DISSERTATIONES ARCHAEOLOGICAE

ex Instituto Archaeologico Universitatis de Rolando Eötvös nominatae

„Hadak útján”

A népvándorláskor fiatal kutatóinak XXVI. konferenciája

GAZDASÁG – KERESKEDELEM – KÉZMŰVESSÉG

26th Conference of Young Scholars on the Migration Period

ECONOMY – TRADE – CRAFTSMANSHIP

Supplementum 2. | 2018

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Budapest, 2016. november 3–4.

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A *„Hadak útján" – A népvándorláskor fiatal kutatóinak konferenciáját* először 1990-ben, Szentesen rendezték meg nagy érdeklődés közepette. A rendezvény hiánypótlónak számított, korábban ugyanis nem volt lehetősége a pályakezdő népvándorlás koros régészeknek, hogy saját korosztályuk körében megosszák egymással tudományos eredményeiket. Már az első találkozó interdiszciplináris együttműködésre törekedett: régészek mellett történészek, művészettörténészek és nyelvészek is előadást tartottak; az előadások alapján készült tanulmányok külön kötetben jelentek meg. A konferencia elnöki tisztjét az első alkalom óta dr. Tomka Péter, a Kárpát-medencei népvándorlás kor kiemelkedő kutatója tölti be.

A szentesi konferencia egy sikeres sorozat első állomása lett: 2015-ben, Révkomáromban a kezdeményezés már negyedszázados születésnapját ünnepelhette. A „Hadak útján" 26. találkozójának megszervezését – a sorozat történetében először – az ELTE BTK Régészettudományi Intézete vállalta magára. Témájául a népvándorlás kori gazdaság, kereskedelem és kézművesség kérdésköreit választottuk. 2016. november 3–4-én összesen 47 előadótól mintegy 32 előadást hallhattunk, amelyeket témakörök szerint több szekcióba – kapcsolatrendszerek, kereskedelem, gazdálkodás és háztartások, anyag és technológia, valamint kézművesség – soroltunk. Ezek közül most 13 előadás jelenik meg írásos formában is, részben magyarul, részben azonban – a megjelenésnek teret biztosító folyóirat, a *Dissertationes Archaeologicae* irányelvei alapján – angol és német nyelven. Reméljük, hogy az idegen nyelvű kiadás segítségével a konferencián bemutatott sokrétű és gyakran új módszertani megközelítésre támaszkodó eredmények a nemzetközi kutatás számára is hozzáférhetővé válnak.

Budapest, 2018. október 1.

A konferencia eddigi helyszínei

1990 Szentes
1991 Nyíregyháza
1992 Sátoraljaújhely
1993 Visegrád
1994 Szenna
1995 Velem
1996 Pécs
1997 Veszprém
1998 Eger
1999 Szeged – Domaszék
2000 Székesfehérvár
2001 Simontornya
2002 Gyula
2003 Keszthely
2004 Várgesztes
2005 Nagykovácsi
2006 Nagyvárad
2007 Kecskemét
2008 Győr
2010 Budapest – Szigethalom
2011 Szeged
2012 Visegrád
2013 Veszprém
2014 Esztergom
2015 Révkomárom
2016 Budapest
2017 Debrecen
2018 Mosonmagyaróvár

The organization of ceramic production: A comparative analysis of typology and petrography at the Avar Age settlement of Daruszentmiklós (Hungary)

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Abstract
Following the typological evaluation of the various fast wheeled, slow wheeled and hand formed pottery revealed at the Avar Age settlement of Daruszentmiklós F05, 58 samples were chosen and subjected to petrographic, XRD and XRF analyses. The study compares the results of the archaeological and archaeometric investigations, and evaluates the relationship between the groups created by archaeological, petrographic and geochemical methods. The petrographic results available from other Avar Age sites have also been taken into consideration. By these means unexpected correlations could be observed. Finally, an attempt has been made to reconstruct former ceramic manufacturing practices, and draw conclusions regarding the possible ways of social organization of the time.

Introduction, research possibilities

Similarly to any other settlements, pottery sherds constituted the majority of the finds in the Avar Age settlement of Daruszentmiklós. Due to their fragmentary nature it is difficult to define their onetime forms precisely or find their exact analogies, therefore analyzing their raw material and technology is of prime importance. However, pottery is not only significant in respect of typochronology, but it also raises further research questions and possibilities. Ceramic analyses have already been carried out on some Avar Age pottery: first on the vessels of the pottery kilns excavated near Szekszárd,[1] then on the pottery of the Környe[2] and

1 Balla 1990.
2 Salamon – Duma 1982.

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Szekszárd-Palánk[3] cemeteries, as well as on the 9th century polished ware of Zalavár[4] and Mikulčice in the 2000s,[5] and the vessels of the site of Zillingtal.[6] The subject of the most recent ceramic petrographic analyses has been the cemetery of Dunaszentgyörgy – Kaszás-tanya[7] and the settlement of Kaposvár,[8] the results of which have been compared to the petrographic results of the settlement section presented here.

Avar Age pottery typology and chronology is based on three production technological groups: fast-wheeled, slow-wheeled and hand-formed technologies.[9] Although pottery sherds can be usually classified into one of these categories on the basis of certain formal and technological characteristics and traces, these are only assessments that cannot be defined in detail by contemporary pottery techniques or tools, since we know neither the circumstances nor the organizational background of their production. However, the analysis of Avar Age settlement pottery made by different techniques, especially by fast wheel, is of prime importance in many respects. On the one hand, due to the comparability of fast-wheeled vessels to grave pottery they may help in defining the chronological frameworks of settlements.[10] Although only a few Avar Age examples have been known so far, a considerable amount of information can be obtained by comparing the occurrence of fast-wheeled pottery types in graves and settlements.[11] On the other hand, the diversity of pottery may allow functional analyses; based on waste scattering activity zones, possible social differences – or at least the demand of representation of the households – can be detected.[12] The presence of fast-wheeled pottery opens new avenues for functional investigation: besides cooking and storage vessels that can be distinguished within slow-wheeled and hand-formed pottery, different types of so-called decorative or tablewares also occur, and the functional distinction of fats wheeled storage vessels can also be refined within the fast-wheeled category. The third reason for their examination is that they allow a more complex analysis of the extent and nature of ceramic manufacture. Besides products of household industry and individual workshops, we can suppose the existence of specialized workshops; and in the case of certain fast-wheeled vessel types workshop areas, and by analyzing ceramics, their relationships can also be examined. In this way vessels of similar raw material and form cannot only be interpreted as typological groups but also as a group of wares the production of which may indicate a well-organized pottery manufacture.[13]

Due to the above-listed possibilities, we examined the raw material and composition of ceramics and whether the material groups defined visually can be supported by more objective analysis. We also analysed the differences and connections between the raw materials, tem-

3 Salamon – Duma 1984.
4 Bajnóczi et al. 2005; Herold 2007; Herold 2010a.
5 Herold 2008.
6 Herold 2010b; Herold 2011.
7 Kreiter et al. 2017.
8 Kreiter – Skoda 2016.
9 Researchers also distinguish another, transitional production technological group, the so-called post-wheeled technique that can be classified between hand-formed and slow-wheeled vessels (Vida 1999, 28; Bajkai 2014, 39; Kondé 2016, 340). Although it cannot be distinguished as an individual technological group, based on the raw material and the technological features of the black wares of Dunaszentgyörgy it appeared that they constituted a transition between slow- and fast-wheeled products (Kreiter et al. 2017).
10 Vida 1999.
11 Herold 2010b.
12 Becker 1995; Chesson 2012; Nishimura 2012; Fábián 2013; Kalla 2013.
13 Peacock 1982, 25–50.

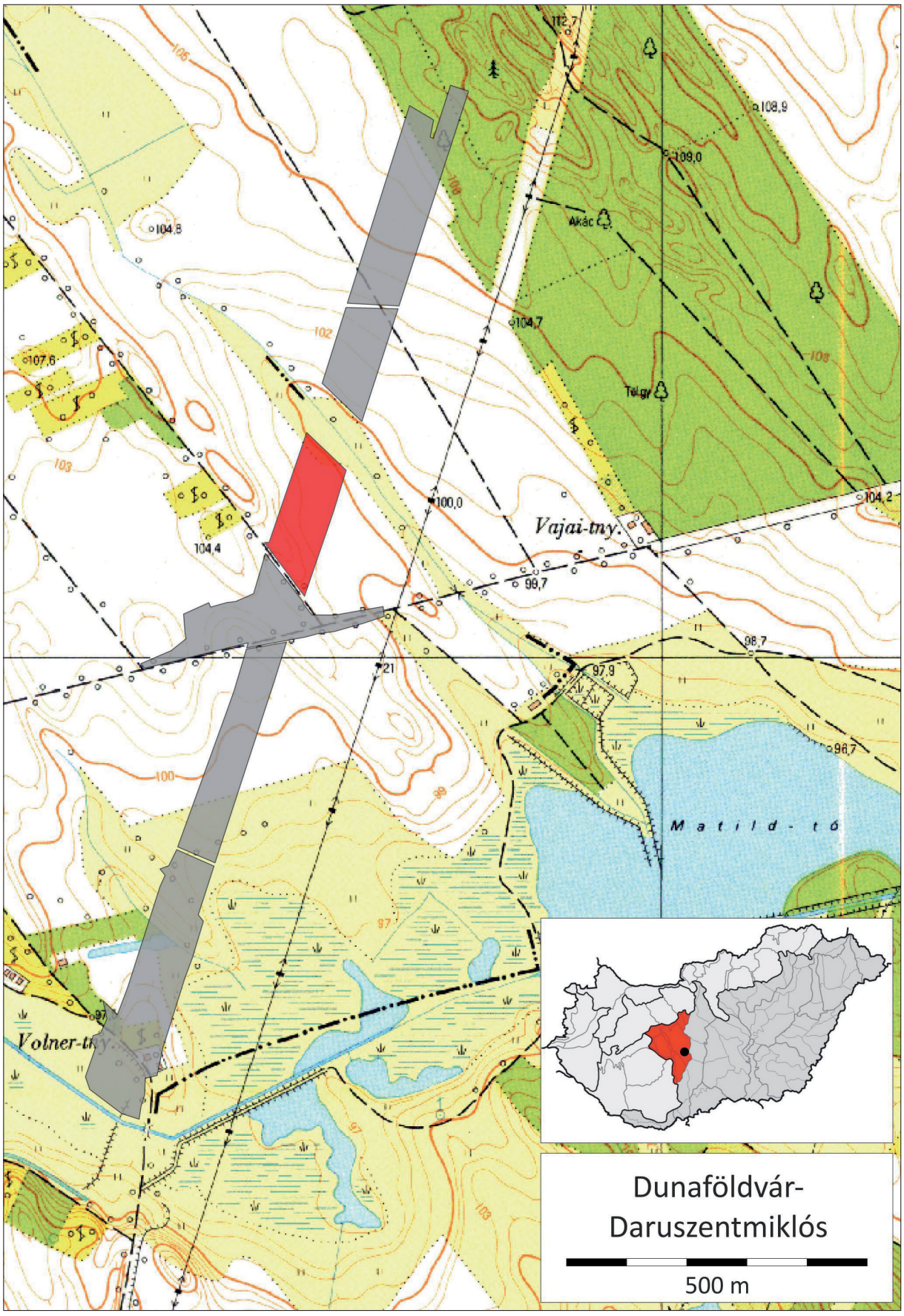

Fig. 1. Geographical position and topographical map of Daruszentmiklós site F05

perings, and firing conditions of the vessels distinguished by archaeological typology and production technological categories. We further assessed the possible relationships between the raw materials and/or tempers of fast-wheeled, slow-wheeled and hand-formed vessels. It was a significant question whether fast-wheeled vessels were specialized products, whether the different fast-wheeled wares have been made from various raw materials, and whether the petrographic similarities can be specified by geochemical analyses. We analysed what raw materials may reveal about the nature and extent of ceramic production: Can we observe standardization in the case of raw materials and/or tempers of vessels produced by certain techniques? Can we identify different levels of ceramic manufacture, imported goods, or other forms of ceramic production? In case we can observe the products of specialized workshops, where can we find these workshops, were they local or these products were produced in more distant workshops?

The size of the Daruszentmiklós settlement and its find material – which is more variable than that of most of the settlements published so far – allow the investigation of these questions. We chose 58 samples from the densest site, Daruszentmiklós F05, which were subjected to petrographic, XRD and XRF analyses. Then we compared these results with the typological system and assessed the results. We investigated the relationship between the groups created by archaeological and petrographic and geochemical methods, also the possible connection between raw material choices and production technologies, and attempted to reconstruct former ceramic manufacturing practices and social organization.

Daruszentmiklós and its geographical environment

The site of Daruszentmiklós is located on the border of Fejér and Tolna counties, in the Middle-Mezőföld microregion within the Mezőföld middle-region belonging to the Great Hungarian Plain, east of the town of Daruszentmiklós, on an alluvial plain covered with loess *(Fig. 1)*.[14] The archaeological site was unearthed during 2008–2009, as a result of rescue excavations preceding the construction of the Dunaújváros-Szekszárd section of the M6 motorway. The majority of the site was a nearly 7 hectare large settlement section exclusively containing Avar Age features.[15] Colleagues of the Hungarian National Museum, the Field Service for Cultural Heritage and the Institute of Archaeological Sciences of the Eötvös Loránd University uncovered more than 800 features on 6 excavation surfaces,[16] which were documented in detail and supplemented by sampling necessary for natural scientific inquiries.[17] The site is situated on the two sides of a stream flowing into the Matild Lake, and it is bordered by another stream and a swampy area from the south-south eastern, and by a forested elevation from the

14 Marosi – Somogyi 1990, 107–112.

15 Cséki 2009; Cséki 2010; Szenthe 2009.

16 From north to south: Dunaföldvár – Vajai tanya II, RM 05; Dunaföldvár – Vajai tanya I, F06; Daruszentmiklós F05; Daruszentmiklós RM14; Daruszentmiklós – Alsó Pázmánd, F04; Dunaföldvár – Vaji tanya III, RM06. The excavations were led by archaeologists Andrea Cséki, Zsuzsanna Farkas, Dóra Kemsei, Gergely Szenthe and Gábor Váczi. We would like to express our gratitude for their work.

17 The animal bones (Bárány 2012; Bárány 2014) and the archaeological features (Szabó 2016) of site F05 have been partly assessed. Furthermore, malacological, anthropological and dendrochronological investigations were carried out on the finds of the site. Reports can be accessed in the Hungarian National Museum Archaeology Database: http://archeodatabase.hnm.hu/hu/node/729, 27th February 2017. The aim of Zsófia Kondé's doctoral thesis in process is to evaluate and analyse the site by traditional and household archaeological methods. She owes thanks to Gergely Szenthe for providing the possibility to process the site.

Fig. 2. The Avar Age settlement features of Daruszentmikós site F05

north-north eastern direction. The site was densest in respect of features as well as find materials on the hillside slightly elevating southwards from the right bank of the stream crossing the site, at the excavation surface named F05 *(Fig. 2)*.[18] It has a research historical significance because the first Avar Age settlement published in a monograph – Dunaújváros-Öreghegy – is only located 20 km north of the site of Daruszentmiklós.[19] However, this region is still hardly known with respect to the research of the Avar Age, and only a few of the numerous sites discovered here have been evaluated or published so far.[20]

Pottery typology

With respect to technology, 15% (454 pieces) of the pottery sherds found on surface F05 are fast-wheeled, 60% (1806 pieces) are slow-wheeled, 23% (724 pieces) are hand-formed and 2% (89 pieces) are probably post-wheeled *(Fig. 3)*.[21]

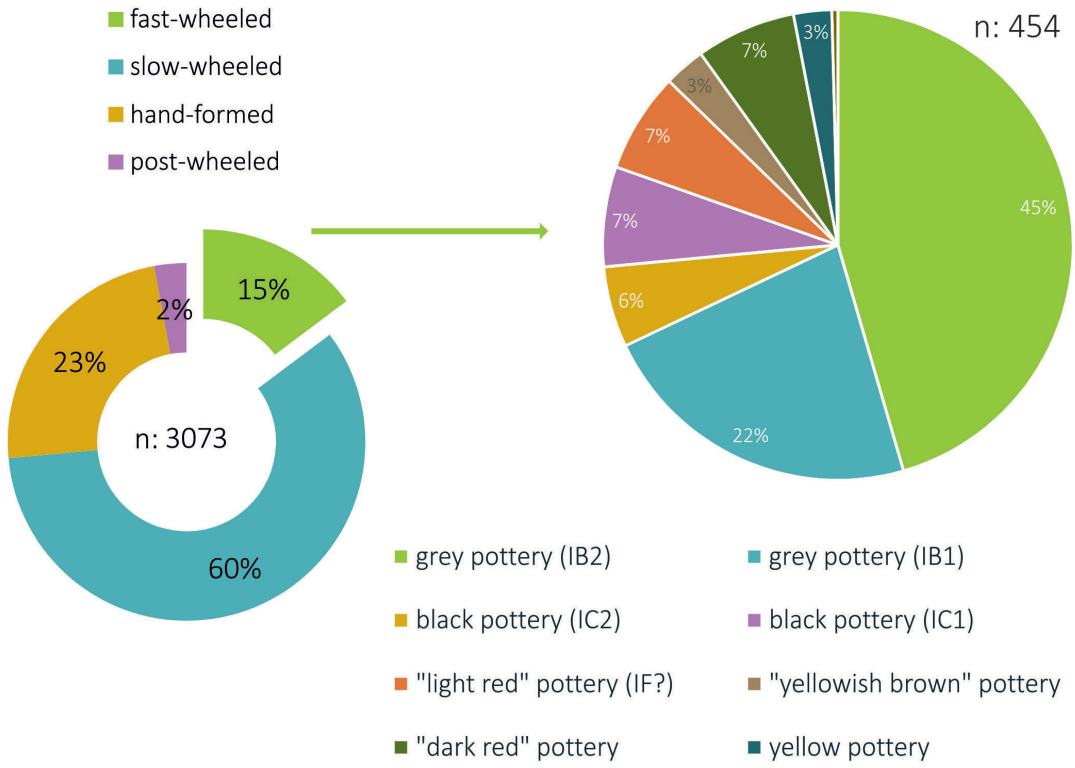

Fig. 3. Proportion of the pottery made by the different techniques, and the proportion of fast-wheeled pottery types

Fast-wheeled vessels

The majority of fast-wheeled sherds could be correlated with the characteristic vessel types that are mostly found in graves; however, new pottery types without, or with only a few analogies, have also occurred *(Fig. 3)*.

18 Gergely Szenthe also carried out field walking surveys on the territory, according to which only ca. 10% of the settlement could be revealed during the course of the excavation.
19 Bóna 1973.
20 Marosi – Fettich 1936; Bóna 1971a; Fülöp 1984; Bakó 2014; Szücsi 2015; Szücsi 2016.
21 The total number of pieces is 3073, from which a maximum of 2798 vessels can be reconstructed.

Grey pottery

Among the fast-wheeled vessel types, grey pottery (type IB_2)[22] occurs in the greatest number. These were made from a fine, "clean" raw material, sometimes containing sand or a small amount of tiny pebbles, and were fired within reduced conditions resulting in a uniform good quality on the entire vessel. Their color is light grey, grey, sometimes beige, and at times secondary soot stains occur on them; their external surface is smooth, chalk-like, and wheel ribs can be often observed on their interior surface *(Fig. 4.1)*. Their wall thickness varies between 0.3–1 cm, and with respect to forms, mugs/cups, small and thin-walled pots, jugs with spout and band handle, bottles and little bowls can be distinguished *(Fig. 6.1,6,10–19)*. Their characteristic decorations are finely incised lines or bunches of lines, or most frequently, fast amplitude bunches of wavy lines and their combinations were applied *(Fig. 6.10,11,13,15,17)*. This vessel type has long been known from graves, and for a long time researchers considered it as the only tableware of the Early Avar Age.[23] In the beginning even its origin and provenance was disputed,[24] but recent analyses, just like the following results, support that this type was produced in local workshops.[25] This vessel type is also known from settlements; it occurred in Dunaújváros-Öreghegy in a similar proportion, constituting 9% of the entire find material.[26] The grey pottery of the settlement of Kölked-Feketekapu even revealed that this ware type shows much more variability in terms of form than grave pottery.[27]

Sherds of the so-called poorer quality version of the characteristic grey pottery (type IB_1) also came to light in Daruszentmiklós. These have coarser raw materials and show inappropriate firing *(Fig. 4.2)*. These fragments were difficult to be associated with exact forms, therefore they could represent mugs/cups, bottles or little bowls *(Figs. 6.2–5,7–9)*. This poorer quality vessel type is also known among Transdanubian grave pottery,[28] and it not only differs from the earlier known IB_2 group technologically, but also in the spectrum of forms and distribution.[29]

Black pottery

The third and fourth type of wares is the so-called black pottery (type IC_2)[30] and its poorer quality variant (type IC_1).[31] The material of the sherds belonging to group IC_2 is fine, slightly sandy, sometimes showing small pebbles. Their color is black; however, their cross-section is often reddish, even in the case of vessels seemingly made from finer materials. Their surface is mostly smooth, sometimes chalk-like or slightly coarse, and wheel ribs can often be found on their inner surface *(Fig. 4.3)*. Their wall thickness is 0.3–1.1 cm, their forms can be reconstructed as pots, mugs/bowls or bottles, and their typical decoration is an incised bundle of lines *(Fig. 7.3,5,6)*.

