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Characteristics of active faults along the Nankai trough revealed by high resolution submarine topographic map

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The Nankai trough extends along the boundary between the Philippine Sea Plate and Eurasian Plate. Many large and destractive earthquakes have occurred along the trough during the historical period. The trough is a candidate site for the occurrence of large earthquakes in near future. The trough has been well studied by many marine geologists and they have revealed characteristic features of the plate boundary.
However, fundamental information such as the detailed distribution of active faults is not yet well known mainly due to the lack of data about submarine topography. To make a more precise submarine active fault map along the trough, we have made detailed a submarine topographic map with 10m-interval contours based on 3-second (about 90m) DEM processed from the original data obtained by Japan Coast Guard since 1986 using multi-narrow beam echo sounder. Then we have made stereo-pair copies of the topographic maps for interpretation of active faults, similar in manner to how we use air-photo stereo sets for inland active faults. The stereo-pairs allow us to rather easily get 3D images and map active faults on the sea bottom as compared to single ordinary topographic maps. We have also prepared anaglyph images from the stereo-pairs for discussion.
As mapped by previous works (Research Group for Active Submarine Faults off Tokai; 1999, Kimura and Kinoshita eds., 2009), there are many trough-parallel north-dipping thrusts. Among these the Frontal Thrust and associated splay thrusts are predominant. We are now able to depict location and their extent in more detail.
On the other hand, the imbricated in-sequence thrust structures which are widely accepted as a common feature along the frontal zone are not well recognizable. Rather, many trough-parallel short faults developed in the up-warped zones to the north of major thrusts. Most of them are associated with elongated depressions between parallel-running fault traces.
Strike-slip faults with right-lateral slip are observed along the so-called outer ridge south of fore-arc basins. The strike-slip faults generally extend NE-SW to ENE-WSW and merge in thrust faults. In places, gullies are displaced right-laterally, and the up-thrown side along the faults changes frequently.
Another important tectonic feature is a flexure scarp along outer margin of the island-shelf. Most of the submarine canyons and valleys are meandering and dissecting the smooth and gentle scarp, indicating that flat sea-bottom has been deformed by younger warping. This flexure zone extends close to the land from Omaezaki to the east to Hyuga-Nada to the west. We assume that an extensive subsurface reverse fault system is taking important role for formation of the zone.
It is noteworthy that most of the areas except in the flat sea-bottom are widely modified and covered by landslides and slope failures. Some of them are extensive and as a consequence, where faults are numerous between major thrusts, some areas are largely occupied by landslides. Steep fault scarps along Nankai trough and Suruga trough are severely modified by numerous landslides

and slope failures. To confirm our interpretation, we will compare the topography we observe to geological structures revealed by geophysical reflection surveys.

Keywords: submarine active fault, Nakai trough, sea-floor topography