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Osmium-rich alloys and Ru-Os sulphides from podiform chromitites at Unst (U.K.) and Guli (Russia): constraints from mineral chemistry and osmium isotopes

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This study presents chemical and Os-isotope compositions of Os-rich sulphides and alloys (laurite-erlichmanite series (RuS_2–OsS_2), Ir-Os and Os-Ir alloys) derived from oceanic (Unst, UK) and subcontinental (Guli, Russia) ultramafic complexes, which contain small bodies of podiform chromitite associated with dunite.

The investigation employed a multi-technique approach and utilized a number of analytical techniques, including electron microprobe analysis, ID ICP-MS after high pressure acid digestion and LA MC-ICP-MS.

A 'primary' euhedrally shaped (up to 110 μm in size) platinum-group mineral (PGM) assemblage mainly composed of laurite, osmian iridium and iridian osmium occur as solitary or composite inclusions in chromite. The preponderance of laurite and Os-rich alloys is consistent with a negatively sloped chondrite-normalized platinum-group elements (PGE) pattern, typical of podiform chromitites from mantle sections for globally distributed dunite-harzburgite massifs. At Unst, the osmium isotope results identify 'unradiogenic' $^{187}Os/^{188}Os$ values for 'primary' PGMs (e.g., 0.12043–12558 with median of 0.12441, n=33), being within uncertainty of the chromitite composition (0.1240 ± 0.0006). At Guli, the Os-isotope systematics of iridian osmium and chromitite also show compatible 'unradiogenic' values ($^{187}Os/^{188}Os = 0.1243 \pm 0.0001$ and $^{187}Os/^{188}Os = 0.1242 \pm 0.0004$, respectively).

The observed similarity in the initial Os-isotope composition between chromitite and PGMs suggests that the whole-rock Os-isotope budget is largely controlled by Os-rich alloy and sulphide, supporting the conclusion for a common near-to-chondritic source for the PGE. The study was partly supported by the Uralian Branch of RAS (grant 12-P-5-1020) and RFBR (12-05-01166).