# LATE SARMATIAN POTTERY WORKSHOP IN NAGYMÁGOCS–PAPTANYA

## KÉSŐ SZARMATA FAZEKASMŰHELY NAGYMÁGOCS–PAPTANYÁN•

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### Abstract

*In this study, we present the results of the first scientific analysis of the micaceous-pebbly ceramic material uncovered from the late Sarmatian settlement in Nagymágocs–Paptanya, Hungary. It is noteworthy that 810 micaceous-pebbly ceramic fragments were found in the settlement. In this respect the settlement has outstanding importance among the late Sarmatian sites of the Southern Great Plain. Evidenced by the excavated pottery workshop, the associated pottery kiln, the clay-extracting pits and the ceramic slags and clay pieces found in the objects, there were Sarmatian age pottery activities at Nagymágocs–Paptanya. However, it was debatable, whether the micaceous-pebbly ceramics were produced locally or the finished products were transported to the settlement. The origin of the temper used in the ceramics also raises questions, as the micaceous rock type found in the ceramics is not accessible in the immediate geological environment of the site. 15 sherds were selected for examination both by the conventional typological methods and petrographic microscopic analysis. The ceramic analyses were also supplemented by the petrographic analysis of a gneiss fragment, which was found in the side wall of the pottery workshop. Based on our results, the vessels proved to be the products of the same manufacturing tradition which applied freshly crushed micaceous gneiss tempering (providing both the denominating mica and pebble grains of ceramics). In one case, additional grog tempering was also detected. Exact petrographic relations could not be drawn of the gneiss temper in ceramics and the gneiss fragment found at the workshop. Homogeneity of the micaceous-pebbly pottery at Nagymágocs and the ideal conditions of pottery production at the settlement can indicate that this ceramic type was made locally and the tempering material was transported to the settlement.*

### Kivonat

*A tanulmány témája Nagymágocs–Paptanya késő szarmata település kavicsos-csillámos kerámiaanyagának első természettudományos vizsgálata. A település kiemelkedő fontosságú a dél-alföldi késő szarmata kori lelőhelyek között a 810 db kavicsos-csillámos kerámiatöredéknek köszönhetően. A nagymágocsi telepen biztosan készítettek kerámiát, ezt igazolta a feltárt fazekasműhely, a hozzátartozó edényégető kemence, az agyagnyerő gödrök és az objektumokban talált kerámiasalakok és agyagcsomók. Kérdéses volt azonban, hogy a kavicsos-csillámos edényeket helyben készítették-e vagy importálták a telepre, mivel a kerámiákban található csillámtartalmú kőzet a lelőhely közvetlen földtani környezetében nem fordul elő. A leletanyagból kiválasztott 15 kerámiatöredéket a hagyományos régészeti tipológiai módszerek mellett petrográfiai mikroszkópos vizsgálatokkal elemeztük a telepen feltárt fazekasműhely oldalfalában kialakított fülkéből származó csillámos kőzettörmelékkel együtt. Vizsgálataink azt mutatják, hogy a vizsgált kavicsos-csillámos kerámiák azonos műhelyhagyomány termékei, amelyek készítéséhez (a névadó csillám és kavics közös forrásaként) tört gneisz kőzettörmeléket használtak. Egy esetben ehhez még tört kerámiát is adtak. A kerámiákban előforduló gneisz nem azonosítható a fazekasműhelyből előkerült gneisz kőzetdarabbal. A csillámos-kavicsos kerámia anyagbeli egységessége, illetve a lelőhelynek a fazekas tevékenységhez kiváló adottságai alapján feltehető, hogy ez a kerámiatípus helyben készült Nagymágocson és a soványító anyagot szállították a helyszínre.*

KEYWORDS: CERAMIC PETROGRAPHY, MICACEOUS-PEBBLY CERAMIC, LATE SARMATIAN POTTERY WORKSHOP

KULCSSZAVAK: KERÁMIA PETROGRÁFIA, CSILLÁMOS-KAVICSOS KERÁMIA, KÉSŐ SZARMATA FAZEKASMŰHELY

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## *Introduction*

Slow wheel-turned micaceous-pebbly ceramic appeared at the turn of 4th and 5th centuries as a new ceramic type of the late Sarmatian settlements in the Carpathian Basin. This type of ceramics was mainly prevalent in the Southern Great Plain (i.e. the southern region of the Great Hungarian Plain and the northern areas of Bačka and Banat) (Walter et al. 2018, 156, Fig. 11). Cooking pots and clay cauldrons were the most common forms made from this type of ceramic material. During their production, two or three types of tempering material have been added to the clay (Walter 2022, 33). The name of the type also refers to this phenomenon, because these pots are tempered with „mica and gravel", as well as with sand, grog (crushed ceramic) and rarely crushed, over-fired ceramic fragments (Walter et al. 2018, 137). The pots were made using the coiling technique. The walls of the pots were assembled from clay loops and then smoothed on a slow wheel (Walter 2022, 32). The slow wheel-turned vessels are often decorated. The decoration is mostly composed of comb impressed wavy or straight lines, or their combination. The decorations cover only the upper third of the pots. These vessels have a dating value, as archaeologists conventionally connect this type of pottery to the late Sarmatian era. In addition, due to their characteristic material, the fragments can be clearly and easily identified in the assemblages of settlements. The importance of the topic is increased by the fact that the main tempering material of the pots, the glittering rock, is foreign to the central areas of the Great Plain (Walter 2022, 31).

25% of the ceramic assemblage at the late Sarmatian settlement in Nagymágocs–Paptanya is slow wheel-turned micaceous-pebbly ceramic. This proportion is outstanding among the late Sarmatian settlements of the Southern Great Plain. The settlement in Nagymágocs had a total of 810 ceramic fragments tempered with a micaceous-pebbly material, this number means 465 vessels. The complete micaceous-pebbly ceramic assemblage of the settlement has already been published (Walter 2022). Most of the fragments are cooking pots and clay cauldrons, as well as lids, bowls and a colander/ember's cover (Walter 2022, 33–36). At first sight, the tempering materials are varied since mica, gravel, sand and grog were used.

The present study is the first petrographic investigation of micaceous-pebbly ceramics at the late Sarmatian Nagymágocs–Paptanya settlement. Our primary goal was to supplement the research of micaceous-pebbly ceramics with additional scientific data. In the following, we determine the mineralogical composition of the ceramics using petrographic microscopy. Then, we compare the ceramics to the mica-rich rock fragment found in the wall of the pottery workshop.

