

Genesis of high-Ni olivine phenocrysts of the Dali picrites in the Central Emeishan large igneous province

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The Emeishan Large Igneous Province (ELIP) is considered as one of the typical mantle plume-derived LIPs. The picrites formed at relatively high temperatures in this ELIP provide one of the important lines of argument for the role of mantle plume. Here we report trace element data on olivine phenocrysts in the Dali picrites from the ELIP. The olivines are Ni-rich, and characterized by high (>1.4) $100 \times \text{Mn}/\text{Fe}$ value and low (<13) $10000 \times \text{Zn}/\text{Fe}$ value, indicating a peridotite dominated source. Since olivine-melt Ni partition coefficient ($K_D \text{Ni}^{\text{ol/melt}}$) will decrease at high temperature and pressure, the picrites derived from peridotite melting at high pressure and which crystallized olivines at lower pressure can generate high concentrations of Ni in olivine phenocrysts, excluding the necessity of a metasomatic pyroxenite contribution. Based on the Al-in-olivine thermometer, olivine crystallization temperature and mantle potential temperature (T_p) were calculated at $\sim 1491^\circ\text{C}$ and $\sim 1559^\circ\text{C}$ respectively. Our results are $\sim 200^\circ\text{C}$ higher than that of the normal asthenospheric mantle, and are consistent with the role of mantle thermal plume for the ELIP.

Keywords: Emeishan large igneous province, Picrite, Olivine, Trace element geochemistry, Mantle plume

