Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

SSS30-12 Room:Main Hall Time:April 28 14:30-14:45

Heat flow distribution along the Nankai Trough: Influence of the structure of the Shikoku Basin oceanic crust

YAMANO, Makoto[1*] ; KAWADA, Yoshifumi[1] ; GOTO, Shusaku[2] ; HAMAMOTO, Hideki[3]

[1]Earthq. Res. Inst., Univ. Tokyo, [2]Geol. Surv. Japan, AIST, [3]Center Environ. Sci. Saitama

The thermal structure of the Philippine Sea plate (Shikoku Basin) subducting along the Nankai Trough, one of the most important factors controlling the temperature structure around the plate interface, significantly affects physical/chemical processes in the seismogenic zone of subduction earthquakes. Surface heat flow observed on the floor of the Nankai Trough should reflect the thermal structure of the incoming Shikoku Basin. Previous surveys showed that heat flow on the trough floor is extremely high for the seafloor age between 135^{o}E and 136^{o}E (south of the Kii Peninsula), while it is comparable to the value expected from the age in the neighboring area to the east of 136^{o}E. The transition zone from high to normal heat flow lies in the vicinity of the rupture segmentation boundary between the 1944 Tonankai and the 1946 Nankai earthquakes, across which seismicity on the landward side of the trough significantly changes, implying influence of the temperature structure on subduction earthquake processes.

For further investigation of the along-strike variation in heat flow on the trough floor, we conducted heat flow measurements around the Nankai Trough off the Kii Peninsula and off Shikoku in 2011 to 2013. Most of the measurements were made in the area around 136^{o}E, where the high to normal heat flow transition occurs, and on the trough floor to the south of Shikoku, where the existing data were very sparse. 39 new heat flow data on the trough floor allowed us to delineate heat flow variation along the trough. A conspicuous change in heat flow distribution was found at around 136^{o}E. On the west of 136^{o}E, heat flow is extremely high and variable, ranging from 130 to 250 mW/m^2,while on the east of 136^{o}E, heat flow monotonously decreases eastward from 200 to 100 mW/m^2 in about 50 km with no appreciable scatter. On the trough floor south of Shikoku, west of 134.5^{o}E, no significant change was observed along the trough in spite of westward increase in the seafloor age.

The heat flow distribution described above appears to be correlated with the structure of the Shikoku Basin oceanic crust. The high and variable heat flow area between 134.5^{o}E and 136^{o}E corresponds to the youngest part of the Shikoku Basin which was formed by spreading in NE-SW direction, whereas the neighboring areas with less scattered heat flow, east of 136^{o}E and west of 134.5^{o}E are the older parts formed by E-W spreading. The thickness of the oceanic crust and the basement relief also change around 136^{o}E, in the vicinity of the heat flow transition boundary. Spinelli and Wang (2008) proposed a model for the high heat flow around 135^{o}E that vigorous pore fluid circulation in a permeable layer in the subducting oceanic crust efficiently transfers heat upward along the plate interface. We may infer that the permeability structure of the oceanic crust changes at the transform boundaries between the E-W and NE-SW spreading, which yields variations in vigor and/or pattern of pore fluid circulation, resulting in the contrasting heat flow distributions. Since heat transfer by fluid circulation in the subducting oceanic crust lowers the temperature of the plate interface, the along-strike variation in the trough floor heat flow could indicate corresponding variation in the temperature distribution in the seismogenic zone.

Keywords: Nankai Trough, heat flow, pore fluid, oceanic crust, temperature structure, seismogenic zone