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Tsunami lore in sand deposits

Its time to take stock of the dreaded Tsunami, says S.Ananthanarayanqn

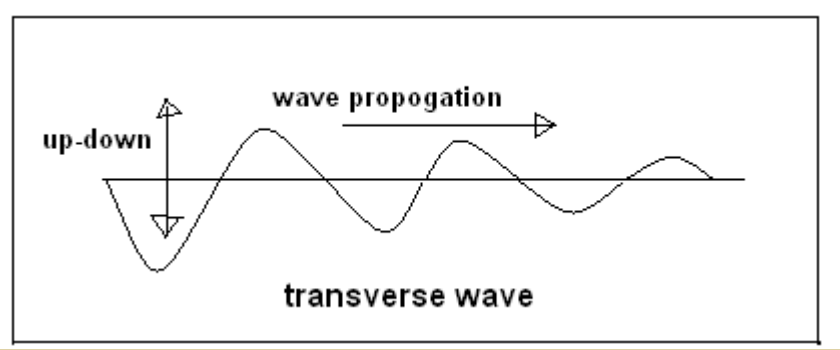
Calamities that strike and pass, not to be repeated in the same lifetime, are often not recorded and generally not studied. The ***Tsunami***, the killer wall of water that rams into coasts and causes devastation, is one such. The word Tsunami is from Japan, where there are records of about 195 Tsunami having struck, but there has been no scientific record or data or even folklore about the Tsunami.

Waves

The Tsunami is best described as a longitudinal shock wave in a mass of water. This is kind of wave is unlike ocean waves, which are caused by the up-down movement of water. When water is pressed down at a place, like when a stone is thrown into a pond, the water pressed down pushes up the water just surrounding the stone. The lifted ring of water then falls back, pushing up another ring of water just around it and so on. The energy of the stone falling in is thus transferred and spread out along the surface.

Ocean waves are similar up-down movement of larger masses of water, set off by winds or currents. When such waves come to shallow water, the up-down movement tips forward and causes the wave to 'break', causing the 'surf' at the beach.

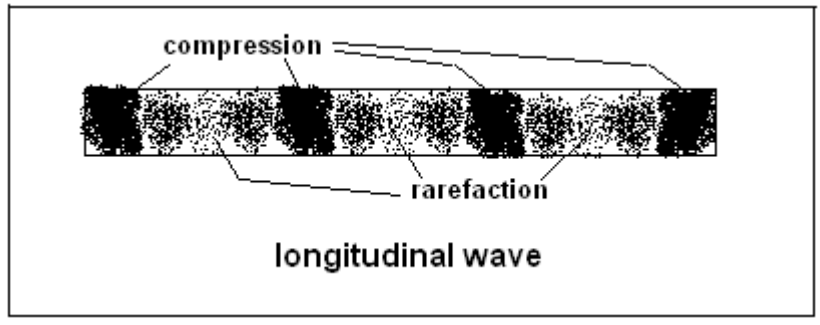
In sound, the medium does not move up-down, but gets compressed and relaxed – the first compression of air expands, to compresses the air in front, which does the same to the air ahead, and so on. This kind of wave, where the movement is in the same direction as the wave, is called a longitudinal wave. The ocean type of wave, where the water moves up-down while the wave goes forward, is called a transverse wave.



The speed of transverse waves depends on the properties of density, viscosity and surface tension of the medium, and in the sea, is a few kilometers an hour. But longitudinal waves depend on the elastic properties of the material – how fast it rebounds when compressed. And as water is practically incompressible, longitudinal waves in water travel at several hundreds of kilometers an hour!

The Tsunami

Tsunami are longitudinal waves caused by violent events like underwater earthquakes. Minor events would rapidly dissipate and disappear. But when a kilometers-long ridge at the bottom of the ocean rises or falls many metres in a second, millions of tonnes of water are rapidly displaced. Tremendous pressures are created and the disturbance rushes forward at the speed of longitudinal waves. As the movement takes a few seconds, and the waves moves so fast, the displacement in the transverse direction is not much and in deep water, a Tsunami can go past almost unnoticed.



