

Biotic Response of Ostracodes to the Middle Eocene Climatic Optimum (MECO; 40.0 Ma) in the Southern Indian Ocean (ODP Site 748)

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ABSTRACT

The long-term cooling trend from “greenhouse” to “icehouse” conditions through the middle-to-late Eocene (49.0 – 33.7 Ma) was interrupted by the middle-Eocene Climatic Optimum (MECO; ~40.0 Ma), a transient (~500 kyr) global warming of ~4-6 C° widely recorded in marine and terrestrial stratigraphic sections. The broad biotic response to the MECO is poorly known, with most published studies focused on planktonic protists such as foraminifera, calcareous nannoplankton, and dinoflagellates. To initiate a complementary benthic biotic perspective, we conducted a high-resolution ostracode faunal analysis (>150 µm size-fraction) through the MECO at Ocean Drilling Program Site 748 on the southern margin of the Kerguelen Plateau (~725 m paleodepth) in the southern Indian Ocean. Ostracodes are the only readily preserved deep-ocean metazoans and thereby provide a unique biotic perspective on this geographically vast ecosystem.

The ostracode faunal assemblages were assigned to three stratigraphic intervals (pre-MECO, MECO, and post-MECO) based on the nominal onset and termination of the oxygen-isotope excursion. Ostracode generic richness, Margalef’s d , and Simpson’s Index ($1/\lambda$) were all significantly lower (ANOVA; $p < 0.001$) within the MECO interval, indicating a decrease in ostracode diversity. A Likelihood Ratio Test (LRT) was used to further evaluate the diversity loss via an ecological response versus a sampling artifact. Decline in ostracode diversity is also denoted by the disappearance of *Bairdia* during the MECO interval, a significant pattern revealed by the LRT. In addition, within the MECO interval, the whole-faunal percentage of smoother, less ornate genera was significantly lower while some genus-specific adult:juvenile valve ratios were significantly higher; both patterns are consistent with a hypothesized decrease in carbonate saturation during the MECO. The absence of faunal turnover and pronounced changes in faunal percentages through the MECO stands in stark contrast to ostracode assemblages previously documented during other intervals of rapid climate change (i.e., PETM)