In situ observation of electrical current generation in deep-sea

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Deep-sea hydrothermal vents discharge subsea floor hot and reductive fluids into cool and oxidative seawater. The inter-fluidal oxidation-reduction potential substantially drives various abiotic and biotic oxidation-reduction reactions and supports chemosynthetic ecosystems in the mixing zones. It is predicted that electric current is generated if the two solutions are connected by conductor with electrodes [1]. Here we conducted in situ electrochemical analyses of high temperature of hydrothermal fluids and ambient seawater. We succeeded in measurement of the oxidation-reduction potential as about -39mV at high temperature about 309˚C in deep-sea hydrothermal fluid. The voltammetry analyses indicated that the open circuit voltage between the hydrothermal fluid and ambient seawater bridged by platinum electrodes was up to 0.74 V but the average current density generated in the seawater cathode was much lower than that in the hydrothermal-fluid-anode. By harvesting the natural setting of potential steep, we for the first time show proof of in situ generation of electricity in a newly developed fuel cell installed in deep-sea hydrothermal vents and witness light emitting diode lamp lighting in dark deep-sea environment. The results provide important clues not only to understanding of extracellular electron transports in the deep-sea vent microbial communities but also to future development of in situ electric power plants that will supply the electricity for the exploration of deep-sea resources and the following observatories of the deep-sea environments and ecosystems.

[1] R.Nakamura *et al*. Angew. Chem. 2010 **49**, 7692.

Millennial-scale wet and dry climate changes during the last glacial maximum in the south Siberia

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To investigate the millenial-scale wet and dry climate changes in the south Siberian region for the last 33 kyr, the centennial scale analysis (less than 70 years) of the the inorganic elements (e.g. K and Ti) for the Lake Baikal sediment core (VER99G12) were carried out. The flucutuation of the K/Ti ratio during the last glacial maximum period (LGM; 26–19 cal kyr BP) was observed (Fig. 1). Because of the susceptible to water leaching of K comparing to Ti in soil environment, this fluctuation indicates the millennial-scale wet and dry climate changes during the LGM in the south Sibiran region. Also, the increase in the precipitation at the climate transition period between OIS2 and 1 (OIS2/1, 11.5 cal kyr BP) was indicated by the significant decrease in the K/Ti ratio. The result of the grain size distribution of the same core is also disscussed as well.

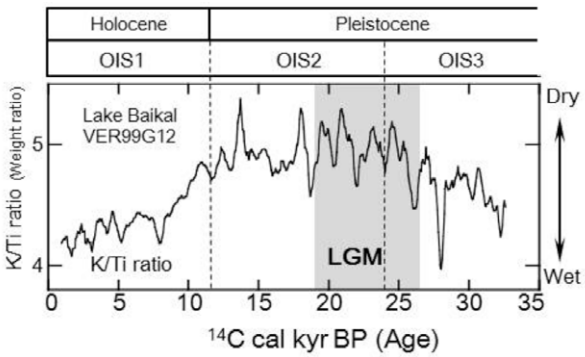

Figure 1. Vertical profile of the K/Ti ratio of the Lake Baikal sediment core (VER99G12).
OIS; Oxygen isotope stage

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