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## 摘要:

岩浆型铁矿床是我国的重要铁矿类型之一,也是峨眉山幔柱系统的有机组成部分。但是,这类矿床的成因问题长期没有解决。本文以黑山铁矿中的脉状铁矿体为例,试图通过锆石矿物地球化学的系统分析揭示岩浆型铁矿床脉状铁矿体的成因。锆石Ti温度计和 $\delta\text{Ce}$ 氧逸度计计算结果表明,脉状铁矿体的成矿温度 $T$ 介于 $631\sim 768^\circ\text{C}$ 之间,加权平均为 $681^\circ\text{C}$ ;成矿氧逸度 $\log f_{\text{O}_2}$ 介于 $-25.7\sim -15.6$ 之间,加权平均为 $-20.8$ 。这与实验得到的富铁质岩浆成矿温度相差近 $400^\circ\text{C}$ ,但又明显高于岩浆热液的温度。因此,本文认为“铁矿浆”很可能是溶解了大量成矿金属的超临界流体处于岩浆-热液过渡状态。这一认识得到了锆石 $(\text{Sm}/\text{La})_{\text{N}}$  vs.  $\text{La}$ 和 $\text{Ce}/\text{Ce}^*$  vs.  $(\text{Sm}/\text{La})_{\text{N}}$ 判别图解以及CL图像的进一步支持。大量流体组分的存在能够有效降低“铁矿浆”的粘度和密度,从而有利于其沿裂隙贯入或挤入围岩中,这可以很好的解释铁矿体的不规则脉状产状和围岩蚀变特征。结合前人资料,“铁矿浆”中的流体组分包括C-H-O-S等,这些流体组分除了岩浆自身结晶分异作用而富集的挥发分外,还包括外来幔源流体和地表流体的加入。“铁矿浆”在贯入围岩后经历了相分离作用,因而触发了钛铁氧化物的结晶从而富集形成矿石,这一流体地质过程记录在锆石Eu异常特征中。黑山铁矿床脉状铁矿体的形成机理可能也适用于包括攀枝花式铁矿在内的其他岩浆型铁矿床中的脉状铁矿体。

## 英文摘要:

Magmatic iron deposit is not only one of the most important types of iron resources in China, but also an intimate component of the Emeishan mantle plume. However, the metallogenic mechanism of magmatic iron deposit is still controversial. We investigate the vein-type iron orebody in the Heishan iron deposit as an example, and aim to unravel the genesis of vein-type iron orebody in magmatic iron deposit by zircon mineral geochemistry. Using Ti-in-zircon geothermometer and  $\delta\text{Ce}$ -in-zircon oxygen geobarometer, the metallogenic temperature and oxygen fugacity of vein-type iron orebody are  $631\sim 768^\circ\text{C}$  (average= $681^\circ\text{C}$ ) and  $-25.7\sim -15.6$  (average= $-20.8$ ), respectively. It is much lower than the saturation of ferro-rich magma about  $400^\circ\text{C}$ , and higher than the temperature of hydrothermal fluid, which imply the "iron ore magma" is in the state of supercritical fluid dissolving numerous metal material. This conclusion is further confirmed by the CL images, discriminant diagrams of  $(\text{Sm}/\text{La})_{\text{N}}$  vs.  $\text{La}$  and  $\text{Ce}/\text{Ce}^*$  vs.  $(\text{Sm}/\text{La})_{\text{N}}$  for zircons. Being enriched with fluid component would effectively reduce the viscosity and density of "iron ore magma" and be beneficial to its injection, which could well interpret its irregular-shaped vein occurrence and wall-rock alteration. Based on previous studies, chemical components of the fluid component in the "iron ore magma" comprise C-H-O-S, which are enriched by magma fractional crystallization and addition of transmagmaic and surface fluid. Phase separation after injection of the "iron ore magma" triggers crystallization of Fe-Ti oxide and ore-formation. This fluid geological process is recorded by Eu anomaly in zircon. The metallogenic mechanism of the vein-type iron orebody in the Heishan iron deposit may be comparable to that of other magmatic iron deposits, including the Panzhihua-type iron deposits.

关键词: [岩浆型铁矿床](#) [矿浆](#) [黑山](#) [超临界流体](#) [锆石Ti温度计](#) [锆石 \$\delta\text{Ce}\$ 氧逸度计](#) [攀枝花式铁矿](#)

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