THE APPLICABILITY OF USING APATITE GEOCHEMISTRY FOR DIFFERENTIATING MESOZOIC I- AND S-TYPE AND INTERMEDIARY GRANITOIDS IN S CHINA

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Abstract

The immensely distributed Mesozoic granitoids in S China (~197,000 km^2) can be geochronologically grouped as Triassic, Jurassic and Cretaceous rocks. Jurassic granitoids, although the most widespread, are uncertain for their contribution to crustal growth as compared with Triassic Darongshan (DRS) and Cretaceous Fuzhou-Zhangzhou Complex (FZC) granites that are typical S- and I-type, respectively. In this study, apatites separated from seven representative plutons of vast Jurassic Nanling Mountains (NLM) granites (ASI = 0.91-1.21, CaO = 0.71-3.68 wt%, Na_2O = 2.42-4.00 wt%, Isr = 0.7123-0.7223 and εNd(T) = -6.6 to -12.4) as well as one gabbro and three syenites (ASI = 0.70-0.92, CaO = 1.70-9.44 wt%, Na_2O = 2.55-7.45 wt%, Isr = 0.7048-0.7075 and εNd(T) = 3.0 to -2.6) are used to compare with those collected from DRS and FZC granites for their elemental abundances, especially the rare earth elements (REEs). The apatite geochemistry reveals that Na, Si, S, Mn, Sr, U, Th concentrations and shapes of the REE distribution patterns for apatites from DRS and FZC granites basically follow the S and I granite types of the Lachlan Fold Belt (Australia), but those from NLM granites (SiO_2 = 63-77 wt%) are closely related to the ASI and εNd(T), rather than the mafic-felsic relationship, of the host rock. Apatites from NLM granites with ASI >1.1 and εNd(T) <-11.6 (e.g., Zengchen and sample 99GD18 of Guidong) have elemental abundances and REE patterns similar to DRS apatites (high Na and Mn, low S, Sr and Th, and near flat REE distribution patterns), whereas those with ASI <1.0 and εNd(T) >-6.6 (e.g., Qitianling) as well as gabbro and syenite are similar to FZC apatites (high Si, Sr and Th, low Na and Mn, and right-inclined REE distribution patterns). The majority of NLM samples (ASI = 0.97-1.08 and εNd(T) = -8.8 to -11.5) cannot be correlated straightly to the granite types by having intermediate properties on apatites. In light of the Sr and Nd isotope mixing model, magmas of NLM granites fit the melt derived largely from modified DRS granites with only minor involvement of mantle-derived melts (5-20%). This supports the idea that the vast NLM granites were formed mainly through a large scale in-situ remelting or anatexis of the overlying crust materials under the relaxation of a continental lithosphere and the accompanied mafic undrplating.