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Early Cenozoic glacial history: Insights from Pacific records of seawater δ^{18}O

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Constraints on Earth's glacial history come from the deep-sea oxygen isotope (δ^{18}O) record. The growth of Antarctic ice during the early Cenozoic is modelled to have driven changes in seawater δ^{18}O of up to 0.5 per mil (DeConto and Pollard, 2003). Larger shifts in the mean δ^{18}O of seawater therefore require some storage of ice in the Northern Hemisphere. In order to study the evolution of ice volume during the early Cenozoic, we developed high-resolution records of seawater δ^{18}O for three sites in the tropical Pacific by combining new and published (Lear et al., 2004; Coxall et al., 2005; Tripati et al., 2005) records of benthic foraminiferal δ^{18}O with Mg/Ca-based paleotemperatures. Deep Pacific δ^{18}O records are the most representative of mean δ^{18}O due to the size of the ocean basin. Fluctuations in carbonate ion concentrations during the time interval studied (Tripati et al., 2005) may have resulted in estimates of seawater δ^{18}O that are biased by 0.1 per mil (Elderfield et al., 2006), and thus we use 0.6 per mil as a threshold value for Northern Hemisphere ice storage. The seawater δ^{18}O reconstructions for Sites 1209, 1218 and 1219 show that several large ($>$0.6 per mil) shifts in seawater δ^{18}O occurred throughout the middle Eocene to early Oligocene. The magnitude of variations in seawater δ^{18}O necessitate the storage of ice in both the Northern and Southern Hemisphere at about 44.5 Ma, 42 Ma, 38 Ma, and after 34 Ma.

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