

January 27, 2003 Pülümür (Turkey) Earthquake

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Introduction

27 January 2003 Pülümür (Tunceli) earthquake occurred at 07:26 local time. According to Kandilli Observatory, the epicenter of the earthquake that measured of magnitude $M_s=6.2$ was located at about 4.5 km W-SW Saglamtaş village. One person died and 7 people injured in this earthquake. Most of the public buildings collapsed and some adobe buildings got heavily damaged in several villages of Pülümür district. Many seismological centers have reported the earthquake. The parameters of the January 27, 2003 Pülümür Earthquake has as given by KOERI, CSEM, USGS and ETHZ are presented in table1.

<i>Origin Time (U.T.)</i>	<i>Coordinates</i>		<i>Depth (km.)</i>	<i>Magnitude</i>				<i>Network-Center</i>
	<i>Latitude</i>	<i>Longitude</i>		<i>Mb</i>	<i>Ms</i>	<i>Mw</i>	<i>Md</i>	
05:26:28.0	39.48	39.77	10.0	6.2	6.0	6.1	ISK-Kandilli (Turkey)	
05:26:24.1	39.48	39.88	20.0	5.8			CSEM-French	
05:26:22.0	39.48	39.78	10.0	5.7	6.0	6.1	USGS-USA	
05:26:23.1	39.50	39.80	25.0			6.2	ETHZ- Switzerland	

Table1. : Preliminary epicentral coordinates and magnitudes.

Seismotectonic setting

Turkey is a tectonically active region that experiences frequent destructive earthquakes. At a large scale, the tectonics of the region near this earthquake is controlled by the collision of the Arabian Plate and the Eurasian Plate. A large piece of continental crust almost the size of Turkey, called the Anatolian block, is being squeezed to the west. The block is bounded to the north by the North Anatolian Fault and to the southeast by the East Anatolian fault. East Anatolian strike-slip fault mark a distributed, irregular, and young continental collision zone. This collision zone is further characterized by a topographic high that is actively deforming. Tectonic escape is taking place to the west, as evidenced by the right-lateral strike-slip movement along the North Anatolian fault system and with left-lateral movement along the East Anatolian fault system. In the region, tectonic activity is marked by the motion of the Arabian Plate to the Eurasian Plate with 20mm/yr in north-northwest direction and the collision has occurred along Bitlis-Zagros Thrust fault that has also caused westward displacement and counterclockwise rotation of the Anatolian block with 20-25 mm/yr (McClusky et al., 2003).



Figure 1. General tectonic setting of Turkey and Pülümür Earthquake location

Field Observation

The preliminary field observation undertaken by Seismology Team. The hypocentral location of the 2003 Pülümür earthquake is about 4.5 km W-SW distance of the Sağlamtaş village. This region located between Hor brook and Sal brook (Kalafat et al., 2003).



Figure 2. Fault trace and a sample of traditional village house damaged by earthquake

There is not heavily population and also soil is compact. Pülümür earthquake occurred on the Pülümür fault that has 45 degree with eastern part of the North Anatolian Fault. According to preliminary studies, rupture zone displayed oblique fault mechanism. Following the occurrence of the main shock many aftershocks were recorded by Seismology Division. Aftershocks of this earthquake are generally located in Pülümür region and its vicinity. Aftershock activity localized along NE-SW zone with 35 km (Figure 3.)

