that moment on, as we step into the next phase – the definition of the new discoveries – can be and has to be understood from the perspective that I previously stated. In this new phase, the culture was defined at first as two different cultures, as Lepenski Vir Culture (Srejović 1966) on the one side (literary, as it was located on one side of the Danube) and Schela Cladovei Culture (Boroneanţ 1969) on the other side (of the river).

The next step in the evolution of the new archaeological concept was comparing the discoveries to the ones found in proximity. Thereby, similarities were observed. This in turn produced, what we might be inclined to consider as the completion of the paradigm formation, with the emergence of the definitions and terminologies that stated the fact that this was one and the same culture: the Lepenski Vir – Schela Cladovei (Srejović 1969, 19; 1972b, 35) or Schela Cladovei – Lepenski Vir Culture (Boroneanţ 1980).

A brief definition of this paradigm would be as it follows:

- The culture is identified, mostly by tools of bone, antler and boar's tusks decorated or not, and through sculptures made on stone boulders with elongated shape, decorated or not, figurative or not, the figurative ones representing human faces, some having a mixed aspect of anthropozoological type.
- The culture has a lithic industry dominated by quartzite, a fact that explains a restricted typological variation.
- The architecture of the habitations is specific in a certain stage of this culture, with a trapezoidal shape and rectangular hearths. It has to be noted that these trapezoidal structures in general have a floor specially made from burned clay or from a mixture of lime and sand with a consistence resembling mortar.
- The hearths generally are made from stones relatively rectangular in shape, joined (in some cas-

es) with a binder similar to the material used for the floors.

- The shape and structure of these habitations evolved in time from the simple shape bordered with pebbles to the complex one with plastered floors.
- The diet of those past humans was mainly fish (they relied heavily on aquatic resources, according to faunal remains mainly sturgeon), game (mostly of red deer) and edible parts of plants.
- The burials were mostly in supine positions, but there were other positions, such as the one labelled 'sitting position', another with the legs flexed to the pelvis, as well as secondary burials after a process of excarnation and 'head removal'.

This definition is a general one that brings together elements found within the sites. The ones that are predominant are the bone tools, antler and boar's tusks and the chipped stone tools. The one that is specific to one site only are the boulder sculptures. That is to say that not all the elements were found on each site (or recorded – one has to make this remark, if one is dealing with archaeology, though maybe precisely that makes it redundant), but most of them were, albeit in different proportions.

The global conceptual definition of the new paradigm only opened the doors for a new phase that is normal with each paradigm formation: the debate phase. This was started in the sixties of the 20th century and is not quite finished. Perhaps we are in its final phase. To establish this, is the purpose of this paper and by this, to answer the implied question that opens it: whether if the Lepenski Vir – Schela Cladovei Culture is in a state of paradigm paralysis.

A Paradigm Paralysis?

To answer such a question we have to examine the history of research of this culture. After its initial stages, which included excavations and interpretations of the new discoveries, research began to expand, starting with the nineties of the last century. A new generation of researchers conducted analysis on the material remains recovered from the excavations. Also, a new perspective of research emerged, following archaeology's own evolution. Thus, the data increased with information on chronology, architecture, diet consumption, economy, tool typology, spiritual manifestations (artistic and mortuary), inter-human violence, sites' locations, sites' types, (internal) cultural evolution, (external) cultural interactions and other lines of interest. All these analyses were done with the help of new technologies, which appeared during the last century and still are being developed in present times and were deployed by archaeologists in their own research of the human past. However, the archaeologists themselves are of most importance, because they work with the data. Thus, I will name the ones that started the research from the last two decades of the 20th century onwards, who form the category of the new generation of archaeologists interested with the material remains of the 'Lepenski Vir – Schela Cladovei Culture'.

They are (with all respect to the ones that out of lack of knowledge I do not mention):

S. Bököny, B. Gavela, M. Sladić, J. K. Kozłowski, S. K. Kozłowski, Gh. Lazarovici, B. Prinz, J. Chapman, T. D. Price, R. Vasić, B. A. Voytek, R. Tringham, L. Domanska, M. P. Neeley, G. A. Clark, L. Bartosiewicz, C. Bonsall, S. Stalibrass, I. Radovanović, R. Lennon, K. Mcsweeney, C. Stewart, D. Harkness, R. Payton, G. Cook, M. Scott, M. Živko, M. Roksandić, D. Borić, M. Garašanin, D. Antonović, D. Mihailović, M. G. Macklin, A. Whittle, P. Pettit, M. Richards, P. Miracle, V. Dimitrijević, G. Grupe, J. Peters, Ž. Mikić, L. Babović, A. Boroneanţ, A. Dinu, D. Meiggs, A. Bălăşeanu, A. Soficaru, N. Mirițoiu, M. Lazarovici, Lenneis, C. French, V. Şişu, M. Jackes, C. Meiklejohn, J. Raičević, S. Stefanović, B. Čuljković, S. Romac, T. Higham, C. Pickard, H. Greenfield (Rusu 2010).

As was stated for the researchers involved in the discoveries of the material remains of 'Lepenski Vir – Schela Cladovei Culture', it would be useful to consider how the younger ones were shaped as archaeologists, because the quality of the researcher determines the quality of the data. Or, as Clarke stated: 'It has become clear that every archaeologist has thoughtfully or unthinkingly chosen to use concepts of a certain kind – thus committing himself to a metaphysical position, restricting himself to certain paradigms, to use certain methodologies, to accept certain modes of explanation and to pursue certain aims; at the same time explicitly or tacitly rejecting other metaphysical positions, paradigms, methods, explanations and aims. In each era archaeologists represent the temporary state of their disciplinary knowledge by a metaphysical theory which presents appropriate ideals of explanation and procedure’ (Clarke 1973, 12).

Since we can touch the subject only briefly, let us just mention that some of the researchers were contemporaneous – in respect to education, training and professional formation – with the discoverers and the others (the large majority) were formed in archaeological schools during the second half of the 20th century and at the beginning of this century.

All of those researchers’ analyses were published and they constitute the published data of ‘Lepenski Vir – Schela Cladovei Culture’ (for further insights see bibliographies at Radovanović 1996; Rusu 2010; Boroneanț 2012).

Out of the published results we will name the ones that triggered our question, and also that stand for explanation.

Those were: ‘La 30 de ani de la începerea săpăturilor arheologice de la Schela Cladovei’ (Boroneanţ 1996) (aproximate translation: ‘30 years since the begging of archaeological excavations at Schela Cladovei’); ‘Vlasac revisited: formation process, stratigraphy and dating’ (Borić et al. 2008); and ‘The Icoana burials revisited’ (Boroneanţ et al. 2008).

The most recent ones, which further our inquiry, are: ‘The 1965–1968 excavations at Schela Cladovei (Romania) revisited’ (Boroneanţ/Bonsall 2013); ‘Adaptation and transformations of the Danube Gorges Foragers (c. 13.000–5500 BC): An overview’ (Borić 2011) and ‘Late Mesolithic lifeways and deathways at Vlasac (Serbia)’ (Borić et al. 2014).

All these are just some examples of the vast enterprise that was carried out with results published in more than one hundred papers or books. In addition, there are tangential publications, which are evidently in a greater number than the ones I know of, and they exceed my possibilities (Rusu 2010).

What stands out for the named examples is implied by their own titles, namely the process of revisiting old material and even some sites (such as Schela Clavodei and Vlasac) and the process of reviewing (part of which is my own current study).

A normal evolution of scientific research would be that after the initial formation of one type of paradigm the work would focus in the given limits of it. In our case particularly, the archaeological research would focus on the existing material that had not yet been processed and published and on excavating the available sites. However, the research on the ‘Lepenski Vir – Schela Cladovei Culture’ while performing all the above, is still trying to define its paradigmatic limits.

Because of this, the debate on this phase, within its limits that were set about sixty years earlier, tends to stagnate, as it is revisiting (going back) only, instead of moving forward with research (visiting new horizons of archaeological discoveries). Limits that seem to be elusive both empirical and theoretical, but which in fact keep the scientists within the same matrix, arguing for the use of one or the other terminology that seems more appropriate as a label for the discoveries, as for example Epipaleolithic/Mesolithic vs. Early Neolithic, Mesolithic/Neolithic transition vs. contact phase or vs. transformational phase. The same is true for the new periodisation systems, which emerge from time to time in publications, systems that are arguing for the use of one of the terminologies listed above.

The stagnation becomes obvious, because after all this time research is still in the debate phase, while researchers up to now were not able to define the paradigm.

We can see this in the following examples:

After his Epipalaeolithic phase identified as ‘Clisurean’, follows the phenomenon he labels ‘Schela Cladovei-Lepenski Vir culture’, which is divided into four developmental stages. The name of this ‘culture’ to describe various phases from a number of sites on both sides of the river comes from the Romanian site of Schela Cladovei and the Serbian site of Lepenski Vir, both of which Boroneanţ considers the type-sites of this particular historical development. It is easy to see that the use of the names of these two key sites, one from the Romanian and the other from the Serbian banks of the Danube reflects the research politics and a consensus to have this phenomenon represented by one of the most representative sites from each country. However, the choice of name is not only entirely arbitrary but is also misguided since the sequence at Lepenski Vir is not the best candidate to describe the typical Mesolithic development of the Danube Gorges, as will be explained later' (Borić 2011, 167).

Further below Borić is giving a more accurate definition:

'Taking all this into account, if one wanted to select representative type-sites for the characteristics of the Mesolithic existence in the Danube Gorges, instead of the culture history label 'Schela Cladovei-Lepenski Vir culture', which is still widely used by many Romanian archaeologists, who follow Boroneanţ's terminology (see above), one would more accurately describe typical cultural elements characteristic of the (Late) Mesolithic in the region by a hyphenated label 'Schela Cladovei-Vlasac' type of sites' (Borić 2011, 167).

And he continues:

'While Lepenski Vir must be considered paradigms for the Mesolithic-Neolithic transition phase in the region, the intensity of human activity and creative expression seen at Vlasac and at Schela Cladovei (Bonsall 2008) appropriately casts these two sites as paradigmatic of the Mesolithic period. The 'Lepenski Vir culture' as a label to describe the Mesolithic of the Danube Gorges region should now be replaced with the more appropriate 'Vlasac-Schela Cladovei culture.'' (Borić et al. 2014, 27).

I presume these examples to be sufficient to illustrate the phase in which the research presently remains, and thus the one that the paradigm itself is.

However, let us remember from where we started: the so-called pre-paradigm phase, with its own stages of formation of the researchers who later on would discover and analyse the archaeological remains that will create the paradigm itself. As Kuhn states: 'The pre-paradigm period, in particular is regularly marked by frequent and deep debates over legitimate methods, problems, and standards of solution, though these serve rather to define schools than to produce agreement' (Kuhn 1996, 48). Thus, each of the researchers involved in analysing the remains of this archaeological culture is a product of a certain school, and by this, mostly unconsciously, the guiding lines are set forth by their own (direct or assumed) predecessors.

Following the above arguments one should not assume that the pre-paradigm phase is over, since the debate is ongoing and thus, a paradigm is not completely formed.

There is a further argument for a stagnation in the pre-paradigm phase: if this phase would be completed, then research would produce a clear definition of the paradigm that could be used without hesitation (as it is now) by other researchers (not directly involved on it) within their own fields of expertise, as an definitive and clear analogy or testing tool for their archaeological discoveries. Equally, it should be possible to use it as an example for the understanding of the past for the wider public.

Considering all of the above, we can state that the Lepenski Vir – Schela Cladovei paradigm is still in the debating phase and that to label this with the term 'paradigm paralysis' is perfectly correct.

Conclusion

In short, the formation process of the paradigm 'Lepenski Vir – Schela Cladovei Culture' and its current phase can be summarised as follows:

- Field research/archaeological excavations.
- Discovery of new archaeological finds.
- Interpretation of the discoveries, defining them to belong to two distinct cultures: Lepenski Vir and Schela Cladovei.
- Noticing the analogies. Debate phase over the two being one.
- Acknowledgement (by some researchers) that it is one and the same culture.
- Defining it as one culture.
- Phase of debate on its cultural features and periodisation (ongoing).

Let there be known that since our purpose was to establish if the paradigmatic process was in a state of paralysis or not, and that this discussion focuses on the paradigmatic formation, then having a critical approach of the process in itself was not intended. Perhaps my future research, as a consequence of this one, will emerge itself again in the debating process. Arguably, only to produce the consensus needed, so that this paradigm could find its limits so that it would become a full tool for further research of the human past.

One could argue that in my analysis I should have followed also the internal evolution of archaeology from 'culture historical' phase to 'processual' phase to 'post-processual' phase, and thus to make a distinction between the different works that were carried out and published, and such to find out to which theoretical phase the paradigmatic paralysis belongs. However, considering that 'That existing bodies of theory are not only mutually comprehensible but capable to some degree of selective integration is evidence that they should not be regarded as paradigms' (Trigger 2003, 5) and as such the paralysis belongs to the whole of archaeological theories and methods employed to analyse the archaeological remains of what could become the paradigm Lepenski Vir – Schela Cladovei culture.

If one is to make a brief comment on the subject of 'culture historical'/'processual'/'post-processual' archaeology, one could observe that the 'Lepenski Vir – Schela Cladovei culture' stands as a, perhaps, just another example of archaeology's own evolution and the state that it is today.

As my research is not a critique of the archaeological process, but rather an observation of it, then using Kuhn's work is the most proper approach.

For now, with the present paper the intention is, without a doubt, to create awareness within the exiting (and future) researchers that focus their endeavours upon 'Lepenski Vir – Schela Cladovei cultural' remains. Because, as it so often happens, when one is focusing too much on the details, one loses the perspective on the whole. And hopefully quotations like this one, that 'A new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die, and a new generation grows up that is familiar with it' (Planck 1949, 33 f.) will lose its validity.

Aurelian Rusu
Str. Nicolae Titulescu nr.1 bl.280 ap.131
RO-510096 Alba Iulia
aurelian.rusu@gmail.com

Bibliography

Bonsall 2008: C. Bonsall, The Mesolithic of the Iron Gates. In: G. Bailey/P. Spikins (eds.), Mesolithic Europe (Cambridge 2008) 238–279.

Borić et al. 2008: D. Borić/C. French/V. Dimitrijević, Vlasac Revisited. Formation Process, Stratigraphy and Dating. Documenta Praehistorica 35, 2008, 261–287.

Borić 2011: D. Borić, Adaptations and Transformations of the Danube Gorges Foragers (c. 13,000–5500 cal. BC). An Overview. In: R. Krauss (ed.), Beginnings – New Research in the Appearance of the Neolithic between Northwest Anatolia and the Carpathian Basin. Papers of the International Workshop 8th–9th April 2009, Istanbul. Menschen – Kulturen – Traditionen 1 (Rahden/Westfalen 2011) 157–203.

Borić et al. 2014: D. Borić/C. A. I. French/S. Stefanović/V. Dimitrijević/E. Cristiani/M. Gurova/D. Antonović/E. Allue/D. Filipović, Late Mesolithic Lifeways and Deathways at Vlasac (Serbia). Journal of Field Archaeology 39.1, 2014, 4–31.

Boroneanţ 1969: V. Boroneanț, Découverte d'objets d'art épipaléolithique dans la zone des Portes de Fer du Danube. Rivista di Scienze Preistorische 24.2, 1969, 283–298.

Boroneanţ 1980: V. Boroneanț, Probleme ale culturii Schela Cladovei – Lepénski Vir în lumina noilor descoperiri. Drobeta 4, 1980, 27–42.

Boroneanţ 1996: V. Boroneanț, La 30 de ani de la începerea săpăturilor arheologice de la Schela Cladovei. Drobeta 7, 1996, 3–11.

Boroneanţ 2000: V. Boroneanț, Paleolithique superieur final at Epipaleolithique dans la zone des Portes de Fer (Bucarest 2000).

Boroneanț 2012: A. Boroneanț, Aspecte ale tranziție de la mesolitic la neoliticul timpuriu în zona Porțile de Fier, ed. Mega (Cluj-Napoca 2012).

Boroneanţ/Bonsall 2013: A. Boroneanţ/C. Bonsall, The 1965–1968 Excavations at Schela Cladovei (Romania) Revisited. In: E. Starnini (ed.), Unconformist Archaeology. Papers in Honour of Paolo Biagi. BAR International Series 2528 (Oxford 2013) 35–54.

Boroneanţ et al. 2008: A. Boroneanţ/V. Boroneanţ/D. Miriţoiu/A .Soficaru, The Icoana Burials Revisited. Studii de Preistorie 5, 2008, 51–60.

Clarke 1973: D. Clarke, The Loss of Innocence. Antiquity 48, 1973, 6–18.

Kuhn 1996: T. Kuhn, The Structure of Scientific Revolutions (Chicago 1996).

Planck 1949: M. Planck, Scientific Autobiography and Other Papers (New York 1949).

Radovanović 1996: I. Radovanović, The Iron Gates Mesolithic. International Monographs in Prehistory. Archaeological Series 11 (Ann Arbor 1996).

Rusu 2010: A. Rusu, Istoriografia culturii Lepenski Vir – Schela Cladovei. Brukenthal Acta Musei 5.1, 2010, 11–28.

