DEFINING AGE CONSTRAINTS FOR MANTLE EVENTS FROM Re-Os ISOTOPES AND TRACKING METASOMATIC PROCESSES IN LITHOSPHERIC MANTLE DOMAINS BENEATH NEW ENGLAND

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The New England Orogen is the easternmost structural element of the Australian continent. It is interpreted to have been accreted as a result of subduction of Pacific plate during Palaeozoic and Early Mesozoic time (e.g., Leitch 1974 *Journal of the Geological Society of Australia*; Murray et al. 1987 *Australian Journal of Earth Sciences*; Roberts and Engel 1987 *Australian Journal of Earth Sciences*). The specific tectonic setting has been modelled in slightly different ways, but the southern part of the orogen is typically divided into two crustal domains: referred to here as the Tamworth Belt and the Tablelands Complex. These domains are separated by the Peel Fault System and the Great Serpentinite belt, interpreted by some as the suture along which subduction took place.

Spinel peridotite xenoliths collected as part of this study represent samples of the sub-continental lithospheric mantle (SCLM) brought to Earth's surface by erupting basalts in the Tertiary. Xenoliths from six localities (three in the Tamworth Belt and three in the Tablelands Complex) have been used to characterise the SCLM beneath the New England Orogen, to assess any regional heterogeneity and to determine if there are any systematic differences in the lithospheric mantle underlying the two crustal domains.

Geochemical signatures based on trace-element abundances in clinopyroxene indicate variations in the melting history and the type and extent of metasomatism in the lithospheric mantle both within and between the Tamworth Belt and Tablelands Complex. Xenoliths from Allyn River, for example, contain evidence of metasomatism by a volatile-rich fluid such as a carbonatitic melt, whereas samples from Wallabadah Rocks have a trace-element signature indicating progressive chromatographic metasomatism by an evolving silicate fluid at low fluid-rock ratios.

Re-Os isotopic data (in situ and whole-rock) provide age constraints on the New England SCLM. This system is suited to the dating of mantle material, as Os is compatible whereas Re is incompatible during melting. Rhenium depletion model ages (T_{RD}) assume all Re is lost during melting, and are thus considered minimum estimates of isolation from the convecting mantle. Re-Os T_{RD} ages based on in-situ analysis of sulfide grains in these samples indicate the lithospheric mantle beneath New England contains material of at least Proterozoic age.