Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)


MIS23-P06 Room:Convention Hall Time:May 24 16:15-17:30

# Thermal properties of the sedimentary rocks at Site C0020, IODP Expedition 337 in Sanriku-oki basin

Wataru Tanikawa[1*], Tadai Osamu[2], Sumito Morita[3], Masafumi MURAYAMA[4], Fumio Inagaki[1], Kai-Uwe Hinrichs[5], Yusuke Kubo[6], IODP Expedition 337 Scientific Party[1]

[1]Japan Agency for Marine-Earth Science and Technology, Kochi Instutute for Core Sample Research, [2]Marine Works Japan Ltd., [3]National Institute of Advanced Industrial Science and Technology, [4]Center for Advanced Marine Core Research , Kochi University, [5]University of Bremen, [6]Japan Agency for Marine-Earth Science and Technology

Thermal properties of thick sedimentary basins are important parameters to evaluate the thermal structure at depth and the maturation process for organic materials. Therefore, thermal conductivity measurement is listed as routine measurements for IODP program on board. However, to understand non-steady state processes for heat flow and diffusion, thermal diffusivity and specific heat are necessary to be evaluated as well. Therefore, in this study, a series of thermal property measurements were conducted on the sediment cores at site C0020 from IODP expedition 337 in Sanriku-oki basin. Thermal conductivity and thermal diffusivity were measured by Hot Disk method (Hot Disk AB Ltd., TPS 1500). Hot disk method (or the transient plane source technique) enables us to measure both thermal conductivity and thermal diffusivity at the same time within few minutes. We used half round core samples with 4 cm length in all measurements. The flat sensor was placed between the surfaces of a half round core sample and a heat insulating material (expanded polyethylene, thermal conductivity = 0.034W/mK) during measurements. Before measurements, half round core samples were saturated by NaCl solutions with 35 per mil, and we loaded 4.9 N during measurement at room temperature.

Thermal conductivity of sample ranged from 0.4 to 2.9 W/mK. Thermal conductivity of sandstone and siltstone increased with depth from 1.4 (1,278 mbsf) to 1.9 W/mK (2,466 mbsf). Lignite showed very low thermal conductivity and the largest thermal conductivity values were observed in carbonate cemented sedimentary rocks. A half-space line source method using TK04 (TeKa Ltd.) was applied to measure the half round core samples on D/V CHIKYU during IODP expedition 337, and the thermal conductivity and the lithological variation of the thermal conductivity measured on board were similar with our data. Thermal diffusivity was decreased with depth from 0.5 $mm^2$/s to 0.9 $mm^2$/s as well. Thermal conductivity was scattered at depth from 1,900 to 2,000 mbsf, and this scattering reflects the lithological variation of core samples. Thermal diffusivity of lignite (or coal) was 0.16 $mm^2$/s, and the largest value of 1.9 $mm^2$/s was observed on unconsolidated coarse sand. The increase in the thermal conductivity and thermal diffusivity is consistent with reduction in porosity with depth. On the other hand, thermal conductivities of lignite and cemented rocks will depend more on the pore structure and chemical compositions. Thermal diffusivities for most samples are exponentially increased with increasing thermal conductivity, though, the thermal conductivity of unconsolidated coarse sand is deviated from the exponential curve. We measured thermal properties under atmospheric condition; therefore, our data might underestimate in-situ values. Therefore, to investigate the relationship between thermal property, porosity, and pore structure at depth, we can estimate the in-situ thermal property indirectly.

Keywords: IODP expedition 337, thermal conductivity, thermal diffusivity, Sanriku-oki basin