

Experimental liquid lines of descent for low-Ti and high-Ti basalts of the Emeishan Large Igneous Province, SW China

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We present a full investigation of the liquid lines of descent of high-Ti and low-Ti magma series of the Emeishan large igneous province (Emeishan LIP). A stepwise experimental approach was used to reproduce fractional crystallization with the objective to understand the effect of starting compositions, crystallization sequences, and fO_2 on the formation of Fe-Ti-V and/or Ni-Cu-(PGE) ore deposits in the Emeishan LIP.

Synthetic high-Ti and low-Ti picritic starting compositions were selected from a compiled database of Emeishan lavas. Experiments were carried out in one-atmosphere gas-mixing furnace (CO-CO₂ gas mixtures) from 1330 to 1120 °C under the QFM buffer (quartz-fayalite-magnetite) and QFM+2. The crystallization sequences of high-Ti magmas in step-1 (1330–1160 °C) are olivine + spinel ± augite at both two fO_2 , whereas those of low-Ti magmas are olivine + spinel ± augite ± plagioclase. The occurrence of plagioclase quickly increased the crystallinity in low-Ti magmas with cooling. The step-2 (1200–1120 °C) experiments were carried out using starting materials synthesized from residual melt composition produced at 1170 °C of step-1. The crystallization sequences of high-Ti and low-Ti magmas are augite + pigeonite + plagioclase ± Fe-Ti-oxides.

Overall, the results of the experiments are in good agreement with the mineralogy of natural rocks and minerals compositions observed in Emeishan LIP. Differentiation of high-Ti picritic magmas produces compositions that are comparable with the proposed parental magma compositions of the Fe-Ti oxides bearing intrusions (liquidus at ~1200 °C with Mg-number ~ 52; Pang et al., 2008). More oxidizing conditions of the parental magmas may contribute to the early saturation of Fe-Ti oxides.

References:

Pang et al., (2008) *Contrib Mineral Petrol.*, 156(3): 307–321.