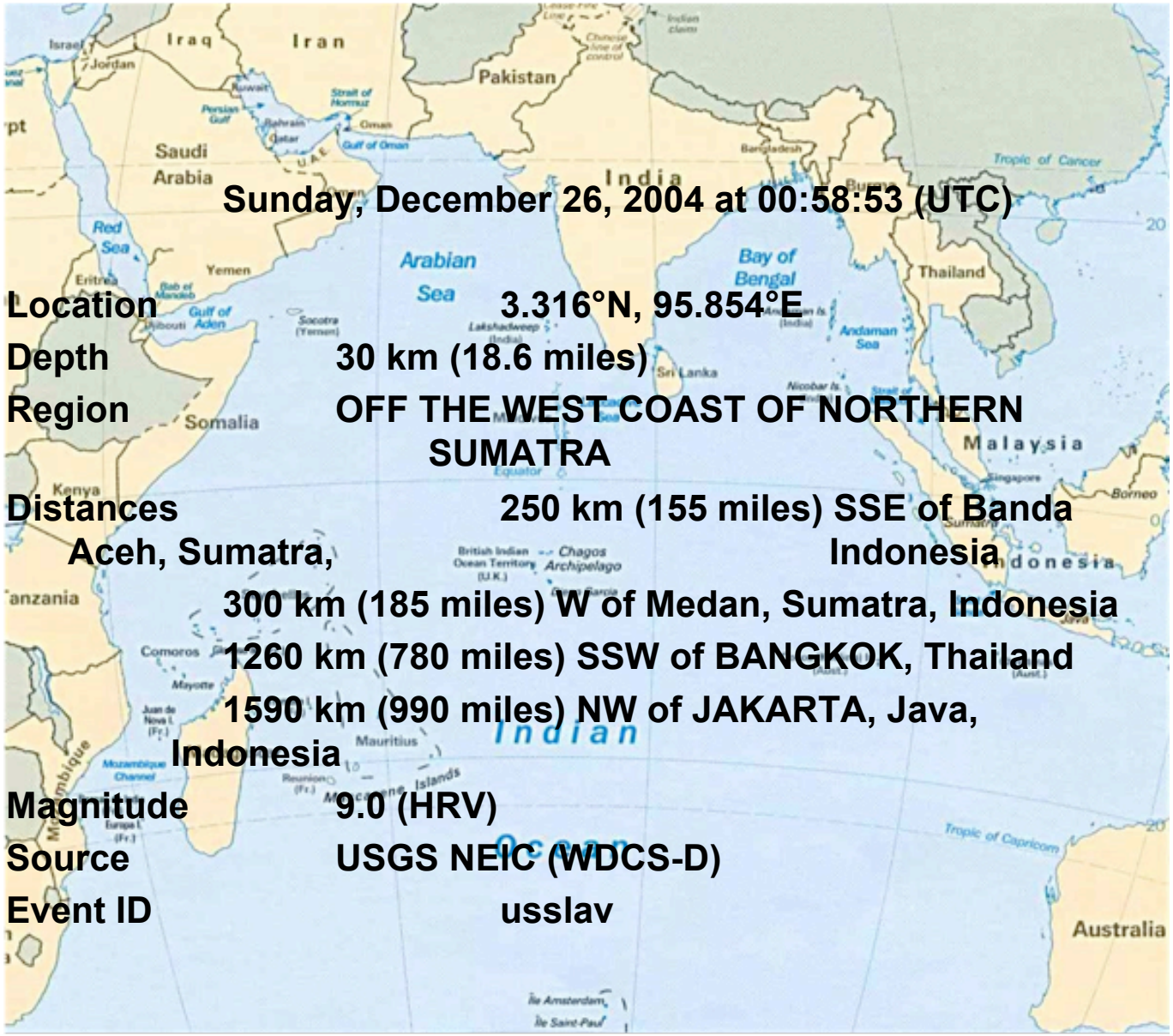
9.0 Sumatra

December 26, 2004

