Geophysical Research Abstracts, Vol. 8, 09119, 2006
SRef-ID: 1607-7962/gra/EGU06-A-09119

Landslides and mass wasting offshore Sumatra – results from the HMS Scott and SEATOS surveys 2005.

D. R. Tappin, (1), D. Mosher (2), L. McNeill (3), T. Henstock (3), K. Moran (4) and SEATOS SCIENCE PARTY

(1) British Geological Survey, Keyworth, Nottingham, NG12 5GG, England

(2) Geological Survey of Canada, Dartmouth, NS B2Y 4A2, Canada

(3) National Oceanography Centre, Southampton, England

(3) National Oceanography Centre, Southampton, England,

(4) University of Rhode Island, Narragansett, RI 02882, United States

Earthquakes are commonly cited as a mechanism for triggering submarine landslides that have the potential to generate damaging tsunamis (e.g. Papua New Guinea 1998). Notwithstanding, based on the evidence now available, the Great Indian Ocean earthquake of December 26th 2005 is generally agreed to have been the only cause of both far field and local tsunami runups, with no contribution from submarine landslides. However, if earthquakes are such a common trigger for landslides then the magnitude 9.3 earthquake of December 26th might be expected to have caused numerous seabed failures within the area of rupture that may have contributed to local tsunami runup.

This contribution discusses the seabed and subseabed morphology and structure offshore of Sumatra acquired during the surveys carried out in 2005 by HMS Scott and the Sumatra Earthquake and Tsunami Offshore Survey (SEATOS). The Scott survey utilised high resolution 12 kHz, 361-beam hull-mounted Sass IV sonar, mapping over 40,000 square kilometres of seabed. During the SEATOS single channel seismic and seabed images from a Remotely Operated Vehicle were acquired over the area mapped by the Scott. One of the objectives of the surveys was to identify submarine slope failures that may have contributed to the tsunami. This paper reports on the results of this investigation.

The area mapped is an accretionary complex formed as the two plates (Indian and

Asian) have converged over the past 40 million years. Several seabed failure mechanisms of various ages have been identified. Along the plate margin in the west of the survey area the deformation front comprises a series of young thrust folds up to 1000 m in elevation and tens of kilometres in length. In places the seaward faces of these folds have failed cohesively and slumped blocks 100's of metres high and up to several kilometres long have been displaced up to 13 kilometres onto the inner trench floor. At other locations older episodes of failure are identified by the presence of displaced slumped blocks located on the crests of the folds; the slumps thus predating uplift.

Where young thrust folds are absent, the outer margin of the accretionary prism is deeply dissected and comprises a steeply sloping seabed incised by numerous gullies and slide scars. Here, mechanisms of failure are incremental, and take place mainly through headwall erosion. There are small cohesive failures, although most sediment appears to be shed from the gullies into the inner trench through channels incised into the seabed. Sediment overflow from the channels has resulted in the construction of sediment fans upon which are located giant sediment waves. Along both the outer margin of the prism and within the forearc basin the Single Channel Seismic data shows that mass sediment flow is a common mechanism of failure.

Inboard of the deformation front, the accretionary prism the thrust folds are, deeply dissected and buried by hemipelagic sediment. There are no cross-cutting submarine canyons. The likeliest explanation for the lack of large failures and absence of cross-cutting canyons, seems to be that the region is sediment starved, with the main sediment input from offscraping along the plate boundary. There is little sediment input from Sumatra.