The material of group IC_1 is coarser, frequently mixed with pebbles or grit, its firing is less

22 The typological classification of the known fast-wheeled vessels was carried out on the basis of Tivadar Vida's monograph evaluating the Early and Middle Avar Age grave pottery (Vida 1999).
23 Bialeková 1968; Vida 1999, 43.
24 Vida 1999, 43–44.
25 Bóna 1973, 75–76; Salamon – Duma 1982; Salamon – Duma 1984; Balla 1990.
26 Bóna 1973, 73–76.
27 Hajnal 2013.
28 Rosner 1979, 103, 105; Rosner 1981, 46–48; Vida 1999, 56–63.
29 Vida 1999, 42–43.
30 Vida 1999, 63–73.
31 Vida 1999, 63–72.

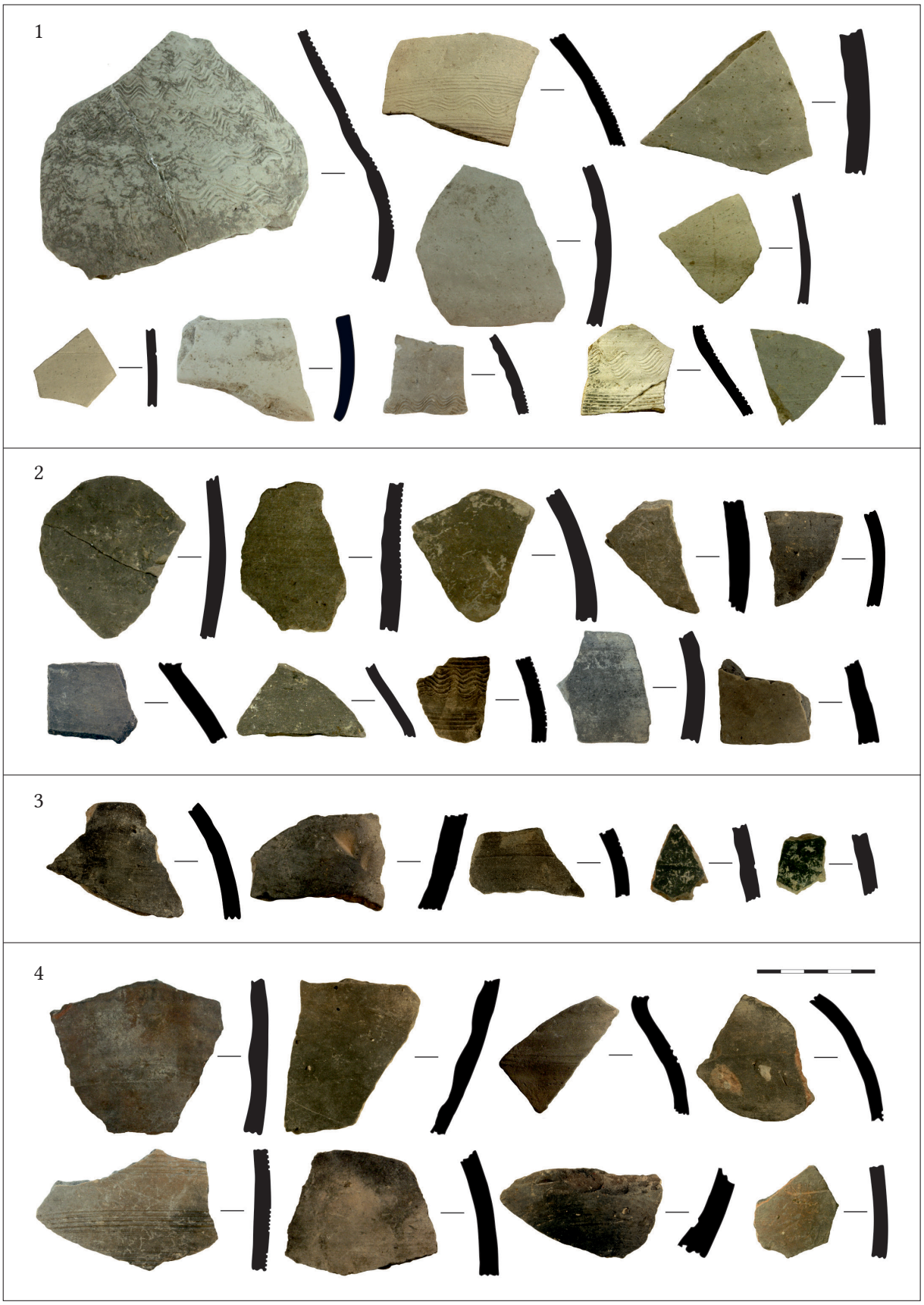

Fig. 4. Daruszentmiklós site F05. Archaeological classification of the fast-wheeled vessels. 1–2 – grey pottery IB_2 and IB_1, 3–4 – black pottery IC_2 and IC_1

even, its cross-section is always red. Thus it differs from the dark grey/black, often patchy internal and external surface *(Fig. 4.4)*. Their wall thickness is between 0.4–1.3 cm and decoration barely occurs on them. In terms of forms, small pots, mugs/cups and bowls can be distinguished *(Fig. 7.1,2,4)*.

"Dark red" pottery

One of the characteristics of the group named "dark red" by its color is that, although its material is well-prepared, it is often mixed with pebbles, grit or limestone of various sizes. Its firing is diverse; the interior and exterior almost always differ from the cross-section *(Fig. 5.1)*. Its surface is smooth or slightly coarse, and its interior surface frequently shows wheel ribs. The thickness of the sherds which can be classified into this group varies between 0.5–1.1 cm, and incised bundles of lines and/or wavy lines can be observed on their surface. Their forms can be reconstructed as pots and mugs or cups *(Fig. 8.7–12)*. Their tempering material, wall thickness, and partly their firing raised the possibility, even prior to ceramic analysis, that these sherds could be related to the poorer quality variants of black pottery.

"Yellowish-brown" pottery

The raw material of the so-called "yellowish-brown" pottery is fine sandy mixed with a few small pebbles or grit. Their firing is mixed, their surface is often patchy, yellowish brown, or light red, and their cross-section is usually grey *(Fig. 5.2)*. Their surface is smooth, perhaps with a small unevenness, and their wall thickness varies between 0.5–1.2 cm. They can be defined as pots or other thin-walled vessels, and they are decorated with incised bunches of lines and wavy lines *(Fig. 7.13–17)*. They may be associated with the so-called yellowish red pottery of the Danube-Tisza Interfluve (type IE); however, due to their fragmentary nature this cannot be decided certainly.

"Light red" or Late Antique pottery

Specimens of the so-called "light red" group were either made of very fine material or a slightly grainy and sandy material mixed with a small amount of grit or little pebbles. Oxidized firing is characteristic of them, but firing was homogeneous in only a few cases. Due to their small number, it is not reasonable to create a more detailed typology. However, they could be further divided not only by fineness and firing but also by color: a part of them is homogeneous light red, and another part of them is reddish brown, patchy *(Fig. 5.3)*. In the first case a smooth, chalk-like surface is typical, while in the other case the surface is smooth or coarse. Their wall thickness is between 0.4–0.8 cm, and incised bundles of lines and/or wavy lines appear on them as decorations. The sherds of the finer material group can be reconstructed as jugs or bottles and small mugs, and the coarser sherds as pots and bowls *(Fig. 8)*. They can most probably be classified as in the Byzantine-Balkanic and Late Antique pottery group IF in Transdanubian grave pottery,[32] the specimens of which were also present at the settlement of Kölked-Feketekapu, where both local imitations and imported sherds could be distinguished.[33]

Yellow pottery

By material and color, 12 sherds could be unambiguously classified to the group of the so-called Late Avar Age yellow pottery.[34] Their material is fine, usually without tempering, their

32 Vida 1999, 88–106.
33 Hajnal 2005.
34 Bialeková 1967; Garam 1969.

Fig. 5. Daruszentmiklós site F05. Archaeological classification of the fast-wheeled vessels. 1 – "dark red" pottery, 2 – "yellowish brown" (IE?) pottery, 3 – "light red" (IF?) pottery, 4 – yellow pottery

firing is oxidized in homogeneous good quality, their color is yellowish red, their surface is smooth and chalk-like, and their decoration consists of finely incised bundles of lines *(Fig. 5.4)*. The wall thickness of the sherds is between 0.5–1 cm, but the small sherds do not allow the identification of the vessel types they represent.

Slow-wheeled pottery

By macroscopic analyses slow-wheeled pottery could be classified into six groups (Fabrics L1–L6), which however did not differ from each other as clearly as slow-wheeled wares. The most characteristic feature of the six groups was the amount of the visible tempering material, while the method and quality of firing only played a role in the case of two groups. The specimens of the finest-looking material group contained little amounts of tempering materials, their firing was relatively homogeneous, and they can be reconstructed as pots and thin-walled vessels (cups/mugs) (Fabrics L1–L4). Most of the slow-wheeled sherds belonged to pots and bowls *(Fig. 9.1–6, Fig. 10)*, and coarser fabrics (L5–L6) contained sherds of storage vessels and baking bells as well *(Fig. 9.7–13)*. Most of the slow-wheeled material groups can be characterized by mixed, patchy firing and uneven surface elaboration, although traces of the wheel-thrown technique appear on the external surface in many cases *(Figs. 9–10)*.

Hand-made and post-wheeled vessels

No material groups have been distinguished in the case of hand-made and post-wheeled vessels because, although their material was similar to slow-wheeled vessels, it seems that their composition was even more random. With respect to forms, hand-made vessels were represented by cups/mugs, small pots, pots, lids, bowls, storage vessels, baking bells, and in an uncertain case a cauldron could be observed *(Figs. 12–13)*. Irregularly incised lines, wavy lines and bunches of wavy lines, comb-impressed patterns are their typical decorations. The edge of the rim is also frequently decorated with stabbed or comb-, finger- or nail-impressed patterns *(Fig. 13.7–10)*.

Chronological conclusions

Since the fast-wheeled vessel types that can be associated with grave pottery cover the entire Avar period, in the future the use time of the settlement section can be specified based on the percentage of the various types and their common occurrence within certain features. Based on the preliminary evaluation, the vessels date the settlement to the middle or the second half of the 7th century; however, due to the presence of the yellow ware, the possibility of its use at the end of the 7th century and beginning of the 8th century cannot be excluded based on our present knowledge *(Fig. 14)*.

Petrographic analysis of ceramics

Fifty-eight ceramics were chosen for petrographic analysis, namely 8 hand-formed, 23 slow-wheeled and 27 fast-wheeled vessels (see Catalogue).[35] During sample selection our aim was to include as many vessel types as possible in order to compare the technological characteristics and raw materials of the main vessel groups (hand-formed, slow-wheeled, fast-wheeled).

35 Petrographic analysis was carried out in two phases. In 2011 43 samples were analysed (8 hand-formed, 20 slow-wheeled and 15 fast-wheeled), then in 2016 a further 15 samples (3 slow-wheeled and 12 fast-wheeled) were analysed in thin sections.

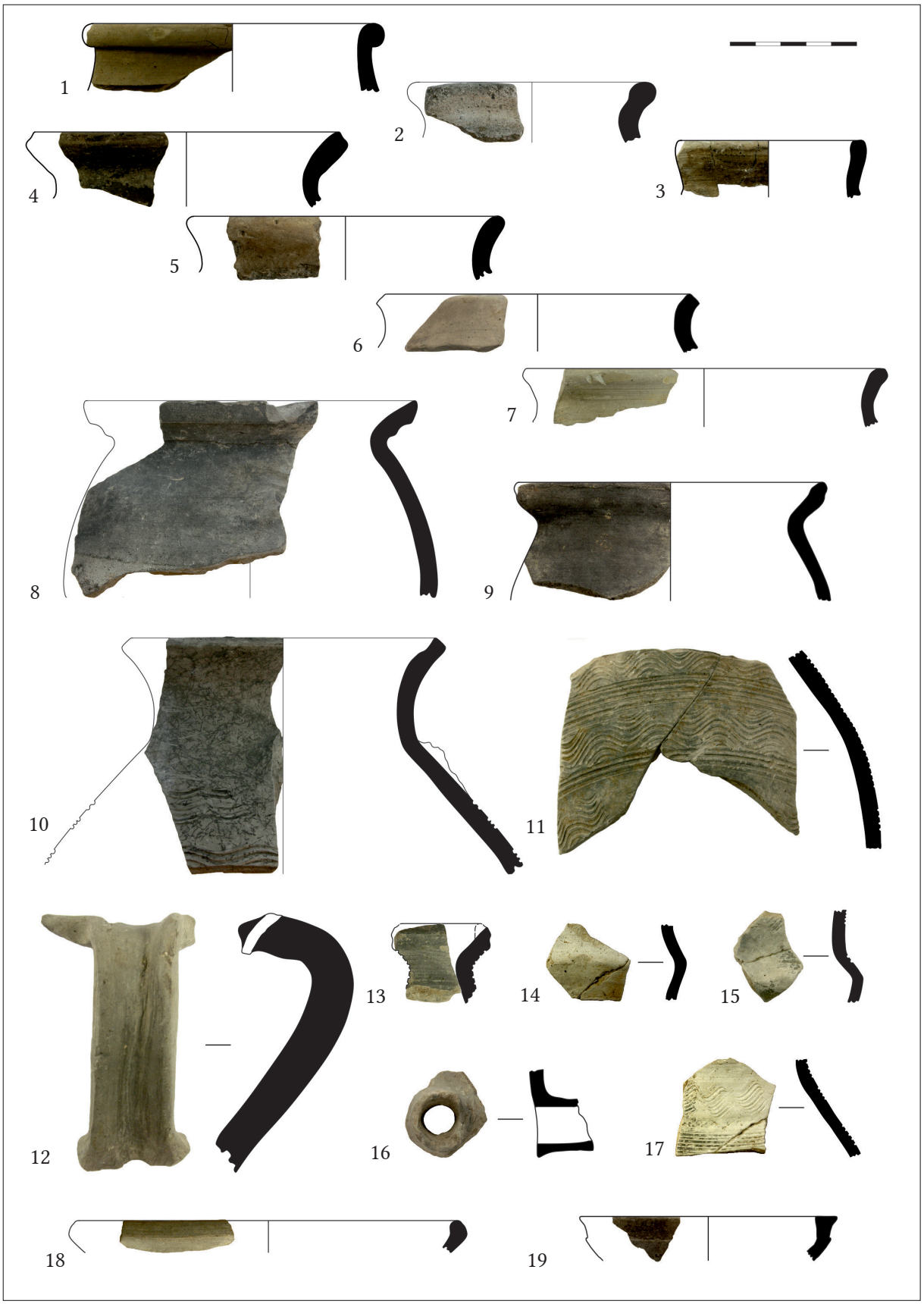

Fig. 6. A selection of the fast-wheeled grey pottery (IB_{1-2}) of Daruszentmiklós site F05. 1–9 – mugs/cups, pots of various sizes, 10–17 – jugs and pots with spout and band handle, 18–19 – little bowls

In light of these results a second sampling was also carried out, focusing mainly on fast-wheeled vessels in order to better understand their organization of production.

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.[36] 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.

Fabric 1

Six samples belong to this group *(Fig. 15)*.

- fast-wheeled: pots (*9* = 7.2009.563, *18* = 7.2009.1011, *35* = 7.2009.2482, *38* = 7.2009.2655, *53* = 7.2009.625) and a bottle (*29* = 7.2009.1955)

The raw materials of these vessels are well distinguishable. The fabrics are very fine "clean", which contain hardly any observable inclusions using a polarizing microscope. The raw materials of the ceramics contain naturally present calcareous inclusions. The amount of non-plastic inclusions is sparse (~3–7%), the dominant size of inclusions is very fine (0.02–0.1 mm). The fabrics are dense, indicating that the raw materials were well prepared. The pores are rounded, subrounded and elongated, their size varies between 0.03–0.9 mm. The fabrics are serial and the inclusions are oriented. The size of inclusions is very well sorted. The raw materials are naturally calcareous, in which mainly subangular and subrounded monocrystalline quartz and muscovite mica appear. Rare amounts of polycrystalline quartz also appear. Accessory inclusions are opaque minerals and iron oxide nodules. These ceramics were most probably not tempered, and their raw materials may have been levigated.

Fabric 2

Sixteen samples belong to this group *(Figs. 16–17)*.

- fast-wheeled: pots and undiagnostic vessel fragments (*2* = 7.2009.76, *16* = 7.2009.906, *34* = 7.2009.2480, *57* = 7.2009.1242, *58* = 7.2009.1291, *55* = 7.2009.768, *59* = 7.2009.1295, *61* = 7.2009.1302, *63* = 7.2009.2137); bowls (*28* = 7.2009.1710, *32* = 7.2009.2074); mug (*60* = 7.2009.1300)
- slow-wheeled: pots (*20* = 7.2009.1257, *30* = 7.2009.2011, *51* = 7.2009.91)
- hand-formed: baking bell (*24* = 7.2009.1611)

According to their compositions the samples are classified into four subgroups. From the fast-wheeled vessels three pots, a vessel and a mug (2, 16, 58, 60, 61) belong to Fabric 2a *(Fig. 16)*, which is a sandy and also naturally calcareous raw material. Fabric 2b *(Fig. 16)* is also a sandy raw material with rare amounts of naturally present calcareous inclusions. A fast-wheeled (34) and two slow-wheeled (20, 30) pots, a fast-wheeled bowl (28), and two fast-wheeled vessels (55, 63) belong to this group. Fabric 2c *(Fig. 17)* is a better sorted finer sandy fabric than the previous fabrics, but it also has rare amounts of naturally present calcareous inclusions.

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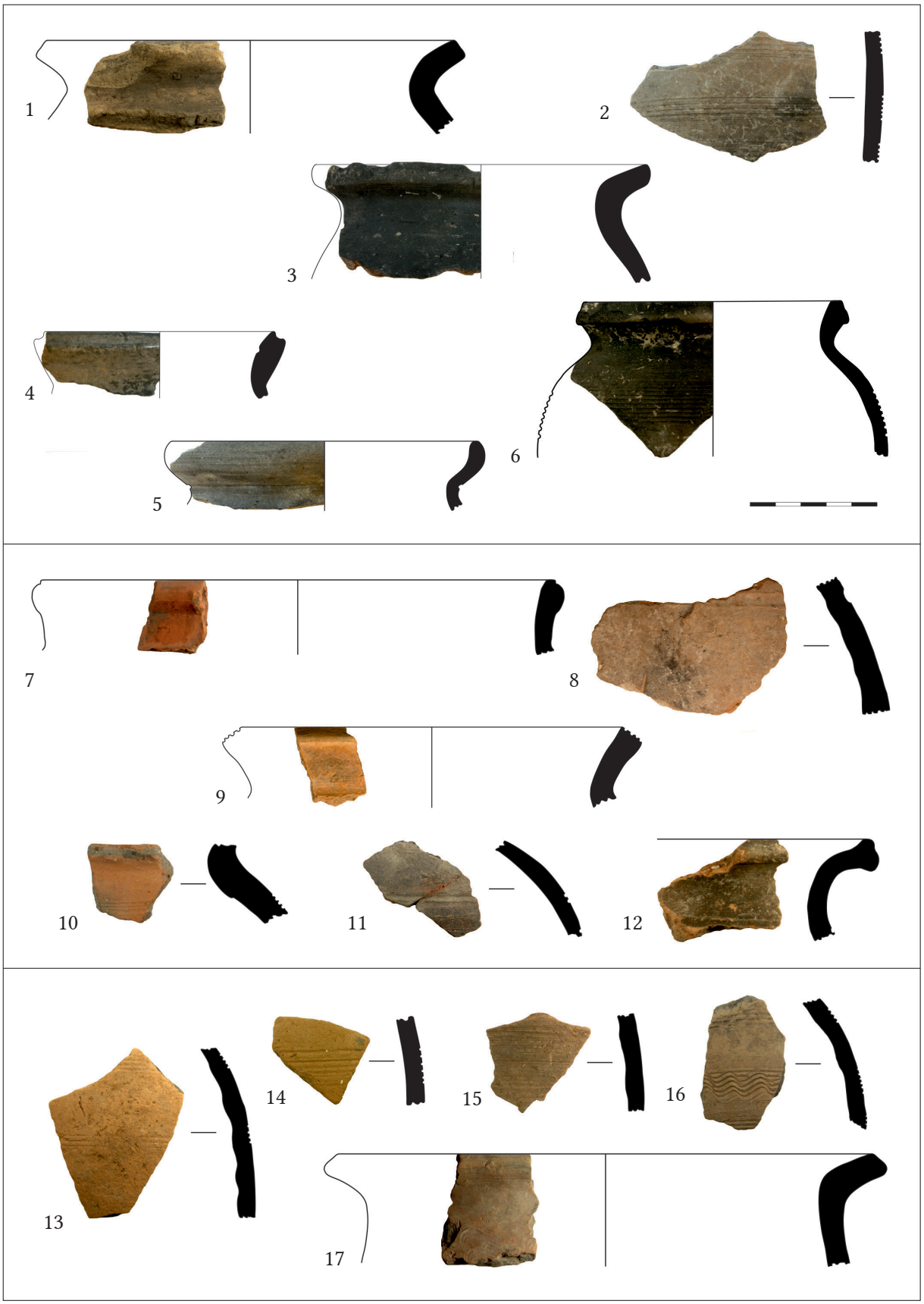

Fig. 7. A selection of the fast-wheeled mugs/cups and pots of Daruszentmiklós site F05. 1–6 – black pottery (IC_{1-2}), 7–12 – "dark red" pottery, 13–17 – "yellowish brown" pottery

This group is represented by a fast-wheeled bowl (32), a slow-wheeled pot (51), a fast-wheeled pot (57) and a fast-wheeled vessel (59). Fabric 2d *(Fig. 17)* is also sandy with rare calcareous inclusions, although the baking bell (24) is also tempered with vegetal material.

