Geophysical Research Abstracts
Vol. 13, EGU2011-12701, 2011
EGU General Assembly 2011

Subantarctic dust-driven nutrient utilization on millennial to orbital timescales

Martin Ziegler (1), Ian Hall (1), and Paula Diz (2)
(1) Cardiff University, School of Earth and Ocean Sciences, Cardiff, United Kingdom , (2) Universidade de Vigo, Spain

The Subantarctic zone (SAZ) in the northern domain of the Southern Ocean is widely thought to be one of the key players in shaping glacial-interglacial climate change. It has been speculated the glacial reduction in atmospheric pCO2 could be attributed to the combination of reduced upwelling of old carbon-rich deepwater in the Antarctic zone and decreased nutrient utilization in the Subantarctic. Within the Subantarctic zone Subantarctic Mode Water (SAMW) is convectively formed. Currently SAMW is the main conduit of nutrients from the Southern Ocean to the upwelling regions of the low latitudes, where the majority of the ocean's calcium carbonate is produced. A change in the nutrient status of the SAMW can have a significant effect on the global carbon cycle.

Here we present high-resolution (average spacing 330 years) paleoceanographic records from CASQ core MD02-2588 retrieved from the southwestern flank of the Agulhas Plateau (41°19.90'S, 25°49.7'E, 2907 m water depth). The site is located close to the modern day Subtropical Front (STF) and at depth is close to the lower limit of the southward flowing North Atlantic Deep Water that feeds Circumpolar Deep Water (CPW). Paired stable isotope (δ18O, δ 13C) measurements were carried out on the epifaunal benthic foraminiferal species Cibicidoides wuellerstorfi, and on the deep dwelling planktonic foraminifera Globorotalia truncatulinoides (sinistral form). The age scale for core MD02-2588 is based on a combination of twelve 14C ages and graphically tuning of the benthic δ18O to the marine δ18O benthic stack of Lisiecki and Raymo (2005).

We interpret the difference between the benthic and planktic carbon isotope records ($\Delta\delta$13C), as an indication of how the nutrient content is transformed at the surface during the transition from deepwater (recorded by the benthic foraminifera) to mode water (recorded in the planktic foraminifera), hence as an indication of the efficiency of the Subantarctic biological pump. The $\Delta\delta$13C record strongly co-varied with the dust flux recorded in the Antarctic ice core record (EPICA Dome C) on millennial to orbital timescales over the last 350,000 years. This supports the Southern Ocean iron fertilization hypothesis. Both, the dust input and $\Delta\delta$13C, exhibit a strong 41-kyr periodicity, pointing at obliquity as the main external forcing. We therefore suggest that Patagonian dust supply introduces persistent obliquity variance to the global carbon cycle and climate system throughout the Pleistocene.