# Deciphering thermal events in the Capricorn Orogen using titanite

R.J.M. TAYLOR[1]*, S.M. REDDY[1], C. CLARK[1], S.P. JOHNSON[2]

[1]TIGeR – The Institute for Geoscience Research, Dept of Applied Geology, WASM, Curtin University, Perth, Australia

[2]Geological Survey of Western Australia, Mineral House, Plain Street, Perth, Australia

(richard.taylor@curtin.edu.au)

Titanite ($CaTiSiO_5$) is a common accessory phase in both igneous and metamorphic rocks, and can form or be modified under a variety of geological conditions With a lower Pb closure temperature than zircon, it can record orogenic events and thermal processes that zircon cannot. As well as U and Pb titanite also contains a large suite of other trace elements, including transition metals, and rare earth elements which can be used to monitor formation conditions and geological processes. This includes thermometry (Zr in titanite), coexitence with other phases (e.g. REE in garnet), as well as redox state and fluid alteration (e.g. Eu anomoly, Nb/Ta, Th/U).

The Capricorn Orogen of Western Australia records a long lived tectonic history as the collision zone between the Archean Pilbara and Yilgarn Cratons. Discrete granite-forming events occur at c. 2.55, 2.00, 1.80 and 1.68 Ga as recorded by zircon U–Pb. Following this there are also multiple reworking events at c. 1.25, 1.00 and 0.57 Ga, that did not result in melting and associated pluton formation. Zircon U–Pb can therefore only provide information on approximately half of this two billion year geological history.

Titanite is able to record the post-Paleoproterozoic history of the Capricorn Orogen through resetting of the U–Pb system. Combining isotopic age data with trace element chemistry provides key signatures that identify recrystallised titanite within pre-existing granite suites. Single grain studies also highlight some of the problems and benefits of titanite as a monitor of crustal processes.

Titanite provides a framework for the evolution of the orogen through crystallisation within granite plutons and subsequent recrystallisation. The Capricorn Orogen also contains economic mineral deposits within which titanite affected by hydrothermal events may have specific trace element compositions. Identification of such trace element signatures means that titanite can be used in a broad scale mineral systems approach to target mineral deposits that may be buried under cover.