Fe isotope composition of Paleoproterozoic Superior-type iron formation from North China Craton

Z.H. Li, X.K. Zhu

Lab Isotope Geol., MLR, Inst. Geol., CAGS, Beijing, China
(lizh1129@cags.ac.cn; xiangkun@cags.ac.cn)

Fe is not only the important ore-forming element but also the most abundant element engaging in redox chemistry, and is one of the element has been used biologically at very early stage. Thus understanding the geochemical cycling of Fe has great implications for the development of atmosphere oxygenation, ore genesis and the origin of life. Banded iron formations (BIFs) are marine chemical precipitates. They have potential to preserve paleoceanographic signitures. Here we report the results of an Fe isotope study on Superior-type iron formation from North China Craton.

The BIFs studied were formed at Paleoproterozoic (~2.3 Ga), and subjected to greenschist to ampiblite-facies metamorphism. They consist of layered alternating beds dominated by magnetite/hematite and quartz respectively, with minor siderite, specularite, limonite and pyrite.

Fe isotope compositions of bulk samples as well as mineral separates of hematite, magnetite and siderite, were measured using a Nu Plasma HR MC-ICP-MS at high-resolution mode after purification using anion exchange chromatography. The results show some important features: 1) Fe isotope compositions of iron ore bulk samples show heavy Fe isotope enrichment, and the overall variation in Fe isotope compositions ranges from 0.03 to 0.76‰ in δ^{56}Fe values; 2) Both hematite and Magnite of mineral separates show heavy Fe isotope enrichment, and siderire show both positive and negtive$\delta^{56}Fe_{IRMM-14}$ values; 3) The relative order of $\delta^{56}Fe_{IRMM-14}$ values appears to decrease from magnetite to hematite to siderite.

The average Fe isotope compositions obtained from the Superior-type BIF in this study for bulk rocks show heavy Fe isotope enrichment which are silimar with the Algoma-type BIF from NE China, and is explained by partial oxidation of Fe and the variations in Fe isotope compositions may be explained in terms of different degree of precipitation.

In all, the results obtained in this study demonstrates that the oxygen fugacity in the depositional environment was relatively low and the seawater was not oxygenated enough to have Fe quatitatively precipitated .