

## **Tectonic Earthquakes**

Earthquakes caused by plate tectonics are called tectonic quakes. They account for most earthquakes worldwide and usually occur at the boundaries of tectonic plates or right within the plate.

## **Induced Earthquakes**

Induced quakes are caused by human activity, like tunnel construction, filling reservoirs and implementing geothermal.

## **Volcanic Earthquakes**

Volcanic quakes are associated with active volcanism. They are generally not as powerful as tectonic quakes and often occur relatively near the surface. Consequently, they are usually only felt in the vicinity of the hypocentre.

## **Collapse Earthquakes**

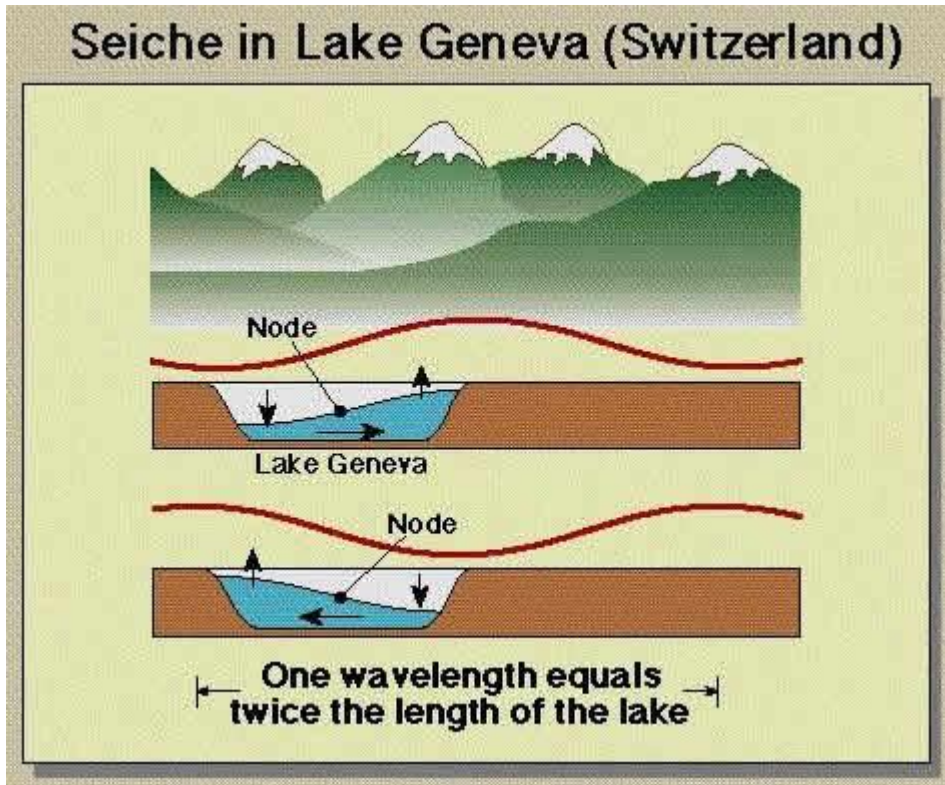
Collapse quakes can be triggered by such phenomena as cave-ins, mostly in karst areas or close to mining facilities, as a result of subsidence.

## Tsunami

Very long-water waves in oceans or seas called tsunamis, or sea waves, sometimes of great height, sweep inshore following certain earthquakes.

## Seiche

Seiche is a standing wave with longer period of water-level oscillations (i.e. rhythmic motions) of the water in lakes, reservoirs, swimming pools, bays, harbours and seas, and are sometimes excited by earthquakes and by tsunami. These oscillations may last for hours or even for one or two days.



