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Character of the UG2 Chromitite and Host Rocks and Petrogenesis of Its Pegmatoidal Footwall, Northeastern Bushveld Complex*

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Abstract

The UG2 chromitite and its immediate footwall have been mapped at the centimeter scale in a characteristic section exposed in a wall in the Middelpunt mine, northeast Bushveld Complex. In this region the UG2 chromitite and its coarse-grained footwall rocks are underlain and overlain by plagioclase pyroxenite. The UG2 chromitite itself is a massive, 70-cm-thick layer composed of 75 to 90 percent chromite with plagioclase as the dominant interstitial mineral. Immediately beneath the chromitite is the so-called mixed layer, a previously undescribed but distinct, mappable layer, 50 to 70 cm thick, consisting of chromite-bearing pegmatoidal pyroxenite and chromitite intimately mixed at scales of centimeters to decimeters. The mixture is chaotic with no megascopic fabric and contains in bulk about 15 percent chromite. The contact between the mixed layer and overlying chromitite is well defined but sinuous at scales of centimeters to decimeters. Based on observations of drill core and outcrop, the mixed layer appears to exist throughout the central sector of the eastern Bushveld and may be ubiquitous throughout the entire Complex. The mixed layer usually rests directly on the UG2 pegmatoid, which is a well known and widespread pegmatoidal plagioclase pyroxenite. The pegmatoid is much coarser grained than the underlying pyroxenite, but the two lithologic units are similar in terms of mineral modes and compositions. The contact between them is irregular at scales of decimeters to meters, with vertical fingers of pegmatoid extending into the pyroxenite. The mixed layer and UG2 pegmatoid contain rare lenses of massive anorthosite encased by continuous, centimeter-thick rims of chromitite.

A model is proposed to account for the footwall sequence of the UG2 chromitite. In this model, the UG2 pegmatoid formed when hydrous, interstitial melt percolated up through the partially molten crystal pile, accumulated beneath the preexisting, compacted, massive chromitite, and metasomatized and partially melted the pyroxenite protolith, which upon cooling recrystallized to a coarse-grained rock. On the basis of published experiments illustrating the effect of water on melting in mafic systems, it is shown how the hydrous melt was able to penetrate the pyroxene-bearing assemblages below the chromitite but unable to partially melt the chromitite itself, which in consequence remained relatively impermeable. The anorthosite lenses in the pegmatoid mark local areas of relatively high degrees of hydration partial melting, with the anorthosite representing the crystalline residue. The mixed layer formed by gradual collapse of the base of the UG2 chromitite into the less dense, relatively fluid footwall. The mixed layer and UG2 pegmatoid are diagnostic of the UG2 chromitite, and the three lithologic units should be considered a single petrologic unit.

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