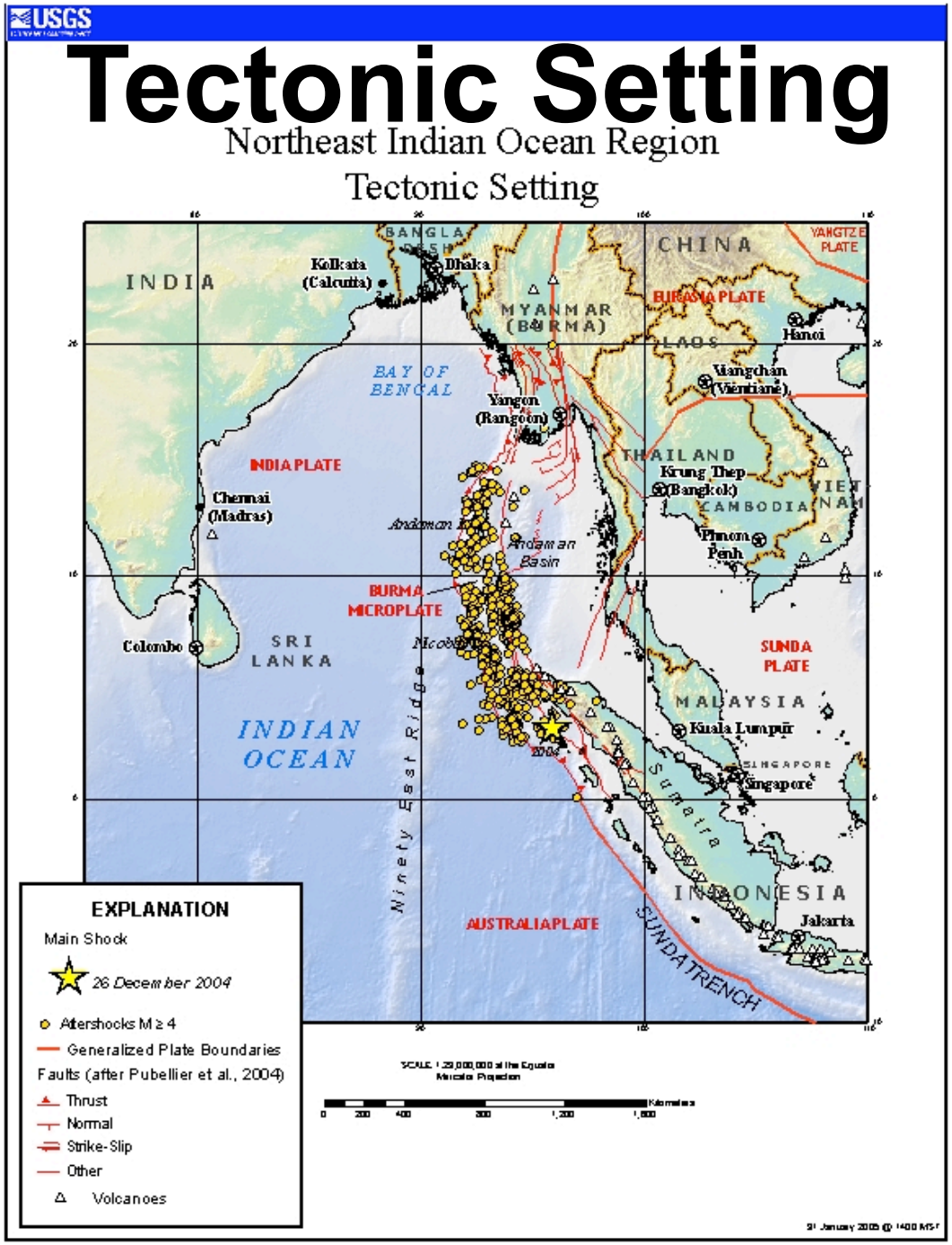
Andaman Islands Earthquake



