

Sediment provenance: a tool for correlating 'late basin' successions in the Eastern Goldfields Province



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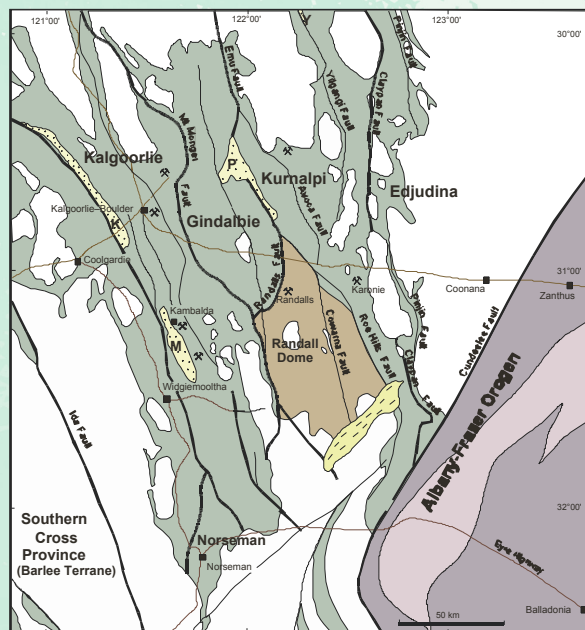
Background

Archean gold terranes around the world have similar deformational and sedimentological evolution: greenstones overlain by coarse-grained polymictic 'late basins'. The boundary between these two units is important to mineral-exploration companies because many of the major Au deposits occur close to this major contact (e.g. Kanowna Belle, Wallaby, Agnew, Dome and Campbell-Red Lake). Despite recognition of the stunning spatial relationship between the major gold deposits and the contact separating the 'late basin' sediments and the greenstones, uncertainty remains about the timing of sedimentation relative to east–west deformation (e.g., are the 'late basins' pre-D2 or synorogenic?), why some 'late basins' are arcuate (e.g., Kanowna Belle) and others elongate, and what the temporal and spatial relationship is between 'late basin' units that host major gold deposits in the numerous domains and terranes of the Eastern Goldfields Province. Our investigation, commencing in May 2006, will investigate the provenance of the 'late basin' sediment in order to improved our understanding of the temporal and spatial associations of the 'late basin' packages. These data will be used to provide important constraints on the tectonic and metallogenic evolution of the region (e.g., are Wallaby and Kanowna Belle hosted by remnants of the same 'late basin' or spatially and temporally unrelated basins?). Samples for detrital-zircon age dating (using laser ablation ICP-MS and SHRIMP) and wholerock geochemistry of conglomerate and breccia clasts will be selected following detailed logging and mapping of the volcanic lithofacies from key localities. This work will ultimately enable correlation of units between domains and terranes, resulting in maps that show the distribution of key 'late basin' stratigraphic units within the entire Eastern Goldfields Province.

Laser ablation age dating of detrital zircons

Detrital-zircon age data enables fingerprinting of the sediments using the provenance of the zircons (i.e., the source area, or areas, of the zircons making up the sediment). The presence or absence of zircons of specific ages places a powerful constraint on possible source terranes, and changes in the zircon age mix are a sensitive indicator of shifts in provenance through a sedimentary succession. These variations may be used to correlate stratigraphic units between different geological terranes that are currently considered indistinguishable (e.g., late basin sediments that host the Wallaby and Kanowna Belle deposits).

Previous studies of detrital zircons from the Kalgoorlie-Kambalda area have shown that only about 20% of the grains are sufficiently concordant to give reliable dates. The use of the laser ablation ICP-MS for U-Pb age-dating of the zircons represents a quicker (about 10x as fast) and considerably less-expensive alternative to the traditional U-Pb age-dating method using the SHRIMP. However, data generated during the first stage of this investigation would represent a *first pass* at assessing the ages of the detrital zircons. Concordant grains from each of the main populations identified by laser ICP-MS, will be dated by SHRIMP at Curtin University.



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