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Beyond the technological chain: Neolithic potters in social networks

Co je skryto za výrobním řetězcem: sociální pozadí neolitických hrnčířů

Petr Květina – Louise Gomart – Richard Thér – Klára Neumannová

Formal and technological attributes of pottery mirror potters' habitus, actions, and decisions inhibited or stimulated by users of pottery. The variability of these attributes in time and space reflects networks of producers embedded in a complex social network. But how the knowledge of pottery manufacturing processes can be used to gain more accurate understanding of the society behind the "chaînes opératoires" when the basis for the interpretation is archaeological evidence? Can archaeologists reach reliable picture on relations between pottery technology and society? Can the interpretations be built on testable hypotheses? Those are painful issues accompanying all the archaeological attempts to understand variability and changes in pottery technology, the issues that motivate the main theme of the thematic issue of Archeologické rozhledy: the pursuit of archaeologists to integrate pottery technology analysis to the complex interpretation of the Neolithic societies.

technology – pottery – chaînes opératoires – Neolithic

Formální a technologické vlastnosti keramických nádob mají potenciál odrážet habitus hrnčíře, jeho výrobní postupy a volby, které jsou omezovány nebo naopak stimulovány uživateli jeho výrobků. Různorodost těchto keramických vlastností v čase i v prostoru zrcadlí zapojení výrobců do provázané sítě v rámci celkové sociální struktury. Je však vůbec možné dobrat se, skrze analýzu výrobních procesů keramiky na základě archeologických nálezů, porozumění tomuto společenskému rámci, který se skrývá za jednotlivými operačními řetězci? Je reálné, aby archeologové dospěli k odpovídající představě vztahů mezi keramickou technologií a společností? Lze v tomto smyslu vytvářet interpretace na základě testovatelných hypotéz? To jsou palčivé otázky, které logicky doprovázejí archeologické studium variability a změn postupů keramické výroby. A jsou to také otázky, jež motivovaly téma tohoto sešitu Archeologických rozhledů: úsilí o zapojení analýz keramické technologie do komplexní interpretace neolitických společností.

technologie – keramika – operační řetězec – neolit

There can be no doubt that recent archaeological and anthropological studies have shown the importance of reconstructing the manufacturing process of pottery for dealing with such critical issues as social interaction networks and identities (see for instance: *van der Leeuw 1977*; *Lemonnier ed. 1993*; *Gosselain 1992*; *Livingstone Smith et al. eds. 2005*; *Sillar – Tite 2000*; *Skibo 2013*). This thematic volume of the *Archeologické rozhledy* explores essential questions concerning the understanding and the interpretation of Neolithic pottery manufacturing processes. It stems from a session that was organised during the 21st Annual Meeting of the European Association of Archaeologists that was held in Glasgow (UK) from the 2nd to the 5th September 2015. The general assumption about the production of ceramics in archaic societies is that formal and technological attributes of pottery mirror potters' habitus, actions and decisions that can be inhibited or stimulated by users of pottery. The variability of these attributes in time and space reflects networks of producers who are embedded in a complex social network. But how can the knowledge of the pottery manufacturing processes be used to obtain a more accurate understanding of the society behind the *chaînes opératoires* when the main basis for the interpretation is archaeological evidence? Can archaeologists achieve a reliable concept of the relationship between pottery technology and society? Can the interpretations be founded on testable hypotheses? Those are difficult issues that are associated with all the archaeological attempts to understand the variability and the changes in pottery technology, whereby the issues that have led to the articles in this thematic issue comprise the archaeologist's pursuit to integrate pottery technology analysis with the complex interpretation of past societies.

The articles that are published in this issue of the *Archeologické rozhledy* deal with two general themes, but each of them from different perspective: i.e. (1) The application of reliable methods for identifying manufacturing processes, which clearly requires defined diagnostic attributes that have been validated by experimental research; (2) Archaeological assemblages with a potential to address the relations between technology and the cultural variables of the past societies.

The first thematic area represents a crucial issue for technological studies. If we are searching for the link between society and technology, in the first place we need reliable methodology for the detailed identification of technological processes. The dynamic development of analytical and imaging methods in the recent years promises new insights into internal structure and composition of ceramic objects. However, reconstruction of technological processes based on the results of application of the novel techniques is not straightforward. A systematic experimental research is needed to define links between the technological practices and phenomena observable on archaeological pottery, which could be a consequence of the practices. Also the potential to apply the methods for analysis of a statistically representative number of samples is crucial for their meaningful employment.

In this volume Klára Neumannová and her colleagues present a new approach to Linear Pottery culture (LBK) technology in the Czech Republic, integrating macro-analyses, experimental approaches and micro-tomography. The authors demonstrate potential of the micro-tomographic analysis for studying the microstructure of ancient ceramics. They link the phenomena observed on the archaeological pottery with those that can be observed on experimentally replicated samples. Based on detailed macro-analyses of the Bylany and Těšetice sites the LBK pottery samples suggested the cow-dung had been used for tempering and that different methods of coiling had also been used. Subsequently the experimental samples were produced and compared with the archaeological ceramics with the aim of validating the technological hypotheses. This article brings novel evidence about LBK pottery, such as linking the potter's technical gestures with the internal microstructure of their ceramics.

The second thematic section is focused on the potential of archaeological assemblages to address the relationships between technology and the cultural variables of the past societies. One of the particularly important questions regarding this issue is the mutual relationship between pottery manufacture on one hand, and its stylistic attributes on the other hand. They both embody manifestation of social identity (whatever we may think that means!). However, they do reflect the different facets and dynamics of social communication. Style is a basic constituent of the visual aspect of pottery. It is a means of expression of social or cultural information, which can be communicated independently of the manufacturer.

The transmission of the ideas behind the attributes that are related to style does not necessarily mean that the transmission of technological processes lead to the appropriate performance. On the other hand manufacturing processes such as paste-preparation, forming or firing is based on technological concepts that can only be transmitted through direct learning. The pottery attributes that are the consequence of these manufacturing processes are not regarded as representing a means of social communication, but more indirectly they reflect the social communication amongst potters and between potters and users of pottery.

The spreading of manufacturing practices that are transmitted by direct learning has a different dynamic than the transmission of visually perceived formal and stylistic features. Changes in pottery technology were curbed by the nature of technological knowledge and its reproduction by means of a learning process in preindustrial societies. Only a part of human behaviour is based on discursive practices, while most of it is on the level of practical consciousness – individuals know how to act in specific situations without knowing how to nor needing to articulate this ability. Practical consciousness represents complex and deeply rooted bonds between the mind, the body and the environment. It is learned without becoming an object of cognisance and thereby it remains an object of choice (*Giddens 1984*, 41–49; *Bourdieu 1977*, 17–19). This is why the learned practices are considered to be amongst the most conservative aspects of human behaviour. If we focus on the technological behaviour of potters, especially their practices that do not leave any apparent traces on the finished products and that rely principally on specialised gestures and shared information about clay-sources and recipes are resistant to change (e.g. *Arnold 1985*, 235–237; *Gosselain 2000*, 192–193; *Nicklin 1971*; *Rice 1984*, 244).

The interdependence of steps in a technological process is another aspect that contributes to the stability of manufacturing processes. A change in one part of the sequence will usually influence the other parts and, moreover, this dependence goes beyond the manufacturing process itself, such as encompassing the ways in which the products are used in a given social context (cf. *Skibo – Schiffer 2008*, 9–10). Thus, innovativeness in pottery technology can be seen as a parameter reflecting the dynamics of social and cultural changes. Consequently, a comparison of the ceramic materials that are used for pottery production adds a different point of view to the traditional formal and stylistic analysis of material culture. It allows the reconstruction of more direct relations between populations in different regions and periods. Consequently a contextual study of changes in style and in the manufacturing processes can illuminate the social dimensions of past societies more comprehensively.

Oliver Mecking, Isabel Hohle and Sabine Wolfram focused on the very question how do changes in the decoration of vessels correspond with changes in the first step of the operational sequence of ceramic production – the selection of raw materials and the preparation of the pottery paste. The large Neolithic settlement site Eythra (Sachsen, Germany) became the key site studied. Altogether 30 hectares were surveyed, making it the largest excavated settlement of the LBK and Stroked Pottery culture (SBK) areas to date, including some 300 ground plans of longhouses (*Stäuble – Veit 2016*). The ceramic typology indicates that the site was occupied from the early phase of the LBK until the late SBK period. In view of the extremely long duration of the Eythra settlement, the authors were able to concentrate on studying the technological changes during the course of the two most distinctive chronological (cultural?) transitions: a) between the earliest LBK period and the fully developed

LBK, and b) between the LBK and the SBK periods. In particular, they examined the clay tempering system and the vessels' surface treatment. Among the separate stylistic phases of the Neolithic settlement at Eythra the proportion of the two distinct types of tempering materials (potassic and ferrous) vary significantly. The results of the technological analyses of the pottery from Eythra indicate significant changes between the technology of the earliest LBK and the fully developed LBK on the one hand, and between the LBK and the SBK on the other. However, there is also a partial overlap of pottery technology in both of these chronological horizons. In the case of the earliest/early LBK transformation, this similarity should be seen in relation to the generally greater variability in the technological aspects of LBK's earliest pottery production, while the classic LBK indicates increased standardisation. The differences between the technological aspects of the LBK and the subsequent SBK are clearly evident at least in the composition of the coarse pottery. The change in tempering materials between the LBK and SBK can be described in both typological and functional terms as representing the introduction of a specific new vessel shape and type of ware. In contrast to the coarse ware, in some cases the SBK fine ware continues to show pronounced similarities to that of the LBK.

Another article that discusses the cultural variables of past societies is the work of Louise Gomart and Michael Ilett. It examines the relationship between the pottery forming technique and its decoration. Although it is part of a single technological process, it is unusual that the two procedures were also examined in relation to each other (*Livingstone Smith 2005*, 7, and also *Stark et al. 2000*). While the formation of the vessel is usually studied within the context of specifically targeted and behaviourally oriented research, traditionally its decoration is examined in order to be able to construct relative chronologies. The problem is precisely in the lack of there being any interconnection between the two approaches (*Skibo 1999*, 2). The research topic of both the authors is directly linked to a long-term project dealing with the complex spatial and chronological relationships of the archaeological features and the assemblages on the early Neolithic site of Cuiry-lès-Chaudardes (north-eastern France). It represents a typical LBK (c. 5000 cal BC) settlement site, comprising thirty-three house-plans associated with lateral pits, and it covers a total surface area of just over 6 hectares. Like on other similar sites the common problems include the question as to whether the archaeological remains from the lateral pits also reflect at least some of the activities that were carried out in the house. While elsewhere researchers who have to face this tricky question frequently achieve rather negative results (see e.g. *Stäuble 1997*; *Květina 2010*), a team of French archaeologists seems to have succeeded (see the most recent *Gomart et al. 2015*).

In their article in this volume the authors expand on their research by comparing variation in decoration with pottery-manufacturing sequences. They reveal a possible relationship between atypical types of decoration (i.e. exogenous or non-standard LBK decoration) and pottery forming methods that have been identified as possibly exogenous. The spatial distribution of these atypical forms or types of decoration shows that they tend to occur in smaller houses that are characterised by other less common or exogenous forming methods and they also tend to increase in number throughout the sequence. Key findings that confirm the results that are published in this volume concern precisely the differences between larger and smaller houses, which may well reflect two differing types of socio-economic functioning (*Gomart et al. 2015*). In this context, it is possible that the residents in the smaller structures were not locals but newcomers from other LBK settlements or other LBK settlement areas. Apparently the transfer of technological and decorative styles then took place in individual households, which would correspond to the well-known ethnoarchaeological models (*Gosselain 2008*; *Roux 2010*).

Chiara La Marca and her colleagues present the first results of an integrated study of ceramic assemblages that was undertaken at four early Neolithic sites located in the Marche region (in Italy, the 6th millennium BC). The authors address all the steps of the operational ceramic sequence (raw material choices and their preparation, forming and decoration techniques) with a focus on raw materials, investigated by means of petrographic analysis. The detailed description of the ceramic chaînes opératoires provides an important basis for obtaining a better understanding of the Neolithisation processes in the Northern Mediterranean, as well as of the networks of the early farmers in Neolithic Italy and their interaction. On the basis of the different petrofacies that they identified, the authors are proposing the co-existence of different production entities within their specific study area. These groups made use of locally available materials and also carried-out their production on a domestic scale. They seem to have been engaged in complex regional and extra-regional networks, as is revealed by the presence of non-local vessels made of volcanic pastes amongst the ceramic assemblages.

The study of Miriam Cubas deals with the issue of the Neolithisation process in the Cantabrian region (northern Spain) through pottery technology. The author outlines different aspects of the pottery technology analysis and assesses the potential of its application to the archaeological evidence in her particular case. She brings important questions such as how to deal with assemblages with a limited representativeness in the regions that are at the margins of archaeological research? How to link such archaeological material with general models and with technological or theoretical concepts? One important point concerns the procurement of raw materials. The coherence between the ceramic samples' mineralogy and the local geology allows the author to conclude that the pottery of this region spreads through the adoption of the technology by means of a transfer of knowledge rather than by an exchange of products. The paper also evokes the possibilities of implementing a technological analysis of the other phases of the fabrication sequence. The answers to the topics that are introduced at the very beginning of the region's ceramic production are generally limited by the archaeological evidence that is available.

Sławomir Kadrow and Anna Rauba-Bukowska employed an impressive quantity of thin sections (more than 500) to explore cultural changes in the wide region to the west and the north of the Carpathians during the Neolithic. The authors are seeking for both similarities and differences in regard to the technological attributes of the pottery amongst the spatially and chronologically defined Neolithic cultures. They are focusing on selection of raw materials and the preparation of pottery pastes – which is the phase that is most readily identifiable based on thin section petrography. Using this approach they open-up key issues in regard to cultural evolution in the region during the Neolithic: the evolution of the LBK ceramics, the influence of the Alföld LBK on the evolution of the LBK pottery in Małopolska, the cultural change at the turn of the LBK and the Malice culture in Małopolska, or at the turn of the Malice culture and the Lublin-Volhynia culture.

The result of the works focused on the study of ceramic technology is not necessarily confined to the reconstruction of operational sequence nor to the interpretation of the social background leading to the production and distribution. It can also reveal information regarding refuse management and other site formation processes (*Rice 1996*, 182; *Skibo 1999*, 7). An example of this approach is the study by Hélène Pioffet and Vincent Ard, which examines the dynamics of the ceramic production evolution in Neolithic Britain, especially during the Early Neolithic (3700–3300 cal BC). The most significant differences between sites and regions can be seen in elaborate decorative patterns, which were patently used as a means of social identity recognition. The effort to learn about "the action of man on matter" (*Lemonnier 1983*) also coincides with the search for the social identities of Neolithic pottery makers and users. The authors, relying on a *chaîne opératoire* approach, also methodically integrated the examination of stylistic and technological characteristics. The analyses were based predominantly on macroscopic examination that aimed to identify and define the potters' knowledge and know-how, which theoretically also reflect their social and their cultural environment (*Roux 2010*). Selected examples from East Anglia perfectly illustrate the ending of the Early Neolithic phenomenon of native ceramic-style construction. The particular research problem was located at the Kilverstone settlement site. For explaining the site type and its formation the excavators proposed three alternatives. The first views the site as representing an occupation involving pits with a short lifespan that are also used by different communities. The second anticipates a lengthy occupation and permanent settlement, most probably close to the site. The last scenario implies a long-lasting but generally discontinuous occupation by different communities. The study of the pottery *chaînes opératoires* by Pioffet and Ard seems to support the latter scenario of a long-lasting sporadic occupation by different communities. However the technological and stylistic affinity of the identified ceramic groups implies the communities' proximity.

Most of the contributions in this volume strive to go beyond the borders of the pottery technology agenda and thereby overcome one of the significant problems of the studies that address the Neolithic pottery technology, which is overspecialisation of the research. As in current archaeology in general, the creation of factions of researchers who meet among themselves and publish in specialised journals is imminent here too. Many find it difficult to communicate to archaeologists who are outside their own group and vice versa; this represents a serious problem from the perspective of the dissemination of knowledge (*Skibo 1999*, 2). It is nevertheless evident that archaeological methods regarding pottery technology comprise a patchwork of methods and theories that are drawn from geology, ceramic engineering, anthropology, sociology, and archaeological theory (*Livingsone Smith 2005*, 8), and trying to find out what is beyond the technological chain is only possible through mutual communication.

However, the ambition to use pottery technology studies for a better understanding of Neolithic society meets several problems. As is aptly noted by *Warren R. DeBoer* (*1991*, 147) "pottery is a small part of life, even a small part of the material inventory. Pottery is always but one of a number of container technologies that include vessels of wood, stone, skin, aluminium and plastic. By focusing on pottery alone, the archaeologist is always looking through a small window." Moreover, the technological analyses mostly focus on a specific selection of attributes that reflect only a narrow range of manufacturing practices, thereby oversimplifying the complexity of pottery production and reducing it to a few meagre dimensions of variability (*Rice 1996*, 191). It may not always be an appropriate path to reconstruct the social background of its production, its use and its distribution.

Another problem is the existence of pottery attributes that are independent of technological processes, organisational forms of production or the intentions of the potters. It can be difficult to distinguish these attributes and, subsequently, they can mask technological diversity. In this regard, analyses of ceramic paste compositions may be especially problematical (e.g. *Arnold 1991*, 79–81; *Rice 1996*, 169–170). Thus, although exact analyses refer to "archaeologically meaningful groups", these may not be a reflection of the real social "units" nor of their "relations".

Even if we are able to filter the adequate attributes related to technology and to reliably interpret them in terms of manufacturing practices, there is still uncertainty in regard to the reconstruction of the social environment of these practices. Ethnoarchaeological studies show us that pottery manufacturing traditions are not direct reflections of social units. They may vary extensively within a single social or ethnic entity (e.g. *Longacre 1991*, 1–10; *Stark et al. 2000*) or they may be shared across social or cultural groups.

Other problems are related to the archaeological context of technological studies. Interpretative potential suffers from the partialness of analysed assemblages, both in terms of chronology and of geographic provenance. Last, but not least, there is a difficulty in distinguishing between the social context of production and the social context of consumption (*Dietler – Herbich 1994*, 461). While most studies refer to production, the archaeological record is related rather to the contexts of distribution and consumption.

In spite of these limitations, ceramic assemblages, and the relatively narrow range of properties that archaeologists identify on them, still constitutes the basis for the spatiotemporal taxonomy of the Neolithic period. It often happens that ceramic finds themselves are interpreted within their own context of meaning (*Hodder 1991*, 72) instead of being considered as the result of a complex interaction between man (culture) and nature (environment and site formation processes). This problem considerably concerns the elemental notion of Neolithic archaeological cultures, which despite all existing criticism are still considered as the basis for social interpretation (*Shennan 1989*, 1–5; *Reher – Fernández-Götz 2015*) disregarding the repeated arguments that archaeological cultures are not real existing entities, and hence cannot be considered as a direct reflection of an ethnic or another self-identifying unit. Such units, the definition of which is problematical in its own right in pre-state systems, are analytically absolutely different from its substantive archaeological culture (*Sommer 2007*). Archaeological studies in pottery technology should be primarily designed to critically assess the models of material reflection of social and cultural identity rather than to build new weakly-grounded constructs.

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Variability in coiling technique in LBK pottery inferred by experiments and pore structure micro-tomography analysis

Variabilita výrobní techniky keramiky LBK ve světle archeologických experimentů a mikrotomografické analýzy struktury pórů

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The article aims at identifying the origin of voids left by burnt-out organic material within the ceramic paste of Neolithic pottery from the Czech Republic territory. In methodological terms, an experimental reference collection was created and compared with the original early Neolithic pottery from the sites of Bylany by Kutná Hora and Těšetice-Kyjovice. The key analytical procedure consisted in non-destructive 3D micro-tomography (uCT) analysis, which is especially well suited for the study of the internal spatial organization of voids and temper. It allows to determine whether it is possible to define different manufacturing techniques employed for vessel construction on the basis of internal distribution of voids. The research identified cow dung as the probable organic temper within the original LBK ceramic paste. The 'S'-forming technique, consisting in pressing the coil to the vessel wall, most closely corresponded to features observed at the Neolithic vessels.

forming techniques – coiling – Linear Pottery culture (LBK) – archaeological experiment – micro-tomography

Cílem článku je identifikování původu porozit, tj. stop po vyhořelé organické příměsi uvnitř hrnčířské hmoty, u neolitické keramiky (LBK) z území České republiky. Metodicky je práce založena na srovnání experimentálně zhotovených vzorků s originální keramikou staršího neolitu z lokalit Bylany u Kutné Hory a Těšetice-Kyjovice. Klíčovým analytickým postupem byla nedestruktivní 3D mikrotomografická analýza (uCT), která je přínosná právě pro studium vnitřní prostorové organizace porozit a příměsí. Umožňuje tak zkoumat, jestli je možné na základě vnitřního uspořádání pórů definovat odlišné výrobní techniky použité pro stavbu nádob. Výsledkem výzkumu bylo identifikování kravského hnoje jako pravděpodobné organické příměsi v keramické hmotě původní LBK. Jako utvářecí výrobní postup, který nejblíže odpovídal znakům pozorovaným na neolitických nádobách, byla určena tzv. technika „S", založená na přimačkávání válečku ke stěně nádoby.

technika formování nádob – válečková technika – kultura s lineární keramikou – archeologický experiment – mikrotomografie

Introduction

Despite the apparent uniformity in the shape and decoration preferences of pottery made by early farmers in Central Europe, which is known as LBK ceramics or Linearbandkeramik (e.g. *Modderman 1988*; *Rulf 1997*), not a lot is known about the technological preferences of makers of LBK vessels in Central-Eastern Europe. The assessment of variation in technology requires a combination of different analytical approaches. Among studies of LBK pottery technology, there is a predominance of archaeometric and raw-material studies, especially petrographic analyses of paste composition using thin sections. Studies of void morphology and its connection to potential variants of organic matter are one complementary approach, and their results provide information on organic material preferences in Central-Eastern Europe (*Franklin 1998*; *Kreiter 2010*; *Kreiter – Szakmány 2011*; *Kreiter – Pető – Pánczél 2013*; *Mecking et al. 2012*).

Studies dealing with organic matter usually prove the use of local clays combined with a non-specific organic temper, although sometimes the type of temper is evident, such as in the case of chaff (*Kreiter 2010*; *Kreiter – Szakmány 2011*; *Kreiter – Pető – Pánczél 2013*). Animal dung (*Franklin 1998*) and even wood and straw (*Hložek 2012*, 29) have been suggested as possible organic materials. Generally, the organic material got burnt out during the firing process, leaving voids with a specific morphology (e.g. *Maritan et al. 2006*; *Santacreu 2014*, 98–100). This enables the identification of the organic material itself. In addition, elongated voids aid the recognition of the inner structure of pottery. Because voids tend to orient themselves according to pressure, their spatial organization reflects different forming techniques (e.g. *Lindahl – Pikirayi 2010*; *Berg 2008*). Elongated organic tempering materials reflect the forming technique more than materials with round particles.

At the moment, technological studies of LBK pottery do not cover the whole distribution area of this archaeological culture. Despite being scattered all across Europe, however, their results show certain similar tendencies in technological processes. A description of the operational sequence (*chaîne opératoire*) for LBK pottery was included already in the synthesis of *J. Destexhe-Jamotte* (*1962*, 8–9). Besides other forming techniques he mentioned pinched coil and successive addition of coils on top of each other. *Bosquet et al.* (*2005*) described Belgian LBK ceramics from a single pit associated with an isolated house at the LBK site of Remicourt 'En Bia Flo' II (Liege prov.). They also described different forming techniques based on configurations in sherd cross sections and also pinched coils.

Complex technological studies are rare for the LBK period. An elaborate macroscopic study was conducted at the Cuiry-lès-Chaudardes site in the Aisne valley in France (*Gomart 2014*). Two dominant forming techniques were identified, and both technological groups are described as made of coils. A complex study of LBK pottery technology is underway at the Bylany site in the Czech Republic (*Neumannová et al. 2016*). The diagnostic marks of forming techniques are analysed according to different criteria: the morphology and position of sherd fractures, the microstructure that is visible on the edge of the sherd, the morphology of the surface, and wall thickness and its variability. Specific combinations of these attributes have been associated with complex categories.

Besides studies based on thin sections and the macroscopic approach, there are other, less common possibilities. One of them is micro-tomography (uCT), which has recently been tested in archaeological pottery studies. This method was developed for the visualization and analysis of inner structures. It enables the visualization of porous structures and calculates geometrical parameters such as total porosity, pore size distribution and pore shape (*Appoloni et al. 2004*). It has already been applied to the study of meso-neolithic pottery from northern Germany (*Kahl – Ramminger 2012*) and Early Neolithic pottery from the Low Don Basin (*Kulkova – Kulkov 2014*) with the aim to reveal different tempering materials and the orientation of pore structures indicative of vessel-forming techniques. Micro-tomography analysis can be used to infer the nature of organic temper even when all plant remains are completely burnt out during the firing process (*Machado et al. 2013*).

We took an experimental approach combined with uCT to examine the appearance of voids produced by different forming techniques. Our main aim was to identify the organic material used (1), the properties and spatial organization of voids left by burnt-out organic material within experimental samples (2), and to explore how different coiling techniques relate to different types of void structures and how to recognize them (3). The morphology and size distribution of experimental organic temper will be analysed to establish an analytical base usable for a comparison with LBK pottery samples. Original LBK samples were selected from assemblages of the prominent early farmers' sites Bylany and Těšetice – Kyjovice to illustrate the spatial variability or uniformity in early pottery technology. We hope to contribute to future comparisons of the forming techniques used by early farmers of the LBK pottery culture in Central Europe.

Material and experiment

We carried out several preliminary experiments combining different quantities and types of organic materials mixed with natural clay with the aim to find an appropriate organic temper that will form voids comparable to those found in LBK material. Experiments with straw and hay were inconclusive. The pores were too large and it was complicated to select a fine mixture of materials. Other organic residues were also tested, but they were not as easy to apply as animal dung. We made experimental pottery samples with different proportions of cow dung from a pasture. Once we found an appropriate temper for the experimental samples, we prepared a mixture of 30 % of cow dung and 70 % of natural clay. With this ceramic paste, we tested different types of coiling techniques.

Our main objective was to verify the variations in coiling technique and to examine differences in the inner organization of the pore structure deformed by the application of the coil to the vessel body in more usual ways. Before preparing the experimental samples, we carried out a series of preliminary experiments to analyse variation in inner structure resulting from different techniques of coiling. We used clay of a different colour for each coil to understand in detail what was happening inside the wall of each vase.

The most common techniques of coiling are generally described as the 'U' and 'N' technique. Coils are regularly joined in the horizontal direction. In cross section, they are either 'U-shaped' or in bevel position. Coils of the 'N' and 'U' type can be made in a very similar way, but the direction in which the coils are smoothed differs.

More specifically, coils in the 'U' technique are laid one on top of the other (*fig. 1: 1*, first row), without any important inner deformation during the joining (*fig. 1: 2*, first row). The coils were smoothed superficially using a rib (*fig. 1: 2*, first row), both sides in the same direction. This technique produces a 'U' shaped distortion of the coils (*fig. 1: 3*, first row).

In the 'N' technique, coils are also laid one on top of the other as in for the 'U' coil technique (*fig. 1: 1*, second row). They are also superficially smoothed using a rib, but in the opposite directions from the inner and outer surface of the wall. (*fig. 1: 2*, second row). This variant produces a bevel-shaped (N) distortion of the coils (*fig. 1: 3*, second row).

Pinched 'S' coils are stacked alternately, inclined towards the inner and outer side of the vessel (*fig. 1: 1*). They are joined by pinching, which deforms considerably the inner structure of the coil (*fig. 1: 2*). The coils are crushed by a rhythmic gesture, which also produces

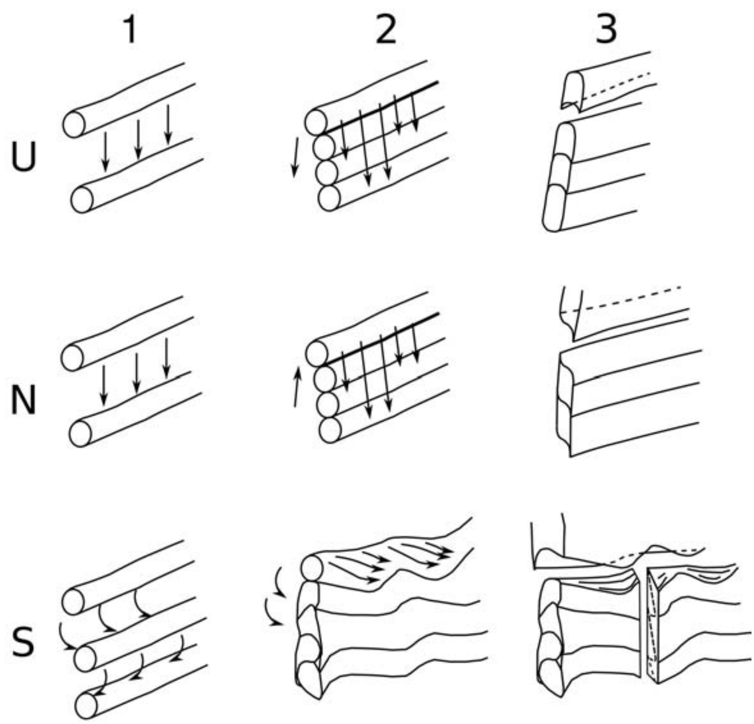

Fig. 1. Scheme of techniques reconstructed for uCT analysis of experimental samples. The position of the adjunction of coils, the type of joining and marks on fractured sherds are presented for the three selected techniques. The different techniques used to manufacture the experimental samples can be explained in three steps. First (column 1) is the position of joining of the coils, second (column 2) is the mode of the joining, and third (column 3) is the general characteristics of fractures in joins of coils. The first row illustrates the 'U' technique, the second row illustrates the 'N' technique, and the third row illustrates the pinching 'S' technique.

the inner rotation of each coil (*fig. 1: 2*). The rhythmicity and distortion of the coils are indicated by irregularities on the wall surface even on the joins of coils (*fig. 1: 3*).

We also tested the pinched coil technique, attempting to reproduce the diagnostic traces of LBK sherds as closely as possible (referred to herein as 'S' coils). Our experiments with this technique were inspired by ethno-archaeological examples, especially the unfinished vases from the collections of *Alexandre Livingstone Smith* (*2001*). Further pre-experiments were necessary to experience this forming technique. We aimed to obtain marks that would correspond to LBK pottery, in which a specific rhythmicity of the pinching of the coils is clearly visible.

The main advantage of these experiments lay in the fact that we could control the details of the technological process of fabricating the experimental samples. This allowed us to test our hypotheses about the origins of the raw materials and their organization, depending on the forming technique. Our methodological strategy for the future is to compare original artefacts with experimentally produced samples and thereby test our hypotheses about the technological processes used by LBK potters.

Method of uCT analysis

The porosity of the samples was determined by X-ray micro computed tomography (micro CT). Micro CT measurements of samples were performed using the laboratory system GE phoenix v|tome|x L 240 equipped with a 240 kV / 300 W maximum-power nanofocus X-ray tube and a high-contrast flat panel detector DXR250 with 2048 × 2048 pixels and 200 × 200 µm pixel size. Tomographic measurements were performed at the temperature of 21 °C. The parameters of the tomographic measurement were adjusted according to the size and morphology of the specimens. *Table 1* shows the parameters of each specimen.

The tomographic reconstruction was realized using GE phoenix datos|x 2.0 3D computed tomography software. The visualization of samples and the porosity analysis were performed in VG Studio MAX 2.2 software. The segmentation of pores was based on the simple thresholding procedure, and the automatic tool of VG Studio was used for threshold determination. This tool determines the background peak and the material peak in histograms for all slices and then calculates the grey value of the material boundary. Most micro cracks were not included in the pore analysis, because their dimensions were below the voxel resolution.

An alternative approach to study void structures is based on carbon coatings (see *fig. 2*) produced on the inner surface of voids by residues of organic matter remaining on the surface of ceramic voids (*Hanykýř – Kutzendörfer 2002*, 95). It was possible to reveal this coating by adjusting the visualised spectra.

LBK ceramic sherds

The samples examined in thus study come from two important LBK sites: Bylany in central Bohemia (excavated by the Czech Academy of Sciences) and Těšetice in Moravia (excavated by Masaryk University in Brno), both long-term excavations. Both LBK settlements cover the interval of c. 5350–4900 cal BC (*Kuča et al. 2012*; *Pavlů ed. – Zápotocká 2007*, 27–31).

Specimen	Bylany	Těšetice	N' coil technique	U' coil technique	S' coil technique
Acceleration voltage [kV]	170	150	150	150	150
X-ray tube current [uA]	100	100	100	100	100
Exposure time [ms]	500	333	300	300	300
Number of projections	2000	2000	2400	2400	2600
Linear voxel size [um]	60	34	25	25	25

Tab. 1. Technical specifications of uCT analyses of the pottery samples.

Site	Sample No.	Inventory No.	Feature	Context	Original shape
Bylany	B1	278 389	2164	house no. 2209	undetermined
Těšetice-Kyjovice	IV 76	96.254	464	house no. D20	storage vessel
Těšetice-Kyjovice	MH 10	K96254/3	225	irregular pit	globular vessel

Tab. 2. Essential information concerning the archaeological samples choosen for the uCT analysis.

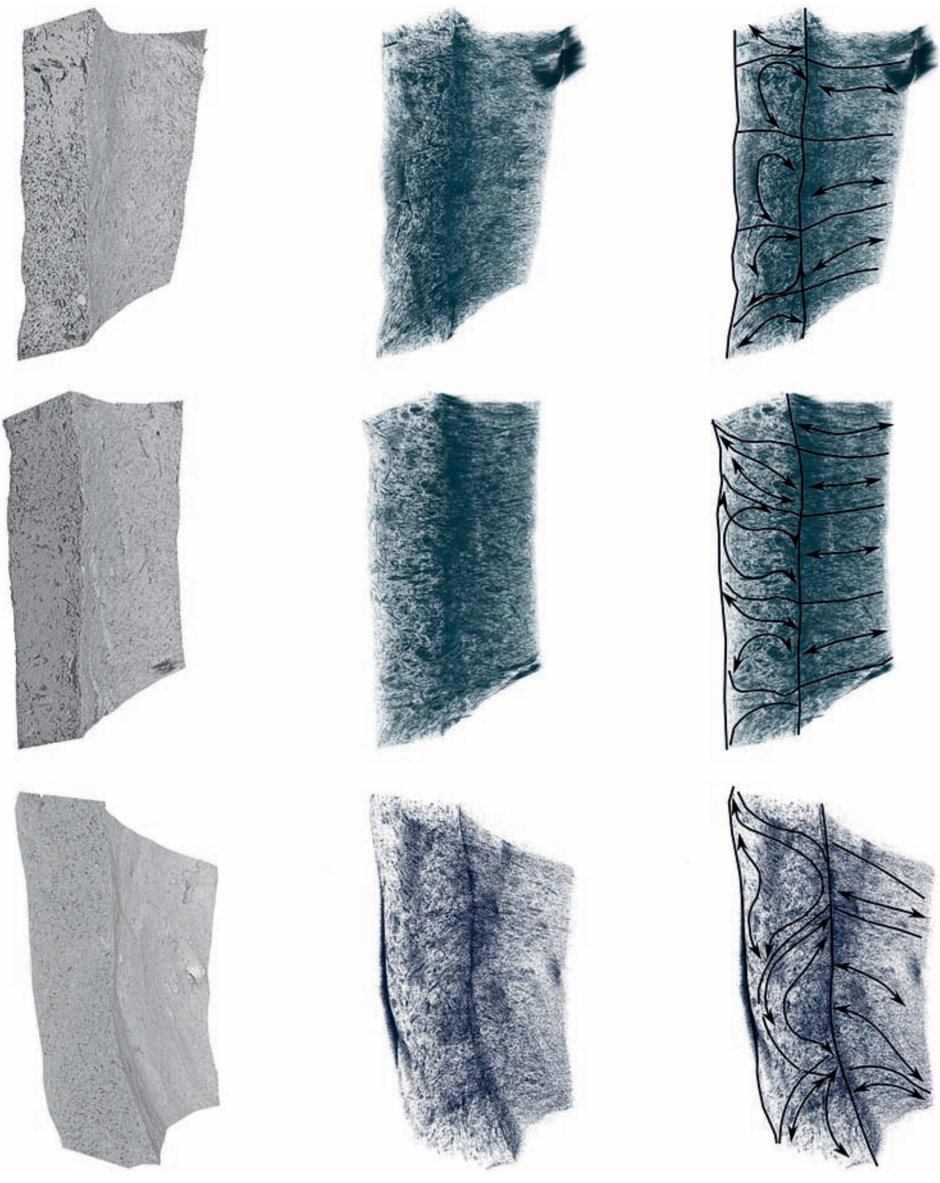

Fig. 2. Segments of experimental samples visualised using adjusted spectra to reveal the carbon coating of voids. It shows the void orientation and approximate joins between coils in experimental samples prepared using different forming techniques.

The Neolithic settlement area at Bylany was discovered in the 1950s by Bohumil Soudský. Large-scale archaeological excavations were undertaken here between 1955 and 1967. Seven hectares of Linearbandkeramik settlement (LBK, linear pottery culture) and subsequent Stichbandkeramik settlement (STK, stroked pottery) were excavated and explored.

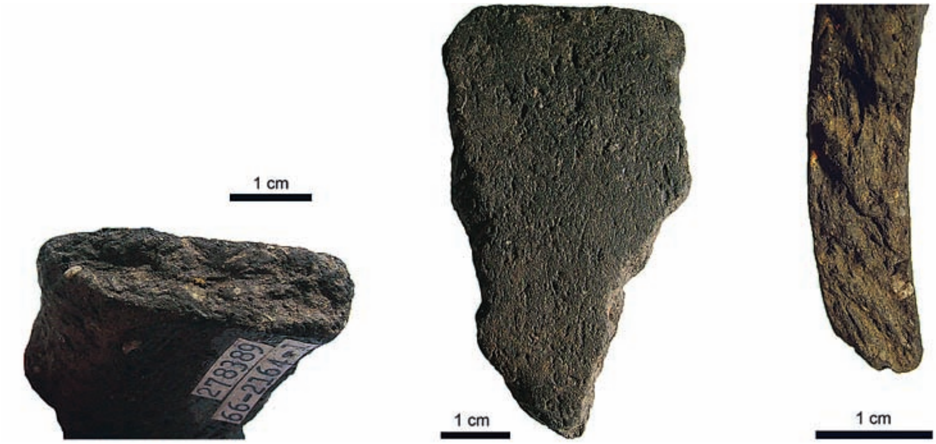

Fig. 3. Bylany sample B1 and macroscopic traces, join of coils (upper part and detail in the bottom left corner) and the elongation of the structure on the section (top right corner). Authors K. Neumannová and K. Kleinová.

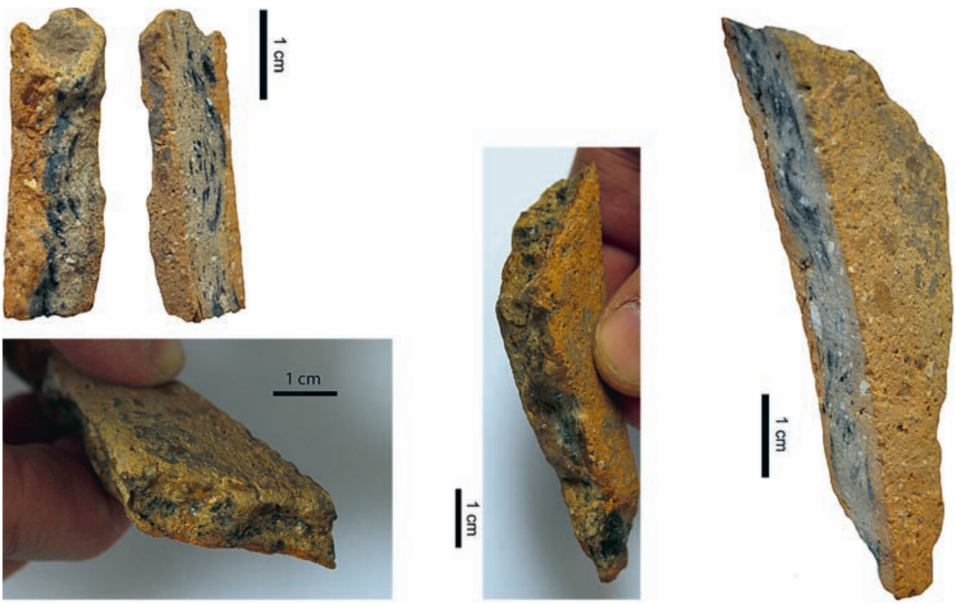

Fig. 4. Těšetice sample MH10. Burnt-out organic material facilitates the recognition of the structure. On the section there is a C-shaped organization of pores (detail on the left, upper photo), join of coils (detail on the left, photo below). Authors K. Neumannová and K. Kleinová.

The site is one of the most important excavations of Neolithic settlements in Europe (*Pavlů et al. 1986*, *Květina – Pavlů 2007*). The excavations revealed a characteristic picture of LBK settlement residues, comprising ground plans of timber pole long-houses surrounded by a large number of pits.

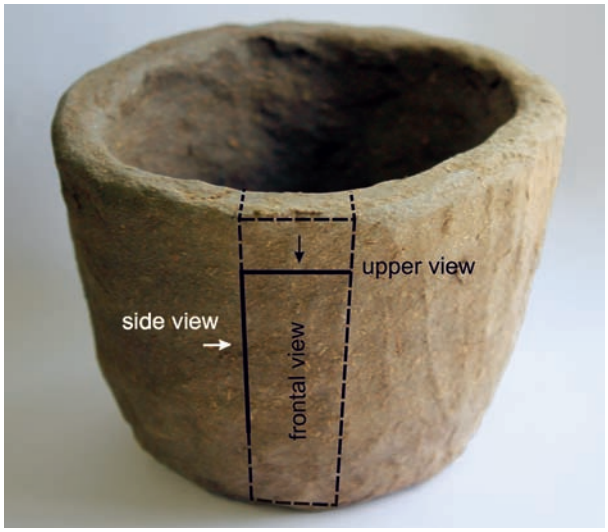

Fig. 5. Example of the experimental vessel with the depiction of views used for the uCT analysis visualisations.

The Těšetice-Kyjovice site is situated in the district of Znojmo. Systematic excavation has uncovered a multi-period site with settlement remains from the Neolithic to the Iron Age. The LBK settlement is concentrated in the north-east section of the excavated area, where over 120 features were uncovered together with 20 not well preserved outlines of post-hole houses and 11 inhumation burials (*Vostrovská – Prokeš 2012*). A geophysical survey ascertained that the settlement extends further towards the north-east, and 80–130 other construction complexes (longhouses with longitudinal pits) arranged in several rows can be identified here (*Milo 2013*).

Micro-tomographical samples and their contexts are presented in *table 2*. Sample selection was based on macroscopic observation of technological traits typical of burnt-out organic material and associated with different coiling techniques. We chose two samples from each side that macroscopically correspond to our hypotheses concerning the 'S' coil technique and one from the site Těšetice-Kyjovice (IV 76), in which we attempted to identify the inner structure, which is not macroscopically visible.

Results

Segments of experimental vessels are visualized in *fig. 2* (left column), using the adjustment of spectra on the carbon coating of voids. It shows the voids' orientation and approximate joins of coils for different forming techniques on experimental samples. The arrows indicate the dominant void orientation (*fig. 2*, central and right columns). The visualization of voids in front view, side view and upper view offers much more detailed insights into the complexity of the spatial organization of voids associated with different forming techniques (*fig. 6*).

'U' coil technique: Front view (*fig. 6*, first row, first column): There is no visible join of coils in front view. Voids are oriented horizontally, parallel. Occasionally, the orientation

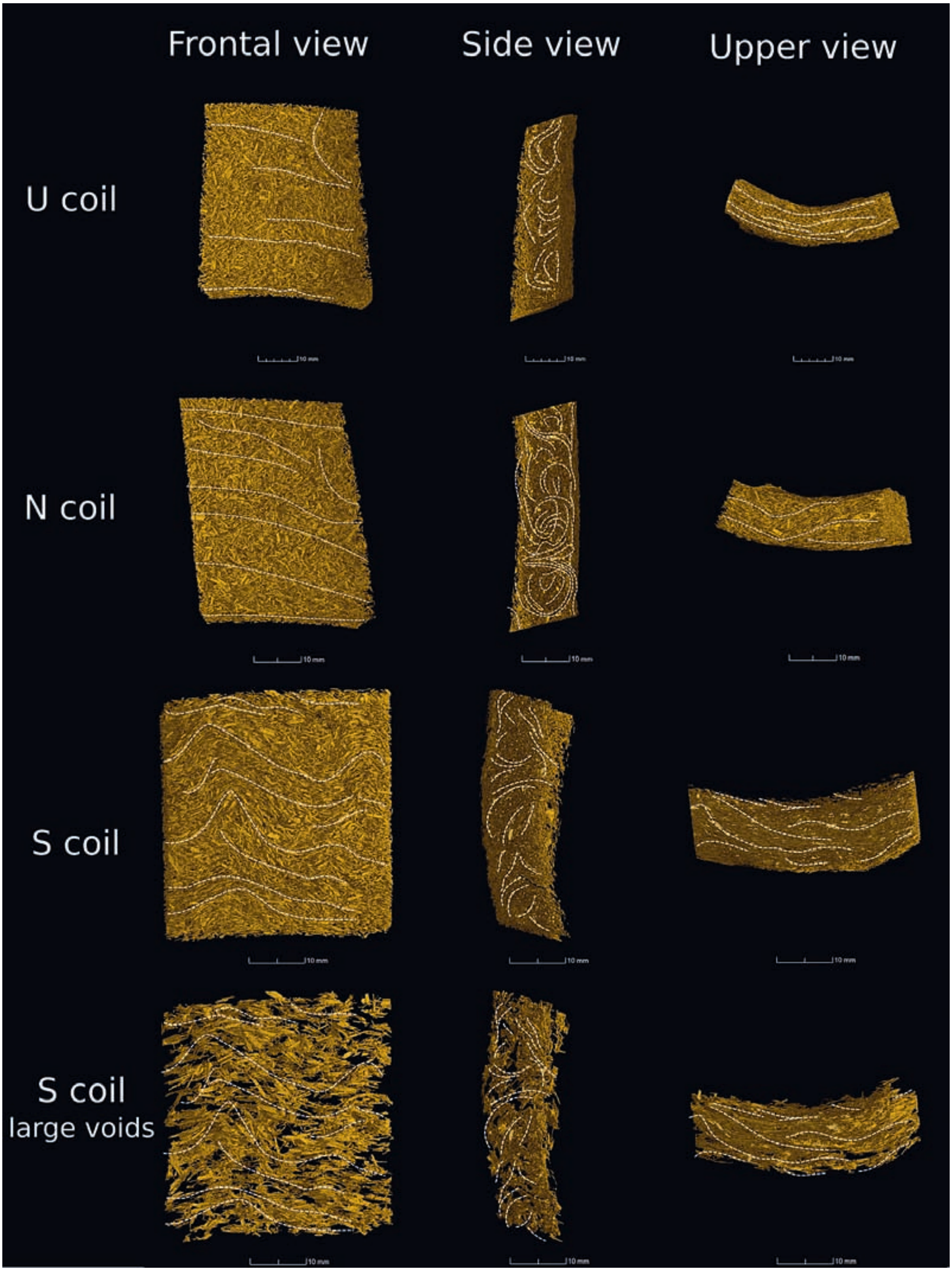

Fig. 6. Visualization of voids in front view, side view and upper view. White lines illustrate the dominant orientation of voids.

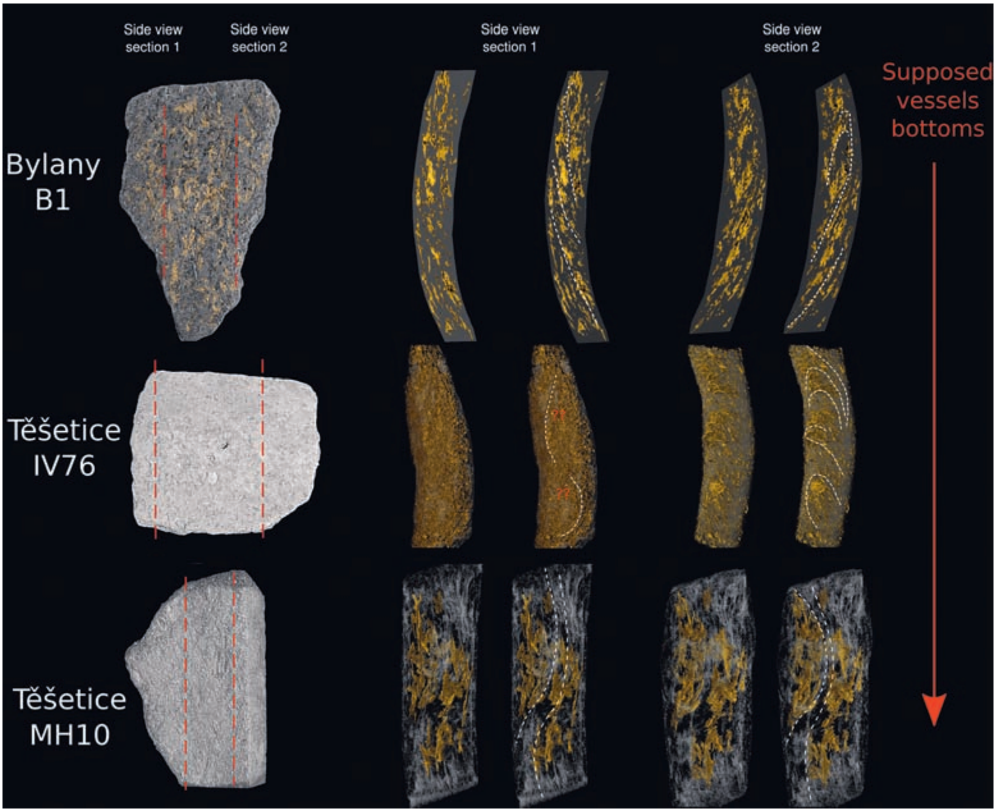

Fig. 7. Samples from the sites Bylany and Těšetice. Variability in the coil deformation is clearly visible if different side-view cross-sections are directly compared. White lines illustrate the dominant orientation of voids.

is deformed around mineral grains into a fluidal texture. Side view (*fig. 6*, first row, second column): Elongated voids are oriented into concentric structures. A typical 'U' shape is visible if the elongate voids close to the surface are oriented towards the vessel bottom. The structure matches well the original position of the coils, the margins of which are clearly recognizable. The shape of coils is similar in different side-view cross-sections. Upper view (*fig. 6*, first row, third column): Voids are parallel to the coils and rim of the vessel.

'N' coil technique: Front view (*fig. 6*, second row, first column): The structure of voids in front view is similar to the 'U' coil sample. There is no visible join of coils in front view. Elongate voids are horizontal and parallel as the 'U' coil sample in front view.

Side view (*fig. 6*, second row, second column): Elongate voids are oriented into concentric structures in the central part of coils. Their orientation is inverse close to opposite surfaces of the vessel walls. The inverted orientation around opposite sides is typical for 'N' coil technique. The shape of coils is similar in different side-view cross-sections. Upper view (*fig. 6*, second row, third column): Voids are parallel to the coils and rim of the vessel. The visible discontinuity is probably related to a joining of two different coils (*fig. 6*, second row, third column).

'S' coil technique: Front view (*fig. 6*, third row, first column): There is no visible join of coils in front view. The voids are parallel, but not horizontally oriented. The orientation of voids orientation is deformed into wavy or folded structures. Side view (*fig. 6*, third row, second column): Elongate voids are oriented according to the intensity of deformation in different parts of the vessel wall. Less deformed zones contain concentric structures similar to what could be caused by the 'U' technique. More deformed zones contain drop-like irregular structures. Coils are occasionally connected into continuous 'S' joins. Upper view (*fig. 6*, third row, second column): A rhythmic variation of slightly parallel and more deformed parts is visible in upper view.

Method of uCT analysis of LBK artefacts from the sites Bylany and Těšetice: LBK samples from the sites Bylany and Těšetice were selected for consequent comparison with experimental samples. Variability in the coil deformation is clearly visible if different side-view cross-sections are directly compared (*fig. 7*). Side-view sections 1 show the more deformed zones of both artefacts. Coil joins are not visible at all in these cross-sections. Side-view sections 2 run through the less deformed part of both artefacts. Coils are clearly visible. uCT sections exhibit variability of coils in space and transitions between less and more deformed zones in samples Bylany B1 and Těšetice MH10. In sample Těšetice IV76, no zone with clearly visible structures indicating less deformed coils could be identified. It could be caused by a different size and shape of the original organic temper and by a different forming technique, which does not directly correspond to our experimental model. On the other hand, there is an overall similarity to the more deformed zones of samples Bylany B1 and Těšetice MH10. The inner structure of sample IV76 does not fit into our experimental models. Perhaps this sample is more difficult to interpret than the others, which were selected due to well visible macroscopic marks. On a limited number of samples, we tested whether uCT analysis can aid the interpretation of sherds that are difficult to identify. The results support our conclusions based on the application of other methods of technological analysis.

Discussion

An important part of our experiments was the testing of different organic materials suitable for uCT analysis. Experiments with straw and hay were inconclusive. Even the finest particles of hay we found produced pores that were too large for our purposes. It was a complicated and time-consuming task to select a fine mixture of these materials. The first closer look at cow dung answered some of our questions that arose during the macroscopic study of organic residues in Neolithic pottery. Most notably, the use of dung may explain the infinitely variable shapes of very tiny particles resembling the remains of grains and parts of plants. Furthermore, dung is perfectly suited for mixing with clay in contrast to sharp and rough particles we tried to use before. It influences the workability of clay, but not as much as other materials.

The proportion of cow dung and clay was only approximate, although we strived to be as exact as possible. The volume to weight ratio of both materials depends on their moisture content. Anyhow, it does not reflect the final proportion of pores and clay, because cow dung also consists of a fine material that gets incorporated in the clay. For the uCT analysis, we settled on a mixture containing 30 % of cow dung, but the final amount of pores is probably higher than within original artefacts. Our experiments with variation in the proportion of organic matter have also brought other useful information, for example on the limits of macroscopic resolution (around 10 % of cow dung) and how it influences the solidity of pottery. Our experiments also included the crushing of experimental pots and the study of macroscopic marks of different coiling techniques.

For our study, we focused on three types of coiling techniques, which of course do not cover the whole range of possible techniques. Our aim was to produce experimental pottery that matches LBK pottery as closely as possible to enable comparisons with original sherds and to touch on questions that arose during the macroscopic study of LBK assemblages. Experiments with forming techniques demand considerable experience in pottery making. Even though we performed a series of preliminary experiments, there were still differences in the quality and regularity between the 'U' coil technique sample and the other ones, which required the experimenter to adjust their modus operandi. The 'S' coil technique requires the fine tuning of motoric skills and a regular rhythmicity.

The most significant marks of the 'U' coil technique are visible in the side view. The structure matches well the position of the coils, the margins of which are clearly recognizable. The coils are continuous in side-view cross-sections. A typical void orientation in vessels made by the 'N' coil technique is also visible in side view. The orientation of the voids is approximately parallel along the opposing surfaces of the vessel walls, forming a stretched 'N' shaped pattern. Another difference in comparison to the 'U' coil technique resides in the symmetrical cores of the coils. The appearance of the inner structure is similar to the 'U' coil vessel: horizontal and parallel. The void orientation in side view is similar to 'U' technique vessels in some side-view sections: slightly concentric to slightly parallel to the vessel wall surfaces, but the pattern is irregular and the most pinched parts cause 'S'-like structures in side view. It is caused by the alternation of more or less deformed zones. In front view, voids are parallel but deformed into wavy or folded structures. The technique we call 'S' coil, which we designed to reproduce the technique observed on LBK pottery, represents only one of many variants of pinched-coil techniques. Pinching produces irregularities in the wall structure, which may constitute many of more or less visible sub-variants.

Beside the spatial organization of voids, we also documented their morphology. The size and shape of voids produced by the use of dung is very specific. The bovine digestive tract causes the fragmentation of grass tissues into angular pieces of variable size. Void size distribution seems to be a possible marker of different organic materials used as temper.

The results of our experimental reconstruction of the 'U', 'N' and 'S' techniques only partly matched what has been identified in archaeological finds. In Remicourt 'En Bia Flo' II, the configurations are called 'C', 'O' and 'S', but all of these configurations correspond to the pinched coil technique (*Bosquet et al. 2005*, 110). The configurations are richly illustrated, but not interpreted in detail. Configuration 'C' (see *Bosquet et al. 2005*, 109) seems to correspond with the 'S' technique, but this would require a closer comparison. At Cuiry-lès-Chaudardes in France, the techniques are characterized more precisely. The first group (CCF1) is described by specific diagnostic marks (*Gomart 2014*, 63): In cross sections, voids can be distinguished at regular distances. Between these voids, pores and particles are oriented sub-circularly. The voids are inclined in alternating directions, which correspond with the orientation of the porosity. It is called the 'S' or 'Z' configuration. This method of manufacture can be recognized also by longitudinal indentations on the interior of vessels left by the pressure of the potter's fingers (*Gomart 2014*, 63).

These technological marks have not been interpreted in detail (*Gomart 2014*, 63). One of the mentioned variants is pinched coil pottery. *Alexander Livingstone Smith* (*2001*, 121) described the correspondence of these macro-traces with the pinched coil technique in ethno-archaeological material from Africa. The second main technique (CCF2) corresponds with the 'U' coil technique, in that study referred to as 'C/O'. It is described as thin coils that were only superficially deformed during the forming of the vessel. Signs of these two techniques were identified also at other sites in France and Belgium, but not at all of them (*Gomart 2014*, 280, see tab. 81).

At the Bylany site in the Czech Republic, signs of the 'S' technique have been observed systematically (*Neumannová et al. 2016*), besides other techniques, as a less pronounced variant of coiling, which can be associated with the 'U' technique or a better smoothed and drawn variant reshaped during secondary forming. Similar tendencies were randomly observed also at other sites in the Czech Republic, for example, Těšetice in Moravia and Nové Dvory (see *fig. 6*), which is situated in the close vicinity of the Bylany site (*Neumannová et al. 2016*). Macroscopic studies show similar trends in technological processes across different regions of Europe. The coiling technique is predominant. Macroscopic studies also provide details on the methods of joining coils and some data on the composition of ceramic paste.

Comparison of our uCT results for experimental samples and selected LBK samples shows similar signs in the 'S' technique experimental sample and in LBK artefacts. There is clearly visible variability in the deformation of coils.

Conclusion

A closer analysis of LBK artefacts will be the subject of a follow-up study. The method of uCT analysis seems to be suitable for this purpose. It allows to visualize the spatial orientation of pore structures in experimental pottery in relation to deformations caused by the pinched coil forming technique.

Rhythmic irregularities in wall structure caused by the pinching technique pose difficulties for thin-section and similar one-dimensional section analyses. This non-uniform and dynamic phenomenon in the structure of ceramic sherds requires the consideration of different perspectives and scales (macro/micro). Deeper insights into the topic will require the application of multiple approaches.

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The development of pottery technology in Eythra from the Early Linear Pottery culture to the Late Stroke Ornamented Pottery culture

Vývoj keramické technologie v Eythra od časné kultury s lineární keramikou po pozdní kulturu s vypíchanou keramikou

Oliver Mecking – Isabel Hohle – Sabine Wolfram

The site of Eythra, a former village located on the western bank of the White Elster River, has yielded numerous remains of a settlement that existed there during the early Neolithic cultures – the Linear Pottery culture (LBK) and the Stroke Ornamented Pottery culture (SBK). The site covers some 30 hectares, making it the largest excavated settlement of the LBK and SBK areas to date. Chemical analyses of the ceramic fragments from the consecutive stylistic phases that were represented in Eythra were carried out. The objective of this was to find out whether the stylistic changes in the shape and the decoration of the ceramic material correspond to technological changes in regard to such aspects as clay composition and tempering. The transitions between the earliest and the early LBK phases and between LBK and SBK were of particular interest in this respect, as also were the localised developments that took place within the two phases of the LBK and SBK.

Linear Pottery culture – Eythra – ceramic technology – chemical analyses of ceramics – continuity – discontinuity

Z lokality Eythra, bývalé osady na západním břehu řeky Bílý Halštrov, pochází mnoho pozůstatků osídlení, které zde existovalo v průběhu prvních neolitických kultur – kultur s lineární keramikou (LBK) a vypíchanou keramikou (SBK). Lokalita se rozkládá na ca 30 ha, což z ní činí dosud největší zkoumané sídliště v oblasti LBK a SBK. Byly provedeny chemické analýzy keramických střepů z jednotlivých stylistických fází, které byly v Eythra zastoupeny. Účelem těchto analýz bylo zjistit, jestli stylistické změny ve tvaru keramiky a její výzdobě odpovídají technologickým změnám, např. co do složení keramické hlíny a ostřiva. V tomto ohledu byla zvláštní pozornost věnována přechodu mezi nejstarší a časnou fází LBK a přechodu mezi LBK a SBK, stejně jako lokálním inovacím, které se uskutečnily ve zmíněných fázích LBK a následující SBK.

kultura s lineární keramikou – Eythra – keramická technologie – chemické analýzy keramiky – kontinuita – diskontinuita

Introduction

Starting in 1993, large-scale excavations were conducted in the former open-cast lignite mining district of Zwenkau (located some 15 km to the south of Leipzig) by the State Archaeological Heritage Office Saxony (LfA, or *Landesamt für Archäologie Sachsen*) at the site where the village of Eythra had once stood on the west bank of the White Elster River. Numerous traces were uncovered there of a settlement that had flourished during the Neolithic cultures of Linear Pottery and of Stroke Ornamented Pottery (e.g. *Stäuble 2007*; *Cladders et al. 2012*). In a joint project of the LfA and the Chair for Pre- and Protohistoric Archaeology (*Ur- und Frühgeschichte*) of Leipzig University, which was funded by the DFG

(*Deutsche Forschungsgemeinschaft*), the structural remains and the found material of the Bandkeramik culture from Eythra were examined between 2009 and 2016. More than 9,000 structural remains of the Bandkeramik culture had been documented in an area covering some 30 hectares (ca. 75 acres), including some 300 houses, a circular enclosure consisting of three concentric rings, and two wells dated dendrochronologically to 5098/97 BC and 5221 ± 10 BC respectively.[1] This makes Eythra the largest excavated settlement site of the Bandkeramik to date. The ceramic typology indicates that the site was occupied from the early phase of the LBK until the late SBK period (*Frirdich 2016*).[2] In addition, the remains of a small settlement of the earliest LBK period were discovered across from Eythra on the eastern bank of the White Elster River in Zwenkau-Nord (*Hohle 2011*; *2012*; see *fig. 1*). As some of the pottery fragments from Eythra also display certain traits of the earliest LBK[3], it is a distinct possibility that there was a simultaneous settlement on both banks of the river during this initial phase of the LBK, which needs to be considered. In order to ascertain this contemporaneity, a series of samples of ceramic fragments from Zwenkau-Nord were analysed and compared with fragments from Eythra of the earliest and the early LBK (*Mecking et al. 2012*). Some of the sherds were recovered from a house-site that probably dates to the earliest period of the LBK (*fig. 2*: the house, picked out in dark grey, lies in the northeast part of the site plan).

