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GEOARCHAEOLOGY  
AND SOIL MICROMORPHOLOGY  
OF EARLY BRONZE AGE  
ANTHROPIC FEATURES  
FROM NATSARGORA SETTLEMENT  
(SOUTHERN CAUCASUS, GEORGIA).  
PRELIMINARY DATA  
FROM THE GEORGIAN-ITALIAN SHIDA KARTLI  
ARCHAEOLOGICAL PROJECT<sup>1</sup>

GIOVANNI BOSCHIAN,  
ELENA ROVA

ABSTRACT

*At the Kura-Araxes site of Natsargora in Georgia, soil micromorphological study was carried out in 2011 on a sequence of prepared external surfaces and on two different combustion features (a typical clay hearth with inner projections, and a shallow cuvette of sub-rectangular shape). Prepared floors were intentionally fashioned by repeatedly laying down layers of yellowish local marine sediment of variable thickness, while the thin dark horizons included between them represent residues of activities carried out on the floors, e.g. of processing of cereals and occasional animal parking. The first analysed installation turned out to be the result of the superimposition of two successive combustion features of the same type, while the second one was probably associated with cereal processing.*

<sup>1</sup> This article represents a revised version of the paper presented in Warsaw in May 2012: while the latter mainly focused on sampling strategies (based on the integration of controlled <sup>14</sup>C sampling from stratigraphically reliable contexts with the use of micro-archaeological methods) for improving <sup>14</sup>C regional chronology, this article will instead discuss the first results of the soil-micromorphological analyses carried out on samples collected in 2011. The results of <sup>14</sup>C analyses and the general results of the integrated sampling approach will be the topic of future contributions by the members of the research team. Field research and laboratory analyses were financially supported by the following institutions: Ca' Foscari University, Ministero degli Affari Esteri, and the Shelby White-Leon Levy Program for Archaeological Publications. Thanks are due to Prof. David Lordkipanidze (General Director, Georgian National Museum) and to the Georgian co-directors of the 'Shida Kartli Archaeological Project' for the possibility of sampling the site and exporting the relevant samples for analysis.

## INTRODUCTION

The Early Bronze Age cultures of the Southern Caucasus region are of major importance for understanding connections and the diffusion of ideas and technologies in a southern direction as far as the Southern Levant and *vice versa*, but still insufficiently understood for tackling wider questions of historical developments. Not just the relative and absolute chronology of the area are still debated, but also lifestyle, economy, land use and settlement patterns of these groups are still largely unknown. The aim of the ‘Georgian-Italian Shida Kartli Archaeological Project’ is to investigate these issues both by working on collections of cultural remains deriving from previous excavations, and by carrying out new excavations and surveys in the territory of present-day Georgia.<sup>2</sup> New research integrates wide-range studies, including extended <sup>14</sup>C datings on organic remains sampled in the field from stratigraphically controlled contexts, archaeobotanical studies, geomorphology (Furlani *et al.* 2012), and geoarchaeology.

The aim of the geoarchaeological study of the Natsargora site is twofold. The first goal is to identify the use of the Early Bronze Age installations included within the sequence; this aspect is particularly relevant because these installations were badly damaged by storage pits dug out during subsequent frequentations of Late Bronze Age date, so that their shape is rarely preserved and their use is not clearly understood at present. The second – but no less important – scope of the study is to assess the characteristics of the environment before the settlement’s foundation, and its change during the life of the site, as due to natural and anthropic factors. This study presents the preliminary results of the soil micromorphological study carried out on some specific installations and features – still partly enigmatic – of the Natsargora site during the 2011 field season. These are the preserved bottom of a combustion feature (installation 0093), an enigmatic combustion feature (installation 0342), and finally a sequence of finely laminated yellow and grey sediment, corresponding to locus 0305, situated in quadrants 099.099a-b (Fig.1).

All samples were collected in the SW part of the excavation: this belonged to the S periphery of the ancient settlement, and yielded a densely packed sequence of external surfaces, sloping in SE direction, coated with compacted yellowish sandy silt. The area was occupied by small, frequently re-built open air installations, most of which showed strong traces of fire.<sup>3</sup> The whole, up to 50-cm-thick sequence of surfaces dates to the Kura-Araxes II period, and was formed over a rather short period of time, probably less than 100 years, as confirmed by different <sup>14</sup>C dates,<sup>4</sup> all of which indicate the 30<sup>th</sup> century BC as the most probable date. The three samples belong to the upper part of the sequence, and can be considered as roughly contemporary with each other.<sup>5</sup>

2 The results of the 2010 and 2011 field seasons are discussed by Makharadze *et al.*, this volume, where references to previous reports can also be found.

