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CLAY MINERALOGY OF GLACIAL DEPOSITS : II. VARIOUS CLAY FRACTIONS AND ORIGIN OF CLAY MINERALS IN SOILS

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ABSTRACT

Detection of small amount of mineral or minerals which may otherwise be obscured by the more abundant or easily detected minerals is possible by the analysis of various size fractions of clay rather than the bulk clay sample. To study this, bulk clay (<2μm) samples from three profiles (Caernarfon, Lleiniog and Penmon) were sub-divided into four size fractions (2-0.63, 0.63-0.2, 0.2-0.063 and <0.063μm). Clay fractions saturated with different cations were mounted on the glass slides, treated by different diagnostic treatments and X- rayed on a Phillips Wide-range goniometer (PW-1050/23) which was equipped with a PW-1011 generator producing Mn filtered Fe-Kα radiation at 50kv and 40mA. The results indicated that hydrous mica, vermiculite and kaolinite were the dominant clay minerals showing decreasing and increasing trends with depth and occurred in the coarse fraction. Smectite, present in minor amounts, occurred in the finer fraction with varying amounts of chlorite which was found in the coarse fraction in smaller amounts. Mineralogies of the soils were inferred to be originated from the underlying parent materials (Carboniferous sandstone) or contributing rocks, i.e. Shale.

INTRODUCTION

Clay fraction (<2μm e.s.d.) is the most reactive fraction of a soil (Wilson and Pittman, 1978; and Welton, 1984), and it is responsible for most of the physico-chemical processes that occur in soils. Investigation of clay minerals in soil may indicate the [redacted] genic processes, like size fractions. It was, therefore, decided to fractionate the bulk clay into four sub-divisions, i.e. 2.0-0.63, 0.63-0.2, 0.2-0.063, and <0.063μm for X-Ray Diffraction Analysis (XRDA). This paper reports mineralogical composition of different clay size fractions from three sites.

MATERIALS AND METHODS

Soil samples, at various depths, from three profiles (Caernarfon, Lleiniog, and Penmon) were collected. The soil-water suspension, in 1 litre cylinder, was dispersed by at least 20 strokes with a plunger and allowed to stand for a specific time before siphoning (20 hrs = 16 cm at 20° C). Separation of different clay fractions was accomplished by centrifugation on a Bechman-14 refrigerated centrifuge machine using stokes equation as proposed by Livesey (1964). The polythene bottles used had the capacity of 250 ml. The temperature of the rotor and hence of the suspension was maintained at 10° C . Distilled water was used as the suspending medium for all the fractionation. The clay suspension, having particles of a particular size was equally divided into two beakers, and saturated one with K ions and the other with Mg ions. Four size fractions of clay, saturated with different cations, were collected by centrifugation, mounted on the glass slides and subjected to different diagnostic treatments. Potassium saturated samples were heated at 350° C and 550° C for 3 hrs, whereas Mg-saturated clays were solvated with ethylene glycol by vapour saturation for 12 to 24 hrs. A Phillips wide-range goniometer (PW 1050/23),