U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

M7.3 Nicobar Islands Earthquake of 24 July 2005, Principal Aftershock of the M9.0 26 December 2004 Sumatra - Andaman Islands Earthquake

Tectonic Setting

SCALE 1:20,000,000 at the Equator

Kilometers 0 200 400 800 1,200 1,600

RELATIVE PLATE MOTIONS

The broad red vectors represent the motion of the India and Australia plates with respect to the interior of the Eurasia plate. The motion of India and Australia generally northward with respect to Eurasia produces motion of many smaller plates that lie between the India/Australia plates and the Eurasia plate. The 26 December earthquake occurred on the boundary between one of the smaller plates, the Burma microplate, and the India plate.

Faults and plate-boundaries in this map are represented at two levels of precision. Within the rectangle labeled "Detailed Map," faults are represented as mapped in regional geologic and oceanographic studies (Pubellier and others, 2003). These faults are also shown in the detailed map in the center of this poster. Outside the "Detailed Map" rectangle, plate boundaries are represented very generally. Some of the mapped boundaries correspond to narrow fault zones, but others of the mapped boundaries are line approximations to what are in fact broad areas of distributed deformation, and yet others correspond to boundaries between regions having different levels of deformation.

The Burma microplate is the 200 km - 400 km region that is bounded on the west by the thrust-fault system that outcrops at the Sunda trench and on the east by a zone of strike-slip faults and normal faults that passes east of the Andaman Islands and Nicobar Islands. The Burma microplate is taken to extend south from a zone of deformation in southern Burma, through the Andaman and Nicobar Islands, to northern Sumatra.

EXPLANATION

Main Shock

24 July 2005

Earthquakes 26 Dec 2004 - 26 July 2005

- 4.0 - 4.9
- 5.0 - 5.9
- 6.0 - 6.9
- 7.0 - 7.9

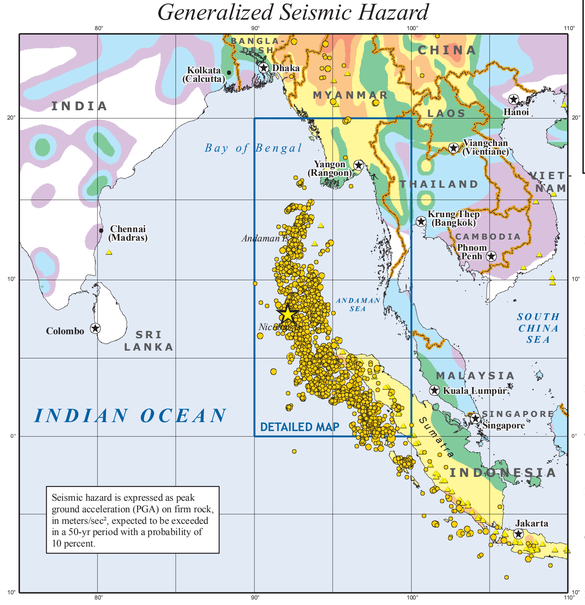
Seismic Hazard

- 0 - 0.2 m/sec²
- 0.2 - 0.4
- 0.4 - 0.8
- 0.8 - 1.6
- 1.6 - 3.2
- 3.2 - 6.4
- 6.4 - 9.7

Plate Boundaries

- Continental Convergent
- Continental Rift
- Continental LL Transform
- Continental RL Transform
- Oceanic Convergent
- Oceanic Rift
- Oceanic RL Transform
- Subduction
- Volcanoes

