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PROCEEDINGS
OF THE WORKSHOP
OF NAMUR (BELGIUM)
ACTES DE LA TABLE RONDE
DE NAMUR (BELGIQUE)
29 et 30 mai 2015
29 and 30 may 2015

Textes publiés sous la direction de
Laurence Burnez-Lanotte

MATIÈRES À PENSER

RAW MATERIALS ACQUISITION AND PROCESSING IN EARLY NEOLITHIC POTTERY PRODUCTIONS

MATIÈRES À PENSER

SÉLECTION ET TRAITEMENT DES MATIÈRES PREMIÈRES DANS LES PRODUCTIONS POTIÈRES DU NÉOLITHIQUE ANCIEN

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Looking into houses: analysis of LBK ceramic technological change on a household level

Attila Kreiter, Tibor Marton, Louise Gomart, Krisztián Oross, Péter Pánczél

Abstract: Excavations on the Neolithic site of Balatonszárszó-Kis-erdei-dűlő, located in western Hungary in central Transdanubia, on the southern shore of Lake Balaton, revealed several thousand features. On the basis of material culture and architectural features, the settlement can be assigned to the Central European Linearbandkeramik culture (LBK; ca. 5,350–5,000/4,900 cal. BC). Apart from pits, traces of 48 houses were discovered. At least 14 other sets of features could also be interpreted as houses, mainly through the presence of characteristic elongated pits.
In the first model of the site's development, five pottery style groups were distinguished on the basis of stylistic elements such as shape and decoration. These style groups show a spatial pattern within the settlement. Their major characteristics are easy to correlate with traditional typochronological units of the LBK in the western Carpathian Basin. Although chronological relevance can be attributed to the groups, certain typological and stylistic attributes had a long duration and appear in different style groups.
For the purposes of this study, eight houses and their associated features were selected. The ceramics from these features are characteristic of each style group. The aim was to examine the technology of ceramics, in particular choices in raw materials and intentionally added tempers, as well as building techniques.
During a previous analysis of ceramics from the settlement, 461 sherds were chosen for macroscopic analysis, from which 131 samples were selected for further petrographic thin section analysis. Of these samples, 99 come from the eight houses and pits examined in this study. These features produced a total of 9,161 sherds. As part of the analysis of vessel building techniques, all the available material from the examined houses was assessed, out of which 109 vessels could be attributed to a forming method.
Ceramic petrographic results show that there is a clear change in ceramic technology at household level. The earliest houses of the site show little variability in choices of raw materials and tempers, while houses of Style groups 2–5 show increased choice in raw materials and purposefully added tempers. As far as vessel fashioning is concerned, an opposite trend can be observed. Style group 1 ceramics show considerable variety in technical practices, with at least three forming methods, while ceramics in Style groups 2–3 and 5 are characterized by only one or two forming methods. Thus it seems that variability in building methods slightly decreased towards the end of the settlement.
Ceramic technological changes could be identified on a household level, providing an insight into settlement dynamics. These patterns in the use of raw materials/tempers and building methods may be related to the fact that producers came from different learning networks and had different conceptions of how to build a culturally appropriate vessel. The strength of analysing ceramic technologies on a household level is that we are able to model where ceramic technological changes first appeared within a given settlement and we can assess the nature of these changes. In turn, these patterns can be correlated with typochronology and the analysis of other types of material culture from the part of the site where the changes appeared. In this way we can improve our understanding of settlement dynamics and social changes.

Keywords: Neolithic, LBK, ceramic technology, household, learning network.

Résumé : Dans la partie centrale de la Transdanubie (ouest de la Hongrie), sur la rive sud du lac Balaton, plusieurs centaines de structures ont été mises au jour sur le site néolithique de Balatonszárszó-Kis-erdei-dűlő. Sur la base de sa culture matérielle et de son architecture, le site peut être attribué à la Céramique Linéaire centre européenne (LBK ; environ 5350–5000/4900 cal. BC). En plus des fosses, les traces de 48 bâtiments ont été découvertes. Au moins 14 autres ensembles de structures peuvent également être interprétés comme d'anciens bâtiments.
Dans le cadre de l'établissement d'un premier modèle de développement du village, cinq groupes de poteries ont pu être distingués sur la base de leurs attributs stylistiques (formes et décors). Ces groupes stylistiques montrent une distribution spatiale spécifique au sein de l'habitat et sont rattachables aux étapes chronologiques traditionnelles de la Céramique Linéaire de l'ouest de Carpates. Bien

qu'une valeur chronologique puisse leur être attribuée, certains traits typologiques et stylistiques sont identifiés sur la longue durée et sont communs à plusieurs groupes.
Pour la présente étude, huit maisons ainsi que les structures qui y sont associées ont été sélectionnées. Ces unités d'habitation ont livré un matériel céramique représentatif de chacun des groupes. L'objectif est d'appréhender les techniques mises en œuvre pour la fabrication des céramiques, en particulier les choix opérés pour les matières premières et les dégraissants volontairement ajoutés, ainsi que les techniques de façonnage. Les données sont analysées à l'échelle de la maisonnée et par rapport aux différents groupes stylistiques. Lors d'une précédente analyse de la céramique du site, 461 tessons ont été sélectionnés pour analyse macroscopique, parmi lesquels 131 ont ensuite été analysés en lame mince. Parmi ces échantillons, 99 sont issus des huit maisons et fosses examinées dans le cadre de la présente étude (ces dernières ayant livré un total de 9 161 tessons). L'analyse des méthodes de façonnage a porté sur l'ensemble du matériel issu des maisons et fosses sélectionnées et un total de 109 vases a pu être attribué à une méthode de façonnage.
Les résultats pétrographiques montrent un changement net dans les techniques céramiques à l'échelle de la maisonnée. Les maisons les plus anciennes du site montrent une faible variabilité dans les choix opérés en termes de matière première et de dégraissants, tandis que les maisons associées aux groupes stylistiques 2-5 témoignent d'une grande diversité de choix pour ces mêmes étapes de la chaîne opératoire. En ce qui concerne le façonnage, une tendance inverse est observée. Les poteries rattachées au groupe stylistique 1 sont en effet caractérisées par une diversité des pratiques techniques, avec la mise en œuvre d'au moins trois méthodes de façonnage, tandis que les céramiques appartenant aux groupes stylistiques 2-3 et 5 sont associées à seulement une ou deux méthodes de façonnage. Il semble que la variabilité des pratiques liées au façonnage diminue légèrement à la fin de l'occupation.
L'analyse des modifications qui s'opèrent dans les pratiques techniques à l'échelle de la maisonnée fournit des informations sur les dynamiques de l'habitat. Les modèles observés quant aux matières premières et aux méthodes de façonnage pourraient être liés à la présence de producteurs issus de réseaux d'apprentissage distincts, ayant des conceptions différentes de la manière de fabriquer un vase qui soit « culturellement adapté ». Cette réflexion à l'échelle de la maisonnée permet de comprendre où les changements techniques apparaissent au sein d'un habitat donné et d'évaluer précisément la nature de ces changements. Les modèles sont corrélés avec la chronologie et comparés aux autres éléments de la culture matérielle dans les zones de l'habitat où ont lieu ces changements techniques. La démarche développée permet de saisir finement les dynamiques de l'habitat ainsi que les changements sociaux qui peuvent y survenir.

Mots-clés : Néolithique, Céramique Linéaire, technologie céramique, maisonnée, réseaux d'apprentissage.

INTRODUCTION

The investigations that led to the discovery of the Neolithic settlement at Balatonszárszó-Kis-erdei-dűlő (fig. 1), on the southern shore of Lake Balaton in central Transdanubia, Hungary, started prior to the construction of the M7 Motorway in 2000.

The site is located on a tongue-shaped natural plateau that begins with a mild slope towards the lake and is bordered by 20–22 m deep small valleys on its eastern, southern and western sides. The modern shoreline lies at a distance of 2–2.5 km from the excavated areas, but was most probably closer to the settlement during the Neolithic.

Targeting the Neolithic settlement, extensive areas were investigated in three campaigns between 2001 and 2003, and a smaller excavation was also carried out in 2006. The total area uncovered on the site is about 12 hectares; Neolithic settlement features were recorded over approximately 10 hectares (Oross, 2004 and 2013).

Posthole structures representing typical timber-framed, above-ground buildings of the Central European Linearbandkeramik culture (LBK) were identified, together with long pits flanking the longitudinal walls of the constructions. The latter features are considered to be integral parts of the LBK house units. Traces of 48 houses were investigated and documented as building remains of the Neolithic community (Oross, 2010), and were designated as Category A house plans (fig. 1). The presence of 11 additional houses could be reconstructed on the basis of long pits and some scattered postholes between them, and were designated Category B house plans (Oross, 2013; here fig. 1). The modelling of the settlement layout enabled the identification of 3 further possible house plans, so that 62 house units now provide the basis for further analysis (Oross, 2013, p. 322–323). The northernmost part of an LBK enclosure was also investigated.

The houses in the northern settlement area were built at a considerable distance from each other, as far as 50 or even 80 metres. In contrast, houses were more densely spaced in the southern part of the settlement. The timber-framed buildings form clusters, each consisting of 3–6 houses. The short, façade sides of the buildings are often aligned with each other, forming groups. Of course this does not mean that all the houses within a house cluster stood at the same time; questions related to the building sequence and dynamics of the houses in the clusters are among the most complicated issues involved in the analysis of the site.

At Balatonszárszó, LBK ceramics were present in 1,477 archaeological features, even though the number of features belonging to the Neolithic settlement is much higher if we include the postholes of the timber-framed houses. Over 40,000 sherds were recorded from these 1,477 features.

According to the density of the Neolithic features and spatial distribution of house plans, a well-separated northern and southern settlement part can be distinguished. The ceramic finds from these two areas also show specific differences: the northern part contains stylistic elements of the early LBK period, while the southern part contains late LBK elements (Marton

and Oross, 2009, p. 57). Although the evaluation of the assemblage is still in progress, it appears that the settlement was established as a small hamlet during the early LBK period and developed southwards into a larger settlement in the later and late LBK phases.

The preliminary analysis of individual radiocarbon dates from the site broadly refers to an interval between 5,350–5,000/4,900 cal. BC; the larger, southern settlement part was most probably founded during the 53rd century BC.

