BESIDES VESSELS: INVESTIGATING EARLY NEOLITHIC FIRED CLAY ARTEFACTS FROM HUNGARY

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Abstract: *The preliminary results of an archaeometric study of ceramic samples and fired clay artefacts of the Early Neolithic Körös Culture (Hungary), dating to the beginning of the VIIth millennium BP and representing the earliest farmers of the Carpathian Basin are illustrated. The samples, collected from some of the most important sites of the Körös Valley, comprise both potsherds and non-vessel fired clay artefacts, such as the so-called net weights, loomweights, daub and plaster fragments. The latter were studied with the aim to better characterize the local raw material composition and to compare it to that of pottery production. It is in fact supposed that the raw material for plastering the structures of the settlements was collected from sources located for logistic reasons in the very proximity of the sites. The methods of investigation comprise the petrographic study, combined with geochemical analyses. The results show that in this region both vessels and non-vessel clay artefacts were made with local clayey sediments, with the important difference that for the pottery a carbonate free raw material with higher Al-content was selected.*
Keywords: *Neolithic clay artefacts, Körös Culture, petrography, geochemistry*

INTRODUCTION

The aim of the project was the characterization of the earliest pottery production in the Carpathian Basin, a crucial area for the study of the Neolithisation of continental Europe from which the expansion of the Linear Pottery Culture (LBK) originated. For this research, samples were selected from the most important Early Neolithic (EN) Körös Culture sites of the Great Hungarian Plain (Alföld). The selected sites are distributed along the Körös River Valley (**Fig. 1**), and were excavated at the end of the last century, following a programme of systematic surveys for the preparation of the archaeological map of Békés County, the so-called Microregional Topographical Survey Project (*Jankovich et al. 1989*). The sites examined are all located at a short distance from each other in the territory of the present-day towns of Szarvas and Endrőd (*Jankovich et al. 1989, p. 121, Fig. 3. Endrőd; p. 376, Fig. 8. Szarvas*). They correspond, according to the names given during their mapping, to Endrőd 6 (E6), Endrőd 39 (E39), Endrőd 119 (E119), Szarvas 8 (Sz8), Szarvas 23 (Sz23) and Szarvas 56 (Sz56). Radiocarbon dates show that the sites belong to the beginning of the VIIth millennium UNCAL BP (*Whittle et al. 2002*).

During the research 54 pottery samples representing the different ceramic fabrics (fine-medium-coarse wares), recognized during the archaeological classification, were analysed (*Starnini et al. 2007; Szakmány & Starnini 2007*). Besides vessels, a total of 26 fired clay artefacts and 18 soil samples were analysed (*Starnini & Szakmány 2007*). 14 samples are clay plasters, which can be referred, according to their macroscopic characteristic (colour, texture, shape, fabric), to both wall parts of wattle-and-daub structures (houses or settlement infrastructures) (**Fig. 2a-b**) and floors or horizontal structures (firing structures, platforms, ovens) (**Fig. 2c-d**). The other 12 samples are 'non-vessel' fired, clay artefacts, among which are the so-called net weights (**Fig. 2e**), loom weights (**Fig. 2f**) and one clay tablet or clay 'bread'. All these latter samples were selected with the main aim of investigating the possible existence of different choices in raw material use and manufacture of the fired clay artefacts in comparison to the pottery production, in order to obtain also a comparative data-set, which better reflects the composition of the local raw materials certainly exploited by the Neolithic potters. In fact archaeological, logistic and past and present ethnographic information, suggest that for building purposes (plastering and constructing wattle-and daub structures) the clay was usually extracted in the very proximity of the settlement, or close to the hut structure itself.

