
Morphology, Texture, and Microstructure of Halloysitic Soil Clays as Related to Weathering and Exchangeable Cation

B. Delvaux¹, D. Tessier², A. J. Herbillon³, G. Burtin³, Anne-Marie Jaunet² and L. Vielvoye⁴

¹ Unité des Sciences du Sol, U.C.L., Place Croix du Sud, 2, bte 10, 1348 Louvain-la-Neuve, Belgium

² INRA, Station de Science du Sol, Route de Saint-Cyr, 78026 Versailles Cedex, France

³ Centre de Pédologie Biologique, UP6831 du CNRS, associée à l'Université de Nancy I, BP 5, 54501 Vandoeuvre-les-Nancy Cedex 1, France

⁴ Section de Physico-chimie Minérale, MRAC, Place Croix du Sud, 1, 1348 Louvain-la-Neuve, Belgium

Abstract: This paper aims at characterizing the morphology, texture, and microstructure of three hydrated kaolin rich clays ($f < 0.2 \mu\text{m}$) from volcanic soils. These clays represent a weathering sequence in which CEC, halloysite content with respect to kaolinite, as well as smectite content in the halloysite-smectite mixed-layer clays decrease with increased weathering. The clay samples were made homoionic (K^+ or Mg^{2+}) and hydrated under a low suction pressure (3.2 kPa). After replacing water by a resin, ultrathin sections were cut and examined by TEM. Particle shape varies with increased weathering, as follows: spheroids \rightarrow tubes \rightarrow platelets. Higher aggregation and dispersion are observed by TEM after Mg^{2+} and K^+ saturation, respectively, at two levels of the clay-water system organization: intraparticle and interparticle. The microstructure variations induced by the nature of the exchangeable cation become less pronounced with decreasing layer charge of the 2:1 layers. They are thus related here to the presence of smectite layers localized in the halloysite habitus, mostly at the particle periphery. These results show that small amounts of smectite largely affect the organization of clays rich in kaolins at a high water content, and that K^+ behaves here as a dispersing ion.

Key Words: Exchangeable cation • Halloysite • Interstratification • Microstructure • Smectite • TEM

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