Japan Geoscience Union Meeting 2010
(May 23-28 2010 at Makuhari, Chiba, Japan)

BPT013-02 Room: 301B Time: May 26 09:15-09:30

The d13Ccarb, d13Corg and d18Ocarb profiles of the Ediacaran carbonate rocks in South China

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The Ediacaran is one of the most important periods in the history of evolving life when multicellular animals firstly appeared on the earth. However, it is still ambiguous the relationship among the abrupt biological evolution and climatic change. We analyzed carbon and oxygen isotopes of ca.400 samples of carbonate and organic carbon isotope of ca.100 samples from drill cores at Three Gorge area, South China. The delta13C profile of carbonate displays five negative anomalies. And the delta13C profile of organic matters displays almost constant value. The oxygen isotopes display very high delta18O values around 0 permil in the early Ediacaran.
We compared the delta13Ccarb profile with fragmented delta13Ccarb profiles in other sections such as Siberia, Australia and Oman in the world. The delta13Ccarb profile of this work possesses all of the anomalies in other sections. The consistency indicates that the delta13Ccarb of this work represents the global oceanic delta13Ccarb change in the Ediacaran. The lack of correlation between delta13Ccarb and delta13Corg can be explained by three different ideas. One is the shutdown of primary production. In this case, the carbonate and organic carbons were supplied from only riverine or atmosphere. However, the presence of algae fossils through the Ediacaran and no correlation of total organic carbon contents with their carbon isotope values are inconsistent with the idea. Second is the fractionation factor between inorganic and organic carbon during the primary production changed completely synchronous to the change of inorganic carbon isotopes. However, the quite large variation in the calculated fractionation factor requires the biological shifting synchronous to the delta13Ccarb change. It is possibly unrealistic. Third is the presence of quite large dissolved organic carbon reservoir, which conceals the concomitant delta13 Ccarb change with the delta13Corg change. General speaking, the DOC reservoir is always smaller than dissolved inorganic carbon reservoir in carbon cycle of the Phanerozoic ocean. The presence of much larger DOC reservoir than the DIC reservoir is one of the most distinct features between the carbon cycles in the Ediacaran and Phanerozoic. The negative excursion of delta13 Ccarb is caused by extensive remineralization of the DOC (Fike et al., 2006).
Post-depositional alteration causes the delta18O value to decrease because interstitial water commonly has low delta18O value and the recrystallization proceeds under the warmer condition than the deposition. In addition, the interstitial water commonly has low delta13C values. Therefore, the secondary alteration usually causes decrease in both oxygen and carbon isotopes. Anticorrelation between delta13C and delta18O is obvious and ubiquitous in the lower Doushantuo Formation. The occurrence of anticorrelation and their high delta18O values suggests the carbonates of drill core samples still preserve the primary signature of even the oxygen isotopes. In the case, the high delta18O values indicate that surface temperature was relatively low in the early Ediacaran. Especially, there is a relatively large positive excursion of delta18O, together with quite large negative excursion of delta13C and geological evidence for eustatic sea-level falling in the middle Doushantuo Formation. The presence of positive excursion of delta18O and eustatic sea-level falling indicates the global cooling in the middle Ediacaran. This cooling event possibly corresponds to the 580 Ma Gaskiers glaciation, which is the most severe glaciation in the

Ediacaran. On the other hand, the delta18O in the upper Doushantuo Formation, with a large negative excursion of delta13C (Shuram excursion), shows negative excursion. In addition, geological evidence lacks during the Shuram excursion, which does not support a glaciation-related event, and requires another cause.

Keywords: d13Ccaarb, d13Corg, d18Ocarb, Ediacaran, Climatic change, carbon cycle