K080-003 Room: C402 Time: May 31 9:21-9:33

Along-arc variation of mantle characteristics beneath the Izu-Bonin arc -Constraints from high-precision Pb isotopic study-

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We present new high-precision Pb isotope data by the double-spike method for back-arc volcanics from the northern and middle parts of the Izu-Bonin arc and discuss the spatial variation of the mantle source heterogeneity, together with the effects of slab input.

The Izu-Bonin arc exhibits wide variation in volcanotectonic features in both along- and across-arc directions. Both the northern and middle sections of the arc have back-arc seamount chains extending for over 150 km in an ENE-WSW direction. Volcanism had been active mainly between 17 and 3 Ma on the back-arc seamount chains. Back-arc rifting initiated at ca. 2.8 Ma and occurs only in the middle part of the arc.

Systematic along-arc variation in magma chemistry is a notable feature of the Izu-Bonin frontal arc and back-arc region. The isotopic variation is coherent between the volcanic front and back-arc. In contrast to Sr isotopes, which are more radiogenic in the north, Pb isotopes are less radiogenic in the north compared to the middle part of the arc (Fig. 1). This is particularly apparent in the back-arc seamount chains. Decoupled variation of Pb and Sr isotopes cannot be explained by variation in the amount of single subduction component and implies that along-arc variation of Pb isotopes is not dominated by slab-derived fluid which controls the variation of Sr isotopes.

Almost parallel but distinct trends on Pb-Pb plots imply differing mantle sources in the northern and middle parts 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. An internally consistent model which explains along- and across-arc isotopic trends can be obtained by assuming mixing between the two mantle sources, but a lesser contribution of Pacific MORB-type source in the northern part of the arc.

Rifting-related volcanism has distinct source from the back-arc seamount chain volcanism, but both early and late stage rifting were fed by a similar source which has a much strong signature of Pacific MORB-type source.

A strong correlation between Sr, Pb isotopes and fluid-mobile element enrichment implies a significant contribution of slab-derived fluid to the source of volcanic front. In contrast, back-arc seamount chain lavas and rifting-related volcanism show limited evidence of fluid phase contribution to their source. Instead, high delta7/4 and low 143Nd/144Nd associated with high Th/Ce, Th/Nb and negative Ce anomalies imply that subducted sediment is an important component in the back-arc. By assuming the above-mentioned mantle end-member components, the relative contribution of subduction-related component can be estimated. In terms of the back-arc seamount chain magmatism, for both northern part and middle part of the arc, 0.2 to 0.3% of sediment addition to the source is estimated. Minimal addition of fluid from altered oceanic crust is also predicted. For the rifting-related magmatism, lower amount of sediment contribution is estimated (0.1-0.2%). Volcanic front magmatism is compatible with having no direct sediment (melt) input, but is likely to involve the contribution of 0.8 to 1 % of a fluid derived from sediment and altered oceanic crust in a mixing ratio of about 1 : 50.

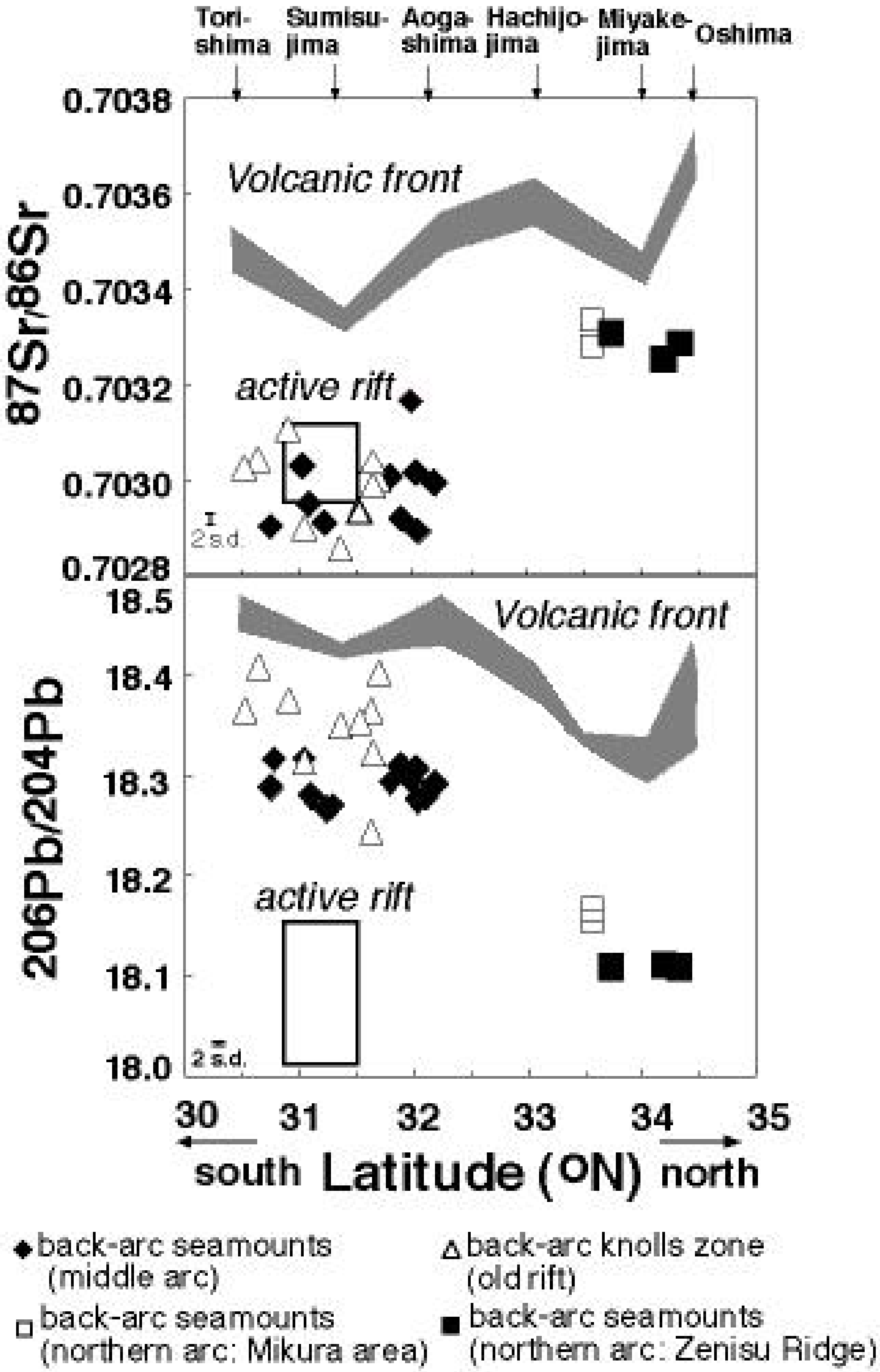

Fig. 1 Along-arc variation of $^{87}Sr/^{86}Sr$ and $^{206}Pb/^{204}Pb$ isotopic ratios. Variation along the volcanic front (Taylor and Nesbitt, 1998) is also indicated for comparison.