

Local heat flow anomaly at the toe of Nankai accretionary prism off Muroto and its hydrological interpretation

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The Nankai Trough is a plate boundary where the Philippine Sea plate subducts beneath the Southwestern Japan arc. Thick turbidite sediment underlain by the hemipelagic sediment forms an accretionary prism landward of the trench axis. Heat flow between the trench axis and accretionary prism off Muroto is higher than that predicted from the age of subducting Shikoku Basin. During the KR02-10 Cruise of R/V KAIREI and ROV KAIKO (JAMSTEC), closely-spaced heat flow measurement was conducted across the second frontal thrust near the toe of Nankai accretionary prism. Whereas the average heat flow is 160(mW/m²) around this area, heat flow within 50m of the second frontal thrust is as high as 279(mW/m²). This anomaly can be caused by fluid expulsion along the thrust. In order to elucidate the relationship between the heat flow anomaly on the seafloor, permeability in the fault zone, and the pore pressure anomaly within decollement, we constructed a 2-D steady state numerical model for the fluid and heat flow regime within the toe of accretionary prism. As one of the results, we found that observed high heat flow fits well with 10⁻¹³(m²) as the channel permeability and 0.065(MPa) as excess pore pressure applied at the landward boundary of decollement, and 10⁻¹⁷(m²) as the ambient permeability. After 500 simulations, the relationship between the applied excess pore pressure dP(MPa), channel permeability Kch(m²), and the maximum heat flow Q(mW/m²) can be simply formulated in the form: $Q=1.6E16 \cdot Kch \cdot dp + Q_{base}$, where Qbase is the basal heat flux from below. Estimation from ODP results suggests that the applied excess pore pressure below the decollement is 4.2(MPa) or less. This leads to a minimum possible permeability Kch as 2E-15m². These results indicate that the surface heat flow is influenced by the fluid flow through the high permeability channel.