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胶东蚀变岩型金矿矿物微区地球化学特征

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摘要:

胶东半岛金矿集区是我国主要的产金地之一,其中“蚀变岩型”和“石英脉型”金矿为该区两个典型的矿床类型。位于胶东半岛西北部的三山岛-仓上断裂带发育两个典型的“蚀变岩型”金矿:三山岛金矿和新立金矿。这两个金矿区金矿物赋存状态以晶隙金、裂隙金和包裹金为主,呈片状、椭圆状、短柱状和板状形态赋存于载金矿物之中,载金矿物主要为黄铁矿,少量方铅矿、闪锌矿等硫化物。扫描电镜背散射(BSE)电子图像和二次电子图像发现,单个金颗粒表面具有明显的凹坑或凹槽,因内部填充杂质或反光而呈暗黑色区域。电子探针(EMPA)分析可得金矿物中Au含量为63.34%~72.54%,含有较高的Ag含量(27.39%~36.34%),属于银金矿系列。银金矿单个颗粒微区能谱分析(SEM-EDS)显示,银金矿中除了Au和Ag外,还存在N(6.12%~9.79%)、O(1.89%~6.18%)、W(0.42%~0.84%)、P(6.32%~10.38%)和Fe(1.62%~3.37%)等元素。研究区银金矿与玲珑金矿(“石英脉型”金矿)金矿物微区元素对比分析发现,具有相同的Au、Ag、N、O和Fe元素,但是仅在研究区银金矿中发现W元素,并且所含N、O和Fe的含量远低于玲珑金矿床。研究区银金矿中低O含量反应金形成环境为还原环境,并且与“石英脉型”金矿形成环境相对比,还原性更高。N元素的存在可能指示成矿流体中有大气降水混入,并且“蚀变岩型”金矿比“石英脉型”金矿混入量较少。P可指示成矿流体中有幔源流体的加入。W指示成矿流体可能源自早白垩世岩浆作用形成的初始岩浆流体。通过金矿物微区地球化学与成矿流体氢氧同位素综合分析可得,胶东金矿成矿流体为多源混合。成矿物质来源与早白垩世中-基性脉岩具有同源性,可能源自深部地幔。Au运移过程中,主要以硫化物Au(HS)₂的形式运移。

英文摘要:

Jiaodong gold concentrated area is one of the most important gold in China. There are two typical deposit types, such as 'altered fracture-type' and 'quartz vein-type', which host the mostly ore deposits in Jiaodong Peninsula. The Sanshandao and Xinli gold deposits, typical 'altered fracture-type' ore deposits, are located in northwestern Jiaodong Peninsula and both of them are controlled by Sanshandao-Cangsang fault. Gold is embodied as intergranular, fissure-filling and inclusion in gold-bearing minerals which are consisted of pyrite, galena, sphalerite and chalcopyrite. Various morphological types of gold grains were found in photomicrograph, which include schistic, ellipsoid, stumpy and slabby. Through back-scattered electron images (BSE) and secondary electron image of gold grains, we found a lot of cavities and pits in the surface and dark gray areas resulted from impurities containing in the that. The data of electronic microprobe analysis (EMPA) shows that the Au content is 63.34%~72.54% with high Ag content (27.39%~36.34%), which belong to electrum. The Scanning Electron Microscope and Energy Dispersive Spectrum (SEM-EDS) micro-analysis of gold grains contain that the major elements is Au and Ag, and the trace elements include N (6.12%~9.79%), O (1.89%~6.18%), W (0.42%~0.84%), P (6.32%~10.38%), Fe (1.62%~3.37%). Compared to the micro-analysis of gold grains from Linglong gold deposit, one of typical 'quartz vein-type' gold deposits in Jiaodong, both of them have the same elements such as Au, Ag, N, O and Fe, but the contents of N, O and Fe of gold grains in this article are less than Linglong gold deposit. We detected W in the micro-analysis of gold grains from Xinli and Sanshandao gold deposits without Linglong gold deposit. The low content of O indicates precipitation of Au occurs in reducing conditions and 'altered fracture-type' gold is stronger than 'quartz vein-type' gold deposits. N implied that small amount of meteoric water mixed in the ore fluids, and the fluids of 'altered fracture-type' are less admixed meteoric water than 'quartz vein-type'. P implied that there is mantle-derived fluid mixing. W is origin of primary magma fluid formed by early cretaceous magmatism and the precipitation of W and Au indicates the weak alkalic conditions. The analysis of combining micro-chemistry with H-O isotope implies the source of ore fluid of Jiaodong gold deposit is mixed kinds of origins. The Early-Cretaceous intermediate-basic dykes show similarity origin of metal to the gold ore. The Au(HS)₂ complex is as the most likely gold bisulfide complex for gold transport.

关键词: 金矿物 矿物学 微区地球化学 成矿流体 同位素 胶东半岛

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