Slab controlled petrogenesis of High-Sr intermediate and felsic (adakitic) as a result of the propagating slab tear in a hot subduction system

PINEDA-VELASCO, I. [1*], KITAGAWA, H. [1], NGUYEN[123], T.T., KOBAYASHI, K. [1] & NAKAMURA, E.[1]

[1] Pheasant Memorial Laboratory, Institute for Planetary Materials, Okayama University, 682-0193, Yamada 827, Tottori, Japan (*correspondence: ivan_pineda@okayama-u.ac.jp)

[2] Institute of Earth Sciences, Academia Sinica, Taipei 11529, Taiwan

[3] Department of Geology, Hanoi University of Mining and Geology, Hanoi, Viet Nam

This work presents the K-Ar ages, major and trace element concentrations, and Sr-Nd-Pb isotope data for late Cenozoic volcanic rocks from the Chugoku district, Southwest Japan arc. Andesite and dacite lavas in this region are enriched in Sr (mostly >800 $\mu g \cdot g^{-1}$) and exhibit the geochemical characteristics of volcanic rocks typically referred as “adakites” [1]. K-Ar dating of these lavas revealed that the eruption of high-Sr andesitic to dacitic magmas occurred during the last 2 Myrs, following or concurrent with the eruption of basalt in adjacent regions [2, 3]. Trace-element characteristics of high-Sr andesites and dacites are consistent with the formation of their parent magmas by partial melting of the basaltic layer of the subducting Shikoku Basin [3]. Mass balance modeling of trace element concentrations and isotopic compositions suggests that the parental magmas of high-Sr andesites and dacites are best explained by mixing of partial melts from oceanic crust (F = 5–15%) and sediment (F = 30%) at 80:20 to 55:45 ratios. Spatial coincidence of the occurrences of high-Sr andesites and dacites and seismic gaps of the subducting slab demonstrates the causal link between slab melting and mantle upwelling at slab tears [3]. Therefore, the authors speculate that these tears could have been formed by subduction of ridges on the plate. Finally, a warm mantle upwelled through tears [4], preventing the solidification of the siliceous slab melts in the mantle and facilitating the transportation of these melts to the surface.

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