## Ocean Microseisms

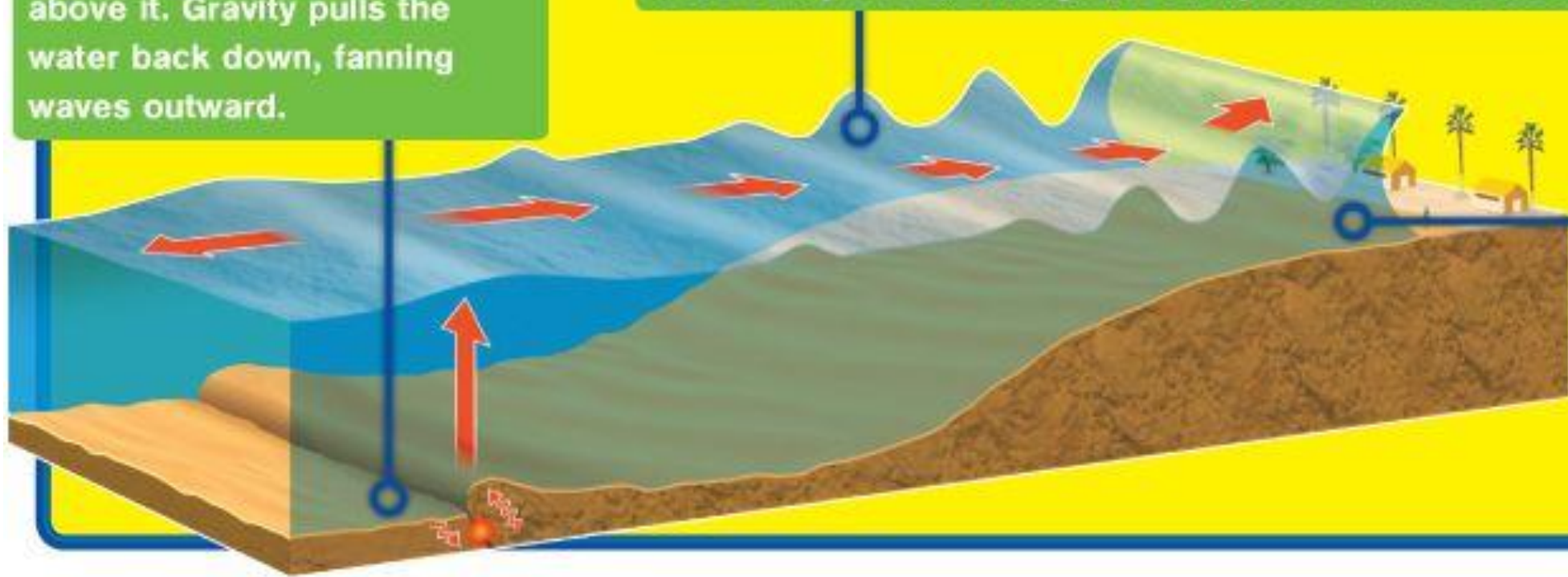
A disturbance, similar to cultural noise, is generated by action of wind in the ocean. Various interactions between atmosphere, ocean and solid Earth give rise to microseismic noise sometimes also called ocean microseisms. Dominant frequencies of microseisms occupy a broad low-frequency range from less than 0.01 Hz to 0.5 Hz.

# HOW A TSUNAMI FORMS

**1** An underwater earthquake occurs; the seafloor snaps up, lifting a column of water above it. Gravity pulls the water back down, fanning waves outward.