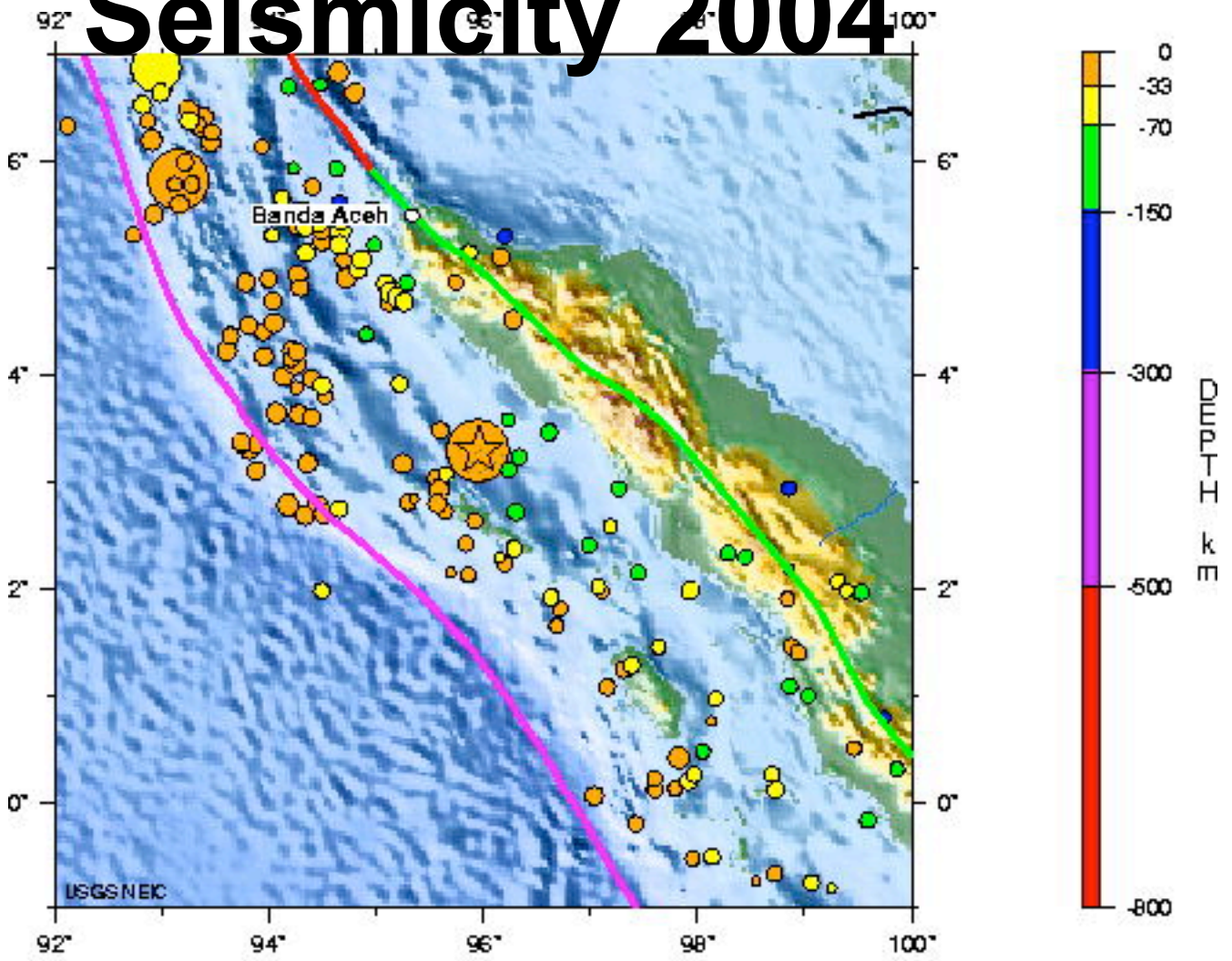
Sunday, December 26, 2004 at 00:58:53 (UTC)

