Investigating Changes in North Pacific Intermediate Water During the Last 4 Million Years

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In the ocean, intermediate and deep water circulation is extremely important because it transports heat and nutrients globally. The Pliocene warm period is an optimal time in Earth's history to study how intermediate and deep water circulation functions during globally warm periods. Here we use an Ocean Drilling Program (ODP) marine sediment core from the California Margin to investigate changes in intermediate water during the last 4 million years. The benthic foraminifera *Uvigerina* spp. were picked from ODP Site 1014A core samples, then crushed and chemically cleaned. Using the Inductively Coupled Plasma-Mass Spectrometer (ICP-MS), Mg/Ca and Li/Mg ratios were measured and converted to bottom water temperatures. These temperatures and the previously published $\delta^{18}O$ of benthic foraminifera (Kwiek and Ravelo, 1999) were used to calculate the $\delta^{18}O$ of seawater. Reconstructed temperatures during the Plio-Pleistocene are ~2°C, which is cooler than modern temperature (~4°C). As the California Margin is a highly productive region, the Plio-Pleistocene cooler than modern temperatures could be due to post-depositional processes within the sediment as we would expect warmer temperatures during the warm Pliocene in comparison to modern; for this reason, we interpret relative change in temperature and $\delta^{18}O$ of seawater changes over the Plio-Pleistocene. Results show that intermediate water during the Pliocene was warmer than Pleistocene. Mg/Ca and Li/Mg-derived $\delta^{18}O$ of seawater records increase at ~3100 kyrs, suggesting an increase in ice volume consistent with initiation of Northern Hemisphere Glaciation. To isolate local changes in $\delta^{18}O$ of seawater, we used available deep Pacific $\delta^{18}O$ of seawater records to approximate for changes in mean $\delta^{18}O$ of seawater related to Northern Hemisphere Glaciation. Local $\delta^{18}O$ of seawater show that intermediate water during the Pliocene was fresher than in the Pleistocene.