An initial modelling of the site's development and dynamics, based on pottery styles, house clusters, and some individual radiocarbon dates, identified five phases. They correspond in fact to style groups and must be regarded as a framework, mostly inspired by traditional typochronology. Considering common elements of different style groups, there is also a possibility that the use periods of various pottery style groups overlapped each other or some of them were even contemporary. In fact, similarities between style groups and some contradictions between radiocarbon dates and associated pottery assemblages suggest a more complex site development, rather than the existence of successive typochronological phases.

The technological study of ceramics concentrates on vessels associated with selected houses from the different style groups, in order to assess possible technological similarities or differences on a household level through the ceramic style groups of the settlement.

MATERIALS AND METHODS

In the last few decades a significant amount of research has been undertaken on the relationship between ceramic production, identity, social boundaries and organisation of production (e.g. Barley, 1994; Sillar, 1997; Gosselain, 2000; Arnold, 2011 and 2012; Jeffra, 2015; Michelaki et al., 2015; Roux, 2015). Ethnographic

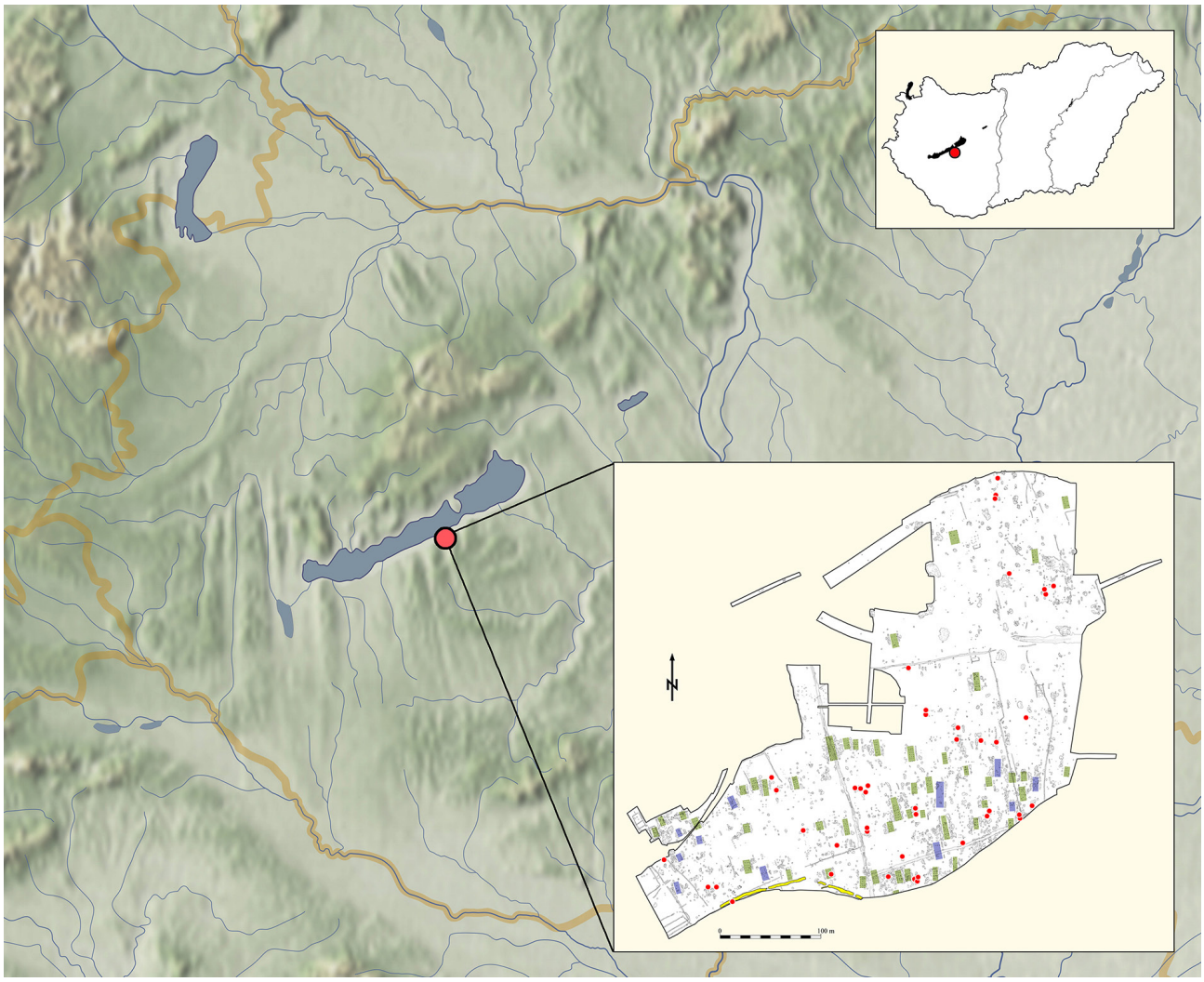


Fig 1 – Location of Balatonszárszó-Kis-erdei-dűlő in Hungary and plan of the excavated area of the Neolithic settlement. Colour coding for site plan: green – house category A; purple – house category B; red – burials; yellow – ditch.
***Fig 1** – Localisation du site de Balatonszárszó-Kis-erdei-dűlő en Hongrie et plan de la zone fouillée de l'habitat néolithique. Code couleur du plan du site : vert – maison catégorie A ; violet - maison catégorie B ; rouge – sépultures ; jaune - fossé.*

examples clearly indicate that potting is dynamic, involving both active and passive choices; that is, choices derived from learned and lived-through practices. These studies also show that the most visible aspects of pottery manufacture are embedded in local symbolic systems, carrying cultural values; but these practices are more exposed to social manipulations than the invisible aspects of technology (Gosselain, 1999 and 2000). Raw material selection and fashioning techniques, on the other hand, represent a more stable aspect of pottery traditions and are expected to reflect more enduring facets of identity (Woods, 1984; Gosselain, 1999 and 2000). It has been shown that patterns in vessel building techniques closely correspond with social boundaries such as those of language groups (Arnold, 1981), specialist groups (Miller, 1985; Mahias, 2002), and gender (Hosler, 1996). These practices become internalised motor habits that are acquired through repeated practice during early learning. For this reason, these are the most resistant to change (Foster, 1966; Nicklin, 1971; Hill, 1977; Reina and Hill, 1978; Saraswati, 1978; Arnold, 1981, 1985 and 1994; Hayden and Cannon, 1984; Roux and Corbetta, 1990; Gosselain, 1998 and 2000).

In light of this, the investigation of preferences in ceramic raw materials/tempers and building techniques on a household level provides information on settlement dynamics, which in turn can help archaeologists understand where and how changes occurred within a settlement. This can further be compared with the results of other types of analyses, such as stone tools, consumption habits, agricultural production, animal husbandry, traditional typochronology and so on.

We have a fairly complete view of the development of Neolithic ceramic traditions in Hungary, which is suitable for highlighting 'tendencies' in the dynamics and changes in ceramic technologies (Szakmány, 1996 and 2001; Szakmány et al., 2005; Szakmány and Starnini, 2007; Szilágyi et al., 2008; Kreiter et al., 2009; Kreiter, 2010; Kreiter et al., 2011; Kreiter et al., in press; Kreiter and Szakmány, 2011; Kalicz et al., 2012; Zsók et al., 2012). However, no analyses have so far been carried out on a Hungarian Neolithic settlement with an aim toward exploring the nature and extent of changes in ceramic technologies on a household level and assessing where changes first appeared within a given settlement.

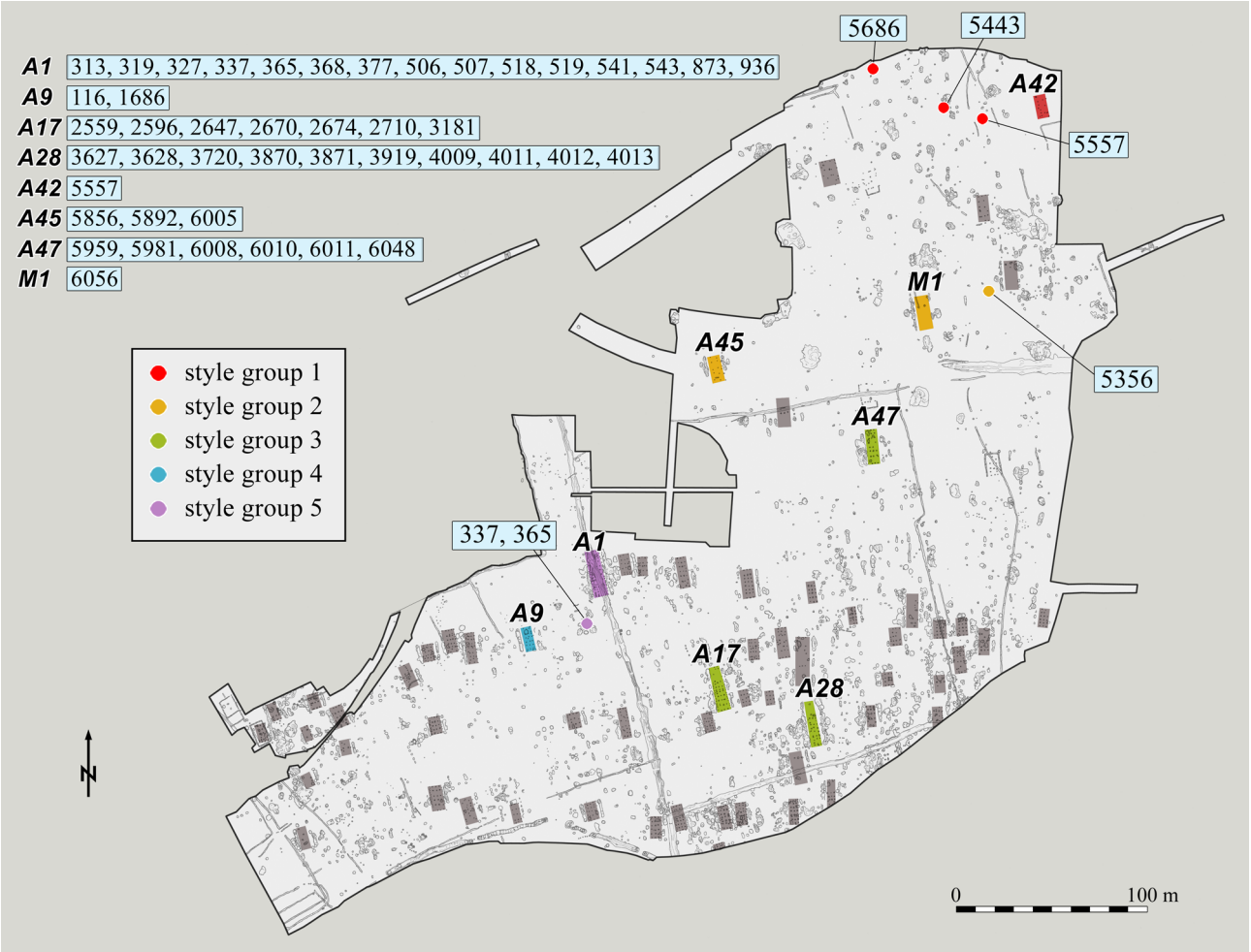


Fig. 2 – The eight houses analysed in this study. Isolated features integrated in the analysis are indicated by dots.
***Fig. 2** – Les huits maisons analysées dans cette étude. Les structures isolées intégrées dans l'analyse sont signalées par des points.*

