

Melting of an enriched lithology on the SE Indian Ridge and possibly other ridges from Pb-Th-U isotopes

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Our recent studies of compositional variations along the eastern Southeast Indian Ridge (SEIR; i.e. east of Kerguelen and Amsterdam-St. Paul hotspots) reveal along-axis gradients in (²³⁰Th/²³²Th) and Th/U (κ), with high (²³⁰Th/²³²Th) and low κ values occurring along the western SEIR, and low (²³⁰Th/²³²Th) and high κ in the east near the Australian-Antarctic Discordance. Similar along-axis gradients are observed in other mantle tracers such as time integrated Th/U (κ_{Pb} ; calculated from the radiogenic component of measured ²⁰⁸Pb/²⁰⁴Pb and ²⁰⁶Pb/²⁰⁴Pb [1]), as well as ³He/⁴He [2]. But κ_{Pb} variations are much smaller than κ variations and they converge to $\kappa \approx \kappa_{Pb} \approx 4.0$ in the east; in the west $\kappa \ll \kappa_{Pb}$. The high κ and κ_{Pb} endmember sits on the geochron, indicative of a long time integrated history of coherent Th-U-Pb abundances as a closed system at roughly the Bulk Earth value.

These along-axis chemical gradients indicate that melts of the enriched, high Th/U, mantle dominate eastern SEIR MORB and, moving west, are variably mixed to a lesser degree with melts of a relatively low Th/U, depleted MORB mantle-like (DMM) component. The highest κ and κ_{Pb} , lowest ³He/⁴He lavas are also lower in (²³⁰Th/²³⁸U). Melt modeling using the constant upwelling rate applicable to this portion of the SEIR suggests that the high Th/U mantle melts much more extensively and/or rapidly than the DMM component. It therefore has the potential to dominate other radiogenic isotope and incompatible trace element compositions of MORB in the region, even if it comprises a volumetrically smaller fraction of the mantle.

Similar κ and κ_{Pb} values are highly unusual in MORB, but do rarely occur at some hotspots, such as Reunion [3] and Samoa [4], indicating that mantle with this composition is not unique to the eastern SEIR. It may even exist beneath other ridges, allowing one to speculate that such mantle may play a role in melt supply fluctuations along other ridge systems that are not easily rationalized by upwelling rate variations.

[1] Mahoney *et al.* (2002) *J. Petrology* **43**, 1155-1176.

[2] Graham *et al.* (2001) *Nature* **409**, 701-703. [3] Vlastelic *et al.* (2006) *EPSL* **248**, 379-393. [4] Sims & Hart (2006) *EPSL* **245**, 743-761.

Sorption characteristics of dissolved organic Phosphorus onto Iron (oxy)hydroxides in seawater

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Sorption of phosphorus (P) onto particulate surfaces significantly influences dissolved P concentrations in aquatic environments. We present results of a study contrasting the sorption behavior of several dissolved organic phosphorus (DOP) compounds and phosphate onto three commonly occurring iron (oxy)hydroxides: ferrihydrite, goethite, and hematite. The DOP compounds were chosen to represent a range of molecular weights and structures, and include: Adenosine tri-phosphate (ATP), Adenosine Monophosphate (AMP), Glucose-6-phosphate (G6P), and Amino Ethyl Phosphonic Acid (AEP).

All DOP compounds and phosphate displayed a decreasing trend of sorption density as a function of the degree of crystallinity of the iron (oxy)hydroxide substrate, with ferrihydrite adsorbing the most, hematite the least, and goethite adsorbing a quantity intermediate between these two end-members. The affinity of phosphomonoesters ATP and AMP exceeded that of G6P, and AEP was intermediate.

Without exception, DOP compounds showed less affinity for sorption than did free orthophosphate. This suggests that in aquatic systems enriched in reactive iron minerals, as suspended particulates in the water column or in benthic sediments, DOP bioavailability may become enhanced relative to orthophosphate. Since uptake of P from DOP requires enzymatic cleavage of orthophosphate, a system enriched in DOP relative to orthophosphate may impact community structure of the ecosystem.