3 For further details about the context, see Makharadze *et al.*, this volume.

4 See Makharadze *et al.*, this volume: fn. 13.

5 From the point of view of stratigraphy, installation 0093, connected with surface 0081, is the latest; locus 0305, corresponding to the layer between surface 0081 and surface 0065, occupies an intermediate position, while installation 0342, connected with surface 0354 underlying 0065, is the earliest one.

## MATERIALS AND METHODS

From a conceptual point of view, the installations were presumed to consist of lithologically homogeneous units; these may be construction parts (walls, plastering, surface treatments, etc.), and infillings that may result from the primary use of the features, or from secondary utilisation (Boschian and Colombo 2009). Following the above mentioned assumptions, the installations were sampled as follows. Samples were taken from vertical profiles corresponding to excavation baulks (in some cases expedient ones), or from small-size *ad hoc* soundings that were later checked for consistency with the general scheme of the installation. The samples usually consisted of 100 x 80 x 50 mm undisturbed monoliths of sediment (smaller if necessary) that were wrapped in soft paper and labelled, with up/down polarity indication. When sampling sequences were longer than the maximum length of the samples, care was taken to keep some centimetres of overlapping between samples.

The monoliths were air-dried at 30°C in a laboratory oven for 10 days, and then impregnated under high vacuum with low-viscosity epoxy resin. After polymerisation, the monoliths were cut by a diamond disc, polished, glued on 90 x 60 mm microscope slides, and ground to 30 µm thickness. Eventually, the thin sections were covered by standard cover glasses and labelled.

Soil micromorphological observations were carried out under a Leica DM/LP standard petrographic microscope equipped with reflected light and UV/blue epifluorescence kits. The descriptions follow the standard formalised by Bullock *et al.* (1985) and Stoops (2003) for soil thin sections.

## RESULTS

### *Installation 0093*

Installation 0093 (Fig. 2, a) is a small circular combustion feature located near the W limit of the excavation, not far from the present slope of the mound. Although its top had been damaged and largely removed by subsequent Late Bronze Age activities, it can be easily recognised as belonging to the type with inner projection, which is widely attested in Georgia, in particular in the Shida Kartli region, during the Kura-Araxes period.<sup>6</sup> It consists of a raised ring of clay, whose diameter is 43 cm, with an internal 'bowl' (diameter 31 cm), whose surface is carefully smoothed and coated by a thick film of soot. On its bottom, there is a small, 4-cm-deep hemispherical cavity. The 'bowl' was filled with ashy sediment and burnt soil. The installation consists of at least four concave-upward layers (Fig. 3, a) with different composition (Tab.1) that dip towards its centre.

Three 90 x 60 mm thin sections were cut through the whole thickness of the feature; a mosaic of microphotographs through Layer 1 is presented in Fig. 3, b-c. At microscopic

6 For some illustrated examples, see Palumbi 2008: 170-187 *et passim*.

scale, the uppermost level (Layer 1, about 2.9 cm thick) is remarkably compact (Fig. 3, d-e), and is made up of clay mixed with quartz and other silicate sand-size grains, daub (Fig. 4, a-b) and pottery fragments (a sort of *chamotte*) up to 10-20 mm large, small clods of local fine sediment and reddish soil (Fig. 4, c-d), and finely ground calcite or possibly lime. The use of lime (probably by hot mixing) is indicated also by the occurrence of lime lumps, *i.e.* small whitish to brownish aggregates of very fine calcite (sometimes submicroscopic) deriving from the thermal high-temperature (above 800°C) processing of limestone. In several cases an unmetamorphosed core of the original rock can be observed inside these lumps (Fig. 3, f-g), testifying to incomplete processing of the original rock. The lime was mixed with aggregate made up of sand, clay, pottery/daub fragments of local origin.

The surface of the layer (corresponding to the surface of the 'bowl') was accurately smoothed, but no trace of particle reorientation caused by strong rubbing of the fresh paste can be observed at microscopic scale, e.g. a striated b-fabric. This is not surprising because the clay content of this layer is not extremely high, and corroborates the hypothesis that a paste of clay, lime and coarser material (a sort of mortar) was simply laid down with care. Casts of burned vegetal components – probably used to strengthen the whole feature – are represented by thin and elongated voids occurring in its lower part; these include straw and herbivore dung, respectively indicated by opal phytoliths still aligned in vital position within the voids (Fig. 4, e), and calcareous faecal spherulites preserved within other pores (Fig. 4, f).

The whole layer underwent relatively strong heating; FTIR analysis results indicate  $T < 400^\circ\text{C}$  as an average of the bulk of the layer, whereas at least  $600^\circ\text{C}$  are likely for the uppermost 5 mm of the layer, where very fine and low birefringence micrite with crystallitic b-fabric suggests a higher grade of thermal alteration. This aspect shows that lime lumps did not result only from *in situ* thermal alteration due to the normal use of the feature, but also from intentional production of lime: the lumps occur also in the part of the layer where thermal alteration was less strong, and the temperature was lower than the threshold of calcite decomposition.

