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Petroplinthite formation in a Quaternary complex paleosol along NW Italian coast: from micromorphology to landscape evolution.

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According to the World Reference Base for Soil Classification a petroplinthic horizon is a continuous, fractured or broken layer of indurated material, cemented mainly by Fe (and in some cases also by Mn) and in which organic matter is either absent or present only in traces. Petroplinthic horizons are closely associated with plinthic horizons, from which they develop when exposed to repeated wetting and drying cycles. At the present time, (petro)plinthite is commonly found in soils forming in subhumid tropical climates with distinct wet and dry seasons and it pertains to the material called “laterite”.
The aim of this work is to document the evolution of costal complex paleosol developed in NW Italy during the Quaternary, and to discuss the genesis of its petroplinthic horizon, within the context of the environmental changes recorded in this sector of Mediterranean coast from the Late Pliocene to Holocene. These events affected the soil at different levels and most of the transformation has been recorded at the microscopic scale; consequently, soil micromorphology is the most efficient tool for studying this paleosol.
The paleosol was described at the inner margin of the marine terrace of Natta near Celle Ligure (SV, Northern Italy), 75 m above sea level. On the terrace surface is possible to observe both marine and continental deposits that cover the Oligocene poligenic conglomerate bedrock. The Natta pedosedimentary sequence, more than 4 m thick, can be regarded as polycyclic pedocomplex which contains different paleosols. These paleosols have been truncated, reworked and have been supplied with an imput of sediments during their development. The strong development of the pedosedimentary sequence is mainly due to superimposed pedogenetic phases (e.g. overlapping of illuvial horizons) in an accretional landscape. In particular the petroplinthitic horizon represents the response to seasonal fluctuation of the water table, and doesen’t show any genetic link with the weathered bedrock.
Micromorphological and mineralogical results demonstrated that the plinthitisation/ferrugunization has been derived from iron enrichment and accumulation from an external upslope source, due mainly by post-depositional precipitation of neo-formed Fe and Al rich minerals (mainly hisingerite) and Fe-rich clay minerals (saponite, nontronite, smectite). These mineral associations seem to be originated from the dissolution of pre-existing hematite in detrital Pliocenic lateritic soils (duricrust) fragments, which developed in higher landscape positions.
The complex interactions between rapid uplift and climate change controlled processes, should not have been favourable to laterization: for this reason, it would be more correct to identify the petroplinthic horizon as ferricrete more than a lateritic body.