Location	**3.316°N, 95.854°E**
Depth	**30 km (18.6 miles)**
Region	**OFF THE WEST COAST OF NORTHERN SUMATRA**
Distances	**250 km (155 miles) SSE of Banda Aceh, Sumatra, Indonesia**
	300 km (185 miles) W of Medan, Sumatra, Indonesia
	1260 km (780 miles) SSW of BANGKOK, Thailand
	1590 km (990 miles) NW of JAKARTA, Java, Indonesia
Magnitude	**9.0 (HRV)**
Source	**USGS NEIC (WDCS-D)**
Event ID	**usslav**

Tectonic Setting



Seismicity 2004



OFF THE WEST COAST OF NORTHERN SUMATRA

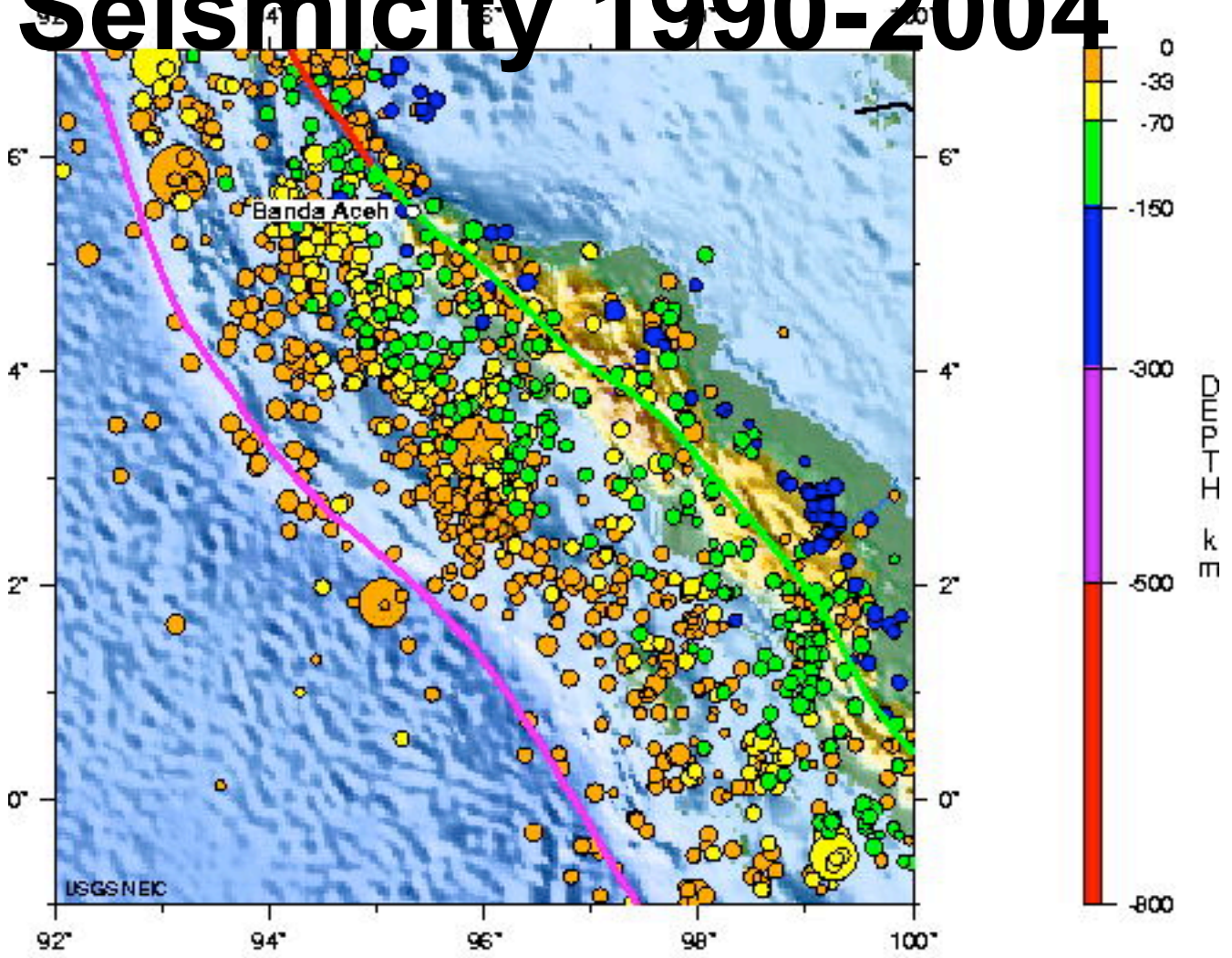
2004 12 26 00:58:53 UTC 3.30N 95.96E Depth: 30 km, Magnitude: 9.0

