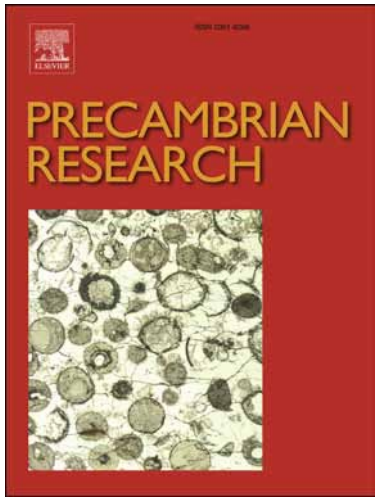

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The Mount Hay block, central Australia: Another puzzle piece for Paleo-Mesoproterozoic tectonic history

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Abstract

The 100 km^2 Mount Hay block (Arunta Region, central Australia) is a >15 km thick crustal cross-section comprised of granulite facies tectonites containing a tectonothermal record from ca. 1803 to ca. 1552 Ma, as demonstrated by the combination of prior work and new monazite geochronology and thermobarometry. Igneous and sedimentary protoliths formed ca. 1803 – 1798 Ma during 1810-1790 Ma Stafford-Tanami time. Between ca. 1790 and 1740 Ma, nearly continuous magmatism in the Aileron Province, and possibly ages of recrystallized zircon and monazite in the Mount Hay block, are part of the record of an arcuate subduction zone along the southern margin of the Proterozoic Australia-Mawson continent as envisioned by Betts et al. (2008, 2015). Geologic mapping and zircon and monazite geochronology demonstrate that the Mount Hay block was penetratively deformed between ca. 1720 Ma and 1700 Ma during 1735-1690 Ma Strangways time. This includes the >8 km thick Mount Hay sheath fold, which records NE-SW subhorizontal shear, once Paleozoic tilting of the Mount Hay block is removed. This and W-NW directed reverse-sense shear recorded by sheath folding in the Strangways Metamorphic Complex are most likely related to the subduction zone along the Australia-Mawson continent. While still in the deeper crust (>798 ± 33°C; >7.6 ± 0.7 kbar), fabrics along the northern edge of the Mount Hay block were transposed by the cross-cutting >7 km thick Capricorn ridge shear zone at ca. 1551.7 ± 5.5 Ma, during Chewings time. Once restored, the Capricorn ridge shear zone records NE-SW extension. A jump in strain rate while at high temperatures (~725°C) initiated severe localization accommodated initially by pseudotachylite formation and cataclasis then mylonitization during Fe-rich fluid flux. Shearing continued to pressure-temperature conditions of <630 ± 25°C and ~3-5 ± 1.2 kbar indicating ~7–14 km uplift. Fluid flow in the Capricorn ridge shear zone corresponds well with growing evidence for regional Fe ± K ± Si metasomatism with similar timing. In published tectonic reconstructions, Chewings aged deformation, including the Capricorn Ridge shear zone, may be related to subduction to the south, or re-convergence between the Proterozoic Australia-Mawson continent and Laurentia. Robust links between the kinematics of deformation and geochronologic constraints, and the ability to restore major structures to their original orientations, makes the Mount Hay block a valuable additional puzzle piece for Proterozoic tectonic reconstructions for Australia, and possibly the supercontinent Nuna.

Key words: Australia, Mount Hay, Strangways, Chewings, extension, fluid

1. Introduction

Australia's Paleoproterozoic and Mesoproterozoic tectonic and paleogeographic history are valuable records for reconstructing the supercontinent Nuna (Payne et al., 2009; Betts et al., 2011 and 2015; Pisarevsky et al., 2014; Schmidt, 2014; Betts et al., 2015) and largely depend on as few as five field areas studies are cited for kinematic constraints from basement exposures in central Australia (Goscombe, 1992; Vassallo and Wilson, 2002; Bagas, 2004; Stewart and Betts, 2010a, b; Li et al., 2013). This is unsurprising given the nature of discontinuous exposure over vast areas across Australia. Further, most exposures are often of polydeformed high grade gneiss terranes, meaning assigning ages