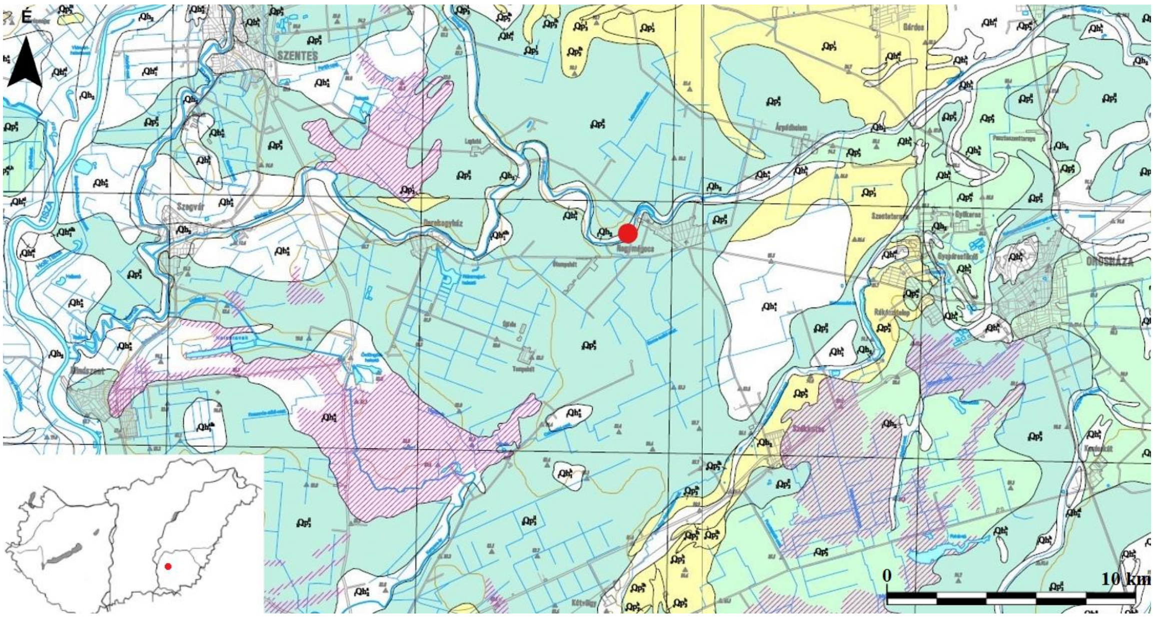


**Fig. 1.:** Location of Nagymágocs–Paptanya and its geological environment

Color key: white – young clay; light green – older clay; dark green –infusion loess; yellow – loess, sand; purple hatched areas – saline area.10x10 km, north-south and east-west grid (source of the map: Gyalog 2005).

**1. ábra:** Nagymágocs–Paptanya elhelyezkedése és földtani környezete

Színkulcs: fehér – fiatal agyag; világoszöld – idősebb agyag; sötétzöld – infúziós lösz; sárga – lösz, homok; lila sraffozott területek – szikesek. 10x10 km-es, É-D-i és K-Ny-i négyzethálózat (Gyalog 2005).

## *Excavations and the landscape*

The Nagymágocs–Paptanya Late Sarmatian settlement is located in Csongrád – Csanád County, (SE Great Plain), in the saline-swamp steppe interfluve of the rivers Tisza–Körös–Maros. The site is to the south from the present-day Mágocs-brook canal on the high bank. Nagymágocs–Paptanya is located in the Békés ridge micro-region (Körös–Maros Interfluve region) which was formed by the ancient Maros river (clayey sediments of occasionally flooded beds, eolian sediments of the alluvium) (Molnár & Mucsi 1966; Molnár & Szónoky 1973; Sümegi et al. 1999; Kiss et al. 2012, 2013, 2014). This region is a west-northwest sloping alluvial cone plain covered by thin layers of Upper Pleistocene–Holocene infusion loess, loess mud and secondary eolian sand, having gradually finer grains size from east to the west (**Fig. 1.**). To the north, the surface is covered by the high floodplain clayey sediments of the Békés plain, to the west, there is the alluvial loess-mud of the Csongrád plain (Sümegi et al. 1999). These sediments are covered by an east to west thickening infusion loess layer (Wein et al. 1974; Rónai et al. 1979; Andó 1983). The Sarmatian inhabitants settled on the high bank of the Mágocs-brook, a tributary of Maros river. The high-quality, easy-to-form clay is essential for the production of ceramics (Szöllősi 2008, 329). Such material could have been found in the immediate geological environment of the site.

In 1983, preventive excavations were carried out at the site by the Koszta József Museum (Szentes) due to the operation of a sand mine. By the supervision of Gabriella Vörös, the site was excavated in four subsequent campaigns between 1983 and 1986. The excavation covered a total area of 7,000 $m^2$ in three block-like sections. Based on the 88 archaeological features, seven semi-subterranean dwellings, five trenches, three ovens, one metallurgical/blacksmith workshop, one smoking complex and 71 pits belonged to the Late Sarmatian settlement (Walter 2022, 31–32). It is likely that it continued to the north and east, and on the basis of the excavated material, it can be dated from the end of the $4^{th}$ century to the beginning of the $5^{th}$ century AD.

## *The pottery workshop*

Local ceramic production is evidenced by the excavated pottery workshop, the associated pottery kiln, the clay-extracting pits and the ceramic slags, clay pieces and gneiss fragments found in the objects (Walter 2022, 36). The pottery kiln was discovered during the excavation of the site in the 1950s during sand mining, which was documented on site by the local priest, Father Felicián (József Neubauer) (**Fig. 2.**).

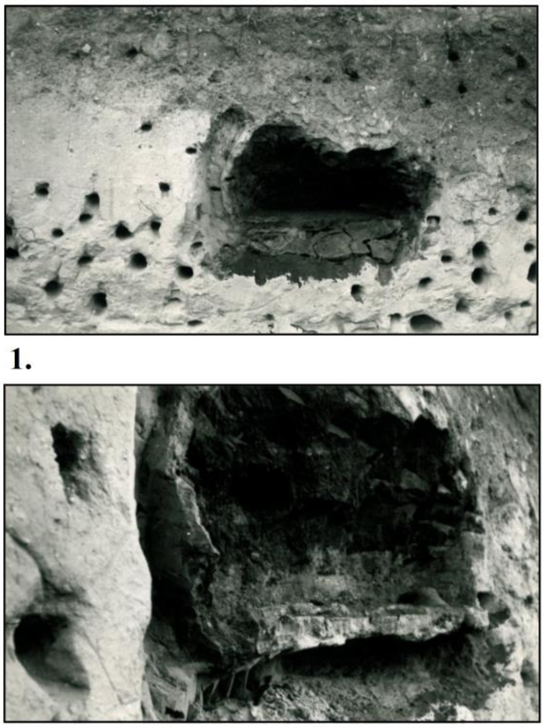

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**Fig. 2.:** Pottery kiln from Nagymágocs–Paptanya (KJM Archaeological Repository: 115-84)

