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胶东新立构造蚀变岩型金矿床元素地球化学行为

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摘要:

新立金矿位于华北克拉通东部胶东金矿省内,是一个典型的蚀变岩型(焦家型)金矿床,矿床受区域三山岛-仓上断裂带控制,产出于蚀变的玲珑花岗岩中。在主断裂带下盘蚀变矿化发育,可以划分为五个阶段:钾长石化阶段、绢英岩化阶段、黄铁绢英岩矿化阶段、多金属硫化物矿化阶段和碳酸盐化阶段。不同的蚀变矿化过程导致各阶段样品具有不同的矿物组合和地球化学特征。钾长石化花岗岩以高钾钠含量为特征,因为样品中含有新生成的二次钾长石及残留的钠长石;绢英岩的钙钠含量明显低于钾长石化花岗岩,是绢英岩化阶段斜长石蚀变分解所致;黄铁绢英岩 Fe_2O_3 含量普遍较高且 SiO_2 含量波动明显,与该阶段样品中大量黄铁矿的产出及部分样品中包含石英团块或石英脉相一致;多金属硫化物矿化样品的元素含量与黄铁绢英岩基本类似;碳酸盐化蚀变样品以高CaO含量为特征,与该阶段大量沉淀析出的方解石相符。在原始地幔标准化微量元素配分图上,不同阶段矿化蚀变样品,大离子亲石元素Rb、Ba、K、Sr差异性明显,而高场强元素Zr、Hf、Nb、Ta、P差异性较小,表明热液蚀变过程中大离子亲石元素活性较强,高场强元素相对稳定。在稀土元素球粒陨石标准化图中,不同阶段样品均呈明显的右倾性,蚀变早期(钾长石化阶段)样品钕异常不明显,蚀变矿化中期(绢英岩化阶段至多金属硫化物矿化阶段)样品普遍具有负钕异常,而蚀变晚期(碳酸盐化阶段)样品普遍具有正钕异常。元素相关性分析表明,金与银、砷、铋和硫具明显正相关,与铜、铅具有一定的相关性。成矿元素因子分析也显示出金与砷、硫、铁、钴在矿化过程中具有类似的地球化学行为。实测剖面上不同位置样品元素地球化学特征的差异性主要受构造及蚀变矿化类型、强度控制,成矿元素在主断裂附近达到峰值,在远离主断裂方向上,其含量整体呈下降趋势,但在次级矿化断裂发育地段,含量又明显回升;另外在断裂附近由于微裂隙及节理相对发育,有利于热液的渗透,蚀变较强,对成矿元素的空间分布亦具有控制作用。

英文摘要:

The Xinli gold deposit is a typical altered rock (Jiaojia) type ore deposit, which is located in the Jiaodong Peninsula, eastern part of North China Craton. The deposit is controlled by the regional Sanshandao-Cangshang fault zone and occurs in the altered Linglong granite. The paragenetic sequence of altered and mineralized samples are complex in the footwall of the major fault, including the stages of K-feldspar alteration, sericite-quartz alteration, pyrite-sericite-quartz mineralization, polymetallic sulfide mineralization, and carbonation. The samples from different stages have diverse mineral assemblages and geochemistry characteristics due to various processes of alteration and mineralization. K-feldspar alteration granite samples have high content of K_2O and Na_2O because of the secondary K-feldspar and residual albite. Sericite-quartz samples display low content of CaO and Na_2O due to the alteration and decomposition of plagioclase. Pyrite-sericite-quartz samples have high content of Fe_2O_3 and fluctuating content of SiO_2 , which are consistent with the occurrence of abundant pyrite in almost all pyrite-sericite-quartz samples and quartz pods or veins in some samples. Polymetallic sulfide samples show similar geochemistry characteristics with pyrite-sericite-quartz samples. Carbonation samples have high content of CaO due to the precipitation of calcite. According to primitive mantle-normalized trace element patterns, large ion lithophile elements (e.g., Rb, Ba, K, Sr) are diverse and high field strength elements (e.g., Zr, Hf, Nb, Ta, P) are analogous in samples from different stages, which indicated that large ion lithophile elements are impressionable and high field strength elements are relatively stable during alteration and mineralization. Based on chondrite-normalized rare earth elements patterns, all samples show moderate enrichments in light rare earth elements relative to heavy rare earth elements. K-feldspar alteration granite samples show negligible negative Eu anomalies. Sericite-quartz, pyrite-sericite-quartz and polymetallic sulfide samples display significant negative Eu anomalies, and carbonation samples show moderately positive Eu anomalies. According to elements correlation and principal component analysis, Au reveals similar behaviors with S, As, Bi, Ag, Fe, Cu and Pb during mineralization. Samples from different locations of the measured profiles show unlike geochemistry characteristics, which are controlled by structures and the types and intensity of alteration. The contents of metallogenic elements are high near the major fault and have a decreased trend away from the major fault. However, the contents increase rapidly near the zone of subordinate faults. The micro-fractures and joints are relatively developed near faults facilitating fluids permeation, with high intensity of alteration and mineralization, which also control the distribution of metallogenic elements in the measured profile.

关键词: 蚀变 矿化 元素行为 新立 胶东

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