Srejović 1966: D. Srejović, Lepenski Vir. A New Prehistoric Culture in the Danube Region. Archaeologia Iugoslavica 7, 1966, 13–17.

Srejović 1972a: D. Srejović, Europe's First Monumental Sculpture. Lepenski Vir (London 1972).

Srejović 1972b: D. Srejović, Kulturen des Frühen Postglazials im Südlichen Donauraum. Balcanica 3, 1972, 11–47.

Trigger 2003: B. Trigger, Archaeological Theory. The Big Picture (Brigham 2003).

RAIKO KRAUSS

The Mesolithic-Neolithic Transition in the Carpathian Basin

Keywords: Mesolithic, Neolithic, Carpathian Basin, Central European – Balkanic Agroecological Barrier

Compared to other regions of Central Europe the Mesolithic period in the Carpathian Basin is still poorly known. If we want to understand how the Neolithic could establish itself in this region, we have to deal not only with the dynamic of the Neolithisation process but also with the issue of the Pre-Neolithic occupation. Only in this way we can develop a credible hypothesis or model of how the transition from mobile hunter-gatherer to agricultural and sedentary communities has taken place. Several factors might have contributed to the scarce evidence of this particular period in the loess plains of the Carpathian Basin with their strongly meandering rivers. One can assume a low density or high mobility of the Mesolithic population, which produced ephemeral sites. It was also taken into account, that Mesolithic sites are located in unstable geomorphologic situations or in a position where they have been destroyed by modern agricultural activities (Eichmann et al. 2010, 211). Furthermore, it is also obvious that a period with potentially poor find material is more difficult to investigate than times with an expectedly rich material culture. Accordingly the insufficient research on the Mesolithic in the Carpathian Basin was repeatedly highlighted (Starnini 2001, 396; Eichmann et al. 2010, 215 f.). With regard to the landscape there is no good reason to believe that Mesolithic hunter-gatherer groups would have avoided the floodplains, rich in fish and shellfish, of the Danube and Tisza rivers with their biodiverse gallery forests (Bánffy 2004, 21). The land offers more than enough attractive resources for communities with a livelihood based on fishing and hunting. So the question arises, how the almost complete absence of Mesolithic sites in the Carpathian Basin could be explained. Therefore, I would like to begin with a synthesis on the state of research on the Late Mesolithic in the Carpathian Basin before addressing some aspects of the Early Neolithic occupation in this region.

According to the terminology developed in Central Europe the Mesolithic covers the climatic stages from Pre-Boreal to the early Atlantic Period, in absolute dates the timespan of 9700–5500 calBC. It is divided into Early Mesolithic with the two techno complexes of the Beuronien and the Sauveterrien from 9700–7000 calBC and Late Mesolithic or Tardenoisien from 7000–5500 calBC (Kozłowski 2001, 261 f.; Kind 2009; Eichmann et al. 2010, 213). This is followed by the so called *Endmesolithikum* which is seen to be already contemporaneous with the appearance of the first Early Neolithic groups in Central Europe, La Houguette in the West and Linienbandkeramik (LBK) in the East (Gronenborn 1997, 132–139). The question arises what to expect in the lithic industry for the Late Mesolithic in the Carpathian Basin. To assess the Mesolithic of this particular region it is worthwhile first to consider this epoch briefly in the surrounding areas.

The Mesolithic Development in the Areas Surrounding the Carpathian Basin

The so called *Spätmesolithikum* in southern Germany which extends into the north-westerly neighbouring areas of the Carpathian Basin, such as Bohemia, Moravia and Lower Austria (*fig. 1*) is comparatively well investigated. Its beginnings remain controversial, but may be placed in the time of the incipient Atlantic period, between 7000 and 6500 BC. Characteristic finds are particularly trapezes and regular blades with facetted platform remnants (Gronenborn 1997, 129). The continuation of Mesolithic stone chipping techniques into the 6th mill. BC by some researchers was considered as an indication of an autochthonous development of the Earliest LBK in Central Europe (Tillmann 1993; Kind 1998). However, this hypothesis was later discussed controversially (e.g. Gronenborn 1994; Zimmermann 2010).

To the Southwest of the Carpathian Basin the Castelnovian was initially described as a southeastern variant of the French Tardenoisian (de Fonton 1967). The Mesolithic inventories are characterized by trapezes, notched blades, subconical cores and microburins. A series of radiocarbon dates indicates a beginning also parallel to the Atlantic period (Biagi 2001, 71) and recently the chronological framework for the Castelnovian was given from 6600–5600 calBC (Perrin/Binder 2014, 274). Its distribution extends from northern Italy to the East at least as far as the Slovenian Karst (Perrin/Binder 2014, fig. 1). Concerning the tradition of stone chipping techniques from the Castelnovian into the subsequent Neolithic rather the breaks than the continuities have been emphasised (Biagi 2001, 77 – 81) even if, at least in Italy, the lithic assemblages of the Early Neolithic Impressed Ware show only few differences to those assigned to the Castelnovian (Perrin/Binder 2014, 277).

Directly neighbouring to the Southeast of the Carpathian Basin is the region of the Iron Gates. Luckily, this region is one of the best studied in Europe (see the contributions of Bonsall/Boroneanţ in this volume). But it has to be stated again that only very little about the Mesolithic is known from other regions in the Balkan-Carpathian region. The stone tool inventory of the Iron Gates Late Mesolithic is comprehensive and consists of several types of end-scrapers, side-scrapers, retouched flakes, burins, perforators, awls, retouched bladelets and tranchets (Radovanović 1996, 233–251). A striking element are the trapezoidal plans of the dwellings that possibly can be seen as solid realisations of preceding tent or hut constructions (Srejović 1973, 50–108; Radovanović 1996, 60–159; Borić 2011, fig. 14). Due to the peculiarity of the landscape in the narrow gorge of the Danube even in the times of the Early Neolithic Proto-Starčevo Culture the economy in this particular region remained based on fishing and hunting. For that reason this region is appropriate to examine the interactions between Mesolithic and Neolithic. On the basis of many radiocarbon dates the Late Mesolithic in the Iron Gates can be limited to the centuries from 7400–6200 calBC. This is followed by a phase of a transformation to the Early Neolithic from 6200–5900 calBC (Borić 2011, 168–181).

To the East the Mesolithic in the Carpathians is still poorly investigated. For the Ukrainian territory Leonid G. Matskevoi has defined several cultures (Мацкевый 2001). But in view of their stratigraphic uncertainty and the heterogeneous character of the material they remain doubtful (Dolukhanov 2008, 290). S. Kozłowski classifies the Late Mesolithic material from Transcarpathian Ukraine as belonging to the Janisławice Culture (Kozłowski 2001, 267). For the adjacent North-Pontic steppe zone two cultural areas could be distinguished (see the contribution of Kiosak in this volume). In the southern area there is the Grebeniki variant which is surrounded by the Kukrek Culture. Both expressions of the Mesolithic in the steppe show significant territorial overlaps. The chronological frame of the Mesolithic features east of the Carpathians is not very well defined (Dolukhanov 2008, 289 f.) but the appearance of

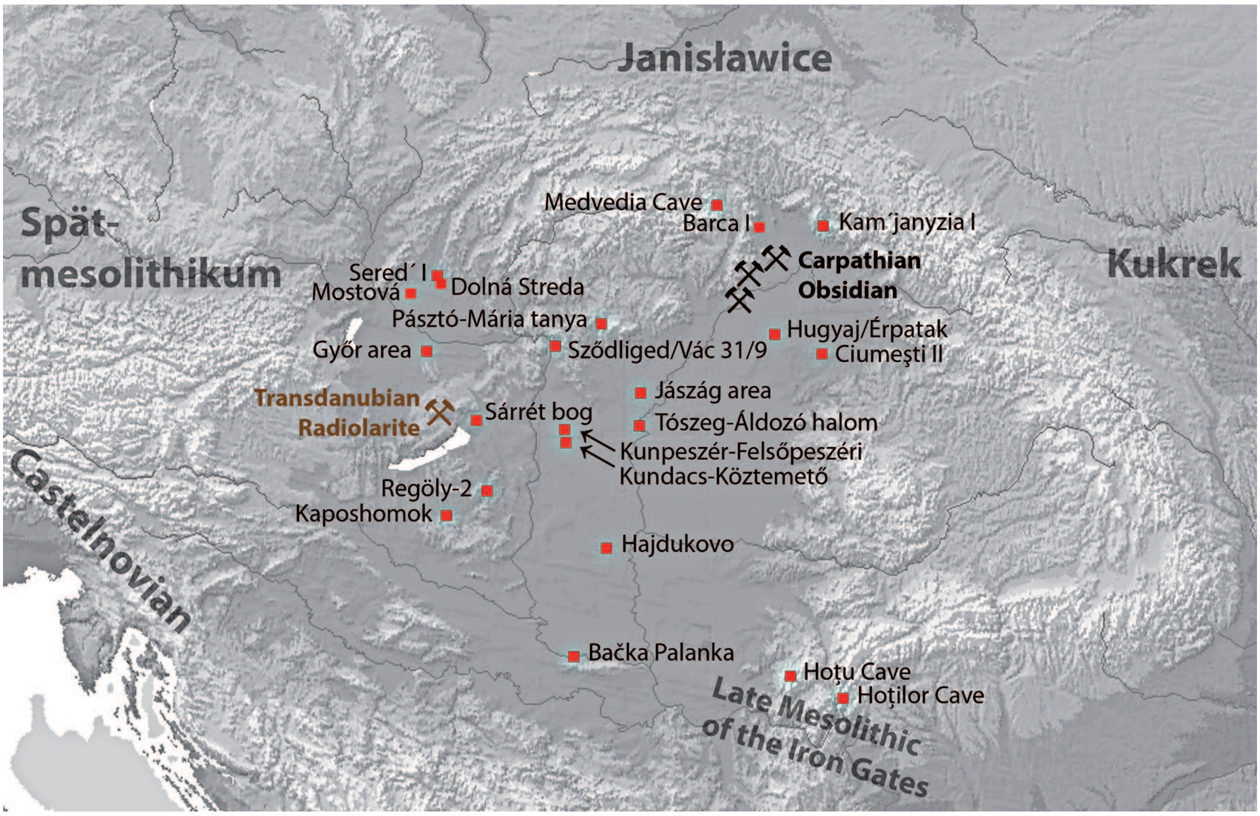

Fig. 1. Mesolithic sites and sources of lithic raw material in the Carpathian Basin.

the Bug-Dniester Culture as the oldest manifestation of Neolithic in the region gives at least a terminus *ante quem* of around 6000 calBC.

North of the Carpathian Basin eventually the Janisławice Culture must be mentioned. Its chronological frame is given roughly from the 7th to the 4th mill. BC (Kozłowski/Kozłowski 1979, 105). The stone industry is characterised by a high number of side- and end-scrapers, microliths and rarely burins, truncations and the typical Janisławice points (Kozłowski 1975, 74 f.). A rich deposit of silex with a characteristic chocolate colour in the upper Vistula Basin seems to be of major importance as a source of raw material for the Janisławice Culture (Bednarz 2001).

Evidences for Mesolithic Habitation in Banat and Bačka

The state of research on the Mesolithic in Banat has been well summarised by Adina Boroneanţ (2011). From this, it is clear that Mesolithic sites are exclusively situated in the southern Banat, a region which is part of the Iron Gates region of the Danube and nowadays only administratively belongs to the Romanian Banat. The only two sites located not in the gorges themselves, Hoţu Cave, next to Steierdorf (Anina) and Băile Herculane-Hoţilor Cave, are situated just a few kilometres north of the Iron Gates. From the Hoţu Cave a few chipped artefacts were reported, including a backed microlithic point. Because of the small number of finds hardly any correlation other than chronological could be made. Two samples of charcoal from a hearth in the cave yielded a date in the middle of the 7th mill. BC (Boroneanţ 2011, 106 f.). The inventory of the Hoţilor Cave consisted almost exclusively of microlithes (96 %) made from local lithic raw material. End-scrapers, burins, geometric segments, backed bladelets and Azilian points are mentioned as characteristic shapes (Boroneanţ 2011, 118). One single radiocarbon date from the Mesolithic layer of the caves stratigraphy points to an equally early date. With a range of 11.559 – 11.215 calBC the date still fits into the range of the Epipaleolithic of the Iron Gates (Borić 2011, 191; Boroneanţ 2011, 118). Throughout the

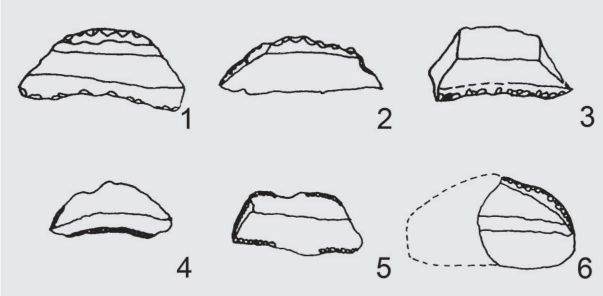

Fig. 2. Hajdukovo, Vojvodina (SRB). Mesolithic stone tools: trapezes and crescents. After Brukner 1974, fig. V.1 (without scale).

northern part of the Banat the Mesolithic sequence is unknown, either because of the conditions for preservation or because of the state of research.

The situation in the western adjacent Bačka is only slightly better. Bogdan Brukner has reported geometric microliths in a Tardenoisian tradition from Hajdukovo (*fig. 2*), an ephemeral site close to Subotica. A second site which yielded trapezoid and crescent-shaped microlithes is situated on the sandy coast of the Danube at Bačka Palanka, west from Novi Sad (Brukner 1974, 23). In both cases these are old finds that occurred only very sporadically. The question of the supply of raw materials is of some importance, because both sites are located in areas of the Bačka without any significant deposits of flint stones. Thus, if the geomorphological base is an important factor for the preservation of Mesolithic sites, it seems to be the most important reason, why no Mesolithic sites have been discovered in the loess plains of Banat and Bačka. The few known sites in the Bačka are located exclusively on the banks of the alluvial plains of the rivers and the sites in Banat are situated already in the hilly parts of the southern Carpathians.

The Mesolithic in Transdanubia and Western Slovakia

Much better is the state of research for the Mesolithic in the Hungarian parts of the Carpathian Basin and the Slovakian territories adjacent to the north. The state of research on Mesolithic in Transdanubia was summarized by Eichmann, Kertész and Marton (Eichmann et al. 2010). From the area of Győr they reported a total of eight Mesolithic find collections that no longer can be assigned to any specific site (Eichmann et al. 2010, 216). Most of the materials have been collected by Benedictine monks in the late 19th century and were assigned later to the Magdalenian or Tardenoisian. Nonetheless, because of their uncertain provenance these finds were considered to offer only ambiguous evidence for the Mesolithic in the vicinity of Győr (Eichmann et al. 2010, 217).

Possibly Mesolithic are two barbed bone harpoons uncovered in the Sárrét bog, a former Early Holocene lake, during peat-cutting activities in the field of Csór-Merítőpuszta and next to the village of Nádasdladány (Eichmann et al. 2010, 217).

From a sand dune on the floodplain of the Kapos River at Kaposhomok a private collection of flint artefacts was reported, that in comparison with assemblages from southern Germany could be assigned conceivably to the late Early and Late Mesolithic (Eichmann et al. 2010, 217–219). The material consists of regular blades, notched blades, truncated blades, abruptly backed blades, thumbnail scrapers, borers, exhausted cores, and geometric microliths like triangles and trapezes (Eichmann et al. 2010, 217). Interestingly, a large proportion of the raw material consists already of Transdanubian radiolarite, probably from the Szentgál mine, which was extensively used later in the Early Neolithic. Most likely the Mesolithic groups had not only access to this source, but perhaps also controlled this outstanding deposits (Bánffy 2008, 153). There is evidence that Szentgál radiolarite was brought further north into southern Moravia already during the Mesolithic (Mateiciucová 2003, fig. 12).

