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Micromorphological Aspects of Forensic Geopedology: can vivianite be a marker of human remains permanence in soil?

Stephania Irmgard Elena Ern (1,3), Luca Trombino (1,2), and Cristina Cattaneo (3)

(1) University of Milano, Earth Sciences Department, Milano, Italy (stephania.ern@unimi.it), (2) National Council of Research, Dynamic of Environmental Processes Institute, Milano, Italy, (3) University of Milano, Legal Medicine Institute, Milano, Italy

The number of death cases of forensic interest grows up every year. When decomposed or skeletal remains come out from the soil, the bones become of anthropological competence and the scene of crime become of soil specialists competence.
The present study concerns real cases of buried/hidden remains in clandestine graves which have been studied in order to prove the permanence in soil even if the soil particles have been washed away or the body is no more buried.
One hypothesis has been taken in account, related to the evidences of vivianite crystallization on the bones. The vivianite is an iron hydrate phosphate (Fe3(PO4)2·8(H2O)) that usually forms in anoxic, reducing and rich in organic matter conditions. In these conditions the iron in the soil is in reduced form (Fe2+) and associates with the phosphorous, present in the environment, as attested in archaeological contexts. Going back to the cases of buried/hidden remains, it is possible to state that the soil can be source of iron, while the bones can supply phosphorous and the decomposition process induces the anoxic/reducing conditions in the burial area. In this light, the presence of vivianite crystallizations on the bones could be a method to discriminate burial (i.e. permanence in soil) even if the remains are found in a different context than a clandestine grave.
Analyses have been performed using petrographic microscope and scanning electron microscope microanalysis (SEM-EDS) on bones, and point out the presence of vivianite crystallizations on the bones. This evidence, thanks to the significance of vivianite in the archaeological context, can be regarded as a marker of the permanence of the human remains into the soil, like a ‘buried evidence’ testimonial; on the contrary the absence of vivianite is not indicative of a ‘non buried status’. Further studies and new experiments are in progress in order to clarify the pathways of vivianite crystallization on different skeletal districts, in different time of burial and in different kind of soils.