**2. ábra:** Edényégető kemence Nagymágocs–Paptanyáról (KJM Régészeti Adattár: 115-84)

It is clear from his valuable records that the kiln was used to burn pots. The kiln may have been a sunken up-draught kiln with two firing chambers and a perforated floor. Pottery kilns excavated in similar Late Sarmatian settlements are known from the Southern Great Plain: Sándorfalva–Eperjes (Vörös 1982), Makó–Dáli-ugar M43 40. site (Benedek-Bene & Benedek 2015, 205; Sóskuti 2016, 77–78) and Timişoara/Temesvár–Freidorf (Mare et al. 2011, 119; 136–137; Grumeza 2016, 74–75).

The potter's workshop might have been the semi-subterranean dwelling No. 7, with prepared, greyish-purple clay lumps on the floor (**Fig. 3.**). Such clay pieces indicating pottery manufacturing activities were typical also at other Sarmatian settlements, such as Hódmezővásárhely, Solt–Palé (Párducz 1938, 113) and later in the Polgár–Kengyel settlements (Hajdú et al. 1997, 107). The geographically closest pottery workshop to Nagymágocs is known from Sándorfalva–Eperjes, where buildings No. 8 and No. 9 are assumed to be the potter's workshops. In terms of the building structures, No. 8 at Sándorfalva–Eperjes is identical to house No. 7 of Nagymágocs. Both houses were semi-subterranean dwellings with one posthole.

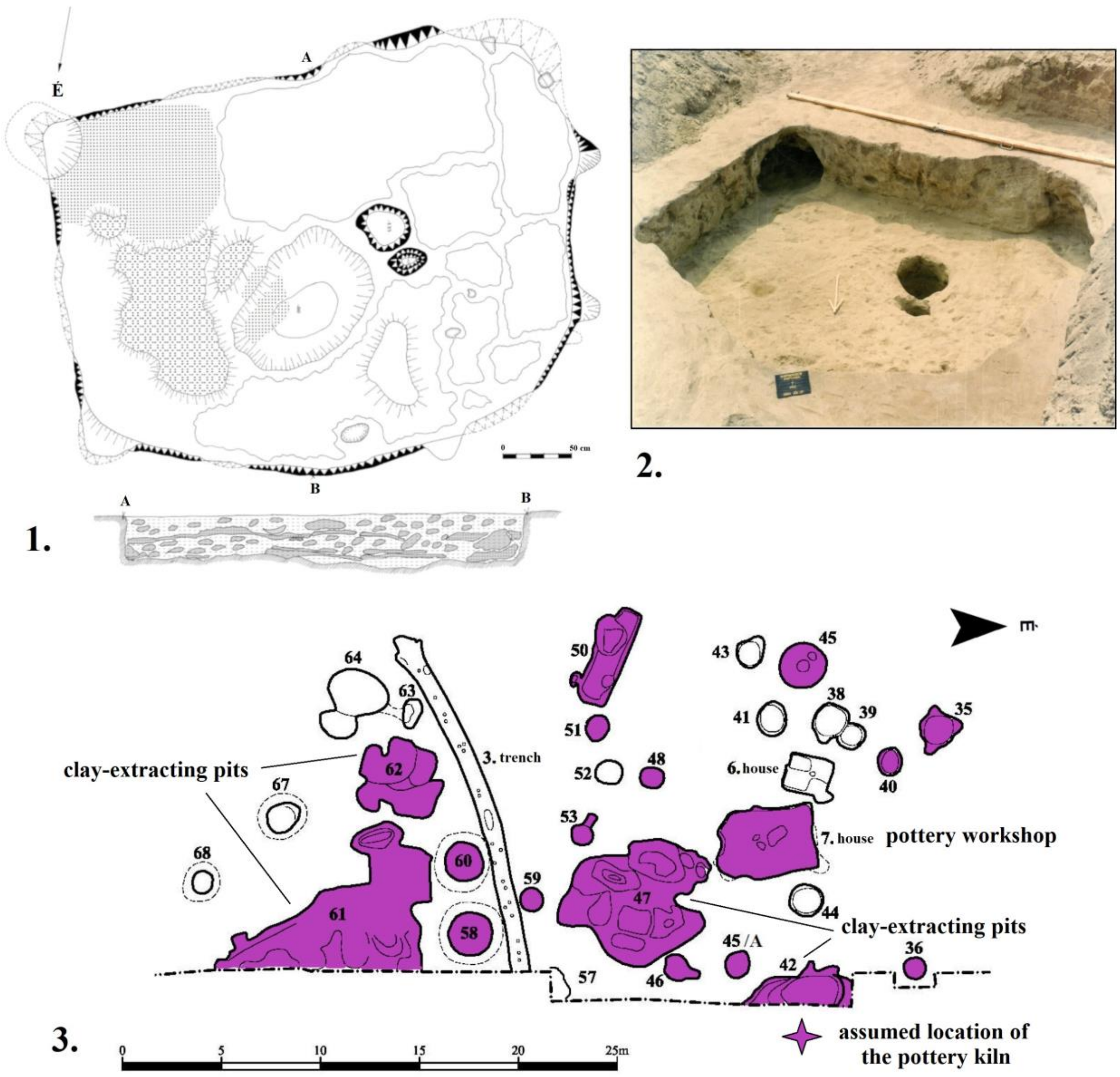


**Fig. 3.:** Nagymágocs–Paptanya, the pottery workshop is semi-subterranean dwelling No. 7, 1: drawing and 2: photo, 3: map of the location of the pottery workshop

**3. ábra:** Fazekasműhely, Nagymágocs–Paptanya 7. félig földbe mélyített épülete 1: rajza és 2: fotója, 3: térképrészlet a fazekasműhely elhelyezkedéséről

A special feature of the pottery workshop at Nagymágocs is that a gneiss rock fragment was found in the compartment formed in its wall, which is supposed to be the main tempering material in slow wheel-turned micaceous-pebbly ceramics. To determine whether the micaceous material found in the slow wheel-turned ceramics might derive from this rock type, petrographic analyses are necessary.

