CONSTANTIN HAITĂ*

PRELIMINARY CONSIDERATIONS OF THE SEDIMENTOLOGICAL SONDAGES PERFORMED AT THE NEO-ENEOLITHIC TELL BORDUŞANI POPINĂ

Abstract: Acest studiu prezintă câteva date ale analizei sedimentologice realizate asupra succesiunilor sedimentare observate în cadrul a trei sondaje realizate în campania anului 1998 în scopul înţelegerii relaţiilor stratigrafice dintre nivelurile culturale din alcătuirea *tell*-ului şi depunerile naturale din baza acestuia. Principalul scop al acestui studiu este reconstituirea cadrului geografic din prima fază de locuire, ca şi a condiţiilor de mediu din timpul locuirii. Principalele rezultate ale acestui studiu, aşa cum au rezultat în urma corelării stratigrafice a succesiunilor sedimentare studiate în cele trei sondaje, sunt: 1. *Tell*-ul Borduşani Popină este format pe un martor de eroziune al terasei de vârstă holocenă inferioară, constituită din depozite de tipul *loess*-ului; 2. Fragmentele ceramice descoperite în primul nivel de locuire observat în Sondajul 1, realizat la limita nivelurilor culturale din *tell*-ul mare au fost atribuite culturii Boian, faza Giuleşti. Corelarea altitudinii relative la care apare acest nivel cu depunerile cercetate în Sondajul 2, realizat în zona dintre cele două *tell*-uri, sugerează faptul că locuirea aparţinând culturii Boian se situează pe întreaga suprafaţă a celor două popine, ambele de origine naturală. Pe suprafaţa *tell*-ului mic locuirea se limitează probabil la faza culturală menţionată, pentru ca ulterior să se extindă pe suprafaţa zonei mai înalte, ce constituie în prezent *tell*-ul mare; 3. Prezenţa nivelurilor de acumulare aluvială ce includ frecvenţi constituenţi antropici, în Sondajul 2, sugerează că cele două popine erau separate de o zonă mai joasă periodic inundată, rezultat al unui canal aluvial sau al acţiunii antropice, fapt ce va fi evidenţiat prin cercetările sedimentologice viitoare; 4. În Sondajul 3, efectuat la baza popinei, în extremitatea nord-estică a sa, a fost observat un nivel de paleosol ce suprapune o secvenţă sedimentară ce nu include constituenţi antropici. Acest nivel de sol este suprapus de acumulări de origine aluvială ce includ frecvenţi constituenţi antropici, atribuite stratigrafic perioadei de locuire neo-eneolitică. La partea superioară a acestor acumulări a fost observat un nivel granular cu frecvente fragmente de chirpici ars remaniate şi rulate, atribuite unui moment de inundaţie mai important, interpretat, ipotetic, ca fiind cauza abandonului aşezării în perioada eneolitică; 5. După nivelul atribuit momentului de abandon al aşezării, în acelaşi sondaj au fost observate acumulări de origine aluvială fără constituenţi antropici, dar cu cochilii de bivalve, suprapuse de un nivel de paleosol şi de aluviunile acumulate până în prezent.

Keywords: neo-eneolithic, Boian culture, Giuleşti phase, Gumelniţa culture, *tell*, sedimentology.

1. General Background.

The Neo-Eneolithic *tell* Borduşani *Popină* is situated in Balta Ialomiţei, a large island within the Danube floodplain, periodically flooded, bordered to the west by the Borcea channel of the Danube (Fig.1) and to the east by Danube itself. This area provides an important geomorphologic complexity consisting of a series of alluvial bars, lakes and temporary channels (Bandrabur, Patrulius 1967: 8).

The site Borduşani *Popină* has a double *tell* morphology: the main (bigger) one is oval in shape (dia. 180 x70 m and height 15,40 m); the second is almost

* National Museum of Romanian History, National Center of Pluridisciplinary Researches, Bucureşti. e-mail: sedimentologie@mnir.ro.

circular (dia. 30x20 m and height 8 m (Marinescu-Bîlcu 1997: 36-37). The anthropogenic deposits forming the *tell* are attributed to Gumelniţa A2 phase and are overlapped by the La Tène levels of the Iron Age occupation (Marinescu-Bîlcu et al. 1997: 64).

