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The Record of Subduction and Collision along the Southern Margin Zone of the Damara Orogen

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The Southern Marginal Zone (SMZ) of the Damara Belt, exposed in the Gaub Canyon in central Namibia, consists of seven litho-tectonic units of high strain amphibolite facies rock with pelagic, hemi-pelagic and clastic sedimentary protoliths. These rocks are intercalated with lenses of metabasite. Regional high-pressure - low-temperature metamorphic conditions dominated the Southern and Southern Marginal Zones of the Damara Belt, leading to the interpretation that these tectonostratigraphic terrains formed as an accretionary prism along an ancient subduction margin [1].

The structures in the SMZ are the result of progressive deformation, inferred to have initiated under low-grade metamorphic conditions (D_1) and evolved through prograde to peak metamorphism (D_2), ending in relatively low-temperature retrograde conditions (D_3). Each of the deformation phases is characterised by a structural foliation. D_1 is associated with approximately symmetrical layer-parallel extension characterised by disrupted lithological layering and bedding-parallel foliation S_{0+1}. D_2 is defined as deformation related to the formation of an axial-planar S_2 foliation caused by folding of the S_{0+1} fabric. Widespread isoclinal recumbent folds resulted in transposition of these fabrics and the general foliation is thus termed S_{0+1+2}. This composite foliation contains a down-dip L_2 stretching lineation. Folding was contemporaneous with top-to-the-SE directed thrusting in D_2 faults and shear zones that are seen to displace D_1 fabric. D_3 is defined by a crenulation cleavage S_3, at near right angles to S_{0+1+2} foliation. This phase of deformation may also be associated with retrograde, reverse faulting that occurred along some of the D_2 shear zones. The presence, in places, of a sub-horizontal stretching lineation (L_3) is attributed to a component of strike-slip during D_3 deformation.

We relate the deformation phases to processes observed in modern accretionary prisms. In this model, D_1 deformation is associated with underthrusting of marine and trench-fill sediments beneath the accretionary prism. D_2 deformation is attributed to underplating of underthrust sediment by duplex accretion, and occurred under high-pressure, prograde greenschist- to amphibolite-facies conditions. Subsequent isoclinal recumbent folding during bulk shear of the accreted thrust packages generated axial planar S_2 which was transposed with S_{0+1} through progressive deformation. D_3 structures are interpreted to record the change from the accretionary to the collisional phase in the Damara Orogeny. If this is true, then exhumation-related deformation and retrogression of the Khomas accretionary prism was concentrated on discrete D_2 structures, as continental crust entered the subduction zone. As a result, the individual litho-tectonic units that make up the SMZ show very little evidence for the

(probably short-lived) collision between the Kalahari and Congo Cratons and deformation features related to the accretionary phases are remarkably well preserved.

References:

[1] Kukla P A and Stanistreet I G (1991) Geology *19*(5): 473-476