### *Samples and scientific analysis methods*

This is the first archaeometric analysis of the micaceous-pebbly ceramic material in Nagymágocs. Fragments of 15 vessels and a micaceous rock fragment, found in the compartment in the wall of the pottery workshop were selected for petrographic examination (**Fig. 4.**). The main aspect of the sample selection was the type of the pots, as we wanted to compare the most common cooking pots (Fig. 4, 1–11) and clay cauldrons (Fig. 4, 12–14) made from this type of ceramic material, as well as a piece of a colander / ember's cover (**Fig. 4.: 15**).

The samples were examined both macroscopically and microscopically. Petrographic microscopic thin sections of the ceramics (**Figs. 5-9.**) were studied under (Zeiss Opton type) polarizing microscope. We observed the fabric of the ceramic, the properties (e.g. size, shape) of the plastic paste, the aplastic components and the pores. The numbering of the petrographic samples is based on the distinctive third group of the inventory number (e.g. the inventory number of Sample 264 is 2014.4.264.).

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**Fig. 4:** Photos of the examined micaceous-pebbly sherds from Nagymágocs–Paptanya
**4. ábra:** A vizsgált nagymágocs-paptanyai csillámos-kavicsos kerámiatöredékek fotói

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**Table 1.:** Petrographic groups of the 15 micaceous-pebbly ceramic samples

**1. táblázat:** A 15 kavicsos-csillámos kerámia minta kőzettani alapú csoportosítása

| Group | Sample sign | Ceramic type | Group characteristics | Unique features |
|---|---|---|---|---|
| Gneiss tempered group | NM-P-264 | pot fragment | Ferrous, low-mica silty-fine sandy clay (few and <10 µm tourmaline) + medium sand-fine gravel-sized, angular, crushed, epidotic-two mica gneiss rock and mineral fragments as tempering material | |
| | NM-P-295 | pot fragment | | |
| | NM-P-326 | clay cauldron fragment | | |
| | NM-P-392 | pot fragment | | limonitic nodules |
| | NM-P-477 | pot fragment | | limonitic nodules |
| | NM-P-483 | pot fragment | | |
| | NM-P-805 | pot fragment | | |
| | NM-P-855 | clay cauldron fragment | | |
| | NM-P-1105 | pot fragment | | limonitic nodules |
| | NM-P-1107 | pot fragment | | |
| | NM-P-1135 | colander / ember's cover fragment | | limonitic nodules |
| | NM-P-1149 | pot fragment | | |
| | NM-P-1389 | pot fragment | | glass |
| | NM-P-1455 | pot fragment | | loess nodules |
| Gneiss and grog tempered "group" | NM-P-865 | pot fragment | Ferrous, low-mica silty-fine sandy clay (common and 50–100 µm tourmaline) + medium sand-fine gravel-sized, angular, crushed, epidotic-two-mica gneiss rock and mineral fragments + grog | loess nodules |

## *Results*

### Petrographic characteristics of ceramics

The 15 ceramic fragments constitute a homogeneous group with one exception (sample 865) (**Table 1.**). All of them are coarse-grained, poorly-very poorly sorted and have hiatal fabric (**Fig. 6.**). The particle size distribution of most samples can be described by a bimodal distribution curve (with two maxima at 30–120 µm and at 250–4500 µm). The fine sand grains give a compact character to the clayey paste, while the medium sand-fine gravel is typically intentionally added as a tempering material.

The plastic paste is silty-fine sandy clay which would not necessitate artificial tempering. However, based on the textural features, all micaceous-pebbly ceramics consist of silty-fine sandy clay and artificially added sand-gravel.

The shape of the aplastic particles (~30–32 vol%) does not differ significantly in the dominant grain size (i.e. silt-fine-sand and sand-gravel) fractions, the grains are slightly (mica) to medium spheric, and slightly angular to angular. On the one hand these morphological properties indicate, the relatively short-term transport of the silty clayey sediments used as paste and, on the other hand, it also indicates that the tempering material was freshly crushed (**Fig. 5.**).

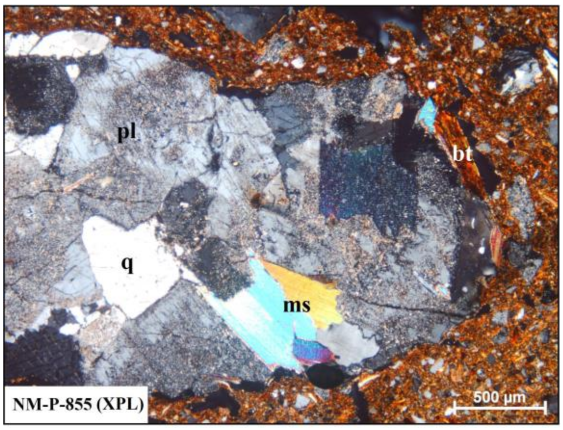



**Fig. 5.:** Mica (bt = biotite, ms = muscovite) in tempering rock fragment, in the form of complex quartz + feldspar + mica lithoclasts (q = quartz, kfp = potassium feldspar / microcline, (s) pl = (sericitic) plagioclase, ms = muscovite, bt = biotite) (sample No. 855)

**5. ábra:** Csillám (bt=biotit, ms=muszkovit) a soványítóanyagként használt kőzetben, összetett, kvarc+földpát+csillám kőzettörmelékei (q=kvarc, kfp=káliföldpát/mikroklin, (s) pl = (szericites) plagioklász, ms=muszkovit, bt=biotit) (855. minta)

