

Marine geological and geophysical surveys after Sumatra Earthquake: Reports of MD149, SO186-2, and SO189- cruises

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After 2004 Sumatra Earthquake, several marine surveys were carried out at off Andaman-Sumatra. We introduce results of those geological and geophysical cruises, which we joined as onboard members.

Sumatra Aftershocks cruise/MD149: Marine survey (2005 July/August) using R/V Marion Dufresne was carried out in order to 1) monitor aftershock seismicity, 2) collect bathymetric data, 3) measure pore pressure of sediments, and heat-flow and collect sediments in the west and northwest areas of Sumatra Island. French, Indonesia, India, and Japanese scientists joined in this comprehensive cruise. 1) Twenty OBSs were deployed in the perpendicular line to arc-trench with the interval of 40-60 km, and recovered after observation for 16 days. Continuous collection of bathymetric data from the trench to arc and extension of West Andaman fault did clarify that three splay faults are growing at the outer-arc high, and that the extension of West Andaman Fault is characterized by a group of discontinuous faults showing an echelon pattern. 3) Heat-flow measurement and piezometer, and coring were carried out in a broad area. High value of heat-flow and trace of biological activity around splay fault suggest active geological phenomena currently. The piezometer result suggests sediment liquefaction, which might be caused from the strong shaking of 2004 Earthquake. A paleocurrent direction of turbidite in Ache basin, which can be estimated from magnetic fabric and paleomagnetic directions, is useful tool to derive information of seismogenic turbidite. We conceive this approach makes possible to establish the paleo seismo-record of off Sumatra with additional C14 age control.

SEACAUSE/SO186-2 cruise: SO186-2 cruise was carried out off northern Sumatra in Jan and Feb, 2006 to acquire multi-channel seismic data. Scientific party was organized as an international team from German, US, Japan, England, Russia, and Indonesia. The multi-channel system used for our survey consisted of tuned air-guns, and a 3000 m-length streamer having 240 channels. 45 survey lines had been completed without trouble, and total length of surveyed lines reached to 5000 km. Onboard analyzing and quick interpretation by help of softwares reveal that images of acoustic cross section are characterized by a typical accretionary prism structure such as offscraping & underplating, imbricate thrusts, and out-of-sequence thrusts. Fore-arc basins, their formation are controlled by the dextral slip Mentawai fault, are developed in the landward-side of outer arc high. The plate-boundary was identified clearly in some southern survey lines, and 50-km long continuous identification is possible landward from the deformation front in these profiles. However that of northern show unclearness in the profiles.

SUMATRA /SO189-2 cruise: The geological survey in Sept to Oct 2006 by R/V SONNE was carried out by BGR at Sumatra fore-arc basins. Geological sampling and detail observation of the surface were taken at all fore-arc basins off Sumatra using various sampling tools. A wide area was mapped by a multi-narrow beam system to fill blank areas formed in previous cruises. Geological sampling was intensively performed to obtain information for hydrocarbon potential, geochemistry and microbiology, mass-flow caused by collapse relating to earthquakes. We found a site of active seepage and sediment containing methane gas at the area faulted or folded in the southern Simeulue basin. Subbottom shallow acoustic profiling could detect fold or faulted sequences at Simeulue basin, slumped sequence at Nias basin. Slope of Nias Basin showed a narrow-spacing normal fault system at very surface. We recovered a soft slumped sequence overlaid with a coherent sequence at Nias basin. This recovery suggests ground truth for acoustic subbottom features. All above mentioned features are considered to be active or formed in very recent time.