Detecting Changes in Antarctic Bottom Water Formation Using Authigenic Uranium During Marine Isotope Stage 11

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Authigenic uranium (aU) is a redox sensitive element found in marine sediments under reducing conditions. This makes aU a useful proxy for past bottom water oxygen concentrations, because sediments deposited during periods with low bottom water oxygen concentrations have more aU. In the Southern Ocean low bottom water oxygen concentrations can be the result of either decreased Antarctic Bottom Water formation, or increased delivery of organic matter to the sediment. One problem with aU analyses is "burn down," the remobilization of aU when conditions change from reductive to oxidative. Here, we present aU concentrations in a deep Southern Ocean core (ODP Site 1094), along with the isotopic composition of the authigenic uranium, a new tool to account for "burn down" effects.

We first focus on Marine Isotope Stage 11, a period of higher-than-present temperature and sea level around 400,000 years ago. Preliminary results suggest millennial-scale changes in Antarctic Bottom Water circulation that have implications for understanding global changes under warm climate conditions relevant to today's climate. During Marine Isotope Stage 11 we observe two peaks in aU, the first during peak interglacial warmth and the second during a period of falling atmospheric CO_2. This is consistent with a period of reduced Antarctic Bottom Water formation. Should the modern ocean experience a reduction in the formation of Antarctic Bottom Water, due potentially to enhanced Antarctic glacier melt, there would be an increase the amount of CO_2 stored in the deep ocean.