

## On some unidentified ceramic objects from Seglamen, northern Ethiopia

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### ABSTRACT

A series of unidentified ceramic objects, dating back to the “Pre-Aksumite” period, was discovered in the site of Seglamen (northern Ethiopia) during an archaeological expedition of the Naples University “L'Orientale”. Minero-petrographic analyses, performed at the Naples University Federico II, evidenced that most samples were manufactured by using a locally available tempering raw material, mostly composed of felsic rock fragments.

SEM observation and XRPD analyses evidenced the occurrence of both well fired ( $T > 800$  °C) and scarcely fired products. The latter most probably represent production wastes and, therefore, another clue of a possible local manufacture.

**KEY WORDS:** Ceramic objects, Seglamen, Ethiopia, Minero-petrographic analyses.

### INTRODUCTION

Since 2010 the Italian Archaeological Expedition in Tigray, northern Ethiopia, directed by Rodolfo Fattovich (2010-2013) and Andrea Manzo (2014) of the Naples University “L'Orientale”, conducts archaeological investigations at the site of Seglamen, where evidence of a large settlement has been brought to the light through systematic excavations.

The settlement is characterised by three major architectural phases (labelled as I, II, and III) of stone-built houses associated to a cemetery with shaft tombs marked by sandstone stelae. All date back, on the basis of ceramics typology, to the so-called “Pre-Aksumite” period (ca. 800-400 BC) (Fattovich et al. 2012; Sernicola et al. 2013; Sernicola 2014) when a hierarchical, literate society, economically based on mixed agriculture and domesticated livestock, showing in some cases cultural traits of southern Arabian affinity, appeared on the highland regions of northern Ethiopia and central Eritrea.

In the collapse of the structures of Phase II and in some of the subsequent levels, a small corpus of similar ceramic objects has been collected (Sernicola et al. 2013) and constitutes the subject of this paper. These are fragments of a never attested and so far unidentified category of objects with square or circular sections and tapering, roughly pointed or rounded ends; three specimens, one of which almost complete but



Fig. 1 – A representative sample of a ceramic object from Seglamen.

unfired, show a slightly curved profile. Fabrics are orange to light brown with abundant mineral inclusions; surfaces are carefully smoothed or, sometimes, burnished. Dimensions (length×width×thickness) range between 15×6.5×8 cm and 4×5×4.5 cm; the almost complete, curved item measures 18×9×7 cm. Despite the thickness of the recovered specimens, the colour of the cross-section is interestingly uniform, unlike what happens for most of the contemporary ceramic vessels. This might suggest the adoption of a different type of kiln characterized by a more controlled atmosphere and capable to reach higher temperatures than the open-air shaft traditionally used for pottery making, or of a longer firing period. Both options would provide additional information on the technological achievements of this society.

Intriguingly, the earliest evidence of these objects are contextual and in close proximity to a possible circular stone furnace partially preserved in the levels of architectural phase II and associated to a thick layer of ashy soil (Fattovich et al. 2012). Due to the complex occupational history of this area, characterised by at least three phases of overlapping structures, the stratigraphy of the site is likely marred by mixture and contamination as pits and artificial layers of dumping and levelling, highly disturbing the preservation of more ancient contexts, were created to prepare the surface for the foundations and erection of subsequent structures. Therefore, it cannot be excluded that the occurrence of these objects in the

upper levels is the result of later disturbance and that all of them belong to phase II. Their occurrence as fragments or unfinished specimens suggests that they were possibly manufactured at the site and used elsewhere.

**GEOLOGICAL SETTING**

Ethiopia lies at the northern tip of the East African Rift System (Schlüter, 2008).

The study area is located in the northern Ethiopia in the Tigray plateau (average elevation 2200 m), which is included between two main rivers, the Mereb to the north and the Tekeze to the south (Fig. 2). A radial system of rivers crosses the area around the city of Aksum. The Seglamen archaeological site is about ten km south of Aksum, at the edge of the western cliff of the Mai Nigus River, which flows southwards to the Tekeze River (Sernicola & Phillipson, 2011).

