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Deep 3D structure within the Nankai Trough and implications for the seismogenic zone

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Two 3D seismic reflection surveys across the Nankai Trough have imaged the deep structure of the subduction zone megathrust from the trench into the up dip end of the seismogenic zone where slip occurred during the most recent megathrust earthquakes. In 1999 we acquired a 3D seismic volume across the Muroto transect in the vicinity of the Muroto peninsula, offshore Shikoku Island, Japan. These data imaged 70 km of the subduction thrust from the toe of the accretionary wedge, across the up dip rupture area of the 1946 Nankaido M 8.1 earthquake, to 8 km depth below seafloor. At the down dip edge of the 3D volume we see a 1 km high seamount that has subducted to 7 km below seafloor, producing several very distinctive structures that imply uplift of the overriding accretionary wedge, removal of $\sim$ 1 km of material from the overriding plate, and a 1 km thick underthrust sediment sequence that appears to have been subducted to 5 km below seafloor in the wake of the subducted seamount.

In 2006 we acquired a second 3D volume across the Kumano Basin in the vicinity of the IODP NanTroSEIZE drilling area that imaged the subducting plate boundary megathrust across the up dip edge of the seismogenic zone where it ruptured during the 1944 Tonankai M8.0 earthquake. Distinctive structures similar to those related to the subducting seamount along the Muroto transect are observed but across a larger area than the Muroto transect. These include 1- 2 km of uplift of the seaward edge of the Kumano Basin, and a subduction megathrust that lies well above the top of the subducting basement with a thick 1-2 km sequence of underthrust sediment that is subducted to greater than 10 km below seafloor. The similarities between these transects implies structures of the subducting ocean crust is the root cause of the deep sediment subduction in both cases despite no direct detection yet of a basement structure beneath the Kumano Basin in its presumed location down dip of the 3D survey. The underthrust sediment beneath the Kumano Basin will potentially affect the fluid content, rock properties and slip behavior, of at least 1/8 of the Tonankai rupture area.