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Platinum-group mineral composition and mineralogy of LG6 and LG6a chromitites of the western Bushveld Complex, South Africa

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The Bushveld Complex (BVC) in South Africa hosts the majority of global resources of chromium and platinum group elements (PGE) [1]. A correlation between chromitite seams and PGE is exceptionally well expressed as all chromitite layers carry elevated levels of PGE [2]. Furthermore, the Bushveld chromitite seams show a progressive and massive increase in PPGE (Pt, Pd, Rh) contents up sequence, whereas the IPGE (Os, Ir, Ru) values remain broadly constant or rise only slightly [1,3,4]. This trend coincides with decreasing Cr/Fe of the chromitites resulting in a focus of mining the upper seams, namely the upper group (UG)-2 for PGE and the middle groups (MG)/ lower groups (LG) for chromite. In recent years, companies already commenced extracting PGE from the MGs and LGs as a by-product during and/or after chromite production [5]. However, only few mineralogical studies about the siting of the PGE (in silicates, sulfides or discrete platinum-group minerals (PGM)) in the LGs and MGs are available ([5] and references therein). Furthermore, information about parameters such as variation of the proportions of PGM within the chromitite seams, PGM association and grain sizes are scarce. From a geometallurgical perspective, these fundamental parameters about modal mineralogy and microfabric of the PGM in the chromite ores are crucial.

The purpose of this study is to fill this knowledge gap for the western limb of the BVC by investigating drill cores of the LG6 and LG6a seam from the Thaba mine near Thabazimbi. Currently, the deposit is mined for chromite by CRONIMET Chrome SA (Pty.) Ltd. The study follows systematic studies of Voordouw et al. [6]. More than 60 polished thin sections from three drill cores were analyzed by mineral liberation analysis to determine both, the modal mineralogy and the contained PGM (>100 grains per section in average) as well as base metal sulfides *in-situ*. This work was complemented by detailed analysis of the PGM, base metal sulfides (pentlandite, pyrite, pyrrhotite) and silicates by electron probe microanalyzer. The PPGE-bearing minerals include various Pt-Pd-Rh sulfides and -alloys as well as a significant amount of PPGE arsenides, bismuthides, and antimonides. IPGE are bound in laurite as well as sulfarsenides with various composition. The PGM are associated with sulfides as well as chromite and minor silicates. Grain-sizes are typically small (below 10 µm, usually c. 5 µm and smaller). Furthermore, feed, concentrate and tailings from the Thaba mine processing plant were investigated to estimate the mineralogical controls on the distribution of the PGM during chromite processing.

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