Estimation of the thermal structure of the Nankai subduction zone

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Underground thermal structure is generally calculated from the surface heat flow data assuming thermal conductivity and radioactive heat production distributions. We estimated the thermal structure of the Nankai subduction zone using the observed heat flow profiles as constraints.

Wang et al. (1995) and Hyndman et al. (1995) estimated the temperature structures with 2-D isoparametric finite-element models for sections across Shikoku and across the Ki-i Peninsula. Their results could not be constrained by the surface heat flow, since there were few data on the accretionary prism. In particular, there were no reliable heat flow data in shallow sea areas because of large thermal disturbances due to bottom water temperature variations. Recent development of pop-up type long-term temperature monitoring systems enabled us to obtain sediment temperature profile records for about one year and to determine heat flow by reducing the effect of bottom water temperature variations.

We used 2-D finite-element models similar to the one presented by Wang et al. (1995). We assumed a steady state, since calculations were made in a rather confined area, within 100 km of the deformation front. The shape of the plate interface was determined based on results of recent seismic surveys. The age of the subducting plate and the subduction rate were treated as known parameters.

We tried to estimate the radioactive heat production in the landward plate and the frictional heating along the underthrusting plate boundary by comparing the calculated surface heat flow with the observed data. Various combinations of these two parameters, however, give heat flow profiles consistent with the observation. We thus examined how much difference in the plate interface temperatures can be expected for possible combinations of these parameters.