

Beyond the technological chain: Neolithic potters in social networks

Co je skryto za výrobním řetězcem: sociální pozadí neolitických hrnčičů

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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 hrnčiče, 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 smal-

ler 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 H  l  ne 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 *cha  ne op  ratoire* 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 *cha  nes op  ratoires* 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 (*Livingstone 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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