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HOUSEHOLD AND BURIAL CERAMICS FROM THE EARLY IRON AGE FROM SW SLOVAKIA: A MINERALOGICAL AND PETROGRAPHICAL STUDY

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ABSTRACT. This study presents results of the mineralogical and petrographical analysis of Kalenderberg household and burial ceramics from three important localities in Slovakia. The questions of raw material provenance, forming techniques of the vessels and firing conditions were inferred from the mineralogical and petrographic characteristics of analysed sherds. The household pottery from Dunajská Lužná – Nové Košariská and Dolné Janíky was made from alluvial sediments of the Danube River and was fired at 700-800°C, occasionally 900°C for secondary over-fired ceramics from burned dwellings. The pottery from Castle Devín was made either from clayey sediments of Studienske formations (group DH1) or alluvial sediments (group DH2). The firing temperature reached 600-700°C for group DH1 and 700-800°C for group DH2. All analysed pottery was made by modelling techniques, especially by drawing or pinching technique.

Key words: Kalenderberg culture, burial ceramics, household ceramics, mineralogical and petrographical composition, raw material provenance, modelling technique, firing temperature

Introduction

The first information on technological aspects of the Kalenderberg ceramics from SW Slovakia was brought by Chocholoušek and Neruda (1966). The questions of firing temperature, raw material provenance and forming techniques were considered in their study. However, their interest was focused only on the burial pottery coming from burial mounds near Dunajská Lužná – Nové Košariská. The household pottery was not studied. Raw material provenance was determined using spectral analysis and the firing temperature was inferred from experimentally fired clay samples. Opposite to these methods, this study presents data acquired by using standard analytical methods in mineralogical and petrographical research. This study brings also the first information on provenance of raw materials, modelling methods and firing conditions of Kalenderberg pottery.

Archaeological background

The Early Iron Age – Hallstatt culture lasted from 750 to 450 BC (HaC1-HaD3). This period was named after its eponymous site Hallstatt, an important archaeological locality in Salzkammergut near Salzburg in Upper Austria. The northern part of Austria together with the NW part of the Transdanubian area in Hungary and the SW part of Slovakia belongs to the cultural-social group called Kalenderberg culture, which is part of the NE Halstattian cultural complex. The Kalenderberg culture falls within the 750-600/550 BC (HaC1-HaD1) period. Two kinds of settlements are typical for the Kalenderberg culture in Slovakia. The first one includes fortified hill-forts in the Malé Karpaty Mountains as Smolenice-Molpír (Dušek, Dušek, 1984), Devín (Plachá, Furmánek, 1975) and Bratislava castle hilltop (Studeníková, 1993). The second type includes settlements situated on the lowland of SW Slovakia. These settlements have agricultural characters as in Chorvátsky Grob – Triblavina (Studeníková, 1981), Dolné Janíky (Čambal, 2006), Dunajská Lužná – Nové Košariská (Čambal, 2007), Bratislava City (Hoššo, 1992) or Pusté Úľany (König, 2003).

The most common archaeological finds at the Kalenderberg culture settlements are the sherds of household pottery. Various types of amphora like vessels, pots, bowls or cups are typical in the ceramic inventory (Fig. 1). Specific are the fragments of the so called moon idols.

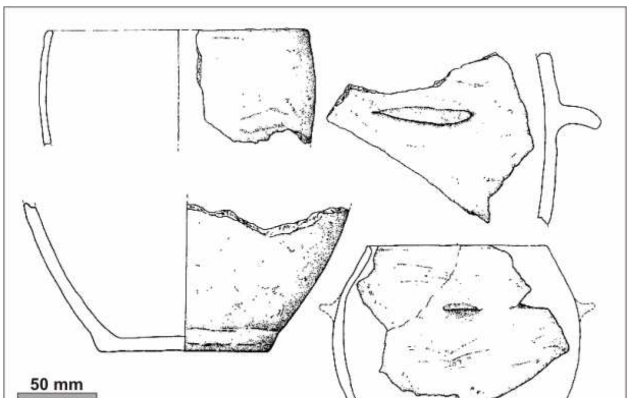

Fig. 1. Selection of Kalenderberg household ceramics from Pusté Úlany (König, 2003)

