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Micromorphological habitus of iron oxides and oxyhydroxides related to different alteration process.

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The mineralogical paragenesis of volcanic paleoalterites or volcanic soils (andosols, brown soils) is frequently dominated by iron oxides and oxihydroxides associated to other major secondary silicates phases (allophanes, clay minerals, zeolites). The parent material is iron rich and strong iron segregation occurs, characterized mostly by neoformation of ferrihydrite, goethite, or haematite, and other oxides as ilmenite, Mn oxides or intimate minerals association such as iddingsite, palagonite, with a large variety of shapes, sizes and trace elements compositions.

Detailed X ray Diffraction analyses give good evidence of such varieties but the Field Emission Gun electronic microscope permit to control their occurrence in situ (on thin section or 3D fragments) within a large range of size, from 0.1 μm to few tens μm or more. This tool brings a new window of observation (in situ nano-metric minerals occurrence) for the micromorphologists and allows improving a better comprehension of the alteration process.

Different parageneses related to various alteration processes, are described and discussed: ferrihydrite-haematite in allophanic soils submitted to temperate or humid climat, goethite-haematite in halloysite rich soils submitted to tropical humid climat, hydrothermalized chloritic relict saprolite in vitric palaeosols, haematite or ilmenite in paleoalterites in interflows submitted to deuteric alteration. The ages of these regoliths located in Europe, Africa or India, vary from few hundred years to few hundred millions years. Microgeochemistry and bulk analyses are compared as well. Fe/Ti and Mn, REE, Mg, Ba, Sr for example, show distributions or fractionations giving evi-

dence of different processes of alteration. Tracing down to the nano-scale, the micro-morphology of these minerals at nano-scale (dissolution, neoformation, pseudomorphism…) permit to describe different types of alteration process and may be a way to find other proxies of paleo-environmental conditions when compare to microgeochemistry.