The research on the Körös pottery production is part of a wider study on the characterization of EN ceramic

Fig. 1 Location of the studied sites (from Visy (ed.), 2003, fig. at p. 98, modified)

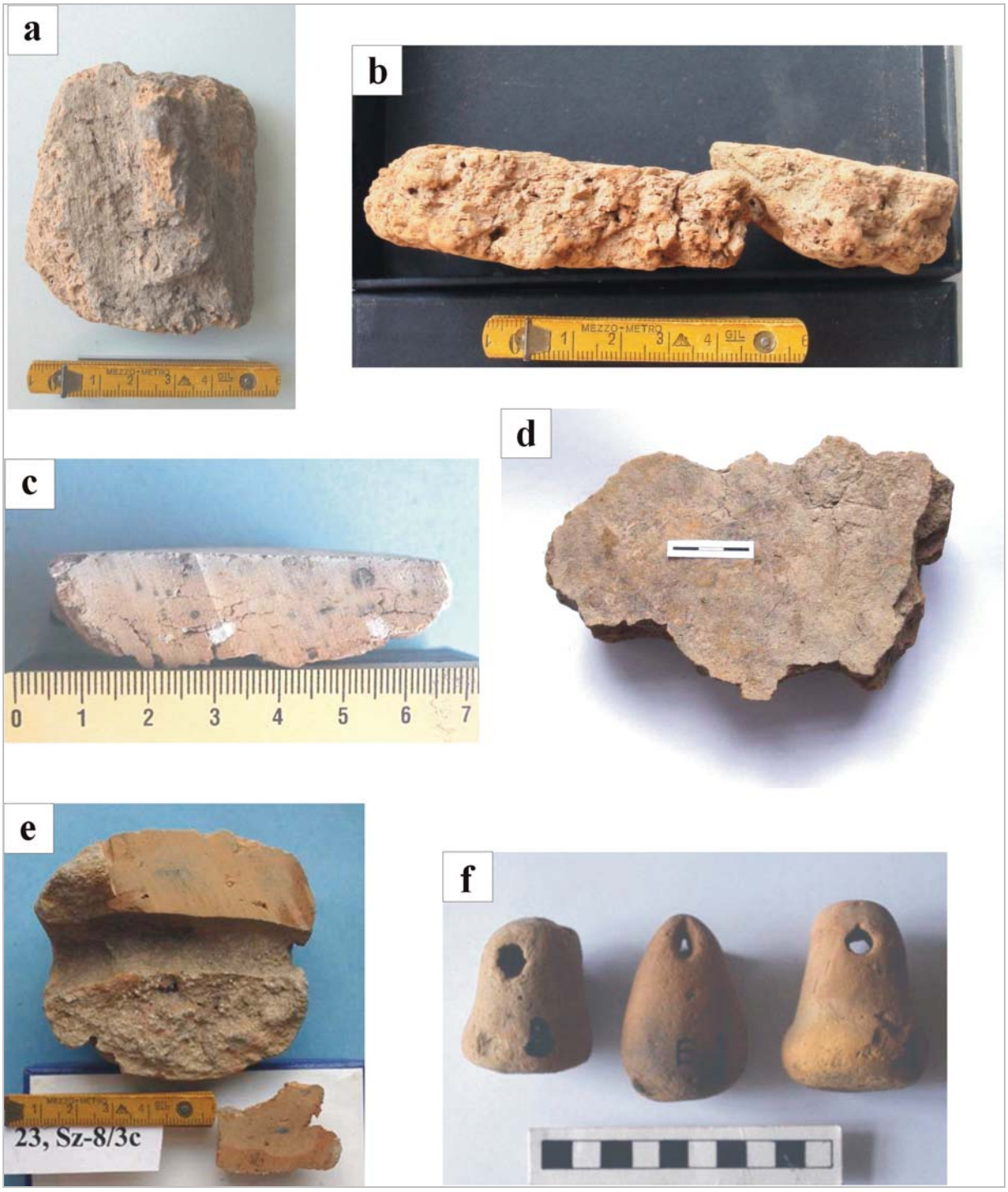

Fig. 2 Non vessel artefacts sampled: a) and b) wall daub rich in chaff temper; c) and d) floor plaster (c) cross section, (d) smoothed surface; e) net weight; f) loom weight

technology in the Carpathian Basin, which includes the study of the parallel aspect in Transdanubia, represented by the Starčevo Culture (*Szakmány et al. 2004; 2006; Gherdán et al. 2004*). In the present paper only the results of analyses of the 'non-vessel' artefacts are summarized.