Compared to Fabric 1, in Fabric 2 the amount of non-plastic inclusions is higher. Ceramics in Fabric 2 were made from very fine grained raw materials, although there are minor differences among the ceramics in terms of the amount of sand and calcareous inclusions. It seems that raw materials are naturally sandy and calcareous; although Fabrics 2b and 2d may have been tempered, because in some samples the inclusions are grouped in clusters, which may indicate that these ceramics were tempered with sparse amounts of sand but the potters did not homogenize the raw materials properly. The characteristic of Fabric 2 is that the amount of non-plastic inclusions is moderate (~10–19%), the dominant grain size falls in the very fine category (0.02 – 0.1 mm). The fabrics are dense and well prepared. Pores are elongated, rounded or irregular, their size varies between 0.04 and 1.4 mm. The inclusions are slightly oriented, the fabrics are serial (0.03–0.2). Inclusions are moderately sorted. Samples show different amounts of calcareous inclusions and mainly subangular, subrounded, monocrystalline quartz and muscovite mica. Rare amounts of polycrystalline quartz, plagioclase feldspar, and orthoclase feldspar also appear. Accessory minerals include opaque minerals, iron oxide nodules, amphibole, tourmaline, zircon, epidote, pyroxene and microcrystalline quartz.

Fabric 3

Twelve samples belong to this group *(Figs. 17–19)*.

- *slow-wheeled:* pots (*7* = 7.2009.444, *14* = 7.2009.782, *15* = 7.2009.793, *19* = 7.2009.1187, *23* = 7.2009.1503, *26* = 7.2009.1674, *33* = 7.2009.2443)
- *hand-formed*: baking cover (*1* = 7.2009.31.1); pot (*3* = 7.2009.284, *4* = 7.2009.285, *6* = 7.2009.366, *10* = 7.2009.583)

According to their compositions, samples are divided into five subgroups. The main difference between the subgroups is that, apart from naturally present calcareous inclusions and sand, some of the samples also contain pebble, grog and vegetal tempering. Fabric 3a *(Fig. 17)* is represented by a baking bell (1) and two pots (4, 6). These samples are tempered with sand, pebble and grog. Fabric 3b *(Fig. 18)* is also tempered with sand, grog and argillaceous rock fragments (hard clay fragments). This fabric is represented by two hand-formed (3, 10) and one slow-wheeled (23) pots. Fabric 3c *(Fig. 18)* is also tempered with sand and grog. This fabric is represented by five slow-wheeled pots (7, 14, 15, 26, 33). Fabric 3d *(Fig. 19)* is tempered with sand, pebble, grog and vegetal material. Only a slow-wheeled pot (19) belongs to this group.

Compared to Fabric 2, this group is coarser; in the samples clayey/calcareous concretions appear, thus Fabric 3 is characteristically distinct from the previous fabrics. Fabric 3 shows differences in sand tempering as well. For example, samples 10 and 23 contain less sand than the other ceramics in this group. The main characteristic of Fabric 3 is that the amount of non-plastic inclusions is moderate or common (~10–19%; 20–29%), the dominant grain size is very fine and fine (0.02–0.25 mm). The fabrics are slightly porous, the pores are elongated, irregular or rounded, their size varies between 0.04–1 mm. Non-plastic inclusions are slightly oriented, the grain size distribution is hiatal (0.03–0.1 mm; 0.2–3 mm). Inclusions are poorly or moderately sorted.

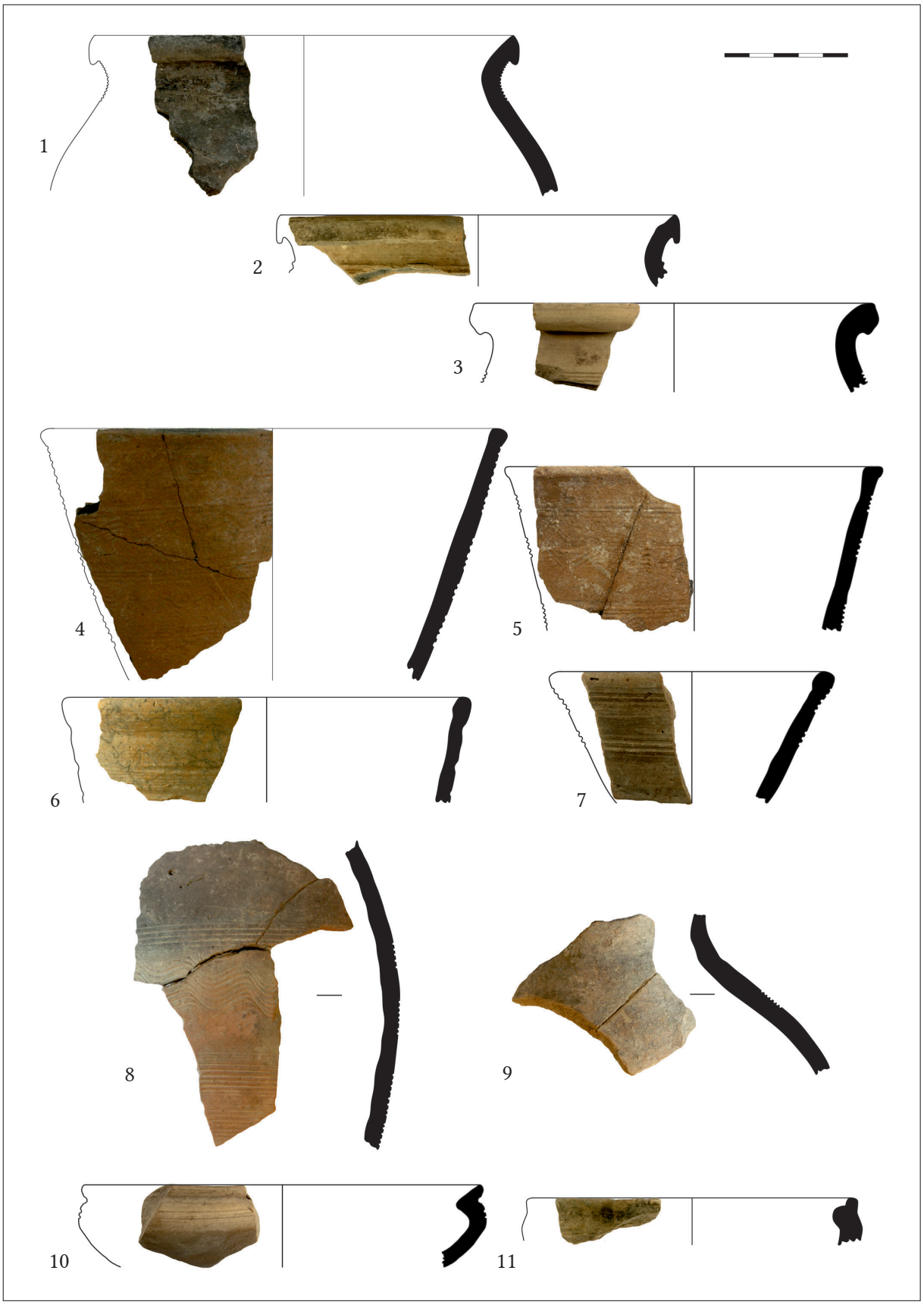

Fig. 8. A selection of the fast-wheeled "light red" or Late Antique (IF) pottery of Daruszentmiklós site F05. 1–3 – pots, 4–7, 10–11 – mugs/bowls, 8–9 – jugs/bottles

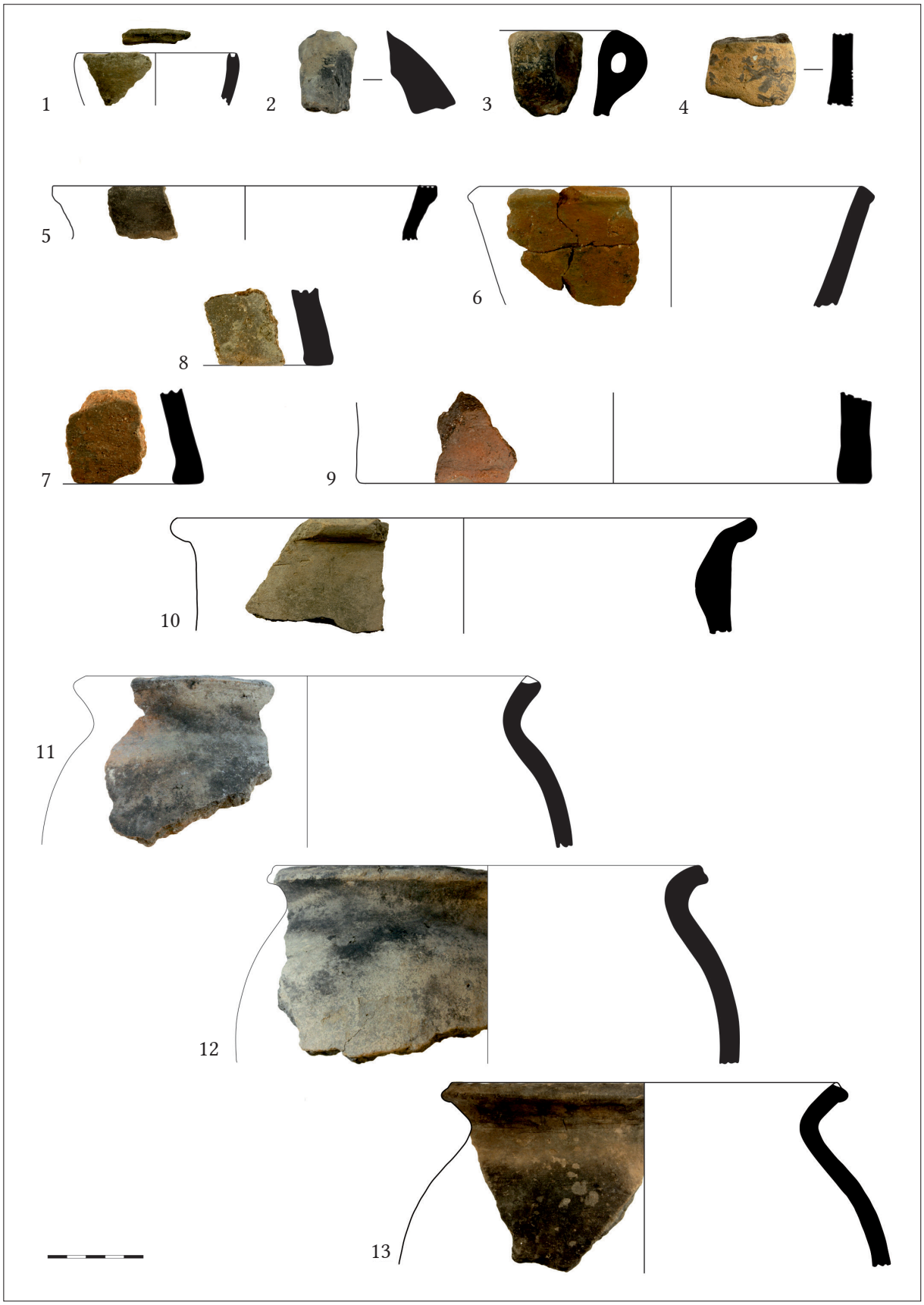

Fig. 9. A selection of the slow-wheeled pottery of Daruszentmiklós site F05. 1: cup. 2–3 – vessels with handle, 4 – jug/bottle, 5–6 – bowls, 7–9 – baking bells, 10 – cauldron (?), 11–13 – large pots/storage vessels

Fig. 10. A selection of the slow-wheeled pottery of Daruszentmiklós site F05. 1–17 – pots of various forms

As opposed to Fabric 2, this fabric is not calcareous but the sand used for tempering it contained calcareous inclusions (The size of calcareous inclusions is similar to that of the sand used for tempering). The majority of inclusions are angular, subangular and subrounded monocrystalline quartz, muscovite and clayey/calcareous concretions. Rare amounts of polycrystalline quartz, plagioclase and orthoclase feldspar, grog and argillaceous fragments, metamorphic fragments, sandstone, granitic fragments and mollusc fragments (1, 3) appear. Accessory minerals include opaque minerals, iron oxide nodules, tourmaline, rutile, amphibole, zircon, epidote, microcrystalline quartz and garnet.

Fabric 4

Eight samples belong to this group *(Fig. 19)*.

- *fast-wheeled:* pots (*12* = 7.2009.760, *17* = 7.2009.932, *27* = 7.2009.1709, *37* = 7.2009.2547, *42* = 7.2009.3005, *54* = 7.2009.762, *56* = 7.2009.1212, *64* = 7.2009.3091)

According to their compositions, the samples are divided into three subgroups. The main difference between the subgroups is that they were tempered with different types of sand. Fabric 4a includes fast-wheeled vessels (12, 56, 64), the inclusions in these vessels are very well sorted. Fabric 4b (17, 37, 42, 54) is represented by pots. In their sandy raw materials, sparse amounts of muscovite can be observed. Fabric 4c (27) also has a sandy raw material but without muscovite; rare amounts of granitic fragments also appear (0.4–1.4 mm). Thus, this raw material may be from a different source. Fabric 4a does not contain muscovite either, but in 4a the dominant size range is larger and grain size distribution is better.

In general, in Fabric 4 the grain size distribution is very good; potters used very well prepared raw materials. In one pot (37) rare amounts of clayey/calcareous concretions appear, while in another pot (27) rare granitic fragments also appear. The main characteristics of Fabric 4 is that the amount of non-plastic inclusions is common (~20–29%), the dominant grain size is very fine and fine (0.02–0.25 mm). The fabrics are slightly porous, the pores are elongated, irregular or rounded, their size varies between 0.05–1 mm. Non-plastic inclusions are slightly oriented, the grain size distribution is serial (mainly 0.03–0.25 mm). Inclusions are well sorted. The majority of inclusions are angular, subangular and subrounded monocrystalline quartz. Muscovite also appears just as rare amounts of polycrystalline quartz, plagioclase and orthoclase feldspar, clayey/calcareous inclusions (37) and granitic fragments (27). Accessory minerals also appear, such as opaque minerals, iron oxide nodules, tourmaline, rutile, amphibole, zircon, epidote, microcrystalline quartz and garnet. The ceramics in this fabric were made from very well prepared raw materials.

Fabric 5

Three samples belong to this group *(Fig. 20)*.

- *slow-wheeled:* pots (*21* = 7.2009.1345, *50* = 7.2009.35, *52* = 7.2009.487)

There are two subgroups in this fabric. Fabric 5a (21, 50) is characterized by well-rounded fine to medium sand tempering. The raw materials of the samples are coarser than other sand tempered fabrics. Calcareous inclusions and clayey/calcareous concretions could have been part of the sand used for tempering. The sand is mainly calcareous (~70–80%) for Fabric 5b (52) in which mollusc fragments are also present.

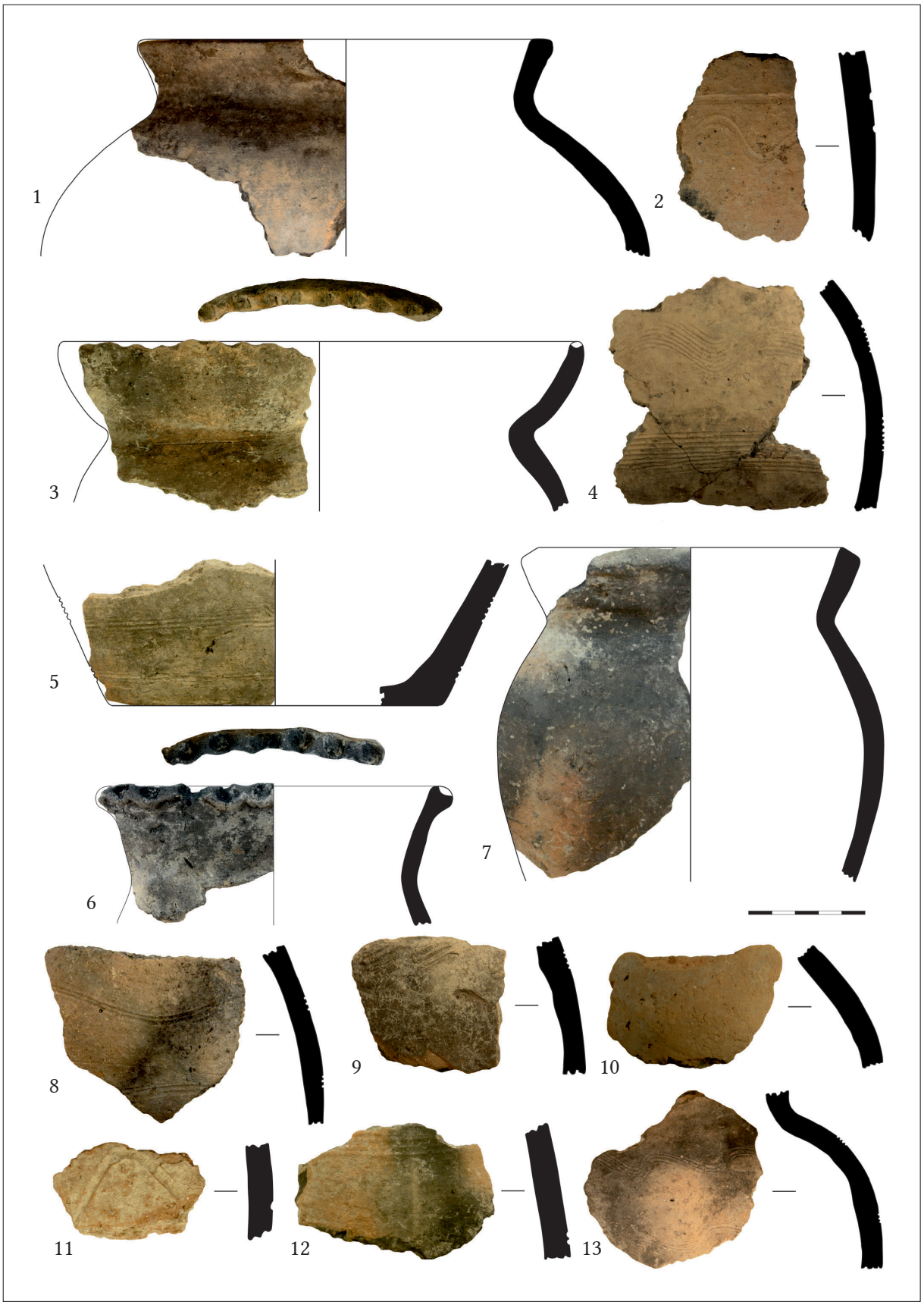

Fig. 11. A selection of the „post-wheeled" pottery of Daruszentmiklós site F05. 1–13 – pots and storage vessels

