

Long-term trends in Pliocene stable isotope stratigraphy: new insights from the southwest Pacific

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Abstract

Pliocene studies, based on stable isotope records, have been used to assess the ocean's response to major perturbations in the climate system. While numerous studies have focused on the Atlantic Ocean, the Pacific Ocean, in particular at high southern latitudes, is less well studied. In this study we analyzed stable isotopes of oxygen ($\delta^{18}\text{O}$) and carbon ($\delta^{13}\text{C}$) from benthic foraminifera from deep waters in the southwest Pacific spanning ~4.3 to 2.6 Ma. This time period is characterized by exceptional warmth during the Early Pliocene, Late Pliocene Southern Hemisphere cooling with the initiation of Northern Hemisphere Glaciation (iNHG) at ~2.7 Ma. The southwest Pacific $\delta^{18}\text{O}$ record is consistent with the globally distributed records of ice volume and temperature. However, a dichotomy between the southwest Pacific and South Atlantic $\delta^{13}\text{C}$ records spanning the mid-Pliocene suggests the dominant water masses bathing these sites were different in terms of their Northern vs. Southern Hemisphere contributions. Primarily, the long-term changes in $\delta^{13}\text{C}$ values imply alteration in preformed values in which increased remineralization of inorganic carbon was a result of reduced deep ocean ventilation. This was likely the consequence of increased extent and duration of sea ice in the Southern Ocean resulting from Antarctic ice sheet expansion and cooling.

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