Effects of rough relief of subducting plate on the deformation of frontal accretionary wedge and SVLFEs activity in the Nankai Trough

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The forearc of the Nankai Trough is characterized by the development of accretionary prism, and shallow slow earthquakes and tremors. Recent integrated investigations of seismic reflection and other geophysical-geological surveys reveal that the structure of the plate boundary fault and accretionary prism are very heterogeneous and complicated. In this study, we focus on the structure of the accretionary wedge of the Nankai Trough south of the Shionomisaki-canyon off the Kii Peninsula, SW Japan.

The seismic reflection profile KR02-11 D1 normal to the strike of the trough presents a horst surface of the Philippine Sea Plate. The landward edge of the horst is situated at the ramp-up location of the frontal thrust from the decollement, which is incipient in pelagic sediment beneath the trench filling wedge along the surface morphology above the horst (red broken lie in Figure). An underthrust package between the frontal thrust and the incipient decollement is translucent and deformed by minor reverse faults. The hanging wall of the frontal thrust shows anticlinal crest eroded along the trench-ward slope (1 in Figure). Seabed surface of the crest is ~375 m higher than the Nankai trough floor.

The layer parallel decollement north of the frontal thrust continues further ~10 km inward beneath the second crest of the accretionary prism (2 in Figure). Internal structure of the second crest is obscure but splayed thrusts are developed at the southern wing of the crest.

Slope basin deposits unconformably overlay the accretionary prism between the crests1and 2(Figure). The sediments diminish to the crest 1 but thicken and involved into the fold-and-thrust of the crest 2 . This structure indicates growth strata of syn-tectonic deposition.

Plate tectonic interpretation for the above observation based on the NNR-MORVEL 56 model is as follows; The relative convergence of Amur/ Philippine Sea Plates is ~6cm/y along azimuth 300^0 in this location, which projected ~5.2 cm/y on the profile. Pulling back the Philippine Sea Plate to ~70k years ago, the northern edge of the horst set back beneath the present deformation front, where the frontal thrust started to ramp up. The ~375 m anticlinal uplift of the crest 1 might play back to ~ 70 ky ago. Therefore, mean uplift rate is more than 5.3 mm/y, which is comparable with the rate of the Himalaya Mountains.

The location east of the Shionomisaki canyon is within a cluster of SVLFEs and tremors, that occur beneath the frontal slope described. The fault rock analysis of the frontal thrust recovered by the ocean drilling revealed that superimposed deformation of slow and fast tsunamigenic slip. How the plate convergence and uplift is partitioned in space and time is a matter of concern.

Keywords: accretionary wedge, Nankai trough, subduction zone, very low frequency earthquake