Exhumation of the Peake and Denison Ranges; insights from low-temperature thermochronology

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EXHUMATION OF THE PEAKE AND DENISON RANGES

ABSTRACT

Multi-method thermochronology applied to the Peake and Denison Ranges (northern South Australia) reveals multiple episodes of exhumation. Apatite Fission Track (AFT) data suggest three time periods in which exhumation induced basement cooling of the Ranges into AFT closure temperatures (~60-120 °C): Approximately 470-440 Ma, 340-290 Ma and 200-180 Ma. The Carboniferous and Jurassic exhumation episodes are supported by additional zircon (ZHe) and apatite (AHe) (U-Th-Sm)/He results respectively. We interpret the first pulses of rapid cooling as a result of the final pulses of the Delamerian and/or start of the Alice Springs Orogeny. Erosion and sedimentary burial during the Devonian brought the basement rocks back to ZHe closure temperatures (~200-180 °C). Shortly after, during the Carboniferous, the Ranges were exhumed to the surface which is likely a result of the final pulse of the Alice Springs Orogeny (~300 Ma). The presence of the Mount Margaret Surface during the Late Permian provides independent geological evidence that the Ranges were exposed at the surface at that time. During the Late Triassic-Early Jurassic, the Ranges were once again reheated to AFT closure temperatures, however, the lack of preserved sedimentary rocks of age suggests that this may not be simply due to burial.

Alternatively, the Ranges could have been affected by a well-documented and widespread hydrothermal pulse, which reheated the rocks without significant sedimentary burial. Cretaceous AHe ages coupled with the presence of coarse-grained terrigeneous rocks at that time indicate that the ranges were shallowly buried during this time before Late Cretaceous exhumation (potentially caused by the rifting of Antarctica from Australia), exhumed the Ranges back to the surface. One additional Miocene AHe age was obtained near the fault-escarpment of the Davenport Range. This was thought to be related with enhanced fault activity at that time and finalised the exhumation history of the Ranges.

KEYWORDS

Exhumation, Peake and Denison Ranges, Low-Temperature Thermochronology, Apatite Fission Track, Apatite Helium, Zircon Helium, South Australia.

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