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ANTHROPIC SEDIMENTS FROM NEOLITHIC TO IRON AGE SETTLEMENTS: INTERPRETATION ACCORDING TO MICROMORPHOLOGICAL, ARCHAEOZOOLOGICAL AND ARCHAEOLOGICAL DATA

To Marylin Gil (†)

Abstract - The data that will be discussed come from two important French archaeological sites, excavated by Jean-Louis Voruz, the Gardon cave and the open air settlement of Saint-Alban. The first one was occupied from Early Neolithic until the Middle Ages, the second one from the final Bronze Age until the Middle Ages. The micromorphological study of these sites first led to preliminary interpretations. These results then were compared with other archaeological and archaeozoological data. This integration of diverse results led to the confirmation, specification or reconsideration of the first micromorphological interpretations. Examples are given of various deposits, resulting from different human activities, such as construction, stock farming or items produced after the settlements were abandoned. The stratigraphic and micromorphological study of the Gardon cave allowed us to correlate some deposits with climatic fluctuations and to address environmental and archaeological questions.

Key words - Soil micromorphology, archaeozoology, anthropogenous sediments, Neolithic, Bronze Age, France.

Riassunto - *Sedimenti antropici di insediamenti dal Neolitico all'Età del Ferro: interpretazione in base a dati micromorfologici, archeozoologici ed archeologici*. I dati qui discussi provengono da due importanti siti archeologici francesi scavati da Jean-Louis Voruz: la Grotte du Gardon e l'insediamento di Saint-Alban. La prima è stata occupata dal Neolitico antico al Medio Evo, il secondo dall'Età del Bronzo finale al Medio Evo. Lo studio micromorfologico di questi siti ha portato ad alcune interpretazioni preliminari, e questi risultati sono stati poi confrontati con dati archeologici ed archeozoologici, portando alla conferma o al raffinamento o alla riconsiderazione delle prime interpretazioni della micromorfologia. Sono qui descritti esempi di depositi derivanti da varie attività umane, quali costruzione ed allevamento, oppure originati dopo l'abbandono degli insediamenti. Lo studio stratigrafico e micromorfologico della Grotte du Gardon ha permesso di correlare alcuni depositi con le oscillazioni climatiche e di porre interrogativi ambientali ed archeologici.

Parole chiave - Micromorfologia dei suoli, archeozoologia, sedimenti antropogenici, Neolitico, Età del Bronzo, Francia.

INTRODUCTION

The two sites studied here are located at the southern tip of the Jura mountains, in eastern France (Fig. 1). The Gardon cave is located at the entrance of a karstic gallery and was occupied from Early Neolithic, near 5300 cal BC, until the 15th-17th century (Fig. 2). The open-air settlement of Saint-Alban is situated at the top of a small hill, on the left bank of the Rhône River, and was occupied from the Final Bronze Age until the Middle Ages (Fig. 3).
In these sites, certain sedimentary facies were selected, that are specific for some periods. The aspect of these deposits is examined, first in their natural setting, then under the petrographic microscope (micromorphology). Firstly, a sedimentological interpretation is presented, supported by comparisons with experimental thin sections or with published results. Then, when possible, the micromorphological results are compared with other archaeological and archeozoological data.

THE GARDON CAVE

The Gardon cave was excavated between 1985 and 2000. It opens at an altitude of 360 m a.s.l., at the bottom of a cliff closing a small valley. A vast entrance, with a surface of 200 m^2, is followed by a wide gallery, slowly descending over 50 m to a water level. Generally, the exsurgence of underground waters is located lower in the valley, but during very rainy periods waters are exceptionally evacuated through the gallery. Stratigraphic and sedimentological study of the sedimentary fill has shown that the site was flooded several times during prehistoric periods (Fig. 4; Sordoillet, 1999a; Sordoillet & Voruz, 2002). Main flooding periods have been correlated with high lake-level phases in the Jura Mountains, related to climatic cooling events (Magny, 1999, 2004). On the contrary, drier periods allowed human settlements, causing important accumulations of anthropic sediments.
Following the flooding and occupation, two main types of deposits have been formed in the cavity: yellowish alluvial sandy silts and greyish brown silts. In the descending gallery the deposits are 3 to 4 meters thick, mainly from the Neolithic periods. At the entrance of the cave, deposits 1 to 2 meters thick formed during the Bronze Age or more recently. Excavation and strati-

