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Research Article

Production and Distribution of Greyware Tripod Bowls in 1st and 2nd Centuries AD Noricum (Austria)

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Abstract

Greyware tripod-bowls are common on 1st to 3rd centuries AD sites in present-day Austria, known as Noricum. They measure between 18 and 22cm in diameter and were used for cooking. Due to their abundance and macroscopic homogeneity, tripod-bowls hold important potential to study the technology and infer aspects of the production organisation and trade between the communities that manufactured and used them. To answer these questions, 23 samples were selected from six settlement sites in Noricum, and their mineralogical composition was examined in thin section petrography.

The results indicate that Roman potters shared technological practices of paste preparation, forming, and firing tripod-bowls. However, the mineralogical examination allowed the identification of several distinct petrographic groups. Most compositional groups are restricted to a single site. Comparison of the petrographic groups with the geological setting of Noricum allows to suggest that potters' communities were active at each of the six sites studied; they produced tripod-bowls and distributed them on the local market. Only one compositional group occurs at several sites; despite its pending provenance, it is assumed that this workshop successfully produced and traded tripod-bowls within the wider region of Noricum.

Keywords: Roman tripod bowls; Production technology; Provenance; Trade; Austria

Introduction

The Roman province of Noricum covered most of modern-day Austria, south-eastern Germany as well as northern Slovenia and northern Italy. The province is defined by a flat northern area on the right bank of the Danube River, and a mountainous southern region of the eastern Alps. It was incorporated in the Roman Empire in 15AD and ultimately integrated during Emperor Claudius' reign between AD 41-54 [1]. This is witnessed by the development of various settlements. More specifically, the hilltop settlement on the Mount Magdalena (known as 'Magdalensberg') developed into a prosperous trading centre until around 50AD, when the capital of Noricum was created at Virunum (Zollfeld). Several towns originated, including Aguntum (Dölsach), Teurnia (St. Peter in Holz) and Iuvavum (Salzburg), as well as roadside settlements, such as Immurium (Moosham) (Figure. 1).

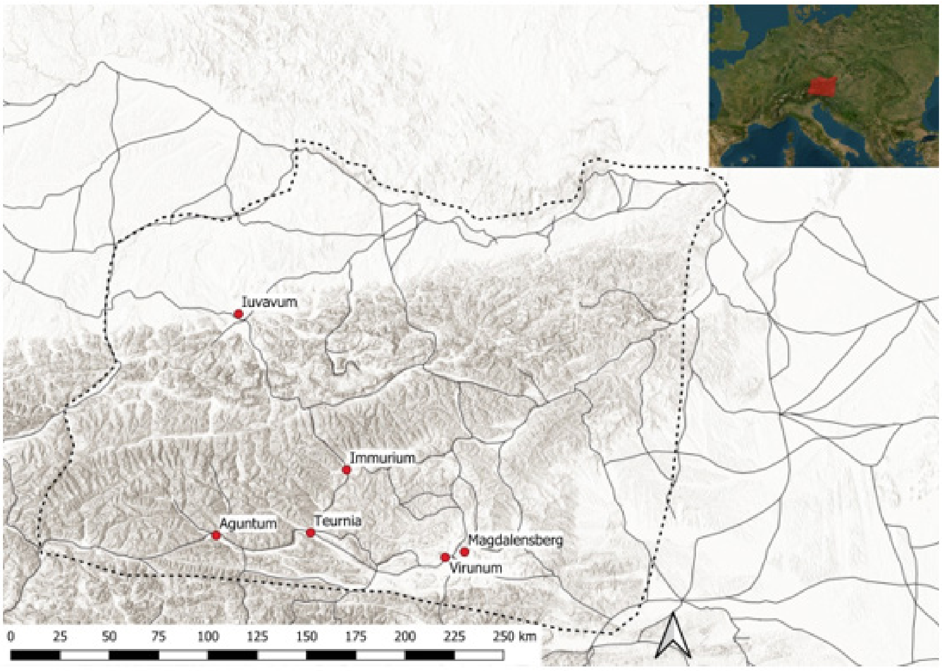

Figure 1: Map of Noricum, with the provincial border indicated in dotted line, and the Roman roads in solid.

