College of Earth, Ocean, and Atmospheric Sciences
Oregon State University, 104 CEOAS Administration Building, Corvallis, Oregon 97331-5503
T 541-737-3504 | **F** 541-737-2064 | http://www.coas.oregonstate.edu

Monday, September 30, 2013

To the GEOTRACES Project Office coordinators,

I intend to lead a proposal to NSF to apply for funding to analyze neodymium (Nd) isotopes and the rare earth elements (REEs) for the GEOTRACES Arctic cruise leg (with collaborators - see below).

Scientific Objectives: Neodymium isotopes are listed as a key parameter to be made on each GEOTRACES cruise[1]. This isotopic system is thought to be a "quasi-conservative" tracer for circulation, with great potential for understanding long-term changes in global circulation[2]. Only recently have the first seawater Nd isotope data from the Arctic been analyzed[3]: thus, this basin remains largely "unknown" in terms of Nd isotopes. Being one of the lanthanide series, Nd isotopic data are generally improved and better understood in relation to a complete REE data set. For example, the biogeochemistry of the REEs will aid tremendously in understanding how the Nd isotopic signatures are imparted or modified in water masses[4]. I have recently had colleagues take samples from their Arctic cruise for REE analyses, and have found that the Canadian Basin (our samples) and those from the Eurasian Basin[5] markedly differ from other ocean basins (manuscript is currently in preparation). These are the only two data sets on Arctic REEs known to me. A more complete and systematic investigation of the Canadian Basin would certainly be desirable to help understand these differences.

Collaborations: I would welcome the chance to coordinate and work with other groups interested in analyzing both Nd isotopes and the REEs. Indeed, I have been in discussion with Leo Pena and Steve Goldstein (at LDEO) and Howie Scher (U. South Carolina) about working together to make these analyses. Leo, Steve and I are also working together on the S.E. Pacific GEOTRACES leg at the moment. We have participated in the previous planning workshops for the Arctic leg (both in Washington D.C. and San Diego). I feel confident that we would be able to write a strong proposal to do this work for the Arctic GEOTRACES leg. This work would foster a number of possible discussions with other groups interested in watermass sources and circulation, particle-water, and ice-water interactions and exchanges at boundaries (in the Arctic, this is especially poignant for the shelf and slope).

Sample Needs: 10l of filtered, acidified seawater for Nd isotope, and 30ml for REE (can be taken from the larger volume) analyses. A small, custom-built coreing device for GEOTRACES work has also been successfully deployed on various legs; we would ask that this device be also used in the Arctic cruise. These uppermost sediments are expected to be very useful in determining the nature of sediment-water interactions that would otherwise only be inferred from the bottom water data alone.

College of Oceanic & Atmospheric Sciences
Oregon State University, 104 COAS Administration Building, Corvallis, Oregon 97331-5503
T 541-737-3504 | **F** 541-737-2064 | http://www.coas.oregonstate.edu

Berths: If successful, I hope to be able to participate on the cruise in sample collection, on behalf of the Nd/REE group. The water taken for Nd is large-volume and often co-sampled with Th-Pa, ^{210}Pb-^{210}Po as well as other ultra-trace systems. As such, I would be happy to co-ordinate with others on sampling.

Thank you very much for your consideration.
Sincerely,

Brian Haley

1. GEOTRACES Planning Group (2006) *GEOTRACES Science Plan*. Baltimore, Mayland: Scientific Committee on Oceanic Research.
2. e.g., Frank, M. (2002) *Rev. Geophys*., 40, A1–A38.
3. Andersson et al. (2008) *GCA,* 72, doi: 10.1016/j.gca.2008.04.008; Porcelli et al., (2009) *GCA,* 73, doi: 10.1016/j.gca.2008.11.046.
4. e.g., Elderfield H. (1988) *Philos. Trans. R. Soc. London* 325, 105–126; Byrne R. H. and Sholkovitz E. R. (1996) In *The Handbook on the Physics and Chemistry of the Rare Earths* (eds. K. A. Gschneidner, Jr. and L. (Eyring), pp. 497–593. Elsevier, Amsterdam, the Netherlands.
5. Westerlund, S. and Ohman, P. (1992) Rare earth elements in the Arctic Ocean. Deep-Sea Res., 39, 1613-1626.