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Micromorphology of Soils on volcanic Efflata in Europe. A Synthesis

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The present contribution is based on micromorphological studies made by the author, partly in the frame of the COST-622 action, and on a detailed analysis of literature. Micromorphological characteristics are compared with those of soils on volcanic materials in other continents.

In literature relative few attention has been given to the micromorphology of volcanic ash soils in Europe, and especially the “young” soils have been neglected. In most parts of continental Europe (e.g. in Germany) a strong contamination by aeolian deposits (loess) masks the real andic features.

The fabric of a fresh efflata deposit corresponds to a loose packing of ash and/or lapilli. The first indication of pedogenesis is the appearance of coatings of fine material around the coarser fragments. This feature is sometimes preserved during later stages, as shown by differences in colour and limpidity when compared to the rest of the micromass. In a more advanced stage of soil formation, when more clay is liberated, an enaulic c/f related distribution pattern appears, that gradually gives rise to a granular microstructure. When biological activity is very restricted, microstratigraphy can be preserved during these stages (e.g. in very cold climates). With increasing pedogenesis (formation of a Bw) a blocky microstructure is formed, preserving however an intrapedal granular one.

During all these stages of development the b-fabric remains undifferentiated and normally no pedofeatures are present, except those related to bioturbation. Depending upon special local conditions, however, specific features can be superposed. For instance isoband fabrics appear in cryic soils, and oxidoreduction features in waterlogged conditions.

In older soils (e.g. on some of the Canary Islands or the Azores) alteration and argillification is more progressed. This is directly reflected by the disappearance of most weatherable minerals and the transformation of the volcanic glass to palagonite-like alteromorphs. Indirectly one sees the appearance of clay coatings, either isotropic, similar to the glass alteromorphs, or anisotropic, pointing to a mobility of the clay, and the replacement of the undifferentiated b-fabric by a speckled one, corresponding to the formation of layer phyllosilicate clays. Under stronger leaching conditions gibbsite coatings and alteromorphs appear. In more dry conditions, such as on Fuertaventura (Canary Islands), accumulations of calcite or gypsum take place, even leading to the formation of Calcic and Gypsic horizons, totally masking the andic morphological characteristics of the soil.

Repeated volcanic activities and efflata deposits makes that soils in these regions are very often polygenetic. Cambic horizons sometimes represent layers of sediments (colluvium) derived from older, more developed soils, rather than *in situ* developed pedogenic horizons. Palaeosols and buried palaeosols are common. They often have micromorphological characteristics comparable to those of present day soils in (sub)tropical regions. In continental Europe the influence of the loess leads to the formation of anisotropic clay coatings in the otherwise andic material.

Micromorphology proved to be a precious tool to disentangle both the genesis of the material (e.g. presence of microstratifications) and the pedogenesis (e.g. *in situ* weathering, microheterogeneity).