In the study area, rocks of the Precambrian basement outcrop. The Mai Kenetal Block (tectono-stratigraphic blocks of Tadesse, 1997) in the south-eastern corner (Fig. 2) includes variegated slates (Logmitti Slate) and weakly metamorphosed limestone (Filafil Limestone). The Adwa Block outcrops in the eastern sector and comprises low-grade intermediate to acidic metavolcanics, volcanoclastic metasediments (meta-

agglomerate), metachert, phyllitic schist, lithic to arkosic metagreywacke and metaconglomerate (volcanic, chert and quartzite pebbles). The Chila Block is represented in the northern area and includes black graphitic quartzite, phyllite and graphitic schist (Tadesse, 1997).

Plutonic rocks mainly outcrop in the northern area and are represented by granitoids (granite, granodiorite, tonalite, diorite) and strongly tectonised mafic and ultramafic rocks (metapyroxenite, talc schists, metagabbro, serpentinite, meta basalt). Granite also outcrops in a restricted area in the south-western sector (Fig. 2).

Mesozoic sedimentary rocks unconformably overlay the Precambrian basement in the southcentral area. They are mostly represented by sandstone, conglomerate (quartz, granite and metavolcanic pebbles), and siltstone (Tadesse, 1997).

In the Cenozoic extensive faulting (E–W and NE–SW trending) occurred (Natali et al., 2013) and was accompanied by a paroxysmal volcanic activity that covered large parts of the Tigray with stratified continental flood basalts (Koyetsa volcanics). They formed a gently undulating plateau surface characterised by a distinctive terraced topography with a succession of flat surfaces and steep steps (Schmid et al., 2008).

