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The Dwalile Supracrustal Suite of the Ancient Gneiss Complex, Swaziland: evidence for discontinuous deposition and polymetamorphism

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The Archaean greenstone remnants of the Dwalile Supracrustal Suite (DSS) are infolded within the gneisses of the Ancient Gneiss Complex (AGC) in Swaziland [1]. The greenstone rocks are complex and are affected by multiple processes. A combined study of geochronology and pseudosection modelling is used to provide new evidence for the timing of deposition, provenance and metamorphism.

Although the DSS rocks are affected by alteration and polymetamorphism it is evident that there were different pulses of sedimentation, which shows that the stratigraphy is not continuous and that different source regions were active. Within the DSS two metamorphic events are distinguished. These combined findings have implications for the existing geodynamic models for this area.

The first metamorphic event is dated at ca. 3150 Ma by U-Pb on zircon and monazite. The zircons show sector zoning but are irregular in shape and have low Th/U ratios of <0.06 and <0.21, respectively, which is distinctive of metamorphic zircon grown in the amphibolite facies [2]. Schists with a St + Grt + Bt + Ms + Qtz mineral assemblage equilibrated under syn-tectonic peak metamorphic conditions of 550 to 625°C and 4 to 6.5 kbar. A younger but higher-grade metamorphic event is recorded in two peraluminous samples that contain secondary euhedral zircons with distinctive fir-tree sector zoning. Elevated $^{176}Hf/^{177}Hf$ ratios, but almost unchanged $^{176}Lu/^{177}Hf$ ratios argue for the presence of melt [3]. One sample is a Pl + Opx + Crd + Bt + Hc + Qtz bearing rock and another sample contains Grt + Hc + sericite (likely after Crd and Pl). These samples underwent low-P granulite facies metamorphism with peak temperature conditions above 800°C at approximately 2990 Ma.

The 3150 Ma metamorphic event pre-dates the intrusion of the 3140 Ma Pigg's Peak Batholith [4]. It most likely records a renewed NW-ward subduction starting at ca. 3180–3160 Ma as proposed by Taylor et al. [5] for the high-grade Luboya–Kubuta terrane, south-central Swaziland. The geodynamic context of the ca. 2990 Ma granulites is somewhat more certain. These rocks record crustal thinning by rifting and heating due to mantle upwelling, partial melting and the intrusion of mantle melts into the crust. This is documented by the ca. 2995 Ma mafic to intermediate Usushwana Complex [6], which intrudes the DSS to the southwest.

References:

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