METHODS

All the selected samples were routinely studied in thin section with a polarizing microscope. A more restricted number of samples, representing the main fabrics of the

artefacts and the different types of soils as potential raw materials, were submitted to chemical analyses (XRF, NAA). XRF was performed at the Department of Geochemistry of the University of Tübingen and NAA analyses at ACME-Analytical Laboratories of Vancouver (Canada). Moreover, representative samples were also analysed by X-ray diffraction (XRD) at the Department of Earth Sciences and Environment of the University of Veszprém (*Szakmány et al. 2005*).

DESCRIPTION OF THE SAMPLES

The plaster/daub samples from the Körös sites can be subdivided into two main categories: the first comprises reddish-brown or brick-red fragments with a light yellowish, flat surface (**Fig. 2c-d**), which most probably corresponds to the used/exposed part (9 samples). The fabric is compact/massive and silty with a thickness up to 5 cm. This type is frequently interpreted as the remains of plastered floors, platforms, house interior infrastructures, ovens or firing installations (*Tasca 1998; Moffa 2005; Carneiro & Mateiciucová 2007*). A second type is represented by porous and lighter daub fragments, with vegetal (straw and chaff) temper easily visible in the shape of imprints and voids in the clay matrix (5 samples). The colour of the paste is homogeneous and reddish-brown or light pinkish brown. In some cases clear imprints of wooden twigs are preserved on one face, which suggest that they originally belonged to wattle-and-daub structures (**Fig. 2a-b**). They have been found during the excavations because they were fired, most probably accidentally, but under similar conditions (T°, atmosphere) to the other clay artefacts. However, because a great part of the clay plaster is well fired, this state might have been achieved intentionally to increase durability of this material during use (*Carneiro & Mateiciucová 2007, p. 272*).

Among the studied samples is also one of the so-called 'clay breads'. These fired clay artefacts, the function of which is still unknown, show an elliptic or sub-rectangular shape with rounded corners, which resembles the form of the so-called enigmatic tablets or *Brotlaibidol* of the Bronze Age (*Sidoli 2003*). They are on average 15 cm long, 7-8 cm wide, and 4 cm thick; their fabric can be compared to that of the medium-coarse wares. They are commonly found in all of the Körös Culture sites studied during the present research. The so-called net weights (9 samples) have been traditionally considered, by archaeologists, as related to fishing activity (*Banner 1932, p. 22; 1937, p. 34; Kutzián 1947, p. 8*). More recently they have been interpreted as possible parts of house roofing systems, with a function as weights for fixing the reeds covering the roofs or as ornaments (*Oross & Whittle 2007, p. 624*). Nevertheless, they are fired clay, perforated objects of different shapes: cylindrical, spherical, discoid or 'tomato'-shaped (*Kutzián 1947, Pl. XLV, 1-16*). They have been found sometimes in settlements in thick concentrations (*Makkay 2007, fig. 68, 2*) or commonly in refuse pits. Their average diameter is about 8 cm and their weight is commonly around 500 gr; however a few specimens are up to 1 kg. They are commonly roughly shaped, fragile objects with a coarse fabric tempered with vegetal matter (**Fig. 2e**).

All these characteristics do not sustain convincingly the hypothesis of their use as net weights because the consistence of their fabrics is not suitable for a frequent/constant use hanging and sunken in the water. However, the absence of systematic spatial and contextual analyses of this type of objects in the excavations does not allow the formulation of a convincing alternative explanation of their function.

Finally, the loom-weights (2 samples) are small, sub-conical, sub-cylindrical or pear-shaped fired clay objects with a suspension shaft-hole at one edge, some 6 cm long, and 4.5 cm thick and weighing slightly above 100 gr. They have been found commonly in the settlements even in concentrations or rows and have been related to textile making activity (*Makkay 2001, figs. 19-20*).

RESULT OF THE OPTICAL MICROSCOPY ANALYSES: PETROGRAPHY

All the non-vessel artefacts have quite a similar non-plastic composition except for the carbonatic component. On the basis of the carbonate content, the samples can be subdivided into two groups: non-carbonatic and carbonatic (**Fig. 3a-f**). In the latter, primary carbonates show great variety: there are micrite, sparitic grains, micritic or sparitic rounded or sub-rounded aggregates, bioclasts (mostly shell fragments). Secondary carbonate may also occur, and in some cases the matrix is strongly carbonatic. Generally, plaster samples are carbonatic (except for Sz23/A32), net weight and daub are partly carbonatic and partly non-carbonatic.