In the surroundings of Aksum this plateau is intruded by the

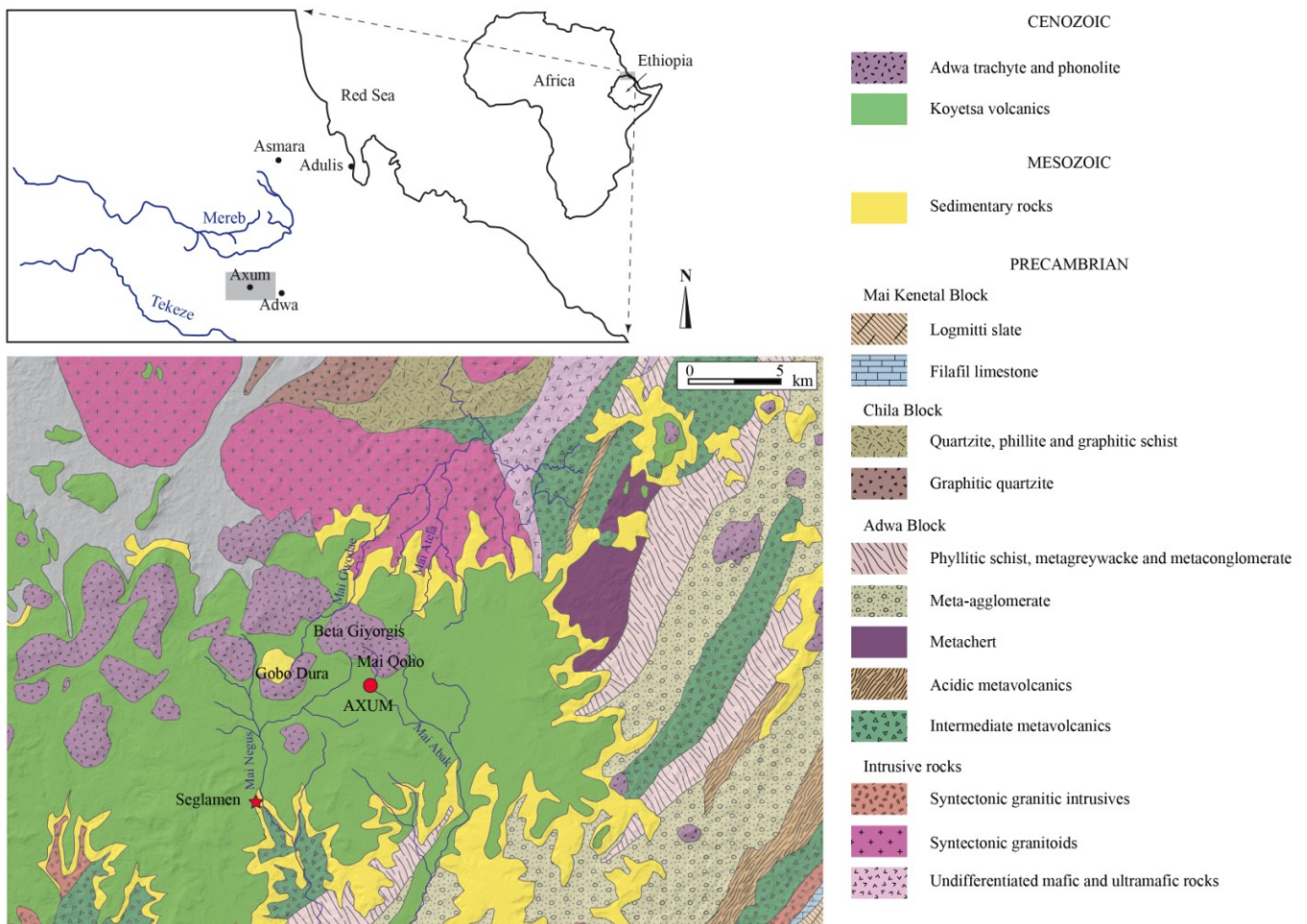


Fig. 2 – Geological sketch map of the Aksum area (adapted from the 1:250,000 Aksum map sheet ND 37-6, Ethiopian Institute of Geological Survey, 1999).