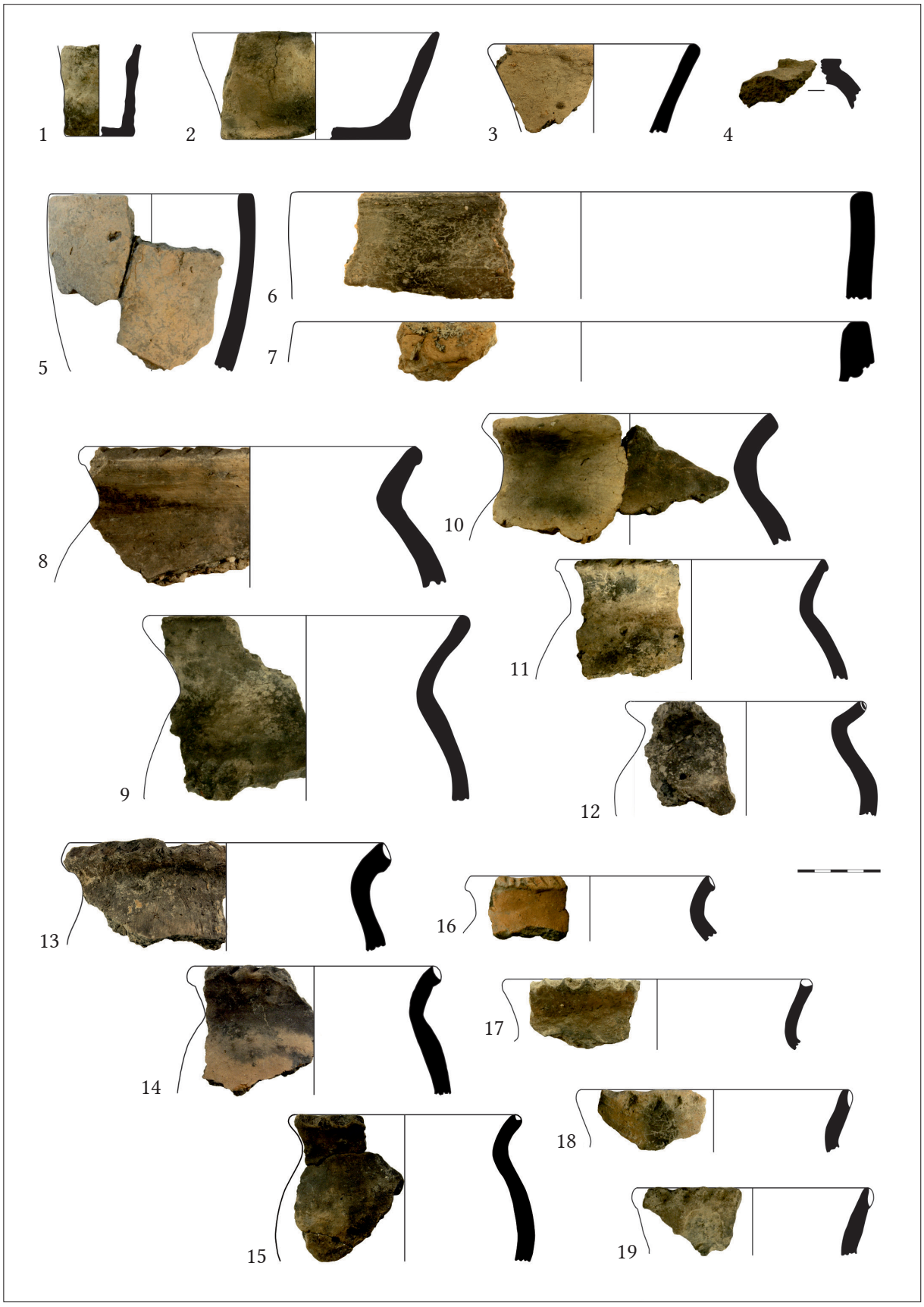

Fig. 12. A selection of the hand-formed pottery of Daruszentmiklós site F05. 1. miniature vessel. 2–3 – cups/mugs, 4 – lid, 5–7 – bowls, 8–19 – pots

The amount of inclusions in Fabric 5 is common (~20–29%), the dominant grain size is very fine to medium (<0.1–1 mm), grain size distribution is bimodal (0.05–0.2 and 0.3–0.8 mm). The ceramics are slightly porous, their shape is irregular, their size varies between 0.05–0.8 mm. The fabrics are slightly oriented, the inclusions are well rounded and moderately sorted. The majority of inclusions are angular, subangular and subrounded monocrystalline quartz, and in the case of Fabric 5b well-rounded calcareous inclusions are characteristic. Sparse amounts of muscovite also appear. There are rare amounts of polycrystalline quartz, plagioclase and orthoclase feldspar, granitic fragments and clayey/calcareous concretions. Accessory minerals include opaque minerals, iron oxide nodules, tourmaline, amphibole, epidote, microcrystalline quartz and garnet. Feldspars altered to clay minerals, and their iron content was converted to hematite.

Fabric 6

Five samples belong to this group *(Fig. 20)*.

- *slow-wheeled:* pot (*5* = 7.2009.301, *11* = 7.2009.641, *13* = 7.2009.781, *31* = 7.2009.2016)
- *hand-formed:* baking bell (*25* = 7.2009.1623)

Samples are classified into two subgroups. Fabric 6a is a calcareous raw material tempered with rock fragments. Slow-wheeled pots (11, 13, 31) were also tempered with more sand, while the hand-formed baking pot (25) was tempered with less sand. Fabric 6b contains a slow-wheeled pot (5) which was tempered with rock fragments, sand and grog.

The main characteristics of Fabric 6 is that the amount of non-plastic inclusions is sparse to moderate (~3–19%), the dominant grain size is very fine (0.1> mm). Grain size distribution is hiatal, it has two maxima (0.03–0.1 mm; 0.3–2 mm). Fabrics show elongated cracks, and larger rock fragments are also surrounded by cracks. The fabrics are porous, the pores are elongated and irregular, and their size varies between 0.03 and 1 mm. Fabrics show a slight orientation. Inclusions are poorly sorted. The raw materials are naturally calcareous in which angular, subangular, subrounded and rounded monocrystalline quartz dominates. There are sparse amounts of polycrystalline quartz, and rare amounts of muscovite, plagioclase and orthoclase feldspar, biotite, granitic fragments, sandstone, metamorphic fragments and clayey/calcareous concretions. Accessory minerals include opaque minerals, iron oxide nodules, tourmaline, amphibole, epidote, rutile, microcrystalline quartz and garnet. Feldspars altered to clay minerals, microcrystalline quartz grains are hematitic, and some quartz grains contain chlorite inclusions.

Fabric 7

Seven samples belong to this group *(Fig. 21)*.

- *slow-wheeled:* pots (*36* = 7.2009.2521, *39* = 7.2009.2922, *43* = 7.2009.2877)
- *hand-formed:* pots (*8* = 7.2009.497, *40* = 7.2009.2942, *41* = 7.2009.2966); bowl (*22* = 7.2009.1347)

This fabric is distinguished from Fabric 6 in that, even though Fabric 7 is similarly tempered with rock fragments and sand, in this fabric there are no calcareous inclusions. Thus, the raw material source of Fabric 7 is different from that of Fabric 6. There are two subgroups. Fabric 7a included hand-formed pots (8, 41) a hand-formed bowl (22) and slow-wheeled pots (36, 39, 43). These vessels were tempered with sand and rock fragments, while the hand-formed pot (40) in Fabric 7b was tempered similarly and also with grog.

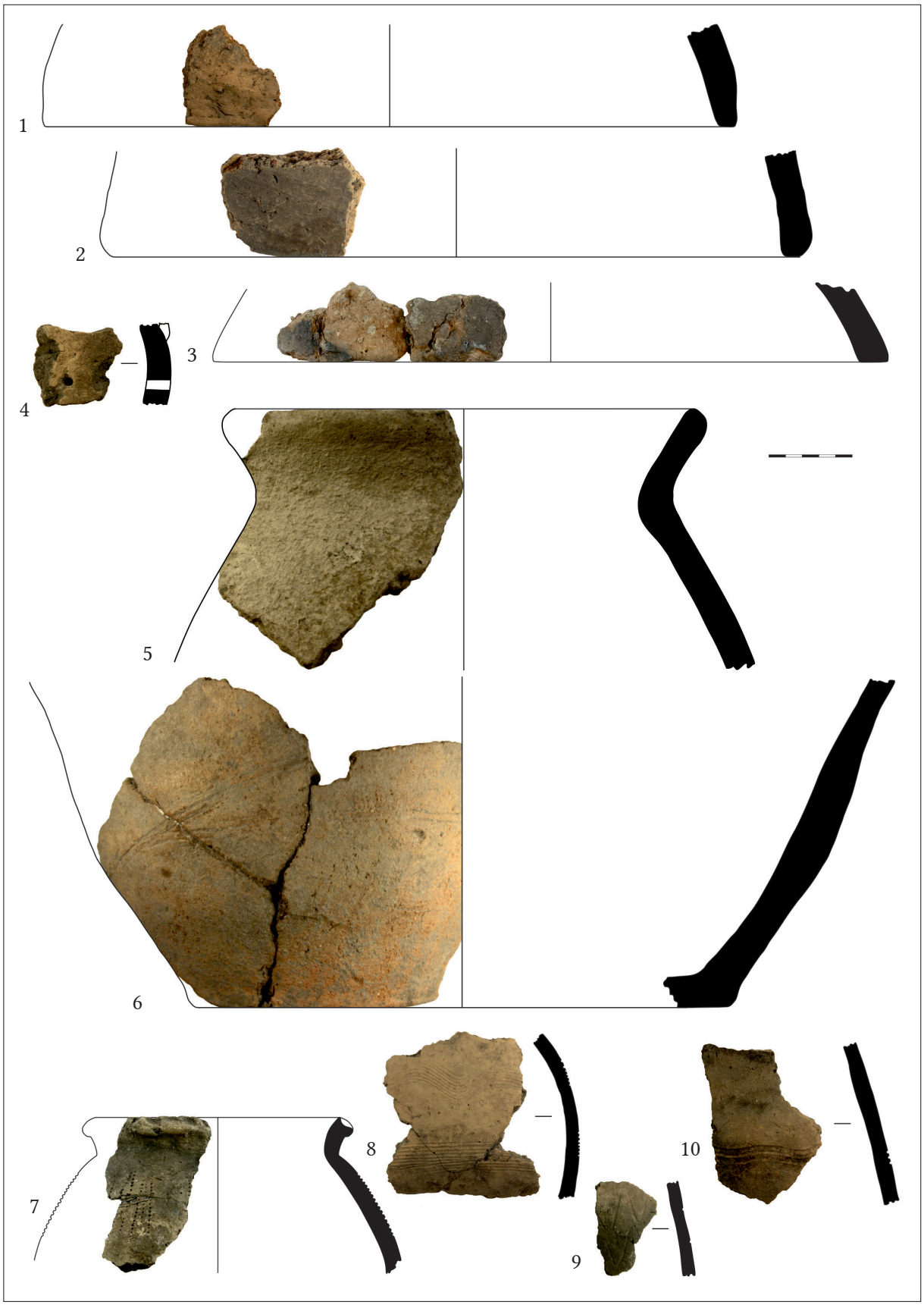

Fig. 13. A selection of the hand-formed pottery of Daruszentmiklós site F05. 1–3 – baking bells, 4 – cauldron, 5–6 – storage vessels, 7–10 – decorations on hand-formed vessels

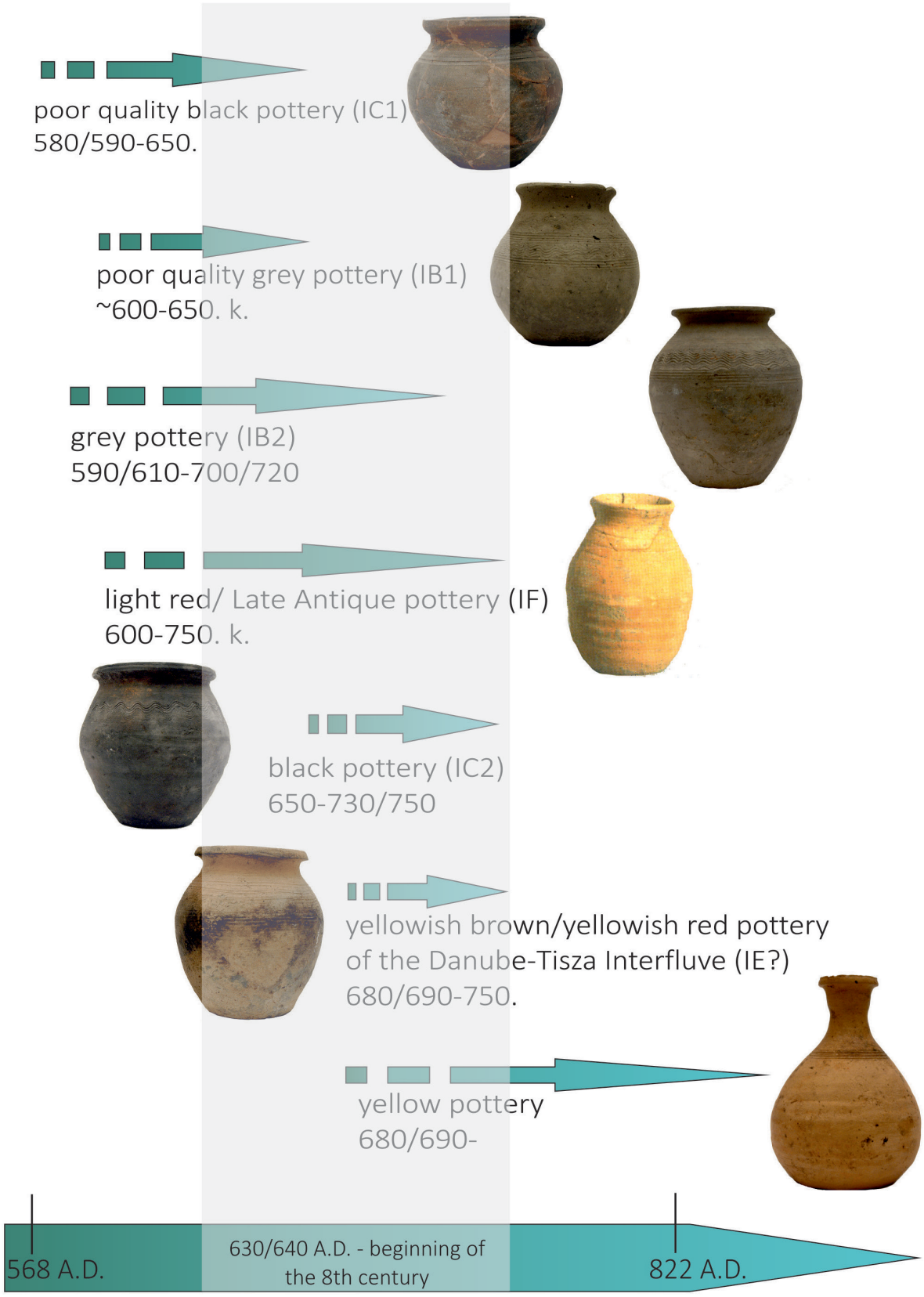

Fig. 14. The most probable use time of the site based on the traditional typochronology of Avar Age fast-wheeled grave pottery

The main characteristic of Fabric 7 is that the amount of non-plastic inclusions is sparse to moderate (~7–15%), the dominant grain size is very fine and fine (0.3–0.25 mm). Grain size distribution is hiatal, it shows two maxima (0.03–0.2 mm; 0.4–2 mm). Pores are irregular and elongated, their size is 0.04–2 mm. Inclusions are poorly sorted. The majority of inclusions are angular, subangular and subrounded monocrystalline quartz, although in one pot (41) polycrystalline quartz dominates. Sparse amounts of rock fragments (granitic, andesite) also appear. There are rare or sparse amounts of polycrystalline quartz and muscovite, rare amounts of plagioclase and orthoclase feldspar and biotite. Accessory minerals include opaque minerals, iron oxide nodules, tourmaline, zircon, amphibole, epidote, garnet, microcrystalline quartz and quartz with equigranular texture. Some of the feldspars are perthitic and partially replaced by clay minerals, and biotite grains are also altered. In one of the pots (41) polycrystalline quartz dominates.

Fabric 8

One sample belongs to this group *(Fig. 21)*.

- *fast-wheeled:* pot (*62* = 7.2009.1333)

The raw material of the pot belonging to this fabric is different from the previous ones. However, some of its features are similar to sample 23 in Fabric 3 and also to the composition of grog in sample 3. Fabric 8 however does not contain sand and grog tempering, only argillaceous fragments. The amount on non-plastic inclusions is moderate (~10–15%), the grain size is mainly very fine, although sparse amounts of fine grains also appear (0.1–0.15 mm). Inclusions are well sorted although well rounded, 0.5–3 mm argillaceous inclusions also appear. The amount of inclusions within these fragments is around 30%, thus more than in the ceramic's fabric. This indicates that argillaceous fragments represent a different raw material. Therefore, these hard clay fragments may have been added as temper. The majority of inclusions are subangular monocrystalline quartz. Sparse amounts of muscovite, and rare amounts orthoclase feldspar, epidote and mollusc fragments, also appear.

Correlations between raw materials, vessel building techniques and ceramic types

Fast-wheeled ceramics

Based on macroscopic observations, 27 vessels were made by the fast wheel among the investigated samples.

From Fabric 1 five pots (9, 18, 35, 38, 53) and a bottle (29); from Fabric 2 nine pots and undiagnostic vessels (2, 16, 34, 55, 57, 58, 59, 61, 63), two bowls (28, 32) and a mug (60); from Fabric 4 eight pots (12, 17, 27, 37, 42, 54, 56, 64); and from Fabric 8 a pot (62) was made by the fast wheel. It is worth mentioning that in the case of three sherds of Fabric 5 (21, 50, 52) it could not be determined by technological features whether they were fast- or slow-wheeled; however, due to their textural similarities they can rather be connected to slow-wheeled samples.

Fabric 1 only contains fast-wheeled vessels with very fine grained, untempered "clean" raw materials. Grey (IB_2) (18, 29, 53) and yellow (9, 35, 38) vessels show very similar raw materials petrographically *(Fig. 22)*, therefore it is highly likely that they were made from very similar or identical raw materials. As a result, it seems that the raw materials of

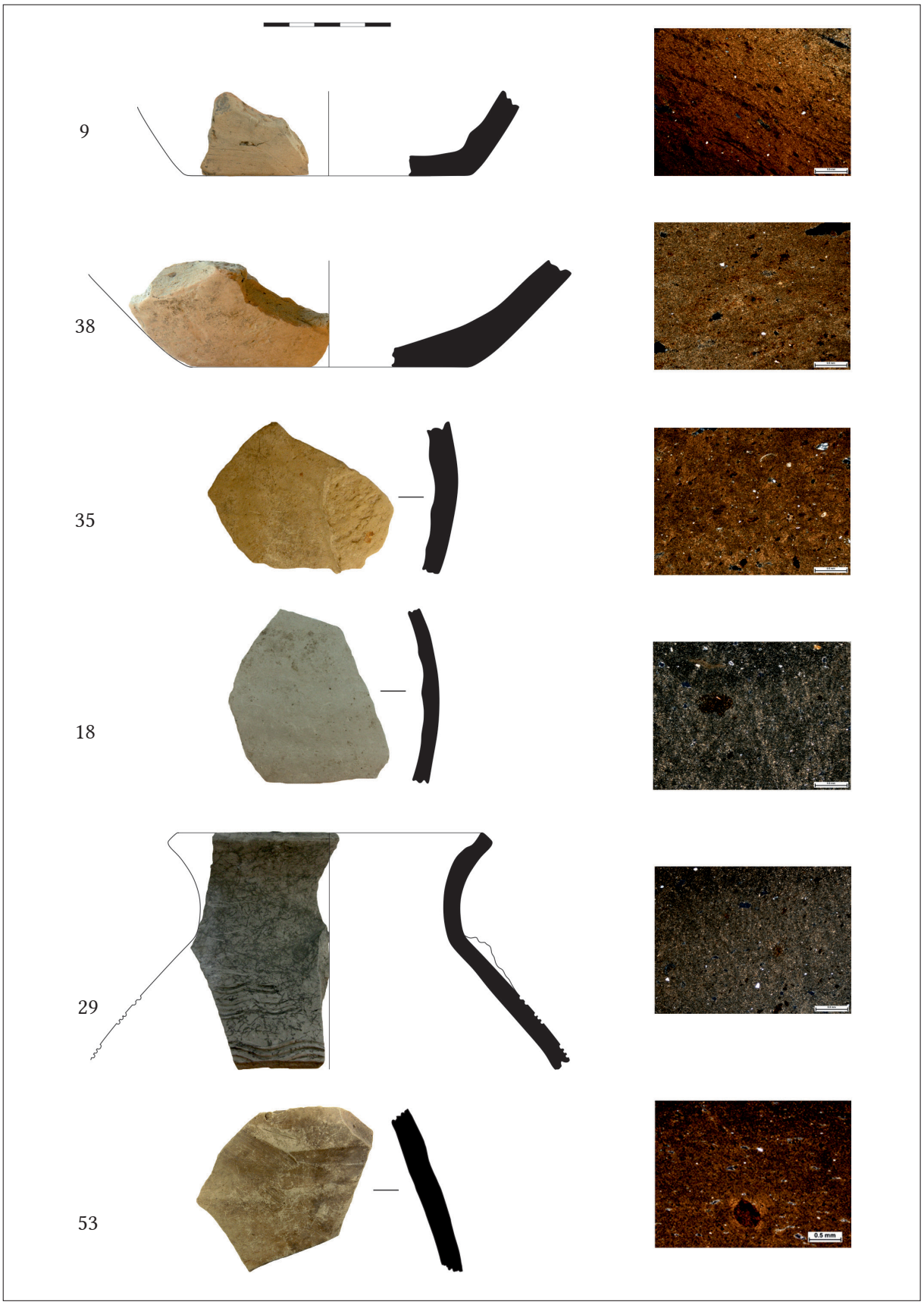

Fig. 15. Petrographic analysis of pottery from Daruszentmiklós site F05. Fabric 1

Fabric 1 were suitable for the production of both grey and yellow vessels. In this group only one sherd (53) could not be classified certainly: due to the heterogeneity of its firing it occurred that this sherd may belong to the so-called poorer quality group of grey pottery (IB_1), although its raw material is similar to that of the fine grey (IB_2) and yellow pottery. Ceramic analysis confirmed that in the case of grey pottery a choice in raw material is more important than firing. Therefore, good quality, carefully prepared vessels that were rather heterogeneously fired to beige instead of homogeneous grey could be made from the same material as yellow and fine grey ceramics (IB_2), or even produced in the same workshop.

