Post-Disaster Geologic Brief

Java Tsunami, July 18, 2006

(Image: Derived from the Asia Pacific Natural Hazards and Vulnerabilities Atlas http://atlas.pdc.org)

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Fostering Disaster-Resilient Communities through Information, Science, and Technology

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Cover graphic: Derived from the Pacific Disaster Center's *Asia Pacific Natural Hazards and Vulnerabilities Atlas*. http://atlas.pdc.org

Event Summary

At approximately 3:18 pm local time (08:18 GMT), a M7.7 earthquake occurred at the plate boundary where the Australian Plate is subducted beneath the Sunda Plate. The event resulted in a localized tsunami which struck the coast of West Java approximately twenty minutes later. The beach resort town of Pangandaran was reported to have suffered the greatest loss of life and damage to infrastructure. Tsunami wave height was reported to be 2 to 7 meters with a reported inundation of 500 meters in some areas. No ocean-wide tsunami was generated. As of July 18, Over 300 people have been reported killed, with many more missing or injured. Over 20 aftershocks have followed (See Figure 1).

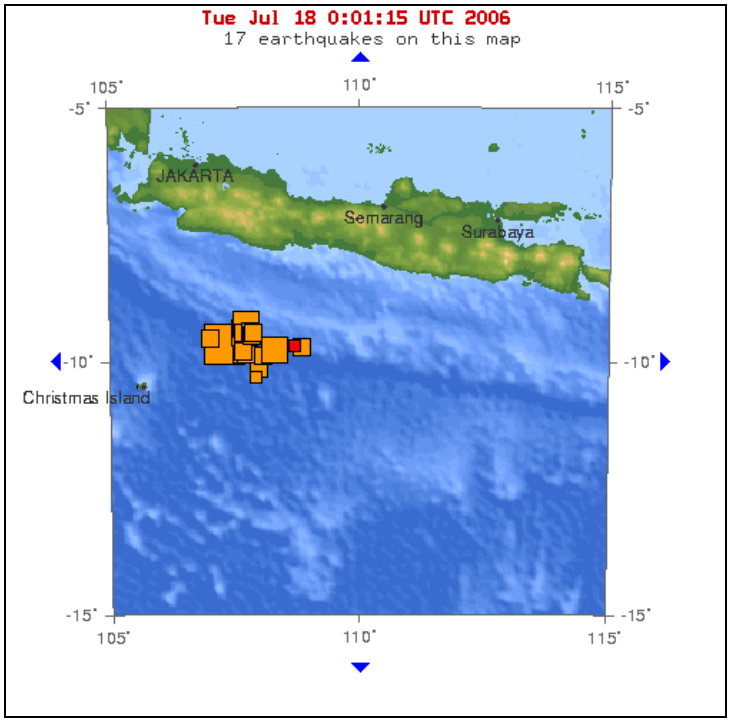

Figure 1: Recent earthquake locations near the epicenter of the M7.7 earthquake. Squares represent relative earthquake magnitude. (Source: USGS NEIC)

Seismic Data and Commentary

Type: thrust-fault – plate boundary – tsunami genic
Time: 3:19pm local time (08:19 GMT)
Magnitude: 7.7M
Location: 9.334S 107.263E – 150 m SW of Java's west coast
Depth: 10.0 km - Sundra Fault
Aftershocks: **22** (as of July 18, 2006):

M5.7	10km	09:05 (GMT)	9.798E 107.961S	2006/07/17
M6.2	10km	19:13 (GMT)	9.111E 107.688S	2006/07/17
M5.4	10km	10:44 (GMT)	9.117E 107.646S	2006/07/17
M5.8	10km	11:07 (GMT)	9.524E 107.622S	2006/07/17
M5.4	10km	12:52 (GMT)	9.081E 107.796S	2006/07/17
M4.9	10km	13:39 (GMT)	9.983E 107.890S	2006/07/17
M5.1	10km	13:54 (GMT)	9.572E 108.044S	2006/07/17
M5.2	10km	14:51 (GMT)	9.203E 106.989S	2006/07/17
M5.5	10km	15:42 (GMT)	9.539E 107.716S	2006/07/17
M6.3	10km	15:45 (GMT)	9.453E 108.267S	2006/07/17
M5.8	10km	16:09 (GMT)	9.392E 108.830S	2006/07/17
M5.4	10km	16:39 (GMT)	9.458E 107.635S	2006/07/17
M5.1	10km	19:09 (GMT)	9.175E 107.819S	2006/07/17
M5.4	10km	19:49 (GMT)	9.113E 107.836S	2006/07/17
M4.8	10km	23:24 (GMT)	9.377E 108.667S	2006/07/17
M5.7	35.5km	00:15 (GMT)	9.281E 108.741S	2006/07/18
M5.2	31.3km	03:02 (GMT)	9.277E 108.867S	2006/07/18
M5.6	10km	04:18 (GMT)	9.394E 108.761S	2006/07/18
M5.0	10km	06:52 (GMT)	9.748E 107.975S	2006/07/18
M5.4	10km	14:55 (GMT)	9.094E 107.683S	2006/07/18
M5.1	10km	17:28 (GMT)	9.310E 107.672S	2006/07/18
M5.1	33.2km	19:11 (GMT)	9.468E 108.608S	2006/07/18

