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辽宁省丹东地区“前震旦纪”侵入岩的锆石U-Pb年代学、地球化学及其构造意义

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摘要:

本文对辽东南丹东地区部分原定前震旦纪侵入岩进行了锆石LA-ICP-MS U-Pb年代学和岩石地球化学研究, 以便对其岩石成因和区域构造演化给予制约。详细的岩石学和岩相学研究表明, 四个侵入岩体岩性分别为二长花岗岩、角闪石黑云母二长花岗岩、黑云母二长花岗岩和角闪辉长岩。所选样品中锆石均呈半自形-自形晶形、阴极发光图像显示具有成分生长环带或条痕状吸收特点, 结合其高的Th/U比值(0.53~2.4)和亏损轻稀土元素(LREEs)、相对富集重稀土元素(HREEs)以及负Eu异常和正Ce异常等特征, 表明其典型岩浆成因特点。锆石LA-ICP-MS U-Pb定年结果表明, 它们均形成于早白垩世(峰期为126Ma)。岩石学和地球化学分析结果显示, 研究区早白垩世侵入岩具有双峰式岩浆作用点, 其中花岗质岩石 $\text{SiO}_2=66.99\% \sim 73.13\%$, $\text{K}_2\text{O}=3.52\% \sim 4.67\%$, $\text{K}_2\text{O}/\text{Na}_2\text{O}=1.01 \sim 1.43$, $\text{MgO}=0.45\% \sim 2.61\%$, $\text{Mg}^\#$ 值为29~69, $\text{Al}_2\text{O}_3=13.97\% \sim 14.92\%$, 富集LREEs和大离子亲石元素(LILEs), 亏损HREEs和高场强元素(HFSEs), 暗示其具有I型花岗岩特点, 岩浆起源于下地壳的部分熔融; 而角闪辉长岩 $\text{SiO}_2=50.22\%$, $\text{MgO}=10.61\%$, $\text{Mg}^\#$ 值为69, Cr(196×10^{-6})、Co(44.8×10^{-6})、Ni(73.4×10^{-6})含量较高, 富集LREEs和LILEs, 亏损HREEs和Nb、Ta、Ti等HFSEs, 暗示其岩浆应起源于受俯冲流体交代的岩石圈地幔楔。结合区域地质资料表明, 辽东南丹东地区早白垩世侵入岩应形成于类似弧后盆地的伸展环境, 其形成应与古太平洋板块北西向向欧亚大陆之下的俯冲作用相系。

英文摘要:

LA-ICP-MS zircon U-Pb ages and geochemical data are presented for the previously believed Pre-Sinian intrusive rocks from the Dandong area of southeastern Liaoning Province, with the aim of determining their petrogenesis and the regional tectonic evolution. Detailed petrological studies have shown that the four-selected intrusive rocks are monzogranite, hornblende biotite monzogranite granite, biotite monzogranite granite and amphibole gabbro, respectively. All zircons are euhedral-subhedral in shape, display striped absorption and fine-scale oscillatory growth zoning in cathodoluminescence (CL) images, have high Th/U ratios (0.53~2.40), and show depletion in light rare earth elements (LREEs), relative enrichment in heavy rare earth elements (HREEs), negative Eu and positive Ce anomalies in chondrite-normalized REE patterns, indicating a typical magmatic origin. Zircon U-Pb dating results show that they were formed in the Early Cretaceous (ca. 126Ma). Petrologically and geochemically, the Early Cretaceous intrusive rocks are typical of bimodal magmatism. The granitoids have $\text{SiO}_2=66.99\% \sim 73.13\%$, $\text{K}_2\text{O}/\text{Na}_2\text{O}=1.01 \sim 1.43$, $\text{MgO}=0.45\% \sim 2.61\%$, $\text{Mg}^\#=29 \sim 69$, $\text{Al}_2\text{O}_3=13.97\% \sim 14.92\%$, and display enrichment in LREEs and LILEs and relative depletion in HREEs and HFSEs, suggesting that they have the features of A-type granites and originate by partial melting of lower crust. On the other hand, the amphibole gabbro has $\text{SiO}_2=50.22\%$, $\text{MgO}=10.61\%$, $\text{Mg}^\#=69$, high Cr (196×10^{-6}), Co (44.8×10^{-6}), Ni (73.4×10^{-6}) contents, is enriched in LREEs and LILEs, and is relatively depleted in HREEs and HFSEs such as Nb, Ta and Ti, indicating the magma could be derived from the partial melting of the lithospheric mantle modified by subducted slab-derived fluids. Together with the regional geological data, it is proposed that the Early Cretaceous intrusive rocks from the Dandong area of southeast Liaoning Province could form in an extensional environment similar to a back-arc basin, which be possibly related to the NW subduction of the Paleo-Pacific plate beneath the Eurasian plate.

关键词: [早白垩世](#) [侵入岩](#) [锆石U-Pb年代学](#) [地球化学](#) [构造背景](#) [丹东](#) [辽东南](#)

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