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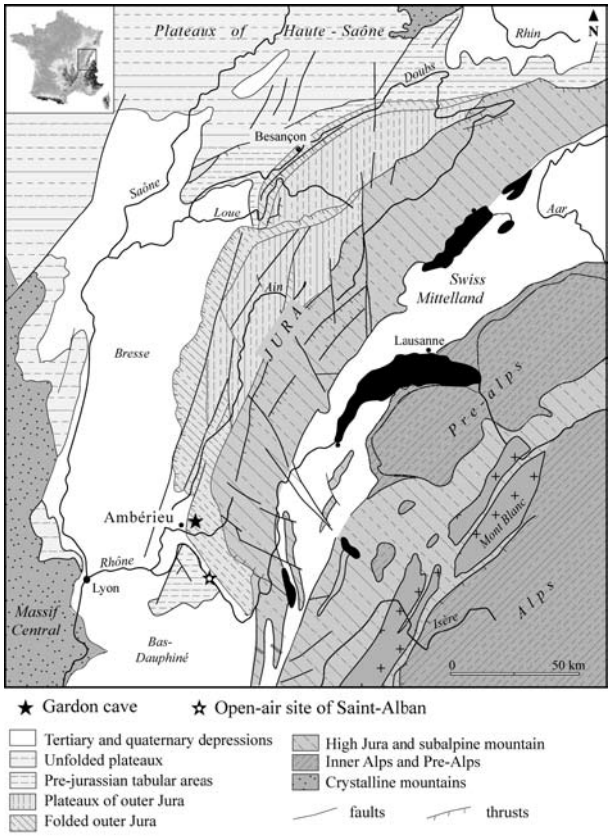

Fig. 1 - Geographic situation of the sites.

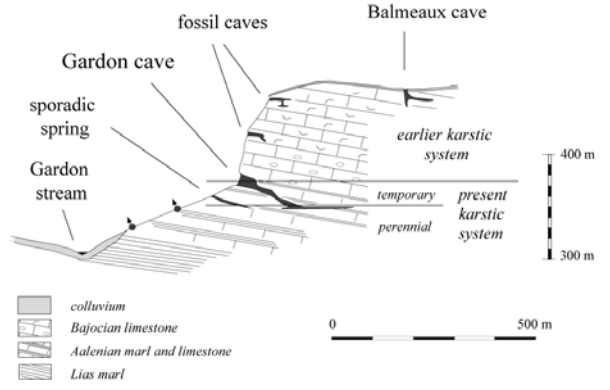

Fig. 2 - Situation of the Gardon cave, at the mouth of a karstic gallery.

graphic study has led to distinguish more than sixty layers, grouped together in 15 main sedimentary formations (Fig. 5). Thirty radiocarbon datations and typologic studies of pottery have led to the establishment of the occupation chronology.

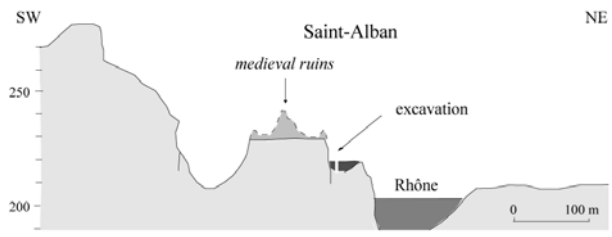

Fig. 3 - Situation of Saint-Alban at the top of a small hill, on the left bank of the Rhône River.

Middle Neolithic deposits

The Middle Neolithic deposits are brown silts, with more or less pebbles, and with a few interstratified ashy layers.

Microscopically, these deposits are characterised by large amounts of plant fragments and calcitic spherulites (Brochier, 1983). Some subrounded aggregates look like sheep-goat coprolites or dung fragments (Courty *et al.*, 1989). Other aggregates, a few centimetres long, and with numerous phytoliths, look like cow coprolite fragments (Pl. 6a). This composition leads us to interpret the middle Neolithic brown silts as dung accumulations. Charcoal and fragments of pottery are embedded in dung and attest to the contemporaneous occupation by humans. Most of the dung accumulations are strongly reworked by past biological activity and are sometimes covered by alluvial deposits, both indicating discontinuous occupation (Pl. 6b). We therefore conclude that the cave, or at least part of the cave, was used several times during the Middle Neolithic for stock penning.