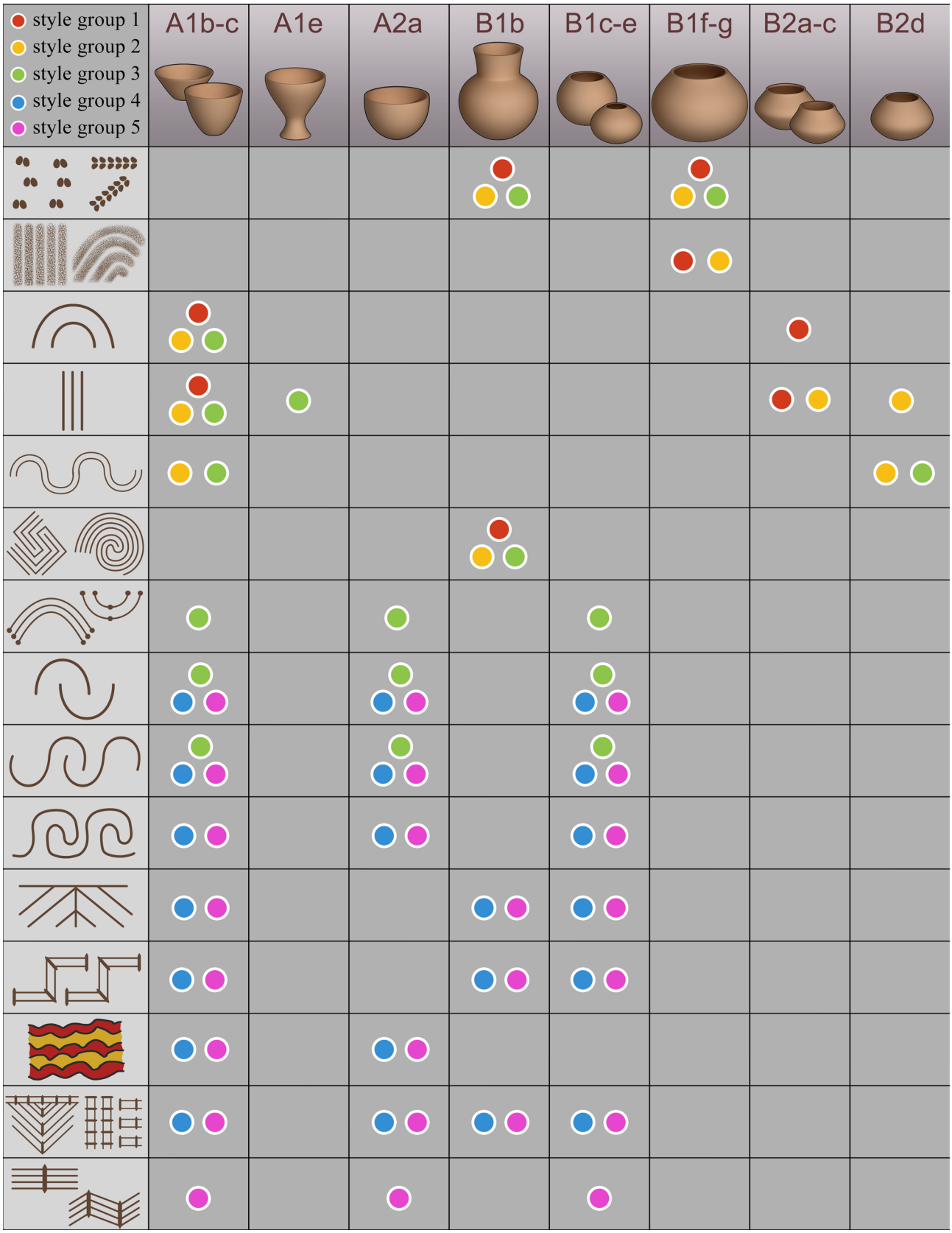


Fig. 3 – Characteristic combinations of vessel forms and decorations according to style groups of Balatonszárszó.
***Fig. 3** – Associations caractéristiques de formes et de décors céramiques, et styles céramiques identifiés à Balatonszárszó.*

As far as ceramic production at Balatonszárszó is concerned, an assessment of the scale of production, together with the identification of areas of production within the settlement, would shed more light on the meaning of technological variability on a household level. However, the scale of pottery production could not be assessed since to date there is no clear evidence for pottery production at any Neolithic settlement in Hungary. In order to define a pottery production site, one has to consider a range of data that may accompany ceramic production such as wasters, production tools, raw materials, structural evidence for the curing/mining of clay and the presence of distinctive manufacturing assemblages (Wardle, 1992, p. 63-73). On these criteria, no pottery production sites have yet been found anywhere within the Hungarian Neolithic.

In this study, the examined ceramics are considered household-related objects. Although the place and nature of the ceramic production is unknown, vessels ended up in households that reflect both the identity of their users and the social settings in which the vessels were produced and utilised. Technological change can thus be identified on a household level, enabling us to gain a better understanding of the spatial organisation of production behaviour, or at least ceramic use.

With a view to identifying changes in raw materials through the ceramic style groups and on a household level, all the available ceramics were examined macroscopically. Subsequently, 461 sherds were chosen for further macroscopic analysis, mainly from features associated with buildings. The selection of samples was based on typological and technological attributes. The aim was to include samples from all ceramic style groups at the site, including variations within the main forms and also taking into account macroscopically observable differences in fabrics. The selected samples are thus considered to represent the technological variability of the site in terms of raw materials and tempers. As a result of our macroscopic analysis, 131 samples were selected for petrographic analysis, from which 99 come from the eight houses and associated features examined in this study (fig. 2). These houses provided the largest quantity of ceramics, and their relative chronology is also well established.

During the petrographic analysis, the inclusion density, size categories, inclusion sorting and roundness of the components were determined according to the guidelines of the *Prehistoric Ceramic Research Group* (PCRG, 2010). Inclusion density: rare (< 3%), sparse (3–9%), moderate (10–19%), common (20–29%), very common (30–39%) and abundant (> 40%). Size classification: very fine (< 0.1 mm), fine (0.1–0.25 mm), medium (0.25–1 mm), coarse (1–3 mm) and very coarse (> 3 mm). Inclusion sorting: poorly-sorted, moderately-sorted, well-sorted, and very well-sorted. Roundness classes: angular, subangular, subrounded, rounded and well-rounded.

The eight examined houses and pits produced 9,161 sherds, 109 of which, all belonging to different vessels, could be attributed to a forming method. The analysis of forming methods focused on characteristics of surface topography, lines of fractures, variation in wall thickness, change in surface texture, as well as orientation of particles and porosity in cross-section (Livingstone Smith, 2001). Each macrotrace was recorded, coded, photographed and replaced on the profile of the recorded vessel. The identified macrotraces were interpreted in terms of techniques and methods of fashioning on the basis of several experimental and ethnographic reference works (e.g. Shepard, 1956; Rye, 1981; Livingstone Smith, 2001; Gosselain, 2002; Gelbert, 2003).

On the basis of the spatial distribution of typological groups and their characteristic combinations the ceramic material was divided into style groups (fig. 3; Marton, 2008, p. 198–201 and 2015, p. 107–142). The spatial pattern of different style groups could be described with five characteristic combinations, meaning that the common occurrence of particular pottery forms and decorations in certain features and house units could be observed repeatedly in the course of the study. The local assemblage does not include all typochronological horizons of the Transdanubian LBK sequence, as the formative LBK phase was not present (Marton, 2008, p. 202; Marton and Oross, 2009, p. 60 and 2012, p. 223). The validity of the style groups was confirmed by multivariate statistical methods (Marton, 2015, p. 202–214). At Balatonszárszó, the earliest horizon (characterized by Style group 1) could be linked to the northeastern part of the excavated area (fig. 2). The stylistic attributes of the ceramics represent the early LBK period of the western Carpathian Basin, and show extensive similarities to finds from Budapest-Aranyhegyi út and the earliest phase of the Neolithic occupation at Bicske-Galagonyás (Makkay, 1978, p. 28, Plates III–VI; Kalicz-Schreiber and Kalicz, 1992, p. 51, Abbildung 3–5), as well as with the material from Bíňa in southwestern Slovakia (Pavúk, 1980, p. 10, Abbildung 23).

House A42 and its associated feature (Pit 5557) were analysed from Style group 1. In the distribution area of Style group 1, house plans are widely spaced, and their flanking pits could not be observed. Therefore, it was necessary to use a different approach to collect more ceramic technological data, for subsequent comparison with the households of other parts of the settlement. For this reason, Pit 5443 was also considered. Although it is located about 30 metres from House A42, the pottery is very similar to the assemblage from this house. In order to gather more comparative data from the earliest occupation of the site, another feature was also included (Pit 5686), which is about 50 metres from House A42. Even though the association of these latter pits with the house is uncertain, they were included in the study because they contain a very distinctive early LBK assemblage. Furthermore, we wanted the number of samples included from the early LBK period to be similar to the number included from the late LBK period, in order to avoid skewing the ceramic technological data.

Style group 2 is representative of the northeastern area of Balatonszárszó and, within that, its southern edge. The typological characteristics of ceramics in this area show broad similarities to the material from Milanovce (Pavúk, 1980, p. 47, Abbildung 19, 2 and Abbildung 41, 1–2), representing the latest phase of the early LBK period, in a purely typochronological approach (Marton, 2013, p. 171). It is worth noting that settlements with Milanovce pottery were recently dated to 5,300–5,200 cal BC, a time when later LBK units already existed (Stadler and Kotova, 2010, p. 338). This information is another sign of a more complex site development rather than a series of consecutive typochronological phases. In order to analyse the ceramic technology of this style group, Houses A45 and M1 were chosen. The postholes were well preserved, and the flanking pits in an ordered position around House A45 are also characteristic. For the analysis of House M1 a nearby pit (Pit 5356) was also included because its assemblage was very similar to that of the house. These houses seem particularly suitable for household analysis because their associated features contained comparative amounts of ceramics.

