COMMUNICATIONES ARCHÆOLOGICÆ HUNGARIÆ

2024

COMMUNICATIONES ARCHÆOLOGICÆ HUNGARIÆ

2024

Magyar Nemzeti Múzeum
Budapest, 2024

Főszerkesztő / editor-in-chief
SZENTHE GERGELY

Szerkesztők / editors
FÜZESI ANDRÁS, TARBAY JÁNOS GÁBOR

A szerkesztőbizottság tagjai / editorial board
BÁRÁNY ANNAMÁRIA, IVAN BUGARSKI, HORIA I. CIUGUDEAN, MARKO DIZDAR,
GÁLL ERWIN, LANGÓ PÉTER, LÁNG ORSOLYA, LENGYEL GYÖRGY, MORDOVIN MAXIM

The conference session and the publication was implemented with the support provided by the Ministry of Innovation and Technology of Hungary from the National Research, Development and Innovation Fund, financed under the TKP2021-NKTA-24 funding scheme.

NATIONAL RESEARCH, DEVELOPMENT AND INNOVATION OFFICE HUNGARY

PROGRAM FINANCED FROM THE NRDI FUND

Szerkesztőség / editorial office
Magyar Nemzeti Múzeum Régészeti Tár
H-1088, Budapest, Múzeum körút 14–16.

A folyóirat cikkei elérhetők / journal access: http://ojs.elte.hu/comarchhung
Kéziratbeküldés és szerzői útmutató / submission and guidelines: http://ojs.elte.hu/comarchhung/about/submissions

© A szerző(k) és a Magyar Nemzeti Múzeum / Author(s) and the Hungarian National Museum
Ez egy nyílt hozzáférésű tudományos folyóirat, amely a Creative Commons CC BY-NC 4.0 licence alapján, megfelelő hivatkozással, nem üzleti célra, szabadon felhasználható. / This is an open-access scientific journal distributed under the terms of the Creative Commons Attribution-Non Commercial 4.0 International Licence (CC BY-NC 4.0).

ISSN 0231-133X (Print)
ISSN 2786-295X (Online)

Felelős kiadó / publisher responsible
Demeter Szilárd elnök

TARTALOM – INDEX

FROM LOCAL TO MICROREGIONAL AND BEYOND: SPATIAL STRUCTURES IN AND AROUND THE EARLY MEDIEVAL CARPATHIAN BASIN

Papers submitted to the session organised at the 28th EAA Annual Meeting, Budapest, Hungary, 31 August–3 September 2022

Edited by Ivan Bugarski – Erwin Gáll – Gergely Szenthe

Ivan Bugarski

Space use in Syrmia during the Migration and Avar periods 7

Térhasználat a Szerémségben a népvándorlás korában és az avar korban 29

Bartłomiej Szymon Szmoniewski

Central places or ritual places and the oldest hillforts in Slavic territory in Central and Eastern Europe (5th/6th–7th centuries) 31

Központi- vagy rituális helyek, és a szláv terület legkorábbi magaslati erődjei Közép- és Kelet-Európában (5/6.–7. század) 55

Roman Sauer – Falko Daim – Katharina Richter

Petrographical and mineralogical analyses of pottery from the cemetery of Mödling-An der Goldenen Stiege (Lower Austria): Methods and preliminary results 57

Mödling-An der Goldenen Stiege lelőhelyről (Alsó-Ausztria) származó kerámiák petrográfiai és ásványösszetételi elemzése. Módszerek és előzetes eredmények 78

Zsófia Básti – Bence Gulyás

Burials with sheepskins in light of the changes between the Early and Late Avar periods 81

Juhbőrös temetkezések a kora és késő avar kori változások kontextusában 107

Réka Fülöp

Typological analysis of beads from selected Late Avar cemeteries 109

Késő avar kori temetők gyöngyanyagának tipológiai elemzése 134

Pia Šmalcelj Novaković – Anita Rapan Papeša

Make me a star. Crescent hoop earrings from the southwestern edge of the Khaganate – Identity and status markers 135

Csillagok, csillagok… Csillag alakú csüngővel ellátott fülbevalók mint az identitás és a társadalmi helyzet markerei az avar kaganátus délnyugati peremvidékén 159

Erwin Gáll – Levente Daczó

Asymmetrical relationship between a peripheral region and the Late Avar Khaganate: The Sighişoara microregion in the Early Middle Ages (7th/8th–9th centuries) and the importance of microregional research 161

Aszimmetrikus regionális kapcsolatok a késő avar kaganátusban. Segesvár kistérsége a kora középkorban (7/8–9. század) és a mikroregionális kutatás fontossága 192

Natália Gerthoferová

'Nitra-type' cast earrings in the Middle and Lower Danube region 193

„Nyitra-típusú" öntött fülbevalók a Közép-Duna-medencében és az Al-Dunánál 204

Milica Radišić – Viktorija Uzelac

The southernmost exceptional archaeological discovery from the Hungarian Conquest period: The significance of several finds from the Bačka region (Serbia) 207

A legdélebbi jelentős honfoglalás kori lelet. Néhány Bácska területén előkerült tárgy jelentőségéről 235

Cristina Paraschiv-Talmaţchi

Considerations on the production and distribution of pottery in Dobruja at the beginning of the Middle Ages 237

Gondolatok a dobrudzsai kerámiaelőállításról és -terjesztésről a középkor elején 252

* * *

Kristóf István Szegedi – György Lengyel – Tibor Marton

The problem of 'Epipalaeolithic' in the Carpathian Basin: Lithic finds from Hont-Várhegy, Northern Hungary 255

A Kárpát-medence „epipaleolitikumának" kérdéséhez: pattintott kövek Hont-Várhegyről (Észak-Magyarország) 265

János Gábor Tarbay – Zoltán Kis – Boglárka Maróti

X-ray and neutron radiography of Late Bronze Age weapons and armour from Western Hungary 267

Késő bronzkori, nyugat-dunántúli fegyverek és páncélok röngten és neutronradiográfiás vizsgálata 280

János Gábor Tarbay – Tamás Pétervváry – András Kovács – Bence Soós

A Late Bronze Age collar from Somló Hill: Preliminary report on Somló hoard VII 283

Késő bronzkori nyakék a Somlóról. Előzetes jelentés a VII. depóról 310

Bence Soós – Balázs Lukács – Csilla Líbor
A unique Early Iron Age brooch from Somló Hill 313
Egy különleges kora vaskori fibula a Somló-hegyről 324

RECENSIONES

Rózsa Dékány
Beszédes József: Római kori sírkövek Carnuntumból és városi territoriumáról 327

Tóth Boglárka
Jiří Košta, Jiří Hošek, Petr Žákovský: Ninth to Mid-Sixteenth Century Swords from the Czech Republic in their European Context. Part I: The Finds. Part II: Swords of Medieval and Early Renaissance Europe as a Technological and Archaeological Source 331

Communicationes Archæologicæ Hungariæ 2024, 57–79. DOI: doi.org/10.54640/CAH.2024.57

PETROGRAPHICAL AND MINERALOGICAL ANALYSES OF POTTERY FROM THE CEMETERY OF MÖDLING-AN DER GOLDENEN STIEGE (LOWER AUSTRIA). METHODS AND PRELIMINARY RESULTS

Roman Sauer[1] – Falko Daim[2] – Katharina Richter[3]

Representative samples from various vessels found in an Avar cemetery at Mödling-An der Goldenen Stiege were analysed using archaeometrical methods. The samples were selected by Falko Daim in 1997. This paper gives a short overview of the methods applied for the archaeometric pottery analyses, presenting some typical examples and providing a first overview of some, still preliminary, analytic results and their interpretation. It also briefly discusses the benefits of some techniques used for these analyses.

A tanulmány Mödling-An der Goldenen Stiege avar temetőjéből származó kerámiaanyagból vett reprezentatív minta archaeometriai elemzésének eredményeit adja közre. A mintákat Falko Daim válogatta 1997-ben. A tanulmány összefoglalja az archaeometriai kerámiavizsgálat során alkalmazott módszereket. Ezt néhány jellegzetes példa leírása, majd a hangsúlyozottan előzetes eredmények áttekintése és értelmezése követi. A tanulmány röviden tárgyalja bizonyos technikák alkalmazásának előnyeit az elemzés során.

Keywords: *Petrographical pottery analysis, mineralogical pottery analysis, early medieval archaeology, Avar archaeology*

Kulcsszavak: *petrográfiai kerámiaelemzés, kerámia ásványiösszetétel-elemzés, kora középkori régészet, avar régészet*

Goals

The analysis was carried out with the following goals in focus:

1) Gaining information on pottery technology, including clay preparation techniques, firing conditions, surface treatments, etc.
2) Petrographical characterisation of the partially, already macroscopically distinguishable, pottery fabrics.
3) Interpreting the analytic results.
4) Defining locally made pottery and distinguishing it from possible imports.
5) Evaluating possible variations in pottery found in graves from different ages.
6) Identifying local raw materials suitable for pottery production.

The cemetery (F.D.)

The cemetery of Mödling-An der Goldenen Stiege lies on a terrace on the western slope of the Vienna Woods. Just above the burial site is the *Hochquellwasserleitung*, a water pipeline that has run from the Schneeberg area to Vienna since 1873. From there, one can see the parish church of St. Othmar and its adjacent ossuary in the north, while in the east and southeast, the Vienna Basin opens up, a flat landscape which, as shown by numerous archaeological finds, was densely populated from the Middle Avar Period. Of course, the Avars were not the first to settle there: since the Early Neolithic at the latest, people have taken advantage of the favourable conditions for agriculture and the connection to important trade routes, not least the east-west route along the Danube via the Vienna Gate.

▹ Received 11.03.2024 | Accepted 23.06.2024 | Published online 19.12.2024

1 Dr. Roman Sauer, Wien; roman.rosa@aon.at

2 Universität Wien, Institut für Urgeschichte und Historische Archäologie; falko.daim@univie.ac.at; ORCID: https://orcid.org/0000-0003-2873-2361

3 Universität Wien, Institut für Urgeschichte und Historische Archäologie; richter@krahuletzmuseum.at; ORCID: https://orcid.org/0009-0009-0458-2371

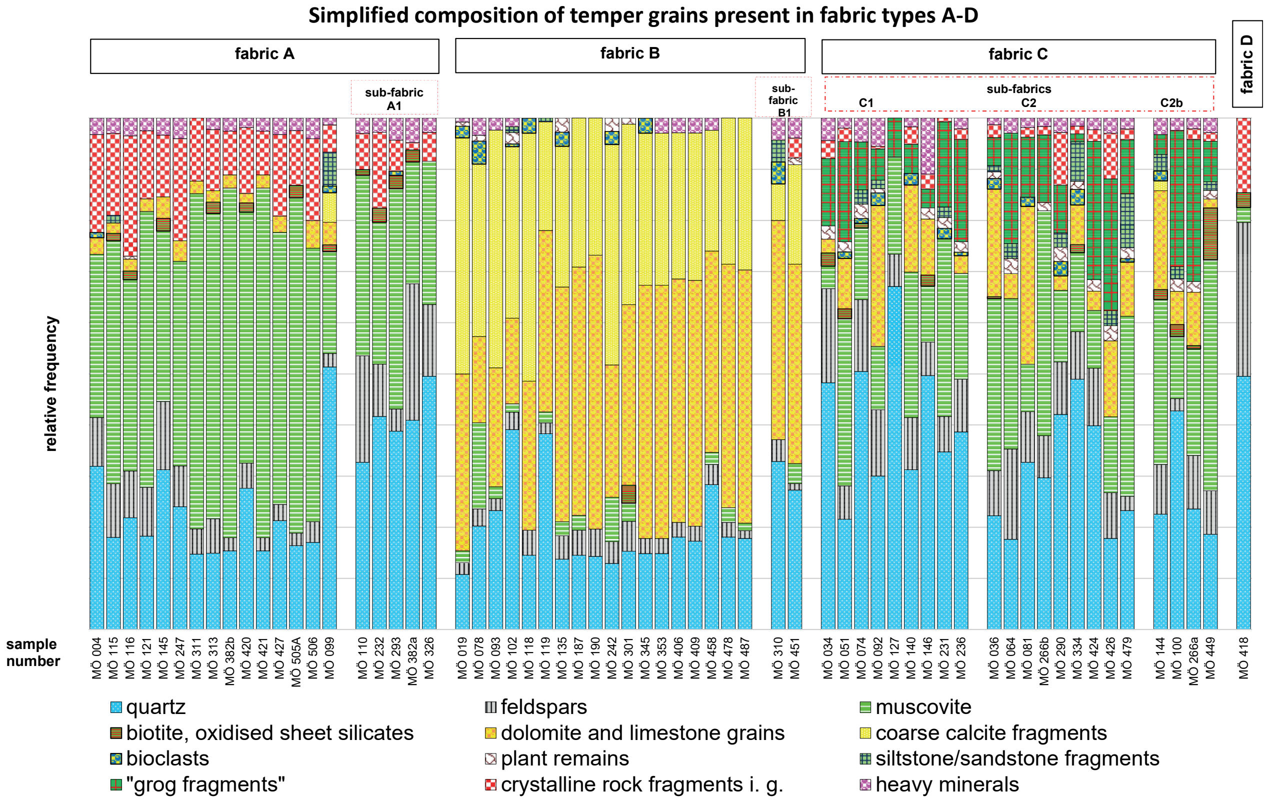


Fig. 1. Summarised, simplified composition of the temper grains of all analysed samples of fabric types A–D
1. kép. Soványítóanyagként használt szemcsetípusok megoszlása az A–D kerámiatípusok vizsgált mintáiban