Completely amorphous, high temperature pottery/daub fragments also occur within the upper part of the layer, whereas higher birefringence, lower temperature shards can be observed in the lower part. In some cases, these fragments include other *chamotte*, suggesting repeated recycling of the construction material. Wood ash residues can be easily detected on the smoothed surface of this combustion feature, resulting from its primary use. After the abandonment of the feature, these were covered by a coating of fine dirty clay leached into the cavity by percolating water.

Layer 1 was laid upon at least two other layers that make up the body of the kiln (Layers 2 and 3). These are made up of a complex and more or less loose mix of coarse particles, including common fragments of daub at various degrees of firing, and pottery fragments, sandy silt sediment, few lime lumps. The matrix is abundant and mainly consists of ash in Layer 2, while Layer 3 is rather poor in matrix and more compact. It is also noteworthy that the top part of Layer 3 is somewhat compacted and

includes mostly pottery fragments fired at high temperature, as testified by their completely amorphous micromass.

Hearth 0093 lay upon a yellowish surface of compacted silt (0081) covered by a layer of black burnt soil, which corresponds to Layer 3. The hearth was deepened from this surface downwards into what appear to be the remains of an earlier installation of similar function (installation 0332, see Fig. 2, b), which was associated with an earlier yellowish surface, and that had probably been levelled in order to be used as a base for 0093. Layer 4 of the kiln sequence is also mainly made up of lime lumps embedded in a compact matrix of reacted fine lime, indicating a careful preparation of the feature with a sort of mortar. Only the bottom of this earlier hearth is preserved: it consists of a rounded, 30-cm-wide area filled with reddish soil, surrounded by a sub-rectangular area of light yellowish compact clay, about 55 x 42 cm wide. Interestingly, the later installation is not located exactly over the earlier one, but is slightly shifted in a NE direction.

#### *Installation 0342*

Installation 0342 (Fig. 5) belongs to a group of features whose use is enigmatic even if apparently connected with combustion. All these features were badly damaged by Late Bronze Age pits, but their outline is still recognisable.

Installation 0342 is a shallow *cuvette*, subrectangular or square, about 130 x 130 cm wide and 16-20 cm deep, surrounded on three sides by tiny clay walls, 15 cm wide. Its walls lie upon a series of pre-existing prepared floors terminated at the top by surface 0354, which sealed a similar, but differently oriented installation (locus 0371, associated with another yellowish surface, 0373). The inside of the *cuvette* is filled by a sequence of five sub-horizontal, 2 to 5 centimetre-thick layers (Fig. 6, Tab. 2).

The top of this feature is rather close to the present-day surface of the mound, i.e. to the bottom of Ramishvili's excavations, so that is not clear now whether its upper part may have been cut, and it was in fact (much?) deeper. The whole sequence of the installation infill was examined microscopically under two thin sections of samples that partially overlap.

The uppermost horizon (Layer 1) is dark brown to dark reddish, rather patchy because of variable preservation, somewhat loose, and includes very common fragments of more or less strongly fired daub, with very few clay matrix (not ash) and some organics, mostly charred seeds (Fig. 7, a-b). The daub is very spongy, even at eye-scale, because of very common elongated voids resulting from the burning of vegetal components (stems, straw, etc.).

Layers 2 and 4 are greyish-yellowish, and include mainly sandy silt deriving from the dismantling or quarrying of the local sediments. They are rather compact and display locally some horizontal laminar microstructure, which indicates some degree of trampling. Voids of elongated shape, including articulated phytoliths (Fig. 7, c-d), indicate that straw, hay or grasses were laid down within the layer when it was set down in place. It is also noteworthy that Layer 4 is made up of discontinuous clods of sediment, probably resulting from the disruption of a more continuous layer, like 2.

Layers 3 and 5 are basically similar, even if the former looks somewhat more brownish. They consist of reworked anthropogenic sediments, sand, unsorted clods of local marine sediment, common small flakes and bits of amorphous organic matter of vegetal origin (Fig. 7, e-f), a few pottery fragments, and variable quantities of daub at various degrees of firing. In these cases, the firing is always less thorough than in Layer 1. The somewhat fluffy structure that can be observed in some areas may indicate biological activity.

The interpretation of this sequence, and of its location within an installation, is somewhat problematic. Though it looks reasonably clear that the yellowish silt layers are prepared floors, the grey ones are apparently a mix of household waste and detritus deriving from the dismantling or collapse of some buildings of the site. Only Layer 1 is apparently burned *in situ*.

#### *Sequence of prepared surfaces (Locus 0305)*

Locus 305 was defined during the excavation as a 3-10 cm-thick layer between the top of yellowish surface 0081 and the top of an earlier, similar surface (0065). It thus consists of surface 0081 (the thickness of which varied from less than 1 to 2-3 cm) and the filling over surface 0065. Besides the sediments which accumulated over the latter surface, this filling may have included a few minor episodes of re-plastering of the same surface.