The archaeological deposits of the *tell* are represented mainly by fine layers of yellow, yellowish-brown or greyish silts (often preserving fine vegetal prints and fragments) micro-stratified with layers of compact silts (without anthropogenic constituents), lens of ashes and charcoal, fine layers with frequent organic constituents (mammal and fish bones, shells and wood), complex anthropogenic accumulations, levels of destruction (with burned daub, charcoal and ashes) and layers of brown silt with organic matrix (Haită 1997: 85). During the 1998 campaign of archaeological researches, three sedimentological sondages were dug into the *tell*, in order to study the stratigraphic relations between the cultural layers forming the *tell* and the natural deposits that had accumulated before and after the occupation.

The main goal of this study was to reconstruct both the geographical background present at the time of the first phase of occupation and the related environment conditions (from the sedimentological point of view) that occurred during the Neo-Eneolithic occupation until the abandonment of the settlement.

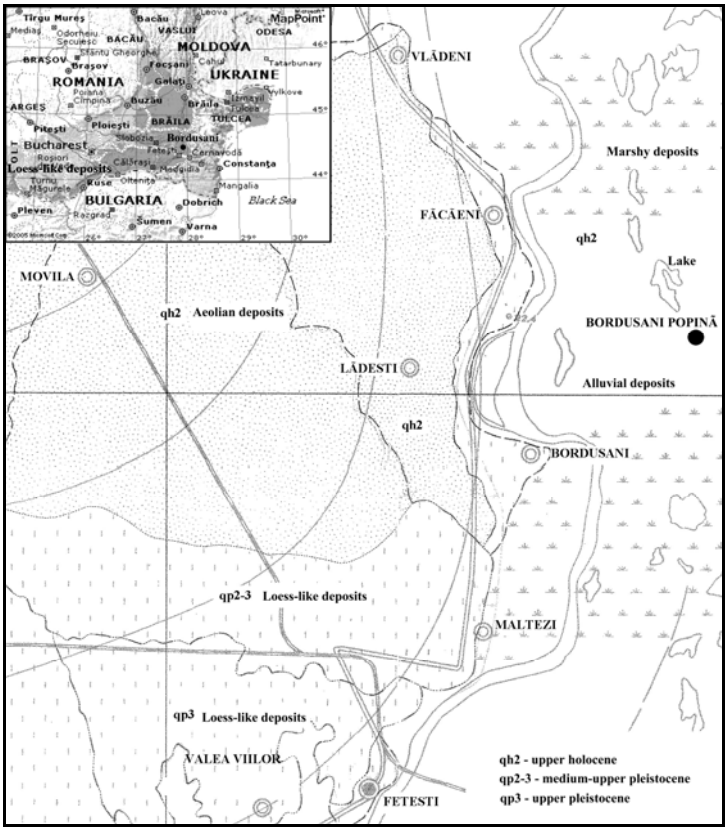


Fig.1 The position of the *tell* Borduşani *Popină* on the geological map, scale 1:200000 (Modified from Liteanu, Chiriac 1967).

The first sondage (Sondage 1), located in the northeastern extremity of the site, on the *tell* slope, consisted of two steps, each about 1 m height (Fig.2) which were located very close to the limit of the cultural layers, at the edge of the occupied area. This sondage was done on the interval -7,15 : -9,37 m from the reference point (z=0), located at the top of the *tell* (Fig.3).

The second sondage (Sondage 2) is located in the edge of the small *tell*, on the northern side of an ice-preserving pit, on the depth interval -13,81 : -15,56 m from the reference point (Fig.3).

The third sondage (Sondage 3) is located at the base of the *tell*, in the northeastern zone, in the same area as the first one, on the depth interval -14,14 : -16,56 m from the reference point (Fig.3).

