



## **Geochemistry and zircon U-Pb geochronology of igneous rocks from southwestern Vietnam: implications for the transition from an active continental margin to post-orogenic extension**

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Late Mesozoic igneous rocks are predominately found in the Dalat zone, but also in smaller volumes to the southwest, in the Bay Nui – Ba Hon area, southwestern Vietnam. Within the latter area three different groups can be distinguished based on petrological features: (1) the Dinhquan intrusive magmatic suite; (2) the Deoca intrusive magmatic suite and (3) the Ankroet suite. The Dinhquan suite comprises mainly diorite, monzodiorite, monzonite, and syenite. The Deoca suite is the major magmatic group and consists mainly of granodiorite and granite. The major and trace element composition point to a calc-alkaline nature of both intrusive suites. Samples collected from the Dinhquan suite are metaluminous, while the Deoca suite rocks are metaluminous to peraluminous and usually contain the minerals amphibole, titanite and allanite. The Dinhquan–Deoca igneous series display a typical fractional crystallization trend similar to Cordilleran I-type batholiths. The trace elements versus silica plots indicate that crystallization of Ti-Fe oxides and ferromagnesian minerals (e.g., amphibole) occurred in both suites. By contrast, the Ankroet suite displays a higher content and narrower variation in silica as well as a peraluminous composition typical for A-type and S-type granitoids. Granites of the Ankroet suite tendentially have a higher content in heavy rare earth elements (HREE) and strong negative Eu, Sr, Ba, Ti anomalies on primitive mantle normalized plots compared to samples from the Dinhquan-Deoca series. The pronounced negative Eu and Ba anomalies suggest fractional crystallization of feldspar.

U-Pb zircon ages yield values of  $105.0 \pm 0.6$  for the Dinhquan suite,  $86.5 \pm 1.9$  to  $93.0 \pm 0.9$  Ma for the Deoca suite, and  $89.3 \pm 0.9$  Ma for the Ankroet suite. Several zircons of the Deoca samples show inherited cores with ages similar to those of the Dinhquan suite. The presence of mafic enclaves representing the Dinhquan suite within the Deoca suite as well as similar trends in primitive mantle and chondrite normalized plots indicates a close genetic relationship of both suites. In comparison with the equivalent Cretaceous igneous rock suites from the Dalat zone, the rocks in southwestern Vietnam are generally more basic in composition, contain more potassium, and have a larger variation in Mg# indicating a higher degree in fractional crystallization.

Based on the geochemistry we conclude that the Dinhquan-Deoca series are part of the still active continental arc, which existed along the eastern margin of the Eurasian continent during the Late Mesozoic. However, the occurrence of the contemporaneous post-orogenic Ankroet suite indicates a transition in the tectonic setting and may be related to the beginning of extension which lead to the opening of the East Sea (South China Sea).