

有機炭素及び硫黄同位体を用いた 18 億年前の海洋環境推定： カナダ・フリントロン帯

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Reconstruction of 1.8Ga sea environment constrained by Carbon and Sulfur isotopes: The Flin Flon Belt, Canada.

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The environment of the earth has changed several times during its 4.6 billion year history. Regarded as one of the greatest changes was the jump in the concentration of oxygen known as the Great Oxidation Event (GOE) (Lyons et al., 2014). The ocean of mid-proterozoic is called the Canfield ocean and oxic, euxinic and ferruginous conditions are estimated for surface, middle and bottom of the ocean (Canfield, 1998). Furthermore, huge Volcanogenic Massive Sulfide (VMS) is formed at 1.8 Ga, and its formation was occurred in arc setting while IFs formed around continental shelf environments. The differences of ocean environment between island arc and continental shelf is still obscurely.

The Flin Flon belt in the Trans-Hudson orogen include island arc type volcanics and sedimentary rocks which are rich in organic matter. We focus on an alternation of sandstone and black shale exposed at the north end of Embury Lake, and the drill core TS07-01 from the lake. The organic carbon and sulfur isotopes were measured and we reconstructed the ocean environment at ca.1.8 Ga.

The core TS07-01 drilled at Embury Lake (N54 49' 09", W101 47' 46") includes a 470 m alternation of sandstone and black shale. Five main units are distinguished in the whole core based on the younging direction. Three members are identified for the R1 unit, which is the longest unit through the core, based on upward fining structure.

Total organic carbon (TOC) and total sulfur (TS) contents of the core TS07-01 is the range of 0.90 to 3.61 wt% and 0.006 to 0.326 wt%. The organic carbon and sulfur isotopes is -39.6 to -26.4 ‰ and 3.0 to 18.7 ‰, however, sulfur isotopes mainly take 3.0 to 6.2 ‰.

Organic carbon isotopes values of the core TS07-01 are mainly in the range of -32 to -28 ‰. The organic carbon values fixed by cyanobacteria and chromatiaceae such as purple sulfur bacteria takes around -30 ‰ (Schidlowski 1988). Therefore, the data from TS07-01 indicate the organism of cyanobacteria or purple sulfur bacteria. TOC values show a wide range, which depend on the rate of sedimentation. When sedimentation of minerals like quartz included in black shale occurs rapidly, TOC has a low value. Conversely, when sedimentation rate of the mineral is slow, TOC has a high value. Sulfur concentration is very low in the core, the highest value is 0.3 wt%. Then, the TOC vs TS plot falls in the field for fresh water sediments which is proposed by Berner and Raiswell (1983), and the average of S/C ratio is 0.04. This implies a low sulfate sea environment at 1.84 Ga. Sulfur isotope data of the core is almost comparable with VMS deposit of Embury Lake reported by Polito et al. (2007). This similarity suggest that pyrite of the core formed under hydrothermal effect.

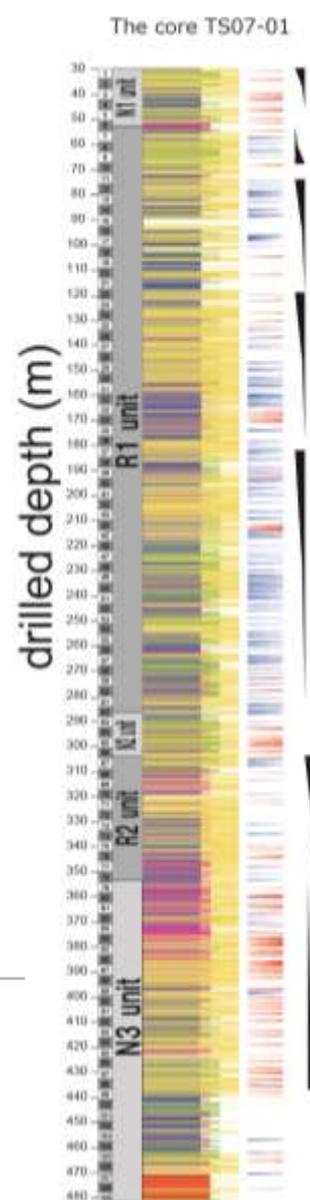


Fig. 1 Lithologic column of the whole core TS07-01.

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