Magnitude 7.0 GREECE
Friday, October 30, 2020 at 11:51:27 UTC

A magnitude 7.0 earthquake occurred in the Aegean Sea 62.9 km (39.1 miles) south southwest of İzmir, Turkey and 13 kilometers (8 miles) north northeast of the Greek island of Samos.

Twelve people are reported dead in Turkey, and another 522 people have been injured. Rescue operations are continuing. In Greece's island of Samos, two teenagers died.

Buildings have been damaged in both countries. There are reports of at least 20 buildings destroyed in Izmir, Turkey, and reports of crushed cars. Some coastal towns have been flooded.

Local Time 2:51 PM
Latitude 37.918° N
Longitude 26.790° E
Depth 21 km

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Rescue workers try to save people trapped in the debris of a collapsed building in Izmir, Turkey. (AP Photo/Ismail Gokmen)

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Seawater floods a square after an earthquake at the port of Vathi on the eastern Aegean island of Samos, Greece. (AP Photo/Michael Svarnias)

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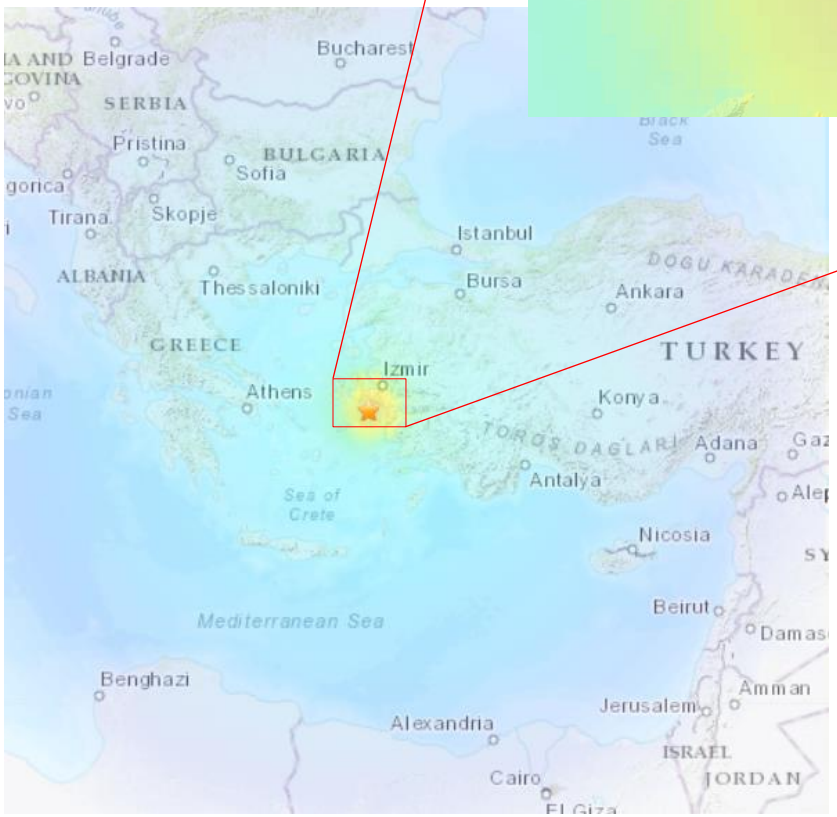
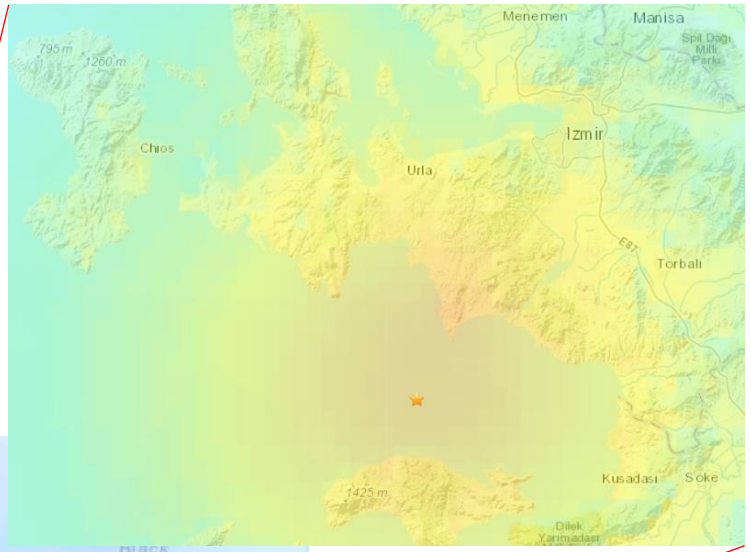
The Modified-Mercalli Intensity (MMI) scale is a twelve-stage scale, from I to XII, that indicates the severity of ground shaking. Intensity is dependent on the magnitude, depth, bedrock, and location.

