

High resolution CA-ID-TIMS U-Pb dating of the Rustenburg layered suite: Out of sequence layering in the upper critical zone?

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The Rustenburg layered suite (RLS) of the Bushveld igneous complex is a lopolithic sill complex about 450 km in diameter and up to 9 km thick. Field observations of the stratigraphic sequence of cyclic units support the long-held interpretation that the RLS was deposited as a continuously upward-aggrading sequence of igneous cumulate layers at the floor of a sill-shaped magma chamber.

U-Pb ID-TIMS zircon and baddeleyite data have been obtained from cyclic units intersected through 823 m of drill core from the Western Bushveld RLS, near Rustenburg. Zircon grains were pretreated by chemical abrasion [1] and multiple zircon analyses in each of five samples overlapped with individual analytical uncertainties of $\sim 0.01\%$ in their $^{207}\text{Pb}/^{206}\text{Pb}$ ages. The five samples represent the Main Zone (MZ), Merensky Reef (MR), Upper Group 1 (UG1), Middle Group 4 (MG4), and Middle Group 2 (MG2) units. With the exception of the UG1 unit, all dated samples fall within 0.275 Myr of 2056.59 Ma, in agreement with a preliminary 2056.4 Ma age for the UG2 obtained by similar methods on two zircons in our lab [2]. However, our zircon and baddeleyite data indicate that the UG1 pyroxenite has an age that is ~ 0.57 Myr older with a minimum age gap of 0.2 Myr at the 2σ confidence level. All of our dated samples from the Critical Zone crystallized in < 1 Myr. This conflicts with a previous report of a 4 Myr hiatus between the UG2 and MR units [3].

If the UG1 unit is at least 0.2 Myr older than the underlying layers, then our new ages present the possibility that the RLS was emplaced, at least in part, as a stack of separate sills rather than deposited as sequential layers, as is generally supposed. Complex cross-cutting relations in the UG1 may support this possibility.

[1] Mattinson (2005). *Chem. Geol.* **220**, 47-66. [2] Liu (2013), unpublished BSc thesis, University of Toronto, 41 pp. [3] Scoates, Wall, Friedman, VanTongeren, Mathez (2012), *Min. Mag.* v. **76**, p. 2348.