Generalized Seismic Hazard

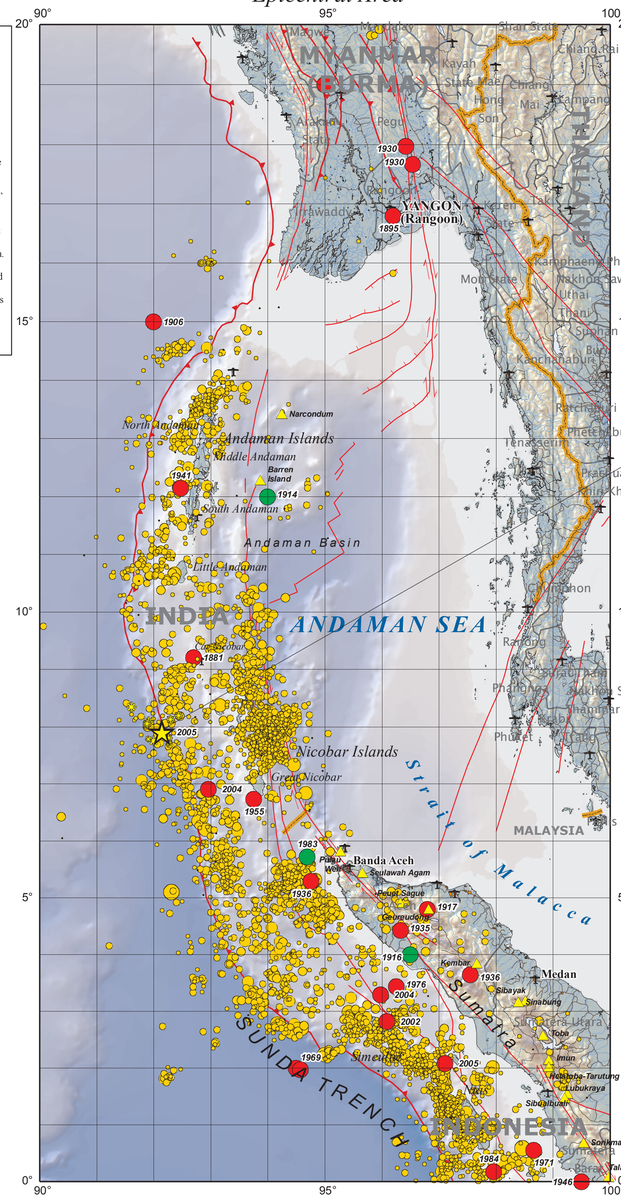


Seismic hazard is expressed as peak ground acceleration (PGA) on firm rock, in meters/sec², expected to be exceeded in a 50-yr period with a probability of 10 percent.

SCALE 1:20,000,000 at the Equator

Kilometers 0 200 400 800 1,200 1,600

Epicentral Area



SCALE 1:5,500,000 at the Equator
Mercator Projection

Kilometers 0 100 200 400 600 800

DISCLAIMER

Base map data, such as place names and political boundaries, are the best available but may not be current or may contain inaccuracies and therefore should not be regarded as having official significance.

DISCUSSION

This earthquake occurred near the western boundary of the aftershock zone of the devastating Sumatra-Andaman Islands earthquake of 26 December 2004. The aftershock zone of the 26 December earthquake continues to be active and forms a crescent-shaped region extending about 1200 km north of Sumatra, Indonesia. The recent event was a strike-slip earthquake, probably in the India plate below its shallow-dipping boundary with the Burma plate. The earthquake resulted from horizontal displacement of the ground across a nearly vertical fault plane. This is unlike the thrust-fault motion that produced the 26 December earthquake and that occurred on the interface of the eastward-subducting India plate and the overriding Burma plate. The recent event therefore occurred on a different fault than the fault that caused the Great Sumatra-Andaman Islands earthquake. However, the two earthquakes are almost certainly related. A great earthquake can trigger earthquake activity on faults that are distinct from the main-shock fault plane, and separated from it by tens or even hundreds of kilometers. A magnitude 7.3 earthquake is considered a major earthquake, but the size of this recent earthquake pales in comparison with the 26 December earthquake. A M7.3 strike-slip earthquake typically ruptures a 15 km by 80 km patch along a fault, whereas the 26 December 2004 earthquake ruptured a fault patch about 1200 km long and 200 km wide.

NICOBAR ISLANDS

24 July 2005 15:42:06.06 UTC
7.909° N., 92.139° E.
Depth 16 km
Mw = 7.3 (HRV)

This earthquake was the largest aftershock of the great Sumatra - Andaman Islands earthquake of 26 December 2004. Some buildings damaged in the Andaman and Nicobar Islands. Felt (V) on Car Nicobar, Katchal and Nancowry. Also felt (V) at Campbell Bay, Great Nicobar and Port Blair, South Andaman Island. Felt (IV) at Chennai; (III) at Srikakulam, Visakhapatnam, Vizianagaram and other coastal areas of Andhra Pradesh and at Dum Dum and Garia, West Bengal, India. Felt at Mamallapuram, India. Felt (IV) in Aceh Province, Indonesia. Felt (III) at Colombo, Matale and Kandy, Sri Lanka. Felt at Peraliya and Sri Jayawardenepura Kotte, Sri Lanka. Also felt at Male, Maldives and on Phuket, Thailand.

EXPLANATION

Main Shock

24 July 2005

Aftershocks

24 - 31 July 2005

Earthquakes 26 Dec 2004 - 26 July 2005

- M < 4.0
- 4.0 - 4.4
- 4.5 - 4.9
- 5.0 - 5.4
- 5.5 - 5.9
- 6.0 - 6.4
- 6.5 - 6.9
- 7.0 - 7.4

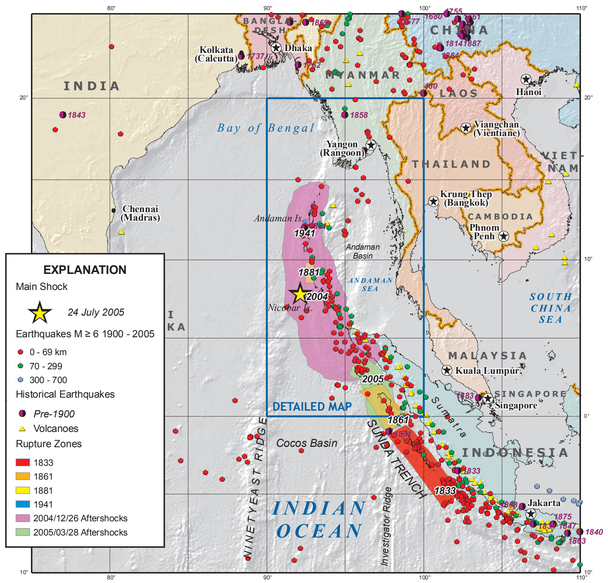
Large Earthquakes M ≥ 7 1900 - 2005

- 0 - 69 km
- 70 - 299
- Volcanoes

Faults (after Pubellier & others, 2003)