The site of Regöly-2 in Transdanubia was investigated systematically in recent years. Although no radiocarbon dates are available, typologically the finds can be assigned to the Late Mesolithic (Eichmann et al. 2010, 223–227). The lithic inventory consists of exhausted single- and multi-platform cores, blades with dorsal scars, regular blades in many sizes, short, narrow blades, scrapers, perforators and geometric mircolithes with trapezes and abruptly backed blades (*fig. 3–4*). As sources for the radiolarite predominantly used two deposits, one in the Bakony Mountains the other in the eastern Mecsek Mountains, could be identified (Eichmann et al. 2010, 226). Hydroquarzite and/or limnoquarzite are rarely present in

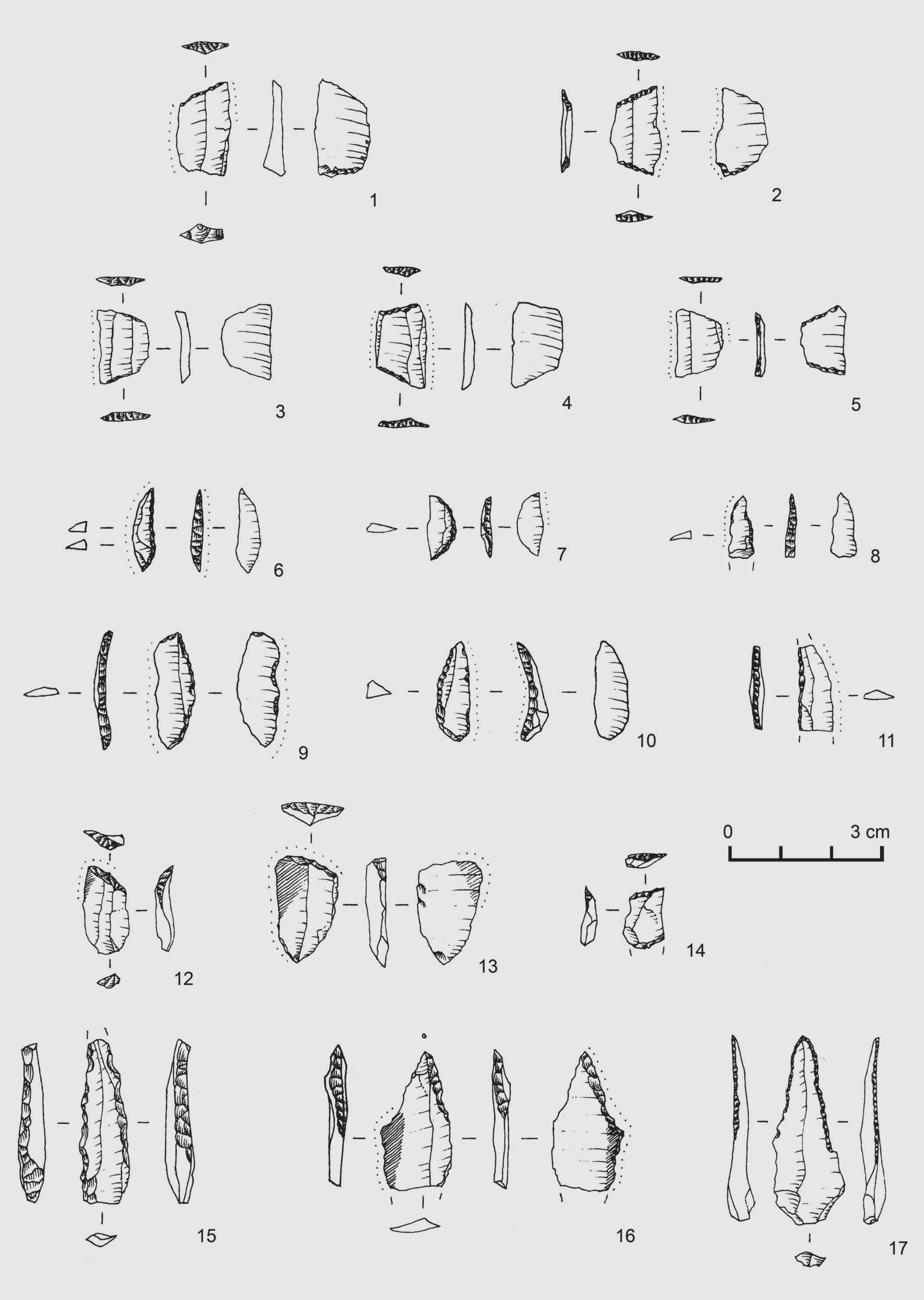

Fig. 3. Regöly 2, Transdanubia (HU). Mesolithic stone tools: microliths and tools on blades. After Eichmann et al. 2010, fig. 3.

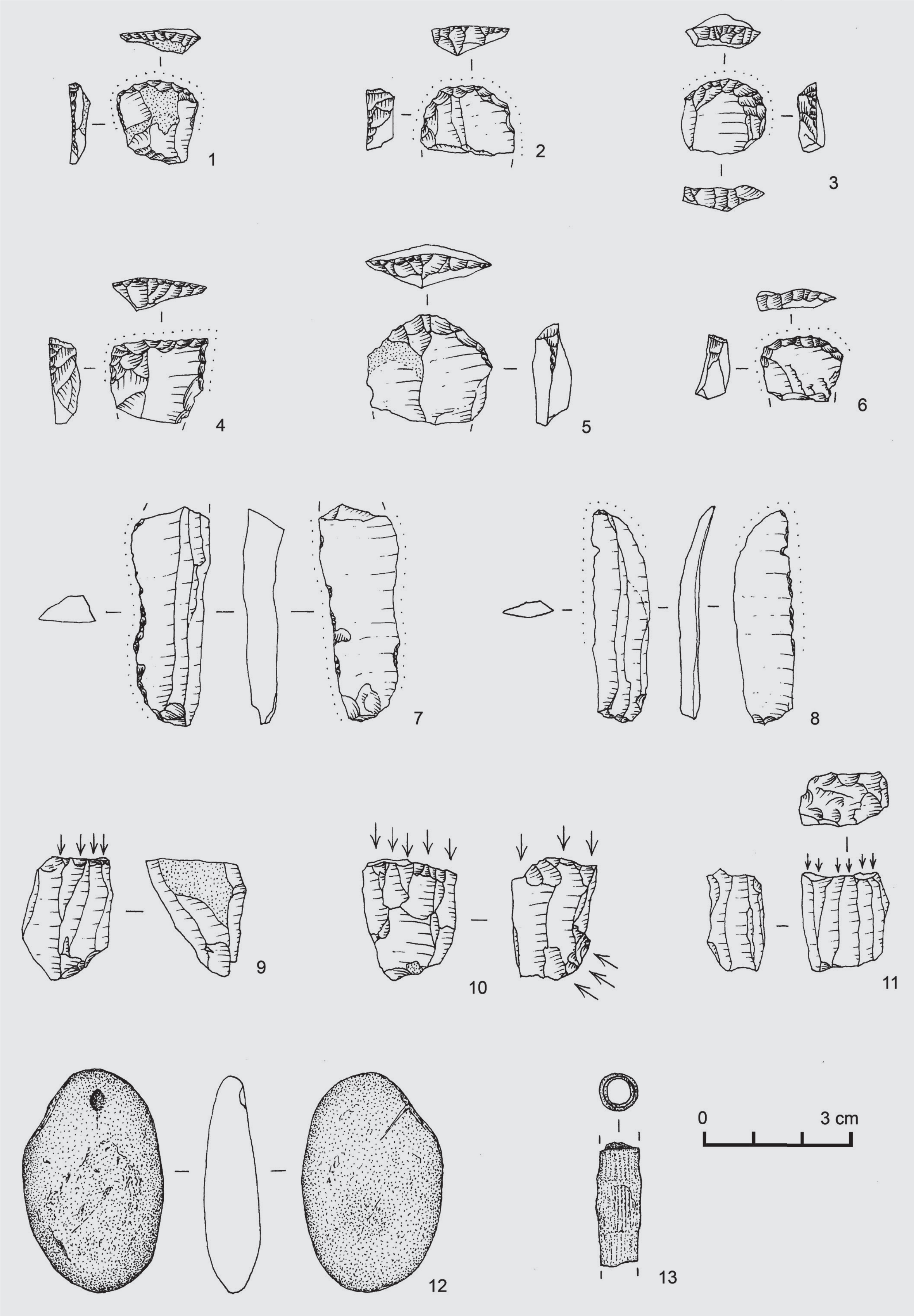

Fig. 4. Regöly 2, Transdanubia (HU). Mesolithic stone tools: scrapers (1 – 6), blades (7 – 8) and blade cores (9 – 11). 12: partially drilled gravel. 13: fossil dentalium shell. After Eichmann et al. 2010, fig. 4.

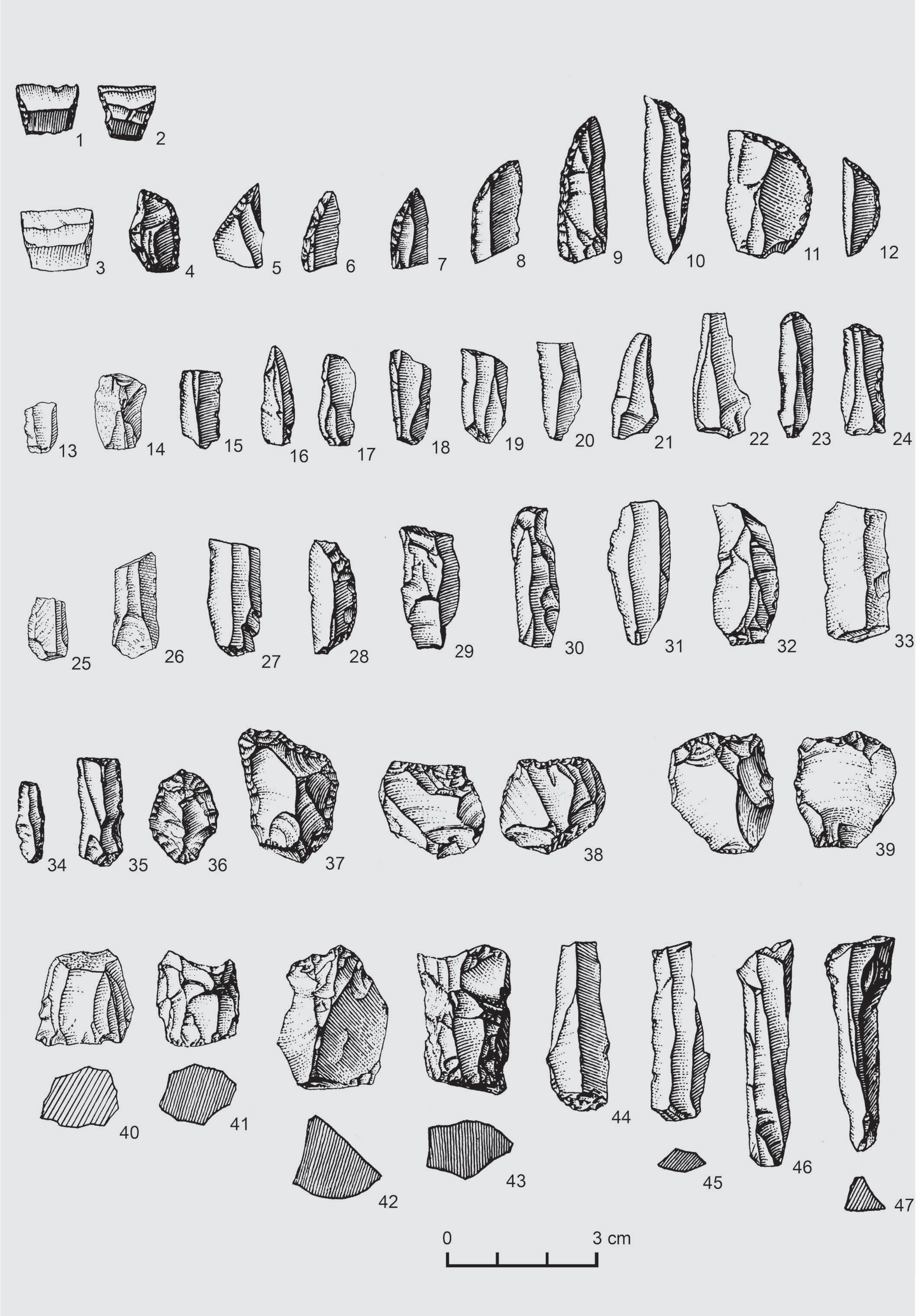

Fig. 5. Dolná Streda, Trnavský kraj (SK). Mesolithic stone tools: trapezes (1 – 3), triangles and backed segments (4 – 12), blade fragments (13 – 35), scrapers (36 – 39), cores (40 – 43) and core pieces (44 – 47). After Bárta 1972, fig. 9.

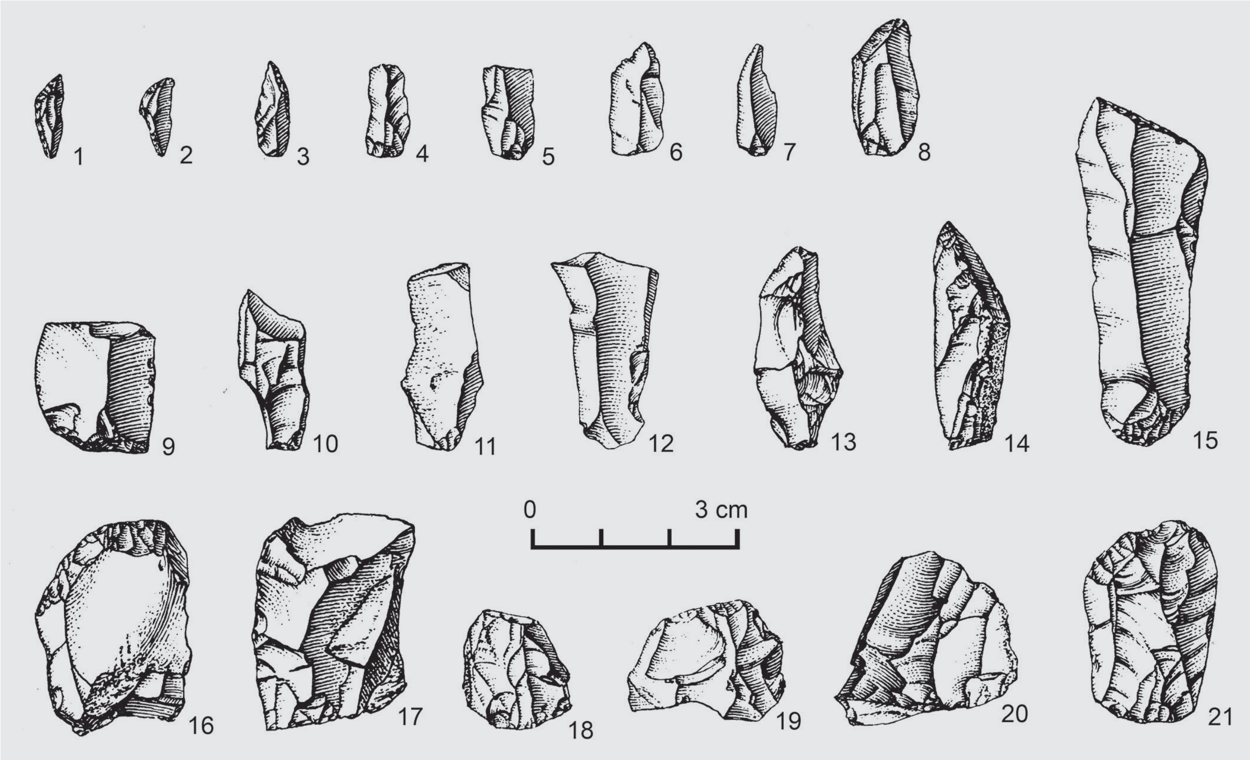

Fig. 6. Mostová, Trnavský kraj (SK). Mesolithic stone tools: backed segments (1 – 3), blade fragments (4 – 12), shattered pices (13 – 14), retouched blade (15), scrapers (16, 21) and cores (17 – 20). After Bárta 1972, fig. 10.

the raw material and two pieces are made of obsidian. About the structure of the settlement very little was reported up to now. Soon the ongoing excavations will certainly deliver more information about how the dwellings of a Mesolithic site have looked like and how life was organized beyond the production of stone artefacts.

Substantial Mesolithic material comes from the long-term excavations at Sereď I, Mačianske vŕšky in western Slovakia (Bárta 1972, 57 – 69). This site is located on a sand dune above the northern bank of the Danube. Analysis of malakofaunal remains, some charcoal and of pollen from the sediments demonstrates that the environment in Mesolithic times had the character of a forest-steppe. Oak, pine, willow, maple, birch, hazel and *rosaceae* could be detected (Bárta 1972, 63). The chipped stone inventory has been described extensively by Juraj Bárta and was compared with the Late Tardenoisian and the *Spätmesolithikum* in southern Germany (Bárta 1972, 63). Unfortunately because of later processes of soil formation settlement structures could not been detected at Sereď I. Nevertheless, quite a lot is known about the economy of the settlement. Based on the animal bones hunt on red deer, roe deer, wild boar, bison, aurochs, donkey, horse and hare could be identified. Also the snail *Helix pomatia* played a role in the diet (Bárta 1972, 64).

The finds from Sereď I provided the opportunity for further investigations of the dunes in the vicinity of Bratislava by the Slovakian colleagues. Subsequently, the sites of Dolná Streda, Veľká Mača, Šoporňa-Štrkovec, Sladečkovec, Mostová, Čierna Voda and Tomášikovo were registered. From them a fair assortment with cores, regular blades, scrapers, small points with side retouch and a few microlithic trapezes from Dolná Streda (*fig. 5*) and Mostová (*fig. 6*) was presented.

