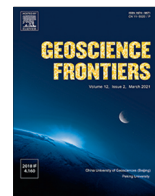


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Research Paper

A continental back-arc setting for the Namaqua belt: Evidence from the Kakamas Domain



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ABSTRACT

A study of the NW Kakamas Domain in South Africa/Namibia provides a new, unified lithostratigraphy and evolutionary history applicable to the whole Namaqua Sector. The Mesoproterozoic history ranges from ~1350 Ma to 960 Ma, but isotopic evidence suggests it was built upon pre-existing Paleoproterozoic continental crust that extended west from the Archaean Craton. In eastern Namaqualand, early rift-related magmatism and sedimentation at ~1350 Ma occurred in a confined ocean basin. Subsequent tectonic reversal and subduction at ~1290–1240 Ma led to establishment of the Areachap, Konkiep and Kaaien Domains. In the Kakamas Domain, widespread deposition of pelitic sediments occurred at ~1220 Ma (Narries Group). These contain detrital zircons derived from proximal crust with ages between ~2020 Ma and 1800 Ma (western Palaeoproterozoic domains) and 1350–1240 Ma (eastern early Namaqua domains), suggesting pre-sedimentation juxtaposition. The pelites underwent granulite grade metamorphism at ~1210 Ma (peak conditions: 4.5–6 kbar and 770–850 °C), associated with voluminous, predominantly S-type granitoid orthogneisses between ~1210 Ma and 1190 Ma (Eendoorn and Ham River Suites) and low-angle ductile (D₂) deformation which continued until ~1110 Ma, interspersed with periods of sedimentation. This enduring P-T regime is inconsistent with the expected crustal over-thickening associated with the generally-accepted collision-accretion Namaqualand model. Rather, we propose the Namaqua Sector is a 'hot orogen' developed in a wide continental back-arc with subduction west of the present-day outcrop. The observed high geotherm resulted from thinned back-arc lithosphere accompanied by an influx of mantle-derived melts. Ductile D₂ deformation resulted from "bottom-driven" tectonics and viscous drag within the crust by convective flow in the underlying asthenospheric mantle. This extended tectonothermal regime ceased at ~1110 Ma when SW-directed thrusting stacked the Namaqua Domains into their current positions, constrained in the Kakamas Domain by late- to post-tectonic I-type granitoids intruded between ~1125 Ma and 1100 Ma (Komsberg Suite). The thermal peak then shifted west to the Bushmanland and Aus Domains, where voluminous granites (1080–1025 Ma) were associated with high-T/low-P granulite facies thermal metamorphism and mega-scale open folding (D₃). Unroofing of the Namaqua Sector is marked by large-scale, NW-trending, sub-vertical transcurrent dextral shear zones and associated pegmatites and leucogranites at ~990 Ma.

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