Geophysical Research Abstracts
Vol. 16, EGU2014-614, 2014
EGU General Assembly 2014

Frost features in soil thin sections as a tool for Holocene reconstruction: a study case from the Northern Apennines

Guido Stefano Mariani, Chiara Compostella, and Luca Trombino

Dipartimento di Scienze della Terra "A. Desio", Università degli Studi di Milano Via Mangiagalli 34, I-20133 Milano, Italy (guido.mariani@unimi.it)

The study of Holocene paleosols can be difficult in many cases, since soil features are usually much less expressed than in older paleosols and the ability to detect single genetic phases is much impaired. Frost action, a key diagnostic feature in past climate reconstructions, is not exempt to this rule, and can sometimes remain undetected at the macroscopic scale. In such cases micromorphology can be one of great use, since it raises the resolution of our observations allowing us to identify some of the less visible features.
The northern slope of Mt. Cusna (2121 m a.s.l.) in the Northern Apennines is characterized by the presence of a paleosurface formed since the end of the last glacial period. Four soil profiles related to a morphologically flat area inside the paleosurface (at around 1760 m a.s.l.) were described and sampled for bulk and micromorphological analyses.
Field descriptions and bulk analyses indicated the presence of two main soil units. The upper unit showed the structure of a colluvial deposit interested by a weak pedogenesis. The lower unit was composed by a truncated paleosol with strong evidence of clay illuviation. At the top of the lower unit, a blackish organic horizon poor in coarse particles and without apparent structure was found. At the microscopic level the microstructure of this blackish horizon, composed by fine (40-80 μm) rounded granules, was interested by a pattern of parallel-perpendicular planar voids, which can be interpreted as the result of frost action. Moreover, in one profile they were expressed enough to form a secondary angular blocky structure, and in another profile a series of vertical fissures a few millimeters wide was also found at the top of the blackish horizon. These features weren't identified in any of the other horizons of the four described profiles.
The micromorphological characteristics of these buried organic levels, coupled with the paleoenvironmental context of the profiles, allowed to interpret these horizons as the results of an independent pedogenetic phase. In fact, in mountain environments accumulation of organic matter at the soil surface without significant development is a likely sign of a period of climatic recrudescence. The presence of frost features clearly confirms this hypothesis. The absence of frost features both in the deeper paleosol unit and in the colluvium above suggests two things: first, that this period can be viewed as a climatic recrudescence of the previous one, during which a temperate forest paleosol was formed. Second, that temperatures were probably also colder than present, which implies a successive warming. Radiocarbon dating from one of the profiles puts the formation of the blackish horizon, and thus the period of climatic recrudescence, somewhere between the boundary Middle-Late Holocene and the Little Ice Age. This is consistent with the Holocene climatic fluctuations attested for Northern Italy, which describe the Late Holocene as an unstable phase of colder periods.