Benthic Foraminiferal Faunal Response to the Middle Miocene Climatic Transition from Greenhouse to Icehouse Conditions

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Abstract

The Monterey Formation, consisting of siliceous and calcareous biogenic sediments, was deposited during the transition from a relatively warm greenhouse climate in the early Miocene to the cooler temperatures of icehouse climatic conditions during the early middle to late Miocene. This cooling event is associated with global paleoclimatic and oceanic changes assumed to be related to the deposition of organic carbon-rich sediments into the marginal basins of California. The distribution of benthic foraminiferal assemblages found in the middle to late Miocene benthic foraminiferal faunas was controlled by both local tectonic, environmental, and depositional events and global variations associated with the climatic transition from greenhouse to icehouse conditions, including changes in water mass stratification, changes in productivity, and eustatic cycles. Both the local and regional environmental parameters changed in both space and time related to the Neogene evolution of the continental margin basins along central and southern California. A comparison of faunal distributions across the continental margin benthic foraminiferal assemblages occurring in the outer and inner margin basins will establish the possible relationship between climatic-controlled oceanic events and faunal responses. The Luisian-Mohnian boundary is readily recognized by a change in a number of easily identified species common in the Luisian and have their highest stratigraphic occurrence immediately below or at the boundary between the Luisian-Mohnian contact. This faunal turnover is related to the climatic and oceanographic changes occurring with the middle Miocene end of the Monterey Excursion and the onset of EAIS glaciation. The benthic foraminiferal assemblages of the early Miocene were associated with a warm, weakly stratified ocean with a homogeneous distribution of the deep benthic faunas. The faunal homogeneity was related to warm (low $\delta^{18}O$ value) bottom water and sluggish circulation at depth (Savin et al. 1981).