Formation and evolution of Hailaer basin, NE China: Constraints from zircon U-Pb geochronology of Mesozoic volcanic rocks

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The Hailaer basin is located in the Ergun massif of the central Asian Orogenic belt between the North China Craton and the Siberian Craton. The Mesozoic strata including the Nantun Formation and Xing'anling Group contain a voluminous volcanic rocks in this basin. The formation timing of the strata and evolution of the basin are controversal issues due to lack of precise dating data. The volcanic rocks of the Nantun Formation are composed mainly of rhyolite whereas the Xing'anling Group consists chiefly of andesite and rhyolite. Six zircons from rhyolitic volcanic rocks in the Nantun Formation and Xing'anling Group display typical oscillatory zoning and have high Th/U ratios (0.50-2.44), suggesting their magmatic origin. LA-ICP-MS zircon U-Pb dating results indicate that weighted mean $^{206}Pb/^{238}U$ ages of zircons from six rhyolites in the Nantun Formation and Xing'anling Group range from 120Ma to 127Ma, representing the formation timing of the volcanic rocks, i.e. early Cretaceous. These early Cretaceous volcanic rocks chemically show bimodal volcianism. Combined with the existence of contemporaneous bimodal magmatism in the eastern Chnia [1], it is suggested that they formed under an extensional environment, which is corresponding for the faulting during the basin formation. Combined with the spatial variations of chemical compositions of the Early Cretaceous volcanic rocks in northeastern China [2], we conclude that the early Cretaceous volcanism in the Hailaer basin should be related to the subduction of the Paleo-pacific plate beneath the Eurasian continent.

This research was financially supported by research grant from the Natural Science Foundation of China (grant No. 90814003).

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Mid-Eocene (42-44 Ma) melting of overthickened crustal materials in the Himalayan collisional belt

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Within the Himalyan collisional belt, granotoids occur along two sub-parallel belts, the North Himalayan Gneiss Dome (NHGD) and the High Himalayan Crystalline Belt (HHC). In the Yardoi area of NHGD, a new type, two-mica granites occur in the core of the Yardoi gneiss dome (YGD), the Dala and Quedang plutons from north to south, and extends at least 50 km long. These granites have similar mineral composition, elemental and radiogenic isotope geochemistry, and age of formation [1, 2, 3]. SHRIMP zircon U/Pb dating indicates that the two-mica granites from the core of YGD and the Quedang formed at 42.6±1.1 Ma and 42.8±0.6 Ma, respectively, similar to those from the Dala pluton [4, 5]. These two-mica granites have (1) high SiO_2 (>68 wt%), Al_2O_3 (>15 wt%), and A/CNK (>1.0); (2) relatively high Sr and LREE, but low Y (<10 ppm) and Yb (<1 ppm); (3) high Sr/Y (>40 and up to 250) and La/Yb (>30); (4) very weak or no Eu anomalies; and (5) low initial Sr ($^{87}Sr/^{86}Sr$ (i)<0.7120) and unradiogenic Nd (ε_{Nd} (i)= -8.9~-15.0) isotopic compositions, similar to those in the amphibolite but significantly different from those in the metapelite and granitic gneiss. Two-mica granites from the Yardoi area are of Na-rich peraluminous granite and have an adakite-like geochemistry. Such features are distinct from those in the younger leucogranites along the HHC as well as in the NHGD, and require melting of source consisting dominantly of amphibolite at overthickened conditions. This is also supported by the presence of amphibolites with similar Sr and Nd isotope compositions, and similar ages of metamorphism. Similar two-mica granites also occur in the other NHGD gneiss domes and along the HHC belt, implying that Mid-Eocene melting of overthickened crustal materials was widespread and the Tethyan Himalaya might have reached similar to or even higher elevations than the present-day High Himalaya.

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