A study of bone remains tends to confirm this interpretation. Faunal analysis reveals the presence of domestic animals, including pig, cattle, sheep and goat, and an occupation during the winter and spring time. The discovery of several shed milk teeth shows that these teeth were probably lost by animals living on the site. The presence of several remains of dead-born or of individuals of very young age (less than a few weeks) attests infant mortality on the site, this could also imply the keeping of livestock (Chiquet *et al.*, 2003).

The analysis of anthropic structures also suggests short stays. Paving, pits, hearths, postholes, indicating domestic areas, were recognised at most of the archaeological layers, except for one (c. 43) identified as a refuse dump (Fig. 6). The dwellings were few and rudimentary, thus indicating temporary human settlements.

Finally, the sedimentological, archaeological and zoological results all lead to the idea of a discontinuous occupation by shepherds. During the Middle Neolithic, the cave was probably used mostly as an occasional cattle pen during the winter and the time of birth. It is also conceivable that the back zone of the cave used to be a stable bordered by a dwelling built under the porch that is now vanished.

Middle Bronze Age deposits

The Middle Bronze Age deposits are mostly composed of thick layers of powdery grey silts, with white intercalated ash lenses.

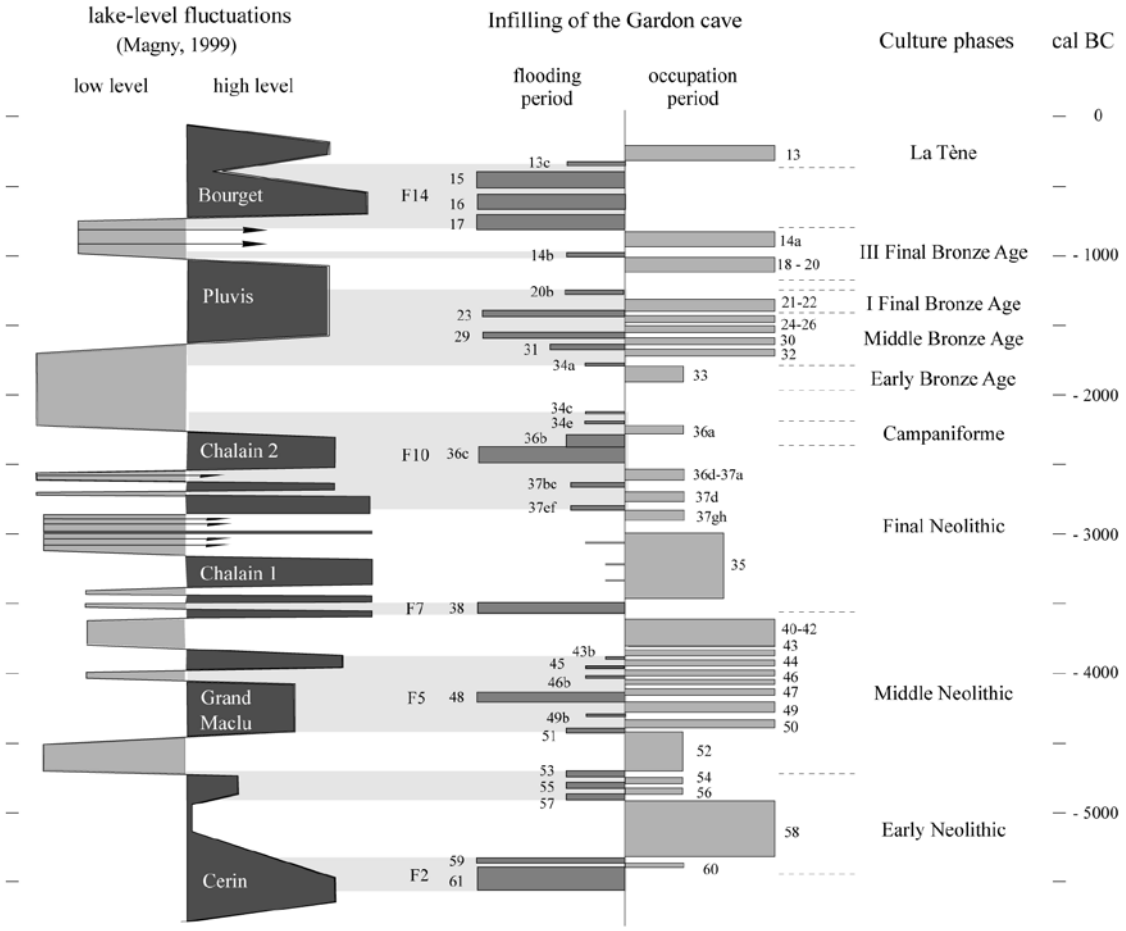

Fig. 4 - Comparison of occupation and flooding periods of the cave with lake-level fluctuations in the Jura. The main alluvial layers were formed during periods of human abandonment, which coincided with a wetter climate (as indicated by lake transgressions). Periods of human abandonment without alluvial deposition, around 4700-4500 cal BC (layer 52) or around 3800-3600 cal BC (layers 42-40), coincided with drier climatic phases (marked by lake regressions).

