

Spatial and temporal variability of magmatism at the northern end of the Mariana Trough - Interactions between arc magmatism and nascent rifting

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The southern end of the Izu-Bonin arc and northernmost part of Mariana arc are characterized by highly alkaline shoshonitic lavas, referred to as the alkalic volcano province (AVP) (e.g., Bloomer et al., 1989; Sun and Stern, 2001; Ishizuka et al., 2007). These compositions are unusual for intra-oceanic arcs. Back-arc and intra-arc rifting forming Mariana Trough is propagating northward through this area, while back-arc spreading and creation of oceanic crust has not begun. This area coincides closely with the location of shear wave speed anomalies in the mantle wedge (Isse *et al.* 2009).

Dredge sampling along the northern tip of Mariana Trough (West Mariana Ridge: WMR) recovered exclusively medium K to shoshonitic basalts. These basalts have significantly higher alkali contents than Mariana Trough basalts, and show clear arc-like signatures. High-precision Pb isotopic analyses reveal that the monogenetic volcanoes form a single trend on Pb-Pb isotopic plots between 2 components, one with lower ²⁰⁶Pb/²⁰⁴Pb and high Δ7/4, and another with high ²⁰⁶Pb/²⁰⁴Pb as well as low Δ7/4 and 8/4 (HIMU-like). These components could correspond respectively to subducted pelagic sediment and subducted HIMU seamounts.

Age of shoshonitic lavas systematically becomes younger toward north. The age of c. 6Ma was obtained at 21.5°N, c. 3 Ma at 23-23.5°N, and zero-age shoshonites occur on Ioto Island at 24.4°N. This implies that shoshonitic magmatism represents the leading edge of rifting and is propagating northward with time. Older (12-10 Ma) rear arc volcanoes west of the WMR are not shoshonitic, but still have higher ²⁰⁶Pb/²⁰⁴Pb compared to the rear arc volcanoes to the north, implying that high ²⁰⁶Pb/²⁰⁴Pb (HIMU-like) subducting component existed prior to onset of alkaline magmatism.

We will test whether alkaline magmatism in this area is caused purely by mantle process associated with rifting or induced by variation of subducting material.

Variations in the redox state of As and Fe measured by X-ray absorption spectroscopy in aquifers of Bangladesh and their effect on As adsorption

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Groundwater contamination by naturally occurring arsenic (As) is a very serious problem. In Bangladesh, household well waters contaminated by As generally show a large variation of As concentration even throughout a small village. This variation creates a difficulty in the design of mitigation strategies. We hypothesized that the concentration of As in each well is controlled by an adsorption-desorption equilibrium between sediment and groundwater. To verify the hypothesis, two factors are focused upon in this study: (i) speciation of As and Fe in the solid phase, and (ii) the adsorption properties of As(III) and As(V) to sediment. Sediment core samples were collected from an As-contaminated aquifer at Sonargaon, central eastern Bangladesh. The oxidation states of As and Fe in the sediments as determined by X-ray absorption near the edge structure (XANES) showed a distinct redox boundary below 5 m from the ground surface, whereas the peak of dissolved As is observed below 15 m. The apparent distribution coefficient ($K_d = C_{\text{solid}}/C_{\text{solution}}$) of As(V) is always larger than that of As(III) at all the depths. A simulated concentrations of As in the groundwater obtained by multiplying the amount of P-extracted As and K_d^{-1} with considering the oxidation state of As is consistent with depth profile of As in groundwater. This suggests that the concentration of dissolved As is strongly controlled by an adsorption-desorption equilibrium between sediment and groundwater. Variation in K_d is basically controlled by oxidation state of As and the concentration of Fe oxyhydroxides. The discrepancy between the depth of the redox boundary and the peak of dissolved As is attributed to the difference in abundance of P-extracted As rather than to a variation of K_d . The adsorption equilibrium model proposed in this study can be applied to the quantitative evaluation of the great variation in aqueous As concentration in groundwater from Holocene aquifers.