Seismicity in 2004

Major Tectonic Boundaries: Subduction Zones - purple, Ridges - red and Transform Faults - green

USGS National Earthquake Information Center

Seismicity 1990-2004



OFF THE WEST COAST OF NORTHERN SUMATRA

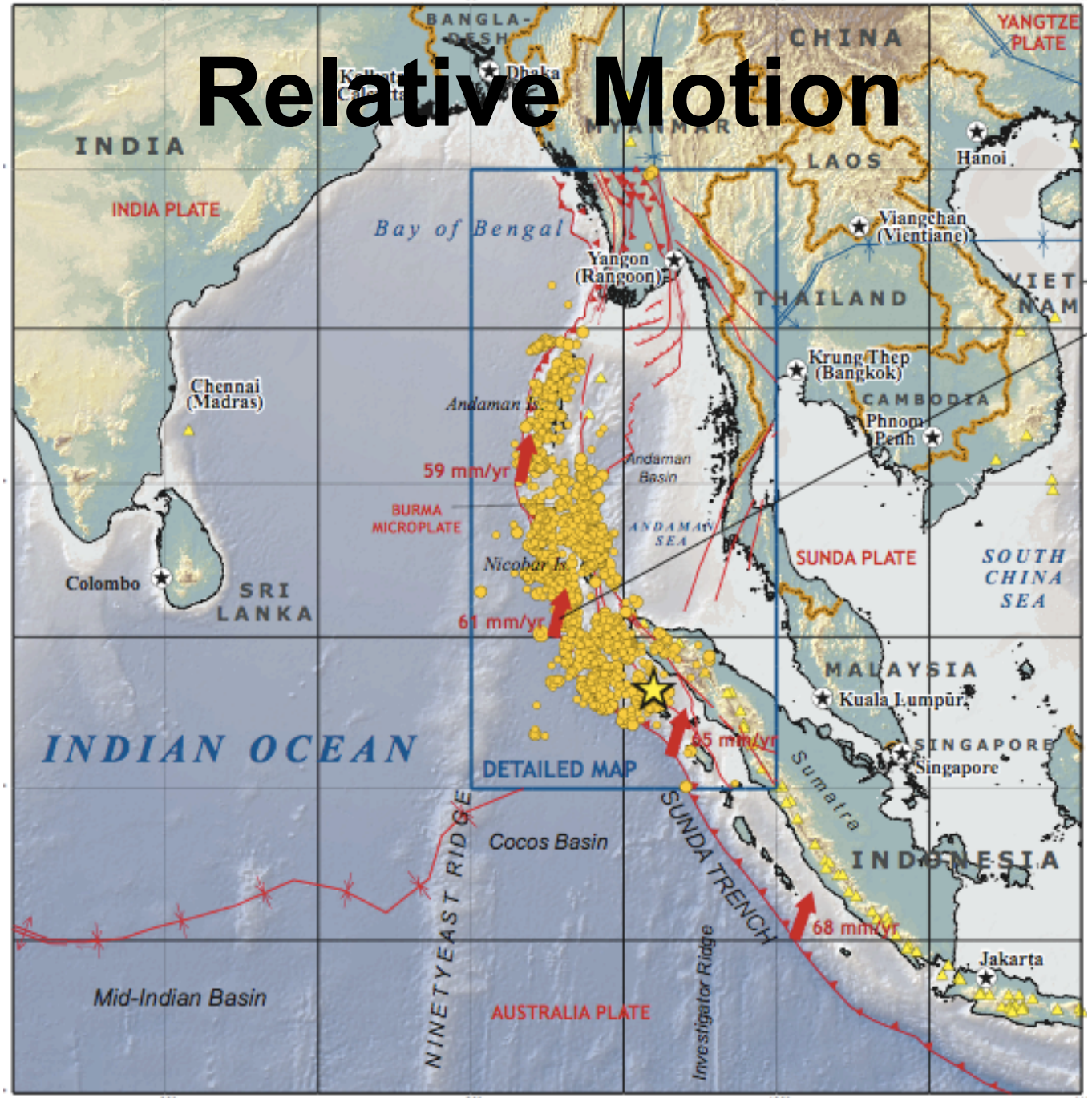
2004 12 26 00:58:53 UTC 3.30N 95.96E Depth: 30 km, Magnitude: 9.0

