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Geological evolution of the Aurus Mountains, Sperregebiet Domain, Namibia

Thomas, R.J.¹, Macey, P.H.¹, Spencer, C.² Dhansay, T. ¹ and Lambert, C¹

¹Council for Geoscience, Oos Street, Bellville, 7535, South Africa. bthomas@geoscience.org.za

²Department of Applied Geology, Curtin University, Perth, Australia

The Aurus Mountains form a ~50 km long, NW-trending escarpment ridge plus neighbouring inselbergs in the southernmost Namib desert of SW Namibia. Access to this former diamond mining area (the Sperregebiet) was until recently restricted and as a result the Aurus Mountains have never been geologically surveyed apart from research visits to the Roter Kamm impact crater, the details of which are documented in Miller [1]. The spine of the Aurus Mountains follows a major NW-trending shear zone of the Ediacaran-Cambrian Pan African Gariep Orogen which deforms a variety of older Proterozoic basement rocks. This basement inlier, referred to here as the “Sperrgebiet Domain” of the Namaqua Belt, was mapped as part of a collaborative project between the CGS of South Africa and the Geological Survey of Namibia. We present a new stratigraphy and tectonic history for the area based on field mapping and U-Pb zircon geochronology (Table 1).

The calc-alkaline granodioritic (quartz-diorite/tonalite to monzogranite) orthogneisses of the Wasserkuppe Suite (ca. 2020 Ma) represent the predominant and oldest rocks in the Aurus Mountains. We interpret these gneisses to form part of a ca. 2 Ga “Sperregebiet Arc”. The Wasserkuppe Suite is clearly intruded by alkali granite (Ramansdrift Subsuite) and microgranodiorite (Goodhouse Subsuite) of the Vioolsdrif Suite at ca. 1885 Ma. These younger intrusive rocks are distal representatives of the ca. 250 km wide “Richtersveld Arc” that occurs east of the Sperregebiet and intruded synchronous with amphibolite grade deformation of the Wasserkuppe Suite (the so-called Orange River Orogeny). The arc rocks are overlain by a clastic sedimentary sequence (Aurus Group) of medium- to low grade semi-pelitic to psammitic schist and massive quartzite. The detrital geochronology indicates the metasedimentary rocks were mostly derived from the arc rocks with scant input from Archean sources and younger ca. 1700 Ma detritus, from an unknown source region. Sheets and small plutons of terminal Mesoproterozoic (ca. 1000 Ma) medium-grained grey granite and pegmatite are mapped throughout the Aurus Mountains. These intrusions are correlated with similarly aged S-type granitic intrusions of the Warmbad Suite found for ca. 200 km east of the Sperregebiet and associated with dextral shear zones of the Late Namaqua Orogeny.

The quartzo-feldspathic schist/gneisses dated at ca. 840 Ma are thought to represent metamorphosed felsic igneous rocks of the Richtersveld Igneous Complex which, along with the Gannakouriep metabasic dykes, formed during lithospheric thinning and early rifting of the proto-Gariep basin. Sedimentary rocks of the Gariep Supergroup occur at the margins of the basement inlier and conglomerates show derivation from Meso- to Palaeoproterozoic sources. The Proterozoic rocks are variably deformed by the Pan-African Gariep Orogeny that produced regionally-pervasive fabrics, discrete high-strain shear zones and widespread hydrous retrogression.

Lithostratigraphic Unit	Lithology	Age	Interpretation
Gariiep Supergroup (detrital zircons)	Conglomerate matrix	> ca. 1070 Ma	Meso- and Palaeoproterozoic sources
Richtersveld Suite	Quartzofeldspathic schist/gneiss	841 ± 15 Ma	Meta-rholitic volcanic rocks
Warmbad Suite (3 samples)	Granite (Boesmansberg-type)	1009 ± 14 Ma	Late Namaqua granite
Aurus Group (detrital zircons)	Glassy recrystallised quartzite	> ca. 1770 Ma	Sedimentary rocks post-dating both "Sperrgebiet" and "Richtersveld" arcs
	Psammitic schist	> ca. 1800 Ma	
Vioolsdrift Suite (Goodhouse Subsuite)	Bluish-grey microgranodiorite	1873 ± 20 Ma	Plutonic rocks of the "Richtersveld Arc"
Vioolsdrift Suite (Rammansdrift Subsuite)	Alkali granite (Weissequartzkuppe-type)	1913 ± 38 Ma	
Wasserkuppe Suite	Granitic orthogneiss	2004 ± 84 Ma	Plutonic rocks of the "Sperrgebiet Arc"
	Granite (Roter Kamm-type)	2020 ± 35 Ma	
	Granodiorite orthogneiss	2021 ± 30 Ma	
	Migmatized granodiorite orthogneiss	2028 ± 69 Ma	

Table 1: Lithostratigraphy and age of the Sperrgebiet Domain (green = detrital; pink = magmatic).

Reference:

[1] Miller, R. McG. 2008. The geology of Namibia. Handbook, Geological Survey of Namibia, 3 volumes.