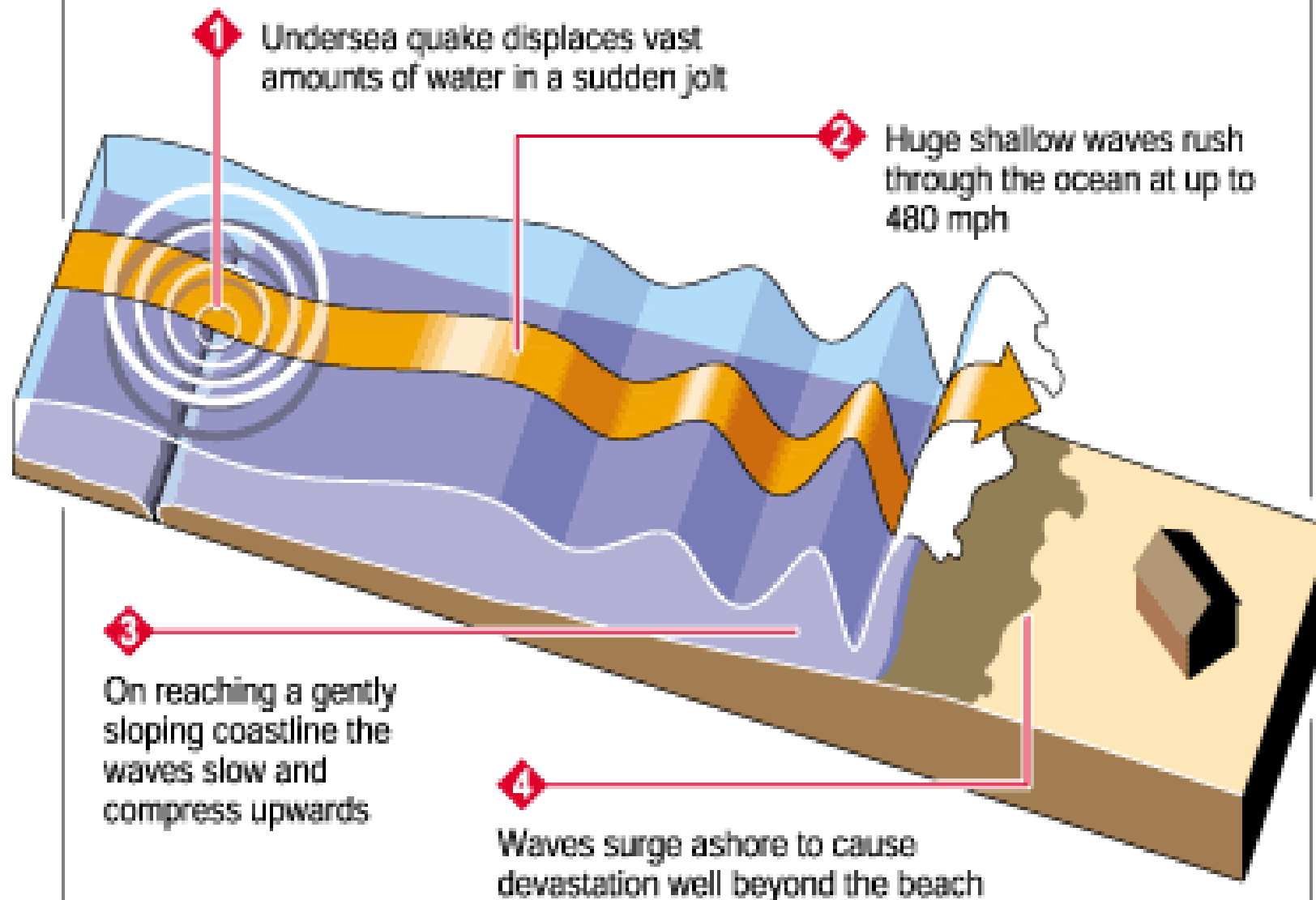
**2** Individual waves in a tsunami are spread out: The distance between two wave peaks, called the *wavelength*, can be hundreds of kilometers long. Each wave's *amplitude*, or height, is rarely more than 0.9 meters (3 feet) at first.

**3** As waves meet the continental slope and shallower water, wavelength decreases and wave amplitude rises.



# HOW TSUNAMI FORM

The world's biggest quake in 40 years unleashed walls of water that devastated coastlines around the Indian Ocean.

