Organic Nitrogen/Carbon isotope ratios from the Middle Proterozoic sedimentary rocks, McArthur Basin, Northern Australia

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Oxygenation of Earth's surface is expected to be deeply linked to evolution of life. Many of independent evidence suggest that the Earth’s atmospheric oxidation state is increased in two steps: from 2,400 to 2,300 million years ago, and around 600 million years ago (Holland, 2006). On the other hand, ocean was mostly dominated by reducing conditions during the Archean, whereas the ocean-atmosphere system in the Phanerozoic was as oxygenated as it is now. It has been generally assumed that the middle Proterozoic ocean was globally oxic at the surface and sulfidic (euxinic) at depth. Nitrogen limitation caused by trace metal scarcity has been proposed as an explanation for why eukaryotic diversification is delayed (Canfield, 1998; Anbar & Knoll, 2002).

Here we show nitrogen and carbon isotope compositions of middle Proterozoic sediments, mainly carbonate rocks, mudstones and black shales prepared from six drillcore samples (Mount Young 2, McArthur River 2, Urapunga 4, Urapunga 5, Jamison-1 and 14MCDDH002) in McArthur Basin, Northern Australia.

$\delta^{15}N_{TN}$ values of the black shale in the Wollogorang and Barney Creek formations are relatively high, ranging from +4 to +7 ‰. The high $\delta^{15}N_{TN}$ values likely reflect the predominance of partial denitrification in the water-column. $\delta^{15}N_{TN}$ values gradually decrease from +7 to +1 ‰ stratigraphically upward, and the average $\delta^{15}N_{TN}$ value is 3.5 ‰.

An increasing nitrate reservoir may have been responsible for the decreasing $\delta^{15}N_{TN}$ value, which implying an ocean oxygenation in the middle Proterozoic.

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