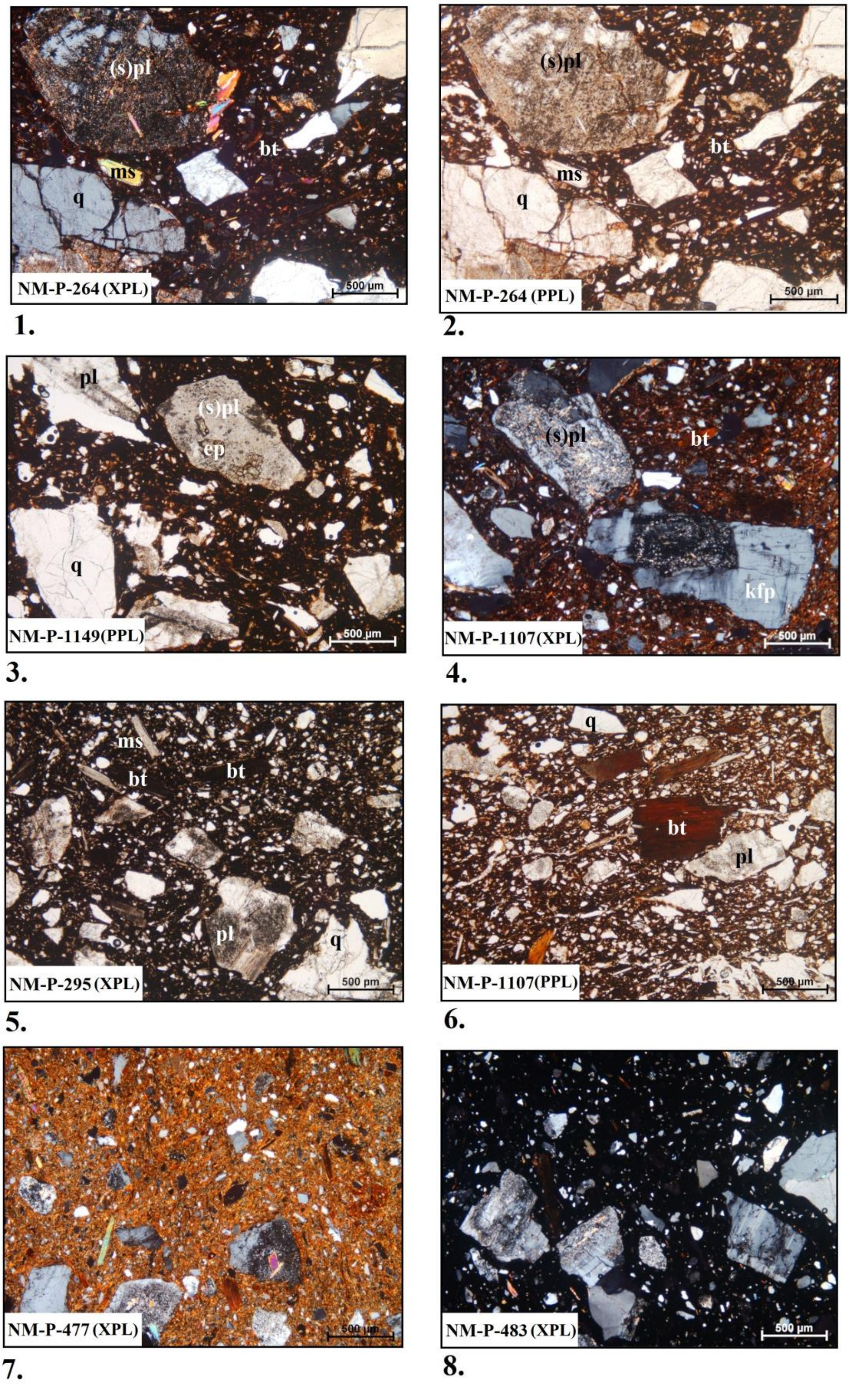
The analyzed ceramics have low to medium porosity (~3–5 vol%), and the pores are elongated due to the moderate plasticity of the clay. The plastic paste of the ceramics (~60–65 vol%) is usually homogeneous, anisotropic (except for three isotropic samples: 295, 487, 1105), ferrous (red-brown-grey-black), silty clay with moderate amount of mica (**Fig. 7.**). The homogeneity of the raw material may be impaired by the fluctuation of the iron content or by the consistency (kneading) of the clay. Anisotropy of the clayey paste, in general, is typical of ceramics fired at low to medium maximum temperatures (<900°C). All isotropic samples are sandwich ceramics with a black core zone showing this property.

The mineralogical composition in the two dominant grain size fractions (silty clay and medium sand-fine gravel) is different. The most common constituent in the fine-grained paste is quartz, with rare muscovite and limonite, and tourmaline as an accessory mineral. Some of the ceramics (samples No. 392, 477, 1105, 1135, 1389) contain limonitic, pedogenic ferric nodules, while in two cases (Samples No. 1455, 865) tourmaline is more abundant. Appearance of tourmaline is a significant difference between the dominant ceramic group and sample No. 865. While the tourmaline rarely appears and the size of the crystals are below 10 μm in the dominant group, its presence is more common and the crystal sizes are up to 100 μm in sample No. 865. This can indicate a slightly different origin of its raw material compared to the dominant group of micaceous-pebbly pottery.

In the sand-gravel fraction, metamorphic gneiss-derived rock and mineral fragments occur: microcline, plagioclase, quartz having undulatory extinction, muscovite, biotite, epidote, opaque minerals, and apatite. The less weathered microcline crystals are larger (up to several mm), while smaller plagioclase crysts often consist of a heavily weathered, sericitizated inclusion-rich core and a fresher, inclusion-free rim. In addition, while muscovites are fresh, the weathering state of biotite crystals varies in the samples (from fresh to strongly limonitic, reddish versions). This can be due to their original condition in the raw material or partly to the high temperature firing of the ceramic. The epidote appears as fresh, fragmented crystals. Mineralogical composition of the sand-gravel fraction evidence that, a freshly crushed epidotic two-mica gneiss rock type was added to the plastic paste, both in the dominant group and in sample No. 865. This monomict composition of the sand-gravel fraction supports the idea of the intentional tempering of the raw material. As a new observation, the nominating micaceous and pebble grains of the tempering material can be derived from the same gneiss rock type, indicating a plainer paste preparation recipe than previously supposed (Vaday 1984, 31).

In sample No. 865, in addition to the above mentioned lithoclasts, black-dark brown, 0.5–3 mm, crushed ceramics (grog) also occur as a tempering material (**Fig. 8.**). The fabric and mineralogical composition (quartz, muscovite, biotite and epidote) of the grog bear a very strong resemblance to that of embedding pottery, while only the colour of the raw material differs (presumably due to double firing). Thus, it can be assumed that fragments of similar micaceous-pebbly ceramics could have been used as grog tempering. In sample No. 1389, a single vitrified shard was identified which might be interpreted similarly to the "vitrified ceramic fragment" found in the micaceous-pebbly ceramics in Sándorfalva–Eperjes (Walter et al. 2018, table 9. e–f).

The examined 15 ceramic fragments can be grouped into 2 main categories based on their material (**Table 1.**). The main criteria for grouping were: (1) the accessory content of the plastic material (quantity and size of tourmaline) and (2) the mineralogical composition of the non-plastic constituent of sand-gravel grain size (presence or absence of grog).




