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辽冀地区条带状铁建造地球化学特征: I. 主量元素特征

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摘要:

辽冀地区(主要包括鞍山-本溪地区和冀东地区)位于华北克拉通东北部, 产出有诸多BIFs型大型-特大型铁矿床。鞍山-本溪地区和冀东地区是我国最大的两个铁矿集区, 其中鞍山地区铁矿储量占全国的24%左右, 冀东地区铁矿资源储量占全国的10%以上。虽然辽冀地区BIFs大多为形成于新太古代绿岩带中的Algoma型BIFs, 但不同矿区BIFs形成环境和受后期改造的程度不一致, 鞍山地区BIFs变质级别为绿片岩相-角闪岩相, 冀东地区BIFs经历了绿片岩相-麻粒岩相的变质作用, 且辽冀地区普遍发育混合岩化。本文主要对比研究了辽冀地区28个铁矿床200件铁矿石的主量元素特征, 为探讨辽冀地区BIFs的形成提供了更多的信息。BIFs样品主要由 SiO_2 和 Fe_2O_3^T 组成, 其中鞍山-本溪地区 $\text{SiO}_2 + \text{Fe}_2\text{O}_3^T$ 平均为95.10%, 冀东地区 $\text{SiO}_2 + \text{Fe}_2\text{O}_3^T$ 平均为88.06%, CaO 和 MgO 含量仅次于 SiO_2 和 Fe_2O_3^T , 且大部分矿区具有正相关关系, Al_2O_3 、 TiO_2 、 K_2O 、 Na_2O 、 MnO 、 P_2O_5 含量很低, 这暗示BIFs原岩为一种化学沉积岩, 主要为含有少量碳酸盐泥的硅质和铁质的胶体沉积; 辽冀地区 Al_2O_3 和 TiO_2 均可见明显的正相关, 这可能是由于BIFs沉积过程中有少量碎屑物质的加入, 这种相关性在冀东地区更为明显, 且除 $\text{SiO}_2 + \text{Fe}_2\text{O}_3^T$ 外, 其它氧化物含量明显高于鞍山地区, 说明冀东地区BIFs形成时沉积环境更为动荡, 有更多的碎屑物质加入; 虽然辽冀不同地区BIFs经历了不同级别的变质作用, 形成了不同的矿物组合, 但是氧化物含量却变化不大, 这说明了变质反应主要为等化学反应; 鞍山地区和冀东地区碱质含量也存在差异性, 前者的 Na_2O 和 K_2O 含量均低于后者, 且后者 $\text{Na}_2\text{O} > \text{K}_2\text{O}$, 结合野外地质特征, 可能暗示了混合岩化作用对冀东地区的影响更为显著。

英文摘要:

Liaoning-eastern Hebei area (it mainly includes Anshan-Benxi area and eastern Hebei Province), where plenty of large-superlarge banded iron formations (BIFs) type iron deposits distributed, is located at the northeastern North China Craton. Anshan-Benxi area and eastern Hebei Province are the two largest iron ore clusters in China. The iron ore reserves of Anshan-Benxi area account for about 24% in China, and the iron ore reserves of eastern Hebei Province account for more than 10%. Although most BIFs which belong to Algoma-type in Liaoning-eastern Hebei area formed in Neoproterozoic granite-greenstone belt, they may formed at different environment and experienced different late reformations. The BIFs in Anshan-Benxi experienced greenschist to amphibolite facies metamorphism, however the BIFs experienced greenschist to granulite facies metamorphism in eastern Hebei Province, and migmatization is ubiquity in both areas. In this study, we mainly report major elements of 200 iron ore samples from 28 iron deposits in the Liaoning-eastern Hebei area, which offers more information of the formation of the BIFs. The studied BIFs are mostly composed of $\text{SiO}_2 + \text{Fe}_2\text{O}_3^T$ (the average value of Anshan-Benxi area is 95.10%, the average value of eastern Hebei Province is 88.06%). The contents of MgO and CaO are next to SiO_2 and Fe_2O_3^T , and the positive correlation also between MgO and CaO in the studied area. The contents of Al_2O_3 , TiO_2 , K_2O , Na_2O , MnO , P_2O_5 are very low, all of which indicate that BIFs are typical chemical sedimentary rock, the protolith of BIFs are colloid composed of silicious, iron and small amounts of carbonate mud; Both Al_2O_3 and TiO_2 simultaneously increase in the studied BIFs indicates that these chemical sediments incorporate minor detrital components. In eastern Hebei Province, this correlation is more obvious, and the major elements concentrations are higher than that of Anshan-Benxi area except $\text{SiO}_2 + \text{Fe}_2\text{O}_3^T$, all of which represents eastern Hebei Province BIFs forming at wave base, more detrital material input. The average bulk chemistry of BIFs, from greenschist to granulite facies, which formed different mineral composition, the major elements are very similar, these suggest that metamorphic reaction is essentially isochemical. Alkali contents of Anshan-Benxi area BIFs ($\text{Na}_2\text{O} > \text{K}_2\text{O}$) and eastern Hebei Province (both are higher than Anshan-Benxi area, and $\text{Na}_2\text{O} > \text{K}_2\text{O}$) are different, combining with field geological characteristics, may indicate that migmatization had more strong influence on eastern Hebei Province.

nce than Anshan-Benxi area BIFs.

关键词: [主量元素](#) [条带状铁建造](#) [鞍山-本溪地区](#) [冀东地区](#) [华北克拉通](#)

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