The clasts observed in the non-vessel clay artefacts are almost the same as those occurring in the pottery samples (*Szakmány & Starnini 2007*); they are mainly composed of angular-subangular mono-crystalline quartz. Polycrystalline quartz is rare and occurs only as coarser grain fraction. There are few plagioclase and K-feldspars, moreover different amounts of muscovite, which are generally small flakes, but there are also some coarser grained or aggregate specimens. Muscovite is not oriented, except for the loom weight sample. The amount of altered biotite is significantly less than that of muscovite. Accessory minerals are relatively few: epidote/clinozoisite, garnet, zircon, rutile, tourmaline (green), amphibole (generally brown, rarely green), clinopyroxene, and occasionally kyanite. Opaque minerals are fine-grained. The coarser-grained samples contain few metamorphites, and/or volcanites.

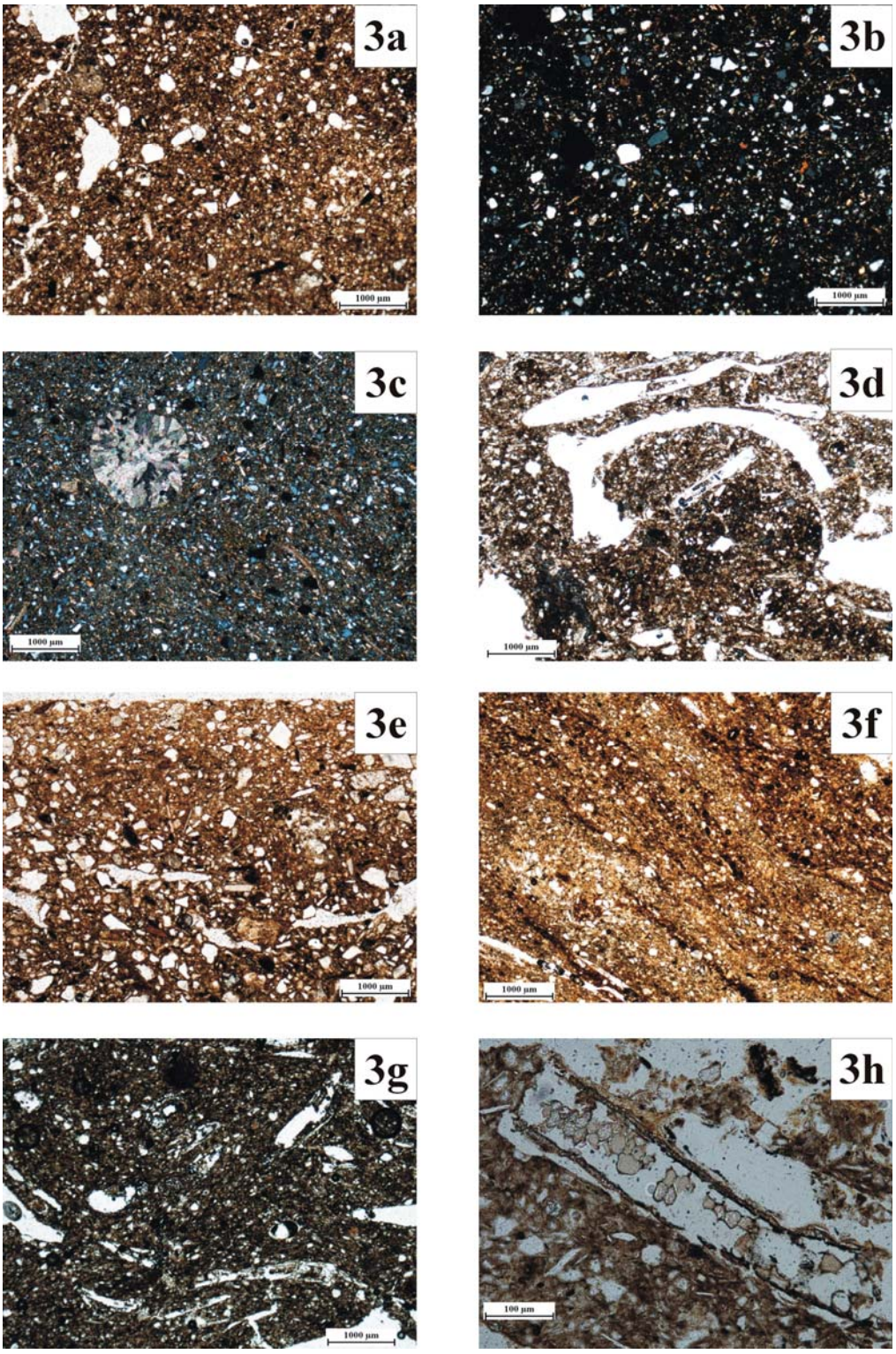

Fig. 3 Sample micrographs of net weights and plasters of the Körös Culture: a) and b) net weight from Endrőd 39 without carbonate content (sample E39/4; 1N and XN); c) net weight from Endrőd 119 with primary carbonate (sparitic grains, nodule and shell fragment) content (sample E119/P4; XN); d) wall fragment from Endrőd 39 with many large voids left by vegetal temper (sample E39/PL2; 1N); e) floor plaster sample from Szarvas 23 with massive texture and slightly visible stratification, parallel to the surface (upper part) (sample Sz23/A32; 1N); f) loom weight from Endrőd 119 with oriented structure (sample E119/P5; 1N); g) wall fragment from Szarvas 23 with phytoliths of cereals inside the voids (sample Sz23/PL11; 1N); h) net weight from Szarvas 8 with well visible phytoliths in anatomical order (sample Sz8/3a; 1N)

Rarely a few radiolarian and some limonitic clay nodules have been observed. The daub, some net weights and the loom weight contain different amounts of phytoliths. Also noted is the presence, observed in thin section, of several phytoliths (*Rovner 1983; Piperno 1987*) still in anatomical order, which are the remnants of the vegetal temper intentionally added during manufacture and are oriented in respect to the surface of the artefact (**Fig. 3g-h**). The best preserved specimens and also the most numerous are found in the daub samples, while they were few to absent in the plaster samples. When the paste is not uniformly fired, somewhat carbonized remnants of the vegetal temper are easily visible.

