Changes in glacial overturning circulation structure based on neodymium isotope measurements from the Cape Basin

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Perhaps Wally Broecker's best-known contribution to paleoceanography is his description of the "Great Ocean Conveyor", which connects shallow and deep ocean circulation and plays a crucial role in global climate. The Agulhas Current is a key part of the warm water surface return route in the ocean's overturning circulation. At the Agulhas Retroflection, a portion of this current "leaks" into the Atlantic, transporting salt and heat and contributing to the formation of North Atlantic Deep Water (NADW). NADW has a neodymium isotopic composition that is distinct from water originating in the Pacific, and mixing between these water masses in the subsurface is quasi-conservative. We present authigenic neodymium isotope measurements from IODP Site U1479, located in the Cape Basin (35°03.53′S; 17°24.06′E, 2615 m water depth). In the modern ocean, this Site is bathed in remnant NADW, characterized by its salinity and temperature, as well as its εNd minimum. Holocene samples at Site U1479 have εNd of ~-10.5, and Last Glacial Maximum (LGM, ~22–18 ka) values are ~-8.3. During Marine Isotope Stage (MIS) 3, εNd values drop to ~-9.7 at ~50 ka, then increase to near LGM levels at MIS 4 (-8.7 at ~62 ka), and drop to near Holocene values during MIS 5. These variations are consistent with other Cape Basin εNd records, including ODP Sites 1087 and 1088 (1372 and 2082 m, respectively)[1] and TN057-21/RC11-83 (4981/4718 m)[2]. We do not see evidence for an increase in the influence of NADW at Sites 1087/1088 when it decreases at Site U1479. This would be expected if NADW shoaled in the water column, as is indicated by benthic $\delta^{13}C$ data from the western Atlantic [3]. Instead, Site U1479 has the most negative εNd values of these sites across the last glacial cycle, implying a more complex glacial circulation structure in the Cape Basin.

[1] Hu *et al*. (2016) *EPSL* **455**, 106–114. [2] Piotrowski *et al*. (2005) *Science* **307**, 1933–1938. [3] Curry and Oppo (2005) *Paleoceanography* **20**, PA1017.