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Petrogenesis of the PGE Mineralized Mafic-Ultramafic Sills on Uitloop Farm, Northern Limb

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The concept of Platreef-style mineralization has reshaped exploration perspectives, highlighting PGE and sulfide precipitation enrichment beyond discrete stratabound layers in the northern limb of the Bushveld Complex. Recent borehole investigations in the western Uitloop area unveiled PGE-enriched mafic-ultramafic sills nestled within the Transvaal Supergroup metasediments, alongside the Uitloop II intrusion of lower zone affinity. The complex interfingering contacts and composite structure of the sills, encompassing ultramafic subunits, present a significant challenge in assigning them to either the Platreef/critical zone offshoots or marginal sills. Their differentiated and locally layered nature favours the former option, supported by occurrences of uneven lenses and seams of chromitites, characteristic of the Platreef body.

Geochemical data and the elevated proportion of interstitial plagioclase further indicate a CZ/Platreef affinity for the mafic-ultramafic sills. Correlation arrays of Cr# (0.6–0.83) vs. Mg# (0.12–0.39) for chromites from the Uitloop sills and the main Platreef body, suggest a similar type of contaminated magma, akin to that parental to the Platreef chromitites. The relatively moderate PGE-enrichment of Uitloop chromitites and marginal-style mineralization align with the characteristics of the lower, contaminated portions of the main Platreef body. Multiple S isotope compositions of sulphides from magmatic and contact metamorphosed sedimentary rocks indicate the involvement of crustal S in the formation of Ni- Cu-PGE mineralization in the LZ and Platreef sills at Uitloop. The elevated $\delta^{34}\text{S}$ values (+3.1 to +12.9‰) and mostly near-zero $\Delta^{33}\text{S}$ values of Uitloop LZ and Platreef magmatic sulphides on Uitloop suggest S derivation from Paleoproterozoic sedimentary sulphates of the upper Duitschland Formation rather than from Archaean dolomites and shales, consistent with earlier conclusions based on the multiple S isotope data for neighbouring areas.