Characterization and Genetic Interpretation of Clays in an Acid Brown Soil (Dystrochrept) Developed in a Granitic Saprolite

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Abstract: X-ray diffraction and chemical analyses were performed on clay fractions separated from an acid brown soil (Dystrochrept) by means of size fractionations using high-gradient magnetic separation techniques. Breakdown of large phyllosilicates preexisting in the saprolite involved physical fragmentation and mineralogical transformations strongly related to chemical weathering.

Compared to the C horizon, the proportion of chlorite and vermiculite decreased strongly in the silt and coarse-clay fractions of the Al horizon, but was maintained in the finer clay fraction (< 1 μm). The distribution of mica in the different fractions was quite the opposite. Micas are the major component of the Al, 1 – 2 μm fractions, and their proportion progressively decreased with decreasing fraction size. Thus, it is concluded that during fragmentation and/or simple transformation of the larger phyllosilicates, clusters of chlorite, mica/vermiculite, and vermiculite layers were preferentially affected. A concentration of mica layers took place in the coarse clay fractions as chlorite and vermiculite residues were accumulated in the fine clays.

The process involved the loss of Fe and Mg, leaving, or forming, more aluminous dioctahedral minerals. As the transformation processes occurred, dissolution of preexisting minerals led to the precipitation of amorphous and/or crystalline Fe- and Al-oxides, and possibly of phyllosilicates. The new phyllosilicates appear to be montmorillonitic.

The most abundant end products of the weathering processes in either the Al or the Bw horizons appeared to be quite different. In the Al horizon they were identified mainly a hydroxyl-Al (Fe) intergrade smectite (montmorillonite), whereas in the Bw horizon the major component was an intergrade vermiculite originating, at least in part, from chlorite.

Key Words: Soil clays • Weathering • Soil vermiculite • Soil smectite • Hydroxy-Al intergrades • Chlorite • Dystrochrept

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