In the region south of Leipzig, a large number of Bandkeramik sites are strung out along the White Elster River like pearls on a string (*Stäuble 2014*). One well-known site lies at Zwenkau-Harth. This settlement, which existed both during the LBK and the SBK, was excavated in the 1950's by Hans Quitta. Against this background, it was one of the objectives of the Eythra project to explore the significance of the find site both within its micro-region and beyond, in the wider context of the distribution areas of the Bandkeramik in Northwest Saxony and in Central Germany (*fig. 3*). In addition, a ceramic chronology was established on the basis of the material found in Eythra and the more distant Saxon sites which provides, for the first time, a comprehensive data set that covers the entire stylistic development of LBK pottery (*Frirdich 2016*).

Because the settlement at Eythra existed for a very long time (unlike most of the other sites of the Bandkeramik) it provided a welcome opportunity for a closer study of the continuities and the discontinuities in the development of pottery. In this respect, the examination extended beyond the mere observation of shapes and decoration by also taking into account possible technological changes in ceramic production too. Further questions concerning the correlation of such changes with the evolution of other groups of artefacts, the construction of the houses and the overall settlement pattern, could then be appended.

Two essential questions were intended to be answered through chemical analyses of the ceramic materials (*Mecking et al. 2012*):

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[1] An earthwork and a palisaded enclosure were also discovered, but their chronological position in the Linear Pottery culture remains tentative (cf. *Tischendorf – Girardelli 2016*, 34–37).

[2] The terminology of the Bandkeramik sub-phases that is used in this text is based upon the chronology of *D. Kaufmann* (*1987*).

[3] For the supposedly oldest house site of the Linear Pottery, House 236, and the ceramic material of Interval 1 of the type chronology, cf. *Cladders 2016*, 54–56. The series does not include lugs, however, which are interpreted here as traits of the earliest LBK (*Cladders et al. 2012*, fig. 7, especially A, B, C, E, G).

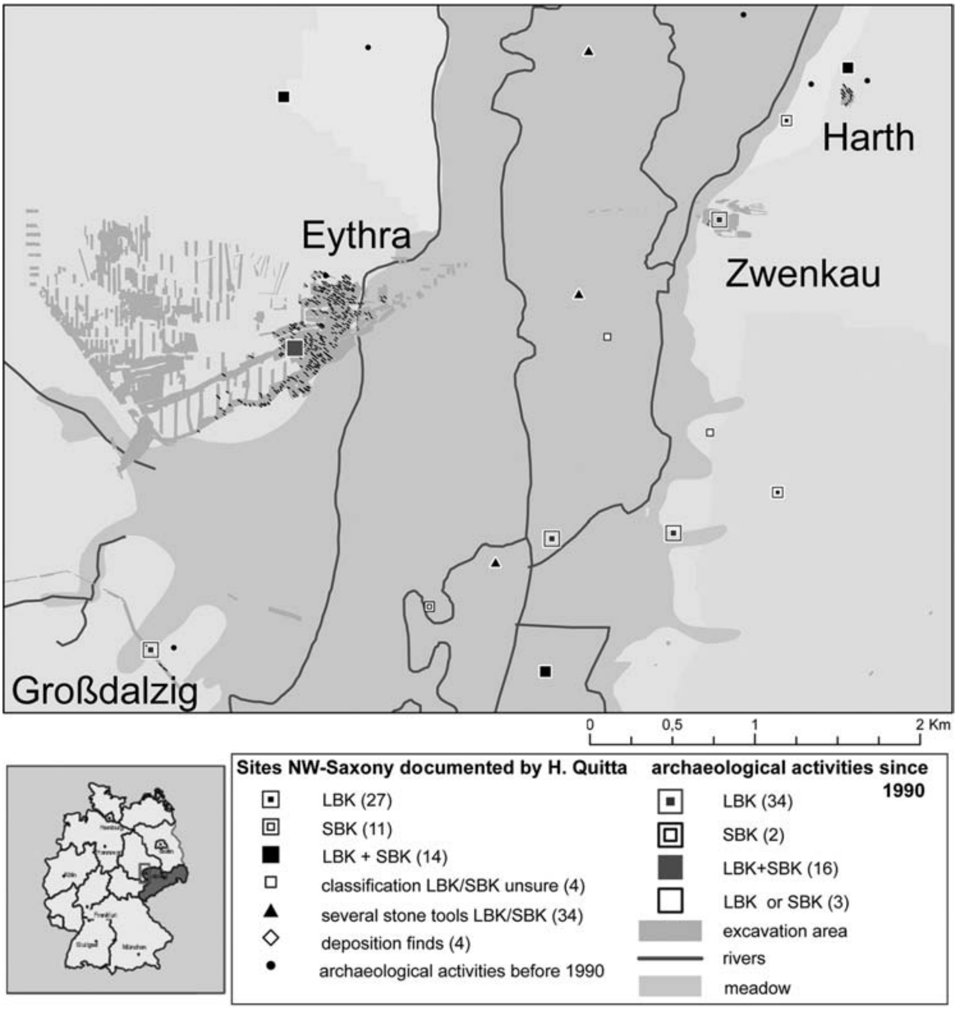

Fig. 1. Bandkeramik on both sides of the Weiße Elster River: the sites Eythra and Zwenkau-Nord (source: *Stäuble 2014*, fig. 4). The symbols on the left in the legend mark the sites that were compiled by Hans Quitta, the symbols on the right mark excavations since 1990.

1. How do changes in the decoration of vessels correspond with changes in ceramic production (e.g. in clay composition and tempering)?

2. To what extent can continuities or discontinuities displayed by ceramic materials also be discerned in other contemporary or non-contemporary aspects of the material culture?

As an answer to the second question is only possible based on a joint evaluation with the colleagues examining the artefacts and the houses of Eythra, the present paper concentrates on the first question.

In this context, the transitions from the earliest to the early phase of the Linear Pottery culture and from the LBK to the SBK are of particular interest, as representing the most

Fig. 2. Plan of Eythra and of the plot that was the original source of the samples. The rondel and the earthwork are both highlighted in dark grey as well as the probably earliest LBK house (© Landesamt für Archäologie Sachsen).

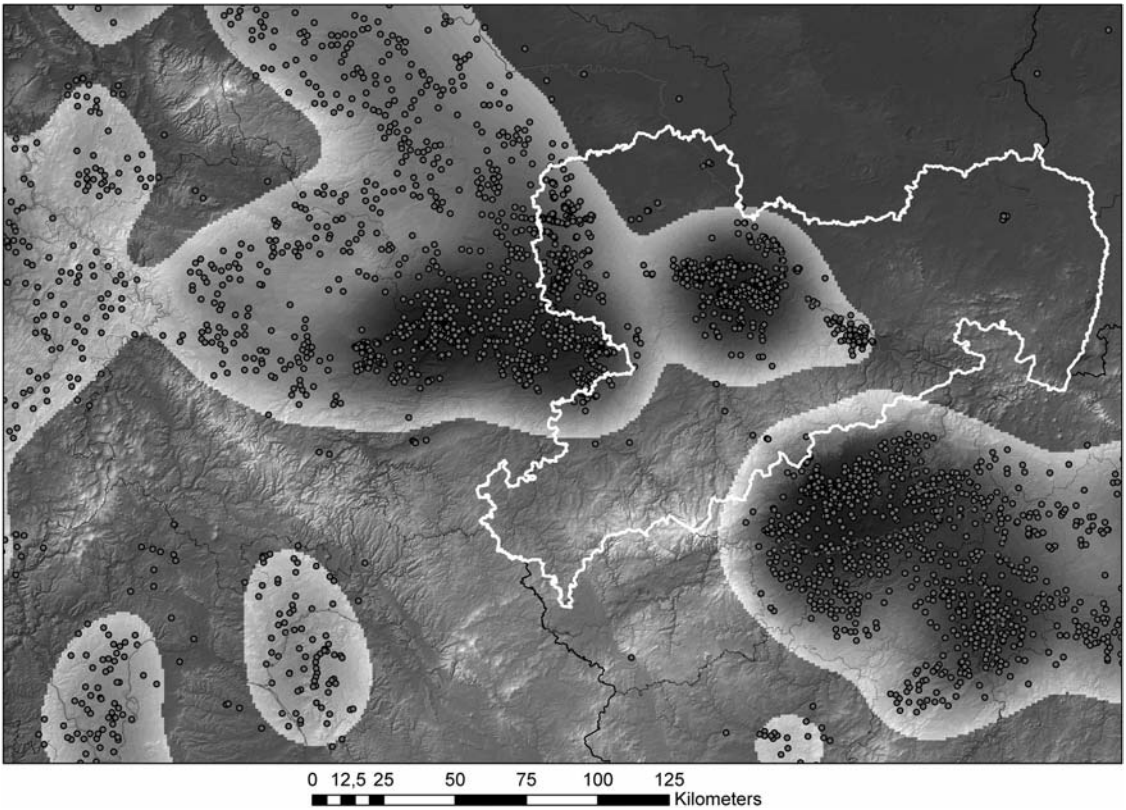

Fig. 3. The distribution of Bandkeramik sites in Central/East Germany and in Bohemia (source: *Stäuble 2014*, fig. 3); Saxony is highlighted in white.

distinct changes that can occur in respect to pottery shapes and decoration (in addition to house construction and settlement patterns) that can be found here. The developments in ceramic technology both within the LBK and the SBK are likewise the subject of our study.

The results are able to provide crucial stimuli to the interpretation of stylistic changes in the development of ceramics or of possible continuities in ceramic production that may not be discernable through purely typological analyses. Concerning the relationship between the earliest and the early phases of the LBK, it is a point of debate as to whether they constitute two distinct variants of a single cultural tradition that existed alongside one another for some length of time (*Cladders – Stäuble 2003*), or whether the early LBK may have evolved directly from the earliest phase – a theory that is supported by several find sites in Baden-Württemberg, e.g. Gerlingen (*Neth – Strien 1999*). According to the present state of research on the relationship between the LBK and the SBK, it appears that the actual break in the development occurred as late as the transition from the early to the late phases of the SBK. The early SBK itself seems to be rooted firmly in LBK traditions, especially as far as fine-ware is concerned, and on a regional level it displays continuous development rather than any definite break (*Link 2014*, 216–220; *Hoffmann 1963*, 118–120; *Kaufmann 2009*). While the decoration of early SBK vessels does display a greater degree of the standardisation of ornamental motifs, the characteristic angular line motif with vertical strokes had already been around prior to the late phase of the LBK. Shapewise, the gourd-like vessels of the early SBK resemble those of the LBK, while the beakers only acquire their position as being the dominant vessel-type as the SBK progresses. Even the eponymous stroke ornaments are not really a novelty of the SBK. Such ornaments were applied with tools, which had either one or several lines, and the later ornament is certainly considered a characteristic trait of the late LBK in some regions (*Jeunesse 2008*; *Jeunesse – Strien 2009*; *Einicke 2014*, 281–286; *Kaufmann 1987*, 286–287). Even the floor plans of the houses of the early SBK can be shown to be continuing a trend that had already existed during the late LBK. The settlement site of Dresden-Prohlis (*Link 2014*) is currently the only find site where this continuous development is documented in an unambiguous fashion, but evidence of settlement continuity from the LBK to the SBK also appears in Eythra and also numerous additional find sites. With these insights in mind, it seemed promising to take a closer look at our recent findings regarding the development of ceramic technology. From the material from Eythra a total of 153 sherds were selected for this approach. These came from a variety of vessel types and wares belonging to all the stylistic phases that are represented here, which were recovered from a wide range of structural remains (*fig. 2*).[4] A selection of the vessels that were chosen for this sampling can be seen in *figs. 4* and *5*.

Compared to later periods, the chemical, physical or mineralogical analyses of Neolithic ceramic materials are actually quite rare (*Daskiewicz et al. 2008*; *Hagn 1995*; *Jorge et al. 2013*; *Lehmann 2000*; *Maggetti 2012*; *Martineau et al. 2007* and others). In regard to the scientific study of the Bandkeramik, the analyses of the material from Eythra definitely fulfill a pioneering role both in terms of their chronological scope and their breadth.

The scientific analyses of the Bandkeramik sherds from Eythra

For producing a vessel, several distinct and successive steps need to be completed. Apart from finding a suitable clay deposit, these may include the preparation of the clay mixture and the addition of tempering materials, as well as using various different methods for shaping the vessel, decorating its surface and firing the result. These diverse steps can influence the properties and the appearance of a vessel to varying degrees (*Maggetti 2012*; *Hoard – Brien 1995*; *Kilikoglou et al. 1998* and others). Each step taken may leave traces in the sherds, which include the clay matrix, the material used for tempering, various kinds of pores, and the appearance of the surface (*Maggetti 2008*). Unfortunately, it is not always possible to connect specific traits of the sherds to specific steps of the production process. But in spite of this reservation, our analyses can provide useful insights into the techniques that were used for Neolithic ceramic production. Two aspects which stand out in this respect are the tempering of the clay and the treatment of the vessels' surfaces. It stands to

[4] The distribution of the sampled sherds across the settlement area mirrors the progress of the project at the time when these samples were taken. As just the pottery of the area in the north, in the circular enclosure and in the earthworks was examined the samples do not represent the entire area of the settlement (see *fig. 2*).

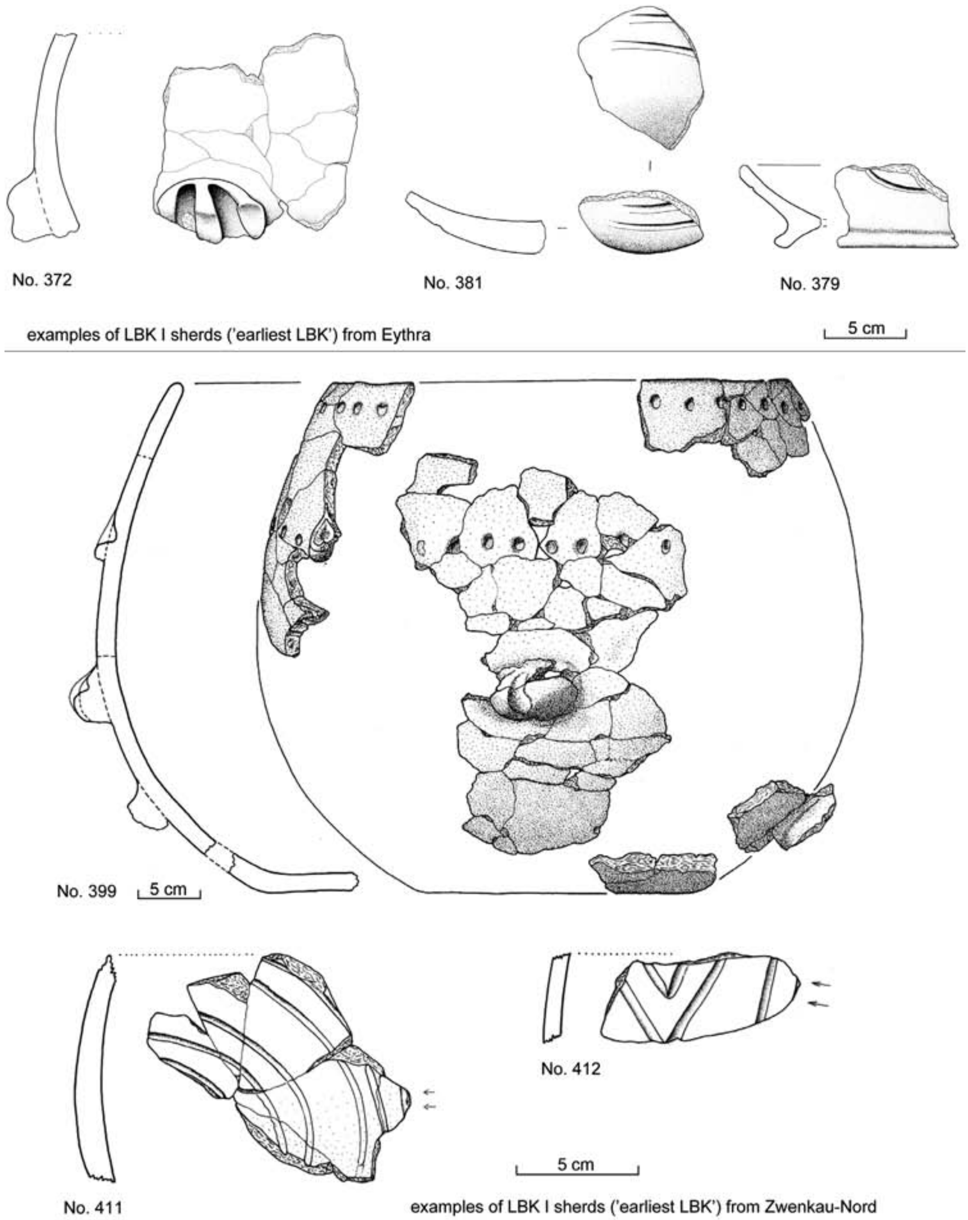

Fig. 4. Examples of earliest LBK sherds sampled from Eythra and Zwenkau-Nord.

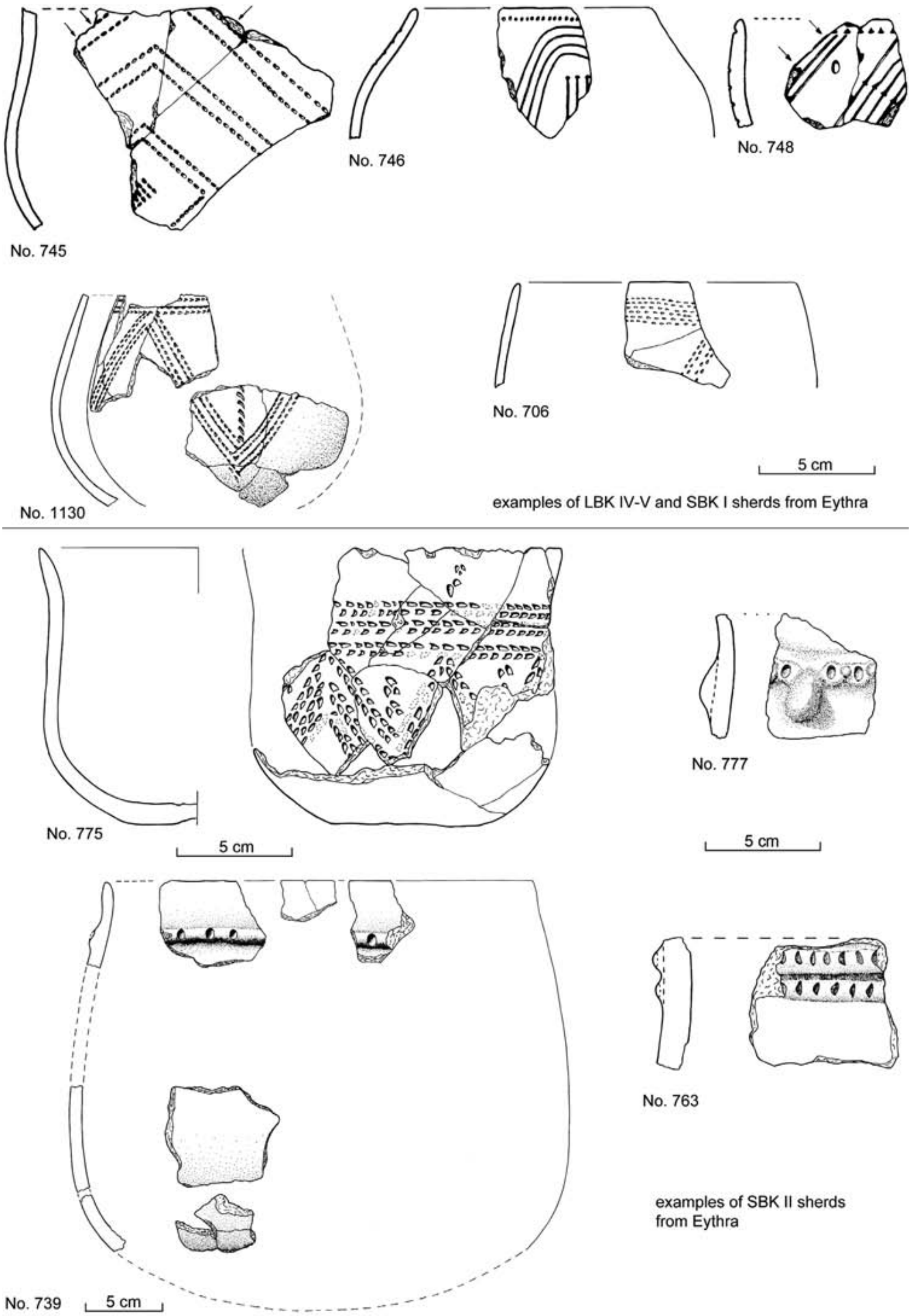

Fig. 5. Examples of sherds sampled from Eythra: late/latest LBK; early and late SBK.

reason that the occurrence of unusual tempering materials of a large diameter and irregular shape means that either a specific type of clay was deliberately chosen which already contained such non-malleable particles, or that these were purposefully added to the clay.

Each kind of clay possesses a geochemical composition that is distinct from that of other clays. But when clay is processed and mixed with a tempering material obviously this will result in the altered composition of the vessel or the sherd (*Sterba et al. 2009*; *2012*). Frequently this will hamper the reconstruction of the composition of the original clay as it was taken from its natural deposit, though the attempt may be successful in individual cases (*Xu 2013*). Finds of refuse material from potteries can help with solving this problem: Wherever such material can be recovered from a site, its characteristic trace elements can be determined (*Bartle et al. 2007*; *Biegert et al. 2002*; *Mommsen 2003*; *Mommsen et al. 1995*; *Maggetti – Galetti 1980* and more). This can provide a reference group to which sherds of an unknown provenance can be compared. However, as the production of vessels during the LBK seems to have been located predominantly at the level of the individual household, finds of distinctive pottery refuse can hardly be expected.

Changes in the composition of trace elements may indicate that different types of clays have been used or an altered manner of processing the clay, or the introduction of new tempering materials. When the results display an extreme variety, this may point to the ceramics having been produced in individual households. On the other hand, if within this variety a distinct trend becomes discernable, some degree of organisation of ceramic production above that of the household level may safely be assumed to have taken place.

In order to better understand the evolution of the ceramic material from Eythra, analyses were carried out both to determine the nature of the tempering materials and the geochemical composition of the sherds. For determining the tempering materials, measurements were taken from a freshly fractured cross-section of each sherd using micro-XRF spectroscopy.[5] A point matrix was superimposed on the sherd to guide the sequence of the measurements that were taken automatically. The observed element content was then translated onto a diagram as colour-coded information – e.g. the higher the proportion of a specific element the lighter the colour, and the lower the proportion the darker the colour. A black colouration indicates that the element was not encountered at all. This method enables the determination of both the composition of the clay and the nature, the volume and the size and shape of the requisite tempering material.

In order to facilitate the interpretation of the element distribution data in the diagrams[6], the tempering materials were sorted into four size categories. The first category included those samples that had no trace of tempering. The next category was defined by sherds that were comprised of small tempering particles. This group was further subdivided into samples comprising either a few or multiple particles, and this same approach was also applied to the other size categories. These included a group comprising medium-sized particles, and a group that encompassed all the larger particles (*figs. 6* and *7*).

Two distinctive types of tempering materials – i.e. potassic and ferrous – were found to exhibit marked differences across the separate stylistic phases of the Bandkeramik in Eythra. A third element, silicium, appears as a distinctive marker for quartz tempering, but as our

5 Eagle III by *Röntgenanalytik*, with a 300 micrometers Spot.

6 The element distribution patterns of 143 sherds were documented.

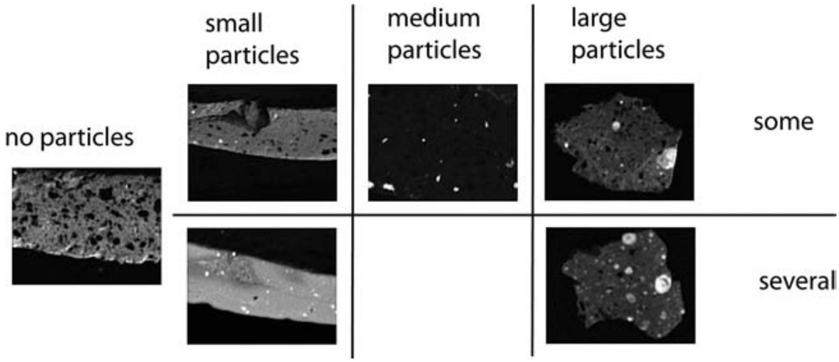

Fig. 6. The determination of the ferrous tempering materials.

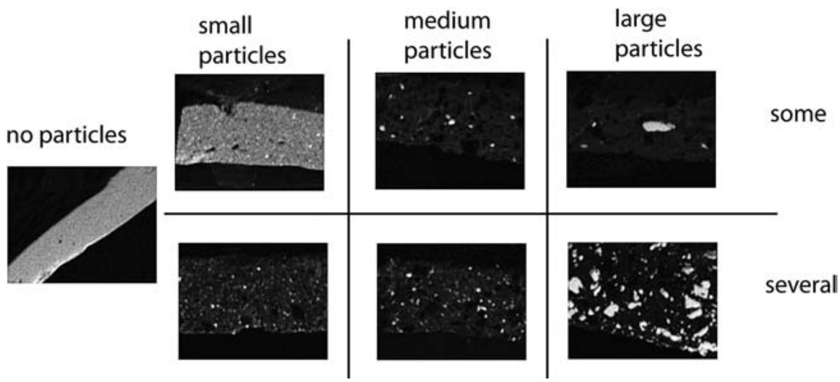

Fig. 7. The determination of the potassic tempering materials.

examination did not discover any significant trends across the chronological phases in this instance, it is not further discussed in this paper.

As is described above those samples with ferrous tempering were sorted into seven separate groups and subgroups (*fig. 6*). The changes that occur within these groupings in the course of the Linear Pottery culture (*fig. 8*) are remarkable. In the earliest phase of the LBK, some 20 % of the samples (i.e. four sherds identified as: Ker 391, 393, 394 and 395) exhibit more than three large iron particles. Another sherd with fewer large iron particles (Ker 409) can be added to this group. In the early LBK only one sherd (Ker 388) comprised several large iron particles. Three of the sherds (Ker 365, Ker 377 and Ker 390) all now display less than three iron particles. In the following chronological phases, samples comprising several large iron particles are completely absent. Thus, only the earliest phase of the LBK exhibits a larger proportion of sherds that comprise more than three ferrous particles. This phenomenon seems to disappear with the advent of the middle phase of the LBK. Only isolated samples with large ferrous particles occur during the early and middle LBK (Ker 721 and Ker 734). A single example was detected in a sherd (Ker 706) from the early SBK.

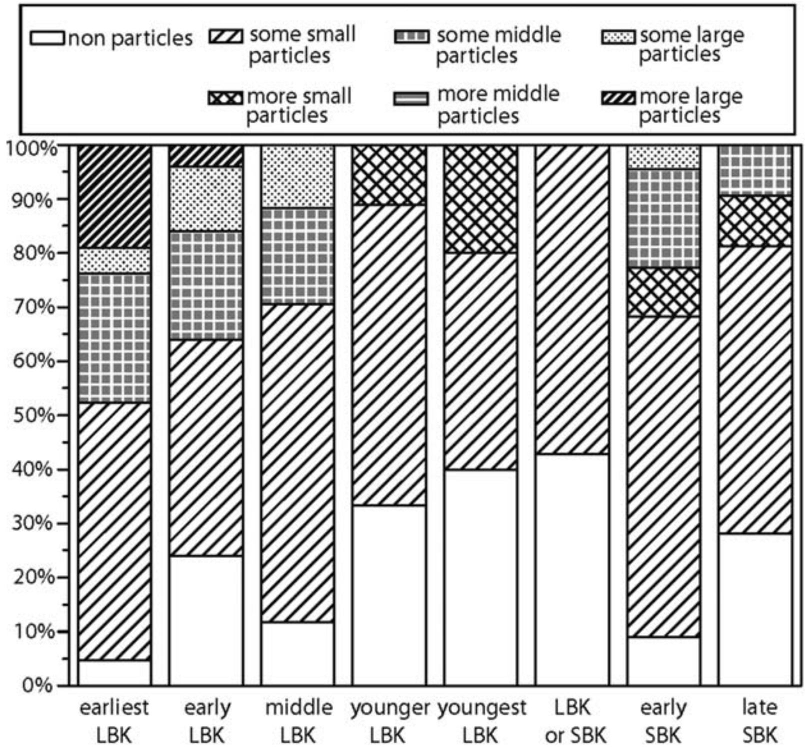

Fig. 8. The chronological development of the ferrous tempering material; "LBK or SBK" indicate the undecorated sherds that could be either one or the other.

This evident trend is mirrored in the overall iron content of the samples. On average, the sherds of the earliest and the early LBK display a higher content of iron than those of the subsequent phases. The iron content of the samples from the earliest LBK averages around 7.99 % of Fe_2O_3, dropping to 7.28 % in the early LBK, with an additional drop to 6.24 % in the late LBK. Thereafter, the mean value for the sherds of the SBK sinks to only 5 % of Fe_2O_3.

The ferrous component of the samples does not consist solely of iron oxide. In order to clarify the exact composition, micro-XRF spectroscopy measurements were taken (*fig. 9*). These evaluated the iron content in relation to a fundamental parameter. The result was that the content of iron oxide could be shown to have risen significantly, approaching values of up to 40 %. In contrast, the values of all the other elements (with the exception of manganese) exhibited a distinct decline. This indicates that hematite was not used for tempering, as this would have resulted in a higher iron content. The utilisation of an iron-enriched type of clay is much more likely.

Sherds from Eythra and Zwenkau were also examined by *Ramminger et al.* (*2013*) in the manner of polished thin-section analyses. These analyses confirmed the absence of pure hematite. Some differences between the basic substance of the sherds and the zones of iron enrichment are discernible, however. As these concentrations of ferrous mineral appear to

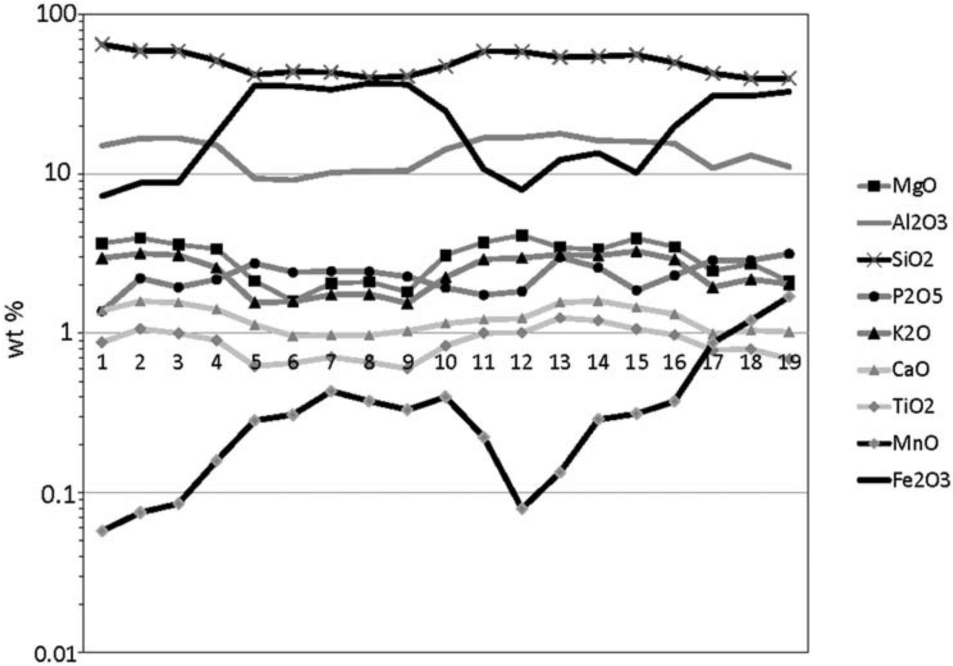

Fig. 9. A scan of a ferrous particle.

be rounded, it is conceivable that they were created by a natural tempering and were not an intentional addition (*fig. 6*).

A contrasting chronological development is evinced by such potassium-based tempering materials as potassic feldspar (*figs. 7* and *10*). Only a single sherd (Ker 384) in the earliest and early LBK contained a large potassic tempering particle. All the other samples emanating from these chronological phases displayed either small or (rarely) medium sized potassium particles or none at all. From the middle phase of the LBK, there are three samples that include individual large potassium particles (Ker 723, 728 and 731). Turning to the late LBK, only a single sherd out of a total of nine (Ker 720) featured a significant number of large potassium particles. Likewise, the youngest LBK provided a single sample containing several large tempering particles (Ker 738) out of the five sherds of this phase that were examined. Of the ceramic fragments that could be ascribed to both the SBK and the LBK[7], two out of the seven sherds displayed a number of larger tempering particles (Ker 737 and Ker 749). A distinct increase in the number of samples with large potassic tempering particles is discernible in the SBK: 19 of the 54 sherds that were examined contained several large inclusions. This constitutes a full third of all the samples.

A remarkable feature shared by all of these samples is the angular shape of the tempering particles (see *fig. 7*). This trait suggests that some kind of material was intentionally

[7] The analyses also included some undecorated sherds. These were potentially attributable to both the later LBK and the SBK, and the clarification of their status was a desirable goal.

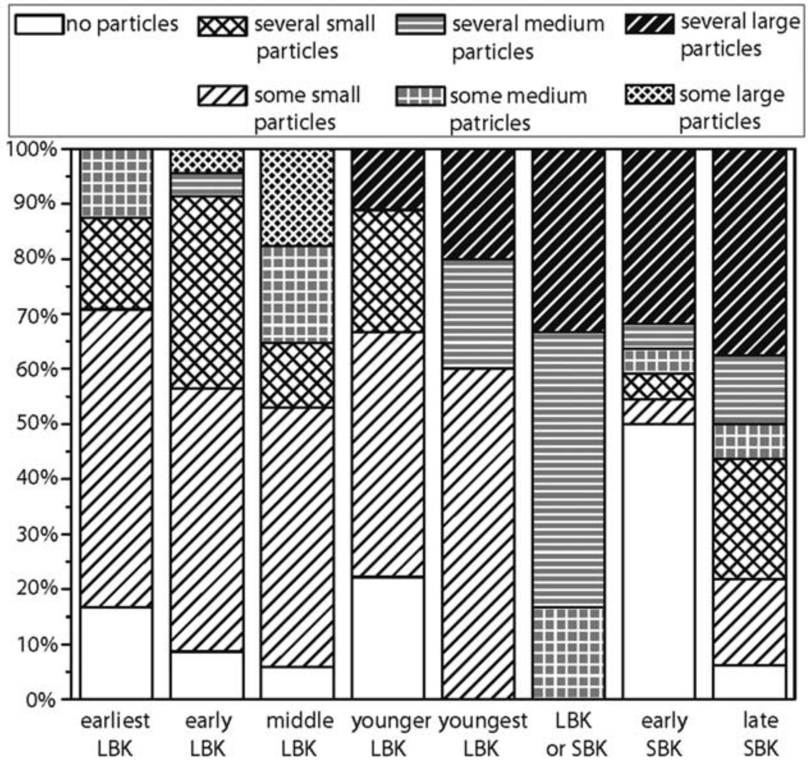

Fig. 10. The chronological development of the potassic tempering material.

added to the clay and this manner of tempering occurs mostly in relation to the coarser kind of pottery. One conspicuous result of the examination is the complete absence of any small potassium particles in the early SBK, particularly in samples of fine-ware.

Thereby two potential trends can be identified: First mostly used during the earliest LBK there were clay types that contained several larger ferrous inclusions and they made some isolated appearances during the early LBK. Second, during the SBK, potassic tempering materials such as feldspar were added to the clay, which was mostly used for producing coarse pottery, a method that had isolated the precursors during the late and the latest LBK.

In addition to tempering materials, the content and the proportions of major, minor, and trace elements in the samples were also examined. This was carried-out by first detaching a fragment from a sherd, from which the surface layer was then removed in order to preclude any possible contamination (*Franklin – Vitali 1985*; *Schneider 1989* and others). This purified piece was ground-up in a ball mill, and the resulting powder was heated to 800 °C to remove any organic components. In order to determine the major elements and some trace elements[8], a precise 600 mg of this powder were weighed and mixed carefully with

[8] Magnesium, aluminium, silicon, phosphorus, potassium, calcium, titanium, manganese, iron, strontium, rubidium and zirconium.

20 % of wax. A pressed pellet was then formed and measured using micro-XRF spectroscopy (Eagle III, by *Röntgenanalytik*). Each pellet was measured at twelve different points, and in each instance an area of 4.5 x 4.5 mm of the surface was scanned. The samples were analysed with reference to 26 different clay standards in order to guarantee their comparability with the external measurements.

To determine the trace elements, 100 mg of the sample was dissolved with 4.5 ml of hydrofluoric acid (HF), 0.5 ml of hydrochloric acid (HCl) and 1 ml of nitric acid (HNO_3). The mixture was then digested at 240 °C in a microwave oven (*The Multiwave 3000 by Anton Paar*). The solution was then vaporised and absorbed by diluted nitric acid. The resulting solution was measured by means of the ICP-MS (*Elan DRC by Perkin Elmer*) using rhodium for an internal standard.

One particularly interesting result is the extremely low calcium content of the samples. Their mean value is 1.2 % by weight of CaO, and the maximum value lies at 2.5 % by weight. This could indicate either that clay types that were low in calcium were intentionally used to produce this pottery, or that these clays were processed prior to their use to lower their calcium content.

The analysis of elements is a useful tool for determining the chemical composition of the sample sherds. We must bear in mind, however, that each sample is composed both of clay and of tempering materials. As was described above, clearly employed were clays with ferrous inclusions as well as potassic tempering and this should be reflected in the results of the analyses. This aspect is best illustrated by a diagram that compares the occurrence of iron and potassium (see *fig. 11*).

On average, it is the earliest LBK phase that displays the highest iron content of all the samples, with the values for coarse pottery being somewhat higher than those of the fine ware. At the same time, the values for potassium oxide (K_2O) are closely grouped, with a median value of 3.06 and a standard deviation of 0.42.

During the early LBK period, the iron content remains comparatively high, though it decreases slightly to 7.28 % from the weight of the Fe_2O_3. At the same time, the potassium content remains within a comparable order of magnitude (with a median value of 2.84), while the values vary, but little (with a standard deviation of 0.32).

In the middle LBK, the iron contents decrease further to 7.07 % by weight on average, a value that is still high. The contents of potassium remain within an order of magnitude that is comparable with the previous phases (with a median value of 3.05 % by weight of potassium oxide (K_2O), but the distribution of the values widens slightly (with a standard deviation of 0.57). This can be explained by the occurrence of a few odd samples that contain isolated large potassium particles.

In the late LBK, the iron contents decreased more markedly, to settle at around 6.24 % by weight on average. In contrast, the potassium contents increased slightly to 3.31 % by weight, while at the same time their standard deviation increased to 1.05. This trend continued into the latest LBK: The values for iron sink to 5.51 % by weight while the potassium contents rise to 3.72 % by weight. More significantly, the standard deviation of the potassium contents increases further to arrive at a value of 1.54. These trends can definitely be associated with the observed changes in tempering material. Those samples of coarse pottery (*fig. 11b*) that contain feldspar tempering also display the highest potassium content.

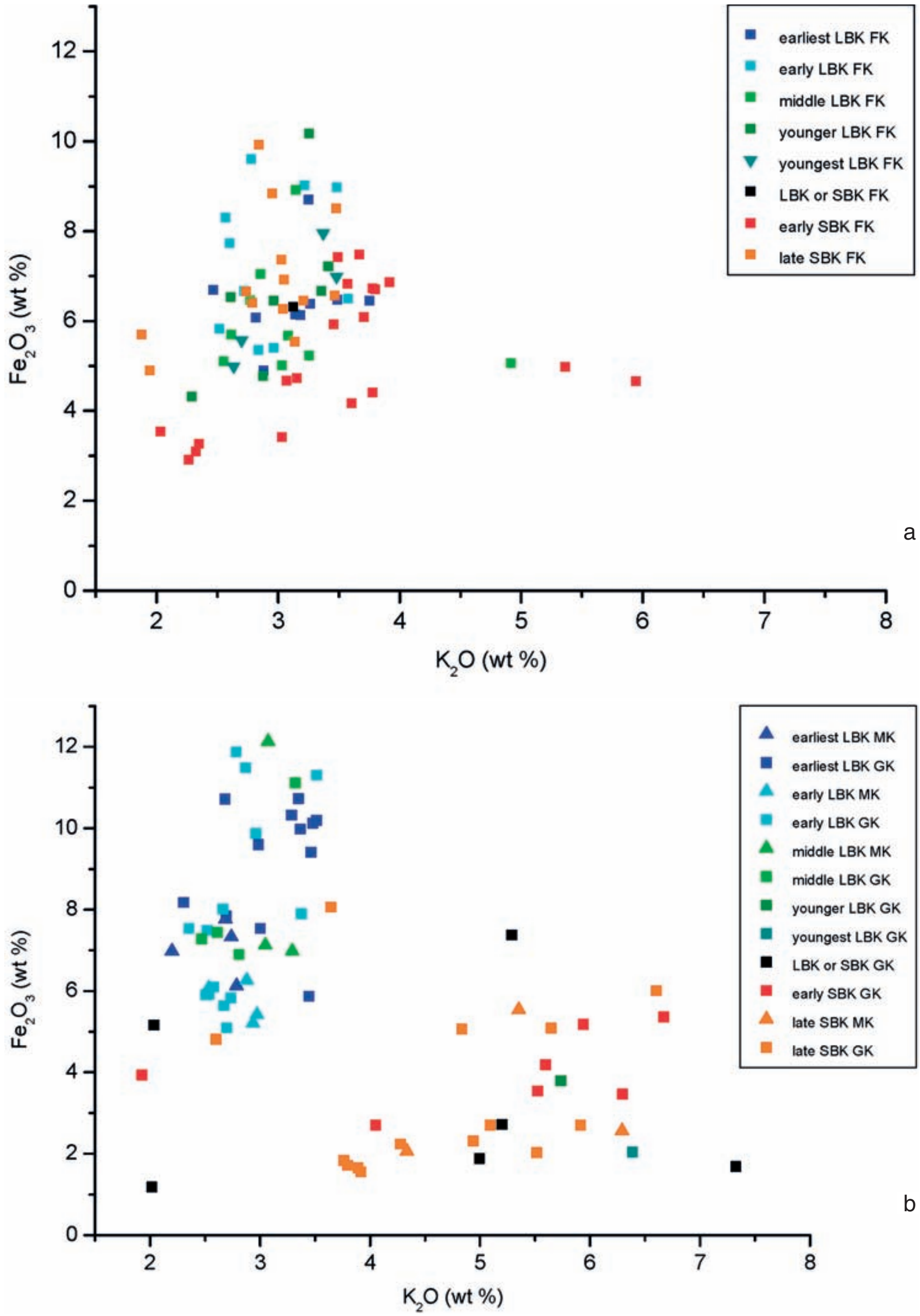

Fig. 11. A comparison of the K and Fe tempering materials (FK: fine-ware, MK: medium-ware and GK: coarse pottery; "LBK or SBK" indicate the undecorated sherds that could be either one or the other).

This is a clear (but anticipated) confirmation of our initial assumption that tempering affects the sherds composition.

Using archaeological criteria, the ceramic material was sorted into the following categories: fine-ware (*Feinkeramik*, FK), medium-ware (*Mittlere Keramik*, MK), and coarse pottery (*Grobkeramik*, GK).[9] High potassium contents are found predominantly in coarse pottery, thereby constituting a distinctive group. In the fine-ware of the SBK, some sherds display lower iron and potassium contents than the samples from the LBK. This would seem to indicate that different clays or mixtures were used to produce the respective ceramic vessels.

While tempering was intended as a means of introducing new elements into the clay, it is also conceivable that particles that were geochemically related to the original material might have also been introduced. If a method using multivariate statistics (e.g. cluster analyses, main component analyses) were applied to our data set, this would merely lead to a sorting of the sherds according to specific tempering materials. It is also conceivable that identical clays were used, but that different tempering materials were added. In order to measure the actual composition of the samples, the Pearson's correlation coefficients for all the possible element combinations were determined.

Certain elements will correlate with one another because of their geochemical similarities. This phenomenon can best be described using the rare earths as an example. These will frequently display coefficients with values that exceed 0.9 (specifically in the cases of neodymium-cerium, lanthanum-cerium, holmium-erbium, gadolinium-dysprosium and others). This is due to the fact that rare earths have similar geochemical traits because of their closely related atomic radii and charges (*Markl – Marks 2008*, 473–480). Apart from the rare earths, there are other elements that also correlate with one another, such as calcium – both with strontium and barium. In this case, the correlation for strontium is 0.71 and for barium 0.64. The reason for this close similarity is that these elements all belong to the second main group of the periodic system of elements, where they appear in sequence as calcium, strontium and barium. This proximity also results in a strong geochemical similarity and correlation of these elements. At this point, a closer look at those elements that were introduced through tempering may be of some interest. Of these affinities iron has close correlations with cobalt (0.645), chromium (0.717), nickel (0.762), scandium (0.701) and vanadium (0.777). The correlations with manganese (0.426), copper (0.487) and zinc (0.472) are distinctly weaker. Potassium displays close correlations with rubidium (0.6), cerium (0.677), caesium (0.626), lanthanum (0.654), neodymium (0.608) and thorium (0.597). Its correlations with other rare earth elements are significantly weaker, though europium with a correlation of 0.213 constitutes an exception. As europium can occur in two different valences, separate sources for these rare earths are probable. If the above aspects are not taken into consideration, any multivariate statistical analysis of the samples is likely to mirror only the development of the tempering processes. Pottery, however,

[9] The definition of the wares is based on three factors: the thickness of the sherds, the sherd's surface and the amount/size of the tempering materials. From fine to coarse the sherds become thicker, the tempering increases in size and quantity, and finally the surface changes from polished to roughly smoothed. Because the recognition of a medium ware is difficult and not necessarily distinguishable, in future studies it is suggested to ignore this ware.

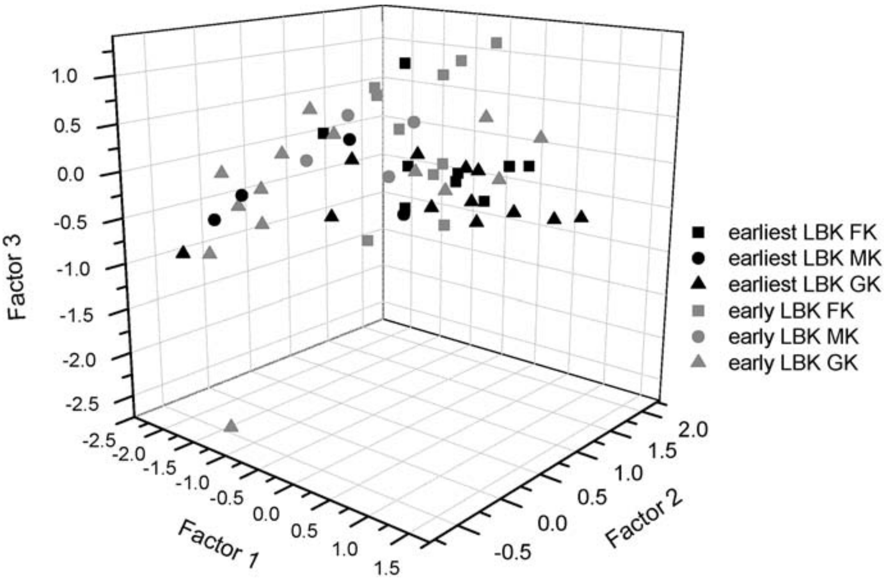

Fig. 12. An analysis of the main components with a reduced number of elements for the earliest and early LBK (FK: fine-ware, MK: medium-ware and GK: coarse pottery).

consists of both clay and tempering material. In order to assess the actual development taking-place during the use of clay types, it is necessary to filter the influence of tempering from our observations. To achieve this, as the next step of our study, an analysis of the main components excluding the above-named elements was carried.

During the earliest and the early LBK phases potassic tempering was not yet being used. Consequently the rare earths, such as rubidium, potassium and thorium can all be retained for this part of the study. An analysis of the main components exhibits only minor differences at this stage compared with the later phases (*fig. 12*). The diagram also displays some specific groupings (see *Mecking et al. 2012*). The variances in the earliest phase of the LBK are much stronger than those of the early LBK. The differences between the individual sherds are also significant. This may indicate that the selection or the processing of the clays was more varied. While the sherds of the early LBK overlap with those of the earliest LBK period, whereby the distribution of the measured values is generally closer in the former. This trend continues after the early LBK, in regard to both fine and coarse pottery. While sherds that display strong similarities to samples from the earliest and the early LBK can still be found, the number of fragments with marked differences is now on the increase (*fig. 13*). This development still persists in the late and the latest LBK. This can only mean that new clay deposits were accessed and new clay-processing methods were utilised that had not yet been developed during the early and the earliest LBK phases. With the transition to Stroke Ornamented ware, the composition changes once again, mainly as a result of the introduction of potassic tempering for coarse pottery. This change can be ascribed to the different clays or clay-mixtures that were employed for producing this type of pottery; however changes in the composition of contemporary fine-ware also occurred (*fig. 13a*).

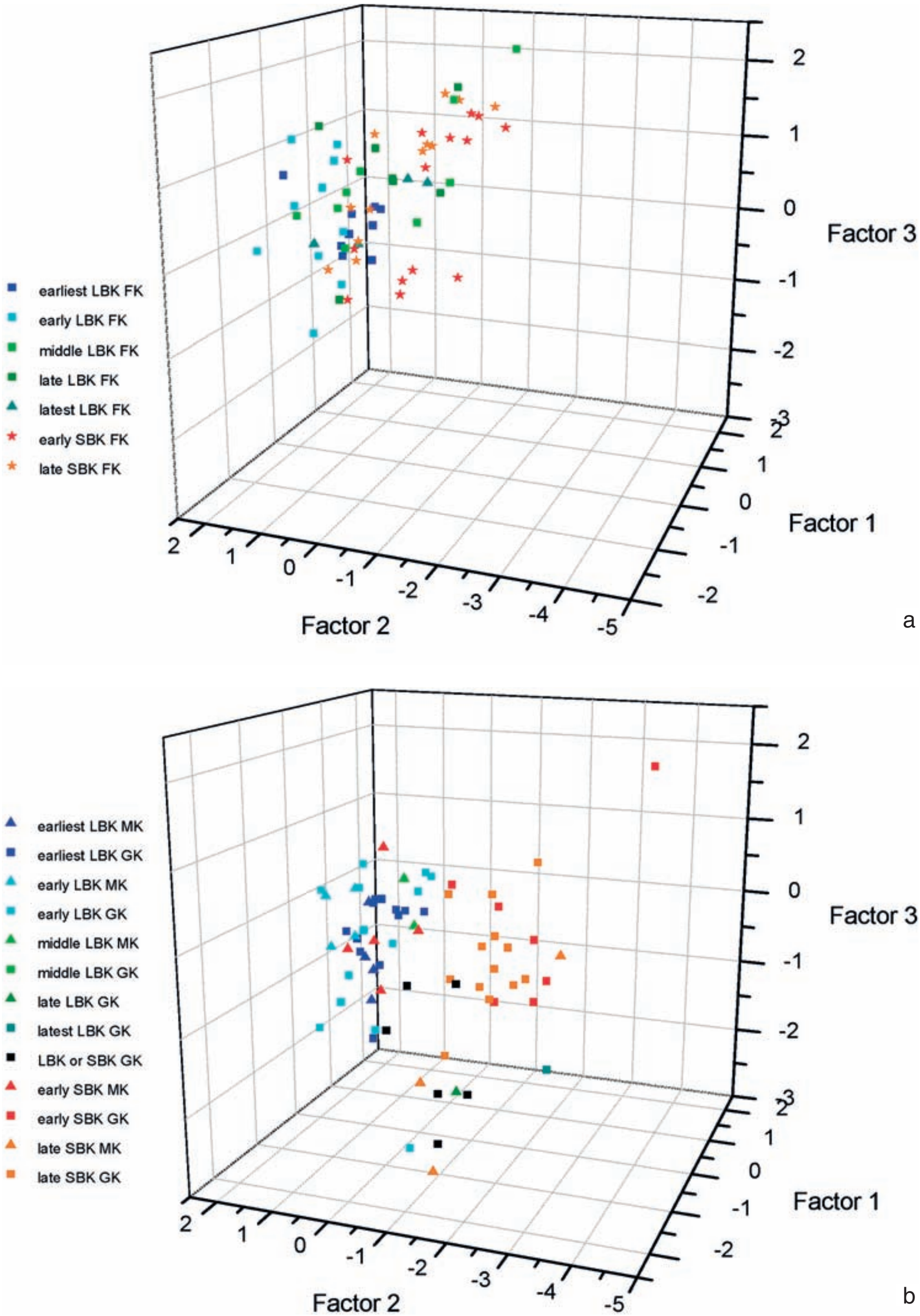

Fig. 13. An analysis of the main components with a reduced number of elements (FK: fine-ware, MK: medium-ware and GK: coarse pottery).

Most of the coarse pottery sherds from the SBK come from beakers, a vessel type that is characteristic of this late phase (for samples from Eythra see *fig. 5*). Potassic tempering may also occur occasionally in sherds of the middle and late LBK, perhaps introducing the early stages of the development of this new method.

Summary

The ceramic analyses of the sherds of the Bandkeramik from Eythra have basically confirmed our assumptions that the most significant changes in ceramic technology can be discerned between the earliest LBK and the fully developed LBK on the one hand, and between the LBK and the SBK on the other hand. But a more detailed scrutiny suggests that we should assume that as distinctive overlapping phenomena are still in evidence there is some sort of continuing development between the earliest and the early LBK with an actual break in ceramic production. Nevertheless, there are also clear indications of an increased standardisation in the composition of the early LBK clay, which contrasts with the greater variance in the earliest LBK period, which, in turn, may be attributed to the individual preference for a manner of production that is based on household units.

The nature of the database makes the interpretation of the "break" in ceramic production between the LBK and SBK difficult. From the point of view of ceramic chronology, the material is burdened by an imbalance between the individual stylistic phases of the LBK in Eythra. As only a handful of ceramic fragments display the traits of the latest LBK, the number of samples from this phase was barely sufficient (for examples see *fig. 5*). Nevertheless, the results are very interesting: on the one hand they show the conspicuous evolution in clay processing between the earliest and the fully developed LBK, and, on the other hand, a distinct change in the tempering methods during the course of the transition between the LBK and the SBK.

The irregular and angular shapes of the potassic feldspar particles in the SBK samples indicate the addition to the clay of an external material, demonstrating the practice of intentional tempering. An approach of this nature is difficult to ascertain for the LBK, with the exception of the vegetal tempering that is used in the earliest phase. In the late SBK intentional tempering only seems to become a standard procedure with the appearance of a new vessel shape. A large number of the potassic sherds belong to coarse-ware beakers, which frequently are beakers decorated with moulded ribbons (*fig. 5*). These vessels are a characteristic type of the late SBK (*Kaufmann 1976*, 20). Thus, the change in the tempering materials between the LBK and SBK can also be described in both a typological and a functional sense as representing the introduction of a specific new vessel shape and type of ware.

In contrast to this, in some cases the fine ware that the SBK continues to exhibit has pronounced similarities to that of the LBK. There are some indications that the evolution of clay composition actually occurred from the middle LBK into the late LBK. As indicated above, the change from LBK to SBK, which initially appeared to be a distinctive break in regard to the ceramic decoration, in some respects might now be defined as a gradual development. This assessment has been confirmed by the results of ceramic analyses: while a in the composition of the coarse pottery of the Stroke-ornamented ware a clear break is obvious, the fine-ware exhibits do not undergo such radical changes.

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From potters' hands to settlement dynamics in the Early Neolithic site of Cuiry-lès-Chaudardes (Picardy, France)

Od rukou hrnčířů po sídlištní dynamiku v časně neolitické lokalitě Cuiry-lès-Chaudardes (Pikardie, Francie)

Louise Gomart – Michael Ilett

The paper follows on from a joint research project on the ceramics from the late LBK settlement of Cuiry-lès-Chaudardes, Picardy region, north-eastern France. In the course of this project, studies on raw materials, manufacturing sequences and decoration techniques have revealed a wide variety of technical practices throughout the occupation of the site. Most recently, analysis of variations in raw materials and tempers in relation to manufacturing sequences revealed that production was mostly carried out at house level, with the producers in each house implementing their own clay recipe and pot-forming method. Here we extend this research by comparing data on pot-forming and decoration at Cuiry-lès-Chaudardes. In this new study, no obvious relationships could be observed between pottery manufacturing sequences and decoration. However, comparison of the various house assemblages indicates a possible link between atypical decoration (i.e. non-local LBK styles) and exogenous pot-forming methods. Although requiring validation on a larger sample of ceramic assemblages from other sites, these preliminary observations provide some new insights into the complex dynamics at play in LBK settlements.

LBK – ceramics – technology – manufacturing – decoration – socio-economic function – mobility

Článek vychází ze společného výzkumného projektu zaměřeného na keramický soubor ze sídliště LBK Cuiry-lès-Chaudardes (Pikardie, severovýchodní Francie). V rámci tohoto projektu byly studovány různé kroky výroby keramiky na úrovni domácnosti: komplexní průzkum surovin, výrobních postupů a výzdobných technik odhalil vysokou variabilitu technických praktik v průběhu osídlení lokality. Nedávno jsme analyzovali také rozdíly v použitých surovinách a ostřivech v závislosti na výrobních postupech. Tato první křížová analýza odhalila, že výroba se odehrávala převážně na úrovni domácnosti, tj. že hrnčíři v jednotlivých domech používali své vlastní složení keramického těsta a techniku stavby nádoby. Výzkum jsme rozšířili srovnáním postupů výroby keramiky s odchylkami ve výzdobě. Na základě syntézy výsledků různých studií, které naše výzkumná skupina uskutečnila dříve, předkládáme předběžnou analýzu propojující údaje o výzdobě a stavbě nádoby. Tento výzkum ukazuje možnou souvislost mezi atypickou výzdobou (např. exogenní nebo nestandardní LBK výzdoba) a způsoby tváření nádob, které byly označeny jako patrně exogenní. Tyto postřehy, které je teprve nutno statisticky ověřit na větším množství keramických souborů, poskytují nový vhled do složité sídelní dynamiky zemědělců LBK.

LBK – keramika – technologie – výroba – výzdoba – socio-ekonomická funkce – mobilita

1. Introduction

In this article, we compare variation in pottery decoration and pottery-manufacturing sequences at the Early Neolithic site of Cuiry-lès-Chaudardes (Picardy region, north-eastern France). Extensively excavated from the 1970s to the 1990s, the site contains thirty-three houseplans associated with lateral pits, and covers a surface area of just over 6 hectares.

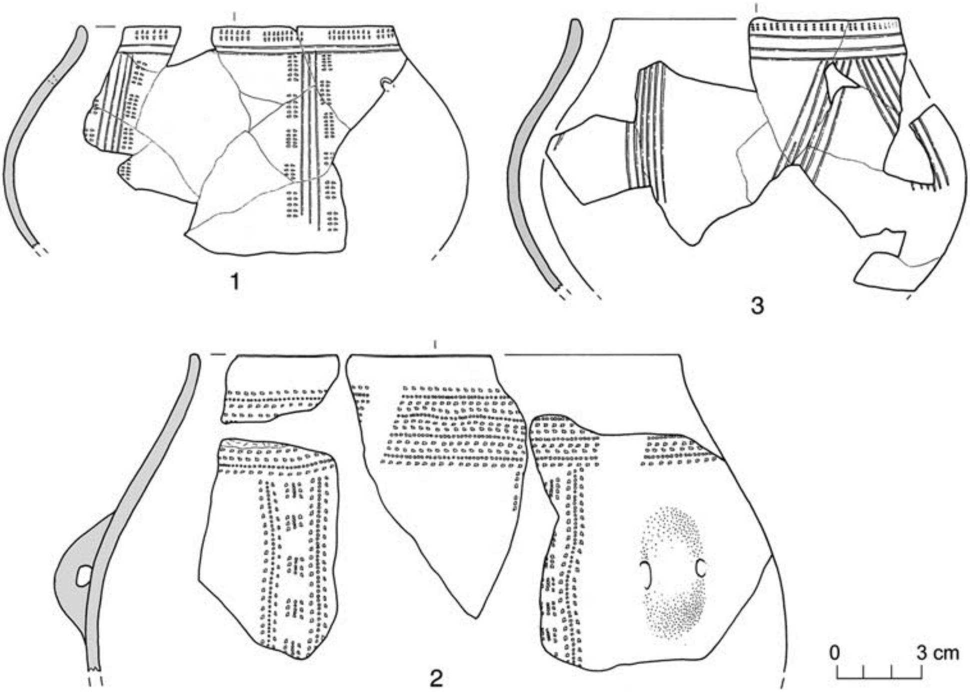

Fig. 1. Typical pottery decoration styles at Cuiry-lès-Chaudardes, showing examples of vertical and oblique themes. 1: pit 556, house 570; 2: pits 240, 241, house 225; 3: pit 378, house 380.

The pits produced large amounts of archaeological finds attributed to the late stage of the Linear Pottery culture (LBK), dated to around 5000 cal BC. Finds have been studied over many years by a research group working in synergy (*Allard 2005*; *Bakels 1995*; *1999*; *Bonnardin 2009*; *Chartier 1991*; *Constantin 1985*; *Coudart 1998*; *Dubouloz 2003*; *Gomart 2014*; *Gomart et al. 2015*; *Hachem 1996*; *2000*; *2011*; *Hachem – Hamon 2014*; *Ilett 1989*; *2012*; *Ilett et al. 1986*; *Ilett – Hachem 2001*; *Hamon 2006*; *Ilett – Constantin 2010*; *Sidéra 1989*; *2012*). As (i) no overlapping was observed between buildings and (ii) many ceramic refits have been found between the pits located along the same house, we assert that the lateral pits of each house form part of its domestic space (*Allard et al. 2013*; *Gomart et al. 2015*). Therefore, the archaeological remains from the lateral pits reflect at least some of the activities carried out within the house.