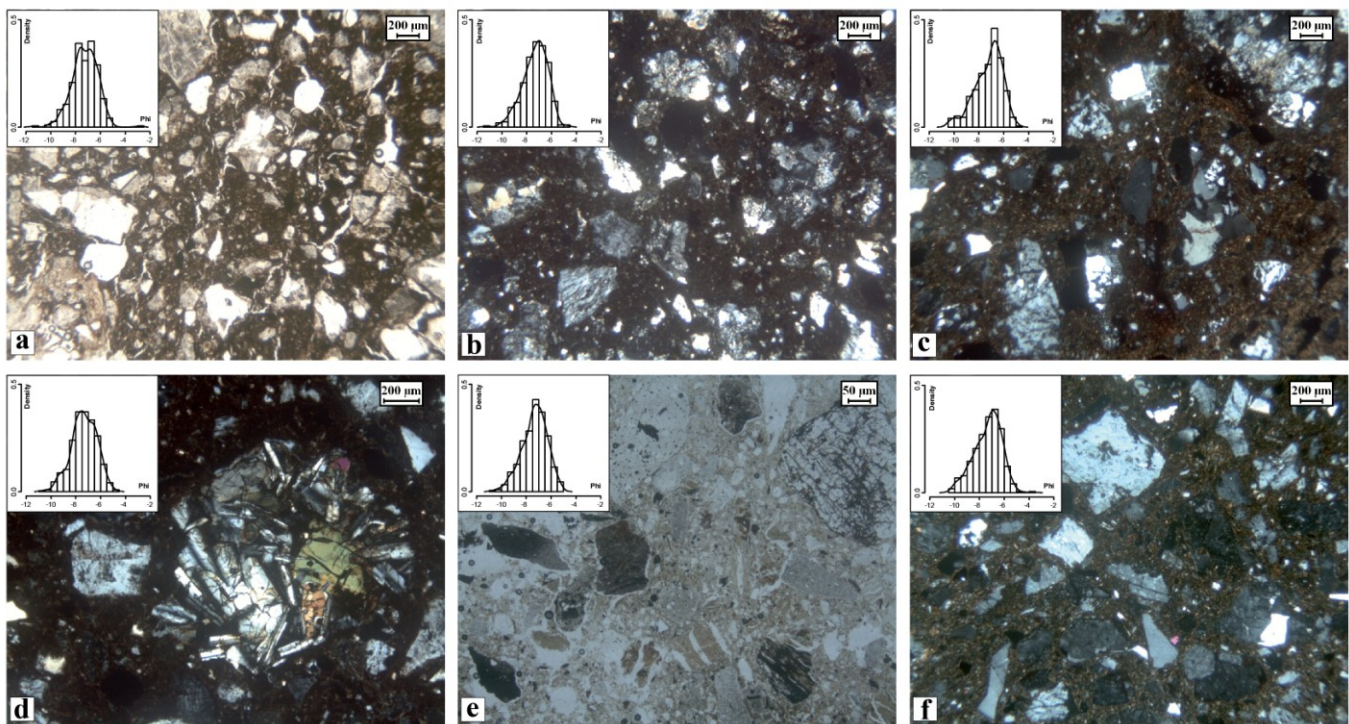


Fig. 3 – PLM images and Grain Size Distribution density histograms for the analysed samples. a) SF25. b) INV28. c) INV42. d) INV43. e) INV44. f) INV45.

Adwa trachyte and phonolite (with nepheline syenite subvolcanic intrusions) associated to mildly alkaline/alkaline basalts, probably representing parental magma (Natali et al., 2013). These rocks form plugs and domes, which stand out as circular hills, such as Beta Giyorgis, May Qoho hills and Gobo Dura.

Quaternary deposits (alluvium and colluvium) are found along major river valleys, depressions, and along the foot slopes of volcanic domes. Soils reflect the lithological and topographic variations. On volcanic hilltops, soils are formed by silty or clay loam containing kaolinite, smectite, illite and minor chlorite. Soils formed on syenite are reddish and rich in kaolinite; on the plain the soils mostly contain dark grey smectite (Schmid et al., 2008).

### MINERO-PETROGRAPHIC CHARACTERISTICS

Macroscopic analyses showed that two samples (SF25, INV28) are characterised by a light reddish (Mus. 5YR 6/3) and hard ceramic body; other samples (INV42–45) showed a reddish brown colour (Mus. 5YR 6/4) and friable pastes.

On Polarised Light Microscopy (PLM; Leitz Laborlux 12 POL microscope) ceramic matrix showed optical inactivity (SF25) or faint birefringence (INV28); other samples are characterised by birefringent (INV42, 43, 45) or very birefringent (INV44) matrix. All samples are porous with an inclusion amount ranging from 30 to 40%.

Grain size measurements were performed via image analysis (Leica DFC280 camera and Leica Q Win software) and statistically processed with the R Development Team software (Balassone et al., 2014; Grifa et al., 2013, 2015).

Inclusions showed an average size of 200 µm. In one case (SF25) grain size distribution is quite symmetrical (Fig. 3a), while in the other cases is characterised by a skewness to coarser grains (lower Phi values; Fig. 3b-f); maximum grain size reaches about 1500 µm (INV42–45) up to around 2500 µm (SF25, INV28). Inclusions mainly showed an angular or sub-angular morphology.

Inclusions showed a prevailing felsic composition (Fig. 3a-f) characterised by the presence of acidic rocks fragments (granitoids), alkali feldspar, microcline, and quartz (frequently showing undulate extinction). Graphic intergrowths of feldspars and quartz often occur. Chalcedony was observed in INV42, whereas gabbroic/doleritic lithics (plagioclase, pyroxene) in INV43 (Fig. 3d). One sample (INV44) is characterised by the presence of mudstone, and phyllosilicate. Alkali feldspar and quartz are in minor amount with respect to the other samples; rare plagioclase was also observed.

