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Geochemical modeling towards a comprehensive understanding of high-Mg andesite formation in the Setouchi volcanic belt

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Possible mechanisms for production of mantle-derived, high-Mg andesite magmas, including (1) partial melting of mantle wedge peridotites by addition of aqueous fluids from the subducting lithosphere and (2) partial melting of the subducting sediments and the altered oceanic crust and subsequent melt-mantle interaction, were examined by geochemical formulation of dehydration, partial melting and melt-solid reactions. The modeling results demonstrate that both mechanisms can reasonably explain the incompatible trace element characteristics of high-Mg andesites in the Setouchi volcanic belt, SW Japan. However, simple hydrous melting of mantle wedge peridotites cannot elucidate Sr-Nd-Pb-Hf isotopic compositions of such andesites. By contrast, the latter mechanism, which is consistent with thermal structures beneath the Setouchi volcanic belt, can well reproduce the isotopic signature of those high-Mg andesites.