Beside the household ceramics also burial pottery is characteristic for Kalenderberg culture (Fig. 2). Untouched vessels were found at burial-mounds near Dunajská Lužná – Nové Košariská (Pichlerová, 1969), Chorvátsky Grob – Triblavina, Most pri Bratislave (Studeníková, 1986) or in Pusté Úľany (Studeníková, 1981) and Biely Kostol (Urmínsky 2001). Red and black paintings with geometric motifs are typical for the burial pottery.

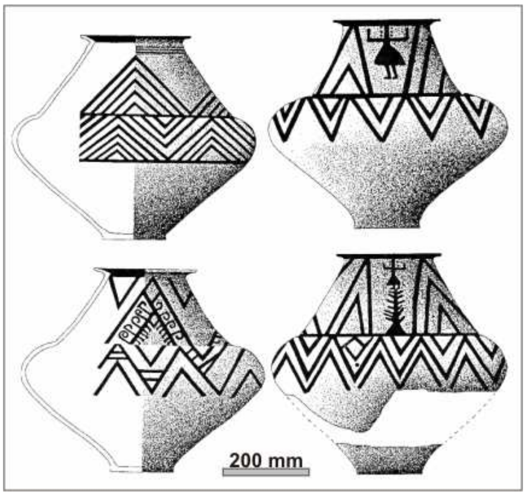

Fig. 2. Selection of burial ceramics with typical red and black paintings. According to Studeníková

Analytical methods

Thirty-five samples of household pottery (Dunajská Lužná – Nové Košariská, Dolné Janíky and Devín) and two samples of burial pottery (Dolné Janíky) were chosen for the study. The collection includes the most representative ceramic types. From each sherd, two slides were cut across and parallel to the wall, in order to prepare thin sections for the mineralogical and petrographic observations in polarized light. Optical microscopy (OM) was performed at Olympus BX51. The granulometric characterisation of the sherds was obtained by planimetric measurements in thin sections using Eltinor IV counting device with 1000 points per sample. One gram from each fragment was milled in agate mortar and measured with X-ray powder diffraction (PXRD) at room temperature using a Dron-3 diffractometer (Geological Institute, Faculty of Natural Sciences, Comenius University) operating at 40 kV and 15 mA using Co Kα radiation at scan speed of 0.02° 2Θ in the range of 4-74° 2Θ. The analysis focused on mineralogical and petrographic study of thermally altered clay matrix, non-plastic inclusions and granulometric composition of sherds, in order to estimate the ceramic fines, to infer the firing conditions and styles of making the vessels and to solve the question of raw material provenance.

Results

Macroscopic observations and granulometry

Macroscopically, the samples of household pottery from all mentioned archaeological localities (Dunajská Lužná – Nové Košariská and Dolné Janíky) show different colour of ceramic body and they were divided in thick-walled (A) and thin-walled ceramics (B). From Devín only the thick-walled sherds were studied. The surface of selected sherds was either polished or was rough without any further surface treatment. Small irregular knobs were observed on the inner parts of the same sherds. The analysed burial ceramics from the burial mound in Dolné Janíky were grey in colour. The surface was polished and covered with black geometric paintings. According to modified Wentworth`s granulometric classification diagram (Fig. 3) (Ionescu, Ghergari, 2002) all samples (also thick-walled and thin-walled) belong to coarse ware, occasionally they belong to semi-fine ware.