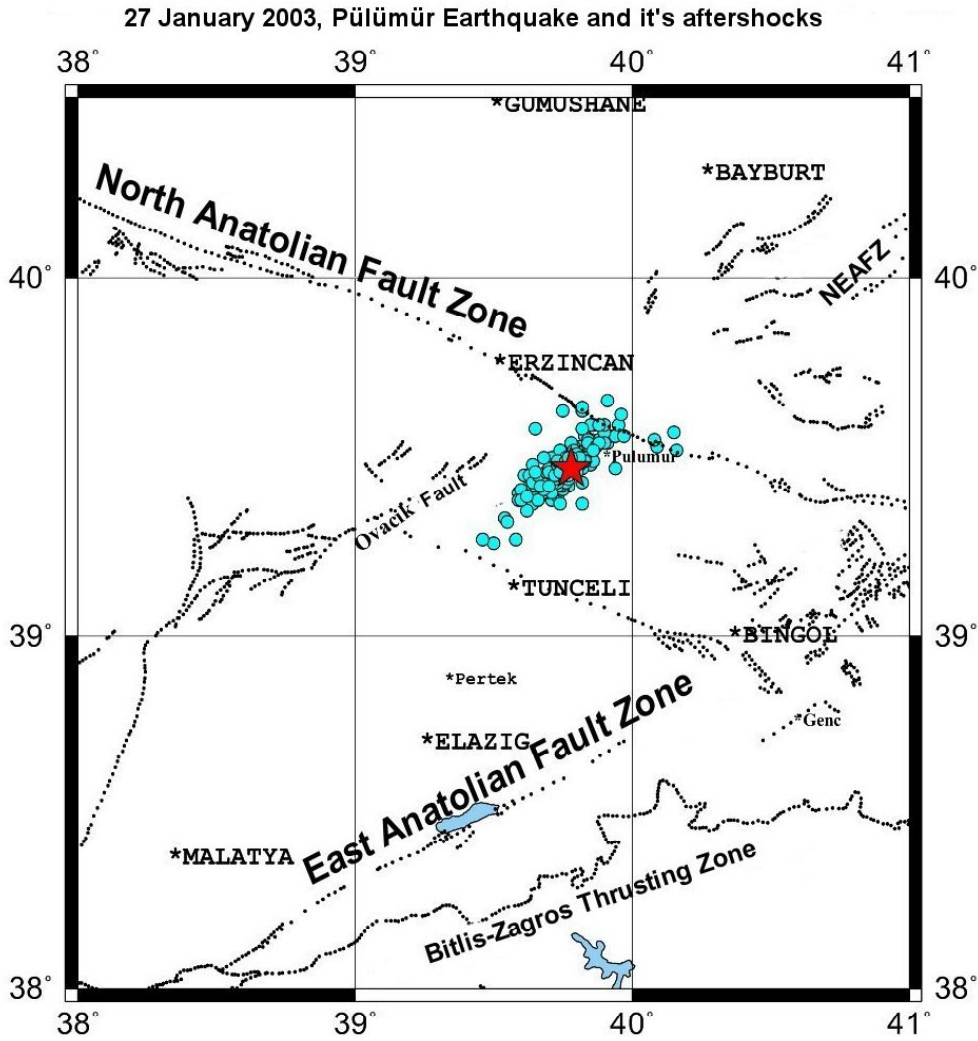


Figure 3. Aftershock activity of Pülümür earthquake.

Focal Mechanism and Rupture Zone

In this paper , 308 station data was investigated belongs to IRIS/USGS global broadband network. According to this study, the distance was selected as minimum 30 degrees and maximum 90 degrees and signal/noise ratio was selected by using 20 P, 5 SH phases and 25 teleseismic events for inversion solution. Another important point of this study was that amplitude of the SH phases four times larger than P phases.

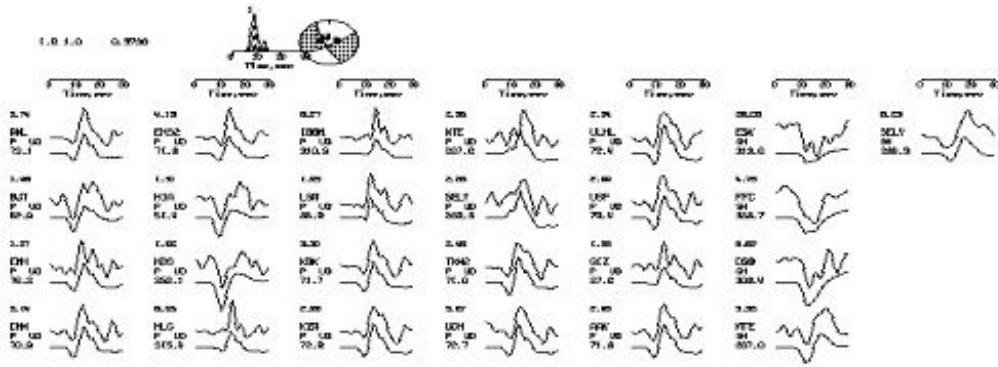


Figure 4. Focal mechanism solution of the mainshock.

Kikuchi and Kanamori (1991) technique was used in this study. According to this technique, the correlation between observational and theoretical sesimograms can be found by applying inversion for different focal depths. The same harmony was observed at all seismograms that have different azimuths. 27 January 2003 Pülümür earthquake shows the left-lateral strike slip that has a vertical component with oblique fault. The seismic moment is $M_0 = 1.5 \times 10^{18}$ Nm indicates a moment magnitude (M_w) of 6.0.

Seismic Moment (N*m)	Strike (degree)	Dip (degree)	Rake (degree)
$M_0=1.15 \times 10^{18}$	62	80	-13

Table 2. : According to this study; Pülümür earthquake source parameters (Seismic Moment, strike, dip and rake) presented.

Conclusion

On January 27, 2003 an earthquake measuring 6.2 magnitude struck the eastern part of Turkey, centered near Pülümür. This is a sparsely populated region that has an extremely rough terrain with mountains and plateaus. So, only one person was died but due to the buildings were all poorly built with poor construction materials, some of them were heavily damaged in Pülümür and its some villages. We should not forget that there are many damaging historical and recent earthquakes that have been reported in eastern Turkey. So, it should be aimed to evaluate the structural and non structural elements damage for building quality that is very important for protecting vulnerable people in the event of future disasters in this region.

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