The Avar Period cemetery was discovered during the construction of a large residential complex. In 1967, Prof. Karl Matzner, a secondary school teacher in Mödling, learned that skeletal finds had come to light at the Goldene Stiege. A short time later, a pottery vessel from the construction site was brought to him, followed by earrings and spindle whorls. In 1968, Matzner began systematic excavations, assisted by some of his students, including Peter Stadler, who later studied chemistry, prehistory, and early history. The *Arbeitsgemeinschaft* für Ur- und *Frühgeschichte* under Clemens Eibner and Alexandrine Persy rushed to help and uncovered a Hallstatt Period cremation grave. Hermann and Lotte Schwammenhöfer – also members of the *Arbeitsgemeinschaft* – continued excavating the Avar burials and some prehistoric features. At the end of 1970, Karl Matzner had to withdraw due to severe illness; the Schwammenhöfers continued the excavations largely on their own, assisted by a skilled backhoe operator who removed the humus layer so that the soil stains of the grave pits were revealed in the light-coloured subsoil. In 1972, Karl Matzner could resume documenting and packing the finds. In 1973, the last of the graves were excavated (Eibner, Matzner 1969; Matzner 1970; Matzner 1971; Schwammenhöfer, Schwammenhöfer 1972; Schwammenhöfer, Schwammenhöfer 1973; Matzner, Schwammenhöfer 1974; Mödling 1977). Some archaeological finds were restored at the Academy of Fine Arts in Vienna, but most of them by Hermann Schwammenhöfer himself. Finally, the artefacts came to the Museum of Mödling, while the Natural History Museum in Vienna acquired the skeletal finds and the animal bones.

At first glance, the necropolis of the Goldene Stiege resembles other Avar cemeteries. It consists of 1–2 m deep inhumation graves, probably most with wooden coffins. The graves are orientated between ESE/WSW (facing the rising sun) and SE/NW. Complete and partial horse burials (horse hide depositions) are not known from Mödling. Since hardly any graves overlap, they were probably visible above ground. Apparently, the dead were buried in garments with jewellery, and whatever else they wore, such as knives, fire strikers and flints (mostly men), needle cases with needles and spinning equipment (mostly women). The grave goods could include weapons, such as a sword or sabre, a recursive bow and arrows, and vessels with their contents. Among

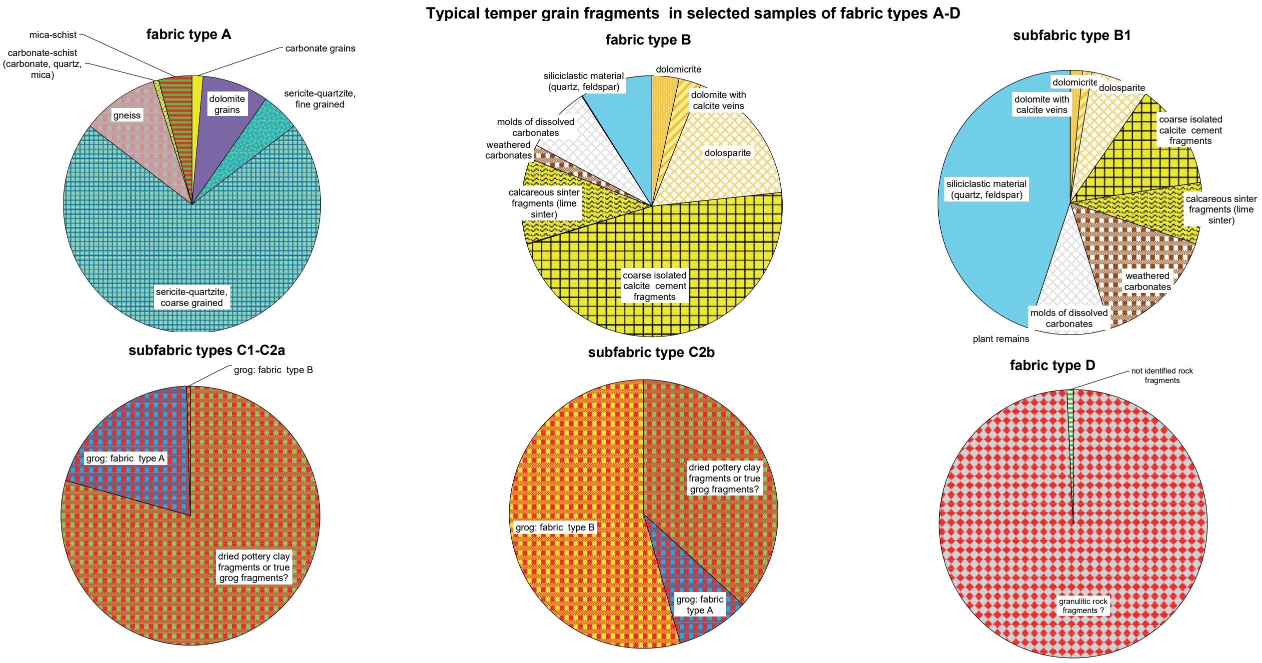


Fig. 2. Examples of typical temper grain compositions present in selected samples of fabric types A–D
2. kép. Soványítóanyagok jellegzetes szemcseösszetétele az A–D kerámiatípusok kiválasztott mintáiban

the offerings might also be cuts of meat (from which, of course, we find only the bones).

As far as men's and women's jewellery is concerned, their fashion follows, by and large, supra-regional trends. Privileged men wore plait clasps and belts decorated with metal fittings; women wore earrings, bead necklaces, bracelets, finger rings, and sometimes two-piece clasps on their outer garments.

Two men were buried with their dogs (Graves 152, 489), which is most unusual for the Avars; one of the dogs even wore a cast bronze pendant on a leash. Two children's graves (433, 464) and the burial of a young adult (Grave 345) contained thin iron lamellar armour plates, probably worn as amulets. The graves of numerous males contained items with female connotations: complex earrings, short necklaces (or parts of them), and spindle whorls; something like that would be inconceivable, for example, in the roughly contemporaneous cemetery of Leobersdorf, about 20 km south of Mödling (Daim 1987).

It is also interesting that, from the beginning, the Mödling cemetery was apparently structured around groups of close relatives. In contrast, the 7th- and early 8th-century graves at Leobersdorf were probably arranged initially according to the date of death, and it was not until the mid-8th century that groups of close relatives appeared in the cemetery. Could this valourisation of the closer kinship in the cemetery be due to an influence of models followed by other communities, like Mödling? (Results to be published in the frames of the Histogenes ERC project, Project No. Histogenes /856453 ERC-2019-SYG/, see https://www.histogenes.org/).

What makes the Goldene Stiege cemetery so distinctive are the numerous pottery vessels. Since many could be well-dated by accompanying finds, a chronology of the pottery record of Mödling had already been established without input from the natural sciences (for the first attempt, see Daim 1994). In a second step, we carried out a mineralogical-petrographic examination of several vessels differing visibly in form, colour, type of manufacture, and decoration. The thin-section analyses yielded astonishing results concerning the everyday practice in the Avar Period community of Mödling.

Applied analytic methods (R. S.)

Introduction

This part gives a short overview of the methods applied in the archaeometric pottery analyses of the vessels' material. It presents some typical examples and concludes with a first overview of some preliminary analytic results and their interpretation. It also briefly discusses the benefits of some techniques used for these analyses. For this preliminary study, 63 samples from various vessels were processed by thin section (63 samples) and heavy mineral analyses (57 samples).

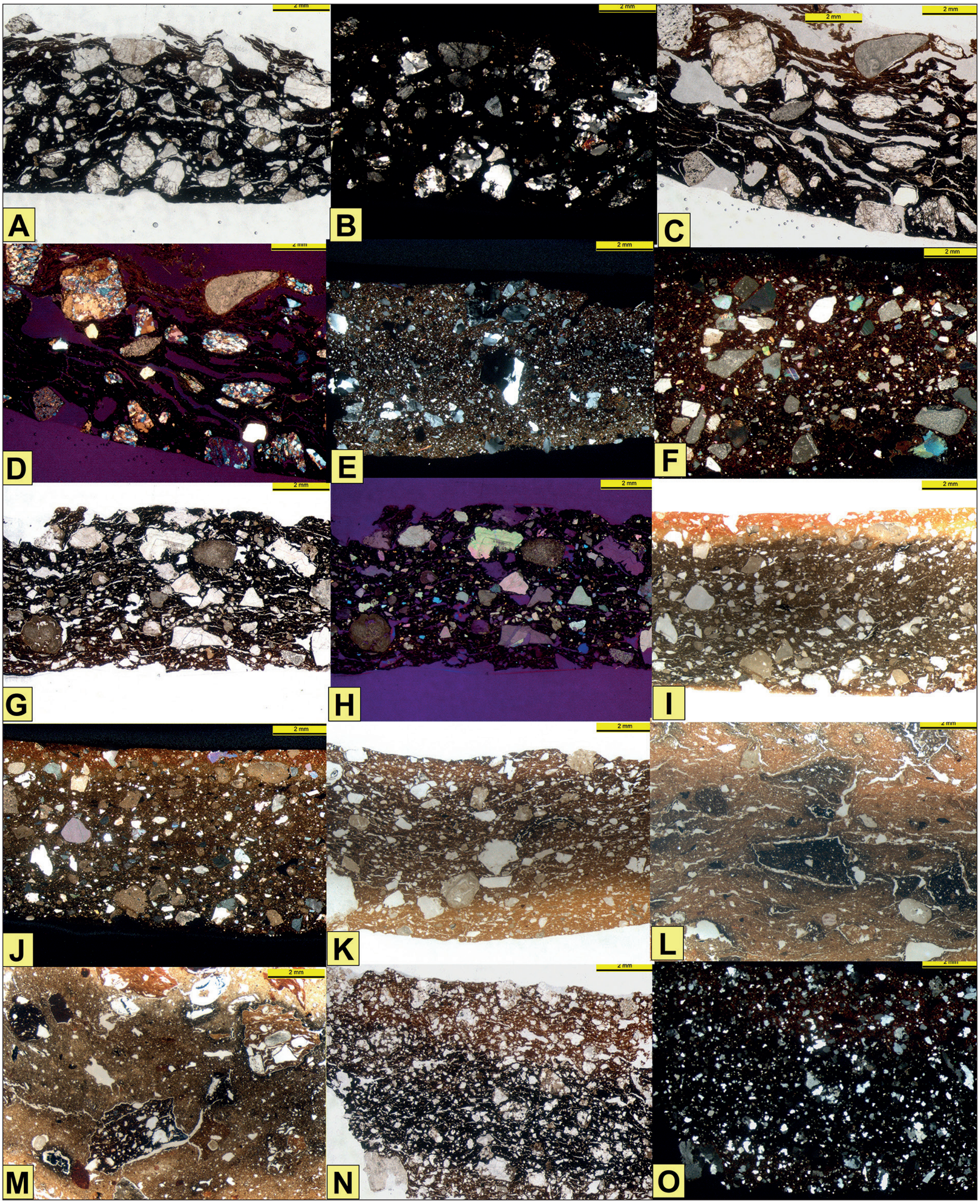


Fig. 3. Typical thin section overview photomicrographs of the fabric types A–D. A: MÖD-311, Fabric type A, tempered mainly with abundant siliciclastic material, PPL; B: MÖD-311, Fabric type A; tempered mainly with abundant siliciclastic material, XPL; C: MÖD-382b, Fabric type A, tempered with partly well-rounded, mainly siliciclastic material and very rarely, carbonates, PPL; D: MÖD-382b, Fabric type A, tempered with partly well-rounded, mainly siliciclastic material and very rarely, carbonates, XPL + gypsum plate; E: MÖD-382a, Fabric subtype A1, tempered with poorly sorted siliciclastic material and no carbonates, XPL; F: MÖD-135, Fabric type B, tempered with abundant carbonate material (limestone, calcite, dolomite), XPL; G: MÖD-242, Fabric type B, tempered with abundant carbonate material ►

Goals

The following goals were set at the start:

1) Gaining information on pottery technology, including clay preparation techniques, firing conditions, surface treatments, etc.
2) Petrographic characterisation of the partially, already macroscopically distinguishable, pottery fabrics.
3) Interpreting analytic results.
4) Defining locally made pottery and distinguishing it from possible imports.
5) Evaluating possible variations in grave pottery from different ages.
6) Identifying local raw materials suitable for pottery production.

