

# Tsunami!

You've seen in the movies and the news the destruction they leave in their wake, but what physical processes are actually responsible for creating these mammoth waves?

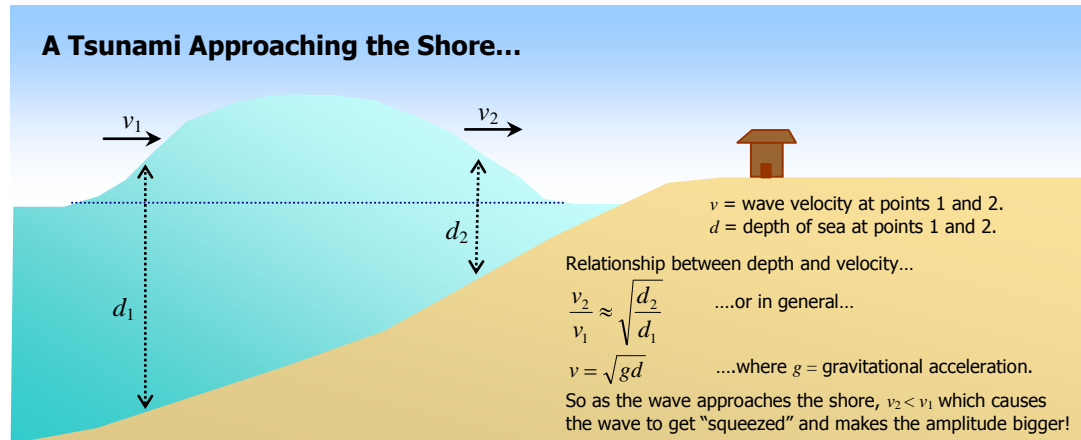
Picture : <http://libziblog.files.wordpress.com/2007/12/tsunami.jpg>

## What is a tsunami?

- A **tsunami** is a series of very large waves that can travel over large bodies of water such as oceans and seas. They occur when this water is quickly displaced by geophysical events such as **underwater earthquakes, landslides or volcanic eruptions**, and also by other less common occurrences such as asteroid impacts.
- Over large oceans, tsunamis can travel in excess of 450mph and have a **wavelength** of about 120 miles, but **amplitudes** of less than 1m. As they approach the coast and the depth of water decreases, their velocity falls to around 50mph and their wavelength shortens to only a few miles, but their amplitude dramatically increases, resembling a tremendous wall of water.
- Tsunamis are often referred to as "**tidal waves**" as they appear to be a rapidly increasing high tide, but this a common misconception – the tides do not affect tsunamis. Another misconception is that tsunamis are large waves caused by extreme weather conditions. Strictly speaking, these waves are known as "**storm surges**", not tsunamis.

### DID YOU KNOW?

When a tsunami strikes the coast, the waves may arrive up to an hour apart, and the first wave is almost never the largest.



- On 26<sup>th</sup> December 2004 an underwater earthquake in the Indian Ocean (reportedly the biggest ever recorded and reaching 9.15 on the **Richter scale**) created a tsunami that killed an estimated 300 000 people. While the worst-affected countries included Thailand and India (reporting waves an estimated 30m high), the tsunami even reached as far as Africa, some 3000 miles away.  
Shown left is an image of the "**Boxing Day Tsunami**" striking Ao Nang in Thailand.