Mineralogical and petrographical composition

Dunajská Lužná – Nové Košariská

Although the samples from Dunajská Lužná – Nové Košariská (DL/NK) were divided to thick walled (DL/NK$_A$) and thin-walled ware (DL/NK$_B$), the mineralogical and petrographical composition is similar. The non-plastic inclusions are often well rounded. Quartz, feldspars (potassium feldspars and plagioclases) and micas (muscovite and biotite) are common non-plastic inclusions. The most typical inclusions in case of analysed sherds are lithoclasts of radiolarites (Fig. 4), granites (e.g. Fig. 5), and sandstones. Occasionally also crystaloclasts of well rounded amphibole and pedogenic nodules were identified.

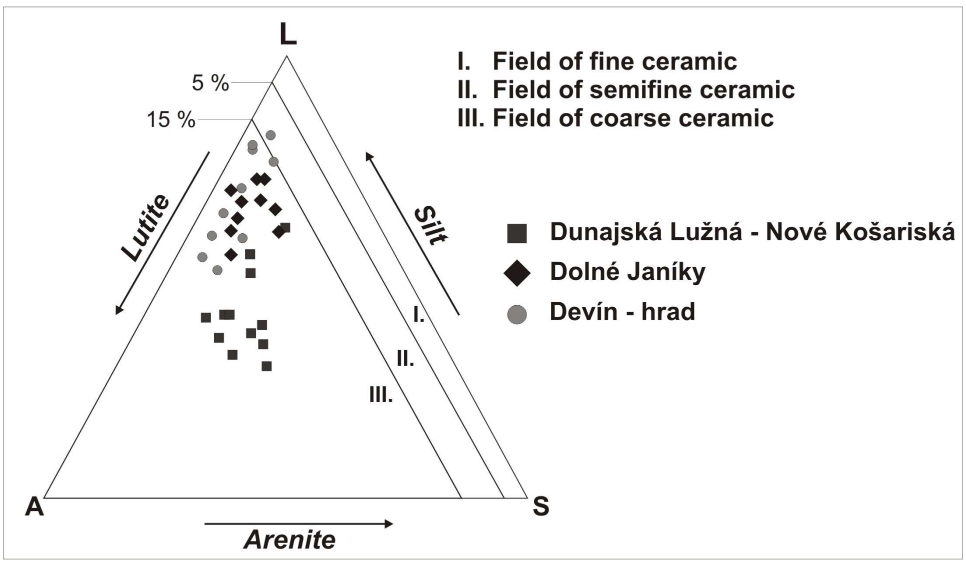

Fig. 3. Modified Wentworth`s granulometric classification diagram (Ionescu, Ghergari, 2002): A – arenite, S – silt, L – lutite

The matrix is anisotropic and microcrystalline in all analysed samples. Isotropic matrix was observed only in sherds coming from burned dwellings. Fabric was chaotic and the distribution of the non-plastic inclusions was bimodal in both groups. Voids of prolonged shape were randomly distributed in the ceramic body. They were created either during the modelling process or they were created during the drying of the vessels by shrinking of the clay paste. Contraction voids around quartz crystaloclasts were observed as well.

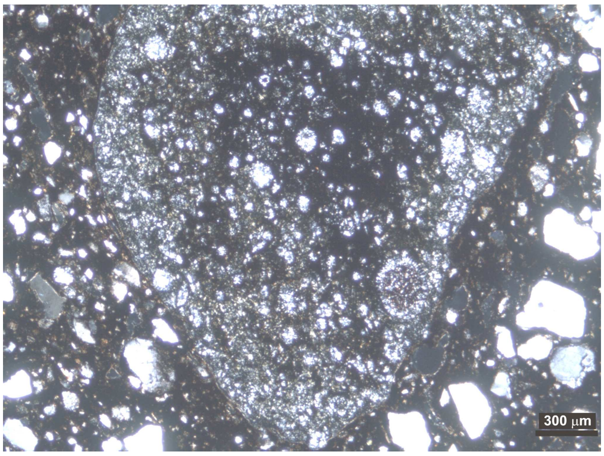

Fig. 4. The radiolarite lithoclasts in the household ceramics from Dunajská Lužná – Nové Košariská; bimodal distribution of the non-plastic inclusion and well rounded shape of the grain (crossed polars)

X-ray analysis obtained from powdered samples showed the presence of thermally unchanged minerals as quartz and feldspars. The diminishing of 0.1 and 0.45 nm diffraction lines of illite was observed in all selected samples. This was due to the partial collapse of crystalline structure of clay minerals, mostly illite during the firing (Maggetti, 1982; Herz, Garisson, 1998). Absence of illite diffraction peaks were observed in ceramics samples coming from burned dwellings.