Severe shaking was felt in the area closest to the earthquake.

MMI	Perceived Shaking
X	Extreme
IX	Violent
VIII	Severe
VII	Very Strong
VI	Strong
V	Moderate
IV	Light
II-III	Weak
I	Not Felt

Image courtesy of the USGS





USGS Estimated shaking intensity from M 7.0 Earthquake

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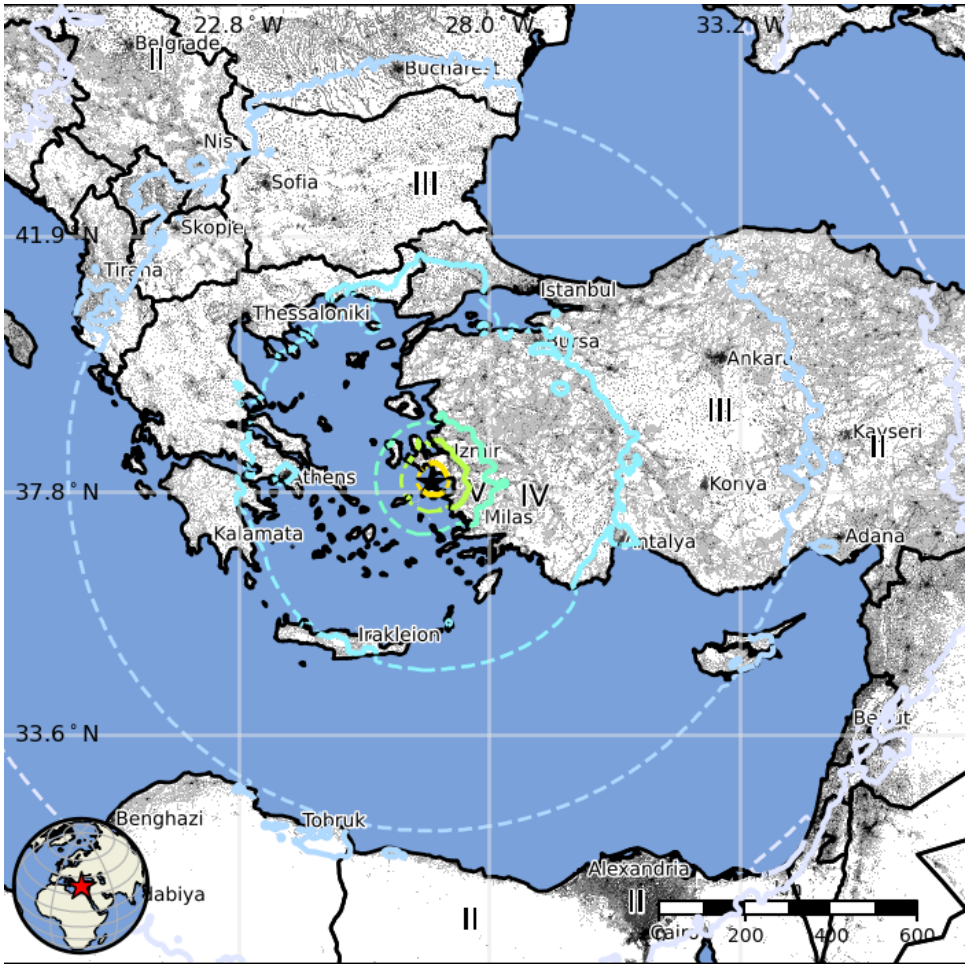
The USGS PAGER map shows the population exposed to different Modified Mercalli Intensity (MMI) levels.

