Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

SCG059-13 Room:105 Time:May 26 15:15-15:30

Landslide-related decoupled anomalies of heat flow and pore water chemistry: Nankai Trough off Muroto

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We observed surface heat flow and biological activity, and sampled push cores near the deformation front of the Nankai Trough accretionary prism off Muroto, in order to obtain relationships between the distribution of fluid discharge and the topography. Fine scale topography near the deformation thrust is characterized by a regularly-spaced stairway-like structure with a period of 1 km across the subduction axis. Each step consists of a flat area of 600-800 m long with a gentle landward down-dipping, and a steep wall of 400-200 m long and 100 m high. Near the foot of each steep wall, the exits of the sequentially thrusts cutting through the decollement are expected. We took an observation line, which crosses the hypothetical exit of the secondary frontal thrust perpendicularly to its strike. We found that the anomalies of pore water chemistry and biological activity were correlated in location, and that the anomalies of heat flow were not always correlated to the former anomalies in location. (1) On a flat place near the ODP hole 808I, regional mean heat flow value of 150 mW/m2 was observed, and neither chemical anomalies nor biological activities was detected. (2) Near the foot of a slope structure where the exit of sequential thrust is expected, high heat flow anomaly as high as 250 mW/m2 was observed, but no other anomalies were detected. (3) On the slope just above the foot, low heat flow anomaly around 120 mW/m2 was observed, and no other anomalies were found. (4) At a flat terrace-like place 40 m above the foot of the slope, where landslide structures were visible, moderately high heat flow anomalies around 200 mW/m2 were observed and both of biological activities (calyptogenas and tubeworms) and chemical anomalies (methane and ammonium) were found. The present observation basically agrees with a commonly accepted qualitative model, in which conduit-like fluid flow upwells through the thrusts and is restricted by near-surface geological structures such as landslides. However, the origin of the high heat flow anomaly observed near the foot of the slope is remained to be solved.

Keywords: Nankai Trough, heat flow, accretionary prism, landslide, pore water, off Muroto