Dolné Janíky

The analysed sherds of household pottery (thick-walled and thin-walled) from Dolné Janíky show similar composition as in the case of Dunajská Lužná – Nové Košariská. Granite (Fig. 5), sandstone and radiolarite lithoclasts and amphibole crystaloclasts are characteristic non-plastic inclusions. The analysed samples show either anisotropic and microcrystalline matrix or isotropic matrix. Occasionally, secondary calcite was observed in cracks and voids. Identified voids of prolonged shape and contraction voids around quartz crystaloclasts were randomly distributed in the ceramic body.

The mineralogical composition of burial pottery was inferred only from PXRD analysis as the sherds were easy to crumble and it was not possible to prepare an ordinary thin section. According to the PXRD analysis, the sherds of burial pottery consist of thermally unchanged minerals as quartz, feldspars (booth potassium feldspars and plagioclase), illite/muscovite and smectite. The PXRD analyses of household ceramics are similar to the previous samples from Dunajská Lužná – Nové Košariská. The samples consist of thermally unchanged minerals as quartz and feldspars. The diminishing of 0.1 and 0.45 nm diffraction lines of illite was also observed in these samples.

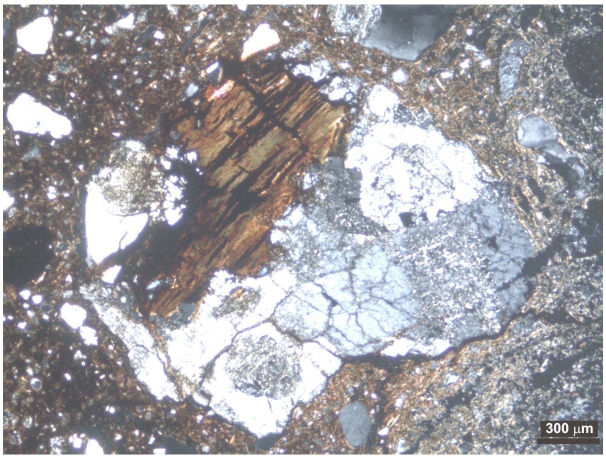

Fig. 5. Presence of anisotropic matrix and granitic lithoclast in household ceramics from Dolné Janíky. The chaotic matrix is also well observable (crossed polars)

Devín castle

The samples from Devín castle (DH) were divided in two groups DH1 and DH2 according to the petrographic composition of non-plastic inclusions. The group DH1 includes sherds with presence of calcite crystaloclasts and fragments of microfossils as bryozoa, lithotamnia and foraminifera (Fig. 6). All crystaloclasts and fossils consist of thermally untouched micritic and occasionally sparitic calcite. The subgroup DH2 includes sherds with presence of microcline crystaloclasts and granitic (to mica granites) lithoclasts (Fig. 7). Also the presence of pedogenic nodules is typical for the second group.

