Public Abstract

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Title:Permeability, Clay Mineralogy, and Microfabric of Fine-grained Sediments from the Nankai Trough and Shikoku Basin, Offshore Southwest Japan

The Nankai Trough, a convergent plate boundary between the subducting Philippine Sea plate and overriding Eurasian plate, is located off the coast of southwest Japan. This study covers the central portion of the Kumano transect, eastern province of the Nankai Trough, which consists of six morphotectonic zones, such as, from southeast to northwest, subduction inputs in the Shikoku Basin, trench zone, frontal thrust zone, imbricated thrust zone, megasplay fault zone, and Kumano forearc basin. The objectives of this study are: (1) to show how permeability varies as a function of burial depth, lithostratigraphy, and structural position within the Nankai Trough subduction zone; and (2) to document the permeability anisotropy and consider how it changes with microfabric and mineralogy. Constant-flow permeability tests were executed to measure permeability for vertical (along-core) and horizontal (cross-core) sections of twenty-one core samples collected during Integrated Ocean Drilling Program (IODP) Expeditions 316 and 333. Comparison of the horizontal (kh) to the vertical (kv) permeability defines the anisotropy (kh/kv). Environmental scanning electron microscopy (ESEM) was used to image the fabric of samples in horizontal and vertical sections. The images were analyzed to compute the standard deviations and the indexes (i) of microfabric orientation. The relative clay mineral percentages in bulk sediment were calculated using previously analyzed X-ray diffraction data.

Samples from megasplay fault zone (IODP Sites C0004 and C0008) came from ~51 to 381 meters below the sea floor (mbsf). The vertical permeability ranges between 1.61E-17 m2 and 1.86E-18 m2. Samples from frontal thrust zone (IODP Sites C0006 and C0007), were taken from ~35 to 564 mbsf. The vertical permeability varies from 1.63E-15 m2 to 2.68E-19 m2. The values of horizontal permeability range between 2.11E-15 m2 and 3.32E-19 m2. Samples from Shikoku Basin (IODP Site C0011) came from ~36 to 362 mbsf. The values of vertical permeability differ between 1.34E-17 m2 and 2.83E-19 m2, whereas the values of horizontal permeability show variations between 1.80E-17 m2 and 5.15E-19 m2. The ratio of horizontal to vertical permeability (kh/kv) ranges between 0.02 and 19.90. The permeability and porosity values decrease as burial depth increases. However, the permeability doesnâ€™t show a statistically significant correlation with porosity. The vertical cut face shows better preferred orientation of grains than microfabric on the horizontal cut, which helps explain the anisotropy of permeability. Ratio of index of microfabric orientation does not show a significant correlation with permeability either direction or the anisotropy value. Vertical permeability values decrease as smectite and total clay minerals increase in abundance. Thus, the permeability and the anisotropy of permeability are not controlled by any single parameter.