Fe isotope composition of BIF from NE China and its paleographic implications

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Fe is the most abundant element engaging in redox chemistry, and is one of the element has been used biologically at very early stage. Thus understand the geochemical cycling of Fe has great implications for the development of an oxygenated atmosphere and the origin of life. Banded iron formations (BIFs) are chemical deposits from oceans. They have potential to preserve paleoceanographic signitures. Here we report the results of an iron isotope study on BIFs from North China Craton.

The BIFs studied were formed at the Archean–Proterozoic transition period (2.5 Ga), and subjected to ampiblite-facies metamorphism. They consist of finely layered alternating beds dominated by magnetite and quartz respectively, with minor amounts of pyrite and hematite. The minerals of magnetite, hematite and pyrite were separated, and the bulk rocks were powdered. After purification using anion exchange chromatography, Fe isotope ratios of both bulk samples and mineral separates were measured using a Nu Plasma HR MC-ICPMS at hi-res mode. The results are expressed as deviations in permil relative to the same isotope ratios of the reference material IRMM-14. The results show some important features: 1) the overall variation in Fe isotope compositions ranges from 0.11 to 2.09‰ in δ^{57}Fe values, significantly heavier than the bulk silicate Earth; 2) Fe isotope compositions of bulk samples are negatively correlated with both Fe (III)/Fe (II) ratios and Fe contents.

The average Fe isotope compositions obtained from BIFs in this study for pyrite and magnetite are unusually high relative to the bulk silicate Earth, other BIFs in Transvall and Greenland, and MOR hydrothermal fluids. This suggests that only a small fraction of Fe (II) in sea water has been oxidised to Fe (III) to form the BIFs in Anshan area, which implies an atmosphere with low O_2 contents at the time. Alteratively, this may imply that some fraction of Fe (II) has been precipitated as iron sulfide or carbonate, resulting relative enrichment of heavy isotopes in seawater, prior to the precipitation of BIF. Indeed, some archean pyrite deposites in North China exhibit very light Fe isotope signature.

Stable sulfur isotope analysis and its application on hydrogen sulfide origin identification in Sichuan Basin

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The Delta S elemental analysis, continuous flow interface, isotope mass spectrometer (EA / ConFlow / IRMS) were adopted in this study, and have established a mature on-line method to get sulfur isotope value of H_2S of natural gas. Taking Sichuan Basin as the research object in this paper.

The H_2S in the Feixianguan Formation of Lower Triassic in Sichuan basin was thought to originate from thermochemical sulphate reduction (TSR) [1], however, Some scholars believe that the source rocks with high FeS_2 can generate H_2S directly [2, 3].

The natural gas of Puguang Gas Field is considered as the highest content of H_2S and an average H_2S content of about 16%, and those in other regions, which is mostly concentrated between 1% and 8%. The H_2S sulfur isotope of natural gas in Moxi Gas Field is the lightest, between 9 ‰ and 12 ‰; those are more similar in Zhongba, Wubaiti, Puguang and Huanglong-chang gas fields, distributed between 12 ‰ and 20 ‰; the sulfur isotope value of H_2S of natural gas in Wolonghe Gas Field is the heaviest, closing to 30 ‰.

In conclusion, the hydrogen sulfide of Puguang, Wubaiti, Zhongba, and Moxi Gas Field come from thermal sulfate reduction reaction.

[1] Guangyou Zhu, *et al*. (2005) Isotopic evidence of TSR origin for natural gas bearing high H2S contents within the Feixianguan Formation of the northeastern Sichuan Basin, southwestern China *[J]. Science in China (SeriesD)* **35**(11) 1037–1046. [2] Jian Li, *et al*. (2005) Geochemistry & origin of sour gas accumulations in the northeastern Sichuan Basin, SW China. *Organic Geochemistry*, **36** (12) 1703–1716. [3] Zengye Xie, *et al*. (2008) Genesis on Hydrogen Sulfide of Feixianguan Formation in Sichuan Basin. *Acta Sedimentologica Sinica*, **26**(2) 314–323.