

U-Pb isotope geochronology and geochemistry of granites from Hainan Island (northern South China Sea margin): constraints on late Paleozoic-Mesozoic tectonic evolution

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Abstract

Hainan island is a key component of the South China Sea region and provides insights on regional geological evolution since the Paleozoic. Ten new LA-ICPMS zircon U-Pb ages from granites of Hainan include Late Permian (254±3 Ma; 252±3 Ma), Middle-Late Triassic (243±2 Ma; 242±3 Ma; 240±2 Ma; 228±2 Ma) and late Early to early Late Cretaceous (105±1 Ma; 101±1 Ma; 96±2 Ma; 95±3 Ma) ages. All samples in the present study, including late Permian, Middle-Late Triassic, and late Early to early Late Cretaceous granitic rocks show geochemical characteristics similar to those of calc-alkaline to high-K calc-alkaline I-type granites. Major and trace element geochemical variations show that during petrogenesis, these granites experienced fractional crystallization of minerals (e.g., Ti oxides and apatite).

Compared to the late Permian and Middle-Late Triassic granitic rocks, middle to late Cretaceous granites generally have lower initial $^{87}\text{Sr}/^{86}\text{Sr}$ ratios of 0.70594 to 0.70886, lower T_{DM2} ages of 1314 to 1382 Ma, and higher $\epsilon\text{Nd}(t)$ of -4.94 to -5.96, implying that the magmatic source for Cretaceous granites received more significant contribution from juvenile material relative to that for Permo-Triassic granites. These new data, combined with data from literature for Hainan Island and the South China Sea (SCS) region underpin a conceptual model for late Paleozoic to Mesozoic tectonic evolution for Hainan Island and the general SCS region as follows, (a) Late Permian (272-252 Ma), the initiation and development of continental arc related to the subduction of Palaeo-Tethys ocean; (b) Triassic (249-228Ma), continued arc magmatism, the gradual cessation of Palaeo-Tethys subduction and subsequent development of an extensional setting; (c) Late Jurassic to early Cretaceous (178-130Ma), the development of an Andean-type continental arc, and regional tectonic regime switch to the westward subduction of the Pacific plate; (d) Middle to late Cretaceous (128-70 Ma), the continuation of the Andean-type arc, the development of an extensional setting due to slab rollback, and the cessation (~70Ma) of Pacific plate subduction.

Key words Zircon U-Pb ages; geochemistry; granitic rocks; tectonic evolution; Hainan Island; South China Sea

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