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Differentiation of halloysite in an extreme hydrolysing context in humid tropical area (Mont Etinde, Cameroon)

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On the oceanic border of the Cameroon volcanic line, the Mont Etindé, 1713 meter high, is a nephelinic volcano submitted to a humid equatorial climate. Partly due to the horst structure of the volcano, contrasted rainfall distribution occurs. Annual average rainfall ranges between 5000 to 9000 mm. Annual average temperature is 22.6 ˚C. Submitted to an extreme hydrolysing context, brown soils, around 1.5 meter thick, are developed on slopes over 60˚. Two types of soils were defined: one on fresh nephelinite, and the other on hydrothermalized nephelinite. Differential alteration of primary material is observed with a vertical anisotropy in the saprolite. Halloysite is the dominant mineral of the paragenese related to the weathering of nephelinite. In both profiles, 10-nm hydrated halloysite characterises the alteromorphs of the saprolite. Then, from the upper part of the saprolite to the summit of the profiles, 10 nm and 7 nm halloysite coexist. Varied micromorphological facies of halloysite indicate the evolution of hydrated halloysites toward the dehydration. SEM micromorphological observations coupled with microprobe analyses showed halloysites resulting from in situ alterations of feldspathoïdes, zeolites or clinopyroxenes. In the profile on hydrothermalised nephelinite, from the upper part of the saprolite, neoformation of gibbsite appears in voids and fissures, resulting from calcite dissolution, associated to zeolites alteration. Then gibbsite occurs up to the organo-mineral horizon. Good drainage, low pH and high temperature conditions favour the neoformation of hematite as well as the leaching of the nephelinite. Nephelinites are volcanic rocks particularly rich in traces elements such as rare earth elements. The mobility of trace elements differs between

halloysite alteromorph after zeolite and halloysite alteromorph after feldspathoïdes. Micromorphological analyses gave also evidence of chemical differentiation in coatings or infillings. Compared to bulk data, such differentiation associated to high leaching conditions, emphases the influence of past hydrothermal activity on the recent weathering process. Microstructures of the different horizons as well as mineralogical and geochemical profile confirm the autochthony of such thin soils developed on 650 ka nephelinite but in equilibrium with a recent pedo-climate linked to a Holocene stable forest cover.