

Evaluation of offshore active faults in the eastern margin of Japan Sea based on dive survey

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There are many active faults in the eastern margin of the Japan Sea and several earthquakes larger than M7.5 have occurred along the faults. However, activity and rupture history, which are required to estimate the future earthquake potential of active faults, are not well known in this area. Survey methods which make clear the activity of offshore active faults have not established. Seismic reflection profiles are widely used to identify offshore active faults and folds, however, the profiles do not have enough time resolution to distinguish each event. Observation of sea-bottom around active faults by a submersible provides useful information to consider the activity of offshore faults.

We have been surveying offshore active faults by submersibles in the eastern margin of the Japan Sea, including eight dives by submersible `Shinkai 6500` in the last summer. After these dives, we have collected sea-bottom images of the most major active faults in the Japan Sea, although the density of surveys is quite different. In addition, we have been studying seismic profiles and sediment cores including seismo-turbidites. In this paper, we will consider the activity of the faults based on the survey data.

In the eastern margin of the Japan Sea, Quaternary folds and faults zones have been growing in several arc-parallel zones which form the Okushiri Ridge, Sado Ridge, Awashima to Oga ridge and some other minor ridges to the west of Hokkaido. Along the Okushiri Ridge, one of the largest ridge in the eastern margin of the Japan Sea, 1940 Shakotan-oki, 1993 Hokkaido-nansei-oki, 1983 Nihonkai-chubu earthquakes have occurred, which indicates that the ridge is active. Dives in the source area of the recent earthquakes widely observed fresh fissures, slope failures and debris on the slope above active faults. In the seismic gaps between the source area of recent earthquakes, fissures, slope failures and debris covered with muddy sediments were widely observed. The observation strongly suggests that large-scale earthquakes which caused wide sea-bottom disruptions have occurred in the seismic gaps within the last thousands years, because the sedimentation rate is presumed to be less than 20 cm/ky. No historical earthquake is known in the Sado Ridge, however, it is considered that the ridge is active and have been strongly shaken by large earthquakes within the last thousand years, because old fissures, slope failures and debris were observed on the western slope of the ridge. A sediment core collected from a minor trough of the Sado Ridge include turbidites at about 1000 years interval during the Holocene time. They suggest that the ridge has a high activity comparative to that of the Okushiri Ridge.

The dive surveys as well as seismic profiling and sedimentological analysis have made possible to estimate roughly the activity of offshore active faults in the eastern Japan Sea, where activity of Quaternary faults have not been well known. To improve the accuracy of the estimation of offshore fault activity comparable to that of onshore faults, there are some problems, e.g. establishing the criteria of ancient events from sediments and improving age determination.