Greyware bowls, jars, and tripod-bowls are widely distributed on 1st to 3rd centuries AD Roman sites in Noricum [2]. Typically, they display a very dark grey to black colour with coarse light-coloured inclusions. Several workshops at Iuvavum in north-western Noricum are known to have produced greyware between the 1st and 3rd centuries AD, as indicated by the presence of kilns and pottery waste [3,4]. Petrographic analysis of pottery waste from these workshops has indicated that it is tempered with micaschist, phyllite, quartzphyllite and dolomite [5]. However, no evidence for workshops has been found in the southern part of Noricum. Despite this, detailed compositional studies have postulated a local origin of calcite-tempered greyware bowls at Aguntum [6- 8] and Lavant [7,8].

Building on previous research, this study examines greyware tripod-bowls, with the aim to reconstruct their technology and derive broader aspects of their production organisation and trade. Using thin section petrography analysis, the mineralogical composition of tripod-bowls from six settlement sites will be examined and compared with the geological background of the area, to understand whether the tripod-bowls were locally produced or imported. The results of the study will be related to previous compositional studies of greyware from Noricum, to gain insight in the production organisation and trade of the greyware tripod-bowls studied.

Archaeological Background

Romans built a trading centre (emporium) at Magdalensberg in southern central Noricum around 50 BC [9]. The town flourished until around 50AD, as witnessed by numerous small finds that arrived from long-distance trade [10,11], and by traces for the production and trade of iron and gold-precious raw materials for the ever-growing Roman Empire [1].

The incorporation of Noricum under Roman rule was a period of socio-economic and technological change; this is visible in the archaeological record through the appearance of urban development on an unprecedented level. More specifically, Virunum was built as the capital of the Roman province in southern central Noricum around 50AD and flourished during the mid-1st and 2nd centuries AD [12,13]. Other towns developed with markets, bath houses and temples, and received municipal rights (municipia). Some municipia were situated in the southern mountainous region of the eastern Alps, including Aguntum [14,15] and Teurnia [16,17], while others were built in the northern plain, such as Iuvavum [18,19]. Smaller settlements also developed along major arteries that connected the towns, such as Immurium [20] (Figure 1).

Urban expansion seems to have gone hand in hand with the appearance of wheel-thrown greyware. Indeed, some of the earliest stratified contexts at Magdalensberg comprise both handmade and wheel-thrown pottery [21]. Tripod-bowls belong to the latter category and occur widely on 1st and 2nd centuries AD sites in Noricum, raising the question of whether they were imported. Morphologically, they consist of a bowl with a horizontal rim and tripod (Figure 2). Evidence for accretion (e.g., deposition of carbon) on their base suggests that tripod-bowls were exposed directly to fire. Tripod-bowls are often found with lids, further supporting the hypothesis that they were used for cooking practices [2,22].

Figure 2: Grey coarse ware tripod.

Geological Setting

Clay deposits in Austria can be divided in two main types, which can be distinguished based on their time of deposition. The Neogene (younger than 23.5 Ma) clays are geologically restricted to the Vienna Basin, the Molasse zone and the intramontane Neogene basins. Geographically, these clays can be limited to Upper Austria, Lower Austria, Burgenland, Styria and parts of Carinthia. The individual Neogene clay districts show clear differences regarding their mineralogy, and they occur in the different stratigraphic layers of the Molasse or the intramontane basins. The second large group are the Quaternary (younger than 2 Ma) clay deposits, which are found throughout Austria (Figure 3).

