Extremely hot plume origin of ultramafic lava in the late Paleogene accretionary prism from Shizuoka, Japan

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We measured major element compositions of spinel inclusions and their host olivine phenocrysts in the ultramafic lava blocks embeded in the late Paleogene accretionary prism, Setogawa belt, from Shizuoka, Japan. Bulk rock major and trace element compositions were also analyzed. These lavas are porphyritic with ca. 25-52 vol.% of olivine phenocrysts. They are classified into meimechaite-komatiite with MgO = 19.0-31.6 wt.%. Olivine control line well explains bulk rock compositional variation of the lavas. Trace element concentration patterns are OIB and/or LIPs-like and different from MORB- and arc picrites. Olivine phenocrysts reveal high-Mg# [=100Mg/(Mg+Fe)] up to 92.8. Al_2O_3 content in olivine incrases up to ca. 0.11 wt. % with increase of Mg#. CaO content in olivine is high with ca. 0.3 wt.%, indicating their igneous origin. Al_2O_3 and TiO_2 contents and Cr# [=100Cr/(Cr+Al)] in spinel are ca. 15 wt.%, 1.5 wt. % and 50-70, respectively, which is similar to the those in OIB. Al-in-olivine geothermometer (Coogan et al., 2014) was applied to estimate the crytallization temperature of olivine phenocrysts. The estimated temperatures increased with increasing Mg# of olivine. The maximum temperature is ca. 1486 ºC for olivine with Mg# of 92.8, which is comparable to the highest temperature estimated for LIPs olivine. We estimated the melting P-T condition for the primitive melt of the lavas, by using the methods of Ichiyama et al. (2014) and Lee et al. (2009), to be ca. 7.5 GPa and ca. 1742 ºC. This P-T condition almost coincides with dry solidus of garnet lherzolite and also consistent with the results of Al-in-olivine thermometry with considering cooling during adiabatic ascent from the depth. Nb/Zr-Zr/Y systematics is well explained by ca. 5-10% batch melting of BSE-like lherzolite with small amount of residual garnet. The potential temperature (T_p) is estimated to be 1626-1649 ºC, which is ca. 200 ºC higher than average ambient mantle and near highest value for LIPs and Ocean Islands. The estimated T_p indicate that the extremely hot mantle plume ascended beneath Pacific plate from near CMB depth at the late Cretaceous-early Tertiary period.