



Surface charge of the clay fraction in newly formed soil aggregates of different size

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The complexes of clay-polyvalent cations-organic matter are the building blocks of soil microaggregates, which in turn cohere yielding larger units of various size. In natural systems, this process is influenced by various factors such as environmental conditions, cementing agents, soil properties. Being the clay fraction the primary floccule, a study was conducted to characterise the surface charge of water dispersible clays isolated from aggregates of different size, obtained in the laboratory, and to evaluate the effects of the formation conditions. The <2 mm fraction of two alpine soils different in clay contents and in mineralogy (one dominated by serpentine and the other by chlorite), was incubated for two weeks after the addition of water with or without small quantities (5 g kg⁻¹) of humic acids (HA). At the end, three fractions of aggregates were separated by dry sieving (<2 , 2-5 and >5 mm) and the water dispersible clay was analysed for electrophoretic mobility and mineralogical composition. Incubation without the addition of HA did not affect the surface charge values of the clay remaining in the non-aggregated fraction (<2 mm), with respect to the initial samples. Water dispersible clay in the 2-5 and >5 mm aggregates showed instead differences both in surface charge and in mineralogical composition. When serpentine dominated, the clay was more positively charged than that of the non-aggregated fraction, with a shift in PZC from pH 2.5 to 3.2. The other soil sample behave in the opposite way, shifting from pH 3.3 to 2.6. The average size of the clay ranged from 0.6 μ m at pH 6 to 1.2-1.3 μ m at pH 2, with a similar trend in all samples. At pH below PZC the positively charged Si-OH or Al-OH edge sites can interact with the negative basal plates forming edge-to-face aggregates. The addition of HA affected clay surface properties of all samples: the PZC was reached at lower pH than in the water-only system of the same size. The particle dimensions varied from 0.5 to 1.4 μ m, indicating a weak effect of HA on dispersion or aggregation of particles. The

wetting treatment differentiated the water dispersible clay of the aggregates from that of the non-aggregated fraction. In fact, the latter maintained the surface properties of the <2 mm sample before the incubation, while the former presented a different net surface charge, with a different effect on the basis of the mineralogical composition of the soil. Upon the addition of moderate amounts, humic acids cause a specific modification of the clay surface properties, independently of mineralogical composition and aggregate size.