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大青山-乌拉山变质杂岩带石拐地区富铝片麻岩成因矿物学与变质演化

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#### 摘要:

大青山-乌拉山变质杂岩中石拐地区富铝片麻岩出露于华北克拉通孔兹岩带中段,包括夕线石榴堇青二长片麻岩、紫苏石榴黑云二长片麻岩和夕线石榴黑云二长片麻岩,与基性麻粒岩彼此呈互层或夹层产出。根据岩相学观察、成因矿物学和变质反应结构的系统研究,结合地质温压计估算以及相平衡模拟的综合分析,揭示石拐地区富铝片麻岩的变质演化可划分为四个变质阶段。其中,早期进变质阶段( $M_1$ )矿物组合以石榴石核部及其包裹的细粒矿物黑云母+石英+斜长石±夕线石±钾长石±尖晶石为特征;峰期变质阶段( $M_2$ )的稳定的矿物组合为石榴石+基质中粗粒夕线石+黑云母+石英+斜长石+钾长石±磁铁矿±钛铁矿,形成的温压条件为 $T=840\sim 860^\circ\text{C}$ ,  $P=10.0\sim 10.5\text{kbar}$ ;峰后近等温减压阶段( $M_3$ )以石榴石边部发育含堇青石的后成合晶为特征,并发生一系列典型的减压反应: $\text{Grt}+\text{Sil}+\text{Qz}\rightarrow\text{Crd}$ 、 $\text{Grt}+\text{Melt}\rightarrow\text{Crd}+\text{Bt}+\text{Pl}$ 和 $\text{Grt}+\text{Melt}\rightarrow\text{Crd}+\text{Qz}\pm\text{Pl}$ ,形成新的矿物组合为石榴石+堇青石+黑云母+斜长石+石英±夕线石±紫苏辉石,相应的温压条件为 $T=720\sim 800^\circ\text{C}$ 和 $P=5.6\sim 6.1\text{kbar}$ ;晚期角闪岩相降温阶段( $M_4$ )的矿物组合是石榴石+石榴石边部细粒黑云母+斜长石+石英+磁铁矿±钾长石±钛铁矿,记录的温压条件为 $T=616\sim 661^\circ\text{C}$ 和 $P=3.4\sim 5.2\text{kbar}$ 。石拐地区富铝片麻岩及相关岩石具有典型的近等温减压的顺时针 $P-T$ 轨迹,峰后经历了近等温减压和近等压降温的变质演化阶段。上述研究结果表明,石拐地区富铝片麻岩曾卷入到华北克拉通西部的阴山陆块和鄂尔多斯陆块间的俯冲-碰撞造山及随后的快速隆升的演化过程。

#### 英文摘要:

Al-rich gneisses as interlayers within mafic granulites are widespread in the Shiguai area, Daqingshan-Wulashan metamorphic complex belt which is belong to the central part of the Khondalite Belt of the North China Craton. Shiguai Al-rich gneisses consist mainly of sillimanite-garnet-cordierite gneiss, hypersthene-garnet gneiss and sillimanite-garnet gneiss. Based on integrated structural, petrographic, mineral compositional features, geothermobarometric estimations and  $P-T$  pseudosection modelling in the system NCKFMASHTO, the metamorphic evolution for the Shiguai Al-rich gneisses could be subdivided into four metamorphic stages. Thereinto, early prograde metamorphic stage ( $M_1$ ) is characterized by garnet cores and the mineral inclusions of biotite+quartz+plagioclase±sillimanite ±K-feldspar±spinel. In contrast, mineral assemblage at the peak metamorphic stage ( $M_2$ ) is interpreted to be matrix garnet and coarse-grained sillimanite+biotite+quartz+plagioclase + K-feldspar±magnetite±ilmenite, which formed at  $P-T$  conditions of  $840\sim 860^\circ\text{C}$  and  $10.0\sim 10.5\text{kbar}$ . Typical decompressional reactions, such as  $\text{Grt}+\text{Sil}+\text{Qz}\rightarrow\text{Crd}$ 、 $\text{Grt}+\text{Melt}\rightarrow\text{Crd}+\text{Bt}+\text{Pl}$  and  $\text{Grt}+\text{Melt}\rightarrow\text{Crd}+\text{Qz}\pm\text{Pl}$  have been identified at the post-peak metamorphic stage ( $M_3$ ), and new mineral assemblage of garnet+cordierite+biotite+plagioclase+quartz±sillimanite±hypersthene was formed at this stage with  $P-T$  conditions of  $720\sim 800^\circ\text{C}$  and  $5.6\sim 6.1\text{kbar}$ . The late cooling stage ( $M_4$ ) is characterized by a retrogressive mineral assemblage of garnet+biotite+plagioclase+quartz+magnetite ±K-feldspar±ilmenite, which formed at  $P-T$  conditions of  $616\sim 661^\circ\text{C}$  and  $3.4\sim 5.2\text{kbar}$ . This indicates that the Shiguai Al-rich gneisses recorded a clockwise near-isothermal decompression (ITD)  $P-T$  path following by a near-isobaric cooling (IBC) stage. It can be concluded that the Shiguai Al-rich gneisses within the Daqingshan-Wulashan metamorphic complex belt was indeed involved in the subduction-collision orogenic event between Yinshan block and Ordos block at Paleoproterozoic.

关键词: [富铝片麻岩](#) [P-T演化轨迹](#) [孔兹岩带](#) [石拐地区](#) [大青山](#)

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