In the eastern area of the southern and densely built-up part of the settlement, Style group 3 characterizes some house clusters. This group represents the early stage of the so-called Keszthely style (Kalicz, 1991) and some Notenkopf elements (Marton, 2008, p. 203). Style group 3 is also labelled as late LBK and serves as a transitional phase towards the late LBK pottery styles. This type of pottery is well represented in the northern part of Transdanubia as well, for example at Bicske-Galagonyás (Makkay et al., 1996, p. 62, fig. 48–51). Three houses were chosen from this period, characterised by increased variability in vessel shape and decoration.

House units and house clusters associated with Keszthely style ceramics and with pottery of the so-called Zseliz/Želiezovce type decoration (Pavúk, 1969, p. 295, Abbildung 36 and 51, and 1994, p. 145, Tafel 51–52) are typical in the southern part of the settlement. Two further style groups (4 and 5) could also be distinguished based on the frequency and variability of Zseliz/Želiezovce attributes in the pottery assemblage. Two houses (A1 and A9) were analysed from these style groups. These houses are located in the southern part of the settlement and they belong to two neighbouring house groups. House A9 represents Style group 4 while House A1 represents Style group 5. For the analysis of House A1, a pit complex (Pit 337) situated 15 metres from the house was also included. The relationship between House 1 and the pit complex is indicated by conjoining sherds.

In light of the above, the ceramic assemblage of Balatonszárszó offers an exceptional opportunity to analyse the technology of pottery sequences on a household level and to understand intrasite dynamics of pottery use. In the following, the ceramic technology in the examined houses is analysed and possible correlations between technology and the different style groups of the settlement are highlighted.

RESULTS OF PETROGRAPHIC AND CERAMIC BUILDING TECHNOLOGY ANALYSIS

The examined samples are classified into three main fabric groups (fig. 4):

1) Fabric 1 is characterised by very fine (VF) visible non-plastic elements, although it has two subgroups (fig. 4, nos. 1–2); 1a shows chaff tempering (VF/CH) while 1b does not (VF). Nothing other than chaff tempering was identified in association with this raw material. The amount of visible non-plastic elements is moderate to common (10–29%) and the dominant grain size is very fine (< 0.1 mm). The porosity of samples tempered with chaff is high. The pores are elongated and mostly parallel to the vessel wall. The majority of elements are mainly monocrystalline quartz with straight or undulated extinction, but plagioclase, potash feldspar, and muscovite mica are also present.
2) Fabric 2 is characterised by very fine to fine-grained visible non-plastic elements (VF-F) (< 0.1 mm and 0.1–0.25 mm), but sub-groups could also be identified according to the presence/absence of chaff tempering and naturally present calcareous elements (fig. 4, nos. 3 – 6). The basic raw materials of the subgroups in Fabric 2 seem very similar. As the appearance or disappearance of calcareous elements in clays depends on environmental conditions, these elements can appear or disappear within a small area of a given clay source. Therefore, raw materials, which are very similar petrographically to the other samples in this group but show calcareous elements, were also classified into this group.

- Fabric 2a (VF-F) is characterised by very fine to fine (< 0.1 mm and 0.1–0.25 mm) visible non-plastic elements, but neither calcareous elements nor chaff tempering are identified. No intentional tempering could be recognised in this subgroup. The amount of elements is medium to common (10–29%), their size distribution is serial (0.1–0.25 mm); they are well sorted. The majority of elements are monocrystalline quartz with normal or undulated extinction. Potash and plagioclase feldspar and muscovite mica also appear, while biotite mica is less common. Rare amounts of argillaceous fragments are also identified.
- Fabric 2b (VF-F/CH) has a very similar raw material to 2a, but 2b is tempered with chaff. The samples are porous, with elongated pores mainly parallel to the vessel wall. Fabric 2c (VF-F-Ca) shows naturally present calcareous elements. Approximately half of these are micritic, mainly very fine in size (0.05–0.1 mm). There are also larger (0.5–5 mm) calcareous concretions composed of well-rounded micritic and sparry grains.
- Fabric 2d (VF-F-Ca/CH) shows naturally present calcareous elements and chaff tempering.

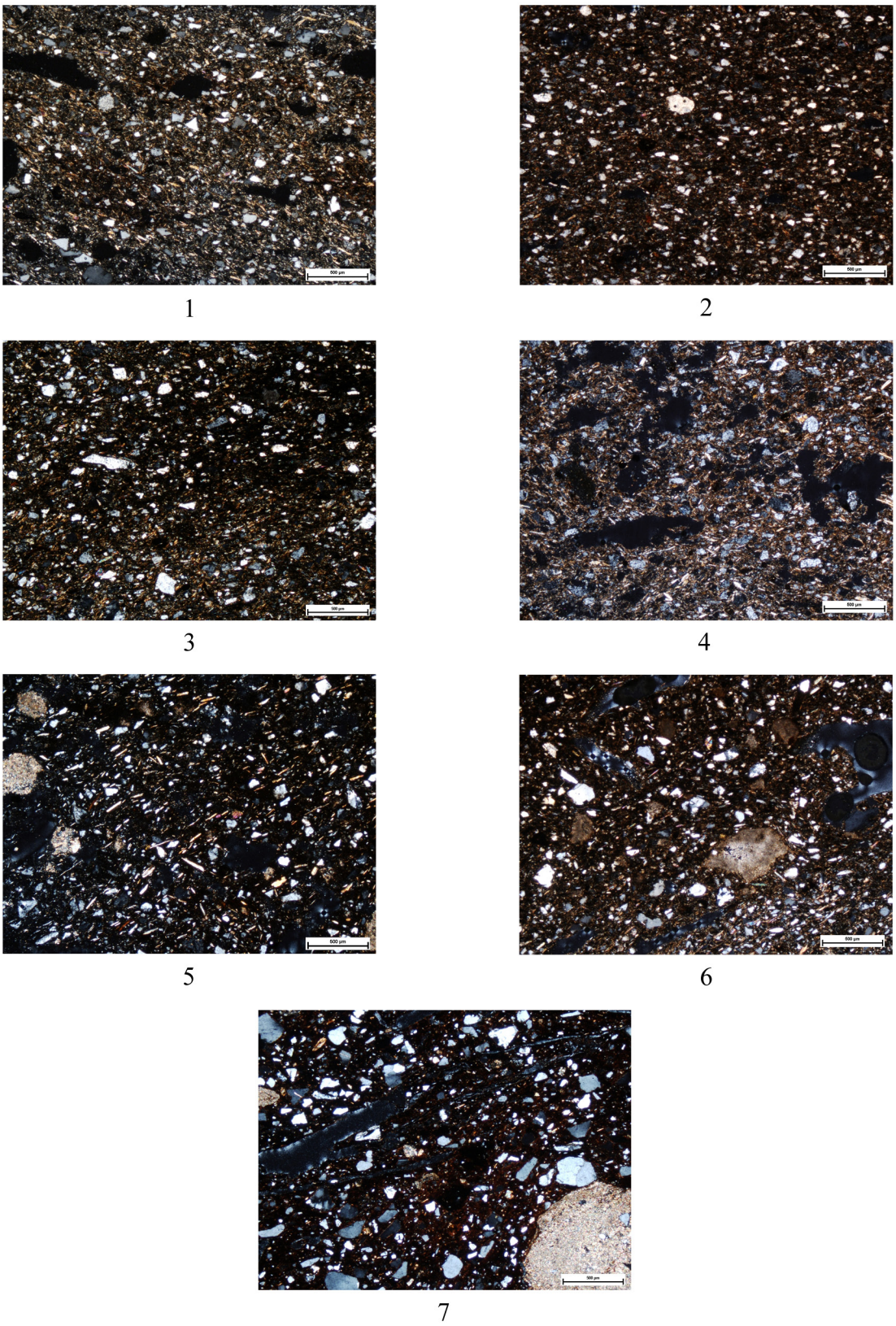
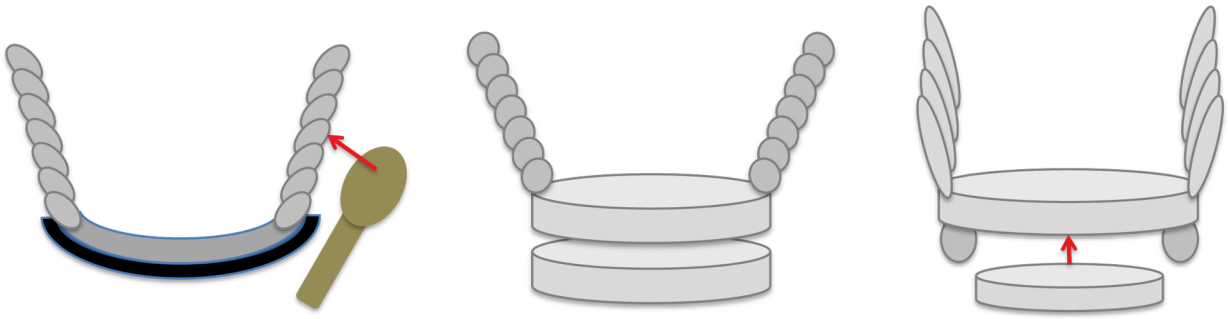
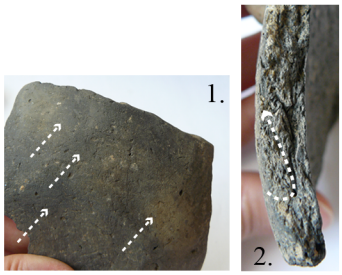


Fig. 4 – Micrographs of fabric groups (40x, +N). 1: Fabric 1a; 2: Fabric 1b; 3: Fabric 2a; 4: Fabric 2b; 5: Fabric 2c; 6: Fabric 2d; 7: Fabric 3.