Microscopically, these deposits are characterised by numerous fine particles of charcoal and ash, and by sub horizontal orientation of the elongated components, thus suggesting a progressive and continuous anthropic sedimentation (Pl. 6c). The deposits also contain compact clayey aggregates, including phytoliths, which are interpreted as man made material used for construction (Pl. 6d). Some calcitic spherulites and coprolites still indicate stock farming activities. Finally, the thickness, the composition and the microstructure of the deposits lead to the conclusion that the Middle Bronze Age layers were probably formed during a long occupation by farmers (Sordoillet, 1999b).
Archaeological results also tend towards this conclusion. Many anthropic structures have been discovered, such as hearths, pits and post holes. Fragments of pottery, agricultural tools and seeds are also much more numerous than in the Neolithic deposits.
Finally, the archeological and sedimentological data both lead to the conclusion that during the Middle Bronze Age the cave was used as a true human settlement.

SAINT-ALBAN SETTLEMENT

The site of Saint-Alban is located at the top of a small hill, along the Rhône valley.
In 1988, an excavation of 2 m^2 led to the discovery of more than 3 meters of stratified archaeological deposits. A study of archaeological remains suggests a long occupation of the site, from the Final Bronze Age until the Middle Ages. At the top, the Roman and Middle Age layers have been strongly reworked by biological activity, but the deeper layers, from the Final Bronze Age until the Early Iron Age, are well preserved.
The litho-stratigraphic study led to distinguish four main sedimentary formations, nearly identical to the