Based on this assumption, comprehensive studies of the large ceramic assemblage from the lateral pits bordering each house were carried out (50,000 sherds, from which 2090 vessels could be recognized). These studies focused on pottery morphology and decoration (*Ilett – Constantin 2010*), raw materials (*Constantin 1985*; *Ilett – Constantin 2010*) and manufacturing processes (*Gomart 2014*). The various analyses carried out separately during individual and collective research projects revealed a significant technical variety at different steps of the production process: two sources of clay materials, two types of temper, four main manufacturing sequences and, for the fine-ware, eight principal types of comb-impressed and incised decoration.

In order to gain a better understanding of the structure of pottery production, we recently implemented an integrated approach on ceramic paste recipes and manufacturing processes at the house level (*Gomart et al. 2017*). This cross analysis revealed a production mostly carried out at the domestic scale. It offered a complex picture of the interactions between production entities, shedding light on knowledge exchanges between groups of producers. The spatial and temporal variations of the forming processes relative to the distribution of the paste recipes showed that within the same apprenticeship network, producers maintain their habitual practices regarding vessel forming, but may change or adjust their paste recipes depending on the production site. While actions associated with pot-forming seem stable over time, the stages of paste preparation appear to vary depending on the interactions between producers.

Here we present a follow-up to this work, with the aim of investigating whether pot-building processes and decoration are related. These two steps of the production sequence are often disconnected from each other when studying an archaeological ceramic assemblage: decoration is traditionally examined in order to build relative chronologies, while pot-building processes are reconstructed in order to identify technical traditions and know-how. But what is the range of options regarding decoration within one technical tradition? Are some decorative techniques and/or motifs specific to a given technical tradition? In this paper, we summarize the main results of each analysis and then present the preliminary tests conducted in order to integrate pot-building and decoration, constituting a first attempt to address these questions.

2. Pottery decoration at Cuiry-lès-Chaudardes

Pottery decoration was systematically described and the main features of fine-ware decoration can be summarized as follows. Vessels are decorated with incised and impressed motifs. The impressions are made with narrow combs (mostly 1.5 to 8 mm in width), classified according to the number of teeth. These range from two to five, although most decoration is made with either two- or three-toothed combs. More rarely, a single-pointed instrument (termed here a point) is used to make impressed decoration. With the exception of the two-toothed combs, most comb impressions are applied with a pivoting movement. Combs are hardly ever used to make incised decoration. Typical rim and main decoration motifs consist of various combinations of incised lines and comb impressions. Decoration themes are mostly horizontal bands for rim decoration and either vertical or oblique bands for the main decoration on the body of the vessel (*fig. 1*). In fact, these vertical and oblique themes account for 94 % of the vessels on the site with an identifiable main decoration pattern. Furthermore, there is no major chronological variation in the relative frequency of these two themes. Motifs composing the oblique theme mostly consist of more or less parallel incised lines. Rather less frequently, this theme is made by single bands of comb impressions. Secondary or intermediate motifs can sometimes be identified on the vessels. Despite the apparent uniformity of decoration outlined above, there are very few truly identical vessels, since a wide range of different combinations are observed, both in the rim and main decoration. However, one noticeable feature is the fact that, on any given vessel with impressed decoration, the same instrument is used to make all the impressions, whether these form part of the rim, main or intermediate decoration.

Seriation of decorated ceramic assemblages from the lateral pits associated with individual houses was used to construct a relative chronology of the settlement occupation. Eight houses were not included in the seriation as the numbers of decorated vessels were too low. The most relevant factor for the periodization is quantitative change in decoration techniques, in particular the varieties of comb-impressed decoration (*Blouet et al. 2013a*; *Ilett 2012*; *Ilett – Constantin 2010*). Based on this evidence, the development of the settlement appears continuous but can be divided into three ceramic phases (Aisne 1, 2 and 3). Majority use of two-toothed combs characterizes the first phase. The second phase sees a rise in the frequency of three-toothed combs. In the last phase, combs with four or five teeth are more frequently used, although the three-toothed comb still dominates the assemblages. Also, some new decorative themes such as garlands appear in the last phase. As a working hypothesis, it will be considered here that each phase represents a group of contemporary or near-contemporary houses and that each phase lasted an estimated 25–50 years. The internal settlement chronology ties in both with the regional sequence (*Ilett – Plateaux 1995*; *Constantin – Ilett 1997*) and with the much longer ceramic chronologies now available for Lorraine and Alsace (*Blouet et al. 2013a*; *2013b*).

3. The pottery manufacturing sequences at Cuiry-lès-Chaudardes

Research on pottery manufacturing relies on behavioural studies showing a direct relationship between the sequence of technical gestures implemented during the construction of a vessel and its producer identity (*Dietler – Herbich 1994*). It has been shown that during learning, the producers acquire motor habits that they will embody and will have difficulties in modifying afterwards (*Roux 2010*). This cognitive mechanism, which involves systematically a tutor and an apprentice who are related socially, leads to the transmission from generation to generation of "ways of doing" within apprenticeship networks, whose perimeter outlines the spread of a given community of practice (*Gosselain 2002*; *Roux 2010*). As a result, the reconstruction of the ceramic manufacturing sequences in archaeological contexts enables the identification and differentiation of groups of producers and can act as a powerful indicator of the spatial and temporal trajectories of these groups (*Mayor 2011*).

The recognition of the building gestures used to make an archaeological vessel is based on material studies which showed that the type of pressure applied on the clay material during pot-forming directly affects the spatial organisation of the pores and the mineral inclusions contained in the clay (*Pierret et al. 1996*). In line with these observations, several experimental and ethno-historical studies showed that given technical gestures implemented during the production sequence resulted in specific micro- and macrotraces visible on the ceramics surfaces and cross-sections (e.g. *Gelbert 2003*; *Livingstone-Smith 2001*; *Rye 1981*; *Shepard 1956*). The interpretation of the technical traces visible on the vessels from Cuiry-lès-Chaudardes relied on these reference works. The ceramic assemblage was examined macroscopically with a focus on the spatial organisation of the porous system and the mineral inclusions in the radial and the equatorial planes, the discontinuities occurring in the tangential plane, as well as the fracture networks: 1767 vessels exhibited diagnostic macrotraces, among which 1145 could be associated with a manufacturing sequence.

The analysis revealed a diversity of pottery technical practices throughout the settlement occupation, independent of morpho-dimensional pottery types (*Gomart 2014*; *Gomart et al. 2017*): twelve forming methods could be identified, among which four prevail (*tab. 1*). The first prevailing method (CCF1) is defined by a roughing of the base using thin superimposed coils and a shaping by hand pressure against a concave support. The body, the neck and the rim are then roughed using thick elongated coils or slabs showing oblique alternate overlapping, and shaped with discontinuous finger pressure. The second method (CCF2) comprises vessels entirely built with thin superimposed coils, which were deformed slightly or not during their placement. The vessels associated with the third method (CCF7) have no base preserved. Their body is also built with thin non-deformed coils, but their rim was formed using a largely folded band of clay. The fourth prevailing method (CCF12) also includes pots without preserved bases. The vessels show macrotraces indicating that the body and the rim were formed by superposition of thin coils, and then shaped using the beating technique (for a detailed account of the technical traces associated with these four methods, see *Gomart 2014*).

As three of these four forming methods were identified in houses attributed to two or three successive chronological phases of the settlement (forming methods CCF1, CCF2, CCF7), we assume that they were transmitted from one generation to another in the village. The fourth forming method (CCF12) was identified on a substantial number of ceramics in two houses attributed to the third chronological phase. As a result, we proposed that ceramic production at Cuiry-lès-Chaudardes was handled by four learning networks, mirroring four distinct groups of producers. The other seven identified forming methods (CCF3, CCF4, CCF5, CCF6, CCF8, CCF9, CCF10, CCF11) cannot be attributed to local learning networks, as they may reflect (i) individual variability within the settlement; or (ii) imports of vessels from other LBK settlements located in the Aisne valley, where the available clay resources are particularly homogeneous (*Gomart et al. 2017*; *Ilett – Constantin 2010*).

In a single chronological phase, several houses can be defined by the same prevailing forming method (*tab. 1*). However, these houses do not necessarily use the same clay material nor the same temper (*Gomart et al. 2017*). This observation implies a manufacturing organization at the domestic scale, where the producer (or group of producers) inhabiting each house possess their own clay recipe associated with a specific sequence of technical gestures to build their vessels. Nevertheless, we did not exclude forms of cooperation between houses, as a part of the assemblage of some houses provided vessels manufactured with a clay recipe and a forming method prevailing in other contemporary houses (*Gomart et al. 2017*).

Accepting the hypothesis of production mostly implemented at the domestic scale, we then examined the distribution of the four forming methods at the house level, in order to understand the dynamics of the pottery production throughout the settlement occupation. This provided precious information on the processes operating within the settlement, involving in particular differences between the larger and the smaller houses (*Gomart et al. 2015*).

During the first chronological phase, a high uniformity of technical practices was identified both at settlement and house levels, suggesting the foundation of the village by a single group of migrants. Two to four pot-forming methods have been identified for each house (*tab. 1*). Method CCF1 clearly prevails in five houses out of six (Houses 45, 390, 640,

	House 45		House 90		House 126		House 390		House 640		House 112	
Forming method	N total	% total	N total	% total	N total	% total	N total	% total	N total	% total	N total	% total
CCF1	16	80.0%	13	37.1%	17	68.0%	18	90.0%	28	84.8%	10	71.4%
CCF2	2	10.0%	18	51.4%	6	24.0%	1	5.0%	3	9.1%	4	28.6%
CCF3	2	10.0%	–	–	–	–	1	5.0%	–	–	–	–
CCF4	–	–	2	5.7%	–	–	–	–	–	–	–	–
CCF5	–	–	2	5.7%	1	4.0%	–	–	–	–	–	–
CCF10	–	–	–	–	1	4.0%	–	–	2	6.1%	–	–
Total	20	100%	35	100%	25	100%	20	100%	33	100%	14	100%

	House 89		House 380		House 400		House 330		House 425		House 570		House 580		House 440	
Forming method	N total	% total	N total	% total	N total	% total	N total	% total	N total	% total	N total	% total	N total	% total	N total	% total
CCF1	2	6.7%	37	22.4%	27	75.0%	36	85.7%	11	24.4%	2	4.5%	6	26.1%	35	48.6%
CCF2	7	23.3%	36	21.8%	4	11.1%	3	7.1%	26	57.8%	28	63.6%	16	69.6%	26	36.1%
CCF3	–	–	2	1.2%	1	2.8%	1	2.4%	–	–	–	–	–	–	1	1.4%
CCF4	–	–	3	1.8%	–	–	–	–	–	–	–	–	1	4.3%	1	1.4%
CCF5	4	13.3%	21	12.7%	2	5.6%	–	–	1	2.2%	1	2.3%	–	–	–	–
CCF6	–	–	–	–	1	2.8%	–	–	1	2.2%	1	2.3%	–	–	–	–
CCF7	14	46.7%	44	26.7%	–	–	1	2.4%	5	11.1%	7	15.9%	–	–	–	–
CCF8	–	–	9	5.5%	–	–	–	–	–	–	–	–	–	–	–	–
CCF9	2	6.7%	2	1.2%	1	2.8%	–	–	–	–	–	–	–	–	6	8.3%
CCF10	–	–	11	6.7%	–	–	1	2.4%	1	2.2%	1	2.3%	–	–	3	4.2%
CCF11	–	–	–	–	–	–	–	–	–	–	1	2.3%	–	–	–	–
CCF12	1	3.3%	–	–	–	–	–	–	–	–	3	6.8%	–	–	–	–
Total	30	100%	165	100%	36	100%	42	100%	45	100%	44	100%	23	100%	72	100%

	House 225		House 245		House 280		House 360		House 530		House 420		House 690		House 500	House 520
Forming method	N total	% total	N total	% total	N total	% total	N total	% total	N total	% total	N total	% total	N total	% total	N total	% total
CCF1	19	28.4%	8	9.1%	4	9.1%	10	10.6%	5	12.5%	19	18.4%	6	25.0%	5	5
CCF2	31	46.3%	58	65.9%	29	65.9%	53	56.4%	29	72.5%	34	33.0%	7	29.2%	2	–
CCF3	2	3.0%	–	–	–	–	1	1.1%	1	2.5%	–	–	1	4.2%	–	–
CCF4	–	–	1	1.1%	–	–	6	6.4%	–	–	2	1.9%	1	4.2%	–	–
CCF5	7	10.4%	3	3.4%	1	2.3%	1	1.1%	2	5.0%	4	3.9%	1	4.2%	–	1
CCF6	–	–	1	1.1%	1	2.3%	1	1.1%	–	–	1	1.0%	–	–	–	–
CCF7	2	3.0%	9	10.2%	5	11.4%	11	11.7%	1	2.5%	14	13.6%	1	4.2%	–	–
CCF8	–	–	1	1.1%	–	–	2	2.1%	–	–	2	1.9%	1	4.2%	–	–
CCF9	1	1.5%	2	2.3%	1	2.3%	–	–	–	–	1	1.0%	–	–	–	–
CCF10	1	1.5%	–	–	–	–	5	5.3%	1	2.5%	4	3.9%	–	–	–	–
CCF11	3	4.5%	3	3.4%	–	–	1	1.1%	–	–	1	1.0%	–	–	–	–
CCF12	1	1.5%	2	2.3%	3	6.8%	3	3.2%	1	2.5%	21	20.4%	6	25.0%	–	–
Total	67	100%	88	100%	44	100%	94	100%	40	100%	103	100%	24	100%	7	6

Tab. 1. The forming methods identified for each house at Cuiry-lès-Chaudardes. The houses are grouped according to the three chronological phases (top: phase 1; middle: phase 2; bottom: phase 3).

112, 126). Method CCF2, which predominates in the assemblage from one small house (House 90), evokes the presence in the village of a producer (or a group of producers) from a different learning network, which might have arrived concomitantly or shortly after the group bearing Method CCF1.

During the second chronological phase, Method CCF1 still predominates in two houses out of seven (Houses 330, 400), which indicates a transmission of the technical practices from the first to the second phase. This suggests that the group which founded the settlement is still present in the second phase of the village's development. Moreover, Method CCF2 now dominates the assemblages from three out of seven houses (Houses 570, 580, 425), indicating an assimilation in the village of the group identified only in House 90 during the first chronological phase. Lastly, Method CCF7 appears in the settlement in significant proportions: it dominates the assemblage from a small house (House 89) located in the south-eastern part of the settlement. As the appearance of Method CCF7 is a relatively sudden phenomenon, we suggested that it reflects an arrival in the village of population from another LBK settlement (*Gomart 2014*). During this chronological phase, one can note a diversification of the technical practices both at settlement and house levels: the number of forming methods identified for each house varies from three to nine (*tab. 1*). This increase in the number of pot-forming methods in each house could indicate an intensification of exchange between households or with other nearby LBK villages.

The diversity that defines this second chronological phase is especially apparent in House 380, which is located in the core of the settlement and is the largest house in the phase. It produced a particularly large refuse assemblage, with the highest amounts of flint and bone tools on the site, as well as the largest quantity of aurochs bones (*Hachem 2011*). From the ceramic point of view, House 380 is unlike any other: it is the only one that combines the three pot-forming methods prevailing in the second chronological phase (CCF1, CCF2 and CCF7), in almost equivalent proportions (*tab. 1*). The other houses of this phase are all characterized by the predominance of one or two of these methods. This observation suggests that during the second chronological phase, House 380 may have benefited from occasional or regular inputs of pottery from the various contemporary houses. This hypothesis is reinforced by the observation made by *Hachem* (*2011*) on the aurochs bones associated with this house. She showed that aurochs bones are present in almost all the other houses of the phase, but always in very small amounts. This led her to suppose a redistribution of aurochs meat, probably consumed in a communal context, from House 380 to the other houses in the village. Ultimately, the size, the central position, the particularity of the refuse assemblage and the possible input of pottery from several houses enabled us to propose a communal function for this building (*Gomart 2014*; *Gomart et al. 2015*).

During the third chronological phase, technical practices become more uniform across the settlement. One can note a further increase of Method CCF2, which is now dominant in most houses of the settlement (Houses 225, 245, 280, 360, 530, four of which are large houses). This phenomenon evokes a further consolidation of the group using this method in the village, mostly in the larger houses. Meanwhile, the proportion of vessels manufactured with Methods CCF1 and CCF7 has largely decreased and they no longer predominate in any house, which may suggest that the bearers of these technical practices are no longer present in the village. However, a new method, Method CCF12, appears in large proportions in the assemblages from two smaller houses located in the northern part of the settlement (Houses 690 and 420). This new addition possibly implies a fresh arrival of population in the village. This method, defined by use of the beating technique, is rare in the Paris basin, Alsace and Belgium, but dominant in the Lorraine region. Its appearance during the last chronological phase may thus indicate that producers from this region moved into these houses (*Gomart 2014*). During this third phase, while a homogenisation of technical practices occurs at settlement level, an increase in the number of pot-forming methods is observed

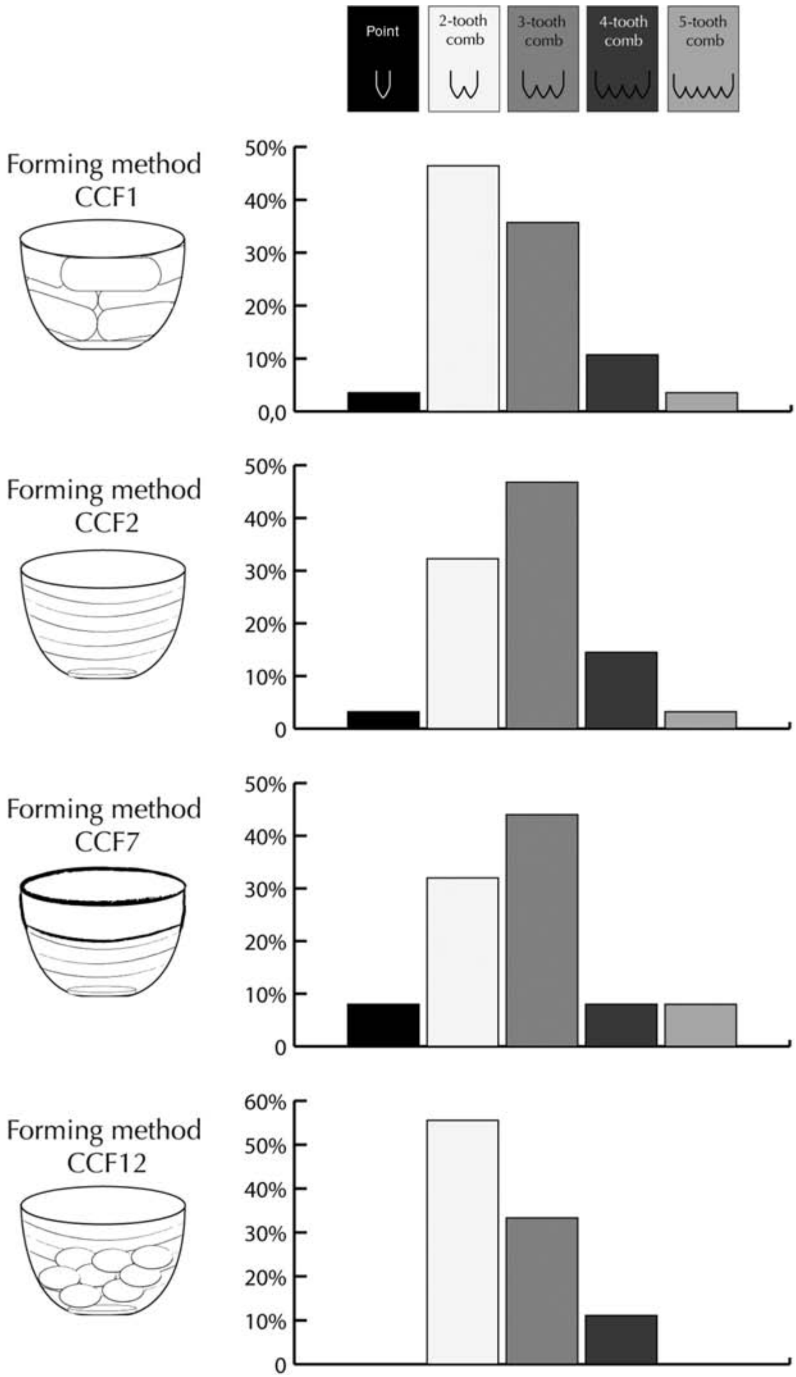

Fig. 2. Comparison between the four prevailing forming methods and the five different instruments used for impressed decoration (i.e. points and combs with two to five teeth) at Cuiry-lès-Chaudardes.

at house level: 8 to 11 are identified for each house (*tab. 1*). This suggests further intensification of exchange between households or with other nearby LBK villages towards the end of the settlement occupation.

Ultimately, the spatial distribution of the four prevailing forming methods for each chronological phase at Cuiry-lès-Chaudardes shows complex settlement dynamics and outlines differences between the larger and the smaller houses throughout the occupation (*Gomart et al. 2015*):

The larger houses (3 back units) are mostly dominated by one of the forming methods that prevail in the chronological phase (Method CCF1 during the first phase, Methods CCF1 and CCF2 during the second and third phases). Therefore, these houses are mostly characterized by homogeneity of pottery technical practices, except House 380 for which a specific communal function was proposed. Moreover, the larger houses attributed to the second and the third phases are systematically characterized by forming methods already identified in the previous chronological phase. These houses thus reflect a continuity (and consequently a transmission) of technical know-how over generations within the settlement (*Gomart et al. 2015*).

The smaller houses (1 or 2 back units) are often characterized by forming methods which are less represented in the various chronological phases (first phase: CCF2 defining only House 90; second phase: CCF7 defining only House 89; third phase: CCF12 defining only Houses 690 and 420). In these houses the pottery built with these less represented forming methods is often associated with vessels made with forming methods prevailing in the larger contemporary houses (*Gomart et al. 2017*). This observation leads us to suppose that the smaller houses received some pots from the larger houses. Besides, in three of these smaller houses attributed to the second phase (House 89) and third phase (Houses 690 and 420) we noted the emergence of a new forming method, which was absent in the previous chronological phase. We assert that these major changes in technical practices reflect arrivals of new populations in the village. While Method CCF7 cannot be directly connected to another site in the current state of analysis, Method CCF12 is dominant on LBK sites in the Moselle region.

House 380 in the second chronological phase is the only large house (3 back units) dominated by three distinct forming methods. The particularities of its refuse assemblage suggest that this building had a communal function.

4. Are forming techniques and decoration related?

4.1. Decoration techniques, instruments and motifs

The reconstruction of pot-forming methods at Cuiry-lès-Chaudardes reveals several learning networks implementing their production at house level. But do these different producer groups have the same standards and techniques when decorating their pots? To address this question, we conducted an analysis to compare pot-forming methods with decoration instruments (*tab. 2*), decoration techniques (*tab. 3*) and main decoration motifs (*tab. 4*). As the number of decorated vessels associated with a pot-forming method is particularly low for each house, we conducted the tests for each chronological phase. This first investigation

		Decoration instrument											
	Forming method	Point		2-tooth comb		3-tooth comb		4-tooth comb		5-tooth comb		Total	
		Nb	%	Nb	%	Nb	%	Nb	%	Nb	%	Nb	%
Aisne 1	CCF1	–	–	1	–	1	–	1	–	–	–	3	–
	CCF2	–	–	3	–	–	–	–	–	–	–	3	–
	CCF3	–	–	2	–	–	–	–	–	–	–	2	–
	CCF5	–	–	–	–	–	–	–	–	–	–	–	–
	Total Aisne 1	***–***	***–***	***6***	***–***	***1***	***–***	***1***	***–***	***–***	***–***	***8***	***–***
Aisne 2	CCF1	1	5.3%	7	36.8%	8	42.1%	2	10.5%	1	5.3%	19	100%
	CCF2	–	–	6	35.3%	9	52.9%	2	11.8%	–	–	17	100%
	CCF3	1	–	–	–	1	–	–	–	–	–	2	–
	CCF5	–	–	–	–	–	–	–	–	–	–	–	–
	CCF7	1	5.6%	8	44.4%	6	33.3%	1	5.6%	2	11.1%	18	100%
	CCF8	–	–	–	–	1	–	–	–	–	–	1	–
	CCF9	1	–	2	–	–	–	1	–	1	–	5	–
	CCF10	–	–	2	–	1	–	–	–	–	–	3	–
	CCF11	–	–	–	–	1	–	–	–	–	–	1	–
	CCF12	–	–	1	–		–	–	–	–	–	1	–
	Total Aisne 2	***4***	***6.0%***	***26***	***38.8%***	***27***	***40.3%***	***6***	***9.0%***	***4***	***6.0%***	***67***	***100%***
Aisne 3	CCF1	–	–	5	–	1	–	–	–	–	–	6	–
	CCF2	2	6.3%	10	31.3%	14	43.8%	6	18.8%	–	–	32	100%
	CCF3	–	–	1	–	–	–	–	–	–	–	1	–
	CCF4	–	–	–	–	1	–	–	–	–	–	1	–
	CCF5	–	–	–	–	1	–	1	–	1	–	3	–
	CCF6	–	–	1	–	–	–	1	–	–	–	2	–
	CCF7	1	–	–	–	2	–	–	–	–	–	3	–
	CCF9	–	–	1	–	–	–	–	–	–	–	1	–
	CCF10	–	–	1	–	–	–	–	–	–	–	1	–
	CCF11	–	–	–		–	–	–	–	–	–	–	–
	CCF12	–	–	2	–	-	-	1	-	-	-	3	-
	Total Aisne 3	***3***	***5.7%***	***21***	***39.6%***	***19***	***35.8%***	***9***	***17.0%***	***1***	***1.9%***	***53***	***100%***

Tab. 2. Relationship between pot-forming methods and decoration instruments (point, 2-tooth comb, 3-tooth comb, 4-tooth comb and 5-tooth comb) at Cuiry-lès-Chaudardes, for each of the three chronological phases. Percentages are not calculated for numbers under 20.

did not reveal a clear correlation between forming and decorating. Figure 2 shows an example of another analysis, in which we compared the four prevailing forming methods with the various instruments used for decorating (points and combs with two to five teeth) for the whole settlement occupation. The slight differences between the forming methods CCF1 and CCF2 regarding the use of two-toothed combs and three-toothed combs appear to be related to chronology. In fact, the first chronological phase is mostly characterized by use of two-toothed combs, but also by the forming method CCF1, which is dominant in five houses out of seven. Furthermore, the second chronological phase is mostly defined by use of three-toothed combs, but also by an increase of the forming method CCF2. Ultimately, we did not find any obvious connection between a given manufacturing sequence and a specific decoration instrument, technique or main motif. Overall, the tests performed suggested that the producers from the four learning networks identified at Cuiry-lès-Chaudardes share common ideas on the decoration of their vessels. This suggests that forming and decorating were associated with different mechanisms, as has already been outlined in many ethno-historical contexts (e.g. *Gelbert 2003*; *Gosselain 2002*).

		Decoration technique							
	Forming method	Pivoted impression		Separate impression		Comb incisions		Total	
		Nb	%	Nb	%	Nb	%	Nb	%
Aisne 1	CCF1	3	–	–	–	–	–	3	–
	CCF2	1	–	2	–	–	–	3	–
	CCF3	1	–	1	–	–	–	2	–
	CCF5	0	–	–	–	–	–	–	–
	Total Aisne 1	***5***	***–***	***3***	***–***	***–***	***–***	***8***	***–***
Aisne 2	CCF1	16	84.2%	3	15.8%	–	–	19	100%
	CCF2	15	88.2%	2	11.8%	–	–	17	100%
	CCF3	1	–	1	–	–	–	2	–
	CCF5	–	–	–	–	–	–	–	–
	CCF7	12	66.7%	6	33.3%	–	–	18	100%
	CCF8	1	–	–	–	–	–	1	–
	CCF9	2	–	3	–	–	–	5	–
	CCF10	2	–	1	–	–	–	3	–
	CCF11	1	–	–	–	–	–	1	–
	CCF12	–	–	1	–	–	–	1	–
	Total Aisne 2	***50***	***74.6%***	***17***	***25.4%***	***–***	***–***	***67***	***100%***
Aisne 3	CCF1	4	–	2	–	–	–	6	–
	CCF2	25	78.1%	5	15.6%	2	6.3%	32	100%
	CCF3	1	–	–	–	–	–	1	–
	CCF4	–	–	1	–	–	–	1	–
	CCF5	3	–	–	–	–	–	3	–
	CCF6	2	–	–	–	–	–	2	–
	CCF7	2	–	1	–	–	–	3	–
	CCF9	1	–	–	–	–	–	1	–
	CCF10	1	–	–	–	–	–	1	–
	CCF11		–	–	–	–	–	–	–
	CCF12	3	–	–	–	–	–	3	–
	Total Aisne 3	***42***	***79.2%***	***9***	***17.0%***	***2***	***3.8%***	***53***	***100%***

Tab. 3. Relationship between pot-forming methods and decoration techniques (pivoted impression, separate impression and comb incisions) at Cuiry-lès-Chaudardes, for each of the three chronological phases. Percentages are not calculated for numbers under 20.

4.2. Atypical decoration

The variation we observed between houses in pot-forming practices led us to extend our investigation to the decoration that appears to differ from the local decorative standards. Thus, as a second step, we tracked the vessels characterized by what can be termed *atypical* decoration and examined how they were spatially and chronologically distributed within the settlement. Atypical decoration is defined here as main decoration motifs and themes that are different from the predominant local styles but similar to decoration found in other LBK settlement regions (*fig. 3*). Six regions are relevant here, covering most of the Rhine basin and ranging from the Rhine-Meuse area in the north to upper Alsace in the south (*tab. 5*). Vessels with atypical main decoration represent around 8 % of the whole decorated fine-ware assemblage at Cuiry-lès-Chaudardes. Most of this exogenous decoration is comparable to styles typical of the Moselle region, notably Lorraine. A recent review of the evidence mentions eight types of main decoration that can be attributed to stylistic traditions from the Moselle (*Blouet et al. 2013b*). The most commonly represented theme is a chevron pattern consisting of comb-impressed bands, occasionally combined with an incised line (*fig. 3: 1, 2*;

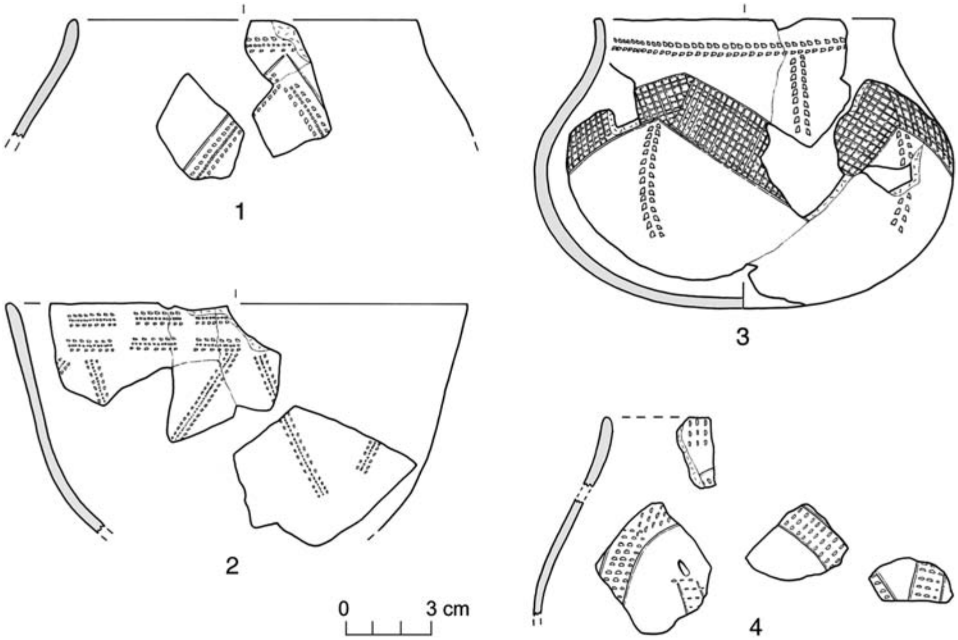

Fig. 3. Examples of atypical pottery decoration in Moselle style at Cuiry-lès-Chaudardes. 1: pit 233, house 225; 2: pit 556, house 570; 3: pit 295, house 280; 4: pit 358, house 360.

Blouet et al. 2013a, figs. 59 and 63). Rarer motifs include incised bands filled-in with either crossed incised lines (*fig. 3: 3*; *Blouet et al. 2013a*, figs. 56 and 58) or comb impressions (*fig 3: 4*; *Blouet et al. 2013a*, fig. 57).

It is important to note that at Cuiry-lès-Chaudardes, atypical decoration occurs on vessels made with local raw materials, suggesting they were produced in the settlement or in other nearby settlements in the Aisne valley with broadly similar clay resources. Therefore, this atypical decoration does not seem to involve vessels imported from the actual regions where the exogenous decoration styles are supposed to originate. It must be underlined that many of the vessels with atypical decoration are represented by small sherds that cannot be easily attributed to a pot-forming method. For this reason, the approach adopted here is to examine the distribution of atypical decoration in the various houses assigned to the three chronological phases and compare this evidence with the prevalent pot-forming methods in each of these houses (*tab. 5*).

This analysis enables us to make several observations:

– First, the area of origin of the atypical decoration varies through the occupation sequence of the settlement, with the exception of the 'Moselle' styles, present from beginning to end. 'Upper Alsace' decoration only occurs in the first phase. 'Rhine-Meuse' motifs are also attested from the beginning of the sequence, but continue into the second phase. 'Middle Rhine' decoration is present from the second chronological phase onwards. In the third phase, the 'Rhine-Meuse' motifs disappear, and 'lower Alsace' and the 'Main-Weser' motifs appear for the first time.

		Main decoration motif															
	Forming method	B		BLB		L		RB		LB		RL		T		Total	
		Nb	%	Nb	%	Nb	%	Nb	%	Nb	%	Nb	%	Nb	%	Nb	%
Aisne 1	CCF1	2	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–
	CCF2	2	–	1	–	1	–	–	–	–	–	–	–	–	–	4	–
	CCF3	1	–	–	–	1	–	–	–	–	–	–	–	–	–	2	–
	CCF5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0	–
	Total Aisne 1	*5*	*–*	*1*	*–*	*2*	*–*	*–*	*–*	*–*	*–*	*–*	*–*	*–*	*–*	*8*	*–*
Aisne 2	CCF1	8	80.0%	1	10.0%	1	10.0%	–	–	–	–	–	–	–	–	10	
	CCF2	8	80.0%	1	10.0%	1	10.0%	–	–	–	–	–	–	–	–	10	100%
	CCF3	2	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–
	CCF5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0	–
	CCF7	6	40.0%	6	40.0%	2	13.3%	–	–	–	–	1	6.7%	–	–	15	100%
	CCF8	1	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–
	CCF9	1	–	1	–	–	–	–	–	1	–	–	–	–	–	3	–
	CCF10	1	–	1	–	–	–	–	–	–	–	–	–	–	–	2	–
	CCF11	1	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–
	CCF12	–	–	–	–	1	–	–	–	–	–	–	–	–	–	1	–
	Total Aisne 2	*28*	*62.2%*	*10*	*22.2%*	*5*	*11.1%*	*–*	*–*	*1*	*2.2%*	*1*	*2.2%*	*–*	*–*	*45*	*100%*
Aisne 3	CCF1	2	–	1	–	1	–	–	–	–	–	–	–	1	–	5	–
	CCF2	13	56.5%	4	17.4%	4	17.4%	–	–	–	–	2	8.7%	–	–	23	100%
	CCF3	–	–	1	–	2	–	–	–	–	–	–	–	–	–	3	–
	CCF4	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1	–
	CCF5	1	–	1	–	1	–	–	–	–	–	–	–	–	–	3	–
	CCF6	–	–	–	–	1	–	–	–	–	–	1	–	–	–	2	–
	CCF7	1	–	–	–	–	–	–	–	–	–	1	–	–	–	2	–
	CCF9	–	–	–	–	2	–	–	–	–	–	–	–	–	–	2	–
	CCF10	1	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–
	CCF11	–	–	–	–	1	–	–	–	–	–	–	–	–	–	1	–
	CCF12	1	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–
	Total Aisne 3	*19*	*43.2%*	*7*	*15.9%*	*12*	*27.3%*	*1*	*2.3%*	*–*	*–*	*4*	*9.1%*	*1*	*2.3%*	*44*	*100%*

Tab. 4. Relationship between pot-forming methods and main motifs at Cuiry-lès-Chaudardes, for each of the three chronological phases. B: band(s) of impressions; BLB: incised line(s) bordered on both sides by band of impressions; L: incised lines; RB: incised band filled with impressions; LB: incised line(s) bordered on one side by band of impressions; RL: incised band filled with incised lines; T: incised triangle. Percentages are not calculated for numbers under 20.

– Second, atypical decorations tend to increase over time at the settlement. During the first chronological phase, 8 vessels show atypical decoration; during the second phase, 21 decorated vessels can be defined as atypical; during the third phase, 26 atypical decorated vessels were identified. This trend is less marked in terms of relative frequency (ratio atypical vessels/all decorated vessels), but the third phase still shows a slightly higher proportion of atypical vessels.

– Third, all the houses characterized by less common or exogenous forming methods comprise at least one atypical decoration, even during the first chronological phase, where atypical decoration occurs in only three houses out of six. This is also the case during the second and third phases, where there are larger numbers of vessels with atypical decoration, with House 89 (CCF7, phase 2) and with Houses 420 and 690 (CCF12, phase 3).

– Lastly, House 380, interpreted as a communal building, is associated with a higher number of atypically decorated vessels than other houses dated to the second chronological phase.

				Atypical decoration							
House n°	Phase n°	N rear bays	Prevailing pot-forming methods	upper Alsace	Rhine-Meuse	Moselle	middle Rhine	lower Alsace	Main-Weser	Total atypical (vessels)	Total decorated vessels
45	*1*	3	CCF1	1	1	2				4	21
90	*1*	1	CCF2/CCF1			2				2	22
112	*1*	1	CCF1/CCF2								9
126	*1*	1	CCF1/CCF2								18
390	*1*	1	CCF1								13
640	*1*	?	CCF1			2				2	19
11	*2*	3	ND			1				1	11
89	*2*	1	CCF7/CCF2				1			1	12
330	*2*	1	CCF1				1			1	29
380	*2*	3	CCF1/CCF2/CCF7		2	4	1			7	86
400	*2*	1	CCF1		1	1				2	19
410	*2*	1	ND								9
425	*2*	1	CCF1/CCF2		1					1	20
440	*2*	1	CCF1/CCF2		2	2				4	44
570	*2*	1	CCF2			3				3	29
580	*2*	1	CCF1/CCF2			1				1	22
225	*3*	3	CCF2			2	2	2	1	7	83
245	*3*	3	CCF2			1	1	1	1	4	42
280	*3*	2	CCF2			4				4	21
360	*3*	2	CCF2			5	2			7	58
420	*3*	2	CCF1/CCF2/CCF12			1				1	13
500	*3*	3	ND			1				1	9
530	*3*	2	CCF2			1				1	27
690	*3*	1	CCF1/CCF2/CCF12			1				1	16
Total	–	–	–	**1**	**7**	**34**	**8**	**3**	**2**	**55**	**652**

Tab. 5. Atypical main decoration (in numbers of vessels) for dated house assemblages at Cuiry-lès-Chaudardes, in relation to probable regions of stylistic influence. N rear bays: number of bays after the rear corridor, given as an indication of house size (after *Gomart et al. 2015*, fig. 3). ND: no data.

5. Discussion

At Cuiry-lès-Chaudardes, no obvious relationship can be observed between pottery manufacturing sequences and decoration. However, a qualitative analysis of the evidence both for decoration differing from local standards and for the prevalent pot-forming methods in each house shows some spatial and chronological trends, enabling us to formulate new working hypotheses.

An important point is the congruence, throughout the occupation sequence at Cuiry-lès-Chaudardes, between the appearance of new pot-forming methods, the increase in the number of pot-forming methods for each house and the increase in vessels with atypical decoration. We interpreted the appearance of new pot-forming methods as an indicator of successive arrivals of population in the settlement and the increasing number of pot-forming methods attested for houses as an intensification of exchange and contact between houses or with other LBK villages. The spatial and chronological distribution of atypical decoration tends to reinforce these hypotheses. In fact, it is tempting to assume that the incoming producers would not have suddenly abandoned their own decorative standards. Rather, we can suppose that they first implemented their own standards, and would then have gradually started using the local decorative norms. This hypothesis could not only explain the systematic occurrence of locally-made vessels showing atypical decoration in the smaller houses dominated by exogenous forming methods, but also the increasing number of atypically decorated vessels through the whole occupation sequence of the settlement. Following this transitional process, the newcomers would have fully adopted the local decorative standards, but would have kept their own manufacturing methods. This process could explain the occurrence in the same houses of vessels made with exogenous forming methods, but decorated in local style. Before offering any definitive interpretation, the relation between atypical decoration and specific technical know-how needs to be addressed through comprehensive statistical analyses on a larger sample of assemblages, integrating the ceramic evidence from all LBK sites in the Aisne region.

Tracking the exogenous decorations on a larger pottery sample may enable us to pursue these hypotheses further. The evidence outlined above for atypically decorated vessels at Cuiry-lès-Chaudardes suggests some chronological variation in the various regions of influence (lower Alsace, Rhine-Meuse etc.). Further work is required here, and it remains to be seen whether this is a specific feature related to this site or whether this is a general trend affecting all the Aisne valley settlements. This investigation, associated with the comprehensive reconstruction of pot-forming methods, could enable us to trace the trajectories of specific producer groups and to draw the perimeter of interaction networks within the LBK sphere with an unprecedented resolution.

This investigation at Cuiry-lès-Chaudardes also raises the question of the status of the locally-made vessels with atypical decoration, and in turn of their producers. As we have seen, House 380, interpreted as a place for communal gatherings that probably involved consumption of aurochs, comprises the highest number of atypically decorated vessels for the second chronological phase. Future studies will now be orientated towards a thorough examination of the specificities of houses that seem more closely associated with atypical decoration.

6. Conclusion

Throughout its occupation, the settlement of Cuiry-lès-Chaudardes comprises two groups of houses, which may reflect two types of socio-economic functioning (*Gomart et al. 2015*). With the larger houses, the conservatism of ceramic forming processes suggests a transmission of technical know-how over the long term in the settlement. With the smaller houses, substantially different behaviour can be assumed: the emergence of new ceramic forming methods, which were absent in previous chronological phases, could indicate incoming people from other LBK settlements or other LBK settlement areas. In this study, we have confronted this evidence with the data on pottery decoration. While decoration techniques, instruments and motifs did not show a direct relationship with manufacturing processes, the examination of locally-made vessels with atypical decoration enabled us to formulate new hypotheses. The preliminary results we obtained on atypical decoration tend to reinforce and refine the image of a community in constant interaction within the village, but also widely connected to other regions. At Cuiry-lès-Chaudardes, there could well be a relationship between the occurrence of exogenous forming methods in the second and third chronological phases and higher numbers of atypical decorations. These observations remain anecdotal as they currently rely on a limited body of data. However, bearing in mind that producers from other LBK villages or other LBK settlement regions may have moved in to Cuiry-lès-Chaudardes throughout the occupation of the settlement, these observations raise the question of the newcomers' behaviour concerning local decoration standards. Overall, this first test, that has yet to be statistically confirmed, raises the crucial question of the assimilation of individuals in the LBK village communities and provides food for thought about the social dynamics involved in Early Neolithic mobility.

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Early Neolithic potters of the Italian Middle Adriatic region

Časně neolitičtí hrnčíři v oblasti italského středního Jadranu

Chiara La Marca – Giacomo Eramo – Italo Maria Muntoni – Cecilia Conati Barbaro

This paper presents the preliminary results of the study of the Early Neolithic pottery production in the Marche region, Italy (VI mill. BC). The main goal of this research is to expand the knowledge of pottery manufacturing processes associated to the typical Central Adriatic Impressed Ware, at present poorly understood. All sites under analysis are located in the piedmont hills of the Apennine Mountains, except one which is on the coast. This study aims to highlight synchronic and diachronic variability in pottery technology, to identify common traits and to investigate the raw materials selection and exploitation strategies. The pottery assemblages are examined by means of an integrated approach which include techno-typological and archaeometric analyses. The environmental factors, the distribution of resources, the technology solutions taken by these early Neolithic communities are considered.

Early Neolithic – Italy – Impressed Ware culture – ceramic analysis – archaeometry – thin section petrography

Článek předkládá předběžné výsledky studia časně neolitické výroby keramiky v oblasti Marche, Itálie (6. tisíciletí př. Kr.). Hlavním cílem tohoto výzkumu bylo rozšířit dosud sporé znalosti o keramických výrobních postupech spojených s typickou středojadranskou keramikou impresso. Všechny zkoumané lokality se nacházejí v předhůří Apenin, kromě jedné, která leží na pobřeží. Cílem studia je upozornit na synchronní a diachronní variabilitu keramické technologie, určit společné prvky a zkoumat výběr surovin a těžební strategie. Keramické soubory byly zkoumány jednotným postupem zahrnujícím techno-typologické a archeometrické analýzy. V potaz byly brány i přírodní prostředí, rozmístění zdrojů a technologická řešení, která sledované časně neolitické komunity volily.

časný neolit – Itálie – kultura s impresso keramikou – keramická analýza – archeometrie – petrografie výbrusů

Introduction

This paper presents the preliminary results of an analytical study conducted on the first pottery of Italian Middle Adriatic region, in particular from the territory of Marche (*fig. 1*). The study is based on an integrated approach applied to the reconstruction of pottery manufacturing processes, showing how variability in time and space can be used to understand Early Neolithic societies, which are almost unknown for this period in the area.

The Neolithisation process in Italy is dated to 6100 BC cal. approximately (*Tiné 2002*; *Forenbaher – Miracle 2005*; *Pessina – Tiné 2008*): impressed pottery first appears in Apulia as part of the "Neolithic package"; 400 years later the first agriculture reaches the Middle Adriatic region (Abruzzo, Marche, Emilia Romagna). This area is characterized by a peculiar style, which was defined as Middle Adriatic Impressed Ware culture by *Antonio*

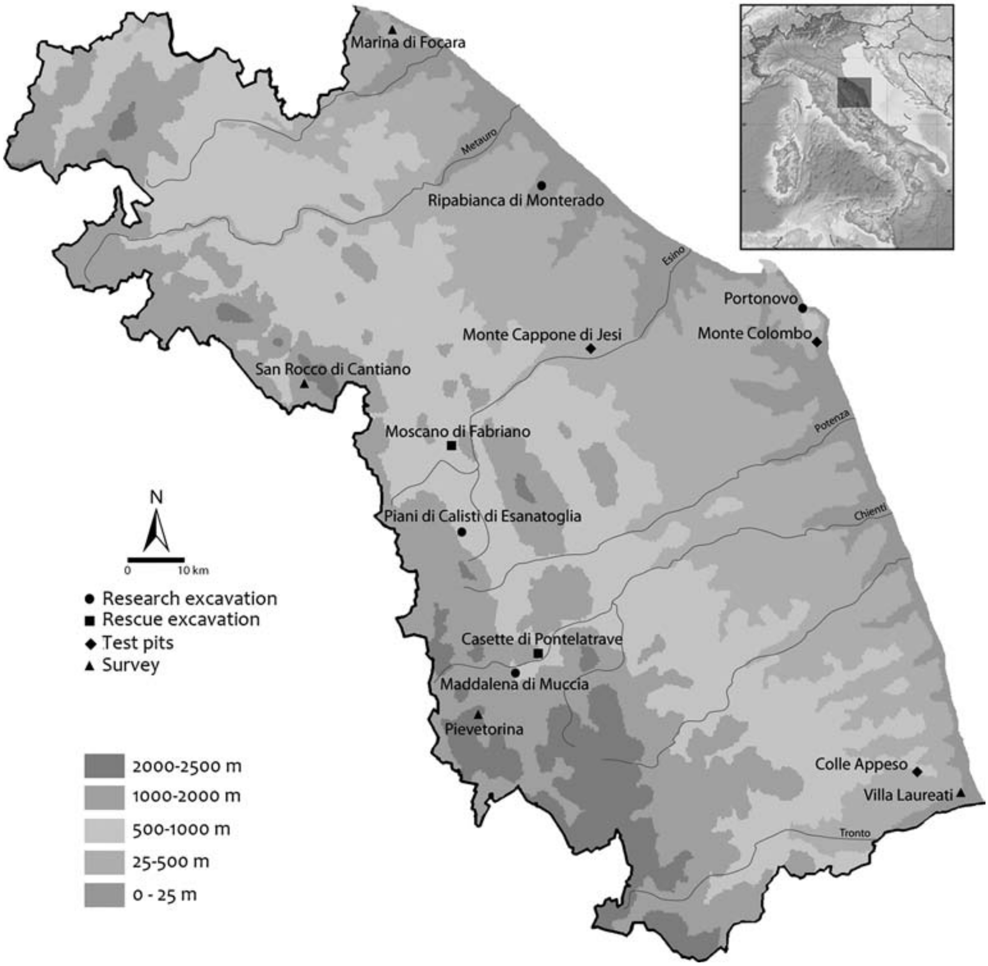


Fig. 1. Early Neolithic sites of the Marche region distinguished by method of investigation.

Radmilli (*1974*). It refers to the first appearance of productive economy along the central and north Italian Adriatic coast: the initial phase, dated to the first half of the 6^{th} mill. BC, is characterized by pottery with standardized and slightly monotonous decoration: finger, finger-nail or instrumental impressions and patterns realized by bands of incised lines. Within the last centuries of the 6^{th} mill BC, this cultural homogeneity come to an end and local production reflects general links with the north Italian Po Valley, Abruzzo (Catignano culture) and the Tyrrhenian area (Linear Pottery culture; *Pessina 2002*).

As regards the Marche region the Neolithisation process is still poorly understood. An overview on the arrival of the first farmers has been outlined in the 1960s by *Delia Lollini* (*1965*), who conducted excavations in the entire area as archaeologist of the Superintendence for the Archaeological Heritage of Marche. However, only few sites were extensively excavated, while others were explored through test pits or surface collections

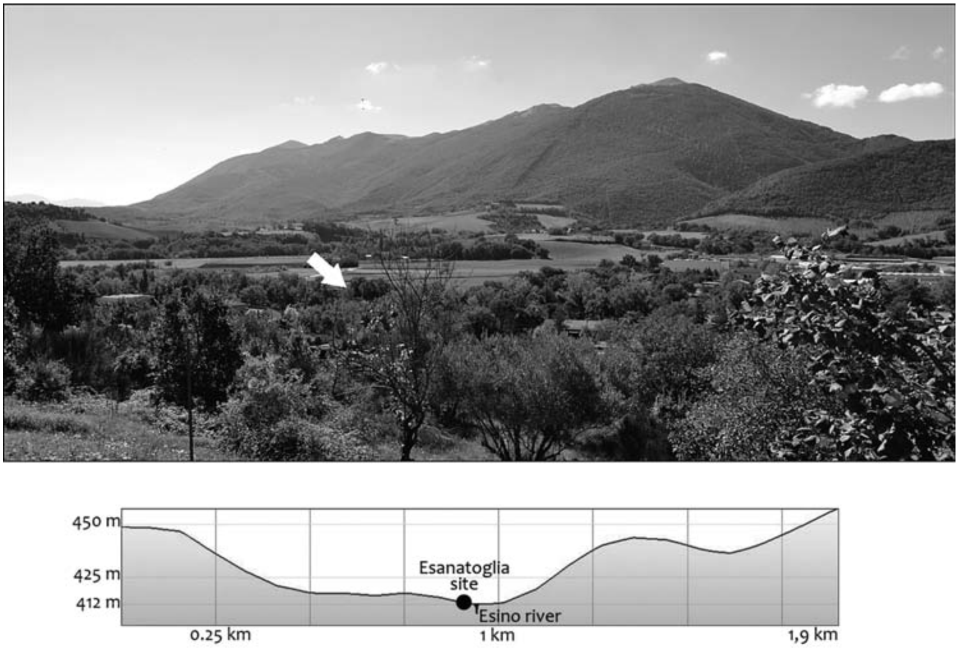


Fig. 2. Esanatoglia-Piani di Calisti. Panoramic view of the area of the site and elevation profile of the valley (NE-SW direction).

(*Conati Barbaro et al. 2014*). Later on, Maddalena di Muccia (*De Marinis et al. 2003*; *Conati Barbaro et al. 2005*; *Manfredini 2014*), Ripabianca di Monterado (*Rosini et al. 2005*; *Rosini – Silvestrini 2006*) and Portonovo Fosso Fontanaccia (*Conati Barbaro 2013*; *Conati Barbaro et al. 2013*; *2015*) were investigated by extensive excavation. Some of them are considered key sites for the study of the Neolithisation process in central Italy.

However, there are no systematic studies on early ceramics from these territories, with the exception of Ripabianca di Monterado site, partially published (*Rosini et al. 2005*; *Rosini – Silvestrini 2006*). The available archaeometric data are based on 18 samples from an Early Neolithic pit (US 114, *Muntoni 2005*; *Laviano – Muntoni 2007*) and 27 samples from the Lollini area (*Spataro 2002*, 142) of the village of Maddalena di Muccia. Furthermore, 30 fragments from Ripabianca di Monterado were also analyzed (*Spataro 2002*, 151; *2009*).

The purpose of this project is to investigate an entire geographical area, starting from a systematic study of pottery production in order to reconstruct the production processes. For this purpose, the pottery production of four sites has been analyzed: Maddalena di Muccia, Esanatoglia-Piani di Calisti (*fig. 2*), Moscano di Fabriano, all placed in the inland valleys of the region, and Portonovo-Fosso Fontanaccia, located along the Adriatic coast (*fig. 3*).

For the first time the Central Adriatic Impressed Ware pottery from Marche region is examined by means of an integrated approach which include techno-typological and archaeometric study.

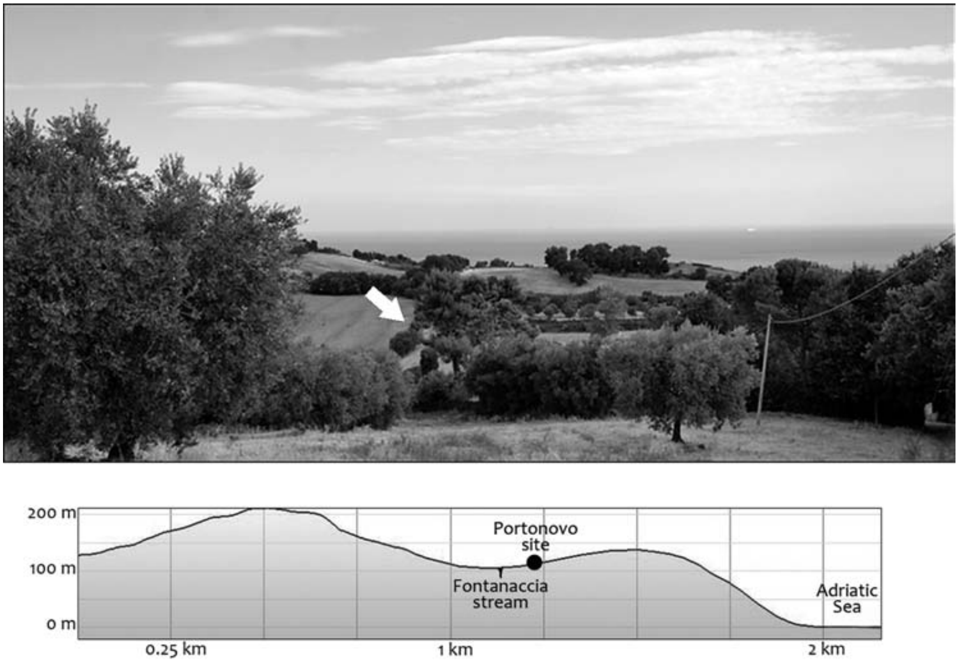


Fig. 3. Portonovo-Fosso Fontanaccia. Panoramic view of the area of the site and elevation profile of the valley (NE-SW direction).

Geographical and geological overview

During the Early Neolithic in the Marche region, the higher density of sites is recorded in piedmont hills of the Apennine Mountains. Settlements are located along the main rivers, which cross the region in a west-east direction (*fig. 1*). As a matter of fact the inland river valleys play an important role as preferential ways between the Apennines and the coast still today: inland sites were located along natural transit routes of the Apennines, which connect the Adriatic coast with the Tyrrhenian area. These sites are Maddalena di Muccia, Esanatoglia-Piani di Calisti and Moscano di Fabriano. Other sites are known from surface collections, as San Rocco di Cantiano and Pievetorina (*Conati Barbaro et al. 2014*).

The bedrock of inland territories is characterized by limestone and marly limestone formations, with outcrops of sandstone and pelitic-sandstone on the hills. The sites in this area are generally located on Pleistocene terraced alluvial deposits, which mainly consist of gravelly fluvial sediments (*Cilla – Dramis 2005*; *Deiana 2009*). In some cases, clayey red-soils rich in iron oxihydroides are present on the top of these deposits, as a result of flood alterations (Esanatoglia *Ferretto* soil; Cilla, personal comm.).

Very few sites lie close to the Adriatic coast. Portonovo is located at almost 600 m from the sea, while Ripabianca di Monterado is about 10 km far from the sea (*Rosini et al. 2005*). Other sites are known thanks to surface collections, such as Marina di Focara, Monte Colombo, Villa Laureati, or test pits, as Colle Appeso (*Conati Barbaro et al. 2014*).

Site	Lab.	BP	Cal 1σ BC	Cal 2σ BC	Sample
Esanatoglia, US 52	LTL15327A	6225±45	5300-5070	5310-5050	charcoal (*Alnus*)
Esanatoglia, US 1 tg. I	LTL15328A	6311±45	5330-5220	5470-5200	charcoal (*Quercus* sp. evergreen type)
Moscano, US 3 tg. VII	LTL15329A	6397±45	5470-5320	5480-5310	charcoal (*Fraxinus* sp.)
Moscano, US 3 tg. III-V	LTL15330A	6263±45	5310-5210	5330-5060	charcoal (*Buxus sempervirens*)

Tab. 1. New radiometric dates from the sites of Esanatoglia and Moscano.

The coastal area of the region is characterized by significant sandstone and pelitic-sandstone deposits moulded in low hills (*Cilla – Dramis 2005*; *Sarti – Coltorti eds. 2011*). In particular, the archaeological structures at Portonovo are excavated in a marl deposit (*fig. 9: 1*) on the northern part of the site and in an eluvial-colluvial deposit in the southern area (*fig. 9: 3*).

Chronology

According to radiometric dating and to the archaeological material, the Early Neolithic of the region can be divided in two chronological phases.

The Maddalena di Muccia (*Manfredini et al. 2005b*; *Alessio et al. 1970*, 603) and Portonovo (*Conati Barbaro 2013*, 48; *Conati Barbaro – Celant in press*) sites are dated to the first phase (first half/half of 6th mill. BC).

Esanatoglia and Moscano belong to the second phase according to typological observations on pottery material and to similarities with ceramics of Ripabianca di Monterado. The latter is dated in absolute chronology at the second half/end of 6th mill. BC (*Alessio et al. 1970*, 602–603).

Four new radiocarbon dates were obtained for Esanatoglia and Moscano, which confirm the typological observations (*tab. 1*). Short-life wood samples were selected among anthracological remains.[1] They were analyzed at the CEDAD of the University of Salento, by AMS technology.

Archaeological contexts

The site of Muccia was first excavated by Delia Lollini in 1960 and 1965. She found a series of irregular underground structures, which were traditionally interpreted as pit huts (*Lollini 1965*, 309–310; *Lollini ed. 1991*, 52–57). In the 2000s, new excavations undertaken by the Sapienza University revealed a large Copper Age village (*Manfredini et al. 2005a*; *Manfredini 2014*). After reviewing the documentation of Lollini's excavations it is possible to assume that not all the archaeological findings could be referred to the Early Neolithic:

1 *Taxa* were identified by prof. Alessandra Celant, Sapienza University.

materials related to more advanced stages of the Neolithic (Diana and late Ripoli pottery) and to the late Copper Age have also been recognized (*La Marca 2016*, 122).

The underground structures dated to the first occupation of the site fall in a Neolithic tradition not only typical of the Marche region, but common to the entire peninsula. These are often the unique preserved evidence, especially in floodplain sites, where erosion and exploitation of soils have a greater impact. As regards the site of Muccia it seems possible to assume a function as storing pits at least for some cavities. In one case a reuse of a cavity for funerary purposes was documented, but mostly it is easier to identify their secondary function as midden pits (*La Marca 2016*, 123).

The site of Portonovo is located on a south-facing slope, along the Fontanaccia stream, on the Conero promontory, near the Adriatic coast (*fig. 3*). After its identification in 1990s the site was excavated by the Superintendence of Marche and later by the Sapienza University of Rome. Dozens of domed ovens were found. These were originally excavated in the ground, and share standard shapes and dimensions. The ovens have circular base and, in some cases, the vault is preserved. The inner chamber has a clay lining, smooth on the base, and they are 1.80 up to 2 m large. The ovens follow different alignment along the slope and the excavation of wide, shallow and irregular pits in front of them probably allowed the construction of the structures and the access for their use (*Conati Barbaro 2013*, 32–40).

The temperatures inside the ovens did not exceed 500 °C, estimated using X-ray powder diffraction analysis (PXRD) on hardened sediments, sampled as a compact block of deposit from the structures (*Muntoni – Ruggiero 2013*). These temperatures seem suitable for several uses, such as cooking and food processing, for example baking or roasting grains. No evidence of housing or domestic structures were identified during research, so it is possible to describe Portonovo as a production area.

The Esanatoglia and Moscano sites returned limited evidence and should be assigned to phase 2 of the Early Neolithic of Marche. The Esanatoglia site (*fig. 2*) was excavated in 2004 and 2006 by the Sapienza University (*Silvestrini 2006*; *2007*). The settlement has been heavily eroded by the Esino river. The gravel bank revealed a marked difference in height, forming a short slope with E-W orientation, probably related to the edge of a palaeochannel. The structures were originally excavated in a dark silty palaeosol and in the gravel bank of the alluvial terrace. Some pits were identified, filled with well preserved ceramics, mixed with lithic and faunal remains. A few postholes were also identified, some of which were aligned. The presence of wooden structures, even if it was not possible to recognize specific alignments, and the good preservation of findings allows us to assume a stable occupation of the terrace by the first Neolithic groups.

