A B S T R A C T

Drill core samples from three Deep Sea Drilling Project sites in the Indian Ocean have been examined mineralogically and chemically to understand the nature and extent of burial diagenesis in the pelitic sediments of the Indian Ocean. Fiftyone samples ranging in age from Upper Cretaceous to Recent have been analyzed for depth dependent mineralogical variations.

In the Bengal Fan the sediments are essentially of continental origin while in the Somali and Mozambique Basins, sediments are also derived from submarine sources. In the Bengal Fan the clay mineral suite consists of illite, chlorite, kaolinite and montmorillonite while in the Somali and Mozambique Basins the dominant mineral is montmorillonite. The western Indian Ocean appears to be low in chlorite. The clay mineral suite in all the basins remains fairly constant with no marked variations being noticed in the clay mineral abundance with depth. The pressure and temperature conditions are fairly low in the Bengal Fan and in the Mozambique Basin but in the Somali Basin they appear to be appreciable. Illite in all the sites is essentially 1 Md polymorph. The only change noticed in the clay minerals is an increase in the crystallinity of illite, montmorillonite and chlorite with increasing depth. The depletion of magnesium, potassium and sodium in the interstitial waters, the breakdown of K-feldspar and the increase in the potassium content in the clay fraction indicate that these ions are incorporated in clay mineral lattices - Mg in chlorite, K and to a minor extent Na in illite/montmorillonite minerals. However X-ray diffraction patterns reveal that these processes are not pronounced. Kaolinite is present in all the basins and appears to be stable in a marine environment. All variations noticed are independent of geological age and formation boundaries. The green, gray, black and brown clays do not show any characteristic differences in their clay mineralogy.

In the Bengal Fan and in the Mozambique Basin there is an apparent increase in discrete illite content and a corresponding

decrease in montmorillonite content below approximately 300 metres while Matter (1974) records an increase in montmorillonite content and a decrease in illite content for the same depth range in the Arabian Sea. However it is evident that clay mineral diagenesis is indeed initiated at shallow levels as proposed by Matter (1974).

The apparent lack of significant diagenetic transformations could be attributed to low temperature and pressure conditions existing at the bottom of the drill holes as a consequence of relatively shallow burial. The original composition of the sediments may also be responsible for the slowness of diagenetic transformations. Burst (1959, 1969), Weaver (1967), Dunoyer de Segonzac (1969), and Weaver and Beck (1971) believe that for significant diagenetic transformations to occur, depths of burial beyond 3000 to 5000 metres are essential. The probable mineralogical transformations in the Bengal Fan are interpreted to be as follows :

montmorillonite + K-feldspar + (illite) ⟶
montmorillonite/illite mixed layers + chlorite + quartz

In the Somali and Mozambique Basins the transformations may be summarized in the following equation :

illite + montmorillonite + kaolinite ⟶
mixed layer illite/montmorillonite.

Based on the clay mineralogy at the three sites, the sediments may be regarded to be in the early to middle diagenetic stage of Dunoyer de Segonzac (1970) where exchange reactions are the main mechanism of diagenesis there being no appreciable change in the basic lattice of clay minerals.
