Geophysical Research Abstracts
Vol. 13, EGU2011-3514, 2011
EGU General Assembly 2011

Plio-Pleistocene evolution of water mass exchange and erosional input in the Fram Strait

Claudia Teschner (1), Martin Frank (2), and Brian Alexander Haley (3)

(1) IFM-GEOMAR, Kiel, Germany (cteschner@ifm-geomar.de), (2) IFM-GEOMAR, Kiel, Germany (mfrank@ifm-geomar.de), (3) IFM-GEOMAR/Kiel, now at COAS, Corvallis, Oregon (bhaley@coas.oregonstate.edu)

We determined the isotopic composition of neodymium (Nd) and lead (Pb) of past seawater to reconstruct water mass exchange and erosional input between the Arctic Ocean and the Norwegian-Greenland Seas over the past 5 Ma. For this purpose, sediments of ODP site 911 (leg 151) located at 900 m water depth on the Yermak Plateau in the Fram Strait were used. The paleo-seawater variability of Nd and Pb isotopes was extracted from the sea water-derived metal oxide coatings on the sediment particles following the leaching method of Gutjahr et al. (2007). All radiogenic isotope data were acquired by Multi-Collector (MC) ICP-MS. The site 911 stratigraphy of Knies et al. (2009) was applied.

Surface sediment Sr and Nd isotope data, as well as downcore Sr isotope data obtained on the same leaches are close to seawater and confirm the seawater origin of the Nd and Pb isotope signatures. The deep water Nd isotope time series extracted from site 911 was in general more radiogenic (εNd = -7.5 to -10) than present day deep water (εNd = -9.8 to -11.8) in the area of the Fram Strait (Andersson et al., 2008) and does not show a systematic trend with time. In contrast, the radiogenic isotope composition of Pb evolved from $^{206}Pb/^{204}Pb$ ratios around 18.7 to more radiogenic values around 19.2 between 2 Ma and today.

The data indicate that mixing of water masses from the Arctic Ocean and the Norwegian-Greenland Seas has controlled the Nd isotope signatures of deep waters on the Yermak Plateau over the past 5 Ma. Prior to 1.7 Ma the Nd isotope signatures on the Yermak Plateau were less radiogenic than waters from the same depth in the central Arctic Ocean (Haley et al., 2008) pointing to a greater influence from the Norwegian-Greenland Seas. After 1.7 Ma the central Arctic and Yermak Plateau data have varied around similar values indicating water mass mixing overall similar to today.

In contrast, the Pb isotope composition of deep waters in the Fram Strait appears to have been dominated by weathering inputs from glacially weathering old continental landmasses, such as Greenland or parts of Svalbard since 2 Ma. A similar control over the Pb isotope evolution of seawater since the onset of Northern Hemisphere Glaciation was recorded by ferromanganese crusts that grew from North Atlantic Deep Water in the western North Atlantic.

References:

Gutjahr, M., Frank, M., Stirling, C.H., Klemm, V., van de Flierdt, T. and Halliday, A.N. (2007): Reliable extraction of a deepwater trace metal isotope signal from Fe-Mn oxyhydroxide coatings of marine sediments.- Chemical Geology 242, 351-370

Haley B. A., M. Frank, R.F. Spielhagen and A. Eisenhauer (2008): Influence of brine formation on Arctic Ocean circulation over the past 15 million years. Nature Geoscience 1, 68–72

Andersson, P.S., Porcelli, D., Frank, M., Björk, G., Dahlqvist, R. and Gustafsson, Ö. (2008): Neodymium isotopes in seawater from the Barents Sea and Fram Strait Arctic-Atlantic gateways.- Geochim. Cosmochim. Acta 72, 2854-2867

Knies, J., J. Matthiessen, C. Vogt, J.S. Laberg, B.O. Hjelstuen, M.Smelror, E. Larsen, K. Andreassen, T. Eidvin and T.O. Vorren (2009): The Plio-Pleistocene glaciation of the Barents Sea–Svalbard region: a new model based on revised chronostratigraphy - Quaternary Science Reviews 28, 9-10, 812-829