Geochemistry and genetic conditions of primary boninites from the Ogasawara (Bonin) Islands and the Oman Ophiolite

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Both the Izu-Ogasawara (Bonin)-Mariana (IBM) Arc and the Oman Ophiolite preserve the entire geological records of intra-oceanic subduction initiation and arc evolution. Specifically primitive boninite sequences provide the evolutionary history of thermochemical structure of the wedge mantle. We have investigated melt (glass) inclusions enclosed by boninite-derived chrome spinel grains in beach sand, called “uguisu-zuna” from Ogasawara islands, and in wadi sand from the Oman Ophiolite. Glass inclusions in spinel have more Mg-rich compositions than aphyric whole rocks, indicating their primitive nature since derivation from the source mantle, which experienced least modification by the processes such as crystal fractionation, and assimilation and contamination by the crust. Volatile measurements of melt inclusions confirmed that they were only slightly degassed and retain primitive contents. Five geochemical types (BIC-1~5) are identified among boninites from the Ogasawara Islands and a single geochemical type from the Oman Ophiolite. Both Ogasawara and Oman low-Si boninites show lower H2O contents than high-Si boninites. Assuming that the most magnesium-rich melts of each geochemical type in Ogasawara and Oman boninites coexisted with olivine and orthopyroxene, the P-T conditions of these primary boninite magmas were estimated by using the ol-liquid and ol-opx-liquid geothermobarometers [1]. High-Si boninites erupted on the Ogasawara Islands during 48-46 Ma were generated at 1400-1440 °C and 0.7-0.9 GPa, whereas the subsequent low-Si boninite at 45 Ma formed at 1380-1400 °C and 0.8-0.95 GPa. This suggest that the geothermal gradient descended from 48 Ma to 45 Ma. On the other hand, low-Si boninite from the Oman Ophiolite was generated at 1320 °C and 0.5 GPa. Hence, it is apparent that the wedge mantle beneath the proto-IBM arc was significantly hotter than that in the Oman paleoarc.

[1] Putirka (2008) Reviews in *Mineralogy*, **69**