ABSTRACT

This dissertation deals with the identification of the secondary clay minerals in sixteen different Trinidad clays from six localities (Valencia, Wallerfield, Bank of Aripo River, Upper Manzanilla, Chaguanas and the Guatabajaro Area). Two general areas of the subject were investigated. (i) the mineralogy of the clays and (ii) their physical ceramic properties. Regarding mineralogy, two techniques were used for determination. (i) X-ray diffraction analysis and (ii) surface area measurements. The physical ceramic properties investigated include the plastic, drying and firing properties.

An account is given of the various methods used for crystallographic identification, particularly with respect to the clay minerals montmorillonite, illite, kaolinite, vermiculite and chlorite; and some mention is made of the means of identification of the accessory minerals quartz, feldspar, talc and pyrophyllite.

The established methods of sample preparation for X-ray identification as well as modifications of them are described and discussed. The procedure, devised by *Henry et al (1951)* for indexing X-ray powder patterns and the determination of unit cell parameters is discussed, as is also a modification of the method. This modification was successfully applied in an analysis of a sample of the pure clay mineral illite, and subsequently of a sample of an unknown clay, which was determined as being predominantly illite. Particular attention is paid to the problem of indexing, since with clays, it is not uncommon to find a particular set of Miller Indices associated in differing conditions with varying Bragg angles and intensities of diffraction.

With regard to the technique of Counter Diffractometry, attention is focussed on particle size separations, and sample preparation as essential preliminaries to the process of obtaining the X-ray diffraction spectra. The method allows for the immediate recognition of the presence of quartz as well as very fine-grained material which may be present in fractions of particle size less than two microns, and the need for its removal in the preparation of the sample for X-ray analysis is discussed. The success of such separations is assessed and, indeed it might be noted here that as a result of these separations, material was procured which served to provide reference diffractograms for the identification of quartz. These are discussed in Chapters 4, 5 and 6.

Analysis by surface area, which forms the subject of Chapters 7 and 8, is limited in that it effectively tells us only whether or not there is smectite associated with all the other secondary clay minerals. Some typical values for some pure clay minerals reported by *Davis (1968)* are presented and are compared with those obtained from similar pure clay minerals in the investigations described in this dissertation. The method followed was essentially that devised by *Eltantawy and Arnold (1973)*.

The determination of some physical ceramic properties of the clay samples is described, and the results obtained are compared with the findings from the surface area measurements and mineralogical composition.

Wherever appropriate, each chapter ends with a discussion or comment on the investigations described in it and the results obtained. Finally, in an overall perspective, the main experimental findings are reviewed, and in the last Chapter (10) summarised and appraised. This is then followed by suggestions as to future research in extension of the work described in this dissertation.