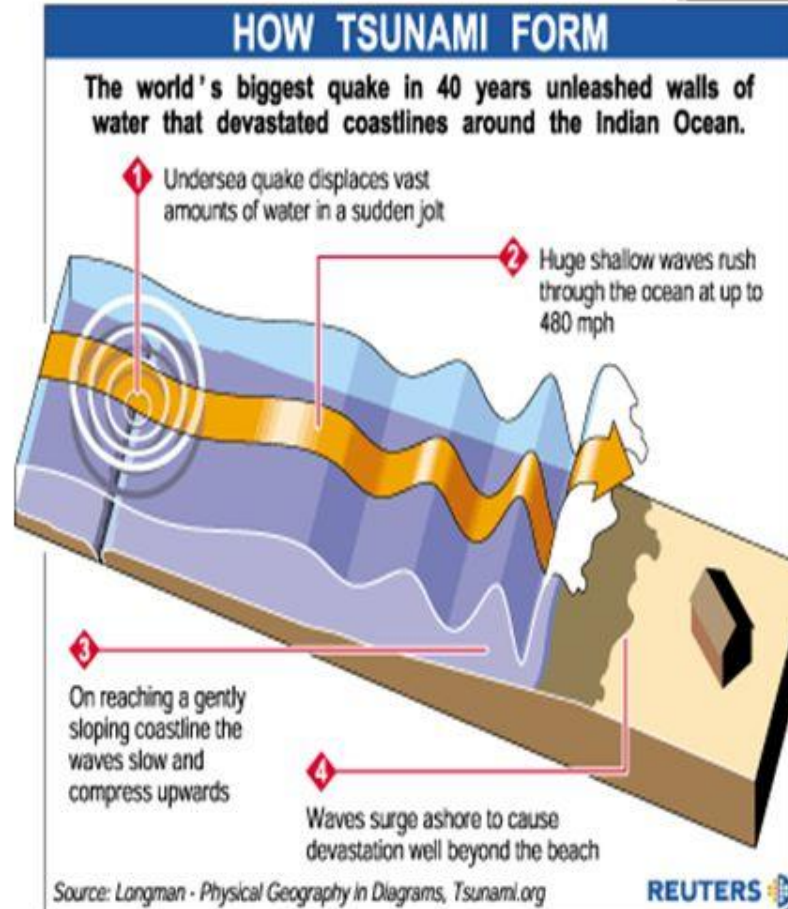


Source: Longman - Physical Geography in Diagrams, Tsunami.org



# Causes of Earthquake Damage

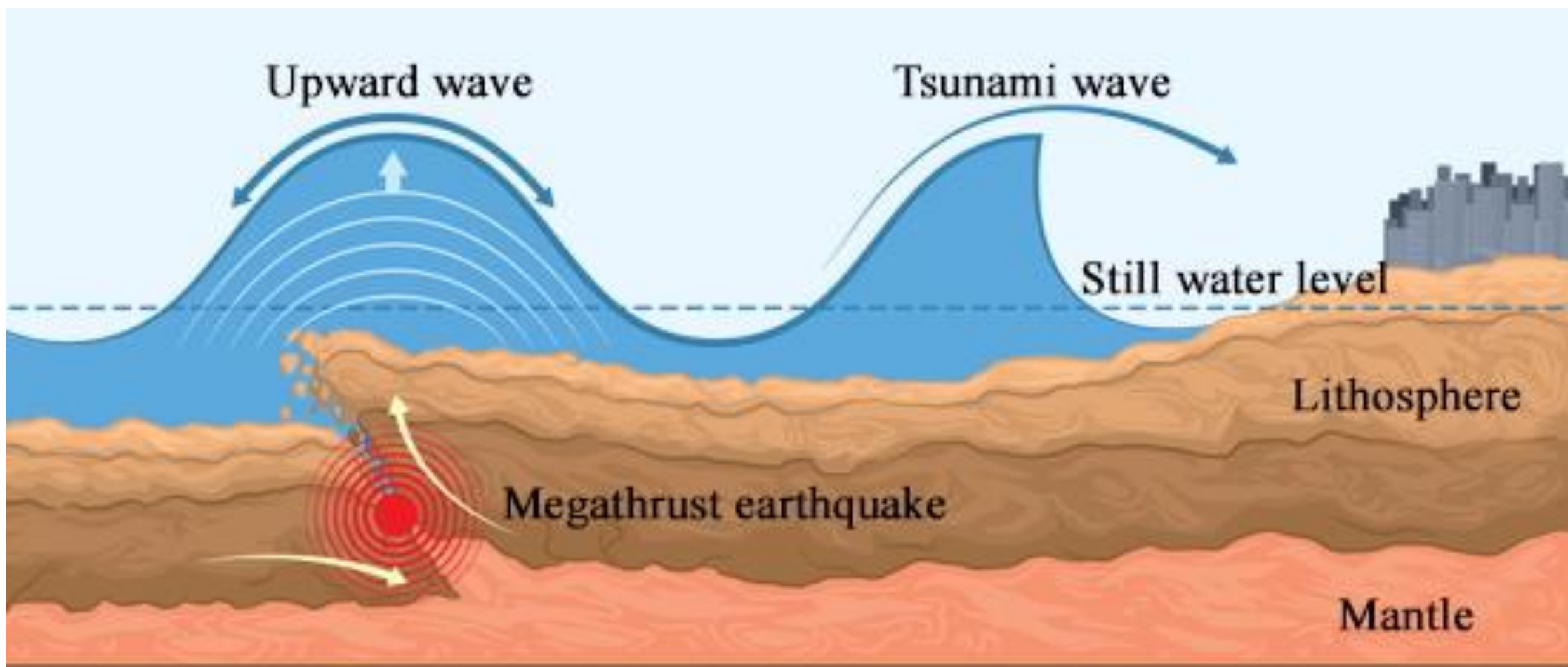
- A tsunami wave in open ocean is only a meter high but moves very fast; at hundreds of miles per hour.
- As the wave enters shallower water near a shore, the water slows down and the waves begin to pile up.
- When the waves do hit shore, they are much bigger due to the compression and hit with devastating force sweeping inland for miles.



