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内蒙古集宁三岔口夕线堇青石榴二长片麻岩变质作用及年代学研究

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摘要:

三岔口夕线堇青石榴二长片麻岩出露于华北克拉通孔兹岩带东部的集宁变质杂岩中, 该岩石保留了典型的减压反应结构。系统的岩相观察和矿物化学研究表明, 三岔口地区夕线堇青石榴二长片麻岩保存了两个阶段变质作用的矿物组合及相应的变质反应结构, 其中峰期阶段 M_1 的矿物组合为石榴石+夕线石+黑云母+石英+斜长石+钾长石+钛铁矿±磁铁矿; 峰后减压的 M_{2-1} 变质阶段矿物组合为石榴石+堇青石+夕线石+石英+斜长石+钾长石+钛铁矿±尖晶石, M_{2-2} 阶段的矿物组合为石榴石+堇青石+黑云母+石英+斜长石+钾长石+钛铁矿+磁铁矿±尖晶石。自峰期变质阶段到峰后减压阶段, 典型的转变(减压)反应包括: $Grt+Sil+Melt \rightarrow Crd+Bt+Fe\text{-oxide}$ 和 $Grt+Sil \rightarrow Crd+Sp$ 。相平衡模拟结合传统地质温压计限定峰期变质阶段的温压条件为 $T=852\sim 862^\circ\text{C}$, $P=9.3\sim 10.2\text{kbar}$; 峰期后近等温减压的 M_{2-1} 和 M_{2-2} 段的温压条件分别为 $854\sim 880^\circ\text{C}$ 和 $7.0\sim 7.4\text{kbar}$, $820\sim 848^\circ\text{C}$ 和 $5.3\sim 6.4\text{kbar}$ 。三岔口夕线堇青石榴二长片麻岩记录了典型的近等温减压型的顺时针 P - T 轨迹。阴极发光图像特征显示夕线堇青石榴二长片麻岩存在大量变质锆石, LA-ICP-MS U-Pb定年结果表明, 所有变质锆石记录了十分一致的 $^{207}\text{Pb}/^{206}\text{Pb}$ 年龄, 其变质时代为 $1912\pm 11\text{Ma}$ 。变质作用历史说明内蒙古孔兹岩带东段的集宁地体卷入了华北克拉通西部的阴山陆块和鄂尔多斯陆块之间的俯冲-碰撞, 并经历了古元古代($\sim 1912\text{Ma}$)的麻粒岩相变质作用后快速折返至地表的过程。

英文摘要:

Sanchakou sillimanite-cordierite-garnet paragneisses, showing distinct decompressional textures, crop out in Jirg Complex in the eastern segment of the Khondalite Belt, the North China Craton (NCC). The mineral assemblages and microtextures of the Sanchakou sillimanite-cordierite-garnet paragneisses allow a reconstruction of the metamorphic history of the area. The rocks contain two distinct metamorphic assemblages according to the systematic petrographic observations and mineral chemistry, namely the peak (M_1) and the post-peak (M_2) stages. The peak (M_1) assemblage consists of garnet (mantle)+sillimanite+biotite+quartz+plagioclase+K-feldspar+ilmenite±magnetite. Post-peak near-isothermal decompressional (M_2) stage following the peak stage could be subdivided into two stages M_{2-1} and M_{2-2} . The M_{2-1} stage is characterized by garnet and the development of cordierite+sillimanite+quartz+plagioclase+K-feldspar+ilmenite±spinel corona, and the M_{2-2} stage is represented by garnet+cordierite+biotite+quartz+plagioclase+K-feldspar+ilmenite+magnetite±spinel, involving the reactions of garnet+sillimanite+melt \rightarrow cordierite+biotite+Fe-oxide and garnet+sillimanite \rightarrow cordierite+spinel. Quantitative phase equilibria modeling in the system $\text{Na}_2\text{O}-\text{CaO}-\text{K}_2\text{O}-\text{FeO}-\text{MgO}-\text{Al}_2\text{O}_3-\text{SiO}_2-\text{H}_2\text{O}-\text{TiO}_2-\text{Fe}_2\text{O}_3$, in combination with traditional thermobarometry, was applied to obtain P - T conditions of $852\sim 862^\circ\text{C}$ and $9.3\sim 10.2\text{kbar}$ for M_1 , $854\sim 880^\circ\text{C}$ and $7.0\sim 7.4\text{kbar}$ for M_{2-1} , $820\sim 848^\circ\text{C}$ and $5.3\sim 6.4\text{kbar}$ for M_{2-2} . The combination of the mineral assemblages, mineral compositions, and metamorphic reaction histories in the Sanchakou sillimanite-cordierite-garnet paragneisses defines a clockwise P - T path that involves near-isothermal decompression that followed the peak granulite-facies metamorphism. Cathodoluminescent images show that zircons contained in the Sanchakou sillimanite-cordierite-garnet paragneisses mostly are metamorphic zircons. Analyses of LA-ICP-MS zircon U-Pb dating indicate that metamorphic zircons recorded concordant $^{207}\text{Pb}/^{206}\text{Pb}$ ages, and metamorphic age of the sillimanite-cordierite-garnet paragneisses is $1912\pm 11\text{Ma}$. The clockwise P - T path reveals that the Jining terrane involved in the subduction or collision followed by exhumation and cooling events and experienced the Paleoproterozoic ($\sim 1912\text{Ma}$) granulite-face metamorphism to form the Khondalite Belt with the amalgamation of the Yinshan and the Ordos blocks in the Western Block of the North China Craton.

关键词: [变泥质岩](#) [相平衡模拟](#) [U-Pb年代学](#) [古元古代](#) [三岔口](#) [集宁地区](#)

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