Orbital-scale climate variability recorded near the Oligocene-Miocene boundary

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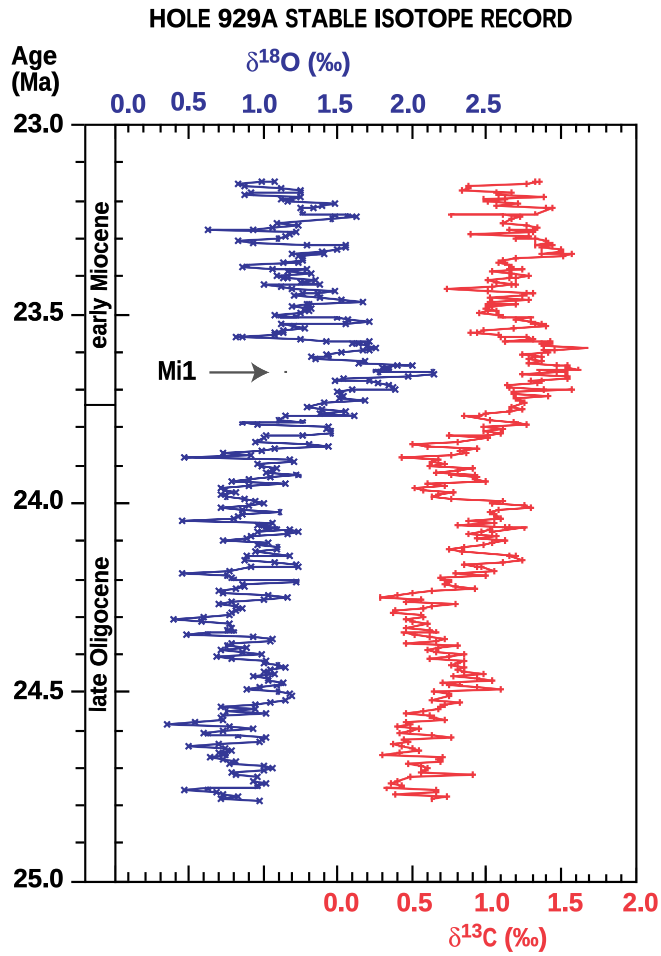
The late Oligocene through early Miocene was an interval of generally increasing global warmth and decreasing global ice volume, which was interrupted by several large-scale Antarctic glaciations. The cause of these glaciations is intriguing, because they constitute reversals of general global warming during the ca. 28 to 17 Ma interval. In particular, a major glaciation near the Oligocene-Miocene boundary at ca. 23.7 Ma (termed Mi1) occurred during a distinctly warm interval of the mid-Cenozoic. To better understand the Mi1 glaciation, we generated high-resolution (~5 k.y.) stable isotope records based on benthic foraminifers from Ocean Drilling Program (ODP) Hole 929A on the Ceara Rise (western equatorial Atlantic) spanning the Oligocene-Miocene boundary [*Flower et al.,* in press a,b]. Oxygen isotopic data better define the nature of $\delta^{18}O$ maximum Mi1, and its association with the $\delta^{13}C$ maximum near the Oligocene-Miocene boundary. The $\delta^{13}C$ maximum is reached at the end of several $\delta^{13}C$ cycles of about 400 k.y. period, culminating at 23.7 Ma (coincident with the $\delta^{18}O$ maximum). Covariance of oxygen and carbon isotopic data through the sequence studied suggests organic carbon burial played a role in polar cooling near the Oligocene-Miocene boundary.

Spectral analysis confirms that high-frequency variations in $\delta^{18}O$ and $\delta^{13}C$ were paced by orbital forcing with a dominant period of about 41 k.y., especially during the 24.0-24.8 Ma interval. Concentration of variance at this period strongly suggests a high-latitude control, involving Southern Ocean sea-surface temperatures and East Antarctic ice sheet variability.



References

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