The USGS estimates that six thousand people felt severe shaking from this earthquake.

I	Not Felt	22,725 k*
II-III	Weak	193,818 k*
IV	Light	14,823 k
V	Moderate	2,163 k
VI	Strong	3,213 k
VII	Very Strong	71 k
VIII	Severe	6 k
IX	Violent	0 k
X	Extreme	0 k



The color-coded contour lines outline regions of MMI intensity. The total population exposure to a given MMI value is obtained by summing the population between the contour lines. The estimated population exposure to each MMI Intensity is shown in the table.

Image courtesy of the US Geological Survey

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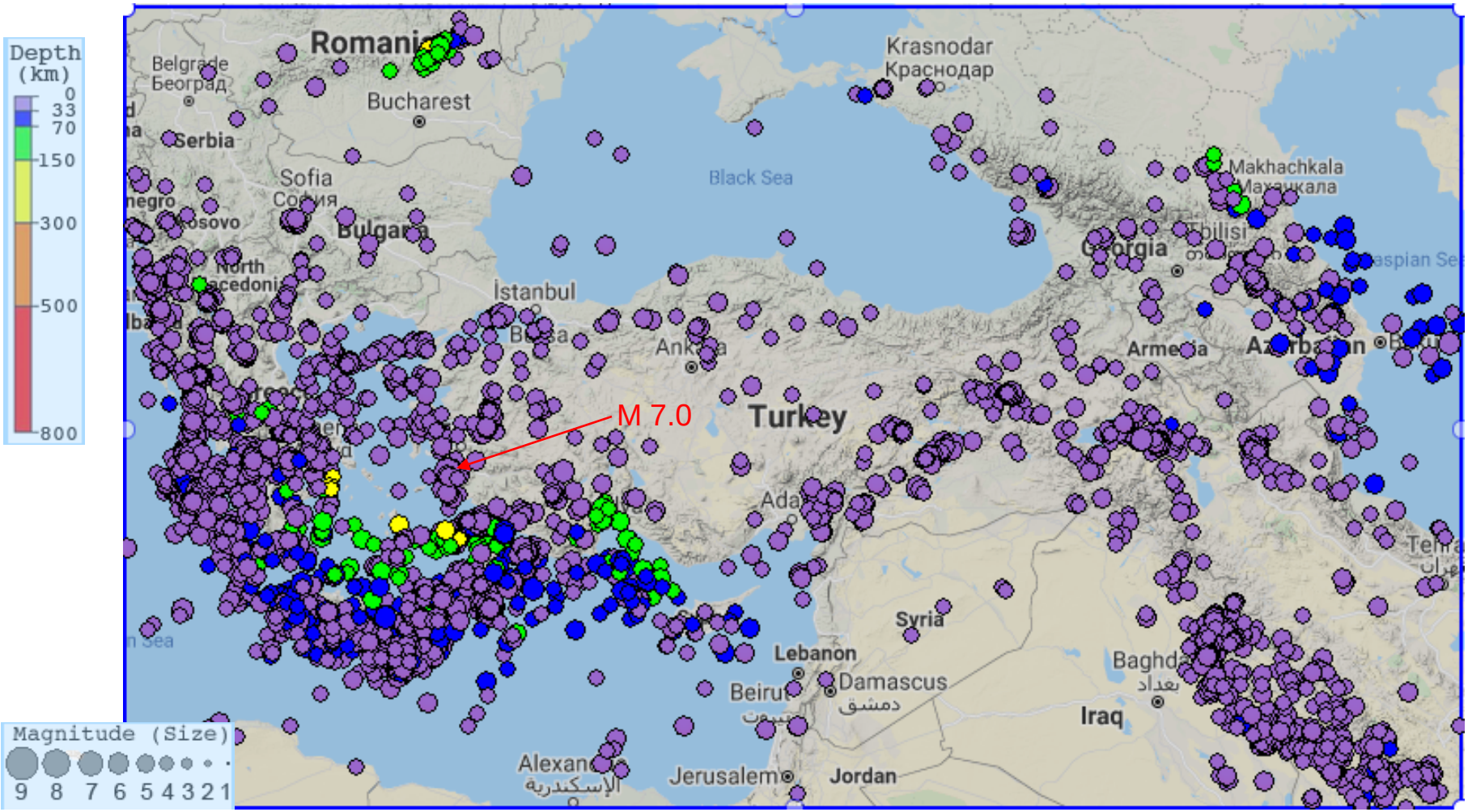
Turkey and Greece are tectonically active countries. This earthquake is shown on a map of regional historic seismicity along with the most recent 4000 earthquakes greater than magnitude 4.