The prevailing grain sizes of clasts are generally between 15 and 80 μm, the coarser-grained types measure up to 200-250 μm, the maximum grain size is 300 μm. The daub samples are predominantly fine-grained (maximum 120 μm). The non-plastic inclusions have serial distribution. The sorting is variable, from weakly to well-sorted. The amount of non-plastic inclusion is highly variable (8-60%, but the range of the clasts of the daub is quite narrow, i.e. 12-20%).

The raw material is very similar to the local Pleistocene and Holocene silty-clay alluvial sediments and of carbonatic type (*Szakmány & Starnini 2007*).

Most probably it was collected from a pedological horizon enriched in carbonates. The quantity and size of the pores are variable in the different types of the clay artefacts. The less porous (1-8%, generally 1-4%) are the floor samples (**Fig. 3e**), but also the paste of the loom weight has only few pores (**Fig. 3f**). The highest porosity (generally >15%, but often reaching the 25%) was observed in the daub samples (**Fig. 3d**). The net weight, the loom weight and the clay tablet have 'medium' amounts of voids, generally 8-12% (maximum 15%).

Finally, we would like to emphasize that daub samples have both the highest porosity and the highest occurrence of phytoliths; the clast components are the same occurring in the other non-vessel clay artefacts, but they are finer-grained.

To conclude, among the non-vessel clay artefacts, the daub is the category which shows a more careful selection of the raw material and preparation of the paste.

RESULTS OF THE GEOCHEMICAL ANALYSES

The scope of the chemical analyses was, 1) to compare the different categories of artefacts to see possible similarities/differences in the use of raw materials and, 2) to compare them with the characteristics of the raw materials available in the area, to understand if there was any raw material manipulation during the manufacture.

