Mo isotope variations in meromictic Lake Cadagno

T.W. DAHL[1], A.D. ANBAR[2], G.W. GORDON[2], R. FREI[1] AND D.E. CANFIELD[4]

[1]Nordic Center for Earth Evolution (NordCEE), Øster Voldgade 5-7, 1350 Copenhagen K, Denmark
[2]School of Earth and Space Exploration, Arizona State University, Tempe, AZ 85287-1404, USA
[3]Nordic Center for Earth Evolution (NordCEE) Campusvej 55, 5230 Odense M, Denmark

Mo isotope systematics can be used to infer the extent of ocean oxygenation in the past. Isotope fractionation during adsorption to Mn-oxides exerts an important influence on the isotopic composition of the oceanic Mo reservoir. Measurements indicate that this process was less important between 1.7 - 1.4 Ga compared to today (Arnold *et al*. 2004) consistent with other lines of evidence (Canfield 1998). However, quantitative interpretation of Mo isotope variations in ancient sediments requires an understanding of how Mo isotopes fractionate in sulfidic environments in which Mo removal from the water column is not quantitative.

The alpine Lake Cadagno in Switzerland offers an opportunity to examine Mo isotope fractionation in a sulfidic water column. Mo exists as the soluble molybdate anion in the oxic surface zone. Mo concentration decreases by 30-50% below the chemocline, where Mo speciation presumably is dominated by particle-reactive oxythiomolybdates. Isotopically, in the oxic part of the lake we find δ97/95Mo = 0.5-0.6‰, matching the riverine inflow. In contrast, the sulfidic deeper waters are heavier: δ97/95Mo = 1.1-1.2‰.

The mechanism by which this isotope shift occurs is at present uncertain. It is possible that heavy Mo enters the deep waters from dolomitic subaquatic springs. Alternatively, isotope fractionation may occur at or below the chemocline. The data could be explained by preferential adsorption of light Mo onto ferromanganese particles below the chemocline. In cases of incomplete Mo removal in euxinic waters the isotope effect is unknown and needs to be studied.

References

Arnold G.L., Anbar A.D, Barling J., and Lyons T.W. (2004), *Science* **304** 87-90.
Canfield D.E. (1998), *Nature* **396** 450-453.

Nd isotopes in Bering Strait and Chukchi Sea water

R. DAHLQVIST[1], P.S. ANDERSSON[2] AND D. PORCELLI[1]

[1]University of Oxford, Dept. of Earth Sciences, Oxford OX1 3PR, UK; (Ralf.Dahlqvist@earth.ox.ac.uk)
[2]Swedish Museum of Natural History, Lab. for Isotope Geology, Stockholm, Sweden; (per.andersson@nrm.se)

The Nd isotopic composition, $\varepsilon_{Nd(0)}$, was determined for the first time in filtered (0.22 µm) water samples collected from the Bering Strait and the Chukchi Sea in the Arctic Ocean. Vertical profiles and surface waters were collected in the east and west passages of Bering Strait, the Chukchi Sea, and the Chukchi Abyssal Plain.

In Bering Strait $\varepsilon_{Nd(0)}$ vary between -4.02 and -5.94, with slightly more radiogenic values at the surface. Temperature and salinity profiles show a well mixed water column with a surface layer of 5-10 m depth, which is warmer an less saline. The isotopic composition is primarily influenced by inflow from the north Pacific Ocean with values of -4 to -5. The slightly lower surface values can be explained by input from local sources to the Bering Sea, e.g. Yukon River water.

Two surface water samples collected in the Chukchi Sea have more negative $\varepsilon_{Nd(0)}$ compared to Bering Strait water, indicating a different source than Pacific Ocean water, possible river water from Russian rivers.

In the Chukchi Abyssal Plain $\varepsilon_{Nd(0)}$ decreases with depth from -6.52 at the surface to -11.47 close to the bottom. Salinity and temperature profiles show a well-defined stratification, and the variation with depth is clearly related to the origin of these different water masses. The surface value of -6.52 demonstrate the significance of Chukchi Sea shelf waters, while less radiogenic values at depth are related to warm Atlantic derived water and Canada Basin bottom water.

Nd concentrations (C_{Nd}) determined with isotope dilution vary between 24.6 and 39.5 pM in the Chukchi Abyssal plain and Bering Strait respectively. In this filtered fraction no significant variation in C_{Nd} can be observed with depth in Bering Strait or the Chukchi Abyssal Plain.

$\varepsilon_{Nd(0)}$ values in samples from Bering Strait and the Chukchi shelf are more negative than reported values from the North Pacific surface water. This indicates that the isotopic signal changes in water flowing from the Pacific Ocean into the Arctic. This shift may be caused by interaction with suspended particulate matter on the shallow shelf surrounding Bering Strait and in the Chukchi Sea. Support for this theory can be observed in measured C_{Nd} in this study, which show higher concentrations on the shelf area compared to North Pacific surface water.

These new data are setting important constraints for inflow and mixing of Pacific Ocean water with the general circulation of Arctic Ocean water.