Neodymium isotopic composition and concentration in equatorial to North Atlantic seawater

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The Nd isotopic composition of seawater is widely used as a tracer for ocean circulation, as each individual water mass is tagged with a characteristic Nd isotope fingerprint. The reconstruction of past water mass configurations and ocean circulation are useful to understand the role of the ocean in past climate change and hence comprehend the future evolution of climate. Even though the Nd isotopic composition is often assumed to be an ideal ocean circulation tracer, our understanding of the modern cycle of Nd in the ocean is still poor. Indeed, while the continents are assumed to be the major source of Nd in the ocean, it is not yet clear how exactly water masses acquire their Nd isotopic composition.

The goal of the present study is to investigate whether Nd isotopes in seawater behave conservatively along the flow path of North Atlantic Deep Water. The samples measured to address this question were collected in 2010 on the Pelagia during the first two legs of the Dutch GEOTRACES Atlantic Ocean transect (Iceland to Brazil). Twelve seawater profiles were analysed for their Nd isotopic compositions and concentrations. Each profile comprises 10 to 12 depths, providing a better depth resolution than previous studies and covering some areas that have never been investigated for Nd isotopes or concentrations.

The new results will be discussed in the context of previously published Nd data, constraints from physical oceanography, and other proxy data collected on the same samples.

High-precision atmospheric helium isotope measurement in volcanic areas

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Current helium isotope analysis is sufficient to distinguish numerous geological end members, but determining the subtle isotopic variation in the air still poses a challenge to modern analytical techniques. The newly designed helium isotope measuring system, CRPG air-line, has reached the required precision to distinguish subtle differences in atmospheric helium isotopic ratios [1]. This technique marks a milestone for opening up new research directions for helium isotope study. Giving such high measuring precision, investigating geographical and temporal helium isotopic variation is within reach.

With this measuring system, we have identified that the average atmospheric helium isotopic ratios of the Big Island (Hawaii) and Afar region (Ethiopia) are 2.1-2.7 per mil higher than that in Nancy, France. Further investigation is needed to explain the cause of the difference, but comparing atmospheric helium isotopes from different tectonic settings is intriguing and may shed light on atmospheric helium dispersion patterns. Etna is an ideal place to study atmospheric helium isotopes since it has been constantly active and it offers various degassing mechanisms, such as: plumes, fumaroles, faults, and soil degassing. In June 2012, we took air samples from various sites, including the summit craters, fumaroles, Pernicana fault area, Paternò and Vallone Salato. We also took plume samples by flying through the trail on a gyroplane.

The $^{3}He/^{4}He$ ratio of the plume is 2.156±0.006 R_A (ratio normalized to atmospheric ratio of Nancy), while the ratio of the crater air is similar to that of Nancy. This indicates that the plume is the major helium degassing outlet of Etna, and helium seems to concentrate in the plume column rather than dispersing at the crater area. We will present the results of atmospheric helium isotope measurement of samples from Hawaii, Ethiopia and Etna; and hopefully will propose a model to elucidate the helium flux from Etna plume.

[1] Mabry, J., Marty, B., & Burnard, P. (2013), *Mineralogical Magazine*, 77(2).

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