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エディアカラ紀からカンブリア紀にかけての窒素循環の変遷
Nitrogen cycles through Ediacaran to Cambrian transition

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In the Ediacaran and Cambrian, multicellular animals first appeared on Earth and were rapidly evolved. Biogeochemical nitrogen cycles are essential for ecosystems, and thus may have changed after the appearance of animals in this period. However, the link between nitrogen cycling and animal evolution is still largely unknown. Nitrogen isotopes can be useful to trace the past biogeochemical N cycle, though there is so far no report for N isotope geochemistry of the Ediacaran period.

For the first time, I determined nitrogen isotope ratios of organic matter of this time interval, by using drill core samples from South China. The results show that d15NTN values are high (around +6per mil) until middle Ediacaran, and gradually drop down to -1per mil at the earliest Cambrian, then rise back to +5per mil in the end of the Early Cambrian.

The recorded low N isotope anomaly is the most extensive in this two billion years. Onset of the observed negative N isotope excursion coincided with a global carbon isotope excursion event (Shuram excursion), when Ediacaran organic-carbon-rich ocean may have been oxygenated at that time. Before the Shuram event, the high d15N probably reflects denitrification activity and thus implies modestly nitrate-rich Proterozoic ocean condition. At the time of Shuram event, both d13Ccarb and d15NTN values were dropped probably due to massive re-mineralization of organic matter, which may have resulted in anoxic condition. This scenario is supported by anomalously low TOC/TN ratio, implying high ammonium concentration of water column. At the end of Shuram event, d15NTN value continued to decrease in spites of d13Ccarb rose back to +5per mil. This suggests ocean oxygenation may have resulted in more nitrate-rich condition. The long-term negative d15N excursion and gradual decrease of C/N ratio suggests increasing nitrate concentration trend in this period and increasing animal activity depositing more nitrogen into sediment. Thus, the new result first indicates the direct link between oxygenation, nitrogen cycling and appearance of animal within the ecosystem.