Seismicity 1990 to Present

Major Tectonic Boundaries: Subduction Zones - purple, Ridges - red and Transform Faults - green

USGS National Earthquake Information Center

Relative Motion



Tsunami


BANGLADESH
INDIA
MYANMAR
(BURMA)
THAILAND
SRI
LANKA
MALAYSIA
SOMALIA
MALDIVES
KENYA
INDONESIA
TANZANIA
SEYCHELLES
Indian
Ocean
MADAGASCAR
SOUTH
AFRICA

Casualties

Indonesia:228,448
India:10,749
Andaman Islands: 7,000
Sri Lanka:30,959
Thailand:5,388
Malaysia:68
Myanmar:90
Bangladesh:2
Somalia:150
Maldives:82
Tanzania:10
Seychelles:3
Kenya:1

TOTALS

Dead:275,648-283,100
Missing:14,459
Displaced:2,242,212

Documentation

http://www.pbs.org/wgbh/nova/tsunami/once-flash.html

http://video.pbs.org/video/1281662767/program/979359664

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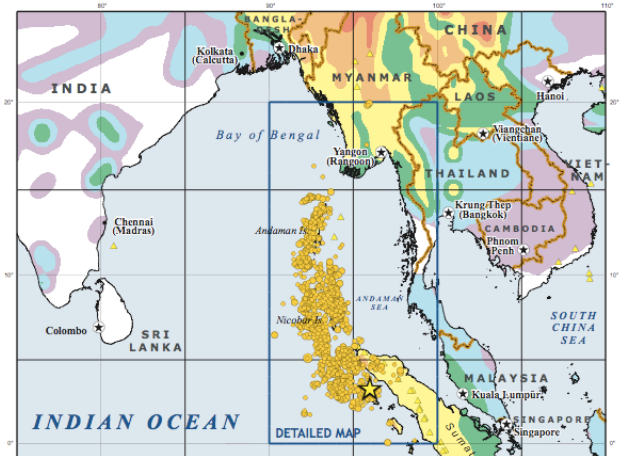
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

M9.0 Sumatra - Andaman Islands Earthquake of 26 December

Tectonic Setting

SCALE 1:20,000,000 at the Equator

Generalized Seismic Hazard



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.

