RESTITE IN S-TYPE GRANITES OF THE LACHLAN FOLD BELT, SE AUSTRALIA

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In order to evaluate the extent of high-level contamination in granites, it is necessary to determine the amount of restite or resistate present. Granites of the Lachlan Fold Belt (LFB) of SE Australia are the most consistently interpreted in terms of the "restite hypothesis." LFB resistate-rich peraluminous (S-type) "dirty" granites or diatexites appear to be close to their source and generally contain little or no mafic magmatic contaminant (e.g., no microgranitoid enclaves). For example, the Cooma Granodiorite was formed by water-present partial melting of feldpsathic metapsammites; the magma physically incorporated xenoliths of metapelite-derived migmatite resistate. The more abundant, high-level S-type granites (e.g., Cowra Granodiorite) typically contain microgranitoid enclaves (mainly peraluminous microtonalites), which have been interpreted as restite, though they have igneous microstructures and show evidence of mixing of S-type felsic magma with more mafic magma. The high-level S-type granites also contain metasedimentary xenoliths of deep but uncertain origin; being mainly metapelite, they cannot be residuals (restite) from the melting of quartzofeldspathic rocks that produced the host granitic magma, but instead are probably accidental xenoliths collected from high-grade (amphibolite facies) metamorphic rocks above the unexposed source, which probably consisted of granulite facies rocks. The absence of enclaves from such a source and the igneous origin of the microgranitoid enclaves suggest that LFB S-type granites contain little or no restite. Unobserved deep sources are typical for the larger LFB granite plutons (e.g., the Murrumbidgee Batholith). They may not be conventional migmatite complexes, but must contain abundant quartzofeldspathic material. Such source terranes (possibly varieties of "MASH" zones) may have been heated and partly mixed with mantle-derived mafic magma, but not enough to obliterate the S-type character of the resulting magma. An example of the upper part of such a melting zone may be the Hidaka Metamorphic Belt, Hokkaido, Japan, in which S-type garnet-orthopyroxene tonalite formed by partial melting of granulite facies rocks intruded by mafic and ultramafic magma, in response to magmatic heating by mantle upwelling. Mixing of this tonalite magma with small amounts of more mafic magma conceivably could provide suitable magmas for tonalite enclaves in the LFB S-type granites.