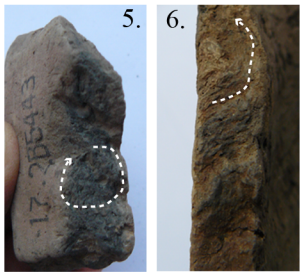
***Fig. 4** – Microphotographies des groupes pétrographiques de pâte (40x, +N). 1 : Groupe de pâte 1a ; 2 : Groupe de pâte 1b ; 3 : Groupe de pâte 2a ; 4 : Groupe de pâte 2b ; 5 : Groupe de pâte 2c ; 6 : Groupe de pâte 2d ; 7 : Groupe de pâte 3.*



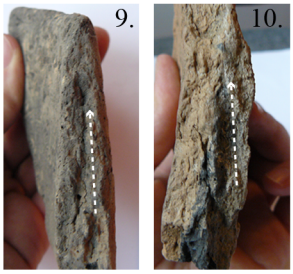
Method 1 Method 2 Method 3



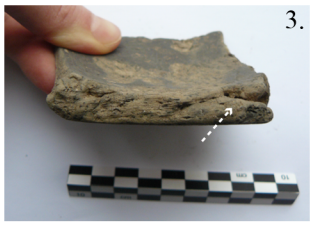
Macrotraces observed on the body and the rim of the vessels associated with Method 1: (1.) Overlapping sub-circular flat areas on the outer surface suggest shaping with the beating technique; (2) Slightly elongated coils visible in cross-section (the orientation of pores is sub-circular to oblique).



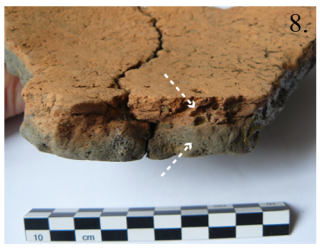
Macrotraces observed on the body and the rim of the vessels associated with Method 2: (5 and 6) Non deformed coils visible in cross-section (sub-circular orientation of pores).



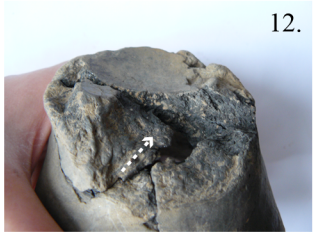
Macrotraces observed on the body and the rim of the vessels associated with Method 3: (9 and 10) Slabs or very elongated coils visible in cross section (vertical orientation of pores).



Macrotraces observed on the base of the vessels associated with Method 1: (3.) Coil visible in cross-section; (4.) Pressures made by fingers on the inner surface suggest shaping by pressure against a concave support.



Macrotraces observed on the base of the vessels associated with Method 2: (7 and 8) Overlapping of two slabs, visible in cross-section.



Macrotraces observed on the base of the vessels associated with Method 3: (11 and 12) A slab is visible at the centre of the base and fills the previously formed foot.

Fig. 5 – Schematic representations of building methods and associated macrotraces.
***Fig. 5** – Représentation schématique des méthodes de façonnage et des macrotraces associées.*

3) Fabric 3 (F-M-Ca/CH) is distinct from other fabrics in that it has a coarser matrix (fig. 4, no. 7). This fabric is characterised by fine to medium visible non-plastic elements (0.1–1 mm); naturally present calcareous elements also appear, as does chaff tempering. The amount of elements is moderate to common (10–29%) and the dominant size range is fine and medium (0.1–0.7 mm). The visible non-plastic elements show serial size distribution. The elements are moderately sorted. The majority of elements are monocrystalline quartz, with normal or undulated extinction. Rare amounts of potash and plagioclase feldspar and muscovite mica also appear. Calcareous elements appear in the form of medium to very coarse (0.5–5 mm) concretions.

As far as fashioning techniques are concerned, three forming methods were identified (fig. 5):

1) Method 1. The first forming method (fig. 5, no. 1) is characterized by a base formed with a thin coil in spiral, as shown by the presence of a sub-circular configuration on edges of vertical fractures (fig. 5, no. 3). Longitudinal depressions on the inner surface of the base suggest shaping by compression against a support (fig. 5, no. 4). The body and the rim present, on the edge of vertical fractures, sub-oval sections of coils (fig. 5, no. 2), sometimes associated with a foliated internal structure. On the outer surface of the belly and the rim, overlapping sub-circular flat areas are often observed (fig. 5, no. 1). The combination of these macrotraces indicates that the body and the rim were formed by superposition of thin coils and then shaped using the beating technique. It is important to note that the intensity of the beating seems to vary from one vessel to another. Thus, on the vessels shaped with an intense beating, the regular taps of the paddle on outer surfaces cause a change in the internal structure of the clay, giving it a foliated aspect. On vessels shaped with a less intense beating, the macrotraces related to the percussion of the paddle are less clear and more difficult to distinguish on surfaces and in cross-section.
2) Method 2. The second fashioning method (fig. 5, no. 2) includes vessels whose base is formed with two overlaid slabs: the joins between the slabs are often visible in cross-section (fig. 5, nos. 7 and 8). Each of these slabs shows, in cross-section, a sub-circular pattern, which suggests the use of coils in spiral. The body and the rim of these pots also show, on the edges of vertical fractures, sub-circular sections of coils which suggest that they were formed by superposition of thin coils, slightly or not deformed during their placement.
3) In Method 3 (fig. 5, no. 3), the vessel bases (when preserved) show a wide range of technical macrotraces, which suggests fashioning in three phases. First, a slab is formed with thin coils in spiral, as shown by the sub-circular pattern visible in cross-section. Secondly a coil, often visible in cross-section, is applied on the junction between the base and the body, to form an annular foot. Third, a slab is applied at the centre of the base in order to fill the previously formed annular foot (fig. 5, nos. 11 and 12). The body and the rim of these vessels show sections of very elongated elements (fig. 5, nos. 9 and 10). The pots present many oblique to vertical fractures and several sherds are vertically broken. These observations suggest initial forming with slabs or very elongated coils, probably followed by thinning operations.

COMPARISON OF VESSEL FORMS, FABRICS AND HOUSEHOLDS – DISCUSSION

In the following section the ceramic types and their technological characteristics are examined through the houses and style groups of the settlement, and changes in raw material use and fashioning techniques are highlighted. Five style groups have been distinguished based on vessel forms and decoration. At this site, Style groups 1 and 2 represent the early LBK, and Style groups 3–5 represent the late LBK.

Style group 1

From Style group 1, House A42 and Pits 5557 and 5443 were analysed along with Pit 5686, according to the previously mentioned principles (tables 1–3). The ceramics from these features show similarities in terms of vessel forms, surface treatments and decorations. Fine wares such as conical bowls and biconical bowls, the latter type with three-fold symmetrically repeated decoration, are characteristic in all features. Similar decoration combinations are also observed in several cases. Fine wares can clearly be characterised by surface burnishing. Coarse vessels show channelled barbotine and different types of applied rib and knob decoration. Vessels with cylindrical necks and combined incised spiral and meander motifs are typical.

Petrographic data indicate that raw material selection in Style group 1 (early LBK part of the settlement) was restricted to the use of a few raw materials (tables 1–3) that were all tempered with chaff. Moreover, these fabrics remained in use and were the most characteristic until the end of the site (see the presence of Fabrics 1a, 2b and 2d: tables 1–11 and fig. 6). It seems that the earliest potters of the site were conservative, using a restricted number of raw materials and tempering these with chaff. Studies from other Neolithic sites also indicate that chaff tempering was ubiquitous in the Early Neolithic (Körös and Starčevo) and in the early phases of the Middle Neolithic of Hungary, and other tempering practices were hardly used (Kreiter, 2010; Kreiter et al., 2011). In this respect the earliest ceramic raw material selection at Balatonszárszó is very uniform, showing little variability and a strong resemblance to Early Neolithic ceramic traditions (Kreiter et al., 2013).

House A42	Fabric 1a - VF/CH	Fabric 2b - VF-F/CH	Fabric 2d - VF-F-Ca/CH	Forming method
Conical bowl with straight wall (type A1b)		1		nd
Conical bowl with arched wall (type A1c)		1	1	Method 1 (1pc)
Conical bowl with pedestal (type A1e)		1		nd
Hemispherical bowl (A2a)		1		nd
Vessel with cylindrical neck and incised decoration (type B1b.5)		1	2	Method 1 (1 pc)
Globular fine vessel (type B1e)	1			nd
Globular storage vessel (B1f)	2	1		nd
Globular vessel (type B1g)		1		Method 2 (1 pc)
Biconical fine vessel (type B2b)		2		Method 1 (2 pcs)
Not thin sectioned				Method 1 (1 pc)
Total	**3**	**9**	**3**	**5**

Table 1 – Distribution of fabrics and building methods to vessel types associated with House A42 (nd = non determinable).
***Tabl. 1** – Distribution des groupes de pâte et des méthodes de façonnage en fonction de la morphologie des vases dans la maison A42 (nd = indéterminé).*

Pit 5686	Fabric 1a - VF/CH	Fabric 2b - VF-F/CH	Fabric 2d - VF-F-Ca/CH	Forming method
Conical bowl with straight wall (type A1b)		1		nd
Vessel with cylindrical neck (type B1b)		2		nd
Vessel with cylindrical neck (incised decoration) (type B1b.5)		1		nd
Globular vessel (type B1g)	1	1		nd
Biconical vessel (pedestal) (type B2c)		1		Method 3 (1 pc)
Pedestal			1	nd
Not thin sectioned				Method 1 (2 pcs)
Total	**1**	**6**	**1**	**3**

Table 2 – Distribution of fabrics and building methods to vessel types in Pit 5686 (nd = non determinable).
***Tabl. 2** – Distribution des groupes de pâte et des méthodes de façonnage en fonction de la morphologie des vases dans la fosse 5686 (nd = indéterminé).*

Pit 5443	Fabric 2b - VF-F/CH	Forming method
Globular vessel (type B1g)	2	Method 2 (1 pc)
Globular vessel (pedestal) (type B1d)	1	nd
Hemispherical bowl (type A2a)	1	nd
Not thin sectioned		Method 1 (6 pcs), Method 3 (2 pcs)
Total	**4**	**9**

Table 3 – Distribution of fabrics and building methods to vessel types in Pit 5443 (nd = non determinable).
***Tabl. 3** – Distribution des groupes de pâte et des méthodes de façonnage en fonction de la morphologie des vases dans la fosse 5443 (nd = indéterminé).*

Concerning the fashioning techniques of Style group 1, the vessels are characterized either by coiling followed by beating (Method 1; House A42, Pits 5443 and 5686), by the overlapping of two slabs to form the base and the use of fine coils to build the walls (Method 2; House A42, Pits 5443 and 5686), or by the technique of the 'filled base' followed by the use of slabs (or very elongated coils) to build the body (Method 3; Pit 5686). In House A42, a combination of Methods 1 and 2 could be observed on one vessel: two slabs were overlapped to form the base, then the body was roughed out with coils and then shaped using the beating technique. No relationship can be established between vessel shapes and forming methods. Biconical vessels could thus be formed using Method 1 (House A42) or Method 3 (Pit 5686). Moreover, in the same house (A42), Method 1 had been used for the fashioning of several shapes (e.g. conical bowl, vessel with cylindrical neck or biconical fine vessel).

