

THE 2011 VAN EARTHQUAKES OCURRED IN TURKEY

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Geology of Turkey

Turkey's most severe earthquake in the twentieth century occurred in Erzincan on the night of 1939-12-27; it devastated most of the city and caused an estimated 33.000 deaths. Earthquakes of moderate intensity often continue with sporadic aftershocks over periods of several days or even weeks. The most earthquake-prone part of Turkey is an arc-shaped region stretching from the general vicinity of Kocaeli to the area north of Lake Van on the border with Armenia and Georgia.

Anatolian Plate

The Anatolian Plate is a continental tectonic plate consisting primarily of the country of Turkey. The easterly side is a boundary with the Arabian Plate, the East Anatolian Fault, a left lateral transform fault.[1]

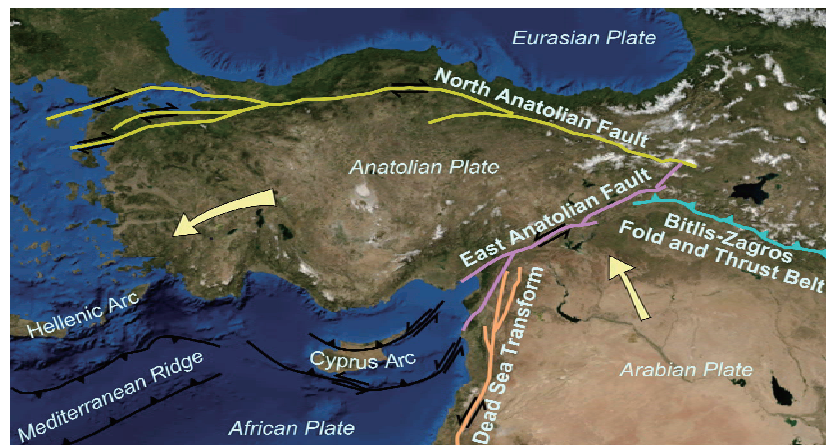


Fig.1: Anatolian Plate

The southerly and southwesterly sides comprise a convergent boundary with the African Plate, manifest in compressive features of the oceanic crust beneath the Mediterranean as well as within the continental crust of Anatolia itself, and also by what are generally considered to be subduction zones along the Hellenic and Cyprus Arcs.

The northerly side is a transform boundary with the Eurasian Plate forming the North Anatolian Fault Zone (NAFZ).

Research indicates that the Anatolian Plate is rotating counterclockwise as it is being pushed west by the Arabian Plate, impeded from any northerly movement by the Eurasian Plate.

In some references, the Anatolian Plate is referred to as a "block" of continental crust still coupled to the Eurasian Plate. But studies of the North Anatolian Fault indicate that Anatolia is de-coupled from the Eurasian Plate. It is now being squeezed by the Arabian Plate from the east and forced toward the west as the Eurasian Plate to its north is blocking motion in that direction. The African Plate is subducting beneath the Anatolian Plate along the Cyprus and Hellenic Arcs offshore in the Mediterranean Sea.

Van City

Van city is a province in eastern Turkey, between Lake Van and the Iranian border. It is 19,069 km² in area and had a population of 1.022.532.[2] This area was the heartland of Armenians, who lived in these areas from the time of Hayk in the 3rd millennium BCE right up to the late 19th century when the Ottoman Empire seized all the land from the natives[3] In the 9th century BC the Van area was the center of the Urartian kingdom [4]. The area was a major Armenian population center. The region came under the control of the Armenian Orontids in the 7th century BC and later Persians in the mid 6th century BC. By the early 2nd century BC it was part of the Kingdom of Armenia. It became an important center during the reign of the Armenian king, Tigranes II, who founded the city of Tigranakert in the 1st century BC⁴. This region was ruled by the Arsacid Dynasty of Armenia before 4th century AD. In 908-1021 was central part of Armenian Kingdom of Vaspurakan, then joined Byzantine Empire. With the Seljuq victory at the Battle of Malazgirt in 1071, just north of Lake Van, it became a part of Seljuq Empire and later the Ottoman Empire.