But when the wave comes to shallow water, the wave slows down and must swell to contain the same energy. This is the rising ‘wall’ of Tsunami, that crashes into the coastline, still at the speed of a battering ram.

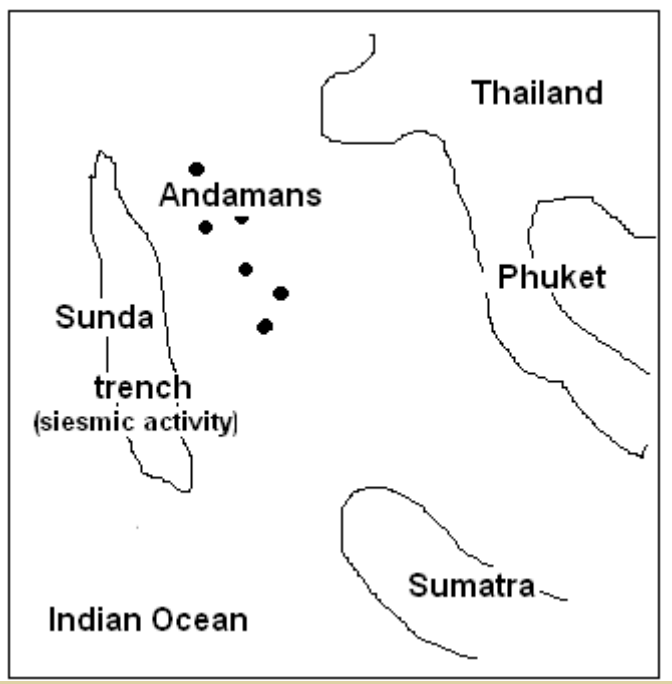
History

The earliest mention of the Tsunami is by the Greek historian Thusydides (460 to 395 BC). Thucydides even speculated on the source of the wave and correctly surmised that it must arise from an underwater earthquake. There are then records of isolated instances in different parts of the world, but evidently there was no communication of data or description or comparison of one Tsunami with another. Tsunami also do not leave behind durable traces, that they could be studied even without historical records. But the isolated records, such as they are, are mainly in the Pacific and their occurrence can be traced as having arisen from known geological features which are prone to tension by the movement of tectonic plates and sudden release of pressure, leading to quakes.

But yet another record is incidentally preserved by the great mass of sand that a Tsunami transports on to the coastline when it strikes. The Tsunami typically rushes one or two kilometers inland and when it recedes, it leaves behind a layer of sand, several centimeters thick, where nearest to the sea. The land is then gradually built up with the accumulation of earth, as the shore extends into the sea, in the form of a series of ridges, over centuries. Studying the structure of the ridges and the slopes between them, in places where there could have been Tsunami, may then reveal layers of sand deposit and provide a record of when Tsunami occurred.

Current studies

Nature, this week, reports two studies of coastal sediments near Phuket, in Thailand and Sumatra, both sites which the 2004 Tsumani had battered with 20 and 35 metre waves. Brian Atwater and colleagues and a team led by Katrin Monecke took hundreds of 'bore hole' samples, to the depth of about tow metres, parallel to the coast and moving inland and looked for light coloured Tsunami sand between layers of dark, organic soil. As the sand contained traces of plant remains, carbon dating could help fix the time of deposit of the sand.



Both teams discovered a layer of sand some 1.3 metres beneath the most recent deposit, of 2004 and carbon dating put the time of the deposit at 550 to 700 years ago, the time when there was a Tsunami like the one of 2004 in the Indian Ocean. There was also evidence of earlier deposits, some 1290 – 1400 and 780 to 990 years ago and also traces of a smaller Tsunami of 1907.

The main finding, in any case, is that Tsunami strike once in many centuries and thus leave no memories among living persons, to create concern of how to prepare for the next one. It is only in modern times that the Tsunami is recognized as a hazard and measures are being taken to provide warning systems and facilities for escape.