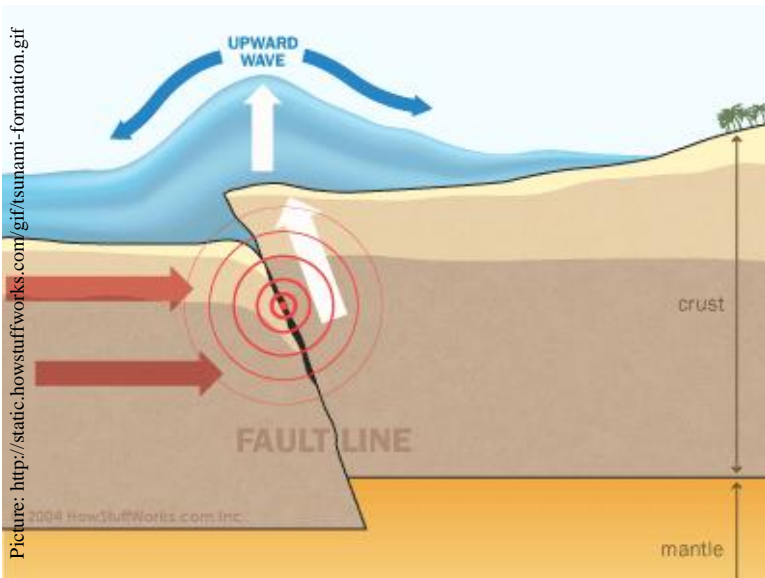
Picture: <http://upload.wikimedia.org/wikipedia/commons/2/2d/2004-tsunami.jpg>

# How are tsunamis created?

## DID YOU KNOW?

Due to their small amplitude and huge wavelength far out in deep oceans, tsunamis often pass by ships unnoticed.

As mentioned overleaf, the main causes for tsunamis are geophysical events - the most common of which are underwater earthquakes. Earthquakes occur when **tectonic plates** move relative to one another. These are large plates that make up continental crust (mainly dry land) and oceanic crust (ocean bed) that 'float' on top of the hot mantle beneath the Earth's surface. They move at a rate of only a couple of inches a year and come together at **plate boundaries**.



At a **destructive boundary** the plates are moving *towards* one another, causing the denser plate to be **subducted** (pushed beneath) the less dense plate and be destroyed by the mantle. This causes an earthquake. The denser of the two plates is usually oceanic, and the extraordinary pressures involved in this cause the continental crust to be forced upwards. If this occurs underwater, it will result in the transfer of vast amounts of energy to the water above the continental crust, thus displacing it and creating a tsunami.

## DID YOU KNOW?

The term "**tsunami**" (soo-NAH-me) is of Japanese origin, derived from the words "**tsu**" (harbour) and "**nami**" (wave).

Besides geophysical events, there are much less common triggers for tsunamis. One possible cause would be a nuclear explosion, though this has never happened, (and is unlikely to do so soon as testing has been banned).

Although unlikely, if an asteroid collided with Earth, landing in the ocean, it would most definitely create a tsunami. In fact, scientists have found evidence that 3.5 billion years ago an asteroid impacted us and caused a giant tsunami to form (see website below). This then travelled round Earth several times, engulfing everything apart from the mountains. They believe that this wiped out most of the living beings on the planet and changed coastlines of the continents dramatically.

## DID YOU KNOW?

Before the first wave of a tsunami, the shoreline drastically recedes, revealing areas of the seabed that are not even seen during low tide and leaving behind many fish. This tempted victims of the 2004 tsunami to stay at the shore and collect them, resulting in their deaths.

## Glossary of Terms

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**Wavelength** – The distance between two consecutive wave peaks or troughs.  
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**Amplitude** – The height of a wave above sea level or its equilibrium point.  
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**Richter scale** – A logarithmic scale used for measuring the seismic energy released by earthquakes. A measurement of >8 would indicate serious damage being caused.  
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**Fault line** – The areas of the Earth where plate movement is most dramatic resulting in high seismic activity, i.e. plate boundaries.  
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## Further Reading

If you're interested in finding out more about tsunamis and their formation, then check out these web pages!

- <http://en.wikipedia.org/wiki/Tsunami> - Provides a basic knowledge of tsunamis, with several useful links.
- <http://science.howstuffworks.com/tsunami.htm> - Full of useful videos and diagrams and explanations about tsunamis.
- [http://news.nationalgeographic.com/news/2002/08/0823\\_020823\\_asteroid.html](http://news.nationalgeographic.com/news/2002/08/0823_020823_asteroid.html) - A news article about an asteroid that hit us 3.5 billion years ago, creating a giant tsunami that destroyed most life on Earth.