Layers of laminated yellowish sandy silt, interbedded with thicker levels of greyish to brownish sediment are common features at Natsargora, where they often build up sequences up to 20-30 cm thick. The silt is finely laminated, with millimetre- or sub-millimetre-thick secondary dark laminae occurring within the silt (Fig. 8, a). As a general rule, these sequences are horizontal, even if in a very few cases they dip into depressions of the underlying surface.

Well-developed horizontal cracks can be observed also at eye-scale, giving the silt a fissured aspect, and derive from repeated trampling of surfaces prepared by laying down the local marine sediment of which the hill where the site was built is composed. Vesicular voids are also common, and corroborate the trampling hypothesis. It is noteworthy that no traces of lime use, like lime lumps or finely dispersed calcite, were observed within these levels, therefore it is not likely that these floors were prepared by intentionally adding lime to the sediment.

The fine dark laminae are mostly made up of phytoliths, often still articulated, some amorphous organic matter of vegetal origin (Fig. 8, b-c), and rare clusters of faecal spherulites (that are produced within the caecum of ruminants, including sheep/goat and cattle). Some finely dispersed, high-temperature ash is included within these levels. Apparently, these sequences testify to cyclical phases of preparation and use of these pavements, which were probably used in the processing of cereals; in some cases also the presence of ruminants is testified. At the end of the use, the vegetal residues lying upon these floors were (partially) burned and immediately covered by a new layer of silt. This issue is quite evident, because the fine bands of articulated phytoliths

would not have resisted water erosion or wind deflation for a long time. The characteristics of the thick greyish levels interbedded between these sequences of floors correspond to those of levels 3 and 5 of installation 0342, probably indicating longer phases of domestic use.

#### CONCLUSIONS

Even if these results are largely preliminary and a thorough geoarchaeological and soil micromorphological study is still in progress, some relevant conclusions can be drawn from the available data.

Installation 0093 is in fact the result of the superimposition of two combustion features, as shown by a twofold repetition of the sequence. The inner surface of the features – i.e. the cooking/firing space – was intentionally covered by a thin layer of lime plaster obtained from the mixing of dry slacked lime, pottery and daub fragments and loose sediment, probably with some lime putty as binding matrix (Karkanas 2007). Conversely, the body and walls of the features were made up of more or less compactly packed clay, sediment clods and daub, reinforced with vegetal fibres (straw, stems, etc.).

Regarding the prepared floors, these were intentionally fashioned by laying down layers of variable thickness, consisting of yellowish local marine sediment accidentally including some residues of domestic activity. The thin dark horizons included between the yellowish ones represent residues of activities carried out on the floors; the remarkable amounts of articulated phytoliths may indicate processing of cereals or the use of a sort of litter or mat to cover the floors. The latter hypothesis looks more likely because of the well-preserved articulation of the phytoliths, which would have been disrupted during thrashing; occasional animal parking is indicated by the occurrence of faecal spherulites (Canti 1998).

Additionally, the meaning of installation 0342 remains in large part enigmatic; its infill is apparently made up of two episodes of floor preparation, covered by levels of domestic waste that are much thicker than those between the typical prepared floors. The uppermost horizon shows clear traces of burning, associated with residues of cereal processing (some charred grains), suggesting that some sort of thermal treatment of the grains may have taken place within the installation.

Finally, it can be observed that a large part of the studied features are apparently connected with the processing of cereals, whereas the traces of ruminant droppings are rather scanty; this may provisionally indicate that animals were kept in other parts of the settlement, or even outside of it.



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Level	Colour	Aggregation	Compaction	Other	FTIR T (°C)
1	Light brown	massive	compact	sooty upper film	<400
2	Pinkish-light brown	granular poorly developed	moderately compact	ash matrix	<300
3	Light reddish darker mottles	massive	relatively compact	small ash aggregates	
4	Whitish-pinkish large darker mottles	massive	compact	very few fine charcoal	
5	Dark greyish brown	granular moderately developed	relatively compact	some charcoal	

Table 1: Stratigraphic sequence of installation 0093

Level	Colour	Texture	Aggregation Compaction	Other
1	Reddish brown to blackish	few sandy loam matrix cm-size daub clods	loose granular	
2	Light grey to brown	silty loam	massive	
3	Greyish to brown	silt loam cm-size daub clods	massive to poorly developed granular	
4	Yellowish	fine sandy silt	massive platy clods	
5	Greyish	silty loam	poorly developed granular	
6	Yellowish	silt	massive	Dark laminae

