TIMING, DURATION AND CONDITIONS OF METAMORPHISM AND CRUSTAL MELTING IN THE CURNAMONA PROVINCE

MINEX CRC PROGRAM 3

National Drilling Initiative

PHD PROJECT

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RESEARCH PROJECT

The Curnamona Province of southeastern Australia hosts the supergiant Broken Hill Pb-Zn-Ag deposit as well as numerous other Pb-Zn, Cu and Au deposits. Despite extensive lithological and structural mapping and a demonstrated association with anomalous metal enrichment, the duration of the Palaeoproterozoic-Mesoproterozoic thermal events recorded across this region are surprisingly poorly constrained. Similarly, despite crustal-scale geophysical imaging, the origin of the deeper crust remains unknown. The aims of this project are: (1) to use state-of-the-art petrochronological methods to delineate the timing, duration and conditions of Proterozoic thermal events; and (2) to use the late-stagegranites as lithoprobes to investigate the deep crust of the Curnamona Province.

Aim 1: The Willyama Supergroup is characterised by garnet- and zircon/monazite-bearing metamorphic assemblages of varying grade that are well suited to mineral equilibria modelling, U-Pb dating and integrated trace element analysis. Despite this, existing P-T and age constraints are sparse, and none have been acquired via modern petrochronology techniques that offer the best means to reconstruct the prograde metamorphic record. As such, the footprint and temporal development of high geothermal gradient metamorphism is poorly understood, and its persistence across the reworked structural architecture of Curnamona Province is unknown. These results will establish a revised thermo□metamorphic framework for the Willyama Supergroup and provide an integrated understanding of the thermal drivers for Proterozoic metamorphism.

Aim 2: Voluminous late-stage S-type granites intrude the Willyama Supergroup but their origin is uncertain. Existing isotopic data suggests the granites are derived from sequences similar to those they intrude, however, such constraints are only general in nature and based on a limited dataset that may not be regionally representative. Furthermore, the depth of melting and the age of the source sequences are unknown. These parameters will be constrained by systematic targeting of inherited zircons within the granites. Comparison with existing detrital zircon datasets for the Willyama Supergroup will determine if the granites are derived from a basement succession or from deeper parts of a Willyama basinal system. Geochemical datasets combined with petrological modelling will be used to determine the stability of petrogenetically sensitive minerals (garnet and plagioclase) to derive estimates on the depth of melting. These estimates will provide a measure of how deep into the lower crust the granites are derived and therefore their utility as crustal lithoprobes.