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An Unusual Occurrence of PGE-bearing Sulphide Minerals in the LG-6 Chromitite Layer at Eastern Chrome Mine, Eastern Bushveld Complex, South Africa

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The Bushveld Igneous Complex (BIC) is one of the most fascinating geological features in South Africa, the largest layered complex of its kind in the world (Clarke et al., 2009). Platinum mineralization in the eastern limb of the BIC is usually hosted within or associated with sulphide minerals that can occur in chromitite layers (e.g. UG-2) or, in the case of the Merensky Reef, within a specific horizon of silicate rocks (Cawthorn, 1999). In the central eastern limb of the BIC, the chromitite layers of the Critical Zone are of paramount importance for both chrome and platinum.
The aim of this study is to describe and explain the succession of the Lower to Critical Zone rocks immediately north of the Steelpoort fault, a major lineament and possible feeder to the eastern limb. This abstract reports on an unusual occurrence of base metal sulphides (pyrite, pyrrhotite, chalcopyrite, pentlandite) and PGE sulphides (laurite, braggite/cooperite) in the LG-6 chromitite layer.
The chromitites in drill core WV-30 are representative of the succession of chromitites in the area. The LG chromitites are well developed and have a maximum thickness of about 1.8 m (LG-6). The MG layers are thin and often tenuous. The UG layers are present and contain platinum mineralization, but are also poorly developed and slender. The origin of PGE mineralization is closely related to the genesis of chromitite and therefore the interrelation of PGE, sulphide and chromite is important to understand for any study involving the chromitites of the BIC.
Previous authors (e.g. Von Gruenewaldt et al, 1986) have concluded that the LG layers are generally deficient in sulphide and in PGEs. The accepted theory is that these rocks lost sulphur after emplacement due to subsequent low-temperature dissolution of sulphide. However, in 4 thin sections of LG-6, grains of pyrrhotite, chalcopyrite and pentlandite with sizes between 50 and 120 μm were found in uncommonly large amounts for LG chromitites. Whole-rock PGE analysis of the LG-6 and LG-7, as determined by ICP-MS analysis after NiS collection, shows Pt, Pd and Ru as the most abundant PGE. Total PGE content is very low (about 0.62 ppm).
A preliminary scanning electron microscope study for platinum mineralization supports PGE analysis results, showing laurite and braggite as the principal PGMs. Laurite contains Ru with minor Os and Ir and was found as discrete grains in chromite. Pt-Pd sulphide (braggite or cooperite) was found associated with base metal sulphide of composition varying between chalcopyrite, pentlandite and pyrrhotite. Between 1 and 2% arsenic and tellurium were found in selected grains. Additional trace minerals of interest include a Fe-Cr-Ni alloy associated with intergranular fractures as well as native bismuth and fluorite. A hydrothermal origin with a reducing ore fluid is suggested for the sulphides.

References

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