The comparison of the chemical composition was conducted on the basis of major and trace elements in bivariant and ternary diagrams. From the comparative evaluation of the results it is possible to conclude that the chemical composition of the different raw materials sampled in the Körös Valley is very similar. The main characteristic trend in the use of the raw materials, comparing ceramics versus non-vessel artefacts, is a generally higher Al_2O_3 value, combined with lower CaO content for the pottery samples (**Fig. 4**). This pattern is in accordance with the observations made in thin section of the plaster and net-weight samples, which are particularly rich in carbonates. Plaster generally contains higher percentage of CaO if compared with soil values, whilst soil Al_2O_3 content is similar to that of ceramics.

Regarding the trace elements, we note a general similarity except in the more mobile elements (Rb, Sr, Ba). In particular soil, plaster and net weights have a very similar immobile trace element distribution, whilst ceramic samples show values slightly higher, probably due to their higher clay content.

Generally the major element diagrams show that non-vessel clay artefacts have a wider chemical distribution than the pottery samples, the latter concentrate in a small area on the diagrams.

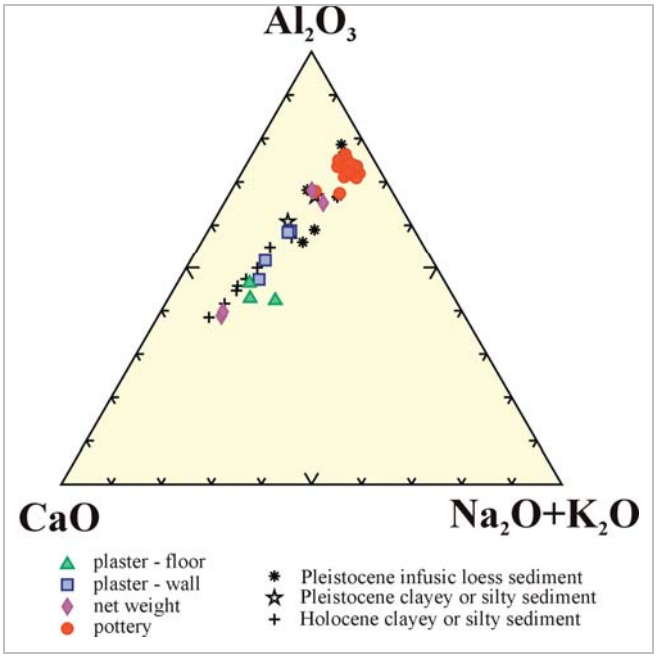

Fig. 4 Chemical composition of pottery, plasters, net weights and local clayish sediment. CaO-Al_2O_3-Na_2O+K_2O ternary diagram shows that the pottery was manufactured with carbonate-free raw material, whilst for plaster and net weights both carbonatic and non-carbonatic raw material was utilized. Remarks: the composition of the plaster and net weights is very similar to the local clayey sediments.

