PLATINUM AND PALLADIUM MINERALS IN CHROMITITES FROM THE MANTLE-CRUST TRANSITION ZONE AT OUEN ISLAND (NEW CALEDONIA)

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INTRODUCTION

Podiform chromitites hosted by mantle tectonites in ophiolitic complexes are relatively poor in PGE (usually below 1 ppm) and show negative-sloped, chondrite-normalized PGE patterns (are enriched in Os, Ir and Ru relative to Rh, Pt and Pd). On the other hand, some few chromitites located in the mantle-crust transition zone (hosted by cumulate mafic rocks) exhibit higher PGE contents and positive-sloped, chondrite-normalized PGE patterns (are enriched in Pt and Pd relative to Os, Ir and Ru). A set of these chromitites occurs in the Ouen Island, in southernmost part of main New Caledonia island. They are small in size (few meters long and some centimetres wide), contain up to 10 ppm Pt+Pd and are associated with wehrlites, plagioclase-wehrlites and pyroxenites overlaying the mantle series.

MINERALOGY OF PLATINUM-GROUP ELEMENTS

The Ouen Island chromitites contain a complex and unusual assemblage of platinum-group minerals (PGM), characterized by the abundance of Pt and Pd phases. The most abundant are Pt-Fe alloys [isoferroplatinum (Pt_3Fe), tetraferroplatinum (PtFe)], undetermined Pt-Fe oxides and complex Pt-Pd-Fe-Cu-Rh-Ni, Pt-Ir and Rh-Pd alloys. Other frequent PGM are malanite (Pt_2CuS_4), cuproiridsite (Ir_2CuS_4), cooperite (PtS), braggite [(Pt,Pd)S], Pt-bearing pentlandite and an unknown (Pt,Ir)S mineral. Minor PGM are sudburyite (PdSb), potarite (PdHg), honshiite (PtCu), Cu-bearing Pd tellurides and native Pt and Pd. These Pt and Pd minerals occur associated with other PGM like laurite (RuS_2), erlichmanite (OsS_2), (Ru, Rh, Pt)-bearing pentlandite, native Ru, Os and Rh, irarsite (IrAsS), hollingworthite (RhAsS), prassoite (RhS) and some unknown Os, Ir, Ru and Rh sulfides and alloys, as well as with Cu-Fe sulfides and Fe-Ni sulfides, arsenides, sulpharsenides and alloys. All these minerals are found as small (usually below 10μm across), isolated, biphase or polyphase grains included, mainly in chromite (in fresh and altered chromite) but also in open fractures of chromite and in the host silicates.

DISCUSSION AND CONCLUSIONS

This mineral assemblage results from the combination of magmatic processes related to the crystallization of chromite and of late hydrothermal alteration events (mainly serpentinization and probably weathering) developed on cooling. Magmatic parageneses, including isoferroplatinum, cooperite, laurite, etc, are recorded in the fresh, unfractured chromite and, at lesser extent, in anhydrous primary silicate crystals, whereas postmagmatic assemblages occur in fractures of chromite and in the altered zones of the silicate matrix. Serpentinization lowers both fO_2 and fS_2 giving place to partial desulfurisation of primary magmatic sulfides and forming assemblages characterized by S-poor sulfides and alloys (e.g. Pt-Pd-Fe-Cu-Rh-Ni, Pt-Ir and Rh-Pd alloys). Serpentinization fluids (specially during the later stages) could also supply other elements such as As, Hg, Te, Sn and Cu. These late fluids jointly with weathering associated to lateritization could create highly oxidation conditions which favour the formation of PGE oxides.