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The lithostratigraphy and structural components of the Eureka Shear Zone, southern Namibia

Angombe, M[1,2], Macey, P.H.[3], Miller, J.A.[2] and Lambert, C.W.[3]

[1]Geological Survey of Namibia, Windhoek, Namibia
[2]Dept. Geology, University of Stellenbosch, South Africa
[3]Council for Geoscience, South Africa

The newly recognized Eureka Shear Zone (ESZ) in southern Namibia is a Late-Mesoproterozoic to Early Neoproterozoic high strain zone in the Namaqua sector of the Namaqua Natal Metamorphic Province (NNMP). Its current outcrop trace is closely aligned with the previously identified terrane boundary between the Palaeoproterozoic Richtersveld Subprovince and the Mesoproterozoic Gordonia Subprovince (South Africa) or Grunau Terrane (Namibia) [2]. This has raised the question of what this high strain zone represent in terms of its lithostratigraphy and tectonic history. A joint mapping program between the Geological Survey of Namibia and the Council for Geoscience in South Africa, has redefined and clarified aspects of the regional geology and the relationship between different crustal blocks within the Namaqua sector. Chief amongst these are the redefinition of: (1) the Palaeoproterozoic Richtersveld Subprovince into the Richtersveld Magmatic Arc (comprised of the greenschist-facies Vioolsdrif Domain and the amphibolite-facies Pella Domain) in both South Africa and Namibia; (2) the Mesoproterozoic Grunau Terrane into the Kakamas Domain in Namibia; (3) the SW-vergent, subhorizontal Lower Fish River-Onseepkans Thrust (LFROT) that juxtaposes the granulite-facies Kakamas Domain on top of the Pella Domain, and (4) a zone of highly deformed and imbricated units on top of the LFROT that reworks the Kakamas Domain referred to as the Lower-Fish-River-Onseepkans Thrust Zone (LFROTZ) and which also includes unique units not found in the Kakamas or Pella domains [1]. In this study, detailed field mapping, petrography, structural analysis and U-Pb zircon dating on the ESZ was undertaken to understand its relationship to the LFROTZ and the nearby Marshall-Rocks-Pofadder Shear Zone (MRPSZ) with a view to understanding the evolution of the ESZ in the broader context of the Namaqua sector and NNMP. The ESZ is a ~2 to 5 km wide, 50 km long, and WNW-trending zone of high strain. It is dominantly composed of two distinct lithostratigraphic packages: (1) the Eureka Complex (EC) in the north, a heterogeneous sheared garnet-bearing gneiss with isolated m-scale, and lens-shaped remnants of pelitic granulite whose metamorphic grade and detrital zircon patterns correlate this unit to the Kakamas Domain; and (2) fault/thrust-bounded packages of interlayered quartz-feldspar gneiss and amphibolite (MQ), that occur as sigmoid-shaped mega-lenses within the EC and which are correlated to units considered to be unique to the LFROTZ. South of the EC and MQ outcrops, the ESZ shears migmatitic volcanoclastic rocks of the Pella Domain. Petrographic studies indicate that the rocks of the ESZ were affected by retrograde metamorphism at mid to upper greenschist facies during shearing. Fault rocks textures in the ESZ vary from phyllonite to cataclasite dominant, with rarer mylonitic textures. This implies a complex interplay between rheological contrast, slip rate and crustal depth under enhanced brittle to viscous shearing conditions where potassium feldspar is brittle and quartz is viscous. The orientation of the shear fabrics varies with the ESZ but maintains a dominant WNW strike steeply dipping shear foliation accompanied by a NE trending and moderate to steep plunging lineation. The ESZ was intruded by significant volumes of foliation sub-parallel, sheet-like, pegmatite and leucocratic equigranular granite dykes which date at ~1000 Ma and constrain the age of the shear zone. The geometry, age and strain regime of ESZ is similar to the adjacent (MRPSZ) [3], but its lithostratigraphy

reveal the presence of the LFROTZ making the ESZ a younger shear zone exploiting the older terrane boundary between the Kakamas and Pella domain.

[1] Macey, P.H., et al., Explanation to 1:50 000 Geological Map Sheets for 2818 Warmbad sheet.

[2] Blignault, H.J., Van Aswegen, G., Van Der Merwe, S.W., Colliston, W.P., 1983. Geol. Soc. South Africa, Spec. Publ. 10, 1–29.

[3] Lambert, C.W., 2013. MSc dissertation, University of Stellenbosch. 1-128