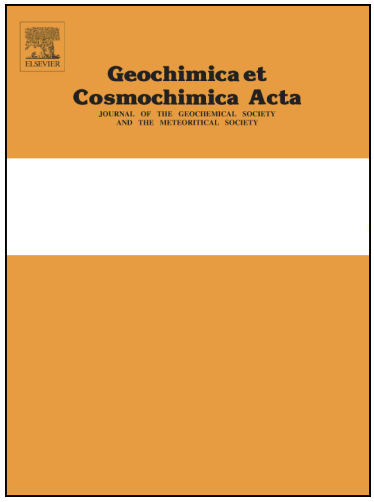

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Paragenesis of multiple platinum-group mineral populations in Shetland ophiolite chromitite: 3D X-ray tomography and in situ Os isotopes

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Key words:- PGM, PGE, Chromite, X-ray computed tomography, laurite, Shetland ophiolite.

Abstract

Chromitite from the Harold's Grave locality in the mantle section of the Shetland ophiolite complex is extremely enriched in Ru, Os and Ir, at µg/g concentrations. Volumes were collected on micro-cores from these chromitites using high-resolution X-ray computed tomography have been processed to determine the location, size, distribution and morphology of the platinum-group minerals (PGM). There are five generations of PGM in these chromitites. Small (average 5 µm in equivalent sphere diameter, ESD) euhedral laurites, often with Os-Ir alloys, are totally enclosed in the chromite and are likely to have formed first by direct crystallisation from the magma as the chromite crystallised. Also within the chromitite there are clusters of larger (50 µm ESD) aligned elongate crystals of Pt-, Rh-, Ir-, Os- and Ru-bearing PGM that have different orientations in different chromite crystals. These may have formed either by exsolution, or by preferential nucleation of PGMs in boundary layers around particular growing chromite grains. Thirdly there is a generation of large (100µm ESD) composite Os-Ir-Ru-rich PGM that are all interstitial to the chromite grains and sometimes form in clusters. It is proposed that Os, Ir and Ru in this generation were concentrated in base metal sulfide droplets that were then re-dissolved into a later S undersaturated magma, leaving PGM interstitial to the chromite grains. Fourthly there is a group of almost spherical large (80 µm ESD) laurites, hosting minor Os-Ir-Ru-rich PGM that form on the edge or enclosed in chromite grains occurring in a sheet crosscutting a chromitite layer. These may be hosted in an annealed late syn- or post magmatic fracture. Finally a few of the PGM have been deformed in localised shear zones through the chromitites.