Atlantic and Pacific deep ocean circulation and carbon cycling changes during the Mid- Pleistocene Transition

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The last few million years saw changing boundary conditions to the Earth system which set the stage for bi-polar glaciation and Milankovitch-forced glacial-interglacial cycles which dominate Quaternary climate variability. Recent studies have constrained the relative importance of temperature, ice volume and deep ocean circulation changes during the Mid-Pleistocene Transition at ~900 ka (Elderfield et al., 2012, Pena and Goldstein, 2014). Reconstructing the history of Atlantic-to-Pacific deep water propagation and the carbon content of these water masses is important for understanding the ocean's role in amplifying climate changes to cause glacial-interglacial transitions.

We present new high resolution foraminiferal-coating Nd isotope records from ODP Site 1123 on the deep Chatham Rise and ODP Site 929 from the deep western equatorial Atlantic Ocean, extending from the Holocene to 1.3 Ma at a sample spacing of ~5 kyr. They show similar structure exhibiting 100 kyr glacial and shorter cyclicity, linking Atlantic water mass propagation into the Pacific Ocean via the Southern Ocean. The Atlantic and Pacific records have different characteristics during the Mid Pleistocene Transition (MPT; 950-850 Ma, MIS 25-21). By comparing Nd and C isotopes at high resolution during this interval we can see that a circulation change was stronger in the Atlantic record, but the Pacific Ocean responded with a larger change in carbon isotopes. This suggests that during the MPT a carbon cycling change occurred in the Southern Ocean and was circulated into the Pacific. The observed Nd and C isotope changes during the MPT are not observed during other glacials, suggesting a southern hemisphere carbon cycling amplification was critical in causing this step change in climate boundary conditions.