First, all vessels have been studied macroscopically and photo-documented by archaeologists. Then, representative samples were selected and analysed using qualitative and semi-quantitative microscopic methods based mainly on distinct macroscopic stylistic or typological characteristics and with consideration to the total amount of the available material. The sampling was done by an archaeologist (Falko Daim) and a laboratory technician (Hans Haiden). After sample preparation, Roman Sauer (1997) carried out the microscopic analyses. Mainly thin section and heavy mineral analyses have been performed. Additionally, a few chemical carbonate staining tests were made to distinguish between calcite and dolomite. The samples were classified into microscopically distinguishable petrographic fabric types based on the results of the analyses. Finally, these results were interpreted together with archaeologists. To facilitate the interpretation of the analytic results, some raw clays and materials suitable for tempering were also collected in the surroundings of Mödling; they were studied the same way as pottery and used as reference. These analyses and the study of further, more distant raw materials are still not completed.

The studied material is presented in *Fig. 1*, where the sample numbers refer to the grave numbers. *Figs. 1, 2, and 8* show typical analytic results in simplified form. Representative thin-section micrographs are provided in *Figs. 3–6*, and heavy mineral examples in *Fig. 7*.

Thin section analyses

The texture, optical properties of the ceramic matrix, grain size, sorting, pore types, and amount and type of tempering materials of 63 petrographic thin-section samples have been analysed to study the various pottery types. Typical tempering agents like rock fragments or heavy minerals were examined in more detail to obtain the best possible information on provenance.

► (limestone, calcite, dolomite), PPL; H: MÖD-242, Fabric type B, tempered with abundant carbonate material (limestone, calcite, dolomite), XPL + gypsum plate; I: MÖD-353, Fabric type B, tempered with abundant carbonate material (limestone, calcite, dolomite), PPL + incident light; J: MÖD-353, Fabric type B, tempered with abundant carbonate material (limestone, calcite, dolomite), XPL; K: MÖD-102, Fabric type B, tempered with abundant carbonate material (limestone, calcite, dolomite) higher content in siliciclastic material, PPL + incident light; L: MÖD-266a, Fabric subtype C2b, inhomogeneous, grog tempered (mainly with fabric type B ware), PPL + incident light; M: MÖD-449, Fabric subtype C2b, inhomogeneous, grog-tempered (mainly with Fabric type B ware), PPL + incident light; N: MÖD-418; Fabric type D, tempered with fine grained siliciclastic material, rich in crystalline rock fragments (partly granulite?), PPL; O: MÖD-418, Fabric type D, tempered with fine grained, siliciclastic grains, rich in crystalline fragments (partly granulite?), XPL

3. kép. Az A–D kerámiatípusok jellegzetes mikroszkópi megjelenése (PPL: egy nikolos fotó; XPL: keresztezett nikolok). A: MÖD-311, A típus, főként erős sziliklasztos soványítás (PPL); B: MÖD-311, A típus, főként erős sziliklasztos soványítás (XPL); C: MÖD-382b, A típus, részint jól koptatott, főként sziliklasztos soványítás, gyér karbonátos szemcsékkel (PPL); D: MÖD-382b, A típus, részint jól koptatott, főként sziliklasztos soványítás, gyér karbonátos szemcsékkel (XPL gipszlemez háttérrel); E: MÖD-382a, A1 altípus, változó szemcseméretű sziliklasztos soványítás, karbonátszemcsék nélkül (XPL); F: MÖD-135, B típus, gazdag karbonátos soványítás (mészkő, kalcit, dolomit) (PPL); G. MÖD-242, B típus, karbonátos soványítás (mészkő, kalcit, dolomit) (PPL); H: MÖD-242, B típus, gazdag karbonátos soványítás (mészkő, kalcit, dolomit) (XPL gipszlemez háttérrel); I: MÖD-353, B típus, gazdag karbonátos soványítás (mészkő, kalcit, dolomit) (PPL beeső fénnyel); J: MÖD-353, B típus, gazdag karbonátos soványítás (mészkő, kalcit, dolomit) (XPL); K: MÖD-102, B típus, gazdag karbonátos soványítás (mészkő, kalcit, dolomit) relatíve magas sziliciklaszt-tartalommal (PPL beeső fénnyel); L: MÖD-266a, C2b altípus, inhomogén, zúzott kerámiás (főleg B típus) soványítással (PPL beeső fénnyel); M: MÖD-449, C2b altípus, inhomogén, zúzott kerámiás (főleg B típus) soványítással (PPL beeső fénnyel); N: MÖD-418, kristályos (részint granulit?) szemcsékben gazdag, finomszemcsés sziliklasztos soványítással (PPL); O: MÖD-418, kristályos (részint granulit?) szemcsékben gazdag, finomszemcsés sziliklasztos soványítással (XPL)

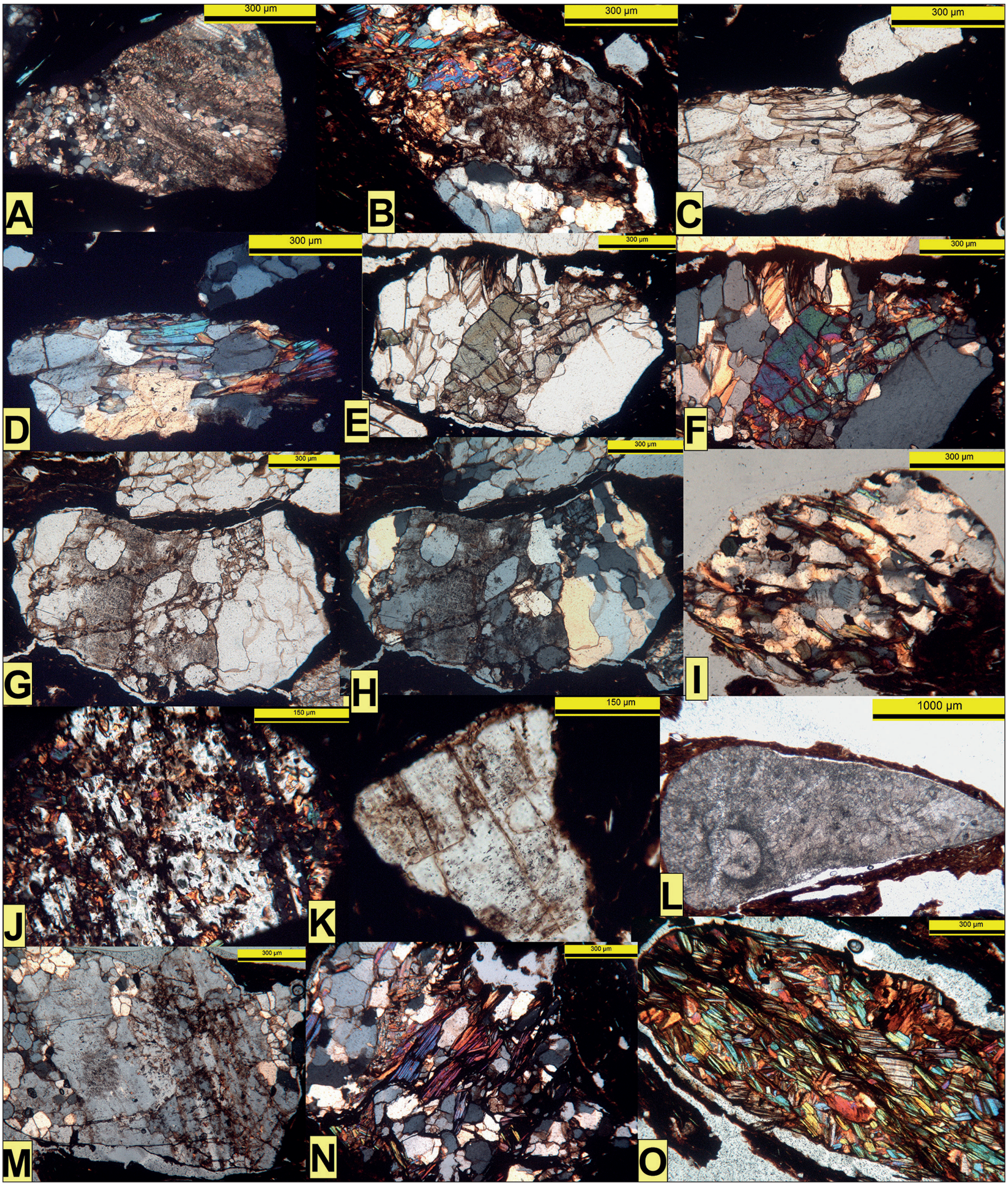


Fig. 4. Typical temper particles of Fabric type A. A: MÖD-311, metamorphic carbonate schist with quartz inclusions, XPL; B: MÖD-311, gneiss fragment (muscovite, feldspar, quartz), XPL+ mica plate; C: MÖD-311, muscovite-quartzite grain, PPL; D: MÖD-311, muscovite-quartzite grain, XPL + mica plate; E: MÖD-311, mica-quartzite with tourmaline inclusion, PPL; F: MÖD-311, mica-quartzite with tourmaline inclusion, XPL + mica plate; G: MÖD-311, gneiss fragment (feldspar, quartz), PPL; H: MÖD-311, gneiss fragment (feldspar, quartz), XPL + mica plate; I: MÖD-311, muscovite-chlorite-quartzite, XPL + mica plate; J: MÖD-311, feldspar grain filled with epidote und chlorite, XPL; K: MÖD-311, weathered feldspar grain with black inclusions (ore?), PPL; L: MÖD-382B, rounded carbonate grain with microfossil remains (algal dolomite?), PPL; M: MÖD-382B, feldspar with quartz inclusions (gneiss fragment), XPL + mica plate; N: MÖD-382B, quartz-mica schist, XPL + mica plate; O: MÖD-382B, mica schist fragment, XPL + mica plate ►

The ceramic matrix:tempering agent proportions were estimated by comparison charts (Mathew et al. 1991; Orton et al. 1994) and partly also by point counting analysis. The applied techniques strongly depend on the quality of the thin section sample. Unfortunately, some of the samples were weakly indurated and partially still water-sensitive, which influenced their quality negatively. More sophisticated preparation methods, such as vacuum impregnation and different grinding liquids (e.g., grinding oil instead of water), were unavailable or could not be used at the time of preparation. Therefore, the quality (thickness) of the prepared thin sections varies highly, and parts of the matrix or sensitive grains may already be lost.

In our study, the grain size fraction of >15 μm was used to separate between the ceramic matrix and the tempering material.

Natural and added tempering agents were not differentiated quantitatively (i.e., the natural sand/silt content of the raw material and intentionally added tempering materials like sand or crushed carbonates). Grain size of bigger than 15 microns was big enough to be easily distinguish between clay with some fine mica (= ceramic matrix) and more coarse-grained silt and sand grains (that were already naturally present in the clay or were intentionally added later).