The Moscano site was unearthed in 2007 by the Superintendence of Marche, during preventive excavation on the new railway line Orte-Falconara. One area returned evidence of an Early Neolithic occupation: a thick, dark grey, sandy clay layer, filled with numerous findings (ceramic, lithic and faunal remains) and an underlying structure, probably related to a fire area. It consists in a circular pit with a reddish friable fill, its outer perimeter was delimited by a band of black carbonaceous layer. Inside, there were large portions of vessels, which were fully or partially reconstructed for this research.

Techno-typological analysis

Macro analysis of pottery assemblages focused on qualitative and quantitative analysis, remarking on morphological, typological and technological characteristics. For the decorative techniques a documentation system was developed, focused on the reconstruction of the gesture and the used tool. The study was based on a total of 17,640 potsherds.

Pottery production is characterized by predominance of coarse pastes (Muccia 43 %; Moscano 70 %; Esanatoglia 80 %), with the exception of Portonovo site (26 %), where the wide variety of fine pastes is probably related to the local availability and selection of resources. At the macroscopic scale it was easy to distinguish different kind of inclusions, such as calcareous, chert or vitreous elements, and to make a division into several sub-groups. Fine (Portonovo 47 %; Muccia 18 %; Moscano 18 %; Esanatoglia 5 %) and semi-fine pastes (Portonovo 27 %; Muccia 39 %; Moscano 12 %; Esanatoglia 15 %) are characterized by a more compact and homogeneous texture, with rare or less visible inclusions. All the classes often show pores or zoned sections due to the presence of organic matter in the paste. Few sherds are associated to a very fine paste, characterized by very homogeneous and powdery texture, floury surfaces, colour from yellow to pinkish yellow. They can be attributed to the *figulina* ware, a particular type of pottery widespread along the Adriatic coastlines during Neolithic (*Spataro 2009*).

A high variability of decorating techniques has been observed. Production related to phase 1 sites (Muccia, Portonovo) is characterized by a strong variability of the techniques used and in the decorative patterns created (*fig. 4*). This great changeability tends to disappear during the second chronological phase (*fig. 5*). The decorative motifs found can be divided according to the techniques used:

– impression technique, pressing with a tool on the surface of the vessel while still plastic (*fig. 4: 2–5, 10–12*; *fig. 5: 1, 8*);
– incision technique, pushing and then dragging the tool on the surface of the vessel while still plastic (*fig. 4: 2–3, 8*; *fig. 5: 9*);
– plastic decoration, realized with additions of parts modelled separately and then applied to the surface of the vessel (*fig. 5: 2–3, 6–8*).

The "tool" most commonly used is the hand of the potter: decorative patterns are realized using finger (*fig. 4: 10, 12*), nails (*fig. 5: 1, 8*) or pinching the surface (*fig. 4: 2, 5*); other motifs are realized with the help of tools with a round, elliptical or triangular section (points, dots, small circles; *fig. 4: 4, 11*), probably made of wood, bone or flint, as suggested for other Italian contexts by experimental tests (*Natali 2009*, 236). More common incised decoration consists of bands distributed on the surface of the vessel, according to more (*fig. 4: 3*) or less ordered patterns (*fig. 4: 8*; *fig. 5: 9*).

In phase 1, ceramic shapes show a certain homogeneity in terms of typology, with predominance of tronco-conical and ovoid shapes of medium and large dimensions in coarse pastes (*fig. 4: 2, 5, 10*), necked vases in semi-fine paste (*fig. 4: 7*), with traces of special treatment of the inner surfaces. The handles are rare (*fig. 4: 6*). The incidence of impression technique varies from 21 % (Portonovo) to 61 % (Muccia); incision technique from 5 % (Portonovo) to 12 % (Muccia). Plastic decoration is between 1.5 % (Portonovo) and 3.5 % (Muccia).

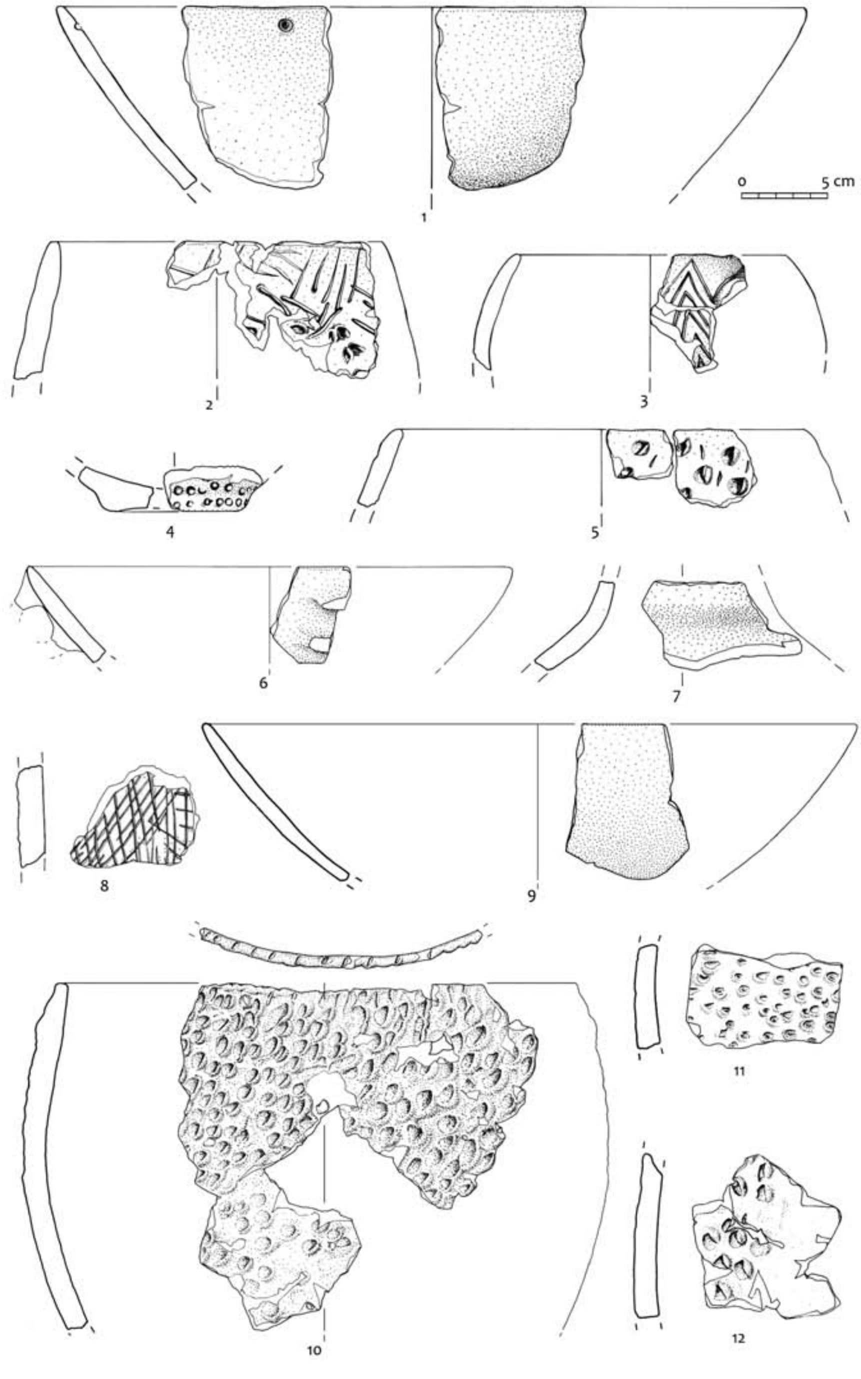


Fig. 4. Early Neolithic of Marche, phase 1 pottery. 1–5 Maddalena di Muccia. 6–12 Portonovo-Fosso Fontanaccia. Drawings by C. La Marca (1–8) and G. Carboni (9–12).

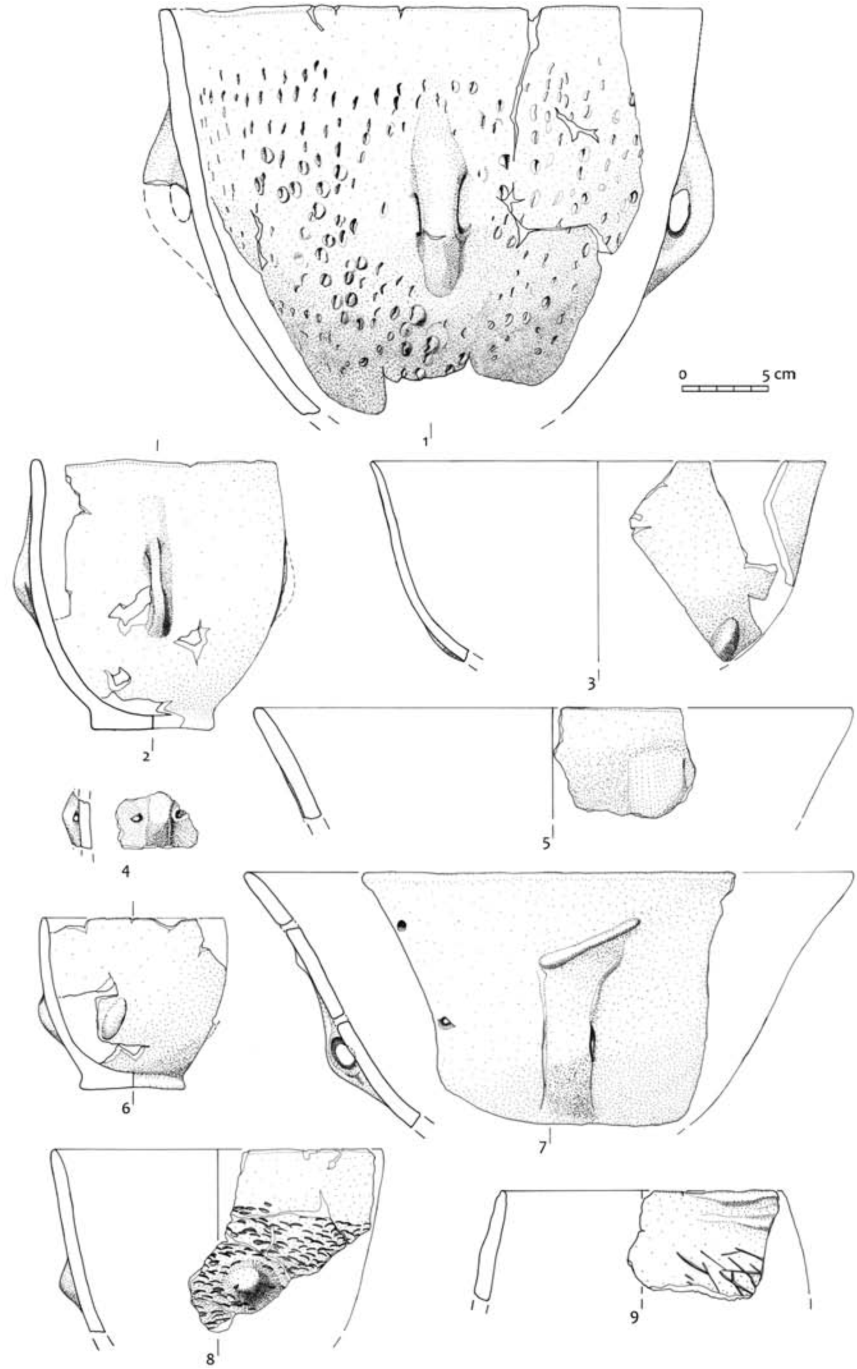
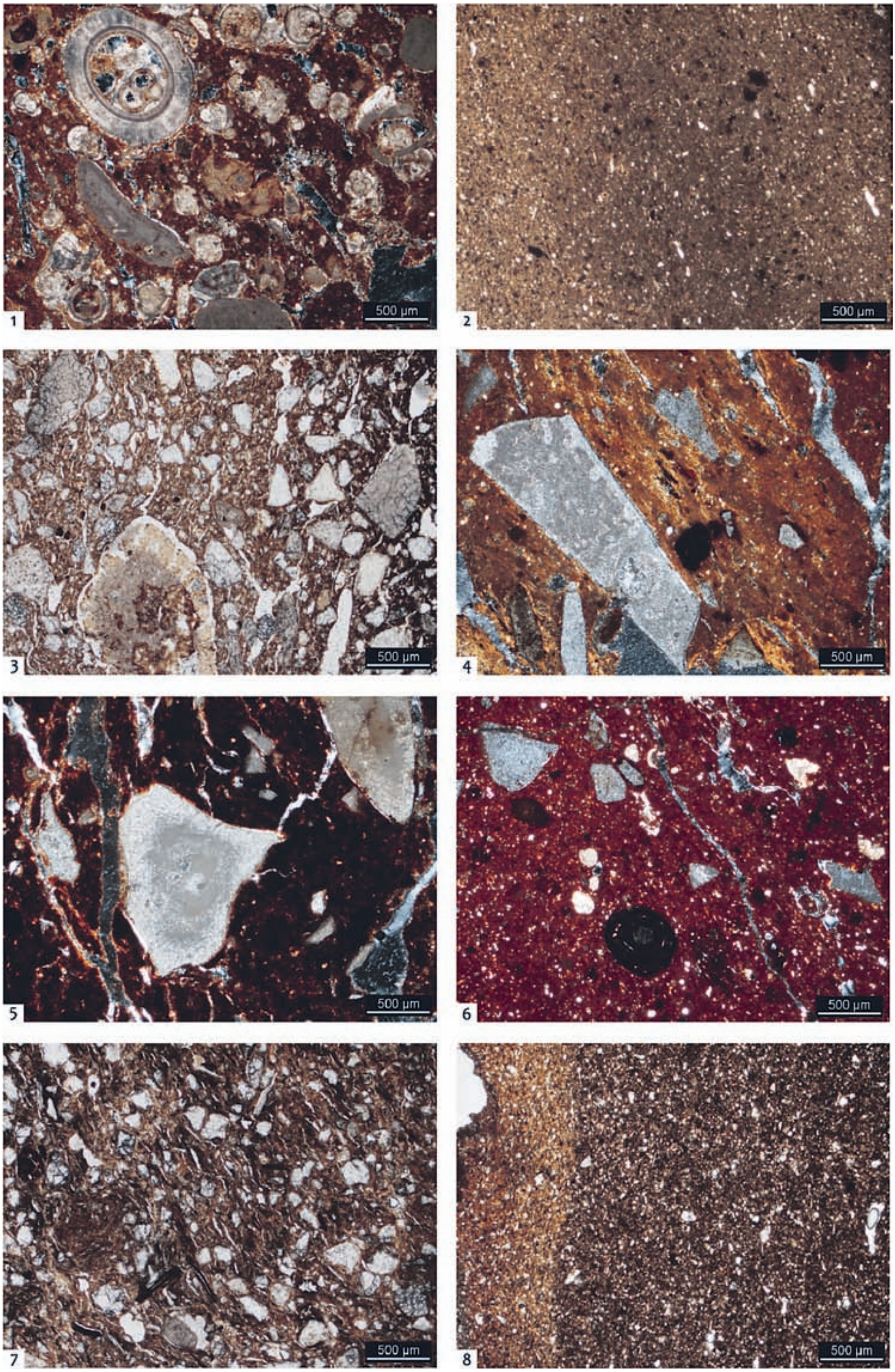


Fig. 5. Early Neolithic of Marche, phase 2 pottery. 1–2) Moscano di Fabriano. 3–9) Esanatoglia-Piani di Calisti. Drawings by C. La Marca.

Fig. 6. Technology, macro-traces on pottery. 1 Adherence of the first coil to the base plate (Moscano). 2 Simple attachment of the handle (Portonovo). 3 Assemblage of parts moulded separately (Moscano).

In phase 2 (Esanatoglia, Moscano), the impressed decoration is still used but decorative motifs seems to be much more limited: some decorative patterns disappear, such as impressed small circles, in favor of a higher incidence of plastic decoration (*fig. 5*). New features appear: grip elements, mainly plastic *appliqués*, become more common; short oblique or vertical cordons (*fig. 5: 6–7*), conical studs (*fig. 5: 8*) or tight ribbon-like handles (*fig. 5: 5, 7*) are placed on about half of the vessel. The incidence of impression technique is about 13 % in each site; incision technique varies from 10 % (Esanatoglia) to 14 % (Moscano). Plastic decoration is between 8 % (Moscano) and 10 % (Esanatoglia). The incidence of *figulina* pottery grows (from 0.14 % in phase 1 up to 7 % in phase 2). No painted pottery was found, in contrast to what happens in contemporary sites of Abruzzo, for example at Catignano (*Colombo 2010*).

Fig. 7. Thin section of ceramics: some of the groups identified. 1 Calcareous and fossiliferous matrix with calcare-nite rock fragments (Portonovo, 2.5x, N+). 2 *Figulina* ware, very low birefringence and unimodal texture (Esanatoglia, 2.5x, N//). 3 Non-calcareous matrix with abundant chert and calcite (Portonovo, 2.5x, N//). 4 Ferrouginous, argillaceous matrix with chert inclusions (Muccia, 2.5x, N+). 5 Ferrouginous, argillaceous matrix and chert inclusions with recrystallization rim (Esanatoglia, 2.5x, N+). 6 Ferrouginous matrix with chert inclusions, rich in pisolite aggregates (Moscano, 2.5x, N+). 7 Non-calcareous matrix rich in biotite and amphibole (Esanatoglia, 2.5x, N//). 8 Non-calcareous matrix with partial oxidation of the organic matter due to the carbonization of plant remains (Portonovo, 2.5x, N+).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The observation of macrotraces on the surface and section of the sherds and their comparison with archaeological (*Gomart 2014*; *2010*; *Angeli 2012*; *Burens-Carozza et al. 2011*), ethnographic (*Skibo 2013*; *1992*; *Livingstone Smith 2007*; *Gelbert 2003*) or experimental (*Skibo 2013*; *Gibson – Woods 1997*; *Rye 1981*) reference models allowed to define building techniques.

Vessels are mainly produced by coiling technique, the assembly of multiple parts moulded separately is indicated by the union of horizontal fracture lines in a circular pattern bands of 1.5 up to 5 centimetres (*fig. 6: 3*) and by the detection of specific fractures connected to the first coil at the base of the vessels (*fig. 6: 1*). Handles and grip elements are always applied by simple attachment to the vessel surface (*fig. 6: 2*), firmly pressing them into place and often leaving finger or thumb marks. A different technique was observed in the case of a single sherd from Muccia: the grip element has a cylindrical end inserted in a hole on the surface of the vessel. Surface finishing treatments undergo changes over the time. During phase 1, the outer surfaces are smoothed or left rough, while the inner surfaces are mostly smoothed. In phase 2, both surfaces are generally smoothed.

Petrographic analysis

Archaeometric analysis were performed with the aim to identify the provenance of the clay, raw materials selection system and technological specialization for each settlement.

The pottery assemblages and the local/proximal clayey sediments underwent petrographic, mineralogical and chemical analysis (OM, PXRD, XRF, SEM). They were performed at the University of Bari (Dipartimento di Scienze della Terra e Geoambientali). The discussion will focus on the most indicative data of this preliminary study, in particular on some aspects of the mineralogical examination on thin sections.

To obtain a representative sampling for each site a different number of ceramic sherds were collected, relating it to identified changes in paste classes. Petrographic analysis were performed on 57 ceramic samples from the four sites (*figs. 7* and *8*). In addition we added 38 samples of clayey sediments (*fig. 9*) from two sites, Portonovo (phase 1, coast) and Esanatoglia (phase 2, inland).

Thin sections were examined by means of a petrographical microscope, distinguishing among temper, matrix and voids characters (*Maggetti 1982*).

Pottery petrographic groups can be divided into two macro-groups according to the amount of calcite in the ceramic body: non calcareous clays (*fig. 7: 3–8*) are more abundant and characterized by a content of CaO less than 8 % (XRF); calcareous clays (CaO more than 8 %) are less numerous (*fig. 7: 1–2*).

In Ca-rich samples, calcite is mainly of biological origin (*fig. 7: 1*), such as fossiliferous limestone or fine-grained calcite. Samples characterized by a Ca-poor body register heterogeneous grain size and texture, clayey matrix. Non-plastic inclusions are primarily represented by quartz and chert (*fig. 7: 3–6*). Groups can be clearly distinguished by the presence of carbonate, metamorphic or volcanic rock fragments (*fig. 8*), in other cases by the predominance of biotite and amphibole (*fig. 7: 7*), or ferruginous aggregates (*fig. 7: 6*).

The optical birefringence of the ceramic matrix is, in general, medium or medium-high, except for the *figulina* group (*fig. 7: 2*); sometimes the matrix is zoned because of the partial

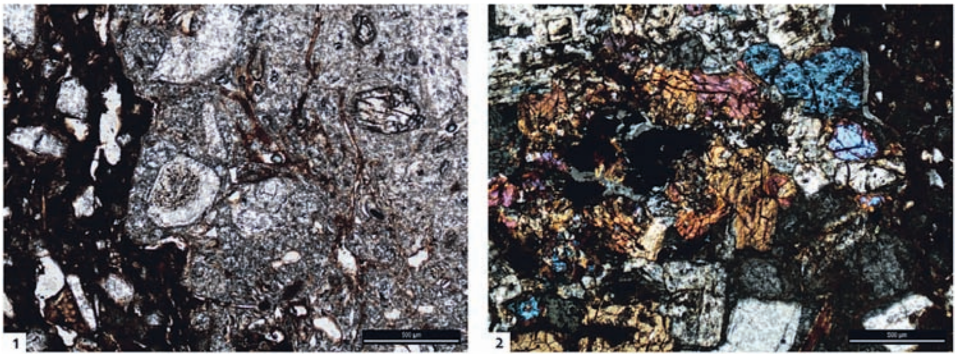

Fig. 8. Thin sections of ceramics: volcanic group from Portonovo site with low birefringence and limited porosity, bimodal texture, rhyolitic rock fragments. 1 5x, N//. 2 5x, N+. Scales: 500 micrometres.

oxidation of the organic matter originally present in the clay. Primary porosity, due to the manipulation of the clay, and secondary porosity, due to drying and firing operations, were detected. Some secondary pores were originated by the combustion of vegetal inclusions. Rare carbonized vegetal relics are clearly recognizable in some samples (*fig. 7: 8*).

A strong compositional variability in raw materials was evidenced, which can be read as a non-standardized raw material selection; this can be verified in each site and in total complex. Therefore, it is evident the plurality of choices regarding the raw material exploitation, related to availability of different clayey sediments.

The correspondence identified in pottery (*fig. 7*) and sediments (*fig. 9*) account for the exploitation of alluvial deposits available close to the settlements, although the similar geological substratum of the investigated sites in proximal areas makes difficult to exclude *a priori* other provenances in the same region. Some of these match with identified geological formations in the vicinity of the sites, while others appear to be as far as 4 km.

The volcanic group (*fig. 8*), typical of Portonovo site, shows rhyolitic rock fragments, pyroxenes and other volcanic inclusions which point to the subalkaline volcanites of the Tuscany magmatic province (*Peccerillo 2003*).

There is also evidence about the possible treatment of the clay, although most of the samples confirm a usage of unprocessed sediment. It is the case of groups characterized by a large amount of chert as a non-plastic inclusion (*fig. 7: 3–6*), for which we found analogous texture and composition in local sediments (*fig. 9: 2, 5–6*). The recrystallization rim around chert inclusions in coarse samples (*fig. 7: 5*) points to the use of unprocessed chert-bearing clays (*fig. 9: 5*). For samples characterized by a significant amount of secondary pores or partial oxidation of the vegetal relics, it is possible to propose an intentional addition (*fig. 7: 8*). *Figulina* ware has been produced with a calcareous and fossiliferous clay, it has very homogeneous matrix, very low birefringence and limited porosity, very fine grain size and unimodal texture (*fig. 7: 2*). It is possible to think that it was probably levigated, because of the coarser body of the sediment samples with similar characteristics.

In a general overview, there was a certain homogeneity in the firing conditions of the artifacts: in most of the samples section is zoned due to alternating reducing and oxidizing conditions during the firing. Only the very-fine paste pottery (*figulina*) shows high sintering:

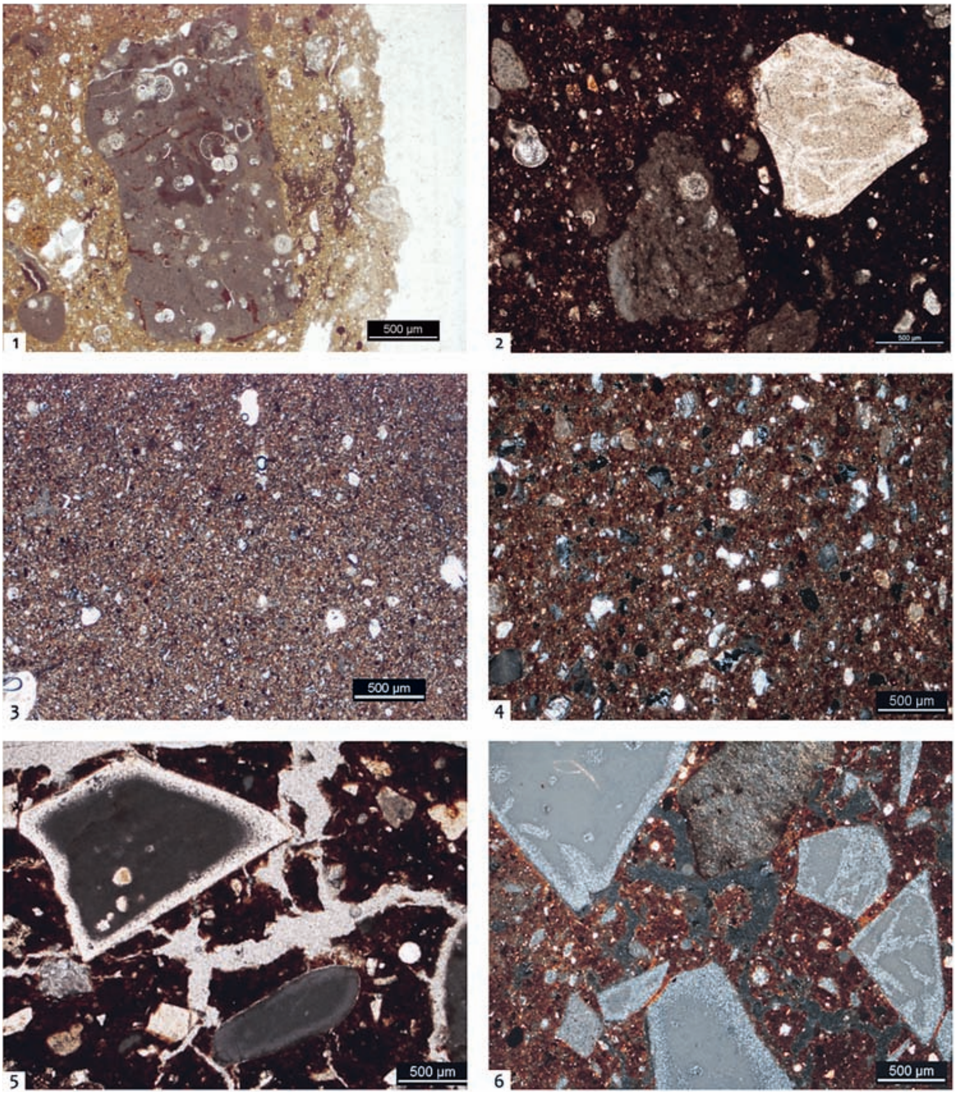

Fig. 9. Thin sections of some of the clayey sediments sampled: Portonovo (1–3), Esanatoglia (4–6). 1 Marl deposit in which some of the ovens of Portonovo were originally excavated (marl and clayey marl Shlier formation, 2.5x, N//). 2 Sediment from landslide with chert and calcareous lithic fragments (limestone Scaglia and marl Shlier formations, 2.5x, N//). 3 Red-soil in which some of the ovens of Portonovo were originally excavated (eluvial/colluvial deposit, 2.5x, N//). 4 Eluvial/colluvial sediment (Camerino Formation, 2.5x, N+). 5 Colluvial soil rich in red chert (Scaglia formation contribution, 2.5x, N//). 6 Terraced alluvial deposit, argilloceous red-soil rich in iron oxihydroides and chert (*Ferretto* soil, 2.5x, N+).

the very low birefringence of the matrix and the vitrification of the fabric indicate high-firing temperature, confirmed by the presence of neoformation phases in PXRD analysis. It could be probably indicative of vessels used in different activities than cooking.

Conclusion

The study of the four pottery assemblages outlines a clear pattern of the pottery production for each local group, highlighting links, affinities and differences between them and allowing comparison with other contemporary cultural horizons.

How can these new data give us more clues about the Neolithisation process of this area?

The process of Neolithisation of this region seems to have followed the main river valleys which link the hinterland to the coast and which were preferred for settlement location. However, the actual correlation between higher dating of sites of inland Abruzzo, Rio Tana (*D'Ercole et al. 2001*, 83) and those of the coastal site of Portonovo (*Conati Barbaro 2013*, 48; *Conati Barbaro – Celant in press*), overcomes the hypothesis of an early appearance of the productive economy in the inner valleys (*Cazzella 2000*). It defines an active role of the coastal areas in this process.

The Early Neolithic of western Middle Adriatic region is marked by characteristic pottery styles which allow to distinguish a two stages process: the Impressed Ware pottery, which has a long duration, first appears in its traditional style in Portonovo and Muccia; over time a change in local pottery production is recognizable by the appearance of new elements, probably in part related to new impulses and contacts with cultures of Central Italy (Catignano, Linear pottery) and the Po Valley (Fiorano, Vho).

The Neolithisation of the area and, more in general, of the Middle Adriatic Italian region, might be more complex than previously known and the coastal sites may have played an important role in the diffusion of the first pottery and settled villages along the region.

How can we read the high variability observed on the supply of raw material?

The exploitation of raw material seems to be closely linked to the territory and to the presence of domestic productions. Some of these sources match with the geological formations in the vicinity of the sites, while others appear to be as far as 4 km. The presence of fabrics with locally available *petrofacies* may be interpreted either (a) as the result of a local production (to exploit the same clay from proximal areas to make pottery elsewhere is technologically meaningless); (b) or it could suggest the presence of other unknown settlements along the fluvial valleys which made the same pottery.

Therefore, the use of sources located at varying distances from the settlements could indicate different units of domestic production within a village or the presence of small groups spread over a limited area using different clay sources. This internal variability probably suggests the existence of several groups in the same valley connected to each other, whose echo survives in the archaeological record.

There is also evidence of non-local provenance of some pottery sherds. It is the case of the volcanic group, to which only three samples from Portonovo refer. At macroscopic scale they are well-recognizable by the presence of "vitreous" inclusions, so it was possible to define the incidence of this group on the entire record (less then 0.2 %). Their brown colour with darker section and the characteristic inclusions find comparisons with some Tuscany Neolithic ceramics, such as samples from Grotta del Beato Benincasa site (*Martini et al. 1996*, 131). Volcanic pastes with the same petrographic characteristics are variously attested in different Tyrrhenian sites: Muraccio-Pian di Cerreto, San Rossore-Poggio di Mezzo, Pianosa-Cala Giovanna Piano, Le Secche-Isola del Giglio (*Gabriele – Tozzi 2013*). An extra-regional provenance of this class could be considered, suggesting contacts with contemporary Neolithic groups of the north-Tyrrhenian area.

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Identifying manufacturing groups through the mineralogical analysis of prehistoric pottery: the example of the Cantabrian region (north of Spain)

Identifikace výrobních skupin prostřednictvím mineralogické analýzy pravěké keramiky: případ Kantábrie, severní Španělsko

Miriam Cubas

Earliest pottery evidence in Cantabrian Spain materialises the way this new technology was adopted on the threshold of the 5th millennium cal BC. These ceramic assemblages have rarely been the object of specific study owing to their limited representativeness from both numerical and morpho-decorative points of view. This paper presents an update on the archaeological evidence, chronology and technological characteristics of the first pottery in the Cantabrian region. It summarizes recent research on this topic focused on technological analysis of some paradigmatic pottery assemblages. It focuses on the importance of the technological study of the first ceramic assemblages in the Cantabrian region (northern Spain) as a way to approach the social significance of this technological innovation. The available information supports the assertion that the appearance of ceramics in the region does not correspond to an exchange of products, but rather to a transfer of technology, and summarizes the nature of this technology and the main activities related to it.

south-western Europe – Cantabrian Spain – cultural transfer – Neolithic – thin-section – XRD – provenance – raw material

Nejstarší známé doklady keramiky ve španělské Kantábrii dokumentují způsob převzetí nové technologie na prahu 5. století cal BC. Tyto keramické soubory byly vinou své malé reprezentativnosti jak co do kvantity, tak po morfologicko-dekorativní stránce jen výjimečně předmětem specifického studia. Článek se zaměřuje na technologické studium nejstarších lokálních keramických souborů z Kantábrie (severní Španělsko), jehož prostřednictvím lze přiblížit společenský význam této technologické inovace. Studie, které jsou o těchto artefaktech k dispozici (mineralogické – analýzy výbrusů a rentgenová difrakční analýza, a geochemické – skenování elektronovou mikroskopií s energo disperzní rentgenovou spektrometrií), umožnily určit zdrojové oblasti surovin a různé výrobní postupy používané k výrobě těchto nejstarších nádob. Ve světle dostupných informací se článek kloní k závěru, že výskyt keramiky v tomto regionu nesouvisí se směnou výrobků, ale spíše s přenosem technologie, a shrnuje podstatu této technologie a hlavní aktivity s ní spojené.

jihozápadní Evropa – Kantábrie – kulturní přenos – neolit – výbrus – XRD – provenience – suroviny

1. Introduction

Neolithisation involves a series of complex changes in human societies, enabling their transition from a way of life based on hunting, fishing and gathering, to other ways which include agriculture and pastoralism and also imply social and symbolic transformation of these societies (*Whittle 2003*). One of the traits traditionally associated with this historical process is the adoption of ceramic vessels, to the extent that their presence has been regarded in many regions as clear archaeological evidence of the transition from the Mesolithic to the Neolithic. However, the appearance of pottery technology and the adoption of farming were

Fig. 1. Location of the sites in the Cantabrian region where earliest pottery assemblages have been recorded.

not coeval processes, and it is now known that pottery appeared at different times in different geographical areas.

The available archaeological information indicates that pottery technology originated simultaneously in three independent locations in Asia (Japan, China and the extreme east of Russia) and displayed different technological and typological characteristics (*Derevianko et al. 2004*; *Hommel et al. 2016*; *Keally et al. 2004*; *Kuzmin 2006*; *2013*). In Europe, the different chronologies for the earliest pottery have allowed to develop a model explaining the origin and the spread of this technology across the continent (*Jordan – Zvelebil 2009*; *Gibbs – Jordan 2016*; *Jordan et al. 2016*). From the original locations in Asia, it is thought to have spread towards northern Europe through the Volga and Ural river basins in central Russia (*Jordan – Zvelebil 2009*), where oldest pottery assemblages, dated between 8300 and 7000 cal BC (*Dolukhanov 2008*), have been found. Within this general model of the adoption of pottery, the expansion of this technology in south-west Europe is related to the spread of the *Linearbandkeramik Kultur* or Linear Band culture (LBK) through central Europe and the impressed pottery tradition in some Mediterranean regions (*Jordan – Zvelebil 2009*). However, the ways in which the technology was adopted are diverse, resulting in multiple situations, including its assimilation by hunter-gatherer groups, as occurred in the north of the continent (*Zvelebil 2008*).

The process was not synchronic either on a European scale or within the Iberian Peninsula and, therefore, regional studies are of vital importance for the understanding the dynamics of introduction of this technology. The first pottery in Iberia, dated in the 6th millennium cal BC, has been documented in Mediterranean regions and is associated with the spread of impressed pottery (*Bernabeu Aubán et al. 2009*; *2011*). However, later dates have been proposed for the North-West (*Prieto-Martínez 2005*) and the Cantabrian region (*Cubas 2013*), showing a delay in the introduction of this technology. For that reason, this last region constitutes an interesting case of study to analyse the transfer mechanisms involve in pottery technology. This paper reappraises the information about the chronology, the archaeological contexts and the technological and morpho-decorative characteristics of the early pottery evidence in the Cantabrian region and its contribution to our understanding of social dynamics during the first half of the 5th millennium cal BC.

2. Chronology and archaeological context of the earliest ceramics in the Cantabrian region

The introduction of pottery technology in Cantabrian Spain took place in the first half of the 5th millennium cal BC; a crucial time in which the neolithisation process (or processes) occurred. This period is characterised by a complex archaeological scenario with great diversity in the archaeological record, in terms of both the information and the entity of the archaeological sites (*Cubas – Fano 2011*).

The oldest evidence of pottery (see *tab. 1*; *fig. 1*) has been found at the sites of Los Canes (*Arias 2002*), El Mirón (*Straus – González-Morales 2012*), Arenillas (*Bohigas – Muñoz 2002*), Los Gitanos (*Ontañón-Peredo et al. 2013*), Arenaza (*Apellániz – Altuna 1975*) and Kobaederra (*Zapata et al. 1997*).

These are all cave sites, dated in the first half of the 5th millennium cal BC, but the occupations were of different kind. Most of the pottery assemblages attributed to this chronology come from non-funerary sites (El Mirón, Los Gitanos, Arenaza and Kobaederra), although in other cases a dubious association with isolated human remains has been cited (Los Canes, Arenillas).

In the Province of Asturias, the only archaeological deposit attributed to this moment is in the Cave of Los Canes (Arangas, Cabrales). The pottery found in Stratigraphic Unit 7 comes from a large hollow occupying the central part of the cave; its function could not be determined, although human bones were found in a secondary position (*Arias 2012*).

In the Province of Cantabria, the sites of Los Gitanos (Sámano, Castro Urdiales), Arenillas (Islares, Castro Urdiales) and El Mirón (Ramales de la Victoria) have yielded the earliest pottery assemblages. At the former site, the oldest pottery was found in Sub-levels A4 and A3. Sub-level A4 is thought to be a habitation layer consisting of large numbers of faunal and industrial remains dispersed over a calcite floor (*Ontañón-Peredo et al. 2013*). The more recent Sub-level A3 consists of a greater concentration of occupation waste. In turn, at the small cave of Arenillas, some pottery fragments were found associated with a shell-midden layer (*Bohigas – Muñoz 2002*) but the nature of the deposit does not allow greater precision as regards other aspects. The largest ceramic assemblage attributed to this time was found in El Mirón (*Vega 2012*), where the archaeological Levels 10, 303 and 303.1 are thought to represent a domestic site or animal pen (*Straus – González-Morales 2012*).

In the Basque Country, two early pottery assemblages have been documented in the caves of Arenaza (San Pedro de Galdames) and Kobaederra (Kortezubi), both in the Province of Biscay. According to the few references available about Arenaza, Level 1C2 represents the oldest phase, in which a small number of sherds with impressed decoration were documented (*Apellániz – Altuna 1975*), associated with remains of domestic fauna (*Arias – Altuna 1999*) and a knapped lithic assemblage including geometric microliths. Finally, early pottery was found at the site of Kobaederra in Levels IV and III. Evidence of agriculture was attested in both levels by remains of cereals. In the lower Level IV, the assemblage was associated with a lithic assemblage containing a high proportion of bladelets and double-bevelled geometrics (segments and triangles), which were also found in Level III, together with abundant backed tools (*Zapata et al. 1997*).

Thanks to the improved understanding of Later Prehistory in the region during the 1990s, we can now state that pottery appeared in Cantabrian Spain in the first half of the 5th millennium cal BC, apparently related to the introduction of cereals and domestic animals, although this association is not attested in the Western area of the region.

3. Summarizing the information: the *"manufacturing sequence"* of Neolithic pottery

3.1. Characterization of the assemblages

The analysis of pottery as the result of a production sequence is a relatively recent approach in studies of prehistoric pottery in Cantabrian Spain. Pottery products are the result of a manufacturing sequence that involves transforming clay into a recipient with different physico-chemical properties from the original raw materials.

The studies currently available about the ceramic assemblages at Los Canes (*Cubas – d. Pedro – Arias 2014*), Los Gitanos (*Cubas et al. 2014*), El Mirón (*Vega 2012*), Arenaza (*Apellániz – Altuna 1975*) and Kobaederra (*Cubas et al. 2012*), in addition to studies bringing together information about Neolithic pottery (*Alday 2003*; *Cubas 2013*), allow a general understanding of the most typical traits of pottery manufactures in this first half of the 5th millennium cal BC. In general, pottery assemblages are characterized by a high fragmentation index, heterogeneity and the absence of complete vessels or profiles.

3.2. Raw materials for pottery manufacturing during the first half of the 5th millennium cal BC

The latest studies of pottery technology have succeeded in determining aspects of the production sequence that were unknown until now. These studies reveal that the first phases of the manufacturing sequence are characterised by the local procurement of raw materials, as great coherence is observed between the mineralogy of the ceramic samples that have been analysed and the surrounding geology (*Cubas et al. 2012*; *2014*; *Vega 2012*; *Cubas – d. Pedro – Arias 2014*). However, the sediment types are diverse and reflect the use of different types of clay in the pottery manufacture (*Cubas et al. 2012*; *2014*; *Cubas – d. Pedro – Arias 2014*).

The distances from the procurement areas for the raw materials used in pottery manufacture is an aspect that has been widely discussed in ethno-archaeological literature (e.g. *Arnold 1985*; *2006*; *Mercader et al. 2000*; *Stark et al. 2000*). These models are based on three basic factors: identification of the exact procurement areas, functionality of the settlement and manufacturing context. The determination of the distances from the potential procurement areas is clearly dependent on the establishment of the production site, the place where the pottery was manufactured (*Gosselain 2002*). However, the archaeological evidence in Cantabrian Spain displays certain limitations for the application of interpretative models proposed in the field of ethno-archaeology. The functionality of the sites is one

Site	Level	Sample	Dating method	Laboratory ref.	Date BP	Calibration cal BC 2σ	Reference
Arenaza	IC2	*Bos taurus*. Bone	14C AMS	OxA-7157	6040±75	5210–4780	*Arias – Altuna 1999*
Los Canes	UE 7	Human bone	14C AMS	TO-11219	5980±80	5200–4680	*Arias 2005/2006*
Los Gitanos	A3	Bone. Fauna	14C AMS	AA-29113	5945±55	4980–4710	*Arias et al. 1999*
Los Gitanos	A4	Calcite	TL	MAD-860	5834±566	4970–2710	*Arias et al. 1999*
Los Canes	UE 7	Charcoal. Pottery	14C AMS	AA-5788	5865±70	4910–4550	*Arias 2002*
Kobaederra	III	Charcoal	14C	UBAR-471	5820±240	5310–4230	*Zapata et al. 1997*
El Mirón	303.3	Charcoal	14C AMS	GX-25856	5790±90	4880–4460	*Straus – González-Morales 2012*
Los Gitanos	A3	Pottery	14C AMS	MAD-656	5771±499	4770–2780	*Arias et al. 1999*
Arenaza	IC2	Bone. *Bos taurus*	14C AMS	OxA-7156	5755±65	4770–4460	*Arias – Altuna 1999*
El Mirón	10	Charcoal	14C AMS	GX-23413	5690±50	4690–4400	*Straus – González-Morales 2012*
Los Gitanos	A2	Pottery	TL	MAD-654	5669±541	4760–2591	*Arias et al. 1999*
Kobaederra	IV	Charcoal	14C	UBAR-470	5630±100	4710–4270	*Zapata et al. 1997*
Covacho de Arenillas	Conchero	Charcoal	14C AMS	GrN-19596	5580±80	4610–4260	*Bohigas – Muñoz 2002*
El Mirón	10	Charcoal	14C AMS	GX-23414	5570±50	4500–4340	*Straus – González-Morales 2012*
El Mirón	303.3	Cereal	14C AMS	GX-30910	5550±40	4490–4330	*Straus – González-Morales 2012*
El Mirón	303.1	Charcoal	14C AMS	GX-25855	5520±70	4500–4240	*Straus – González-Morales 2012*
El Mirón	303	Charcoal	14C AMS	GX-25854	5500±90	4540–4070	*Straus – González-Morales 2012*

Tab. 1. Absolute dates of archaeological levels containing the first evidence of pottery in the Cantabrian region. Radiocarbon determinations have been calibrated with IntCal13 calibration curve (*Reimer et al. 2013*), using the program OxCal 4.2 (*Ramsey 2001*; *2009*).

of the main issues in Late Prehistory studies in the region. The known sites of this chronology are mainly caves, which mean it is difficult to determine the place where certain everyday activities, such as pottery manufacturing, took place. The archaeological record does not allow the interpretation of production places and site functionality. At the three sites that have been analysed directly, Los Canes, Los Gitanos and Kobaederra, the mineralogy of the samples is coherent with the geology in the surroundings of the sites, which suggest that the pottery was manufactured with local raw materials. However, it cannot be stated that the manufacture took place at the archaeological site itself and therefore, *a priori* we do not know exactly where the pottery was made, which is an aspect closely related to site functionality. The raw materials used to make the pottery at Los Canes and Los Gitanos and the nature of the occupations at the sites, particularly in the latter case, seems to suggest that the pottery was made somewhere near the sites, as no direct evidence of pottery manufacturing has been found in their deposits. In contrast, at Kobaederra (Level IV and III) the pottery may have been made in the cave, as the lithic assemblage includes tools with use-wear associated with scraping a semi-humid mineral substance, possibly clay (*Ibáñez 2001*).

3.3. The modification of the raw material and the manufacturing process

Clay preparation

Illite-group clays were used most both in their natural state and modified by the addition of different types of temper (*Cubas 2013*; *Cubas et al. 2012*; *2014*; *Cubas – d. Pedro – Arias 2014*). Although the most representative are the non-tempered products, it can be highlighted the identification of some tempers.

Calcite is the most common inclusion, although in varying proportions depending on the site and stratigraphic unit where the pottery was found (*fig. 2A*). Indeed, it was in frequent use in Iberia from the beginning of the Neolithic (*Clop-García 2000*; *2011*; *Martín et al. 2010*) and has been documented across the whole of the western Mediterranean basin (*Convertini 2010*). Flint temper has also been identified (*fig. 2B*) but is less common as in the Cantabrian region it only appears at the site of Kobaederra (*Cubas et al. 2012*). However, it has been recognised at other Iberian (La Carigüela: *Navarrete et al. 1991*) and European sites (Lagnano da Poiede and Ripa Tetta in Italy: *Eygun 2001*). The possible addition of fragments of other rock varieties has also been regarded as intentional in some recipients. The possible use of the sandstone in the site of Kobaederra (*fig. 2C*), the limestone in Los Gitanos (*fig. 2E*), and the presence of rocks with an ophitic texture was documented in pottery from both Los Gitanos (*Cubas et al. 2014*) and Kobaederra (*fig. 2D*; *Cubas et al. 2012*). This latter temper is also found at other sites in Iberia, such as Los Murciélagos in Zuheros (*Barrios et al. 1999*) and Papa Uvas (*Barrios et al. 2005*) with slightly more recent chronologies. Finally, it should be noted that grog was identified at the site of Kobaederra (*fig. 2F*). This temper is relatively frequent at Iberian and some authors suggest the hypothesis that in the western Mediterranean was the first temper (*Clop 2012*).

In general, the most common temper is calcite, which has been documented at all the sites with a representative number of samples whereas the other kinds reflect a sporadic and clearly minor use in comparison with it. The intentional addition of other rock fragments, such as sandstones or ophitic-texture rocks, is difficult to argue due to their scarce abundance in the samples. Indeed, in some cases the detritical fraction is composed by minerals related to the weathering of these rocks, impeding differentiate two different resources in the mineralogical composition.

Manufacturing techniques, the firing process and the ceramic products

The high fragmentation index does not allow an analysis of the central processes in the manufacturing sequence: the modelling. Certain uniformity is apparently seen in these phases of the sequence, but this apparent *homogeneity* is a consequence of the low representativeness of the assemblage.

No technological evidence has been observed in connection with the shaping although, *grosso modo*, certain complexity may be supposed, with the use and combination of several techniques, as attested by the available ethno-archaeological evidence for hand-made pottery (see, among others *García-Roselló – Calvo 2013*; *Gelbert 2001*; *Gosselain 2002*; *Livingstone Smith 2007*; *Neupert 2000*; *Stark et al. 2000*).

The only trait that can be noted in reference to the shaping of the vessels is the identification of different surface treatments (scraping, smoothing, burnishing), which are of greater or lesser importance at each site and in each stratigraphic unit. These forms of treatment,

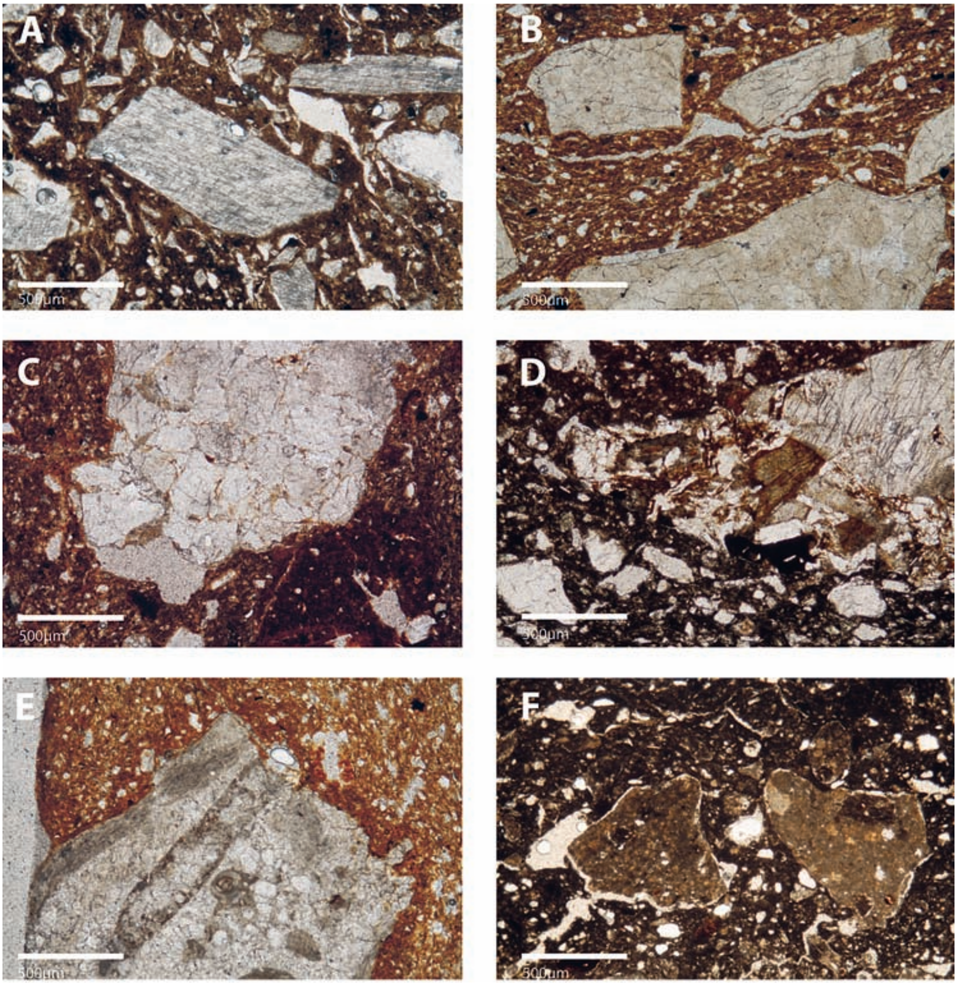

Fig 2. Main temper identified in the Cantabrian region. Microphotograph images with plane-polarized light. A. Calcite (Los Gitanos, sample 735). B. Flint (Kobaederra, sample 1246). C. Sandstone (Kobaederra, sample 1241). D. Ophitic texture rock (Los Gitanos, sample 726). E. Limestone (Los Gitanos, sample 729). F. Grog (Kobaederra, sample 1238).

which are identified by technological macro-traces (*fig. 3*), are seen on the inner and outer surfaces of the sherds and appear individually or in combination with one another.

In the firing processes, these recipients were subjected to low firing temperatures, with maximum temperatures between 700 and 800 °C. The lower limit may be established as 300–350 °C because at this temperature the clay is physically transformed as it loses its superficial and compositional water (*Rice 1987*). The higher limit is determined by the mineralogy that can be observed. In the samples from Los Canes, Los Gitanos and Kobaederra, no refractory minerals, such as gehlenite or spinel, which can indicate temperatures above 800 °C, have been recorded (*Cubas 2013*; *Cubas et al. 2012*; *2014*; *Cubas – d. Pedro – Arias*

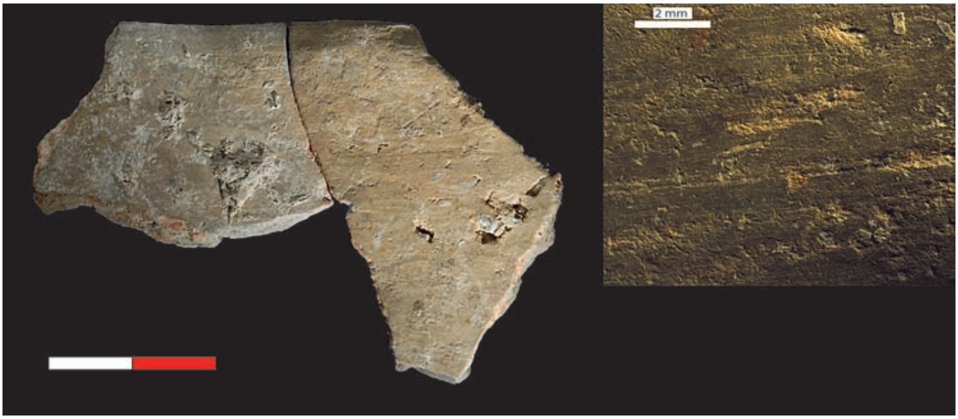

Fig. 3. Technological traces related to the superficial treatment. Los Gitanos.

2014). The colouration observed in the sherds suggests alternating or reducing atmospheres, and colouring related with oxidising firing conditions is less common.

The final products of the manufacturing sequences are difficult to classify. The impossibility of obtaining complete profiles does not allow any appreciation of the possible forms of the recipients (*fig. 4*). No macroscopic features have been observed susceptible of characterising the pottery forms attributed to these chronologies, as the morphological and decorative traits are inconclusive. Finally, the decorative techniques identified include impression, incision and plastic decoration, although smooth, undecorated sherds predominate (*fig. 4*). These techniques are found irregularly across the region, and no regional patterns have been recognised.

4. Discussion: the contribution of pottery to our understanding of social dynamics

The variability of archaeological assemblages allows certain inferences about production modalities to be drawn. It is generally accepted that low variability is indicative of standardised production (*Rice 1981*; *1984*; *1996*) and this is the result of a process associated with specialisation, intensification in the production system and an increase in political and social complexity (*Morrison 1994*; *Rice 1981*).

The problem lies, therefore, in determining the correspondence between the variability observed in the pottery assemblages and the different production processes, and in how to measure the degree of standardisation or uniformity of the assemblages. In addition, this aspect can only be observed in certain phases of the manufacturing sequence.

As the main characteristics of the pottery assemblages documented in northern Spain in the first half of the 5th millennium cal BC have been described, it is now necessary to propose a hypothesis enabling an approach to how the pottery production was organised. The archaeological evidence seems to reflect certain continuity in the use of clay types and the choice of temper. A random (or non-selective) use of raw materials would give

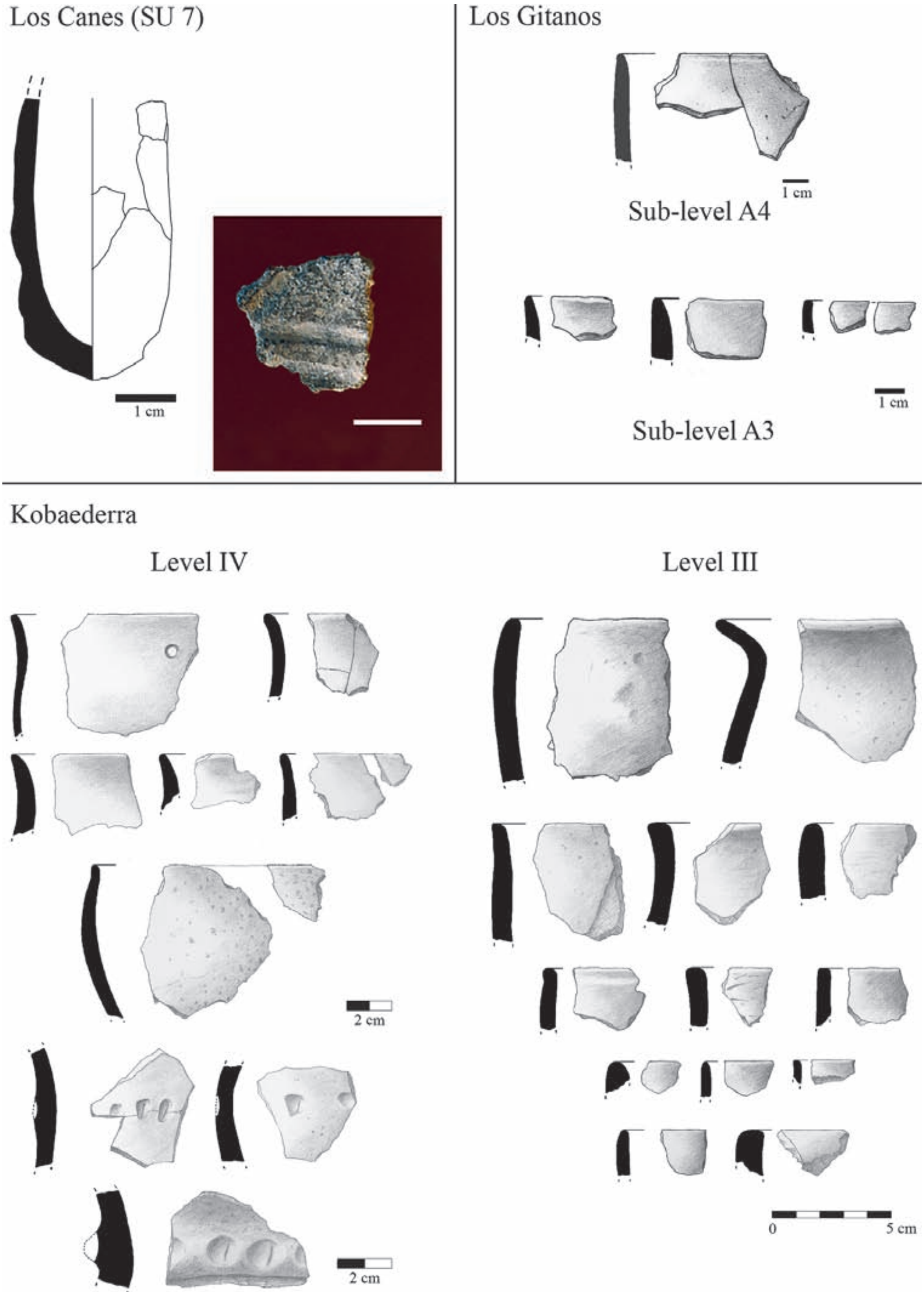

Fig. 4. Main morphological and decorative characteristics of the assemblages recorded at Los Canes (SU 7), Los Gitanos (sublevel A4 and A3) and Kobaederra (levels IV and III).

rise to greater mineralogical heterogeneity both in general and within each assemblage. However, most of the samples that have been analysed display great mineralogical coherence, especially in the reiterative use of types of temper. Therefore, it is thought that the use of certain raw materials is not accidental or fortuitous, but denotes a deliberate choice of temper.

At the same time, both the character of the manufactures and the contexts in which they are documented seem to indicate that pottery production was a daily activity forming part of the group's subsistence tasks. It is seen, therefore, that the procurement of raw materials was selective and carried out in the immediate (physical and functional) surroundings of the site with the objective of making products to be used within the group to satisfy its own needs.

The appearance of this new technology in northern Spain brings with it major implications in the study of the neolithisation processes, as its introduction in the first half of the 5th millennium cal BC is simultaneous with the first unmistakable signs of socio-economic change. This prompts questions about the role pottery played in these processes and whether it was added to material culture as a result of the dissemination of technology or by the arrival in the area of groups bringing pottery with them. The present study supports the explanation that the appearance of pottery in northern Spain was not the result of an exchange of products, but was due to technological dissemination, as the recipients were made in the area with raw materials available in the surroundings. However, this dissemination could be the result of the transfer of knowledge through several mechanisms (*Dietler – Herbich 1994*) or of the arrival from other geographical areas of human groups who possessed ceramic technology. Sufficient evidence is not currently available to choose between one or other hypothesis.

In general terms, the neolithisation process in Cantabrian Spain has been associated with the expansion of the Mediterranean Neolithic along the Ebro valley (*Arias 2007*). However, if the Ebro valley was the focus of influence for the transmission of pottery technology, a temporal gradient would exist; a spatial articulation of the sites with pottery on each side of the watershed in a diachronic sequence. Equally, certain similarities would be seen between the production in the original focus and those within reach of its technological influence.

The available absolute dates situate the earliest evidence of pottery in the middle-upper Ebro basin (*Alday 2009*) and the Pyrenees in the first half of the 6th millennium cal BC, reflecting certain temporal difference between these areas and Cantabrian Spain. This indicates different rates in the transfer of pottery technology between the two areas, but no diagnostic traits are seen in the characteristics of the pottery assemblages in each one. In both cases, the recipients are characterised by lack of morphological and decorative definition and solely common technological traits can be recognised, such as the use of calcite, whereas the morphological and decorative features are inconclusive in an attempt to determine influences. The available archaeological evidence do not display a high correlation in comparison with other regions in the vicinity (*Cubas et al. 2016*).

Within Cantabrian Spain, the first pottery manufactures are associated with the earliest evidence of domestication in the central-eastern sector of the region. Here, a clear link is seen between the appearance of domestic species and the first evidence of pottery technology (El Mirón, Los Gitanos, Kobaederra and Arenaza), apart from at a few sites, like Herriko Barra, where the absence of this technology might be connected with the function of the site as a specialised hunting camp (*Iriarte et al. 2005*). However, this association is less clear in the western sector, where the limited archaeological record is insufficient to characterise the subsistence pattern in the first half of the 5th millennium cal BC. This lack of archaeological evidence is only offset by the limited information from Los Canes (SU 7) where its precariousness does not allow an assessment of the subsistence model it was associated with.