Table 2: Stratigraphic sequence of installation 0342

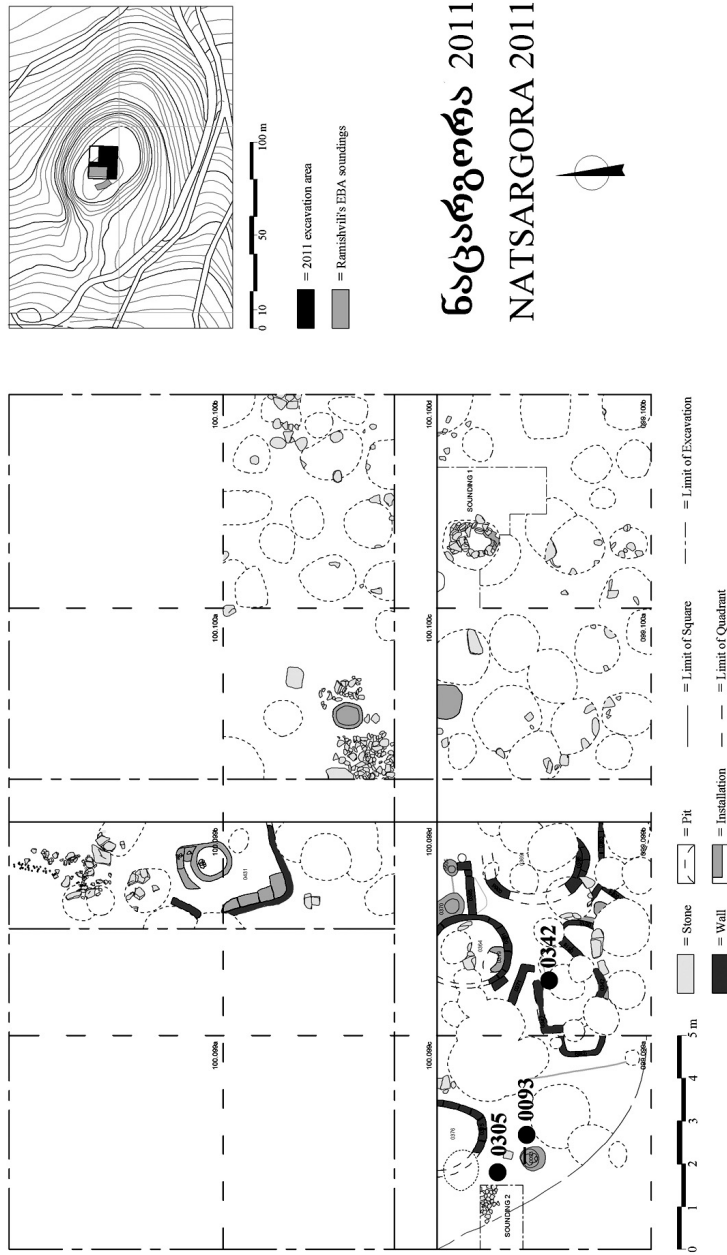


Fig. 1: Natsargora: plan of the 2011 excavation with location of the analysed soil-micromorphological samples.

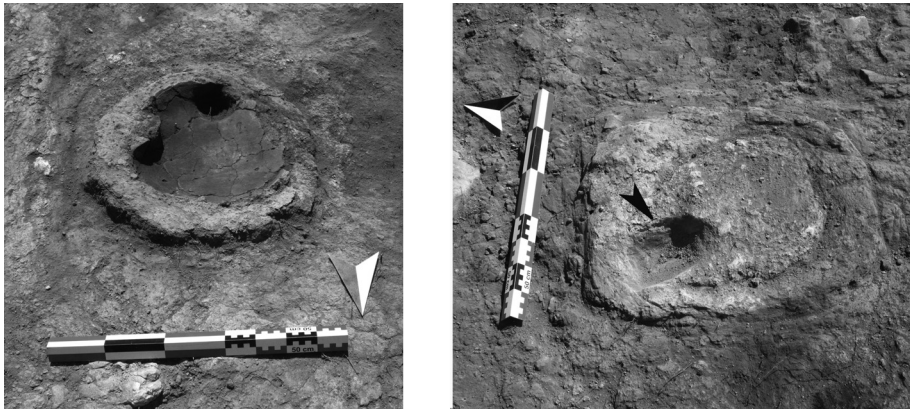


Fig. 2: View of installation (hearth) 0093 from N (left) and installation 0332 under it from W (right): the black arrow shows the location of the soil micromorphological sample.

