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Rare metal endowment of primary granitic melts from the geochemistry of anatectic restites

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Major strategic rare metal deposits are associated with crust-derived granitic intrusions. The partial melting of crustal rocks in the lower crust is a crucial stage, defining the metal endowment and overall geochemical characteristics of the magmas. A compilation of data from over 20 migmatite complexes reveals that anatexis in different environments results in contrasting restite depletion patterns and generation of granitic magmas with different trace element compositions. The depletion of restites in Rb, Cs and U is almost universal, suggesting widespread enrichment of these elements in crustal granites. Be and Li show differential behaviour dependent on pressure. LREE, Th and sometimes Zr are depleted only in UHT melting of undehydrated metasediments. Lead could be slightly incompatible during anatexis, whereas Zn and Cu tend to remain in residue. For Sn the data are fragmentary but suggest different behavior depending either on protolith or melting conditions. The behaviour of Nb and Ta in restites varies from slight enrichment to weak depletion and could be observed from deviation of Nb/Ta from crustal values, owing to the compatibility of these elements in residual minerals. For many elements, especially chalcophile ones, the data are insufficient and it is often not clear whether metamorphic devolatilization of anatexis would be more important in their extraction to the upper crust. The loss of metals during anatexis is the key region of global ore forming systems and the geochemistry of restites should be considered in the development of the models of concentration of metals by granitic magmatism.