In this context, the appearance and development of pottery technology in Cantabrian Spain was integrated as an everyday activity, immersed in the subsistence strategies of the human groups. The everyday nature of pottery-making is supported by the use of local raw materials and its documentation at sites in which other activities were carried out. No evidence has been found allowing it to be considered a prestige item, and therefore it must have been adopted by these human groups as practical technology (following the conceptualisation proposed by *Hayden 1995*; *1998*). The technological, morphological and decorative characteristics of the pottery reflect a limited investment in time and effort, possibly in accordance with the everyday and practical nature of the products. In addition, in the pottery, no sign can be identified suggesting it was an indicator of status or identity, or that it was used as a surface on which to transmit symbolic thought. Therefore, both the contexts in which it is found and its most significant characteristics indicate that pottery did not play a symbolic role within the human groups.

5. Conclusions

To sum up, pottery manufacturing appeared as an activity carried out in the region in the first half of the 5th millennium, when it became part of the daily tasks of the human groups, in a historic moment characterised by changes in their model of subsistence. With the available archaeological data, it is not possible to establish the mechanisms that operated in the transfer of the technology, and it can only be stated that it developed as a local technology using local raw materials, and no exchange of products with neighbouring geographical regions has been identified. Furthermore, no traits have been observed allowing it to be considered a prestige item. Pottery was therefore adopted by the human groups in the region as a practical technology, as the technological, morphological and decorative characteristics of the recipients reflect a limited investment in time and effort probably in accordance with the everyday and practical nature of the products.

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The selection of ceramic raw material: convenience or a technological idea? A case study of the Danubian cultures north of the Carpathians

Výběr keramických surovin: příhodnost nebo technologický plán? Případová studie podunajských kultur severně od Karpat

Sławomir Kadrow – Anna Rauba-Bukowska

This paper reconstructs the rules governing the selection of ceramic raw material and considers certain technological aspects of the production of ceramic vessels in some Danubian cultures around the Carpathians in the Neolithic. The analysis encompassed more than 500 samples of ceramics produced by various cultural units across different chronological horizons. The results of the analysis are used to verify several hypotheses concerning the relationships and the mechanisms of cultural change in the Carpathian region. The most important questions include: (1) *evolution of the LBK ceramics,* (2) *influence of the ALPC on the evolution of the LBK pottery in Małopolska,* (3) *technology of the LBK ceramics east of the Carpathians,* (4) *culture change at the turn of the LBK and the MC in Małopolska and* (5) *culture change at the turn of the MC and the L-VC in the same region. The suitability of the pottery technological analysis to solve some prehistoric problems was confirmed.*

LBK – ALPC – trans-Carpathian contacts – pottery – clay raw materials – technological analysis

Článek rekonstruuje pravidla ovládající výběr keramických surovin a zvažuje určité technologické aspekty výroby keramických nádob v některých podunajských kulturách neolitu v oblasti Karpat. Analyzováno bylo více než 500 keramických vzorků vytvořených různými kulturními jednotkami různých chronologických horizontů. Výsledky analýzy slouží k ověření několika hypotéz týkajících se souvislostí a mechanismů kulturní změny v karpatské oblasti. Mezi nejdůležitější otázky patří: (1) *vývoj LBK keramiky,* (2) *vliv ALPC na vývoj LBK keramiky v Malopolsku,* (3) *technologie LBK keramiky východně od Karpat,* (4) *kulturní změna na přechodu mezi LBK a MC v Malopolsku,* (5) *kulturní změna na přechodu mezi MC a L-VC v téže oblasti. Výsledky potvrzují vhodnost analýzy technologie keramiky pro objasnění některých otázek pravěku.*

LBK – ALPC – trans-karpatské kontakty – keramika – keramické suroviny – technologická analýza

Introduction

The aim of this paper is to reconstruct the rules governing the selection of ceramic raw material and to consider certain technological aspects of the production of ceramic vessels by the Linear Pottery culture (LBK) and some younger Danubian cultures north of the Carpathians. The analysis encompassed more than 500 samples of ceramics produced by various cultural units in various chronological periods (*Rauba-Bukowska et al. 2007*; *Rauba-Bukowska 2011*; *2014a*; *2014b*; *Czekaj-Zastawny – Rauba-Bukowska 2013*; *2014*; *Kozłowski et al. 2014*; *Czekaj-Zastawny et al. 2017*). In this paper we take also into consideration new samples: the Starčevo-Criş culture in its final phase; the LBK in phases I–III; the Alföld Linear

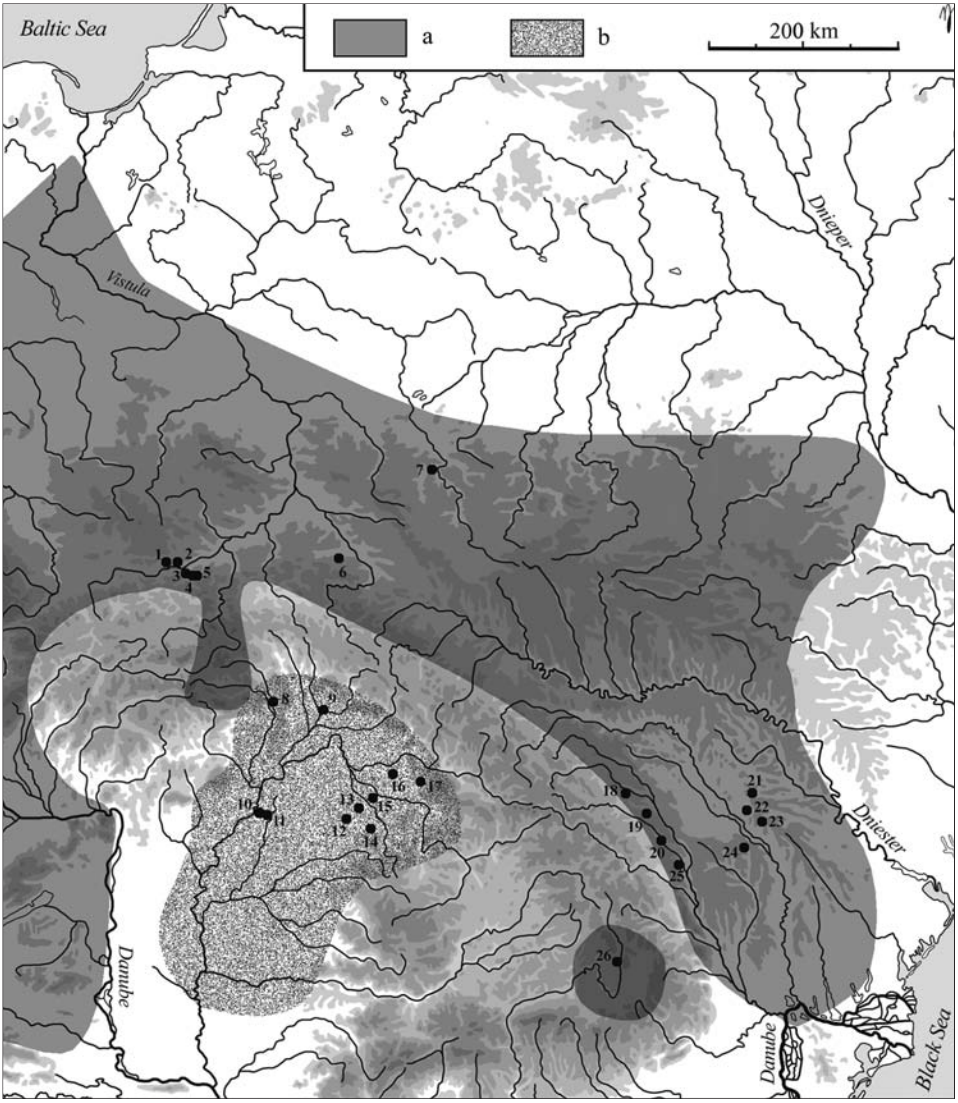

Fig. 1. Locations of the sites with ceramic material analysed in the article; 1 – Modlnica 5; 2 – Kraków – Nowa Huta – Mogiła 62; 3 – Zagórze 2; 4 – Brzezie 17; 5 – Targowisko 10–11; 6 – Rozbórz 42; 7 – Świerszczów 3; 8 – Šarišské Michaľany; 9 – Zemplínske Kopčany; 10 – Polgár-Csőszhalom; 11 – Polgár-Piocasi; 12 – Pişcolt; 13 – Căpleni; 14 – Tăşnad; 15 – Homorodul; 16 – Halmeu; 17 – Călineşti-Oaş; 18 – Mihoveni; 19 – Preuteşti; 20 – Târpeşti; 21 – Chişcăreni; 22 – Bumbăta; 23 – Găureni; 24 – Isaiia; 25 – Traian Dealul, dept. Neamţ; 26 – Olteni; a – LBK area; b – ALPC area.

Pottery culture (ALPC) in its younger phase (including Pişcolt group); the post-ALPC Iclod group; the Malice (MC) and the Lublin-Volhynia (L-VC) cultures (*fig. 1*; *tab. 1*). The units evolved for over 1500 years, from c. 5500 BC to c. 4000/3800 BC (*fig. 2*).

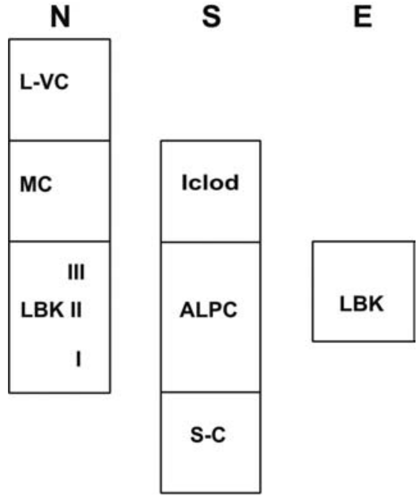

Fig. 2. Chronological synchronization of cultural units referred to in the article; N – areas North of Carpthians, S – areas South of Carpathians, E – areas East of Carpathians; S-C – Starčevo-Criş culture, LBK – Linear Pottery culture, ALPC – Alföld Linear Pottery culture, MC – Malice culture, L-VC – Lublin-Volhynian culture, Iclod – Iclod group.

The results of the analysis are used to verify several hypotheses concerning the relationships and the mechanisms of cultural change in the Carpathian region. The most important questions include the continuity or discontinuity of Danube settlement in south-eastern Poland at the turn of the LBK and the MC until the early Eneolithic, as well as the chronology of the LBK east of the arc of the Carpathians, in eastern Romania and in Moldova. The samples, taken from such an extensive area and dated to such a long period, make it possible to reconstruct significant changes in the production of ceramics in the context of crucial sociocultural processes in Małopolska (Little Poland) and the adjacent areas.

The spatial and chronological range of the analysis

The research area has covered large areas of Małopolska, the northern Carpathian Basin, Moldavia east of the arc of the Carpathians, as well as one site in south-eastern Transylvania (*fig. 1: 26*). The ceramic samples have been taken from five sites in western Małopolska: Modlnica 5 and Nowa Huta-Mogiła 62 north of the Vistula, and Zagórze 2, Brzezie 17 and Targowisko 10–11 south of that river (all the sites are located in the Kraków region; *fig. 1: 1–5*), as well as from two sites in eastern Małopolska: Rozbórz 42 and Świerszczów 3 (*fig. 1: 6–7*).

The Slovakian site Zemplínske Kopčany lies in the northern part of the Great Hungarian Plain; Šarišské Michaľany is situated in the hilly Šariš region in the Western Carpathians (*fig. 1: 8–9*), while the Hungarian sites Polgár-Csőszhalom and Polgár-Piocasi are located east of the Tisza in the Great Hungarian Plain (*fig. 1: 10–11*).

The north-western Romanian sites: Pişcolt, Căpleni, Homorodul Vechi, Halmeu, Tăşnad and Călineşti-Oaş (*fig. 1: 12–1*7), are located in the farthest north-eastern part of the Great Hungarian Plain. Several Moldavian sites in Romania lie in the Siret basin (Mihoveni, Preuteşti and Târpeşti; *fig. 1: 18–20*); other sites are located in the Prut basin (Isaiia and Traian Dealul; *fig. 24–25*). The sites in the Republic of Moldova lie in the Prut basin (Chişcăreni,

Id.	State	Site	Cultural affiliation	Localisation at the sample
7	Poland	Rozbórz	Linear Pottery culture (LBK)	feature 3233
8	Poland	Rozbórz	Linear Pottery culture (LBK)	feature 3233
9	Poland	Rozbórz	Linear Pottery culture (LBK)	feature 2980
10	Poland	Rozbórz	Linear Pottery culture (LBK)	feature 2980
11	Poland	Rozbórz	Malice culture (MC)	feature 500
12	Poland	Rozbórz	Linear Pottery culture (LBK)	feature 2980
13	Poland	Rozbórz	Linear Pottery culture (LBK)	feature 3233
14	Poland	Rozbórz	Malice culture (MC)	feature 500
15	Poland	Rozbórz	Malice culture (MC)	feature 371
16	Poland	Rozbórz	Linear Pottery culture (LBK)	feature 2980
41	Poland	Zagórze	Linear Pottery culture (LBK)	feature 7073
42	Poland	Zagórze	Linear Pottery culture (LBK)	feature 7073
43	Poland	Zagórze	Linear Pottery culture (LBK)	feature 7073
44	Poland	Zagórze	Linear Pottery culture (LBK)	feature 7073
45	Poland	Rozbórz	Linear Pottery culture (LBK)	feature 111
46	Poland	Rozbórz	Linear Pottery culture (LBK)	feature 111
47	Poland	Rozbórz	Linear Pottery culture (LBK)	feature 111
48	Poland	Rozbórz	Linear Pottery culture (LBK)	feature 111
49	Poland	Rozbórz	Linear Pottery culture (LBK)	feature 111
50	Poland	Rozbórz	Linear Pottery culture (LBK)	feature 500
51	Poland	Rozbórz	Linear Pottery culture (LBK)	feature 500
52	Poland	Rozbórz	Linear Pottery culture (LBK)	feature 111
53	Poland	Rozbórz	Malice culture (MC)	feature 500
54	Poland	Rozbórz	Malice culture (MC)	feature 111
55	Poland	Rozbórz	Malice culture (MC)	feature 111
56	Poland	Rozbórz	Malice culture (MC)	feature 111
57	Poland	Rozbórz	Malice culture (MC)	feature 111
58	Poland	Rozbórz	Linear Pottery culture (LBK)	feature 500
59	Poland	Rozbórz	Malice culture (MC)	feature 111
60	Poland	Świerszczów	Lublin-Volhynia culture (L-VC)	feature 143
61	Poland	Świerszczów	Lublin-Volhynia culture (L-VC)	feature 143
62	Poland	Świerszczów	Lublin-Volhynia culture (L-VC)	feature 143
63	Poland	Świerszczów	Lublin-Volhynia culture (L-VC)	feature 125
64	Poland	Świerszczów	Lublin-Volhynia culture (L-VC)	feature 125
65	Poland	Świerszczów	Lublin-Volhynia culture (L-VC)	feature 143
66	Poland	Świerszczów	Lublin-Volhynia culture (L-VC)	feature 6
67	Poland	Świerszczów	Lublin-Volhynia culture (L-VC)	feature 141/A
68	Poland	Świerszczów	Lublin-Volhynia culture (L-VC)	feature 143
69	Poland	Świerszczów	Lublin-Volhynia culture (L-VC)	feature 143
70	Romania	Isaiia, jud.Iaşi	Linear Pottery culture (LBK)	*
71	Romania	Isaiia, jud.Iaşi	Linear Pottery culture (LBK)	*
72	Romania	Isaiia, jud.Iaşi	Linear Pottery culture (LBK)	*
73	Romania	Isaiia, jud.Iaşi	Linear Pottery culture (LBK)	*
74	Romania	Isaiia, jud.Iaşi	Linear Pottery culture (LBK)	*
75	Romania	Olteni, jud. Covasna	Linear Pottery culture (LBK)	*
76	Romania	Olteni, jud. Covasna	Linear Pottery culture (LBK)	*
77	Romania	Olteni, jud. Covasna	Linear Pottery culture (LBK)	*
78	Romania	Olteni, jud. Covasna	Linear Pottery culture (LBK)	*
79	Romania	Mihoveni, jud. Suceava	Linear Pottery culture (LBK)	*
80	Romania	Mihoveni, jud. Suceava	Linear Pottery culture (LBK)	*
81	Romania	Preuteşti-Ciritei, jud. Suceava	Linear Pottery culture (LBK)	*
82	Romania	Preuteşti-Ciritei, jud. Suceava	Linear Pottery culture (LBK)	*
83	Romania	Traian-Dealul Fântânilor, jud. Neamţ	Linear Pottery culture (LBK)	*
84	Romania	Traian-Dealul Fântânilor, jud. Neamţ	Linear Pottery culture (LBK)	*
85	Romania	Traian-Dealul Fântânilor, jud. Neamţ	Linear Pottery culture (LBK)	*
86	Romania	Traian-Dealul Fântânilor, jud. Neamţ	Linear Pottery culture (LBK)	*
87	Romania	Traian-Dealul Fântânilor, jud. Neamţ	Linear Pottery culture (LBK)	*
88	Romania	Târpeşti, jud. Neamţ	Linear Pottery culture (LBK)	*
89	Romania	Târpeşti, jud. Neamţ	Linear Pottery culture (LBK)	*
90	Romania	Târpeşti, jud. Neamţ	Linear Pottery culture (LBK)	*
91	Romania	Târpeşti, jud. Neamţ	Linear Pottery culture (LBK)	*
92	Romania	Târpeşti, jud. Neamţ	Linear Pottery culture (LBK)	*

93	Romania	Tăşnad-Sere 2014	Starčevo-Criş culture	Pit 1- Analystra Hotel section, 2014
94	Romania	Tăşnad-Sere 2014	Starčevo-Criş culture	Pit 1- Analystra Hotel section, 2014
95	Romania	Tăşnad-Sere 2014	Starčevo-Criş culture	Pit 1- Analystra Hotel section, 2014
96	Romania	Tăşnad-Sere 2014	Starčevo-Criş culture	Pit 1- Analystra Hotel section, 2014
97	Romania	Tăşnad-Sere 2014	Starčevo-Criş culture	Pit 1- Analystra Hotel section, 2014
98	Romania	Călineşti-Oaş 2001	Starčevo-Criş culture	Dâmbul Sfinetei Marii, S I, C 1 – 0,40–0,5 m, 2001
99	Romania	Călineşti-Oaş 2001	Starčevo-Criş culture	Dâmbul Sfinetei Marii, S I, C 1 – 0,40–0,5 m, 2001
100	Romania	Călineşti-Oaş 2001	Starčevo-Criş culture	Dâmbul Sfinetei Marii, S I, C 1 – 0,40–0,5 m, 2001
101	Romania	Călineşti-Oaş 2001	Starčevo-Criş culture	Dâmbul Sfinetei Marii, S I, C 1 – 0,40–0,5 m, 2001
102	Romania	Călineşti-Oaş 2001	Starčevo-Criş culture	Dâmbul Sfinetei Marii, S I, C 1 – 0,40–0,5 m, 2001
104	Romania	Homorodul	Starčevo-Criş culture	Cx. 1 (Pit 1)
105	Romania	Homorodul	Starčevo-Criş culture	Cx. 1 (Pit 1)
106	Romania	Homorodul	Starčevo-Criş culture	Cx. 1 (Pit 1)
107	Romania	Homorodul	Starčevo-Criş culture	Cx. 1 (Pit 1)
108	Romania	Halmeu-Vamă	Alföld Linear Pottery culture (ALPC) – Pişcolt group	Cx 46
109	Romania	Halmeu-Vamă	Alföld Linear Pottery culture (ALPC) – Pişcolt group	Cx 46
110	Romania	Halmeu-Vamă	Alföld Linear Pottery culture (ALPC) – Pişcolt group	Cx 46
112	Romania	Halmeu-Vamă	Alföld Linear Pottery culture (ALPC) – Pişcolt group	Cx 46
113	Romania	Halmeu-Vamă	post Alföld Linear Pottery culture (ALPC) – Iclod group	Cx. 5
114	Romania	Halmeu-Vamă	post Alföld Linear Pottery culture (ALPC) – Iclod group	Cx. 5
115	Romania	Halmeu-Vamă	post Alföld Linear Pottery culture (ALPC) – Iclod group	Cx. 5
116	Romania	Halmeu-Vamă	post Alföld Linear Pottery culture (ALPC) – Iclod group	Cx. 5
117	Romania	Halmeu-Vamă	post Alföld Linear Pottery culture (ALPC) – Iclod group	Cx. 5
119	Romania	Pişcolt-Lutărie	Alföld Linear Pottery culture (ALPC) – Pişcolt group	G1
120	Romania	Pişcolt-Lutărie	Alföld Linear Pottery culture (ALPC) – Pişcolt group	G1
121	Romania	Pişcolt-Lutărie	Alföld Linear Pottery culture (ALPC) – Pişcolt group	G1
122	Romania	Pişcolt-Lutărie	Alföld Linear Pottery culture (ALPC) – Pişcolt group	G1
123	Romania	Pişcolt-Lutărie	Alföld Linear Pottery culture (ALPC) – Pişcolt group	G1
124	Romania	Pişcolt-Lutărie	Alföld Linear Pottery culture (ALPC) – Pişcolt group	G1
125	Romania	Pişcolt-Lutărie	Alföld Linear Pottery culture (ALPC) – Pişcolt group	G1
126	Romania	Pişcolt-Lutărie	Alföld Linear Pottery culture (ALPC) – Pişcolt group	G1
127	Romania	Pişcolt-Lutărie	Alföld Linear Pottery culture (ALPC) – Pişcolt group	G1
128	Romania	Pişcolt-Lutărie	Alföld Linear Pottery culture (ALPC) – Pişcolt group	*
129	Romania	Pişcolt-Lutărie	Alföld Linear Pottery culture (ALPC) – Pişcolt group	*
130	Romania	Pişcolt-Lutărie	Alföld Linear Pottery culture (ALPC) – Pişcolt group	*
131	Romania	Pişcolt-Lutărie	Alföld Linear Pottery culture (ALPC) – Pişcolt group	*
132	Romania	Pişcolt-Lutărie	Alföld Linear Pottery culture (ALPC) – Pişcolt group	*
134	Romania	Pişcolt-Lutărie	Alföld Linear Pottery culture (ALPC) – Pişcolt group	G 8/9
135	Romania	Pişcolt-Lutărie	Alföld Linear Pottery culture (ALPC) – Pişcolt group	G 8/9
136	Romania	Pişcolt-Lutărie	Alföld Linear Pottery culture (ALPC) – Pişcolt group	G 8/9
137	Romania	Pişcolt-Lutărie	Alföld Linear Pottery culture (ALPC) – Pişcolt group	G 8/9
138	Romania	Căpleni-Drumul	Alföld Linear Pottery culture (ALPC) – Pişcolt group	G1
139	Romania	Căpleni-Drumul	Alföld Linear Pottery culture (ALPC) – Pişcolt group	G1
140	Romania	Căpleni-Drumul	Alföld Linear Pottery culture (ALPC) – Pişcolt group	G1
141	Romania	Căpleni-Drumul	Alföld Linear Pottery culture (ALPC) – Pişcolt group	G1
142	Romania	Căpleni-Drumul	Alföld Linear Pottery culture (ALPC) – Pişcolt group	G1
143	Moldova	Chişcăreni XIV	Linear Pottery culture (LBK)	*
144	Moldova	Chişcăreni XIV	Linear Pottery culture (LBK)	*
145	Moldova	Bumbăta	Linear Pottery culture (LBK)	sondaj 1
146	Moldova	Bumbăta	Linear Pottery culture (LBK)	sondaj 1
147	Moldova	Găureni	Linear Pottery culture (LBK)	sondaj 2
148	Moldova	Găureni	Linear Pottery culture (LBK)	sondaj 2

Tab. 1. List of analyzed samples.

Bumbăta and Găureni; *fig. 1: 21–23*). The only Transylvanian site is situated in Olteni (*fig. 1: 26*).

The samples recovered from the sites in Małopolska represent the LBK (*fig. 1: 2–6*), the MC (*fig. 1: 4–6*) or the L-VC (*fig. 1: 1, 7*). All the samples from Slovakia and Hungary represent the ALPC (*fig. 1: 8–11*), while those from north-western Romania come from the final phase of the Starčevo-Criş culture (*fig. 1: 14, 15, 17*), from Pişcolt, i.e. an element of the ALPC (*fig. 1: 12, 13, 16*), or from the Iclod group (*fig. 1: 16*), representing the post-ALPC horizon of the younger Neolithic. All the other samples from Transylvania (*fig. 1: 26*), eastern Romania (*fig. 1: 18–20, 24–25*) and the Republic of Moldova (*fig. 1: 21–23*) represent the LBK.

The issues considered here, i.e. the changes in the technology of ceramic production, do not require a more precise chronological framework; it is sufficient to propose the general synchronisation of Neolithic cultural phenomena in the areas located north (Małopolska), south (the Great Hungarian Plain) or east (Moldova) of the Carpathians. The analysed assemblages of ceramics have been dated to the long period from the mid-6th millennium to the early 4th millennium BC. They represent several stages in the development of Neolithic pottery in Central and Eastern Europe (*fig. 2*). The proposed chronological schema is based on the findings of researchers who specialise in Neolithic chronology of particular regions (e.g. *Kulczycka-Leciejewiczowa 1979*; *Kadrow 1990*; *2006*; *Kadrow – Zakościelna 2000*; *Pavúk 1980*; *2005*; *Czekaj-Zastawny 2008*; *Dębiec 2015* – Małopolska; *Kalicz – Makkay 1977*; *Kalicz – Raczky 1987*; *Šiška 1989*; *1995*; *Astalos et al. 2013* – the northern part of the Great Hungarian Plain; *Larina 1999*; *2009*; *Dębiec 2012*; *Dębiec – Saile 2015*; *Saile et al. 2016* – Moldova and Ukraine).

The cultural evolution and cultural change around the Carpathians in the Neolithic

The LBK spread to Małopolska and the Western Volhynian Upland in Ukraine in its pre-music-note (I) phase (the Bíňa and the Milanovce phases in south-western Slovakia; cf. *Pavúk 2004*; *Kulczycka-Leciejewiczowa 1983*; *Czekaj-Zastawny 2008*, 16–18; *Dębiec 2015*). The earliest LBK groups migrated to south-eastern Poland from south-western Slovakia and Moravia through the Moravian Gate. There are nearly 30 sites representing the older LBK phase in Małopolska (*Kozłowski et al. 2014*, 39).

In the music-note phase (II), the LBK population gradually increased, reaching its peak in the Želiezovce phase (III). During the LBK evolution, the inner rhythm of cultural change was the same throughout almost the whole of Małopolska and in south-western Slovakia. The course of its development ran differently, however, in the Dniester basin (Ukraine and Moldova) and in the areas on the Prut and the Seret rivers (Moldova), where assemblages from the music-note (II) phase have been the only LBK pottery recorded and where no ceramic materials representing the Želiezovce phase (III) have been found to date. It is difficult to determine, therefore, whether LBK settlement lasted there solely to the end of phase II (e.g. *Larina 1999*) or longer, to the end of phase III, but without adapting the Želiezovce style used in the ornamentation of ceramics in south-western Slovakia, although the influences may have come through Małopolska (e.g. *Kozłowski 1981*; *Dębiec 2012*).

Some archaeologists argue that there was no cultural or settlement continuation of the LBK in the MC. They believe that contacts between Małopolska and the borderland between east Slovakia and north-eastern Hungary ceased abruptly with the end of the LBK and the Bükk culture (*Kozłowski et al. 2014*, 41). Post-Linear settlers, i.e. Malice communities, came presumably from the Carpathian Basin across the mountains (*Kaczanowska 1990*; *Kamieńska – Kozłowski 1990*; *Kozłowski 2004*, 11).

Other researchers question that explanation. They prefer the model of a gradual but profound process of change within the LBK community in its late (III) phase (*Kulczycka-Leciejewiczowa 2004*, 21). The change, they maintain, brought about the transformation of the LBK into the MC (*Kadrow 2005*, 26–27).

The origin of the L-VC remains unclear. The culture was still Neolithic in its oldest phase and then it developed into a fully Eneolithic unit under the Polgár influence (*Zakościelna 2010*, 218–233). Some researchers point to its local character and to its relationship with the MC (*Kadrow – Zakościelna 2000*, 245–249). Others emphasise the forming impact of the communities inhabiting the Carpathian Basin (e.g. *Kozłowski 1989*, 192–195).

The ALPC originated and evolved initially in the middle and upper Tisza basin. It resulted from the expansion of the Starčevo-Criş culture to the area. The Méhtelek and the Szatmar groups functioned as transitional units between the Starčevo-Criş culture and the developed ALPC (*Kozłowski et al. 2014*, 42–43).

From the outset, ALPC ceramics showed regional differentiation and thus diverging from the relatively uniform ceramics of the LBK. Both cultural complexes differed considerably in their settlement patterns and dwelling constructions.

The Tisza culture (TC) in its earliest phase developed on the basis of late ALPC groups (*Kalicz – Raczky 1987*, 30). Its formation in the borderland between Hungary, Romania and Carpathian Ruthenia was accompanied by the development of similar cultural units, e.g. the Iclod group. Romanian researchers argue that the Starčevo-Criş culture lasted for a long period in that area, being partly contemporaneous with the ALPC (cf. *Astalos et al. 2013*).

The methods of analysing the samples

Nearly 500 samples of ceramics and clay ascribed to the LBK (the earlier Neolithic), the MC (the later Neolithic) and the L-VC (early Eneolithic) from Małopolska, including imports and imitations of the ALPC, have been collected in recent years. The technological analysis of the ceramics from south-eastern Poland, the northern Carpathian Basin and the areas east of the Carpathians has centred on the mineralogical and petrographic composition and component quantity ratios.

Thin sections taken from the ceramic fragments have been examined with a Nikon Eclipse LV100N POL polarized light microscope. Next, quantitative petrographic analysis (point counting; see *Quinn 2013* with references within) was used to determine the percentage of individual components: clay minerals, quartz, alkali feldspars, plagioclases, muscovite, biotite, carbonates, grains of sedimentary, igneous or metamorphic rocks, grog fragments and organic material (*tab. 2*). The research also involved the schematic petrographic description of individual thin sections.

lp.	site	clay minerals	grains < 0,02 mm	quartz (>0,02 mm)	flint/chalcedony	K-feldspars	plagioclases	fragments of sedimentary rocks	fragments of igneous rocks	fragments of metamorphic rocks	muscovite	biotite	opaque minerals	iron oxides and hydroxides	grog	clasts of unmixed clay	organic fragments	voids	carbonates	amphiboles	others
7	Rozbórz	53.8	8.9	23.4	0.9	4.5	0.3		0.3	0.1	1.5	0	0.3	1.5		2.7		1.8			
8	Rozbórz	48.6	15.4	7.7	0	1.9	0				11.2	0.1	0.4	4.6	0.1		0.8	7.3			1.9
9	Rozbórz	56	17.8	7.4	0	1.4					6.9	1.1	0.3	2.6				6.5			
10	Rozbórz	49.4	22.1	21.3	0.1	2.6	0.1				1.8	0.3	0	0				2.3			
11	Rozbórz	66.8	18.9	3.4		0.6					2.7	0.3	0.6	4				2.7			
12	Rozbórz	55.2	14.8	15.6	0.4	2.3					3.1		3.9	3.5		1.2		0			
13	Rozbórz	56.5	7.3	21.1	0.1	5.8	0.1			0.9	0.9		0	1.8		2.9		2.6			
14	Rozbórz	43.4	19.9	11.6		3.7	0.4				9.7	7.9	1.5	0		0.4		1.5			
15	Rozbórz	59.6	7.8	3.4	0.1	0.6					0.6		0	3.4	8.9	6.7		8.9			
16	Rozbórz	53	20	8.4	1.8	1.1					1.1		0	0.4		5.4	2.6	6.2			
41	Zagórze	62.7	9.4	6.7		0.6					0.9		1.5	1.8		2.6	5.9	7.6			0.3
42	Zagórze	57	12	9.5		1.4		0.8			3.3					1.1	9.6	5			0.3
43	Zagórze	51.9	7	30.5		0.8								2.9		0.5	0.5	5.3			0.6
44	Zagórze	55.6	11	10.2							1.9			0.3		2.8	6.6	11			0.6
45	Rozbórz	54.7	17.3	14.5	0.3	1.9		0.1			2.2		1.4	3.1		0.6	1.1	2.8			
46	Rozbórz	70.1	14.8	3.7		0					6.4	1.3	0.3	0.7		0.7	0.3	1.7			
47	Rozbórz	65	14.1	9.9	0.1	1.7					1.4		1.9	1.7		0.9	0	3.3			
48	Rozbórz	51.8	14	20.8	0.1	8.4				0.5	0.8		0	0.8		0	0.3	2.5			
49	Rozbórz	39	35	11		1.2					4.5	1.8	0.6	0.3		4.2	0.3	0.9			1.2
50	Rozbórz	55.6	5.3	17.3		3.6			0.8		0.3		0.3	0.6		0	8.9	7.3			
51	Rozbórz	52.8	12.3	18.8	0.1	2.7				0.3	2.1	0.3	0.6	2.4		5.2	0	2.4			
52	Rozbórz	54.1	3.5	11.2		1.9					0.3		0	4.5		16.8	2.1	5.6			
53	Rozbórz	53.9	23.3	8.9		2.9	0.3				6.9	0.3	0	0.3		0.6	0.3	2.3			
54	Rozbórz	58.6	10.5	2.8		0.7			0.3	0.7	2.8		0.3	0.7	14.6	1.4	0.3	6.3			
55	Rozbórz	60	10.8	10.4		4.1				0.2	3.2	0.5	2.8	5.1	0	1.4	0.5	1			
56	Rozbórz	51.6	19	12.6	0.1	4.7					2.6	1	0	1.6	0	3.1	0.8	2.9			
57	Rozbórz	62.4	6.3	1.7		0.8					0.8		0	0.4	14.2	0.4		13			
58	Rozbórz	56	14.5	11		8	0.1			0.1	2.1		0.9	0.7		5.1	0.1	1.4			
59	Rozbórz	54.1	7.6	3.9		1.5					0.6		0.9	10.3	12.7	4.5		3.9			
60	Świerszczów	57.6	2.3	7.3		0.6									9.9	5.5	0	16.6			0.2
61	Świerszczów	56.4	6.2	5.7										3.5	9.5	11.7		7			
62	Świerszczów	41.6	22.7	17.2	0.1	3.4					0.3		1.5		5.8	4	0	1.8		0.1	1.5
63	Świerszczów	57.1	14.2	3.2		0.3							0.8	0.3	21.7	0.3	0.3	1.8			
64	Świerszczów	56.2	4	13		3.7								0.5	5.8	2.7	0	13.5		0.1	0.5
65	Świerszczów	55.3	10.1	8.8		0.5					0.3		1	0.5	15.5	1.8	1.3	4.8			0.1
66	Świerszczów	61.3	4.7	11		0.4								0.6	11.9	1.8	0.3	7.7			0.3
67	Świerszczów	42.5	18.9	11.3		1.8							0.9	0.6	12.8	0.9	1.2	8.5			0.6
68	Świerszczów	45.6	5.3	16.2		0.9							0.3	1.5	23.5	1.2	0	4.7			0.8
69	Świerszczów	50.5	5.3	9.6		0.9				0.7	0.2		0.5	0.7	14.2	4.8		12.5			0.1
70	Isaiia, jud.Iaşi	45	16.8	13.4	0.5	1.4			0.8	0.8	3.4	0.3	0	1.1	0	0.6	0.8	5.9	8.9		0.3
71	Isaiia, jud.Iaşi	61	23.1	3.8		1					2	0.5	0.5			1.4		3.8	2.4		0.5
72	Isaiia, jud.Iaşi	52.8	9.9	14.1		1.5		1			2.2	0.6			1.6	0.6	1.9	9.9	3.5		0.4
73	Isaiia, jud.Iaşi	60.3	12.2	5.4		1.5					1.8		0.3	2.7		1.2	4.2	9.2	0.9		0.3
74	Isaiia, jud.Iaşi	66.7	10.6	5		3.1					1.4		1.4	1			2		8.6		0.2
75	Olteni, jud. Covasna	46.5	7.9	4.2		2.5	0.3	2.3			1.1		2.3	3.1	0	15.5	4.5	9.6		0.2	
76	Olteni, jud. Covasna	55.7	14	9.7		1.7	0.3		2.3		0.6	0.3	0.3	0.6	0	0.9	4.3	7.7		0.9	0.7
77	Olteni, jud. Covasna	54.7	20	3.3		1.8			1.4		6.9	2.9	0.4	1.8		4.7	0	1.4			0.7
78	Olteni, jud. Covasna	57.6	11.8	8.6		5		0.3			6.5	0.5	1	5.8		1.2	0	1.5			0.2
79	Mihoveni, jud. Suceava	68.7	10.3	12.8		3.5					0.6		1.3	0.3		2.2		0.3			
80	Mihoveni, jud. Suceava	53.7	16.3	9		2.9				0.3	3.4		0.6	0.6		0.6	4.6	8			
81	Preuteşti-Ciritei, jud. Suceava	70.5	2.3	13.3		4.9		0.6				0.3	1	3.9		0.6	0	2.3			0.3
82	Preuteşti-Ciritei, jud. Suceava	50.4	8	24.5		7.2		0.5		1.8	2.1		2.1	0.3		0.3	0	2.8			
83	Traian-Dealul Fântânilor, jud. Neamţ	52	7	7		3					2.5		0.6		12.6	8.2	1	4.6	0.2		1.3

84	Traian-Dealul Fântânilor, jud. Neamţ	81.1	6.5	3		1.2					2.4	0.3		2.7		0.3		0.6	1.5		0.4
85	Traian-Dealul Fântânilor, jud. Neamţ	58.2	16.1	6.9		4		1.2		0.3	3.5		0.6	2.9		1.4	1.7	2.9			0.3
86	Traian-Dealul Fântânilor, jud. Neamţ	52.6	10.5	13.2		9					0.9	0.6	1.5	0.3		0.6	1.8	8.4			0.6
87	Traian-Dealul Fântânilor, jud. Neamţ	59.9	20	7.1	0.3		3.8				3.2		1.3	1.9		1.3		0.3			0.9
88	Târpeşti, jud. Neamţ	55.3	14	13.5		4.3			0.3	0.6	1.2		1.2	0.9			3.5	2.6			2.6
89	Târpeşti, jud. Neamţ	39.2	19.1	13.6	0.3	3.7				0.3	1.9	1.1	0.8	1.3		1.6		1.3	14.4		1.4
90	Târpeşti, jud. Neamţ	60.7	14.3	7.5		2.2					1.6			1.2		3.1		1.9	6.5		1
91	Târpeşti, jud. Neamţ	79.4	8.7	2.8		1.4					0.9		0.9	1.8		2.3	0.9	0.9			
92	Târpeşti, jud. Neamţ	60.4	20.2	3.8		2.2					1.6		0.6	2.2			1	1.6	5.8		0.6
93	Tăşnad-Sere	44.4	14.4	17.9		7.4					1.4		0.2	2.9	0	4.5	0.5	5		0.1	1.3
94	Tăşnad-Sere	54.7	14.2	11.7		3.7					0.6	0.3		0.3			3.1	7.7		0.6	3.1
95	Tăşnad-Sere	46.3	20.7	12.7	0.1	5.5			0.3	3.2	0.9		0.3	1.7		0.9	1.2	5.5		0.1	0.6
96	Tăşnad-Sere	39.9	17.5	20.6	0.3	4.2	0.8	0.3		1.1			0.8	2.1		2.6	0.8	7.7		0.5	0.8
97	Tăşnad-Sere	52.3	15.6	16.2		4.5					0.3	0.3		1.6		3.9	0	3.6		0.1	1.6
98	Călineşti-Oaş	56.5	11.9	6.6		2.2	0.3		5.5	0.1	0.8	0.3	0.3	2.8		4.7	2.8	4.2		0.3	0.7
99	Călineşti-Oaş	51	13.2	11.2		1.4			6.3		0.3			5.7		1.1	0.3	8.9			0.6
100	Călineşti-Oaş	38.6	12.6	7.2	0.3	2.6	0.5		29		0.3		0.8	1		2.3		3.9			0.9
101	Călineşti-Oaş	54	11.2	10.9		3.4			5.6		0.6		0.6	5.3		2.8	0.6	4.7			0.3
102	Călineşti-Oaş	50.6	19.4	9.4		2.8	0.3		2.8		0.8		0.6	5.8		1.7	0.8	3		0.3	1.7
104	Homorodul	47.5	9.5	19.4	0.1	6.2				2.1	0.5		0.2	3.1		4.3	2.6	3.8		0.1	0.6
105	Homorodul	49.2	8.6	19.4		6.7		0.2		0.7	0.5		0.2	1		0.5	3.4	7.2		0.5	1.9
106	Homorodul	39.2	19.7	12.9		4.4					3.8	1.1	0.3	3.3		1.6	2.7	8.2		1.4	1.4
107	Homorodul	58.7	7	12.5		3				3	0.3	0.3	5.2	1.6			1.4	6.3		0.3	0.4
108	Halmeu-Vamă	51.4	14.7	4.7		1.4	0.1				2.5		0.5	1.6	6.3	2.9	2.9	9.9	1.1		
109	Halmeu-Vamă	47.8	14	13.3		3.5					2.9	0.6	0.9	2.9		0.6	4.3	8.4		0.2	0.6
110	Halmeu-Vamă	53.4	16.1	9		2.4					4.2			1.2			10.7	2.7			0.3
112	Halmeu-Vamă	51.2	13	8.5		3.6					5.4	0.8	0.5	0.3			13.4	2.8			0.5
113	Halmeu-Vamă	46.5	25.6	10		3.2				0.1	5.7	0.2	0.2	1		3		4.2		0.1	0.2
114	Halmeu-Vamă	41.4	26.2	17.5		4				0.5	3.9	2.6		1				2.1			0.8
115	Halmeu-Vamă	58	14.4	6.5		0.8					0.8		0.4	0.8	12.5	2.3		2.7		0.8	
116	Halmeu-Vamă	53.6	19	4.7		3.1					1.7	0.3		1	3.7	1.7		11.2	0		
117	Halmeu-Vamă	48	18.1	8		1.8	0.1				2.2		0.3	1.5	9.2	3.4		7.1			0.3
119	Pişcolt-Lutărie	38	16.8	15.1		5					7	0.2	2.2	1.7			10.1	2.7			1.2
120	Pişcolt-Lutărie	55.9	7.8	5.2		2.6					2.6			0.7		0.7	14.6	9.3	0.3		0.3
121	Pişcolt-Lutărie	50	15.3	0.9		1.5					3.9	0.9	0.9	2.7			10.6	12.4		0.3	0.6
122	Pişcolt-Lutărie	46	24	6.1		0.9					5.5	0.3	0.9	2.8			6.7	6.1		0.1	0.6
123	Pişcolt-Lutărie	51.3	17	11.1	0.2	1.7		0.5			2	0.2		0.2	10.6		1	3.7			0.5
124	Pişcolt-Lutărie	56.6	6.9	8		5.2	0.3	0.8			1.1		0.6				9.9	5	5		0.6
125	Pişcolt-Lutărie	49.7	12	3.4		1					1	0.1				1.5	17.6	12	0.1	0.1	1.5
126	Pişcolt-Lutărie	47.7	18.4	11.3	0.3	1.3				0.3	0.5		0.3			0.5	9.7	8.7		0.1	0.9
127	Pişcolt-Lutărie	57.1	8.2	4.5		0.9			0.2		1.1		0.7	0.5		0.2	8.2	15.6	2.5	0.1	0.2
128	Pişcolt-Lutărie	45.3	8.2	7.2		1.6					1.3		0.6	0.6	28.2	1.6	2.2	2.5		0.1	0.6
129	Pişcolt-Lutărie	54.1	5.7	8.1	0.3	0.5					1.9		0.3	1.1			13.5	14.1		0.1	0.3
130	Pişcolt-Lutărie	61.2	8.5	5.5		1.5		1.5			1.8		0.3	0.6			9.4	9.4			0.3
131	Pişcolt-Lutărie	52.7	11.9	9.1		0.5					4.1	0.5	0.3	0.5		0.8	10.6	7.3	1.3		0.4
132	Pişcolt-Lutărie	63	3	7.6	0.1	0.9				0.3	0.9					2.1	11.8	10.3			
134	Pişcolt-Lutărie	47.2	12.7	10.7		0.6				0.1	3.1			0.6			16.3	7.9		0.1	0.7
135	Pişcolt-Lutărie	51.7	13.8	9.8	0.1	6.7					0.8		0.8	0.3			8.4	7.6			
136	Pişcolt-Lutărie	49	13	7.8		1.3					1.9					3.5	13.7	9.4		0.1	0.3
137	Pişcolt-Lutărie	58.5	9	8.5	0.3	2.8	0.1				0.8		0.6	0.8		0.3	14.7	3.4			0.2
138	Căpleni-Drumul	47	7.7	6.4		0.6					0.6			0.3	15.4	11.3	0.1	10.3	0.3		
139	Căpleni-Drumul	61.5	7.7	4.4		1.5					0.5		0.3	0.5	12.9	1.3	0.5	8.8		0.1	
140	Căpleni-Drumul	47.1	6.8	7		1.6					0.3			0.8	2.7	4.9	21	7.1		0.3	0.4
141	Căpleni-Drumul	67	7.1	7.7		0.3					0.3		1.3			7.1	5.7	3.4		0.1	
142	Căpleni-Drumul	65.3	0.7	2.4							0.3		0.3			5.9	16.4	8.7			
143	Chişcăreni XIV	61.6	10.8	5.6	0.3	0.9										1.5	1.5	7.7	10.1		
144	Chişcăreni XIV	60.7	10.7	12.3		2.1					3.8	0.8	0.5	0.3				0.5	7.2		1.1
145	Bumbăta	54.5	20.7	13.1		1.8	0.5			0.1	1.3	0.3	0.5	0.5		1	1.8	3.9			
146	Bumbăta	64.4	11.5	11.8		2.6					2.3		0.3	1.3			0.3	0.3	4.9		0.3
147	Găureni	68.7	8.5	9.5		1.7					0.7			1		1.4	2.4	4.4	1.7		
148	Găureni	65.9	5.2	3.7							1.2		0.9	0.3		19.1		2.5	0.9		0.3

Tab. 2. Mineral and petrographic composition of the samples. Value in percentage.

Granulometric analysis measuring the grain diameter of crystal grains and clay clasts (*Quinn 2013*) were made for microscopic images of the thin sections. The length of section grains (500–1000 grains) in the picture was calculated using script in the MATLAB R2007b software applied to automatic image analysis. The calculation was made within the following ranges: 0.002–0.02 mm, 0.02–0.05 mm, 0.05–0.1 mm, 0.1–0.2 mm, 0.2–0.5 mm, 0.5–1 mm, 1–2 mm and ∅ > 2 mm. The analysis was based on the classification proposed by the Polish Society of Soil Science (Polskie Towarzystwo Gleboznawcze 2009). The samples were grouped according to hierarchical cluster analysis with the MATLAB R2007b software (cf. also *Kozłowski et al. 2014*, 55–60). Factor analysis (with the STATISTICA software) was additionally used for the same purpose. The examination started with mineralogical-petrographic composition and the following components was chosen for cluster and factor analysis: content of grains of silty fraction, quartz grains (>0.02 mm), clay clasts, grog, mica group minerals and organic material, presence of rounded grains, presence of angular fragments of rocks.

The raw materials

The analysed areas (*fig. 1*) are dominated by loess, particularly in the uplands, often settled by Danubian communities in the Neolithic. The loess soil covers Miocene sediments in many places, which is typical not only of Małopolska (Little Poland). Miocene and silty clays have often been identified as the raw material used in the production of ceramic vessels. Miocene clays are easy to identify, while the reverse is true of alluvial deposits, more varied in composition, usually combining such sediments as the substratum of river valleys (Miocene clay in this case), sediments cut by river valleys (loess soil) or detritus material flowing along with rivers (Jurassic material in this case).The alluvial sediments are mostly dominated by silty fraction of quartz and particles of flint, chalcedony and micrite (lime mud; cf. *Kozłowski et al. 2014*, 52–53).

Miocene heavy marine clay, with characteristic relics of plankton, volcanic glass and glauconite, seems to have been commonly used in pottery production. Other kinds of raw material include Holocene alluvial clay, containing grains of crushed flint and fragments of Carpathian flysch rocks, and – in fine ceramics – loess-like sediment. Moreover, calcium carbonate and calcium phosphate rich sediments have been recorded in some cases, e.g. in LBK pottery deposited in caves (cf. *Czekaj-Zastawny et al. 2017*, fig. 5).

All those types of raw material were altered while being prepared for the production of ceramics. The original composition changed in the course of storing, mixing and kneading the clay, which may now complicate the identification of the raw material used in the production (cf. *Czekaj-Zastawny et al. 2017*).

In the northern part of the Great Hungarian Plain, two kinds of clay can be distinguished. The first one, characteristic of the Zemplín area, is very silty with fine material, a significant content of muscovite and grains of feldspars. The second kind, typical of the Šariš region, has a lower content of quartz and muscovite, and its grains are coarser in size (*Kozłowski et al. 2014*; *Czekaj-Zastawny et al. 2017*). This division corresponds with two types of ceramic paste.

The technological types of ceramics of the LBK, the MC and the L-VC in Małopolska

The analysis made previously has identified the basic technological and mineralogical types of the LBK ceramics in south-eastern Poland. The first and second technological type, recorded in fine ornamented ceramics, is characterized by well sorted and mixed clay, sometimes containing an organic admixture. The third and fourth types are characteristic of cooking and storage ceramics. Cooking ceramics, medium-walled, were made of silty or heavy clay with sand and an organic admixture, while storage ceramics were made of poorly mixed heterogeneous clay with an admixture of organic material, sometimes with grog (cf. *Rauba-Bukowska et al. 2007*).

The MC ceramics from Rozbórz 42 in eastern Małopolska are usually made of well prepared homogenous mass with no mineral intentional admixture. Makers of coarse pottery tended to use ceramic paste with grog temper (*Kadrow – Rauba-Bukowska 2016*).

The MC ceramics from Targowisko 10–11 in western Małopolska are made of various raw materials, usually of clay with grains of sedimentary rock from Carpathian flysch (*Rauba-Bukowska 2014b*; *Kadrow – Rauba-Bukowska 2016*).

There are slight differences between the MC ceramics recovered from those two sites. At Targowisko 10–11, the way of clay preparing based on ceramic mass with grog and sand temper predominates. At Rozbórz 42, well-sorted clay is frequent, though grog temper was used in the production of coarse pottery. There is no intentional mineral admixture (*Kadrow – Rauba-Bukowska 2016*, fig. 4).

Two types of ceramic fabric used in the production of the L-VC ceramics have been identified at Świerszczów 3 in eastern Małopolska (*fig. 1: 7*). The first, more common, type is characterized by the use of heavy clay (very small content of silty fraction) in which numerous rounded quartz and feldspars grains are visible; the mass also contains grog fragments and intraclasts of unmixed clay. That type of mass has many planar voids and cracks, probably because the vessels were shaped out of too wet heavy clay. The second type of the ceramic paste in the L-VC pottery is silty clay with grog temper.

Similar results have been obtained in the technological analysis of ceramics from Modlnica 5 in western Małopolska, dated to the same period (*fig. 1: 1*; cf. *Rauba-Bukowska 2011*, 568–573, pl. XXIII–XXXI).

The petrographic groups of ceramics in the northern part of the Great Hungarian Plain

The ceramics produced in the late phase of the Stračevo-Criş culture can be divided into coarse and fine varieties. The coarse vessels (e.g. sample no 104, cf. *tab. 2*) are made of clay with an admixture of sandy fraction, while the fine items (e.g. samples no 102; cf. *tab. 2*) are shaped out of fine-grained clay, sometimes with an admixture of bigger grains of volcanic rock. The analysis has shown that the raw material was prepared in the same way. The paste consisted of fine-grained clay with numerous coarser grains of minerals, mostly quartz and feldspars, sometimes flint, and fragments of volcanic or metamorphic rock, with

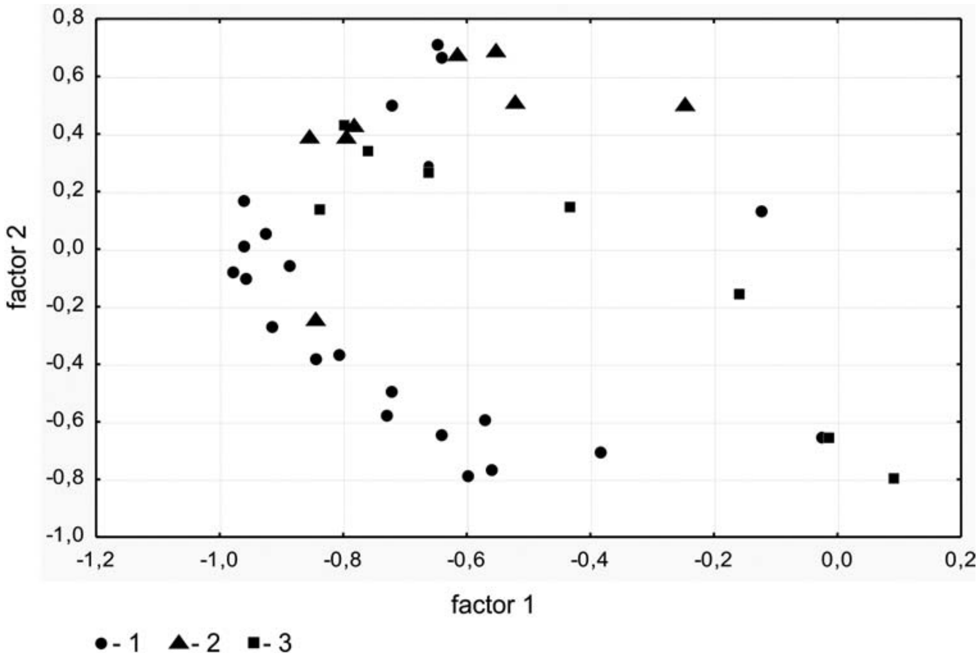

Fig. 3. Factor analysis of LBK pottery features from Kraków – Nowa Huta – Mogiła 62; 1 – pre-music note phase (I); 2 – music note phase (II), 3 – Želiezovce phase (III).

an organic admixture and with no grog temper. The samples differ slightly in their content of specific minerals and rocks.

The ceramics from Tăşnad (*fig. 1: 14*) are made of fine-grained silty clay with a significant amount of coarse clastic material. The analysed samples contain quartz, feldspars (c. 0.5 mm) and fragments of metamorphic rock (c. 0.1–0.2 mm).

The mass of clay in the ceramics from Călineşti (*fig. 1: 17*) is fine-grained, too, though it has a lower content of coarse clastic material. The analysis of the samples has also identified quite numerous fragments of volcanic rock, quartz and feldspars.

The ceramics from Homorodul (*fig. 1: 15*) are made of fine-grained clay with a significant amount of non-plastic inclusions. The analysis has recorded angular grains of feldspars, quartz, polycrystalline quartz, flint, fragments of metamorphic rock, fine grains of amphiboles and sometimes rutile (c. 0.1 mm).

The pottery produced by the Tiszadob-Kapušany group of the middle ALPC is characterized by fine-grained ceramic paste with a small organic admixture. Its mineralogical composition includes fragments of metamorphic rock – micaschists (*Rauba-Bukowska 2014a*).

The ceramic mass used by the Bükk culture, an element of the younger ALPC, is distinctly fine-grained, pure and very dense. Characteristic elements are difficult to find in that silty type of clay, but the fine-grained mass contains small grains of feldspars, mica flakes and heavy minerals (*Rauba-Bukowska 2014a*).

The content of clay minerals in the material used in the production of ceramics by the Tiszadob-Kapušany and the Bükk cultures ranges between 35 % and 72 %; that of quartz –

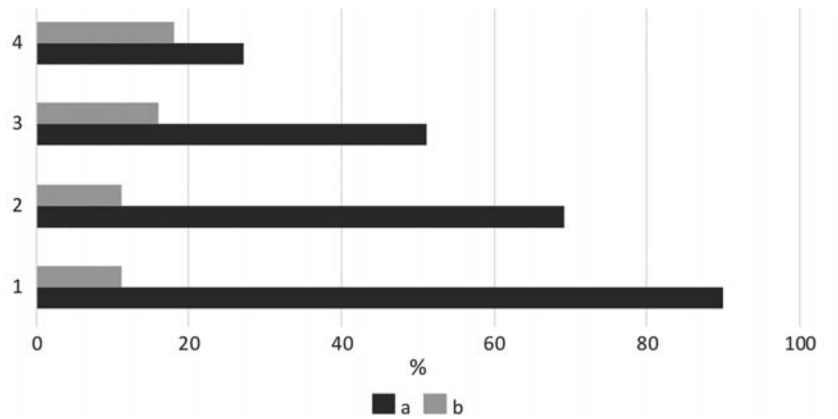

Fig. 4. Frequency plot of grog (chamotte) and organic admixture in LBK and ALPC pottery; a – organic admixture, b – grog (chamotte) admixture; 1 – LBK, phase I; 2 – LBK, phase II; 3 – LBK, phase III; 4 – ALPC.

between 18 % and 48 %. The entire ceramics are made of fine-grained and well sorted mass of clay with no admixture of coarser non-plastic inclusions; organic material is very rare. A number of the vessels are made of silty clay with a small content of feldspars; some are enriched with muscovite (*Czekaj-Zastawny – Rauba-Bukowska 2014*; *Czekaj-Zastawny et al. 2017*).

The Pişcolt group of the ALPC (*fig. 1: 12, 13, 16*) used two types of ceramic fabric, with the first type additionally divided into two subtypes. The mass in subtype 1a is fine-grained, with a small amount of quartz pellet and with numerous particles of an organic admixture. The mass in subtype 1b has a considerable amount of quartz pellet with a large organic admixture. The second type of the mass contains grog temper and usually no organic fragments.

The ceramics produced by the post-ALPC Iclod group are made of homogeneous fine-grained silty clay with grog temper. The mass contains no organic fragments, which makes the Iclod ceramics different from the previously described vessels produced by the Pişcolt group.

Concluding remarks

Through the conducted research we managed to achieve several goals assumed in the introduction of this article. The reconstruction of the rules governing the selection of ceramic raw material and considering certain technological aspects of the production of ceramic vessels in LBK and younger Danubian cultures allowed us to formulate some conclusion about the development of Neolithic communities in the south-eastern part of Poland and east of Carpathians.

a) The evolution of the LBK ceramics

The unpublished petrographic analysis of pottery from Site 62 in Nowa Huta-Mogiła, which has been dated to every phase of the LBK (*figs. 1* and *2*), identified the basic trends in the evolution in clay preparation (*figs. 3* and *4*).

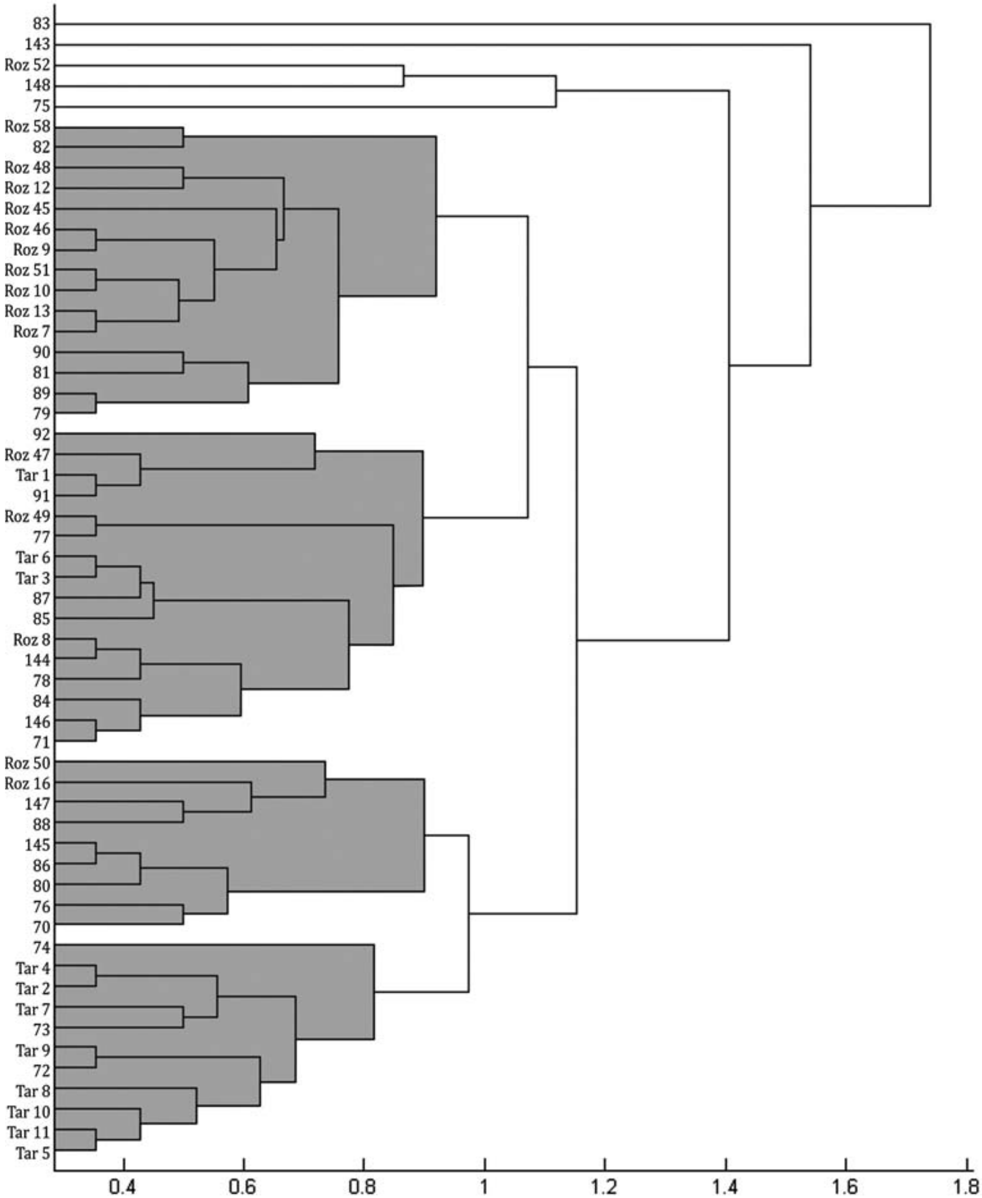

Fig. 5. Cluster hierarchical analysis of LBK pottery samples from Targowisko 10–11, Rozbórz 42 and from sites in Moldova (Romania and Republic of Moldova) in the form of dendrograms.