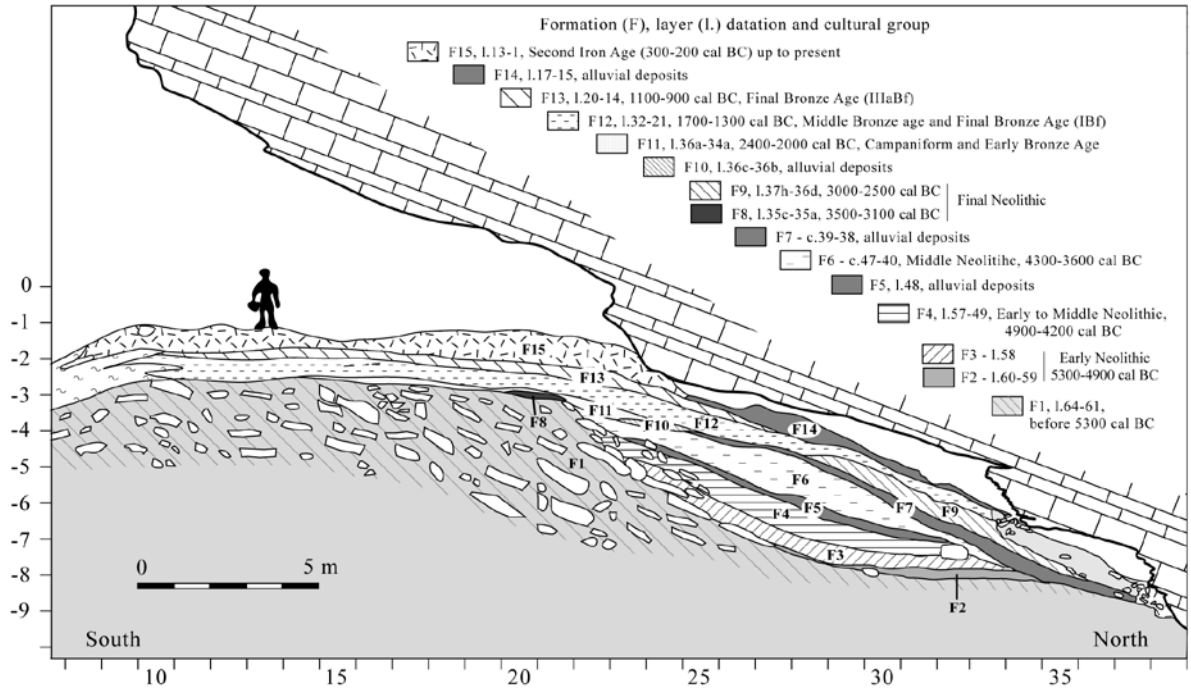

Fig. 5 - Synthetic stratigraphic section in the fill of the Gardon cave. The lowest part of the fill is formed of large roof-fall blocks and karstic alluvium. Above this, silt deposits contain remains from the Neolithic until the Middle ages. Sand layers are interstratified with these archaeological deposits, giving evidence of inundations from the underground waters.

groups defined by the typological study of pottery (Fig. 7). At the bottom, the first formation includes IIIa Final Bronze Age remains, dated approximately 950 cal BC. The second formation shows a transition between IIIa and IIIb Final Bronze Age, between 950 and 900 cal BC. The third formation includes typical IIIb pottery, aged from 900 to 800 cal BC. The last formation, number 4, corresponds to the beginning of the Early Iron Age, between 800 and 750 cal BC.

The bottom of each main sedimentary group is characterised by several yellowish, reddish or greyish thin layers. These layers are thought to be construction and occupation levels. On the contrary, the upper parts of the main sedimentary groups are formed by aggregated yellowish brown thick deposits, interpreted as destruction deposits. This way, the four sedimentary groups have been associated to four main occupation periods. During these four periods, nearly 12 construction phases have been identified, according to the number of thin layers preserved at the bottom of each sedimentary group.

Microscopically, the occupation levels are characterised by the superposition of constructed floors and occupation deposits. The constructed floors are clayey to sandy layers, with a porphyric distribution of coarse grains (Pl. 6e). The occupation layers are characterised by an accumulation of stratified plant fragments (Pl. 6f). The abandonment deposits show loosely packed aggregates and are strongly reworked by earthworm activity.

At the bottom, the IIIa Final Bronze Age deposits are more clayey and grey than those of the other periods, and led to different interpretations, according to archaeological or micromorphological data. According to the archaeological study, three occupation floors, well characterised by in situ broken pottery and by ashy and charcoal lenses, are covered by destruction deposits. Under the microscope, one of these destruction deposits (Fig. 7, east section, layer 27) looks to be mostly formed by fine and densely compacted particles of ash and charcoal (Pl. 6g). Inside the micritic mass, prismatic calcite crystals are typical of wood ash (Brochier, 1983; Wattez & Courty, 1987). Decayed brownish plant fragments and a few detritic mineral particles are also present. Phytoliths are more frequent in the upper part of the deposit. There, the phytoliths are still connected inside several thin horizontal lenses, of half a millimeter thick and a few millimetres long (Pl. 7h). At first, these lenses of articulated phytoliths were thought to be possible remains of matting (Gé *et al*., 1993; Matthews & Postgate, 1994). Burnt cattle dung was another possible interpretation (Courty *et al*., 1994; Brochier & Claustre, 2000). A third hypothesis proposed that these phytoliths, mainly dendritic, could indicate stocking of agricultural products (Brochier, 2002). In both cases, the entire deposit was thought to be a thick occupation layer rather than a destruction layer. According to the archaeological data, another interpretation has been preferred: the lenses of phytoliths most probably result from the breaking down of human installations, such as fencing

