



The Petrography and Geochemistry of the Marginal and Lower Zones, Eastern Bushveld Complex, South Africa

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There is still no clarity about the relationship between the Marginal Zone and the entire Bushveld Complex, or the emplacement and differentiation of the magmas involved at the earliest stage. The Marginal Zone norites have conventionally been regarded as the lowest part of the Rustenburg Layered Suite. How the Marginal Zone and the Lower Zone are related is yet to be understood and this has been inadequately studied due to poor exposures and concealed contacts. The main debates have been about the nature of the plagioclase-rich Marginal rocks and whether or not they are representative of a parental magma composition or formed by differentiation from an earlier phase of the intrusion. This work presents preliminary results from a study of a 690 m CH6 borehole that intersects the contact between the Marginal and Lower Zones of the Eastern Limb of the Bushveld Complex.

The stratigraphy of CH6 shows norites at the base of the Marginal Zone section becoming progressively enriched in plagioclase with increasing height. The overlying Lower Zone consists predominantly of orthopyroxenite. The mineral assemblages observed vary from plagioclase + pyroxene in the Marginal Zone to orthopyroxene \pm olivine in the Lower Zone with plagioclase and clinopyroxene present as interstitial phases. This therefore represents a reversal to more primitive compositions. Layering in both zones is expressed mainly by modal variations of plagioclase and orthopyroxene. The two zones show different major and trace element trends suggesting that the two zones did not form from the same liquid. The Marginal Zone norite shows relatively evolved whole rock contents as indicated by Mg#, An content, Cr₂O and NiO with respect to the overlying pyroxenites of the Lower Zone. The data show that both zones were formed through fractional crystallization. The Lower Zone, however, reflects fractionation from a more primitive magma and repeated injection of new magma concurrent with fractionation. The Marginal Zone norite is relatively enriched in incompatible trace elements compared to the Lower Zone orthopyroxenite. As these units make up the lowest exposed part of the Bushveld Complex they provide insight into the compositions of parental magmas and the earliest processes by which the magma chamber of this major intrusion operated.