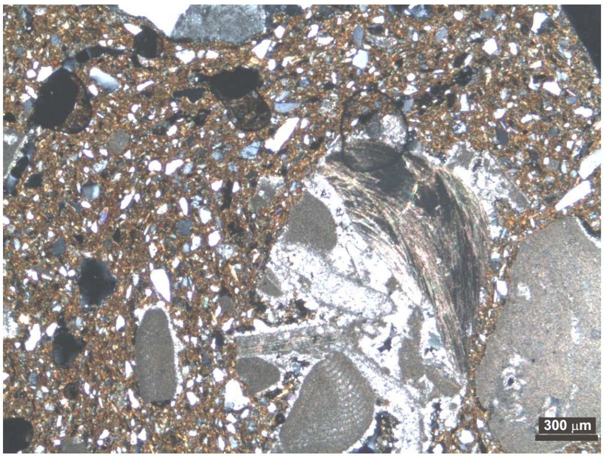

Fig. 6. Bimodal distribution of the temper in household ceramics from DH1 group. The anisotropic matrix without any sintering process and fragments of fossils and thermally untouched calcite is well observable (crossed polars)

All samples shows anisotropic and microcrystalline matrix typical for illitic clays (Ionescu et al., 2007), occasionally the near isotropic matrix was observed in samples from group DH2. The fabric is chaotic and the distribution of non-plastic inclusions is bimodal in all samples.

The X-ray analysis obtained from powdered samples of group DH1 showed the presence of thermally unchanged minerals as quartz, feldspars and calcite. The diminishing of illite diffraction lines was not observed. The sherds of group DH2 consist of thermally unchanged quartz and feldspars. The diminishing is of illite diffraction lines were observed in all samples from the group DH2.

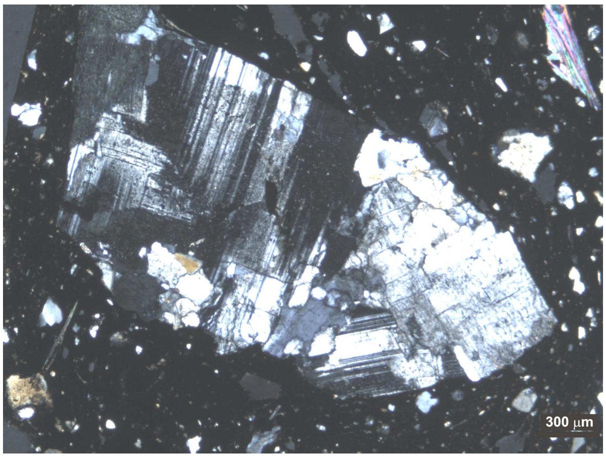

Fig. 7. Presence of granitic lithoclast in DH2 group; the isotropic matrix is well observable (crossed polars)

Discussion

Raw materials provenance and preparation

The raw material provenance was inferred from the mineralogical and petrographical composition of the matrix and non-plastic inclusions. By comparing these results with the geological situation in the surrounding of archaeological site, it was possible to determine the possible origin of raw material used to make the pottery. The bimodal distribution of the non-plastic inclusions is characteristic for all analyzed samples. The bimodal distribution reflects the purposeful adding of the non-plastic inclusions into the clay paste to enhance its workability and plasticity.

Dunajská Lužná – Nové Košariská and Dolné Janíky

Both archaeological sites are situated near the Danube River and according to the previous geological studies (Vaškoský, Halouzka, 1975) the surroundings of both sites are created by fluvial sediments of the Danube River (Pleistocene – Holocene). The fluvial sediments consist of gravels and clays. Clayey and sand-loamy flood sediments also occur very often. Fluvial soils were formed on the top of the flood sediments.

The presence of well rounded non-plastic inclusions and their specific composition (amphibole crystaloclasts, granitic, sandstone and radiolarite lithoclasts) refer to use of fluvial sediments of the Danube River for production of the pottery. Purposefully added non-plastic inclusions of arenite size were extracted from sandy sediments, whereas the clay paste was extracted from clayey sediments. Pedogenic nodules identified in some thin sections could possibly reflect the use of fluvial soil as raw material for pottery production.

