Fluid-mantle interaction in an intra-oceanic arc: constraints from high-precision Pb isotopes

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We present new isotopic and trace element data for back-arc lavas from the Izu-Bonin arc including high-precision double-spike Pb isotope measurements. Systematic along-arc isotopic variation of lavas has been identified, with coherent isotopic trends for the volcanic front and back-arc volcanoes. Sr isotopes are more radiogenic, while Pb isotopes are less radiogenic in the northern compared to the central part of the arc. This is particularly apparent in the back-arc seamounts. Decoupled variation of Pb and Sr isotopes cannot be explained by variation in the amount of single subduction component.

Almost parallel but distinct trends on Pb-Pb plots imply differing mantle sources in the northern and central sections of the arc. The decoupling of Sr and Pb isotopic variation for both volcanic front and back-arc can be explained by the presence of two mantle components; a MORB source observed in the back-arc basins of the Philippine Sea Plate (e.g. Hickey-Vargas, 1998) and a Pacific MORB-like source. Lesser contribution of Pacific MORB-type source in the northern part of the arc could consistently explain along-arc isotopic variation.

By assuming the regional mantle end-member components, volcanic front magmatism is compatible with having no direct sediment (melt) input, but having 2 to 2.5 % of a fluid derived from sediment and altered oceanic crust in a mixing ratio of about 1:100. In contrast, high $\Delta 7/4$ and low $^{143}Nd/^{144}Nd$ associated with high Th/Ce imply that subducted sediment melt is an important component in the back-arc. The magmatism in the back-arc seamounts is estimated to have 0.2 to 0.3% of sediment melt (bulk sediment) and 0.5% of fluid from altered oceanic crust added to the source for both northern and central parts of the arc.

In the arc where sediment melt is significant as a slab-derived component, slab input could become more significant towards the back-arc for the elements like Nd and Th, while it becomes less significant towards back-arc for fluid-mobile elements.

References

Hickey-Vargas R., (1998), *J. Geophys. Res.* 103. 20963-20979.

Geochemistry of ostracode calcite: Empirical calibration of 3 species from Page Pond, Ohio, U.S.A.

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Ostracode life cycles, shell geochemistry, and associated hydrochemistry were studied over a period of one year in a holomictic oligohaline pond with surface and groundwater inflow in northeastern Ohio, USA. Species and water samples were collected monthly from 5 stations within the pond, including the inlet, the middle, two groundwater inflow sites, and the outlet. Adult and juvenile *Physocypria globula* and *Cipridopsis vidua*, both nektonic species, were found year round. High numbers of adult *P. globula* were found late February - late September, and juveniles were abundant during mid-summer. Large populations of juvenile and adult *C. vidua* were found late May - September. *Candona. crogmaniana* adults (a benthonic species) appeared November – March with juveniles abundant March - October. *P. globula* shell chemistry is consistent with the species moulting to adult stage during the warmest month of August when the water temperature was consistently well above 15ºC. *C. vidua*, on the other hand, moulted to adult stage June – October whenever the water temperature was ≥15ºC. The shell chemistry of *C. crogmaniana* is consistent with its becoming adult during the cold months (November – March?) but reflecting its infaunal habitat within groundwater inflow sites, shows a large scatter in $\delta^{18}O$, Mg/Ca and Sr/Ca values. Thus the fossil shells of *P globula* are a record of the hydrochemical environment that prevailed when water temperature was well above 15ºC. Because *C. vidua* juveniles undergo the final moult whenever water is =15ºC, the species is likely to have short life cycles during those time periods, and the individuals that become adults in October overwinter until May when the reproductive cycle resumes. Thus the fossil shells of *C. vidua* record a range of hydrochemical conditions that existed during those time periods when water temperature was ≥15ºC. For a mid-latitude temperate locality such as northeastern Ohio those conditions occur 5 to 6 months of the year whereas in warmer climates those conditions may be met year-round. This suggests that the fossil shells of *C. vidua* (and possibly of *P. globula* as well) should only be analyzed as large pooled samples to obtain some sort of averaged paleoenvironmental information. Nektonic ostracode species are more likely than benthonic species to track overall hydrochemical conditions of the water body.