



Department of Geology and Geophysics

MID-PALAEOZOIC SHEAR ZONES IN THE  
STRANGWAYS RANGE:

A RECORD OF INTRACRATONIC TECTONISM IN  
THE ARUNTA INLIER, CENTRAL AUSTRALIA

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# TABLE OF CONTENTS

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Table of Contents.....	i
List of Figures.....	v
List of Tables.....	vii
Abstract.....	ix
Disclaimer.....	xi
Acknowledgements.....	xiii
Dedication.....	xv
Chapter 1: Introduction.....	1
1.1 Project overview and aims.....	1
1.2 Thesis outline.....	2
Chapter 2: Geological Overview of Shear Zones in the Strangways Metamorphic Complex.....	5
2.1 Introduction.....	5
2.2 Shear Zones in the Strangways Metamorphic Complex.....	8
2.3 The age of the shear zones.....	10
2.4 Description of key locations.....	10
2.4.1 The Yambah Shear Zone.....	10
2.4.2 The Pinnacles Bore Shear Zone.....	11
2.4.3 The Erontonga Shear Zone.....	14
2.5 Summary.....	16
Chapter 3: Sm-Nd evidence for Palaeozoic polymetamorphism in the Strangways Metamorphic Complex .....	17
3.1 Introduction.....	17
3.2 Geochronology of shear zones in the Strangways Metamorphic Complex.....	17
3.3 The use of Sm-Nd geochronology in dating amphibolite facies rocks.....	18
3.4 Sample selection.....	19
3.5 Analytical techniques.....	19
3.6 Results.....	20
3.7 Discussion.....	23
3.8 Summary.....	27
Chapter 4: Thermobarometric evolution of metapelitic schists.....	29
4.1 Introduction.....	29
4.2 Lithological observations from the Pinnacles Bore and Winnecke areas.....	30
4.2.1 Petrography.....	30
4.2.1.1 Plagioclase-absent metapelites.....	33
4.2.1.2 Calcic metapelites.....	33
4.2.2 Mineral chemistry.....	33
4.2.2.1 Mineral chemistry of the metapelitic schists.....	33
4.2.2.2 Mineral chemistry of the calcic metapelites.....	35
4.3 Metamorphic evolution of the metasedimentary schists.....	36
4.3.1 Pressure-temperature paths from zoned garnets.....	36
4.3.1.1 Methodology.....	36
4.3.1.2 Compositional maps from metapelitic rocks.....	38
<i>Pinnacles Bore Shear Zone</i> .....	38
<i>Winnecke</i> .....	38
<i>Interpretation</i> .....	38
4.3.1.3 Compositional maps from calcic metapelites .....	40
<i>Pinnacles Bore Shear Zone</i> .....	40
<i>Interpretation</i> .....	40

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	<i>Cadney Metamorphics</i> .....	44
	<i>Interpretation</i> .....	46
	4.3.1.4 Synopsis of discussion on compositional maps.....	47
4.3.2	Metamorphic conditions from conventional geothermobarometry.....	47
	4.3.2.1 Results from the Pinnacles Bore Shear Zone.....	47
	4.3.2.2 Results from Winnecke.....	47
	4.3.2.3 Results from Pinnacles Bore Shear Zone calcic metapelites.....	48
	4.3.2.4 Results from Cadney Metamorphics calcic metapelites.....	48
4.3.3	Geothermobarometry using THERMOCALC mode 2.....	48
	4.3.3.1 Results from Pinnacles Bore Shear Zone metapelites.....	49
	4.3.3.2 Results from Winnecke.....	49
	4.3.3.3 Results from Pinnacles Bore calcic metapelites.....	49
	4.3.3.4 Results from Cadney Metamorphics calcic metapelites.....	50
4.3.4	Discussion.....	50
4.4	Conclusion.....	52
Chapter 5:	Phase equilibria of the metapelitic schists.....	55
5.1	Introduction.....	55
5.2	Petrogenetic grids and P-T pseudosections.....	56
5.3	Petrogenetic evidence for the P-T evolution of plagioclase-absent metapelites.....	57
5.4	Petrogenetic evidence for the P-T evolution of the calcic metapelites.....	59
	5.4.1 The CaKFMASH and NaKFMASH subsystem grids.....	64
	5.4.2 The NaCaKFMASH grid.....	67
	5.4.3 Results.....	68
5.5	Conclusion.....	68
Chapter 6:	Metamorphic evolution of Palaeozoic metabasites in the Yambah Schist Zone.....	71
6.1	Introduction.....	71
6.2	Lithological observations in the Yambah Schist Zone.....	72
	6.2.1 Petrography.....	73
	6.2.2 Mineral Chemistry.....	73
6.3	Physical conditions of metamorphism.....	78
	6.3.1 Compositional mapping and P-T paths from zoned garnets.....	78
	6.3.1.1 Results.....	78
	6.3.1.2 Discussion.....	81
	6.3.2 Conventional Geothermobarometry.....	83
	6.3.2.1 Results of geothermobarometry on the metabasites.....	83
	6.3.3 Average P-T calculations using THERMOCALC.....	84
	6.3.4 Petrogenetic evidence for the P-T evolution of metabasic schists from the YSZ.....	87
6.4	Conclusions.....	94
Chapter 7:	Fluid flow and Stable Isotope alteration in ASO shear zones.....	95
7.1	Introduction.....	95
7.2	Shear zone descriptions and sampling strategy.....	96
	7.2.1 The Yambah Schist Zone.....	97
	7.2.2 The Erontonga Shear Zone.....	98
7.3	Stable Isotope Geochemistry.....	98
	7.3.1 Methodology.....	98
	7.3.2 Results from the Yambah Schist Zone.....	98
	7.3.3 Results from the Erontonga Shear Zone.....	101
	7.3.4 Mineral Fractionations.....	102
	7.3.5 Stable Isotope data from other shear zones in the Winnecke area.....	104
7.4	Whole-rock Geochemistry.....	104
	7.4.1 Mass balance calculations.....	104
	7.4.2 Element mobility in the Yambah Schist Zone rocks.....	106
	7.4.3 Element mobility in the Erontonga Shear Zone rocks.....	106
	7.4.4 Discussion.....	107
7.5	Assessing the Fluid Regime.....	107
	7.5.1 The Fluid Source.....	107
	7.5.1.1 Devolatilization of the Granulites.....	108
	7.5.1.2 Direct introduction of a meteoric or basinal fluid to the shear zones.....	108
	7.5.1.3 Dewatering of the Amadeus Basin sediments.....	109
	7.5.2 The tectono-metamorphic environment and mechanisms of fluid flow.....	110
7.6	Conclusions.....	113