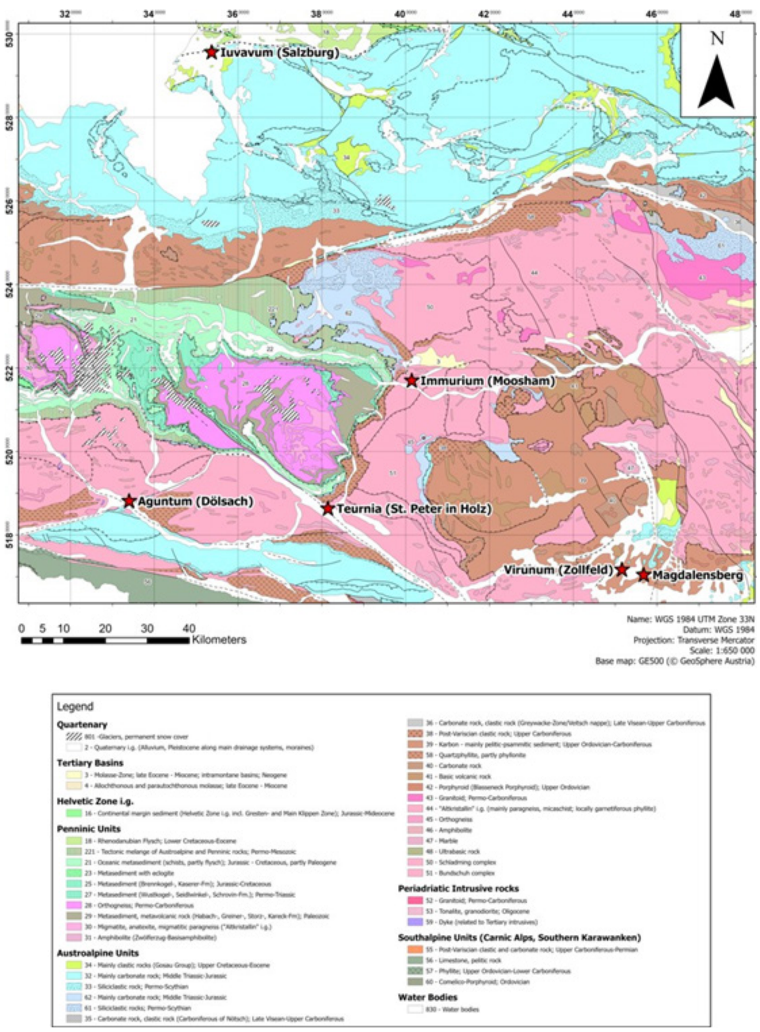

Figure 3: Simplified geological map of Noricum, based on Geosphere Austria.

For Tyrol, Vorarlberg, Salzburg, and parts of Carinthia these form the only raw material sources for clays. These clays formed in lakes and can be characterised as lacustrine to glaciolacustrine deposits. They are characterized by a uniform grain size composition and variable proportions of silt and clay. In addition, from a mineralogical point of view, they generally show low carbonate contents, which, however, can vary greatly with regard to the catchment area. A common characteristic, however, is the consistently dominant proportion of illite and micas (muscovite) and chlorite [23].

Aguntum (Dölsach, East Tyrol)

Geologically, the Roman town of Aguntum in eastern Tyrol lies in the Quaternary deposits of the Lienz valley floor (Figure 3). The Lienz area is enclosed by the rocks of the Koralpe-Wölz nappe system in the north and the Drauzug-Gurktal nappe system in the west, south and east. The rocks north of Aguntum consist mainly of paragneisses and micaschists, in which young intrusive rocks and amphibolites can be found. North of the Koralpe-Wölz nappe system the Martei-Nordrahmen Zone, a tectonic melange of calcareous micaschists, marbles and ophiolitic rocks at the southern edge of the Tauern Window, occurs. The western and eastern part of the Drauzug-Gurktal nappe system in the area around Lienz consists largely of quartzphyllites and paragneisses. The latter are characterised by intercalations of orthogneisses, and young intrusives. South of Aguntum, the Lienz Dolomites occur, which are predominantly composed of dolomite and limestone (GeoSphere Austria 2018a, b).

Teurnia (St. Peter in Holz, Carinthia)

The Roman city of Teurnia in Carinthia is located on the southern border of the Penninic Tauern Window within the Koralpe-Wölz nappe system. The rocks around the former town generally consist of micaschists and paragneisses of the Koralpe-Wölz-and Silvretta-Seckau (Radstadt) nappe systems. Towards the north, they are quickly replaced by the rim of the Tauern window, the Glockner nappe system, which can be described as former oceanic metasediments with intercalations of greenschists. In the east, west and south, however, the typical paragneisses and micaschists of the Koralpe-Wölz-and Drazug-Gurktal nappe systems occur (GeoSphere Austria 2018a, b) (Figure 3).

Immurium (Moosham, Salzburg)

The area around Immurium is characterised by micaschists and paragneisses of the two tectonic nappe systems Koralpe-Wölz and Ötztal-Bundschuh. Towards the east, however, there is a lithological change to the quartzphyllites of the Silvretta-Seckau (Radstadt) nappe system and the transition to the Tauern Window (Figure 3). Similar to the other sites, Quaternary valley fill from the last ice age occurs (GeoSphere Austria 2018a, b).

Virunum (Zollfeld, Carinthia) and Magdalensberg (Carinthia)

The two archaeological sites Virunum and Magdalensberg are located north-east of Klagenfurt in the Klagenfurt Basin, which belongs to the inner Alpine basins. Similar to the Vienna and Styrian basins, extension and subsidence occurred in this area from the early Neogene onwards due to the tectonic formation of the Pannonian Basin and subsequently the basin was filled with Quaternary sediments. The basins morphology today can be traced back to the last ice ages and erosion by river systems [24].

