

Lateral persistence of the Merensky Cyclic Unit and the significance of footwall reconstitution within Normal to Regional Pothole reef types in the Bushveld Complex

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At Northam Platinum Mine, in the Western Limb of the Rustenburg Layered Suite of the Bushveld Complex, South Africa, a regional-scale (km-scale) excursion, or “pothole” structure, commences at the level of the Merensky Reef (Normal Reef sub-facies) and transgresses underlying cumulate lithologies as part of the Regional Pothole Reef sub-facies. At several discrete levels within this sub-facies, the Merensky Cyclic Unit (MCU) becomes conformable to cumulate layering and results in four distinctive Regional Pothole reef types, namely the NP2, P2, FWP2 and FWP1 Reefs. The immediate footwall (<1 to 3 m) to the MCU in Normal and Regional Pothole reef types displays mineralogical and textural evidence for thermal and chemical interaction with the MCU magma, referred to as “reconstitution fronts”, and carry significant PGE grade. In this contribution, we present the results of a petrological and whole-rock geochemical investigation of Normal and two Regional Pothole reef types (NP2 and P2), with a particular focus on the petrogenesis of reconstitution fronts, that was undertaken to test magmatic versus hydrothermal models of PGE mineralization and the potential role of fluids in the formation of the Regional Pothole Reef sub-facies.

The petrology and geochemistry of reconstituted rocks indicates that the erosional surface to the MCU in Normal and Regional Pothole Reef sub-facies at Northam was affected by the influx of the Merensky magma rather than fluid-related processes. Reconstitution occurred in response to thermal and chemical gradients at the local interface between the Merensky magma and variable footwall lithologies (a function of the level of transgression). These observations suggest that the Regional Pothole Reef sub-facies was not a site of significant fluid streaming and that pothole formation was most likely associated with thermo-mechanical erosion. Significantly, the asymmetrical magmatic PGE signature persists from Normal Reef sub-facies into the Regional Pothole Reef sub-facies and indicates that PGE mineralization inherent to the Merensky magma occurred as a drape over a variably eroded footwall surface.