2. Preliminary results of the sedimentological sondages

Performed at the macroscopic level, the preliminary study of the stratigraphic sequences from the three sedimentological sondages documents the following aspects:

1. In the northeastern zone of the *tell* the limit between the cultural layers and the natural deposits at the base of the site is observed at the depth of 8,70 m (from the top of the *tell*) (tab. 1). In the southern area of the *tell*, at the base of Sondage 2 (at a depth of 15,56 m), reworked cultural material was observed within alluvial deposits (tab. 2). This fact suggests that at the moment of the first occupation phase, the mound that formed the base of the *tell* had an asymmetrical profile running North-South (Fig.3). The presence of anthropic inclusions almost throughout the succession studied in Sondage 2 indicates that the occupation was situated close to the edge of the *tell*; almost all the surface was occupied at this stage. Later on, as the profile of the *tell* suggests, occupation was concentrated on the higher, northern, zone of the *tell*.

2. The sedimentary sequence observed in Sondage 2 is represented by yellowish and greenish-brown silt and fine sand, including fine fragments of pottery, mammal and fish bones and grains of charcoal, alternating with silty and fine sandy micro-stratified layers without or with very few anthropic inclusions, the last ones resulting from the natural accumulation during the main flood events. The layers including anthropic constituents are accumulated both by colluviation and water reshuffling, probably in the area near by the edge of the settlement.

These observations direct us to the conclusion that the period of Neo-Eneolithic occupation was characterised by frequent flooding events.

3. In Sondage 3 (as in Sondage 2) were recorded silty and fine sandy micro-stratified layers that had resulted from the natural accumulation during floods (tab. 3). At the top of the sequence studied in this sondage it was a layer with granular structure, including fine anthropic constituents, presenting signatures of water reworking (i.e., good sorting, alluvial matrix).

These observations are interpreted as an argument for the conclusion that the period before the occupation, as well as during the occupation (at least in the first phases) was characterized by frequent flooding events.

4. In Sondage 1 were recorded the floors and successive fitting-out units corresponding to two dwelling-type structures. The layering of these floors and the fitting-out of the space (as well as those studied in the excavated area - from the cultural layers of Gumelniţa A2 phase) can be related to the internal area of the houses (Fig.2). These structures are fired. In the corresponding levels were

identified fragments of pottery attributed to the Boian culture (Giuleşti phase)[1].

