

The Plume Source As Characterized by Trace Elements in Olivine

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Trace elements in high Fo (>87) olivines suggest that three plumes (Hawaii, and the Emeishan and Deccan Large Igneous Provinces, or LIPs) are unlikely to carry core-derived material. While Ni is enriched at Hawaii compared to the EPR, Emeishan and Deccan fail to show a Ni-enrichment. In addition, the LIPs are enriched in Co, while Hawaii is not, and none of the three plumes are enriched in other light or moderately siderophile elements (LMSE; e.g., Ga, V or Zn). And while both LIPs are enriched in Mn, Hawaii has less Mn than at the EPR. Given these inconsistent LMSE enrichments, it is difficult to ascribe Ni enrichments at Hawaii or elsewhere to a core or core-reacted component. However, our high Fo olivines reveal distinct plume enrichments in Ti and Cr at all three plume localities. We also see LIP (but not Hawaiian) enrichments in Sc and Cu. Enrichments in Ti and Cr are not easily explained by a pyroxenite source, as bulk partition coefficients are about double those for a peridotite mineralogy. But neither is it clear that Ti and Cr can be explained by partial melting. We tentatively conclude that high Ti and Cr characterize a deep mantle source, close to where plumes nucleate (and so common to all plumes), and that LIP-restricted enrichments (Cu, Sc, and Na at both LIPs; Zn and Al at Emeishan) reflect LIP-distinct sources or processes that cannot be generalized to the mantle as a whole.