The area around Magdalensberg and Virunum is characterised by a hilly landscape consisting of Quaternary deposits, clay shales, phyllites and greywackes of the Drauzug-Gurktal nappe system (Figure 3). The valley bottom of the Krappfeld basin follows to the north. Especially in this area, clay deposits can still be found today, stratigraphically in the Upper Cretaceous to Eocene Gosau strata or the Quaternary postglacial deposits. In the Lavant Valley to the east, there are also Neogene clay deposits (GeoSphere Austria 2018a, b, c).

Iuvavum (Salzburg)

The archaeological site of Iuvavum lies in the Salzburg Basin, a glacially formed basin that was filled with fine clastic lacrustine sediments and fluviatile gravels and sands during the last Late- and Postglacial periods. Towards the south, the city is bordered by the rocks of the Tyrolian-Noric nappe system of the Northern Calcareous Alps and to the east by the rocks of the Rhenodanubian Flysch zone (Figure 3). Further to the north, the Molasse zone borders the Flysch zone, within which the majority of Austria's most important Neogene and Quaternary clay deposits are found [23] GeoSphere Austria 2018a, b, c). In addition, deep borehole profiles from drillings within the city of Salzburg also show that the Quaternary backfill from the glaciers and the sediments of the glacial Salzburg Lake also show clay deposits [25].

Materials and Method

A total of 23 tripod-bowls were selected from six sites, comprising Magadelensberg (n = 1), Virunum (n = 3), Aguntum (n = 6), Teurnia (n = 4), Iuvavum (n = 5) and Immurium (n = 4; Table 1). All samples were examined in detail, combining macroscopic observation with microscopic analysis, with the aim to reconstruct all the steps of the production sequence, including raw materials (i.e., base clay), paste recipe (i.e., temper), forming and firing technology. It also highlighted the existence of diverse and shared technological traditions to produce tripod-bowls.

In the first step, the rim diameter and wall thickness of the greyware tripod-bowls were recorded at the University of Innsbruck. In the second step, fragments of all (23) tripod-bowls were prepared as thin sections and analysed with a Leica DM4500P polarising light microscope at the Department of Lithospheric Research, University of Vienna. The ceramic thin sections were classified in petrographic groups, based on the nature of the inclusions, matrix, and voids [26,27]. The texture and structure of the thin sections were also examined to detect the presence of specific technological practices, such as intentionally added temper and forming technique (26-28). Small-sized inclusions (15 - 20 μm) are taken to be naturally present in the base clay [29,30].

In the third step, observation of the wall thickness (e.g., regulatory), the rim diameter (e.g., symmetry) and the interior base (e.g., presence of striations and grooves) of the tripod-bowls was combined to identify the forming technique used by ancient potters [28,31]. Further to this, the birefringence of the matrix of the ceramic thin sections [26], as well as the colour of the samples in hand specimen [24,31] were useful criteria to reconstruct the firing temperature and atmosphere.

Results

Macroscopic analysis

All 23 tripod-bowls appear to have been thrown on the fast wheel, as suggested by the undulating grooves on the interior base. This is further supported by the regulatory of the wall thickness, varying between 0.5 and 0.6cm, and by the axial symmetry of the rim diameter, measuring between 18cm and 22cm [2]. In the second forming stage (i.e., when the bowls were dry or leather-hard), tripods were added to the base. For all ceramic vessels studied, the tripod appears to have been cut from a base- ring; the latter also appears to have been wheel-thrown, as suggested by parallel grooves (Figure 2).

Most tripod-bowls display a dark yellowish brown or black surface colour (Munsell (1994) hue 10YR, with values 3/4-3/6, 2/1) and a black core (Munsell (1994) hue 10YR, with value 2/1). This suggests that they were fired in a reducing atmosphere.

Thin section petrographic analysis

The texture of all the (23) ceramic in thin sections varies from coarse to very coarse. The inclusions and voids are aligned parallel to the margins of the thin sections. Compositional differences between the ceramic thin sections have permitted to classify them in eight petrographic compositions (Table 1). Groups 1 and 6 are the largest (with five samples each), followed by Group 5 (with 4 samples). Group 7 includes three samples, whiles Groups 4 and 8 comprise two samples each. Fabrics 2 and 3, finally, are loners. Regarding their geographical distribution, only Group 6 samples occur on several sites, while other compositions are confined to one site.