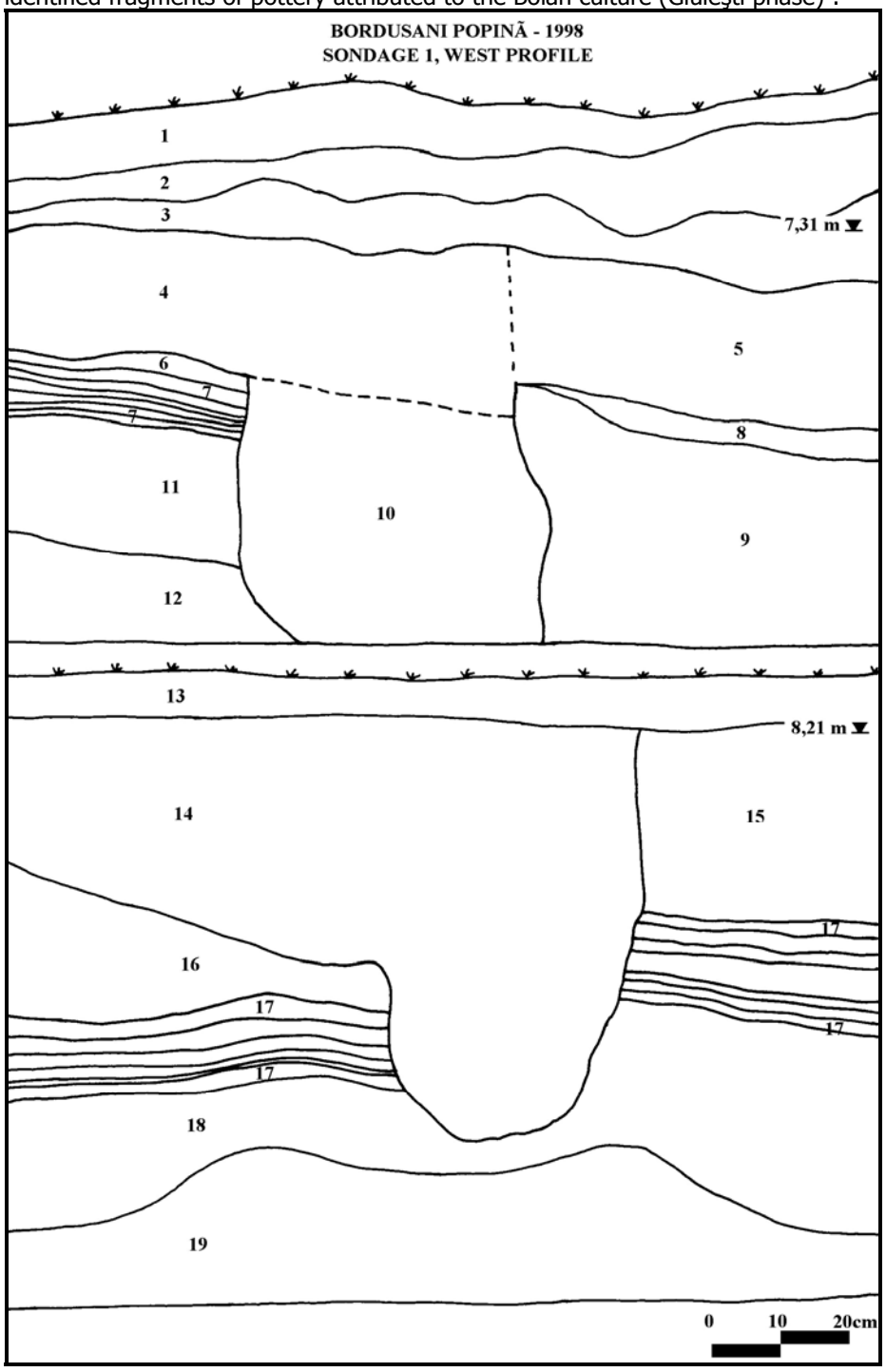


Fig. 2 West profile of Sondage 1, at the limit between the anthropic deposits of *tell* and the remnant of the terrace. See layers description in table 1.

5. As it could be observed on the west profile of Sondage 1, two small ditches (or trenches), dug in both cases from the stratigraphic level of the destruction layer, cut the floor units of both dwelling structures. The ditches are 0,75 m and 0,70 m deep with a narrower and deeper zone in the centre and with the top widening in the southern direction, up to 1,10 m and respectively 0,90 (Fig.2). The fill of these structures consists of greyish-brown and yellowish-brown, homogeneous, loose silt, including rare and fine anthropic constituents which probably originated in the (none-fire) destruction of the anthropic structures.