The content of organic material in the ceramic fabric used by the LBK changed with time and depended on the type of pottery. It has been recorded in 90 % of the analysed ceramic fragments dating from phase I (e.g. at Site 2 in Zagórze; *fig. 1: 3*); in 53 % of fine pottery and 97 % of coarse pottery in the classic phase (II); in 37 % of fine pottery and 75 %

of coarse pottery in the late phase (III). In the younger (III) phase of the LBK, the content of silty raw material increased in comparison to phases I and II. Statistically, the ceramics from the younger (III) phase of the LBK became similar to the ALPC ceramics (*fig. 4*; cf. *Czekaj-Zastawny et al. 2017*).

The ceramic material from other multi-stage sites in Małopolska (*fig. 1: 2–6*), as well as from eastern Romania (*fig. 1: 18–20, 24–26*) and from Moldova (*fig. 1: 21–23*) confirms the developmental trend in the clay preparation of the LBK ceramics reconstructed in the analysis of the material from Nowa Huta-Mogiła 62 (*fig. 1: 2*).

b) The influence of the ALPC on the evolution of the LBK pottery in Małopolska

One determinant of the technological changes in the LBK ceramics in Małopolska, especially in its late phase, was the adaptation of Transcarpathian influences of the ALPC in the LBK environment in Małopolska (cf. *Kaczanowska – Godłowska 2009*; *Kozłowski et al. 2014*; *Czekaj-Zastawny et al. 2017*).

The analysis of the ceramics from Site 17 in Brzezie has helped to distinguish imported vessels from the ALPC area from vessels which were produced locally, but which imitated the southern patterns (*Rauba-Bukowska 2014a*; *Czekaj-Zastawny – Rauba-Bukowska 2014*).

Those two kinds of ceramics differ primarily in the type of raw material used in their production, although both groups are made of silty clay. In the imported pottery, the average content of quartz amounts to 33 %, while the content of clay minerals is 51 %. Similarly, the pottery recovered from Brzezie 17 has the average content of quartz equalling 26 % and the average content of clay minerals equalling 67 %. The most striking difference, however, consists in the content of muscovite and feldspars. In the imported ceramics, the content of muscovite is 3.8 %, and that of feldspars is 4 %, while the imitations and the locally produced pottery have the contents amounting to 0.8 % and 0.4 %, respectively. The quantity of organic material in both kinds of ceramics is similarly very low. However, the locally produced pottery more often includes organic temper, destroyed to a greater or lesser extent (*Czekaj-Zastawny – Rauba-Bukowska 2014*; *Czekaj-Zastawny et al. 2017*).

The development of the LBK, phases I to III, was marked by the following trends: (1) the increasing use of silty clay; (2) the decreasing use of organic material as an admixture; (3) the use of grog in the mass of clay toward the end of the LBK evolution. The evolutionary changes in the LBK ceramics resulted mostly from intensifying contacts with the ALPC.

c) The technology of the LBK ceramics east of the Carpathians

The LBK ceramics from eastern Romania and Moldova differ considerably from the ceramics of the late Starčevo-Criş culture, of the Pişcolt group within the ALPC and of the post-Linear Iclod group in north-western Romania. Moreover, the vessels show no clear relationships with the post-Linear cultural units in Małopolska (the MC and the L-VC). However, the technology of the pottery is reminiscent of the LBK ceramic assemblages from Targowisko 10–11 (phases I and II; cf. *Rauba-Bukowska 2014b*) and Rozbórz 42 (phase III).

The LBK ceramic assemblages from Małopolska (*fig. 1: 5, 6*), eastern Romania and Moldavia (*fig. 1: 18–26*) have been subjected to hierarchical cluster analysis (*fig.* 5) with the MatLab programme. Eight traits have been examined: the content of silty fraction, coarser clastic material, clay clasts and micaceous minerals (muscovite, biotite) and also – as intentional admixture, presence of rounded grains, presence of larger angular fragments of rocks and presence of grog. This qualities describe both: the choice of appropriate raw material and admixture which has been used to the clay. The quantities of the minerals have been ascribed to four categories: 1) absence; 2) small amount; 3) average amount; 4) large amount. The resulting dendrogram (*fig. 5*) illustrates close affinity of the discussed ceramic assemblages.

The dendrogram corroborates the widely accepted thesis that eastern Romania, Moldova and the adjacent parts of Ukraine (the Dniester basin) were settled by the LBK population from Małopolska at the beginning of phase II (cf. *Kozłowski 1985*; *Larina 1999*; *Dębiec 2012*, etc.). The ceramics from the eastern areas show no stylistic features of the Želiezovce phase (III). Consequently, some researchers (e.g. *Larina 1999*) conclude that LBK settlement in the Seret, the Prut and the Dniester basins was limited to phase II of the LBK. Since those areas have provided no ceramics whose technology would be related closely to phase II of the Małopolska LBK, the culture seems to have lasted much longer, even though no traces of the Želiezovce style have been recorded (*Kozłowski 1985*; *Dębiec 2012*).

d) The culture change at the turn of the LBK and the MC in Małopolska

The cultural change at the turn of the LBK and the MC has already been discussed elsewhere in the context of the developmental trends traced in the technology of ceramics (*Kadrow – Rauba-Bukowska 2016*). Two sites, Targowisko 10–11 in western Małopolska (*fig. 1: 5*) and Rozbórz 42 in eastern Małopolska (*fig. 1: 6*), have provided series of samples for comparison, with classic MC pottery recorded at both locations. Targowisko 10–11 was dominated by ceramics dated to the music-note phase (II) (cf. *Rauba-Bukowska 2014b*), while Rozbórz 42 mostly contained items from the Želiezovce phase (III) of the LBK.

The LBK ceramics from Rozbórz nad Targowisko differ considerably, which is due in part to their originating in various phases of the LBK evolution. The material from Targowisko 10–11 continues the older LBK traditions, as shown by the raw material used and the method of preparing the mass of clay. Potters at Targowisko 10–11 added an organic admixture to the mass and used unsorted clay with natural grains of various size. In Rozbórz 42, a well sorted mass was mostly used without an organic admixture, in the same way as in some ALPC traditions. Additionally, the ceramic mass of the LBK coarse pottery in Rozbórz 42 contained lumps of dry clay (*Kadrow – Rauba-Bukowska 2016*).

The LBK and MC ceramics from Rozbórz show essential similarities, especially as regards the raw material. Local potters mostly used well prepared homogenous mass of clay with no admixture. Certain differences can be observed in the coarse pottery. The mass of clay in the LBK items has no organic admixture, while the MC vessels are made of ceramic mass with grog temper.

The results of the technological analysis mentioned above confirm the hypothesis (based on other grounds; cf. *Kadrow 1990b*, 59–63; *Kadrow – Zakościelna 2000*, 241–244; *Kadrow 2006*) that the MC originated in eastern Małopolska, as proven by the technological similarity of the LBK and MC ceramics in Rozbórz 42. The new archaeological culture spread subsequently to the other areas of Małopolska from the eastern part of the region (*Kadrow – Rauba-Bukowska 2016*). Moreover, the similarity between the ceramics produced by the MC and by the late LBK is greater than the similarity between the products of the MC and those of the Iclod group, a post-ALPC cultural unit from the north-eastern Carpathian Basin.

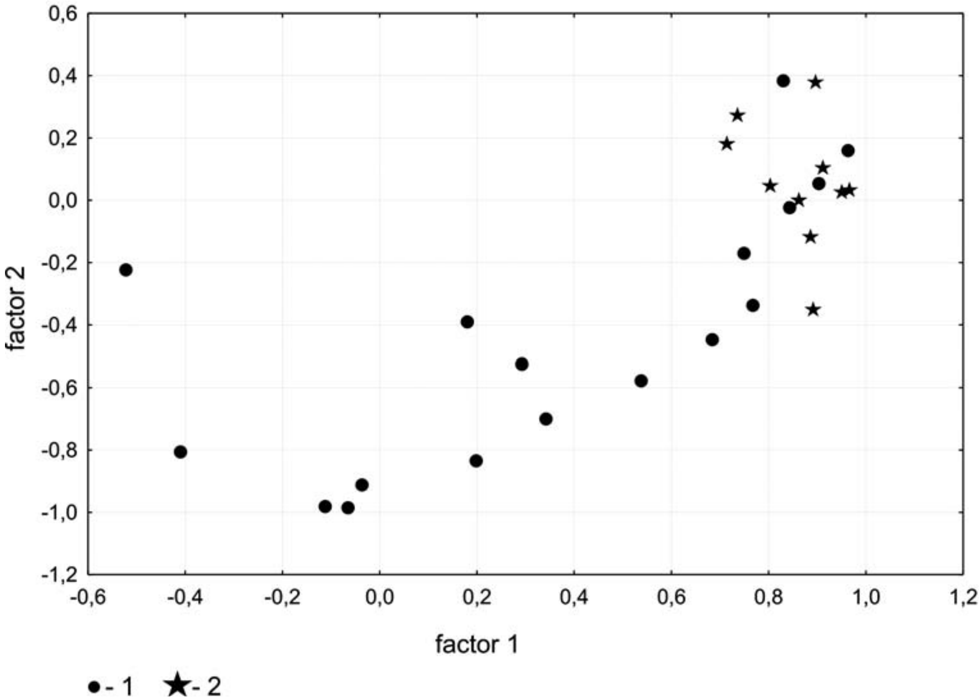

Fig. 6. Factor analysis of MC (Rozbórz 42) and L-VC (Świerszczów 3) pottery samples.

e) The culture change at the turn of the MC and the L-VC

Comparison of the MC ceramics with the L-VC ceramics (*fig. 6*) shows that the tendencies present already in the MC were continued and developed in the selection of the raw material and in the preparation of the mass of clay in the latter cultural unit. Changes in various elements of material culture, such as metallurgy, flint working or funeral rites, indicate that the population succumbed gradually to external influences. The influences, however, were mainly noticeable in the classic phase and they reached their highest point in the late phase of the L-VC. The early phase was dominated by local elements that continued the local MC traits, which points to the indigenous origin of the L-VC (*Kadrow 2016*, 30–33).

As it has been argued in the preceding sections of this paper, the tendency discernible at the turn of the MC and the L-VC may be considered as the culmination of a long process of change in the technology of ceramics in Małopolska from the early Neolithic to the early Eneolithic periods. The process was local in character, though it was also shaped by external factors, especially by the ALPC affecting the production of ceramics in the late phase (III) of the LBK in south-eastern Poland.

The change consisted in the gradually decreasing content of organic admixture, still discernible in some of the MC ceramics, and in the increasing content of grog (*fig. 7*), which was used sporadically in the late LBK and became the dominant temper in the L-VC. The technology of production was less and less frequently adjusted to particular categories of

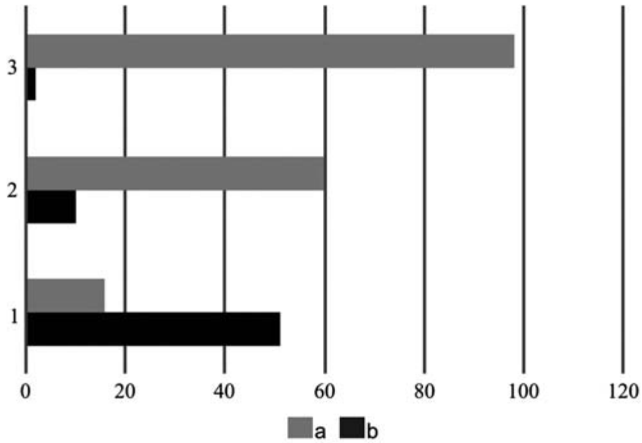

Fig. 7. Frequency plot of grog (chamotte) and organic admixture in LBK, MC and L-VC pottery in Małopolska; a – organic admixture, b – grog (chamotte) admixture; 1 – LBK, phase III; 2 – MC; 3 – L-VC.

vessels. The LBK still distinguished clearly the technological categories of serving vessels, cooking vessels and storage vessels, while in the MC, fine ceramics were technologically different from coarse ceramics. The L-VC, however, made no technological distinctions between the types of pottery which served different purposes.

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From sherds to potters: the contribution of techno-morphological approaches to understanding the British Neolithic

Od střepů k hrnčířům
Příspěvek techno-morfologického přístupu k chápání britského neolitu

Hélène Pioffet – Vincent Ard

The British Neolithic transition, occurring around 4000 BC, at least one millennium after the continental part of Northwest Europe, is still subject to important debate these days. Various studies suggest that the Neolithic start involved farming immigrants from various parts of the Continent. However, ceramics of the Early Neolithic of Britain became increasingly distinct from their Continental roots, particularly in the Southwest and Southeast of England. We recently completed two important projects, one on Early Neolithic British and Irish pottery and the other on Peterborough Ware, integrating a new way of considering these early productions through a technological approach and the observation of various steps of the chaîne opératoire. This paper is the opportunity to present preliminary results which shed a new light on the evolution of pottery wares during the fourth millennium BC in Southern Britain. It specifically highlights strong connections between Early Neolithic and Middle Neolithic pottery, in terms of style, but above in terms of manufacturing techniques.

Early Neolithic – Middle Neolithic – chaîne opératoire – pottery – manufacturing techniques – decorative grammar – British islands

Přechod k neolitu v Británii, který se odehrál kolem 4000 BC, nejméně o jedno tisíciletí později než v kontinentální části severozápadní Evropy, je v současnosti stále předmětem diskusí. Různé studie připouštějí myšlenku, že začátek neolitu byl spojený se zemědělci – imigranty z různých částí kontinentální Evropy. Keramika britského časného neolitu se nicméně s časem stále více odlišovala od svých kontinentálních kořenů, a to zejména na jihozápadě a jihovýchodě Anglie. V nedávné době se podařilo realizovat dva projekty, jeden zaměřený na časně neolitickou britskou a irskou keramiku, druhý zacílený na keramickou tradici Peterborough. Technologickým přístupem a studiem jednotlivých kroků (chaîne opératoire) oba projekty přispěly k novému pohledu na tyto časné tradice. Tento článek prezentuje předběžné výsledky, které vrhají nové světlo na vývoj keramických tradic v průběhu 4. tisíciletí BC v jižní Británii. Zdůrazňuje souvislost mezi časně neolitickou a středoneolitickou keramikou co do stylu a hlavně výrobních technik.

časný neolit – střední neolit – chaîne opératoire – keramika – výrobní techniky – výzdoba – Britské ostrovy

1. Introduction

From the beginning of the 4th millennium BC onwards, a shift in subsistence economy spread throughout Britain and Ireland. During the same period, on the Continent, the transition to Neolithic economy seems to be completed, approximately a millennium earlier, everywhere but in Northern Europe. The beginning of this millennium shows distinct transformations on miscellaneous aspects of culture such as the development of fortified enclosures (numerous in Northern France and Southern Belgium), the increase of trade, particularly through exploitation of flint mines, and above all an outburst of various cultural and material traditions. Nevertheless, the shift to the Neolithic is far more gradual in the Northern part of Europe with a very slow adoption of an agricultural economy by hunter-gatherers. The slow shift to the Neolithic economy in Britain is the very core of this paper, with help of a strong cultural landmark: pottery wares.

In previous research, stylistic studies were made on pottery productions, allowing confrontations with continental material that would help identifying contacts accounting for the transition. Yet this method rapidly reaches its limits when applied alone. Here, a new approach had to be found to highlight links or, on the contrary, breaches between continental and insular productions. This new approach integrated stylistic characters observations (carried out with an accurate analysis grid) as well as technical characters relying on a *chaîne opératoire* analysis. Indeed these analyses encompass the potters' knowledge and know-how, but can also reflect their social and cultural environment (*Roux – Courty 2007*; *Roux 2010*). The technical traits studied here can therefore be understood as the action of man on matter (*Lemonnier 1983*). This work questioned new elements of this major transition, particularly regarding cognitive movements and transfers from the continent to Britain.

Numerous discussions dealt with the fact that the beginning of the Neolithic could be divided into two phases: an *Earlier Neolithic*, spreading from c. 4000 cal BC to c. 3700 cal BC, and an *Early Neolithic* spreading from c. 3700 cal BC to c. 3300 cal BC (*Whittle 1977*). This Ph.D. project reassessed a division between two phases during which different situations are observed. During the first phase, the results obtained shed a new light on two wide areas appearing in the first centuries of the Neolithic (between c. 4000 and 3700/3650 cal BC), on the Atlantic façade and western Channel on the one hand, and on the North Sea façade and eastern Channel on the other hand. These areas showed that transition modalities were divergent from one area to the other. Later, pottery productions seem to find a regional basis, developing elaborate decorative patterns, probably used as a means of recognition. Interestingly, these productions seem to rely on the same stylistic codes that are used in the recognition process afterwards, highlighting the gradual emphasis on know-how transmission, through more and more significant exchange network. Hence one can legitimately wonder what the impacts of pottery are, in terms of cultural identity development.

The following presentation aims to give an insight into this second phase, taking the example of East Anglian and South East pottery (*fig. 1*). It is indeed from this second phase that the techno-morphological characteristics of pottery start to clearly be developed and make more sense in terms of an outburst of cultural identity.

2. East Anglian pottery: an insight in the Early Neolithic cultural identity

Relying on our research work, a regional synthesis combining and comparing these data can be suggested, although the similarities between pottery materials have already pointed out (*Garrow et al. 2006*). In both cases, pits revealed successive fills containing archaeological material. The point in selecting these two sites is all the more interesting as they are very much alike in type and the material represented is more or less the same. The archaeological contexts are identical as the material comes from fills of clustered pits. On both sites,

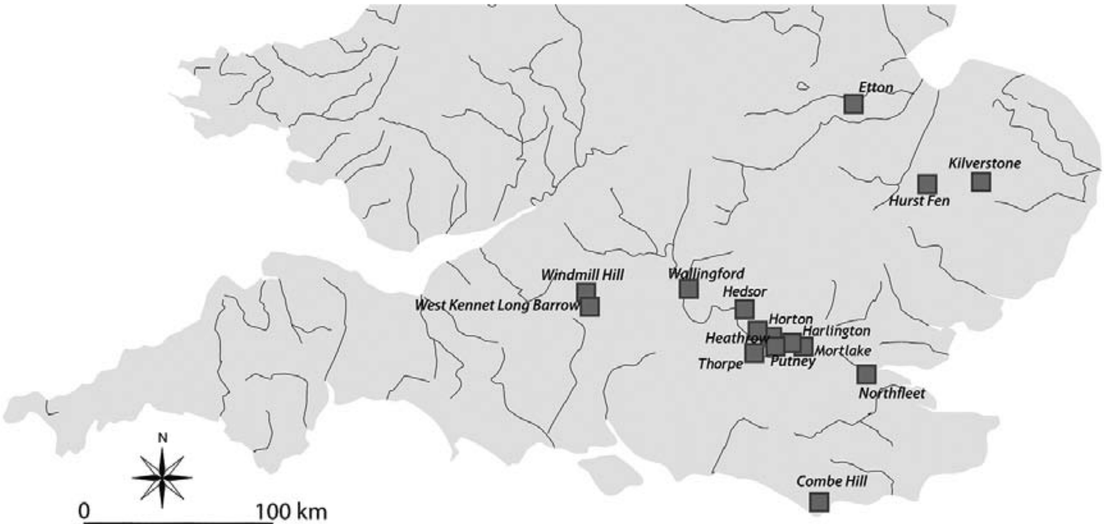

Fig. 1. Distribution map of sites mentioned in the text.

chrono-stratigraphic relations are rather arduous to understand, unless some pits recut others. Only absolute dating is then useful to better understand the site history.

2.1. Kilverstone

The site of Kilverstone, located in the Breckland Forest Soils, encompasses several occupations from the Early Neolithic to Modern periods. The excavation (*Garrow et al. 2006*) followed survey and test pits that had uncovered pit clusters and a knapping area (*Garrow 2000*). According to the authors, some clues suggest rapid pit filling. Firstly, material is trapped in the filling layer, coming from a primary deposit. Moreover, refitting between material from pits belonging to the same clusters and pits cuttings made the authors think of pit filling up in short time lapse. Yet, if unique fillings may be clues for a short-time use of each pit, it seems a little more problematic to assess the lifespan of pits. Material in the pit fills provided dating, that could, most of the time, be associated to pottery. A model was put forward (*Whittle et al. 2011*) for pit usage between 3725–3525 cal BC and 3625–3320 cal BC (95 % confidence).

Pottery from areas A and E were studied integrally. This came from 141 pits, corresponding to 144 different contexts, the majority of which contained only one fill. Pits with pottery were located in area A (within clusters S, T, U, W, X, Y, AA and BB), and in area E (within clusters A to R). Kilverstone Early Neolithic pottery material was studied integrally. The entire collection had already been studied (*Knight 2006*), yet it showed great potential, particularly for technological observations, that are presented here (*tab. 1*).

Kilverstone pottery was studied according to a specific methodology integrating aesthetical and technological observations. This paper illustrates how these two types of observations are interconnected, first by looking at the process of *chaînes opératoires*, leading to the identification of specific assemblages.

Site	Sherds quantity	Minimum number of individuals
Kilverstone	2392	215
Hurst Fen	754	138

Tab. 1. Material selected on Kilverstone and Hurst Fen.

2.2. Hurst Fen

Hurst Fen (*Clark 1960*) is located on Mildenhall parish, Suffolk, about twenty kilometres South West of Kilverstone site. It is situated 2 kilometres from the closest river, the Lark river. It was discovered in 1954 by Lady G. Briscoe, who labelled it as part of the East Anglian group. Following this discovery, Clark ran several excavation campaigns in 1954, 1957 and 1958.

The Hurst Fen excavation being rather ancient, little information could be exploited from it. The site was excavated through a large window, opened on a region containing pit clusters as well as a ditch running through the site from North West to South East. 200 pits were exposed (in comparison to the 226 pits from Kilverstone). *Clark* (*1960*) interpreted these pit clusters as means to store cereals, in relation to different households. A more recent explanation by *Pollard* (*1999*) proposes the central cluster as he works of an initial community, while the surrounding clusters would be linked to later installations. It could therefore be interpreted as long-term clustering. Hurst Fen raises the same interpretation issues as Kilverstone regarding the contexts, specifically the first and second deposits and the pit lifespan. Very little information is given regarding the various fills contained in the pits. The author suggested that several pits could be in use at the same time. The excavation uncovered a large amount of archaeological material. The pottery sample selected comes from 31 pits, among which 24 are located in the northern part of the site.

Only a sample of the Hurst Fen collection was studied (*tab. 1*), and comes from 31 of 200 pits excavated on the site, 24 of which were located in the northern part of the site. A corpus of 754 sherds, i.e. 138 MNI were studied. The choice was made to sample the collection as the remaining material was too fragmentary to be studied.

2.3. The Mildenhall style

A great morpho-stylistic homogeneity was noticed between these two East Anglian ensembles. Numerous common characteristics were recorded. This style comprises for one part vessels with prominent curves, for another part vessels with sharp carinations or shallow carinations, and for a last part vessels with simple profiles.

Even though chronological elements are rather difficult to obtain, the presence of all these characteristics in both Kilverstone and Hurst Fen assemblages suggest similar production on both sites.

The decorative patterns study on both ensembles first highlight a great number of similarities: decorations cover identical zones on the vessels, i.e. the rim, exterior neck and under maximal diameter. Yet the position variability is greater in the Kilverstone ensemble. This observation pairs with the greater variability of patterns in this ensemble, even though the same basis can be found on both ensembles. Therefore, one can assume that the decorative grammar is far more developed on the Kilverstone ensemble (*fig. 2*).

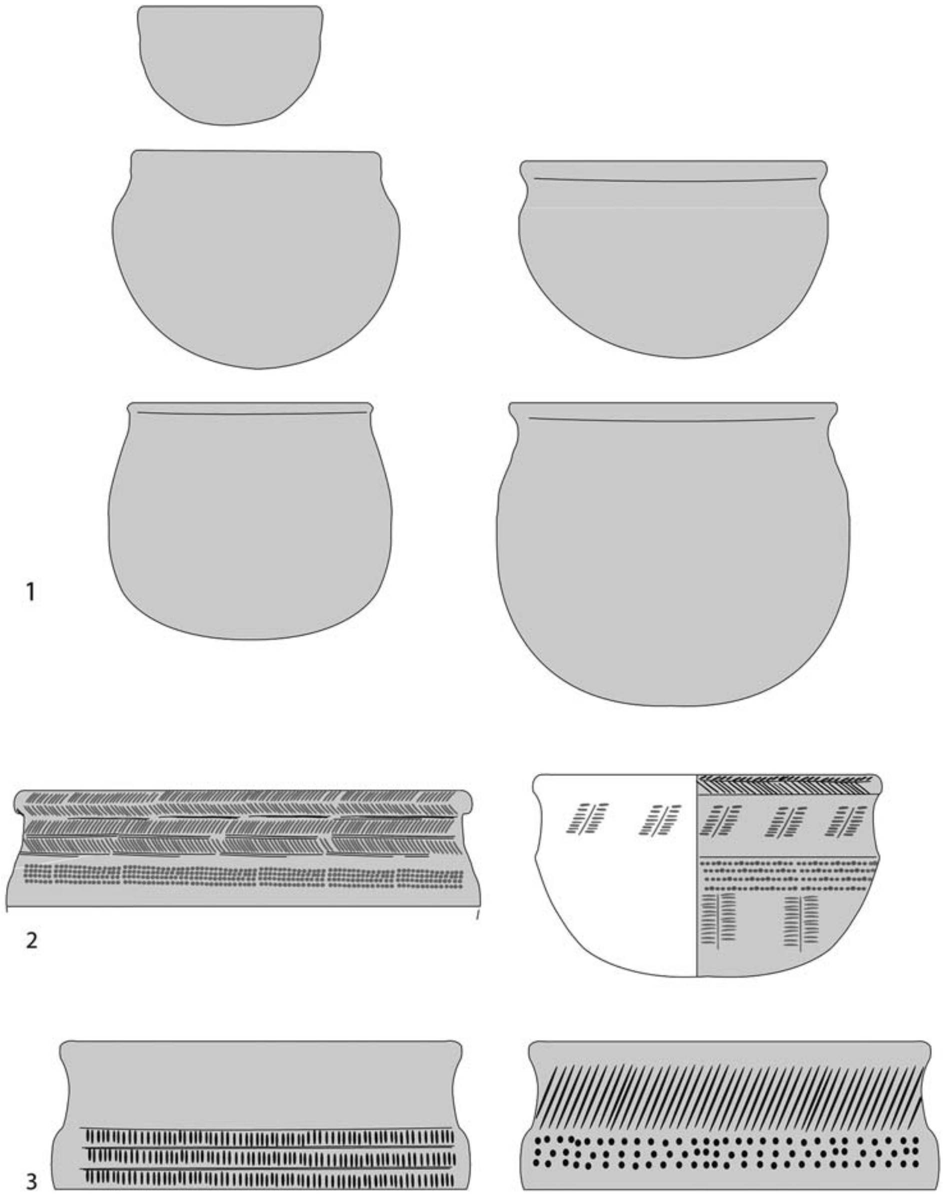

Fig. 2. Synthesis of both East Anglian corpora. 1: common profiles. 2: decorations observed on Kilverstone pottery. 3: decorations observed on Hurst Fen pottery.

It was moreover shown that these vessels with more complex decorative grammar (*Pioffet 2014*) were only located on one part of the site. The development of those specific types of decoration seems therefore to be a major discrimination point between the two sites.

3. Methodology

The study methodology specificity is that it attempted to analyze in an integrated approach the structure of *chaînes opératoires* whilst working with highly fragmented material.

The first studies on the subject of *chaînes opératoires* come from the model developed by *Leroi-Gourhan* (*1965*) for lithic studies, in reaction to studies of material initially focused on mere classifications. In lithic and pottery studies, the idea was therefore to look more accurately at *chaînes opératoires*. Yet this approach raises issues, as the number of definitions is rather important (*Desrosiers 1991*). Moreover the notion of *chaîne opératoire* can apply not only to pottery and lithics but also to other fields of investigations (*Balfet 1991*). In all definitions formulated, a convergence point can be highlighted: one is always confronted with raw material processed into a finished product (*Desrosiers 1991*). *Leroi-Gourhan* (*1964*, 164) asserted that "*the technique is both movement and tool, organized in a chain following a specific rule that gives to the process its stability but also its flexibility*". According to him, a *chaîne opératoire* is made of technical facts, for which operations, articulated chain links, aim at a precise target. Those links are meaningful only when taken as a whole (*Balfet 1975*). The study of a *chaîne opératoire* thus consists in studying all stages that compose its links. Yet this task can be arduous when it comes to studying archaeological material. Reconstructing full *chaînes opératoires* is not manageable with such fragmentary archaeological material, considering the preservation state of material as well as the lack of information regarding some specific stages of *chaînes opératoires*, that would be available when working on ethno-archaeological projects (such as conception stages, raw clay full preparation, firing complete management, etc.). Still, some stages were available for study, allowing to tackle the potters' technical knowledge and background, and to pinpoint exchanges, transfers, adaptations or else modifications of techniques from one production to another. These stages are the preparation of fabric, the construction of vessels (comprising a first forming stage of the vessel and a second shaping, almost reaching the final shape of the vessel), the surface treatments performed on the pottery, the decoration techniques applied and finally the firing stage.

The input of such a study is therefore highly conditioned by the material preservation state as most of the time, only upper parts of vessels are available for study.

4. Investigating the *chaînes opératoires*

4.1. Preparation of fabric

The preparation of fabric at Kilverstone consisted in macroscopic observations regarding temper addition. Some observations had already been provided, based on thin-sectioning (*Sibbesson 2011*). Yet a macroscopic study can bring information regarding the potter's work and preparation of raw clay (*tab. 2*). Fabrics tend to show similar preparation, particularly concerning the type of temper and its size (most of the time in a range of 0.2 to 4mm) mixed with the matrix. Nonetheless, the quantity of temper varies; the most frequently observed fabric (72 individuals) comprised a frequency of 20 % of temper. According to *Matthew et al.* (*1991*) descriptive guideline, it appears that potters would not show great care in sorting inclusions as the range of temper is rather wide.

Site	Fabric number	Matrix structure	Temper type	Inclusions frequency (%)	Inclusions size (mm)
Kilverstone	1	layered	flint, quartz, mica	7	2–4
	2	layered	flint, quartz, mica	15	0.2–4
	3	even	flint, mica	7	2–4
	4	layered	flint, shell, sand	7	0.2–4
	5	layered	flint, shell, sand	20	0.2–4
	6	even	flint, shell	7	0.2–4
	7	layered	shell	7	2–4
	8	even	sand	10	0.2–0.4
Hurst Fen	1	even	flint, small gravel	7–10	0.5–4

Tab. 2. Fabrics characteristics recorded on Kilverstone and Hurst Fen corpora.

Only one fabric was observed among the Hurst Fen sample (*tab. 2*). This type of fabric bears flint inclusions as well as small gravel (which size does not exceed 4 mm). It has to be noted that flint addition seems to have a cultural function; it is indeed present in the Kilverstone and the Hurst Fen ensembles.

4.2. Construction phase

Several individuals in the Kilverstone corpus bear key-elements to understand vessels construction. Two of these were selected to illustrate these key-elements. Firstly, vessel 120 comprises first forming clues with presence of jointed elements, i.e. flat-sectioned coils (*fig. 3*). The inflexion second shaping was probably made with modeling, as illustrated with fingerprints on internal surface. The rim secondary shaping consists of clay addition beneath the rim and, secondly, above. Very little care was taken during the rim equalizing phase. The surface state bears unveiled inclusions, possibly due to wet-handed smoothing.

Vessel 180 is rather badly executed (*fig. 4*). Joint elements of even size show internally-beveled coiled structure. The inflexion second shape seems to be modeled from the inside. As well as for vessel 120, inclusions were revealed on the surface, suggesting wet-handed smoothing. Finally, fluting is visible on external surface, and tends to show poor quality polishing.

In the manner of observations performed on the two previous vessels, *chaînes opératoires* fragments were recorded and can be arranged in various groups (*fig. 5*; *6*). On well-enough preserved fragments of vessels, three main groups can be identified, starting with the primary forming construction techniques. The first group consists of internally-beveled coils; the second shaping of bases and bellies being unfortunately unavailable. Yet the second shaping of inflexions can be made either by modeling, modeling and clay addition on internal surface to reinforce the inflexion or by clay addition on the exterior surface. Rim secondary shaping techniques are variable: internal folding, external folding without or with clay addition, or else by clay addition on top and beneath the rim sketch.

The second group corresponds to vessels firstly forming with flat-sectioned coils. Here again, inflexion shaping varies between modeling only or with clay addition on internal surface. The same techniques as for the first group are applied to make rim shapes.

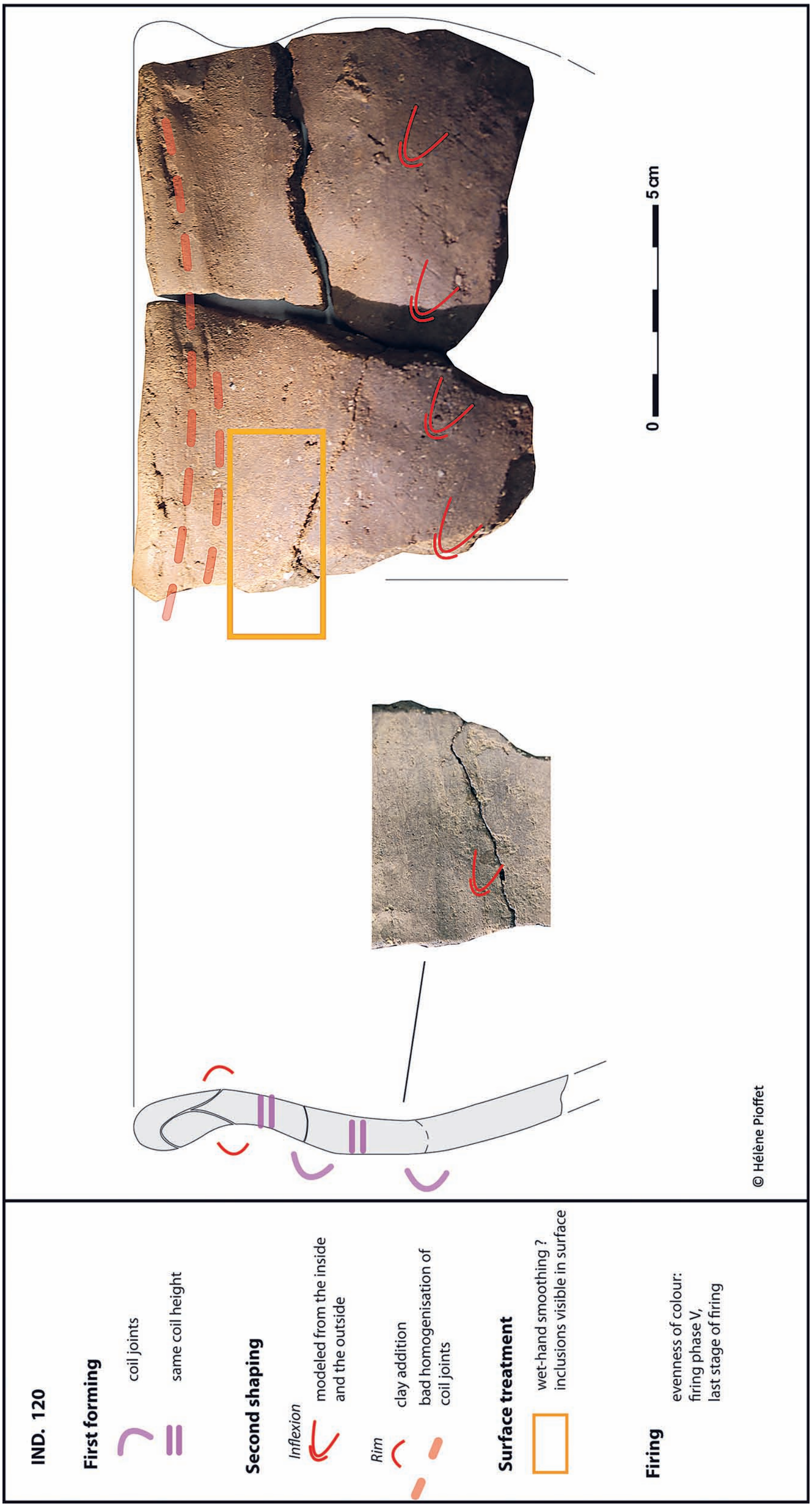

Fig. 3. Description of technical elements on vessel 120.

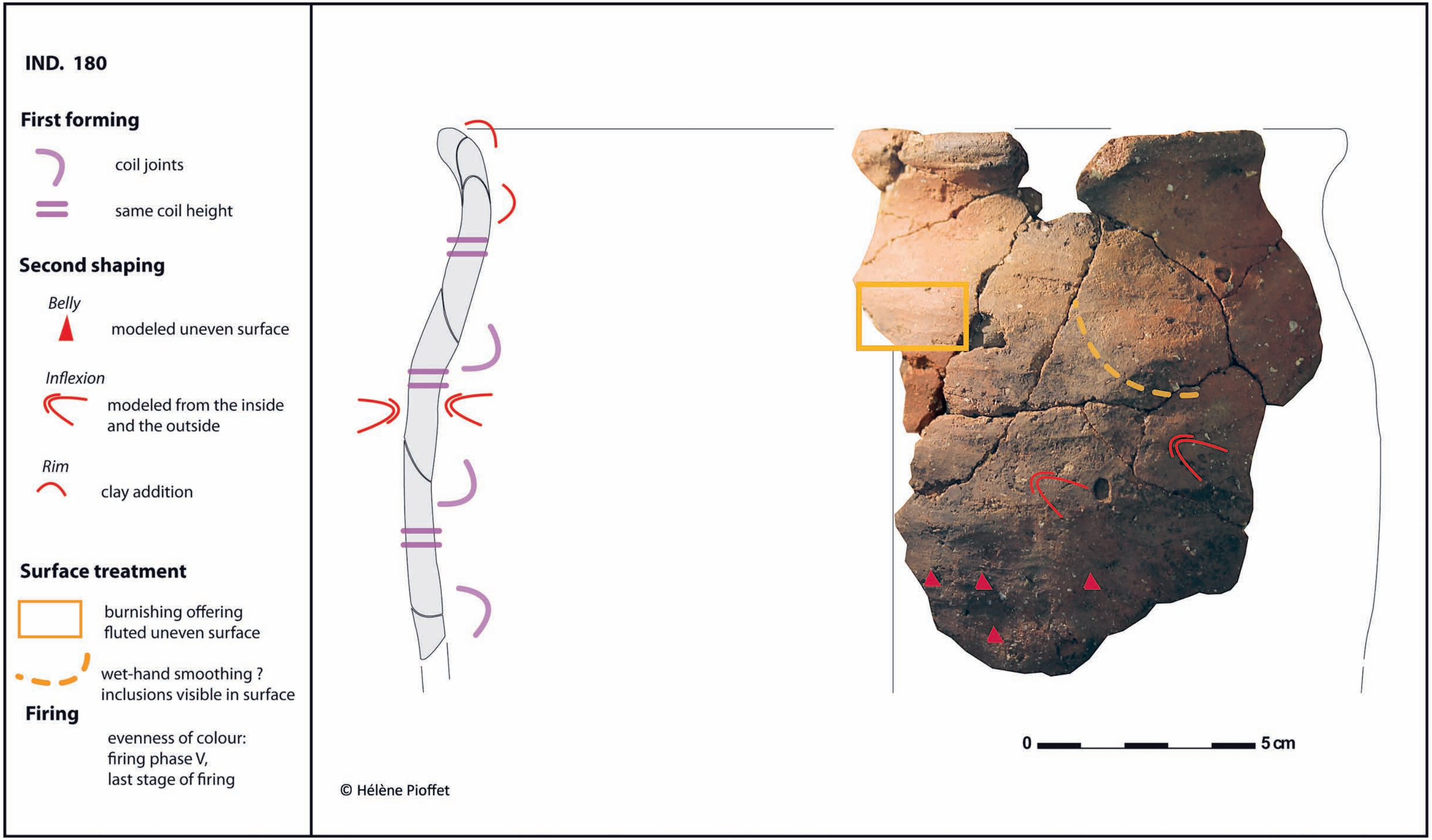

Fig. 4. Description of technical elements on vessel 180.

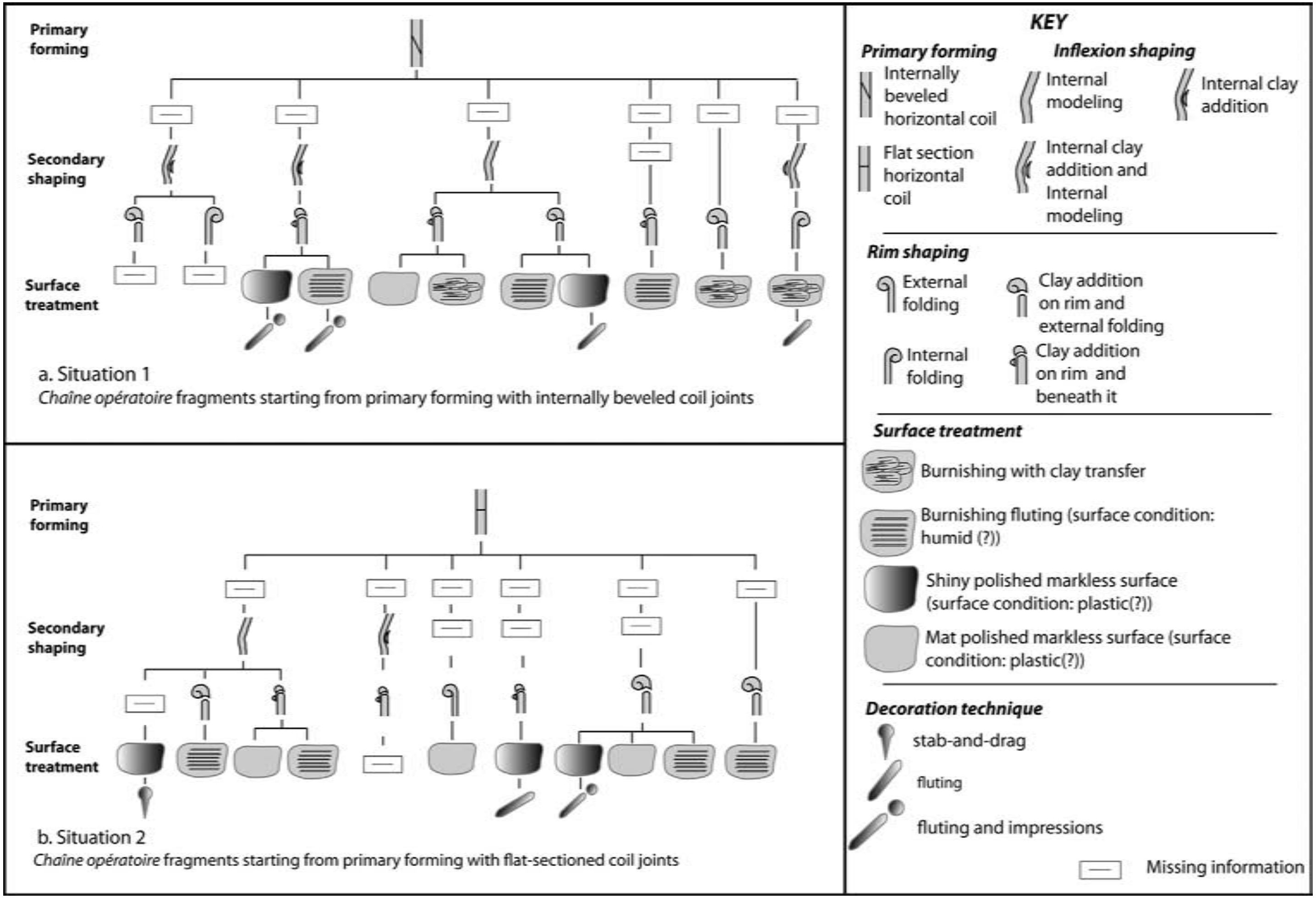

Fig. 5. Groups based on *chaînes opératoires* fragments observed on Kilverstone pottery (situations 1 and 2).

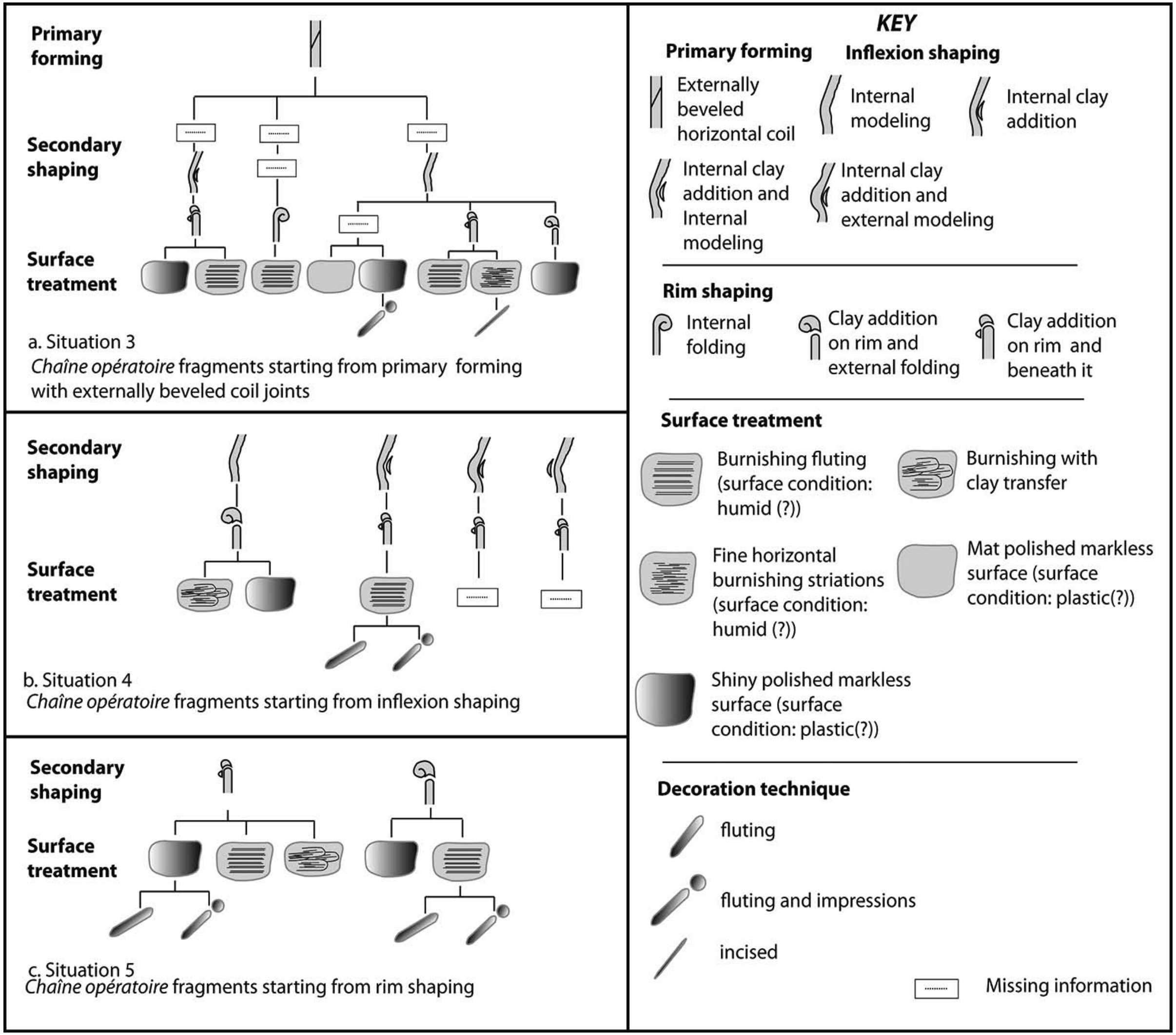

Fig. 6. Groups based on *chaînes opératoires* fragments observed on Kilverstone pottery (situations 3, 4 and 5).

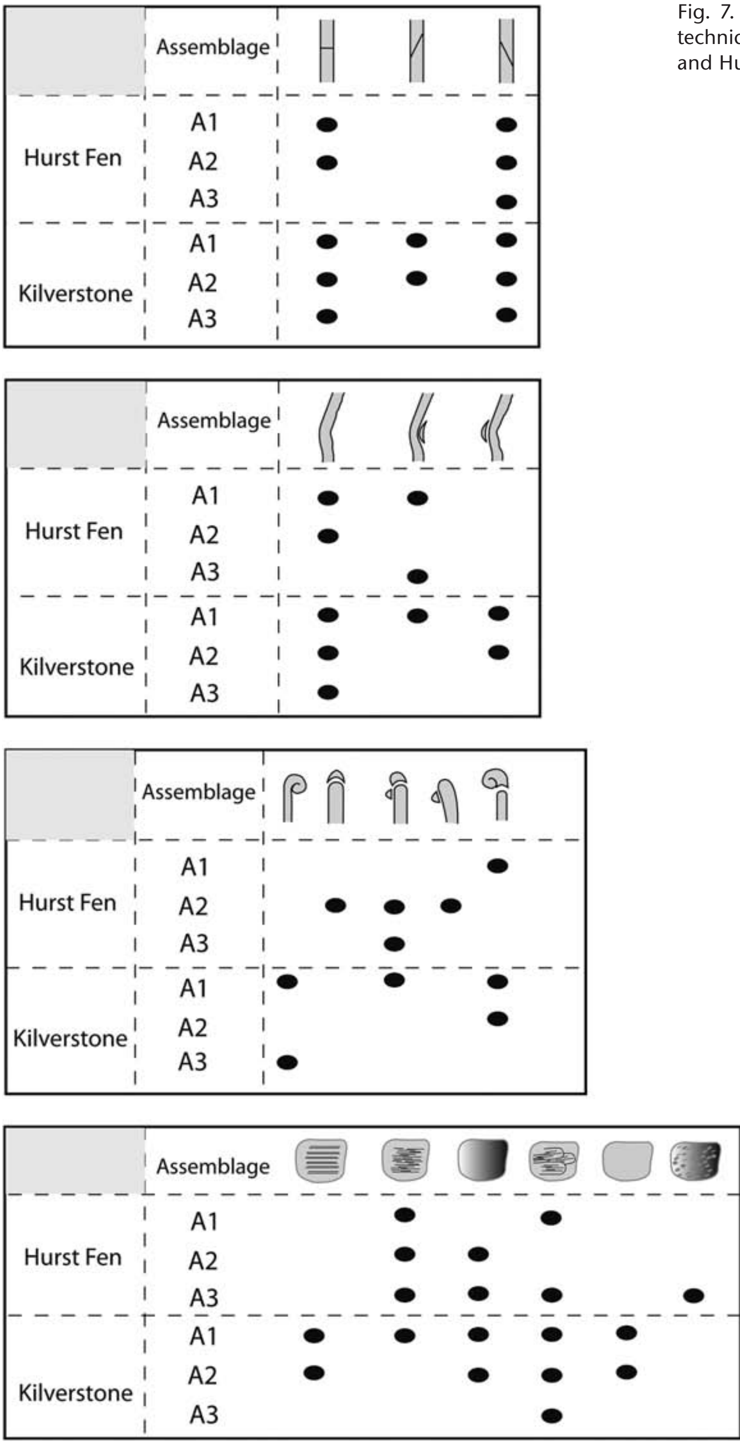

Fig. 7. Comparisons between techniques used in Kilverstone and Hurst Fen.

The third group is based on externally-beveled coiled vessels, showing same second shaping techniques as before.

The other groups, depending on less well preserved vessels, only show *chaînes opératoires* fragments from the second shaping stage (either from inflexion, on rim shaping). The same techniques are here again displayed.

Vessels in the Hurst Fen ensemble bear variable technical elements. Some constructing techniques were noticed, such as first forming built with flat-sectioned or internally-beveled coils, inflexion shaping with external reinforcement, modelling or yet with help surface treatment. Necks were built with flat-sectioned or internally-beveled coils. Rims were shaped by adding clay on the edge or below the edge, and folding outwards, completed with a final burnishing.

Constructing techniques seem to be, on both corpora, predominantly internally beveled coils, or flat-sectioned coils (*fig. 7: a.*). Yet external bevels appear to be present only in Kilverstone assemblages. Moreover inflexions second shapes can be done with help of different techniques: modeling, internal reinforcement and external reinforcement (only used on Kilverstone assemblages; *fig. 7: b.*), the most recurrent one being the modeling. Rim secondary shaping is performed with various techniques, of which only two are shared between the two corpora: clay addition on top and beneath it, and clay addition followed by external folding (*fig. 7: c.*). It is to be noted that some techniques absent in Kilverstone are practiced on Hurst Fen pottery: sole clay addition beneath the rim edge technique.

4.3. Surface treatment

All assemblages presented above for Kilverstone show the same types of treatments: either fine horizontal burnishing striations, burnished clay with clay transfers on the surface, burnishing fluting, mat surface without marks, or finally polished surfaces. These various treatments, the most frequent of which are the burnished conditions, bring different types of information. Firstly the surface conditions tend to show very little care taken into finishing, leaving marks on surfaces. Then, it seems that different tools were used: shallow striations and mat surfaces suggest hand-smoothing, whereas fluting and deeper clay transfers support the idea of wooden or bone tools. Finally, as *Martineau* (*2010*) demonstrated it, surface treatments are applied during the drying first stages of the vessels, and depending on when the gesture is performed, the resulting marks will differ, even of made by the same tool. Therefore, if we consider the use of the potters' hand, our personal experience has shown that mat surface might be possibly the result of a wet hand on rather fresh surface, unveiling small inclusions with the action of capillarity, while striations are drawn when the pot surface has already started to dry. Considering the use of hard tools (wood or bone), the clay transfer implies that the surface is still fairly soft, while the fluting happens later in the drying process. Yet the difference between burnishing and polishing (as exposed by *Martineau 2010*) lies, not in the choice of tools, but rather in an ill-chosen moment in the drying process that leaves marks on the surface (burnishing).

Some contrasts are also visible on surface treatments applied between the assemblages of both corpora (*fig. 7: d.*).The most frequent surface condition on Hurst Fen material is a burnishing with clay transfer, present on all assemblages but one. On the opposite, some surface conditions are scarce, even nonexistent. The burnishing with shallow striations, particularly well represented on Hurst Fen material, is hardly present on Kilverstone pottery. Moreover, the polished surface unveiling small inclusions, illustrating the use of the wet-hand technique, is only recorded for Hurst Fen pottery. An interesting consideration can be brought thanks to surface conditions. All techniques recorded, on both corpora, tend to show little care when it comes to work surfaces and make them even. Only one technique out of six corresponds to polishing without any marks left, this cannot be interpreted as a lack of skill (both polished and unpolished pottery having been made by potters with identical knowledge). It can rather be an indicator of the function that the pot is firstly destined to: most probably, not fit for neither display nor ritual use, and intended for storage or cooking tasks.

4.4. Decoration techniques

Decorations of the Mildenhall style were deeply studied, particularly by Isobel Smith (see for instance *Smith 1956*). Considering once again *chaînes opératoires*, it is interesting to know whether some particular decorative techniques are related to previous stages in the pottery making. Thus, the most frequently used techniques on Kilverstone pottery, i.e. fluting and fluting associated with impressions seem to be related with neither the vessel first forming techniques, nor the inflexion shaping. Rather, it was noted that it is probably related to rim shaping techniques, as these two decorative techniques appear on vessels that have rims made with clay addition on top and beneath the rim. Moreover these two techniques are also preferably applied on polished surfaces rather than burnished ones.

The different techniques used on the vessels, i.e. stab and drag, fingernails, perforations, incisions, fluting and finally impressions have different spatial distribution on the site. For instance, it was noted that incisions associated with fluting are typically located, in the western part of area E (in clusters B, F, I, J and K); equally, the technique combining incisions, fluting and round impressions, used for more elaborate patterns, is typically located on the northern part of area E. This supports other observations previously made (*Pioffet 2014*, 260), concerning the distribution of decoration motifs: the more complicated patterns are located on the northern part of area E, while the less complicated patterns are located in the southern part of area A.

Mildenhall patterns show variability; it was already exposed in previous research (see for instance *Smith 1956*; *Clark 1960*), and most recently compared between Kilverstone and Hurst Fen (*Pioffet 2014*). It appears that decoration techniques are shared between both corpora, stating the differences in the degree of pattern complexity (*fig. 8*).

Nonetheless, the techniques used are similar between the two corpora, so are the types of tools. They consist of most basic equipment: vegetal tools (wooden sticks?), and possibly sharp tools such as flint. Exceptions have yet to be underlined: stone and bird bone impressions seem to be applied only on Hurst Fen pottery.

4.5. Firing

Observations on firing (according to colour observations *Martineau – Petrequin 1999*) tend to show a higher quantity of homogeneously fired vessels on both sites (from surfaces to core; phase V). This allows to think that firing is generally mastered, and that external aspect and colours (brownish range of colours) are looked for. There does not seem to be any specific distribution depending on groups or pit clusters.

5. Looking at technological assemblages

The pottery presented above actually gathered techniques starting from the first forming stages, allowing to tackle techniques still available and visible. Yet this does not suffice to identify the presence of different productions: the variable second shaping, surface treatments as well as decoration techniques are almost equally represented in each group, not necessarily highlighting know-how homogeneity or heterogeneity. Hence, assemblages were suggested, this time based on the most recurrent technical traits between vessels.

5.1. Description of assemblages

Three assemblages were recorded among the Kilverstone corpus (*fig. 9*). The main elements used to identify these assemblages are vessel construction and surface treatment. The first assemblage corresponds to a neck first forming and second shaping made with internal beveled, external beveled or flat-sectioned coils, rim shaping with clay addition on and beneath the rim, inflexion shaping with internal modeling with internal reinforcement and external modeling. Finally surface treatments are recorded: burnishing and polishing.

The second assemblage is marked with neck first forming and second shaping with internal beveled, external beveled or flat-sectioned coils, inflexion second shaping with internal modeling, rim shaping with clay addition on the rim and external folding, surface treatment with burnishing and polishing.

The third assemblage, far more modest, corresponds to vessels made with first forming and second shaping with internal-beveled coiling, inflexion second shaping with internal or external reinforcement and modeling, rim shaping with internal folding and finally surface treatment with burnishing.

These three technical assemblages show main variations regarding rim shaping technique, suggesting a fairly close common background between them. But they also reveal various productions.

If it is hard to assume relative chronology between these assemblages on the Kilverstone site, specific distribution can be noted for each of them. First of all, they are predominantly present in area E: only 9 % of assemblage A1 is present in area A, 4 % of assemblage A2 and none of assemblage A3. Moreover two zones in area E can be distinguished, thanks to assemblages A1 and A2: on the one hand, assemblage A1 is present at 53 % in southeastern part of area E (cluster K to R). On the other hand, assemblage A2 is present at 71 % in the western part of area E (cluster B to I, and N). These observations may lead to an interpretation regarding the evolution of techniques available on Kilverstone, as some pit clusters comprise variable quantity of assemblages A1 and A2. Two hypotheses are conceivable here: either the pit clusters are used during consecutive phases and the same population applied different rim shaping techniques determining the assemblages, during different periods of production; or the pit clusters are used during the same period, in which case different populations apply slightly different techniques.

Three assemblages were recorded among the Hurst Fen ensemble. The first assemblage comprises inflexion shaping made with external reinforcement, rim shaping made with clay addition on the edge and completed with an external folding and burnishing. The second assemblage is composed of wall or neck building with help of flat-sectioned or internally-

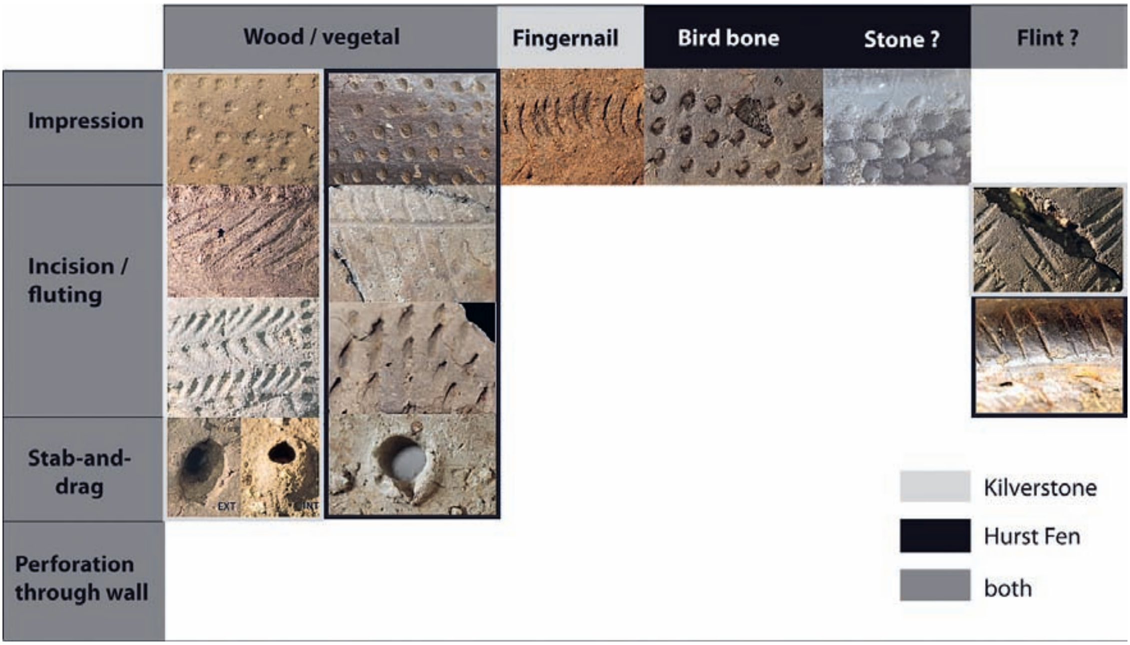

Fig. 8. Comparisons between decorative techniques used in Kilverstone and Hurst Fen.

beveled coil, rim shaping with clay addition under the rim alone and sometimes also on the edge, or burnishing the surface. The inflexion is then shaped by modelling and burnishing. The last assemblage is represented by an inflexion shaping made with external reinforcement, a neck building made with internally beveled coils, a rim shape made with clay addition under the rim and the edge, and finally surface burnishing.

These productions must be confronted to aesthetical observations though to understand the connections with the common aesthetical background.

