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内蒙古中部巴彦乌拉地区晚石炭世-早二叠世火山岩锆石SHRIMP U-Pb定年及其地质意义

作者	单位
李可	北京大学造山带和地壳演化教育部重点实验室, 北京大学地球与空间科学学院, 北京 100871
张志诚	北京大学造山带和地壳演化教育部重点实验室, 北京大学地球与空间科学学院, 北京 100871
冯志硕	北京大学造山带和地壳演化教育部重点实验室, 北京大学地球与空间科学学院, 北京 100871
李建锋	北京大学造山带和地壳演化教育部重点实验室, 北京大学地球与空间科学学院, 北京 100871
汤文豪	北京大学造山带和地壳演化教育部重点实验室, 北京大学地球与空间科学学院, 北京 100871
罗志文	北京大学造山带和地壳演化教育部重点实验室, 北京大学地球与空间科学学院, 北京 100871

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摘要：

内蒙古巴彦乌拉地区广泛出露宝力格组火山-沉积地层。其中流纹岩样品的锆石SHRIMP U-Pb年龄分别为307.1±6.3Ma和308.9±1.8Ma，结合前人研究结果，宝力格组火山岩确切喷发时间应为晚石炭世到早二叠世。样品位于碱性-钙碱性系列岩石过渡区域，在TAS图中，中基性火山岩落入玄武质粗安岩、粗安岩和安山岩区，REE分馏明显，LILE富集，HFSE明显亏损，Nb、Ta、Ti、P负异常，Zr、Hf正异常，形成于岩石圈地幔部分熔融作用；流纹岩LILE（Rb、Th、U）富集，HFSE（Nb、Ta、Ti）明显亏损，具有高正$\varepsilon_{Nd}(t)$和年轻t_{DM1}值，是新增生的陆壳部分熔融的结果，并具有I型和A型两类花岗岩的地球化学属性。综合区域地质特征和前人研究资料表明，宝力格组火山岩形成于后造山构造环境。

英文摘要：

The Inner Mongolia-Da Hinggan Orogenic Belt (IMDOB), located in the east of Central Asian Orogenic Belt (CAOB), records the boundary between the North China Craton and the Siberian Craton, and is the key area to reconstruct th e tectonic history of the CAOB. However many essential issues still remain uncertain at present, such as the evolution of the tectonic environment, especially during Paleozoic period, and the final closure time of the Paleo-Asian Ocean. T he Bayanwula area, situated in the northwest of Sonid Zuoqi, the west of the IMDOB, is characterized by the volcano-sedimentary strata of the Baolige Formation. The strata formed in the Late Paleozoic period is represented by typical i ntermediate-basic, felsic volcanic rocks and pyroclastic rocks. Some people consider these volcanic rocks display a bim odal geochemical distribution. They constitute one part of the Late Paleozoic magma in the IMDOB. So knowing the ch aracteristics of the volcanic rocks is very important and helpful for understanding the tectonic setting and the evolutio n of the Paleo-Asian Ocean in Paleozoic. Therefore the geochronological and geochemical study has been done in ord er to solve these problems. By means of SHRIMP zircon U-Pb dating, the ages of two rhyolite samples are 307.1±6.3 Ma and 308.9±1.8Ma, which are consistent with the ages of the Baolige Formation in the eastern area and about 20 Myr earlier than the intrusive alkaline granite around Bayanwula village in the south. Combined with previous researc h results, it is suggested that the Baolige Formation was not erupted during Early Permian, but between Late Carbon iferous and Early Permian. By the geochemical analysis, the intermediate to mafic rocks fall into basaltic trachyandesit e, trachyandesite and andesite field and locate in the transition area between alkaline and subalkaline rock series in the TAS diagram. In the chondrite-normalized REE and primary mantle-normalized trace element fractional diagrams, t hey all exhibit enrichment in LILE and LREE, depletion in HREE and HFSE, obviously negative in Nb, Ta, Ti, P, and positi ve in Zr, Hf. The ratios of La/Nb (3.08~5.18) and Nb/U (1.58~6.15) are closer to the values in the crust components t han in the mantle components. In the La/Nb vs. La/Ba diagram, the distribution trend of samples is near to the contin ental lithospheric mantle transformed by the subduction. These characters suggest the intermediate to mafic rocks m ay be originated from partial melting of the lithosphere materials. Otherwise, the felsic rocks fall into rhyolite area in t he TAS diagram with the geochemical characteristics of I-and A-type granite in the granite classification figures. Moreo ver these rhyolites are enrichment in LREE and LILE (Rb, Th, U), depletion in HREE and HFSE (Nb, Ta, Ti), and have str ongly depletion in Ti, Sr, Ba. The isotope geochemical characteristics of them are similar to those of the Late Paleozoic granites widely distributed in the Da Hinggan and Northeast China areas with positive $\varepsilon_{Nd}(t)$ (0.5124~0.5125) and yo ung t_{DM1} ages (769~595Ma), which document the juvenile continental crustal formation. With the changes of SiO_2 co ntent, there are some different variational characteristics in the constant and trace elements between mafic and felsic rocks that imply their different source regions. Possibly the felsic volcanic rocks derived from the partial melting of new

ly accreted crustal components induced by the intermediate-basic magma underplating. These volcanic rocks constitute a calc-alkaline to alkaline magmatic suite. In the diagrams of tectonic environment discrimination, the intermediate to mafic rocks are located in the within-plate basalts areas and the felsic rocks mostly fall into the post-collision or post-orogenic areas, implying that they belong to the post-orogenic magmatic rocks. In the adjacent areas, some magma related to the subduction process are formed in 490~422.8Ma. The metamorphic age of Xilin Gol complex (337Ma) forming at the peak stage of orogeny is about 30Myr earlier than the volcanic rocks of the Baolige Formation. Zircons from a microgabbro and a plagiogranite in Hegenshan ophiolite yielded ages of 354Ma and 333Ma, and the ages of Erenhot ophiolite was obtained in 354.2~344.8Ma. Meanwhile some cotemporaneous magma (330~313Ma) standing for post-orogenic environment were reported around Xiwuqi and Xilinhot regions, and a wide range of alkaline granites emplaced during 295~270Ma in the CAOB which indicate a geodynamic regime of regional extension. In addition, the widespread extensional setting can be further confirmed by the emplacement of bimodal volcanic rocks of Early Permian in the adjacent regions. Taken together, the Paleo-Asian Ocean closed before the Late Carboniferous epoch, and the volcanic rocks of the Baolige Formation developed in a post-orogenic extensional regime.

关键词：晚古生代火山岩 锆石SHRIMP U-Pb定年 后造山环境 古亚洲洋

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黔ICP备07002071号-2
主办单位：中国矿物岩石地球化学学会
单位地址：北京9825信箱/北京朝阳区北土城西路19号
本系统由北京勤云科技发展有限公司设计

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