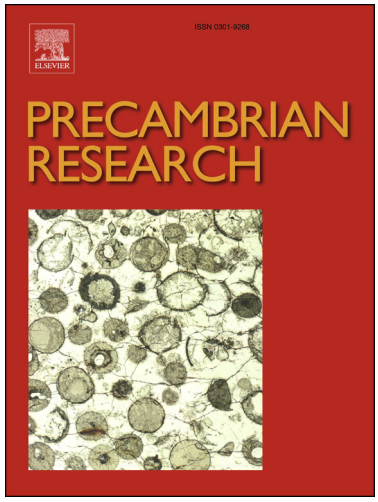

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The Grenvillian Namaqua Fold Belt adjacent to the western Kaapvaal Craton: 2. Archaean Craton and Supercontinent connections

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Key-words: Namaqua-Natal Province, Kaapvaal Craton western edge, Olifantshoek Terrane, Steinkopf Terrane, Kheis Subprovince, Columbia-Kaapvaal Detachment (COLKAD), Rodinia, Columbia

Abstract

The Namaqua sector of the Namaqua-Natal Province consists of large tectonostratigraphic terranes, some of which includes Paleoproterozoic fragments inherited from the supercontinent Columbia. Most of the terranes became part of Rodinia during the Mesoproterozoic Namaqua Orogeny (1.3-1.0 Ga, Grenvillian). The terranes in the western foreland of the Kaapvaal Craton (Kheis Subprovince) form a thin-skin fold and thrust belt (5-15 km depth to sole thrust). Westerly directed thrusting towards the hinterland is reminiscent of thick-skin tectonics, associated with the exhumation of high grade facies terranes, such as the granulitic and migmatitic Grünau Terrane. Upper amphibolite Upington Terrane was thrusted from the west onto thrust sheets contiguous to Kaapvaal Craton, in turn over-ridden near Prieska by the Grünau Terrane. Severity of the ductile deformation is illustrated by regional shear zones, ubiquitous recumbent isoclinal folds and allochthonous mega sheath folds in the Grünau Terrane. Vergence reversal of fold and thrust structures along a narrow (10-20 km) northwesterly trending zone (Vergence Inversion Zone, VIZ), represents a crustal scale pop-up structure coincident with the Namaqua Front, a paired low-high gravity anomaly linked to a mega-scale anticline-syncline pair caused by deep-seated thrusting of the Columbian Moho.

Late Columbian extension (1.6-1.3 Ga, diachronous with early Rodinian events) produced parautochthonous basins with volcano-sedimentary sequences, deformed during the Namaqua Orogeny. Early to mid-Columbian (2.3-1.9 Ga) rocks form basement to the mobile belt, with Steinkopf Terrane as type outcrop area (probably time-equivalent with the Grünau and Pofadder Terranes, Sperrgebiet Domain, Rehoboth structural Province and part of the Congo Craton). The western boundary of the Kaapvaal Craton (and composite Kalahari Craton) exhibits structural wedge edges of Archaean Kaapvaal basement and Ventersdorp-Vaalian basins. Columbia-Kaapvaal Detachment (COLKAD), a décollement between Kaapvaal and Columbia cratons (footwall) and Olifantshoek and other Namaqua terranes (hanging wall) extends for >600 km westwards.

Namaqua crust was thickened (20-25 km) by both structural stacking and sheeted intrusions (Namaqua tectogenesis) with clockwise PTt-paths in the west-central Namaqua sector (Olifantshoek, Grünau, Pofadder, Bladgrond Terranes). In the western part (Okiep/Garies Terrane), crust was dominantly thickened by massive sheetlike granitoid intrusions resulting in granulite grade and anti-clockwise PTt-paths. COLKAD-rooted inter/intra-terrane thrusts are subhorizontal except where rotated by subvertical (discrete) shear zones (e.g. Tantalite Valley and Brakbos-Doringberg-Dabep). Crustal thickening and granulite-uplift stimulated temperature rise with anatexis-palingenesis of early Columbian/supracrustal rocks. Kilometer-scale granitoid bodies, derived from predominantly Columbian crust (according to isotopic source rock models) that are emplaced along shear zones, caused a rise in the brittle to ductile transition zone (i.e. mid-crustal conditions) and low-pressure granulite facies.