Melting phase relations and element partitioning in MORB to deep lower mantle conditions

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Meltign of MORB material atop the CMB has long been discussed in relation to the nature of seismically observed ultralow-velocity zones. We then carried out melting experiments in a pressure range from 35 to 140 GPa based on laser-heated diamond-anvil cell techniques at BL10XU of SPring-8 in order to determine melting phase relations and element partitioning.

We then examined the quenched sample to determine the chemical compositions of partial melt and all the constituent minerals by using FE-EPMA and FE-ATEM for major and minor elements and LA-ICP-MS for trace elements.

Melting textures show that Ca-perovskite (CaPv) as the liquidus phase at all pressures investigated to 140 GPa. Second liquidus phase was then found to be $CaCl_2$-type SiO_2 phase at 70 GPa, followed by Mg-perovskite. Similar observation was found at 101 GPa [1]. At 140 GPa, SiO_2 phase was then found to convert to the first phase to melt likely [2] as a result of post-perovskite phase transition leading to increase of its melting temperature. However, melt formed by 51 wt.% partial melting was still ultrabasic in composition and became depleted in SiO_2 of 42 wt.% and highly enriched in FeO of 17 wt.% contrary to the resent in-situ observations [2]. Obtained CaPv/melt partition coefficients (*D*) for Na and K indicate monotonically increase with pressure to reach more than unity at 140 GPa showing compatible nature. On the other hand, D_{Sm} and D_{Nd} slightly decrease with pressure with the crossover of D_{Sm}/D_{Nd}. This is likely due to the pressure induced change in PC-IR relations.

[1] Pradhan *et al.* (2015) *Earth Planet. Sci. Let.* **431**, 247-255. [2] Andrault *et al.* (2014) *Science* **344**, 892.