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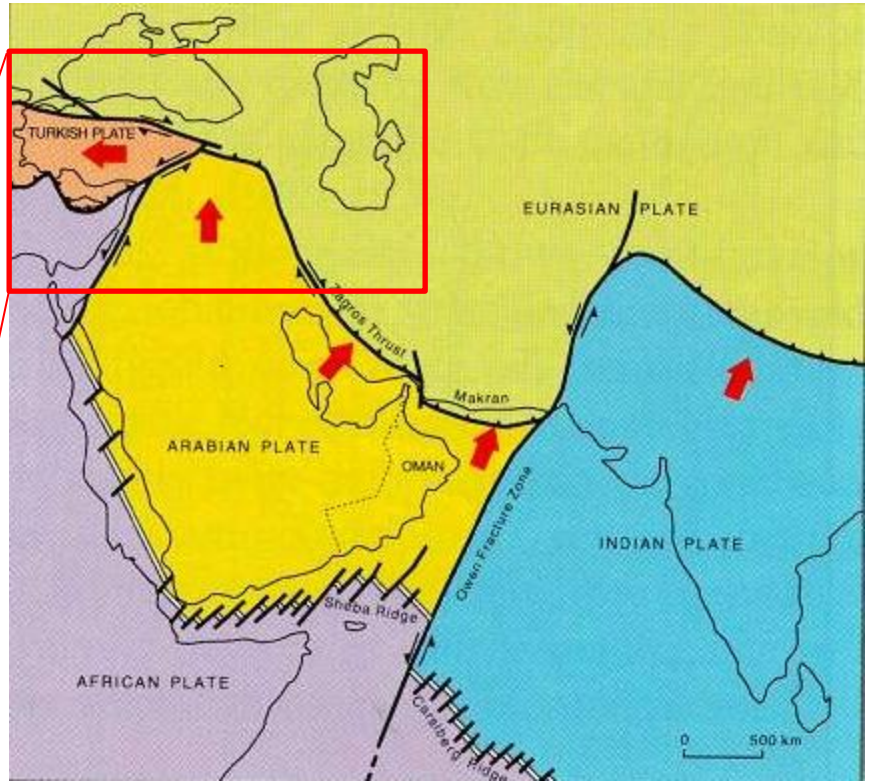
In Eastern Turkey, the Arabian Plate is colliding with Eurasia, and has built a complex mosaic of mountains by thrust and strike-slip faulting. This collision of the Arabian and Eurasian Plates in Eastern Turkey occurs along the East Anatolian Fault Zone (EAFZ) and the Bitlis Suture, a large thrust fault.

Due to this collision, large fault systems extend across much of central and western Turkey and accommodate the western motion of the Anatolian block as it is being squeezed by the converging Arabian and Eurasian Plates.