The transition to the Neolithic in Transdanubia is of particular interest because this part of the Carpathian Basin is regarded as the cradle of the Earliest LBK. However, it seems as if the Neolithic in Transdanubia could have evolved on a new basis, or at least not on the foundations of the Mesolithic tradition, since most researchers rather stress the breaks in the cultural development (Starnini 2001, 401 f.; Bánffy 2004, 21 – 25). But

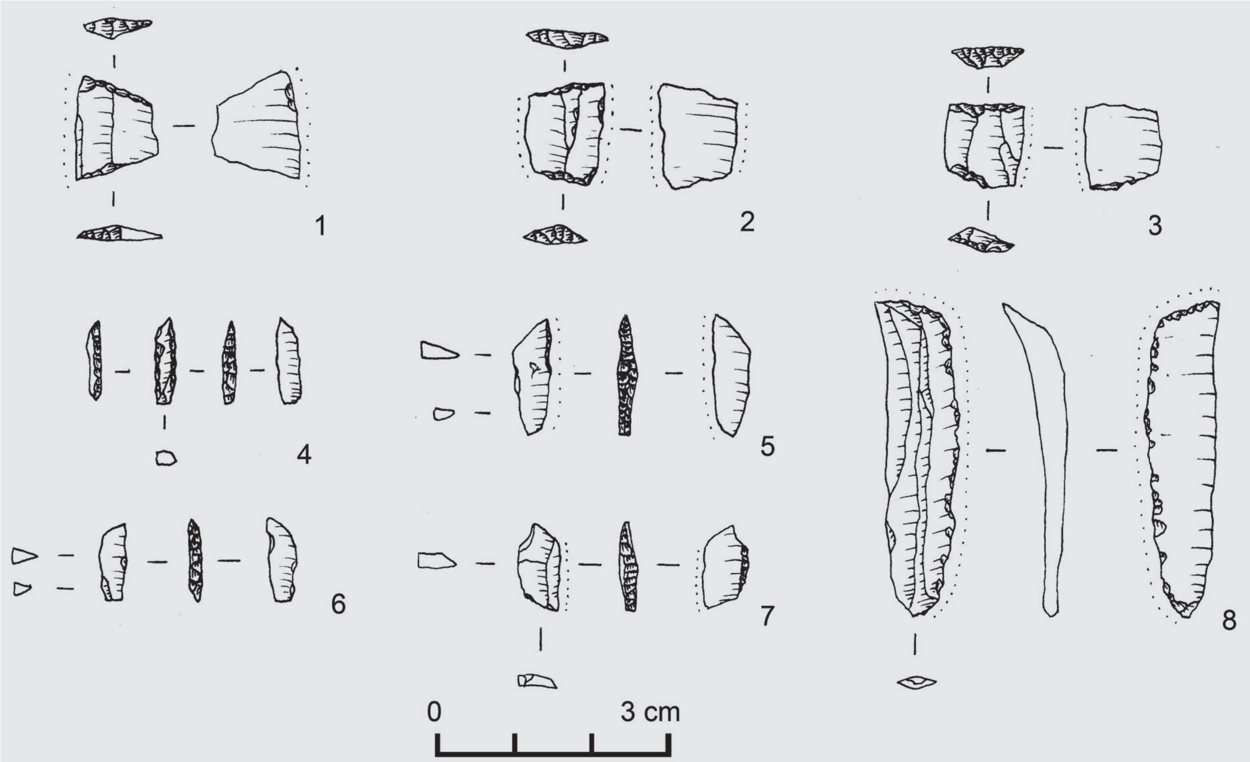

Fig. 7. Sződliget, Älföld (HU). Mesolithic stone tools: trapezes (1 – 3), backed microliths (4 – 7) and regular blade (8). After Eichmann et al. 2010, fig. 2.

here again in comparison to the Neolithic the poor state of research on the Mesolithic settlements has to be taken into account.

The Mesolithic in the Alföld, Eastern Slovakia and in the Carpatho-Ukraine

The treatise of the Mesolithic in the Alföld includes the intra-Carpathian areas of the neighbouring countries, as eastern Slovakia, the Carpatho-Ukraine and one site in north-western Romania.

Thanks to the excavation of Miklós Gabori in Sződliged/Vác and the intense survey of Róbert Kertész in the Jászság area the Mesolithic in the Alföld can be regarded as comparably well researched. At Sződliged, close to the Danube Bend two sites only 200m away from each other were reported, which Gábori excavated in the years 1954 and 1967. A re-investigation of the finds by Eichmann, Kertész and Marton comes to the conclusion that parts of the site date to the late Early or Late Mesolithic (Eichmann et al. 2010, 219–221). The raw material is dominated by low quality hydroquarzites and limnoquarzites from local river cobbles. The inventory consists of lithic debris, many wedges (pièces esquillées or bipolar cores), regular blades, many utilised flakes, abruptly backed pieces, segments, a possible microburin, and trapezes (*fig. 7*). Some of the structures were interpreted as hearth platforms comparable to the oval hearths at the Late Mesolithic sites in the region of the Iron Gates, in particular from Vlasac II and III (Eichmann et al. 2010, 221). A small rectangular structure with rounded corners, measuring 2.4m by 2.2m, outlined with stones was interpreted as a dwelling (Kertész 1996, 22). Accordingly, at Szödliged at least for some time a permanent settlement must have existed. The researchers also highlight other structural similarities between Sződliged and the sites in the region of the Danube Gorges like the position of the site in the valley of the Danube, and specific aspects of the lithic technology like blade production by pressure technique and the predominance of bipolar cores (Eichmann et al. 2010, 221).

The Jászág Basin, a vast flood plain between the upper Tisza River and the Danube Bend in

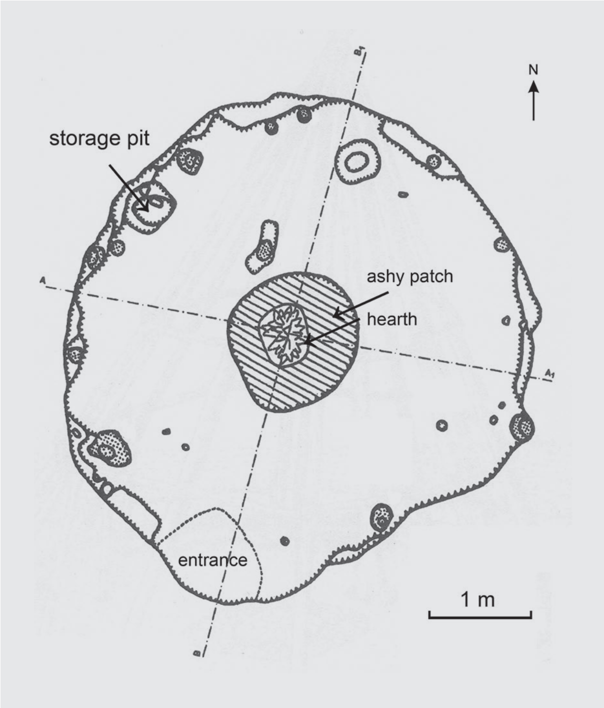

Fig. 8. Jásztelek I, Alföld (HU). Mesolithic dwelling feature. After Kertész 1996, fig. 12.

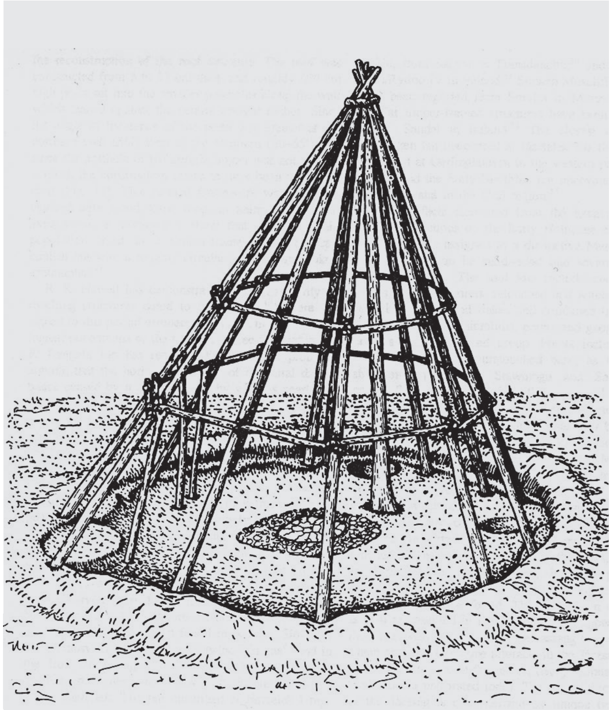

Fig. 9. Jásztelek I, Alföld (HU). Reconstruction of the Mesolithic hut. After Kertész 1996, fig. 13.

the northern Alföld, was extensively surveyed by Kertész and his colleagues (Kertész 1996). Upper Palaeolithic and Epipalaeolithic sites could be recorded on a Pleistocene alluvial fan on a slightly higher-lying Würmian formation which rises above its surroundings. Two Mesolithic sites, Jászberény I and Jásztelek I, were found in the lower zone of the Holocene alluvial plain (Kertész 1996, 13). Both sites consist of 10–15 cm thick cultural layers in a scatter from 12 to 17 m in diameter. One feature, dug into the ground for up to 50cm of depth at Jásztelek I was interpreted as a tent or hut-like dwelling (*fig. 9*). The round structure has a diameter of 500cm and shows postholes along the edge and a hearth platform in the very centre (*fig. 8*). A comparable dwelling structure attributed to the Late Palaeolithic Świdry Culture was uncovered in Mucharz, district of Wadowice, in southern Poland (Valde-Nowak 2010, fig. 5). The reconstruction in Mucharz is slightly different, as this structure is reconstructed with a central post in the middle instead of a fireplace.

The raw material of the lithic inventory of the Jászág sites is dominated by hydroquarzites and limnoquartzites from the nearby Mátra Mountains, while siliceous rocks from more distant areas, such as obsidian, played a subordinate role (Kertész 1996, 19). Kertész has emphasized the unique typological character of the Mesolithic industry from this sites, which comes mainly from Jásztelek I (*fig. 10–12*) and Jászberény IV (*fig. 13*): 'The tool kits include end-scrapers, burins, scrapers, borers, retouched and notched blades, microliths, retouched flakes and combined implements (…) Among microliths, points and geometric microliths form a marked group. Points include pieces with retouched and unretouched base, as well as a shouldered point and Stawinoga and Sauveterrian points. The geometric microliths recovered from the Mesolithic culture layers included segments and various types of triangles. Trapezes have so far only been identified among the material from surface collections and disturbed layers or layers that postdate the Mesolithic. Truncated blades included pieces with transversal, oblique, concave and convex truncations. Backed blades were retouched on one or both sides. The lithic assemblages also contained blanks that have little typological importance, semi-finished pieces and unretouched flakes which, together with cores, indicate local production. Cores include irregular prismatic, conical and rounded types. No

Fig. 10. Jásztelek I, Alföld (HU). Mesolithic stone tools: scrapers. After Kertész 1996, pl. 4.

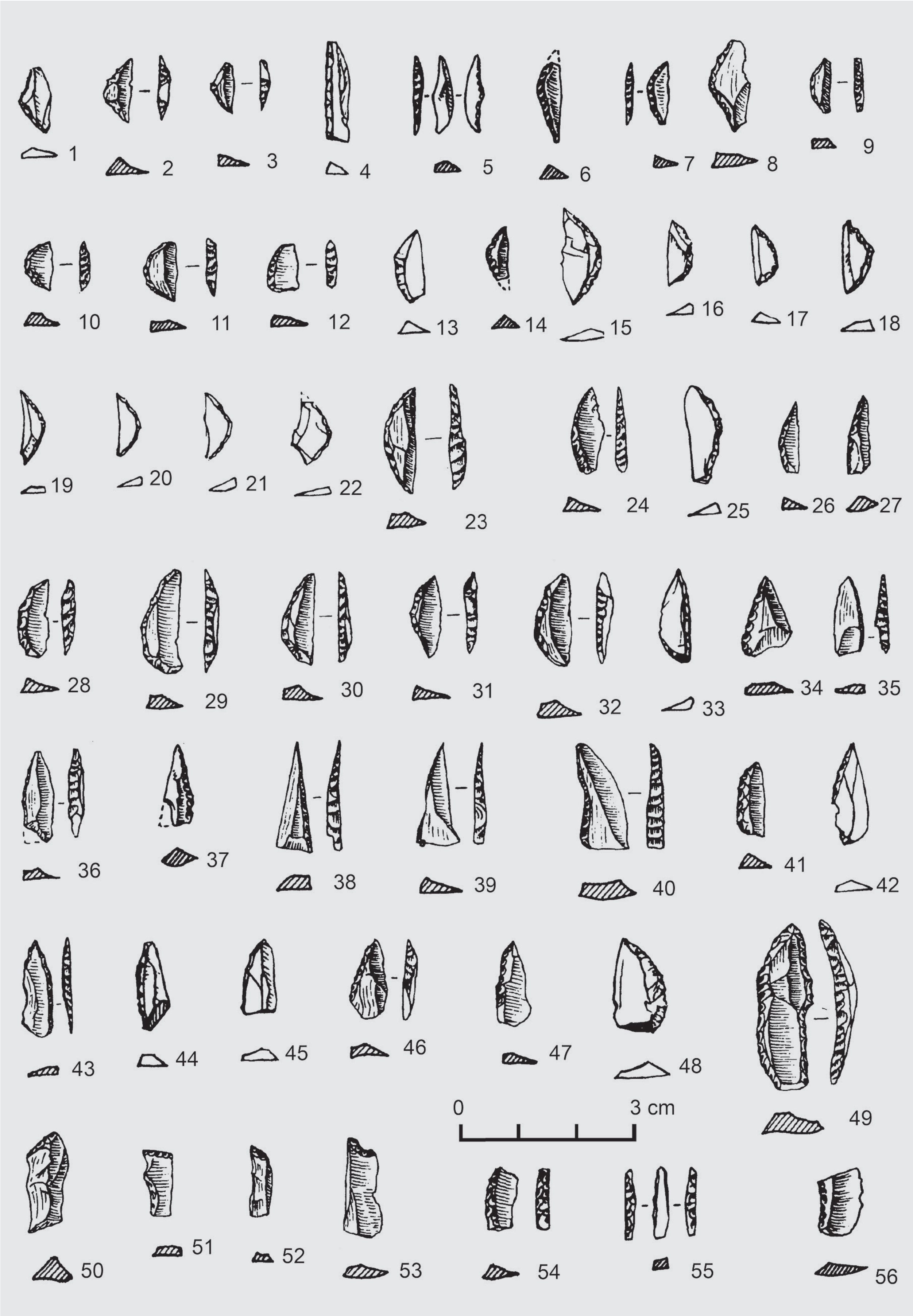

Fig. 11. Jásztelek I, Alföld (HU). Mesolithic stone tools: triangles and backed fragments. After Kertész 1996, pl. 5 – 6.

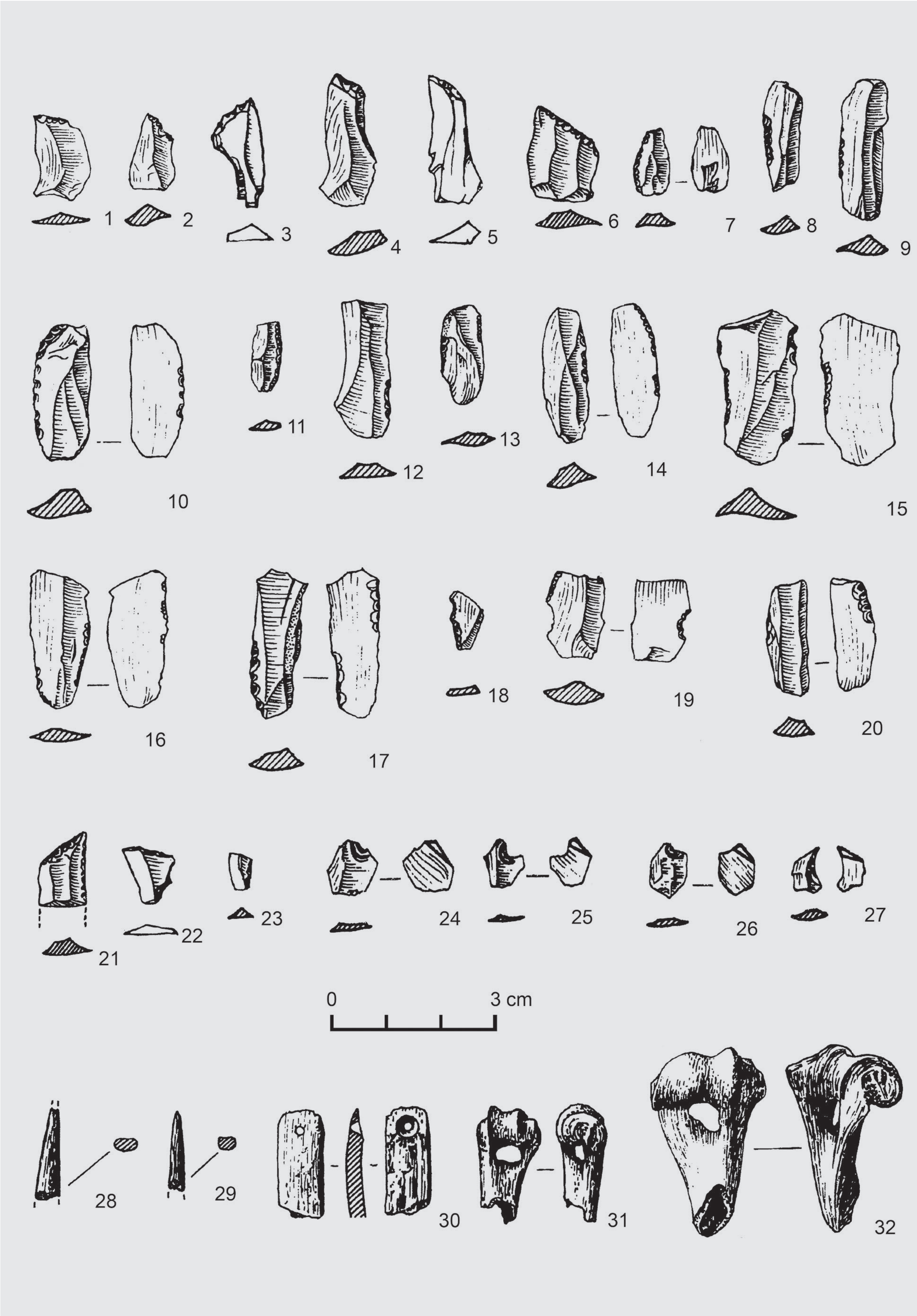

Fig. 12. Jásztelek I, Alföld (HU). Mesolithic stone and bone tools: blades and blade fragments (1 – 23), mico burins (24 – 27), bone points (28 – 29), and perforated bone implements (30 – 32). After Kertész 1996, pl. 6 – 8.

