ADELAIDE UNIVERSITY
AUSTRALIA

Department of Geology and Geophysics

MID-PALAEOZOIC SHEAR ZONES IN THE STRANGWAYS RANGE:

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

Betina Bendall

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ABSTRACT

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 ± (garnet, staurolite) assemblages in metapelites, hornblende + plagioclase ± 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 ± 30 Ma (MSWD = 0.09) and 438 ± 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 $600^{O}C$ 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 ± (garnet, staurolite) assemblages in metapelites and hornblende + plagioclase ± 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 ± 18 Ma (MSWD = 0.8) and 322 ± 6 Ma (MSWD = 0.7). A combined isochron of these samples yields 332 ± 7 Ma (MSWD = 1.3). In the Pinnacles Bore region a garnet-staurolite-biotite-whole rock assemblage produced an isochron of 318 ± 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 $600^{O}C$ 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 the 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.