Tracing deep slab recycling via study of boron isotopes of volcanic rocks from hotspot (OIB) settings

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Boron and B isotopes have potential to be among the best tracers of fluids and crustal components in the deep mantle because isotopically light B, strongly fractionated at the slab or isotopically heavy B, imprinted in the wedge could be recycled. Analytical challenges in basaltic rocks are presented by low B concentrations, and only limited high precision B isotope ratios are reported for OIB volcanic suites [1, 2]. Hence B and B isotopes have not been widely used to quantify potential slab and crustal contributions to hotspot magmas. Here we report LA-ICP-MS and TIMS δ^{11}B ratios and SIMS B concentrations for OIB lavas from key hotspot sites representing end-member components of the various mantle reservoirs. The B contents are always low (generally <5 ppm) and the δ^{11}B ratios are as follows: Society Isl. (+1.3 to -7.7‰; n=10); French Polynesia-Samoa Isl. (+2.8 to -9.1‰; n=10); Mt.Erebus/McMurdo Group/Crary Mts. (+2.3 to –10.4 ‰; n=10); St.Helena Isl. (+19 to -3.8‰; n=5); Reunion Isl. (-1.4 to -10.2‰; n=2) and Gough Isl. (-3.9 to -8.1‰; n=7). Interestingly, our new B and B isotope dataset often shows large deviations from currently accepted intraplate B and B isotope values for the deep mantle [3]. We shall evaluate the impact of processes such as assimilation of seafloor-altered basement and ancient subduction-related metasomatism as possible causes for the observed isotope variations. The overall negative B isotope results, combined with mantle-like Sr and Nd isotope ratios, indicate very sufficient and large volume B losses during the initial (shallower) stages of subduction, confirming the fluid mobile nature of this important slab tracer.

[1] Turner *et al*. (2007) *Nature* **447**, 702–705. [2] Tanaka & Nakamura (2005) *Geochim.Cosmochim Acta* **69**, 3385–3399. [3] Chaussidon & Marty (1995) *Science* **269**, 383–386.

Seasonal dynamics of sulfide oxidation processes in Tokyo Bay dead zone sediment

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Sulfide (H_2S) pool in Tokyo Bay dead zone sediment changed dramatically according to the season (Fig. 1). In early fall with hypoxic bottom water, sediment surface was covered with *Beggiatoa* massively, indicating biological H_2S oxidation with NO_3^-. During winter with oxic bottom water, ascorbate-extractable-iron oxide (Asc-Fe(III)), that reflects ferrihydrite (high reactivity towards H_2S, insulative), showed a seasonal maximum, indicating chemical H_2S oxidation with Fe(III). During late fall, oxalate-extractable-Fe(III) (Oxa-Fe(III)), that reflects magnetite (low reactivity towards H_2S, conductive), showed a remarkable increase with a unique pH signature, pH maximum at oxic-anoxic interface (Fig. 2). Those results suggest that the main process for H_2S oxidation during transition period from hypoxic to oxic bottom water was probably bioelectrochemical reactions with O_2. H_2S oxidation processes in Tokyo Bay dead zone sediment are dynamically shifting in response to O_2 conditions in the bottom water.

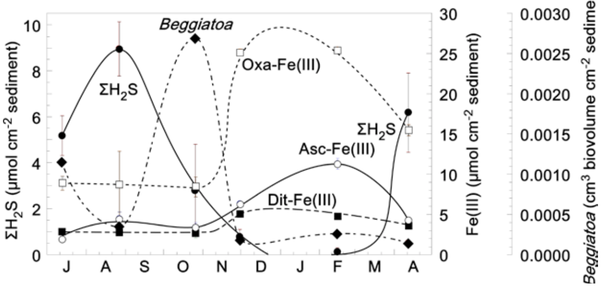

Figure 1: Seasonal changes in depth integrated (0-30mm) pool size of H_2S, *Beggiatoa* and iron oxides in Tokyo Bay dead zone sediment.

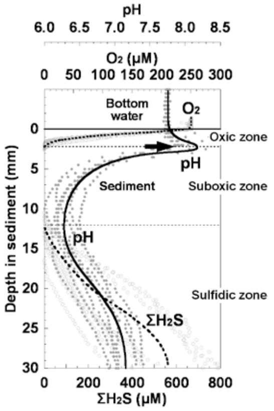

Figure 2: Microprofiles of O_2, pH and H_2S at sediment-water interface during transition period from hypoxic to oxic bottom water (November 30) in Tokyo Bay dead zone sediment.