Variations in rare earth elements within surface waters of the NW Pacific Ocean

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The IOC 2002 cruise of the R/V Melville tested the Duce et al. (1991) model of atmospheric dust deposition to the NW Pacific during the latter half of the peak Asian dust season. The cruise track sampled regions of the ocean where changes in hydrography and large biogeochemical gradients lead to variations in trace element cycling. The cruise sampled from the Kuroshio to the HNLC region at ~50 N, 167 E. A southerly track at 170E traversed from the Western Subarctic Gyre to the Subtropical Gyre. The ship then sailed east ending at the Hawaii Ocean Time-series (HOT) station. Surface water was collected throughout the cruise by a towed surface sampling fish using Teflon lined tubing.

We will discuss rare earth element concentrations in surface waters collected along the IOC 2002 cruise track. REE were determined by flow injection analysis-inductively coupled plasma-mass spectrometry (FIA-ICP-MS). Fe and Al concentrations were determined at sea by FIA. REE concentrations vary substantially across the region, with relatively low concentrations of La (~3 pM), Ce (~4-4.5 pM), and Nd (~8 pM) observed in the Kuroshio. Waters of the Western Subarctic Gyre were up to a factor of 2-3 enriched over those in the Kuroshio, but were similar or slightly greater than in the Subtropical Gyre. Ce anomalies along the cruise track display a trend that reflects the balance between new supply, regenerated supply and scavenging of the REE.

This work strives to determine how variations in atmospheric transport and deposition of continental dust to the surface ocean impact the REE content of seawater of the NW Pacific. We also hope to evaluate the solubility of dust associated REE through a comparison of our data with experiments conducted by Landing and colleagues.

Permian-Triassic magnetostratigraphy in the Karoo Basin of South Africa

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The end-Permian witnessed what probably was the greatest biotic crisis in the Phanerozoic to present day history of life. Until recently most of what was known about the Permian-Triassic boundary (hereafter revered to as the PTB) came from almost exclusively marine successions in Europe and Asia. However, more terrestrial successions have since come to light, and although a major extinction has been recognized in these, some crucial questions related to the timing of the event have remained unanswered. The Karoo Supergroup is host to a unique (in terms of completeness and remarkable fossil preservation) Gondwanian terrestrial record of the PTB. Overlap of biostratigraphic ranges and lack of geochronological constraints have made the exact placement and correlation of the PTB extremely difficult. Stable isotopes have been applied to solve this problem with varying degrees of success due to diagenetic overprinting and multiple spikes. The lithostratigraphic methodology of Ward et al. (2000) proved much more successful in constraining the boundary but still left questions about timing unanswered.

We report here a summary (and current status) of magnetostratigraphic results from the Karoo Basin that has systematically been gathered over the past 4 years. Detailed magnetostratigraphic studies across the presumed PTB in the Karoo succession at localities in the north and especially the south of the main Karoo Basin reveal three magnetic chrons in a R/N/R pattern. The marine extinction took place in a reversed chron close to a R/N boundary (Scholger et al., 2000). The Karoo magnetostratigraphy coupled with the biostratigraphic (despite current disagreement among the paleontological community concerning the placement of the boundary) and the well-established lithostratigraphic framework has important and far reaching implications for the timing and cause of the Permian-Triassic mass extinction.

References

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