THE OLD AND THE NEW - A CRYPTIC RECORD OF CONTRASTING LITHOSPHERIC EVOLTIONS IN CENTRAL AUSTRALIA

A.J. Woodhouse[1,2], M. Hand[1], K. Barovich[1], E. Belousova[3], E. Jagodzinski[2], Michael Wingate[4]

1. Centre for Tectonics, Resources and Exploration (TRaX), University of Adelaide, SA 5005, Australia

2. Department of Primary Industries and Resources of South Australia (PIRSA), Geological Survey Branch, GPO Box 1671, Adelaide, SA 5001, Australia

3. GEMOC, Department of Earth and Planetary Sciences, Macquarie University, Sydney, NSW 2109, Australia

4. Department of Mines and Petroleum, Geological Survey of Western Australia, Perth, WA 6004, Australia

The Musgrave Province is a large, Mesoproterozoic orogenic belt, located at the triple point that joins the three major crustal elements of Proterozoic Australia (the Northern, Southern and Western Australian Cratons). The province is dominated by high-grade metamorphics and synchronous felsic magmatism that formed during the Musgravian Orogeny (*ca* 1230-1150 Ma). Due to access issues, the scale of the belt and the intensity of the Musgravian Orogeny, relatively little is known about the protoliths that accumulated prior to orogenesis.

This study presents in situ U-Pb and Lu-Hf isotopic data from detrital zircons, combined with whole rock Sm-Nd isotopes and REE geochemical data from 14 metasedimentary samples spread ~ 500 km along the belt. Results of this provenance study reveal that Mesoproterozoic sedimentary protoliths within the Musgrave Province were derived from distinct and separate isotopically juvenile and evolved lithospheric columns whose detritus did not mix to any appreciable extent.

Metasedimentary rocks derived from comparatively (in the Australian context), isotopically juvenile crust (n=10) are widespread, and dominated by detrital zircons with concordant (90-110%) $^{207}Pb/^{206}Pb$ ages ranging from *ca* 1700-1300 Ma, with broad peaks between *ca* 1610-1470 Ma and corresponding Lu-Hf two-stage depleted mantle model ages ($^{Hfi}T_{DM}$) ranging between *ca* 1.8-1.5 Ga and whole rock $\varepsilon_{Nd}(1.4)$= +3 to -3. In comparison, metasedimentary rocks derived exclusively from more evolved crust (n=4) contain detrital zircons with concordant $^{207}Pb/^{206}Pb$ ages ranging *ca* 1800-1300 Ma and *ca* 3100-2500 Ma with dominant peaks at *ca* 2700, 1790, 1650 and 1490 Ma. These rocks have $^{Hfi}T_{DM}$ ranging between *ca* 3.4-2.6 Ga and $\varepsilon_{Nd}(1.4)$ = -11 to -12. Importantly Archaean-aged zircons are only identified in two of the four more evolved samples. However the evolved (and by inference reworked), nature of the source region is clearly evident in the Hf zircon and Nd whole rock isotopic data.

Given the intensity of Musgravian orogenesis, and the extensive cover that obscures the surrounds of the Musgrave Province, it is difficult to unequivocally identify the respective source regions. The more juvenile rocks are distinctive in the Australian Proterozoic context and we suggest they are likely to be predominately derived from sources within the Musgrave Province where previous workers (Wade et al., 2006; J. Geology; 114, 43-63; Smithies & Howard, 2009; Geol. Surv. of WA, West Musgrave 1:100 000 Geol. Info. Series 2009 update), have identified *ca* 1600-1550 Ma and 1330-1300 Ma magmatic rocks with relatively juvenile whole rock Sm-Nd signatures. In contrast, a source region for the more evolved metasedimentary rocks requires an internally reworked Archaean terrane, albeit having a magmatic history with significant age overlap with the more juvenile source terrane (*ca* 1700-1300 Ma). One potential source region could be the Albany-Fraser Orogen where a recent study (Spaggiari et al., 2009; Geol. Surv. of WA Record 2009/10) has recognized magmatic protoliths to the Dalyup and Coramup Gneisses with crystallization ages of *ca* 1700-1600 Ma and Nd isotopic signatures strongly suggestive of reworking the Archaean Yilgarn Craton.