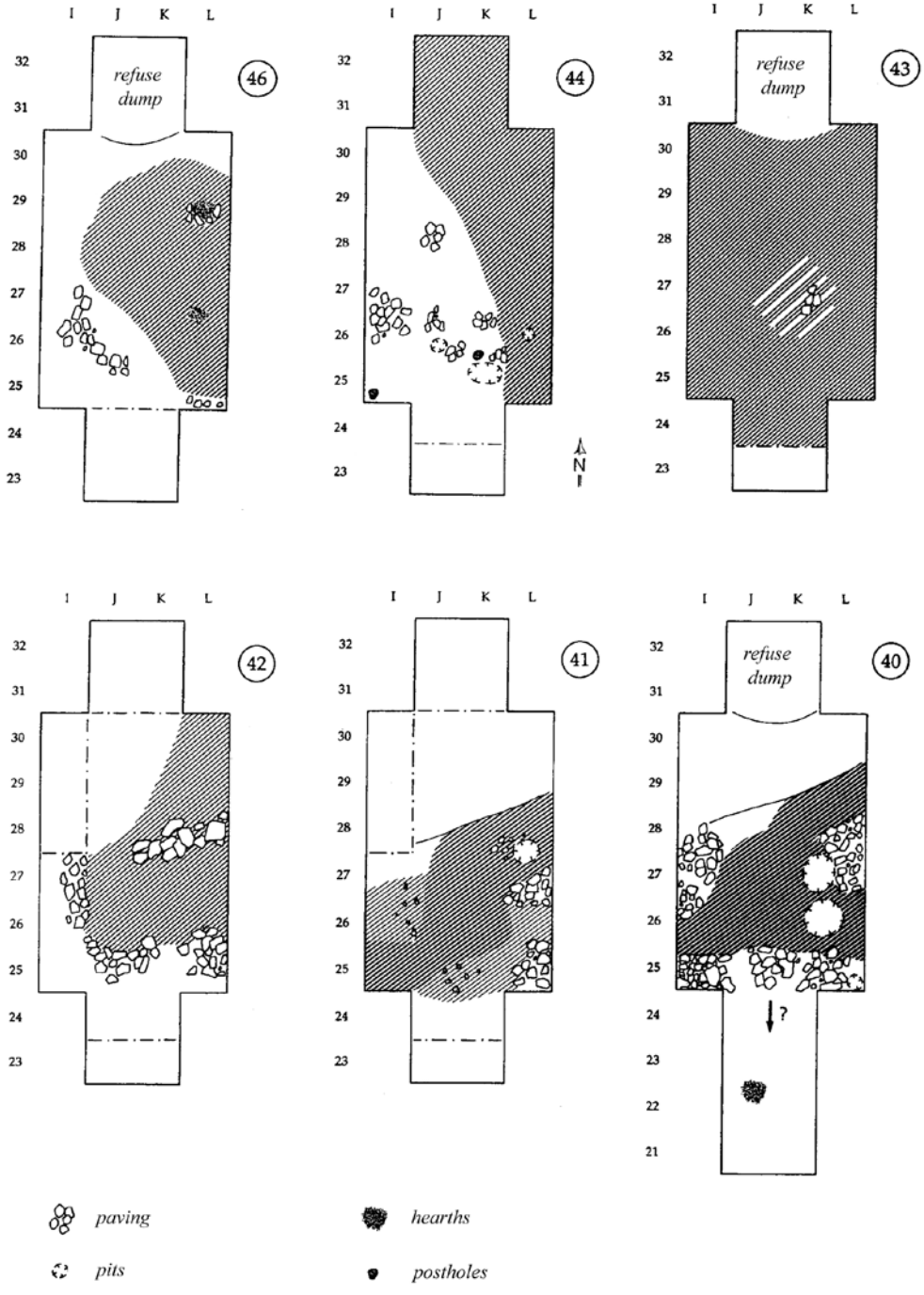

Fig. 6 - Interpretative figures of the spatial analysis of the Gardon Middle Neolithic (layers 46 to 40). Hatching symbolises the accumulation of remains, darker hatching indicates increased density, and dots represent layer limits.