Table 1: Mineralogical composition of Grey Tripods as determined in thin section petrography analysis. Abbreviations: Msh – Micaschist; Sandstone; Slate; Gneiss; Phyllite; Qz – Quartz; Fsp – Feldspar; Ms – Muscovite; Cal – Calcite; ARF – Argillaceous rock fragment; Grog. Optical characteristics of matrix (Mx): ” – High birefringence, ≈Δ – Medium birefringence, ¯” Low birefringence; Ï Present

Crt. No.	Sample no.	Site	Texture	OM												
				Msh	Sand-stone	Slate	Gneiss	Phyllite	Qz	Fsp	Ms	Cal	ARF	Grog	Mx	Petro Group/ Fabric
1	MD6160	Aguntum	Very coarse	●			●		●		●				Δ	1
2	MD6163	Aguntum	Coarse	●			●		●		●				Δ	1
3	MD6171	Aguntum	Coarse	●			●		●		●				Δ	1
4	MD6168	Aguntum	Coarse	●			●		●		●				¯Δ to Is	1
5	MD4911	Aguntum	Very coarse	●			●		●		●				¯Δ to Is	1
6	MD6173	Aguntum	Coarse	●			●		●		●			●	Δ	2 (Loner)
7	MD6237	Magdal-ensberg	Very coarse		●			●	●		●	●	●		≈Δ to ¯Δ	3 (Loner)
8	MD6231	Virunum	Coarse		●			●	●		●		●		Δ	4
9	MD6238	Virunum	Coarse		●			●	●		●		●		Δ	4
10	MD6172	Iuvavum	Very coarse	●		●		●	●	●		●			≈Δ to ¯Δ	5
11	MD6170	Iuvavum	Very coarse	●		●		●	●	●		●			¯Δ to Is	5
12	MD6174	Iuvavum	Very coarse	●		●		●	●	●		●	●		≈Δ to ¯Δ	5
13	MD6167	Iuvavum	Very coarse	●		●		●	●	●		●	●		≈Δ to ¯Δ	5
14	MD6228	Teurnia	Coarse	●				●	●		●	●			Δ	6
15	MD6233	Teurnia	Coarse	●				●	●		●	●			Δ	6
16	MD6169	Immurium	Coarse	●				●	●		●	●			≈Δ to ¯Δ	6
17	MD6162	Iuvavum	Coarse	●				●	●		●	●			≈Δ to ¯Δ	6
18	MD6236	Virunum	Coarse	●				●	●		●	●			Δ	6
19	MD6164	Immurium	Very coarse	●			●	●	●		●	●			≈Δ	7

20	MD6165	Immurium	Very coarse	●			●	●	●		●	●	●		≈Δ	7
21	MD6175	Immurium	Very coarse	●			●	●	●		●	●			≈Δ	7
22	MD6234	Teurnia	Very coarse	●			●		●			●			≈Δ to ¯Δ	8
23	MD6240	Teurnia	Coarse	●			●		●			●			≈Δ to ¯Δ	8

Petrographic Group 1 includes five samples from Aguntum. The samples are characterised by very coarse metasedimentary rock fragments, including paragneisses and micaschists. Coarse individual quartz grains and muscovite mica flakes are also common. The rock fragments are rounded, and they vary in size between 300 and 500 μm, while the size of the individual quartz grains ranges from 200 to 300 μm (Figure 4a). The samples appear to have been intentionally tempered (i.e., 30-35% inclusions versus 55% matrix and 10-15% voids). The clay contains rare small-sized quartz, mica, and iron-rich aggregates. Some black- rimmed voids are the result of burnt organic material (e.g., MD6163, MD6171). Three samples display a high birefringence, while two samples have a low birefringence or are isotropic (Table 1).

Fabric 2 comprises one sample from Aguntum. Similar to Petrographic Group 1, this sample displays metasedimentary rock fragments, comprising paragneisses and micaschists. However, the difference is that the sample from Fabric 2 contains additional grog fragments; they are reddish-brown in colour, angular, and vary in size between 300 and 500 μm (Figure 4b). The matrix comprises small-sized quartz, mica, and iron-rich aggregates. Some voids appear to be the result of burnt organic material, as suggested by their black rims. The matrix displays high birefringence (Table 1).

