

Pin-point seafloor survey in the Nankai Trough by NSS: Site-survey of the seismogenic zone off Kumano

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The main slip area during the 1944 Tonankai earthquake is inferred to extend to the Nankai accretionary prism off Kumano. The NanTroSEIZE research group have proposed the series of IODP drillings for understanding the seismogenic zone off Kumano and our proposals were partly approved. The authors have conducted multidisciplinary studies including cold seep chemistry, structural geology, thermal structure and micro-biology for drilling site survey using submersibles. We also took piston core samples and conducted POGO-style heat flow measurements at the Nankai Trough and the forearc basin. However, it is not easy to take samples or measure heat flow at deep-sea with pinpoint accuracy using the conventional method. In order to identify the position of the tool and approach the target for sampling or measurements, a transponder is recently installed on the cable just above the tools.

The pilot vehicle of the ROV NSS (Navigable Sampling System) can move by four thrusters, observe seafloor by video cameras, release samplers and measurement tools by command from a mother ship, and real time geophysical or geochemical monitoring through an armored cable. Depth capability of the pilot vehicle is 4000m and maximum payload weight is 1.5 Tons.

We conducted pinpoint seafloor survey in the Nankai Trough are by NSS during JAMSTEC KAIYO KY04-11 cruise (chief scientist: Kinoshita, M.). NSS has accuracy of pinpoint navigation within 2m, and allows us to take samples or conduct measurements from narrow fault zones or small clam colonies. We collected piston core samples from the narrow slope basin at the base of the fault scarp, which is the surface expression of a large OOST (out-of-sequence thrust) at the upper prism slope. This OOST is regarded as a splay fault slipped during repeatedly occurred Nankai earthquakes. Existences of chemosynthetic biological communities along the fault also suggest recent fault activity. The piston core samples include several coarse sediment layers suggesting event deposits probably associated with fault displacements or large earthquakes.

During our cruise, a magnitude 7.4 earthquake occurred off-shore southeast of the Kii Peninsula on September 5, 2004. We observed the seafloor, took piston core samples and measure heat flow values by NSS around the epicenter about 2 weeks after the earthquakes. TV camera of the NSS pilot vehicle revealed low visibility near the ocean floor suggesting fine particles settling from turbidity currents caused by the earthquakes. The thicknesses of the low transparency of seawater were about 200m in most sites. The core sample near the epicenter is characterized by loose muddy sediment.