Deglacial changes in neodymium isotopes in the western Indian Ocean

D.J. WILSON*, A.M. PIOTROWSKI AND A. GALY

Department of Earth Sciences, University of Cambridge, Cambridge, CB2 3EQ, UK
(*correspondence: david.wilson@esc.cam.ac.uk)

Neodymium isotopes in the modern oceans appear to behave as a quasi-conservative tracer for deep ocean circulation. One approach used to recover past changes in the Nd isotopic composition (ε_{Nd}) of the oceans, and therefore to reconstruct water mass sourcing and mixing, is selective leaching of dispersed Fe-Mn oxyhydroxides within marine sediments [1–3]. We present a new record generated by this method from the deep western Indian Ocean core WIND 28K (10°S, 52°E, 4157m depth, [4]). A decrease of 3 to 4 ε_{Nd} units through the deglaciation, as well as millennial scale variability coinciding with Heinrich 1, could be interpreted as the signal of watermass mixing in the South Atlantic being propagated effectively into the deep western Indian Ocean.

Given the location near the Madagascan margin, with potential inputs to the sediment from old continental crust, young volcanics and preformed Fe-Mn oxides, the recovery of an authigenic seawater signal here may be challenging (e.g. see [5]). Comparison to a published record from V19-188 (7°S, 61°E, 3356m depth, [6]), approximately 1000 km to the NE, shows a similar pattern of changes which appears to support the applicability of this method.

However, the two records show a difference in absolute values of around 1.5 ε_{Nd} units. This might reflect watermass stratification, but could also arise from boundary exchange or from methodological differences, and these possibilities are explored here. Tests on the effect of sample size and sediment size fraction show that the ε_{Nd} values obtained are sensitive to methodology. In this case, we should be cautious in basing water mass mixing calculations on the comparison of such records.

[1] Bayon *et al.* (2002) *Chem. Geol.* **187**, 179-199. [2] Piotrowski *et al.* (2005) *Science* **307**, 1933-1938. [3] Gutjahr *et al.* (2007) *Chem. Geol.* **242**, 351-370. [4] McCave *et al.* (2005) *Phil. Trans. R. Soc. A*, **363**, 81-99. [5] Bayon *et al.* (2004) *EPSL* **224**, 477-492. [6] Pahnke, Goldstein and Hemming (2008) *Nature Geosci.* **1**, 870-874.

Helium isotopes reveal hydrothermal activity in the Southern Ocean: Filling the 'blank spot' on the global map of hydrothermal venting

GISELA WINCKLER[1]*, ROBERT NEWTON[1] AND PETER SCHLOSSER[1,2,3]

[1]Lamont-Doherty Earth Observatory, Columbia University, Palisades, NY 10964
(*correspondence: winckler@ldeo.columbia.edu)
[2]Department of Earth and Environmental Sciences, Columbia University, New York, NY 10027
[3]Department of Earth and Environmental Engineering, Columbia University, New York, NY 10027

Fourty years after the transformational discovery of mantle-derived ^3He in the Pacific Ocean, helium isotopes continue to be powerful tools to identify and trace hydrothermal activity in the world's oceans [1, 2]. Hydrothermal venting plays an important role in cycling elements and energy between the Earth's surface and interior and provides extreme ecological niches for unique chemosynthetic fauna. Additionally, trace elements emanating from hydrothermal vents such as ^3He are excellent tracers for mapping deep ocean circulation and mixing. Since the 1970s, more than 220 hydrothermal vents have been identified along the global mid-ocean ridges, over half of them in the eastern Pacific Ocean, but no active venting has been observed south of 38°S in the Pacific Ocean or the Pacific sector of the Southern Ocean.

Large-scale oceanographic programs, such as the World Ocean Circulation Program (WOCE) have provided us with a wealth of helium isotope data, more than 20,000 analyses across all ocean basins. Here we use the distribution of helium isotopes along an oceanic transect at 67°S (WOCE line S4P) to identify previously unobserved hydrothermal activity in the Pacific sector of the Southern Ocean. Combining the geochemical information provided by the helium isotope anomaly with independent hydrographic information from the Southern Ocean Database (SODB) we trace the source of the hydrothermal input to the Pacific Antarctic Ridge, one of the major global mid-ocean ridge systems, which has until now been a 'blank spot' on the global map of hydrothermal venting. Mantle outgassing in the deep Southern Ocean labels Antarctic Bottom Water and provides a novel tracer signal uniquely suited for mapping of circulation and ventilation in the Southern Ocean.

[1] Lupton (1998) *JGR* **103**, 15853-15868. [2] Schlosser & Winckler (2002) *Rev. Mineral. Geochem.* **47**, 701-730. [3] Baker & German (2004) *AGU Monograph* **148**