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The geoarchaeology of urban wastes: from refuses to activities and towns organisation (France, 6th c. BC - 10th c. aD)

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In an urban context, geoarchaeological study of man-environment interaction is often neglected, although recent studies of urbic anthrosols and human induced processes show that it can provide a great amount of data. The sedimentary matrix of the archaeological layers, especially its organic and heavy metal contents (phosphore, organic carbon, lead...) and the pedo-sedimentary processes (such as bioturbation, percolation, decay of organic matter...), are evidence of ancient lifestyle and waste disposal habits. This data are even more useful when archaeological evidence is rare or inefficient, such as in the early medieval Dark Earth.
This paper is based on several geoarchaeological studies undertaken since the 1990 in French towns ranging from the Iron Age to the early Middle Ages (Paris, Beauvais, Bayeux, Noyon, Macon, Metz, Lattara...), mainly from rescue excavations. Multi-scale, 3D and fine scale analyses of archaeological stratigraphy are combined with micromorphological studies of undisturbed samples and grain size as well as geochemical analysis of bulk samples ($CaCO_3$, C/N, Fe, Pb, Zn, Cu...).
Spatial sampling reveals complex pattern of activities in finely stratified and well defined architectural context like Lattara (Iron Age). Organic refuses were found mainly in specific urban spaces like courtyards or squares and animal housing areas could be delineate. In more undifferentiated stratigraphy (early medieval Dark Earth), bioturbation is one of the main formation process and seems to have obliterated others. Thus, we analysed the 3D pattern of macro-artefacts on field, combined with micromorphology, geochemical and semi quantitative counting of micro-artefacts on thin sections. It allowed us to characterise Dark Earth by the type of activity refuses, in relation with the pedo-sedimentary context and the uses of the areas. It also allowed us to assess the characters induced by in situ activities and those due to the local background. Moreover, in Metz, early medieval Dark Earth reveals a very high amount of lead (more than 1800 mg/kg), which could be related to air pollution due to local metal craft.
The results taken from different geographical and chronological contexts show that urban sediments and soils are profoundly impacted by activities refuses and use of space. What is usually considered as "natural" processes (such as bioturbation) can be induced by human activities (organic matter inputs, anthropic pressure). In each case, the sedimentary records and their transformations have been linked with urban activities. Areas were characterised as inside (with roof) or outside (courtyard) spaces, with or without specific activities like animal housing, and the recurrence of multi-functionality. The different contexts studied allowed us to compare periods where sewage infrastructures were available or not. It showed that urban waste-disposal at the scale of the city takes a huge part in the morphology of the stratigraphy, by its content on organic matter and heavy metal pollution, which are still preserved in actual towns.