

Earthquake in northern sumatra, indonesia

[Environment](#), [Natural Disaster](#)



On December 26, 2004, mass destruction and devastation was the result of a large earthquake off of the West Coast of Northern Sumatra, Indonesia. The earthquake began in the early morning on Sunday at 7: 58: 53 AM, and wreaked havoc on thousands in the affected areas. BBC News reported on the earthquake, stating that “ Sunday’s tremor - the fourth largest since 1990 - had a particularly widespread effect because it seems to have taken place just below the surface of the ocean, analysts say” (BBC News). The earthquake had significant effect on the region and the people living in these regions.

Not only was the earthquake damaging and devastating, but the quake was also the cause of a correlated tsunami that caused even more damage and destruction to the area. “ This earthquake is the largest event in the world in 40 years, and produced the most devastating tsunami recorded in history” (Lay). “ Coastal communities across South Asia - and more than 4, 000 km away in Africa - were swept away and homes engulfed by waves up to 10 m high after the quake created a tsunami that sped across the ocean” (BBC News). The geographic location of the Earthquake in absolute location is 3. 316?

North, 95. 854? East; and the relative location of the quake was off the West Coast of Northern Sumatra, which was 155 miles South Southeast of Banda Aceh, Sumatra Indonesia, and 185 miles West of Medan, Sumatra, Indonesia (USGS). The earthquake that shook the West of Northern Sumatra, Indonesia, as well as many other neighboring countries, was of a great 9. 0 magnitude on the Richter scale. “ At the source of the earthquake, the interface between the India plate and the Burma plate dips about 10 degrees to the

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east-northeast. The subducting plate dips more steeply at greater depths" (USGS).

The quake occurred when the Earth's crust, a 1,200 km segment of the crust, shifted beneath the Indian Ocean, as far as 10 to 20 meters below (Marshall). As the crust shifted and the quake went into motion, a substantial amount of energy was released. Energy released by this overwhelming earthquake was an "estimated 20×10^{17} Joules, or 475,000 kilotons (475 megatons) of TNT, or the equivalent of 23,000 Nagasaki bombs" (Marshall). All of this stored elastic energy that was released by the earthquake, in turn initiated the "uplift of the seafloor and the displacement of billions of gallons of seawater" (Marshall).

These events lead to a massive tsunami. "Over a period of 10 hours, the tsunami triggered by the quake struck the coasts of over 12 countries" (Marshall). "The region where the great earthquake occurred on 26 December 2004, marks the seismic boundary formed by the movement of the Indo-Australian plate as it collides with the Burma subplate, which is part of the Eurasian plate" (Pararas-Carayannis). "For millions of years the India tectonic plate has drifted and moved in a north/northeast direction, colliding with the Eurasian tectonic plate and forming the Himalayan Mountains.

As a result of such migration and collision with both the Eurasian and the Australian tectonic plates, the Indian plate's eastern boundary is a diffuse zone of seismicity and deformation, characterized by the extensive faulting and numerous large earthquakes" (Pararas-Carayannis). "Previous major earthquakes have occurred further north, in the Andaman Sea and further

South along the Sumatra, Java and Sunda section of one of the earth's greatest fault zones, a subduction zone known as the Sunda Trench.

Slippage and plate subduction make this region highly seismic" (Pararas-Carayannis).

In addition to the Sunda Trench, the Sumatra Fault is responsible for seismic activity on the Island of Sumatra. This is a strike-slip type of fault which extends along the entire length of the island" (Pararas-Carayannis). East of northwest Sumatra, " a divergent plate boundary separates the Burma plate from the Sunda plate" (Pararas-Carayannis). " More specifically, in the region off the west coast of northern Sumatra, the India plate is moving in a northeastward direction at about 5 to 5.5 cm per year relative to the Burma plate" (Pararas-Carayannis).

The region where the earthquake occurred -and particularly the Andaman Sea- is a very active seismic area. Also Sumatra is in the center of one of the world's most seismically active regions. Earthquakes with magnitude greater than 8 struck Sumatra in 1797, 1833, and 1861" (Pararas-Carayannis). It is obvious that Indonesia is an area that is highly susceptible to earthquakes, because of the shifts and movements of the tectonic plates that Indonesia lies on. " Indonesia is surrounded by four major tectonic plates, the Pacific, the Eurasian, the Australian, and the Philippine plates.

All these major tectonic plates and their subplates are presently active.

Major earthquakes and tsunamis can be expected in the semi-enclosed seas and along the Indian Ocean side of Indonesia. Major earthquakes in the semi-enclosed seas can generate destructive local tsunamis in the Sulu, Banda,

and Java Seas. Major earthquakes along the Sunda Trench can generate tsunamis that can be destructive not only in Indonesia but to other countries bordering the Indian Ocean" (Pararas-Carayannis).

The major tectonic feature in the region is the Sunda Arc that extends approximately 5,600 km between the Andaman Islands in the northwest and the Banda Arc in the east. The Sunda Arc consists of three primary segments; the Sumatra segment, the Sunda Strait Segment and the Java Segment. These locations represent the area of greatest seismic exposure..." (Pararas-Carayannis). " In the immediate vicinity off Northern Sumatra, most of the stress and energy that had accumulated were released by the crustal movement that caused the 26 December 2004 earthquake.

The subduction of the India tectonic plate underneath the Burma plate cause upward thrusting of an extensive block and generated the destructive tsunami" (Pararas-Carayannis). As the Burma plate " snapped upward, it was a huge geologic event. The dislocation of the boundary between the Indian and Burma plates took place over a length of 745 miles and within three days had set off 69 aftershocks" (Elliot). " The aftershocks represent nature's way of restoring stability and temporary equilibrium.

