X-RAY MINERALOGY AND PALEOECOLOGY OF THE CAROLINE BASIN

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ABSTRACT

Detrital mineral assemblages in the Caroline Basin are controlled primarily by the geology and climate of the source area, and by the strength and direction of the transporting agents therefrom, the possibility of diagenetic transformation of minerals being ignored due to insufficient evidence. Three assemblages are recognizable: the Caroline Islands assemblage of kaolinite, plagioclase, and montmorillonite; the New Guinea assemblage of mica and kaolinite; and the Australian assemblage of quartz, montmorillonite, and kaolinite. The local assemblages of montmorillonite or kaolinite are dominant in the Oligocene to Middle Miocene; however, from the Upper Miocene onwards, mica becomes the dominant clay mineral, and a great influx of quartz is also seen; these changes being attributed to (1) a severe drying of Australia due to the growth and expansion of the Antarctic ice cap; (2) orogeny and glaciation on New Guinea leading to increased weathering of micaceous crystalline and sedimentary rocks; and (3) peneplanation and reduced weathering of the nearby oceanic islands. Based on this, mica and quartz can be characterized as the continental minerals, being most abundant during periods of global cooling and continental glaciation; while kaolinite may be typified as a mineral of local or nearshore origin, whose occurrence on the nearby oceanic islands depends upon warm temperatures and high rainfall conducive to intense tropical weathering and the development of lateritic soils.

The trends for montmorillonite and chlorite are not clear, although the former appears to show a slight correlation with volcanism in the source area.

A widespread eruption of basalt took place in the Oligocene, which may or may not represent the primal "basement" in this area. Following a brief period of erosion, sedimentation commenced in this region in response to the rechanneling of sea-floor erosion to the Southern Ocean with the rifting of Australia from Antarctica, thick sequences of nannofossil ooze being deposited under an equatorial current system similar to that of the present day. A sharp decrease in bottom temperatures in the Middle Miocene was marked by the development of a strong acoustic reflector, through the compaction and partial cementation of underlying carbonate oozes. Normal sedimentation was resumed in the Upper Miocene; however, an increase in eolian deposition from the deserts of Australia is noted during this period. The Lower Pliocene is marked by the erosion or gross attenuation of sequences in the Basin, correlating with a period of marine cooling and a eustatic lowering of sea-level seen in the deposition of shallow marine to terrestrial sediments on the nearby islands. Again a restoration of pelagic marine sequences is noted in the early part of the Upper Pliocene, followed however by an even more drastic period of global cooling, with a dramatic rise in the compensation depth being accompanied by possible local subsidence and an increased input of fine eolian

and pyroclastic material from outlying areas, leading to the deposition of pelagic clays in the low-lying parts of the Basin.