

## Paradigm shifts in understanding the Bushveld Complex

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The Palaeoproterozoic Bushveld Complex is the major world producer of platinum (73%), rhodium (80%) and chromium (46%) and second largest producer of palladium (39%) and vanadium (35%). Economic concentrations of PGE-Ni-Cu are hosted in the UG2, the Merensky Reef, the Platreef and the Waterberg Reefs. Chromium is sourced from the LG, MG and UG chromitite layers of the Critical Zone, whilst vanadium-bearing magnetite is derived from the Upper Zone.

Research of the last ten years has cast doubt on several established views including: that the B1 magma was parental to the Lower and Critical Zones, as Mg-rich olivines with Mg#93 cannot have been derived from a B1 magma.

For the Platreef of the northern limb, the recognition of multiphase sills, each with a distinct PGE-Ni-Cu budget, Pt-Pd ratio and tenor appears to preclude an 'uppers' model as a mechanism for PGM concentration. At depths in excess of 500 m, the Platreef dip flattens allowing the more undisturbed lithologies to be potentially correlated with the Critical Zone elsewhere in the complex. Only part of the upper sill may be correlatable with the Merensky Reef of the eastern and western limbs.

Strontium isotope studies of the chromitite layers from LG6 upwards have suggested a crustal contamination component was involved in thick chromitite formation, a concept that cannot be ignored in models for the formation of these chromite-rich layers.

In the Waterberg PGE deposit of the far northern limb, Bushveld aged rocks extend for >17 km north of the known exposures of the Bushveld Complex. A lower reef occurs in an ultramafic troctolite-harzburgite basal unit, whilst an upper reef occurs close to the Main Zone-Upper Zone boundary, challenging ideas as to which magma carried the PGE elsewhere in the complex. Both of these reefs are Pd dominated with significant gold in the upper reef. Neither of these mineralised reefs has direct correlatives elsewhere in the complex. In addition, the >20 magnetite layers of the Upper Zone are missing in Upper Zone of the Waterberg deposit north of the Hout River shear zone.