One sample from Magadalensberg has a unique composition and forms Fabric 3. It is characterised by coarse rounded low-grade metamorphic rock (i.e., phyllite), measuring between 300 and 500 μm, as well as sub-angular sedimentary rock fragments (i.e., sandstone) and quartz inclusions. There are more rock fragments than individual quartz grains. The coarse inclusions comprise ca. 30% of the clay body, suggesting that they have been deliberately added. The clayey matrix comprises very few silt-sized quartz and mica inclusions (Figure 4c). Clay pellets (i.e., argillaceous rock fragments) of ca. 300 μm are also common. Black-rimmed voids indicate that organic material was present in the clay body prior to firing, and secondary calcite seems to have deposited in voids. The sample displays medium to low birefringence (Table 1).

Petrographic Group 4 includes two samples from Virunum. They are defined by well-sorted sub-rounded quartz grains, sandstone, and low-grade metamorphic rock fragments (i.e., phyllite), their size varying between 200 and 300 μm. Rare large muscovite mica flakes have also been identified. There are equal numbers of individual (quartz) grains and rock fragments (Figure 4d). Coarse inclusions comprise ca. 30% of the matrix and are sub-angular, suggesting that they have been added. The matrix comprises few small- sized quartz and mica inclusions. Clay pellets have also been identified (e.g., MD6231, MD6238, MD6237). Both samples display high birefringence (Table 1). The coarse inclusions that define the samples from Petrographic Group 4 bear similarities to Fabric 3, with the difference that they are smaller-sized and better-sorted.

Petrographic Group 5 comprises four samples from Iuvavum. This group is defined by very coarse rounded fine- to medium-grained metamorphic rock fragments (micaschist, phyllite, slate, quartzphyllite), varying in size between 300 and 700 μm. Quartz, K-feldspar, and dolomite are also common. The clay matrix contains small-sized biotite, mica, quartz, and opaque inclusions (Figure 4e). The sherds exhibit an isotropic matrix with medium or low birefringence (Table 1).

Petrographic Group 6 includes five samples from Teurnia (n=2), Iuvavum (n=1), Immurium (n=1) and Virunum (n=1). The samples in this group display very coarse well-sorted rounded quartz and carbonate inclusions with micritic texture, varying in size between 300 and 500 μm. Rounded quartzphyllite, measuring between 300 and 500 μm, are also common (Figure 4f). The clay matrix contains very few small- sized quartz and iron-rich aggregates. Occasionally, burnt organic material has been identified (e.g., MD6228, MD6233). Two samples display high birefringence, while the other two display medium or low birefringence (Table 1). The samples from Group 6 are very similar in composition to Group 8 (below), except that they contain proportionally more loose or individual (quartz and carbonate) grains than rock fragments. Petrographic Group 7 comprises three samples from Immurium. This group stands out for the presence of coarse angular sparry calcite inclusions (300-700 μm) and sub-rounded quartz inclusions (200-300 μm). The calcite inclusions have cleavage and derive from crushed marble. Common also paragneiss and micaschist (300-500 μm), as well as rare quartzphyllite (Figure 4g). The quartz, paragneiss, quartzphyllite and micaschist fragments are homogeneous and well-sorted (200-500 μm), while the crushed marble fragments are comparatively large (300-700 μm). The matrix is moderately birefringent (Table 1).

The two samples from Petrographic Group 8 were found in Teurnia. They are defined by very coarse rounded carbonate (300-600 μm), and sub-rounded medium-grained metamorphic rock fragments, including micaschist and paragneiss (400-700 μm). Individual quartz inclusions are also common. The carbonate inclusions are fine-grained, with micritic texture. The size of coarse rock and carbonate inclusions varies between 400 and 600 μm, while individual quartz grains measure between 250 and 400 μm (Figure 4h). Micrite as secondary pore-infill has also been noted. The clay matrix comprises small-sized quartz and opaque inclusions; occasional evidence for burnt organic material has also been identified. Both samples display medium to low birefringence (Table 1).

Discussion

The combined results of the macroscopic and microscopic analysis indicate that all 23 examined tripod- bowls were thrown on the fast wheel and fired in a reducing atmosphere. The presence of organic matter in most if not all samples could suggest that the clays were not prepared prior to the addition of temper. There are eight compositional groups among the samples analysed, most of which are restricted to one site. However, there is also one well-defined group, which occurs at four of the six sites studied. This indicates that pottery production was organised on a local scale and in several workshop. while, one workshop seems to have established a lively trade of its tripod-bowls in Noricum in the 1st and 2nd centuries AD.

