Variation in Porosity of the Nankai Trough Incoming Sediments off the Kii Peninsula, Southwest Japan

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The Nankai Trough is one of the best subduction-zone to study megathrust earthquake fault. Historic, great megathrust earthquakes with a recurrence interval of 100-200 yr have generated strong motion and large tsunamis along the Nankai Trough subduction zone. At the Nankai Trough margin, the Philippine Sea Plate (PSP) is being subducted beneath the Eurasian Plate to the northwest at a convergence rate ~4 cm/yr. The Shikoku Basin, the northern part of the PSP, is estimated to have opened between 25 and 15 Ma by backarc spreading of the Izu-Bonin arc. The >100-km-wide Nankai accretionary wedge, which has developed landward of the trench since the Miocene, mainly consists of offscraped and underplated materials from the trough-fill turbidites and the Shikoku Basin hemipelagic sediments. Particularly, physical properties of the incoming sediments to the Nankai Trough may be critical for seismogenic behavior of the megathrust fault. We have carried out core-log-seismic integration (CLSI) to estimate 3D acoustic impedance and porosity for the incoming sediments to the Nankai Trough off the Kii Peninsula, southwest Japan. For the CLSI, we used 3D seismic reflection, P-wave velocity, density, and porosity data obtained during IODP (Integrated Ocean Drilling Program) Expeditions 322 and 333. We computed acoustic impedance depth profiles for the IODP drilling sites from P-wave velocity and density data. We constructed seismic convolution models with the acoustic impedance profiles and a source wavelet which is extracted from the seismic data, adjusting the seismic models to observed seismic traces with inversion method. As a result, we have successfully obtained 3D acoustic impedance volume. With the 3D acoustic impedance volume and the porosity data at the IODP sites, we have performed multi-attribute transform that allows us to predict rock properties beyond the well location from seismic attributes calibrated with well-log data. The seismic attributes can be calculated internally, or provided as external attributes. The analysis was carried out in several stages: (1) to examine the log and seismic data at well locations to determine which set of attributes is appropriate; (2) to derive a relationship using multi-linear regression or Neural Networks; (3) to apply the derived relationship to a 3D SEG-Y volume to create a volume of the desired log property. In general, the 3D porosities show decrease with depth. We found a porosity anomaly zone with alteration of high and low porosities seaward of the trough axis. In this talk, we will show detailed 3D porosity of the incoming sediments, and present implications of the porosity anomaly zone for the megathrust fault behavior.

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