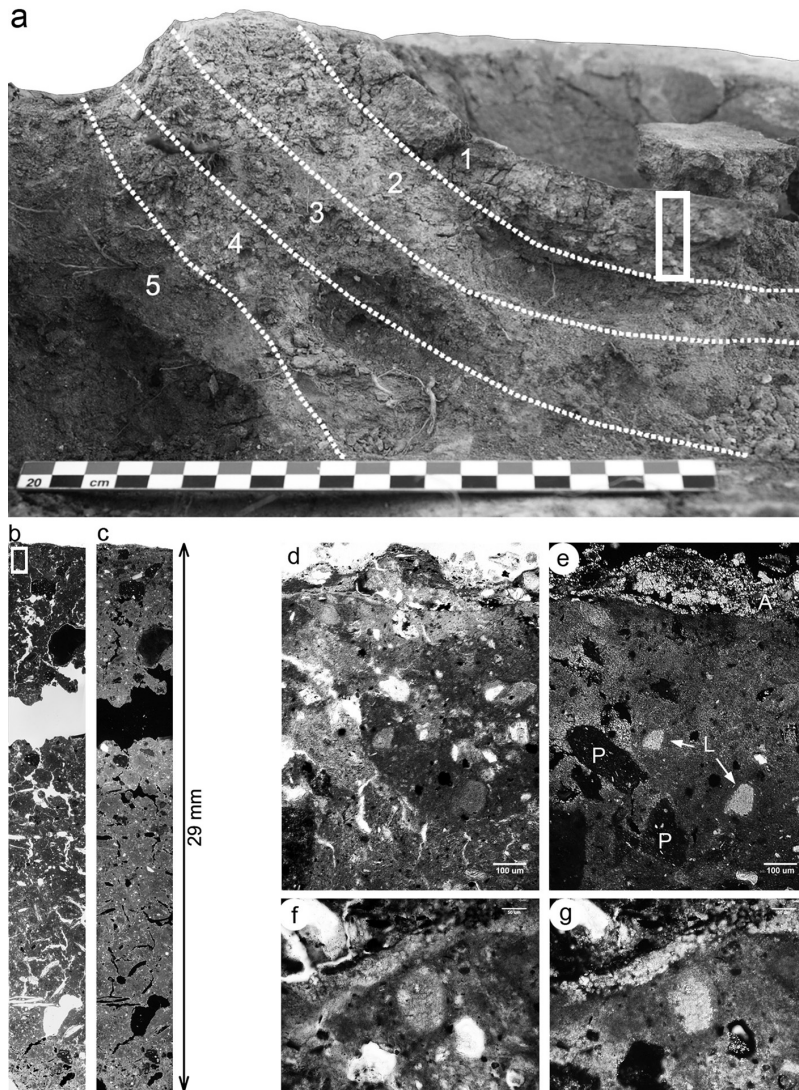


Fig. 3: Installation 0093.

a: vertical profile; white rectangle: area represented in b and c. See Table 1 for layer descriptions.

b: microphotographic profile through layer 1 (parallel polarised light, PPL); white rectangle: area represented in d and e.

c: as in b (crossed polarised light, XPL).

d: microphotograph of layer 1 (PPL).

e: as in d (XPL); P: pottery/daub fragments; L: lime lumps; A: ash layer.

f: microphotograph of layer 1 (PPL); at centre, lime lump with sparitic calcite core.

g: as in f (XPL).

