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

I.Yu. Badanina (1), R.A. Lord (2), K.N. Malich (1), T.C. Meisel (3), and H.M. Prichard (4)
(1) Institute of Geology and Geochemistry, the Uralian Branch of Russian Academy of Sciences, Ekaterinburg, Russia (dunite2009@rambler.ru), (2) University of Teesside, Middlesbrough, U.K. (r.lord@tees.ac.uk), (3) University of Leoben, Leoben, Austria (thomas.meisel@unileoben.ac.at), (4) University of Cardiff, Cardiff, U.K. (hazel@hprichard.freeserve.co.uk)

This study presents chemical and Os-isotope compositions of Os-rich sulphides and alloys (laurite-erlichmanite series (RuS₂–OsS₂), 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’ \(^{187}\text{Os}/^{188}\text{Os}\) 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 \((^{187}\text{Os}/^{188}\text{Os} = 0.1243 ± 0.0001 and ^{187}\text{Os}/^{188}\text{Os} = 0.1242 ± 0.0004, respectively)\).

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).