The Setouchi high magnesium andesites never the evidence for plume-like active mantle upwelling for the Japan Sea opening

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Several researchers considered that plume-like active mantle upwelling would have opened the Japan Sea. The mantle/melting model for the Setouchi high magnesium andesites, which emphasized partial melting of sediments on the subducting plate, would led researchers to such a hypothesis. The mantle/melt reaction model for the Setouchi HMAs, however, have significant incompleteness. (1) There is no successional and petrographical evidence indicating the HMA magmas would have been significantly hydrous. (2) The HMAs associate with basalts in some localities, such as Shodoshima. The mantle/melt reaction model requires an unrealistic temperature variation such as larger than 150 °C at 1GPa to explain the association of basalts and HMAs in Setouchi. (3) Geochemical features are considered to be strong evidence indicating contributions of sediments on the subducting slab to the HMA magma genesis. SW Japan, however, is composed of accretional prisms. Geochemistry could not distinguish which contributed to the HMA magma genesis, subducting sediments on the slab or accreted sediments at the deeper part of the crust. Therefore, an alternative model for the HMA magma genesis was proposed (Mashima, 2009). The alternative model proposed that HMA magmas would have been formed partial melting of relatively anhydrous mantle involving accreted sediments at low pressures such as 0.5 GPa. Accumulations of geological, geophysical and petrological observations support the low-pressure and anhydrous partial melting model for the Setouchi HMAs. The subducting slab inferred from deep earthquakes is absent beneath Shodoshima, which indicates that the slab would not extend there even at the present day. Geophysical observations along the Muroto, where the youngest part of Shioku Basin subducts, indicate that all of sediments on the slab accrete to the overriding plate at the present day. Becasue the slab at 14 Ma was young, mechanical coupling between the plates would have been greater than that at the present day. Thus sediments on the slab would have accreted to the overriding plate at that time. Seismic explorations indicate that the MTL striking northern margin of the Sambagawa Belt dips northward to extend to Shodoshima, which indicates that metamorphic rocks originally accreted sediments would essentially constitute the deeper part of the Setouchi crust. This geophysical interpretation is confirmed by xenoliths of partial pelitic schists included in Setouchi volcanic rocks from Osaka. The alternative model needs the thin crust such as 15 km thickness. The San' in folded zone developed in the late Miocene indicates that the Setouchi crust at 14 Ma would have been thinner than that at the present day, which would have enabled the segregation of the HMA magmas at such a low pressure. The alternative model assumed mantle upwelling along 1300 °C adiabat of melting mantle. The Setouchi HMAs do not require their source mantle with abnormally high temperature. The HMAs are not the evidence for a plume-like active mantle upwelling for the Japan Sea opening.

