Reversal of the expected isotopic character of the crust and mantle: isotopic mapping of magma sources for a Mesoproterozoic SLIP

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The Hiltaba Suite intrusives, Gawler Range Volcanics (GRV), Benagerie Volcanic Suite (BVS) and Crocker Well Suite in the South Australian portion of the Mawson Continent form a Silicic Large Igneous Province (SLIP) with crystallisation ages of ca. 1595 – 1575 Ma[1]. The Gawler Range Volcanics at the core of the SLIP erupted 70,000 km^3 within an 8 Myr timeframe[2]. Associated with these suites are crustally-derived peraluminous granites of the Bimbowrie Suite (bi-mu-bearing) and Munjeela Granite (bi-mu-gt-bearing). These magmatic suites cover an area approximately 700 km x 700 km with the pre-existing geology ranging in age from 3150 Ma to 1600 Ma. As a result, the magmatic rocks of the Hiltaba/GRV/BVS event provide an isotopic and geochemical probe of the lithospheric mantle and lower crust.

Whole rock geochemistry and isotopic data highlight a range of mantle and crustal sources in the magmatism with distinct spatial patterns apparent in the isotopic composition of the magmas. Importantly, the variation in isotopic composition does not appear to be everywhere related simply to varying proportions of crust or mantle-derived melts. This is perhaps best represented by the example of mafic rocks from the central region of the magmatic province which yield $\varepsilon_{Nd}(t)$ values centred around -5, in comparison to crustally derived, gt-mu-bi-bearing granites from the outer edges of the province that have $\varepsilon_{Nd}(t)$ as high as +2. These isotopic characteristics are able to map spatial variation within the lithosphere but can also be correlated to magma petrogenesis. The potential also exists that the isotopic signature of magma sources can be correlated to the various styles of mineralisation associated with the event, including the world-class Olympic Cu-Au Province.

1. Wade CE*, et al. Precambrian Research* 2012, **206:** 17-35.
2. Jagodzinski E*, et al., 2016. AESC*, Adelaide.