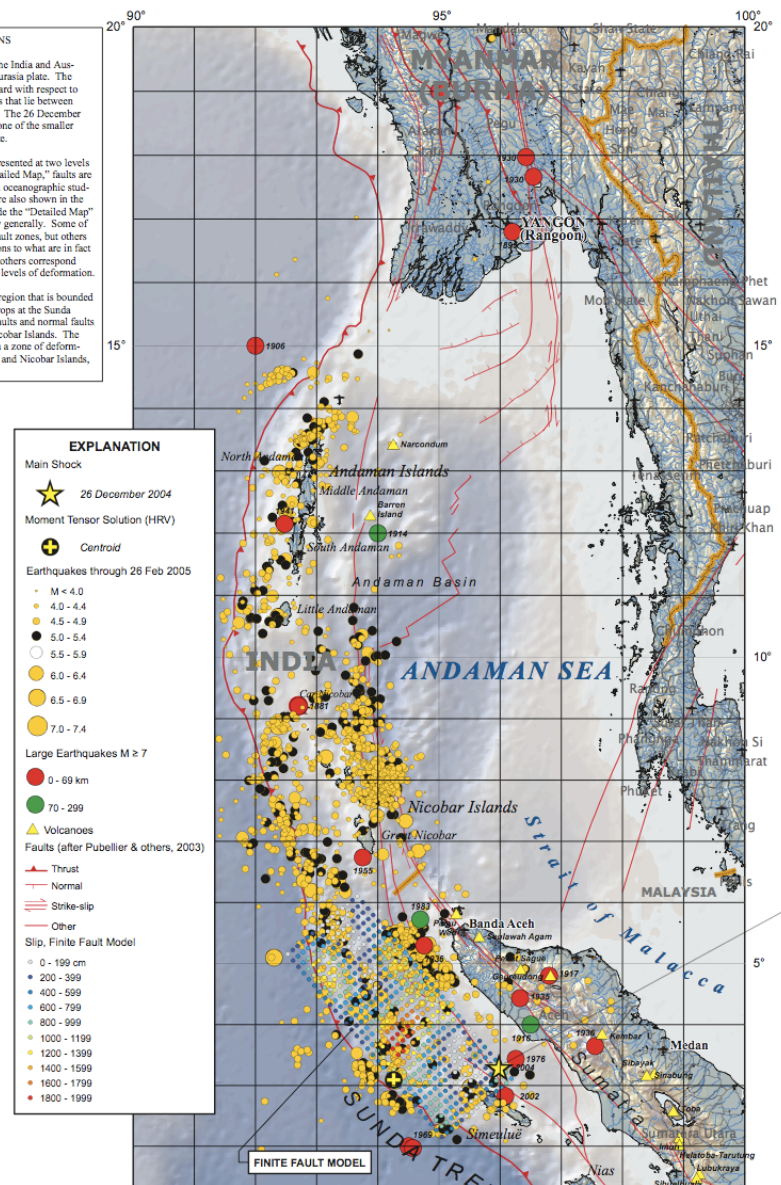
EXPLANATION

Main Shock
- 26 December 2004

Earthquakes through 26 February 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



EXPLANATION

Main Shock
- 26 December 2004

Moment Tensor Solution (HRV)
- Centroid

Earthquakes through 26 Feb 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
- 0 - 69 km
- 70 - 299
- Volcanoes

Faults (after Pubellier & others, 2003)
- Thrust
- Normal
- Strike-slip
- Other

Slip, Finite Fault Model
- 0 - 199 cm
- 200 - 399
- 400 - 599
- 600 - 799
- 800 - 999
- 1000 - 1199
- 1200 - 1399
- 1400 - 1599
- 1600 - 1799
- 1800 - 1999

FINITE FAULT MODEL

DISCUSSION

The devastating earthquake of 26 December 2004 occurred as thru faulting on the interface of the India plate and the Burma microplat In a period of minutes, the faulting released elastic strains that had accumulated for centuries from ongoing subduction of the India pl beneath the overriding Burma microplate.