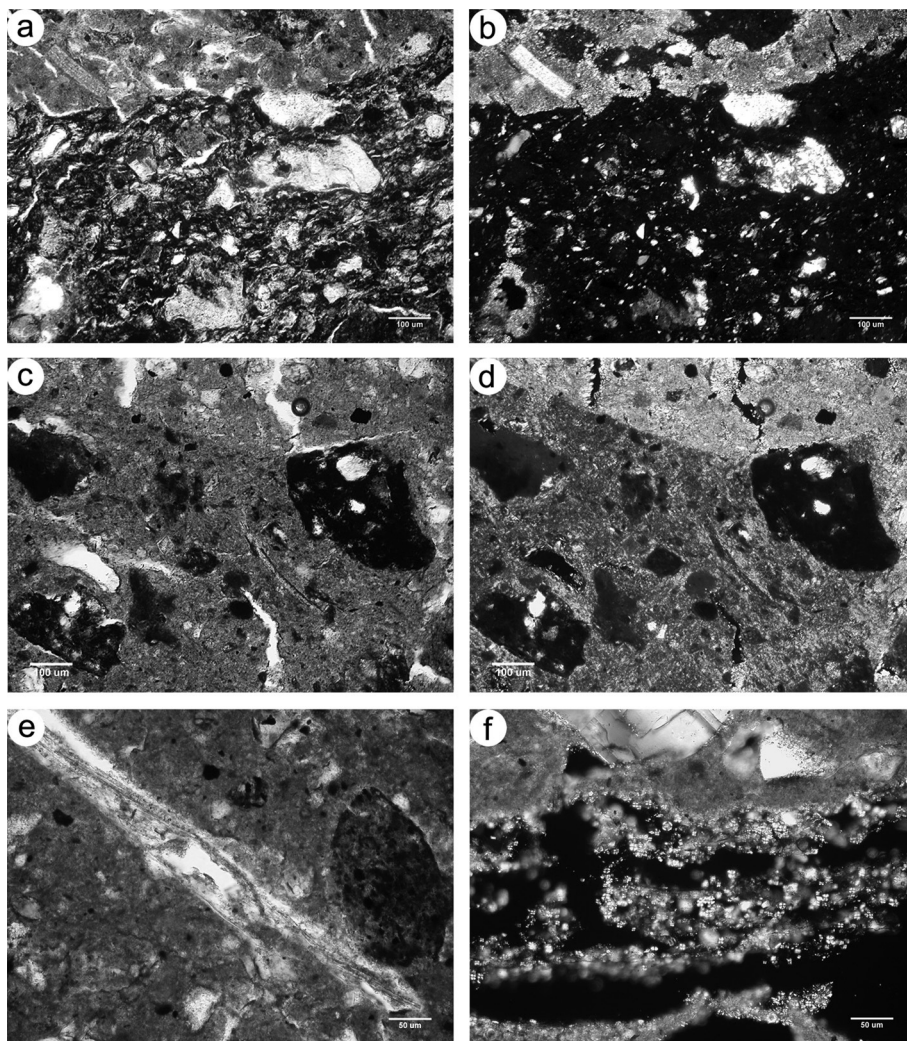


Fig. 4: Microphotographs of sediments of installation 0093.

a: lower 3/4 of the image are occupied by a high-temperature fired daub fragment (PPL).

b: as in a (XPL).

c: lower left part of the field is occupied by a clod of reddish soil including amorphous iron nodules (black) and small mollusc shell fragments (PPL).

d: as in c (XPL).

e: elongated void including articulated phytoliths, probably cast of vegetal residue (PPL).

f: void (black) including faecal spherulites (XPL).



Fig. 5: View of installation 0342 from N. The white arrow indicates the location of the micro-morphological sampling.

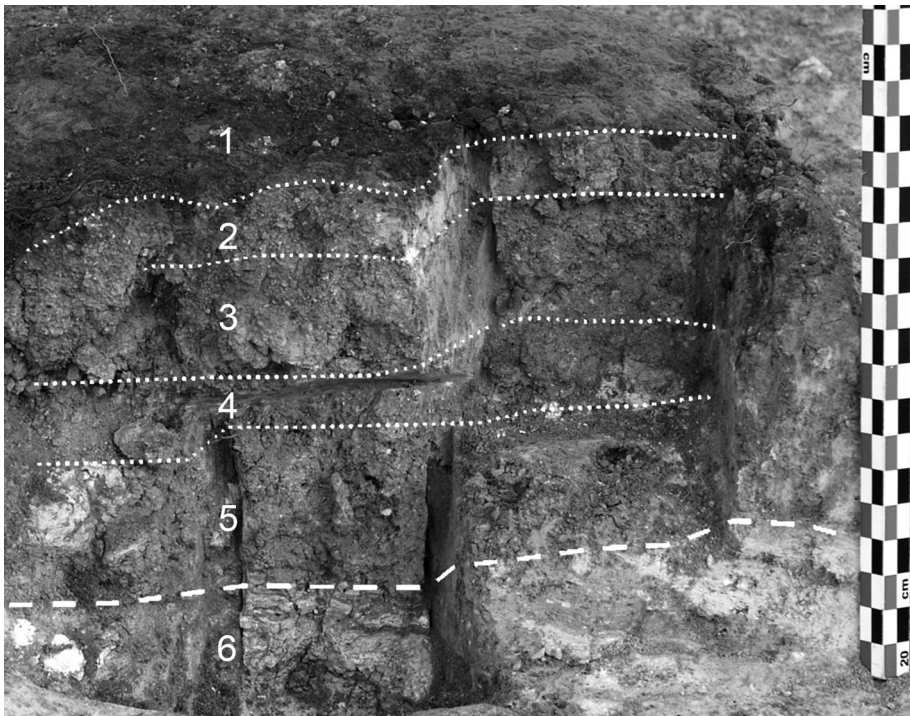


Fig. 6: Installation 0342; vertical profile. See Table 2 for layer descriptions.



