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Effect of the gypsum-salt layer oxidation barrier for ore-formation of Iron-Oxide-Apatite and skarn type iron deposits in the Middle-Lower Yangtze River polymetallic ore Belt, China

Yanhe LI, Chao DUAN, Changfu FAN, Dan HAN, Chengyu WANG, Feng LIU

MLR Key Laboratory of Metallogeny and Mineral Assessment, Institute of Mineral Resource, CAGS, Beijing, 100037, China

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The Middle-Lower Yangtze River polymetallic ore Belt is one of the most important metallogenic belts in East China. Ningwu, Luzong Iron-Oxide-Apatite (porphyrite) and Daye skarn type iron ore distrcts are the most important component of this Belt. The latest researches and prospecting results reveal that the Middle Triassic gypsum-salt layer has very closely relationship with the iron mineralization. However, the ore-controlling mechanism of gypsum-salt layer has still been unrevealed, and gypsum-salt layers as "oxidation barrier" in IOA and skarn type iron deposits have been rarely reported. In these areas, IOA and skarn type iron deposits, and Fe-S deposits commonly contain gypsum. And in one ore deposit/district, iron ore body, Fe-S ore body and gypsum ore body are paragenesis closely. In these deposits, the $\delta^{34}S$ values of sulfide are abnormally high, most of the $\delta^{34}S$ values of gypsum even above 20‰, which are similar to the value of marine sulfate. The sulfur isotopic compositions of the deposits are closely related with the ore genesis types, with the $\delta^{34}S$ value reduced from ore magmatic type to ore magmatic-hydrothermal type to hydrothermal type. The variation of sulfur isotopic composition of the deposits is mainly controlled by the sulfate reduced temperature and the proportion of sulfur derived from magma. The higher the $\delta^{34}S$ value of sulfate or the reduction temperature is, the higher the $\delta^{34}S$ value of sulfide will be. The sulphur proportion from gypsum-salt in these deposits is approximately 80%; the reduction temperature of gypsum is more than 500℃ The temperature of the sulfide precipitation was lower than reduction. Thus, we infer that evaporate salt layers do not just provide a large number of agents for the sodium alteration, scapolitization and skarn alteration in mineralization system, like Na^+, Cl^-, CO_3^{2-} and so on. On the other hand, the evaporate salt layer is the most important oxidation barrier, which could oxidize the Fe^{2+} into Fe^{3+} in the silicate magma and hydrothermal solution, and enrich the iron to be the iron deposit. It is a critical factor for the ore-forming of the IOA and skarn type iron deposit. While the magma contaminated by gypsum-salt layer, SO_4^{2-} oxidizes Fe^{2+} into Fe^{3+} in the silicate melt. Which prevent Fe^{2+} entering the silicate minerals lattice, but forming Fe_3O_4/Fe_2O_3 and poor iron silicate minerals like diopside, actinolite, tremolite and so on. The immiscibility occurs between iron oxide and silicate melt in magma chamber, under the effects of P, NaCl and volatile, forming the iron ore magma. The iron ore magma has strong viscous behavior, with shorter migration distance, near the contact zone of intrusion and salt layers. It forms ore magma type or skarn-like type iron deposit like Gushan and Meishan deposits. Metallogenic hydrothermal has strong mobility, transporting in the form of iron complex, with longer migration distance, concentrating and precipitating in the distal of the contact zone between intrusion and salt layers. These two type iron deposits coexist in the IOA iron deposit, with a certain spatial zonation forming the "double-metallogenic structure". In the contact zone of intrusion and salt layers, there might present the Daye ore magma-skarn iron deposit, and the scale may exceed the ones occurred in the shallow part of subvolcanic rocks or in the volcanic rocks. While the Fe^{2+} is oxidizing, SO_4^{2-} will be reduced into S^{2-} forming pyrite, in the top or side portion of the iron deposit. These are underlying reasons of paragenesis closely among iron deposits, Fe-S deposits and gypsum deposits in IOA and skarn iron metallogenic systems.

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