

Turkey - Sea of Marmara - 17 August 1999

A large earthquake with a magnitude of 7.6 along the Northern Anatolian fault, known as the Kocaeli Earthquake, generated a local tsunami within the Sea of Marmara.

The tsunami was primarily generated by slumping and subsidence of coastal areas, triggered by earthquake motions. An initial recession of the water was observed at both sides of Izmit Bay immediately after the quake, followed subsequently by tsunami waves which had an average runup of 2.5 m. Maximum runup was 4 m in Golcuk which caused damage to the naval base facilities. In fact Golcuk and several coastal areas are now flooded permanently as a result of tectonic subsidence and landslides.

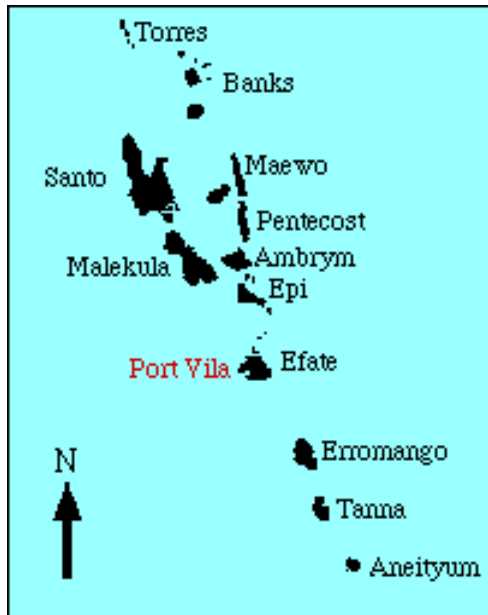
Also large coastal portions of the town of Degirmendere remained flooded as a result of subsidence with sea level reaching the second floors of apartment buildings. Similar permanent flooding, but to a lesser extent, occurred also at Karamursel. The tsunami waves from this earthquake had an extremely short period of less than a minute which indicates that the source for this tsunami was the localized subsidence of coastal areas and underwater slumping, rather than larger scale tectonic movements.

The lesson learned from this event is that tsunamis can occur in any large body of water since a variety of mechanisms can generate them. Obviously the tsunami risk for the Sea of Marmara needs to be carefully evaluated. Measures must be taken to mitigate the effects of future tsunamis in the area. Better construction and building codes will definitely help.



Subsidence and permanent flooding at Degirmendere, Turkey.

Vanuatu - 26 November 1999



A 7.4 magnitude earthquake struck Vanuatu, a group of about 80 islands in the Southwest Pacific that has a population of about 190,000 people. Worst hit was Pentecost, an island with a population of about 12,000. This was the strongest earthquake recorded in the Vanuatu archipelago in the past 30 years.

Centered approximately 90 miles north of Port Vila, the earthquake generated a tsunami which was particularly destructive at the villages of Ena and Vemagely, on the southern tip of Pentecost. Waves, with estimated offshore heights of about 2-3 meters, arrived about half an hour after the earthquake, washing away many of the homes and destroying a church. In some areas, the waves surged two kilometers inland.

Ten people died on Pentecost, two were missing, and four were seriously injured by the combined effects of the earthquake and the tsunami. Five of the deaths were attributed to the earthquake and the other five to the tsunami. Most of the deaths occurred at the villages of Ena

and Vemagely. About 100 people were injured, most by the earthquake.

Thousands of people were left homeless and lost virtually everything in the disaster. There was significant damage to the infrastructure of the country, as landslides blocked roads and communications to some parts in the central and southern parts of Pentecost Island. Water catchment tanks were totally destroyed. Damage also occurred on the islands of Ambrym, Ape and Malacoula. The Vanuatu provinces of Penama and Malempa were declared disaster areas. *Tectonic Map of the region (source: drgeorgepc.com)*

The tsunami was recorded by numerous tide gauge stations throughout the Pacific. At Vanuatu's Port Vila station, the closest to the earthquake's origin, the gauge recorded tsunami waves of 1.2 m.

