Fe isotopic composition of the pyrite of the Canzhuang gold deposit in the Jiaodong Peninsula, China

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In this paper, 36 iron isotopic compositions of pyrites from the Canzhuang gold deposit have been analyzed by multi-collector inductively-coupled plasma spectrometry. 16 pyrites from disseminated deposit (the Shangzhuang gold deposit) show a wide $\delta^{56}Fe$ variation from 0.13 to 0.91‰ and its $\delta^{56}Fe$ values gradually decrease from early to late metallogenic stage, which reveals that the Fe isotope signature of pyrites represent the product of equilibrium fractionation. Meanwhile, pyrites (0.13 to 0.69‰) in late metallogenic stage have a wider range of $\delta^{56}Fe$ variation than that of pyrites (0.67 to 0.91‰) in early metallogenic stage, which indicates that Fe concentrations in the hydrothermal fluid gradually wane or the hydrothermal fluid system varies from open to closed. In contrast, 20 pyrites from quartz veins deposit (the Qilishan gold deposit) show a narrow $\delta^{56}Fe$ variation from 0.52 to 0.74‰ and the mean values of $\delta^{56}Fe$ from early to late metallogenic stage in the quartz veins deposit have a slight increase (from0.63 to 0.66‰). Meanwhile, in the same sample from same metallogenic stage, the early formed pyrites have the medium-course grain subhedral-euhedral texture, but the late formed pyrites have fine grain xenomorphic texture coexistence with calcite, which indicates that the precipitation rate of the late formed pyrites may be fast. Furthermore, $\delta^{56}Fe$ value of the late formed pyrite (0.69‰) is heavier than the early formed pyrite (0.63‰), which manifests that the kinetic fractionation of Fe isotope of pyrites exists in the quartz vein deposit. Although existing the kinetic fractionation, no extremely light Fe isotopic compositions and no obviously Fe isotopic varieties appear in the quartz vein deposit, indicating that the Fe isotope signature of pyrites in the quartz vein deposit mainly represent the product of equilibrium fractionation and the hydrothermal fluid system is always open.

In addition, ores with highest gold grade always have a wide $\delta^{56}Fe$ variation in the disseminated deposit and kinetic fractionation of Fe isotope in the quartz vein deposit of the Canzhuang gold deposit, which suggests that the precipitation of gold may be related to the degree of closure and changes in physicochemical conditions of the ore-forming fluids.