

Exploring the tecto-sedimentary history of the lower Kumano basin: insights from 3D seismic analysis

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The Nankai accretionary margin is seismically active, representing a hazard for the people living along the southwestern Japanese shores. In an effort to better understand its behavior, 3D seismic and well data have been acquired in the area. We are using such data in order to address open research topics such as: the conditions for forearc basin initiation, the role of former slope basins and slope cover sediments in the formation of forearc basins and the role of changes in sedimentation rates -possibly associated with major climatic events- as a major controlling factor in forearc basin evolution. New 3D maps of key surfaces that bound and lie within the lower Kumano basin help us illuminate these topics.

The lower bounding surface, UC4, represents missing section between 5.6-3.8 Ma. Toward the SE UC4 is relatively undeformed, with some structures approximately parallel to the modern-day trench. In contrast, toward the NW UC4 is intensely deformed with two main synforms whose hinges are oriented 15 degrees to the modern-trench. The two synforms have similar wavelengths and amplitudes and define the thickest sediment accumulations in the lower Kumano basin. We hypothesize that UC4 had a protracted evolution with early synform (thrust-bound slope-basins?) followed by a change in the maximum strain/plate convergence direction. This change caused the structural trend observed to the SE. This interpretation is in agreement with previous independent estimations of block rotation based on paleomagnetic analysis of samples from core recovered in the area.

The upper bounding surface of the lower Kumano basin, UC2, underlies 1.5 Ma and younger sediments. Its morphology resembles a much smoother and less deformed version of UC4. It is slightly tilted landward. Seaward, it pinches out against UC4.

Between the two bounding surfaces we recognized a major unconformity that we called UC3a and that we were able to track through most of the studied part of the seismic volume. Morphologically, UC3a is very similar to UC2. We interpret this morphological similarity between UC3a and UC2 as an indicator of a possible steady-state tecto-sedimentary condition through the time span represented by the sediments contained in between both surfaces. On the other hand, the striking morphological contrast between UC4 and UC3a implies that the deformation of the lower basin waned upwards over time, with most of it taking place before the generation of UC3a.

Our interpretations point toward the strong influence of tectonic factors in the formation and evolution of UC4. This clearly tectonic signature is gradually lost toward UC3a, which might have been caused by an increase in the importance of sedimentation during incipient forearc basin development.

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