**Captions for Fig. 6. on next page / a 6. ábra képaláírása a következő oldalon**

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**Fig. 6.:** Photomicrographs of the micaceous-pebbly ceramic type tempered with gneiss (q = quartz, kfp = potassium feldspar / microcline, (s) pl = (sericitic) plagioclase, ms = muscovite, bt = biotite, ep = epidote)

1-2: anisotropic (+ N) and brown (1N) silty clay paste, sand-gravel-sized, angular, crushed gneiss fragments (sample No. 264); 3: crushed, epidotic gneiss fragments (sample No. 1149); 4: two feldspar types in gneiss (fresh potassium feldspar and sericitic plagioclase) (sample No. 1107); 5-6: white (ms) and brown (bt) mica in sand-gravel-sized, angular, crushed gneiss fragments (sample No. 295, 1107); 7-8: hiatal texture with (1) anisotropic and (2) isotropic silty clay (sample No. 477, 483)

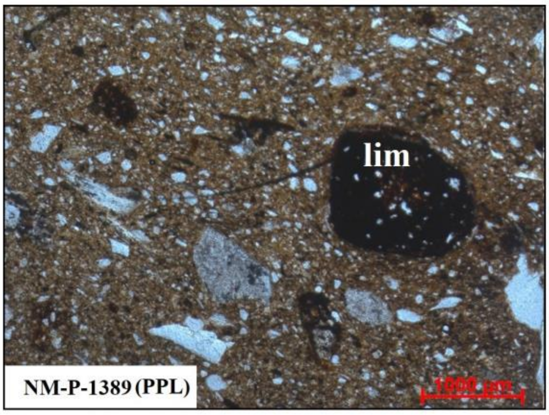
**6. ábra:** A gneisz soványítású csillámos-kavicsos kerámiatípus vékonycsiszolati fotói (q=kvarc, kfp=kálifoldpát/mikroklin, (s)pl=(szericites) plagioklász, ms=muszkovit, bt=biotit, ep = epidot):

1-2: anizotróp (+N) és barna (1N) kőzetlisztes alapanyag, homok-kavics méretű, szögletes, tört gneisztörmelékekkel (264. minta); 3: tört, epidotos gneisztörmelékekkel (1149. minta); 4: kétféle földpát a gneisz kőzettörmelékben (üdébb káliföldpát és szericites plagioklász) (1107. minta); 5-6: homok-kavics méretű, szögletes, tört gneisztörmelékekből származó fehér (ms) és barna (bt) csillámok (295. és 1107. minták); 7-8: hiátuszos szövet, (1) anizotróp és (2) izotróp kőzetlisztes agyag alapanyag (477. és 483. minták)

### Petrographic characterization of the comparative rock sample

Sample No. 1876 is a two-mica gneiss containing microcline (potassic feldspar), plagioclase, and quartz with undulatory extinction, muscovite and biotite (**Fig. 9.**). In addition to the less weathered, occasionally myrmecitic microcline, plagioclase crystals of various sizes are often strongly sericitized, but fresher crystals also occur. Muscovite and biotite crystals are fresh, biotites are often characterized by zircon inclusions with pleochroic halo.

This gneiss composition is similar to that of the gneiss temper of ceramics in many respects: two types of mica, a fresh microcline and sericitic plagioclase. However, there are several features that clearly distinguish it from the latter: the absence of epidote, the absence of zircon-free biotites, and the absence of plagioclases with fresh rim and weathered core. These prove that the material of sample No. 1876 is not identical to the tempering material used for the pottery.

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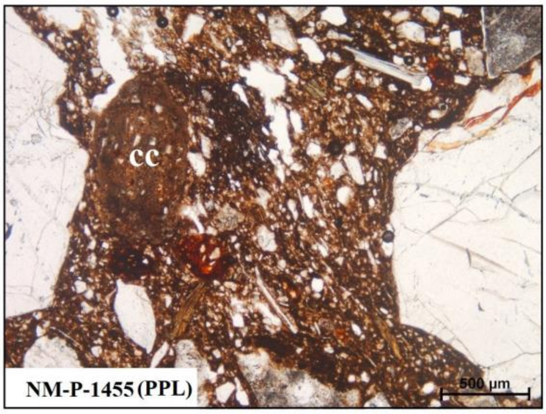


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**Fig. 7.:** Soil and loess related constituents of the clayey raw material in the micaceous-pebbly ceramic, (lim = limonitic nodules, cc = loess nodules) (sample No. 1389, 1455)

**7. ábra:** A csillámos-kavicsos kerámiatípus agyagos alapanyagának talaj és lösz eredetű alkotói (lim=limonitos göbecs, cc=meszes löszgöbecs) (1389. és 1455. minták)

## *Conclusions – Raw materials and potential source areas*

The fabric investigations of the micaceous-pebbly ceramics proved that those were made from an artificial mixture of silty-fine sandy clay and crushed gneiss rock fragments. Based on the mineralogical composition, a single type of tempering material can be identified providing both the ‘mica’ and the ‘pebble’ components. A technological variant also appears (sample No. 865), in which gneiss temper is accompanied with crushed ceramic fragments (grog) (**Fig. 8.**).

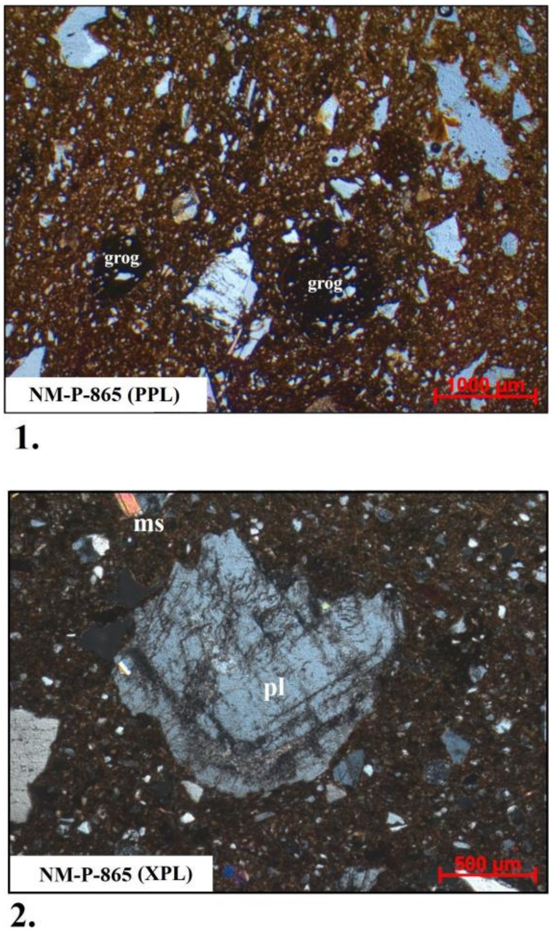


**Fig. 8.:** Grog (crushed ceramic) tempered version of the micaceous-pebbly ceramic type with hiatal texture: 1: brown (1N) and 2: anisotropic (+ N) silty clay paste, sand-gravel sized, angular, crushed ceramic and gneiss fragments (pl = plagioclase, ms = muscovite; sample No. 865)

**8. ábra:** A csillámos-kavicsos kerámiatípus tört kerámia (grog, samott) soványítású változatának hiátuszos szövete: 1: barna (1N) és 2: anizotróp (+N) kőzetlisztes alapanyaggal, homok-kavics méretű, szögletes, tört kerámia- és gneisztöredékekkel (pl=plagioklász, ms=muszkovit; 865. minta)

The clay is a fine-grained sandy sediment, which could form at the groundwater level (having limonitic accumulations) and partly mixed with eolian grains (calcareous loess nodules) (**Fig. 7.**). These characteristics fit into the local or regional geological environment. In the case of sample No. 865, the differing appearance of tourmaline suggests that the potter worked from a different, but still probably local (or regional) clay source.