Vessels in Fabric 2 were also made from very fine grained raw materials. These raw materials however are naturally sandy or perhaps tempered with sparse amounts of sand (2, 16, 28, 32, 34, 55, 57, 58, 59, 60, 61, 63). However, this group also contains slow-wheeled (20, 30, 51) and hand-formed (24) vessels *(Fig. 23)*. In addition, the typological distribution of these fast-wheeled vessels is not as certain as in the case of Fabric 1. Based on the classification, five vessels (2, 16, 28, 32, 34) belong to the group of the poorer quality of "light red" or Late Antique pottery (IF), four sherds (57, 58, 59, 61) belong to the group of "yellowish brown" or yellowish red pottery of the Danube-Tisza Interfluve (IE), and three small sherds (55, 60, 63) belong to the poorer quality group of grey pottery (IB_1). According to archaeological typology the three slow-wheeled sherds belong to two finer material groups (L1 and L3), and the rim fragment of a hand-formed but relatively carefully prepared baking bell was also made from a similar raw material. In the case of this latter sherd, without analysis it could not be suspected that it was made from very similar raw material to the above-listed fast- and slow-wheeled vessels, since it also contained vegetal tempering, which could be observed on its cross-section. Thus, among the fabric groups containing fast-wheeled vessels the secound petrographic group is the most heterogeneous, both in terms of pottery technology and typology. The quality of the fast-wheeled vessels belonging here is not as good as the vessels of fabric 1; their production was not so consistent, thus more than just one or two types of vessels were made from a certain raw material. Although specialized knowledge may have been necessary for their production, in the case of all three vessel types it is possible that they were made as copies of better quality wares.

Even though the raw materials of vessels in Fabric 4 are coarser than in Fabrics 1 and 2, and were tempered with fine sand, Fabric 4 still shows careful raw material preparation, and vessels in this fabric were exclusively made on the fast wheel. Three sherds (17, 27, 42) could be classified as the poorer quality of grey pottery (IB_1), two sherds (37, 54) as black pottery (IC_2), one sherd (12) as the poorer quality of black pottery (IC_1), and two sherds (56, 64) as "dark red" pottery *(Fig. 22)*. The similarity of the material of the first three typological groups was striking, and thus their classification was quite uncertain on the basis of the small sherds found at the settlement. Since it is typical of the poorer quality variant of the black pottery that it was fired to dark red, it occurred that "dark red" sherds were also related to black pottery, only their firing was of poorer quality. Ceramic analysis support that these vessel types were indeed related; they could even be made from very similar raw materials or possibly in the same workshop.

The only sherd of Fabric 8 did not show similarity to any other pottery samples. In addition, it could not only be distinguished by its raw material but also by typology. From a typological perspective, this sherd could be connected to the so-called "light red" pottery or the group of the Late Antique pottery (IF): it formed a typological group that could be distinguished well by its thin wall, fine elaboration, and homogeneous firing *(Fig. 22)*.

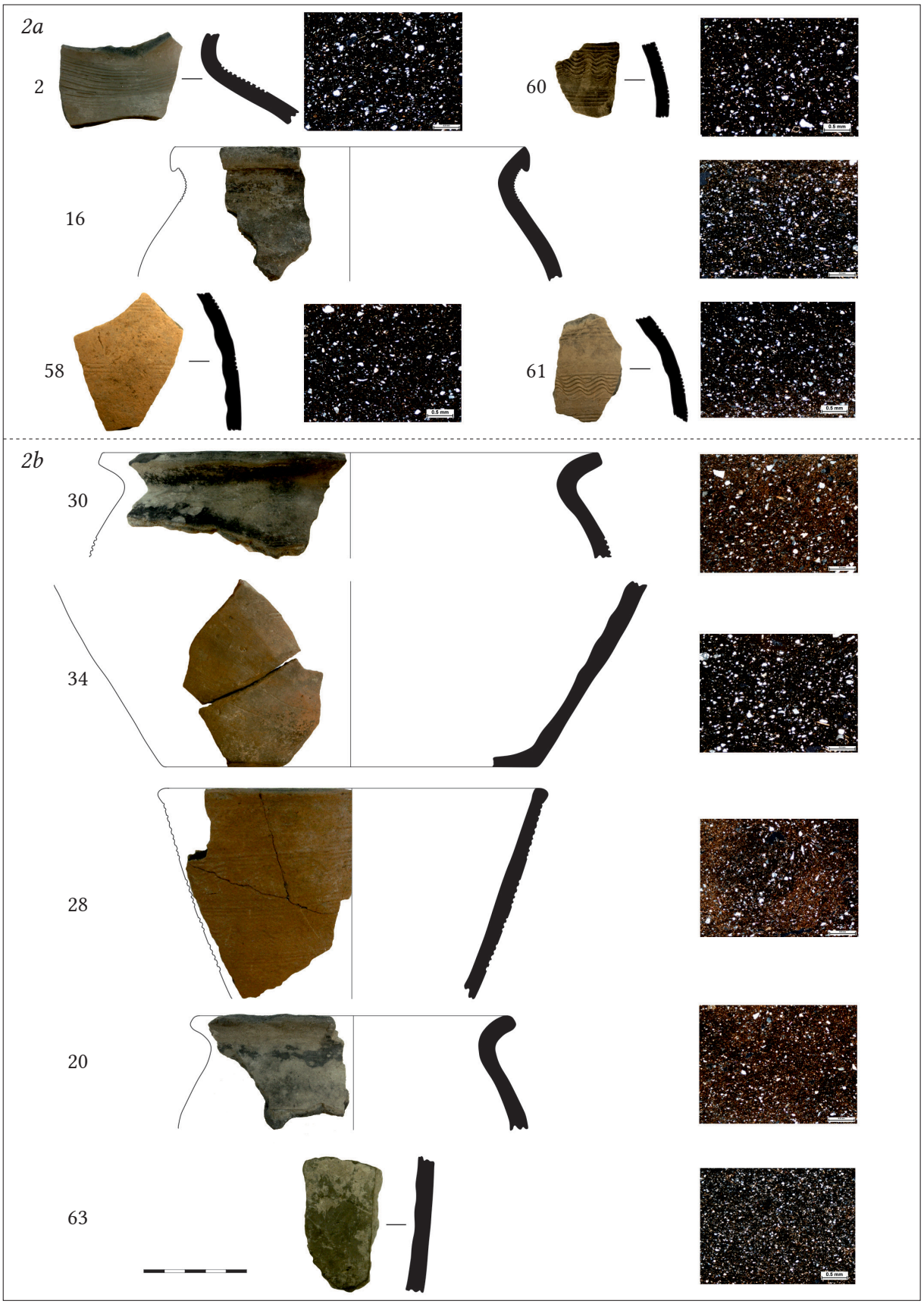

Fig. 16. Petrographic analysis of pottery from Daruszentmiklós site F05. Fabrics 2a and 2b

Slow-wheeled and hand-formed pottery

Based on macroscopic observations, 23 vessels were made by the slow wheel among the examined samples. From Fabric 2 three pots (20, 30, 51), from Fabric 3 eight pots (6, 7, 14, 15, 19, 23, 26, 33), from Fabric 5 three vessels (21, 50, 52), from Fabric 6 four pots (5, 11, 13, 31), and from Fabric 7 four pots (8, 22, 36, 39, 43) were made by slow wheel. Among the investigated samples, eight sherds can be considered hand-formed. From Fabric 2 a baking bell (24), from Fabric 3 a baking bell (1) and three pots (4, 6, 10), from Fabric 6 a baking bell (25), and from Fabric 7 three pots (8, 40, 41) were hand-formed.

Samples 7, 13, 14, 19, 20, 21, 31, 36, 39 were most probably made by slab building and then were refined on a slow wheel. From the hand-formed vessels only samples 3, 23 and 41 show the signs of slab building.

As we have mentioned already, Fabric 2 contained both fast- and slow-wheeled vessels. The slow-wheeled vessels linked to this material group had been classified into the "more finely" elaborated group (L1 and L3) by the earlier, macroscopic typology *(Fig. 23)*. In contrast, Fabrics 3, 6 and 7 mainly contained "more roughly" elaborated and tempered slow-wheeled vessels (Fabrics L4, L5 and L6), although they also contained some sherds of the L3 group considered "finer". Besides these, although in a smaller proportion, hand-formed vessels occurred in all three groups, thus slow-wheeled and hand-formed pottery was also made from the raw materials of all three fabrics *(Fig. 24)*. This leads to a conclusion that in the case of slow-wheeled vessels it is pointless to create detailed material groups macroscopically, since without ceramic analysis slow-wheeled vessels made from various raw materials with different temperings cannot be typologized precisely; vessels made from a "rougher" or "finer" raw material can be distinguished at best. Furthermore, it is a significant result that the raw-materials of vessels made on the slow wheel and without a wheel are very similar, in contrast to fast-wheeled pottery that differs not only by technology and elaboration but also by uniformity in raw material. Fabric 5 deserves special mention, since the technological classification of its sherds was not certain: although they bore technological features similar to the group of the yellowish red pottery of the Danube-Tisza Interfluve, their surface, wall thickness and texture could rather be associated with slow-wheeled vessels *(Fig. 24)*. This may reflect that these vessels formed a transition between fast-wheeled and slow-wheeled ceramics.

The analysed samples were made from different raw materials and even within each fabric group there is some variability in terms of the amount of inclusions. The raw materials of fast-wheeled grey (IB_2) and yellow ceramics are the most homogeneous (Fabric 1); these raw materials are "clean". The samples defined as the so-called "coarser" grey pottery (IB_1) were made from two types of raw material (Fabric 2 and 4), while the typologically distinguished black (IC_1, IC_2) and "dark red" ceramics were made from very similar raw material (Fabric 4). The diversity observed among the specimens of the so-called "light red" or Late Antique (IF) ceramics classified in one typological group was also proved by their raw material, since in their case two petrographic groups could be distinguished (Fabrics 2 and 8). In terms of raw material, the fast-wheeled "yellowish brown" pottery resembles the rougher sherds of this latter pottery type (Fabric 2). The primary typology of the slow-wheeled and hand-formed ceramics only broadly corresponds with the petrographic results, which allows us to draw complex production technology conclusions, similarly to results regarding fast-wheeled ceramics.

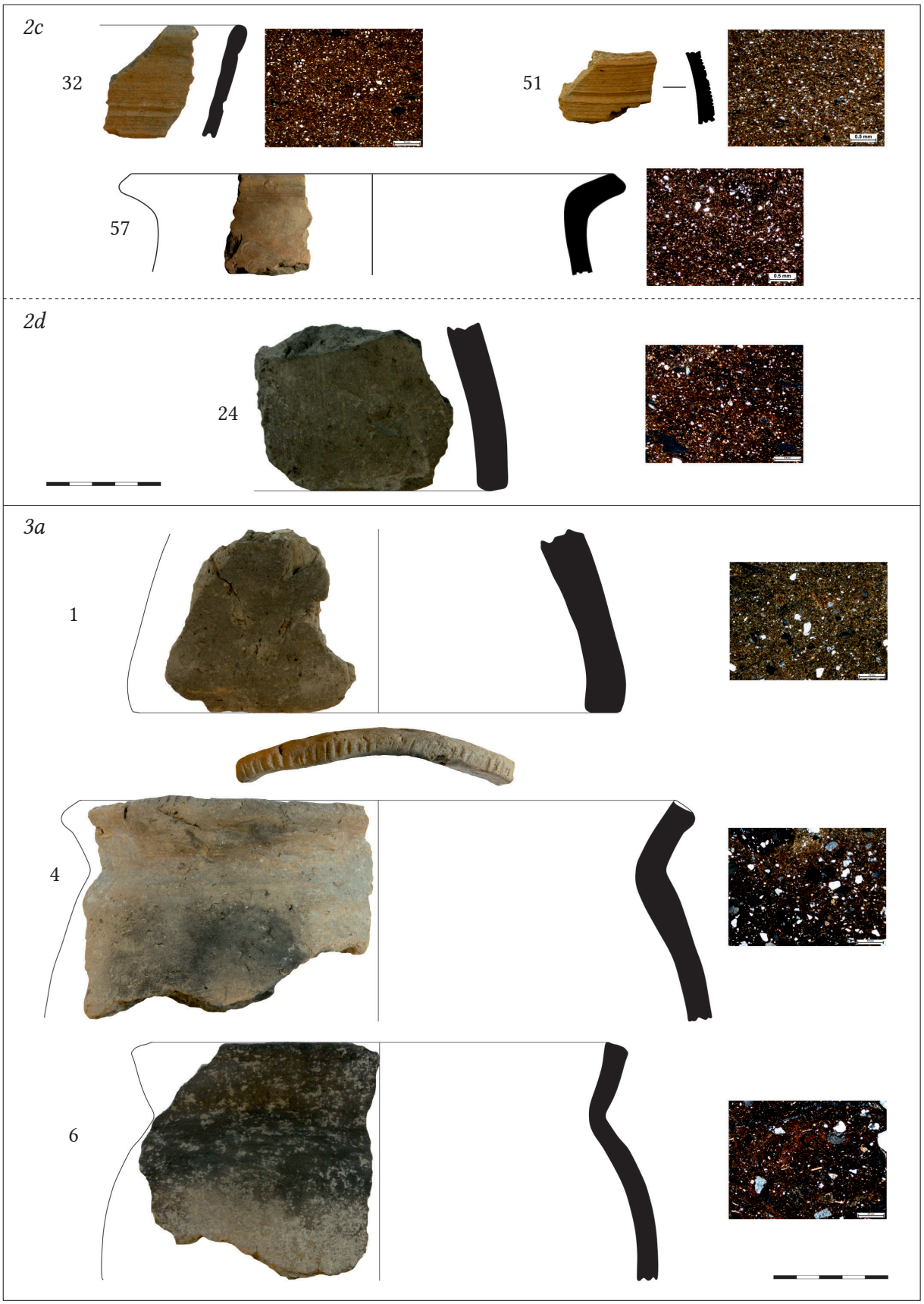

Fig. 17. Petrographic analysis of pottery from Daruszentmiklós site F05. Fabrics 2c, 2d and 3a

Comparison of the results with other sites

Petrographic groups provide a more complex picture on ceramic production when we compare the results of Daruszentmiklós to those from other Avar sites. Petrographic results are available from a cemetery and a settlement. From the settlement of Kaposvár – Fészerlak 19 (Somogy County) – 38 ceramics were analysed petrographically.[37] In the cemetery of Dunaszentgyörgy – Kaszás tanya (RM-20) 327 graves were unearthed, 75 of which contained ceramics. From these, 74 ceramic samples were analysed petrographically.[38]

The raw materials of fast-wheeled grey and yellow ceramics of Fabric 1 of Daruszentmiklós show extensive similarities to those of the fast-wheeled grey and yellow ceramics of Kaposvár and Dunaszentgyörgy *(Fig. 25)*. It cannot be a coincidence that fast-wheeled grey and yellow ceramics show very similar raw materials at these sites (Daruszentmiklós Fabric 1, Dunaszentgyörgy Fabric 3, Kaposvár Fabric 1a). In these fabrics other ceramic types do not appear and the consistent use of this type of raw material for fast-wheeled grey and yellow vessels indicate specialized ceramic production.

The raw materials of fast-wheeled vessels in Fabric 4a (IB_1 type of "coarser" grey, IC_2 and IC_1 types of black and "dark red") also have good analogies at the comparative sites. The raw materials of fast-wheeled vessels in Fabric 5 of Dunaszentgyörgy, and Fabric 8 of Kaposvár, are similar to Fabric 4a *(Fig. 25)*. In this case a specialization can also be assumed when potters specialized in a well-sorted sand-tempered raw material. What is interesting is that in Daruszentmiklós and Dunaszentgyörgy fast-wheeled vessels were made from this special raw material while in Kaposvár it was slow-wheeled vessels. The nature of these differences is yet to be understood. It must be noted that this well-sorted sand-tempered raw material is slightly different at Kaposvár – it is micaceous. Thus, if the vessels made from these special raw materials were imported, they may have been made at different places or at least from slightly different raw materials.

The similarities in raw materials mainly of fast-wheeled vessels at the three sites are summarized in *Figure 25*.