- Thrust
- Normal
- Strike-slip
- Other

Seismicity of the Northeast Indian Ocean 1900 - 2005



EXPLANATION

Main Shock

24 July 2005

Earthquakes M ≥ 6 1900 - 2005

- 0 - 69 km
- 70 - 299
- 300 - 700

Historical Earthquakes

- *Pre-1900*
- Volcanoes

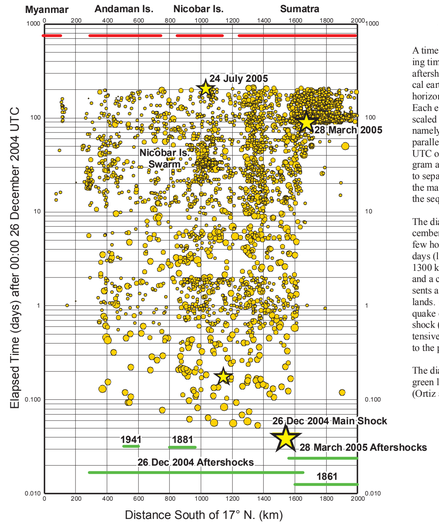
Rupture Zones

- 1833
- 1861
- 1881
- 1941
- 2004/12/26 Aftershocks
- 2005/03/28 Aftershocks

SCALE 1:20,000,000 at the Equator

Kilometers 0 200 400 800 1,200 1,600

Time- Space Seismicity Diagram



TIME- SPACE SEISMICITY DIAGRAM

A time- space diagram is a graphical means of portraying time- dependent phenomena such as earthquake aftershock sequences and earthquake swarms. A typical earthquake time- space diagram is composed of a horizontal distance axis (x) and vertical time axis (y). Each earthquake occurrence (a filled circular symbol scaled by its magnitude) is plotted at its coordinates, namely, the N-S distance (x, in km) from the 17° N. parallel and the elapsed time (y, in days) from 00:00 UTC on 26 December 2004. In the time-space diagram at left, the time scale is logarithmic which serves to separate the numerous aftershocks that followed the main shock in the first few minutes and hours of the sequence.

The diagram shows that the N- S extent of the 26 December 2004 rupture zone was established in the first few hours and only expanded slightly in the next 90 days (long green line). A band of seismicity between 1300 km and 1400 km persisted through that period and a cluster of symbols at about days 30- 50 represents a notable earthquake swarm in the Nicobar Islands. On 28 March 2005, a very large (M8.7) earthquake occurred adjacent to the 26 December aftershock (and presumed rupture) zone, initiating an extensive aftershock sequence of its own that persists to the present day.

The diagram shows the inferred rupture zones (short green lines) of the 1861, 1881, and 1941 earthquakes (Ortiz and Bilham, 2003; Zachariasen and others, 1999).

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IOC, IHO, and BODC, 2003, Centenary Edition of the GEBCO Digital Atlas: CD-ROM(2), British Oceanographic Data Centre, Liverpool, UK.

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Pubellier, M., Ego, F., Chamot-Rooke, N., and Rangin, C., 2003, The building of pericratonic mountain ranges: structural and kinematic constraints applied to GIS-based reconstructions of SE Asia: Bull. Soc. Geol. France, v. 174, p. 561-584.

Zachariasen, J. and others, 1999, Submergence and uplift associated with the giant 1833 Sumatran subduction zone earthquake: Evidence from coral microatolls: J. Geophys. Res., v. 104, p. 895-919.

DATA SOURCES

EARTHQUAKES AND SEISMIC HAZARD
USGS, National Earthquake Information Center
NOAA, National Geophysical Data Center
IASPEI, Centennial Catalog (1900 - 1999) and extensions (Engdahl and Villaseñor, 2002)
HDF (unpublished earthquake catalog) (Engdahl, 2003)
USGS (2003), National Seismic Hazard Maps
Global Seismic Hazard Assessment Program (GSHAP, 1999)

FAULTS AND FOLDS
Pubellier and others (2003)

PLATE TECTONICS
PB2002 (Bird, 2003)

VOLCANOES
Smithsonian Institution, Global Volcano Program

BASE MAP
ESRI (1992), Digital Chart of the World
GLOBE (1999)
IOC, IHO, and BODC (2003)

Map prepared by U.S. Geological Survey
National Earthquake Information Center
3 August 2005 @ 1200 MDT
Map not approved for release by Director USGS