

Michiel O. de Kock, Livhuwani Ravhura, Clarisa Vorster, Nicolas J. Beukes, and Ashley P. Gumsley, 2016. Constraining the Timing of the Molopo Farms Complex Emplacement and Provenance of Its Country Rock. *Acta Geologica Sinica* (English Edition), 90 (supp.1): 78.

Constraining the Timing of the Molopo Farms Complex Emplacement and Provenance of Its Country Rock

Michiel O. de Kock^{1*}, Livhuwani Ravhura¹, Clarisa Vorster¹, Nicolas J. Beukes¹, and Ashley P. Gumsley²

¹ Paleoproterozoic Mineralization Research Group, Department of Geology, University of Johannesburg, PO Box 524 Auckland Park, 2006, Johannesburg, South Africa;

² Department of Geology, Lund University, Sölvegatan 12, SE 223 62 Lund, Sweden

The Molopo Farms Complex (MFC) is a 13000 km² layered, mafic-ultramafic intrusion straddling the southern border of Botswana with South Africa. It does not outcrop due to Cenozoic cover, but is believed to intrude the sedimentary succession of the Neoarchean to Paleoproterozoic Transvaal Supergroup. This is based on numerous intersections in exploration drillcore. The emplacement of the MFC is currently poorly constrained by an unpublished Rb-Sr date of 2044 ± 24 Ma. It is however, widely considered to be related to the Bushveld Large Igneous Province or LIP. Here the U-Pb zircon provenance of sedimentary country rock to the MFC as well as U-Pb baddeleyite geochronology of the mafic-ultramafic rocks of the MFC are reported. Samples for this study originate from eight boreholes from both the southern and northern limbs of the MFC.

The youngest concordant U-Pb ages of detrital zircon grain populations within 6 analysed samples are dominated by ages between 2018 ± 39 Ma and 2276 ± 19 Ma. These do not allow for conclusively distinguishing between characteristic provenance of either the Olifantshoek Group or the Transvaal Supergroup.

U-Pb ID-TIMS dating of four fractions of baddeleyite yield a free regression upper intercept age of 2052±16 Ma, with a negative lower intercept and relatively high MSWD

of 4. However, one of the analyses resulted in a younger $^{207}\text{Pb}/^{206}\text{Pb}$ date compared to other fractions. A weighted mean of all the fractions is 2052±4 Ma, while the weighted mean of the three oldest fractions is 2055±3 Ma, which illustrates this problem. Rejecting the youngest analysis gives a free regression upper intercept date of 2060±6 Ma. The lower intercept points toward discordance associated with the Karoo LIP, and lowers the MSWD to 0.36. Upon forcing regression through 180 Ma, an upper intercept date of 2057±3 Ma, with a MSWD of 0.38, is achieved. This is interpreted as representing the emplacement age for the MFC, and is within error of the age of the Bushveld Complex (i.e., 2054.4 ± 1.3 Ma).

Given the baddeleyite constraints it becomes clear that the sedimentary country rock of the MFC represents the Transvaal Supergroup. What remains unresolved is the possible presence of younger mafic intrusions (e.g., dolerite sills) in the area that are currently wrongfully identified as MFC – as suggested by preliminary geochemical data. Some of these intrusions may likely intrude into sedimentary successions younger than the Transvaal Supergroup, which would explain the presence of younger U-Pb detrital zircon age populations in some of our samples.

* Corresponding author. E-mail: mdecock@uj.ac.za