Another interesting feature is that raw material variability in slow-wheeled vessels in Daruszentmiklós shows an opposite tendency from what can be observed in the raw materials of the slow-wheeled vessels of Dunaszentgyörgy. In the latter site these vessels were made from homogenous raw materials showing less variability (Dunaszentgyörgy Fabric 2).[39] To understand this phenomenon requires further research, but it may be because Daruszentmiklós is a settlement and Dunaszentgyörgy is a cemetery assemblage. Nevertheless, the assessment of ceramics from both sites indicates that grave ceramics were also everyday used vessels and were most probably not made particularly for burials. Their raw materials and tempers do not indicate otherwise.[40]

Production technological and typological conclusions

The diversity of raw materials observed by vessel type, or the uniformity in the use of certain raw materials (e.g. Fabrics 1 and 4), is significant in more respects. On the one hand, we

37 Kreiter – Skoda 2016.
38 Kreiter et al. 2017.
39 Kreiter et al. 2011, 3–4.
40 Logan – Cummings 2011.

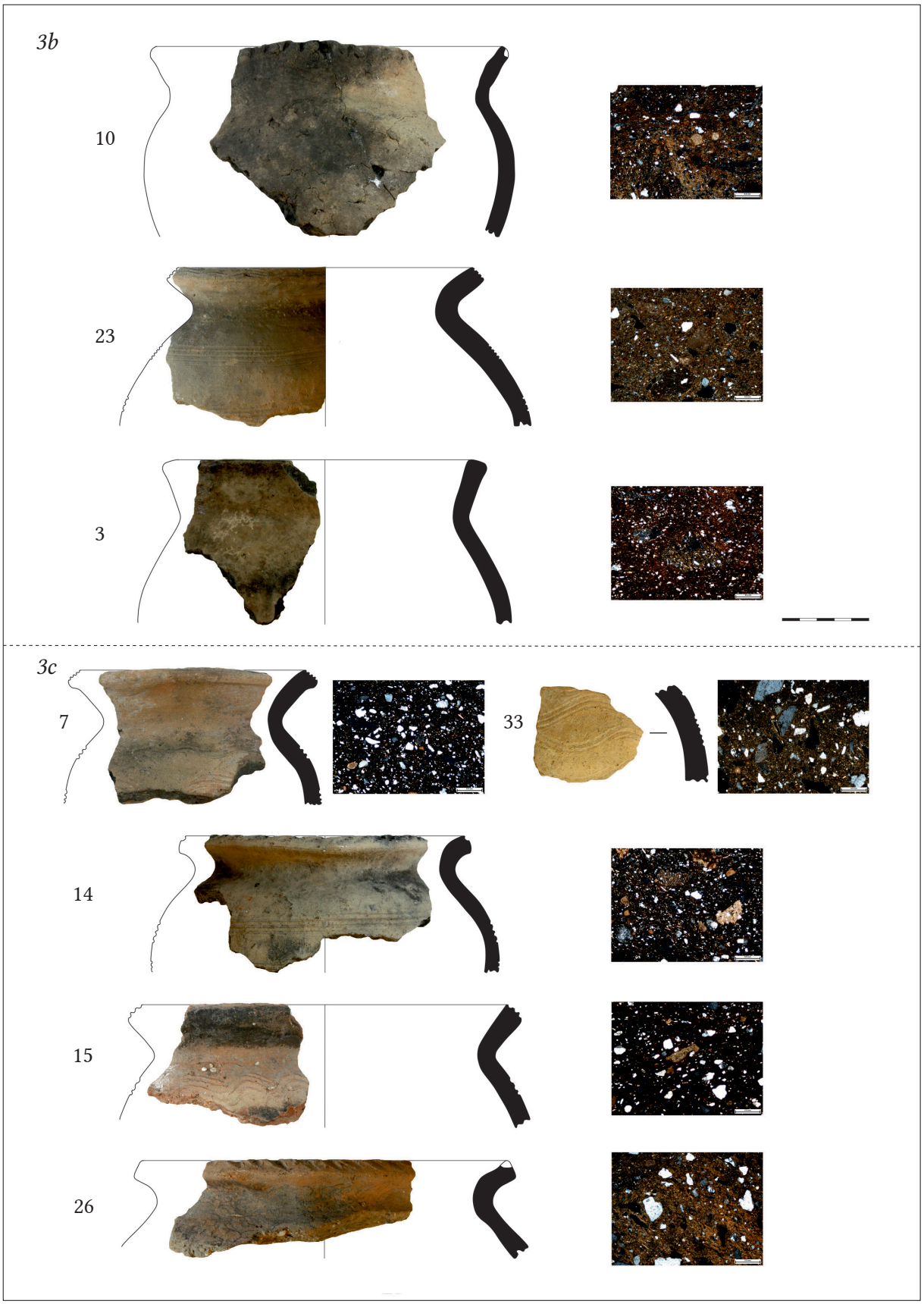

Fig. 18. Petrographic analysis of pottery from Daruszentmiklós site F05. Fabrics 3b and 3c

Fig. 19. Petrographic analysis of pottery from Daruszentmiklós site F05. Fabrics 3d, 4a, 4b and 4c

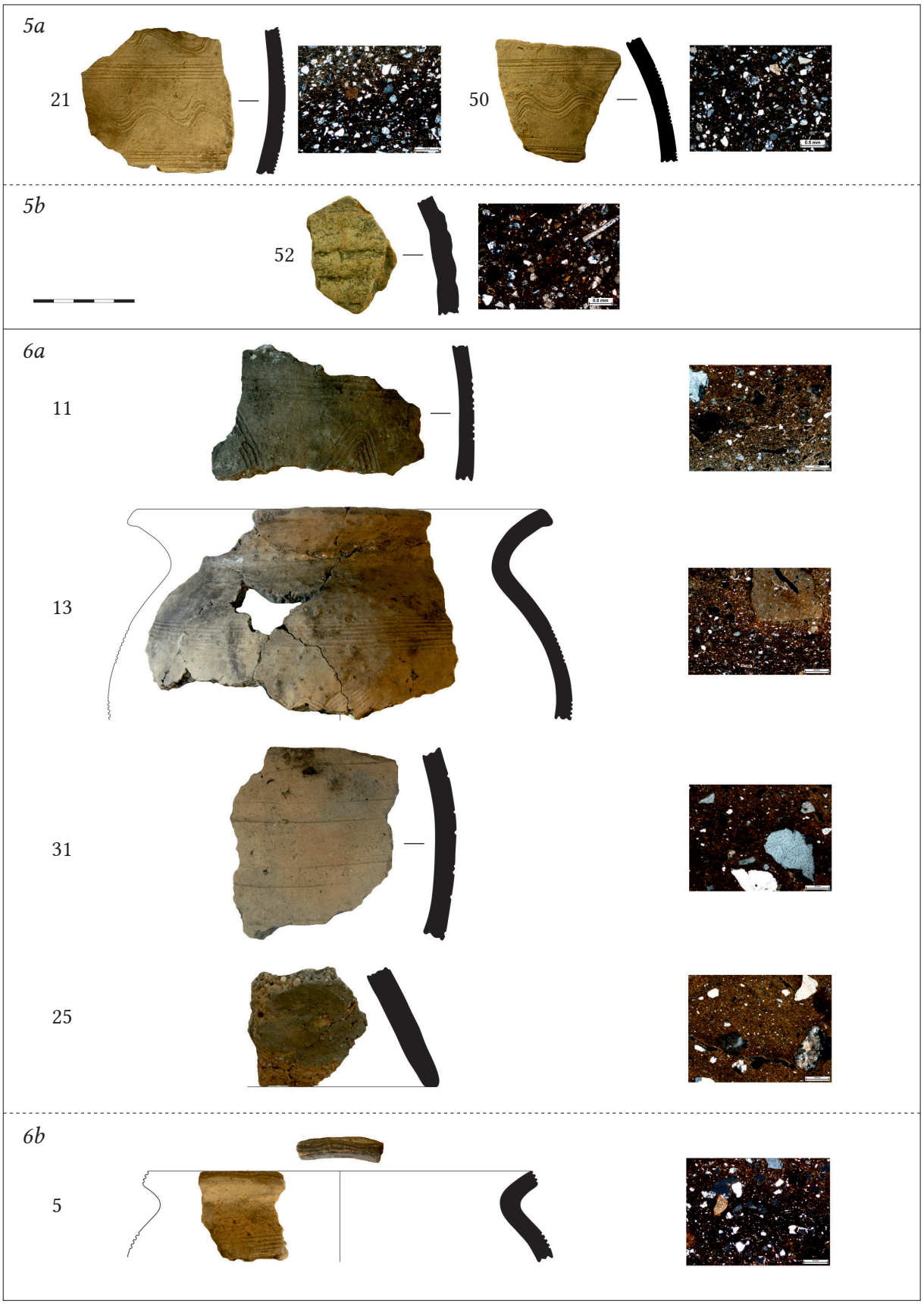

Fig. 20. Petrographic analysis of pottery from Daruszentmiklós site F05. Fabrics 5a, 5b, 6a and 6b

may specify the similarities and differences between ceramics prepared by diverse technology and differentiated by typochronology. On the other hand, although indirectly, we may gain information on the scale of pottery production[41] or possible specialization.[42] The presence of hand-formed, slow-wheeled, and different fast-wheeled vessels alone refers to the complex structure of pottery production, since all these methods require different technological knowledge and experience.

Researchers regard fast-wheeled wares as specialized products, vessels with ornamental or other special functions. Raw material investigations serve as objective evidence for this complex structure: fast-wheeled wares are not only specialized in terms of production technology but in their raw materials too. The fact that a wheel was used is evidence that these vessels could not have been made by people who did not have the expertise and tools necessary for producing them. In addition, ceramic analysis revealed that even the choice in raw materials was carried out carefully, probably by experienced artisans. XRD analysis also supports that great attention was also paid to the firing of these vessels: while the firing temperature of hand-formed and slow-wheeled vessels was maximum 650–700 ℃, the firing temperature of fast-wheeled vessels was between 750–950 ℃ *(Fig. 26)*.[43]

Overlapping in the choices of raw materials for fast-wheeled vessel types indicates that ceramics distinguished by archaeological typology could be produced similarly or even in the same workshop – for instance this could well be the case of fast-wheeled grey and yellow pottery of Fabric 1 *(Fig. 22)*. In their case, due to the previously presented petrographic analogies from Kaposvár and Dunaszentgyörgy, even the existence of a distant workshop can be supposed. In addition, the raw material of these two pottery types is also very similar at these sites; therefore it seems that grey and yellow ceramics could have been made in the same way or in the same workshop. This does not tell us whether they were made at different times or at the same time, but the latter possibility cannot be excluded. Tivadar Vida distinguished a find assemblage in the cemeteries of Lébény and Kölked, as well as did Péter Skriba in the cemetery of Dunaszentgyörgy, in which specimens of the fast-wheeled grey and yellow pottery occurred simultaneously.[44] The settlement of Daruszentmiklós may serve as a further example of this phenomenon, however it is necessary to analyze the distribution and percentage of the finds by features to confirm this. In connection with the pottery kilns excavated in Szekszárd and then in Őcsény in 1975–1976, Gyula Rosner already suggested that there must have been a pottery center in the vicinity of Dunaújváros. Besides the ubiquity of fine grey pottery, his assumption was also based on the results of pottery analyses carried out in cooperation with Márta Balla: they compared the ceramics produced in the workshop of Szekszárd with samples from cemeteries near Dunaújváros and Szeged. These latter samples resembled each other but differed significantly from the ceramics of Szekszárd.[45] Although the raw materials of yellow and grey pottery from Daruszentmiklós are not suitable to determine their exact

41 Peacock 1982.

42 Kreiter et al. 2009, Kreiter et al. 2011.

43 Mária Tóth: Daruszentmiklós – Vajai tanya II, F05 régészeti lelőhelyről előkerült kerámiák archeometriai vizsgálata. The report is in Hungarian, it can be found in the Hungarian National Museum Archaeology Database under interdisciplinary analysis/ceramic analysis: http://archeodatabase.hnm.hu/hu/node/729, February 27th, 2017.

44 Vida 1999, 57; Kreiter et al. 2017.

45 Rosner 1979, 97; Rosner 1990, 125, 127; Balla 1990, 133.

Fig. 21. Petrographic analysis of pottery from Daruszentmiklós site F05. Fabrics 7a, 7b and 8

provenance, since they did not contain components by which workshops could be localized, hopefully the question of workshops can be settled in the future, and it will be possible to outline distribution areas by further analogies and ceramic and sediment analyses.

Similar overlapping can be observed in the case of Fabric 4, the vessels of which were not made from the finest raw material but rather of a specialized, well-sorted raw material, and only by the fast-wheeled technology. With respect to typology, the vessels of this group represented the "poorer" quality variant of grey pottery (IB_1), black pottery with its "poorer" quality variant (IC_1, IC_2), as well as the group named "dark red" by its color *(Fig. 22)*. The differentiation of grey pottery of finer and coarser raw material can also be connected to Gyula Rosner's investigations in Szekszárd, besides which he also discussed fast-wheeled black pottery.[46] It is possible that black and grey pottery was produced together in the pottery kilns near Szekszárd; the author raises the possibility that these two types of vessels succeeded each other as a result of an internal development, as the technique of firing improved.[47] This is also supported by observations according to which the distribution area, decoration, and shape of vessel types IB_1 and IC_1 are significantly similar.[48] Based on their raw material an analogy can also be drawn between the black vessels of the Dunaszentgyörgy cemetery and those of Daruszentmiklós *(Fig. 25)*, thus a common workshop for these sites cannot be excluded. In the case of the fast-wheeled black ceramics of Dunaszentgyörgy, slow wheeled technological features were also observed on the vessels; and it is suggested that they may constitute a transition between slow- and fast-wheeled products, hence between household industry and workshops.[49] In the case of vessels in Fabric 4 of Daruszentmiklós, also containing black pottery, it is possible that they went through changes, thus vessels elaborated and fired in different quality were made identical raw material. However, it is also probable that these vessels of various qualities fulfilled different functions and that is the reason for their rougher elaboration. Settling this question would require knowing the exact form of all vessels to assess their similarities and differences, and refining the chronology would also be necessary.

With respect to the production of a certain ware type as a local or household imitation, or with different function, Fabric 2 can also be mentioned. From this raw material both fast- and slow-wheeled vessels were made *(Fig. 23)*. In their case the typology of the fast-wheeled sherds was not as obvious as in the case of Fabrics 1, 4 or 8 *(Fig. 22)*, however, most of them were associated with the group of the so-called "light red" or the poorer quality of Late Antique (IF) pottery. Besides these, four sherds could be classified into the group of the "yellowish brown" or yellowish red pottery of the Danube-Tisza Interfluve, and three sherds belong to the poorer quality variant of grey pottery. It is possible that the differences can be explained only by the fragmentary nature of the material, and that is why they are difficult to classify typologically. However, it cannot be excluded that more types of less specialized vessels were made from this raw material. This latter theory is supported by the fact that rather finely elaborated slow-wheeled and hand-formed vessels were also made from this raw material. As we have already mentioned above, Fabric 5 can also be considered a similar, "transitional" group, since the sherds belonging to this group carried technological features typical of both slow- and fast-wheeled vessels *(Fig. 24)*.

46 Rosner 1979, 103, 105; Rosner 1981, 46–48.
47 Rosner 1981, 47.
48 Vida 1999, 185, 190.
49 Kreiter et al. 2017.

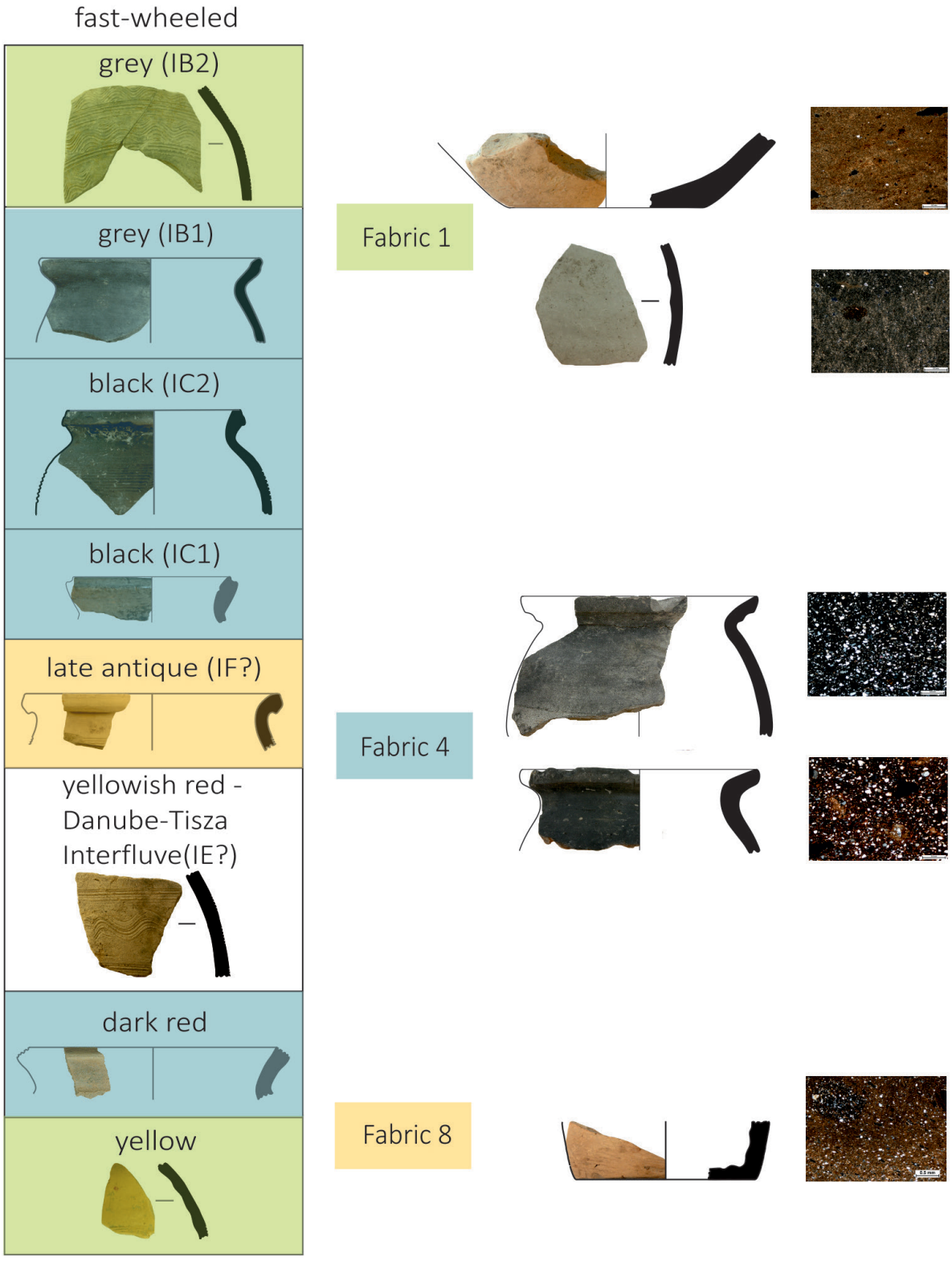

Fig. 22. Correlations between raw materials and ceramic types. Fabrics 1, 4 and 8 and the fast-wheeled pottery types made from these raw materials

The similarities or diversities of the raw materials of identical vessel types or those within a site provide ample information regarding pottery production since potters usually produce a certain vessel type in the same way and they do not change the raw materials or the amount of tempering materials; or it even occurs that potters use the same "recipe" for all the pottery

types that they produce.[50] Considering this, in the course of processing other sites it will be reasonable to distinguish the "light red" ceramics of Fabric 8 as a separate group from similar but more poorly elaborated sherds made from a different raw material (Fabric 2). The diversity within the raw materials of fast-wheeled vessels – they appear in Fabrics 1, 2, 4, 8, thus they were made from at least four different raw materials – may indicate that these were the products of different workshops. In the light of this fast-wheeled vessels may have been produced in four different workshops.

Possible modes of pottery production

Based on the observed typological and production technological diversity, ceramic manufacture can be reconstructed in various ways. Similarly to earlier results, the pottery of Daruszentmiklós also suggests that fast-wheeled wares are specialized products that were probably manufactured by experienced potters carrying out continuous production in workshops, and in series.[51] It must be noted, however, that we do not know whether certain ware types were produced in the same workshop, or whether there were any differences in the size of the workshops (either in the size of the workshop itself or the size or type of the pottery kiln/kilns), or in hierarchy, or there were differences in the number and quality of vessels or in the distribution area of the produced wares. It is also a question which products were manufactured at the same time, and whether the chronological system based on grave pottery can also be applied to settlements. In case we accept the chronological system of fast-wheeled wares based on grave pottery, the vessel types made from seemingly identical raw materials, but classified into different typological groups, could be produced in the same workshops but at different times. According to another possible theory, several different workshops operated at the same time and each produced a certain type of ware at the same time. The third possibility is that the chronological system set up by grave pottery cannot be applied to settlements, and different types of vessels (which according to our present knowledge were not or were only partially contemporary) were produced in the same workshops, and they were made differently according to their intended function or by the demand of the customers' changing needs. For example, as petrographic results prove, ceramics of different forms but made from seemingly identical raw materials could be fired yellow by oxidizing firing or grey by reduced firing; or by using similar raw materials carefully elaborated black pottery or coarser black and grey pottery, suitable for cooking, could also be produced.

Without direct evidence (pottery kiln, wasters, production tools, raw materials, or structural evidence for the curing of clay) it is difficult to assess the scale of ceramic production; but concerning the variability in raw materials it is certain that there was a hierarchy in the modes of production, and these modes could have co-existed. This assumption is supported by the fact that the differences between raw materials required different knowledge and experience from the potters since these raw materials behaved differently during drying and firing.[52] Based on the continuously increasing knowledge on settlement pottery, it is certain that the general dating outlined by grave goods needs further, preferably regional, refinement. At the same time, however, without more precise dating of grave goods it cannot be ruled out that

50 DeBoer – Lathrap 1979, 116–117; Plog 1980, 86–87; Tobert 1984, 226–227; Chávez 1992, 85; Sillar 1997, 8; Frank 1998, 83.

