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

MIS007-13 Room: 304 Time: May 25 09:00-09:15

Carbon isotope geochemistry of the 3.2 Ga DXCL drilling cores in the Pilbara Craton, Western Australia

Kentaro Hosoi[1*], Minoru Ikehara[2], Shoichi Kiyokawa[3], Takashi Ito[4], Fumio Kitajima[3], Kosei E. Yamaguchi[5], Yusuke Suganuma[6]

[1]Earth Science, Kochi Univ., [2]Center Adv. Marine Core Res., [3]Earth and Planetary Sci., Kyushu Univ., [4]Fac. Education, Ibaraki Univ., [5]Toho Univ., JAMSTEC, and NASA, [6]NIPR

Pilbara craton in the Western Australia is one of the best places that low-grade metamorphosed without intensive deformation and well-preserved environmental information of Archean era. Dixon Island and Cleaverville Formations in coastal Pilbara greenstone belt is composed of volcanic rock and organic carbon rich chemical-sedimentary rock sequence that are identified as deep sea hydrothermal sediment at middle Archean (Kiyokawa et al., 2006). In July 2007, modern-weathering free geologic samples of 3.2 Ga were drilled at the Cleaverville beach, west Pilbara under the Dixon Island - Cleaverville (DXCL) Drilling Project (Yamaguchi et al., 2009). In this study, we measured organic carbon (C_{org}) contents and their stable carbon isotope ratio (delta$^{13}C_{org}$) from DXCL cores. The carbon isotope composition of organic matter in sedimentary rocks provides us information about the nature and ancient organism.

The continental drilled cores CL1 (105.3m) and CL2 (92.0m) are recovered from the lower part of the Snapper Beach Formation, and DX (148.3m) is recovered from the upper part of the Dixon Island Formation and Dixon Pillow Basalt. Powdered rock samples which are obtained mainly black shale were prepared by crushing rock chips. The dried powder samples were treated with dilute hydrochloric acid to remove inorganic carbon. Concentration and carbon isotopes were measured by elemental analyzer online mass spectrometer at Kochi University.

Organic carbon contents of each samples are over 0.5wt.%, and especially DX show with an average of 1.2wt.%, maximum value reaches over 3.0wt.%. $C_{org}$of DXCL drilled cores is much higher than those of averaged contents (0.1 to 0.2wt.%) of black chert bed in the exposed Dixon Island Formation (Kiyokawa et al., 2006). These results suggest that the drilled cores have fully preserved the paleoenvironment and biological activity in the Archean ocean. In general, it is understood that C_{org}contents of modern deep sea sediments are low below 0.5wt.%. C_{org}contents that exceeds 3wt.% correspond to modern upwelling region such as Arabian Sea and anoxic seafloor like the Japan Sea. Carbon isotope compositions of organic matter range from -32 to -26 permil in the almost samples. Such delta$^{13}C_{org}$values suggest that the microorganism did not utilize CO_2derived from CH_4-oxidation (Schidlowski, 2001). Therefore production of organic matter in the 3.2 Ga oceanic environments was mainly contributed by phototrophs (i.e., cyanobacteria), which have a delta$^{13}C_{org}$range of -32 to -26 permil. These results suggest that abundant biological activity established along ocean surface at least 3.2 Ga.