



# New data on rock ages from Mt Isa Inlier

A new geological event framework has been produced for 1800–1650 million year old rocks from the Western Fold Belt of the Mount Isa Inlier

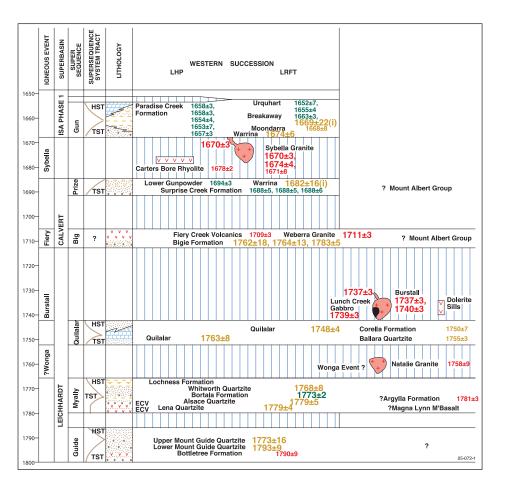
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The Mount Isa Inlier is one of many Australian Proterozoic terrains with a complex but periodic history of sedimentation, magmatism, tectonism, metamorphism, mineralisation and fluid flow through time.

Geochronological data collected using a sensitive high-resolution ion microprobe (SHRIMP) can be used to determine the age of these rocks and develop an event framework for geological regions. New SHRIMP geochronology undertaken within the Regional Studies and Geochronology group of the Minerals Division of Geoscience Australia, in collaboration with the Predictive Mineral Discovery Cooperative Research Centre's (pmd\*CRC) Isa project, has:

- produced a temporal framework for the Leichhardt and Calvert Superbasins
- constrained ages for selected magmatic events in the Western Fold Belt and the Mary Kathleen Zone
- used detrital zircons to test the Gun unconformity at the base of the Isa Superbasin.

The project included collection and interpretation of 29 new U–Pb zircon SHRIMP ages, 20 from sedimentary rocks and nine from igneous rocks. It combined regional sequence stratigraphy and structural analysis with geochronology to produce a new temporal framework for the Leichhardt and Calvert superbasins.



### New age constraints

Previously, the only age constraints on the timing of sedimentation for the Leichhardt and Calvert Superbasins were a U–Pb conventional age for the base of the stratigraphy (Bottletree Formation) of 1790  $\pm$  9 Ma (Page 1983), a SHRIMP U–Pb zircon age of 1709  $\pm$  3 Ma for the Fiery Creek Volcanics (Page & Sweet 1998) and several SHRIMP ages from shallow level intrusives in the Surprise Creek Formation at the top of the Calvert Superbasin (Jackson et al 2005).

Although unconformities have previously been identified within the Leichhardt and Calvert sequences, no time constraints have been placed on the time-significance of these intervals of missing rock record.

The new chronostratigraphic event chart for the interval from ~1800 Ma to 1650 Ma (figure 1) recognises three supersequences in the Leichhardt Superbasin:

- The Guide Supersequence spans the interval ~1800–1785 Ma and includes the Bottletree Formation and Lower and Upper Mount Guide quartzites.
- The overlying Myally Supersequence spans the interval ~1780–1765 Ma and includes the Eastern Creek Volcanics, Lena, Alsace and Whitworth quartzites, and Bortala and Lochness formations.
- The Quilalar Supersequence spans the interval ~1755–1740 Ma and includes the Quilalar and Corella formations and the Ballara Quartzite.
- Figure 1. New event chart for the Leichhardt and Calvert superbasins of the Western Fold Belt and Mary Kathleen Zone, Mount Isa Inlier. Ages in Ma. Colour code for ages: red = magmatic crystallisation age, brown = sedimentary maximum depositional age, green = sedimentary depositional age. Ages in larger font from this study, ages in smaller font summarised in Page et al (2000) and Jackson et al (2005).

Although there are no new depositional age constraints for the younger Bigie Formation, field relationships suggest that it is coeval with the ~1710 Ma Fiery Event. Therefore, we have defined a separate supersequence for the Bigie Formation, the Big Supersequence, even though it may be more genetically related to magmatism of the Fiery Event. The Big Supersequence, together with the ~1690 Ma Prize Sequence, comprises the Calvert Superbasin.

#### Magmatic event times refined

New SHRIMP data has also refined ages for the Burstall, Fiery and Sybella magmatic events (figure 1). The ~1740–1735 Ma Burstall Event represents a bimodal, dominantly intrusive event following sedimentation of the Quilalar Supersequence in the Mary Kathleen Zone and the Eastern Succession. The refined age for the Weberra Granite is within error of the age for the Fiery Creek Volcanics, and indicates that they are both part of the ~1710 Ma Fiery Event.

The three new SHRIMP ages for the Sybella Granite are all within error of each other and are coeval with the Carters Bore Rhyolite, indicating that magmatism associated with these intrusives is constrained to 1675–1670 Ma. Slightly younger ages from other units of the Sybella Granite may indicate that intrusive sheets associated with the Sybella Event were emplaced over an extended time, or as a series of discrete magmatic 'pulses' between 1675 and 1655 Ma, associated with and followed by deposition of the Gun Supersequence.

## Testing depositional ages from detrital zircons in sedimentary rocks

Detrital zircons have also been used to characterise the Gun unconformity at four locations in the Leichhardt River Fault Trough. Detrital zircons in sedimentary units overlying the Gun unconformity at the Oxide Creek and Bull Creek sections provide maximum depositional ages of  $1674 \pm 6$  Ma and  $1672 \pm 15$  Ma, consistent with the age constraints of ~1660 Ma provided by peperites for deposition of the basal Gun Supersequence highstand.

These examples suggest that samples taken directly above regional unconformity surfaces can be used to constrain depositional ages for supersequences. However, in the other two sections the small numbers of young grains, or absence of younger populations, may mean that the maximum depositional ages calculated from detrital zircons are substantially older than the actual age of deposition.

Therefore, it is crucial that maximum depositional ages calculated from sedimentary units be integrated with sequence stratigraphy and basin analysis in Proterozoic basins to construct detailed chronostratigraphic event charts.

#### References

Jackson MJ, Southgate PN, Black LP, Blake PR & Domagala J. 2005. Overcoming Proterozoic quartzite sandbody miscorrelations: Integrated sequence stratigraphy and SHRIMP U–Pb dating of the Surprise Creek Formation, Torpedo Creek and Warrina Park Quartzites, Mount Isa Inlier. Australian Journal of Earth Sciences 52:1–25

Page RW. 1983. Timing of superimposed volcanism in the Proterozoic Mount Isa Inlier, Australia. Precambrian Research 21:223–245.

Page RW & Sweet IP. 1998. Geochronology of basin phases in the western Mt Isa Inlier, and correlation with the McArthur Basin. Australian Journal of Earth Sciences 45:219–232.

Page RW, Jackson MJ & Krassay AA. 2000. Constraining sequence stratigraphy in north Australian basins: SHRIMP U–Pb zircon geochronology between Mt Isa and McArthur River. Australian Journal of Earth Sciences 47:431–459.

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In Brief