Summary tectonic map of eastern Turkey. The large arrows are the approximate directions of motion of Turkey, Arabia, and central Iran relative to Eurasia. NAF=North Anatolian Fault; EAF=East Anatolian Fault; DSF=Dead Sea Fault (*Sandvol et al.)*

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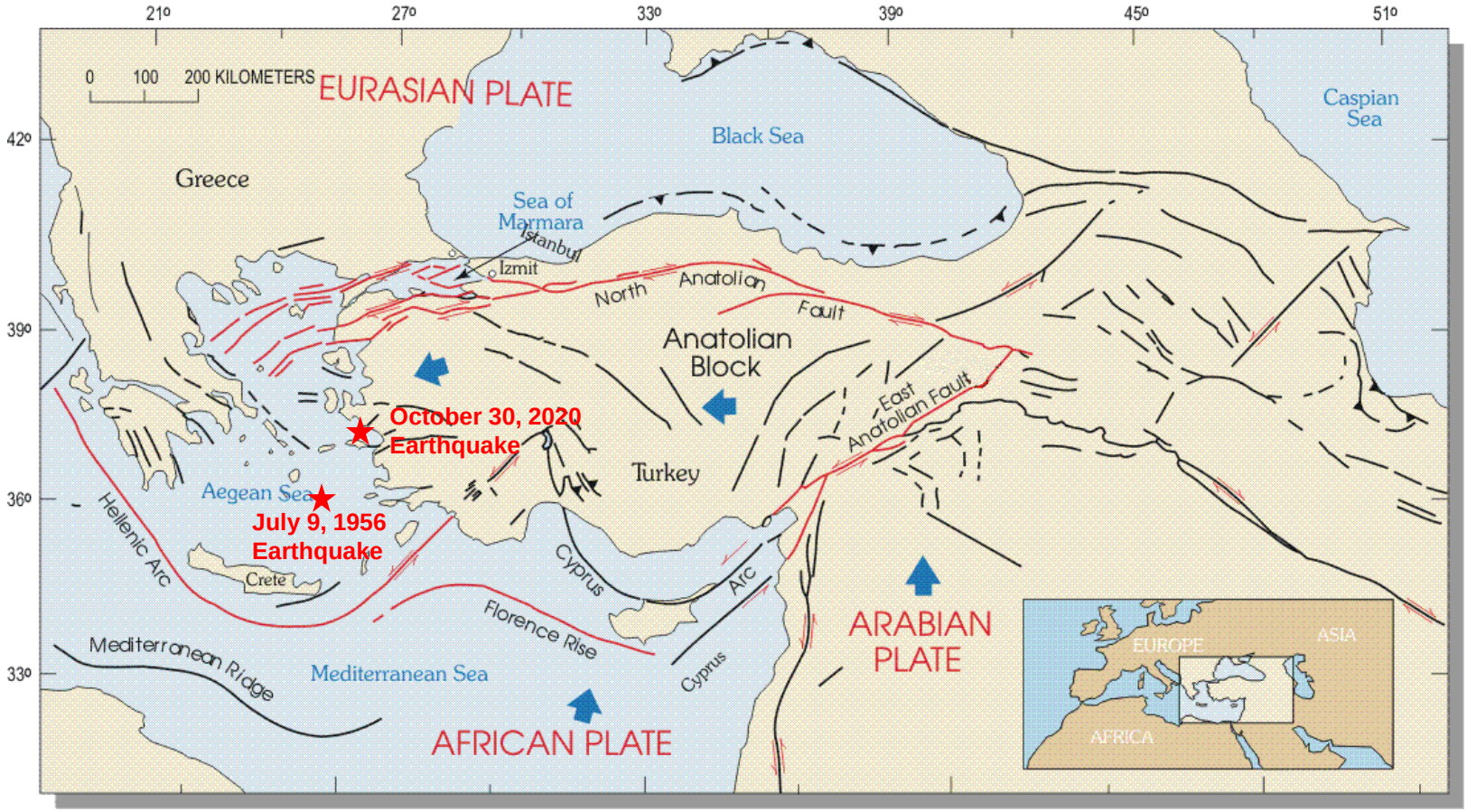

The Anatolian Block is being squeezed towards the Aegean Sea, which itself is a region of distributed deformation between the African, Arabian, and Eurasian Plates. This earthquake occurred as a result of north – south extension that is common of earthquakes in this area. A magnitude 7.7 earthquake, also produced by extension, occurred on July 9, 1956 in the Aegean Sea.

