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华北克拉通阜平杂岩中~2.7Ga TTG片麻岩的厘定及其地质意义

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摘要:

通过详细的地质工作, 本文从阜平杂岩中厘定出一套~2.7Ga的条带状TTG片麻岩系, 其原岩主要为英云闪长岩, 经历了强烈的变形和深熔改造。该片麻岩可分为岩石主体和条带, 按条带形态和成分可分为三种: 细小的暗色条带、深熔浅色条带和后期注入的长英质脉体。用LA-MC-ICPMS法对英云闪长岩中锆石进行了原位U-Pb年龄测试, 其形成年龄为 2669.2 ± 9.7 Ma。该片麻岩 $\text{SiO}_2 = 64.32\% \sim 70.02\%$, 具有高铝 ($\text{Al}_2\text{O}_3 = 14.00\% \sim 15.87\%$) 富钠 ($\text{Na}_2\text{O} = 3.85\% \sim 4.22\%$) 贫钾 ($\text{K}_2\text{O} = 1.13\% \sim 2.42\%$) 及低K/Na比值的特点, $\text{Mg}^\#$ 指数为39.5~49.6。该片麻岩具有中等-强烈程度的稀土元素分异 [$(\text{La}/\text{Yb})_N = 3.67 \sim 51.38$], Eu异常不明显。其富集Sr ($303 \times 10^{-6} \sim 431 \times 10^{-6}$)、Ba ($191 \times 10^{-6} \sim 696 \times 10^{-6}$) 等大离子亲石元素, 亏损Nb ($4.70 \times 10^{-6} \sim 9.78 \times 10^{-6}$)、Ta ($0.19 \times 10^{-6} \sim 0.75 \times 10^{-6}$)、Ti ($1378 \times 10^{-6} \sim 3259 \times 10^{-6}$)、P ($174.6 \times 10^{-6} \sim 960.6 \times 10^{-6}$) 等高场强元素, Cr ($5.87 \times 10^{-6} \sim 119.4 \times 10^{-6}$)、Ni ($6.72 \times 10^{-6} \sim 45.75 \times 10^{-6}$) 等相容元素含量也较低。Yb ($0.31 \times 10^{-6} \sim 1.75 \times 10^{-6}$) 和Y ($3.61 \times 10^{-6} \sim 18.88 \times 10^{-6}$) 含量低, Sr/Y比值高 (16.0~119.1), 属于高铝的TTG, 与高硅埃达克岩特征相似。推断是热的太古宙新生洋壳部分熔融而成。阜平地区~2.7Ga TTG片麻岩的厘定, 进一步证实了华北克拉通在新太古代早期经历了强烈的陆壳增生, 并为华北克拉通早期岩浆事件与世界范围的岩浆事件的对比提供了新的依据, 为华北克拉通早期陆块及绿岩带的划分提供了新的限定。

英文摘要:

Through detailed field geological survey and indoor analysis we have delineated a suite of banded TTG gneisses from the Fuping Complex, North China Craton (NCC). The protolith of the gneisses was predominantly tonalite that has undergone intensive metamorphism, deformation and anatexis. The gneiss can be divided into the main rock body and strips. It extends three kinds of stripes: Tiny dark stripes, light stripes, late poured felsic stripes. The zircon LA-MC-ICPMS U-Pb data shows that the tonalite was formed ca. 2669.2±9.7Ma ago. The tonalite is featured with high silicon ($\text{SiO}_2 = 64.32\% \sim 70.02\%$), high alumina ($\text{Al}_2\text{O}_3 = 14.00\% \sim 15.87\%$), rich in sodic ($\text{Na}_2\text{O} = 3.85\% \sim 4.22\%$), poor in potassium ($\text{K}_2\text{O} = 1.13\% \sim 2.42\%$) with a low K/Na ratio. The Mg index is relatively high ($\text{Mg}^\# \approx 39.5 \sim 49.6$). The gneiss is moderately-strongly fractionated in REE [$(\text{La}/\text{Yb})_N = 3.67 \sim 51.38$]. Eu abnormality is not evident. It is enriched in LILE such as Sr ($303 \times 10^{-6} \sim 431 \times 10^{-6}$), Ba ($191 \times 10^{-6} \sim 696 \times 10^{-6}$) and depleted in HFSE like Nb ($4.70 \times 10^{-6} \sim 9.78 \times 10^{-6}$), Ta ($0.19 \times 10^{-6} \sim 0.75 \times 10^{-6}$), Ti ($1378 \times 10^{-6} \sim 3295 \times 10^{-6}$), P ($174.6 \times 10^{-6} \sim 960.6 \times 10^{-6}$), low contents of Yb ($0.31 \times 10^{-6} \sim 1.75 \times 10^{-6}$) and Y ($3.61 \times 10^{-6} \sim 18.9 \times 10^{-6}$) with high Sr/Y ratio (16.0~119.1). The contents of compatible elements [Cr ($5.9 \times 10^{-6} \sim 119 \times 10^{-6}$) and Ni ($6.72 \times 10^{-6} \sim 45.8 \times 10^{-6}$)] are relatively low. From the above, the gneiss is classified into high-Al TTG series, and has the similar characteristics with high-Si adakite. It is considered to be generated from the partial melting of hot Archean juvenile subducted oceanic crust. The delineation of this ca. 2.7Ga TTG gneiss in the Fuping Complex further proves that the North China Craton experienced large-scale continental crustal accretion in Early Neoproterozoic, and gives new constraints on the contrast of time and scale of the magmatic events between the worldwide ones and the NCC. It also provides the subdivision of the early blocks and greenstone belts of the NCC.

关键词: [TTG片麻岩](#) [2.7Ga](#) [绿岩带](#) [阜平杂岩](#) [华北克拉通](#)

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