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Definition and genesis of a reference Geosol for the Main Ethiopian Rift (MER)

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The Main Ethiopian Rift (MER) and specially its central section, the Ziway – Shala lakes basin, is a well-known reference area for palaeoclimatical studies (Street, 1979; Gillespie et al, 1983, Dagnachew Legesse et al, 2002, Chalié and Gasse, 2002).

With the objective of maximizing the geomorphologic and palaeopedological potential of available palaeoclimatical information, a series of investigations were carried out since the nineties (Benvenuti et al, 2002), with the aim of defining the stratigraphy and chronology of Late Quaternary slope sediments and reconstructing landscape evolution in its interaction with climatic oscillations.

During these investigations, the wide diffusion and significance of an easily identifiable soil (the T'ora soil, Carnicelli et al, 2002) was noted. Its distribution with respect to geological units and geomorphic surfaces pointed to a probable early Holocene age.

Pedological and micromorphological studies allowed identification of such soil as a pedocomplex (Morrison, 1977). The soils represented in the pedocomplex are either two or three, as a result of successive tephra deposition events, and are defined as T'ora I, II and III. This layering contributes greatly to the peculiar and easily identifiable soil morphology.

Micromorphological investigations were extensively used to clarify the attribution of each main horizon to one of the three soil components. Soil-forming processes across the pedocomplex lie between the Phaeozem, Vertisol and Luvisol "end members"; actual position of each horizon with respect to the end members tends varies with

position in the complex and time. Older horizons show better expressed vertic properties, due to the greater amount of smectitic clay produced by weathering and to its better morphological expression. T'ora III only shows Argic development in specially favourable sites, and is normally dominated by Mollic processes. Development of incipient Petroduric (silica-cemented Fragic) horizons is typical of T'ora II, while a Petrocalcic horizon is a common feature of T'ora I.

A suitable buried exposure of this soil was identified and dated by ^{14}C. It includes all three soils in a rather complete sequence, only T'ora I showing evidence of an erosional truncation before burial. Dating of SOM and included charcoal confirmed that the pedocomplex developed between about 10.000 and 4.000 ^{14}C years B.P., also pinpointing the dates of the two tephra events at about 7.000 and about 5.000 ^{14}C years B.P.. The degree of soil development in the buried exposure was compared with that of several well-known relic exposures. The reference pedocomplex, buried about 4000 ^{14}C years B.P., showed little difference with respect to relic ones. The only exception was the Petrocalcic horizon which, in the buried exposure, was not developed beyond the stage of large, hard, individual concretions. This contrasts with relic profiles in the same area, which have a continuous Petrocalcic, while resembling relic profiles in areas of higher present rainfall. This supports the hypothesis of a strong slow down of soil-forming processes after about 4.000 ^{14}C years B.P., corresponding to the major drying up of the region, as evidenced by palaeoclimatical studies.

On the basis of such stratigraphic assessments, the soil is proposed as a formal pedostratigraphic unit (Morrison, 1977), as the T'ora Geosol.

In the context of the MER floor, soils can be reliably correlated on the basis of soil morphology and development. This is due to the strong reduction of the variables time, constrained to little more than the Holocene by the geological history, and parent material, given the absolute dominance of acid-chemistry pyroclastic products. Detailed study of the pedogenetical processes in the T'ora Geosol was then basic in establishing its significance as a stratigraphic unit and the criteria for stratigraphic correlation.

The T'ora Geosol is quite useful in correlating stratigraphic units and landforms. It represents a unique timeline, spread across various geological and morphological units, and then it allows to bridge the gap between morphostratigraphy and unconformal-boundaries stratigraphy.

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