# Isotopic insights into magmatic source regions and crustal architecture in the Eastern

Succession, Mount Isa Block

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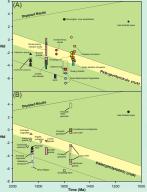


Compilation of new and existing Sm-Nd isotopic data from igneous and metasedimentary rocks shows that Eastern Succession have crustal residence ages ranging from 2.8 to 1.7 Ga (Figs 1-4). These ages generally young going up stratigraphy (Fig. 4) and commonly correlate well with SHRIMP data, which highlights multiple post-1.9 Ga magmatic events, as well many earlier processes reflecting deeper crust events from 2.7 to 1.9 Ga. These Sm-Nd isotopic trends conform to models of vertical crustal accretion by via addition of mantle-derived mafic material between 1.85 and 1.50 Ga. For the most part, however, these data show that the crust is dominated by two isotopic reservoirs separated from the depleted mantle at: 1. ~2.6-2.5 Ga, and 2. ~2.3-2.2 Ga. These data are preserved in metasedimentary rocks, as well and S-, I- and 'A'-type igneous rocks. An older >2.7 Ga isotopic reservoir may be recorded in the basement rocks, although little data is available to substantiate the significance of this reservoir.

Sm-Nd isotopic data from the post-1.8 Ga igneous rocks shows an apparent isotopic 'break' in  ${\rm T}_{\rm DM}$  ages that may correlate with the locality of the west of Pilgrim worm (a major geophysical discontinuity near the Pilgrim Fault, Fig. 1), where rocks on west commonly have older TDM ages (>2.38 Ga) than those on the east (<2.35 Ga). This isotopic difference, together with it's proximity the broadly N-S trending Pilgrim worm may represent an ancient terrane boundary where the eastern rocks were laterally accreted between 2.30 and 1.85 Ga. Furthermore, the Sm-Nd isotopic character (T $_{\rm DM}$  2.6-2.4 Ga) of metasedimentary rocks from the Soldier Cap Group, and the dearth of 1.88-1.84 Ga zircons suggest that these rocks may not have been derived locally, and may have had a source components from most eastern Proterozoic inliers (e.g., Georgetown, Coen etc).

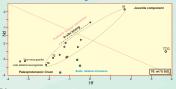
### Sm isotopic data:

### **Crustal Sources and Terrane Genesis:**



edimentary rocks, and syn-ore samples from the Osborne deposit in tha astern Succession. Also shown are the composition of the Hillaha gra the Leichhardt Volcanies and Kalladoon grantie, and Gorella cale-stille cocks. B. Time (Mn) vs. Nof of whole-rock Sm-Nof data for magnatic a edimentary rocks in the Mount Isa Inlier, and Georgetown, Coen, Yan and Daralong inliers. See Mark et al. (2005) for source data.

# Hf isotopic data:



Whole-rock Sm and Hf isotopic data, and geochemical data from post-1.6 Ga intrusions to the east of the Pilgrim worm, Eastern Succession show that the lower (>30 km), middle (15-30 km) and upper (<15 km) part of the exposed crust are compositionally and isotopically distinct (Figs 5-7).

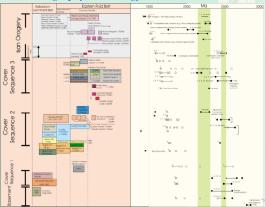
Upper Crust: metaluminous-Peraluminous rocks with wide ranging T<sub>DM</sub> (2.6-<1.7 Ga).

Middle Crust: amphibole-rich mixed mafic-felsic metaigneous rocks with  $T_{DM}$  2.3-2.2 Ga, and  $\epsilon Hf$ (-2 to -1). See Figs 5-7.

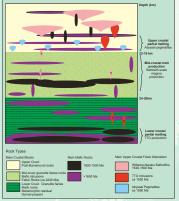
Lower Crust: a mixture of older  $mafic\ granulite\ (T_{DM}\text{:}\ 2.3\text{-}2.2\ Ga;$ εHf: -2 to -1) and younger mafic material ( $T_{DM}$ : <1.85 Ga;  $\epsilon$ Hf: >+3). See Figs 5-7.

Figure 6 (left). εHf vs εNd whole-rock is data for post-peak metamorphic intrusion Eastern Succession. Data show that the po

#### Stratigraphy, chronology and crustal residence



### An isotopic overview of the crust



## **Summary Points:**

Two main isotopic reservoirs:

Older: 2.6-2.5 Ga Younger: 2.3-2.2 Ga

### Crustal Accretion:

- 1. Lateral: isotopic data are consistent with the Pilgrim worm, a broadly N-S trending geophysical discontinuity, may represent an ancient terrane boundary sutured between 2.30 and 1.85 Ga.
- 2. Vertical: emplacement of mantle-derived material between 1.85 and <1.50

Georgetown and Coen Inliers etc: potential sources of sedimentary material to Soldier Cap Group rocks, and thus possibly proximal to Mount Isa prior to 1.6 Ga.

Potassic, 'A-type' intrusions: predominantly crustally derived, and locally mixed with juvenile material at the site of granite emplacement.

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