Behaviour of Ir in chromite-saturated silicate melt - experiments and LA-ICP-MS analysis

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Whenever chromite is concentrated in a fractionating silicate melt, the refractory PGE (Os, Ir, Ru) are also enriched. In podiform chromitite deposits in ophiolites Os, Ir, and Ru may be enriched relative to primitive mantle by up to a factor of 100, and stratiform chromitite horizons in layered intrusions can host these elements in the high ppm concentration range. Whether the enrichment is chemical, i.e. by PGE substitution into the chromite lattice, or controlled by physical processes such as heterogeneous nucleation of PGE phase on chromite surfaces is unknown; fact is that Os, Ir, and Ru in chromite cumulates occur as discrete alloys and high-temperature sulfides rather than in solid solution in chromite.

We are presently examining experimentally the behaviour of Ir in chromite-saturated silicate melts. Starting material is a picrite composition enriched with 15 wt.% $FeCr_2O_4$ and 5 wt.% Ir as Ir_2O_3. In order to grow chromite grains sufficiently large for in-situ contamination-free trace element analysis, the polymerization degree of the silicate melt is lowered by adding about 15 wt.% lithium tetraborate to the picrite. P-T conditions are 1.5 GPa and 1470°C. All runs are carried out in graphite capsules for up to 6 h. Run products are clear, blue-green silicate glasses with abundant chromite microliths up to 45 µm across. Ir_2O_3 is reduced to metal and is crystallized as micron-sized Ir-Fe alloys, preferentially attached to the corners and edges of chromite grains. LA-ICP-MS analyses of chromite-glass pairs are carried out with a New Wave ArF excimer laser coupled to a single-collector magnetic sector ICP Finnigan Element II mass spectrometer. Isotopes recorded are ^{29}Si, ^{52}Cr, ^{53}Cr, ^{57}Fe, and ^{193}Ir. Count rates are normalized to the isotope ^{57}Fe. Contamination of chromite analyses by silicate is corrected for by subtracting from the chromite spectra the proportion of silicate glass as monitored by the ^{29}Si isotope. Preliminary results suggest that contrary to previous suggestions [1], Ir is rather incompatible with the chromite lattice. The high and variable $D_{Ir}^{chromite\text{-}melt}$, reported by Righter et al. [1] to lie between 5 and 22000, are likely caused by Ir nuggets that nucleated heterogeneously on chromite surfaces.

References

[1] Righter K., Campbell A.J., Humayun M., Hervig R.L. (2004) *GCA* **68,** 867-880.