

Understanding Subduction Tectonics : the Nankai Trough Case

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The Philippine sea-Eurasia interplate convergence in central Japan is accommodated along the major subduction zones (eastern Nankai Trough and Suruga Trough).

Whereas to the west of Tenryu Canyon (137.3°E), the convergence of the Philippine Sea and Eurasia plates is mostly accommodated by subduction, east of this limit, about half of the convergence is accommodated by plate subduction and the other half by broadly distributed onland and offshore deformation. This zone which is about 200 km wide, parallel to the Nankai Trough, has experienced a very high mechanical coupling under the influence of the collision of the Izu peninsula with Central Japan since about 2 Ma.

The rate of shortening of the oceanic plate south of the Nankai Trough is estimated at about 10 mm/yr along the Zenisu thrust and the onland shortening rate at about 10 mm/yr. As Seno et al. [1993] estimate the Philippine-Eurasia motion vector in this area at 50 mm/yr, about 30 mm/yr should be absorbed in the subduction.

The intra-oceanic shortening now occurring south of the Eastern Nankai Trough which has produced the Zenisu Ridge has also been responsible for the formation of a previous ridge now buried below the continental margin. This ridge, that we refer to as Paleo Zenisu, is presently adjacent to the backstop and its location coincides with the outer limit of the seismogenic decollement. The subduction of the Paleo Zenisu ridge below the wedge has led to its complete

reorganization of the margin with a sequence of uplift, erosion, growth of a new accretionary wedge and is responsible for the structure of this wedge, well known from geophysical data and tectonic informations available from cruises and dives in this area. Observations and model suggests that the backstop and possibly the wedge are dextrally sheared as they are extruded southwestward in relation with the collision of Izu Bonin ridge with Japan.

The formation of Paleo Zenisu and its consequent subduction has given its identity to the Great Tokai earthquake rupture zone and has induced the tilting of the backstop toward the northwest since about 2 Ma.

On land, the present phase of deformation is accommodated through rapid mountain uplift, major left-lateral faulting, and reverse faulting, probably all initiated during the middle Pleistocene.

The intra-oceanic thrusts which are presently active have an initiation age which appears to be in broad agreement with the onset of the latest stage of onland deformation. This could be interpreted as suggesting that the collision of the Izu peninsula with mainland Japan is fundamentally responsible for both the onland and oceanic deformation.

The whole tectonic system, on both sides of the Zenisu ridge, including the shearing of the margin and the onland deformation area should be considered as a highly coupled mechanical system for the evaluation of the seismic risk.