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sello mashabela

University of the Witwatersrand, Geosciences, South Africa (sello.mashabela@students.wits.ac.za)

EVIDENCE FOR NEOARCHAEOAN EXTENSIONAL FAULTS IN THE VREDEFORT DOME, SOUTH AFRICA

Sello MASHABELA, Kim A.A HEIN, Roger L. GIBSON, Musa S. MANZI

School of Geosciences, University of the Witwatersrand, Private Bag 3, Wits 2050, South Africa.

The Vredefort Dome is an approximately 80-90 km wide impact structure, situated 120 km southwest of Johannesburg in South Africa. The dome is a preserved centrally uplifted region of an ancient 250-300 km wide multi-ringed crater that formed at 2.02 Ga. The ancient crater underwent 5-10 km of erosion to expose the Vredefort Dome, allowing for unique study of the deeper levels of the impact crater.

The Vredefort Dome is composed of a 40 km wide core, bounded by a 20-25 km wide collar. The core is wholly composed of Mesoarchaean basement gneiss (ca. 3.1 Ga), and the collar is made up of mid-amphibolite to lower greenschist facies supracrustal rocks (ca. 3.0-2.2 Ga).

Fault development in the collar has largely been attributed to the impact, except for two fault systems. The two exceptions have been described as pre-impact faults, with apparent strike-slip displacements up to 3 km. It is the focus of this study to distinguish pre-impact structures from impact-related structures.

Ortho-photographs, satellite images, and field mapping have shown that pre-impact faults were listric in character, and associated with second order accommodation faults. The main fault is associated with a 20 m wide zone of pseudotachylitic breccia. Most of the pseudotachylitic breccia in the dome has been attributed to the impact, so these faults were possibly associated with earlier pseudotachylite generation. Cleavage associated with the listric faults is displaced by impact-related faults, confirming the existence of two deformation events in the dome.

The geometry of the listric faults is similar to those observed in the West Wits Line and West Rand gold-fields (55 km north of Vredefort Dome), which have been modelled by Manzi et al. (2012, a, b; submitted) using 3D seismic techniques. The authors attribute the development of listric faults (or a rift-like system of faults) to crustal extension that took place during deposition of Klipriviersberg Group lavas and Platberg Group (2709-2643 Ma) of the Ventersdorp Supergroup. The association potentially means that the Vredefort collar hosts rotated Ventersdorp-age extensional faults or a rift system of faults that predate impact-induced structures.

1. Manzi, M.S.D., Durrheim, R.J., Hein, K.A.A., King N., 2012. 3D edge detection seismic attributes used to map potential conduits for water and methane in deep gold mines in the Witwatersrand basin, South Africa. *Geophysics* 77 (5), 1-16.
2. Manzi, M., Gibson, M. A.S., Hein, K.A.A., King, N., Durrheim, R.J., 2012. Application of 3D Seismic techniques in evaluation of ore resources in the West Wits Line goldfield and portions of the West Rand Goldfield, South Africa. *Geophysics* 77, 1-9.
3. Manzi, M., Hein, K.A.A., King, N, Durrheim, R.J., submitted. NeoArchaeen tectonic history of the Witwatersrand Basin and Ventersdorp Supergroup: New Constraints from high-resolution 3D seismic reflection data. *Tectonophysics*