3-7 GPa trace-element partitioning in Fe-rich picrites

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Mineral-melt partition coefficients (*D* values) have been determined in garnet and clinopyroxene run products, generated in 3 to 7 GPa, 1425-1750°C experiments [1] on a high-Fe mantle melt (ferropicrite) from the Paraná-Etendeka continental flood basalt province [2]. *D* values for both garnet and clinopyroxene decrease with increasing temperature but are less dependent on pressure. At 3GPa, $D^{cpx/liq}$ values for pyroxenes in garnet-pyroxenite run products are generally lower than those reported from Ca-rich pyroxenes generated in melting experiments on eclogites and basalts but higher than those for Ca-poor pyroxenes from peridotites. Sub-liquidus garnet-liquid *D* values for light and heavy rare-earth elements are ≤ 0.07 and > 0.8, respectively, and are similar to those for peridotitic garnets that have comparable grossular but higher pyrope contents. 97SB68 Garnet-liquid partition coefficients for light rare-earth elements are higher, whereas those for heavy rare-earth elements are lower than those for eclogitic garnets which generally have higher grossular contents but lower pyrope contents.

We present simple melting calculations involving anhydrous peridotite and garnet pyroxenite as contributing mantle source regions for high-Fe picritic magmas. These suggest that the high-Fe mantle melts, such as those in the Paraná-Etendeka province, were most likely generated by ~70% partial melting of garnet pyroxenite (with a clinopyroxene:garnet ratio of 25:75) at 5 GPa and ~1630°C. Beneath regions of un-extended continental lithosphere (~125 km thick) the melt contribution from peridotite is very low and has only a mild effect on the major- and trace-element garnet-pyroxenite signature. Variations in rare-earth element ratios of worldwide anhydrous high-Fe mantle melts reflect differences in the degrees of partial melting and/or the garnet:clinopyroxene ratio in the source. Our findings are consistent with those of previous geochemical and experimental studies on ferropicrites that have invoked melting of 'blobs' of re-fertilised peridotite in an upwelling mantle plume.

References

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