Devín

The geological surrounding of this site shows great diversity. Phyllites (Lower Palaeozoic), quartzitic arenites (Lower Triassic) and various types of limestone or dolomites (Middle Triassic) outcrop directly near Castle Devín. Further Badenian marine sediments (calcareous sandstones, lithotamnia limestones, sands) outcrop in the nearest surrounding of mentioned site. The clays and clayey sediments are part of Studienske formations (Lower Badenian). Quaternary deluvial and fluvial sediments of the rivers Danube and Morava occur in the nearest surrounding of the site.

Ceramics from DH1 group were made from clayey sediments of Studienske formation as various fossils (bryozoa, lithotamnia, foraminifera) characteristic for this formation were identified in thin sections. Presence of microcline crystaloclasts and granitic lithoclasts in mineralogical and petrographical composition of DH2 group reflects the use of probable quaternary alluvial deposits of the rivers Morava and Danube.

Forming techniques

Macroscopically all samples have either polished or rough surface with small knobs observed on the inner part of the vessels. Also, the chaotic fabric was identified in all analysed samples. Therefore all the vessels were made by modelling techniques. Especially pinching and drawing technique were used for making the ceramics. The chaotic fabric also suggests the use of paddle and anvil technique, but no beating facets were macroscopically observed on the surface of the selected sherds.

Firing conditions

The optical and X-ray analysis allowed the identification of thermal processes which affected mainly the clayish matrix. The Obtained data was compared with various reference data (Shepard, 1976; Maggeti, 1982; Duminico et al., 1998; Herz, Garisson, 1998; Velde, Druc, 1999; Maritan et al., 2006). By comparing the observations with the reference data, the firing temperature could be inferred.

The presence of anisotropic to near isotropic matrix and observed diminishing of illite diffractions peaks in the case of household pottery from Dunajská Lužná – Nové Košariská, Dolné Janíky and ceramic group DH2 from Devín suggest firing temperature from 700-800°C. Temperature over 900°C was inferred from the isotropic matrix and strong sintering process in the case of household pottery coming from burned dwellings. The presence of thermally untouched calcite and anisotropic matrix with low sintering process suggest temperature from 600-700°C for pottery from group DH1 (Devín Castle). Also the diminishing of illite diffraction peaks was not observed. The firing temperature of burial ceramics from Dolné Janíky was inferred based on the PXRD analysis only. The presence of smectite (Fig. 8) reflects temperature not higher than 300°C.

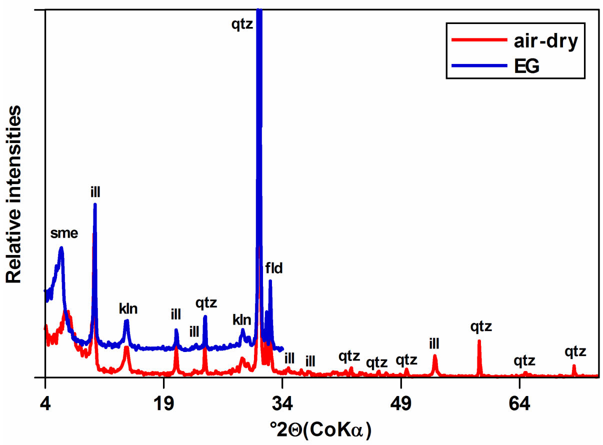

Fig. 7. PXRD analysis of burial ceramics from Dolné Janíky; the presence of smectite reflects low firing temperature not exceeding 300°C

Conclusion

The obtained data from mineralogical and petrographical research is in good correlation with already published data on Kalenderberg burial ceramics (Chocholoušek, Neruda, 1966). Firing temperature inferred from mineralogical composition correspond with firing temperature estimated by experimental firing of selected clays. Data from spectral analysis of clay samples is in good correlation with mineralogical and petrographical composition of pottery, especially non-plastic inclusions. Also, the mineralogical and petrographical study has brought new information about the household pottery. As far as there is a lack of information on Kalenderberg household ceramics in the literature, these investigations bring not only the first information concerning the firing temperature, raw material provenance and modelling techniques, but also new ideas in the way of interpretation of such pottery.

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