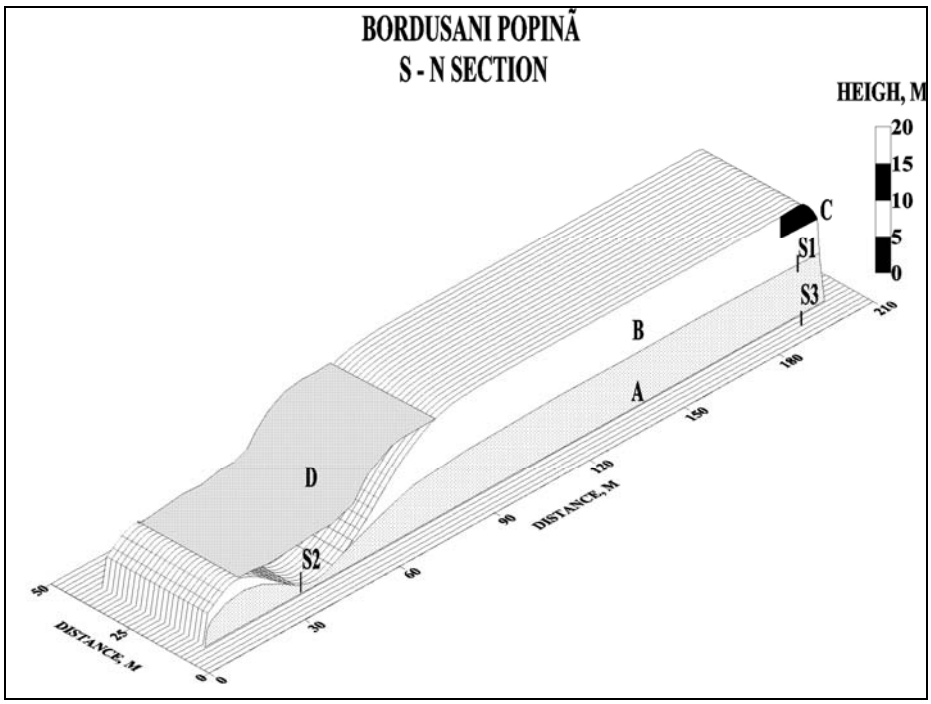


Fig.3 South-North section of the tell, as resulting from the stratigraphic correlation of the sedimentological sondages. A - remnant of the terrace; B - anthropic deposits of the tell; C - area of archaeological researches; D - actual surface; S1, S2, S3 - location of sedimentological sondages.

3. Preliminary considerations on forming and development of the *tell* Borduşani *Popină*

The stratigraphic correlation of the three sedimentological sondages allows a hypothetical reconstruction of the Borduşani *Popină tell* (Fig.3) and allows us to make some preliminary conclusions about the formation and evolution of this site.

- The general stratigraphy suggests that the Neo-Eneolithic occupation is located on an erosional remnant of the terrace, approximately 5,40 m high to the northern side of the site. This geomorphologic element is attributed to the lower Holocene terrace of the Danube, as described on

the geological map (Brandabur, Patrulius 1967: 19) and consists of silty and fine sandy loess-like deposits.

- The presence of the alluvial deposits that include cultural material and which accumulated at the base of the *tell* slope in Sondage 2 suggests that during its evolution, the main (bigger) *tell* was separated from the second (smaller) one by a periodically flooded lower area, 20-25 m wide, located 15,50 m from the top of the *tell*. The presence of the naturally accumulated layers and the general morphology of the site suggest that this erosional remnant continued at the base of the small *tell*: the extension of the anthropic deposits in a N-S direction in this area of occupation was no more than 25 m. In this case, an alluvial channel that would have been filled up during the final occupation phases of the main area, cut the erosional remnant before the occupation. However, it is still possible that this separation be of anthropogenic origin. This area must be studied in the future from the sedimentological point of view.
- Considering the fact that the pottery discovered in Sondage 1 was attributed to the Boian culture (Giuleşti phase), it could be assumed that the Neolithic occupation was developed on the entire area of this mound. If the small *tell* was occupied, the Neolithic occupation in this area was probably restricted to the Boian Giuleşti phase. In a later phase, the occupation was concentrated in the northern area of the mound, forming the main (bigger) *tell*.
- In order to reconstruct the geomorphologic background of the vicinity of the *tell* before and after the Neo-Eneolithic occupation, it is important to consider the alluvial deposits accumulated during the settlement and after the abandonment. As can be observed from the sedimentary sequence studied in Sondage 3, the first soil unit is observed at the depth of about 15 m from the reference point. Considering the fact that the alluvium under this soil horizon does not include any anthropic constituents, this soil can be attributed to the period before the Neo-Eneolithic occupation.
- The sedimentary succession covering this soil consists of alluvial units preserving the original structure alternating with alluvial units slightly pedologically transformed. These units include anthropic constituents and are attributed to the Eneolithic occupation period.
- The level corresponding to the abandonment was situated at -14,47 m from the reference point, at this level being observed the alluvial accumulation with frequent anthropic constituents, intensively reworked by water, with mm-cm dimensions, forming a micro-conglomerate constituted essentially from burned daub. This accumulation corresponds to a more intense flooding event of longer duration that could be assumed to have been one of the possible cause of the abandonment of this settlement in the Eneolithic period. The presence of frequent fragments of burned daub in the alluvial matrix also indicates that the marginal area of the site was flooded (i.e., one or more waste deposits accumulated on slope, including burnt daub from fired structures, being eroded by water).
- After the abandonment of the settlement, alluvial units of silt and silty

sand (including rare fragments of shells) continued to accumulate. These units are superposed, on the interval -14,19 : -14,39 m by a soil horizon, without anthropic constituents, that could correspond to the abandonment of the site and possibly to the Iron Age occupation. After this layer, other layers of alluvium were deposited and this continued until the present. In the vicinity of the *tell*, colluvium accumulated on the *tell* slope are covering these deposits.

