Iron isotope systematics of the Tongshankou porphyry–skarn Cu–Mo deposit, eastern China

ZHI-WEI HE*, FANG HUANG, HUI-MIN YU, SHA CHEN, JIN-TING KANG AND XING-CHAO ZHANG

School of Earth and Space Sciences, University of Science and Technology of China, Hefei, China
(*correspondence: hezw@mail.ustc.edu.cn)

Iron isotopes are useful to trace metal source and unravel the mineralization processes in mineral deposits. Here we present a study of iron isotope systematics of Tongshankou porphyry-skarn Cu-Mo deposit from Eastern China to understand the iron isotope behaviors during magmatic-hydrothermal processes and constrain the evolution of ore-forming fluid in the deposit. The Tongshankou deposit consists of porphyry ore within the granodioritic stock and skarn ore along the contact zones with carbonate rocks [1].

Significant iron isotopic fractionation has been observed in the deposit. Sulfide minerals (pyrite and chalcopyrite) from potassic and phyllic alteration zones within the porphyry stock show moderately light Fe isotopic compositions. The mean values (n = 8) of δ^{56}Fe for pyrite and chalcopyrite are -0.13‰ and -0.22‰, respectively, indicating that the early high-temperature (> 300-400 ºC) ore-forming fluid exsolved from the stock is enriched in light Fe isotopes. δ^{56}Fe of sulfides associated with the early dry skarn minerals (garnet and diopside) ranges from -0.49‰ to +0.07‰, indistinguishable to the values of sulphides from the porphyry stock. This indicates that the skarn ore-forming fluids mainly come from the magmatic porphyry system. Notably, sulfides from the late skarn stage display a wide range of δ^{56}Fe from -1.62‰ to +0.75‰. Both the lightest and heaviest δ^{56}Fe compositions are observed in massive sulphides associated with carbonates far away from the stock, which has experienced low temperature (< 150 ºC) alteration. Taking into account the extensive water-rock interaction in skarn system, it is proposed that the large variations in Fe isotopic signatures of sulfides from the late skarn stage may reflect the striking change of the physicochemical conditions of the ore-forming fluid. In summary, iron isotopes of sulfide minerals show a genetic response to porphyry and skarn mineralizing processes, and they record information of metal sources and fluid evolution histories.

[1] Li *et al*. (2008) *Mineralium Deposita* **43**, 315-336.