Constraining the provenance of Neoproterozoic successions of the northwesternmost Centralian Superbasin, Western Australia

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Unraveling the tectonic evolution of a region and identifying the possible source regions for sedimentary rocks, particularly in Precambrian terranes, relies heavily on U–Pb ages of detrital zircon populations. The durability of zircons allows their survival through many cycles of erosion and sedimentation during transport over hundreds of kilometres. Age and relative abundance of different detrital zircon populations provide maximum age constraints for their deposition, and reflect the age and the degree of exposure of the source regions.

Neoproterozoic metasedimentary rocks of the northwestern Officer and Yeneena basins, northwestern Australia, represent the northwesternmost exposure of the Centralian Superbasin (Walters *et al* 1995, Bagas 2004). Metasedimentary formations of the Neoproterozoic Yeneena Basin are divided into the Throssell Range and Lamil groups (Bagas 2004), separated by large fault systems, with the Throssell Range Group unconformable on the Palaeoproterozoic to Mesoproterozoic Rudall Complex, and bounded to the west and south by the Vines–Southwest–McKay fault system. Immediately west of the Vines–Southwest–McKay fault system, the Tarcunyah Group forms the base of the northwestern Officer Basin. It consists of metasedimentary units that unconformably overlie the southeastern part of the Archaean Pilbara Craton, the eastern part of the Mesoproterozoic Bangemall Supergroup, and Palaeoproterozoic gneiss in the Paterson Orogen.

Correlation between the Tarcunyah, Throssell Range and Lamil groups is unclear, as they are either bound by large fault systems, or contact areas are under Palaeozoic cover. The stratigraphic relationships suggests that at least part of the detritus for the sedimentary protoliths for the Tarcunyah Group has Archaean to Mesoproterozoic sources, whereas Palaeo- to Mesoproterozoic sources constitute a significant part of the detritus for the Throssell Range and Lamil groups. Palaeocurrents from the Tarcunyah, Throssell Range and Lamil groups suggest currents from the southwest (Bagas *et al* 2002, Bagas 2003), although reconnaissance field work in 2004 suggests some sediment supply was possibly from the east (A McIntyre, in litt 2004), at least for part of the basal Coolbro Sandstone of the Throssell Range Group.

Limited U-Pb data from detrital zircon populations from the Gunanya Sandstone at the base of the Tarcunyah Group and sandstone units in the Coolbro Sandstone and Malu Formation of the Yeneena Basin indicate maximum depositional ages of ~0.95 Ga, with age profiles suggesting complex source regions (**Figure 1**, Bagas *et al* 2002, Bagas 2003). The Gunanya Sandstone contains zircons with ages ranging from ~1.0 to >3.0 Ga, with major populations at ~1.78 and 1.68 Ga, a cluster of ages between ~1.31 and ~1.07 Ga, smaller populations between 1.67 and 1.31 Ga, and the remaining few zircons ranging up to Mesoarchaean in age (Bagas 2003). Samples of sandstone from the Coolbro Sandstone and Malu Formation have detrital zircons with U-Pb ages clustering at ~1.07 Ga and ranging up to ~2.0 Ga in age. In samples of the Coolbro Sandstone, there are also minor age populations between ~2.3 and 3.24 Ga, with a significant cluster at ~2.76 Ga. The age ranges for sandstone units in the Tarcunyah, Throssell Range and Lamil groups are compatible with principal sources from Palaeoproterozoic and Mesoproterozoic provinces, possibly from the southwest, as indicated by palaeocurrents from trough cross-bedding in the basal part of each group. The 2.76 Ga age in samples of the Coolbro Sandstone is similar to the age of the Hardy Formation of the Mesoarchaean Fortesque Group in the Pilbara Craton (Blake *et al* 2004). Bagas *et al* (2002) and Bagas (2003) implicated Mesoproterozoic sources from either the Musgrave Complex, 400 km to the southeast, or the Pinjarra Orogen, 800 km to the west. A subordinate source is possibly Palaeoproterozoic rocks of the underlying Rudall Complex or the Arunta Orogen 400 km to the east.

The present data suggest that rocks containing zircons of ~1.07 Ga age form a significant component of the source for sandstone units from both the Yeneena and northwestern Officer basins. This age correlates with the recently recognized Warakurna large igneous province that extends from mafic sills and dykes in the Mesoproterozoic Bangemall Supergroup in west Australia across to the Stuart Pass Dolerite, north of the Amadeus Basin in central Australia (Wingate *et al* 2004). Restricted involvement of Archaean sources is implicated, suggesting that the Pilbara Craton may have been concealed by the Fortesque Group during deposition of the both the northwest Officer and Yeneena basins. Alternatively, the Rudall Complex may be a western extension of the Arunta Orogen that has been displaced from central Australia to its present position, along a series of faults that extend from the Vine-Southwest-McKay fault system to the northern margin of the Amadeus Basin. Until more data are collected, however, correlation with specific provinces remains speculative.