Depending on the grain size distribution in the original clay raw material, the type of pottery, and research questions, other grain size boundaries could also be used for differentiation. In my opinion, all too strict definitions or classifications are always somewhat artificial! Sure, they may help answer some special technical questions and maybe provide benefits in some cases; however, 25 years ago, these questions played only a minor role or were not of special interest to archaeologists. Furthermore, the study of such technical topics requires different sampling procedures and analyses (e.g., larger samples, incident light, etc.) to obtain statistically relevant results.

In our study, intentional tempering is only mentioned if the presence of such an agent is clear or at least very likely; the identification was based on a comparison with local clays. For example, some local, natural weathering clay types in the area of Mödling do not contain coarse siliciclastic sand grains or angular fresh carbonate particles in significant quantities. Grog could occasionally be identified (mainly in Fabric type C) by the presence of typical, often angular, fragments of fabric types B or A.

It was not possible in many thin section samples to distinguish between unfired, still soft, ready-to-use clay substance fragments (dried-up paste, fired with the vessel first) and particles of previously fired, crushed ceramic (true grog) added as tempering, but the presence of grog particles was pretty clear in a few samples. The number of grog-tempered samples in the analysed set was way too low for a statistical evaluation and sophisticated interpretation. Only a few technically good thin sections are available from these pottery types.

It is often difficult to distinguish the primary siliciclastic sand content of the clay from intentionally added material. Natural clays often contain sand and silt, as seen in the raw material samples analysed for comparison, and often, no addition of sand was necessary to improve the properties of the clay. But sometimes, the differences in sorting or a strong grain size hiatus between the primary siliciclastic material of the original clay substance and the added sand grains can hint at an added sand temper.

For the grain size analyses, 50–300 temper grains >15 μm were measured per thin section (depending on quality limitations and the size of the thin section). Carbonate staining methods could also be applied on more recently prepared thin sections of higher quality to facilitate differentiating between calcite and dolomite. The carbonate staining procedure involves first etching the thin section with dilute hydrochloric acid and then treating it with a mixed alizarin red-S and potassium ferricyanide

► *4. kép*. Az A kerámiatípus jellegzetes soványítóanyagai (PPL: egy nikolos fotó, XPL: keresztezett nikolok). A: MÖD-322: metamorf karbonátos pala kvarczárványokkal (XPL); B: MÖD-311, gneisztöredék (muszkovit, földpát, kvarc) (XPL kvarclemez háttérrel); C: MÖD-311 muszkovit-kvarcit szemcse (PPL); D: MÖD-311, muszkovit-kvarcit szemcse (XPL kvarclemez háttérrel); E: MÖD-311, csillámos kvarcit turmalinzárványokkal (PPL); F: MÖD-311, csillámos kvarcit turmalinzárványokkal (XPL kvarclemez háttérrel); G: MÖD-311, gneisztöredék (földpát, kvarc) (PPL); H: MÖD-311, gneisztöredék (földpát, kvarc) (XPL kvarclemez háttérrel); I: MÖD-311, muszkovit, klorit, kvarcit (XPL kvarclemez háttérrel); J: MÖD-311: földpátos szemcse epidottal és klorittal (XPL); K: MÖD-311, mállott földpátos szemcse fekete zárványokkal (érc?) (PPL); L: MÖD-382b; koptatott karbonátos szemcse mikrofisszília-maradványokkal (algás dolomite?) (PPL); M: MÖD-382B, földpát kvarczárványokkal (gneisztöredék) (XPL kvarclemez háttérrel); N: MÖD-382B, kvarcos csillámos pala (XPL)

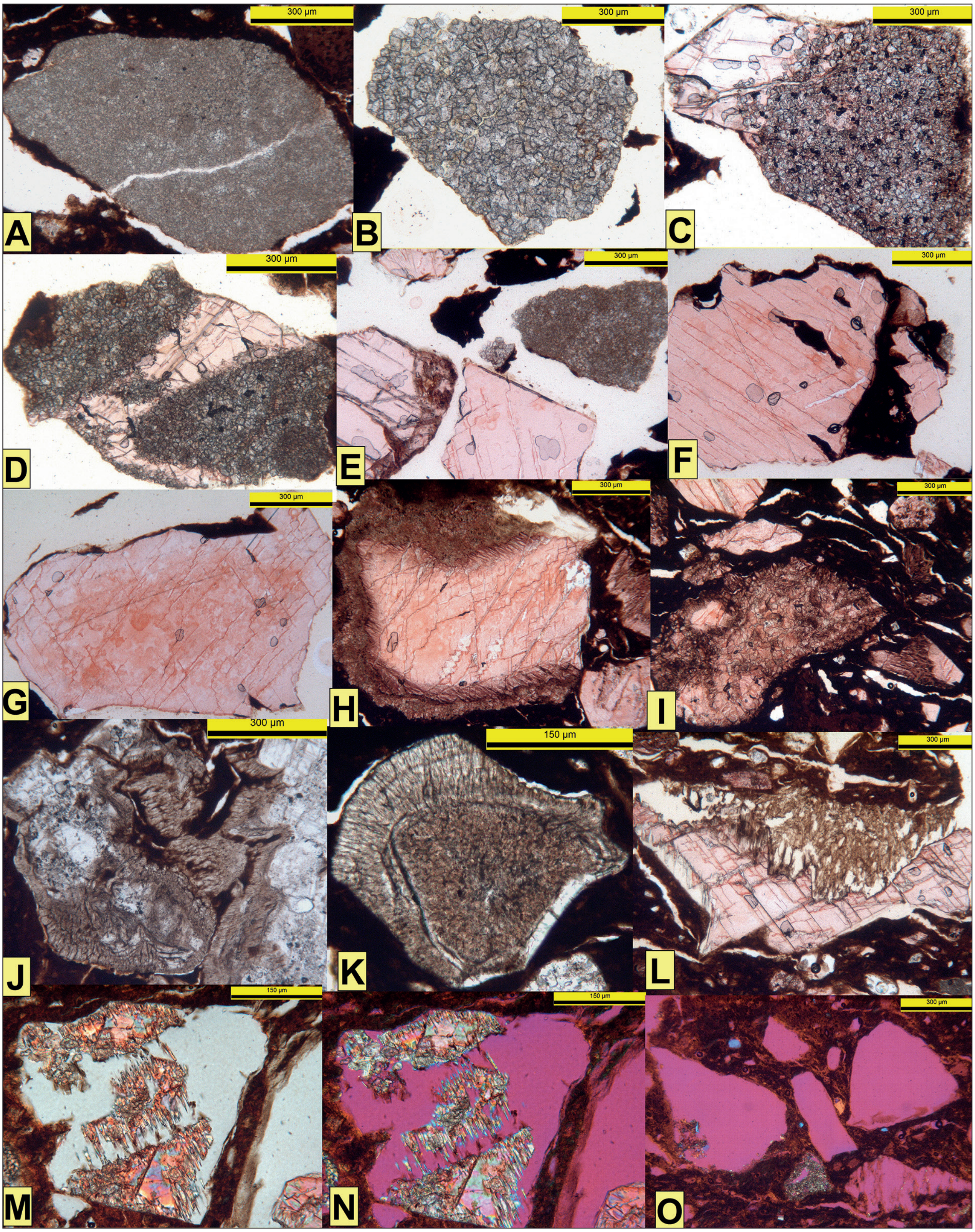


Fig. 5. Typical temper particles of Fabric type B. A: MÖD-019, rounded dolomicrite grain, PPL; B: MÖD-019, dolosparite grain, PPL; C: MÖD-019, dolomicrite to dolomicrosparite, partly replaced by calcite (dedolomitised), overgrown by coarse calcite cement crystal (vein fragment), PPL; D: MÖD-019, dolomicrosparite with calcite veins (stained pink), PPL; E: MÖD-019, calcite fragments, dolomicrosparite (calcite is reddish stained by carbonate staining), XPL; F: MÖD-019, coarse calcite (stained reddish by carbonate staining), PPL; G: MÖD-019, coarse calcite (stained reddish by carbonate staining), PPL; H: MÖD-093, coarse calcite, rimmed by calcite sinter (stained reddish by ►

solution. It allows distinguishing between different types of carbonate phases based on the resulting different colourisation effects. The methods of Dickson (Dickson 1965) and Evamy (Evamy 1963) were used to standardise the characterisation of the 'temper' particles and illustrate the results. The following method was used to semi-quantitatively estimate the proportions of the common temper grains occurring in the ceramic thin sections.

The relative grain proportions were classified as follows:

A) occurrences within one (representative) microscopic field of view

'Dominant'	(more than 20 grains)	A (80)
'Very frequent'	(10–19 grains)	B (50)
'Frequent'	(5–9 grains)	C (30)
'Subordinate'	(2–4 grains)	D (15)

B) occurrence within five fields of view

'Moderate'	(5–9 grains)	E (10)
'Rare'	(2–4 grains)	F (5)

C) The very rare constituents have been classified as follows

'Very rare'	more than one occurrence per thin section	G (3)
'Traces'	one occurrence	H (1)

All samples were analysed using the same magnification (160x). The estimated verbal frequencies were then replaced by the numbers given in parentheses to enable a graphic presentation of the results. Unfortunately, some thin sections were of poor quality and different sizes, making the analysis more difficult and inaccurate. Additionally, typical rock fragments and minerals were separately analysed, and their frequencies were roughly estimated by grain counting.

Heavy mineral analyses

Heavy mineral analyses can provide useful information on provenance and, therefore, help differentiate between imports and local products (for examples, see Sauer, Gassner 1991, Sauer, Gassner 1995, Sauer 2000, Sauer 2006 in Wessely 2006, Sauer 2019). All thin section samples were suitable for evaluation. Of these, 57 examples contained statistically enough heavy mineral residues.

For a quantitative analysis of the heavy mineral composition of the pottery, the heavy minerals had to be concentrated (Sauer 1989). In that order, the pottery samples were first disaggregated with a mortar and pestle, and the grain size fraction of 0.125–0.04 mm was selected by wet sieving. This fraction was later cleaned with diluted hydrochloric acid to remove iron oxide and carbonate incrustations from the surface of the heavy minerals. Because apatite is soluble in hydrochloric acid, it could not be counted.

► carbonate staining), PPL; I: MÖD-093, sinter fragment (stained reddish by carbonate staining), PPL; J: MÖD-078, sinter fragment (no carbonate staining applied), PPL; K: MÖD-078, sinter ooid fragment (no carbonate staining applied), PPL; L: MÖD-093, strongly leached calcite fragment (calcite is reddish stained by carbonate staining), PPL; M: MÖD-093, strongly leached calcite fragment (calcite is reddish stained by carbonate staining), XPL + mica plate; N: MÖD-093, strongly leached calcite fragment (calcite is stained reddish by carbonate staining), open pore spaces are visible in red, XPL + gypsum plate; O: MÖD-093, moulds of totally leached calcite fragments open pore spaces are visible as red spots, XPL + gypsum plate

5. kép. A B kerámiatípus jellegzetes soványítóanyagai (PPL: egy nikolos fotó, XPL: keresztezett nikolok). A: MÖD-019, koptatott dolomikrit szemcsék (PPL); B: MÖD-019, dolopátos szemcsék (PPL); C: MÖD-019, dolomikrit és dolomikropát, részben kalcit (átalakult), durva kalcitcement-kristállyal benőtt (értöredék) (PPL); D: MÖD-019, dolomikropát kalciterekkel (rózsaszín elszíneződés) (PPL); E: MÖD-019, kalcittöredékek, dolomikropát (a karbonátos elszíneződés miatt a kalcit vöröses árnyalatú) (XPL); F: MÖD-019, durva kalcit (a karbonátos elszíneződés miatt vöröses árnyalatú) (PPL); G: MÖD-019, durva kalcit (a karbonátos elszíneződés miatt vöröses árnyalatú) (PPL); H: MÖD-093, durva kalcit szinteres szegéllyel (a karbonátos elszíneződés miatt vöröses árnyalatú) (PPL); I: MÖD-093, szintertöredék (a karbonátos elszíneződés miatt vöröses árnyalatú) (PPL); J: MÖD-078, szintertöredék (karbonátos elszíneződés nélkül) (PPL); J: MÖD-078, szintertöredék (karbonátos elszíneződés nélkül) (PPL); K: MÖD-078, ooidos szintertöredék (karbonátos elszíneződés nélküll); L: MÖD-093, erősen kilúgozódott kalcittöredék (a kalcit karbonátos elszíneződés miatt vöröses árnyalatú) (PPL); M: MÖD-093, erősen kilúgozódott kalcittöredék (a kalcit karbonátos elszíneződés miatt vöröses árnyalatú) (XPL kvarclemez háttérrel); N: MÖD-093m erősen kilúgozódott kalcittöredék (a kalcit karbonátos elszíneződés miatt vöröses árnyalatú), a nyitott pórusok vöröses színűek (XPL gipszlemez háttérrel); O: MÖD-093, teljesen kilúgozódott kalcittöredékek, a nyitott pórusok vörös foltokként jelentkeznek (XPL gipszlemez háttérrel)

