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Magmatic Controls on Platreef Stratigraphy, Northern Limb of the Bushveld Complex, South Africa

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The Platreef, northern limb of the Bushveld Complex, South Africa, is globally renowned as one of the world's largest resources of platinum-group elements (PGEs), with significant additional base metal (Ni, Cu, Co) mineralisation. These metals are essential to the growth of sustainable and environmentally friendly technologies, particularly within the electric automotive industry, a market which is expected to grow exponentially in the coming decades.

The Platreef has PGE grades comparable with the Merensky Reef of the eastern and western limbs of the Bushveld, typically 3-4 g/t (Pt + Pd + Rh + Au), but can increase to 15 g/t. The mineralisation is also present over a much greater thickness, tens of metres, compared to <1 m in the Merensky Reef, along with substantially more Ni-Cu-Co in the form of magmatic sulfides. Better understanding the stratigraphy of the Platreef, both in terms of along strike and down-dip variations, is vital for understanding the controls on grade formation, developing genetic and exploration models, which will aid the prediction of the locations of economically important horizons.

The Platreef is thought to have formed via the emplacement of discrete magmatic units or sills, each with their own metal budgets, thicknesses and geochemical characters. Studies have used bulk geochemistry, Ni:Cu and Pd:Pt ratios, mineralogy and platinum group mineral assemblages to differentiate between these packages in the southern and central sectors of the limb. This study uses downhole major and trace element geochemical data to identify and correlate discrete magmatic units at various locations in the central sector of the Platreef. Several units are identified which can be correlated up dip towards the footwall contact to the north east. The control that this primary magmatic stratigraphy exhibits on grade distribution has been examined, with some units carrying considerable grade, compared to negligible grade in others.