PALEOCEANOGRAPHY OF THE SOUTH-EASTERN INDIAN OCEAN AND PALEOGLACIAL HISTORY OF ANTARCTICA AS REVEALED BY LATE CENOZOIC DEEP-SEA SEDIMENTS

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By

Richard Gerald Blank

Thesis Committee:

Stanley V. Margolis, Chairman
K. E. Chave
R. Buddemeier

ABSTRACT

Examination of sediments and microfossils from three U.S.N.S. Eltanin subantarctic deep-sea cores recovered between 55°S and 60°S and 176°E and 144°E in the Southern Ocean has revealed a detailed paleoglacial and paleoceanographic chronology for the Pliocene. These cores contain sediment sequences overlapping in age from middle Matuyama through the Gilbert "a" event (cores E34-17 and E32-51), and one core (E36-16) extends to the base of the Gilbert (5.1 m.y. B.P.). Quartz grains (>62μ) are found throughout the cores and examination of their surfaces by scanning electron microscopy reveals that the majority of these grains (>55.1%) are of either primary glacial origin or glacial-marine origin (also showing evidence of subaqueous abrasion). The remaining percentage exhibits features similar to grains transported mainly in the subaqueous environment, or to grains from continental weathering profiles, perhaps representing those unaltered during glacial transport. Although glacially derived quartz is present in all cores, its abundance ranges considerably. There is a tremendous increase in glacially derived quartz above the Gilbert "a" event, which is followed by an increasing trend throughout the Gauss to the middle Matuyama epoch. This sudden increase in ice-rafted quartz after the Gilbert "a" event may reflect a major Late Cenozoic increase in antarctic glaciation.

Radiolarian faunas from intervals of Gauss age in cores E34-17 and E32-51 indicate paleotemperatures comparable to modern surface water temperatures at the same latitudes. Warmer water faunas however, are found in sediments of lower Matuyama and upper Gauss age followed by cooler water faunas in the middle Matuyama and upper Gilbert. The warmest interval occurs immediately below the Gilbert "c" event in core E36-16; this interval is significantly warmer than the present-day surface water temperatures at the same latitude and is followed by a marked cooling between the Gilbert "a" and "b" events which precedes the tremendous increase in glacial quartz during the Gilbert "a" event. Although no direct correlation was found between paleoclimatic fluctuations as indicated by Radiolaria and the abundance of ice-rafted quartz, there are indications that antarctic glaciation preceded major cooling of the Southern Ocean and contributed to the long-term worldwide cooling postulated for the Late Cenozoic. The tremendous increase in ice-rafted sediments during the upper Gilbert may be related to an increase in antarctic glaciation perhaps to the point where permanent ice shelves developed, the formation of which may have greatly increased antarctic bottom water activity in the circumpolar region.