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Thin Stringers of “Reaction” Chromitite in the Upper Critical Zone, Eastern limb of the Bushveld Complex

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The use of chromite as a petrogenetic indicator for magmatic systems has long been known (Irvine, 1967) and the repetition of thick chromitites within the Lower Critical Zone (LCZ) and Upper Critical Zone (UCZ) of the 2.055 Ga old Bushveld Complex provides an insight into the origin of layering. The abundance of chromite in the LCZ/UCZ is greater than consistent with suitable parental magmas; chromite may have been injected as crystal slurries during replenishment (Eales and Costin, 2012). Thin chromitite stringers excluded from the numbering system MG3, UG2 etc occur in the UCZ, typically at the contact between ultramafics and anorthosite. The appearance of dark-coloured grains as if etched on a rock face is striking. The possibility of chromite forming as a reaction feature was described by Lee



Reaction chromitite stringer at contact of feldspathic orthopyroxenite (base) and anorthosite (top).

et al. (1983) from a study of the Boulder Bed, Rustenburg, in which stringers occur on the base of spherical bodies of orthopyroxenite. Many of the chromitite stringers are a fundamental component of the UCZ and can be laterally persistent over many km. A well known example occurs at the base of an anorthosite layer located between the MG2 and MG3 (photograph). This stringer demarcates the boundary between the LCZ and UCZ. The regular, dimpled form is characteristic, as is the occurrence of disseminations and schlieren of chromite (derived from the overlying MG3 layer?)

within the anorthosite. Some stringers constitute single grains, in which cases contacts are planar. An unusual example of a reaction chromitite occurs on the edge of a sill-like body of dunite (Fo_{85}), an offshoot of the Driekop pipe (Scoon and Mitchell, 2009). The dunite was intruded between layers of norite and anorthosite; the chromitite occurs on the dunite-anorthosite contact.

Chromitite stringers are important marker layers in the uppermost part of the UCZ of the Winnaarshoek section, Eastern Limb, where they occur between layers of feldspathic orthopyroxenite and anorthosite. A stringer at the *upper* contact of the Bastard Reef (which has not been described before) is the highest occurrence of chromitite in the intrusion. The chromite in the stringers reports

relatively low Cr/Fe ratios. Many stringers contain abundant grains of PGM, as well as badd eleyite, zircon, rutile, and (very scarce) corundum. The unusually anorthositic composition of the plagioclase (An_{85-90}) is significant. Stringers are ascribed to a magmatic process whereby new injections of ultramafic magma were contaminated by partial melting of anorthosite. This reaction triggered crystallization of chromite. As many stringers occur at the upper contacts of layers of feldspathic orthopyroxenite (that in turn may contain thick layers of chromitite), rather than basal contacts, we suggest this is consistent with replenishment of ultramafic magmas via either sills (=layers) or vertical conduits (=pipes). In the case of both layers and pipes, noritic-anorthositic wall rocks predate formation of chromitite stringers.

References:

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