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Micromorphological aspects of forensic geopedology: time-dependent markers of decomposition and permanence in soil in experimental burials

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The importance of the role played by soil scientists grows up in the modern forensic sciences, in particular when buried human remains strongly decomposed or skeletonized are found in different environment situations.
An interdisciplinary team, formed by earth and legal medicine researchers from the University of Milan is working on several sets of experimental burial of pigs in different soil types and for different times of burial, in order to get new evidences on environmental responses to the burial, focusing specifically on geopedological and micropedological aspects.

The present work is aimed at the micromorphological (petrographic microscope) and ultramicroscopic (SEM) cross characterization of bone tissue in buried remains, in order to describe bone alteration pathways due both to decomposition and to permanence in soil.

These methods allow identifying in the tissues of analysed bones:
- Unusual concentrations of metal oxides (i.e. Fe, Mn), in the form of violet-blue colorations (in XPL), which seem to be related to chemical conditions in the burial area; their presence could be a method to discriminate permanence in soil rather than a different environment of decomposition.
- Magnesium phosphate (i.e. Mg3(PO4)2) crystallizations, usually noticed in bones buried from 7 to 103 weeks; their presence seems to be related to the decomposition both of the bones themselves and of soft tissues.
- The presence of significant sulphur levels (i.e. SO_3) in bones buried for over 7 weeks, which seem to be related to the transport and fixation of soft tissues decomposition fluids.

These results point out that micromorphological techniques coupled with spatially resolved chemical analyses allow identifying both indicators of the permanence of the remains into the soil (i.e. metal oxides concentrations) and time-dependent markers of decomposition (i.e. significant sulphur levels and magnesium phosphate) in order to determine PMI (post-mortem-interval) and TSB (time-since-burial).

Further studies and new experiments are in progress in order to better clarify the bone alteration pathways on different skeletal districts and in different kind of soils.