A tsunami propagates throughout an ocean basin as a wave with period  $T$  of around 15–30 min. The entire water column participates in the motion. As a result, the velocity of the wave,  $v$ , is dependent on the water depth,  $d$ , and the acceleration due to gravity,  $g$ , and is given by:

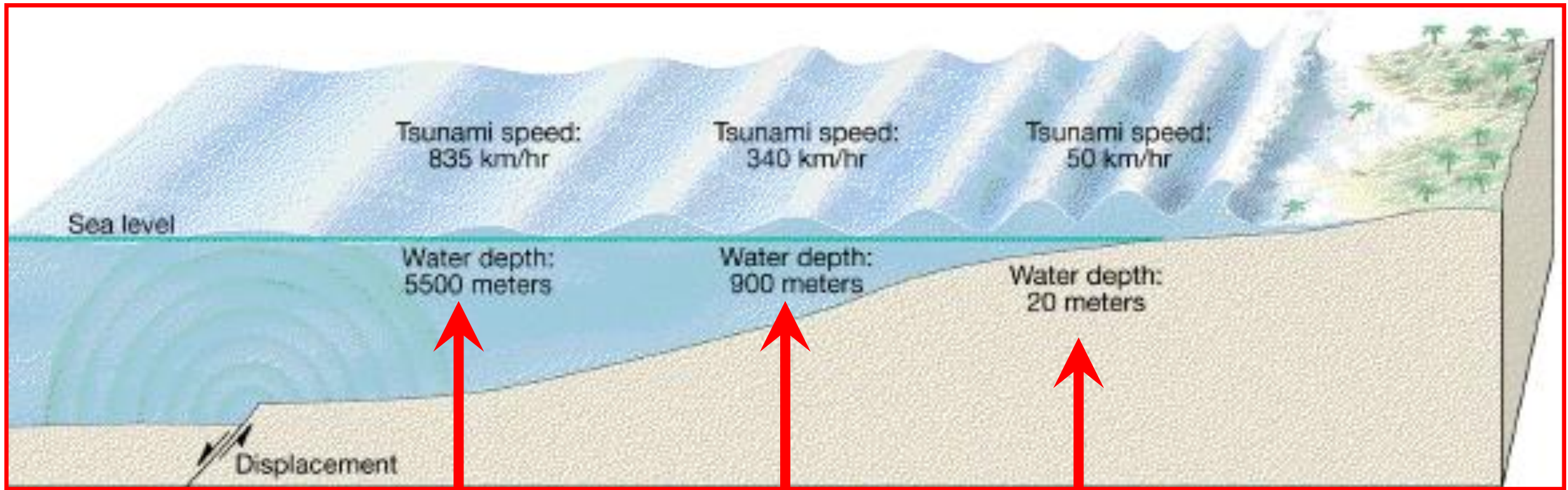
$$v = \sqrt{gd}$$

Over an ocean basin with water depth greater than 4-km, the tsunami velocity is higher than 200 m/s (720km/hour, 450 m.p.h), and the wavelength (equal to the product  $vT$ ) may measure 200 km.