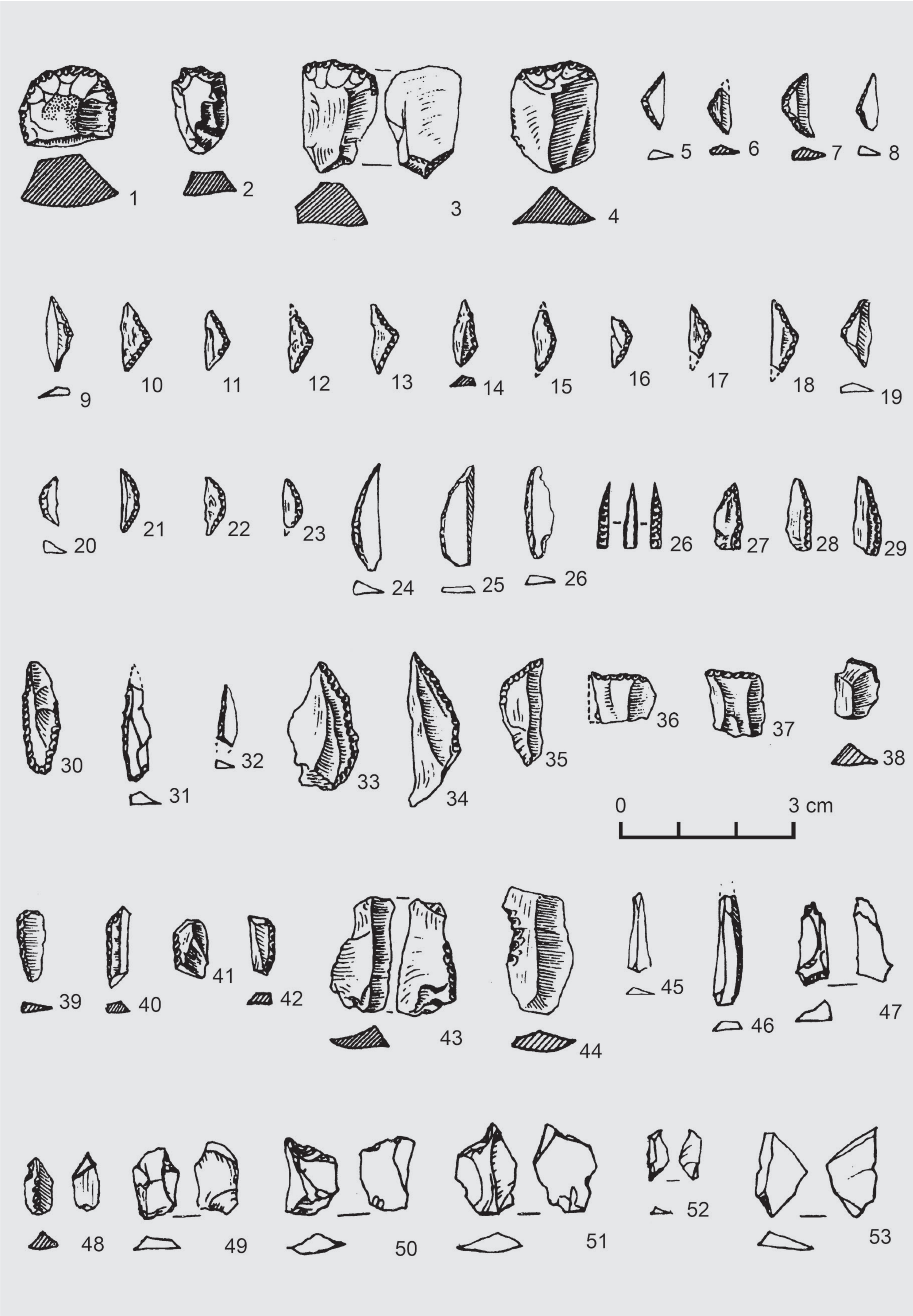

Fig. 13. Jászberény IV, Alföld (HU). Mesolithic stone tools: scrapers (1 – 4), triangles (5 – 19), crescents (20 – 26), backed fragments (26 – 35), retouched blades and blade fragments (36 – 47) and micro burins (48 – 53). After Kertész 1996, pl. 4 – 8.

Fig. 14. Ciumești II, Sathmar region (RO). Mesolithic stone tools: core (1), burin (2), blades (3 – 4, 6), scrapers (5, 10 – 11, 15, 18), utilized blade (14), trapezes (8 – 9, 13, 16 – 17, 20, 22 – 13, 27), and backed pices (7, 12, 19, 21, 24 – 26). After Păunescu 1964, fig. 4.

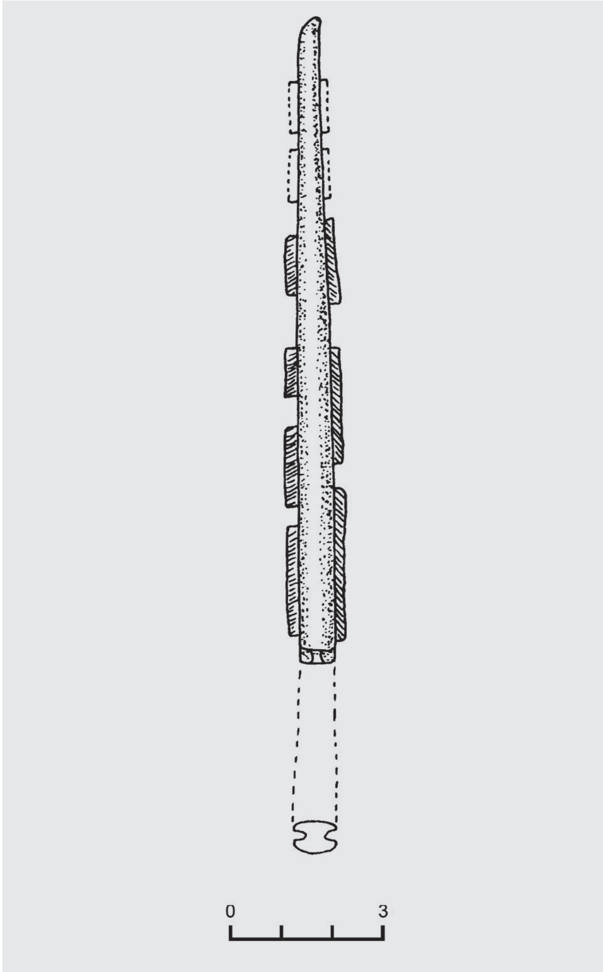

Fig. 15. Medvedia cave, Košice region (SK). Mesolithic bone point with microlithic stone inserts. After Bárta 1989, fig. 5.

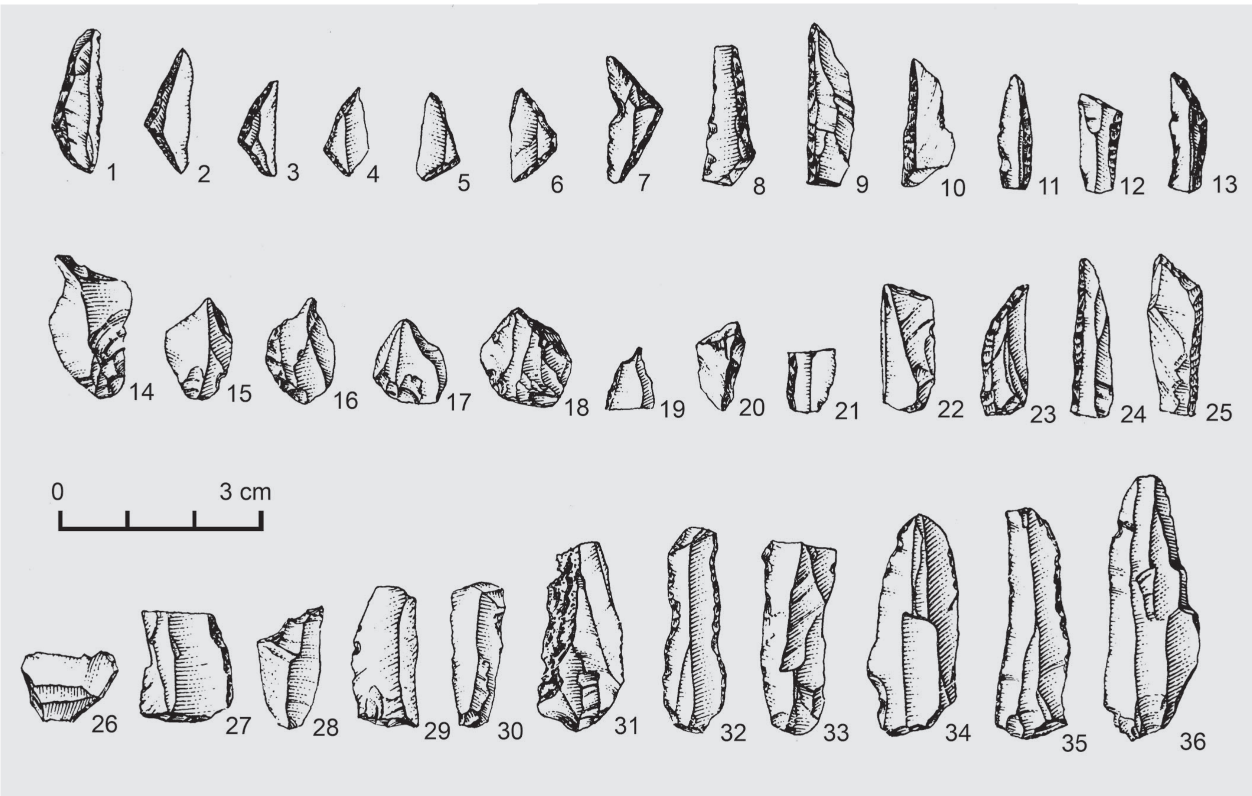

Fig. 16. Barca I, Košice region (SK). Mesolithic triangles (1 – 7), backed segments (8 – 13), borers (14 – 20), blade tools and fragments (21 – 36). After Bárta 1972, fig. 10.

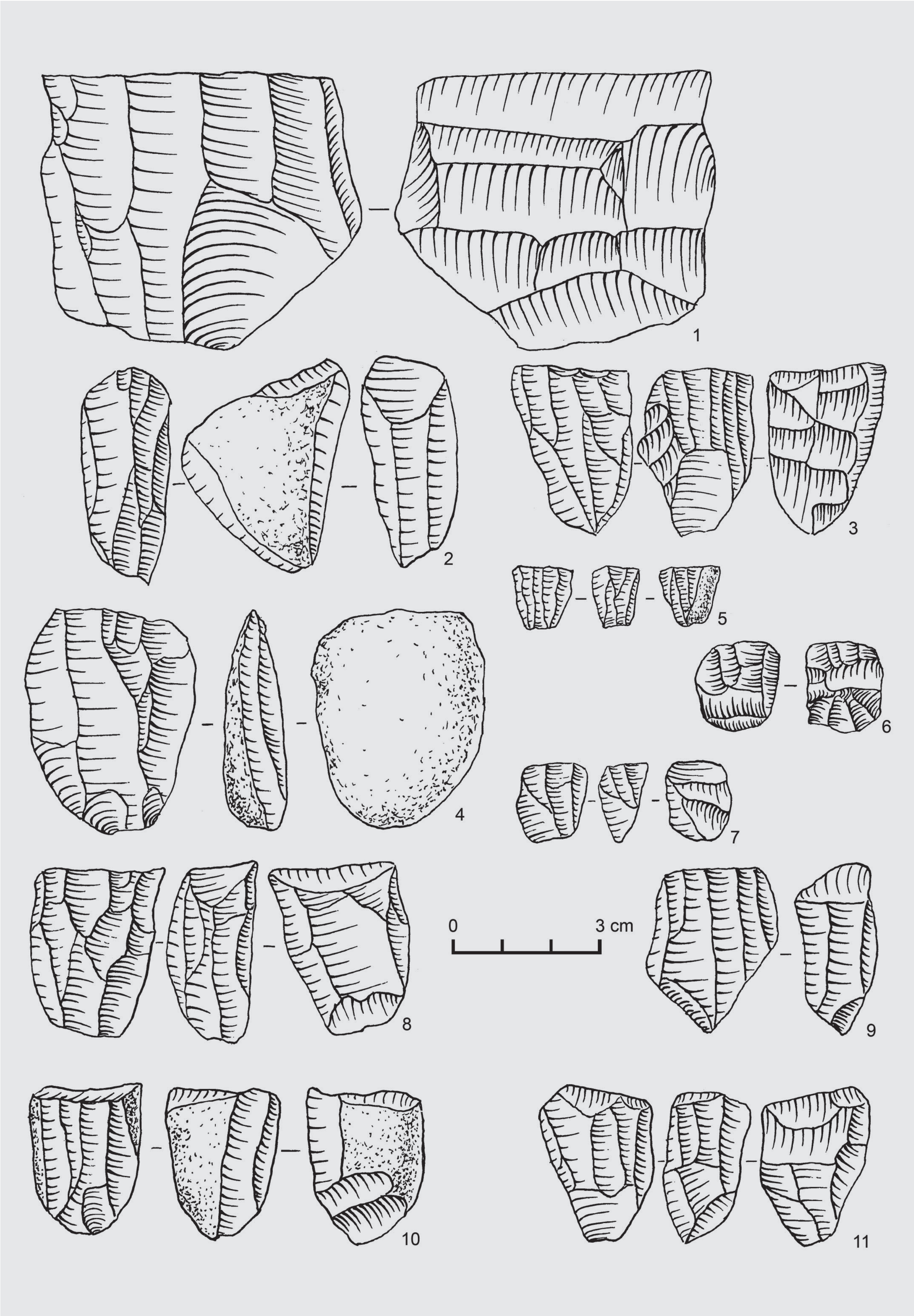

Fig. 17. Kam´janyzia I, Transcarpathia (UA). Mesolithic blade cores. After Мацкевый 2001, fig. 6.