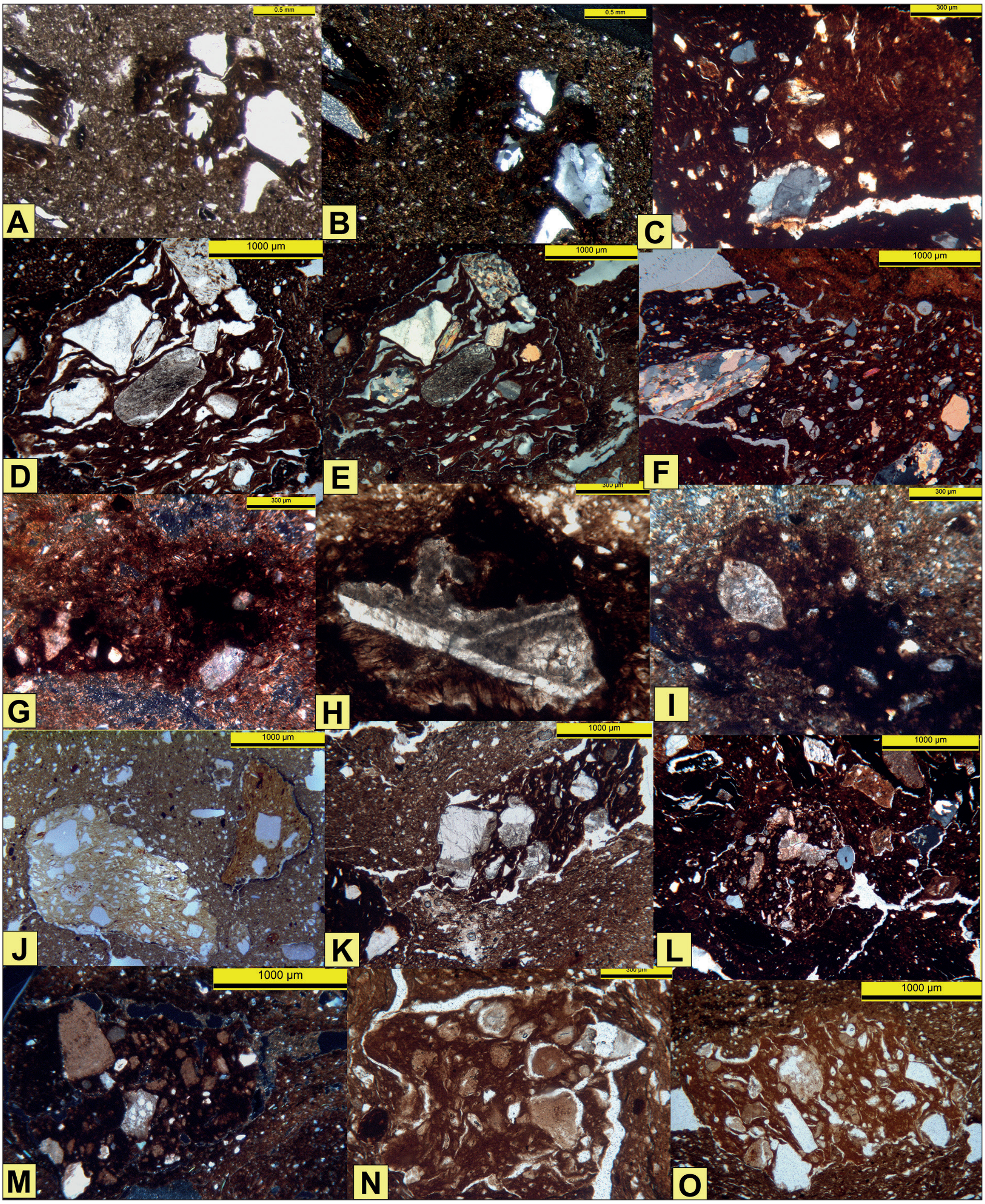


Fig. 6. Typical temper particles of Fabric type C. A: MÖD-036, angular grog grains, tempered by siliciclastic material (Fabric type A), PPL; B: MÖD-036, angular grog grains, tempered by siliciclastic material (Fabric type A), XPL; C: MÖD-290, grog grain, tempered by siliciclastic material (Fabric type A), XPL + mica plate; D: MÖD-449, grog grain, tempered by siliciclastic material rich in metamorphic crystalline rock fragments (fabric type A), PPL, incident light; E: MÖD-449, grog grain, tempered by siliciclastic material rich in metamorphic crystalline rock fragments (Fabric type A), XPL + mica plate; F: MÖD-064, grog grain, tempered by siliciclastic material, rich in metamorphic crystalline rock fragments (Fabric type A), XPL + mica plate; G: MÖD-100, grog grain, tempered by carbonates (Fabric type B), PPL; H: MÖD-100, grog grain, tempered by coarse carbonate grain (fabric type B), PPL; I: MÖD-100, grog grain, ►

This cleaned grain fraction was finally used for heavy mineral separation. Typically, 0.3 to 5 g material per sample was available for that.

The liquid used for separation was bromoform (with a density of 2.85 g/cm³). The obtained heavy mineral fractions were mounted on glass slides with epoxy resin to enable their study using a polarising microscope. The fixed heavy mineral residues were evaluated qualitatively first. The translucent heavy mineral grains for every sample were quantitatively analysed (for a modern textbook on heavy minerals, see Mange, Maurer 1992; for applications of heavy mineral analyses, etc., see also Mange, Wright 2007). Where possible, 200 translucent grains were counted; only samples with less than 0.5 g of fine sand fraction sometimes yielded less than 200 translucent grains.

Examples and summarised results of the heavy mineral analyses are presented in *Fig. 7* and *Fig. 8*.

Preliminary results (R. S.)

The analysed samples can microscopically be divided into main fabric types A–D, while some fabrics can probably be further divided into subtypes (e.g., A1, B1, C1–2b, etc.). However, the number of samples analysed is still insufficient to be sure whether all samples of these subtypes are well-defined (statistically distinguishable). Therefore, only the main, most common petrographic fabric types are described and discussed shortly here.

The results and interpretations of all samples and the documentation of all fabric types are presented in detail in the planned final publication of the whole analysed Avar material of the excavation *Mödling-An der Goldenen Stiege* (Sauer et al. in preparation).

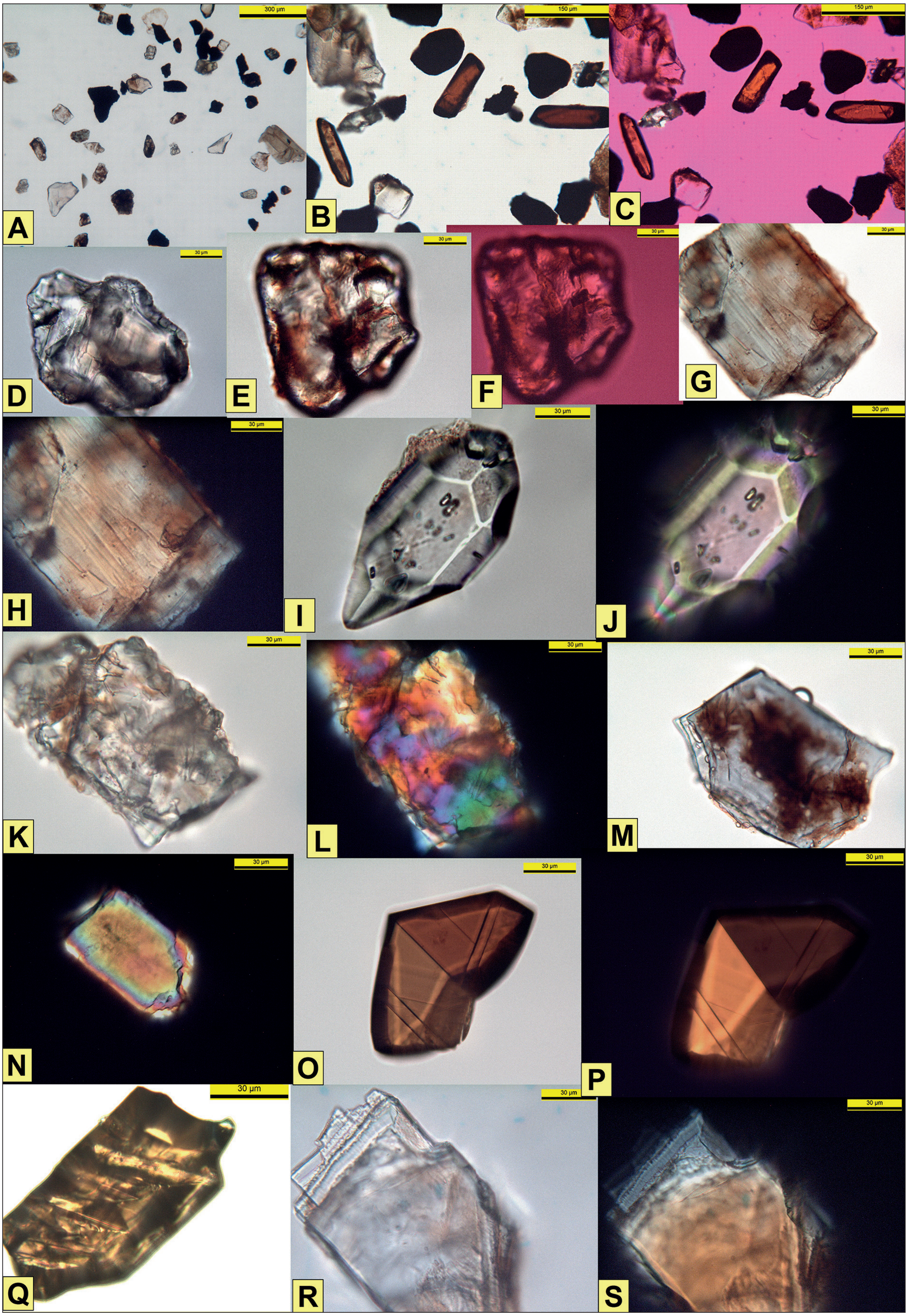
The most significant pottery fabrics (Fig. 1)
Fabric type A
Samples of this type: MÖ/004, MÖ/115, MÖ/116, MÖ/121, MÖ/145, MÖ/145/70, MÖ/247, MÖ/311, MÖ/313, MÖ/382b, MÖ/420, MÖ/421, MÖ/427, MÖ/505A, MÖ/506, MÖ/99 and MÖ/110, MÖ/232, MÖ/293, MÖ/382a, MÖ/326.

All these samples show a characteristic sand temper rich in siliciclastic material. The abundance of crystalline rock fragments is typical. Carbonate particles are rare or even absent (Fabric subtype A1).

Microscopic description: The samples show a yellowish-grey, micaceous, optically mostly active, carbonate-free groundmass fired in a reducing or oxidising environment. The average temper content (grains >15μm) is approximately 32%. It is bimodally sorted and represents partly intentionally added sand. The average grain size is 0.9 mm, and the maximum grain size observed in a thin section is 2.4 mm. For an overview of the simplified temper compositions, see *Fig. 1*.