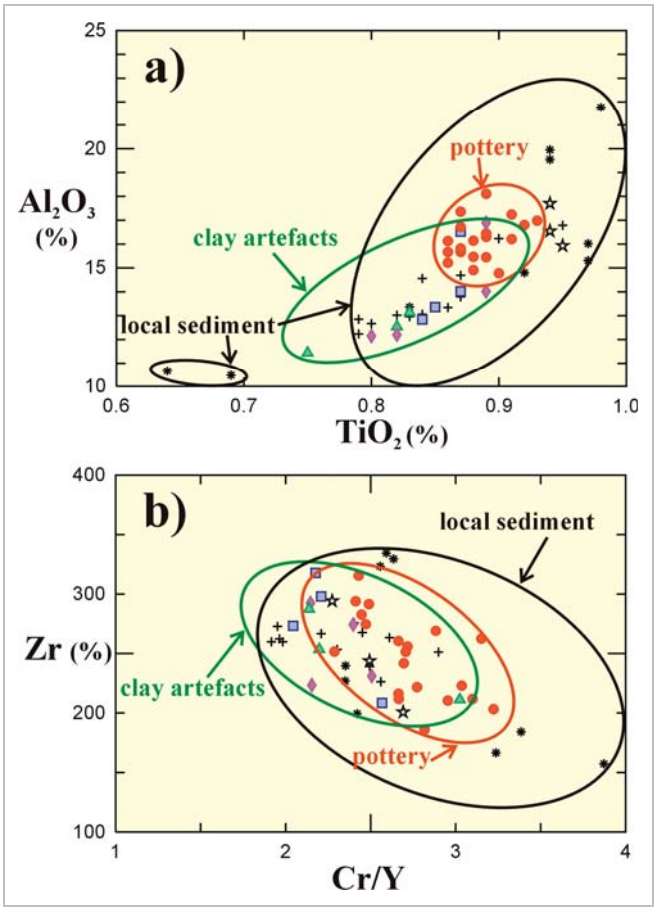

Fig. 5 Chemical composition of pottery, plasters, net weights and local clayish sediment. a) Al_2O_3 versus TiO_2 and b) Zr versus Cr/Y bivariant diagrams. Legend is the same as Fig. 4, see more details in the text.

Clay artefacts have a good overlap with all types of the local clayey sediments, which means that different types of sediments were used for the clay artefacts (**Figs. 4** and **5a**). The trace elements distribution shows that both vessel and non-vessel artefacts are closely similar, due to their similar content of accessories (which influences, first of all, the distribution of the immobile trace elements) (**Fig. 5b**).

DISCUSSION AND CONCLUSIONS

The results of the analyses of the non-vessel artefacts indicate that the composition of their raw materials is very similar. The comparison of the analytical results with those of the soils samples, conducted both on a minero-petrographic and chemical base, suggests the use of local raw materials. The minimal variability is in fact in accordance with the different types of subsoil of the alluvial deposits of the Körös River basin, where Pleistocene infusic loess and clayey deposits alternate with more recent Holocene alluvial sediments.

The raw material was employed without any particular manipulation (i.e. levigation, admixture, additions, etc.) except for the use of vegetal temper in variable amounts; the main difference was observed for the floor-type plaster, which is more compact and does not contain vegetal temper. On the contrary, the daub samples have the most porous structure and the highest amount of vegetal temper. The presence of characteristic imprints visible both to the naked eye and under the microscope, and of typical phytoliths observed in thin section, indicate that the vegetal temper was mainly composed of chaff, i.e. wastes from threshing activity, probably performed within the settlement (*Harvey & Fuller 2005*).

No correlation seems to exist between typology and presence/absence of vegetal temper in the net weights. On the contrary, the variability observed within the plasters and daub does correlate probably with a different function: more massive and compact plasters with no or minimal vegetal content are attributable to the plastering of floors, platforms, firing structures and other functional, domestic infrastructures, whilst lighter, porous daubs, rich in chaff content and sometimes with imprints of twigs on one side, can be interpreted as plastering of house elevations and walls. Similar conclusions were recently achieved for the contemporary site of Ecsegfalva in the Great Hungarian Plain (*Macphail 2007*).

Comparing vessels and non-vessel artefacts, the following observations can be made on the basis of the analysed samples:

- raw materials rich in carbonates were not used for pottery production; secondary carbonates, due to post-depositional processes are sometimes observed.

- the minor/major quantity of vegetal (chaff) temper, intentionally added in the pottery production varies according to the ware category, i.e. fine ware has a lower chaff content in comparison to coarse ware.

- phytoliths were observed in thin sections more frequently in samples from net weights, probably because of the different firing condition due to their thickness.

The maximum firing temperature of the non-ceramic artefacts (net weights and clay artefacts) was estimated from different sources of information, among which is the good state of preservation of the carbonates in the carbonatic-type fabrics, from which we can infer that the firing temperature was undoubtedly lower than 750°-800°C.

Finally, the characteristics of the pastes of the net weights contradict the functional hypothesis proposed by some archaeologists in the past, that they served as fishing implements to weigh down nets or traps. Their fabric is in fact not strong enough to sustain a constant use and dropping them into water. Moreover, their high porosity, due to the vegetal temper, makes these objects relatively light, and consequently not appropriated for use as

weights in the water. We observe that in several prehistoric fishing contexts, the net weights are well documented artefacts, but they are always obtained from notched pebbles (*Cleyet-Merle 1990, pp. 145-147*). However, at present we cannot explain convincingly the function of these clay artefacts within the Körös settlements.

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