



Human imprint on archaeological anthroposols: first assessment of combined micromorphological, pedological and lipid biomarkers analyses of organic matter

Cécilia Cammas (1), Thanh Thuy Nguyen Tu (2), Marion Plessis (3), Raphaël Clotuche (4), and Sylvie Derenne (5)

(1) Inrap - UMR 5140 - DMOS AgroParisTech, 78850 Thiverval-Grignon, France (cecilia.cammas@inrap.fr), (2) BioEMCo – UMR 7618, Université Pierre & Marie Curie, CC120, 4 place Jussieu, 75 252 Paris cedex 05, France (Thanh-Thuy.Nguyen-Tu@snv.jussieu.fr), (3) BioEMCo – UMR 7618, Université Pierre & Marie Curie, CC120, 4 place Jussieu, 75 252 Paris cedex 05, France, (4) Inrap, UMR 7041 ArScAn, Paris X Nanterre, France, (5) BioEMCo – UMR 7618, Université Pierre & Marie Curie, CC120, 4 place Jussieu, 75 252 Paris cedex 05, France

Archaeological anthroposol matrix contains significant amounts of fine organic matter (OM), which can give archaeological information. Geoarchaeological studies of OM aim to reveal its origin in order to reconstruct past human activities. Such studies are complex because the nature and the abundance of OM is the result of human activities together with natural processes. Also, OM evolves over time, a process that is not well understood. Combination of complementary approaches may give further insights into human imprint on archaeological anthroposols. For example, micromorphology gives data on in situ activities and pedological processes with the result that components of animal and vegetal origin can be identified but not some amorphous / fibrous material and very fine residues ($< \sim 10 \mu\text{m}$). On the other hand, pedological and geochemical analyses of bulk samples are often disconnected from contextual studies. Our work aims to (i) identify morphological and geochemical markers of human activity at different scales, (ii) compare results of different analytical methods to better understand the relation between matrix components and features, chemical properties, and geochemical markers, and (iii) infer relations between pedo-sedimentary history and OM preservation. Two tanning pits in urban craft areas were selected for sampling, as they are likely to contain large amounts of organic matter of vegetal and animal origin. The pit of Saint-Denis (SDN, 10 km at the north of Paris, calcareous alluvium, 13th cAD) was a reference tanning pit. The pit of Famars (FAM, near the Belgian border, luvisols, Roman period) was hypothesized to be a part of the tanning process. To assess preservation of organic components and molecules in relation with pedo-sedimentary context and their potential as biomarkers of human activities, methodology combined micromorphology, pedological analysis (C, N, LOI, P total, organic and inorganic phosphorus) and lipid analysis by GC/MS, lipids having a high preservation potential and containing biomarkers indicative of OM origin. Micromorphological study showed a high amount and diversity of organic components in the two pits. At the SDN pit, the interpretation of tanning (liming) was supported by the presence of scarce fragments of lime with calcitic hairs pseudomorphoses. Plant remains and bone fragments were identified, but red fibrous and yellow amorphous material were not. At the FAM pit, bones and coprolithic material were scarce, but there were abundant vegetal remains such as decaying and burnt fragments, as well as siliceous skeletons. Initial results of organic chemistry show that lipids were preserved (0,13 % for SDN, 0,09 % for FAM), and that lipids of vegetal origin were dominant in the two samples. At SDN, both plant and faecal material biomarkers were identified in the form of various sterols and coprostanol, respectively. Lipids extracted from FAM included ubiquitous compounds as well as plant biomarkers, but no faecal markers. The structure of several compounds is still to be elucidated. However, initial results may suggest that vegetal imprint in thin section and in lipid analysis can be correlated. For animal remains, the two methods seem to lead to different but complementary conclusions; the difference noted for inferred source material will be investigated in term of cultural and contextual origin.