Geophysical Research Abstracts
Vol. 19, EGU2017-10947, 2017
EGU General Assembly 2017

Seismotectonics of the Nicobar Swarm and the geodynamic implications for the 2004 Great Sumatran Earthquake

Gordon Lister

Structure Tectonics Group, Research School of Earth Sciences, The Australian National University, Canberra, Australia (gordon.lister@anu.edu.au)

The Great Sumatran Earthquake took place on 26th December 2004. One month into the aftershock sequence, a dense swarm of earthquakes took place beneath the Andaman Sea, northeast of the Nicobar Islands. The swarm continued for ∼11 days, rapidly decreasing in intensity towards the end of that period. Unlike most earthquake swarms, the Nicobar cluster was characterised by a large number of shocks with moment magnitude exceeding five. This meant that centroid moment tensor data could be determined, and this data in turn allows geometric analysis of inferred fault plane motions.

The classification obtained using program *eQuakes* shows aftershocks falling into distinct spatial groups. Thrusts dominate in the south (in the Sumatran domain), and normal faults dominate in the north (in the Andaman domain). Strike-slip faults are more evenly spread. They occur on the Sumatran wrench system, for example, but also on the Indian plate itself. Orientation groups readily emerge from such an analysis. Temporal variation in behaviour is immediately evident, changing after ∼12 months. Orientation groups in the first twelve months are consistent with margin perpendicular extension beneath the Andaman Sea (i.e. mode II megathrust behaviour) whereas afterward the pattern of deformation appears to have reverted to that expected in consequence of relative plate motion. In the first twelve months, strike-slip motion appears to have taken place on faults that are sub-parallel to spreading segments in the Andaman Sea. By early 2006 however normal fault clusters formed that showed ∼N-S extension across these spreading segments had resumed, while the overall density of aftershocks in the Andaman segment had considerably diminished. Throughout this entire period the Sumatran segment exhibited aftershock sequences consistent with ongoing Mode I megathrust behaviour. The Nicobar Swarm marks the transition from one sort of slab dynamics to the other.

The earthquake swarm may have been facilitated by hydrothermal activity related to a seamount, or by magma intrusion. However, the swarm is located where the transpressional regime of the Sumatran strike-slip fault system changes to that of the ‘microplate-bounding’ transtensional wrench involved in the Andaman Sea spreading centre. The swarm thus may be the result of the confluence of two tectonic modes of afterslip on the main rupture, with arc-normal compression to the south, and arc-normal extension to the north. The orientations of the controlling faults can be related to the right-lateral Sumatran strike-slip system, and to oceanic transforms in the spreading system. Faults parallel to the Andaman Sea spreading system axis reactivated as left-lateral strike-slip faults during the period of afterslip. Analysis of the orientation groups shows that the swarm involved synchronous but geometrically incompatible movements on opposing but conjugate fault plane sets with trends that are consistent with Mohr-Coulomb failure, even though the orientation groups delineated require slip in many different directions on these planes. The fault planes allow inference of regional deviatoric stress axes with the principal compressive stress parallel to the prior distortion inferred using satellite geodesy.