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Soils in Pleistocene large-scale sorted striped and blockstreams and their paleoclimatic implications

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Because of extensive Pleistocene glaciations, which erased most of the previously existing soils, slope steepness and climate conditions favoring soil erosion, most soils observed on the Alps (and in other mid-latitude mountain ranges) have developed during the Holocene. However, in few sites, particularly in the outermost sections of the Alpine range, Pleistocene glaciers covered only small and scattered surfaces, and ancient soils could be preserved for long periods of time on stable surfaces. In many cases, these soils retain good memories of Quaternary periglacial activity.
We described and sampled soils developed in large-scale sorted stripes and blockstreams of some locations in the Western Italian Alps (Piemonte Region, Italy). The elevation of the sampling sites ranged between 600 and 1600 m a.s.l., under present-day lower montane Ostrya carpinifolia, montane Fagus sylvatica forests or montane heath/grazed grassland, on metamorphic lithological units such as quartzite, serpentinite and gneiss.
Within the sampling areas, the relict blockfields/blockstreams and sorted stripes were strongly developed and well preserved. The soils preserved in such relict Quaternary periglacial landforms normally showed stratification of different layers (units), separated by structural discontinuities, evidencing different depositional settings and different pedogenic development degree. Soil wedge casts, involutions, strong cryogenic granulometric sorting and deep organic-matter rich layers characterized all the observed soils. Compact and dense layers with strong platy/lenticular structural aggregation, sometimes associated with redoximorphic Fe oxide cementation (plinthic or placic horizons), was often observed along structural discontinuities.
Thus, geomorphology and soil properties evidence the widespread presence of permafrost during cold Pleistocene phases, with different active layer thicknesses in different climatic phases.