Strain Localization in a Hot, Lower Crustal Shear Zone: The Lower Fish River Onseepkans Thrust, Namibia

PHILLIPS, N.J.[1] & ROWE, C.D.[2]

[1] noah.phillips@mail.mcgill.ca
[2] christie.rowe@mcgill.ca
Earth & Planetary Sciences Department, McGill University
Frank Dawson Adams Building 402
3450 University Street
Montreal, QC, Canada
H3A 0E8

The widths of crustal-scale shear zones are poorly defined in the lower crust. In the middle-upper crust, shear strain is often localized into relatively thin (metre scale) anastomosing fault cores that make up a fault zone. However, the distribution of strain is harder to map in the lower crust where localization is less intense and healing is accelerated. The Lower Fish River Onseepkans Thrust (LFROT) is a high-strain zone that was active in the Mesoproterozoic (~1.1 Ga) that juxtaposes higher grade rocks to the northeast (T = ~780°C), next to lower grade rocks to the southwest (T = <700°C). In the study area, the high strain zone has a steeply dipping foliation striking NW to NE with an obliquely dipping lineation that generally plunges ~40° to the NE. Macroscopic shear sense indicators show predominantly sinistral, west-side up, east-side down oblique shear sense. Initial pseudosection work has placed the temperature during faulting at ~700°C and 500 MPa. Within the shear zone, anastomosing seams of biotite-sillimanite-garnet schist envelope quartzofeldspathic gneisses, that in turn contain foliated amphibolite boudins, indicating that the schists are weak relative to the other units. The seams of schist range in width from ~1-50 metres. Shear strain was predominantly accommodated by deformation in the pelitic biotite schist, as evidenced by snowball garnets and asymmetrical porphyroclasts. Evidence of shear strain is ambiguous in the other units, where microstructures are predominantly symmetrical. The macroscopic morphology of the LFROT bears many similarities to, and may be analogous to, the anastomosing fault zones in the middle-upper crust, and attests to strain localization in the deep crust.