

Recovery operation of "anchor-recovery type OBSs" – KR19-06C cruise of R/V Kairei, off Yamagata, Japan Sea

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Many active faults are distributed in the coastal area in the eastern part of the Japan Sea (e.g. Okamura, 2019). In order to understand the seismotectonics of the Japan Sea, it is important to obtain crustal structure images of the coastal area derived from the seismic profile.

In August 2019, we conducted a marine seismic survey to study the crustal structure off Yamagata Prefecture, using 39 ocean bottom seismographs (OBSs) and a tuned air-gun array system of R/V Kairei. The survey covered the areas from the continental shelf to the Yamato Basin and was located near the aftershock area of the earthquake offshore Yamagata Prefecture (M_j 6.7) that occurred on June 18, 2019. The crustal structure is important information to understand the occurrence of this earthquake. However, it is difficult to obtain the structural information in such a coastal area due to economic activities (e.g. fishing activity). To minimize the conflict, we used eight "anchor-recovery type OBSs" in the coastal area. The OBS is connected to the anchor with a rope to wind up the anchor from the seafloor, following the OBS recovery.

In the past, we had some experiences in successfully operating the anchor-recovery type OBSs where the seafloor is shallower than 100 m. However, we had to deploy four anchor-recovery type OBSs deeper than 100 m (max. 646 m) during this survey, and this was our first attempt. To make it possible, we made some improvements to the OBS's recovery system, and conducted experimental tests using a water tank at the JAMSTEC Yokosuka Headquarters.

In addition, we also prepared a sweep-line with grapnel anchors in cases something unexpected happens to the OBS recovery. We designed the sweep-line on the basis of an emergency recovery method for a subsurface observation mooring system which is composed of a main rope, grapnel anchors, depressor weights, and a transponder (e.g. Momma and Hotta, 1986).

During the seismic survey, we recovered eight anchor-recovery type OBSs as well as 31 normal type OBSs after the air-gun shooting. The OBS recovery was carried out as follows: first, R/V Kairei sent an acoustic releasing command to each OBS. Then, surfaced OBS and its anchor connected with a rope were recovered using M/V Hirokai. We recovered seven OBSs with anchor successfully. However, one OBS didn't respond to a releasing command despite a number of trials to make acoustic communication. For this unreleased OBS, we tried to recover using the towed sweep-line with grapnel anchors. The sweep-line was deployed from the stern of R/V Kairei, and towed around the OBS position with a radius of ~100 m. We monitored the sweep-line navigation data from the transponder and vessel navigation data during the towing. The first trial failed probably because the sweep-line didn't reach the seafloor. For the second trial, we added depressor weights and grapnel anchors to the sweep-line, and towed along multiple elliptic courses. As a result of the second trial, the sweep-line caught the OBS with its anchor, and we recovered them.

In this presentation, we report the operations and emerged problems of the anchor-recovery type OBSs.

[References]

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