Paper Number: 244

Hypothesis of non-sequential injection of PGE-rich ultramafic sills in earlier-formed noritic cumulates at Akanani (Platreef), Northern Section of the Bushveld Complex: Evidence from new Sm-Nd isotopic data

Scoon, R.N.[1]

[1]Department of Geology, Rhodes University, Grahamstown, South Africa (rnscoon@iafrica.com)

The stratabound Platreef Unit, which is restricted to the northern limb of the Bushveld Complex, differs from the thin, stratiform reef-deposits of the western and eastern limbs as mineralization is spread across a relatively thick sequence of ultramafic and noritic lithologies. Despite this, many physical attributes of the Platreef are replicated in the Merensky Reef and low-grade Pseudo Reef units. In all three units, PGE are preferentially associated with well-defined layers of harzburgite or orthopyroxenite, together with localized (thin) chromitite layers or stringers [1]. The Akanani section is well-suited to a detailed study as it reveals a relatively thick sequence and is sufficiently removed from the floor contact as to avoid disruptions from dolomite xenoliths. An intriguing feature is the complex intercalation of lithologies with compositions that include noritic (norite, gabbronorite, websterite) and ultramafic (orthopyroxenite, harzburgite, chromitite) components. Many of these rocks occur in well-defined layers but subtle textural differences have hindered core logging; thus some reports reveal a generalized column with little reference to the layering. There are multiple ore-layers within the Platreef Unit at Akanani, but the bulk of the mineralization occurs within the Main Mineralized Reef (MMR) [2] The MMR has a variable thickness, incorporates several different rock layers, but is dominated by harzburgite and pegmatoidal feldspathic orthopyroxenite. Subordinate layers of harzburgite are typically well-mineralized at Akanani, but are not necessarily as laterally contiguous as the group of layers comprised within the MMR.

Bulk rock Sm-Nd isotopic compositions have been determined in the Laboratoire Magmas et Volcanoes, St-Etienne, on a batch of 32 samples, mostly from drill-core ZF-01 at Akanani. Data cover the basal part of the Main Zone together with the noritic and ultramafic components of the uppermost 170 m of the Platreef Unit. Preliminary results reveal a range in ε_{Nd} values consistent with multiple injections of three or more discrete magma-lineages. Noritic rocks (tholeiitic magma) crystallized from a different magma-lineage to the ultramafic rocks (ultramafic magma). This is consistent with the hypothesis promulgated primarily by Andrew Mitchell [1,2] i.e. sequences of norite, gabbronorite, and websterite were fractionally crystallized from numerous replenishment episodes of tholeiitic magmas *prior* to being punctured at various heights by sill-like injections of ultramafic magmas. The timing of the episodes of magma replenishment is not revealed, but the possibility of the column arising from magma-lineages injected alternatively is remote. A spike in values enables the primary (anomalously PGE-rich) magma responsible for the MMR at Akanani and the Merensky Reef at Winnaarshoek, eastern limb (unpublished data), to be fingerprinted. They have similar ε_{Nd} values.

The hypothesis whereby PGE-rich ultramafic magmas responsible for mineralized reefs were injected non-sequentially is consistent with field relationships in many areas of the intrusion, including Winnaarshoek where the relatively thin Merensky Reef Unit is sandwiched between layers of norite-anorthosite tens of m thick. The bifurcation of harzburgite layers (they are bounded top and base by

chromitite stringers) in the Pseudo Reef Unit is also significant. An additional component of this hypothesis, as described in earlier contributions, is the possibility that two of the lithologies with enigmatic textures interlayered with reefs, pegmatoidal feldspathic orthopyroxenite and anorthosite are a consequence of partial melting and recrystallization of wall rocks (leuconorite and melanorite, respectively) to the sills.

References:

[1] Mitchell A A and Scoon R N (2007) Economic Geology 102: 971-1009
[2] Mitchell A A and Scoon R N (2012) South African Journal of Geology 115: 535-550