Acknowledgements

Dr. Silvia Marinescu Bîlcu conducted the 1998 archaeological researches and we are very grateful for invaluable help and support. Mr. Dragomir Popovici, coordinator of the pluridisciplinary researches team provided fruitful discussions and suggestions and we address many thanks. We like to thank sincerely to our colleagues Dragoş Moise, Valentin Parnic, Mihai Tomescu and Radu Coman for help to record the topographic and stratigraphic information. Dr. Douglass Bailey is thanked for comments and suggestions on a draft of this paper.

Notes

1. Information kindly offered by Mr. Florin Vlad (Museum of Ialomiţa County) and we are very gratefully.

References

Brandabur, T., Patrulius, D. 1967. *Harta geologică*, scara 1:200.000, Notă explicativă, foaia Călăraşi, Bucureşti.

Haită, C. 1997. Micromorphological study. In Marinescu-Bîlcu S. et al. Archaeological Researches at Borduşani Popină (Ialomiţa county). Preliminary report 1993-1994. *Cercetări Arheologice* X: 85-92.

Liteanu, E., Chiriac, M. (eds.) 1967. *Harta geologică*, scara 1:200.000, foaia Călăraşi, Institutul Geologic al României, Bucureşti.

Marinescu-Bîlcu, S. 1997. Historical background. In Marinescu-Bîlcu S. et al. Archaeological Researches at Borduşani Popină (Ialomiţa county). Preliminary report 1993-1994. *Cercetări Arheologice* X: 35-38.

Marinescu-Bîlcu, S., Popovici, D., Bem, C., Vlad, F., Voinea, V. 1997. Eneolithic occupation. Gumelniţa levels. In Marinescu Bîlcu S. et al. Archaeological Researches at Borduşani-Popină (Ialomiţa county). Preliminary report 1993-1994. *Cercetări Arheologice* X: 64-69.

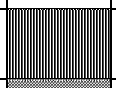
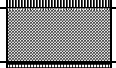
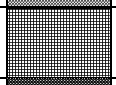
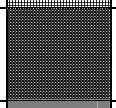
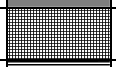
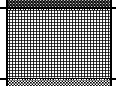
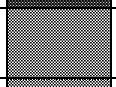
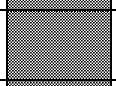
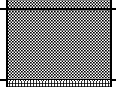
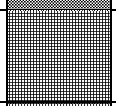
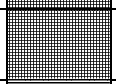
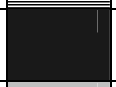
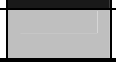
Layer n° (see fig.2)	Depth from z=0 (m)	Profile	Description	Interpretation
1	7,09-7,20		Brown heterogeneous loose silt, with frequent fragments of burned daub, shells and pottery fragments.	Colluvium.
2	7,20-7,25		Yellowish brown silt, homogeneous, without anthropic constituents.	Natural, probably aeolian, accumulation.
3	7,25-7,30		Reddish brown loose silt, heterogeneous, granular structure, with frequents fragments of burned daub.	Destruction.
4	7,30-7,52		Greyish brown loose silt, very heterogeneous, with granular structure with very frequent fragments of pottery, shells, ash and charcoal.	Domestic wastes.
5	7,39-7,65		Light brown loose silt, granular structure, homogeneous, few anthropic constituents.	Occupation in the external area of the structures.
6	7,52-7,57		Silty, dark greyish brown daub, loose and heterogeneous, granular structure.	Destruction by firing.
7	7,57-7,65		Silty, yellowish brown layer, compact, micro-stratified, with very fine anthropic constituents.	Floors and fitting out units inside a dwelling structure.
8	7,65-7,69		Silty fine unit, heterogeneous, of loose ashes with frequent fragments of burned daub, and fine charcoal.	Domestic wastes.
9	7,69-8,09		Silty yellowish brown layer, homogeneous, moderately compact, without anthropic constituents.	Destruction without firing.
10	7,61-8,05		Greyish brown silt, granular structure, homogeneous, loose, with rare anthropic constituents.	Filling of a pit.
11	7,65-7,89		Greenish brown very heterogeneous loose silt, granular structure, with frequent shells, fish bones, ash and charcoal.	Domestic wastes.
12	7,89-8,07		Greenish brown heterogeneous silt, granular structure, with fine fragments of shells and charcoal.	Occupation in the external area of the structures.
13	8,08-8,18		Greyish brown heterogeneous loose silt, granular structure, with fine anthropic constituents.	Occupation in the external area of the structures.
14	8,18-8,94		Greyish brown silt, granular structure, homogeneous, loose, with rare and fine anthropic constituents.	Filling of a pit.
15	8,19-8,55		Medium brown silt, granular structure, heterogeneous, compact, with frequent fragments of burned and unburned daub and charcoal.	Destruction by firing.
16	8,51-8,73		Greenish brown silt, granular structure, compact, with abundant fragments of burned and unburned daub.	Destruction by firing.
17	8,73-8,86 8,55-8,71		Silty yellowish brown micro-stratified layer, compact, with very fine anthropic constituents.	Floors and fitting out units inside a dwelling structure.
18	8,78-9,05		Yellowish light brown silt, granular structure, slightly heterogeneous, compact, including few fragments of shells.	Paleosol on loess-like deposits.
19	9,05-9,37		Yellowish brown silt, homogeneous, compact, without anthropic constituents.	Natural accumulation (remnant of terrace).

