

SHRIMP zircon U-Pb age and geological significance of Caledonian granites in Hainan Island (China)

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Hainan Island is sandwiched between the South China Plate and the Indo-Philippine Plate, and its tectonic properties during the early Paleozoic are still under debate. It is generally known that the Caledonian granites are widely developed in the South China Plate, while for a long time, there has been controversy over whether Caledonian tectonic-magmatic activities exist in Hainan Island.

A group of granitic dikes have been discovered in the Buluncun area, Hainan Island. These dikes intrude along the bedding planes of quartz mica schist and quartz amphibolite strata of the Ewenling Formation of the Late Proterozoic Baoban Group. They display granoblastic and porphyritic-like texture with gneissoid and eyed structures due to the regional metamorphism. Their minerals predominantly consist of plagioclase, K-feldspar, quartz and biotite. Accessory minerals include apatite, zircon, sphene, and a small amount of allanite, epidote, pyrite, chalcopyrite and pyrrhotite.

The Buluncun granitic dikes have major elements varying from 63.35 to 67.15 wt.% for SiO₂, 14.61 to 15.98 wt.% for Al₂O₃, 5.35 to 6.86 wt.% for K₂O+Na₂O with K₂O/Na₂O ratios of 1.10–2.99 and A/CNK ratios of 1.03–1.18, belonging to high-K calc-alkaline granodiorite. They are rich in Rb, Th and U and depleted in Nb, Ta, Sr and Ti, characteristic of continental island arc granite. They have total rare earth element (REE) contents of 541–1245 ppm with a right-leaning distribution pattern (LREE/HREE: 1.94–4.86) and weak Eu anomalies (δEu : 0.44–0.95). Sm–Nd isotopic compositions show high (⁸⁷Sr/⁸⁶Sr)_i ratios (0.7310–0.7561) and low $\epsilon\text{Nd}(t)$ values (-9.2–-8.3). Elemental and Sm–Nd isotopic characteristics suggest that the Buluncun granodiorite is S-type granite and had been originated from an ancient continental crust.

The zircon U-Pb ages of two samples of the Buluncun granodiorites were obtained using the SHRIMP dating method, yielding 449.9±3.6 Ma and 450±3 Ma, respectively. The result confirms that the Buluncun granodiorite is the product of the Caledonian magmatism. We propose that Hainan Island is within a tectonic setting of plate subduction and consumption during the Caledonian period.