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Chapter 8: Metamorphic, geochronological and sedimentological evidence for the Alice Springs Orogeny.....	115
8.1 Introduction.....	115
8.2 Brief Overview of the development of the Amadeus Basin.....	116
8.3 Syn-orogenic sedimentological evidence for the ASO.....	117
8.3.1 The Rodingan Movement.....	118
8.3.2 The Pertnjara Movement.....	120
8.4 Correlating the sedimentary record and evidence from the Arunta Basement.....	122
8.5 Conclusion.....	123
8.6 Future work.....	124
References.....	127
Appendix 1: Sample locality list and detailed petrography of selected samples.....	143
Appendix 2: Mineral chemistry.....	151
Appendix 3: Mineral recalculation using AX and examples of THERMOCALC outputs.....	163
Appendix 4: Thermobarometry.....	169
Appendix 5: Compositional variables for mineral solid solutions used in THERMOCALC.....	185
Appendix 6: Whole-rock geochemistry and correlation diagrams.....	189

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# ABSTRACT

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In the Strangways Metamorphic Complex in the Arunta Inlier central Australia, amphibolite facies shear zones which cross cut Palaeoproterozoic granulite, record two phases of prograde Palaeozoic metamorphism associated with the intracratonic Alice Springs Orogeny. In the north-western Strangways Metamorphic Complex, a system of predominantly east-west trending, steeply north dipping shear zones contain mid-amphibolite facies assemblages commonly consisting of kyanite + mica  $\pm$  (garnet, staurolite) assemblages in metapelites, hornblende + plagioclase  $\pm$  garnet assemblages in metabasic rocks and hornblende + plagioclase + garnet + staurolite assemblages in rare aluminous metabasic rocks. Garnet + hornblende + staurolite assemblages from these shear zones yield Sm-Nd mineral ages ranging between  $379 \pm 30$  Ma (MSWD = 0.09) and  $438 \pm 54$  (MSWD = 0.3). Compositional mapping of garnets coupled with thermobarometric calculations indicates that prograde metamorphism at around 380 Ma reached peak conditions of around  $600^{\circ}\text{C}$  and 6 kbar. These P-T conditions are consistent with calculated phase diagrams for unusual aluminous metabasic assemblages which indicate that mineral textures are also consistent with prograde metamorphism.

In the south-eastern Strangways Metamorphic Complex, shear zones also containing kyanite + mica  $\pm$  (garnet, staurolite) assemblages in metapelites and hornblende + plagioclase  $\pm$  garnet assemblages in metabasic rocks. The shear zones are generally east-west trending and dip steeply north. Shear zones in the Winnecke area yield garnet-staurolite-biotite-whole rock isochrons of  $312 \pm 18$  Ma (MSWD = 0.8) and  $322 \pm 6$  Ma (MSWD = 0.7). A combined isochron of these samples yields  $332 \pm 7$  Ma (MSWD = 1.3). In the Pinnacles Bore region a garnet-staurolite-biotite-whole rock assemblage produced an isochron of  $318 \pm 24$  Ma (MSWD = 0.6). Phase equilibria and P-T estimates on garnet-bearing assemblages from these shear zones indicate peak metamorphism occurred at about  $600^{\circ}\text{C}$  and 6 kbar during a clockwise prograde P-T path.

In comparison to the granulites which they cross cut, the shear zones contain significantly hydrated assemblages suggesting the infiltration of water to the precursor granulites facilitated the crystallisation of the amphibolite facies assemblages. Stable isotope studies indicate that an exotic fluid, probably sourced from the lowest units of the Amadeus Basin sediments, were channelled through the shear zones during progressive diagenesis-prograde metamorphism. The oxygen isotope values of fluids from these deeply buried basin segments vary significantly from fluids which have interacted with shear zone rocks in the Reynolds and Anmatjira Ranges about 150 km north-west of the Strangways Metamorphic Complex, reflecting differences in the basin architecture, in response to local variations in

rift geometry.

Correlations between the syn-orogenic sedimentary record and isotopic, structural and metamorphic evidence from the basement consistently demonstrates a strong link between the development of local structures and epeirogenetic movements in the adjacent Amadeus, Georgina and Ngalia Basins and basement activity during the ASO. It is also evident however that the majority of the sediment record associated with most of the exhumation of the SE Arunta has been lost from these basins, probably to the south-east.

The recognition that the Strangways Metamorphic Complex records at least two prograde mid-Palaeozoic metamorphic events in essentially similar shear zones, indicates that the Alice Springs Orogeny was more thermally complex than previously thought, and suggests that the metamorphic character of shear zones in the Arunta Inlier is not a reliable guide for regional correlation.