Heat flow distribution in the Nankai subduction zone off Kumano

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For thermal modeling of the seismogenic zone of the Nankai subduction zone, it is important to know the thermal structure of the subducting Shikoku Basin lithosphere. The thermal structure of oceanic lithosphere is generally determined by its age. It has been pointed out, however, that surface heat flow observed in the central part of the Nankai Trough, where the Shikoku Basin starts to subduct, is too high for the seafloor age. Recent concentrated measurements in the off-Muroto area (off eastern Shikoku) revealed that the average heat flow on the trough floor reaches about 200 mW/m^2. Taking account of the effect of sedimentation, this value is almost twice as high as that expected for the crustal age (about 15 m.y.). It suggests that the Shikoku Basin lithosphere in this area may be anomalously hot and it may significantly affect the thermal structure of the seismogenic zone. In order to investigate the origin of this extremely high heat flow, it is necessary to delineate the pattern and extent of the anomaly.

We have been conducting heat flow measurements in the off-Kumano area (southeast of the Ki-i Peninsula) since 2002, aiming at comparison with the off-Muroto area. It is the area where IODP deep drilling into the seismogenic zone is being proposed, and heat flow data are thus important for drill site characterization as well. Most of the new heat flow data were obtained on the floor of the Nankai Trough and just south of the trough floor (northern margin of the Shikoku Basin). Heat flow on the trough floor is quite uniform, 100 to 110 mW/m^2, in strong contrast to 200 mW/m^2 in the off-Muroto area. They are almost consistent with the value corresponding to the crustal age (about 20 m.y.) corrected for the sedimentation effect. It suggests that the thermal structure of the Shikoku Basin is normal in the off-Kumano area and there must be a transition zone between the extremely high heat flow off Muroto and the normal heat flow off Kumano. We need to make more measurements to clarify how the transition occurs.

On the frontal part of the accretionary prism, heat flow appears to decrease landward to about 60 mW/m^2 within 20 km of the deformation front, though it needs to be confirmed by additional measurements. Further landward, there is a large forearc basin, Kumano Trough, which lies over the rupture area of the 1944 Tonankai earthquake. It is therefore important to measure heat flow in the Kumano Trough for constraining the thermal structure of this seismogenic zone. However, the water depth in the Kumano Trough is relatively shallow, about 2000 m, and temporal variations in the bottom water temperature are too large for us to make heat flow measurements with ordinary deep-sea equipment. For determination of heat flow by removing the effect of bottom water temperature variation, we have been conducting long-term monitoring of the bottom water temperatures and sediment temperatures in the upper 2m. Results of these long-term measurements are presented in the session T032.