The NSW leucitites: lithospheric melts or hot-spot magmas?

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The New South Wales leucitite suite is dominated by a series of discrete, ultrapotassic lava flows [1]. The leucitites are mineralogically similar, comprising leucite, clinopyroxene, olivine, phlogopite and opaque minerals.

New major and trace element data for 41 samples, together with Sr, Nd, Hf and Pb isotope data for a subset (17) of these, provide insights into the origin of these enigmatic rocks. Samples were selected to span the north-south spread in NSW occurrences, with the entire suite believed to extend from Byrock, NSW, to Cosgrove, Victoria [2] and represent the products of hot-spot magmatism [3].

All samples from this study preserve elevated K_2O and MgO and low SiO_2 contents, and most represent primary magmas. Incompatible element contents are consistent with derivation from an enriched lithospheric mantle source in which phlogopite contributed to the partial melt. There is no evidence to support the assimilation or incorporation of continental crust in the petrogenesis of these magmas. Isotope compositions indicate that enrichment of the mantle source region was ancient and highest beneath the northernmost localities.

Despite some similarities, this study confirms that the lavas of the NSW leucitite suite are distinct from the Cosgrove leucitite occurrence [3], the latter being more closely related to at least some members of the Victorian Newer Volcanics of central Victoria [4]. In the absence of compelling evidence for the involvement of a hot-spot, an alternative explanation for age progressive volcanism could be a southward-propagating 'tear' in the lithosphere, or the reactivation of such a feature, resulting in decompression melting and facilitating the passive upwelling of magma to the sites of eruption.

References

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