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Pliocene-Pleistocene deep-sea benthic foraminifera at DSDP site 238, Central Indian Ocean: faunal response to changing paleoenvironments

AJAI K. RAI[1] and ABHAYANAND S. MAURYA[1]
[1]*Department of Earth and Planetary sciences*

This study quantitatively analyses Pliocene-Pleistocene benthic foraminifera from DSDP site 238 in the central Indian Ocean. A Q-mode factor analysis of 28 highest ranked species defines three significant factor assemblages reflecting different environmental characteristics. The Cibicides wuellerstorfi-Oridorsalis umbonatus assemblage (Factor 1) represents relatively more oxygenated bottom waters with active currents and intermediate to low supply of organic matter. The Uvigerina proboscidea assemblage (Factor 2) indicates a high, continuous flux of organic matters to the sea floor in response to increased surface productivity. The Nuttaleides umbonifera assemblage (Factor 3) is associated with Antarctic Bottom Water (AABW) and reflects cold, low trophic level, more carbonate corrosiveness and high oxygen concentration. In most of the time over past 5 Ma (i.e. 5-4 Ma, 2.8-1.8 Ma and 1.2 Ma to Recent) the distinct occurrences of Cibicides wuellerstorfi-Oridorsalis umbonatus assemblage represent active bottom water currents with more ventilation and relatively low trophic levels at abyssal depths in the central Indian Ocean. The early Late Pliocene (c. 3.6-2.8Ma) and Early Pleistocene (c. 1.8-1.2 Ma) are two significant intervals of prominent faunal change, which indicate entirely different deep-sea conditions during each interval. The prominent occurrence of Nuttaleides umbonifera assemblage during 3.6-2.8 Ma reflects cold, carbonate aggressive and well-oxygenated bottom waters possibly in response to increased flow of AABW towards the central Indian Ocean at abyssal depths. Early Pleistocene (c. 1.8-1.2 Ma) is characterized by distinct occurrence of Uvigerina proboscidea assemblage reflecting higher surface productivity. The widespread, intensified monsoon system during Early Pleistocene causes increased upwelling and higher surface productivity, which also enhances the supply of organic carbon to the ocean floor.