► tempered by carbonates (Fabric type B), XPL; J: MÖD-081, grog grain, tempered by fine, siliciclastic material (Fabric subtype A1?), PPL, incident light; K: MÖD-449, angular grog grain, tempered by carbonates (Fabric type B), PPL; L: MÖD-479, angular grog grain, tempered by carbonates (Fabric type B), black, carbonaceous plant material is visible, XPL + mica plate; M: MÖD-266a, angular grog grain, tempered by carbonates (Fabric type B), XPL; N: MÖD-266a, angular grog grain, tempered by carbonates (Fabric type B), grains are strongly altered due to weathering(?), PPL, incident light; O: MÖD-266a, angular grog grain, tempered by carbonates (Fabric type B), grains are strongly altered or completely leached (due to weathering?), PPL, incident light

6. kép. A C kerámiatípus jellegzetes soványítóanyagai (PPL: egy nikolos fotó, XPL: keresztezett nikolok). A: MÖD-036, szögletes, zúzott, sziliklasztos soványítású kerámiaszemcsék (A típus) (PPL); B: MÖD-036, szögletes, zúzott, sziliklasztos soványítású kerámiaszemcsék (A típus) (XPL); C: MÖD-290, zúzott, sziliklasztos soványítású kerámiaszemcsék (A típus) (XPL kvarclemez háttérrel); D: MÖD-449, zúzott, kristályos törmelékben gazdag sziliklasztos soványítású kerámiaszemcsék (A típus) (PPL beeső fénnyel); E: MÖD-449, zúzott, kristályos törmelékben gazdag sziliklasztos soványítású kerámiaszemcsék (A típus) (XPL kvarclemez háttérrel); F: MÖD-449, zúzott, kristályos törmelékben gazdag sziliklasztos soványítású kerámiaszemcsék (A típus) (XPL kvarclemez háttérrel); G: MÖD-100, karbonátos soványítás (B típus) (PPL); H: MÖD-100, zúzott, durva karbonátos soványítású kerámiaszemcsék (B típus) (PPL); I: MÖD-100, zúzott, durva karbonátos soványítású kerámiaszemcsék (B típus) (XPL); J: MÖD-081, zúzott, finom karbonátos soványítású kerámiaszemcsék (A1 altípus?) (PPL beeső fénnyel); K: MÖD-449, zúzott, szögletes, durva karbonátos soványítású kerámiaszemcsék (B típus) (PPL); L: MÖD-479, zúzott, szögletes, durva karbonátos soványítású kerámiaszemcsék (B típus) fekete, szenült növényi maradványokkal (XPL kvarclemez háttérrel); M: MÖD-266a, zúzott, szögletes, durva karbonátos soványítású kerámiaszemcsék (B típus) (XPL); N: MÖD-266a, zúzott, szögletes, durva karbonátos soványítású kerámiaszemcsék (B típus), a szemcsék erősen átalakultak, talán mállás következtében (PPL beeső fénnyel); O: MÖD-266a, zúzott, szögletes, durva karbonátos soványítású kerámiaszemcsék (B típus), a szemcsék erősen átalakultak, illetve teljesen kilúgozódtak, talán mállás következtében (PPL beeső fénnyel)



300 µm
150 µm
150 µm
A
B
C
D
E
F
G
H
I
J
K
L
M
N
O
P
Q
30 µm
R
S

The heavy mineral residues are dominated by garnet and epidote/clinozoisite, subordinate brookite/anatase, tourmaline, amphibole, rutile, zircon, rare chloritoid, titanite and, as traces, disthene, monazite, andalusite, and staurolite. The crystalline rock fragments consist mainly of gneiss (often with feldspars filled with clinozoisite/epidote) and fine to coarse-grained sericite-quartzite grains, rarely mica-schist. The rare carbonate fragments consist partly of dolosparite. The crystalline rock fragments are partly weathered. For typical examples, see *Figs. 3–4*.

Interpretation of Fabric type A: Sands of this composition are not known locally or in the close surroundings of Mödling. Possible sources could be locations near the Leitha (approximately 30 km southwest of Mödling) or Rosalia Mountains (approximately 35 km south of Mödling), etc. The study and evaluation of the possible sources of these raw materials are still ongoing.

Fabric type B

Samples of this type: MÖ/019, MÖ/078, MÖ/093, MÖ/102, MÖ/118, MÖ/119, MÖ/135, MÖ/187, MÖ/190, MÖ/242, MÖ/301, MÖ/345, MÖ/353, MÖ/406, MÖ/409, MÖ/458, MÖ/478, MÖ/487, MÖ/310, MÖ/451.

All samples are strongly tempered with carbonate-rich sands. These already macroscopically characteristic samples show a rather homogeneous and uniform composition.

Microscopic description: The samples feature a relatively low-fired, optically active, fine, often calcareous groundmass. The firing atmospheres were reducing to oxidising. Also, differences can be observed between the surface zones and the core of the sherds. In all samples, the fine clay of the matrix is, at least partly, intentionally tempered with coarse, whitish carbonate sand. The average temper content is about 33%. The temper grains show a very poor or bimodal sorting. The grain size of the intentionally added grains is about 1 mm (the maximum grain size observed in a thin section is 2.2 mm). Carbonate grains dominate in the temper, which very occasionally also contains monocrystalline quartz, K-feldspars, muscovite, polycrystalline quartz, traces of chert, carbonaceous plant remains, clay clasts, and heavy minerals (*Fig. 1*).

The carbonate grains consist of dolomite, limestone, and calcite (mainly dolomicrite, dolosparite and coarse-grained calcite; see *Fig. 2, Fig. 5*). Especially at the outer surface zones of the vessels, the carbonate grains are partially leached or totally dissolved and form pores. The typical coarse-grained, isolated calcite crystals come most likely from calcite veins originally present in the dolomite. Calcite sinter fragments and ooid-like carbonate grains can also be observed in some samples. In some samples, carbonate grains seem to be strongly altered or weathered.

The heavy mineral assemblages consist mainly of zircon, brookite/anatase rutile, and subordinate of garnet, epidote/zoisite, tourmaline, and amphibole. Rare or as traces, titanite, disthene, monazite staurolite, chloritoid, chromium spinel, clinopyroxene, and not identifiable heavy minerals can be observed. The quantitative heavy mineral assemblage of Fabric type B differs significantly from the other analysed fabrics, A and C (*Fig. 8*).

Interpretation: The carbonate tempering agents, added at least partially intentionally, likely originate from the extensive dolomite areas (Hauptdolomite is the stratigraphical term) nearby and west of Mödling (see Baden, Schnabel 1997, geological map Blatt 58). Most likely, the angular calcite grains also come from weathered and fractured parts of the Hauptdolomite. The fractures are partly filled with calcite (calcite

Fig. 7. Examples of typical heavy minerals. A: MÖD-266b, overview of a heavy mineral residue, PPL; B: MÖD-418, overview of heavy mineral residue (mainly rutile, garnet, opaque grains), PPL; C: MÖD-418, overview of heavy mineral residue (mainly rutile and garnet), XPL + gypsum plate; D: MÖD-311, garnet, PPL; E: MÖD-231, garnet, PPL; F: MÖD-231, garnet, XPL + gypsum plate; G: MÖD-311, amphibole, PPL; H: MÖD-311, amphibole XPL; I: MÖD-102, zircon, PPL; J: MÖD-102, zircon, XPL; K: MÖD-311, epidote, PPL; L: MÖD-311, epidote, XPL; M: MÖD-311, chloritoid, PPL; N: MÖD-102, tourmaline, XPL; O: MÖD-418, rutile, PPL; P: MÖD-418, rutile, XPL; Q: MÖD-102, rutile, PPL; R: MÖD-418, disthene, PPL; S: MÖD-418, disthene, XPL

7. kép. Jellegzetes nehézásvány-szemcsék mikroszkópi megjelenése (PPL: egy nikolos fotó; XPL: keresztezett nikolok). A: MÖD-266b, nehézásvány-maradvány (PPL); B: MÖD-418, nehézásvány-maradvány (főként rutil, gránát és opálos szemcsék) (PPL); C: MÖD-418, nehézásvány-maradvány (főként rutil és gránát) (XPL gipszlemez háttérrel); D: MÖD-311, gránát (PPL); E: MÖD-231, gránát (PPL); F: MÖD-231, gránát (XPL gipszlemez háttérrel); G: MÖD-311, amfibolit (PPL); H: MÖD-311, amfibolit (XPL); I: MÖD-102, cirkónium (PPL); J: MÖD-102, cirkónium (XPL); K: MÖD-311, epidot (PPL); L: MÖD-311, epidot (XPL); M: MÖD-311, kloritoid (PPL); N: MÖD-102, turmalin (XPL); O: MÖD-418, rutil (PPL); P: MÖD-418, rutil (XPL); Q: MÖD-102, rutil (PPL); R: MÖD-418,(PPL); S: MÖD-418, kianit (XPL)

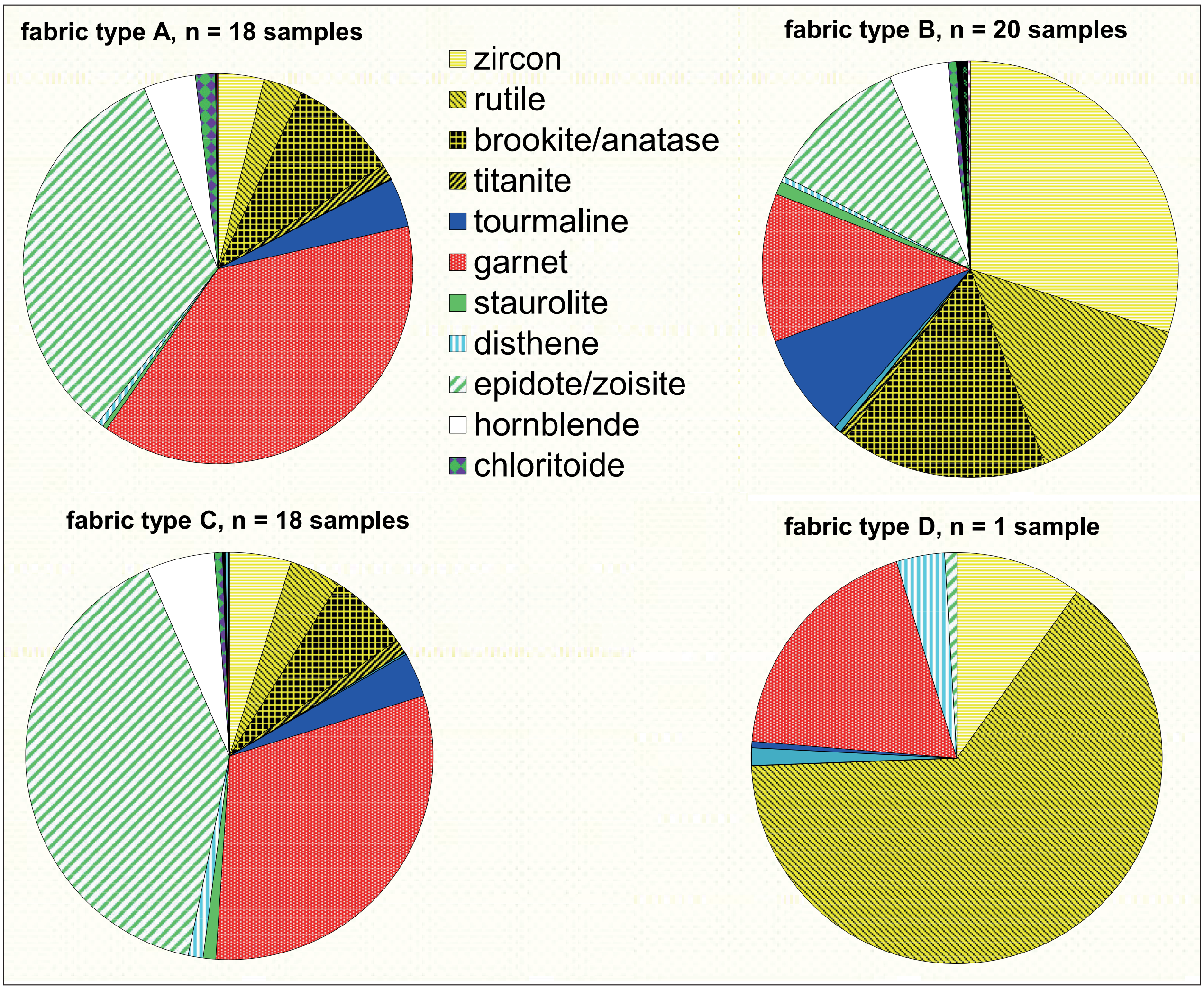


Fig. 8. Typical heavy mineral compositions of Fabric types A–D
8. kép. Az A–D kerámiatípusok jellegzetes nehézásvány-összetételei

veins; e.g., *Fig. 5. C–D*). This material is available in abundance locally and could be easily accessible in the area in the past, too. Preliminary analyses of reference samples of weathered dolomite sand samples taken from Hauptdolomite areas in the surroundings of Mödling showed, at least partly, a very similar petrographic composition. The provenance of the clay raw materials used is still unknown. Calcareous, fine-grained residual loams from soil horizons above the Hauptdolomite and loamy areas in slopes at the border to the Hauptdolomite could have been used (still under investigation). These clays could have been partly tempered with whitish, carbonate-rich weathering sands available nearby. As observed in thin sections of Fabric type B, the natural clay practically seems devoid of coarse-grained siliciclastic particles and mica plates; besides, only occasionally can carbonaceous plant remains be recognised within the clay matrix.