Methods 1 and 3 are predominant in all features, while Method 2 is rarely identified (House A42). Nevertheless, the representativeness of Method 2 in one of the earliest houses of the site is assured by its occurrence in the early LBK pits studied as part of a larger sampling of the Balatonszárszó ceramic assemblage.

The three identified forming methods are often simultaneously distributed in the different features, which raises the question of the organisation of pottery production and exchange (do the products of one or several producers appear in a single house? Were there exchanges or gifts of vessels between contemporary houses?). Nevertheless, the occurrence of a vessel in House A42 that was built using Method 2 for its base (overlapping of two slabs) and Method 1 for its walls (coils then beating) suggests interactions between these different groups of producers. The exact nature of these interactions is difficult to assess, but this 'mixed' way of vessel forming evokes meetings and know-how sharing between producers and/or apprentices during ceramic production.

Since no relationship could be established between forming methods and vessel shapes, this suggests no adaptation of the fashioning gestures to the desired pottery shape. The three different "ways of doing" at the settlement probably indicate three distinct learning networks. This hypothesis is reinforced by the fact that Methods 1 and 3 were predominant in the Starčevo material of Vörs

House A45	Fabric 1a - VF/CH	Fabric 2b - VF-F/CH	Fabric 2d - VF-F-Ca/CH	Forming method
Conical bowl with straight wall (type A1b)	1	1		Method 1 (1 pc)
Conical bowl with straight wall (incised decoration) (type A1b)	1			nd
Conical bowl with arched wall (type A1c)			1	nd
Elongated spherical vessel (type B1a)			1	nd
Elongated spherical vessel (pinch decoration) (type B1a)		1		nd
Vessel with cylindrical neck (type B1b)			1	nd
Globular storage vessel (type B1f)	1			nd
Globular vessel (pinch decoration) (type B1g)		1		nd
Total	**3**	**3**	**3**	**1**

Table 4 – Distribution of fabrics and building methods to vessel types associated with House A45 (nd = non determinable).
***Tabl. 4** – Distribution des groupes de pâte et des méthodes de façonnage en fonction de la morphologie des vases dans la maison A45 (nd = indéterminé).*

House M1	Fabric 1a - VF/CH	Fabric 1b - VF	Fabric 2b - VF-F/CH	Fabric 3 - F-M-Ca/CH	Forming method
Conical bowl with arched wall (type A1c)			1		nd
Vessel with cylindrical neck (type B1b)			1		nd
Vessel with cylindrical neck (incised decoration) (type B1b.5)	1				Method 1 (1 pc)
Globular storage vessel (type B1f)		1		1	nd
Biconical vessel (fine ware) (type B2a)			1		nd
Slightly biconical vessel (fine ware) (type B2d)	1				nd
Total	**2**	**1**	**3**	**1**	**1**

Table 5 – Distribution of fabrics and building methods vs vessel types associated with House M1 (nd = non determinable).
***Tabl. 5** – Distribution des groupes de pâte et des méthodes de façonnage en fonction de la morphologie des vases dans la maison M1 (nd = indéterminé).*

Pit 5356	Fabric 1a - VF/CH	Fabric 2b - VF-F/CH	Fabric 2d - VF-F-Ca/CH	Forming method
Conical bowl with straight wall (type A1b)		1	1	nd
Hemispherical bowl (type A2a)			1	nd
Globular storage vessel (type B1f)	1			nd
storage vessel	1			nd
Total	**2**	**1**	**2**	**0**

Table 6 – Distribution of fabrics and building methods vs vessel types in Pit 5356 (nd = non determinable).
***Tabl. 6** – Distribution des groupes de pâte et des méthodes de façonnage en fonction de la morphologie des vases dans la fosse 5356 (nd = indéterminé).*

Máriaasszony-sziget, while Method 2 was predominant in the Körös assemblage from Nagykörű-Tsz. Gyümölcsös (Gomart, forthcoming). Thus, similarly to raw materials, the forming methods identified in the earliest features of Balatonszárszó show strong similarities to Early Neolithic forming processes.

Style group 2

The characteristics of vessels in Style group 2 are similar in general to those observed in Style group 1. However, one of the main distinguishing features between them is the appearance of incised wavy lines around the circumference of the vessel. Another specific change is that burnishing appears less often; however, this may be caused by abrasion, since vessel surfaces from both examined houses are quite worn. As the number of sherds in each house is similar, they provide a good comparative assemblage for assessing household ceramic technologies. Although there are high numbers of conical bowls in both houses, there are clear differences in the number of fine wares. Biconical vessels in rounded versions, which were characteristic in Style group 2, are more common in House M1 than in House A45. Amongst the coarse wares, large storage vessels are more common in House M1. As a result, different types of knob decoration (mainly on storage vessels) show more variability, and rounded knobs with multiple finger impressions are particularly common. Different types of pinched decoration are clearly characteristic of House A45.

Style group 2 shows changes in the raw materials of vessels (tables 4–6). The most characteristic fabrics (1a, 2b, 2d) of Style group 1 are still present, but new raw materials also appeared. One is a very fine-grained raw material without tempering (Fabric 1b); the other is coarser (and calcareous) but still tempered with chaff (Fabric 3). An interesting point here is that House A45 does not show change, while House M1 does, indicating that different households were affected differently by changes in ceramic technologies.

The most notable change is the appearance of raw materials without chaff tempering. Thus one observes towards the later periods of the site a marked difference in the use of chaff tempering, as well as the use of calcareous raw materials and a clear preference for coarser raw materials with or without chaff tempering. These changes have been observed at a site level in general (Kreiter et al., in press) and also at a regional level (Kreiter et al., 2013). However, by examining these changes at a household level it seems that they appear gradually and differently in the examined houses. Thus, houses belonging to the same style group show differences in the technology of their vessels. This implies that different households adapted to changes differently, showing different social dynamics.

Data on fashioning are scarce for Style group 2. Only two vessels, both associated with Method 1 (coiling followed by beating), could be determined. One of them comes from House A45 (conical bowl), the other from House M1 (vessel with cylindrical neck).

House A47	Fabric 1a - VF/CH	Fabric 1b - VF	Fabric 2b - VF-F/CH	Fabric 2d - VF-F-Ca/CH	Forming method
Conical bowl with arched wall (type A1c)		1	1		nd
Vessel with cylindrical neck (type B1b)	1				nd
Globular storage vessel (type B1f)			2	1	nd
Globular vessel (type B1g)			1	1	nd
Total	**1**	**1**	**4**	**2**	**0**

Table 7 – Distribution of fabrics and building methods vs vessel types associated with House A47 (nd = non determinable).
***Tabl. 7** – Distribution des groupes de pâte et des méthodes de façonnage en fonction de la morphologie des vases dans la maison A47 (nd = indéterminé).*

House A28	Fabric 1b - VF	Fabric 2b - VF-F/CH	Fabric 2c - VF-F-Ca	Fabric 2d - VF-F-Ca/CH	Forming method
Conical bowl with straight wall (type A1b)		3	1		nd
Conical bowl with arched wall (type A1c)		1			nd
Vessel with cylindrical neck (type B1b)		1		1	Method 1 (1 pc)
Globular vessel (fine ware) (type B1c)	1	1			nd
Globular storage vessel (type B1f)				1	Method 3 (1 pc)
Not thin sectioned					Method 1 (18 pcs), Method 3 (15 pcs)
Total	**1**	**6**	**1**	**2**	**35**

Table 8 – Distribution of fabrics and building methods vs vessel types associated with House A28 (nd = non determinable).
***Tabl. 8** – Distribution des groupes de pâte et des méthodes de façonnage en fonction de la morphologie des vases dans la maison A28 (nd = indéterminé).*

House A17	Fabric 1a – VF/CH	Fabric 2a – VF-F	Fabric 2b - VF-F/CH	Fabric 2c - VF-F-Ca	Forming method
Conical bowl with arched wall (type A1c)		1			nd
Conical bowl with arched wall (Notenkopf) (type A1c)	1				nd
Vessel with cylindrical neck (type B1b)			1		nd
Globular storage vessel (type B1f)				1	nd
Globular storage vessel (pinched decoration) (type B1f)			2		Method 3 (1 pc)
Storage vessel			1	1	Method 1 (1 pc)
Not thin sectioned					Method 1 (12 pcs), Method 3 (6 pcs)
Total	**1**	**1**	**4**	**2**	**20**

Table 9 – Distribution of fabrics and building methods vs vessel types associated with House A17 (nd = non determinable).
***Tabl. 9** – Distribution des groupes de pâte et des méthodes de façonnage en fonction de la morphologie des vases dans la maison A17 (nd = indéterminé).*

Style group 3

This group shows more diversity, not only in technology but in typology as well. Several elements of the early LBK (Style groups 1 and 2), such as vessels with incised spiral decoration and meander motifs, are still present. In some features, rounded biconical vessels also appear. In correlation with the appearance of raw materials without tempering, fine wares with thinner walls and arched conical bodies become common. These vessels are usually decorated with incised arched intertwining lines around the circumference of the vessel and with secondary motifs, occasionally with lines ending in music notes. Burnishing the whole surface of the vessels is also common.

The typological characteristics of vessels of the selected houses show clear differences. This perhaps resulted from differences in customs among the houses, and/or their chronology was slightly different. The use life of vessels, like the use life of houses, can obviously be different. For example, in the case of House A47 the spatial distribution of ceramics and the stratigraphy of postholes and some pits suggest that this house may have been extended into a larger building (Oross, 2013, p. 249-250). Characteristics of early LBK ceramics mainly appear in House A28, while the early Keszthely style is more characteristic of House A47, despite the fact that the latter house is located on the southern edge of the northern part of the settlement, which is connected to the early LBK occupation. Notenkopf ceramics are characteristic

of both houses. In the pits of House A17 however, apart from Keszthely type ceramics, Notenkopf vessels with red painted bands also appear. Moreover, the western flanking pit of this house also contained some Zseliz/Želiezovce style fragments decorated with intersected bands. These typological observations place House A17 at the transition from Style group 3 to 4.