5.2. Confrontation with aesthetical assemblages

Confronting aesthetical and technological assemblages underlines the importance of technological traits from Kilverstone assemblages 1 and 2, particularly among assemblage a. (*fig. 9*). The link between technical assemblages 1 and 2 and aesthetical assemblage a. corresponds to techniques of rim shaping, i.e. clay addition on top and beneath the rim, or clay addition on the rim followed by internal folding.

Even though the aesthetical and technological variability is undeniable, it is to be noted that a vessel type (composing the assemblage a.) prevails, with complex shape and prominent curve, is omnipresent in pit fills. This is all the more intriguing as, for this type of context, with an unsettled lifespan, one could expect more variability regarding aesthetical and technical matters. This consideration is supported by a highly homogeneous fabric preparation (flint addition and / or crushed shell addition), as well as firing predominantly stopped at phase V.

Henceforth, if several productions were made and / or deposited on the site, they bear fairly close characters. Technical traits suggest a common cognitive background. Apart from surface conditions, rather variable, it seems that the *chaînes opératoires* may have been close (coiling techniques, inflexions modeling, clay addition on rims). Interestingly, the same *chaînes opératoires* seem to be used indifferently for decorated and undecorated pottery.

Thus, first forming seems to be made either with flat-sectioned, internal or external-beveled coiling, the flat and beveled sections being more frequent. Coil sizes show great stability (between 31 and 40 mm, most frequently between 36 and 40 mm). Inflexion shaping, may it be on a prominent curve or a sharp carination, most of the time, is made with internal modeling, combined on carinations with a following smoothing stage to mark the angle. Rim shaping is predominantly marked by two techniques: clay addition beneath and on the rim on one side, and clay addition followed by external folding on the other. This confrontation tends to show that there is no link between specific types of vessels and the techniques used to make them, but rather that each assemblage comprises several types of vessels.

Contrary to Kilverstone pottery, no general tendency could be isolated on Hurst Fen pottery when confronting aesthetical and technical assemblages (*fig. 10*). Each aesthetical assemblage is associated to two, maybe three technical assemblages, highlighting the variability among the ensemble; yet one has to bear in mind that only a sample of the ensemble could be studied here. Nonetheless, the pattern does not seem to be so different from that of Kilverstone. It is undeniable that both corpora show shared technical characters, on all aforementioned *chaîne opératoire* stages. Yet at each stage, some specificities can be noticed on each corpus. This tends to show two levels of knowledge: first a common technical background that is spread out regionally, conveying the idea that knowledge is transmitted, and reproduced easily. The second level marks the development of local technical knowledge. Two *scenarii* can be suggested here. Either these variable technical traits are due to an evolution (one corpus being younger than the other one). Or the two corpora are rather contemporaneous, in which case techniques are developed separately. It was suggested by *Gosselain* (*2002*), when working with African potters, that a technological style can be perceived, once all external constraints have been mastered. When looking at those two corpora, this is difficult to determine whether these are deliberately developed styles or whether this is an unconscious way to mark differences of know-how.

6. Roots to the Middle Neolithic pottery?

Stylistic and technical observations showed that Mildenhall ware, although being in a stylistic rupture with the first phase, could be, at the end of the Early Neolithic, direct inspiration for later pottery styles. From the first sight, one can be puzzled by the great similarities displayed by Mildenhall and Middle Neolithic wares, in terms of shapes, surface aspects but above all, decorative patterns. Hence a second project tried to shed a new light on these Middle Neolithic ware characteristics (*Ard – Darvill 2015*; *Ard in press*), and to understand the terms of transition from the previous ware.

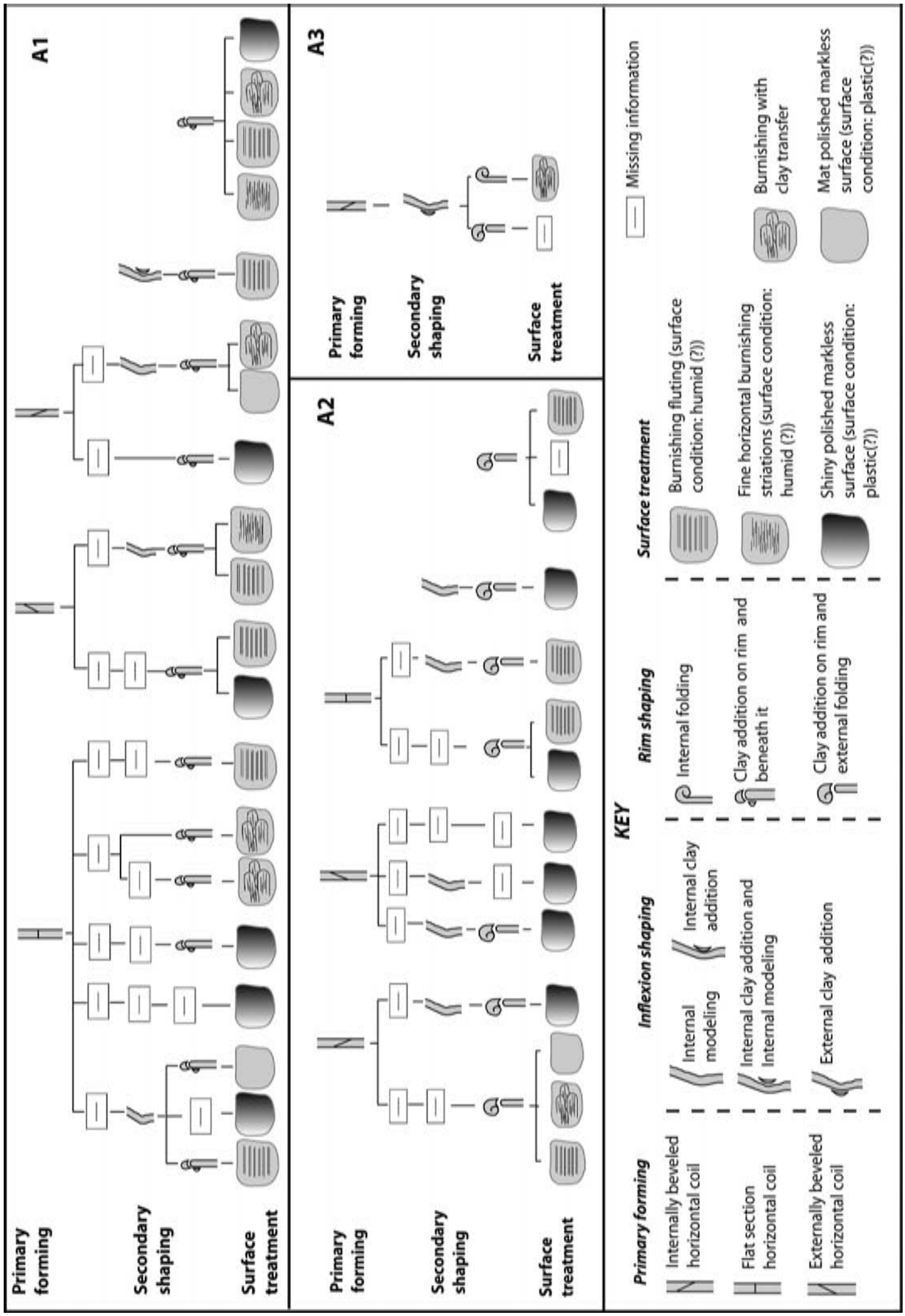

Fig. 9. Composition of technical assemblages of Kilverstone pottery.

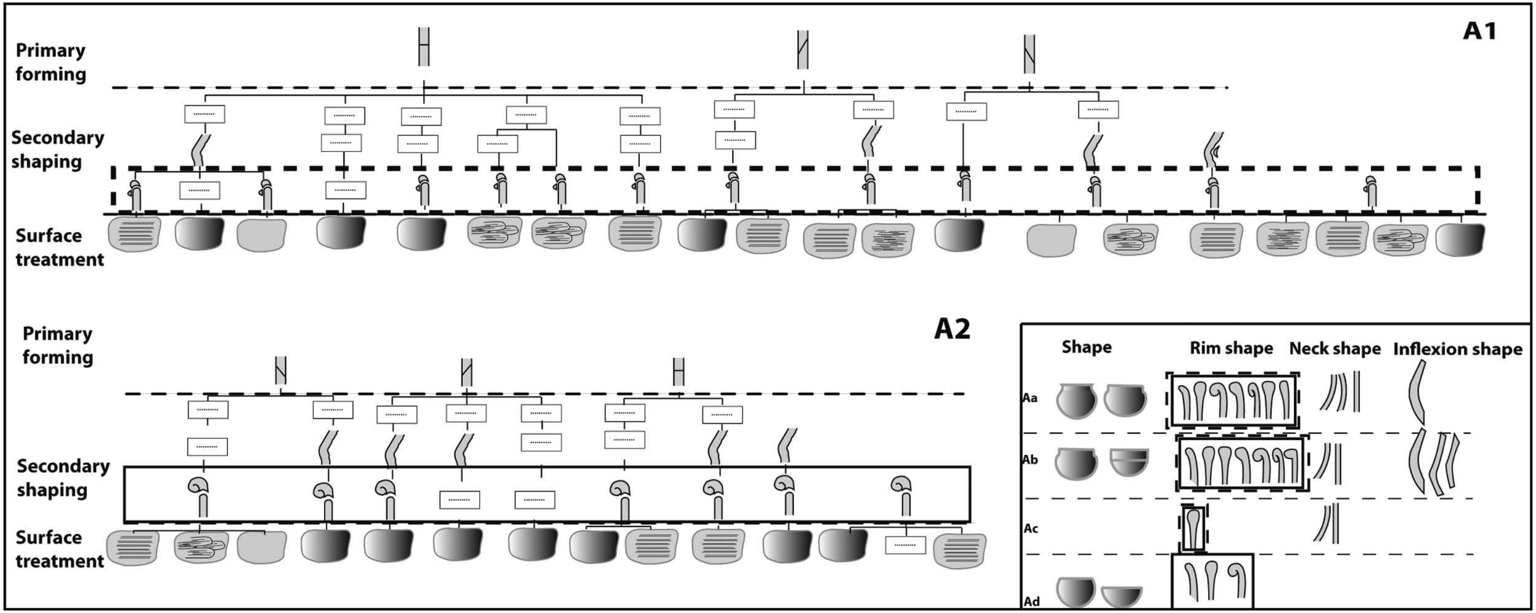

Fig. 10. Techniques observed in aesthetical assemblages of Kilverstone pottery.

6.1. Refreshing the past

6.1.1. Introductive considerations

Contrary to the Early Neolithic, the formerly "Secondary Neolithic" (covering now the Middle and the Late Neolithic) and its most iconic "culture", the Peterborough Ware, received less recent reviews (*Gibson – Kinnes 1997*; *Thomas 1998*; *Ard – Darvill 2015*).

In the "The Neolithic Cultures of the British Isles", *Stuart Piggott* (*1954*) exposed the main characteristics of the Peterborough Ware which was considered as a whole "culture", yet using ubiquitous finds for some other elements of the material culture. He exposed for the first time the main characteristics of these singular potteries. Peterborough Wares were described as bearing coarse fabric with abundant temper, especially flint, and surfaces coarsely smoothed. Pots have shapes mostly with round bottoms and complex lip. Mainly located in the upper part of the pot, a wide variety of decoration is known using different techniques: incisions and cord, comb, fingerprints and bone impressions. He eventually identified two sub-styles of Peterborough Ware – Ebbsfleet and Mortlake – mainly on the basis of shapes and decorations. These two sub-styles are still used today.

In her thesis, *Isobel Smith* (*1956*) defined a new sub-style (Fengate) and offered a chronological sequence from Ebbsfleet to Fengate Ware, through the Mortlake Ware, based on the evolution of morphological characteristics of these ceramics. According to her model, Ebbsfleet emerged from the Decorated style of the Early Neolithic in south-east England (Grimston/Lyles Hill styles), probably around the lower Thames valley, then Fengate which was in contact with Beakers prefigured the Collared Urns of the Early Bronze Age.

6.1.2. Browsing Peterborough ware

During this project, 600 sites were identified, compiling a minimum of 2750 vessels attributed to the Peterborough Ware in England and Wales (*Ard – Darvill 2015*). The Impressed Ware found in Scotland and Ireland was set aside. This updated corpus, nearly 7 times as big as that of S. Piggott in 1954, allows us to review Peterborough Ware on solid foundations. This new inventory highlights two specificities: first most of the material come from unsecured or indeterminate contexts. Moreover, as we underlined it for Mildenhall ware, vessels are highly fragmented, if not represented by one sole sherd.

Among all findings, the Mortlake style dominates by 36 % while the Ebbsfleet and Fengate styles, in equal proportions, are more than twice as scarce. In almost one third of cases, the authors provide no attribution to a sub-style.

Concerning the geographical distribution, new discoveries reaffirm the major role of the Thames Valley. It should be emphasized, however, that these ceramics are found throughout the eastern half of England, not just in the South, with indisputably regional variations and sub-styles such as Rudston style in Yorkshire. There is clearly no significant difference in terms of distribution between the three sub-styles, with the exception of the Ebbsfleet style that tends to be more represented in Central-Southern England.

The fourteen assemblages selected for this study are located in southern-central and eastern part of England, particularly in Wiltshire (West Kennet and Windmill Hill sites) and along the Thames Valley, especially around London (*Ard – Darvill 2015*). They are mainly settlement sites: three causewayed enclosures which enable us to understand the evolution of technical traditions at the individual site scale over the course of several centuries. In total, the corpus contains 300 vessels. Only seven vessels have a complete profile.

6.2. Scrutinizing the pottery chaînes opératoires

These ceramic assemblages were first studied on the basis of observations regarding the pottery fabric and the manufacturing features available such as joints between assembled components (coils, plates…), potters' fingerprints, marks of finishing techniques or else decorative techniques. Hence the possibility to compare the technical choices and practices associated with the three sub-styles of Peterborough Ware.

6.2.1. Fabrics

Regarding the choice of raw materials selected for fabrics, observations of main inclusions were made macroscopically the, as no time could be dedicated to petrographic analyses. Four main tempers can be distinguished: flint, quartz, shell and grog. The comparison between the three sub-styles' fabrics, on all sites, provides very interesting results. It can first be noted that the inclusions of flint, crushed or as splinters, are largely dominant in Ebbsfleet and Mortlake and are far scarcer in Fengate vessels. However, these Fengate ceramics are characterized by a more diverse range of tempers (grog, shell and many quartz), particularly at Etton, as was already shown by Isobel Smith in other sites (*Smith 1956*; *1965*) and more recently by Rosamund Cleal in the Wessex area (*Cleal 1995*). The use of grog for making Fengate ceramics is attested in 21 sites in total.

Fengate ceramics are also distinguished by a finer paste preparation, with removal of coarse inclusions. Generally speaking, the walls of Fengate Ware are finer than those of Mortlake (8.5 against 9.1 mm), but thicker than Ebbsfleet Ware (6.9 mm).

6.2.2. Manufacturing techniques

As well as for the Early Neolithic production, it is quite challenging to reconstruct the whole *chaîne opératoire*, due to the important vessel fragmentation. Yet some observations could be performed (*fig. 11*) regarding rims shaping methods, rims for which Isobel Smith suggested a profile classification (*Smith 1956*), still useful today. It appears that the various types of rim correspond to construction of the lip by different uses of coiling techniques.

Ebbsfleet vessels, with preserved shaping features in 90 % of cases, display walls and rims shaped by coiling, in accordance with the first observations of S. Piggott. The coil that forms the lip of the rim is hemmed inwardly or outwardly with discontinuous digital pressures and sometimes a coil is added to thicken the lip. No shaping methods used to make round bottom could be observed, as it is generally arduous to isolate diagnostic sherds among the assemblages.

Techniques isolated for Mortlake vessels (shaping features preserved in 83 % of cases) tend to be similar to those identified on the Ebbsfleet vessels, as the coiling technique is also used for making walls and rims. Horizontal ripples characteristic of this technique have been exploited to highlight decorations in horizontal impression bands on vessels from Wallingford and Heathrow sites (*Smith 1924*; *Grimes – Close-Brooks 1993*). On 20 vessels scanned, a coil was repeatedly added on the inner surface of the lip to form rim. On the walls, we see that the coils are joined by internal or by external oblique junctions. The shaping method used for the base is delicate to identify but it seems to have been done by modelling a clay mass in a concave mould (spotted on Harlington and Hedsor sites).

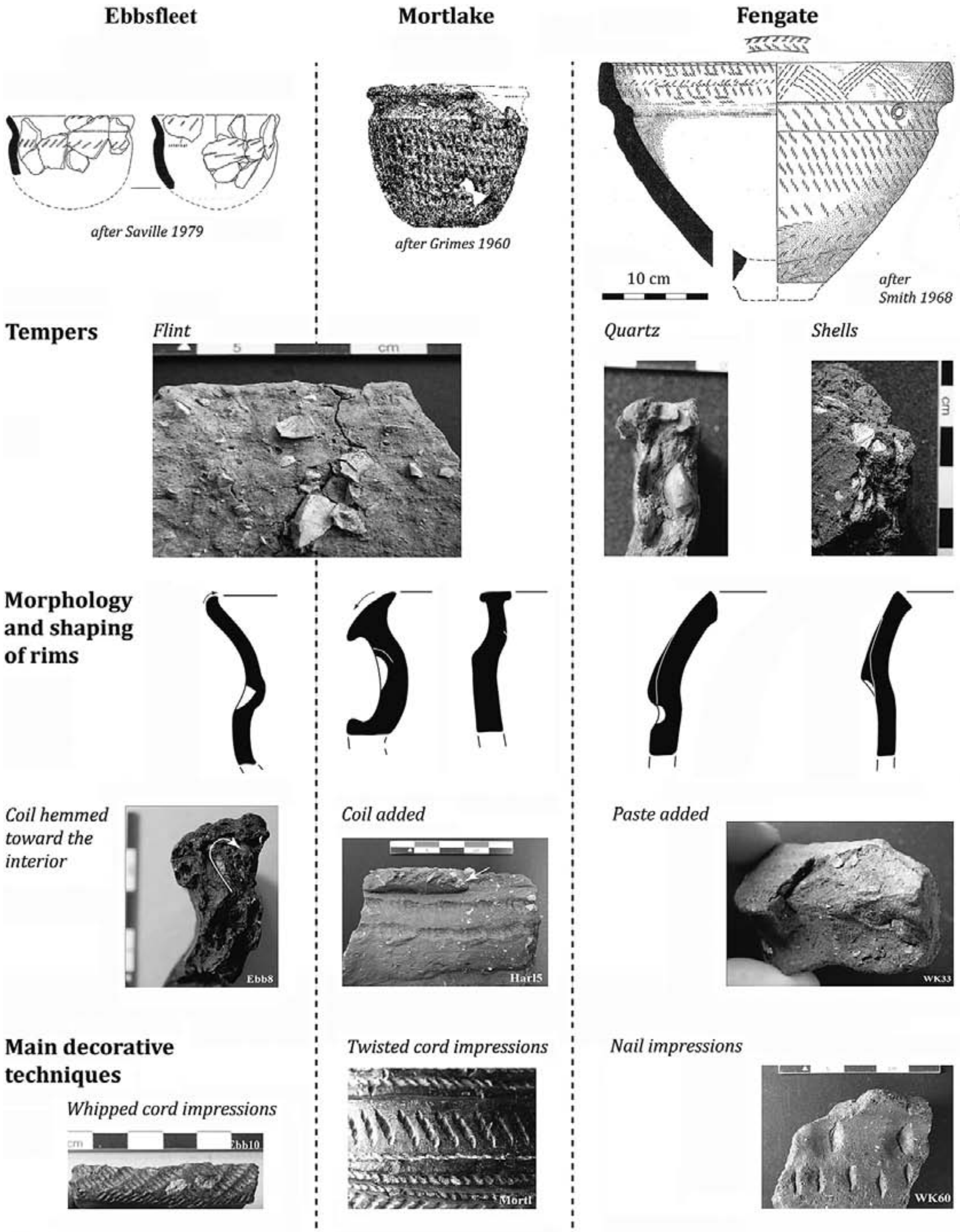

Fig. 11. Techniques used in Peterborough Ware.

Unfortunately, far less data is available for Fengate ware, as vessels are much more fragmented in the studied assemblages. Less than half of the pots (48 %) have features of coiling techniques. The coil forming the lip is almost always hemmed inwardly. The outer profile of the rim is thickened adding a small piece of clay to form a small carination typical of rim types F2 and F3, according to the typology of *I. Smith* (*1956*).

Yet it has to be highlighted that the Fengate style is the only one to offer information on the bottom making. The small flat base, diagnostic of this sub-style, is made by turning the pot on a mouth and by adding a small slab of clay on its round bottom. Three pots show marks of this method: one comes from Horton "Manor Farm" and two from the West Kennet long barrow.

6.2.3. Decoration techniques

Without exploring in detail the very complex diversity of decorative motifs and techniques used for Peterborough Ware, it is still appropriate to suggest a comparison between the main decorative techniques used for the three sub-styles, that could emphasize possible technical habits. The first major observation to pinpoint is that 279 over 300 vessels studied are decorated.

It appears that one impression technique is preferred for each sub-style across the complete pot (rim and wall): whipped cord for the Ebbsfleet style, twisted cord for the Mortlake style and fingernail for the Fengate style. While Ebbsfleet bears most of decorations on the rim, especially on the lip, Mortlake shows more decorations distributed throughout the vessel, from the base of the wall to the rim. The Fengate style is a combination of these two configurations with covering decoration patterns and a preference for the rim, even though the high fragmentation tends to alter our perception of the lower part of the wall.

Bird-bone impressions are poorly represented in Ebbsfleet whereas they can be found in all parts of Mortlake vessels. No studied Fengate vessels present this type of decoration. In Wales, the study of Alex Gibson showed that bird-bone decorations are the most common kind of decoration.

Impressions with whipped cord are dominant in Ebbsfleet, less present in Mortlake and absent in Fengate studied vessels. Equally, the twisted cord impressions are found more often in Mortlake than in Ebsfleet and a few in Fengate.

Other decorative techniques – incisions and finger impressions (fingernail and fingertip) – are ubiquitous. Yet the high variety of finger impressions has to be more thoroughly studied, as it can sometimes leave exceptional prints of the potter's finger as shown by Jonathan Cotton.

7. Discussion

The study of the Kilverstone pottery making techniques eventually allows to shed a new light of various issues. First of all, Kilverstone might very well not be a production site but merely a deposition one, and it was shown in the past that these two types of sites cannot be interpreted in the same way (see for instance *Demoule 1994*). The observations described above show that Kilverstone pottery encompasses not one, but at least three different productions (mainly identified with help of technical assemblages). But the techniques recognised in the *chaînes opératoires* fragments are very similar, if not identical. This testifies of a common cognitive background and suggests the idea of one community or maybe a couple, close enough to share a common knowledge.

These observations bring the discussion back on the *scenarii* exposed by *Garrow et al.* (*2006*, 77). The first scenario consisted of an interpretation of the site as an occupation with a short lifespan of pits, used by different communities. The second one stresses a lengthy occupation, with a permanent settlement, most probably close to the site. The last scenario implies a long-lasting intermittent occupation by different communities. This last scenario was the one favoured by the excavation authors. This study might very well support the long-lasting sporadic occupation by different communities, although they would have to be very close communities, if not the same one to share such a common knowledge. This is all well illustrated by the variable distribution in different regions in area E of assemblages and decorative techniques.

But as it was shown when confronting technological data with Hurst Fen, Kilverstone pottery is clearly well anchored in a regional dynamic, with a common technical background, but still showing site specificities. Kilverstone and the sample from Hurst Fen definitely support the fact that more technical observations should be done on pit sites pottery to shed a new light on occupations interpretation.

It is now appropriate to question the development of such elaborate decorative patterns during the Early Neolithic, in comparison with other regional productions for which decorations remain generally speaking rather scarce. If one looks away towards the East, some similarities can be puzzling. This is the case with the decorative grammar used in the TRB culture. Even more intriguing, is the pottery from the PWC of South Scandinavia that reveals some decorated profiles with perforation lines much like the Mildenhall ones (*Larsson 2010*). Yet it has to be pointed out that the chronology does not favour an East-West influencial movement as the PWC pottery belongs to a slightly later period. Nonetheless, it does not exclude a wave of influence that could be, possibly, initiated in Eastern Britain. Mentioning the TRB culture and the Scandinavian PWC is not really surprising as parallels were already suggested regarding the funerary monuments on the British Eastern façade (see for instance *Whittle 1977* or *Scarre 2004*). These considerations tend to put the emphasis on exchange intensification not only throughout the island but also beyond the seas.

Exchange intensification may also very well account for the diversification of pottery styles during the Middle Neolithic, mainly in terms of profiles and decorative grammar complexification. Yet the various styles presented above seem to be rooted in the Early Neolithic, particularly when looking at the chaînes opératoires that tend to be long-lasting. Here again the question of bonds with the East can be raised. Indeed, styles like the Fengate one show, for instance, striking similarities with the Dutch TRB pottery. This consideration underlines the fact that pottery wares, even when inheriting more or less local technical know-how, ought to be considered more generally in a wide geographical context that could account for stylistic specificities.

In a nutshell, it has to be noted that the pottery from East Anglia illustrates perfectly the end of the Early Neolithic phenomenon of native ceramic style construction, particularly when it comes to developing technical and morphological markers. During the transition to the Middle Neolithic, shapes and decoration patterns appear to be more elaborate, while manufacturing techniques seem to remain rather similar to those used during the Early Neolithic. The Ebbsfleet style is in that respect particularly puzzling as it seems to bear a direct legacy of the Mildenhall pottery (in terms of general morphology, rim shape and decorative techniques). Decorative techniques might well be the most significant part of the Peterborough ware and associated sub-styles, yet their origin still raises questions: should we indeed look further East to find explanations?

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AKTUALITY

SEMINÁŘ DETEKTORY KOVŮ V ARCHEOLOGII 2016

Již tradičně (protože posedmé) jsme se po dvou letech setkali ve Vysokém Mýtě nad tématem detektory kovů a archeologie. Před téměř padesáti účastníky zaznělo třináct příspěvků s různým zaměřením.

Jedním z tradičních témat byla metodika detektorového průzkumu aplikovaná v různých archeologických situacích. M. Beková představila dokumentaci rozoraného depotu kruhových šperků z Klášterce nad Dědinou, kde se podařilo najít jádro depotu, a díky důsledné prostorové dokumentaci i spolehlivě interpretovat způsob rozvlečení jeho obsahu. Vynikající ukázku dokumentace rozoraného depotu mincí z doby římské z Královéhradecka předvedli angažovaní spolupracovníci M. Malý a R. Skácel. Depot obsahuje významný (výhradní?) podíl republikánských mincí, kdy nejmladší složku tvoří dvě mince augustovské, a jde tak o reprezentanta dosud prakticky neznámého depozitního jednání z doby okolo přelomu letopočtu. Jan Mařík seznámil posluchače s již dlouhodobým (nejen) detektorovým průzkumem libického hradiště, kde se kombinací různých nedestrutivních či málo destruktivních postupů podařilo získat informace, které bychom jinak těžko a pracně získávali archeologickým výzkumem, řadu informací bychom však nejspíš nezachytili ani tak. Kamil Smíšek s Jiřím Militkým ukázali precizní dokumentaci mincovního depotu z doby laténské z Libčic nad Vltavou – Chýnova.

Podobně jako v minulých letech, ani letos nechyběli zástupci občanských sdružení, která chtějí používáním detektoru pomoci historii poznávat, nikoliv ničit. Tomáš Merta, zástupce etablovaného a velmi aktivního sdružení Archeo Moravia, představil svoji činnost (především spolupráci s pobočkou Archeologického ústavu Brno v Dolních Dunajovicích) a zároveň ukázal pohled na detektorovou problematiku očima „druhé strany“. Nováčkem byl Klub Hledačů Pardubicka, který se přes zatím krátkou dobu své existence (vznik v r. 2014) může pochlubit velmi zajímavými výsledky.

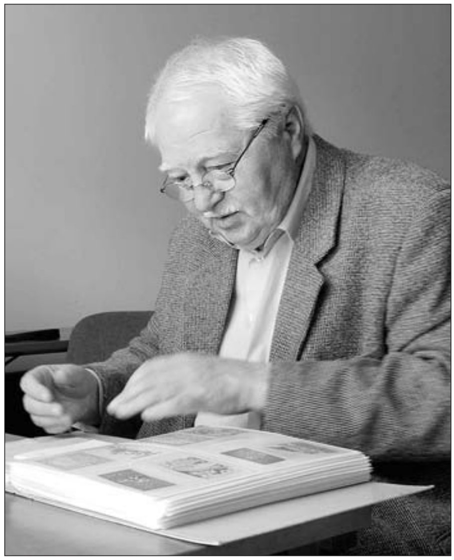
Posledním tématem byly příspěvky zaměřené obecně na problematiku používání detektorů kovů a možnosti/limity spolupráce s neprofesionály. Z nich za zmínku určitě stojí příspěvek J. Militkého zaměřený na keltskou numismatiku, ovšem ve skutečnosti s mnohem širším dopadem. Zásadní roli v detektoringu totiž hraje sběratelství při minimálních možnostech jeho ovlivnění. Zvláštní roli věnoval otázce dokumentace privátních sbírek, jejichž reálný význam daleko přesahuje (alespoň co se keltské numismatiky týká) sbírky veřejné.

Pozoruhodný byl příspěvek Davida Parmy o slitcích z doby bronzové. Tyto nenápadné artefakty jsou při aplikaci správných metodických postupů (odlišení od mladších až recentních slitků, prvková analýza, kategorizace podle vnějších formálních znaků) velmi důležitými prameny o metalurgii doby bronzové. Ty pak boří některé zažité mýty, jako např. představy o vzácnosti měděné/bronzové suroviny na sídlištích atd. Širší studium tohoto pramene slibuje přinést významné informace o práci s kovem v době bronzové a s určitou opatrností i o určitých aspektech organizace společnosti doby bronzové.

Celkově seminář ukázal, že některé dříve aktuální otázky dnes již nejsou v centru pozornosti, jako např. zda spolupracovat s poučenými vlastníky detektorů. Praxe jasně ukazuje mimořádný a všestranný přínos tohoto přístupu (pokud jsou ovšem respektována jasná pravidla garantovaná archeologem příslušné oprávněné organizace). Již nějakou dobu jsme dokonce svědky vzniku takto orientovaných občanských sdružení. Jako žhavá se naopak ukazuje problematika možnosti postihu jednoznačně nelegálních praktik majících nezřídka formu organizovaného zločinu. Zde narážíme na bariéru lhostejnosti široké veřejnosti, a sem bude třeba napřít další úsilí. Další palčivou otázkou je přístup k privátním sbírkám. Tento problém má několik rovin. Jednak vědeckou, kdy privátní sbírky přes svůj původ a z toho vyplývající nezbytnou pramennou kritiku přinášejí naprosto mimořádné informace o minulosti a dokážou bořit desítky let zažitá schémata výkladu. Důležitá je i rovina trestně právní, která naopak práci s tímto pramenným fondem značně problematizuje. Stále zřetelněji pak vystupuje problém finančního krytí preventivní detektorové prospekce, a to nikoliv pouze její terénní části, ale i dalšího zpracování nálezů.

David Vích

ŽIVOTNÍ JUBILEUM SLAVOMILA VENCLA



Osmnáctého října, na svátek evangelisty Lukáše, oslavil v roce 2016 osmdesáté životní výročí Slavomil Vencl. Rodák z Dlouhé Třebové na Ústeckoorlicku je takřka celým svým odborným životem spjat s Archeologickým ústavem v Praze, kde pracoval od r. 1959 a jako emeritní člen je tam činný dodnes.

Z pozice redaktora Archeologických rozhledů dlouhá léta kultivoval psané slovo v prostředí archeologické obce. Řadu let působil na dvou našich vysokých školách. Ač solitér svým zaměřením, jak to bylo charakteristické i pro další příslušníky jeho generace, spolupracoval se širokým okruhem archeologů profesionálních i neprofesionálních. Každopádně, Slavomil Vencl český archeologický diskurz výrazně ovlivnil.

V širokém spektru jubilantova tematického záběru je nesnadné odhadnout, čeho si sám nejvíce považuje, zda svých publikací o paleolitu, o vojenství, o archeologii nenalézaného či o metodologii oboru. Dnes, kdy se Slavomil Vencl věnuje více své životní zálibě, kterou je drobná grafika, nad níž tradičně patronát drží svrchu zmíněný evangelista, je obtížné mu do budoucna popřát co lepšího než radost z nových objevů, i kdyby to neměly být pouze ty archeologické.

Pavel Burgert – Jan Eigner – Vít Vokolek

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Doc. Slavomil Vencl je dále autorem řady drobných zpráv a referátů, hlášení ve Výzkumech v Čechách atd.

NOVÉ PUBLIKACE

Andreas Maier: The Central European Magdalenian. Regional Diversity and Internal Variability. Vertebrate Paleobiology and Paleoanthropology. Springer, *Dordrecht – Heidelberg – New York – London 2015*. ISSN 1877-9077. 455 str.

Monografie představuje fundovanou syntézu vyššího řádu, sice nikoli bez předchůdců (*Rozoy 1988*; *1989*), ale již za situace uspokojivého stavu regionálního výzkumu a publikací ze zájmového území. Všestranně a dokonale odborně připravený autor nabízí přehled středoevropského magdalénienu (dále SEM) od Rhony až po Vislu s katalogem ca 650 souborů z 540 lokalit (a kromě toho i hamburgienu jako srovnávajícího materiálu se 170 soubory ze 160 lokalit, tedy celkem ca 820 souborů ze 700 lokalit), rozdělených do pěti geografických skupin, a přináší rozbory všech aspektů regionální a chronologické struktury tohoto kulturního komplexu z intervalu kolem 18 500 až 14 000 let BP, čímž systematizoval předpoklady pro srovnávání s mateřskou oblastí západně odtud. Databáze umožňuje řešit otázky vedoucí k objasnění rozsáhlých časoprostorových dějů a procesů. Autor přitom důsledně odděluje analytické postupy od interpretací. SEM osídlil rozsáhlé území, zahrnující státy Beneluxu, západní Francie, Německa, Švýcarska, Rakouska, Polska, ČR a údajně i Slovenska (kde by ovšem bylo žádoucí potvrdit přítomnost magdalénienu na jižním úbočí Karpat nespornými doklady). Kniha se opírá se nejen o ca 1300 článků a knih z období 150 let, ale především o vlastní klasifikaci vzorku 26 vybraných pramenů z celého území, jejíž výsledek prezentuje obsáhlý soubor databází pro devět hlavních kategorií (geografická poloha lokalit, kamenné suroviny, schránky měkkýšů, typologie a technologie štípané industrie, rytiny a plasticky zdobené artefakty, fauna, ^{14}C: viz s. 293–455).

A. Maier vychází z poznatku, že pozitivistický sběr deskriptivního popisu empirických faktů nevytváří sám o sobě struktury smysluplných dat. Archeologická data jsou zásadně neúplná, přičemž mezery a rozpory ovlivňují hodnocení. Pouhé – dosud převládající – sledování percentuální frekvence typů štípané industrie nepředstavuje přiměřený nástroj pro poznání čehokoli tak komplexního, jako sociální organizace. Nikoli deskripce, ale analýzy umožňují smysluplnou interpretaci pramenů. Produktivní archeologický výzkum závisí na hermeneutice (metodice správného chápání a výkladu), nepředstavující ovšem volnou spekulaci, ale naopak rozsáhlou a všestrannou verifikaci a kritiku pramenů s nepřímou, ale zásadní orientací na data.

SEM (jehož hranice autor pečlivě diskutuje) sousedí na západě se západoevropským magdalénienem (na území Francie se zásahem na Pyrenejský poloostrov), na severu s creswellienem & hamburgienem (nezávislými, ale s magdalénienem blízce příbuznými, neboť v magdalénienu kořenícími entitami, vzniklými před ca 15 000 cal. BP; odlišnost hamburgienu od magdalénienu zřetelně vyjadřuje tab. 6.53), a jižně od Alp a Karpat s komplexem epigravettienu (fig. 1.1). Databáze lokalit SEM eviduje počet spíše na dolní hranici současného stavu výzkumu (některé velké lokality patrně obsahují nerozlišené fáze osídlení, mezi lokalitami řazenými do mladého paleolitu jich část může náležet magdalénienu, což platí i o nevýrazných souborech z území sousedících s epigravettienem.)

Cenné mapy pylových spekter a složení fauny SEM v kap. 5 názorně dokumentují vývoj a diverzitu přírodního prostředí (jen výjimečně se vyskytne omyl jako kupř. lokalizace moravské jeskyně

Rytířské do severních Čech: fig. 5.7, 5.9, atd.). V kap. 6 provedl autor kritiku dosavadních pokusů o rozlišení lokálních skupin SEM (výčet literatury na str. 81 lze doplnit: např. *Vencl 1991*). Za jisté lokality SEM považuje nálezy spolehlivě datované do intervalu 20 000 až 14 000 let cal BP nebo nálezy nedatované, ale obsahující kombinaci několika diagnostických typů artefaktů; pravděpodobné lokality SEM mají alespoň jeden diagnostický znak a žádné znaky kontroverzní (podle mapy fig. 6.1 uznává v Čechách jen dvě nesporné – nikoli však Putim (*Vencl 2004*), několik pravděpodobných a pár patrně kulturně smíšených lokalit). Po aplikaci uvedených kritérií zjistil, že z 561 kolekcí lokalit SEM náleží do kategorií 1 a 2 ca 59 %, kategorii 3 jen 2 %; ze zbylých souborů není 31 % určitelných a 8 % pravděpodobně postmagdalénienských. Důležité je, že se mapa distribuce lokalit SEM po vyloučení neklasifikovatelných lokalit strukturálně nezměnila (viz fig. 6.1 a 2); autor zastává názor (stejně jako *Rozoy 1988* pro Francii), že dnešní obraz struktury osídlení SEM je již objektivní a definitivní, že ji podstatněji neovlivnila postdepoziční eroze ani různá intenzita lokálního průzkumu. Z mapy fig. 6.2 vyplývá zjevná kumulace lokalit SEM podél větších řek; nápadnou absenci osídlení na některých řekách druhého řádu lze snad interpretovat jejich odlehlostí od zdrojů štěpné suroviny (fig. 6.4; případně ovšem lze lokální absenci osídlení rovněž vykládat malou početností magdalénienských populací, které nestačily čerpat biomasu okolního území). Kolem poloviny lokalit SEM získávalo suroviny hlavně z okruhu ca 50 km; u 97 % lokalit nepřekračují surovinové kontakty vzdálenost 300 km a jen ojediněle se uvádějí vzdálenosti delší. Autor mapoval hlavní směry zásobování kamennou surovinou mezi lokálními skupinami (na fig. 6.12 se u české a moravské skupiny se nápadně jeví absence kontaktů rovnoběžkovým směrem při labsko-dunajském rozvodí v oblasti Českomoravské vrchoviny). Dálkové kontakty dokládají i relativně vzácné nálezy schránek měkkýšů, případně i jantaru (fig. 6.14). Mapy fig. 6.19 až 45 ilustrují prostorový rozptyl jednotlivých typů štípané industrie, kdežto fig. 6.46 až 52 distribuci dochování typů výrobků z organických hmot.

Statistický multivariační rozbor (s. 128 sq.) produkuje tabelace, jejichž vodorovné řádky obsahují soubory a sloupce nezávislé proměnné; jednotlivé testy (např. neparametrický test meziskupinové variability) umožňují číselné i grafické vizualizace objektivně srovnatelných výsledků. Existenci autorem predikovaného, resp. apriorního prostorového rozdělení SEM na pět skupin (jurský region, dunajský region a skupiny Meuse-Rýn, Saale-Vltava, Polsko a Morava) potvrdilo testování přes jejich okrajové teritoriální překryvy na 76 % (např. jen 3 ze 78 lokalit apriorní skupiny 1 bylo po testování nutno přeřadit do skupin 4 a 5); tři západní skupiny jsou si vzájemně podobnější a totéž platí o východních skupinách 4 a 5). Chronologie skupin, rozdělených do čtyř časových úseků podle kalibrovaných dat ^{14}C (tab. 6.12: skupina 1 starší než 16 000 cal BP, 2. skupina 16 000 až 15 000 cal BP, 3. skupina 15 000 až 14 000 cal BP, 4. skupina 14 000 až 13 000 cal BP) byla testována na 78 souborech, obsahujících minimálně 20 štípaných nástrojů (tab. A.36 a 6.12). Zatímco nejstarší a nejmladší skupiny se jeví relativně výrazně a prostorově rozptýleně, skupiny 2 a 3 jsou typologicky homogenní a projevují sklon k vytváření prostorových shluků. Z toho lze soudit, že mezi 16 000 a 14 000 lety BP docházelo k intenzivnímu sdílení idejí. Naproti tomu pokles homogenity nejmladšího magdalénienu autor spojuje s nástupem regionalizace, typické pro období pozdního paleolitu.

Z grafické vizualizace na fig. 6.55 vyplývá, že geografická pozice skupin na grafu odpovídá jejich skutečné poloze na mapě: 1. skupina z okolí Jury leží nejblíž 2. podunajské skupině, kdežto 3. skupina Meuse-Rýn leží na diagramu i ve skutečnosti dále od prvých dvou. Zároveň tři jmenované skupiny tvoří v rámci SEM západní podskupinu; skupiny 4 (Saale-Vltava) a skupina 5 (Polsko a Morava) představují odlehlejší východní skupinu, přičemž skupina 4 (Saale-Vltava) má poněkud blíže ke skupině Meuse-Rýn, kdežto skupina 5 (Morava-Polsko) vykazuje afinity spíše ke skupině podunajské (jejíž expanzi východním směrem jsem připouštěl, ač není nálezově přiměřeně doložena: *Vencl 1991*, 93; *Valoch 2004*, 551, v souladu s ^{14}C daty uvažuje pouze severní kontakty). Odlišnost západní (1–3) a východní (4–5) nadregionální podskupiny SEM se jeví i v distribuci mušlí a jantaru (fig. 6.14). Na základě analýz mohl A. Maier vydělit z jednotlivých skupin lokality náležející k jiným skupinám (např. ze 4. skupiny přiřadil Kvíc /viz i *Benková 2003*/, Kniegrotte a Bad Frankenhausen k polsko-moravské skupině a soubor Gera-Schafgraben přiřadil ke skupině jurské; rakouský Kamegg zase považuje za nejvýchodnější doklad expanze skupiny podunajské).

Vztahy mezi skupinami SEM se projevují jak v technologické, tak typologické variabilitě. Typologicky jsou soubory skupiny Saale-Vltava odlišné od západní podskupiny SEM, přičemž relativně nejblíže stojí ke skupině Meuse-Rýn. Stejně důkladně autor analyzoval geometrické i figurální rytiny a plastiky SEM.

Třetí část knihy obsahuje interpretace SEM: všechny rozbory shodně ukazují, že SEM nepředstavuje homogenní jev, ale naopak je regionálně diferenciován. Vzájemné srovnávání skupin komplikuje různost pramenů: např. nejvíce souborů pochází z regionu Jura (164), zatímco skupina Meuse-Rýn má jen 73 souborů, ovšem z hlediska výskytu inventářů nad 100 nebo 1000 štípaných nástrojů dominuje skupina Meuse-Rýn. Naproti tomu mají skupiny moravsko-polská a východoněmecko-česká přes 100 souborů, ale zároveň vykazují mnoho kulturně neurčitelných a ze sběrů z lokalit pod širým nebem pocházejících souborů (tab. 7.2). Skupina Saale-Vltava obsahuje extrémní zastoupení lokalit pod širým nebem (82 %), samotné Čechy dokonce 87 % atd.

A. Maier podrobil kritice teorii jednosměrné rekolonizace SEM během zlepšení klimatu po odeznění grónského stadiálu 3, protože odporuje současnému stavu poznání radiokarbonového datování v daném prostoru (fig. 8.2). Navrhuje proto novou teorii dvousměrného šíření SEM (fig. 8.5), o němž se domnívám, že může příliš záviset na dnešním stavu regionální ^{14}C chronologie a navíc se opírá o spornou magdalénienskou interpretaci (*Svoboda – Novák 2004* s lit.) Valochových nálezů epigravettienu z Brna – Koněvova ul. (*Valoch 1975*; dnes Vídeňská), kterou výsledky nových výzkumů v této lokalitě nepotvrdily (*Nerudová 2016*). Proto lze spíše uvažovat o možnostech paralelního a nerovnoměrně rychlého šíření malých komunit magdalénienských lovců středoevropskými pahorkatinami k východu více cestami (včetně snadnějšího, a proto rychlejšího, až skokovitého pohybu některých skupin severně a možná i jižně od pahorkatin).

Kniha A. Maiera obsahuje nejen obrovské množství dat a interpretací, ale hlavně představuje syntézu nové kvality, jaké se objevují sotva jednou za generaci.

Slavomil Vencl

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Jaromír Kovárník et al. (eds.): Centenary of Jaroslav Palliardi's Neolithic and Aeneolithic Relative Chronology (1914–2014). FF UHK *Hradec Králové – Ústí nad Orlicí 2016*. ISBN 978-80-7405-396-2. 414 str.

Veliká výročí velikých osobností bývají slavena, a to rozličným způsobem. U příležitosti sta let od vydání základní práce o relativní chronologii moravského neolitu Jaroslavem Palliardim (1861–1922) byla na podzim roku 2014 v Moravských Budějovicích uspořádána konference s názvem „Centetary of Jaroslav Palliardi's Neolithic and Aeneolithic Relative Chronology". Výstupem z konference je sborník, který vyšel přesně po dvou letech.

Dvojjazyčný, německo-anglický svazek je tematicky rozdělen do čtyř oddílů, které obsahují 21 příspěvků od čtyř desítek autorů. Autorské obsazení odpovídá důstojnosti slaveného výročí a obsahuje řadu zvučných jmen středoevropské archeologie. Pokud budeme dále blíže reflektovat jen některé příspěvky, není to způsobeno tím, že by si to ostatní nezasloužily, ale potřebou jistého panoramatického pohledu, předpokládaného zvoleným žánrem. Zmíníme však všechny.

Hned první oddíl, věnovaný chronologii neolitu a eneolitu a vzájemným mezikulturním vztahům poutá pozornost velkými tématy. Eva Lenneis a Franz Pieler předkládají přehlednou stať se zaměřením na chronologii kultury s lineární keramikou v Rakousku. Osm fází, vměstnaných do rozpětí 5670/5413 až 5023/4975 BC je konsekventně popsáno a doplněno patřičným obrazovým doprovodem. Text svou názorností splňuje až učebnicové požadavky a patrně to bylo i jeho cílem. Harald Stäuble shrnuje poslední čtvrtstoletí terénních výzkumů v Sasku zaměřených na období neolitu. Nebylo jich málo a nezbývá než popřát dostatečné množství diplomantů, kteří se s nahromaděnou pramennou základnou seriózně utkají. Ralf Gleser v lákavě znějícím příspěvku o novém způsobu uvažování nad chronologií postneolitických kulturních fenoménů střední Evropy reflektuje tamní nástup pestrých kulturních celků po polovině 5. tisíciletí p. Kr. Synchronizace kulturního vývoje mezi jihozápadním Německem a středoevropským prostorem na základě radiokarbonových dat sice není špatný nápad, ale určitě není ničím novým. Opravdu převratným přístupem by bylo přiznat, že pokroutit živý svět lidských společností, odrážející se jaksi mlhavě v keramickém materiálu, na míru absolutní chronologii je poněkud násilné. O nejistotách takového přístupu referuje ostatně sám Gleser. Autorský kolektiv vedený Martinem Kučou se zaobírá problematikou ukotvení relativně-chronologických stupňů kultury s moravskou malovanou keramikou na ose kalendářních dat. Ne vždycky se to autorům daří tak, jak by si představovali. Avšak možná právě to je ten nejzajímavější výsledek s ukrytým budoucím potenciálem. Do jižního Bavorska, prostoru sevřeného v období mladšího neolitu mezi celky grossgartašské a vypíchané keramiky na straně jedné a lengyelskou kulturu na straně druhé, přivádí zájemce Karin Riedhammer. I přes jisté odlišnosti je patrné, že tamní SOB, jak bývá zkracován termín „Südostbayerisches Mittelneolithikum“, je integrální součástí západního postlineárního vývoje. Přehledný a shrnující článek zdůrazňuje spíše rozdíly, mezi SOB a ostatními skupinami zdobenými vpichy. Podobností je však daleko více.

Zmiňovaný první oddíl zakončují tři příspěvky reflektující vývoj z našeho pohledu na samém okraji středoevropského prostoru. První z nich, od Marko Straky, řeší opět disproporce mezi relativní a absolutní chronologií v 5. tisíciletí p. Kr., tentokrát ovšem v oblasti Slovinska a za použití sofistikovaných metod Bayesiánské statistiky. V dalším uvádí Werner E. Stöckli do věčné problematiky švýcarského eneolitu. Konečně poslední stať tohoto oddílu napsala Lea Čataj a předkládá v ní svou představu chronologického vývoje starého a středního eneolitu (nazíráno naší optikou) v oblasti dnešního Chorvatska.

Ve druhém oddíle referovaného svazku, věnovaném kulturním a sociálním otázkám, je překvapivě zařazen pouze jediný příspěvek. Zda tato skutečnost odráží malou přitažlivost tématu, či zda je to pouze náhoda, je těžké posoudit. Ojedinělým zbloudilcem je Jörg Petrasch s poutavou studií stavící tezi přirozené evoluce sociálních a politických struktur středoevropského neolitu a eneolitu proti představě náhlých kulturních změn. Text jde ruku v ruce s autorovými předchozími pracemi o sociální struktuře neolitické společnosti a je vítaným osvěžením jinak tradičně zamřelého sborníkového ovzduší.

Třetí oddíl, který je zaměřen na terénní výzkumy, obsahuje čtveřici článků informujících o problematice aktuálních odkryvů na Moravě, v Polsku a na Slovensku, to vše v pestré chronologické směsici. O novém nálezu bukovohorské keramiky v jižním Polsku podává předběžnou zprávu Krzysztof Tunia. Jaroslav Bartík s kolektivem píší o překvapivém nálezu dokladů lengyelského osídlení v průkopech intravilánem Moravských Budějovic. Zejména o novém sídlišti kultury nálevkovitých pohárů hovoří ve svém příspěvku Małgorzata Kurgan-Przybylska. Nachází se u slezské Ratiboře a bylo zachyceno tamním záchranným výzkumem. Nedejme se ovšem zmýlit. Realita polských záchranných výzkumů je často jiná než těch českých. Utěšenější. Posledním příspěvkem v tomto oddíle je text věnovaný transkarpatským kulturním vztahům v období badenské kultury mezi Malopolskem a východním

Slovenskem. Jeho autory jsou Albert Zastawny a Eva Horváthová, kteří jím prezentují výsledky společného polsko-slovenského projektu z let 2014 až 2016 (cf. rok konání konference!).

V posledním oddíle sborníku, prezentovaném jako „sonda“ do duchovního života, se nachází více než třetina příspěvků. Otevírá jej stručná zpráva kolektivu autorů pod vedením Miloše Vávry, zabývající se novými nálezy kostrových hrobů lengyelské kultury na Kolínsku. Dříve než vyšel samotný sborník, uveřejnili ovšem autoři kompletní rozbor referovaného nálezu na jiném místě (*Vávra – Beneš – Šťastný 2016*). Kostrový hrob, tentokrát baalberské skupiny nálevkovitých pohárů z moravských Držovic, vyhodnocují Eva Drozdová a Miroslav Šmíd. Tuberkulózou trpící jedinec si svou pozornost jistě zaslouží, stejně jako následující příspěvek Noémi Beljak Pažinové o duchovním světě lengyelských komunit. Snažit se vytvořit představu o duchovním světě pozdního neolitu na základě plastik, závěsků a jiných nestandartních součástí nálezových inventářů je sice podobné, jako pokusit se poskládat obsah synoptických evangelií podle ikonografie křesťanských chrámů, ale co jiného zbývá. Početný tým maďarských badatelů vedených Juditou P. Barnou sestavil přehled aktuálního stavu pramenné základny související s fenoménem kruhových příkopových ohrazení – rondelů – v západním Maďarsku. Jestli je možné všechny tamní struktury tohoto charakteru spojovat s rondelovým fenoménem, jak jej chápeme v česko-moravském prostředí, je již delší dobu diskutováno. Ty bezprostředně časově a prostorově navazující však s největší pravděpodobností ano. Článek Jaromíra Kovárníka o trojitém rondelu v Plotištích nad Labem u Hradce Králové představuje dosud nejúplnější zprávu o tamním systematickém výzkumu z let 2013 až 2014, uskutečněném pod záštitou Katedry archeologie Univerzity v Hradci Králové. K příspěvku se vrátíme níže, zde stojí za zmínku úctyhodná série radiokarbonových dat, získaná z příkopů objektu. S tímto článkem úzce souvisí text věnovaný metodice modelace terénní situace zkoumané v Plotištích, jehož autorem je Štěpán Kravciv. Nové výzkumy ve sto let známé lokalitě s tvarově nestandardním příkopovým útvarem v dolnobavorském Altheimu prezentuje Thomas Saile. Je sporné, jestli nové výzkumy v této lokalitě mohou přinést převratné výsledky, za pozornost však tento objekt rozhodně stojí. Posledním příspěvkem celého sborníku je stať Márie a Ľubomíra Novotných věnovaná slovenským nálezům antropomorfních aplikací na neolitické keramice. Shrnující text je dobře heuristicky zaopatřen a může se stát spolehlivým východiskem dalších syntetických prací.

Referovaný sborník je bezpochyby důstojným, byť trochu opožděným vyvrcholením oslav výročí sta let od vydání základní práce o relativní chronologii moravského neolitu. Nabízí se snad jen otázka, jestli bylo nutné pojímat jej zcela cizojazyčně a tím, při vší upřímnosti, zasunout pod obzor většinové tuzemské čtenářské obce. Zejména když svazek nemá důsledně ucelený koncept a příslušnost k Palliardiho výročí je u většiny příspěvků spíše volná. Články ve své většině nadnárodní přesah nemají a jako řada jiných překladových počinů vzešlých z českého prostředí se svazek bude v nejlepším případě citovat. Jestli se bude číst, je však otázkou.

V každém případě je na tomto místě vhodné uvést na pravou míru nesrovnalosti obsažené v jednom z otištěných textů. Jaromír Kovárník ve svém obsáhlém článku **Das dreifache Rondell der Stichbandkeramischen Kultur (SBK) in Plotiště nad Labem II bei Hradec Králové und analoge Funde** (s. 337–376) uveřejňuje mj. výsledky systematického výzkumu Katedry archeologie Univerzity v Hradci Králové, který probíhal v letech 2013 až 2014. Předmětem výzkumu byl mladoneolitický rondel na katastru Plotišť nad Labem, který je dnes součástí severního předměstí Hradce Králové. Objekt nebyl bezprostředně ohrožen, a jednalo se tak o čistě badatelský záměr autora, na který poskytla prostředky královéhradecká univerzita.

Výsledky odpovídají poměrně skromným podmínkám výzkumu, vedeného zejména jako studentská terénní praxe. Kruhový objekt se třemi příkopy, zjištěný nejdříve leteckou prospekcí, byl zkoumán pouze v malém výseku u jeho jižního vstupu. Jaromír Kovárník jej označuje jako Plotiště nad Labem II, přestože z katastru žádný další rondel znám není. Ve snaze o pochopení tohoto autorova postupu nahlédneme i do jeho předchozích prací.

Text dále přináší přehled rondelových staveb v oblasti labského pravobřeží mezi Jaroměří a Hradcem Králové. Autor dává jejich lokalizaci do souvislosti se soutoky řek a potoků. Například rondel v Semonicích se má nacházet poblíž soutoku Labe, Úpy a Metuje. K současnému ústí Úpy do Labe je to sice skoro 4 km vzdušnou čarou a k Metuji téměř 3 km, ale v mapě na úrovni autoatlasu se souvislost může jevit zřejmou. Co je však důležitější, je skutečnost, že mezi semonickým rondelem a zmiňovanými soutoky leží nejméně tři další soudobá sídliště kultury s vypíchanou keramikou (StK), jedno z nich zkoumané v mimořádném rozsahu 8 ha (*Burgert 2015*). Proč není rondel situován u nich, má-li mít souvislost s říční sítí? Tento úhel pohledu je kamenem úrazu celého konceptu J. Kovárníka. Pojednává totiž rondely samostatně, bez jakékoli souvislosti s tamním mladoneolitickým osídlením. Proč tak autor činí, je obtížné posoudit. Skutečností ovšem zůstává, že sídelní rešerše je náročná činnost a přirozeně se nedá dělat bez materiálu, pouze na základě leteckých snímků.

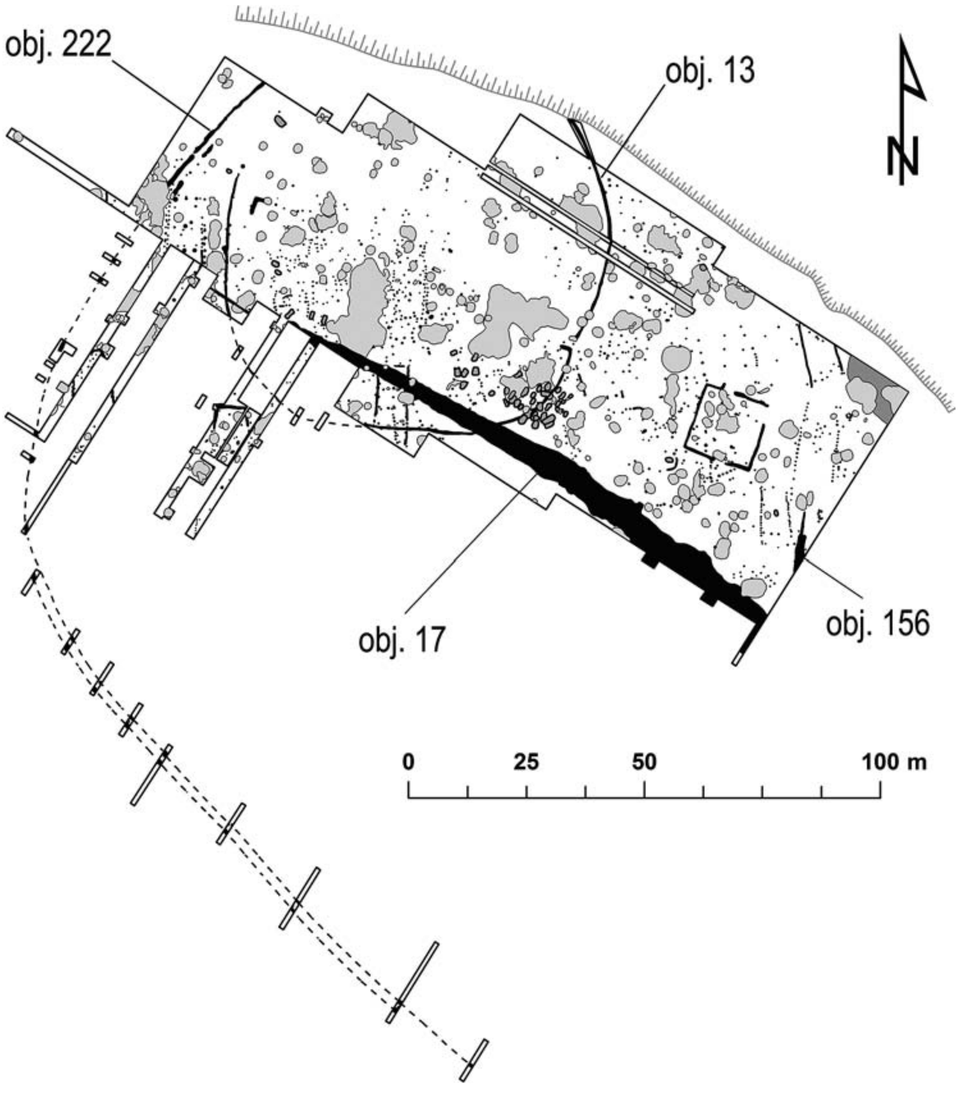
V celém úseku pravobřeží se nachází pětačtyřicet revidovaných lokalit s nálezy keramiky StK. Některé lze sloučit do větších sídlištních celků, většinu nikoli. Osídlení mladšího stupně zde naprosto převládá. Nejsou rondely v této oblasti lokalizovány prostě proto, že se zde nachází silná sídelní enkláva, jejíž osídlení vrcholí v období budování rondelů? A abychom vystoupili z bludného kruhu cílené vazby na říční tok: silné neolitické osídlení je do této oblasti situováno proto, že se sprašové sedimenty vzhledem k převládajícím severozápadním větrům v glaciálech, ukládaly na závětrné straně údolí, v tomto případě tedy na pravobřeží.

Autor neopomněl zdůraznit nálezy nádob kultury s moravskou malovanou keramikou (MMK) v kontextu tamní mladší StK. Doslova uvádí, že jsou to „například lokality Lochenice, Holohlavy a Předměřice“. Jako příklad by to jistě stačilo, kdyby jich ovšem nebylo právě jen tolik. Co již J. Kovárník neuvádí, je skutečnost, že stejné množství je tam i nálezů soudobé keramiky původem ze západních oblastí, tedy oberlauterbašské skupiny. V pozadí nelze nerozpoznat snahu prostřednictvím účelového výběru skutečností dovést čtenáře k předem vytčenému cíli. Ostatně autor své postoje již v minulosti vyjádřil poměrně jasně, když obyvatelstvo StK označil za *retardované* (*Podborský – Kovárník 2005*, 140).

Nyní krátce k terminologii. Plotišťským rondelem s označením I má autor na mysli palisádové ohrazení odkryté dlouhodobým výzkumem A. Rybové a V. Vokolka při výzkumu polykulturní lokality na rozhraní Plotišť a Předměřic nad Labem v letech 1961 až 1970. V předchozím tematickém článku jej takto „pracovně označil“ (*Kovárník 2014*, 21) s odkazem na jiný svůj předchozí text (*Kovárník – Mangel 2013*), kde o něm ovšem blíže nehovoří. Účelem je zjevně tak dlouho uvádět neověřené hypotézy, až se jejich mantrickým opakováním samy potvrdí. Změť autocitací a lapidárních tvrzení typu „jak jsme již dříve uvedli“ budí dojem množství odvedené práce. Opak je však pravdou.

