RARE EARTH ELEMENTS IN THE NORTHWEST PACIFIC OCEAN

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Abstract

Filtered seawater samples from the northwest Pacific Ocean were collected during the IOC 2002 cruise and analyzed for Y and the Rare Earth Elements (REE) using Flow Injection Analysis Inductively Coupled Plasma Mass Spectrometry (FIA-ICPMS).

The highest surface REE concentrations, found near the Kuril Islands in the North Pacific Subarctic Gyre, are attributed to outflow from the Sea of Okhotsk through the Bussol Strait. The highest (least fractionated) Ce anomalies in surface waters were observed in the Kuroshio Extension and Recirculation System, off the coast of Japan. The Ce anomaly in surface waters display a weak positive correlation with the modelled dust deposition rate as reported by Measures et al. (2005), suggesting the Ce anomaly may be used as a proxy for atmospheric dust deposition to the surface ocean. A novel approach is used to calculate the Ce oxidation rate in North Pacific Intermediate Water. The calculated Ce oxidation rate (0.23 - 0.35% d^{-1}) agrees with the Ce oxidation rates in the Sargasso Sea of up to ~0.7% published by Moffett (1990) to within a factor of 2-3. The lower Ce oxdation rate observed in this study is consistent with microbially mediated Ce oxidation, although the possibility of abiotic Ce oxidation is not ruled out.

The use of REE as geochemical tracers of the water masses was investigated. Within the limits of analytical precision, molar ratios of La/Yb, La/Dy and Dy/Yb behave conservatively as a function of potential depth in the open ocean regardless of geographic location, although variations in La relative to the other REE near the coast of Japan suggest that excess La is coastally derived but quickly scavenged in the subtropical gyre. Variations in the Y/La ratio behave predictably as a function of potential density but vary

according to water mass origin, suggesting the Y/La ratio is an unexploited tracer for water mass distribution and origin.