The chemical analyses carried out via X-ray fluorescence (XRF; PANalytical Axios instrument) showed that all samples are characterised by a low CaO concentration (< 2 wt.%). Other major oxides and trace elements showed a quite homogeneous composition, with the exception of sample INV44 (Fig. 4).

X-ray powder diffraction (XRPD) showed the ubiquitous presence of quartz and feldspar, which in the sample INV44 are in lower amounts. Traces of hematite were detected in SF25, INV28, and INV44. Among clay minerals, illite-like phases were noticed in all samples, except in SF25, while kaolinite is present in INV42 and in traces in INV44.

Scanning electron microscopy (SEM; JEOL 5310) showed an extensive vitrification of sample SF25 (Fig. 5a) and a barely

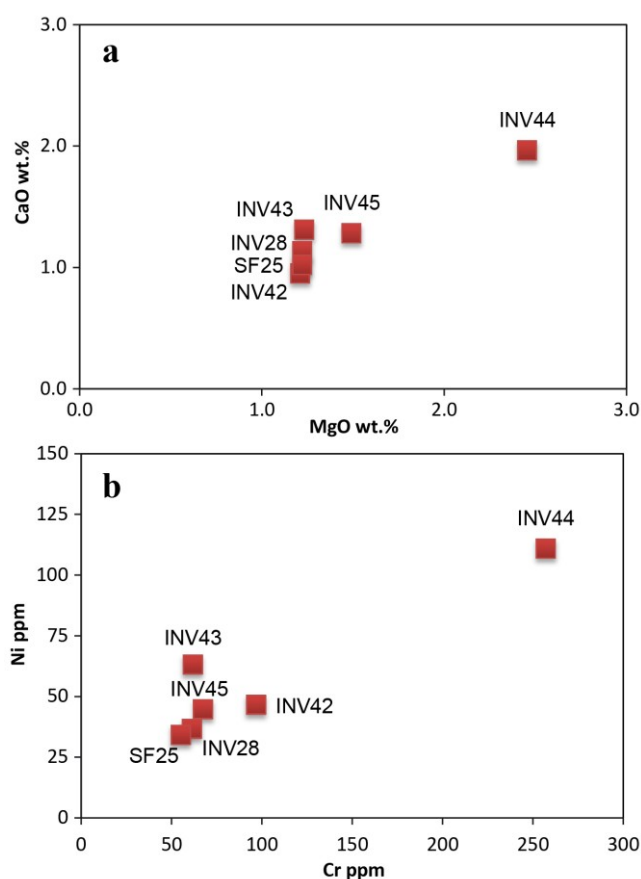


Fig. 4 – Representative binary diagrams of major oxides (a) and trace elements (b) composition.

vitrified microstructure of INV28. Other samples are non-vitrified (Fig. 5b).

### CONCLUDING REMARKS

The analyses showed that all samples were manufactured with low-CaO clayey raw materials (CaO < 6%; Maniatis & Tite, 1981) and contain abundant coarse inclusions with angular morphology, most probably intentionally added as temper.

At this stage of the research, no information on local clay is available, although at least one presently exploited clay source has been located. Future systematic study will certainly provide more accurate indications in this sense. At the moment, composition of the inclusions has helped us to make some hypotheses on the provenance area of the tempering raw material. Temper is mostly composed of felsic plutonic fragments, which can be attributed to the granitoids outcropping immediately north of Aksum or, further east, in the Chila area (Tadesse, 1997; Tadesse-Alemu, 1998). Moreover, in these rocks associated gabbroic rocks were also recorded (Tadesse-Alemu, 1998), which are compatible with the sporadic occurrence of gabbroic/doleritic lithics in one sample (INV43). Nevertheless, we cannot exclude a different origin of the temper. Indeed, plutonic clasts are contained in the Mesozoic sedimentary rocks outcropping in the Seglamen

