



Demise of the planktic foraminifer genus *Morozovella* at ODP Site 1258 (Demerara Rise, west Equatorial Atlantic): understanding biological responses during the Early Eocene Climatic Optimum

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The Early Eocene Climatic Optimum (EECO) expresses the multi-million year interval of peak Cenozoic global warmth and high atmospheric CO₂ concentrations that occurred sometime between 54 and 48 million years ago. An outstanding issue is how life evolved during this crucial interval, and planktic foraminifera represent an excellent class in which to examine such links. Here we present new data on planktic foraminiferal response to the EECO from the equatorial Atlantic ODP Site 1258 (Demerara Rise). Our main result reveals that the relative abundance of the surface-dweller symbiont-bearing genus *Morozovella*, that dominated early Paleogene planktic foraminiferal assemblages from tropical-subtropical regions, markedly and permanently declined at the beginning of the EECO moving from mean percentage of ~34% to less than ~10%. This distinct decrease in abundance occurred within ~20 kyr before a negative $\delta^{13}\text{C}$ excursion known as the “J” event (~ 53.3 Ma), which marks the onset of the EECO. The permanent decrease of morozovellids is associated with reduction in species diversity, but an increase in the abundance and diversity of another symbiont-bearing foraminifera genus, *Acarinina*. The remarkable turnover from *Morozovella* to *Acarinina* was geographically widespread, as it is now recorded at the start of the EECO in the subtropical Pacific (Site 577), and elsewhere in the subtropical Atlantic (Sites 1051 and 1263). Interestingly, the timing of the drop in abundance is close but different at each site. Our new data from Demerara Rise further a notion that the morozovellid decline began first with unfavourable environmental conditions near the equatorial Atlantic Ocean and then extended to higher latitudes. The triggering mechanism for the striking planktic foraminiferal turnover remains elusive, because both *Morozovella* and *Acarinina* existed in the mixed-layer. Most of the morozovellid species that became extinct within the EECO reduced their maximum size. Recent culturing and open ocean observations indicate that omega-calcite saturation state can affect variably sized foraminifera differently, such that larger planktic foraminifera preferentially reduce their calcification. The two dominant genera, *Morozovella* and *Acarinina*, may have had different tolerances to temperature and ocean chemistry. This would explain why anti-phase variations in their abundances occurred during several early Paleogene hyperthermals that happened before the EECO. The EECO interval may represent the time when optimal conditions for morozovellids diminished for a sufficiently long time, such that acarininids dominated surface water habitats afterward.