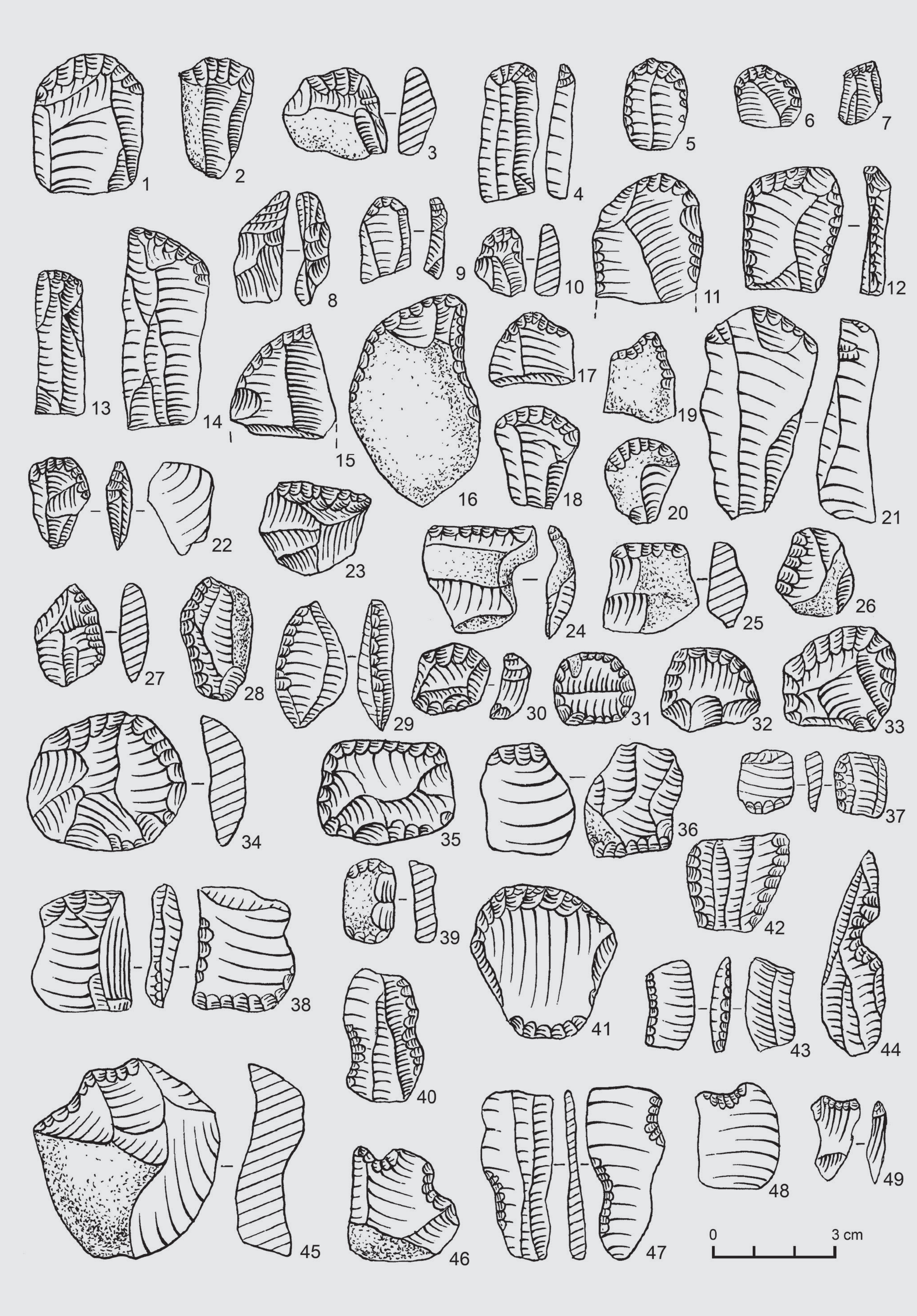

Fig. 18. Kam´janyzia I, Transcarpathia (UA). Mesolithic stone tools: scrapers and utilized blades. After Мацкевый 2001, fig. 7.

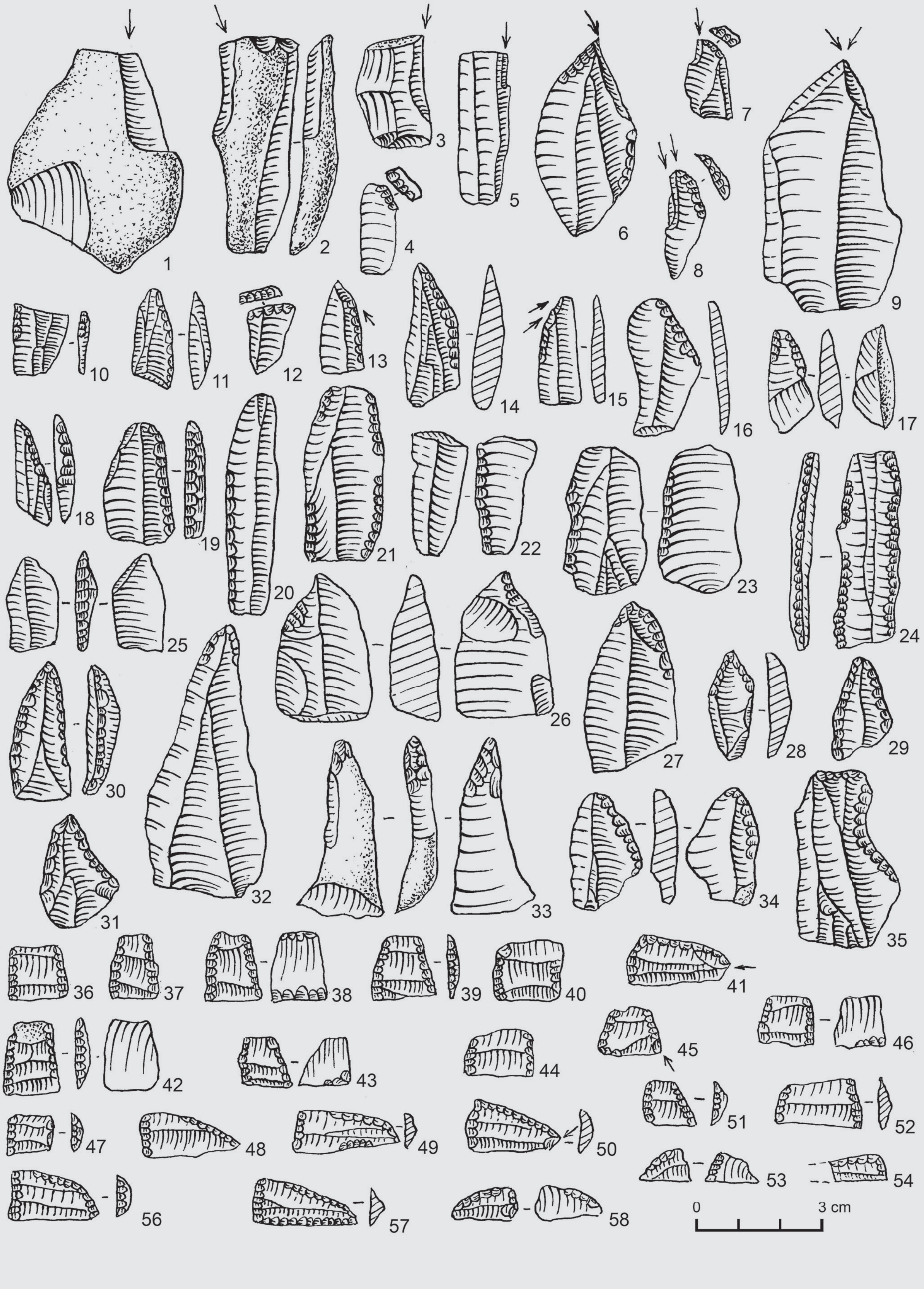

Fig. 19. Kam´janyzia I, Transcarpathia (UA). Mesolithic stone tools: burins, retouched blades, and microlithic trapezes and triangles. After Мацкевый 2001, fig. 8.

typical conical or cylindrical cores were found. The microburin technique is well represented in the industry. The appearance of the Krukowski microburin in the Jászság is noteworthy. There are only few bone artefacts in the Jászság Mesolithic (fig. 12.28 – 32): two bone point fragments, two perforated animal bones and a perforated tooth.' (Kertész 1996, 22). The bones from the slaughter remains show a dominance of aurochs and wild horse among the hunted animals with of red deer, roe deer and wild pig and a rarely pond tortoise and birds also present (Kertész 1996, 23). A pollen sample taken from the Meggyesi-erdő allows the reconstruction of the landscape around the Mesolithic campsite. Extensive gallery forests along the river channels were dominated by oak, elm, willow, lime, and hazel bushes. The higher-lying areas showed a characteristic steppe and forest-steppe vegetation (Kertész 1996, 15).

Besides these two major sites five more Mesolithic complexes from the Alföld have been mentioned in the literature: Kundacs-Köztemető and Kunpeszér-Felsőpeszéri út-Homokbánya on the sandy dunes of the left floodplain of the Danube, Hugyaj/Érpatak, also in a sandy area in the northern Tisza region, Pásztó-Mária tanya on the southern fringes of the northern Carpathian belt and Tószeg-Áldozó halom on the middle reaches of the Tisza, close to Szolnok (Kertész 1996, 16 – 18).

Here Ciumeşti II in the Sathmar district in north-western Romania should be added. The site is also situated on a dune and yielded a small collection (*fig. 14*) consisting of a core, one burin, a few regular blades and scrapers as well as several microlithic trapezes and triangles (Păunescu 1964). As raw materials quartzite and unspecified types of silex, but also obsidian were used.

A special find was made already in 1980 at the Medvedia Cave near Ružin in eastern Slovakia. An obsidian flake and a long bone point with two opposed grooves were found among the bones of two brown bears (*Ursus arctos*) (Bárta 1989, 458). In the grooves seven small inserted blades of limnoquarzite were still preserved (*fig. 15*). The find context indicates that the composite weapon was used to kill at last one of the bears.

With regard to the raw material the site of Barca I in the Slovakian part of the upper Tisza valley is remarkable because of its exclusive use of obsidian. Particularly noteworthy amongst the material are the backed blades and microlithic triangles (*fig. 16*).

From the westernmost part of the Ukraine Matskevoi has mentioned several Mesolithic sites (Мацкевый 2001). Of the numerous stone artefacts presented from the Transcarpathian region, in my opinion only the collection from Kam'janyzia I shows characteristic elements of the Late Mesolithic (*fig. 17 – 19*). The inventory consists of exhausted single- and multi-platform cores, side- and end-scrapers, regular blades, burins, points with retouched edges and a few microlithes, predominantly trapezes. The site is situated in the foothills of the Carpathians, in the valley of the Už River.

Neolithisation of the Southern Carpathian Basin

The Banat is of interest for the early process of Neolithisation, because of all regions in south-eastern Europe that were neolithisised at a particularly early stage, it is the north-westernmost and thus located the farthest from the Aegean and West Anatolia. Furthermore, the Banat likely received initial impulses for the Neolitisation process from its southern neighbours. It is astonishing how quick the first wave of Neolithisation affected the whole of south-eastern Europe in the last decades before 6000 calBC. In terms of climate history it is the time immediately after the Hudson-Bay outflow, at the peak of the Rapid Climate Change (RCC) (Weninger et al. 2005), when the climate in south-eastern Europe stabilized once again.

White-on-red painted ware is the *leitmotif* of this first wave of Neolithisation, which starting from western Anatolia rapidly spread throughout the entire Balkan area and extended as far as Transylvania. Using current dating methods the speed of this dissemination is impossible to detect. Statistically, all dates for complexes containing the oldest pottery appear to be the same age. Although a find horizon prior to white-on-red painted ware can be discerned in the eastern Balkans (Dzhuljunica I), it cannot be distinguished in the general picture of dissemination basing on the evaluation of radiocarbon data (Krauss et al. 2014). This

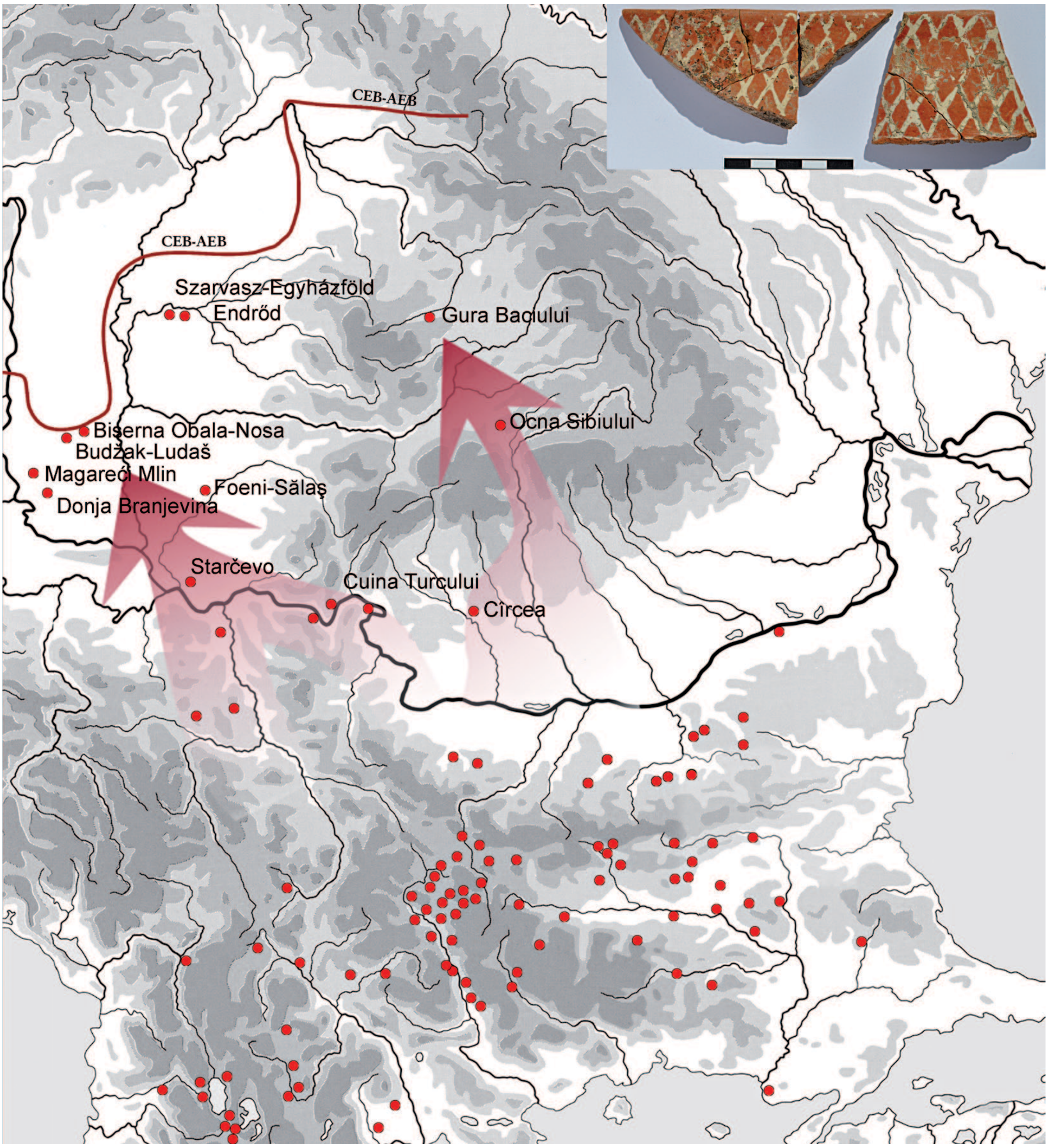

Fig. 20. Distribution of white-on-red painted Early Neolithic pottery in the Balkan-Carpathian region. Sites south of the Danube after Чокани 2012, fig. 138 – 139, with additions.

first wave of Neolithisation in the Carpathian Basin already embraced all of Transylvania and the Körös/Criş region in the southern Alföld. The sites of Gura Baciului, Szarvasz-Egyházföld and Endrőd approximately mark the northernmost boundary at which this wave came to a halt (*fig. 20*). In the West, it reached the southern Bačka with the sites of Donja Branjevina, Magareći Mlin, Budžak-Ludaš and Biserna Obala-Nosa.

Although the lowlands of Banat initially did not belong to the preferred settlement areas of Neolithic farmers, the discovery of white-on-red painted sherds in the settlement of Foeni-Sălaş (Draşovean 2007, fig. 5) provides evidence that the first wave of Neolithisation reached this point. Typically, early settlement sites with characteristic white-on-red painted ware are rarely found north of the Danube River, and almost all of them are situated in large river valleys, for example Körös/Criş or in the wide plain of the lower Tisza River. Thus, the Neolithisation of the Carpathian Basin seems to have followed two main routes: first, through the corridor of the major river systems of the Lower and Middle Danube as well as the Tisza, and, second, by the passage of the river Olt through the southern Carpathian Arc, at first to Transylvania and from there along the smaller streams emptying into the Tisza River from the west into the Banat Plain. The loosely scattered sites with white-on-red painted pottery were certainly still directly related to the very early neolithisised regions south of the Danube. If the model of 'leapfrog colonization' is applied to the Carpathian Basin (Zvelebil 2001, 2), these sites can be considered bridgeheads for the Neolithisation of the region. In this case also the impetus for Neolithisation initially would have derived from immigrating smaller groups, soon afterwards communicating the Neolithic package to a Mesolithic population already settled there.

Only in a second step, from 5800 calBC onwards, did the number of sites increase in the Banat lowlands as well, and the Neolithisation process covered further areas of the Alföld and also southern Transdanubia. Most of the investigated settlements in the Banat Plain date to this period. The find material from this time is characterised predominantly by various kinds of relief decoration and vessels on tall stands.

This second wave of Neolithisation, however, seems to have proceeded slightly differently from the first wave: it can be traced by means of the distribution of flint blades made of 'Balkan' yellow flint with white dots found in Early Neolithic settlements of this period (Kacanowska/Kozłowski 2008, fig. 5). Recently, a flint source located on the Lower Danube near Nikopol was added to the discussion as a possible source of this kind of stone (Biagi/Starnini 2010, 124 – 131). This raw material seems initially to have been traded from the eastern Balkan region into the Carpathian Basin via large rivers like the southern Morava, the Lower Danube, and the Tisza as well (*fig. 21*). Yet, in contrast to the distribution of the white-on-red painted ware, a higher concentration of sites can no longer be noted in the zone south of the Danube. Furthermore, some sites are located at a significant distance from the large rivers, as far as the northern Carpathian Basin. The spectrum of finds can even be densified when, apart from the new source, also some northern Bulgarian sites and two blade fragments presumably made of the same kind of flint and found in Bucova Pusta IV are added.

