The $\delta^{30}Si$ peak values discovered in cherts from middle Proterozoic carbonate rocks in Northern China and its implication on environmental variation of Ancient Ocean

DING T. P[1,2], GAO J. F [1,2], TIAN S. H.[1,2], FAN C. F.[1,2], ZHAO R. [1,2], WAN D. F.[2]

[1] MLR Key Laboratory of Metallogeny and Mineral Assessment, Institute of Mineral Resources, CAGS, Beijing 100037, P. R. China

[2] Open Research Laboratory of Isotope Geology, CAGS, Beijing 100037, P. R. China

The silicon isotope composition of chert has been used to study the historic evolution of Global Ocean recently[1-4]. It was suggested that Precambrian cherts have much higher $\delta^{30}Si$ values than those of Phanerozoic chert and show a general trend of increase from 3.5 to 0.85 Gyr, reflecting decrease of sea water temperature[2]. However, these statements have been challenged because cherts can have various origins and their isotopic compositions might have been reset by metamorphic fluid circulation[3]. Thus different genetic types of cherts should be distinguished in this kind of study[3,4]. The silicon isotope compositions of chert formed in shallow marine environment are considered to better reflect the conditions of the marine water[3]. Here we present a new set of $\delta^{30}Si$ data of cherts from early and middle Proterozoic carbonate rocks (2.35~12.00 Gyr) in China. These $\delta^{30}Si$ data vary in a range of 0.1‰~3.9‰. Among them, the cherts of 1.355~1.325 Gyr show a peak range of 2.2‰~3.9‰, averaging 3.12‰. Based on these results we propose that from Archean to Proterozoic, there was a drastic depletion of silicon contents and increase of $\delta^{30}Si$ value in oceanic water due to temperature decrease and development of biologic activity. This process came to the peak in period of 1.355~1.325 Gyr. After that period the silicon cycle in ocean is controlled by the input of continental weathering and output of oceanic biological absorption, which limits the silicon contents in a low level and the $\delta^{30}Si$ value in a small range around a significantly lower value.

References

Ding, T., Jiang, S., Wan, D., Li, Y., Li, J., Song, H., Liu, Z., Yao, X.(1996) Silicon isotope geochemistry, Geological Publishing House, Beijing, 1996: 125

Robert, F., Chaussidon, M., 2006. A palaeotemperature curve for the Precambrian oceans based on silicon isotopes in cherts. Nature 443 (7114), 969 – 972.

van den Boorn, S., van Bergen, M.J., Nijman, W., Vroon, P.Z., 2007. Dual role of seawater and hydrothermal fluids in Early Archean chert formation: evidence from silicon isotopes. Geol. 35, 939 – 942.

Marin-Carbonne J., Robert F. and Chaussidon M. (2014) The silicon and oxygen isotope compositions of Precambrian cherts: a record of oceanic paleo-temperatures? Precambrian Res. 247,223–234.