There are no hints for the usage of marbles as a tempering material (e.g., from crushed or weathered marble spolia as a source of crystalline calcite), appearing in coeval pottery on other sites (e.g., Hemmaberg/Carinthia; see Gastgeb 1995, etc. and Pottenbrunn/Lower Austria; see Richter forthcoming). Furthermore, no natural marble resources are available near Mödling.

Fabric type C

Fabric type C is rather inhomogeneous and features, at least partially, true grog temper. However, it is partially difficult to distinguish between true (already fired), reused and crushed pottery grains and clasts from dried (previously unfired) clay paste.

Based on slight differences in the type of grog temper present, Fabric type C can be divided into preliminary fabric subtypes C1–C2b, depending on whether the grog comes from Fabric type A or B vessels (*Fig. 2, Fig. 6*).

Unfortunately, due to poor thin section quality, most of these samples were difficult to analyse.

Fabric subtype C1
Samples: MÖ/034, MÖ/051, MÖ/074, MÖ/092, MÖ/127, MÖ/140, MÖ/146, MÖ/231, MÖ/236

Microscopic description: inhomogeneous, crumbly fabric, at least partly tempered with true grog. Occasional inclusions of coarse crystalline rock fragments, quartz, carbonaceous organic matter, and calcareous aggregates of rhizoliths can be observed. Frequent, non-resorbed clasts (visible shale clasts, probably clast remains due to insufficient homogenisation of the raw material during clay preparation,

Fig. 9. Fabric type A: vessels from Graves 247 and 311. Fabric subtype A1: vessels from Graves 232 and 326. Photos by Katharina Richter, Wien
9. kép. A kerámiatípus: edények a 247 és 311. sírból; A1 altípus: edények a 232 és 326. sírból. Fotó: Katharina Richter, Bécs

kneading, etc.) are typical. Fragments of both old dried clay paste and true grog are present.

Fabric subtypes C2 and C2a
Samples: MÖ/036, MÖ/064, MÖ/081, MÖ/266b, MÖ/290, MÖ/334, MÖ/424, MÖ/426, MÖ/479

Microscopic description: The samples are tempered with angular, crushed ceramic fragments (true grog) coming from both Fabric type A and B vessels.

Fabric subtype C2b
Samples: MÖ/ 144, MÖ/100, MÖ/266a, MÖ/449

Tempered mainly with carbonate-rich Fabric type B fragments. Generally, the differentiation between the subtypes of Fabric type C is still not well established, as they only appear in a few large enough samples and partially poor thin sections. It is, therefore, often difficult to prove the presence of other (larger) particles.

Fig. 10. Fabric type B: vessels from Graves 93, 353, 451 and 458. Photos by Katharina Richter, Wien
10. kép. B kerámiatípus: edények a 93, 353, 451 és 458. sírból. Fotó: Katharina Richter, Bécs

Fig. 11. Fabric type C: vessels from Graves 34, 51, 290 and 334. Photos by Katharina Richter, Wien
11. kép. C kerámiatípus: edények a 34, 51, 290 és 334. sírból. Fotó: Katharina Richter, Bécs

Interpretation: The raw materials used for Fabric type C are probably of local origin, or at least all are locally available.

Fabric type D
Sample: MÖ/418

Microscopic description: The presence of granulitic(?) rock fragments in the sand used for tempering and the rutile-rich heavy mineral assemblage (*Fig. 7, Fig. 8*) are typical.

Interpretation: The composition of the tempering material in this sample is unique and very different from the other fabric types (A, B, and C), probably originating from a near-surface weathering loam deposit in a crystalline rock area.

Possible source areas could be found in the Southern Bohemian massif (e.g., Dunkelsteiner Wald) and perhaps also further in Lower Austria. More samples and research would be necessary to achieve a more accurate provenance identification.

The Mödling Avars and their pottery (FD, KR)

The goal of archaeological research is not seeking adventure or acquiring valuable objects: instead, archaeologists aim to understand how past societies might have lived, thought, and organised themselves. The analysis of cemeteries ideally reveals particular patterns of action that allow us to infer traditions, social rules and, in rare cases, cosmological and religious concepts. These patterns of action become particularly evident through the comparison of burial sites. Within the framework of the European Commission's current research project, "*HistoGenes: Integrating genetic, archaeological and historical perspectives on Eastern Central Europe 400–900 AD*", numerous cemeteries from the Avar Period (or parts of them) are being investigated. From the territory of today's Austria, the cemeteries of Leobersdorf and Mödling-An der Goldenen Stiege are two of the most important subjects of interdisciplinary evaluation and archaeo-historical assessment (Daim 1987; Daim 1994; Daim et al. 2023). This extensive project aims to bring together historical, archaeological, and genetic data based on around 6000 skeletons from the Carpathian Basin and the neighbouring areas in order to write a completely new population history. The results of the mineralogical and petrographic pottery analyses presented here are a small contribution to the research of the technical changes in pottery production, the small-scale exchange or trade of pottery between the numerous Avar Period settlements in the southern Vienna Basin, and perhaps even to some aspects of the burial customs of the related communities.

The cemetery of Mödling-An der Golden Stiege contains 497 graves with more than 300 vessels (Daim et al. 2023). The samples taken for thin section analysis in 1997 were mainly from the Late Avar Period. The 63 thin section samples, all from pots, can be divided into four fabric types, most with subtypes. In addition to information on locally produced and imported pottery, a chronological sequence of the site can also be outlined. The entire pottery record will be presented and discussed in the forthcoming publication on the cemetery of Mödling-An der Goldenen Stiege (Daim et al. in preparation; for a summary of the evolution of Avar pottery, see Herold 2010).

Simple clay pots predominated in the Middle Avar Period (second half of the 7th century). They were produced without a rotating base and are mostly undecorated, although the rim was occasionally adorned with a continuous row of straight or oblique incisions. They are thick-walled and small, and their surface is often smooth (Fabric type C; *Figs. 11–12*). However, soon appeared a very sophisticated ware made from probably local clay tempered with sieved, white, carbonate sand (Fabric type B, 20 samples; *Fig. 10*), which, too, could easily have been obtained locally. However, these pots were very carefully made: they are relatively thin-walled and usually have a harmonious, S-shaped profile, for the forming of which a rotating base with an axle (often called a 'slow turntable') and, apparently, a wooden modelling tool were used. These wheel-finished pots have usually simple, protruding rims. The vessels in this phase tended to become a little taller than before. A common decoration of these vessels is a combination of wavy bands between circular, linear bands. Less common are oblique line bundles, comb impressions, and single or bundled wavy circular lines. The decorations are usually very finely impressed, and the vessel surfaces are grainy or pitted. The vessels were air-dried until leather-hard and fired in a reducing environment. However, towards the end of the firing process, additional air was introduced into the firing chamber, turning the pots' surfaces red, red-black or red-black-yellow, while the carbonate sand added to their material created white mottling. There was undoubtedly an aesthetic concept behind this (a fashion), which but disappeared at the begin-

Fig. 12. Fabric type C: vessels from Graves 140 and 144. Fabric type D: vessel from Grave 418.
Photos by Katharina Richter, Wien
12. kép. C kerámiatípus: edények a 140 és 144. sírból; D kerámiatípus: edény a 418. sírból. Fotó: Katharina Richter, Bécs

ning of the 8th century. Around the time when the first black melon seed beads appeared in necklaces (of which they remained a dominant component for around a century), the white-mottled red pottery gradually disappeared.

In the first half of the 8th century, simple, less hard-fired vessels made of local clay (Fabric type C) and pots tempered with carbonate sand still appeared; however, oxidation to create red colouration seems to have been abandoned soon. Shortly after, in the mid-8th century, a technically excellent, hard-fired pottery rich in siliciclastic sand temper and a tendency in design towards angular rims appeared (*Fig. 9*). These wheel-thrown pots are thin-walled and taller than the previous types; their shoulder is more emphasised than before, and in some cases, the neck is slightly profiled. Their surfaces are usually rough. The decorations are more strongly impressed than previously, and rim decorations are common. These pots are often decorated with circular line bundles, wavy bands, and carefully applied oblique comb impressions. Since the siliciclastic sand used for their material does not occur in the vicinity of the Goldene Stiege, these pots must have come to Mödling through exchange or trade from the Leitha Mountains (*Leithagebirge*) or the Hundsheimer Berg about 20 km away in the east, where similar siliciclastic materials occur naturally. Apparently, we have evidence here of a kind of pottery centre that presumably supplied a specific area. Specifying the area of this workshop circle by mineralogical-petrological analyses would be a project for the upcoming years.

The vessel from Grave 418 is a special case. It was also fired to hard ceramic but has a completely different composition than the pots of Fabric type A (*Fig. 12*). This vessel cannot have been made in Mödling either, as both its material and overall appearance differ from the local pottery. It could be dated to the mid-8th century. The rim is short and protruding, decorated on the inside. It is wheel-finished and has deeply impressed decorations in the form of a wavy band, vertical line bundles, and comb stitches.

Strangely enough, pots made of local clay, formed only by hand, still (or again?) appeared in Mödling in the Late Avar Period III (final third of the 8th century). Clearly, these were not considered to be of lower value since they are found in some very well-equipped burials. For example, the 'princess' in Grave 144 was provided with food in such a vessel (Fabric type C, Subtype C2b; *Fig. 12*). Another example is Grave 140, which also included a rare Late Avar bronze belt set.

What can be concluded from this evidence? Could it be that the 'mass-produced' goods from the 'assembly line' were considered inappropriate for the burial of loved ones, and more 'personal', handmade vessels were preferred in this context? Could the making of a funerary vessel have been part of the burial ritual?

It will be a future task to ascertain whether comparable practices can be found in other cemeteries in the immediate and wider vicinity of the site or whether this is a local phenomenon.

REFERENCES

Daim, F. 1987: Das awarische Gräberfeld von Leobersdorf, NÖ. Denkschriften der Österreichischen Akademie der Wissenschaften, phil.-hist. Klasse 194, Wien.

Daim, F. 1994: Zur nachgedrehten Keramik aus dem awarischen Gräberfeld von Mödling-An der Goldenen Stiege. In: Čeněk, S. (ed.), Slawische Keramik in Mitteleuropa vom 8. bis zum 11. Jahrhundert. Kolloquium Mikulčice, 25.–27. Mai 1993. Internationale Tagungen in Mikulčice 1. Brno, 30–52.

Daim, F., Stadler, P., Pohl, W., Sauer, R., Blay, A., Eichert, S., Berner, M., Pany-Kucera, D., Tobias, B., Hofmanová, Z., Wang, K., Richter, K., Herbig, A., Hiss, A., Wiltschke-Schrotta, K. 2023: Auf der Suche nach den feinen Unterschieden. Die awarischen Gräberfelder von Leobersdorf und Mödling – An der Goldenen Stiege. In: Meller, H., Krause, J., Haak, W., Risch, R. (eds.), Kinship, Sex, and Biological Relatedness. The contribution of archaeogenetics to the understanding of social and biological relations. 15. Mitteldeutscher Archäologentag vom 6. bis 8. Oktober 2022 in Halle (Saale). Tagungen des Landesmuseums für Vorgeschichte, Halle, 307–340.

Daim, F., et al. forthcoming: Das awarenzeitliche Gräberfeld von Mödling, An der Goldenen Stiege.

