

Where do the big S-type granites come from? Evaluation of hypotheses

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Evidence provided by phenocrysts in volcanic rocks indicates that little or no restite is transported in ascending magmas responsible for the high-level S-type granites of the Lachlan Fold Belt, south-eastern Australia. Evidence provided by microgranitoid enclaves in the granites and by isotopic studies favours the hypothesis that the granites involved some interaction with mafic magma. As migmatite complexes in the LFB typically are poor in or devoid of mafic magma, a deeper source is likely. This inference, as well as experimental evidence of high-temperature melting and low-pressure magma mixing, favour the hypothesis that the LFB S-type granites were formed by partial melting of metasedimentary rocks at low-pressure, high-temperature (850-950°C) conditions, involving some mixing of the felsic melt with more mafic magma. The most probable source of mafic magma is in the lower crust or at the crust-mantle boundary, possibly in a MASH zone, the upper parts of which may be represented by the Hidaka Metamorphic Belt, Japan. Such a granulite facies (>900°C) mixing source could produce not only hot S-type magmas of the kind represented in the LFB, but also their hybrid peraluminous microgranitoid enclaves. The metasedimentary xenoliths in the LFB S-type granites could have been incorporated as xenoliths in ascending magma from amphibolite facies rocks, such as those of the higher levels of the Hidaka Metamorphic Belt.