Is Fe isotope composition of banded iron formation a proxy of pH? A study of Neoproterozoic iron formations

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The Neoproterozoic era has witnessed a unique global environment change in Earth's history, which is partly recorded in the Neoproterzoic iron formation (NIF). Here a systematic investigation on Fe isotope composition for NIF from Xinyu, Yangtze region, China has been carried out. δ^{56}Fe values of Xinyu NIF vary significantly and show an overall increase upsection, with the Lower BIF around 0‰, and the Upper BIF up to 1.6‰. This isotopic trend is similar to those reported for other NIFs in the world. It seems that this increasing temporal change of Fe isotope composition is common for the NIFs that widespread globally and most likely reflect a global environment change in Neoproterozoic.

The Fe isotope variation in NIFs is most likely controlled by varying degrees of Fe precipitation in the water, which may be effected by changes of either Eh or pH condition. Two models are proposed to explain the trend of Fe isotope variations in NIFs. The first model is based on Eh decrease in seawater resulted from transgression, and the second is based on pH decrease in seawater due to ocean acidification. The "pH decrease" model is preferred, which is additionally supported by correlatively decreasing Si isotope compositions upsection for Xinyu NIF. Implications of this sdudy are that Fe isotope composition may be used as a pH proxy and that ocean acidification event may have occurred during inter-glaciation interval of the Sturtian Snowball Earth period.