Petrographic Group 1 comprises five tripod-bowls, which have been found in Aguntum. The presence of coarse paragneiss and micaschist fragments (Figure 4a) appears to be compatible with a local origin of this group (Figure 3). This hypothesis corroborates the results of previous research on greyware from Aguntum with a similar composition (i.e., defined as a 'local fabric made of silty clay'), for which a local origin has been proposed [6] (Figure 6).

Fabric 2 comprises one tripod-bowl from Aguntum. The metasedimentary rock fragments in Fabric 2 bear are similar in composition to those in Petrographic Group 1. The difference is that the tripod-bowl from Fabric 2 contains additional grog fragments. This practice of crushing pottery and adding it to the base clay has been identified in other greyware bowls from Aguntum, which appear to have been produced locally (Borgers and Auer, in press). It seems reasonable to assume then that the tripod-bowl from Fabric 2 was also produced locally.

One sample from Magdalensberg is included in Fabric 3. It is defined by coarse sedimentary (e.g., sand, sandstone) and low-grade metamorphic (e.g., phyllite) rock fragments (Figure 3c).

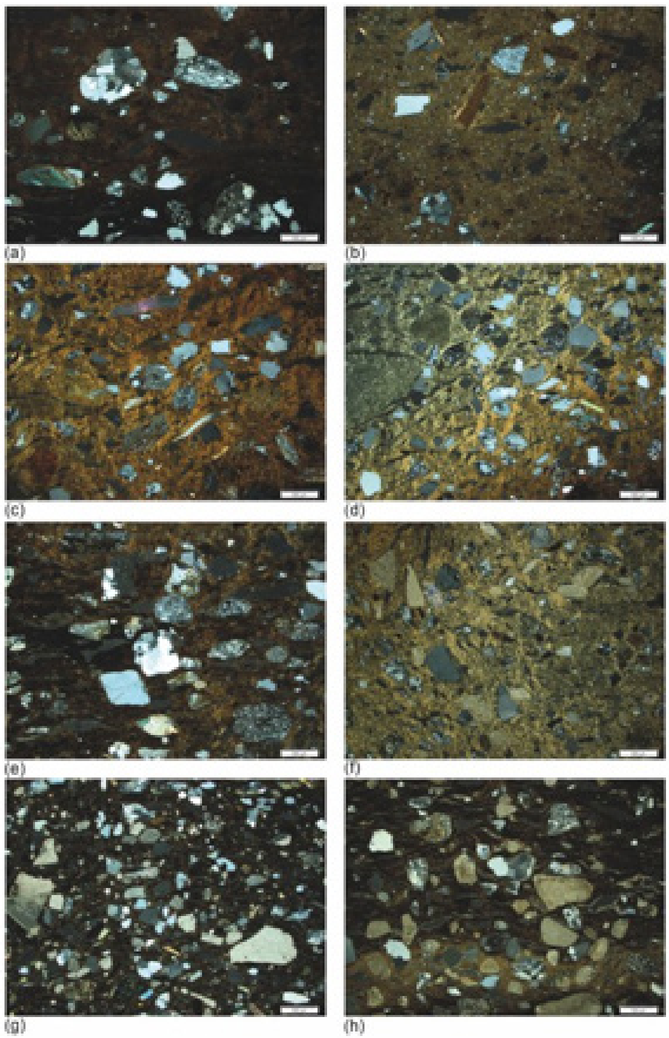

Figure 4: Micrographs of Petrographic Groups and Fabrics (or loners): a) Petrographic Group 1, in MD6171; b) Fabric 2, in MD6173; c) Fabric 3, in MD6237; d) Petrographic Group 4, in MD6231; e) Petrographic Group 5 in MD6174; f) Petrographic Group 6, in MD6228; g) Petrographic Group 7, in MD6715; h) Petrographic Group 8, in MD6234.

The two samples from Petrographic Group 4 bear compositional similarities to Fabric 3, with the difference that the coarse inclusions are smaller-sized and better sorted (Figure 4d). The two tripod-bowls from this group were found in Virunum. The rock fragments present in Fabric 3 and Petrographic Group 4 are compatible with an origin near the sites of Magdelensberg and Virunum, given that there are outcrops with siliciclastic rocks (Figure 3). Petrographic Group 5 includes four samples from Iuvavum. They are defined by coarse fine-to medium- grained metamorphic rock fragments; they share broad similarities with the greyware that was produced in this town [32]. The rounded nature of these coarse inclusions suggests that they might have been sourced from fluviatile gravels and sands (Figure 3).