Table 1 Description o the sedimentary succession studied on west profile of Sondage 1.

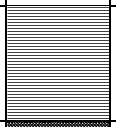
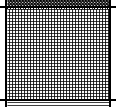
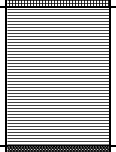
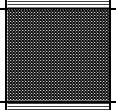
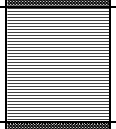
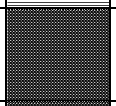
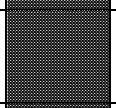
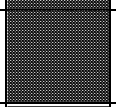
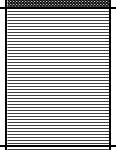
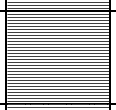
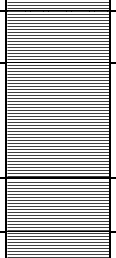
Layer n°	Depth from z=0 (m)	Profile	Description	Interpretation
1	13,81-13,91		Yellowish brown homogeneous silt with rare and fine fragments of bones, shells, burned daub and pottery, inter-stratified with 1-2cm thick, micro-laminated units, with vegetable fragments, shells, bones and charcoal.	Alluvial accumulation. Fine anthropic material reworked.
2	13,91-13,93		Yellowish silt, granular structure, with frequent fragments of burned daub, charcoal, pottery and bones.	Accumulation and reworked of anthropic constituents.
3	13,93-14,01		Yellowish silt, homogeneous, with ferruginous stains and fine carbonatic concretions.	Accumulation and pedological transformation of a destruction unit.
4	14,01-14,25		Greenish yellow and yellowish brown homogeneous silt without anthropic constituents, inter-stratified with fine units, 1-2cm thick, micro-laminated structure, with frequent fish bones and shells and rare charcoal.	Alluvial accumulation. Frequent fine anthropic material reworked.
5	14,25-14,38		Yellowish brown and greyish brown silt, granular structure, with frequent fish bones and shells and rare fragments of charcoal and burned daub.	Accumulation of the reworked anthropic constituents.
6	14,38-14,47		Yellowish brown micro-stratified silt without anthropic constituents and fine sandy units, granular structure, with frequent fragments of burned daub and shells and rare fragments of fish bones and charcoal.	Alluvial accumulation. Frequent fine anthropic material reworked.
7	14,47-14,57		Yellowish brown silt, granular structure, with frequent fragments of fish bones, shells and fine charcoal and rare fragments of burned daub.	Accumulation of the reworked anthropic constituents.
8	14,57-14,61		Yellowish silt, granular structure and micro-conglomerate texture with frequent fragments of burned daub, shells, fish bones, charcoal and carbonates.	Accumulation of the reworked anthropic constituents.
9	14,61-14,85		Greyish-yellowish brown silt, granular structure, with frequent and fine anthropic constituents: fish bones, shells, charcoal and burned daub.	Accumulation of the reworked anthropic constituents.
10	14,85-15,22		Yellowish brown homogeneous silt and fine sand with rare and fine fragments of fish bones, shells, burned daub and charcoal inter-stratified with fine units, 2-4cm thick, micro-laminated structure, with rare fragments of shells, burned daub and charcoal.	Alluvial accumulation. Fine anthropic material reworked.
11	15,22-15,38		Greyish brown silt, homogeneous, with very rare fragments of burned daub, in the central part including a fine micro-laminated unit with few charcoals.	Alluvial accumulation. Anthropic material from a destruction unit reworked.
12	15,38-15,41		Greyish brown silt, micro-laminated, with very rare anthropic constituents.	Alluvial accumulation.
13	15,41-15,51		Greyish brown coarse sand, granular structure, with fine fragments of burned daub and shells, inter-stratified with greenish grey coarse sand, micro-laminated structure, without anthropic constituents.	Alluvial accumulation. Fine anthropic material reworked.
14	15,51-15,53		Greenish grey silt, micro-laminated, with silty fragments and rare bones.	Alluvial accumulation.
15	15,53-15,56		Yellowish brown silt, homogeneous, with very rare anthropic constituents.	Alluvial accumulation.

