



Temperature distribution of the toe of Nankai Trough off Muroto revealed from IODP Exp370 borehole observatory

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In 2016, International Ocean Discovery Program (IODP) Expedition 370 was carried out at the drillsite C0023 (water depth of 4776 m) at the proto-thrust zone of Nankai Trough off Muroto. The expedition aimed to explore the limits of life in the deep seafloor biosphere at a location where temperature was expected to exceed the known temperature maximum of microbial life ($\sim 120^{\circ}\text{C}$) at the sediment/basement interface ~ 1.2 km below the seafloor. We penetrated 1180 m and recovered cores across the sediment/basalt interface. Following the coring operations, a temporary temperature observatory (TTO) was installed in the borehole. TTO included 13 thermistor sensors (spanning from 299 m below seafloor (mbsf) to 860.9 mbsf) attached outside 4-1/2" tubing, which was hung in the 13-3/8" casing. Temperature data was logged and stored in a data logger attached to the wellhead.

In March 2018, we revisited Site C0023 using the JAMSTEC ROV KAIKO during the KR18-04 cruise. We successfully recovered 1.5-year borehole temperature data. Although some sensors were dead or malfunctioning, some were in good condition and were recording temperatures. We noticed that the temperatures in the borehole were recovered to more than 70% of the original formation temperatures at the time of deployment.

Unfortunately some sensors were dead by the end of May 2017, and ~ 6 sensors remain recording temperatures. Some of them reached their maximum temperatures at ~ 200 days after the deployment, followed by a gradual decrease.

Fig. 3 show a preliminary plot of temperature vs. depth profiles. Thermal conductivities measured on core samples are also shown. TTO temperatures are shown as blue bars, whereas temperatures measured upon Advanced piston coring (APCT) are shown as yellow circles. They are consistent to each other, and the temperature at decollement (~ 800 mbsf) is tentatively determined at ~ 90 degC. Some temporary variations are also observed, which may reflect potential hydrological activities.