Fig.2: Location of Van City in Turkey

Van Earthquake

Van earthquake was a destructive magnitude 7.2 Mw earthquake that struck eastern Turkey near the city of Van on Sunday, 23 October 2011 at 13:41:21 local time. It occurred at a shallow depth of 20 kilometers, causing heavy shaking across much of eastern Turkey and lighter tremors across neighboring parts of the South Caucasus and Levant. This earthquake was mostly destructive on Erceğir District where is 40km air distance north of Van City. For this earthquake, the people who living around Van City says First Earthquake or Erceğir Earthquake.

According to Disasters and Emergency Situations Directorate of Turkey (AFAD) on 28 November 2011, the earthquake killed 604 and injured are 4,152. At least 11,232 buildings sustained damage in the region, 6,017 of which were found to be uninhabitable. The uninhabitable homes left as much as 8,321 households with an average household population of around 7.6 homeless in the province; this could mean that at least around 60,000 people were left homeless. The other 5,215 have been damaged but are habitable [5] [6] [7] [8].

Another earthquake with magnitude Mw 5.7 and a depth of 9.4 kilometers [9] hit near Van on 9 November 2011 at 21:23 local time, causing 40 deaths and hundreds injured.[10] It was centered 16 kilometers south of Van.[11] Among the buildings collapsed by the 9 November earthquake was the Bayram Hotel, which hosted some journalists and rescue workers. Some journalists trapped in the rubble sent text messages asking to be rescued.[12] And also a Japanese aid volunteer Dr. Atsushi Miyazaki was reported dead on 10 November 2011. It is not clear yet if the earthquake of November 9 was an aftershock of the October 23 earthquake,[13] while the Kandilli earthquake center of Turkey said that the November 9 earthquake was an independent earthquake.[14]

Rescue workers were able to pull out 25 survivors from the rubble of the collapsed buildings. The earthquake toppled 25 buildings, said Deputy Prime Minister Besir Atalay. Since most buildings were evacuated after the October 2011 earthquake, only 3 buildings were occupied, otherwise the death toll could have been worse.[15]

The First Earthquake (23 October)

The First Earthquake were recorded by different seismic stations. The nearest station was Muradiye Station where located 42 km away from the epicenter. The maximum acceleration was recorded as 178.5 gal North-South direction by this station.

The Second Earthquake (9 November)

After the First Earthquake, some new seismic stations were setup around the Van City. The Second Earthquake was recorded by these new stations. The nearest station was Edremit Station where located 2.9 km away from the epicenter. The maximum acceleration was recorded as 102.6 gal East-West direction by this station, however the maximum acceleration was also recorded as 245.9 gal by Van Merkez Station where was located 12.7 km away from the epicenter.

The First Earthquake
The First Earthquake on 23 October has been mostly affected around Erciş District. Magnitude of the First Earthquake is declared as ML=6.7 by the KOERI-NEMC, however they revised as MW=7.2 after hours from the earthquake.



Fig.3: A Photo from 1st Earthquake

The Second Earthquake
The Second Earthquake on 9 November has been mostly affected Van City. Magnitude of the Second Earthquake is declared as aftershock and ML=5.6 by the KOERI-NEMC. They changed as independent earthquake after days from the shake.



Fig.4: A Photo from 2nd Earthquake

The Third Earthquake
The Third Earthquake on 30.11.2011 has been affected Van City however no destruction. Only damages of some buildings were increased.



Fig. 5: Increased Damages due to 3rd Earthquake

Notes

1. Magnitude of the First Earthquake changed as $M_W=7.2$ by KOERI-NEMC after hours from shake.
2. The Second Earthquake has been declared as aftershock by KOERI-NEMC and changed as independent earthquake days after the shake.
3. The Third Earthquake according to people, there was no destruction, but there was some extra damage to some buildings.

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