

Aging of the seismo-disturbance of bottom in the submarine source region of Hokkaido Nansei-oki earthquake

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YK08-07 cruise of R/V YOKOSUKA with manned submersible SHINKAI 6500 was performed during May 29 to June 18 in 2008. Submarine investigation of the eastern rim of Japan Sea, 2000 to 3600 m in water depth, was conducted.

Investigation method:

Overcoming the limit of the conventional, visual observation, the side-scanning sonar and the sub-bottom profiler were utilized in order to image sea bottom acoustically field-wise and in three dimensions. Such geophysical methods are combined with the visual observation of fine tectonomorphic features, 3D video-camera photography, push coring, and living thing sampling. Eight submersible dives of SHINKAI were conducted: 4 dives along the tectonomorphic boundary between Okushiri Ridge and Shiribeshi Trough (3300 - 2500 m.w.d), 1 dive at ODP 796 site (2570- 2300 m.w.d), 1 dive at the 1993 earthquake epicenter (3600 -2500 m.w.d), and 2 dives at the continental shelf slope (3120 - 3000 m.w.d) offing the Motta cape of southwest Hokkaido.

Results:

The submersible dive visited the epicenter of the 1993 Hokkaido Nansei-oki earthquake on the Okushiri ridge west side slope for the first time during this cruise. There was exposure of bedrock composed of semi consolidated sedimentary layers, where a thin accumulation, about 20cm of fragile sediments covers the bedrock place by place. The damaged bottom was remarkably characterized by high-speed destruction in situ. Similar situation had been observed at the southernmost of the same source region at the sea area southeast-off Okushiri Island and that of 1983 Nihonkai Chubu earthquake. On the other hand, large-scale landslides and slope collapses had occurred on the east slope of the same ridge. Remarkable microbial mats were formed along the boundary fault with the sedimentary flat of the Shiribeshi trough. Such an east-west asymmetry clearly indicates a west-dipping reverse faulting for the earthquake source fault. Moreover, the belt of cold seepage and microbial mats along the source fault suggests the possibility that the fluid took part in the earthquake occurrence.

During this cruise, the drill hole-A of ODP796 could be discovered fortunately by the second challenge after YK99-05 (Dive 483). The drill site where a sample of methane hydrate had been recovered for the first time in Japan was miraculously located in the source region of an earthquake in 1993 although it had excavated four years before the earthquake. Hole-A was unhurt for appearance, while Hole-B may have collapsed in case of the earthquake, although both holes were at the same place. Expected traces of sand blow through those wells as well as surrounding microbial mats could not be found by the submersible dive. It is possible that the strong ground motion is controlled in the Okushiri ridge because the volcanic basement of sedimentary layers is so shallow as illustrated by the seismic reflection profiles. For this reason, while solving surface geological structure with the various data obtained by the cruise, in order to compare it with the deep hypocenter fault, re-analysis of the reflection data is due to be carried out from now on.

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