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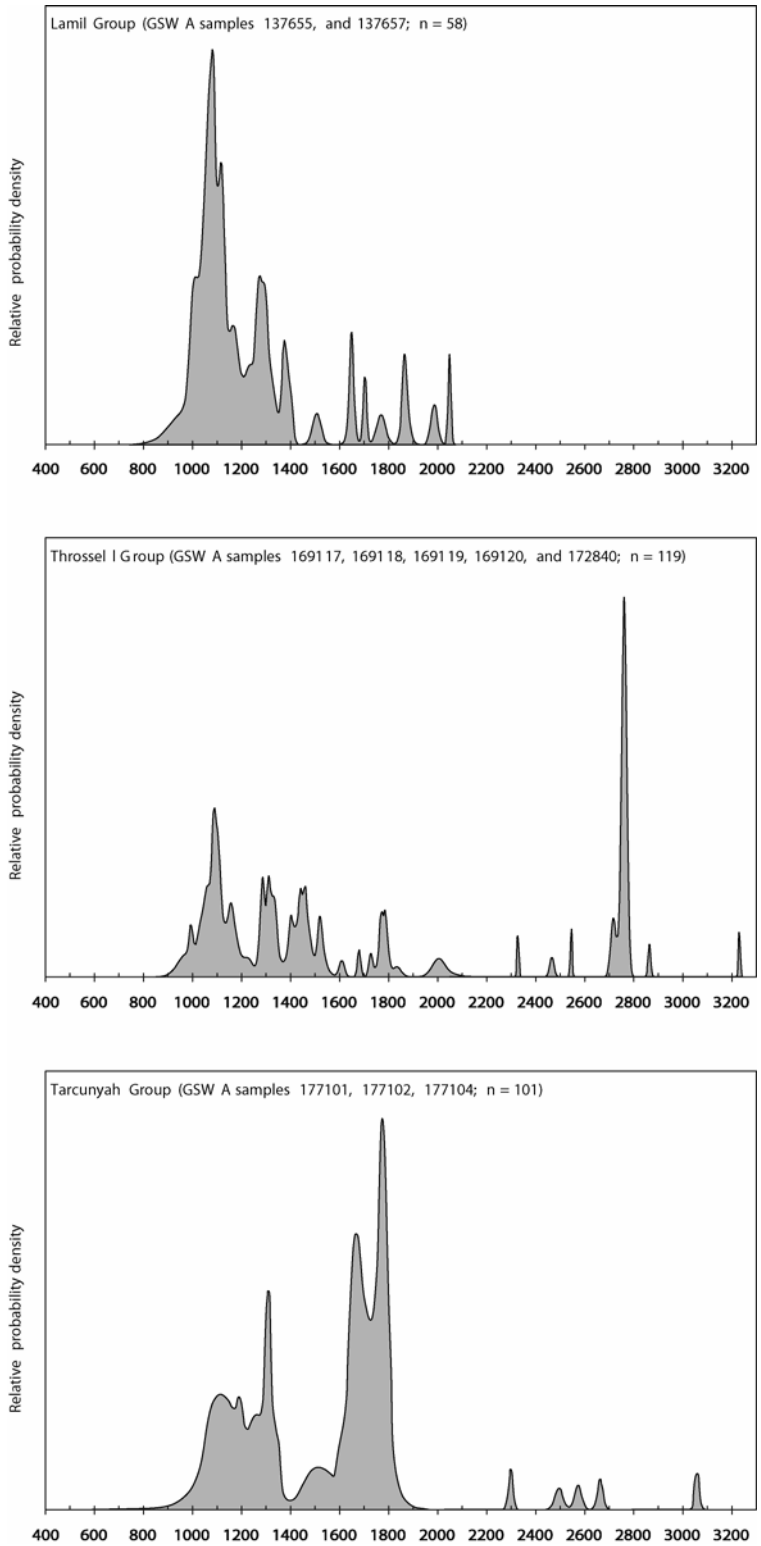

Figure 1. Comparison between relative cumulative probability distributions of pooled and 95 to 105 concordant detrital zircon components in the Lamil (Bagas *et al* 2002), Throssell Range and Tarcunyah groups (Bagas *et al* 2002, Bagas 2003).