Was high-silica boninite originated from ancient recycled slab?

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Primitive melt inclusions in chrome spinel from the Ogasawara Archipelago comprise two discrete groups of high-SiO_2, MgO (high-Si) and low-SiO_2, MgO (low-Si) boninitic suites with ultra-depleted dish- and V-shaped, and less depleted flat rare earth element (REE) patterns. The most magnesian melt inclusions of each geochemical type were used to estimate the genetic T-P conditions for primary boninites, that range from 1421 degC-0.85 GPa to 1345 degC-0.56 GPa for the 48-46 Ma high-Si and low-Si boninites, and 1381 degC-0.85 GPa for the 45 Ma low-Si boninite. The T-P conditions for the low-Si boninites lie on an adiabatic melting path of depleted mid-ocean ridge basalt mantle (DMM) with a mantle potential T (MPT) of 1420 degC, which is in agreement with that of the primary proto-arc basalt (PAB) magma preceding boninites. However, this MPT contradicts the high temperatures for the high-Si boninite magma generation. This discrepancy can be reconciled if the depleted proto-boninite source already existed with the PAB source before the subduction began. With the rise of the PAB source, the refractory harzburgite ascended without melting, and hence retained its high temperature. At 48-46 Ma, introduction of slab fluids caused remelting of the high-T harzburgite and PAB residue, resulted in the high-Si and low-Si boninites, respectively.

The presence of refractory high-Si boninite source is supported by the unradiogenic Os isotopic compositions of chrome spinel derived from high-Si boninite in Ogasawara and harzburgite drilled in the Izu Forearc, which experienced melt extraction in Proterozoic age. The Proterozoic depleted harzburgite megaliths at a depth of around 100 km are most likely recycled slab, which was subducted and stagnated in the transition zone below Rodinia, and was brought up to the base of the continental lithosphere with the ascent of the super plume either during the rifting of Rodinia, or later Gondwana, and was drifted away with the continental fragments and is now spread sporadically below the Pacific and Indian plates.