

# APATITE FISSION TRACK DATING OF THE NORTHERN WESTERN SHIELD, WESTERN AUSTRALIA

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The investigation of the thermotectonic evolution of the northern part of the Precambrian Western Shield of Western Australia using apatite fission track (AFT) thermochronology is the main focus of this study. The study area encompasses Precambrian rocks of the Pilbara craton and the northern part of the Yilgarn craton including the Narryer Gneiss Complex. AFT data, mostly from the Archaean cratons reveal cooling ages ranging between  $260 \pm 8$  Ma and  $400 \pm 20$  Ma. Mean confined horizontal track lengths fall between  $\sim 12$  and  $13 \mu\text{m}$  with standard deviations ranging from  $1.1$ - $2.2 \mu\text{m}$ . Forward modelling of time-temperature history paths for representative samples reveals a period of regional cooling of at least  $\sim 50^\circ\text{C}$  in the late Palaeozoic. Most paths also show a second period of cooling of  $\leq 25^\circ\text{C}$  from temperatures  $< \sim 80$ - $85^\circ\text{C}$ . This later cooling episode occurred in the Mesozoic but its timing is less well constrained. Assuming that the average present day geothermal gradient of  $\sim 18 \pm 2^\circ\text{C.km}^{-1}$  was prevalent since the late Palaeozoic, then the minimum of  $\sim 75^\circ\text{C}$  of cooling predicted by the fission track modelling suggests overall denudation of at least  $\sim 3.7$ - $4.6$  km of section since that time. Phanerozoic basins (Perth, Carnarvon and Canning) adjacent to the north and west of the northern Western Shield mostly continue offshore and form complex structures containing up to  $\sim 15$  km of predominantly clastic sediments of early Ordovician to late Cretaceous age. The basins are likely to have been depocentres for much of the detritus derived from the denudation inferred from the cooling recorded by the AFT. Possible causative events which could be linked to the observed late Palaeozoic cooling are tectonism related to the collision of Gondwanaland with Laurussia in Carboniferous time forming the supercontinent Pangea or a possible far-field effect related to the Alice Springs Orogeny. Further low temperature thermochronological studies using the  $^{40}\text{Ar}/^{39}\text{Ar}$  and (U-Th)/He systems will provide additional information on the post Mesoproterozoic thermal history of the northern Western Shield.

Low temperature thermochronology, apatite fission track dating, denudation, Western Australia, tectonics