Experimental Melting Study of Basalt-Peridotite Hybrid Source

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Magma genesis in prodcutive mantle plume may be largely influenced by recycled oceanic crust component involved in the mantle plume (e.g., Hawaii; Hauri et al., 1996; Takahashi &Nakajima., 2002; Sobolev et al., 2007). Therefore, understanding the melting processes in the basalt/peridotite hybrid plume source is very important. In order to figure out the geochemistry of recycled component as well as their melting process in the plume, and study the density change of such recycled crust during upwelling process of plume, we conducted a series of high-P, high-T experiments.

Hybrid melting experiments were performed under 2.9 GPa with Boyd-England type piston-cylinder (1300~1540°C for dry experiments, 1400~1500°C for hydrous experiments), 5-8GPa with Kawai-type multi-anvil (1300~1650°C for dry experiments, 1350~1550°C for hydrous experiments). Spinel lherzolite KLB-1 (Takahashi 1986) was employed as peridotite component. Two basalts were used as recycled component: Fe-enriched Columbia River basalt (CRB72-180, Takahashi et al., 1998) and N-type MORB (NAM-7, Yasuda et al., 1994).

In dry experiments below peridotite dry solidus, melt compositions ranged from basaltic andesite to tholeiite. Opx reaction band generated between basalt and peridotite layer hindered chemical reaction. On the other hand, alkali basalt was formed in hydrous run products because H_2O promoted melting process in both layers. Compaed with melts formed by N-MORB peridotite runs, those layered experiments with CRB are enriched in FeO, TiO_2, K_2O and LREE at given MgO. In other words, melts produced by CRB-peridotite layered experiments are close to alkali basalts in OIB and tholeiite in Hawaii, while those by layered experiments with N-MORB are poor in FeO, TiO_2 and LREE than tholeiite in Hawaii. Thus we propose that Fe-rich Archean or Proterozoic tholeiite (BVSP 1980) would be a possible candidate for recycled component in OIB and Hawaiian plume.