

Geochemical characteristics of Limahe intrusion in Pan-Xi district (SW China): relation to Emeishan basalts and constraint on ore genesis

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The Limahe mafic-ultramafic intrusion, is one of a number of Cu-Ni sulfide deposits in Pan-Xi district (SW China). The Limahe body is also temporally and spatially associated with Emeishan basalts and is composed of peridotite and gabbro-diorite, in which peridotites occur in veins intruding gabbro-diorite, and all Cu-Ni sulfide ores are hosted in peridotites, suggesting Cu-Ni ores and peridotites were formed later than gabbro-diorite. Major element, trace element and Sr-Nd isotopic geochemical characteristics are reported. Age-corrected ($^{87}\text{Sr}/^{86}\text{Sr}$)_t and $\epsilon_{\text{Nd}}(t)$ isotope values, ranging from 0.687062 to 0.709298 and from -0.6 to -4.13 respectively, are partly overlap the field of Emeishan basalt and OIB, but all lie between upper crust and OIB generally having trend towards upper crust. The extremely low ($^{87}\text{Sr}/^{86}\text{Sr}$)_t can be attributed to strong alteration effects. The similar chondrite-normalized REE patterns and primitive mantle-normalized trace element patterns to ELIP imply the genetic relation with Emeishan basalt. However, remarkably negative Nb, Ta and Ti anomalies exist on the primitive mantle-normalized patterns, characterizing crustal contamination. The lower Nb/U (<30), $(\text{La}/\text{Nb})_{\text{PM}}$ and $(\text{Th}/\text{Ta})_{\text{PM}}$ ratios (<1) indicate the contamination of the upper crust material. Moreover, the diagram of $\log(\text{Th}/\text{Yb})_{\text{PM}}$ vs. $\log(\text{Ta}/\text{Th})_{\text{PM}}$, in which the Limahe intrusion exhibits relatively high $(\text{Th}/\text{Yb})_{\text{PM}}$ and low $(\text{Ta}/\text{Th})_{\text{PM}}$ values, also supports the same conclusion. The extent of crustal contamination of the Limahe rocks estimated by Nd isotope data was estimated to be within 8.2 to 15.0%. Good correlations between MgO and major element oxides suggest the fractional crystallization of olivine, clinopyroxene and minor plagioclase in the deep-seated chamber. Therefore, upper crustal contamination would increase SiO₂ contents or lower FeO contents, which was the trigger for formation of the immiscible sulfide melts. The denser sulfide melts drop down the bottom of magma chamber. Thus, the immiscible sulfide melt was forced out of the deep-seated chamber, and then flowed along the structural fracture, intruded gabbro-diorites.