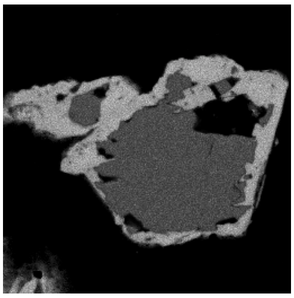
Coupled cation and oxygen exchange between alkali feldspar and aqueous chloride solution

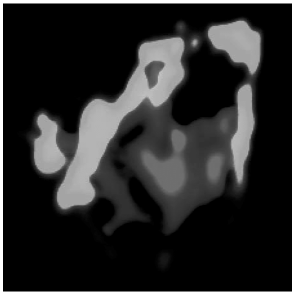
THEODORE LABOTKA[1], DAVID R. COLE[2], MOSTAFA FAYEK[1], AND LEE R. RICIPUTI[2]

[1]Department of Geological Sciences, University of Tennessee, Knoxville TN 37996 <tlabotka@utk.edu>
[2]Chemical Sciences Division, Oak Ridge National Laboratory, Oak Ridge TN 37831

Hydrothermal alteration of alkali feldspar typically results in a change in the Na/(Na + K) ratio and the value of $\delta^{18}O$. We studied the exchange experimentally by placing grains of Amelia albite and Madagascar sanidine in alkali-chloride solutions. We used 1 *m* and 2 *m* NaCl and KCl solutions with a solvent of composition $HD^{18}O_{0.5}{}^{16}O_{0.5}$. We heated the samples to 600 °C at a pressure of 200 Mpa for periods of 4–6 d. In all cases, the rims of the starting feldspar grains exchanged with the solution; the apparent width of the exchanged rims ranged up to ~25% of the grain diameter. We determined the composition of the feldspar grains by electron microprobe analysis, the width of the rims by scanning x-ray and back-scattered electron images, and the distribution of ^{18}O, H, and D by scanning ion images on a secondary ion mass spectrometer.



An example of our experimental results is shown in the two figures. The adjacent image shows a light gray K-feldspar rim on Amelia albite. The rim-core boundary is sharp at the 1–2 µm spatial resolution of the electron probe. The distribution of ^{18}O and ^{16}O in the same grain is shown below; the image is distorted in the horizontal direction in relation to the x-ray image. The light gray regions are the ^{18}O-rich rims, and the darker gray in the core is the ^{16}O-rich region. The pattern of O isotope distribution matches the cation distribution within the resolution of the ion probe. The distribution of D is more difficult to image because of the low count rate, but D also appears to be elevated at the rim. The conclusion reached by O'Neil and Taylor is clearly shown by the combination of imaging techniques applied to our experimental samples. O exchange in alkali feldspar is facilitated by the cation exchange reaction.



NADW formation traced by Nd isotopic ratios

F. LACAN AND C. JEANDEL

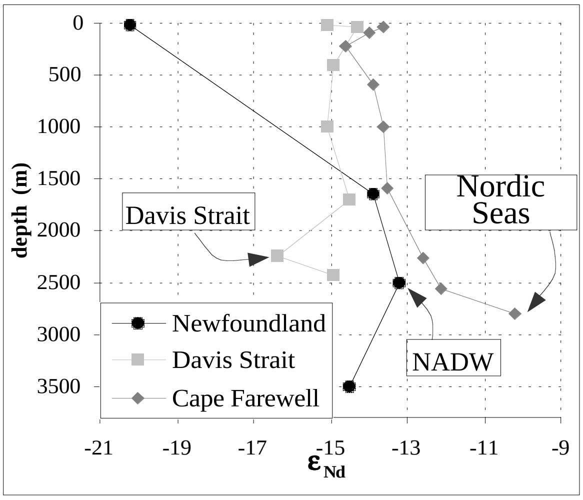
LEGOS, 18 av Ed. Belin, 31401 Toulouse Cedex 4, France
(Francois.Lacan@cnes.fr, Catherine.Jeandel@cnes.fr)

Seawater neodymium isotopic composition is a tracer of water mass pathways and of their interactions with continental material. It can be used to reconstruct both paleo and present day ocean circulation.

The main objective of this work is to understand how the North Atlantic Deep Water (NADW) acquires its neodymium signature in the present day ocean. We collected 340 seawater samples throughout the water column in the North Atlantic Ocean : Labrador Sea, Irminger Sea, Iceland Basin, Iceland Sea, Norwegian Sea and Greenland Sea.

NADW is formed as four distinct water masses, Denmark Strait Overflow Water (DSOW), Iceland Scotland Overflow Water (ISOW), Labrador Sea Water (LSW) and Lower Deep Water (LDW), merge within a deep recirculating cyclonic gyre in the Labrador and Irminger seas [1].

This presentation will focus on new Nd isotopic data from the Labrador and Irminger seas. They will be compared to earlier data [2,3] and discussed in terms of circulation and NADW formation. On the graph, NADW is characterized by the ε_{Nd} maximum at the Newfoundland station. The unradiogenic contribution of the Davis Strait waters (ε_{Nd}=-16.4) and the more radiogenic contribution of Cape Farewell waters reflecting Nordic seas overflows (ε_{Nd}=-10.2), are observed around 2500m.



[1] R.R. Dickson and J. Brown. *J. Geophys. Res.* **99** (1994) 12319-12341.

[2] D.J. Piepgras and G.J. Wasserburg. *Geochim. Cosmochim. Acta* **51** (1987) 1257-1271.

[3] M.C. Stordal and G.J. Wasserburg. *Earth Planet Sci. Lett.* **77** (1986) 259-272.

[4] F. Lacan and C. Jeandel. AGU 2001 Fall Meeting OS21D-04.