

The Merensky Cyclic Unit and its impact on footwall cumulates below Normal and Regional Pothole reef types in the Western Bushveld Complex

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Abstract The Merensky Reef of the Bushveld Complex occurs in its highest stratigraphic position as a heterogeneous, pegmatitic, feldspathic melanorite bounded by two narrow chromitite stringers at the base of the Merensky Cyclic Unit (MCU). In the Swartklip Facies of the Rustenburg Layered Suite, the occurrence of widespread thermal and mechanical erosion termed “potholing” has led to the subdivision of the Merensky Reef into Normal Reef and Regional Pothole Reef sub-facies. The transition between the two sub-facies occurs where the MCU transgresses the lower chromitite stringer of the Normal Merensky Reef and cuts down into the underlying cumulate lithologies. In the Regional Pothole Reef at the Northam Platinum Mine, several economic reef types are identified, where the Merensky Reef becomes conformable to cumu-

late layering, in particular, to the footwall marker (NP2 reef type) and the upper pseudoReef (P2 reef type). The Normal Merensky Reef, as well as the P2 and NP2 Reefs, contains economic platinum group element (PGE) grades and includes the lower portion of the MCU melanorite and the Merensky Chromitite. Whole rock geochemistry indicates that this package is compositionally identical in Normal, P2, and NP2 Reefs, suggesting that the base of the MCU is a relatively homogeneous drape over both Normal and Regional Pothole Reef regions. However, the lower sections of the three Reefs are variables depending on the depth of transgression of the MCU. In the Normal and P2 reef types, transgression by the MCU was arrested within harzburgites, melanorites, and norites, resulting in coarse, pegmatitic textures in the immediate footwall units. For the NP2 Reef, transgression by the MCU was arrested within leucocratic rocks and resulted in the formation of troctolites below the Merensky Chromitite. These troctolites are characterised by a coupled relationship between olivine and sulphides and by changes in major element chemistry and PGE contents relative to equivalent units in the footwall of the Normal Reef. Along with micro-textural relationships, these features suggest that troctolization of leucocratic cumulates in the NP2 Reef beneath the Merensky chromitite was a result of a reactive infiltration of a chromite-saturated melt and an immiscible sulphide liquid from the overlying MCU, rather than a significant fluid flux from below. In all reef types, the concentration of S defines symmetrical peaks centred on the Merensky Chromitite (and chromitites from pre-existing cyclic units in Normal and P2 Reefs), whereas PGE concentrations define asymmetrical peaks with higher PGE contents in reconstituted footwall rocks relative to the MCU melanorite. This signature is attributable to a magmatic model of PGE collection followed by deposition towards the base of

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