

INVESTIGATIONS ON NATURALLY OCCURRING ORGANO-MINERAL COMPLEXES
IN RELATION TO EXTRACTABILITY AND MINERALOGICAL PROPERTIES OF
FIVE SOILS OF SRI LANKA

By

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ABSTRACT

In the soil environment minerals are in constant association with natural organic compounds and micro-organisms. Major products of the interactions of soil minerals with organic components and organisms are organo-mineral complexes. This study was aimed at evaluating quantitatively the extractability of C and N using different extractants, the effects of pretreatments for mineralogical analyses on organo-mineral complexes and the relationship between extractability of C and N with clay mineralogy of soil. For this purpose, five soils (four Ultisols and one Alfisol) were collected from different locations of Sri Lanka, namely, Meepilimana and Sita Eliya, in the Nuwara Eliya district, and Kiribathkumbura, and Peradeniya, in the Kandy district, and Maha Illuppallama in the Anuradhapura district, at two depths viz: 0-15 cm and 15-30cm. The clay fractions of these samples were separated without pretreatments and with pretreatments for mineralogical analysis. Organic substances were extracted from each clay fraction by successive treatments of 0.1M NaOH, to obtain soluble organic fraction. Subsequently they were repeatedly shaken with HF/HCl solution, to dissolve silicate minerals and by 0.1M NaOH to obtain silicate bound C. Organic C and N were determined in these extracts and in the clay residue, which indicate the C and N amounts in highly stabilized organo-mineral complexes. The XRD pattern of the clay

fraction of the samples was recorded after Mg saturation, K saturation, glycerol solvation and heat treatment for the identification and characterization of clay minerals.

Results show that the conventional method (e.g. Walkley and Black acid dichromate method) used for determination of organic C expressed only 45-79% of the total amounts. Experimental data indicate that considerable amounts of organic C and N were made soluble after HF/HCl treatment. The amounts of organic substances which were resistant to extraction differed with organic matter content of soils. Results also show that 53%-57% of organic C in the Ultisols and 24%-31% in the Alfisol were destroyed during pretreatments for clay mineral analyses. Pretreatments destroyed mostly the easily available C and N amounts of the samples. Highly stabilized organo-mineral complexes were not affected by pretreatments. The clay minerals kaolin, gibbsite, mica, illite and vermiculite were found in Ultisols which contained average of 30.6 % organic C in bound form, whereas in an Alfisol (contain average of 47.3 % of bound form C) kaolin, mica, illite and smectite were found. The high amounts of organic C in organo-mineral complexes of the Alfisol can be explained by the presence of smectite clay mineral.