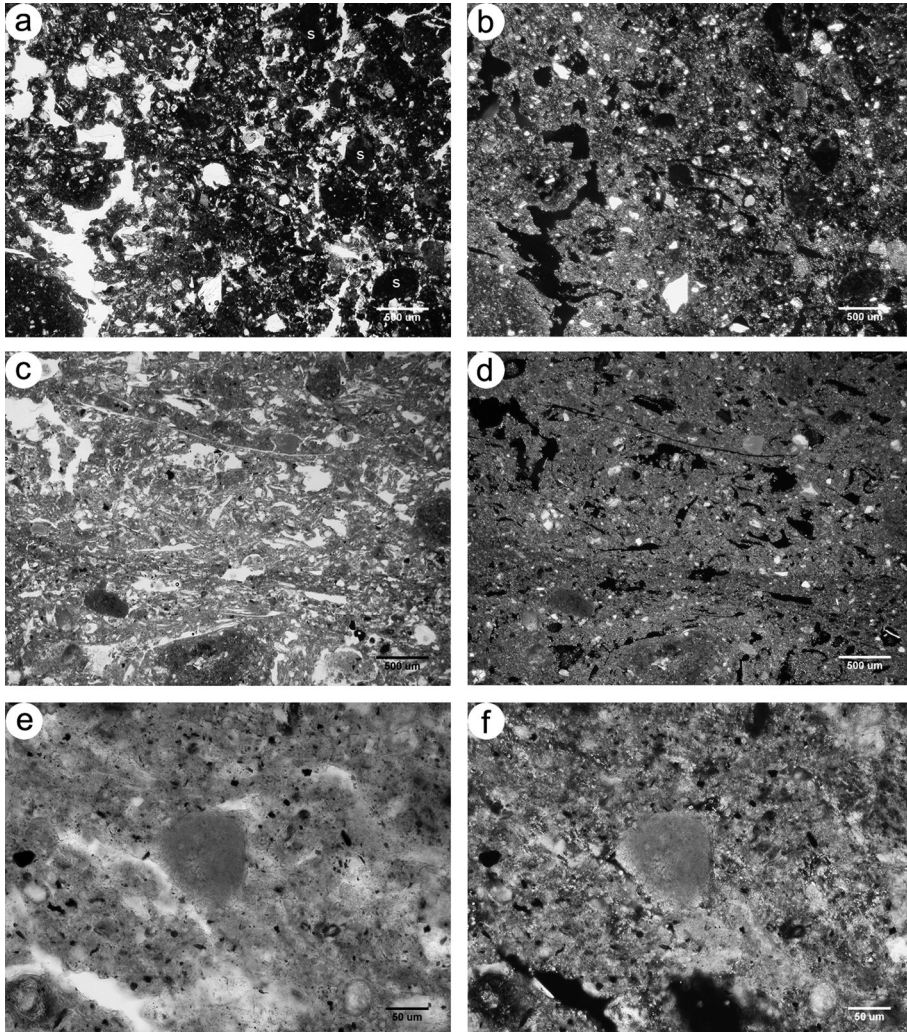


Fig. 7: Microphotographs of sediments of installation 0342.

a: loose granular microstructure; unsorted daub clods at various degrees of firing; few matrix (mostly clay); common partially burned seeds; S: seeds (PPL).

b: as in a (XPL).

c: compact microstructure, with elongated voids often including articulated phytoliths (casts of vegetal components, straw, etc.); silt and clay, with common sand skeleton, mostly quartz; unburned (PPL).

d: as in c (XPL).

e: massive to fluffy microstructure; silt, clay, frequent sand skeleton (mostly quartz), phytoliths, fine amorphous organic matter (PPL).

f: as in e (XPL).

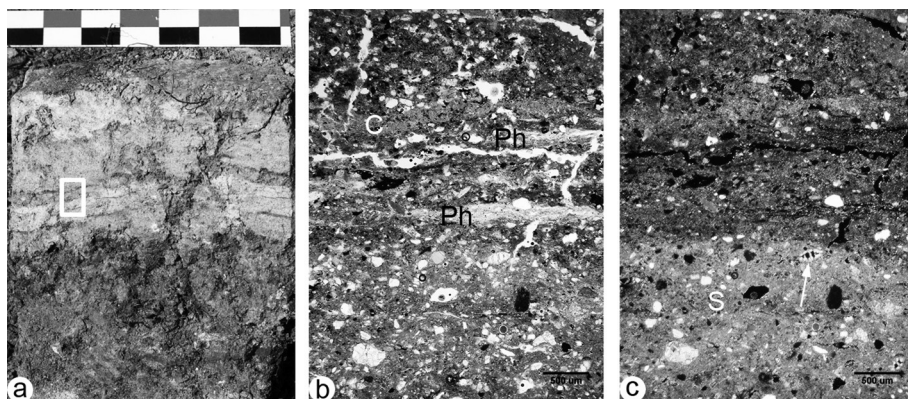


Fig. 8: Locus 0305.

- a: eye-scale sequence of prepared floors: yellowish sandy and/or clay silt, organized in 0.5 to 3 cm-thick layers, alternating with whitish to gray to brown clay loam laminae, 0.5 mm to 3-5 mm-thick. The bottom part is a gray to dark brown sandy clay loam with white to brown to reddish mottles and medium to well-developed crumb structure. The white rectangle indicates the area illustrated in b-c.
- b: very fine layers rich in phytoliths (Ph), or more clayey (C), alternating with silty levels (PPL).
- c: as in a (XPL); S: prepared floor made up of marine sandy silt including foraminifera shells (arrow).