51 Bialeková 1967, Bialeková 1968; Garam 1969; Rosner 1979, 99; Peacock 1982, 25–43.

52 Rice 1987, 104; Kilikoglou et al. 1995; Kilikoglou et al. 1998; Kilikoglou – Vekinis 2002.

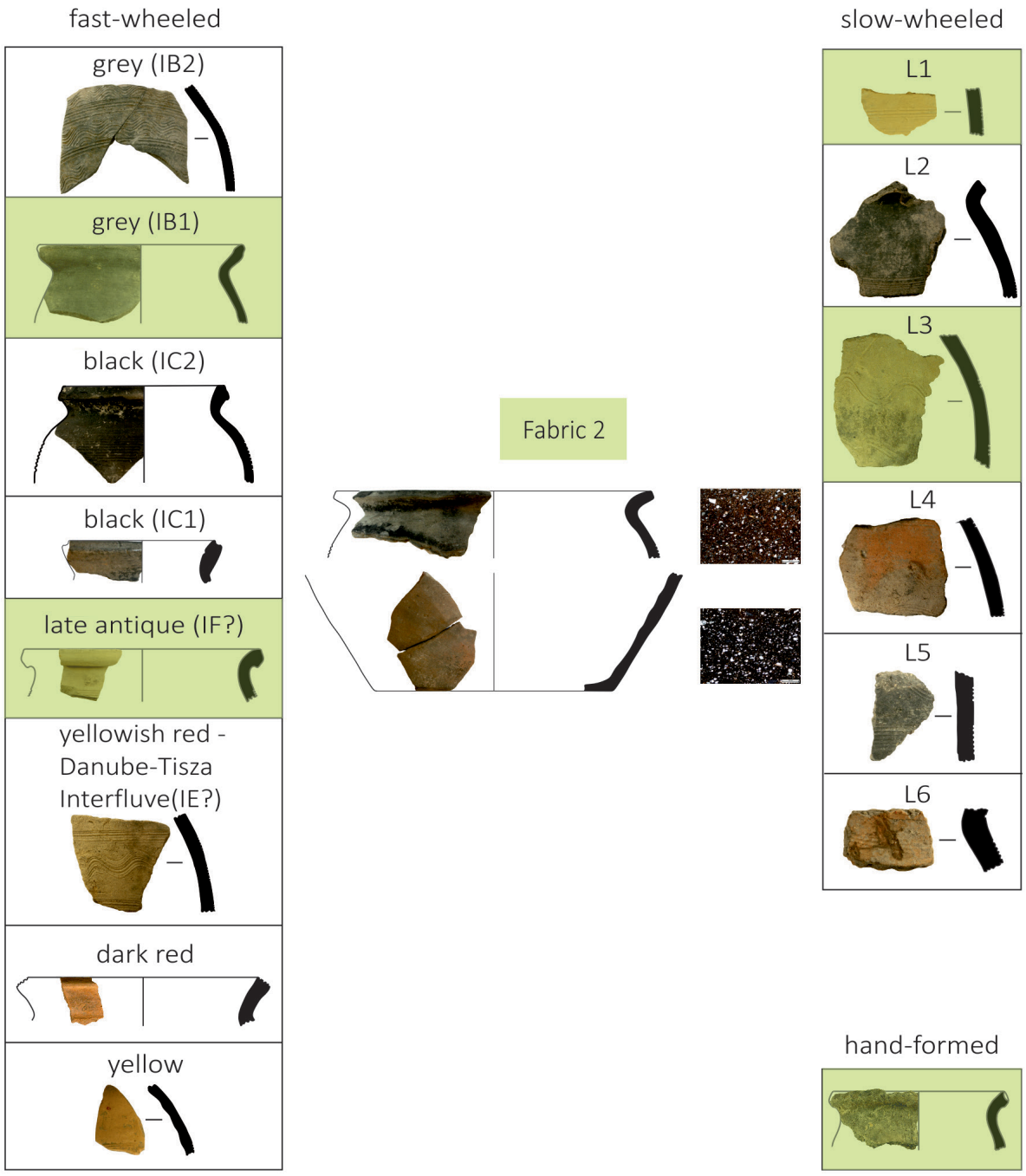

Fig. 23. Correlations between raw materials and ceramic types. Fabric 2 and the fast-wheeled, slow-wheeled and hand-formed pottery types made from this raw material

products of the same workshop went through qualitative changes. Thus for example black vessels made from the same raw material but in different quality were produced in the same workshop. This may also be supported by the material group distinguished as "dark red", which was also fast-wheeled and made from a similar raw material, but its firing was different. As imitations could be distinguished in the case of yellow pottery on the basis of their raw materials, production technology, and poorer quality of firing,[53] the question of imitation, qualitative changes, or possibly the production for different functions could also be studied

53 Garam 1969, 233.

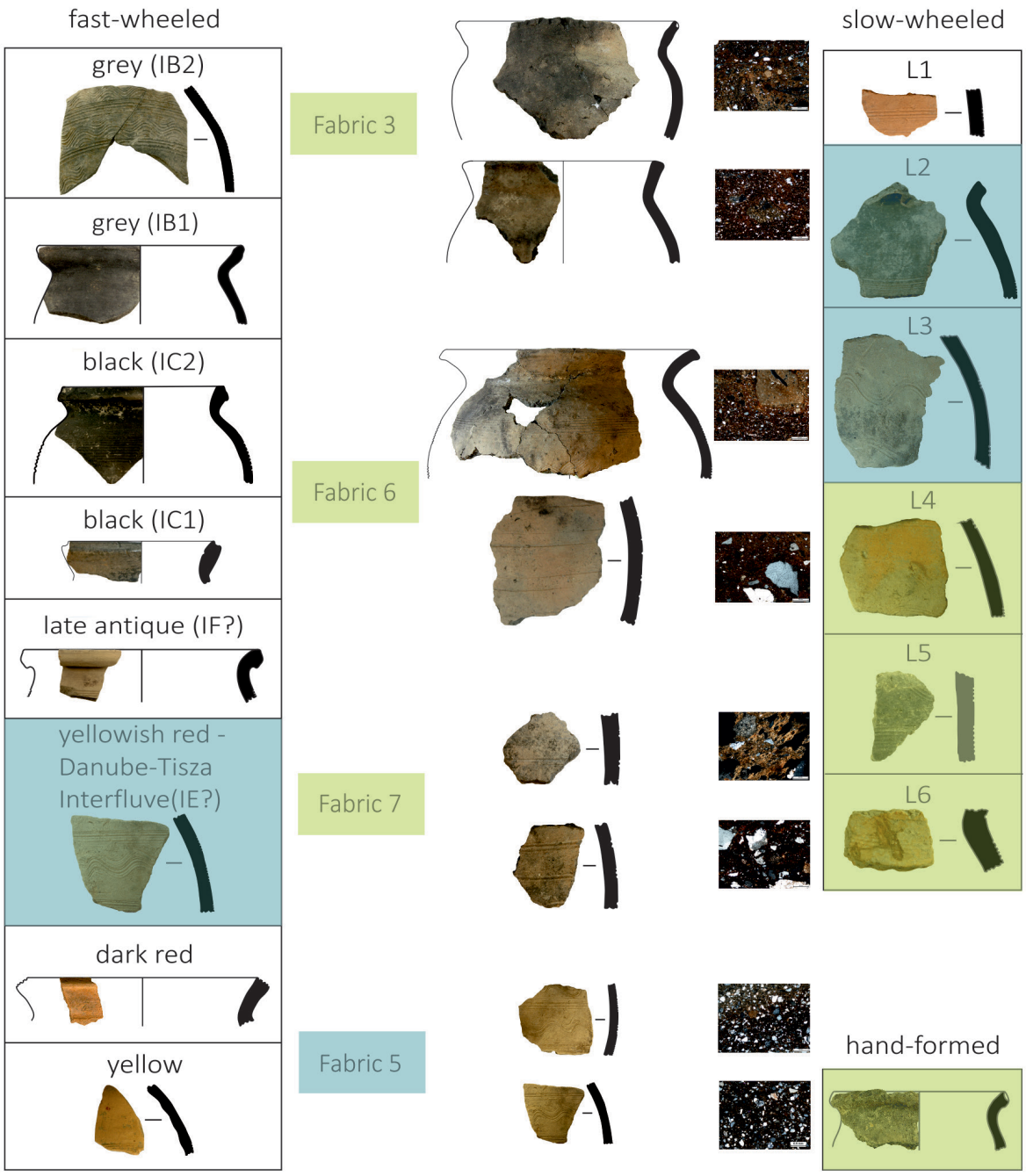

Fig. 24. Correlations between raw materials and ceramic types. Fabrics 3, 6, 7 and 5 and the fast-wheeled, slow-wheeled and hand-formed pottery types made from these raw materials

more elaborately in the case of the above discussed fast-wheeled wares provided that settlement pottery would be suitable for a more detailed formal comparison.

The raw materials of slow-wheeled vessels show much more variability in terms of raw materials and tempers than that of the fast-wheeled vessels.[54] The raw materials and technological

54 Similar observations were made during earlier petrographic analyses of Neolithic (Kreiter et al. 2009; Kreiter 2010; Kreiter et al. 2011; Kreiter et al. 2017) and Iron Age (Kreiter 2006; Kreiter 2007; Kreiter 2009; Kreiter – Tóth 2010; Kreiter et al. 2013) ceramics. Due to increased technological variability, it naturally can be assumed that several producers/workshops coexisted at the same time. Although this is not suprising, it is an important point because in this study the analysis of ceramic production is based on petrographic analysis, which provides a finer grained picture on ceramic producers.

Daruszentmiklós	*Kaposvár*	*Dunaszentgyörgy*
Fabric 1: Samples 9, 18, 35, 38, 29, 53 (7.2009.563, 7.2009.1011, 7.2009.2482, 7.2009.2655, 7.2009.1955)	Fabric 1a: Samples 34, 35 (98/119.262.13, 98/119.273.01)	Fabric 3: Samples 1, 2, 6, 26, 27, 36, 45, 48, 73 (1.63372.59.1, 1.63372.63.1, 1.63372.218.1, 1.63372.97.1, 1.63372.113.1, 1.63372.168.1, 1.63372.227.1, 1.63372.264.1, 1.63372.353.2)
Fabric 2a: Samples 2, 16, 58, 60, 61 (7.2009.76, 7.2009.906, 7.2009.1291, 7.2009.1300, 7.2009.1302)	–	Fabric 1: Samples 32, 68, 70 (1.63372.139.1, 1.63372.101.1, 1.63372.325.1)
Fabric 2b: Samples 34, 55 (7.2009.2480, 7.2009.768)	Fabric 7a: Sample 10 (98/119.086.01)	Fabric 1: Sample 15 (1.63372.48.1)
Fabric 2b: Sample 57 (7.2009.1242)	–	Fabric 1: Samples 18, 40 (1.63372.81.1, 1.63372.183.2)
Fabric 2b: Sample 63 (7.2009.2137)	Fabric 4a: Samples 28, 36 (98/119.175.03, 98/119.292.28)	Fabric 1: Samples 14, 33, 55, 57 (1.6337.47.1, 1.6337.142.1, 1.6337.296.1, 1.6337.309.1)
Fabric 2c: Samples 32, 51, 59 (7.2009.2074, 7.2009.91, 7.2009.1295)	–	Fabric 1: Sample 39 (1.63372.183.1)
Fabric 4a: Samples 12, 56, 64 (7.2009.760, 7.2009.1212, 7.2009.3091)	Fabric 8: Samples 2, 12, 15, 30 (98/119.014.01, 98/119.086.12, 98/119.087.17, 98/119.183.21)	Fabric 5: Samples 13, 17, 49, 50 (1.63372.46.1, 1.63372.78.1, 1.63372.273.1, 1.63372.275.1)
Fabric 4b: Samples 17, 37, 42, 54 (7.2009.932, 7.2009.2547, 7.2009.3005)	Fabrics 6a and 6b: Samples 8,13,16,21,31 (98/119.049.01, 98/119.087.02, 98/119.087.23, 98/119.088.02, 98/119.183.23)	Fabric 1: Sample 22 (1.6337.87.1)

Fig. 25. The ceramic raw materials of certain vessel types from Daruszentmiklós F05, Dunaszentgyörgy – Kaszás Tanya RM20 (Tengelic RM20) and Kaposvár – Fészerlak 19 show extensive similarities

characteristics of slow-wheeled vessels are similar to those of hand-formed vessels *(Fig. 24)*. Slow-wheeled vessels also show grog tempering (Fabrics 3d and 6b) and vegetal tempering (Fabric 3d). These technological practices are characteristic of hand-formed vessels (Fabrics 2d, 3a, 3b, 7b). Typological and technological analyses support the assumption that, in the case of hand-formed and slow-wheeled vessels, choices in their raw materials and tempers had more significance than their building technology.

This is also supported by "post wheeling", thus this transition can also be observed in technology. In the light of this, it seems highly probable that slow-wheeled vessels were not made in specialized workshops, but rather as a household production, for the use of that particular household and perhaps for a small-scale trade. Families may have produced these vessels for their own use without any particular organization of production.[55] According to the slow-wheeled vessels' raw materials, technological features, typological variabilities, and the similarities of these to hand-formed vessels, it is possible that slow-wheeled vessels were produced in the same households where hand-formed vessels were also made. This assumption is somehow contradicted by the presence of the fast wheel technique, since such equipment was probably not available in an average household. Therefore, it is assumed that slow-wheeled vessels were produced in a more organized way than hand-formed vessels. They could have been produced by household industries or individual workshops.[56] In these cases, pottery making was carried out by skilled artisans but potting was not a full-time specialization. In these modes productions were oriented towards markets and the producers were skilled artisans, but the scale and quality of their products did not reach those of specialized workshops.[57] The raw materials and stylistic features of products of household industries or individual workshops are similar to those of hand-formed vessels.

The above-mentioned modes of ceramic production, supported by ethnographic examples,[58] can be certainly specified. On the one hand, there must have been significant differences between the specialized workshops producing fast-wheeled wares, with diversity in the quantity, quality and distribution area of their products. While certain vessel types (e.g. grey and Late Antique ceramics) were made in consistent quality, in large series, and probably only in some workshops manufacturing ceramics according to long-held traditions, other fast-wheeled ceramics only differed from slow-wheeled vessels technologically, but not in terms of their raw materials. According to this, the latter vessels may originate from 'local' workshops producing imitations. On the other hand, significant similarities could be observed among the vessels made in households and individual workshops both in terms of raw materials and elaboration, and technologically they did not differ from each other as sharply as from fast-wheeled vessels.

55 Peacock 1982, 13–17.

56 Household industry: ceramic production is carried out by skilled artisans but pottery making is a part-time activity and not the primary source of subsistence. The mode of production is not affected because potting is a part-time activity. Individual workshop: potting is more specialized and it is a main source of subsistence, but it may be practiced for only part of the year supplemented by other activities that also provide income. The mode of production is affected and additional equipment such as the wheel may be adopted (Peacock 1982, 25–43).

57 Peacock 1982, 17–25.

58 Peacock 1982.

Social conclusions drawn from pottery production

We can draw chronological and social conclusions from these observations if we consider the theory according to which the amount of the ceramics produced by different technologies changed through the Avar period, which has been suggested and proved at several Avar Age sites. According to the traditional chronological schema hand-formed pottery dominated; but

Fast-wheeled pottery		
Inventory No.	*Sample No.*	*~Firing temperature (°C)*
7.2009.76	2	<650–750
7.2009.563	9	~750–850
7.2009.760	12	~750
7.2009.932	17	<650
7.2009.1011.	18	~750–850
7.2009.1709	27	<650–750
7.2009.2482	35	<650–750
7.2009.2547	37	<650–750
7.2009.3005	42	>850–950
Slow-wheeled pottery		
Inventory No.	*Sample No.*	*~ Firing temperature (°C)*
7.2009.301	5	<650–700
7.2009.444	7	<650–700
7.2009.1187	19	<650–700
7.2009.1257	20	550–650
7.2009.1345	21	550–650
7.2009.2443	33	650–700
7.2009.2521	36	<650–700
7.2009.2922	39	<650–700
Hand-formed pottery		
Inventory No.	*Sample No.*	*~ Firing temperature (°C)*
7.2009.31.1	1	<650
7.2009.284	3	<650
7.2009.589	10	<650
7.2009.1611	24	<650
7.2009.1623	25	<650
7.2009.2966	41	<650

Fig. 26. Estimated firing temperatures of vessels made by different techniques according to XRD analysis

in certain areas, especially in Transdanubia, fast-wheeled pottery dominated in the early Avar period.[59] Slow-wheeled pottery appeared around the end of the early Avar period and in the middle Avar period[60] and then their amount increased over hand-formed pottery by the end of the Avar period;[61] and according to our present knowledge, the only fast-wheeled ceramic type in this period was yellow pottery.[62] This has serious social implications since they reflect changes in economic systems and ceramic production and in the organization of production.[63]

Gyula Rosner has already suggested changes in social structure and the division of labor. In his opinion, social division is manifested because members of a group had continuously perfected their craft and their technological knowledge necessary for it. According to the Avar Age workshops near Szekszárd, social division had developed among the members of the community, and potters who worked there did not have to participate in food production, but they could purchase their necessities by selling their products.[64] Besides, Early Avar Age fast-wheeled wares refer to eating and drinking habits that were probably only accessible to a certain group, the "elite", while hand-formed vessels were in use in the entire Avar Empire.[65] After the early period, in line with the changes taking place in the middle Avar period, a new structure appeared in pottery production too: by the end of the Middle Avar period the majority of the workshops producing fast-wheeled wares ceased, and the production of slow-wheeled pottery that spread much more widely and in a larger area began. Thus, while in the Early Avar period all households of the loosely organized local communities supplied themselves with the necessary ceramics (hand-formed vessels) on the one hand, and workshops producing fast-wheeled wares satisfied the needs required by the lifestyle of the elite on the other hand, a so-called "middle class" emerged in the Middle Avar period and its number increased in the Late Avar period, which is proved by the appearance and widespread distribution of slow-wheeled pottery. Consequently, by the end of the Avar period a new way of organization of ceramic production evolved that allowed potters to produce ceramics in full-time, thus a better division of labor and a more egalitarian society had developed, which is also proved by the metal finds of graves.[66]

Based on the settlement of Daruszentmiklós, a less unified social structure can be reconstructed: although slow-wheeled sherds occurred in the largest number, hand-formed and fast-wheeled ceramics were still present. Both typological and petrographic analyses confirmed that the latter category included several types of wares; fast-wheeled ceramics of lesser quality and very fine vessels possibly purchased as imports. This has not only chronological aspects, but social aspects as well: there was a layer among the members of the community once living here that could afford the use of better quality ornamental vessels or tablewares. Besides social division, the question of function also has to be considered since a vessel set necessary for a household did not only contain fast-wheeled wares but also vessels suitable for storage and cooking. However, due to the large number of slow-wheeled and hand-formed sherds, there

59 Bialeková 1968; Vida 1999.
60 Vida 1999, 107, 191; Herold 2010b, 173.
61 Bóna 1971b, 321–324; Bálint 1991, 43; Herold 2006, 64–65, 71; Herold 2010b, 171; Kondé 2016, 341.
62 Bialeková 1967; Garam 1969.
63 Herold 2010b, 97–99; Herold 2014, 220.
64 Rosner 1981, 47–48.
65 Herold 2014, 226.
66 Herold 2014, 226–227.

must have been households the members of which could not afford or did not need to purchase and use fast-wheeled ceramics. Comprehensive household analyses studying archaeological features and different types of finds together may lead us to understand whether functional or social differences were more decisive in the formation of the archaeological remains.

A possible explanation for the presence of a various, structured community is the geographical situation of the Daruszentmiklós settlement. Researchers have proposed several times that Early Avar Age inhabitation was partly influenced by former Late Roman structures, and that the main routes could also be in use with minor changes during the Avar Age.[67] Although it can be presumed that the Avars formed their environment by using their land differently than their predecessors, and that the settlement of Daruszentmiklós cannot be associated directly with the Roman remains nearby,[68] we cannot exclude the possibility that they were able to use the former *limes* road that runs close by.[69] Its vicinity to the Danube must have played a role in the development of the settlement,[70] thanks to which it could join the Danube trade route and profit from its closeness. As the Danube influenced the distribution of several Early and Middle Avar Age fast-wheeled vessel types,[71] it must also be the main reason for the great and various occurrence of fine quality wares at the settlement of Daruszentmiklós. Although the stratigraphic position and overlapping of the features also suggest that the entire, yet only partly known, site was not used at the same time, an extensive and densely populated settlement can be reconstructed which had more commercial contacts than most of the contemporary settlements.

Summary

By comparing the earlier distinguished typological groups and the results of petrographic analyses, we can observe unexpected correlations that could not be seen before. Archaeometric investigations confirmed that fast-wheeled vessels are specialized wares that could be exclusively made by potters who possessed the necessary tools and expertise, who used special, fine quality raw materials that could only be used for creating fast-wheeled wares (Fabrics 1, 4 and 8) *(Fig. 22)*, and that were fired in high temperatures *(Fig. 26)*. Petrographic analogies of the yellow and grey pottery of Fabric 1 indicate the presence of workshops the products of which were widespread and even transported to distant areas. Ceramic analysis revealed pottery types that were separated typologically but correlated by their raw materials, for example the poorer quality variant of grey pottery and the various quality variants of black pottery (Fabrics 2 and 4) *(Figs. 22–23)*. There were vessels that were also made from a fine raw material, but their raw materials were identical to those of slow-wheeled and/or hand-formed vessels (Fabrics 2 and 3) *(Figs. 23–24)*. It was also proved objectively that slow-wheeled and hand-formed vessels were made from much more varied raw materials than fast-wheeled vessels, and that the composition of slow-wheeled and hand-formed vessels showed extensive similarities *(Fig. 24)*. It also proved to be true that in many cases the necessary typological categories provided frames too narrow for analysis, and they could not cover the various products of a diverse pottery manufacture.