Overcoming the Central European-Balkanic Agroecological Barrier

Most informative is the line at which this second wave of Neolithisation terminates (Kalicz 2010, fig. 3), for it also represents the northern border of a Neolithic way of life existing for about 500 years. Only after 5500 calBC, the first crop-cultivating and livestock-raising communities appear together with the Western LBK and the Eastern or Alföld LBK in territories north of this boundary. The northern distribution limit of the Starčevo-Criş-Körös complex runs irregularly from West to East, straight through Transdanubia and the Alföld; it was introduced into literature as a model for the Central European-Balkanic Agroecological Barrier (abbrev. CEB-AEB) (Kertész/Sümegi 2001; Sümegi et al. 2002; Kertész 2002). This model bases upon the dissemination of Late Mesolithic and Early Neolithic communities in the Carpathian Basin (Bánffy 2006, fig. 7; Bánffy/Sümegi 2012) and tries to explain the mutual exclusion in distribution

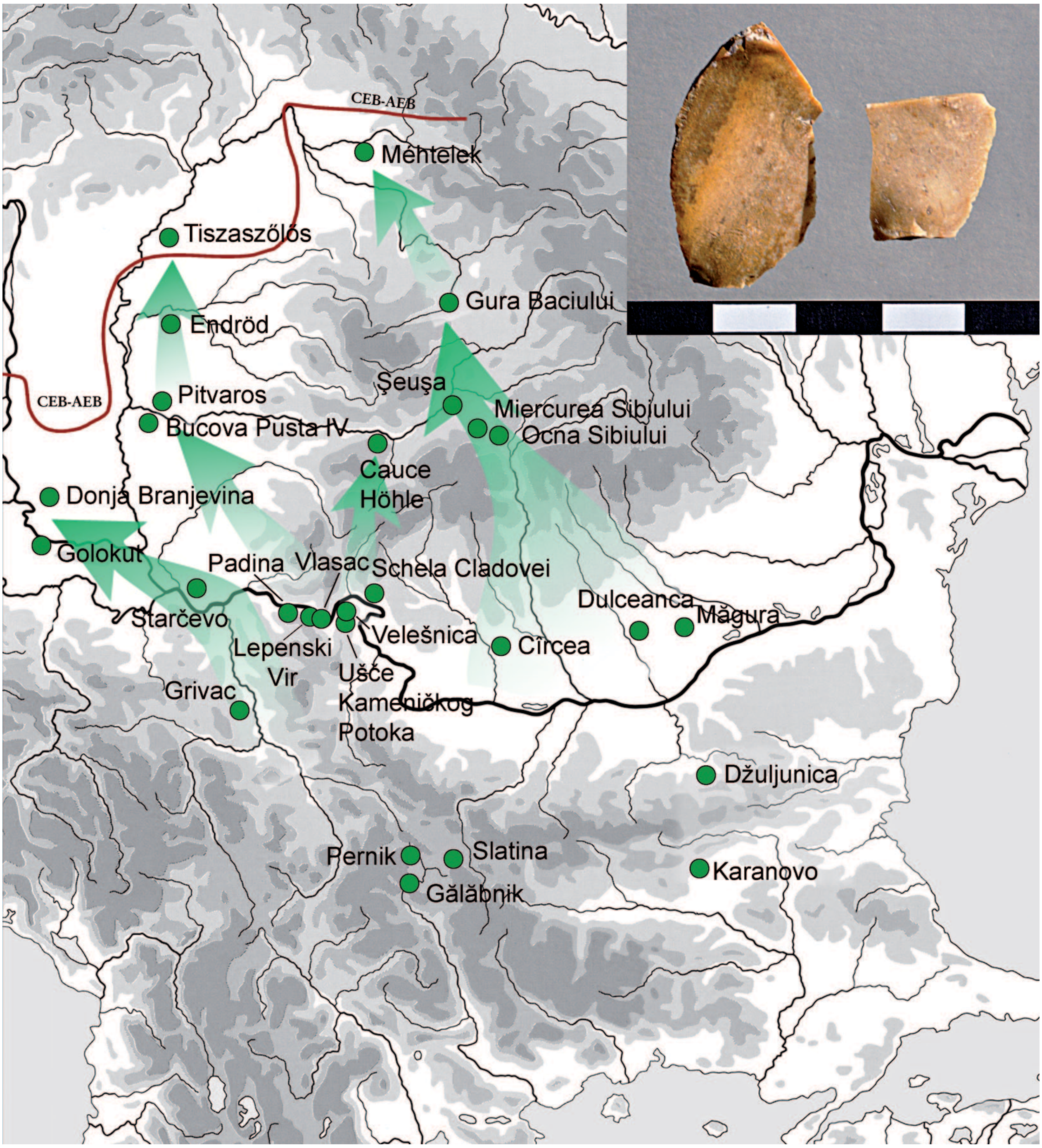

Fig. 21. Distribution of silex artefacts from 'Balcanic' flint. After Biagi/Starnini 2010, fig. 9 with additions.

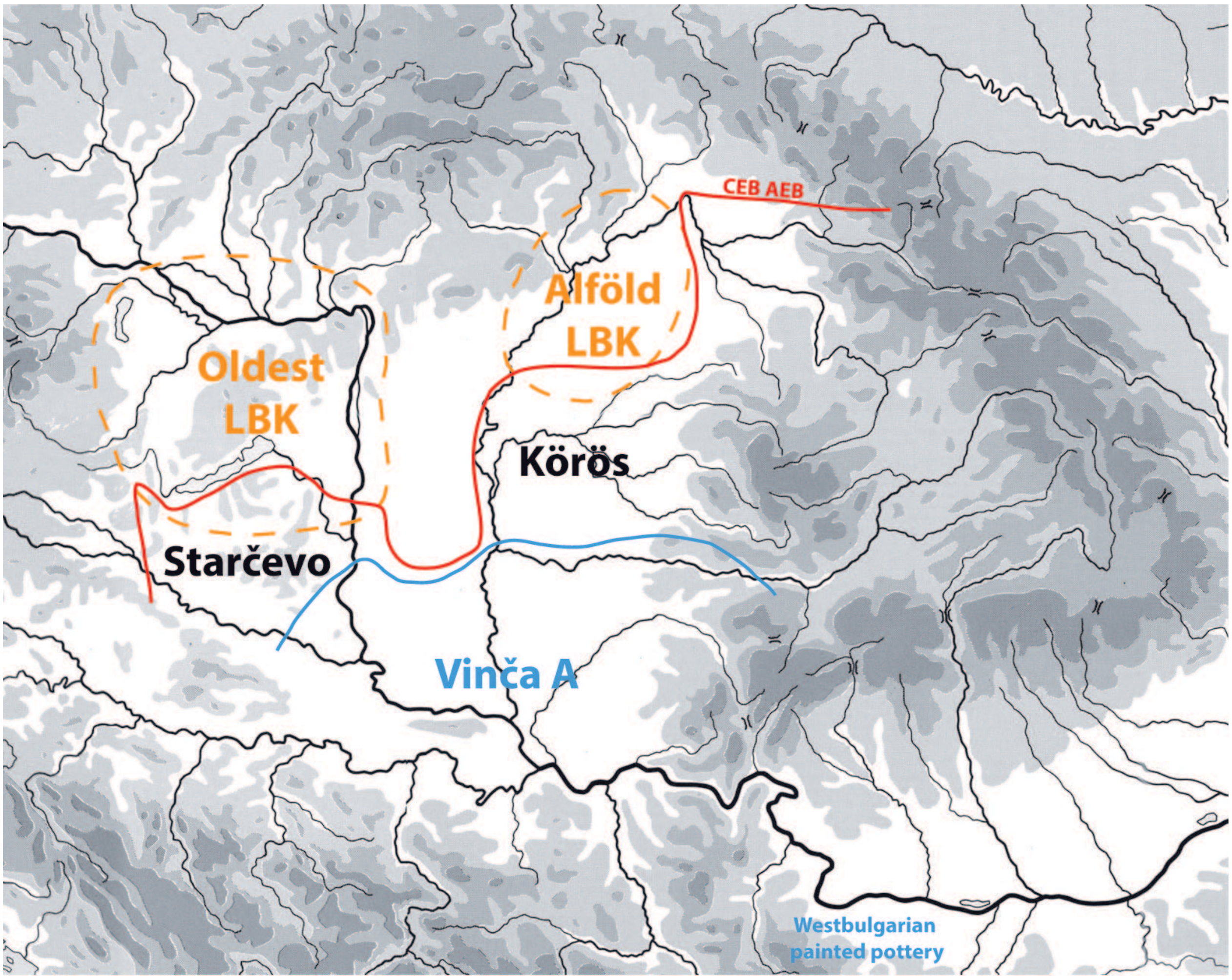

Fig. 22. Cultural groups south and north of the Central-European-Balkanic Agroecological Barrier (CEB-AEB) at around 5500 calBC. After Bánffy 2005, fig. 1.

patterns on the basis of environmental factors. According to this model, environmental factors in areas north of this line, such as the number of hours of sunshine each day and the angle of incidence of the sun, were no longer basically suited for Neolithic methods of cultivation and harvest of crops; also, the increase of domestic animals no longer sufficed as food for communities. The natural distribution boundary is more or less delineated by the silver linden tree (*Tilia tomentosa*) (Sümegi/Bodor 2000, fig. 4). Neolithic communities south of this line obviously needed centuries of time until 5500 calBC to develop a package of technologies that were appropriate for Neolithic production north of the CEB-AEB as well.

After 6000 calBC the Körös Culture evolved in the zone between the Mureş River and the upper reaches of the Tisza (Bánffy 2006, 127 – 129; Domboróczki 2010, 156 – 172) populating the north-eastern areas within the CEB-AEB. Only after a phase of consolidation, that is after 5600 calBC, a time span that is usually necessary to adapt to an agricultural way of life and to changed environmental conditions, do Neolithic groups cross the CEB-AEB to the north along the Tisza (Domboróczki 2010, 158 f.). In Transdanubia the traversing of the CEB-AEB correlates with the development of a new type of house: the longhouse (Bánffy/Sümegi 2011, 251 – 254). A spiritual transformation also seems to have taken place manifesting itself archaeologically in the establishment of cemeteries outside of the settlements. Only this new Neolithic package was so successful that it subsequently could disseminate and neolithisise vast areas as far as the Paris Basin in the west, the Ukrainian steppe in the east and the northern limits of the

Central Mountains in Germany and Poland. The starting point of the expansion of this phenomenon was the formation of the oldest Western *Linienbandkeramik* in Transdanubia and of the Alföld *Linienbandkeramik* in the Great Hungarian Plain, the genesis of which took place at almost the same time as the genesis of the Vinča Culture south of this line (*fig. 22*).

During the last years numerous research efforts have concentrated on the complex processes involved in the northward crossing of the CEB-AEB. It was found that again the exploitation of natural resources, here in particular obsidian deposits in the northern Carpathian Arc, must have been a stimulus (Mester/Rácz 2010; Raczky et al. 2010, colour pl. 7.1; Kozłowski/Nowak 2010). The exploration of the Tokaj region, for example, is assumed to have proceeded along two main routes: on one hand, from the east along the Carpathian Arc and following the headwaters of the Tisza (Domboróczki 2010, fig. 10–11) and, on the other, from the Banat along the middle reaches of the Tisza to the north (Raczky et al. 2010, colour pl. 7.1). In the west as far as the Balaton region Starčevo settlements are attested, which can be assigned to the late phase of the development of this culture (Starčevo Spiraloid B) (Bánffy 2004, 317–319; Kalicz 2010, fig. 2).

Early Farming Communities with a 'Mesolithic' Economy?

To circumvent the alluvial plain of the Tisza in the north-eastern part of the Alföld, the complex model of a 'mental marginal zone' was developed (Raczky et al. 2010). The heterogeneous landscape with large swamp areas would have necessitated a more rapid economic adaptation to this region. In any case, this landscape did not offer ideal conditions for sheep and goat farming, so characteristic of the southern areas. Aspects of this adaptation process can, however, be recognised directly south of the CEB-AEB, for instance by the significant increase of bovine bones in the animal bone spectra of the settlements, as in Ibrány-Nagyerdő (Kovács et al. 2010, 239–242) and Nagykörü (Raczky et al. 2010, 151–158).

In the northernmost settlements of the developed Starčevo-Criş and Körös groups located along the CEB-AEB yet another phenomenon becomes apparent. The faunal spectra show an above-average food proportion from aquatic habitats. In Tiszaszőlős-Domaháza, Ecsegfalfa 23 and Szolnok-Szanda the identifiable taxa from freshwater environments constitute more than one-half of all species (Kovács et al. 2010, fig. 11). In Nagykörü and Ibrány-Nagyerdő almost all taxa derive from aquatic habitats or wet forests.

Based on observations of the faunal and botanical remains from our excavations at Bucova Pusta IV in the Romanian Banat the data for the economy of Early Neolithic settlement in the immediate vicinity of the CEB-AEB can be specified. The Early Neolithic sequence can be limited by a series of radiocarbon dates to the period from 5700–5570 calBC, in terms of relative chronology the phase Starčevo-Criş III. Preliminary results of the investigations of the zoological material from Bucova Pusta IV carried out by Bea De Cupere (Bruxelles, Belgium) showed that the subsistence of the settlement was based on domestic mammals but also on a large proportion of aquatic resources like fish and molluscs. As for the livestock, a dominance of sheep and goat could be stated and cattle was of less importance. The slaughtering age of the animals indicates mainly meat procurement. Among the fish bones sturgeon (*Acipencer sp.*), cyprinids (*Cyprinus carpio*, *Cyprinidae indet*), pike (*Esox lucius*) and catfish (*Silurus glanis*) could be identified. Within the settlement shells of freshwater gastropods (*Lymnea stagnalis*, *Viviparus acerosus*, *Planorbarius corneus*) and freshwater bivalves (*Unio pictorum*, *Unio tumidus*) were found frequently and sometimes in concentrations. Preliminary observations on the basis of the archaeobotanic remains carried out by Elena Marinova (Leuven, Belgium) show a domination of cultivated plants, mainly hulled wheats and their chaff. The relatively few chaff remains most probably indicate a primary processing of the hulled wheat somewhere in the surroundings, but not at the site itself. This evidence fits well with the already available data from other Early Neolithic sites in Hungary (Bogaard et al. 2007). The collected wild plant samples show a variety of gathered fruits and nuts from different habitats. On one hand *Cornus mas*, *Prunus sp.*, *Quercus sp.*, and *Sambucus sp.* are typical representatives for a woodland environment, on the other *Trapa natans* and *Physalis alkekengi* indicate wetlands and *Stipa sp.* open grassland. It is difficult to estimate the role of plant gathering in the economy and diet of the settlement in Bucova Pusta, but the fact that gathered plants are quite frequent indicates that it has an established position in the Neolithic plant economy of the area.[1] Nevertheless, the proportion of aquatic resources is remarkable and forms a contrast to the economy of Neolithic settlements in the southern areas of the Eastern and Central Balkans. Thus, close to the CEB-AEB a quasi-Mesolithic way of living can be discerned as a flexible reaction of Early Neolithic communities on the northern distribution boundary of the Starčevo-Criş-Körös complex at its chronological end. Without doubt these are communities that developed out of the full Neolithic package, as evidenced for example by ceramic production and stone technology; however, from an economic perspective, the basis of existence was no longer constituted by crop cultivation and livestock-raising alone. By this I do not want to exclude the idea that here we are dealing with a neolithisised Mesolithic population. Indeed, a Mesolithic form of economy that lasted well into the Neolithic period can be observed not only in specific microregions like the Iron Gates, but in other places as well. The return to an economy that was well adapted to a habitat marked by wetlands and humid forests becomes evident on the northern fringes of the CEB-AEB landscape that was still suitable for the Neolithic subsistence economy. At the end of the Early Neolithic development a, at least temporary, rejection of the Neolithic economic subsistence can be observed that was a flexible reaction of human communities along this barrier, which had some impact on the overall settlement pattern. Recognisable now is a picture of small settlements, often relocated after short intervals along changing water courses. The general appearance of the Pre-Neolithic population of the region is not known; nonetheless, the oldest Neolithic settlements in the Banat region are no longer comparable to those in the Balkan area. Thus, a Mesolithic tradition of settlement could indeed be evident here, a tradition that becomes all the more visible only through Neolithisation. Long-lasting sites settled for more than four generations are extremely rare on the north-western periphery in contrast to the heartland of the Balkan Neolithic. Mastering life in this border region obviously conditioned Neolithic communities to the extent that they were able to develop a new Neolithic package, which enabled them to carry out a life based on crop cultivation and stock breeding also in areas north and north-west of the CEB-AEB.

1 Personal communication from E. Marinova.

Raiko Krauss
Eberhard Karls Universität Tübingen
Institut für Ur- und Frühgeschichte
und Archäologie des Mittelalters
Burgsteige 11
D-72070 Tübingen
raiko.krauss@uni-tuebingen.de

Bibliography

Bánffy 2004: E. Bánffy, The 6th Millenium BC Boundary in Western Transdanubia and its Role in the Central European Neolithic Transition (The Szentgyörgyvölgy-Pityerdomb Settlement) (Budapest 2004).

