

Various arc magmas from a common plate slab: Sources and genetic conditions of the coexisting alkali basalts, sub-alkali

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In response to the subduction of the young Shikoku Basin of the Philippine Sea Plate (PSP) slab, arc magmas have been active through the late Cenozoic in the SW Japan arc (<15 Ma). Extremely various magma types occurred including oceanic island-type basalt (OIB), shoshonitic to mildly alkalic to sub-alkalic basalts with arc signatures, high-Mg andesites (HMAs), and adakites. The OIB-type basalt was related to the Japan Sea back-arc basin opening and the rests of the lavas with arc signatures were regarded as the results of re-initiation of subduction and subsequent progressive westward subduction of PSP. However, arguments present in both the origin of the magmas and their tectonic implications. To address these issues, we analyzed 324 lava samples from seven Quaternary volcanoes in the SW Japan arc. Geochemical examinations negated possibilities of the origin of the adakites either from lower crustal melts or fractionated melts from mantle derived basalt. We further investigated the genetic conditions of the entire suite lavas using a geochemical mass balance model, Arc Basalt Simulator version 4 (ABS4). The ABS4 model suggested that the adakites originated from slab melts with minimal interactions to the mantle peridotite. Greater involvement of the peridotite fractions in slab melt-fluxed mantle melting explained fairly well the geochemical variations of shoshonites, alkali to sub-alkali basalts, and HMAs. We thus propose that the various arc magmas in the SW Japan arc originated simply by a common slab melt-fluxed mantle melting mechanism with varied conditions including source materials of the slab melts, mantle melting depth and temperature, degree of melting, and slab melt fractions. Such the volcanism began at ~15 Ma, therefore, such the hot subduction system induced by the subduction of the Shikoku Basin, should have been initiated by the time.

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