27億年前の浅海堆積物における炭素同位体負異常の起源
Origin of negative carbon isotope anomaly in a 2.7 Ga shallow water deposits

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Sedimentary organic carbon in some Late Archean rocks are anomalously depleted in ^{13}C ($\delta^{13}C_{org}$ = -45 to -60‰). The origin of the isotope anomaly is still unknown and is possibly resulted from biological uptake of methane (methanotrophy) or deposition of hydrocarbon haze. To test the hypotheses, small-scale isotopic analyses of both inorganic and organic carbon were conducted for various lithologies of 2.7 Ga sedimentary rocks in Fortescue Group, Western Australia. For this purpose, a new analytical method was developed for measuring small samples. As a result, low $\delta^{13}C$ organic matter occurs not only in stromatolite as previously pointed out, but also in black laminated mud. Also, the $\delta^{13}C_{org}$ seems not correlated with $\delta^{13}C_{carb}$ value as opposed to the case expected when methanotrophs are active because methanotrophs typically produce not only very ^{13}C-depleted organic matter but also CO_2. These results do not support the methanotrophy scenario. Furthermore, a relationship between $\delta^{13}C_{org}$ value and TOC contents is consistent with a mixing of two organic end-members with different isotopic ratios. The observed $\delta^{13}C_{org}$-TOC trend appears to occur in each lithology of the sedimentary rocks, suggesting that the source of the low $\delta^{13}C_{org}$ distributed uniformly irrespective to the depositional environment. This may suggest that the anomalously ^{13}C-depleted organics could have been deposited from atmosphere at about 2.7 Ga.

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