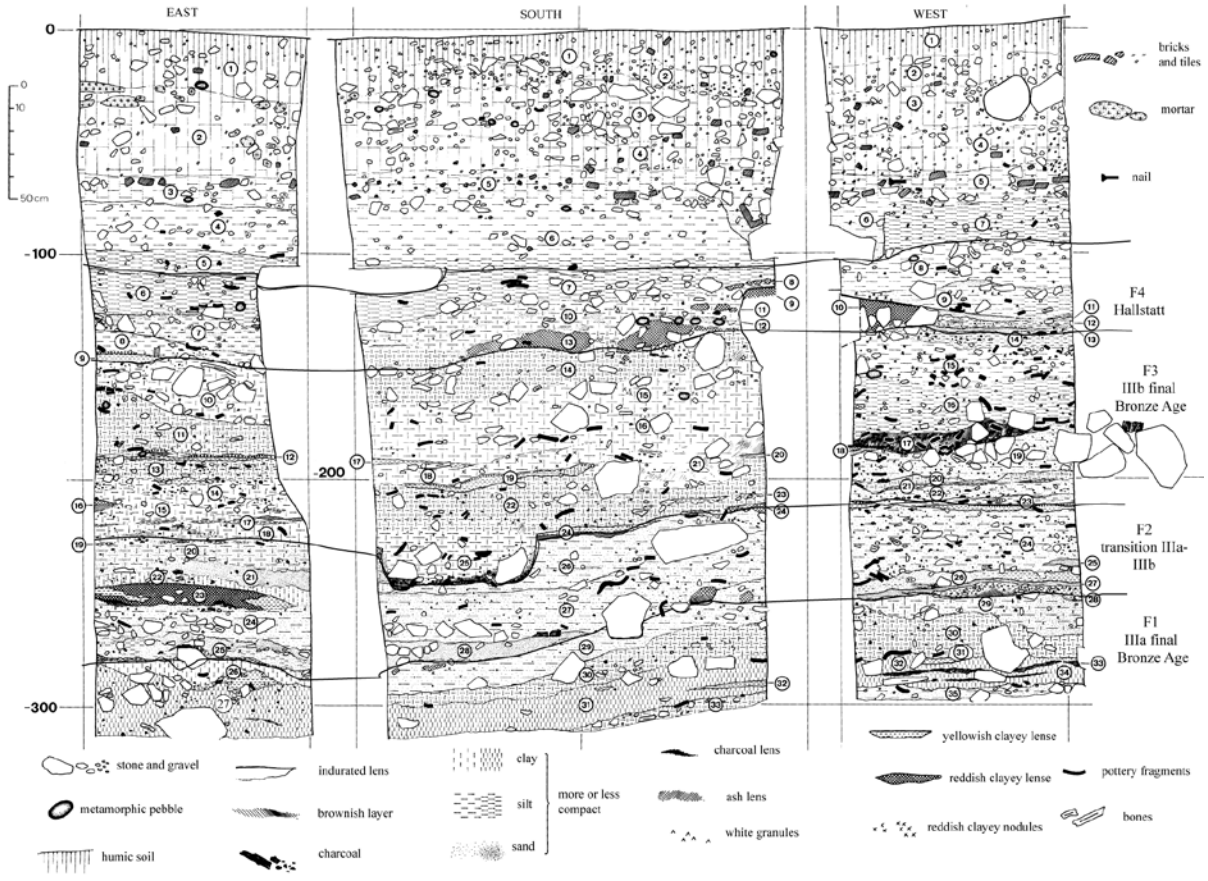

Fig. 7 - Stratigraphy of Saint-Alban site. The lithological characteristics of the deposits allowed us to distinguish five main sedimentary formations. The formations F1 to F4 are dated by ceramic typology from the end of the Final Bronze age until the beginning of the Iron Age.

or thatched roofing. Finally, by integrating archaeological and micromorphological data, it has been concluded that these IIIa Final Bronze age deposits probably indicate wood and straw constructions.

Conclusions

The micromorphological study of the sites of Gardon and Saint-Alban allowed us to identify different sedimentary facies, correlated with natural events or human activities. The identification of facies related to stock farming, human occupation or to the destruction of dwellings, is useful to the general archaeological interpretation. Still, the interpretation of archeological sediments remains difficult because a variety of human activities can produce similar deposits. In that case, the interaction of the various fields of study is necessary to achieve the most plausible interpretation. Archaeological, archaeozoological and sedimentological data have been selected and used here, but the understanding of archaeological sites can be improved through a great number of other studies (Matthews, 2001; Macphail *et al*., 2004).

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