Petrographic Group 6 comprises five samples, which have been found at various sites, including Iuvavum, Immurium, Teurnia and Virunum. The composition of the coarse inclusions, comprising quartzphyllite, quartz and carbonate inclusions, is similar to that of Petrographic Group 8, indicating a possible provenance in the same area. The three samples from Petrographic Group 7 were found in Immurium. They are defined by micaschist, quartzphyllite and paragneiss rock fragments, which occur in the region (Figure 3). However, the samples also contain crushed marble. While carbonate rocks occur in the vicinity of the site at Immurium, marble outcrops are located at ca. 40km south-east (Figure 3). Other greyware with this composition has been found in Aguntum and has been characterised as the 'quartz and crushed coarse crystalline calcite (marble?) fabric' [6] (Figure 6). Whilst it is thought to have been imported to Aguntum, a possible provenance has not been proposed, however [6] Petrographic Group 8 consist of two samples from Teurnia. These samples comprise broadly the same fine to medium-grained metamorphic rock fragments that have been identified in Petrographic Group 7, with the difference that the coarse inclusions in Group 8 samples are larger and more rounded, and the large carbonate fragments display a micritic texture. There are outcrops of metamorphic rock fragments to the west of Teurnia, while carbonate rocks are present to the east of the settlement (Figure 3). This suggests that Petrographic Group 8 may have originated near Teurnia.

Conclusion

Grey tripod-bowls were widely distributed on 1st and 2nd centuries AD sites in Noricum. With scarce or indirect evidence of pottery production centres in the area, this paper examined the composition and production technology of 23 tripod-bowls from six different sites, including Aguntum, Teurnia, Immurium, Virunum, Magdalensberg and Iuvavum. Macroscopic observation was combined with ceramic thin section analysis to reconstruct the production technology. The results were then compared with the geological background of the area, to identify possible locations of origin. This in turn allowed to deduce aspects of the organisation and trade of tripod-bowls in Noricum in the 1st and 2nd centuries AD.

The results indicate that the grey tripod-bowls were thrown on the fast wheel, as suggested by the axial symmetry and even wall thickness (observed in hand specimen), and the parallel orientation of inclusions and voids (as seen in microscopic analysis). Further to this, all tripod-bowls were fired in a reducing atmosphere, following from their dark grey to black colour. This is taken to suggest that potters shared a broad technological knowledge in forming (i.e., wheel throwing), and firing (i.e., reducing atmosphere) tripod-bowls. Discrete compositional differences have been noted in paste recipes (i.e., temper), however Roman potters sourced coarse material from various outcrops, including sedimentary, carbonate and low-to medium-grade metamorphic rock fragments, as well as grog inclusions and intentionally added this to the base clay. Further to this, most compositional groups occur in only one site or location.

Comparison of the petrographic data with the geological background of the area, as well as with previous compositional studies on greyware from Noricum permits to propose the following two hypothesis: The comparison between the petrographic compositions and the geology of the area permits to tentatively suggest that most, if not all, tripod-bowls were produced locally where they were found. More specifically, the data suggest that the tripod-bowls from Group 1 and Fabric 2 may have been produced locally or near Aguntum. Fabrics 2 and 3 might have an origin near Magdalensberg and Virunum, while the Group 5 tripod-bowls indicate an origin from Iuvavum. Further to this, the carbonate fragments with micritic texture that define Groups 6 and 8 point to an origin near Teurnia or Immurium, while the crushed marble rock fragments of Group 7 tripod-bowls, which have been found in Immurium, point to a different, albeit broadly similar, provenance to Groups 6 and 8. From this is also deduced that Roman potters were organised at a local scale-i.e., they produced ceramics for the local market. Bulk chemical analysis of the tripod-bowls and geological prospection of clay deposits in the area will help clarify this hypothesis and will be the next step in research.

Comparison of the petrographic groups of the tripod-bowls studied in this study with previous research on greyware from Noricum allows to say that at least two petrographic groups are common in various settlements in the region. More spefically, tripod-bowls of Group 6 were found in four settlements, including Immurium, Teurnia, Iuvavum and Virunum. Moreover, tripod-bowls of Group 7 found in Immurium also seem to occur in Aguntum. This makes it possible to tentatively suggest that two workshops distributed their products in the region of Noricum in the 1st and 2nd centuries AD. The main roads and arteries that connected the various sites studied would seem to be the most plausible way to transport these tripod- bowls [33].

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Conflict of Interest

There is no conflict of interest.

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