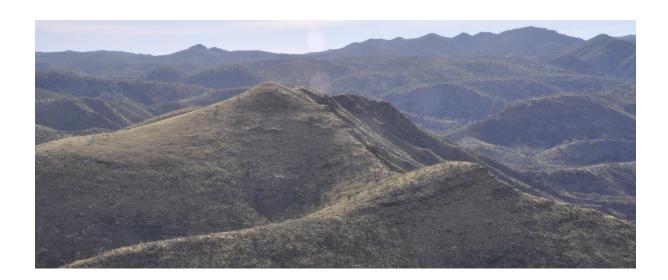




Tectonic Evolution of the Arkaroola Basin: Implications for the development of the Adelaide Rift Complex



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ABSTRACT

The Neoproterozoic to Cambro-Ordovician sediments of the Adelaide Rift Complex (formerly Adelaide Geosyncline) have been the focus of extensive investigation. Despite this, comparatively little is known about the Earliest Adelaidean Callanna Group sediments, due to their sparse preservation in outcrop geology. Exposure of the Callanna Group, and structures related to early Cryogenian graben formation at Arkaroola, in the northern Flinders Ranges, provides a unique opportunity to unravel the local geometries of rift initiation. These rocks have been subjected to multiple intracontinental deformations, most notably the Delamerian Orogeny. Through detailed structural mapping and analysis it is possible to propose models of tectonic evolution for this area. Previous regional scale mapping of the northern Flinders Ranges has identified a disparity between the tectonic history of the Arkaroola Basin and broader northern Flinders Ranges. The nature of the rifting and orogenic evolution of the Arkaroola Basin is determined though analysis of field data, rock samples in thin section and EBSD analysis. Graben formation accommodated an initial period of clastic and evaporitic deposition, followed by riftrelated basalt extrusion. This was followed by several phases of localised rifting and deposition, controlled by evolving fault geometries. Broad-scale orthogonal folding has folded an earlier composite fabric in conjunction with bedding. This initially planar fabric, most notable in the Woodnamoka Phyllite, formed during peak metamorphism of at least 500° C and approximately 3 kbars and is primarily attributed to burial beneath a thick pile of rift and sag phase sediments, coupled with a change in horizontal stresses. This is loosely constrained to post-rift cessation and before a previously indentified thermal pulse, ca 440 Ma. A set of NE-SW trending faults in the basin have been identified as En echelon stepovers of the Paralana Fault system, responsible for the formation of the pull-apart geometries. This system of faults details a strike-slip duplex, the reactivation of which, coupled with an anomalously high-heat producing basement, has controlled and localised deformation of the Arkaroola Basin.

Keywords: Adelaide, rift, Geosyncline, Willouran, Callanna, Paralana, duplex, Flinders, Arkaroola.

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