Dickson, J. A. D. 1965: A modified technique for carbonates in thin section. Nature, v. 205, no. 4971, 587. https://doi.org/10.1038/205587a0

Eibner, C., Matzner, K. 1969: Mödling. Fundberichte aus Österreich 9, Heft 3. 148.

Evamy, B. D. 1963: The application of a chemical staining technique to a study of dedolomitisation. Sedimentology 2, 164–170. https://doi.org/10.1111/j.1365-3091.1963.tb01210.x

Gastgeb, A. 1995: Mineralogisch-sedimentpetrologische Untersuchungen an spätrömischen Grobkeramiken der Ausgrabungen Teurnia und Hemmaberg in Kärnten, Car. I 185, 205–249.

Herold, H. 2010: Zillingtal (Burgenland): Die awarenzeitliche Siedlung und die Keramikfunde des Gräberfeldes. Monographien des Römisch-Germanischen Zentralmuseums 80, Mainz.

Mange, M. A., Maurer, H. F. W. 1992: Heavy Minerals in Colour. London. https://doi.org/10.1007/978-94-011-2308-2

Mange, M. A., Wright, D. T. (eds.) 2007: Heavy Minerals in Use. Developments in Sedimentology 58.

Mathew, A. J., Woods, A. J., Oliver, C. 1991: Spots before your eyes: new comparison charts for visual percentage estimation in archaeological material. In Middletone, A. P., Freestone, I. C. (eds.), Recent developments in ceramic petrology, British Museum Occasional Paper 81 (London: British Museum), 211–263.

Mödling 1977: Awaren. Ausstellung: Ausgrabungen ‚Goldene Stiege'. Mödling.

Matzner, K. 1970: Mödling. Fundberichte aus Österreich 9, Heft 4, 212–217.

Matzner, K. 1971: Mödling. Fundberichte aus Österreich 9, Heft 5, 297–309.

Matzner, K., Schwammenhöfer, H. 1974: Mödling – An der Goldenen Stiege. Fundberichte aus Österreich 12, 1974, 127–129.

Richter, K. forthcoming: Zur frühmittelalterlichen Keramik von Pottenbrunn und Mödling-An der Goldenen Stiege.

Sauer, R. 1989: Die Anwendung der Schwermineralanalyse für die Herkunftsbestimmung von antiker Keramik anhand von Beispielen aus Carnuntum und St. Pölten. Wiener Berichte über Naturwissenschaften in der Kunst 6 (7), 121–141.

Sauer, R. 2000: Archäometrische Untersuchungen zur Keramik von Mautern. In: Gassner, W., Sauer, R., Stiglitz, H., Zabehlicky, H. (eds.), Das Kastell Mautern-Favianis. Der römische Limes in Österreich 39.

Sauer, R. 2006: Archäometrie. In: Wessely, G. (ed.), Geologie von Niederösterreich 416 (655), 323–326.

Sauer, R. 2019: Petrographical and Mineralogical analyses of Pottery and Clay Raw Materials from Brunn am Gebirge, Wolfsholz. In: Stadler, P., Kotova, N. (eds.), Early Neolithic Settlement Brunn am Gebirge, Wolfsholz, Site 2 in Lower Austria and the Origin of the Western Linear Pottery (LPC). Beiträge zur Ur-und Frühgeschichte Mitteleuropas 88, 475–512.

Sauer, R., Daim, F., Richter, K. forthcoming: Das awarische Gräberfeld von Mödling-An der Goldenen Stiege.

Sauer, R., Gassner, V. 1991: Archäometrische Untersuchungen zur Gebrauchskeramik in Carnuntum. Vorläufige Ergebnisse. Der Römische Limes in Österreich 37.

Sauer, R., Gassner, V. 1995: Archäometrische Untersuchungen zur Gebrauchskeramik aus Carnuntum. In: Schreiner, M. (ed.), Naturwissenschaften in der Kunst. Wien.

Schnabel, W. 1997: Geologische Karte der Republik Österreich 1: 50 000, Blatt 58 Baden. Wien.

Schwammenhöfer, H., Schwammenhöfer, L. 1972: Mödling-An der Goldenen Stiege. Fundberichte aus Österreich 10, 102–127.

Schwammenhöfer, H., Schwammenhöfer, L. 1973: Mödling-An der Goldenen Stiege. Fundberichte aus Österreich 11, 122–130.

MÖDLING-AN DER GOLDENEN STIEGE LELŐHELYRŐL (ALSÓ-AUSZTRIA) SZÁRMAZÓ KERÁMIÁK PETROGRÁFIAI ÉS ÁSVÁNYÖSSZETÉTELI ELEMZÉSE. MÓDSZEREK ÉS ELŐZETES EREDMÉNYEK

Összefoglalás

A régészeti kutatás célja nem a kalandkeresés vagy az értékes tárgyak felgyűjtése; a régészek inkább abba próbálnak betekintést nyerni, hogy az egyes közösségek hogyan éltek, gondolkodtak és szerveződtek a múltban. Ideális esetben egy temető elemzése következtetni enged a mögöttes közösség tradícióira, társadalmi szabályrendszerére, illetve (ritka esetben) kozmológiai és vallásos képzeteire is. E cselekvési mintázatok különösképpen jól láthatóvá válnak, ha több temető anyagát hasonlítjuk össze. Az Európai Bizottság által támogatott, jelenleg is futó „*HistoGenes: Integrating genetic, archaeological and historical perspectives on Eastern Central Europe 400–900 AD*" projekt keretében számos avar temető anyaga is (legalább részben) elemzésre kerül. Az interdiszciplináris, régészeti-történeti interpretációt s magába foglaló kutatómunka a mai Ausztria területéről leginkább Leobersdorf és Mödling-An Der Goldenen Stiege temetőit érinti (Daim 1987; Daim 1994; Daim et al. 2023). A nagy volumenű projekt mintegy 6000, a Kárpát-medencéből vagy annak közvetlen környékéről származó egyén történeti, régészeti és genetikai adatait integrálja egy alapjaiban új népességtörténeti rekonsrukcióhoz. A kapcsolódó kerámiaanyag ásványtani és petrográfiai elemzése csekély hozzájárulást jelent e nagy munkához; ennek révén követhetővé válnak a kerámiakészítésben bekövetkezett technológiai változások, az edényeknek a déli Bécsi-medence avar falvai közötti, kis arányú cseréje és kereskedelme, és talán még egyes temetkezési szokások is.

Mödling-An Der Goldenen Stiege avar temetőjének 497 feltárt sírjából több mint 300 edény került elő (Daim et al. 2023). Az 1994-ben vékonycsiszolat-elemzésre kiválasztott minták főként késő avar kori edényekből származtak. A 63, fazekakból vett mintákból készített vékonycsiszolat négy kerámiaanyag-típusba volt sorolható, melyek többségében altípusokat is el lehetett különíteni. A minták nem csupán a helyi és az import kerámiáról szolgáltattak adatokat, de időrend felvázolására is alkalmasnak bizonyultak (a lelőhely teljes kerámiaanyaga közlésre kerül a temető készülő közlésében /Daim et al. in preparation/; az avar kerámia evolúciójáról összefoglalóan lásd Herold 2010).

A középavar időszakban (7. század 2. fele) az egyszerű, korong nélkül készített, jobbára díszítetlen fazekak domináltak, esetenként a peremen körbefutó folyamatos vonallal vagy ferde vonalkázással. E fazekak kisméretűek, vastag fallal és aránylag sima felülettel (C kerámiatípus, *11–12. kép*). Nem sokkal később feltűnik az anyagban egy jóval kifinomultabb, feltehetően helyi agyagból készített változat, melynek anyagát átszitált, fehér, karbonátos homokkal soványították (B kerámiatípus, 20 mintában; *10. kép*). Bár e soványítóanyag szintén elérhető volt helyben, az edények különösen gondos kidolgozásúak és faluk jóval vékonyabb, mint az előző változaté. Harmonikus, S-profilú formájukat lassúkorongon, fából készült eszköz segítségével nyerték el. Ezen utánkorongolt változat edényeinek pereme általában előreugró, egyszerű. E változat példányai általában magasabbak, mint a megelőző időszaké, jellegzetes díszítésük körbefutó minta: a két egyenes vonalköteg között egy hullámos vonalköteg. Ritkábbak a ferde vonalkötegek, a fésűlenyomatok és a magányos vagy kötegbe rendezett körbefutó vonalak. A minták általában igen finoman nyomódnak a szemcsés, apró lyukakkal tarkított, pórusos felületbe. Az edényeket bőrkemény állagig szárították levegőn, majd égetésük redukciós környezetben kezdődött. Az égetés végén friss levegőt juttattak a tűztérbe, így az edények felülete vörös, vörös-fekete, illetve vörös-fekete-sárga színt kapott, míg a karbonátos homok fehéres foltokként vált ki rajta. Ez a felületkialakítás nyilvánvalóan valamiféle tudatos esztétikai koncepció (divat) eredménye, mely a 8. század kezdetére azonban kiveszett a gyakorlatból. Körülbelül a dinnyemag alakú gyöngyök (melyek aztán a következő évszázad során női nyakláncok meghatározó elemei maradtak) feltűnésével egy időben a márványozott vörös-fehér kerámia fokozatosan eltűnik az avar emlékanyagból.

A 8. század első felének anyagában feltűnik egy helyi anyagból készült, kevésbé keményre égetett (C kerámiatípus), valamint egy karbonátos homokkal soványított változat is, ám a vörös szín gyorsan kiveszik, utalva az oxidációs lépés elhagyására az égetési folyamatból. Nem sokkal később, a 8. század közepén kiváló minőségű, keményre égetett,

sziliklasztos homokkal soványított, jellemzően szögletes peremprofilú fazékváltozat tűnik fel (*9. kép*). E korongolt edények jellemzően magasabbak a korábbiaknál; faluk vékony, válluk magas, hangsúlyos, nyakuk gyakran kissé profilált, felületük durva. A minták viszonylag erősen nyomódnak a felületbe; a perem díszítése gyakori. Jellemzően körbefutó egyenes és hullámos vonalkötegek, illetve gondosan benyomott ferde fésűlenyomatok díszítik őket. Minthogy az anyagukban feltűnő sziliklasztos homok nem található meg a lelőhely környezetében, ezek az edények feltehetően csere vagy kereskedelem útján érkeztek ide talán a mintegy 20 km-re keletre húzódó Lajta-hegység vagy a Hundsheimer Berg vidékéről, ahol e soványításhoz használt anyag természetes előfordulásai ismertek. A kapcsolódó műhelykörzet behatárolása, illetve azt ezt célzó petrográfiai és ásványtani elemzések az elkövetkező évek feladatai közé tartozik.

A 418. sírban talált edény különleges darab: keményre égetett, de anyagának összetétele jelentősen eltér az A kerámiatípustól (*12. kép*). Anyaga és formája alapján ez sem lehet helyi gyártmány. A 8. század közepére keltezett fazék rövid, előreugró pereme belül díszített. Utánkorongolt; kívül mélyen benyomott egyenes és hullámos vonalkötegek és fésűlenyomatok díszítik.

Különös módon helyi, kézzel formált edények a lelőhely késő avar III. fázisában, a 8. század utolsó harmadában tűnnek fel ismét (vagy még mindig?). E fazekak értékét használóik nyilván nem gondolták alacsonynak, hiszen a változat példányai gazdag sírokban is feltűnnek; például a 144. sírban eltemetett „hercegnő" ilyen edényben kapott ételmellékletet (C kerámiatípus, C2b altípus, *12. kép*), míg a szintén ilyen edényt tartalmazó 140. sír férfija veretes övet viselt.

Mi következik mindebből? Talán a gyászolók nem tartották megfelelőnek „tömegtermelt" edényeket tenni szeretteik sírjaiba, és inkább „személyesebb", kézzel készített darabokat használtak? Esetleg a sírba kerülő edény készítése maga is a temetési rítus része volt?

Szintén a jövő feladata feltárni, hogy a lelőhely közvetlen és távolabbi környezetében lévő egykorú temetőkben szintén megfigyelhető-e ez a gyakorlat, vagy kizárólagosan helyi jellegzetesség.

© 2024 The Author(s).

This is an open-access article distributed under the terms of the Creative Commons Attribution-Non Commercial 4.0 International Licence (CC BY-NC 4.0).