In a broad sense, the India and Australian plates move toward the north-northeast with respect to the interior of the Eurasia plate wit velocities of about 60 mm/y in the region of the earthquake. This results in oblique convergence at the Sunda trench. The oblique motion is partitioned into thrust-faulting, which occurs on the inte face between the India plate and the Burma microplate and involv slip directed at a large angle to the orientation of the trench, and strike-slip faulting, which occurs on the eastern boundary of the Burma microplate and involves slip directed approximately parall to the trench. Details of the velocity of the Burma microplate remu to be determined and may, in fact, be clarified by further analysis the December main shock and its aftershocks.

Currently available models of the 26 December main-shock fault placement differ in many interesting details, but are consistent in plying that fault-rupture propagated to the northwest from the epi- center and that substantial fault-rupture occurred hundreds of kilo- meters northwest of the epicenter. The data upon which the model ing is based do not permit confident resolution of the extent of rup beyond about 500 km northwest of the main-shock epicenter. The ite fault model shown here implies that the width of the earthquak rupture, measured perpendicular to the Sunda trench, was about 15 kilometers, and that the maximum displacement on the fault plane was about 20 meters. The sea floor overlying the thrust fault woul have been uplifted by several meters as a result of the earthquake.

The zone of aftershocks to the 26 December earthquake is over 13 km long. Because aftershocks occur on and very near the fault- planes of main shocks, the length of the aftershock zone suggests main-shock fault-rupture may have extended north of epicenter by amount significantly larger than 500 km. However, a great earth- quake may also trigger earthquake activity on faults that are distin from the main-shock fault plane and separated from it by tens or e hundreds of kilometers. We will not know until further analysis h much of the 26 December aftershock zone may correspond to acti in the immediate vicinity of the main-shock rupture, and how muc may correspond to activity remote from the main-shock rupture.

Since 1900, earthquakes similarly sized or larger than the 26 Dece ber earthquake have been the magnitude 9.0 1952 Kamchatka eart quake, the magnitude 9.1 1957 Andreanof Islands, Alaska, earthqu the magnitude 9.5 1960 Chile earthquake, and the magnitude 9.2 Prince William Sound, Alaska, earthquake. All of these earthquake like the 26 December earthquake, were mega-thrust events, occurr where one tectonic plate subducts beneath another. All produced structive tsunamis, although deaths and damage from the 26 Dece ber tsunami have far exceeded those caused by tsunamis associate with the earlier earthquakes.

SUMATRA - ANDAMAN ISLANDS

26 December 2004 00:58:53.45 UTC
3.295° N., 95.982° E.
Depth 30 km
Magnitude = 9.0 (HRV)

This is the fourth largest earthquake in the world since 1900 and i the largest since the 1964 Prince William Sound, Alaska earthqua The tsunami caused more casualties than any other in recorded hi In total, more than 275,648 people were killed, 14,459 are still lis as missing and 2,242,212 were displaced in South Asia and East A At least 228,448 people were killed by the earthquake and tsunam Indonesia. Tsunamis killed at least 30,959 people in Sri Lanka, 10 in India, 5,388 in Thailand, 150 in Somalia, 82 in Maldives, 68 in laysia, 90 in Myanmar, 10 in Tanzania, 3 in Seychelles, 2 in Bang and 1 in Kenya. Tsunamis caused damage in Madagascar and Ma and also occurred in Mozambique, South Africa, Australia and An arctica. The tsunami crossed into the Pacific and Atlantic Oceans was recorded in New Zealand and along the west and east coasts South and North America. The earthquake was felt (VIII) at Banda Aceh and (V) at Medan, Sumatra and (II-IV) in parts of Banglade India, Malaysia, Maldives, Myanmar, Singapore, Sri Lanka and Thailand. Subsidence and landslides were observed in Sumatra. A mud volcano near Baratang, Andaman Islands began erupting on December 28.

DATA SOURCES

EARTHQUAKES AND SEISMIC HAZARD
USGS, National Earthquake Information Center
NOAA, National Geophysical Data Center
IASPEI, Centennial Catalog (1900 - 1999) and

References

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- http://earthquake.usgs.gov/earthquakes/eqinthenews/2004/usslav/#summary