The gneiss temper is foreign to the geological environment of the site. The piece of a two-mica gneiss found at the pottery workshop is similar to the gneiss fragments identified in the ceramics, but it is not identical with those.

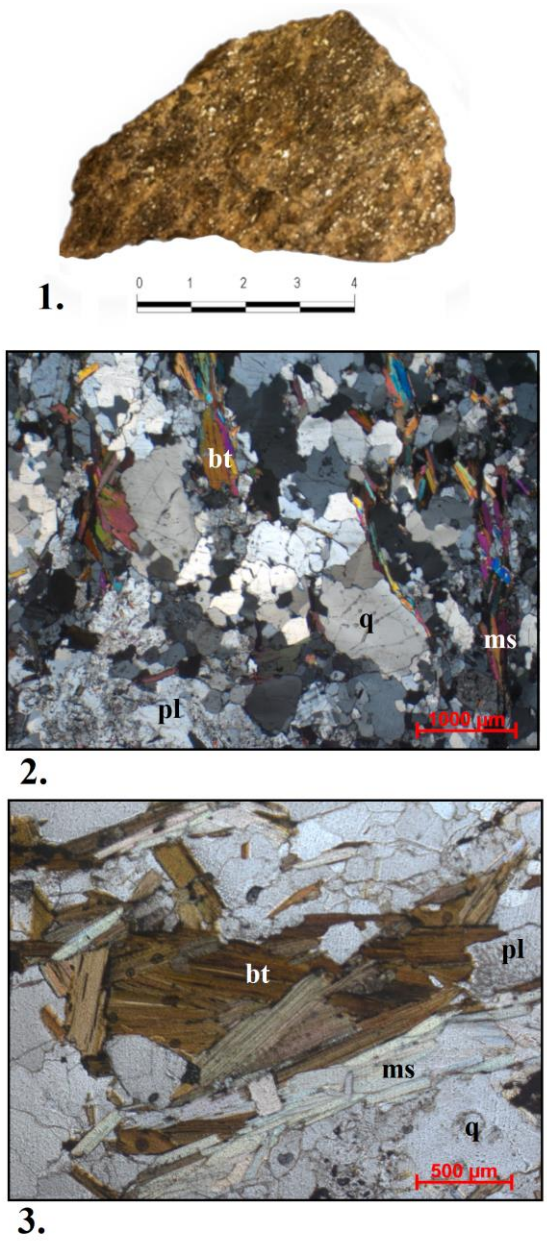


**Fig. 9.:** 1: A gneiss fragment from a compartment in the wall of the pottery workshop; 2-3: microscopic texture of the gneiss (q = quartz, (s) pl = (sericitic) plagioclase, ms = muscovite, bt = biotite)

**9. ábra:** A fazekasműhely oldalfalában kialakított fülkében talált 1: gneiszkőzettömb, 2-3: szöveti képe (q=kvarc, (s) pl = (szericites) plagioklász, ms=muszkovit, bt=biotit)

Similar gneiss sources might be on the catchment area of Körös or Maros rivers, for example in the Apuseni Mts. (Transylvania; e.g. Ianovici et al. 1976, Pană 1998, Dallmeyer et al. 1999). With regard to the source of the micaceous rock, a preliminary petrographic examination of the micaceous-pebbly ceramics from Sándorfalva–Eperjes came to the same conclusion (Walter et al. 2018, 137–138).

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When searching for the manufacturing location of micaceous-pebbly pottery at Nagymágocs, it must be taken into account that all conditions were present for pottery production at the settlement. In addition, reflecting a single handicraft tradition, the same micaceous rock was used for tempering all ceramics, hence it is conceivable that micaceous-pebbly ceramic was made locally and the tempering material was transported to the settlement.

## Summary results

In this study, we carried out archeometric analyses of ceramics found in the late Sarmatian settlement of Nagymágocs–Paptanya. Microscopic petrographic observations of the 15 micaceous-pebbly ceramic samples revealed the use of the same recipe (i.e. clay tempered with micaceous gneiss). The same micaceous rock was found in all types of pots, cooking vessels, clay cauldrons and the colander/embers' cover.

We can conclude that the vessels were the products of the same manufacturing tradition. In one case (sample No. 865) a small technological difference can be shown (it was tempered also with grog), but the same raw material was used in this case too. In addition, it has been shown that the micaceous material was intentionally used as a tempering material, as evidenced by the hiatal texture of the ceramic and the angular grain shapes. We have also shown that the gravel in the ceramic samples is not a tempering material of different origin, but it comes from the same rock as the mica, which is also a new result in this field (**Fig. 6.**). In addition, it was possible to infer the firing temperature of the vessels, which could be below 900°C.

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## References

ANDÓ, M. (1983): A természeti környezet adottságainak és erőforrásainak értékelése. In: KRAJKÓ Gy. (főszerk.): *Csongrád megye gazdasági földrajza*. TIT Csongrád Megyei Szervezete, Szeged, 9–62.

BENEDEK-BENE, Zs. & BENEDEK, A. (2015): Szarmata edényégető kemencék az M43 autópálya nyomvonalán. — Sarmatian pottery kilns on the trail of the M43 highway. In: TÜRK, A., BALOGH, Cs. & MAJOR, B. (szerk.): *Hadak útján XXIV. A népvándorláskor fiatal kutatóinak XXIV. konferenciája. Esztergom, 2014. november 4–6.* 1. kötet, Budapest–Esztergom, 205–225.

DALLMEYER, R.D., PANĂ, D.I., NEUBAUER, F. & ERDMER, P. (1999): Tectonothermal evolution of the Apuseni Mountains, Romania: resolution of Variscan versus Alpine events with Ar-40/Ar-39 ages. *Journal of Geology* **107/3** 329–352.

