Wet and dry basalt magma evolution in Torishima volcano, Izu-Bonin arc, Japan: the possible role of phengite

Y. TAMURA[1] , K. TANI[1], Q. CHANG[1], H. SHUKUNO[1], H. KAWABATA[1] AND R. S. FISKE[2]

[1] IFREE, JAMSTEC, Yokosuka 237-0061, Japan ; tamuray@jamstec.go.jp

[2] Smithsonian Institution, Washington, DC 20560, USA

The frontal volcanoes of Sumisu (31.5°N, 140°E) and Torishima (30.5°N, 140.3°E) in the central Izu-Bonin arc contains low-K basalts originating from both wet and dry basalt magmas (low-Zr basalts and high-Zr basalts, respectively) [1]. These basalts result from different degrees of melting of the same source mantle (~20 % and ~10 % for wet and dry basalt magmas, respectively). Assuming that the wet basalts contain greater abundances of slab-derived components than their dry counterparts, geochemical comparison of these two basalt types permits the identification of the specific elements involved in fluid transport from the subducting slab. Using the abundant geochemical data from Torishima, where the downgoing slab is about 100 km deep, we find that Pb, Ba, and Sr are selectively concentrated in the slab-derived metasomatic fluids below this arc-front volcano, but K and REEs are not. Cs, Rb, Th and U concentrations are variable and are not easy to explain, but these also cannot be explained either by fractional crystallization or by different degrees of mantle melting. We suggest that the K-rich mica, phengite, plays an important role in determining the makeup of fluids released from the downgoing slab. In arc-front settings, where slab depth is =/< 100 km, phengite is stable, and released fluids contain little K. In backarc settings, slab depth is 100-140 km, phengite is unstable, and K-rich fluids are released. We conclude that cross-arc variations of K and Rb are likely related to differing compositions of fluids or melts released rather than the commonly held view that such variations are controlled by the degree of partial melting.

References

[1] Tamura, Y., Tani, K., Ishizuka, O., Chang, Q., Shukuno, H. and Fiske, R. S. (2005) *J. Petrology* **46,** 1769-1803.