Petrogenesis and geochemical diversity of Late Mesoproterozoic S-type granites in the western Yangtze Block, South China: Co-entrainment of peritectic selective phases and accessory minerals

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Deciphering the geochemical diversity of S-type granites is crucial for obtaining more profound insight into their petrogenesis. We therefore undertook an integrated study of whole-rock geochemistry, Sr-Nd isotopes, and zircon U-Pb-Hf isotopes for newly recognized Late Mesoproterozoic S-type granites, including two-mica-, biotite-, garnet-bearing two-mica granites, from the western Yangtze Block, South China. The crystallization ages of these granites are ca. 1040 Ma. They are peraluminous to strongly peraluminous (A/CNK = molar ratio of $Al_2O_3/(CaO + Na_2O + K_2O)$ = 1.02–1.67), high-K calc-alkaline rocks, and display high concentrations of normative-corundum (0.54–7.04 wt.%) as well as positive correlations of A/CNK and FeO^T + MgO values, which are characteristics of S-type granites. These S-type granites are characterized by enriched in Rb, Th, K, and Pb, depleted in Ba, Sr, Ti, and Eu, with negative whole-rock εNd(t) (–0.3 to –6.8) and predominantly negative zircon εHf(t) values (–8.09 to +5.70), indicating the affinity of middle-upper crustal trends and a heterogeneous metasedimentary source. Compared with the geochemical diversity of S-type granites around the world, the variably negative εNd(t) values as well as positive and negative εHf(t) values of our S-type granites may be caused by source heterogeneity and disequilibrium melting processes. More importantly, similar to typical more mafic S-type granites from the Cape Granite Suite (South Africa) and north Queensland (Australia), the high and variable FeO^T + MgO contents (2.21–6.64 wt.%) are significantly attributed to coupled co-entrainment of peritectic and accessory minerals (e.g., garnet, ilmenite, zircon, and monazite), evidenced by positive relationships between FeO^T + MgO and TiO_2, CaO, Zr, Th, Hf, Y, Yb, light rare earth elements (LREEs). Peritectic assemblage entrainment is thus significant for the geochemical diversity of our S-type granites.