Na tomto místě uveďme ve stručnosti několik důležitých okolností, týkajících se výzkumu A. Rybové a V. Vokolka. Výzkum byl v počátku zaměřen na žárové pohřebiště z mladší doby římské. Od první sezóny výzkumu byly průběžně nalézány doklady aktivit i z jiných období pravěku, které se zpravidla nacházely stratigraficky pod římskými žárovými hroby. Rovněž na počátku výzkumu byl zachycen palisádový žlab (obj. č. 13), jehož průběh byl sledován i v dalších letech (*obr. 1*). Později byl v západní části plochy zachycen druhý obdobný žlab (obj. 222), jehož průběh mimo zkoumanou plochu byl zčásti sledován pomocí sond. Souvislost mezi oběma liniovými útvary nemohla být terénním výzkumem vyřešena, protože klíčový úsek předpokládaného průniku obou objektů byl zničen již počátkem 20. století postupující těžbou v přilehlé cihelně předměřického cukrovaru. Kromě jmenovaných dvou palisádových ohrazení se na ploše výzkumu nacházejí rovněž dva příkopy. První z nich (obj. 156) byl zachycen pouze v krátkém úseku při východní hranici zkoumané plochy. Druhým je hluboký příkop (obj. 17), který v jižní části přerušuje zmiňované menší ohrazení (obj. 13).

Datace výše uvedených objektů byla v nedávné době podrobena revizi (*Burgert – Vokolek – Řídký 2016*). Výsledkem analýzy prostorových vztahů a keramického materiálu je zařazení menšího palisádového ohrazení (obj. 13) do časového úseku odpovídajícího mladší StK až staršímu eneolitu. Autoři revize se přiklánějí k dataci do mladšího stupně StK. Průběh většího ohrazení (obj. 222) nebyl narušen žádnými superpozicemi a je možné jej datovat pouze na základě kritického posouzení keramického materiálu z výplně žlábku. Nejpravděpodobnější se u tohoto objektu jeví zařazení do období únětické kultury. Díky pokračujícímu zpracování ostatních pravěkých komponent v lokalitě, kterému se aktuálně věnuje jeden z autorů někdejšího výzkumu V. Vokolek, je možné se blíže vyjádřit i k časovému zařazení obou příkopových útvarů. Menší z nich (obj. 156) náleží slezskoplatěnické kultuře. Větší (obj. 17) je opět řazen do únětické kultury.



Obr. 1. Plotiště nad Labem, okr. Hradec Králové. Plocha výzkumu A. Rybové a V. Vokolka z let 1961–1970 s vyznačením palisádových ohrazení a příkopových útvarů.

Bez jakéhokoli přístupu k terénní dokumentaci či archeologickému materiálu J. Kovárník v referované stati rovněž přistupuje k dataci některých zmíněných objektů. V případě vnitřního ohrazení se domnívá, že náleží mladšímu stupni StK (spekuluje dokonce o jeho příslušnosti k StK IVb). Je však vhodné připomenout, že A. Rybová a po ní i *K. Godłowski* (*1992*) řadili toto ohrazení k mladořímskému pohřebišti a že J. Kovárník z jiných zdrojů nečerpá. Jak tedy ke svým závěrům přišel, není jasné. Příkopový útvar (obj. 17) rovněž jaksi mimoděk datuje do období mladší StK. Domnívá se snad autor, že příkop a palisáda spolu souvisejí a vytvářejí jeden objekt – rondel? Podle označení lokality (viz výše) patrně ano. Nebo si na několika málo dosud publikovaných a vesměs špatně otištěných schématech plete objekty č. 17 (příkop) a 222 (vnější ohrazení)? Nejspíše se jedná o souběh obojího, protože v jiném svém článku J. Kovárník v poznámce pod čarou uvádí: „*Záměrně jsme označili trojitý rondel jako lokalitu Plotiště n/L II, protože považujeme za lokalitu Plotiště n/L I okrouhlý příkop zřejmě vkomponovaný do velkého oválného ohrazení osady kultury s vypíchanou keramikou nacházející se na ploše a v okolí hliníku bývalého cukrovaru v severní části katastru, kterou zkoumali A. Rybová a V. Vokolek v letech 1961–1970*“ (*Kovárník 2016*, 32). Ve zmiňované lokalitě se však žádný okrouhlý příkop nenachází, a už vůbec ne vkomponovaný do velkého oválného ohrazení z doby kultury s vypíchanou keramikou (*obr. 1*).

Vraťme se ještě krátce k jedinému dosud známému rondelu v Plotištích, zkoumanému v letech 2013–2014, který v neorganicky členěném článku poněkud zaniká. V obou výzkumných kampaních bylo z výplně příkopů celkově získáno jen nepatrné množství nálezů. Jedná se o necelou stovku keramických fragmentů, z nichž 27 bylo zdobeno, a 9 kusů štípané industrie. Oněch pár keramických zlomků autor odvážně datuje do vývojového období StK IVa. Proč ne, klidně to tak může být. Ale z logiky věci vyplývá, že funkce objektu je starší než jeho výplň. Jak dlouho vznikala, nelze spolehlivě doložit. Opravdu zajímavým zjištěním je, že se ve výplni objektu nenacházel takřka žádný archeologický materiál, a to i přes to, že byla zkoumána část vstupu, kde se nálezy zpravidla koncentrují (*Řídký a kol. 2012*). Tuto okolnost lze vysvětlit absencí soudobého osídlení v bezprostředním okolí objektu. Od okamžiku ztráty původní funkce se tak do příkopu dostávalo jen malé množství odpadu. O to obezřetněji by se mělo s keramickými nálezy zacházet, věří-li autor, že mají schopnost funkční období objektu chronologicky ukotvit. Závěrem poznamenejme, že na katastrálním území Plotišť nad Labem, které zaujímá plochu zhruba 6,5 km^2, se nachází dalších osm poloh s keramickými nálezy StK. Kdyby autor tuto okolnost znal, mohly by být úvahy o tamním sídelním uspořádání poměrně zajímavé.

I přes řadu nesrovnalostí vyplývajících z autorových zanedbatelných znalostí sídelní struktury východočeského neolitu lze v Kovárníkově stati vyzvednout několik důležitých věcí. V první řadě se jedná o jedinou a dostatečně podrobnou zprávu o výsledcích badatelského výzkumu mladoneolitického rondelu v Plotištích nad Labem, uskutečněného pod záštitou Královéhradecké univerzity v letech 2013 až 2014. Pak také uveřejňuje rozsáhlou sérii radiokarbonových dat získaných z uhlíků ve výplni příkopu. Ta mohou být užitečná dalšímu bádání.

Pavel Burgert

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Šestnáctým svazkem se obměňuje tvář sborníku *Dějiny staveb*. V důsledku přenesení konference z Nečtin do Plas je vyobrazení neogotického zámku na původní titulní straně obálky nahrazeno vedutou cisterciáckého kláštera. Jinak ale grafická úprava sborníku zůstává stále stejná. Nemění se ani jeho koncepce. Naprosto převládají materiálové články stavebních historiků, prezentujících zpravidla výsledky operativních průzkumů. I tentokrát jsou v hojné míře zastoupeny příspěvky o hradní architektuře. Mezi nimi svým syntetickým rázem vyčnívá obšírná studie *J. Varhaníka* (71–84) o typologii a funkci štítových zdí. Na základě širokého souboru příkladů si autor klade otázky, jak se její podoba mění v souvislosti s masivním nástupem těžkých palných zbraní počínaje husitskými válkami. Dochází k předpokladu, že štítová zeď i v 15. stol. plnila stejné funkce jako v předchozím období, kdy se k boření staveb na dálku používaly výhradně velké praky. J. Varhaník se vymezuje vůči často v literatuře uváděným úvahám, že masivní zdi sloužily především jako bariéry proti střelbě. Z balistických křivek munice středověkých děl a praků logicky dovozuje, že střely obléhatelů do hradního jádra shora dopadaly bez ohledu na čelní masivní zdi. U dělových (podobně jako u prakových) projektilů totiž dráha letu musela nabrat značné výšky, aby vůbec zasáhla cíl. Autor se proto domnívá, že štítové zdi do značné míry plnily symbolickou (demonstrační) roli. Zároveň jim ale přisuzuje i praktický účel, ale jiný, než se dosud předpokládalo. Často měly bránit obléhatelům v pozorování vlastního hradu, čímž účinným způsobem znesnadňovaly jeho ostřelování.

T. Karel a *A. Kratochvílová* (143–155) oproti mnoha jiným autorům čtivě seznamují s výsledky podrobného průzkumu zbytků jedno z pozdně gotických paláců hradu Švihova. Ke srozumitelnosti jejich sdělení velkou měrou přispívá bohatá a instruktivní dokumentace. Co je však podstatné, autoři vykračují z tradice českého kastelologického bádání tím, že se primárně zamýšlejí nad otázkou funkce rozlehlé budovy, která – zdá se – postrádala otopná zařízení. Obsahovala velký, nástěnnými malbami zdobený sál s náročně konstruovaným stropem. Autoři zdůrazňují, že jádro švihovského hradu sestávalo z řady dalších reprezentativních prostor, asi v něm ale úplně chyběly klasické obytné jednotky. Tím otevírají podstatné téma, k čemu vlastně sloužily velké hrady čelných představitelů panského stavu. K řešení této problematiky velkou měrou přispívá i článek *L. Šabatové* (129–142), jež předkládá poznatky z hloubkového průzkumu mimořádně dlouhé pozdně gotické sýpky na hradě Pernštejně. Autorka zjistila, že tuto funkci plnila až od 60. let 15. stol., kdy původně obytná, asi ve 14. stol. založená stavba prošla radikální přestavbou. Velký respekt vzbuzuje příspěvek *J. Štětiny* (89–109), který předkládá výsledky komplexního průzkumu zříceniny rozlehlého hradu Holštejna u Blanska. Je těžko představitelné, kolik času autor vynaložil na pořízení celkového plánu lokality a detailních nákresů torz jednotlivých budov.

Klášternímu a městskému opevnění východočeského Broumova se obšírně věnuje *J. Slavík* (183–194). Zaniklé prvky obranného systému rekonstruuje na základě řady barokních a mladších vedut. Hlavně se ale zaobírá pozoruhodnou pozdně gotickou polygonální baštou, která samostatně stála před jednou z městských bran. Na obytný dům přestavěná bašta zanikla v důsledku barbarského rozhodnutí v 60. letech 20. století. Těsně před zbořením byla provedena její dokumentace, na svou dobu poměrně podrobná. Objekt byl pozoruhodný hlavně tím, že v interiéru obsahoval – je otázka, zda už od počátku – kapli. Autor zasazuje baštu do širších regionálních souvislostí a uvádí několik analogických sakrálně-fortifikačních staveb při vstupech do měst ve Slezsku a Horní Lužici.

Z článků věnovaných sakrální architektuře stojí za pozornost syntetická studie *J. Skopce* (110–122) o venkovských kostelích v severozápadních Čechách, nově vybudovaných či výrazně přestavěných ve 2. třetině 15. století. Do tohoto období autor klade hned několik staveb, které veškeré dosavadní bádání na základě formálních znaků datovalo podstatně časněji, zpravidla do 14. století, přičemž se odvolávalo hlavně na tvarosloví kleneb presbytářů. J. Skopec však na základě detailního srovnání s lounským kostelem sv. Petra, spolehlivě datovaným na základě písemných pramenů, předkládá přesvědčivé argumenty pro zařazení podobných venkovských realizací až do pohusitského období. Bádáním dosud přehlížené kamenické značky či specifické detaily kamenosochařské výzdoby dovolují identifikovat konkrétní kameníky, a na základě širšího srovnávacího studia tím pádem umožňují spolehlivou dataci. Nejen archeologovi ze Skopcova článku plyne poučení, že by se neměl příliš spoléhat na údaje v soupisové literatuře.

Pozornost badatelů zabývajících se středověkou stavební kulturou zasluhuje příspěvek *M. Volovára* (289–304), který z konstrukčního hlediska přehledně pojednává archaické venkovské stavby ze samé jihovýchodní výspy Slovenska, které se zde dodnes sporadicky dochovaly ještě v terénu. Zajímají ho příklady rámových konstrukcí – s trámovým nosným skeletem a dřevohliněnými výplněmi. S pozůstatky navlas shodných staveb se archeologové setkávají po celé střední Evropě napříč vrcholným a pozdním středověkem.

Jan Kypta

Julia Farley – Fraser Hunter (eds.): Celts. Art and Identity. Exhibition Catalogue London – Edinburgh. British Museum and National Museum of Scotland, *2015*. ISBN 978-0-7141-2835-1 hardback and 2836-8 paperback. 304 pp., with 267 figs.

Just after I finished a review of *Kruta 2015* for Památky archeologické, this new book for more general public was kindly sent to me, with some suggestions of a deeper insight into the language of Celtic art. The new exhibition catalogue encouraged me to try to approach Celtic art from another angle than it is usual nowadays: to compare it with the Greek art and philosophy of the same time, as already Paul Jacobsthal saw, but later the Celtic school of scholarship went a separate path from the Greek scholars and this idea was not further developed. The rise of the Early La Tène art was contemporary with the peak of Greek enlightened cosmology of Anaxagoras, who considered planets some kind of large meteorites, and the peak of the noble realism in the Parthenon. The founders of La Tène art and the masters of flacons knew the same level of craftsmanship and geometry as the Greek artists (cf. *Kruta 2015*, 38, 57–59; *Megaw 2001*, figs. 54–57, 58–62, 139–141), but their school refused the realistic representations: their dragons should help to introduce through a shock to some ritual in the mystery religion, whose part the feast of drinking with libations apparently was; already the shape was pointing out the difference between the simple form of Etruscan *Schnabelkannen* and its transformation into the sophisticated mannerism of the flacons. The dissolving of realistic representation, some kind of astrology was part of rituals in megalithic constructions, calendars and even ritual vessels (*Kruta 2015*, 177–187). The Celtic art can be seen as reaction against Attic philosophy, in connection with Pythagoreans, whose teaching was similar to that of the druids. The *têtes coupées* with mistletoe which flourishes in winter (*Megaw 2001*, figs. 74–75) were illustrations to the message of the cycle of deaths and rebirths, of consolation, overcoming fear and strengthening hope and courage.

The North Thracian priest Zalmoxis was considered a slave of Pythagoras by Herodotus (Her. IV, 93–96). Of two anecdotes on Celtic perception of the universe one refers on Alexander's meeting with the Celts in the year 335 BC on the Danube (Strabo VII, 3.8). Their only fear in their otherwise courageous attitude was that the sky may fell into their heads. The second is about Brennos in Delphi. In one of the versions the fall of the rock did not stop the Celts to come into the sanctuary, and after seeing the statues of stone and wood instead of expected gold, he started to laugh; after being asked why, he responded that gods could take over any shape, but cannot be forced to stay in one of them (Diod. Bibl. hist. XXI, 9). The nature was in hands of deities, not a clockwise mechanism (see *Venclová 2002*).

The Celtic art during its development followed the subsequent styles of Greek art, but with refusal of realistic representations similarly as the Jewish art reflected the common style of its European neighbours or the Ottoman art of Istanbul the Art Nouveau, but the links with the Greek styles of jewellery are especially strong. The Early Style with autonomous local schools best represented in mask fibulae and belt finials (e.g. *Kruta 2015*, 61, 69 below, 72 below, cf. *Deppert-Lipschitz 1985*, 136–160) was followed by the 4th century 'Italic' styles (*Kruta 2015*, 90–91, 92–95, 97, 99–101) reflecting the Greek 4th century "Ripe Classical" stage (*Deppert-Lipschitz 1985*, 161–199). In the 3rd century it followed the Hellenistic 'baroque' phase (*Kruta 2015*, 114–116, 120–123; *Megaw 2001*, figs. 208–209; cf. *Deppert-Lipschitz 1985*, 205–244) with the final 'rococo' stage ca. 200 BC (*Kruta 2015*, 124–125, 129, 138–139; *Megaw 2001*, figs. 228–230; *Deppert-Lipschitz 1985*, 245–287), and the late "Bucket Style" (*Kruta 2015*, 160, 162–165, 167, the Gundestrup cauldron pp. 168–171; *Megaw 2001*, figs. 246–262, 313–316), followed in its 'noble' version (cf. *Bouzek 2014*) the simplifying forms of so-called Graeco-Roman transitional style in jewellery (cf. *Deppert-Lipschitz 1985*, 279–296) and sculpture. Celtic art lead a polemic with Classical and Hellenistic Greece, accepted some elements of its achievements, but forcefully rejected those features, which were alien to its attitude, its beliefs.

Jan Bouzek

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Lutz Grunwald (Hrsg.): Den Töpfern auf der Spur. Orte der Keramikherstellung im Licht der neusten Forschung. 46. Internationales Symposium Keramikforschung des Arbeitskreises für Keramikforschung und des Römisch-Germanischen Zentralmuseums Mainz vom 16. bis zum 20. September 2013 in Mayen. RGZM – Tagungen 21. Verlag des Römisch-Germanischen Zentralmuseums, *Mainz 2015*. 466 str.

Kvalita sborníků z konferencí spolupořádaných spolkem *Arbeitskreis für Keramikforschung* poměrně výrazně kolísá po obsahové i formální stránce, ovšem svazek vydaný péčí Římsko-germánského centrálního muzea se v obou ohledech řadí k nejzdařilejším. Specifický je ale z toho důvodu, že v něm naprosto dominují příspěvky archeologů, přičemž v ostrém kontrastu s tradicí daných sborníků téměř chybějí články etnografů a historiků umění. Ze zaběhaných kolejí proto vybočuje i chronologická škála pojednávané látky. Novověk je tentokrát pokryt až překvapivě skromně, kdežto nebývale výrazný přesah do antiky a doby římské tvoří jedno ze dvou těžišť. To druhé jako obvykle leží ve vrcholném středověku. Kdo by se těšil na články o kachlích, fajánsi či porcelánu, bude spíše zklamán, byť úplně zkrátka nepřijde. Zato badatelé zabývající se technologií a distribucí běžné keramiky budou nadšeni. Z geografického hlediska je koncepce sborníku tradiční, neboť i tentokrát zcela převládají autoři z jazykově německých zemí. Ve středu jejich zájmu se nejčastěji ocitá Porýní, kde ostatně leží i slavné hrnčířské město Mayen, v němž se konference konala. Zdejší masová produkce keramiky započala už v době laténské a v podstatě kontinuálně přetrvala do novověku.

Tematický a koncepční rozptyl článků je široký. Převažují materiálové příspěvky o archeologických dokladech působnosti hrnčířů v jednotlivých lokalitách, ponejvíce z doby římské a vrcholného středověku. Srovnávací studium obohacuje několik nově publikovaných nálezů pozůstatků vypalovacích pecí. Častěji jsou ale zmiňovány objevy střepišť s výrazným podílem defektních výrobků. Nejen zahraniční badatelé ocení souhrnný článek o hrnčířských pecích na Moravě ve 13.–15. století. Ve sborníku zaujímají hodně místa výsledky petrograficko-mineralogických analýz střepů. Ačkoli se exaktní metody při studiu historické keramiky už mnohokrát osvědčily, většina zde prezentovaných příkladů působí samoúčelně. Detailnímu zkoumání totiž byly podrobeny nálezy z jednotlivých lokalit, aniž by byla předem promyšlena návaznost na řešení obecných kulturněhistorických témat.

Jen okrajově jsou ve sborníku zastoupeny příspěvky experimentální archeologie, pozornost ale zasluhují, zvláště dva články o pokusech s vypalováním keramiky. V obou statích jsou zároveň nastíněny postupy replikace výstavby pece podle konkrétních archeologických nálezů. Východisko jednoho pokusu představovaly nálezy jednoduchých jednokomorových pecí z porýnské lokality Overath, vesnického sídliště merovejské doby, přičemž paralelně byl uskutečněn pokus s vypalováním keramiky tzv. polním způsobem (na milířovitě zakrytém ohni). Rozdílné podmínky výpalu se na charakteru střepu zřetelně projevily vizuálně a hapticky. Originální keramice se mnohem více podobaly výrobky vypálené tzv. polním způsobem, který se překvapivě ukázal jako efektivnější: v peci popraskalo mnohem více nádob. Autoři pokusu přesto nevylučují, že odkryté pece sloužily z vypalování keramiky. Prý mohly sloužit při výrobě jakýchsi vizuálně hodnotnějších (*optisch hochwertigere*) nádob. Lze-li výrobu keramiky na merovejském sídlišti označit za podomáckou, druhý ve sborníku představený experiment s vypalováním keramiky se naopak týká vysoce specializované produkce. Replikována byla výroba kameniny na základě nálezu velké pece (včetně poslední vsázky) z 13. stol. v prostoru zaniklé hrnčířské vsi Bengerode v jižním cípu Dolního Saska. Poněkud překvapivě se ukázalo, že v zadní třetině vypalovací komory nebylo možné dosáhnout dostatečně vysoké teploty, aby zde umístěné nádoby získaly slinutý střep. Nemalá část výrobků proto musela projít dvojím výpalem. Vsázka přitom čítala přibližně 600 nádob, což obnáší asi dvacet dní práce jednoho hrnčíře.

Badatele, kteří se zabývají genezí vrcholně středověké keramiky v severozápadních Čechách, jistě zaujmou dva články o nálezech výrobního hrnčířského odpadu z významného města Wittenberku a zapadlé dolnolužické vísky Neupetershain. Z obou lokalit pochází vyspělá keramika z 2. pol. 12., resp. z 13. stol., k níž po morfologické i technologické stránce nalezneme řadu analogií na českém území. V lužické vsi je doložena výroba nejen běžných kuchyňských a stolních nádob, ale vzácně také miniaturních tvarů z jemně plavené bělavé hlíny. V obou lokalitách lze shodně studovat mísení několika výrobních tradic – domácí („slovanské“) s několika cizími. Nálezy z Wittenberku jsou přímo interpretovány jako doklady přítomnosti hrnčířů, kteří sem přesídlili z rýnsko-vlámského prostoru. A co je zajímavé, v dalších zdejších dílnách se tu paralelně vyráběly prosté kulovité hrnce příznačné zejména pro široký pás zemí při Severním a Baltském moři. Mimochodem, tyto nezdobené nádoby se ve výrazném množství objevují i ve střepišti ve vsi Neupetershain.

Problematika mobility vrcholně středověkých hrnčířů je obsažena i v souhrnném článku o středověkém a novověkém hrnčířství v kantonu Curych. V tamním městě Winterthuru objevená hrnčířská pec z doby kolem roku 1400 je spojována s hrnčířem, který údajně pocházel odněkud ze severního Německa. Otázky mobility řemeslníků a kulturního transferu obecně procházejí celým sborníkem jako červená nit. Počínaje antickým obdobím a konče 19. století. Tehdy do Čech ze západoněmeckého kraje Westerwald přesídlili specialisté na výrobu kameninových lahví na minerální vodu, hlavně bílinskou. O nich přináší řadu životopisných údajů článek německého autora, který pečlivě excerpoval prameny v pražském Národním archivu. Z metodického hlediska stojí za pozornost i příspěvek o keramice z 16.–17. stol. z latinskoamerického města Panama la Vieja, které sloužilo jako uzel dopravních tras z Pacifiku do Atlantiku. Nepřekvapuje, že ve zdejším kulturně a etnicky pestrém prostředí se používala keramika dovážená z mnoha evropských a amerických oblastí. Pozoruhodné jsou zejména osobité adaptace domorodých hrnčířů na módní trendy zámořského původu. Indiáni a míšenci dosti schopně napodobovali žádanou keramiku ze Španělska, která sama vycházela ze vzorů cizích – maurských, potažmo antických. Domorodci ji ale místo na kruhu tvarovali v ruce.

Zapadnout by neměl zdánlivě marginální materiálový článek o pohárech z pozdně středověkého Wittenberku. Nádoby elegantních tvarů patří mezi hrnčinu, od běžného zboží se ale výrazně odlišují tenčím střepem, a zejména specifickou technologií. Otázkou zůstává, jak dávní hrnčíři docílili velice homogenního bělavého střepu s kovově tmavým povrchem vně i uvnitř. Pro další studium je podstatná skutečnost, že se tyto poháry náhle objevují v 15. stol., a to na poměrně širokém území. Článek upozorňuje na několik příkladů z německých zemí. Analogie – po technologické stránce přímé, po typologické stránce volné – lze nacházet i v Čechách (např. na západočeském hradě Preitensteinu: *Mařík 2016*, obr. 9, 24), dosud se ale nedočkaly soustavné pozornosti. Vzhledem k tvarové a výzdobné variabilitě lze tentokrát sotva uvažovat o mobilitě hrnčířů, nechce se ale věřit tomu, že by se velice specifická technologická inovace souběžně objevila v různých koutech střední Evropy nezávisle na sobě. K úvahám tohoto druhu poskytuje referovaný sborník nepřeberné množství podnětů.

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Venceslas Kruta: Le monde des anciens Celtes.

Editions Yoran, *Fouesnant 2016*. ISBN 978-2-3674 7-012-2. 396 pp.

The book is a counterpart to the monumental oeuvre of the author *Art des Celtes* discussing the individual works of art (reviewed in Památky archeologické 2017). It brings a summary of many previous studies and of the compendium of the author (*Kruta 2010*) in a more popular version destined for broader public, but expressing his ideas in more clear and impressive manner understandable not only to specialists, but also to educated non-experts in archaeology.

One point should be stressed. Venceslas Kruta insists in all his recent books and papers that Celtic art, despite of its fragmentary preserving and nearly without live-size monuments, represents an autonomous field of specific spiritual message, comparable with other chapters of human art of the mankind. The origins of La Tène style are contemporary with the peak of Early Classical Greek art and philosophy of enlightenment of Anaxagoras, and it can be seen as the result of opposite spiritual teaching of the druids, very near to that of the Pythagoreans. A number of later styles arose from inspiration by spiritual movements: the pre-Romanesque by the Irish church mission on the continent, the Romanesque by the Benedictines, Gothic by the school of Chartres, renaissance with return to Classical antiquity by humanism, while baroque and Jesuit styles were inspired by restoration of Catholic Church. The book under review also defends the Celtic message for France and Central European countries, opposing the contemporary attempts of British appropriation of Celtic heritage (*Farley – Hunter eds. 2015*), and it also offers the understanding of the universe not as fixed clockwise machine as most of us understand it nowadays, but as something alive: as Gaia, in the Heidegger's distinction *das Werdende*, not *das Seiende*.

Jan Bouzek

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Christopher T. Morehart – Kristin De Lucia (eds.): Surplus: The Politics of Production and the Strategies of Everyday Life. University Press of Colorado, *Boulder 2015*. ISBN 978-1-60732-3 71-6. 338 str.

Koncepcia prebytku a jeho tvorba má svoje náležité miesto v rámci antropológie či ekonomických vied a zohráva hlavnú úlohu v mnohých materialistických interpretáciách spoločenských zmien. Z archeologickej perspektívy predstavuje prebytok významného činiteľa v otázkach historického vývoja, rozloženia moci a spoločenskej stratifikácie zaniknutých civilizácií. Avšak, aj vzhľadom na svoju mimoriadne rôznorodú povahu sa úloha prebytku len ťažko konkretizuje, o čom svedčí aj skutočnosť, že väčšina publikácií túto tému opomína alebo obmedzí len na frázy typu „*produkcia prebytku umožnila…*". Práve túto medzeru v chápaní a interpretácii úlohy prebytku sa pokúša zaplniť nová publikácia s názvom *Surplus: The Politics of Production and Strategies of Everyday Life*, ktorú vydalo vydavateľstvo University Press of Colorado v roku 2015. Publikácia dostala formu kolektívnej monografie a vznikla pod vedením editorskej dvojice Christopher Morehart a Kristin De Lucia. Publikácia je rozčlenená na úvod, 10 kapitol (prípadových štúdií) a záver, pričom nazerá na koncepciu prebytku ako na analytický konštrukt a historický fenomén.

O primárnom zámere publikácie informuje jej mimoriadne obsiahly úvod, v ktorom autori Christopher Morehart a Kristin De Lucia oboznamujú čitateľa s vývojom nazerania na prebytok a jeho rolu v archeologických interpretáciách. Okrem hodnotenia predchádzajúcich vedeckých prác sa tu zamýšľajú aj nad témami úzko spätými s úlohou prebytku a problémami chápania prebytku ako takého. Veľkú pozornosť autori venujú predovšetkým koncepcii *absolútneho prebytku* a z nej vyplývajúcej dichotómii *absolútneho* a *relatívneho prebytku*, ktorú považujú za problematickú, pretože jej opodstatnenosť je podmienená stálosťou a nemennosťou spoločnosti, a teda absenciou akejkoľvek dynamiky. Z tohto dôvodu sa prikláňajú len k rozlišovaniu medzi prítomnosťou prebytku a žiadnym prebytkom. Presnú definíciu prebytku síce úvod neponúka, no zamýšľa sa nad otázkami významu produkcie prebytku, jeho formami, alebo spôsobmi rozlišovania a merania prebytku. Konkrétne aplikácie a odpovede na tieto otázky ponúka nasledujúcich 10 kapitol formou prípadových štúdií.

Prvú z nich ponúka druhá kapitola (*The Cost of Conquest: Assessing the Impact of Inka Tribute Demands on the Wanka of Highland Peru)* od Cathy Costin. Autorka tu na príklade imperializmu inkskej civilizácie demonštruje, aká náročná mohla byť produkcia prebytku. Zameriava sa oblasť Upper Mantaro Valley a porovnáva produkciu prebytku pred ovládnutím oblasti Inkami a po ňom. Za kľúčové identifikátory prebytku považuje textílie a nápoj *chichi*, ktorých výroba sa značne zintenzívnila bezprostredne po začlenení do inkskej sféry vplyvu. Costin si všíma predovšetkým bežné obyvateľstvo a spôsob, akým zvýšená produkcia prebytku a s ňou súvisiace nerovnomerné rozloženie tohto bremena na obyvateľstvo postupne menili vnútrospoločenské vzťahy.

Tretia kapitola (*Surplus and Social Change: The Production of Household and Field in Pre-Aztec Central Mexico*) od dvojice editorov analyzuje význam prebytku na mikroúrovni v chápaní spoločenských zmien. Autori tu kritizujú tzv. top-down prístupy vo vnímaní úlohy prebytku a preferujú tzv. bottom-up perspektívu, pričom pozornosť venujú úrovni jednotlivých domácností a miere, do akej mohli rozhodovať v otázkach nakladania s prebytkom. V tomto kontexte vnímajú prebytok ako strategický spôsob uspokojovania inštitucionálnych, ale aj spoločenských potrieb. Aplikácia takéhoto prístupu je mimoriadne zaujímavá, pretože poodhaľuje spôsob, akým mohli byť niektoré spoločenské zmeny výsledkom konania a rozhodovania „zdola", a nie produktom intenzívnejšieho generovania prebytku.

Štvrtá kapitola (*Surplus in the Indus Civilization: Agricultural Choices, Social Relations, Political Effects*) od autorky Heather Miller sa sústreďuje na oblasť južnej Ázie a motiváciu produkcie prebytku s ohľadom na alternatívne metódy produkcie poľnohospodárskeho prebytku. Miller skúma význam slobodného rozhodovania a existencie spoločenských sietí na úrovniach jednotlivých domácností, komunít a širších spoločenských celkov. Kapitola analyzuje parametre a kontexty, v ktorých sa rozhodovanie dialo a následne sa zamýšľa nad jeho ekonomickými, spoločenskými a politickými dôsledkami. Ústrednou témou kapitoly je však otázka voľby vhodného poľnohospodárskeho systému, ktorý potom ovplyvňuje aj produkciu prebytku, pričom autorka definuje základné stratégie tejto voľby.

Piata kapitola (*Surplus from Below: Self-Organization of Production in Early Sweden*) sa zameriava na oblasť Smålandskej roviny na juhu Švédska a autor T. Thurston tu úlohu prebytku zasadzuje do kontextu konfliktu tradícií a centralizovanej vlády. Na prípade ovládnutia pastorálneho obyvateľstva expanzívnym politickým útvarom a následným zintenzívnením exploatácie nerastných surovín sleduje motiváciu rastu produkcie prebytku. Medzi hlavné dôvody tvorby prebytku autor radí zvýšenie spotreby, očakávanie nedostatku, obchodnú príležitosť či uspokojovanie potrieb elít. Kapitola ilustruje proces, akým pastorálne obyvateľstvo formovalo významný ekonomický subjekt v rámci administratívy, ktorá ťažila z jeho práce a zároveň ho nechávala schudobnené a znevýhodnené.

V šiestej kapitole (*From Surplus Land to Surplus Production in the Viking Age Settlement of Iceland*) sa Douglas Bolender venuje nórskej kolonizácii Islandu. Sleduje tendencie osídľovania a zachytáva transformáciu ostrova z územia s masívnym prebytkom pôdy na územie s vysokou produkciou poľnohospodárskeho prebytku. Okrem toho sa hlbšie zamýšľa aj nad hraničným množstvom pôdy, ktorú dokáže jedna domácnosť efektívne využívať. Rovnako sa zaujíma aj o to, čo už možno považovať za prebytkovú pôdu a spôsob, ako k takémuto prebytku pristupovať.

V siedmej kapitole (*Surplus Capture in Contrasting Modes of Religiosity: Perspectives from Sixteenth-Century Mesoamerica*) Christian Wells analyzuje etnograficko-historické pramene a pokúša sa rekonštruovať vzťah medzi náboženskými praktikami a produkciou prebytku u stredoamerických etník v čase závažných spoločenských zmien počas 16. storočia. Autor sa snaží rozlíšiť, či vzťah medzi kultom a prebytkom reflektuje zaužívané tradície alebo predstavuje transformačný fenomén spojený s nástupom španielskej kolonizácie. Na základe aplikácie Withehouse-ovej kognitívnej teórie alternatívnych módov nábožnosti (*Whitehouse 2004*) sa prikláňa k názoru, že skúsenosť a spôsob vyjadrovania náboženských predstáv mohli vytvoriť podmienky smerujúce k intenzívnejšej produkcii a mobilizácii prebytku.

Ôsma kapitola (*Surplus Houses: Palace Politics in the Bight of Benin West Africa, AD 1650–1727*) zachytáva napätie a problémy spojené s produkciou prebytku v oblasti architektúry v západnej Afrike. Niel Norman tu skúma komplex elitných palácov Heudského kráľovstva a reguláciu prílevu nových tovarov pochádzajúcich z atlantického obchodu. Výsledkom súperenia o moc a prestíž sa v tejto oblasti objavuje množstvo palácových stavieb, ktoré patrili príslušníkom vyššej vrstvy. Práve skutočnosť, že miestna elita disponovala prebytkom pracovnej sily a presmerovala ho do stavby vlastných palácov, naštrbila a následne rozbila dovtedajší systém výroby a výmeny. Tieto spoločenské zmeny mali dopad aj na vládnucu vrstvu, ktorá v snahe udržania si postavenia a prestíže nebola ďalej ochotná deliť sa o luxusný tovar.

V deviatej kapitole (*Surplus Labor, Ceremonial Feasting, and Social Inequality at Cahokia: A Study in Social Process*) sa dvojica autorov, James Brown a John Kelly, pokúša definovať „spoločenský prebytok“ a jeho význam pre spoločenskú štruktúru. Autori sa domnievajú, že v rámci spoločností založených na príbuzenských vzťahoch zohráva kľúčovú rolu spoločné stolovanie, ktoré je určujúcim činiteľom spoločenskej stratifikácie, ak množstvo zúčastnených dosiahne istý počet. Tento prístup autori uplatňujú v lokalite Chokia (IL, USA) a prepájajú v ňom poľnohospodársku výrobu, prebytok pracovnej sily a vzrastanie nerovnosti prostredníctvom neustáleho zadĺženia slabších spoločenských jednotiek. V tomto zmysle chápu prebytok pracovnej sily ako faktor vzostupu elitných domácností.

Autori Victor Thompson a Christopher Moore v desiatej kapitole (*The Sociality of Surplus among Late Archaic Hunter-Gatherers of Coastal Georgia*) hodnotia vzťah medzi spoločným hodovaním, prebytkom a rituálom. Kontextom pre ich výskum je každodenný život na pobreží štátu Georgia (USA) počas neskorého archaického obdobia. Kapitola komentuje doterajší výskum v tejto oblasti a zostavuje typológiu prebytkov produkovaných skupinami lovcov a zberačov, pričom sa snaží poukázať na fakt, že nielenže menšie a jednoduchšie spoločnosti produkovali prebytok, ale dokonca prebytok predstavoval kľúčový parameter pri spoločenskej hierarchizácii takýchto spoločností. Okrem toho si všíma aj samotnú produkciu prebytku v zmenených prírodných podmienkach a možný vplyv týchto zmien na vnútrospoločenské vzťahy a dianie.

Jedenásta kapitola (*The Transactional Dynamics of Surplus in Landscapes of Enslavement: Scalar Perspectives from Interstitial West Africa*) od autorky Ann Stahl uzatvára sekvenciu prípadových štúdií. Autorka sa v nej sústreďuje na úlohu prebytku v stredozápadnej Ghane a snaží sa zachytiť stratégie konverzie prebytku. Kapitola čerpá z rozličných historických, etnograficko-historických zdrojov, orálno-historických prameňov a pridŕža sa Guyerovej modelu o konverzii a tvorbe bohatstva v turbulentných podmienkach (*Guyer 2004*). Výsledkom je zaujímavý obraz spoločnosti, kde má konverzná dynamika prebytku zásadný vplyv na spoločenskú stratifikáciu vzhľadom na problematickú povahu oblasti.

V závere publikácie Timoty Earle prezentuje oveľa užšiu, politicko-ekonomickú perspektívu vnímania prebytku. Sumarizuje jednotlivé prípadové štúdie a na základe princípu rovnováhy syntetizuje metodologický rámec zohľadňujúci *top-down* a *bottom-up* prístupy. Prebytok vníma ako jeden z kľúčových činiteľov, ktoré je nevyhnutné rozlišovať a skúmať za účelom pochopenia priebehu a povahy spoločenských zmien v celej ich zložitosti. Earle sa zamýšľa aj nad spôsobmi, akými možno prebytok zaznamenávať či merať a na základe jednotlivých prípadových štúdií definuje päť oblastí merania: 1. meranie potenciálneho poľnohospodárskeho prebytku v rámci konkrétneho poľnohospodárskeho systému, 2. meranie skladovacích kapacít, 3. meranie pracovnej sily použitej na produkciu prebytku za účelom uspokojenia potrieb vládnucej vrstvy, 4. meranie pracovnej sily použitej na stavbu elitnej architektúry a 5. meranie prebytku produkovaného na úrovni jednotlivých domácností (resp. výmena tovarov medzi domácnosťami).

Publikácia predstavuje významný príspevok k teórii archeológie. Zdôrazňuje význam tvorby prebytku ako spoločenského procesu, ktorý je úzko spätý s komplexným chápaním každodennosti a zmien zaniknutých civilizácií. Nazerá na prebytok nielen ako na proces odohrávajúci sa na makroúrovniach, ale všíma si aj mieru, do akej mohol byť tento proces ovplyvňovaný zdola. Výsledkom je uchopiteľný metodologický prístup, ktorý umožňuje identifikáciu prebytku vo svetle spoločenských a kontextuálnych rozmerov jeho produkcie, distribúcie a spotreby. Silnou stránkou publikácie je jej nazeranie na prebytok z rozličných perspektív a následná demonštrácia na konkrétnych príkladoch. Na druhej strane sa v nej však nevenuje pozornosť iným významným regiónom ako sú Egypt, Mezopotámia či Stredomorie. V každom prípade ide o mimoriadne zaujímavú publikáciu, ktorá aktualizuje štúdium prebytku a udáva smer ďalšieho bádania v tejto problematike.

Denis Hakszer

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Petr Neruda: Čas neandertálců – Time of Neanderthals. Ústav Anthropos, Moravské zemské muzeum, *Brno 2016*. 315 str.

Kniha Petra Nerudy o neandertálcích, vydaná k výstavě Moravského zemského muzea v Brně, představuje shrnutí výsledků jeho dlouholeté specializace na problematiku středního paleolitu nejen v českých zemích a na Slovensku, neboť téma si vynutilo překračování hranic teritoriálních i vědních specializací. Paralelní český a anglický text, pojednávající časoprostorově rozlehlé téma na základě světové literatury, rozdělil autor na sedm kapitol, věnovaných postupně otázkám času a prostoru, antropologii neandertálců, volbě míst k usídlení, neandertálskému domovu, otázkám subsistence, technologie a ekonomiky, problému symbolického chování a estetického cítění. Při výkladu užívá současné poznatky, diskutuje alternativy výkladu, ale zároveň používá jazyk vědy s ohledem na nespecialisty, resp. neprofesionály. Podobně i ilustrace přinášejí přehledně jak autentickou dokumentaci, tak i pro laiky nepostradatelné rekonstrukce současných představ o neandertálcích.

Úvod rekapituluje dějiny výzkumu paleolitu na Moravě, v Čechách i na Slovensku. Prvá kapitola konstatuje problémy s časovým vymezením dlouhého a klimaticky extrémně nehomogenního období středního paleolitu (interval ca 300 000 – 40 000 BP zahrnuje tři glaciály a nejméně dva interglaciály) i s korelací přírodních podmínek s málo poznaným, resp. odlišně strukturovaným vývojem anatomických znaků neandertálců (nejstarší znaky předcházejí a nejmladší naopak přežívají trvání středního paleolitu); mnohé archeologické komplexy středního paleolitu dosud lidské pozůstatky neposkytly, takže jejich tvůrce neznáme, a všechny výroky o kontinuitě zůstávají stále jen postupně zpevňovanými nebo nahrazovanými konstrukcemi mezi řídkými ostrůvky dat. Autor přehledně informuje o změnách flóry a fauny dob ledových a meziledových, přičemž upozorňuje na částečnou schopnost některých druhů přežívat a přizpůsobovat se změněným podmínkám.

Neandertálci osídlili rozsáhlé území v pásu od Pyrenejského poloostrova až po východní Sibiř jižně od vlivu severského zalednění (na úrovni jižní Anglie) po severní a východní břeh Středozemního moře až k severním břehům Arabského moře, přičemž těžiště osídlení leží v západní a jižní Evropě, kde se díky vlivům oceánského klimatu rozvíjelo kontinuálně na rozdíl např. od aridní střední Evropy, která se v glaciálech stávala polární pustinou, zatímco v teplých obdobích tu neandertálci osidlovali území i severně 50. rovnoběžky. Neandertálci zřejmě nepronikli do Afriky (ani přes Gibraltar, ani po východním pobřeží Středozemního moře). Jejich osídlení Blízkého východu trvalo podle radiometrických dat z kosterního materiálu nejméně mezi 75 a 45 tisíciletími BP, a to paralelně s anatomicky moderními lidmi (doloženými v regionu již před 130 000), ale obě populace produkovaly identickou kamennou industrii. Podle adaptací na chlad na kostrách neandertálců je pravděpodobné, že neandertálci pronikli na Blízký východ z Evropy, odkud je zřejmě vytěsnil nástup prvého glaciálního maxima. Autor dále podává přehled středopaleolitického osídlení východní Evropy (s počátkem v průběhu posledního interglaciálu: Eem, MIS 5e, 130 000 – 115 000); překvapivý postup neandertálců (evropského původu podle genetických analýz) východním směrem přes Kavkaz až na Altaj na jihu západní Sibiře způsobilo zřejmě ochlazení v průběhu posledního glaciálu, ale možná i planetární klimatické působení katastrofálního výbuchu sopky Toba na Sumatře.

Autor dále shrnuje současný stav metodiky výzkumu pleistocénu včetně dějin výzkumu (studium zalednění, stratigrafie půdních sedimentů ve spraších, ledovcových vrtů, absolutního i relativního datování).

Druhá kapitola obsahuje informovaný přehled nejstaršího vývoje člověka a počátků osídlení Afriky (nyní nejstarší artefakty z Keni se datují ca 3,3 mil. let) a Evropy (nejstarší pozůstatek člověka spolu se zvířecími kostmi a nástroji z jeskyně Sima del Elephante v pohoří Atapuerca ve Španělsku ca 1,2 mil. let), současný názor na postavení neandertálců ve vývoji člověka (neandertálci jsou podle genetických analýz samostatným druhem, svébytnou evoluční linií, nikoli poddruhem sapientů, což nevylučuje možnost křížení, ale jejich haplotypy postupně z genetického fondu Homo sapiens vymizely), doklady jejich pravorukosti (prokázaná i na opotřebení jejich zubů); anatomické předpoklady pro schopnost plnohodnotné řeči a symbolické chování neandertálců lze vykládat jako nepřímé důkazy schopnosti abstraktního myšlení. Autor dále věnuje značnou pozornost prezentaci moravských a slovenských nálezů neandertálců, jejich osudům, vývoji poznání a rekonstrukci.

Třetí kapitola pojednává o sídlištích neandertálců, spojovaných zpočátku jednostranně s jeskyněmi, v nichž byly jejich pozůstatky, zachované v kontextu, objeveny nejdříve. Ve skutečnosti byli neandertálci značně versatilní a osídlovali otevřená území na pobřeží i ve vnitrozemí, v nížinách i v horách. Z omezeného výskytu jeskyní je zřejmé, že sídliště v otevřené krajině převažují, jejich frekvence závisí vzhledem k nižší nápadnosti nemálo na intenzitě archeologického průzkumu. Různá prostředí poskytovala specifické výhody (krasová území jeskyně, údolí, břehy řek i jezer bohatou biomasu, prameny minerálních pramenů přitahovala teplejším mikroprostředím a stálostí vodního zdroje, jiná místa zase snadným přístupem ke kamenné surovině).

Ve čtvrté kapitole využil autor především výsledky svých analýz jednotlivých fází osídlení Valochova výzkumu Kůlny k přiblížení představy obytného prostoru neandertálců: prostor jeskyně však neměnila jen sedimentace, pohyb lidí a jejich činnost, ale i postdepoziční procesy. V optimálních případech lze současnost a prostorové vztahy prokázat skládankami všech druhů nálezů; prostorová distribuce ohnišť, výrobních míst, jednotlivých typů nástrojů, ale právě tak odpadu, výskyt míst neužívaných, ale i rozptyl výjimečných nálezů, jako jsou mléčné zuby, konkretizují způsoby využívání prostoru. P. Neruda referuje o situaci v dalších lokalitách nejen střední Evropy, diskutuje otázku umělých konstrukcí, které se ovšem vyskytují jen unikátně (jako oválný půdorys z krápníků v jeskyni Bruniquel ve Francii), častěji ovšem v podobě konstrukcí z mamutích kostí na Ukrajině nebo v Rumunsku.

Pátá kapitola otevírá problém potravy neandertálců, adaptovaných na chlad a fyzickou námahu, jejíž základ tvořilo nesporně maso a tuk zvířat. Neandertálci se během svého vývoje i vzhledem k areálu rozšíření přizpůsobovali lokálním podmínkám a lovili především stabilní místní druhy velkých a středně velkých býložravců (mamutová fauna byla dostupná severně Pyrenejí a Alp, kde nutné doplňování stravy rostlinnou složkou představovalo větší problém než v mediteránních oblastech); na specializaci lovu lze usuzovat v případech, kdy se frekvence pozůstatků určitého druhu na sídlištích významně liší od jeho zastoupení v přírodě. Vzácné nálezy koster úlovků velkých savců s nálezy loveckých nástrojů nebo stopami po jejich užití v podobě děr na kostech i řeznické zásahy na jejich kostech mezi odpadem na sídlištích dokládají subsistenční využívání mamutů, nosorožců a lokálně i medvědů. Lov menších a kožešinových zvířat (sobů, koní, jelenů, kozorožců, vlků, lišek, králíků) bývá pro menší odolnost jejich kostí proti rozpadu mezi nálezy podreprezentován podobně jako mořský i sladkovodní rybolov. S výjimkou mořských plžů zanechalo jen vzácné stopy sběračství.

Šestá kapitola, věnovaná technologii a ekonomice, obsahuje zasvěcený přehled rozsáhlé oblasti výroby štípaných kamenných nástrojů, počínaje přímým tvarováním sekáčů, pěstních klínů, asymetrických klínových nožů a drasadel micoquienu (z oblasti mezi Rýnem a Krymem), dokončovaných již měkkými otloukači. Neandertálci vyvinuli metodu seriové výroby úštěpů a později i čepelí z jader různých typů, předpokládající již suverénní speciální dovednosti i znalosti vlastností surovin, ale produkující podstatně větší množství užitného ostří z použité suroviny než u bifaciálně tvarovaných nástrojů. O výrobních procesech štípané industrie informují skládanky, o funkci trasologie. Druhou významnou skupinu představují nástroje z tvrdých živočišných tkání, vyskytujících se hojně až na sklonku vývoje neandertálců; hojné a nepostradatelné, avšak podceňované, neboť jen vzácně dochované nástroje vyráběli ze dřeva; neandertálci byli adaptabilní, protože na pobřežích zahrnuli do své kultury mořské lastury a úspěšně je upravovali na své nástroje. Častý výskyt ohně a manganové rudy na neandertálských sídlištích připouští možnost, že již byli schopni oheň rozdělávat křesáním (křesadla však dosud nalezena nebyla); oheň jim již sloužil i k výrobě smůly z březové kůry suchou destilací (smůla umožňovala výrobu složených nástrojů, např. v Königsaue; ze Sýrie se uvádí použití přírodního bitumenu/asfaltu).

Na rozboru původu surovin ze souvrství v Kůlně P. Neruda demonstroval změny ekonomických strategií během středního paleolitu: stopy nejstarších fází osídlení svědčí o využívání lokálních zdrojů surovin, taubachienský komplex čerpal zdroje z okolí až 90 km vzdáleného, kdežto micoquien se z technologických důvodů omezil na využívání kvalitních surovin logisticky (bez ohledu na vzdálenost zdrojů), který praktikovaly i mladopaleolitické kultury.

Sedmá a poslední kapitola se zabývá nejzávažnějším, ale nejhůře dostupným otázkám duchovního, sociálního, symbolického, estetického aj. chování. Počátky všech etnohistoricky známých kultur se vyznačují projevy náboženského myšlení, avšak chování v předliterárních společnostech produkovalo v materiální oblasti jen omezené, nevyhraněné, a proto víceznačné stopy, připouštějící i v případech optimálního dochování v původním kontextu variabilní interpretace: P. Neruda náleží k zastáncům názoru, že kognitivní schopnosti neandertálců se blížily, až rovnaly schopnostem sapientů. Za projevy estetického cítění lze považovat funkčně nezdůvodnitelnou symetrii artefaktů (např. bifaciálně opracovaných), vyhledávání nápadných surovin nebo výjimečných jevů k výrobě nástrojů, nefunkční zásahy do povrchu předmětů, výskyt barviva na předmětech nebo výskyt úlomků hematitu, zkamenělin, případně „ozdoby" z provrtaných lastur, výskyt rýh a zářezů na kostech a kamenech. Překvapující zjištění z poslední doby představuje stratigraficky prokázaný výskyt rytin mřížovité podoby na stěnách jeskyně Gorham v Gibraltaru. Na druhé straně s výjimkou rytiny zvířecí figury na kosti z ukrajinské lokality Pronjatyn se v prostředí neandertálců nenalezla zobrazení zvířat, ale jen zářezy nebo svazky rýh, záměrně vyhloubené důlky apod. Se symbolickou sférou mohly souviset nestandardní předměty i chování (v Kůlně se nalezl „depot" tří mamutích klů, uložených do svislé skalní dutiny). Naproti tomu dlouhé kosti s řadou děr (vzhledem blízké ke skutečným píšťalkám z aurignacienu) se ukázaly být neúspěšnými pokusy šelem o získání morku. Otázka řeči zůstává otevřená: třebaže z anatomického hlediska byli neandertálci řeči schopni, sotva se podaří její existenci prokázat.

Pohřby neandertálců však pro archeologii znamenají nástup nové kategorie pramenů, tedy nesporný projev nové kvality, otevírající přístup k oblasti představ o posmrtném životě, o schopnosti symbolického myšlení, o sociálních vztazích, o milodarech jako formě obětí atd. Je známo přes 500 fragmentárně dochovaných kosterných pozůstatků, ale především následkem intenzivních postdepozičních procesů přírodního i lidského původu se v Evropě, na Blízkém východě i ve střední Asii dochovalo pouze několik desítek (30–40?) nesporných pohřbů dospělých i dětí od novorozenců v mělkých jamách, které nezvratně dokládají pohřbívání alespoň u některých skupin. O starší formě neandertálského pohřbívání se uvažuje v případech nálezů kumulací pozůstatků i několika desítek jedinců v hloubi jeskyní; specifickým způsobem rituálního pohřbívání mohla být jedna z forem kanibalismu (jako jevu, doprovázejícího lidstvo od starého paleolitu až do současnosti), kdy úctu k nebožtíkovi prokazují příbuzní nebo členové komunity konzumací částí jeho těla atd. Zvýšená frekvence pohřbů na sklonku středního paleolitu (ojediněle se v jeskyních zachovaly i skupiny hrobů pod mohylkami) signalizuje šíření tohoto chování (resp. představ k němu vedoucích), ale nepochybně i okolnost, že hroby z pozdní fáze se zachovaly častěji, neboť nemusely odolávat postdepozičním procesům tak dlouhou dobu. Neustálené počátky jakéhokoli chování sebou nesou rozeznávací potíže: podobně zpočátku nutně nestandardní vkládání milodarů do hrobů představuje problém jejich viditelnosti pro obtížnost jejich odlišení od náhodně vtroušených složek sídlištního odpadu. Teprve nástup opakovaných a stereotypních praktik chování, projevující se jejich kumulací a rozšířením i při jejich nutné regionální variabilitě, zvyšuje věrohodnost interpretací. Vysoké zastoupení zhojených zranění (přirovnávané občas ke frekvenci zranění současných jezdců rodeových soutěží) prokazují, že neandertálci vedli adrenalinový život, resp. byli běžně vystaveni mimořádně četným rizikovým situacím: projevy péče o „neužitečné" (slabé, tj. nejmladší a nejstarší, raněné a nemocné) členy komunity, ukazuje na silnou vnitřní soudržnost příbuzných, resp. na vědomí, že naději na přežití poskytuje život v solidární skupině (na rozdíl od krátkodobě efektivního sobectví singlů). Ve srovnání s technologickými partiemi této hodnotné a dokumentárně i literárně pečlivě vybavené knihy připouštějí témata poslední kapitoly ještě rozsáhlejší pole pro budoucí bádání. P. Nerudovi se zdařil pokus o shrnutí současného stavu poznání doby neandertálců, což představuje přínos nejen pro specialisty na paleolit.

Slavomil Vencl

Zdeňka Nerudová: Lovci posledních mamutů na Moravě – The last mammoth hunters in Moravia. Studie Centra kulturní antropologie 2. Moravské zemské muzeum, *Brno 2016*. 163 str.

V okolí Vídeňské ulice v Brně, pod úpatím Červeného kopce poblíž Svratky, existovaly cihelny, v nichž se nacházely diluviální kosti už na sklonku 19. století. Roku 1972 se při výkopových pracích pro inženýrské sítě v ulici tehdy Koněvově nalezla patinovaná industrie. K. Valoch tam provedl záchranný výzkum několika sondami v linii výkopu, který v místech kumulace zvířecích kostí (mamut, sob, kůň aj.), ohniště a kamenných artefaktů doplňoval dalšími sondami směrem od komunikace (*Valoch 1975*). Bohaté nálezy na výhozech v okolí výkopů svědčily o porušení rozsáhlé lokality. Valochův pokus o rozšíření poznatků sondáží omezeného rozsahu na školní zahradě r. 1988 bohužel nepřinesl významná zjištění. Předstihový výzkum tohoto místa na plošně přístupném pozemku, určeném pro zástavbu proluky na Vídeňské ul. v Brně-Štýřicích zahájili Z. a P. Nerudovi v roce 2009 jednak 11 strojovými rýhami (z nichž jen dvě zachytily paleolitické pozůstatky v autochtonní pozici), jednak odkryvy ve čtvercové síti 5 x 5 m, jimiž se podařilo zachytit i polohu sond z r. 1972. Kromě přírodních postdepozičních procesů narušovaly paleolitické situace i pravěké až středověké aktivity, takže jižní část prostoru staveniště poskytla paleolitické nálezy výhradně v sekundární poloze. Poznávání rozsáhlé plochy usnadňovaly deště, které po odklizu holocenních vrstev místy vyplavovaly na povrch patinovanou industrii: v místech povrchových nálezů prováděný výzkum umožnil vydělit místa s nálezy v autochtonní nebo paraautochtonní poloze ve sprašovité hlíně těsně pod rozhraním s holocenním horizontem. Záchranné práce pokračovaly v závislosti na postupu stavebních prací v letech 2011–2012 a 2014; navzdory komplikacím, vyplývajícím z výskytu četných pravěkých, středověkých i novověkých zásahů na ploše výzkumu, z prostorové kumulace a rozdílů ve složení suroviny, v technologii i typologii kamenné industrie vyplynulo, že jde o dvě pozdně paleolitické lokality (větší, objevená K. Valochem, s označením Brno-Štýřice III, menší a výše na svahu položená IIIa, zasahující na plochu plánované zástavby jen menší jižní částí).

Značnou pozornost věnovala autorka zpracování kamenné industrie: celkem odtud pochází přes 9000 kusů, většina ovšem ze sběrů nebo z proplavování sedimentů (např. přes 3000 šupinek do 5 mm a šupin do 10 mm), takže statisticky popsáno bylo více než 3000 artefaktů. Relativně nepočetně se vyskytla jádra (1,7 %), jejichž preparaci a těžbu lze studovat na základě jejich skládanek (obr. 20 a 25; skládanky obecně viz s. 69–79); metrický rozbor čepelí i převážně jednopodstavových jader dokazuje, že na místě byly zanechány hlavně zlomky a nezdařené kusy, kdežto ostatní byly z lokality odneseny. Autorka zaznamenala i výskyt mikročepelek (občas vyráběných i z hran nástrojů), často unikajících miniaturních součástí ostří složených nástrojů. Malé zastoupení kůry suroviny svědčí o racionální přípravě odnášených kusů suroviny od zdrojů. Skladbu retušovaných nástrojů (13 %) tvoří hlavně tvarově variabilní rydla (ca 37 % nástrojů), laterálně retušované čepele (23 %) vedle čepelek strmě otupeného boku (4 %) pro ostří složených nástrojů, jejichž frekvenci snižuje kromě drobnotvarosti i jejich ztráty mimo sídliště. Ostatní kategorie nevytvářejí vyhraněné typy (laterální retuše, ale i škrabadla) nebo se vyskytují ojediněle (např. retušovaný hrot). Z hlediska funkce patří k nástrojům i krátkodobě používané kusy, projevující se makroskopicky patrnou nespojitou retuší (ca 30 %), po jejichž odečtení by celkový počet nástrojů klesl pod 10 %. Autorka soudí, že skladba nástrojů svědčí o vykonávání jedné činnosti jako hlavní.

Rozbor surovin prokazuje dominanci silicitů z glacigenních sedimentů, rohovce typu Olomučany, spongolitů, kdežto ostatní na Moravě snadno dostupné suroviny včetně rohovce typu Krumlovský les nedosahují 10 %; příměsi radiolaritů připouštějí kontakty s Podunajím. Z lokálních štěrků pocházejí valouny různých hornin, příležitostně používané pro pomocné funkce. O trasologické analýzy usiloval již K. Valoch, nové se připravují.

Strukturu sídliště zkoumala autorka prostorovou analýzou: na ploše lokality III (obr. 44) vydělila 5 velkých koncentrací kamenné industrie a zvířecích kostí. Rozdíly mezi jednotlivými kumulacemi se jeví hlavně ve skladbě surovin, kdežto skladba industrie zůstává podobná. Autorka naznačuje, že jednotlivé kumulace představují patrně následné pobyty téže skupiny lidí v blízkých (periodických, sezónních?) úsecích času. Stejně jako K. Valoch klade autorka nálezy z Brna-Štýřic do epigravettienu, jenž se ve středoevropském prostoru jeví jako dosud nevýrazně doložený a spíše chronologicky vymezovaný shluk dokladů řídkého a nestabilního osídleni v období doznívajícího posledního glaciálu, které se projevuje jako konglomerát variant lokálně adaptovaných skupin (čímž se nápadně odlišuje jak od gravettienu i magdalénienu) v období nestabilních pokusů o usídlení, pojmenovávaných regionálně. Autorka shrnula a komentuje více méně příbuzné nálezy z Moravy, Rakouska, Slovenska, Polska i z Maďarska, Ruska, Itálie aj., všímá si slabých a variabilních projevů kultu, resp. tzv. umění a osobních ozdob. Základní objektivní překážku poznání tohoto období představuje tehdejší převaha eroze nad sedimentací, která vedla k výraznému postižení pozůstatků postdepozičními procesy, k redukci až zániku organických složek pozůstatků a nekontrolovatelnému znehodnocení radiometrických dat průsaky srážek a sezónní průniky holocénní fauny do podloží; antropologické pozůstatky scházejí, z fauny se většinou dochovaly jen nejodolnější části kostí velkých savců, a to v chatrném stavu atd.

Podstatnou část práce věnovala autorka zasazení nálezů z Brna-Štýřic III do kontextu střední Evropy: shrnula radiometrická data té doby, charakterizuje klima a jeho vliv na intenzitu osídlení (ČR, resp. Čechy leží v nejužším místě mezi zaledněním severským a alpským a přes mozaikovitou rezistenci refugií v krasu nebo v údolích řek, zůstávaly prostorem na biomasu relativně chudým). Pro úvahy o složení stravy té doby nedostačují neúplné přímé prameny: zanedbatelné stopy zanechal lov drobných zvířat, ptáků i ryb, chybějí doklady pro významný podíl sběru potravy v podobě kořínků, hlíz, plodů a rostlin nebo pro získávání vitaminů z mízy stromů, konzum tuku nebo obsahu žaludků ulovených býložravců atd., nezbytných pro kompenzaci spotřeby velkých objemů masa, vedoucí k deficitu fosforu v lidském organismu; část tuku přitom spotřebovalo spalování kostí při nedostatku dřeva atd. Úlovky velkých zvířat neznamenaly dlouhodobé zabezpečení potravou, ale zvyšovaly riziko ohrožení predátory; dlouhodobé zásoby by si navíc vynucovaly trvalý pobyt, čemuž nenasvědčuje krátkodobý charakter většiny pozdněpaleolitických lokalit; i při použití smyků se dálkový transport větších nákladů jeví jako nereálný. Rejstříku artefaktů dosud úplně schází organická složka. Pro uspokojivou interpretaci většiny otázek neposkytují zatím současné prameny dostatečná data.

Již starší zmínky o paleolitických nálezech při výstavbě domů v okolních ulicích v Brně-Štýřicích naznačovaly, že publikovaný objem pramenů představuje jen zachráněný vzorek stop po paleolitickém osídlení svahů při úpatí Červeného kopce. Předložená publikace Z. Nerudové, připravovaná již dílčími články za účasti přírodovědců, představuje důkladně dokumentovaný přínos pro poznání středoevropského pozdního paleolitu.

Slavomil Vencl

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