GRUMEZA L. (2016): Post Roman and Sarmatian Pottery Workshops in Banat, Between the End of the 3rd – Beginning of the 5th Century AD. *Ephemeris Napocensis* **26.** Cluj-Napoca: Academia Română – Institutul De Arheologie ŞiIstoria Artei, 67–106.

GYALOG, L. ed., (2005): Magyarország fedett földtani térképe 1:100000. Magyar Állami Földtani Intézet, Budapest.

HAJDÚ Zs., M., NEPPER I., Sz. MÁTHÉ M., RACZKY P., KRIVECZKY B., CSÁNYI M. & TÁRNOKI J. (1997): Polgár–Kengyel-köz. Szarmata település a III–IV. századból. In: RACZKY P., KOVÁCS T. & ANDERS A. (szerk.): *Utak a múltba. Az M3-as autópálya régészeti leletmentései*. Budapest, Magyar Nemzeti Múzeum - Eötvös Loránd Tudományegyetem Régészet-tudományi Intézet, 106–109.

IANOVICI, V., BORCOŞ, M., BLEAHU, M., PATRULIUS, D., LUPU, M., DIMITRESCU, R. & SAVU, H. (1976): *Geology of the Apuseni Mountains.* Academia R.S.R, Bucureşti.631 p.

KISS, T., URDEA, P., SIPOS, Gy., SÜMEGHY, B., KATONA, O., TÓTH, O., ONACA, A., ARDELEAN, F., TIMOFTE, F. & ARDELEAN, C. (2012): A folyó múltja. — The past of the river. In: SIPOS, Gy. (szerk.): *A Maros folyó múltja, jelene, jövője — Past, present, future of the Maros/Mureş River* Szegedi Tudomány-egyetem, Természeti Földrajzi és Geoinformatikai Tanszék, Szeged. 33–64., 167–178.

KISS, T., SÜMEGHY, B., HERNESZ, P., SIPOS, Gy. & MEZŐSI, G. (2013): Az Alsó-Tisza menti ártér és a Maros hordalékkúp késő-pleisztocén és holocén fejlődéstörténete. — Late Pleistocene and Holocene evolution of the Lower Tisza floodplain and the Maros alluvial fan. *Földrajzi Közlemények* **137** 269–277.

KISS, T., SÜMEGHY, B. & SIPOS, Gy. (2014): Late Quaternary paleodrainage reconstruction of the Maros River alluvial fan. *Geomorphology* **204** 49–60.

MARE, M., TĂNASE, D., DRAŞOVEAN, F., SUSI, el G. & GÁL, S.Sz. (2011): *Timişoara–Freidorf. Cercetările arheologice preventive din anul 2006.* Cluj-Napoca: Mega, p. 151.

MOLNÁR, B. & MUCSI, M. (1966): A kardoskúti Fehértó vízföldtani viszonyai. — Hydrogeologische Verhältnisse des Fehér-tó bei Kardoskút. *Hidrológiai Közlöny* **46** 413–420.

MOLNÁR, B. & SZÓNOKY, M. (1973): A kakasszéki szikes tó keletkezése és vízföldtana. — Entstehung und Hydrogeologie des Natron-Sees in Kakasszék. *Hidrológiai Közlöny* **53** 566–570.

PANĂ, D. (1998): *Petrogenesis and tectonics of the basement rocks of the Apuseni Mountains, significance for the Alpine tectonics of the Carpathian–Pannonian region*. PhD thesis, University of Alberta, p. 356.

PÁRDUCZ M. (1938): Római kori lelőhely Hódmezővásárhelyen a Solt-Paléban. *Dolgozatok a Magyar Királyi Ferencz József Tudományegyetem Archaeologiai Intézetéből* **XIV** Szeged: Magyar Királyi Ferencz József Tudományegyetem, 1938, 90–123.

RÓNAI, A., SZÉLES, M. & KŐRÖSSY, L. (1979): *Az Alföld földtani atlasza.* Szeged. Magyar Állami Földtani Intézet, Budapest, 201 p.

SÓSKUTI, K. (2016): Középső bronzkori, szarmata, avar-, Árpád-kori településnyomok, valamint szarmata és avar kori temetkezések Makó Dáli-ugarról. (Előzetes jelentés az M43, 40., HT 43. lelőhelyen végzett régészeti feltárásról). In: KVASSAY, J. (szerk.): *Régészeti Kutatások Magyarországon 2011–2014*. Budapest: Magyar Nemzeti Múzeum, 76–96.

SÜMEGI, P., MAGYARI, E., DÁNIEL, P., HERTELENDI, E. & RUDNER, E. (1999): A kardoskúti Fehér-tó negyedidőszaki fejlődéstörténetének rekonstrukciója. — A reconstruction of the Quaternary geohistory of Fehér lake at Kardoskút. *Földtani Közlöny* **129** 479–519.

SZÖLLŐSI Sz. (2008): Egy kelta edény-égetőműhely működése a régészeti leletek tanulsága alapján. *Első Század* **1** 325–374.

VADAY A. (1984): Késő szarmata agyagbográcsok az Alföldön. — Spätsarmatenzeitliche Tonkessel von der Tiefebene. *Móra Ferenc Múzeum Évkönyve* **1980-81/1** 31–42.

VÖRÖS G. (1982): Késő szarmata fazekasműhely Sándorfalva–Eperjesen. *Múzeumi Kutatások Csongrád Megyében* 27–36.

WALTER D., FINTOR K. & SKULTÉTI Á. (2018): A Sándorfalva–eperjesi késő szarmata kavicsos-csillámos kerámia soványítóanyagának előzetes petrográfiai vizsgálata. — The preliminary petrographic examination of the diluent used for a Late Sarmatian micaceous-pebbly ceramic from Sándorfalva–Eperjes. In: BÁRKÁNYI I. & F. LAJKÓ O. (szerk.): *A Móra Ferenc Múzeum Évkönyve.* Új folyam 4. Szeged: Móra Ferenc Múzeum, 133–157.

WALTER D. (2022): Főzőfazekak és bográcsok, avagy Nagymágocs–Paptanya késő szarmata kori lassúkorongolt, kavicsos-csillámos kerámia-anyagának elemzése. — Cooking pots and pans. Analysis of the Late Sarmatian gravel-gritter ceramic material of Nagymágocs–Paptanya. *Veritatis Imago* **2021/2** 31–60.

WEIN, Gy., BOCZÁN, B., SZÉLES, M. & RÓNAI, A. (1974): *Az Alföld földtani atlasza*. Csongrád. Magyar Állami Földtani Intézet, Budapest, 173 p.

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