Lithospheric and Geodynamic Evolution of the Gawler Craton, South Australia: Integration of Os, Hf and Nd isotopic investigations

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The Palaeo- Mesoproterozoic record of lithospheric growth and amalgamtion offers an opportunity to investigate the relative roles, rates and timing of crustal extraction and lithospheric stabilisation in the Precambrian. Central to resolving geodynamic processes is an appreciation of the relative proportion of new material to the crust from the mantle, and the mechanism by which crustal growth has occurred. Here we present an integrated approach focussing on the timing of extraction of crustal material from the convecting mantle through Nd and Hf isotopes with constraints on the antiquity of the lithosphere supporting it via Os isotopes.

The Gawler Craton, South Australia, contains an excellent record of Palaeo-Mesoproterozoic magmatism through the period ~1620 Ma (juvenile I-type magmatism of the St Peter Suite) through to the voluminous A-type Gawler Range Volcanics (1592 Ma) and Hiltaba Suite Granites (~1595-1585 Ma). Further, various mafic magmatic lithologies which predate these events enable insights into the age of the lithosphere from which they were derived.

The Gawler Range Volcanics preserve a negative correlation between $\varepsilon Hf_{(i)}$ and $^{187}Os/^{188}Os_{(i)}$, reflecting corresponding crustal inputs. Preliminary Os data from the St Peter Suite record subsequent Re mobilisation, possibly during Hiltaba times; however combined Os-Nd isotopes preserve a narrow range of primitive values implying a short crustal prehistory prior to emplacement.

Finally, Os isotopic investigations on chromite separates from older Palaeoporoterozoic mafic to ultramafic units preserve distinct variations across various tectonic domains; hence reflecting varying proportions of juvenile crustal addition and recycling within different portions of the craton.