Style group 3 shows that changes in raw materials and temper, which started in Style group 2, continued (tables 7–9; fig. 6). Assemblages corresponding to Style group 3 are regarded as representing the earliest stage of the late LBK period. However, our study suggests that Style groups 2 and 3 are both part of a broader process of transition with many substantial changes, which can be similarly observed in these style groups.

In the examined houses (A47, A28, A17) the most characteristic fabrics (1a, 2b, 2d) of Style groups 1 and 2 are still present, but chaff tempering started decreasing. New raw materials also appeared (fig. 6), such as very fine to fine without chaff tempering (Fabric 2a) and very fine to fine calcareous raw material without chaff tempering (Fabric 2c).

Similarly to the previous style groups it seems that changes appeared differently at household level: House A28 does not have the finest fabric with chaff tempering (1a), while the other two houses do. In a similar vein, A47 does not have a naturally calcareous fabric without tempering (2c), while the other two houses do. It seems that Style group 3 provides strong evidence for diversification of potting traditions within the community.

Fashioning techniques could be determined for Houses A28 and A17. In these two houses, the vessels were made either using Method 1 (coiling then beating) or Method 3 (slab building). Here again, no direct relationship between the shape of the vessels and their forming methods can be established. For example, the identified storage vessels from House A17 are made using either Method 3 or Method 1.

Style groups 4 and 5

These groups could only be distinguished from each other by the frequency of Zseliz/Želiezovce type ceramics, which are decorated with intersected bands (Marton, 2008, p. 204). Ceramics show similarities in these style groups in terms of surface treatment, such as burnishing and red painting. In the case of fine ceramics the presence of Keszthely style vessels is characteristic, but they show increased variability compared to Style group 3. A new element in the ceramic repertoire is the appearance of coarse wares with thinner walls, practically without decoration. In Style group 4, Zseliz/Želiezovce type vessels with incised or often painted decoration appear sporadically, while in Style group 5 they became much more common. As a result, the two houses (House A1 and A9) chosen from these style groups show considerable differences at the household level. There are remains of further four houses in the vicinity of House A9 which altogether seem to form a row (Marton, 2015, p. 70). Conjoining sherds from these houses, and considerable stylistic similarities between vessels, suggest that changes in ceramic technologies not only show correlations with individual houses but also with house groups. This assumption is strengthened by the fact that several pits around House A9 contained fragments of a number of special face-pots with incised and painted decoration. Such face-pots did not appear in other parts of the settlement.

House A1 and its associated pit complex (their relationship is attested by conjoining sherds) can be characterised by a large number of Zseliz/Želiezovce type ceramics showing high variability in incised decoration – and uniquely at this site, sherds with Sopot typological characteristics were also found; this cultural unit followed the LBK.

As regards raw material use in these style groups that represent the late LBK period, we see similar patterns to

House A9	Fabric 1b - VF	Fabric 2b - VF-F/CH	Fabric 2d - VF-F-Ca/CH	Fabric 3 - F-M-Ca/CH	Forming method
Conical bowl with arched wall (type A1c)			1		nd
Hemispherical bowl (type A2a)		1			nd
Elongated spherical vessel (type B1a)			1		nd
Vessel with cylindrical neck (type B1b)			1	1	nd
Globular vessel (fine ware with Zseliz/Želiezovce decoration, type B1c)	1				nd
Globular vessel (type B1g)		1			nd
Total	**1**	**2**	**3**	**1**	**0**

Table 10 – Distribution of fabrics and building methods vs vessel types associated with House A9 (nd = non determinable).
***Tabl. 10** – Distribution des groupes de pâte et des méthodes de façonnage en fonction de la morphologie des vases dans la maison A9 (nd = indéterminé).*

House A1	Fabric 1b - VF	Fabric 2a - VF-F	Fabric 2b - VF-F/CH	Fabric 2d - VF-F-Ca/CH	Fabric 3 - F-M-Ca/CH	Forming technique
Conical bowl with straight wall (type A1b)				1		nd
Hemispherical bowl (type A2a)				2		Method 1 (1 pc)
Flat bowl (type A2c)			1			nd
Vessel with cylindrical neck (type B1b)				2		nd
Globular vessel (fine ware) (type B1c)	1	1	1			nd
Globular storage vessel (type B1f)			2	1	1	Method 1 (1 pc)
Globular cooking vessel (type B1f)			1			nd
Globular vessel (type B1g)			2			nd
fragments with Zseliz/ Želiezovce decoration		1		1		nd
Not thin sectioned						Method 1 (24 pcs), Method 3 (9 pcs)
Total	**1**	**2**	**7**	**7**	**1**	**35**

Table 11 – Distribution of fabrics and building methods vs vessel types associated with House A1 (nd = non determinable).
Tabl. 11 *– Distribution des groupes de pâte et des méthodes de façonnage en fonction de la morphologie des vases dans la maison A1 (nd = indéterminé).*

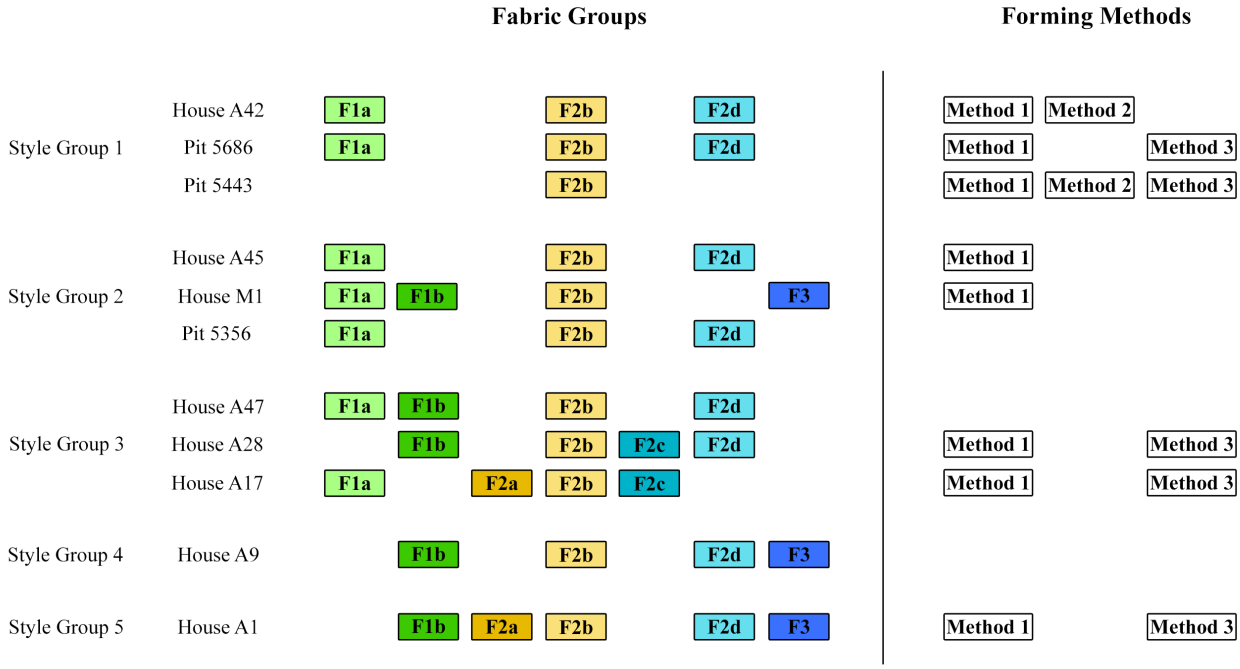


Fig. 6 – Changes in raw materials (potter's clay and added temper) and changes in fashioning techniques: the style groups of Balatonszárszó. Note the opposite tendency as for the variability of the raw materials and of the fashioning techniques. The number of raw materials increases while the number of forming methods decreases towards the late phases.
Fig. 6 *– Changements dans les matières premières (matériaux argileux et dégraissants ajoutés) et les méthodes de façonnage en fonction des groupes stylistiques à Balatonszárszó. On note des tendances opposées entre les matières premières et les méthodes de façonnage : le nombre de matières premières augmente, tandis que le nombre de méthodes de façonnage diminue au cours des phases récentes.*

those emerging in Style groups 2 and 3 (tables 10–11). Here again the most characteristic fabrics (Fabrics 2b and 2d) of Style groups 1 and 2 dominate, but the new raw materials that appeared previously are also present here. Fabrics without tempering (Fabrics 1b, 2a), which appeared in Style group 2, are present, as well as coarse, naturally calcareous raw materials (Fabric 3).

The fashioning techniques of House A1 show that vessels were made using either Method 1 or Method 3, while in House A9 fashioning techniques were not identifiable. As for changes in fashioning techniques in Style groups 3–5, Method 1 and 3, which were predominant in Style group 1, remain the most characteristic in the studied samples. On the contrary, Method 2, which is characteristic of the Körös site of Nagykörű-Tsz. Gyümölcsös, is no longer present. This trend was also observed in the larger studied sample from Balatonszárszó. The possible disappearance of Method 2 from the settlement could be related to specific social processes. In the current state of data, it could be interpreted either as the departure of one group of producers from the settlement or as an homogenisation of forming practices over time, caused by increasing interactions between different groups of producers. The latter hypothesis is reinforced by the identification of a 'mixed' vessel, made using techniques characteristic of both Method 1 and Method 2, suggesting close interaction between producers originating from different learning networks from the beginning of the settlement occupation. Other examples of technically 'mixed' vessels have also been found in the larger examined sample. Bearing in mind that fashioning constitutes a very stable step of the *chaîne opératoire*, these changes in forming practices over time could indicate profound social changes in the course of occupation of the settlement (Gosselain, 2002). On the other hand, higher variability in raw materials may also indicate diversification between potters, including intensified ceramic production when the number of producers increased.