Formation of the Indian Ocean Tsunami



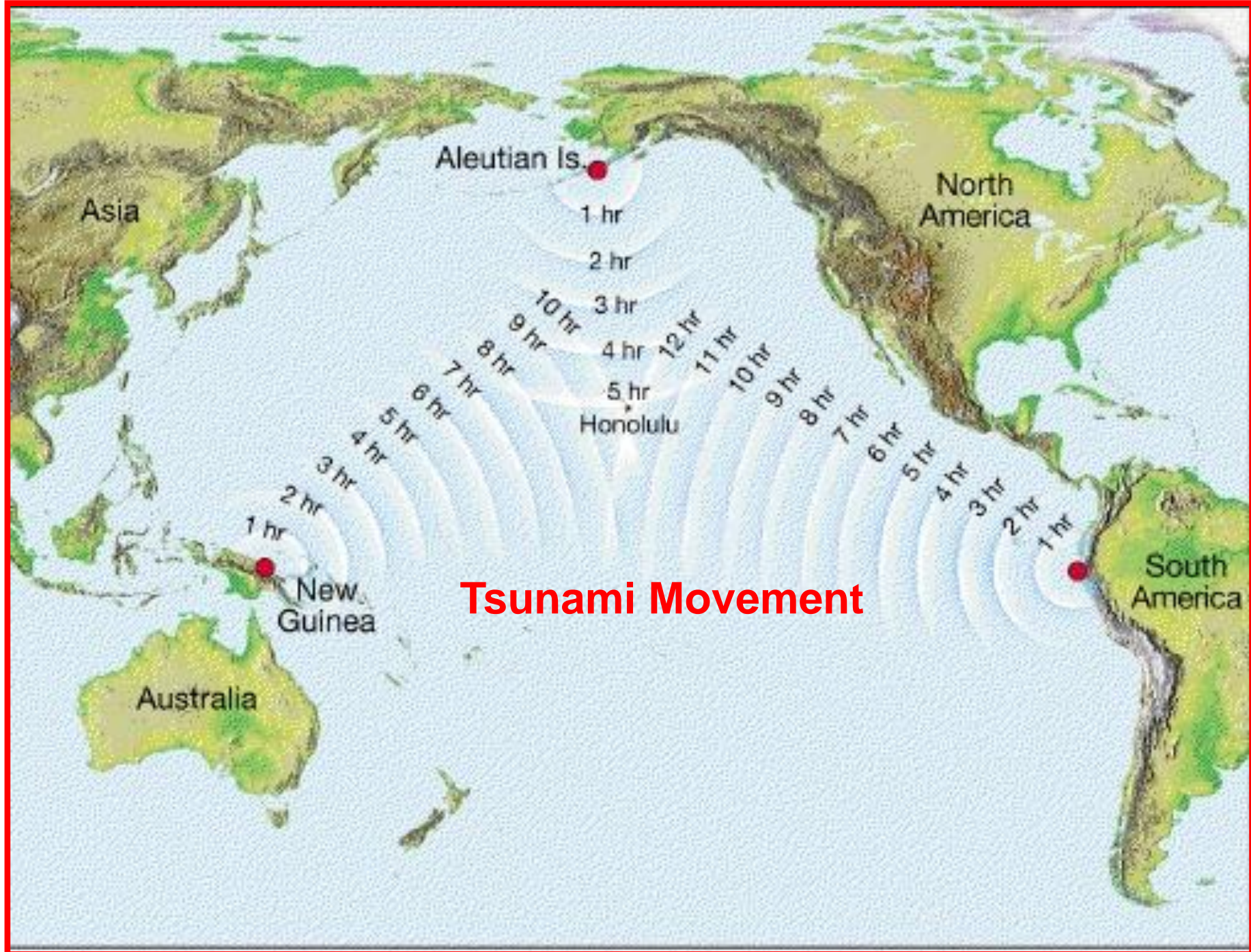


**Tsunami Movement: ~600 mph in deep water**

**~250 mph in medium depth water**

**~35 mph in shallow water**





## Tsunami Movement