

Evolution and exhumation of a granulite - facies terrane in the Arunta block, Central Australia

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The Arunta Block is a 150 000 km² Proterozoic mobile belt in Central Australia, which has sustained a complex history spanning 1500 Ma. The Utralanama Block, a granulite-facies terrane in the southern Strangways Range, in juxtaposition with lower grade rocks to the south across a kilometre-wide E-W shear zone, has undergone a tectonometamorphic evolution that is subdivisible into four major episodes, each associated with N-S compression. During the initial episode, the Arunta Orogeny (1800-1700 Ma), the terrane underwent regional deformation and recrystallisation under moderate-pressure, granulite-facies conditions, with maximum temperatures of 950°-980°C attained, resulting in intense partial melting, removal of minimum melt compositions and extreme LIL depletion. However, deformation and metamorphism associated with subsequent tectonometamorphic episodes was localised, and was associated with brittle-ductile shear zones, which acted as décollements for southerly directed thrusting, resulting in episodic exhumation of the terrane. The Wuluma (1500-1450 Ma) and Ormiston (1050-1000 Ma) Tectonic Episodes were characterised by thick-skinned thrusting, with the Utralanama terrane overthrust to the north during the former, and overthrusting to the south during the latter. Thus the terrane acted as footwall and then hangingwall block to different crustal-scale thrusts during these different episodes; associated with these episodes were displays of hydration-related partial melting, migmatisation and granite genesis, and mafic intrusive activity. The final event, the Alice Springs Orogeny (510-330 Ma), was thin-skinned and involved further southwards-directed thrusting of the Utralanama terrane, interleaving of the Arunta basement with its cover sequence, and further localised hydration of the basement. The P-T-t path for the Utralanama terrane is constrained by this tectonothermal evolution; it has a convoluted form, reflecting these thrust-related, compression-decompression episodes and their associated thermal effects.