Petrogenesis of picrites from the Emeishan large igneous province

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We have done a detailed study of the Dali picrites from the Emeishan large igneous province to investigate the magmatic processes prior to eruption. Petrographic observations, combined with whole rock geochemical characteristics, indicate that the compositional variation observed in the Dali picrites is dominated by variable accumulation of a wehrlitic assemblage, which are transported by low MgO carrier melts to the surface. Groundmass clinopyroxenes were produced by crystallization of the carrier melts. In contrast, compositions of olivine-hosted melt inclusions and clinopyroxene macrocrysts indicate that the olivine and clinopyroxene macrocrysts crystallized from diverse melt batches and are genetic related to the carrier melts, which are consequence of magma mixing.

The major and trace element compositional ranges of melts in equilibrium with clinopyroxene macrocrysts with Mg# <88 are similar to that of melt inclusions hosted in olivine macrocrysts with equivalent forsteritic (Fo) values, while the ranges of melts crystallizing clinopyroxene with Mg# >88 are smaller than that of the melt inclusions hosted in olivine crystals with equivalent Fo values. This observation can be explained by the fact that major elements and trace elements are coupled during partial melting. A process involving periodical magma replenishment, tapping, and fractional crystallization in the magma chamber(s) can be explain the compositional variation recorded in the Dali macrocryst assemblage. The macrocrysts are genetically related to their carrier melts appears to be common to many primitive mafic rocks, which may reflect common deep magma chamber processes whereby diverse mantle-derived melts are injected and evolve, and the primitive macrocrysts thus formed are subsequently transported by the mixed liquid, producing macrocryst-bearing primitive mafic rocks.