Bánffy 2005: E. Bánffy, Mesolithic-Neolithic Contacts as Reflected in Ritual Finds. Documenta Praehistorica 32, 2005, 1–14.

Bánffy 2006: E. Bánffy, Eastern, Central and Western Hungary – Variations of Neolithisation Models. Documenta Praehistorica 33, 2006, 125–142.

Bánffy 2008: E. Bánffy, The Boundary in Western Transdanubia. Variations of Migration and Adaptation. In: D. Bailey/A. Whittle/D. Hofmann (eds.), Living Well Together? Settlement and Materiality in the Neolithic of South-East and Central Europe (Oxford 2008) 151–163.

Bánffy/Sümegi 2011: E. Bánffy/P. Sümegi, The (Environ-) Mental Context of Earliest Neolithic Settlement and Architecture in Western Hungary. In: A. Hadjikoumis/E. Robinson/S. Viner, The Dynamics of Neolithisation in Europe. Studies in Honour of Andrew Sherratt (Oxford 2011) 231–265.

Bánffy/Sümegi 2012: E. Bánffy/P. Sümegi, The Early Neolithic Agro-Ecological Barrier in the Carpathian Basin. A Zone for Interaction. In: P. Anreiter/E. Bánffy/L. Bartosiewicz/W. Meid/C. Metzner-Nebelsick (eds.), Archaeological, Cultural and Linguistic Heritage. Festschrift for Erzsébet Jerem in Honour of her 70th Birthday (Budapest 2012) 57–69.

Bárta 1972: J. Bárta, Die mittlere Steinzeit in der Slowakei. Acta Praehistorica et Archaeologica 3, 1972, 57–76.

Bárta 1989: J. Bárta, Hunting of Brown Bears in the Mesolithic. Evidence from the Medvedia Cave near Ružin in Slovakia. In: C. Bonsall (ed.), The Mesolithic in Europe (Edinburgh 1989) 456–470.

Bednarz 2001: M. Bednarz, Acheminement du silex 'chocolat' pendant le Janisławicien et au Néolithique ancient dans le basin de la Vistule. In: R. Kertész/J. Makkay (eds.), From the Mesolithic to the Neolithic. Proceedings of the International Archaeological Conference, Held in the Damjanich Museum of Szolnok, September 22.–27.1996. Archaeolingua 11 (Budapest 2001) 23–54.

Biagi 2001: P. Biagi, Some Aspects of the Late Mesolithic and Early Neolithic Periods in Northern Italy. In: R. Kertész/J. Makkay (eds.), From the Mesolithic to the Neolithic. Proceedings of the International Archaeological Conference, Held in the Damjanich Museum of Szolnok, September 22.–27.1996. Archaeolingua 11 (Budapest 2001) 71–88.

Biagi/Starnini 2010: P. Biagi/E. Starnini, The Early Neolithic Chipped Stone Assemblages of the Carpathian Basin. Typology and Raw Material Circulation. In: J. K. Kozłowski/P. Raczky (eds.), Neolithization of the Carpathian Basin. Northernmost Distribution of the Starčevo/Körös Culture (Krakau 2010) 119–136.

Bogaard et al. 2007: A. Bogaard/J. Bending/G. Jones, Archaeobotanical Evidence for Plant Husbandry and Use at Ecsegfalva 23. In: A. Whittle (ed.), The Early Neolithic on the Great Hungarian Plain. Investigations of the Körös Culture Site of Ecsegfalva 23, Co. Békés (Budapest 2007) 421–445.

Borić 2011: D. Borić, Adaptations and Transformations of the Danube Gorges Foragers (c. 13,000–5500 cal. BC). An Overview. In: R. Krauss (ed.), Beginnings – New Research in the Appearance of the Neolithic between Northwest Anatolia and the Carpathian Basin. Papers of the International Workshop 8th–9th April 2009, Istanbul. Menschen – Kulturen – Traditionen 1 (Rahden/Westfalen 2011) 157–203.

Boroneanţ 2011: A. Boroneanţ, The Mesolithic in Banat. In: N. Tasić/F. Drașovean (eds.), The Prehistory of Banat 1. The Palaeolithic and Mesolithic (Bucharest 2011) 103–141.

Brukner 1974: B. Brukner, Paleolit i Mesolit. In: B. Brukner/B. Jovanović/N. Tasić, Praistorija Vojvodine (Novi Sad 1974) 17–28.

Dolukhanov 2008: P. Dolukhanov, The Mesolithic of European Russia, Belarus, and the Ukraine. In: G. Bailey/P. Spikins (eds.), Mesolithic Europe (Cambridge 2008) 280–301.

Domboróczki 2010: L. Domboróczki, Report on the Excavation at Tiszaszőlős-Domaháza-Puszta and a New Modell for the Spread of the Körös Culture. In: J. K. Kozłowski/P. Raczky (eds.), Neolithization of the Carpathian Basin. Northernmost Distribution of the Starčevo/Körös Culture (Krakau 2010) 137–176.

Draşovean 2007: F. Draşovean, Regional Aspects in the Process of Neolithisation oft the Banat (South-Western Romania). The Settlement of Foeni-Sălaş. In: M. Spataro/P. Biagi (eds.), A Short Walk Through the Balkans. The First Farmers of the Carpathian Basin and Adjacent Regions. Società Preistoria Protostoria Friuli-Venezia Giulia. Quaderno 12 (Triest 2007) 67–76.

Eichmann et al. 2010: W. J. Eichmann/R. Kertész/T. Marton, Mesolithic in the LBK Heartland of Transdanubia, Western Hungary. In: D. Gronenborn/J. Petrasch (eds.), Die Neolithisierung Mitteleuropas. Internationale Tagung, Mainz 24. bis 26. Juni 2005. The Spread of the Neolithic to Central Europe. International Symposium, Mainz 24 June – 26 June 2005: 1. RGZM Tagungen 4,1 (Mainz 2010) 211–233.

de Fonton 1967: M. E. de Fonton, Tardenoisiens et Castelnovien, Bulletin de la Société préhistorique française. Comptes rendus des séances mensuelles 64.7, 1967, 219–224.

Gronenborn 1994: D. Gronenborn, Überlegungen zur Ausbreitung der bäuerlichen Wirtschaft in Mitteleuropa. Prähistorische Zeitschrift 69, 1994, 135–151.

Gronenborn 1997: D. Gronenborn, Silexartefakte der ältestbandkeramischen Kultur. Universitätsforschungen zur prähistorischen Archäologie 37 (Bonn 1997).

Kacanowska/Kozłowski 2008: M. Kacanowska/J. K. Kozłowski, The Körös and the Early Eastern Linear Culture in the Northern Part of the Carpathian Basin. A View from the Perspective of Lithic Industries. In: S. A. Luca (ed.), Proceedings of the International Colloquium. The Carpathian Basin and its Role in the Neolithisation of the Balkan Peninsula. Acta Terrae Septemcastrensis 6 (Sibiu 2008) 9–37.

Kalicz 2010: N. Kalicz, An der Grenze 'zweier Welten'. Transdanubien (Ungarn) im Frühneolithikum. In: D. Gronenborn/J. Petrasch (Hrsg.), Die Neolithisierung Mitteleuropas. Internationale Tagung, Mainz 24. bis 26. Juni 2005. The Spread of the Neolithic to Central Europe. International Symposium, Mainz 24 June – 26 June 2005: 1. RGZM Tagungen 4,1 (Mainz 2010) 235–254.

Kertész 1996: R. Kertész, The Mesolithic in the Great Hungarian Plain. A Survey of the Evidence. In: L. Tálas, At the Fringes of three Worlds. Hunter-Gatherers and Farmers in the Middle Tisza Valley (Szolnok 1996) 5–34.

Kertész 2002: R. Kertész, Mesolithic Hunter-Gatherers in the Northwestern Part of the Great Hungarian Plain. Praehistoria 3, 2002, 281–304.

Kertész/Sümegi 2001: R. Kertész/P. Sümegi, Theories, Critiques and a Model: Why did the Expansion of the Körös-Starčevo Culture Stop in the Centre of the Carpathian Basin? In: R. Kertész/J. Makkay (eds.), From the Mesolithic to the Neolithic. Proceedings of the International Archaeological Conference, Held in the Damjanich Museum of Szolnok, September 22.–27.1996. Archaeolingua 11 (Budapest 2001) 193–214.

Kind 1998: C.-J. Kind, Komplexe Wildbeuter und frühe Ackerbauern. Bemerkungen zur Ausbreitung der Linearbandkeramik im südlichen Mitteleuropa. Germania 76, 1998, 1–23.

Kind 2009: C.-J. Kind, Mikrolithen und Kopfbestattungen. Das Mesolithikum in Südwestdeutschland. In: Archäologisches Landesmuseum Baden-Württemberg, Stuttgart (ed.), Eiszeit. Kunst und Kultur. Begleitband zur Großen Landesausstellung Eiszeit – Kunst und Kultur, im Kunstgebäude Stuttgart, 18. September 2009–10. Januar 2010 (Stuttgart 2009) 336–339.

Kovács et al. 2010: Z. E. Kovács/E. Gál/L. Bartosiewicz, Early Neolithic Animal Bones from Ibrány-Nagyerdő, Hungary. In: J. K. Kozłowski/P. Raczky (eds.), Neolithization of the Carpathian Basin. Northernmost Distribution of the Starčevo/Körös Culture (Krakau 2010) 238–254.

Kozłowski/Kozłowski 1979: J. Kozłowski/S. Kozłowski, Upper Palaeolithic and Mesolithic in Europe. Taxonomy and Palaeohistory (Warsaw 1979).

Kozłowski 1975: S. K. Kozłowski, Cultural Differentiation of Europe from 10th to 5th Millennium B.C. (Warsaw 1975).

Kozłowski 2001: S. K. Kozłowski, Eco-Cultural/Stylistic Zonation of the Mesolithic/Epipalaeolithic in Central Europe. In: R. Kertész/J. Makkay (eds.), From the Mesolithic to the Neolithic. Proceedings of the International Archaeological Conference, Held in the Damjanich Museum of Szolnok, September 22.–27.1996. Archaeolingua 11 (Budapest 2001) 261–282.

Kozłowski/Nowak 2010: J. K. Kozłowski/M. Nowak, From Körös/Criş to the Early Eastern Linear Complex. Multidirectional Transitions in the North-Eastern Fringe of the Carpathian Basin. In: J. K. Kozłowski/P. Raczky (eds.), Neolithization of the Carpathian Basin. Northernmost Distribution of the Starčevo/Körös Culture (Krakau 2010) 65–90.

Krauss et al. 2014: R. Krauss/N. Elenski/B. Weninger/L. Clare/C. Çakırlar/P. Zidarov, Beginnings of the Neolithic in Southeast Europe. The Early Neolithic Sequence and Absolute Dates from Džuljunica-Smărdeš (Bulgaria). Documenta Praehistorica 41, 2014, 51–77.

Mateiciucová 2003: I. Mateiciucová, Mesolithische Traditionen und der Ursprung der Linearbandkeramik. Archäologische Information 26.2, 2003, 299–320.

Mester/Rácz 2010: Zs. Mester/B. Rácz, The Spread of the Körös Culture and the Raw Material Sources in the Northeastern Part of the Carpathian Basin. A Research Project. In: J. K. Kozłowski/P. Raczky (eds.), Neolithization of the Carpathian Basin. Northernmost Distribution of the Starčevo/Körös Culture (Krakau 2010) 23–35.

Păunescu 1964: Al. Păunescu, Cu privire la perioada de sfârşit a epipaleoliticului în nord-vestul şi nord-estul României şi unele persistenţe ale lui în neoliticul vechi. Studii şi Cercetări de Istorie Veche 15.3, 1964, 321–336.

Perrin/Binder 2014: Th. Perrin/D. Binder, Le Mésolithique à trapèzes et la néolithisation de l'Europe sud-occidental. In: C. Manen/Th. Perrin/J. Guilaine (eds.), La Transition Néolithique en Méditerranée (Arles 2014) 271–281.

Raczky et al. 2010: P. Raczky/P. Sümegi/L. Bartosiewicz/E. Gál/M. Kaczanowska/J. K. Kozłowski/A. Anders, Ecological Barrier Versus Mental Marginal Zone? Problems of the Northernmost Körös Culture Settlements in the Great Hungarian Plain. In: D. Gronenborn/J. Petrasch (Hrsg.), Die Neolithisierung Mitteleuropas. Internationale Tagung, Mainz 24. bis 26. Juni 2005. The Spread of the Neolithic to Central Europe. International Symposium, Mainz 24 June – 26 June 2005: 1. RGZM Tagungen 4,1 (Mainz 2010) 147–173.

Radovanović 1996: I. Radovanović, International Monographs in Prehistory. Archaeological Series 11 (Ann Arbor 1996).

Srejović 1973: D. Srejović, Lepenski Vir. Eine vorgeschichtliche Geburtsstätte europäischer Kultur (Bergisch Gladbach 1973).

Starnini 2001: E. Starnini, The Mesolithic/Neolithic Transition in Hungary. The Lithic Perspective. In: R. Kertész/J. Makkay (eds.), From the Mesolithic to the Neolithic. Proceedings of the International Archaeological Conference, Held in the Damjanich Museum of Szolnok, September 22.–27.1996. Archaeolingua 11 (Budapest 2001) 395–404.

Sümegi/Bodor 2000: P. Sümegi/E. Bodor, Sedimentological, Pollen and Geoarcheological Analysis of Core Sequence at Tököl. In: I. Poroszlai/M. Vicze (eds.), Százhalombatta Archaeological Expedition 1 (Százhalombatta 2000) 83–96.

Sümegi et al. 2002: P. Sümegi/R. Kertész/E. Hertelendi, Environmental Change and Human Adaption in the Carpathian Basin at the Late Glacial/Postglacial Transition. In: E. Jerem/T. Biró (eds.), Archaeometry 98. Proceedings of the 31th International Symposium on Archaeometry, Budapest. Archaeolingua Central European Series 1 = BAR International Series 1043 (Oxford 2002) 171–177.

Tillmann 1993: A. Tillmann, Kontinuität oder Diskontinuität? Zur Frage einer bandkeramischen Landnahme im südlichen Mitteleuropa. Archäologische Information 16.2, 1993, 157–187.

Valde-Nowak 2010: P. Valde-Nowak, The Mesolithic in the Northernmost Periphery of the Carpathian Basin. In: J. K. Kozłowski/P. Raczky (eds.), Neolithization of the Carpathian Basin. Northernmost Distribution of the Starčevo/Körös Culture (Krakau 2010) 7–21.

Weninger et al. 2005: B. Weninger/E. Alram-Stern/E. Bauer/L. Clare/U. Danzeglocke/O. Jöris/C. Kubatzki/G. Rollefson/H. Todorova, Die Neolithisierung von Südosteuropa als Folge des abrupten Klimawandels um 8200 cal BP. In: D. Gronenborn (ed.), Klimaveränderung und Kulturwandel in neolithischen Gesellschaften Mitteleuropas 6700–22 v.Chr. RGZM Tagungen 1 (Mainz 2005) 75–117.

Zimmermann 2010: A. Zimmermann, Migration oder Adaption? Zur Entwicklung vom Mesolithikum zur Bandkeramik im Rheinland. In: D. Gronenborn/J. Petrasch (eds.), Die Neolithisierung Mitteleuropas. Internationale Tagung, Mainz 24. bis 26. Juni 2005. The Spread of the Neolithic to Central Europe. International Symposium, Mainz 24 June – 26 June 2005: 1. RGZM Tagungen 4,1 (Mainz 2010) 509–515.

Zvelebil 2001: M. Zvelebil, The Agricultural Transition and the Origins of Neolithic Society in Europe. Documenta Praehistorica 28, 2001, 1–26.

Мацкевый 2001: Л. Г. Мацкевый, Мезолит крайнего запада Украины. In: R. Kertész/J. Makkay (eds.), From the Mesolithic to the Neolithic. Proceedings of the International Archaeological Conference, Held in the Damjanich Museum of Szolnok, September 22.–27.1996. Archaeolingua 11 (Budapest 2001) 313–337.

Чокани 2012: П. Чокани, Бялорисуваната раннонеолитна керамика в България. Магистърска дипломна работа (Veliko Tărnovo) (unpublished Master thesis, Sv. Sv. Kyrill and Methodius University, Veliko Tarnovo).

This volume provides an insight into the current state of archaeological research in Southeast Europe and its adjacent regions, spanning chronologically from the Aurignacian to the beginning of the Neolithic period. In ten contributions by leading experts in this field, specific topics in regions ranging from the Aegean Sea, the Carpathians, and Western Anatolia to the Apennine Peninsula and Central Europe are presented. This book represents the proceedings of an international workshop, held in May 2014 in Tübingen as a part of the work of the Collaborative Research Centre 1070 ResourceCultures.

The research activities of Raiko Krauss are focused upon the timespan between the Neolithic and the Bronze Age within Central and South-East Europe. Harald Floss is a renowned expert of the Palaeolithic in Europe and a specialist in the study of the transition from the last Neanderthals to Early modern humans. Both teach at the University of Tübingen.

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