

A Study on the Key Control Factors for the Metallogenic Differences in Skarn-Type Fe and Au Deposits in the Western Shandong Region

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There are dozens of skarn-type deposits in Luxi area in the North China Craton, including the Wangwangzhuang large skarn-type iron deposit and the Tongjing medium-sized skarn-type gold deposit. Previous researchers have conducted studies on the mineralization mechanisms and ore-forming fluids of these two deposits. However, the timing and the ore-forming magmatism of different skarn-type deposits are still equivocal. In this study, we carried out analyzing U-Pb ages of zircon and garnet, mineral chemistry, whole-rock major and trace elements, and multi-isotopic compositions (Sr-Nd-Pb-Hf) of ore-forming magmatic rocks to reveal the key controlling factors of skarn-type deposits.

The following conclusion have been found: 1. The formation ages of the iron ore magmatic rocks in the Wangwangzhuang deposit (the zircon $^{238}\text{U}/^{206}\text{Pb}$ age of the biotite monzonite is 122.0 ± 17.0 Ma), the gold ore magmatic rocks in the Tongjing deposit (the zircon $^{238}\text{U}/^{206}\text{Pb}$ age of the diorite is 127.2 ± 1.0 Ma), the skarn in the Wangwangzhuang deposit (the garnet $^{238}\text{U}/^{206}\text{Pb}$ age is 131.9 ± 4.1 Ma), all belonging to the Early Cretaceous (130 Ma). 2. The key factors controlling the differential formation of skarn-type Fe and Au ore magmatic rocks are the magma source region (primary first-order factor). The Fe ore magmatic rocks originated from the EM1-type mantle source region, while the Au ore magmatic rocks originated from the EM2-type mantle source region. 3. In addition, the other control factors (secondary control factors) for the differential formation of skarn-type Fe and Au in the Luxi area also include magma rock properties, magma crystallization temperature and oxygen fugacity. The whole rock geochemical composition reveals that compared with the Au, the Fe ore magmatic rocks have higher $\text{Mg}^\#$ values and MgO , Y, Yb, Cr, Co, Ni, Sr, and Sc contents, and lower Rb contents and Sr/Y and $(\text{La/Yb})_N$ ratios. In terms of magma crystallization temperature, the crystallization temperature of zircon in the Fe ore magmatic rocks is $693 \sim 833^\circ\text{C}$ (average of 779°C), while that in the Au ore magmatic rocks is $677 \sim 769^\circ\text{C}$ (average of 718°C). In addition, the Fe ore magmatic rocks have relatively higher $\text{Ce}^{4+}/\text{Ce}^{3+}$ ratios and δFMQ value, indicating that the Fe ore magmatic rocks have higher oxygen fugacity.

