Heat and fluid fluxes at a biological community site on the Nankai accretionary prism off Kii peninsula

Shusaku Goto[1], Shin'ichi Kuramoto[2], Juichiro Ashi[3], Makoto Yamano[1]

[1] ERI, Univ. Tokyo, [2] JAMSTEC, [3] ORI, Univ. Tokyo

Nankai subduction zone off Kii peninsula is one of the most intensively surveyed areas for studies on the seismogenic zone. This area includes most of the rupture area of 1944 Tonankai earthquake. Multichannel seismic reflection surveys carried out in the area revealed the existence of splay faults that branched from the master megathrust fault [Park et al., 2002]. Along the splay faults, reversal of reflection polarity was observed, indicating elevated pore fluid pressure along the faults. Cold seepages with biological communities were discovered along a seafloor outcrop of one of the splay faults through submersible observations [Ashi et al., 2002]. At one of the biological community sites, a gamma ray intensity anomaly mainly due to U-series radionucleides was detected, suggesting microcrack development under shear stress and resultant release of Rn-222 [Hattori and Okano, 2002]. In order to estimate heat and fluid fluxes along the splay fault, a long-term temperature monitoring system was deployed at the biological community site where the gamma ray intensity anomaly was observed and bottom-water and sub-bottom temperatures were measured for one year. This instrument has two probes (Probe-1 and Probe-2) and each probe contains six thermistor sensors. Probe-1 was inserted into a bacterial mat, while Probe-2 was inserted into ordinary sediment 3 m away from the mat as a reference point. The bottom-water temperature oscillated with an amplitude of up to 0.5 K and predominant periods of 24-30 days. Diurnal and semi-diurnal components were also observed. Sub-bottom temperatures measured with both probes also oscillated reflecting the bottom-water temperature variation but the amplitudes decayed and the phases delayed with depth. From the Probe-2 data outside of the bacterial mat, conductive heat flow was estimated at 123 mW/m2 by correcting the effect of the bottom-water temperature variation. In this experiment, we wrapped yellow vinyl tapes around the probes to indicate the positions of thermistors. Probe-1 was partially penetrated and the color of the tapes located below the seafloor changed into black probably by reaction with hydrogen sulfide, suggesting the existence of active fluid seepage at this site. Assuming an upward pore fluid migration at a constant rate, we estimated the rate of cold seepage and advective heat flow at 1.6x10-7 m/s and 150 mW/m2, respectively. Since heat flow values measured around this site are 64-72 mW/m2, the high heat flow values inside and outside the bacterial mat may reflect upward fluid flow along the splay fault.