Table 2 Description o the sedimentary succession studied on west profile of Sondage 2.

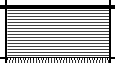
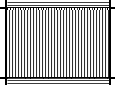
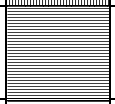
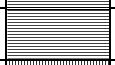
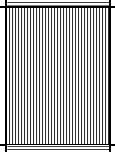
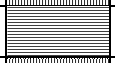
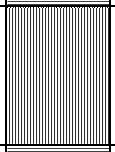
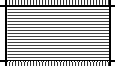
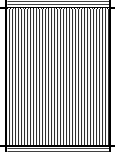
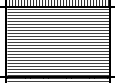
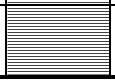
Layer n°	Depth from z=0 (m)	Profile	Description	Interpretation
1	14,14-14,19		Yellowish silt, homogeneous, compact, without anthropic constituents.	Alluvial accumulation.
2	14,19-14,39		Greyish yellowish silt, aggregated structure of faunal bioturbation, homogeneous, without anthropic constituents.	Pedological transformation of alluvium.
3	14,39-14,47		Greyish brown coarse sand, granular structure, with frequent fine fragments of shells and burned daub.	Alluvial accumulation. Reworking of anthropic constituents.
4	14,47-14,64		Yellowish silt, micro-laminated structure, without anthropic constituents.	Alluvial accumulation.
5	14,64-14,68		Yellowish loose silt, homogeneous, with structures of faunal bioturbation and rare fragments of burned daub.	Pedological transformation of alluvium and reworking of anthropic constituents.
6	14,68-14,72		Yellowish silt, homogeneous, without anthropic constituents.	Alluvial accumulation.
7	14,72-15,00		Light brown loose silt, aggregate structure of faunal bioturbation, rare and fine fragments of burned daub and shells.	Pedological transformation of alluvium and reworking of anthropic constituents.
8	15,00-15,03		Yellowish silt, homogeneous, without anthropic constituents.	Alluvial accumulation.
9	15,03-15,05		Light brown loose silt, aggregated structure of faunal bioturbation, with rare and fine burned daub and shells.	Pedological transformation of alluvium and reworking of anthropic constituents.
10	15,05-16,10		Yellowish and light brown silt and fine sand, homogeneous, micro-stratified, without anthropic constituents.	Alluvial accumulation.
11	16,10-16,19		Yellowish silt and fine sand, homogeneous, with fine structures of bioturbation, without anthropic constituents.	Pedological transformation of alluvium.
12	16,19-16,55		Yellowish brown and yellowish silt and fine sand, homogeneous, without anthropic constituents.	Alluvial accumulation.

Table 3 Description o the sedimentary succession studied on north profile of Sondage 3.