Slab morphological evolution underlying volcanic arc: Implications from geochemistry and geochronology of late Cenozoic volcanic rocks in SW Japan

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Southwest Japan arc has been considered to be an atypical island arc due to subduction of young and hot Philippine Sea Plate (PHS). The variable types of volcanic rocks, including ocean-island basalt (OIB), island-arc basalt (IAB), adakite (ADK) and normal island-arc type andesite (IAA), occur in close proximity during the late Cenozoic time [12 million years (Ma) to recent]. However, the genesis of these magmas in relation to PHS slab mophology is still debated. In this study, we detemine K-Ar ages, major- and trace-element concentrations, and Sr-Nd-Pb isotopic compositions of mafic to intermediate volcanic rocks from the Chugoku district, southwest Japan. Two mafic magma types, OIB and IAB, exhibit different major- and trace-element characteristics, including silica saturation and Nb-Ta enrichments. The IAB magma is grouped into two sub-types, based on their enrichments in Sr. The IAB younger than 5 Ma is characterized by higher Sr/Nd ratio than the IAB erupted before 5 Ma. We consider that temporal change in Sr/Nd is resulted from the change in the composition of fluids from the subducting oceanic lithosphere. Similar Sr enrichment is found in ADK andesites and dacites, and the production of high-Sr IAB is interpreted as a result of the interaction between the upwelling mantle and melt with the composition similar to ADK, the inference is supported by the occurrence of high-Sr basalts close to ADK. We propose that tearing of subducting slab began at 5 Ma and propagated with time while the slab melt had significantly metasomatized the wedge mantle during the last 5 Myrs.