Commentary: The quake occurred at the plate boundary between the Australian plate and the Sunda plate, 50 km north of the Java trench. (3) The earthquake has been classified as a 'tsunami earthquake', which is characterized by slow steady movement at approximately half the speed of a normal earthquake. The earthquake is characteristic of low frequency vibrations, which make it difficult to determine the initial magnitude of shaking, hence the change in recorded magnitude from M7.2 to M7.7. The slow shaking nature of the tsunami earthquakes allow for little damage to infrastructure due to ground shaking, but cause heavier displacement of the ocean, generating tsunamis. (5) A few witnesses report having felt a jolt from the earthquake at locations 50 km from the epicenter. High-rise buildings in Jakarta (170 miles away) swayed slightly. (3) For the most part, the earthquake event was not noticed until the tsunami approached the shoreline.

Tsunami Data and Commentary

Type: Local (only affecting the nearby region)

Generation: Earthquake generated – vertical lift of the sea floor due to slow moving plate shift (8)

Area Affected: Coast line of Central and West Java – the coastal resort town of Pangandaran was worst affected

Coastline Affected: 200 km (~110 miles)

Time: ~ 20 to 30 minutes after quake

Height: 7m wave reported in Pangandaran followed by a second 2m high wave (9)

Number: 3 waves (3)

Inundation: 500 m inland at waist deep (4)

Ocean-wide: 7 in run-up on nearby Bali Island and near Australia's Coco Islands
60 cm at Christmas Island (3)

Commentary: Water receded 1500 ft from a beach a half hour before the first wave hit shore. Fish were reported seen jumping on exposed ocean floor. The approaching tsunami wave had the appearance of a black wall. (2) The tsunami inundated both the east and west beaches the peninsula where Pangandaran is located. The damage was reported to be the worst on the east beaches due to the lack of concrete structures to absorb the impact of the waves. (4)

Population Impacts and Infrastructure Damage*

Killed:	Over 500 people
Missing:	more than 200 people (1)
Displaced:	54,000 people (1)
Buildings:	All of the wood structures within the inundation zone were destroyed. The majority of the concrete structures survived. (2) All of the infrastructure damage was related to the tsunami. No earthquake related damage was reported.
Utilities:	Power and phone lines were severed by the wave in Pangandaran. Roads were blocked by debris hindering emergency response teams from reaching the affected areas. (4)

* As of July 18, 2006

Key Geologic Facts

Subduction Zone: The Indonesian island of Java is located on the active plate boundary where the Australian plate is subducted beneath the Sunda plate at the Java Trench. Subduction rate is ~59 mm/yr. (3) The region part of the Pacific Rim of Fire and is highly active and historically prone to large seismic events.

Active Volcanoes: **11.** Most active to least: Merapi, Krakatau, Papandayan, Dieng, Galunggung, Tangkuban Parahu, Slamet, Gede, Salak, Guntur, Ciremai (9)

Past Event History:

May 26, 2006:
M6.3 earthquake event – Yogyakarta quake
Shallow depth within the overriding Sunda plate
Possibly associated with Merapi volcanic activity
No tsunami
5,700 deaths – earthquake related *(7)*

June 2, 1994
M7.8 earthquake event – 600km ESE of July 17 2006 quake
Thrust-fault subduction zone earthquake
Tsunami – 13 m – 300 deaths

August 20, 1977
M8.3 earthquake event – 1200km ESE of July 17 2006 quake
Tsunami – 15 m – ~200 deaths
Normal fault within the Australian Plate

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