67 Tomka 2006, 70–71; Szücsi 2015.
68 Mócsy – Fitz 1990, 121; Tóth 2006, 20; Visy 2011, 27.
69 Lóki et al. 2011, 82–84.
70 The present-day river bed runs 3–4 kilometres from the site.
71 Vida 1999.

Based on the above listed observations, a complex, multi-leveled pottery production and social organization can be reconstructed at the Daruszentmiklós settlement, resulting in the presence of products made in households, household industries, as well as in specialized workshops. By determining the chronological framework of the settlement, and the vessels and households that existed at the same time, it could also be examined whether different types of wares could have been made in the same workshop. It could also be examined whether workshops copied certain vessels which were difficult to purchase or obtain, and if their qualities were altered to make them suitable for different functions.

Therefore, our further goals are the refinement of the inner chronology of the settlement, analyzing more vessels of the region by involving further settlements and cemeteries, and the localization of possible pottery workshops. By learning more about the formal and technological spectra of the Avar Age pottery of the Mezőföld, we hope to gain a more precise image of the dynamics and reasons for the changes in pottery production, its social organization, as well as settlement history and cultural connections.

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Catalogue

Macroscopic description of the analysed samples

Sample 1: 7.2009.31.1. Hand-formed, moderately mixed with vegetal material, grog and grit, rough elaboration, beige and grey, patchy color. Straight rim fragment of a baking bell. Dimensions: 86×78 mm, wall thickness: 6 mm, weight: 113.6 g, *baking bell (Fig. 17)*

Sample 2: 7.2009.76. Fast-wheeled, mixed firing, brown color. Shoulder fragment of a vessel, with bunches of lines on the wall and wheel ribs on the inner surface. Dimensions: 133×90 mm, wall thickness: 5 mm, weight: 89 g, *pot* (poorer quality variant of grey pottery) *(Fig. 16)*

Sample 3: 7.2009.284. Hand-formed, mixed firing, yellowish brown, black, patchy color. Slightly everted, straight cut rim fragment. On the rim slab building technique and a small amount of coarse-very coarse grog tempering can be observed. Dimensions: 96×86 mm, wall thickness: 9 mm, weight: 104 g, *pot (Fig. 18)*

Sample 4: 7.2009.285. Hand-formed, yellowish brown, patchy black, moderately everted rim fragment decorated with incisions. A small amount of coarse-very coarse grog tempering can be observed. Dimensions: 141×95 mm, wall thickness: 11–15 mm, weight: 234.3 g, *storage vessel (Fig. 17)*

Sample 5: 7.2009.301. Slow-wheeled, fired to light red on the interior and exterior and its cross-section is grey. Strongly everted, moderately long rim fragment decorated with a bunch of wavy lines on the edge of the rim and a bunch of lines on the shoulder. Dimensions: 50×48 mm, wall thickness: 10 mm, weight: 34.6 g, *pot (Fig. 20)*

Sample 6: 7.2009.366. Slow-wheeled, fired to beige and patchy black. Moderately everted, straight cut rim and shoulder fragment. Rare amounts of coarse-very coarse grog can be observed. Dimensions: 100×99 mm, wall thickness: 9 mm, weight: 125 g, *pot (Fig. 17)*

Sample 7: 7.2009.444. Slow-wheeled, fired to patchy red, brown and grey. Moderately everted rim and shoulder fragment with comb-impressed decoration on the rim and bunches of wavy lines on the body. Traces referring to slab building technique can be observed. Dimensions: 82×111 mm, wall thickness: 10 mm, weight: 127.1 g, *pot (Fig. 18)*

Sample 8: 7.2009.497. Slow-wheeled, beige on the interior and exterior surfaces, its cross-section is grey. Wall fragment, decorated with deeply incised bunches of lines. Dimensions: 79×59 mm, wall thickness: 13 mm, weight: 54.7 g, *pot (Fig. 21)*

Sample 9: 7.2009.563. Fast-wheeled, fired to yellowish red on its exterior and orange on its interior. Wheel ribs are visible on its interior. Dimensions: 60×41 mm, wall thickness: 10 mm, weight: 25.4 g, *pot* (yellow pottery) *(Fig. 15)*

Sample 10: 7.2009.583. Hand-formed rim fragment fired to patchy beige and black. Sparse amounts of coarse grog can be observed. Dimensions: 56×50 mm, wall thickness: 7–9 mm, weight: 23.1 g, *pot (Fig. 18)*

Sample 11: 7.2009.641. Slow-wheeled wall fragment fired to red and greyish brown, decorated with shallow incised bunches of straight lines and wavy lines. Dimensions: 120×60 mm, wall thickness: 8 mm, weight: 71.8 g, *pot (Fig. 20)*

Sample 12: 7.2009.760. Fast-wheeled wall fragment, fired to rusty brown on its exterior and black on its interior. Wheel ribs are visible on its interior. Dimensions: 85×61 mm, wall thickness: 6 mm, weight: 49.3 g, *pot* (poorer quality variant of black pottery) *(Fig. 19)*

Sample 13: 7.2009.781. Slow-wheeled shoulder and rim fragment fired to patchy black. Strongly everted, decorated with bunches of lines and wavy lines. Traces of slab building technique can be observed, as well as pebbles within the very fine raw material. Dimensions: 157×94 mm, wall thickness: 8 mm, weight: 205 g, *pot (Fig. 20)*

Sample 14: 7.2009.782. Slow-wheeled, fired by mixed technique to patchy black on a brown basis. Fragment with a slightly everted rim with comb-impressed decoration on the rim and a bunch of lines on the wall. Traces referring to slab-building technique can be observed. Dimensions: 145×70 mm, wall thickness: 5 mm, weight: 160 g, *pot (Fig. 18)*

Sample 15: 7.2009.793. Slow-wheeled, fired by an oxidized technique to bright brick red, tempered with pebbles. Slightly everted rim fragment with shallow comb-impressed decoration on the edge of the rim and a shallow and wide bunch of wavy lines on the shoulder. Rare amounts of grog temper can be observed. Dimensions: 91×62 mm, wall thickness: 8 mm, weight: 74.1 g, *pot (Fig. 18)*

Sample 16: 7.2009.906. Fast-wheeled, fired by a mixed technique. Vessel fragment with a moderately everted rim. Dimensions: 68×50 mm, wall thickness: 7 mm, weight: 34.6 g, *pot* ("light red" pottery) *(Fig. 16)*

Sample 17: 7.2009.932. Fast-wheeled vessel fired to dark grey, with slightly everted rim. Dimensions: 131×60 mm, wall thickness: 6 mm, weight: 72.6 g, *pot* (poorer quality variant of grey pottery) *(Fig. 19)*

Sample 18: 7.2009.1011. Fast-wheeled wall fragment fired to light grey. Its surface is smooth, chalk-

like, with wheel ribs on the interior. Dimensions: 94×65 mm, wall thickness: 6 mm, weight: 28.2 g, *pot* (grey pottery) *(Fig. 15)*

Sample 19: 7.2009.1187. Slow-wheeled, fired by a mixed technique to patchy black on a black basis. Moderately everted, straight cut rim and shoulder fragment decorated with incisions. Traces of slab-building technique can be observed on its rim. Dimensions: 114×71 mm, wall thickness: 9–10 mm, weight: 138.6 g, *pot (Fig. 19)*

Sample 20: 7.2009.1257. Slow-wheeled, fired by a mixed technique to patchy brown, grey and black. Wall fragment with everted rim, decorated with a bunch of wavy lines on the interior of the rim, with a coarse surface. Possible traces of slab-building technique can be observed. Dimensions: 90×55 mm, wall thickness: 8 mm, weight: 44.8 g, *pot (Fig. 16)*

Sample 21: 7.2009.1345. Slow-wheeled wall fragment fired to yellowish brown, decorated with bunches of lines and wavy lines. Traces of slab-building and pinching technique can be observed. Dimensions: 73×71 mm, wall thickness: 7 mm, weight: 59.2 g, *pot (Fig. 20)*

Sample 22: 7.2009.1347. Slow-wheeled wall fragment of a vessel, heavily tempered with pebbles, fired to red. Unevenly smoothed and signs of pinching are visible. Dimensions: 84×73 mm, wall thickness: 12 mm, weight: 75.4 g, *vessel (Fig. 21)*

Sample 23: 7.2009.1503. Slow-wheeled, fired to a brownish brick color. Vessel fragment with a slightly everted rim, decorated with a bunch of wavy lines on the edge of the rim and a bunch of lines on the shoulder. Traces of slab-building technique can be observed. Traces of vertical pulling on the interior are also visible. Dimensions: 85×100 mm, wall thickness: 10 mm, weight: 177.3 g, *pot (Fig. 18)*

Sample 24: 7.2009.1611. Hand-formed, roughly shaped baking bell with visible vegetal tempering. Straight, straight cut rim fragment. Dimensions: 92×86 mm, wall thickness: 14 mm, weight: 126.1 g, *baking bell (Fig. 17)*

Sample 25: 7.2009.1623. Hand-formed, roughly shaped baking bell. Straight rim fragment. Dimensions: 84×64 mm, wall thickness: 12–15 mm, weight: 80.5 g, *baking bell (Fig. 20)*

Sample 26: 7.2009.1674. Slow-wheeled, fired to brick red, with crushed granite. Strongly everted rim, decorated with dense incisions on its edge. Traces of pinching are visible under the rim. Dimensions: 118×43 mm, wall thickness: 11 mm, weight: 92.2 g, *pot (Fig. 18)*

Sample 27: 7.2009.1709. Fast-wheeled, fired to dark grey. Base fragment with coarse surface. Scattered traces of vegetal tempering are visible. Dimensions: 36×78 mm, wall thickness: 8 mm, weight: 55.4 g, *pot* (poorer quality variant of grey pottery) *(Fig. 19)*

Sample 28: 7.2009.1710. Fast-wheeled, both sides are light brown, its cross-section is dark grey. Fragment of a deep bowl densely decorated with bunches of lines and wavy lines on the wall. Wheel ribs are visible on its interior. Dimensions: 106×84 mm, wall thickness: 8 mm, weight: 78.8 g, *bowl* ("light red" pottery) *(Fig. 16)*

Sample 29: 7.2009.1955. Fast-wheeled, fired to grey. Rim and neck fragment of a bottle decorated with bunches of wavy lines. Dimensions: 91×64 mm, wall thickness: 6 mm, weight: 57.1 g, *bottle* (grey pottery) *(Fig. 15)*

Sample 30: 7.2009.2011. Slow-wheeled, fired to patchy black on a brown basis. Vessel fragment with a strongly everted rim, its body is decorated with a bunch of lines. Dimensions: 125×52 mm, wall thickness: 8–10 mm, weight: 95.5 g, *pot (Fig. 16)*

Sample 31: 7.2009.2016. Slow-wheeled, fired to yellow on its exterior and grey on interior surface. Wall fragment decorated with irregularly incised horizontal lines. Traces of slab-building technique are visible. Dimensions: 91×90 mm, wall thickness: 9 mm, weight: 98.3 g, *pot (Fig. 20)*

Sample 32: 7.2009.2074. Fast-wheeled, consistently fired to red. Rim fragment of a so-called flowerpot-shaped bowl. Dimensions: 56×43 mm, wall thickness: 5 mm, weight: 12.1 g, *bowl* ("light

red" pottery) *(Fig. 17)*

Sample 33: 7.2009.2443. Slow-wheeled, fired to grey and red. Body fragment with a slightly uneven surface smeared with a thin clay layer. Dimensions: 52×77 mm, wall thickness: 10–12 mm, weight: 73.9 g, *pot (Fig. 18)*

Sample 34: 7.2009.2480. Fast-wheeled, both surfaces are fired to red, its cross-section is dark grey. Base fragment of a vessel with a smooth surface, and wheel ribs on the interior. Dimensions: 115×99 mm, wall thickness: 8 mm, weight: 81 g, *pot* ("light red" pottery) *(Fig. 16)*

Sample 35: 7.2009.2482. Fast-wheeled wall fragment fired to yellow with a damaged exterior surface. The exterior surface is smooth, chalk-like, and wheel ribs are visible on its interior. Dimensions: 89×60 mm, wall thickness: 7 mm, weight: 28.7 g, *pot* (yellow pottery) *(Fig. 15)*

Sample 36: 7.2009.2521. Slow-wheeled, both surfaces are fired to light red, its cross-section is grey. Fragment with a straight, slightly thickening rim and bunches of lines and wavy lines on the body. Large amounts of tempering material or various sizes can be observed. Traces of slab-building technique are also visible. Dimensions: 78×74 mm, wall thickness: 9–12 mm, weight: 87 g, *pot (Fig. 21)*

Sample 37: 7.2009.2547. Fast-wheeled, both surfaces are black, its cross-section is brick red. Strongly everted rim fragment of a pot. A few pebbles are visible in its fabric. Dimensions: 47×88 mm, wall thickness: 8–9 mm, weight: 67.7 g, *pot* (black pottery) *(Fig. 19)*

Sample 38: 7.2009.2655. Fast-wheeled base sherd consistently fired to yellow. Its exterior surface is smooth, chalk-like. Dimensions: 65×71 mm, wall thickness: 8–10 mm, weight: 63.7 g, *pot* (yellow pottery) *(Fig. 15)*

Sample 39: 7.2009.2922. Slow-wheeled wall fragment, mixed firing, its exterior is light brown, its interior is black. It is decorated with deeply incised bunches of triple lines. Traces of slab-building technique are visible. Dimensions: 63×58 mm, wall thickness: 9 mm, weight: 42.7 g, *pot (Fig. 21)*

Sample 40: 7.2009.2942. Hand-formed, burnt to patchy brown and dark grey. Slightly everted rim fragment with finger-impressed decoration. Traces of pinching are clearly visible, and slab-building technique can be also suspected. Dimensions: 34×28 mm, wall thickness: 8 mm, weight: 7.8 g, *pot (Fig. 21)*

Sample 41: 7.2009.2966. Hand-formed/post-wheeled, fired to black. Strongly everted, funnel-shaped rim fragment decorated with triple finger impressions. Traces of slab-building technique and pinching are visible. Dimensions: 75×91 mm, wall thickness: 8–10 mm, weight: 87.2 g, *pot (Fig. 21)*

Sample 42: 7.2009.3005. Fast-wheeled, fired to dark grey. Wall fragment with coarse surface and wheel ribs on the interior. Crushed carbonate fragments are visible. Dimensions: 53×45 mm, wall thickness: 10–11 mm, weight: 25.1 g, *pot* (poorer quality variant of grey pottery) *(Fig. 19)*

Sample 43: 7.2009.2877. Slow-wheeled, heavily mixed with pebbles. Wall fragment decorated with bunches of wavy lines. Dimensions: 250×150 mm, wall thickness: 10–15 mm, weight: 470.9 g, *pot or storage vessel*

Samples 44–49: spindle-whorls

Sample 50: 7.2009.35. Slow-wheeled, well-prepared, fired to light yellowish brown. Its surface is smooth, decorated with two bunches of finely incised sextuple lines and a wavy line. Dimensions: 5.5×6 cm; wall thickness: 0.5 cm; weight: 32.3 cm, *pot (Fig. 20)*

Sample 51: 7.2009.91. Slow-wheeled, well-prepared, consistently fired to light red. Its surface is smooth, decorated with incised lines and bunches of lines. Dimensions: 3.2×4.1 cm; wall thickness: 0.7 cm; weight: 10.3 cm, *pot* (yellowish red pottery of the Danube-Tisza Interfluve?) *(Fig. 17)*

Sample 52: 7.2009.487. Slow-wheeled, fired to red and beige. It shows coarse and ribbed surface. Dimensions: 5.8×4.2 cm; wall thickness: 1 cm; weight: 24.7 g, *vessel (Fig. 20)*

Sample 53: 7.2009.625. Fast-wheeled, fired to greyish beige, its surface is smooth with traces of wheel-throwing. Dimensions: 7.2×5.2 cm; wall thickness: 0.8 cm; weight: 30.8 g, *vessel* (poorer quality variant of grey pottery) *(Fig. 15)*

Sample 54: 7.2009.762. Fast-wheeled, thin-walled, both surfaces are fired to black, its cross-section is red, its surface is smooth with traces of wheel-throwing. Dimensions: 9.3×5 cm; wall thickness: 0.5 cm; weight: 27.4 g, *vessel* (black pottery) *(Fig. 19)*

Sample 55: 7.2009.768. Fast-wheeled, both surfaces are fired to grey, its cross-section is red, wheel ribs are visible on the interior, its exterior is smooth. Dimensions: 4.6×3.3 cm; wall thickness: 0.8 cm; weight: 14.8 cm *vessel* (poorer quality variant of grey pottery) *(Fig. 16)*

Sample 56: 7.2009.1212. Fast-wheeled, dark grey on its interior and cross-section, patchy red and dark grey on the exterior, it has a smooth surface with traces of wheel-throwing. Dimensions: 5×6.5 cm; wall thickness: 0.4 cm; weight: 15.9 g, *vessel* (yellowish red pottery of the Danube-Tisza Interfluve?) *(Fig. 21)*

Sample 57: 7.2009.1242. Fast-wheeled, both surfaces are light red, its cross-section is grey. The interior is uneven, the exterior shows traces of wheel-throwing, it is decorated with shallow incised bunches of wavy lines. Dimensions: 4.3×4.2 cm; rim diameter: 21 cm; wall thickness: 0.9 cm; weight: 30.5 g, *pot* (yellowish red pottery of the Danube-Tisza Interfluve?) *(Fig. 17)*

Sample 58: 7.2009.1291. Fast-wheeled, both surfaces are fired to light red, the exterior is smooth with small holes, the interior shows traces of wheel-throwing. Decorated with two parallel, shallow incised bunches of lines. Dimensions: 6.4×4.9 cm; wall thickness: 0.5 cm; weight: 23.2 cm, *pot* (yellowish red pottery of the Danube-Tisza Interfluve?) *(Fig. 16)*

Sample 59: 7.2009.1295. Fast-wheeled, fired to beige and red, its surface is smooth, decorated with a wide and shallow bunch of lines. Dimensions: 4×3.7 cm; wall thickness: 0.5 cm; weight: 10 g, *vessel* (yellowish brown pottery of the Danube-Tisza Interfluve?)

Sample 60: 7.2009.1300. Fast-wheeled, both surfaces are fired to dark brownish grey, its cross-section is dark grey. It is decorated with two bunches of parallel running quadruple lines and between these with a bunch of fast amplitude double wavy lines. Dimensions: 2.7×3.2 cm; wall thickness: 0.5 cm; weight: 8.2 g, *mug* (poorer quality variant of grey pottery) *(Fig. 16)*

Sample 61: 7.2009.1302. Fast-wheeled, both surfaces are fired to light red, its cross-section is grey. Its surface is smooth, it is decorated with three finely incised bunches of lines and a bunch of fast amplitude, quinary wavy lines. Dimensions: 3×5.1 cm; wall thickness: 0.6 cm; weight: 14.9 g, *vessel* (yellowish red pottery of the Danube-Tisza Interfluve?) *(Fig. 16)*

Sample 62: 7.2009.1333. Fast-wheeled, both surfaces are consistently fired to light red, its cross-section is light grey. Its surface is smooth, chalk-like, with wheel ribs on the interior. Dimensions: 3×6.7 cm; bottom diameter: 9 cm; wall thickness: 0.4-0.6 cm; weight: 25.1 g, *pot* (Late Antique pottery?) *(Fig. 21)*

Sample 63: 7.2009.2137. Fast-wheeled, fired to grey, its exterior is smooth, wheel ribs are visible on the interior. Dimensions: 3.4×6.1 cm; wall thickness: 0.9 cm; weight: 27.4 g, *vessel* (poorer quality variant of grey pottery) *(Fig. 16)*

Sample 64: 7.2009.3091. Fast-wheeled, both surfaces are patchy red. The surface is slightly coarse, wheel ribs are visible on the interior. Dimensions: 3.8×3.5 cm; wall thickness: 0.9–1.2 cm; weight: 18.2 g, *vessel* (dark red pottery) *(Fig. 19)*