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



Rowan Hansberry

Supervisors: David Giles, Alan Collins

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Centre for Tectonics, Resources and Exploration
School of Earth and Environmental Sciences
University of Adelaide, South Australia
rowan.hansberry@student.adelaide.edu.au

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 through 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 rift-related 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 identified 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.

TABLE OF CONTENTS

ABSTRACT	2
TABLE OF CONTENTS	3
1. INTRODUCTION	5
2. GEOLOGICAL AND TECTONIC SETTING	7
2.1 Rodinia: Supercontinental Assembly and Break-up.....	7
2.2 The Adelaide Rift Complex	8
2.3 Early Adelaidean Stratigraphy	10
2.3.1 <i>The Callanna Group</i>	10
2.3.2 <i>The Burra Group</i>	11
2.4 Regional Structure and Deformation	12
2.4.1 <i>Major structures in the northern Flinders Ranges</i>	12
2.4.2 <i>Exhumation of the Mt. Painter Inlier</i>	13
2.4.3 <i>Deformation in the Mt. Painter area</i>	13
3. FIELD RELATIONSHIPS	15
3.1 Lithologies	15
3.2 Structural Observations.....	20
3.2.1 <i>Dominant shear fabric</i>	21
3.2.2 <i>Regional folding</i>	22
3.2.3 <i>Delineating s_z with respect to regional folding</i>	23
3.2.4 <i>Basement high-strain zone</i>	24
3.2.5 <i>Faulting</i>	25
3.2.6 <i>Structural cross-sections</i>	26
4. MICROANALYSIS	29
4.1 Optical Microstructural Analysis	29
4.1.1 <i>Sample RAK1101</i>	29
4.1.2 <i>Sample RAK1103</i>	31
4.1.3 <i>Sample RAK1107</i>	31
4.1.4 <i>Sample RAK1110</i>	32
4.2 Electron Backscatter Diffraction Analysis.....	33
4.2.1 <i>Methodology</i>	34
4.2.2 <i>Analysis</i>	34
4.2.3 <i>Results</i>	34
5. DISCUSSION	37

5.1 Early Cryogenian Rifting and Basin Formation	37
5.2 Burial & Fabric Development.....	40
5.2.1 <i>Development of a high strain zone at the basement-cover contact</i>	40
5.2.2 <i>Development of low-angle schistosity</i>	41
5.2.3 <i>Fluid flow in the basement-cover contact</i>	44
5.3 Broad-Scale Structures of the Arkaroola Basin	45
5.4 Models of Tectonic Evolution	46
5.4.1 <i>Geometries of constrictional deformation</i>	48
6. CONCLUSIONS	49
7. ACKNOWLEDGEMENTS	51
8. REFERENCES.....	52
9. LIST OF TABLES	55
10. FIGURE CAPTIONS	55
11. TABLES.....	61
12. FIGURES.....	Error! Bookmark not defined.