Iron isotopes in the Wulong gold deposit, Liaodong Peninsula, Northeast China

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The North China Craton (NCC) is one of the oldest cratons in the world, and it is composed predominantly of Archean and Paleoproterozoic basement. Unlike other cratons, one of the most striking features of NCC is the presence of large volumes of Mesozoic granitoids and gold deposits in the eastern part, which can be further divided into Jiaodong and Liaodong peninsula. Many of these gold deposits are hosted in granitic rocks with quartz-sulfide mineral assemblages.

Wolong is one of the large gold deposits (>80t at 5.35 g/t) in the Liaodong peninsula and is spatially associated with the Mesozoic granite and diorite. Ore minerals mainly occurred in the quartz veins, and include pyrite, pyrrhotite, bismuth tellurides, and native gold. Pyrites may occur as disseminated in diorite or coexist with pyrrhotites in quartz veins. Granites from the Wulong gold deposit have relatively constant $\delta^{56}Fe$ values ranging from 0.21‰ to 0.26‰, and diorite and diabase have $\delta^{56}Fe$ values ranging from 0.14‰ to 0.21‰, consistent with iron isotopes of igneous rocks worldwide.

Two quartz separates in the quartz-sulfide vein yield $\delta^{56}Fe$ values of -0.02‰ and 0.07‰, respectively. Pyrites and pyrrhotites in the wide auriferous quartz-pyrite-pyrrhotite veins show a wide range in $\delta^{56}Fe$ values, varying between -0.85‰ and 0.78‰. All analyzed pyrites are isotopically heavier than pyrrhotites, which is consistent with Fe isotope fractionation trend in magmatic-hydrothermal systems. Formation temperatures yielded by mineral-mineral pairs are higher than those measured from fluid inclusion studies, which may suggest disequilibrium precipitation.

Iron isotopic compositions in the Wulong gold deposit are quite different from the published iron isotopes of gold deposits in Jiaodong peninsula, despite they share similar geological features. This may due to they formed under different physicochemical conditions.