By breaking down our analysis to vessel types and their raw materials/tempers and correlating these with houses (tables 1–11), we see that conical bowls (A1b, A1c, A1e) were made from the most common fabrics (Fabrics 1a, 2b, 2d) up until Style group 3, when their untempered versions appeared (Fabrics 1b, 2a, 2c) in all three analysed houses. Hemispherical bowls (A2a) were also made from the most common fabrics; however, their raw materials do not change in the late LBK period of the site. Vessels with cylindrical necks (B1b) also show only minor changes in their fabrics in Style group 4, when their coarser versions appeared with chaff tempering (Fabric 3). Globular fine wares (B1c, B1e) show similar patterns to conical bowls: changes appeared in Style group 3, and in Style groups 4 and 5 their untempered versions appeared in all analysed houses (A28, A9, A1). Two samples of globular fine wares with Zseliz/Želiezovce decoration are also untempered (Style groups 4 and 5). One sample from Style group 5 is chaff tempered. The fabrics of globular storage vessels do not show a clear pattern; untempered versions (Fabric 1b) of this type (B1f) appear in Style groups 1 and 2 but were not observed in other style groups. Elongated spherical vessels (B1a) do not seem to have changed. They were made from the most common fabrics even in Style group 4, but no vessel of this type was found in the analysed houses from Style group 5. Biconical fine vessels (B2a, B2b, B2c) were also made from the most common fabrics. In the case of this type it is important to note that its form gradually became more globular (B1c, B1e). The untempered versions of the latter types appeared in the late LBK related style groups. To summarize the raw material changes in vessel types, it seems that conical bowls and globular fine wares were the most susceptible to changes. What is more, changes in their raw materials could be detected in all analysed houses.

The changes that we find in raw materials of the different vessel types correspond well with changes in vessel forms. The late LBK related style groups (Style groups 4 and 5) at Balatonszárszó are associated with greater vessel form diversity, increasing elaboration, and diversity in decoration (mainly for globular forms). Decorations and vessel forms are considered to be susceptible to change and more exposed to social relationships (e.g. Dietler and Herbich, 1994; Gosselain, 2000; Arnold, 2008). This is because, by living close to each other, sharing similar activities, or attending the same market places or other sites of social interaction, people have and use the opportunity to exchange goods and ideas without necessarily engaging in close relationships (Gosselain, 1999 and 2000). Our results are in direct correlation with Gosselain's observations, and it seems that conical bowls and globular fine wares were the most affected by changes. The reason why the technology of these particular vessel types changed the most requires further research. Nevertheless, we witness profound changes at Balatonszárszó, which started in Style group 2 and continued in Style group 3. These changes, together with other developments at the site in settlement patterns, stone tools, burial customs and animal husbandry, are presumably key components of growing house identity and increasing social inequality (e.g. Dueppen, 2015). The earliest settlement shows loosely arranged houses—the settlement was farmstead-like—while in the late phase, in the southern part of the settlement, houses were closely built in rows (Marton and Oross, 2009, p. 56). The size of regular stone tools also shows changes: their size notably increased from the early phase to the late (Marton and Oross, 2009, p. 68). The absolute dating evidence shows that the dates of burials in the early phase match the dates of features close to them. Thus, burial within the settlement took place close to settlement features which were still in use. In the late phase, burials were located in the parts of the settlement that had aready been abandoned (Marton and Oross, 2012, p. 281). According to stable isotope analyses, in the early phase cattle grazed in forested areas and in the late phase on open pasture (Whittle et al., 2013, p. 96).

Petrographic results also suggest that wider selections of raw materials may have been governed by social strategies rather than by practical issues such as potters using the least effort to obtain their raw materials (e.g. DeBoer, 1984, p. 530–549). In Style groups 2–5 new raw materials emerged; but the oldest ones (Fabrics 1a, 2b, 2d in Style group 1) still remained in use. Furthermore, Style groups 2 and 3 are very similar to each other in terms of raw material preferences and stylistic attributes. This suggests a close relationship or interaction between the people of these style groups. In a similar vein, Style groups 4 and 5 are also very similar to each other. These observations offer some support to the preliminary assessment of site development, according to which the style groups could have overlapped chronologically – or some could even have been contemporary. Thus, Style groups 2 and 3 could have been contemporary and the same applies to Style groups 4 and 5. Consequently, a more dynamic picture emerges in which site development is not simplified into successive chronological phases.

Several studies show that clay selection involves technical and economic aspects as well as social and symbolic strategies (Barley, 1984; Sillar, 1997). Individual life histories and social relationships between potters influence their knowledge and learning techniques. Thus technological knowledge is influenced by social behaviour, which is constructed and re-negotiated by potters (Barley, 1984; Chávez, 1992; Sillar, 1997; Gosselain, 2008). Therefore, the selection of appropriate recipes depends on several factors such as social status, notion of tradition, conceptions of technical and functional constraints, relationships between potters and customers, and symbolic meaning of materials and practices (Barley, 1984; Chávez, 1992; Arnold, 2000; Gosselain and Livingstone Smith, 2005). That is, 'potters do not act randomly, but navigate throughout a narrow channel of culturally defined and shared practices' (Gosselain and Livingstone Smith, 2005, p. 41).

According to ethnographic studies, the most explicit changes occur when potters move into a new community as a result of marriages, or for other personal or economic reasons (for sub-Saharan African studies see Gosselain and Livingstone Smith, 2005, p. 42). These can considerably affect clay selection and processing strategies. If potters move to a community where there is pottery production already, they may be confronted with other practices while working with neighbours or meeting potters at clay mines or market places. In this way potters become aware of different practices which are also suitable for producing the desired vessel (Herbich, 1987; Longacre et al., 2000; Gelbert, 2001). Alternatively, they can maintain their practice for social, economic or identity reasons, or simply because they believe that changing their technological practice would change the quality of their products (David and Henning, 1972; Woods, 1984; Sillar, 2000; Wayessa, 2015). Change can also be driven by individual ambitions of potters when they see social and/or economic advantage (Gosselain and Livingstone Smith, 2005, p. 42).

Raw material preferences and forming techniques are considered to be the strongest traditions in potting (Gosselain, 2000; Gosselain and Livingstone Smith, 2005). Since there were changes in these technologies in the style groups, more fundamental changes have to be assumed in the social order at Balatonszárszó, which affected several aspects of the community's life. These changes were not 'superficial', affecting only the visible aspects of technology – in our case vessel forms and decorations – but raw material preferences and probably building techniques as well. While increased variability in raw materials seems to have led to random collections of individual strategies at site level, at household level these changes highlight the importance of the social context (houses) within which the vessels were used. Thus, in order to understand the social nature of variability in ceramic technology, we should also analyse it at a household since this is the context in which the vessels were used. The interesting point is that changes in raw materials and building techniques show at first glance opposite trends, but could in fact be related to the same social dynamics, namely increased interactions between producers. This observation offers potential to explore the different rhythms of change within one learning network, as well as the social dynamics they mirror.

CONCLUSIONS

In this study we analysed the ceramic technology of eight LBK houses and their associated features at Balatonszárszó, Hungary. A particular focus was placed on change and continuity in houses, across the ceramic style groups of the site. It has been shown that ceramic technology at Balatonszárszó was very dynamic through time. During the early LBK occupation only a restricted number of raw materials were used, which were all tempered with chaff. Moreover, some of these fabrics remained in use and were the most characteristic until the end of the site. Three forming methods have been recognized in the early LBK occupation, but no relationship could be identified between forming methods and vessel shapes, suggesting no adaptation of the fashioning gestures to the desired pottery shape. The same method could be used to make several shapes, and two different methods could be implemented to build the same shape. Thus at least three different "ways of doing" were present at the settlement, probably mirroring three distinct learning networks. The three identified forming methods are often simultaneously distributed in the different houses, which suggests strong interactions between different groups of producers.

In the late LBK occupation of the site new raw materials appeared, the most notable change being the appearance of raw materials without chaff tempering. This is a marked difference, revealing a clear break from the oldest ceramic technological tradition in the Hungarian Early and Middle Neolithic. Changes are also indicated by the use of

calcareous raw materials and a clear preference for coarser raw materials, with or without chaff tempering, in the late LBK occupation of the site. Houses of the late LBK period show differences in the technology of their vessels, implying that different households adapted to changes differently and showing different social dynamics.

As regards vessel building techniques, Method 1 and 3, predominant in the earliest houses (Style group 1), remained the most characteristic among the studied samples. The possible disappearance of Method 2 from the settlement could be related to specific social processes, involving an increase in interaction between different groups of producers. Raw material preferences, along with fashioning techniques, are considered to be strong traditions in potting (Gosselain, 2000; Sillar, 2000; Gosselain and Livingstone Smith, 2005). Since changes in raw materials and tempers appeared in the style groups, and changes are identified in stone tools, burial habits and animal husbandry as well, fundamental changes have to be assumed in the social order at Balatonszárszó, affecting several aspects of the community's life. As far as pottery was concerned, these changes not only involved the visible aspects of technology, in this case vessel form and decoration, but raw material preferences and probably building techniques as well. Petrographic results show that conical bowls and globular fine wares were the most susceptible to change, the raw materials of these vessel types changing the most. Furthermore, changes in their raw materials could be detected in all analysed houses. The changes that we found in raw materials of the different vessel types correspond well with changes in vessel forms. The late LBK style groups of Balatonszárszó are characterised by greater vessel form diversity, increased elaboration, and diversity in decoration. The results suggest that the process of increased social differentiation at Balatonszárszó appeared in Style group 2 and Style group 3. The use of assemblages of these two style groups can be linked to the process that led to the establishment of the more extensive late LBK occupation in the southern part of the investigated area (Marton and Oross, 2009, p. 56).

As was highlighted above, fundamental developments occurred at the site which affected the whole community during the late LBK period. These changes have yet to be understood, but the analysis of ceramics at household level is a useful methodological tool for finding out where and how changes occurred within a settlement, thus providing evidence that can in turn be used to assess the nature and scope of social changes.

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Attila Kreiter
Hungarian National Museum
H-1113 Budapest, Daróci út 3
attila.kreiter@gmail.com

Tibor Marton
Hungarian Academy of Sciences, Research Centre for the Humanities, Institute of Archaeology H-1014 Budapest, Úri u. 49
marton.tibor@btk.mta.hu,

Louise Gomart
Maison de l'Archéologie et de l'Ethnologie
UMR 8215 Trajectoires
21, allée de l'Université, 92023
Nanterre Cedex
louise.gomart@cnrs.fr

Krisztián Oross
Hungarian Academy of Sciences, Research Centre for the Humanities, Institute of Archaeology H-1014 Budapest, Úri u. 49
oross.krisztian@btk.mta.hu

Péter Pánczél
Hungarian National Museum
H-1113 Budapest, Daróci út 3
p.panczel@gmail.com