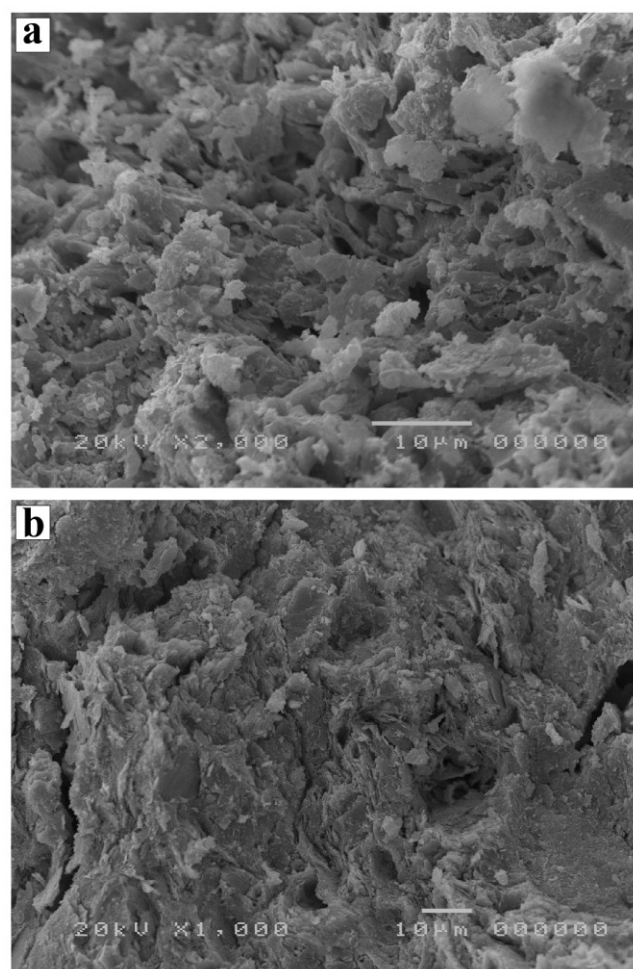


Fig. 5 – Representative SEM images of ceramic microstructures. a) SF25. b) INV42.

area (Tadesse, 1997).

Sample INV44 is characterised by a different mineralogical and chemical composition, showing the use of a different raw material.

As for firing technology, the vitrified microstructure of the sample SF25, along with the absence of illite-like phases, suggests a firing temperature of about 900-950 °C. A slightly lower temperature (800-850 °C) was hypothesized for sample INV28 where illite is in traces and vitrification is incomplete (Maniatis & Tite, 1981). Other samples did not show any vitrification, thus temperatures lower than 800 °C were inferred. In particular, two samples (INV42, INV44) showed evidence of scarce firing due to the presence of kaolinite, which could be due to a low firing temperature (not higher than 500/600 °C) or, probably, to a relatively short firing duration, which causes a shift of mineral breakdown to higher temperatures (De Bonis et al., 2014).

The use of a prevailing oxidising firing atmosphere was inferred due to the occurrence of traces of hematite in three samples (SF25, INV28, INV44).

The occurrence of fragmentary or misfired specimens, along with the traces of a possible furnace in the area, suggests the existence of a local production. However, further

analyses on a larger set of samples would be necessary to better understand the provenance and technology of these materials. Further data can be obtained through the comparison with other ceramic finds of different use from the study area and with locally available raw materials (clay and temper), as performed in other provenance studies (e.g., Morra et al., 2013; De Bonis et al., 2013). Valuable information regarding the possible extraction sites of clay can be collected by combining geological and ethnoarchaeological approaches, in particular by interviewing local potters who currently employ traditional technology (e.g., Fowler et al., 2011; De Bonis et al., 2013).

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