It is unlikely that a destructive tsunami will occur again soon in the same region, however caution is advised for coastal residents in Northern Sumatra and in the Nicobar and Andaman Islands. If an aftershock is strong enough and it is strongly felt, evacuation to higher elevation is advised. In fact, strong shaking of the ground is nature's warning that a tsunami may be

imminent” (Pararas-Carayannis). The natural disasters also create natural warning signs that more damage may be upcoming.

The aftershocks suggest that the earthquake rupture had a maximum length of 1200—1300 km parallel to the Sunda trench and a width of over 100 km perpendicular to the earthquake source” (USGS). Many things can be taken into account, analyzed, and hopefully used in the future to reduce the number of casualties and losses as a result of an earthquake of such magnitude. The importance of this earthquake and its effects on the communities devastated by this earthquake are many. “ According to the latest official reports (Ministry of Health) 166, 320 people were killed, 127, 774 are still missing and 655, 000 people were displaced in Northern Sumatra.

A total of 110 bridges were destroyed, 5 seaports and 2 airports sustained considerable damage, and 82% of all roads were severely damaged. The death toll is expected to rise” (Pararas-Carayannis). “ There were many lessons already learned from this tragic event in Southeast Asia. Many more lessons will be learned in the near future as this tragedy unfolds and reveals the many failures to value and protect human life in this neglected region of the world. Indeed a bitter lesson was already learned that great earthquakes and destructive tsunamis do occur in this region” (Pararas-Carayannis).

The communities of people living in this region that is highly susceptible to earthquakes and tsunamis could learn important information about the somewhat safer areas to reside, or safety techniques to carry out and be aware of while in the midst of a natural disaster. “ The magnitude of the

tsunami disaster could have been mitigated with a proper disaster preparedness plan and a functioning early warning system" (Pararas-Carayannis). " However the strong shaking by the earthquake should have been nature's warning for local residents that a tsunami was imminent and they could have run to higher ground to save their lives.

A simple program of public education and awareness of the potential hazard could have saved many lives in the immediate area" (Pararas-Carayannis). It would be imagined after having at least four earthquakes of 9.0 magnitude or greater in the region, that residents, public officials, and even tourists could easily find or allowed, much less given, information needed to promote awareness for the possible catastrophes and preventive methods for any type of damage that can be sustained and anticipated.

For the more distant coastlines of India, Sri-Lanka, and other locations in the Bay of Bengal and the Indian Ocean, there was ample time to issue a warning -if only an early warning system existed for this region of the world and if there was a way of communicating the information to the coastal residents of threatened areas. No such warning system exists at the present time -the lack of disaster awareness or preparedness is appalling. A simple educational program on hazard awareness could have prevented the extensive losses of lives -particularly of children.

One third of those that perished were children" (Pararas-Carayannis). The severity of damages resulting from the earthquake and subsequent tsunami is devastating, and what makes this natural disaster even more tragic is to know that some preventive measures could have been taken. There are

adequate instruments and warning systems that have been developed and are currently being used currently in other locations around the world where devices sufficiently predict and send signal out for the warning of tsunamis.

It is often because of insufficient funds or simple neglect for an organized plan of action to take in cases of emergencies as such. " India and Sri-Lanka are not members of the International Warning System in the Pacific and they have not shown interest in joining any regional early warning systems. An erroneous belief has persisted that tsunamis do not occur frequently enough to warrant participation into a regional tsunami warning system.

Local government authorities in the region did not even have a plan for disseminating warning information to threatened coastlines -even if a warning had been provided. There was not even a basic educational plan for disaster preparedness. It should be obvious that such a program is necessary to prevent similar tragedies in the future" (Pararas-Carayannis). " In Sri-Lanka alone, more than one million people are displaced and aid workers are under pressure to ensure they have clean water and sanitation to prevent an outbreak of disease" (BBC News).

This earthquake is significantly important to the people affected in the surrounding communities, as well as the geologic setting of this disaster. " Five main reasons why this disaster was so deadly: 1) High population density on low-lying coastal areas of the Indian Ocean, 2) Short distance from tsunami source to populated low lying coasts, leaving little time for warning, 3) No tsunami warning system in the Indian Ocean, 4) Poor and

developing countries with vulnerable infrastructure and minimal disaster preparedness, 5) Little public awareness of tsunami hazard" (Marshall).

It is impossible to be able to prevent natural disasters from occurring, but there are some measures that can be taken to help prevent the cause of some injuries and deaths. The measures that can be taken to prevent more harm than already caused may seem insignificant in the grand scheme of the disaster, yet the smallest preventive measures and knowledge to be aware of certain signals to promote safety awareness, such as knowing when to move to higher ground after initial shaking or some basic understanding of simple, but possibly life-saving medical treatments.

It is apparent that Indonesia and surrounding countries are vulnerable to earthquakes with possible tsunamis that may cause mass destruction.

Residents in Indonesia and surrounding countries should be informed and aware of the potential disaster zones they live in, in efforts to take some sort of preventive procedures such as building more secure homes on more stable location, to keep medical aid kits stocked and easily accessible, and emergency plans of action if disaster strikes and a family is separated for example.

The damage resulting from the 2004 Sumatra, Indonesia Earthquake was remarkably widespread, causing extensive devastation to the land, buildings, and communities including hundreds of thousands of deaths and injuries across thousands of kilometers. It is also obvious that Indonesia and majority of the adjacent countries need to significantly work to create a disaster plan, educational programs to make people knowledgeable about nature's

hazards, and to adapt a system to detect and transmit information and messages for early warning signs.

The great amount of destruction and loss of human life due to these kinds of natural hazards cannot be prevented, but the amount of devastation suffered would be substantially less if these precautions were taken advantage of and actually put into effect.