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The magnitude 7.7 July 1956 Amorgos earthquake had a maximum perceived intensity of IX (violent shaking!) on the Modified-Mercalli Intensity (MMI) scale . The epicenter was to the south of the island of Amorgos, the easternmost island of the Cyclades in the Aegean Sea. There was significant damage on Amorgos and the neighboring island of Santorini.

It was followed 13 minutes later by a magnitude 7.2 earthquake near Santorini. It triggered a major tsunami. The combined effects of the earthquake shaking and the tsunami caused the deaths of 53 people and injured 100 more.

Santorini. Image courtesy Santorini Catholic Archives

Amorgos. Image courtesy Istituto Nazionale Di Geofisica E Vulcanologia

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An animation to explore regional tectonics.

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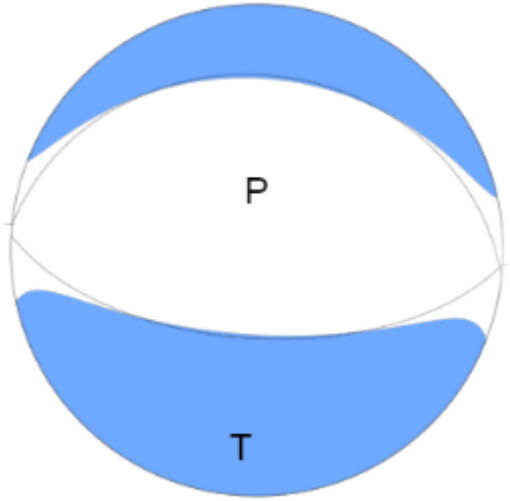
The focal mechanism is how seismologists plot the 3-D stress orientations of an earthquake. Because an earthquake occurs as slip on a fault, it generates primary (P) waves in quadrants where the first pulse is compressional (shaded) and quadrants where the first pulse is extensional (white). The orientation of these quadrants calculated from recorded seismic waves determines the type of fault that produced the earthquake.

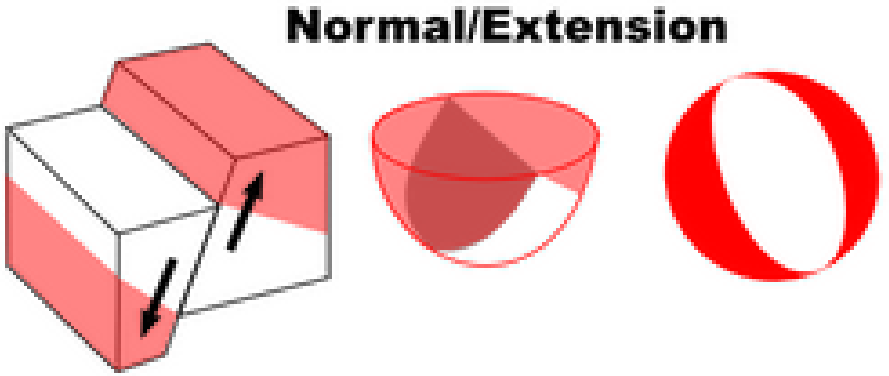


USGS W-phase Moment Tensor Solution

The tension axis (T) reflects the minimum compressive stress direction. The pressure axis (P) reflects the maximum compressive stress direction.

This intraplate earthquake occurred as the result of normal faulting at a shallow crustal depth within the Eurasia Plate in the eastern Aegean Sea.

Normal faulting is due to extension, and north-south oriented extension is common in the Aegean Sea.



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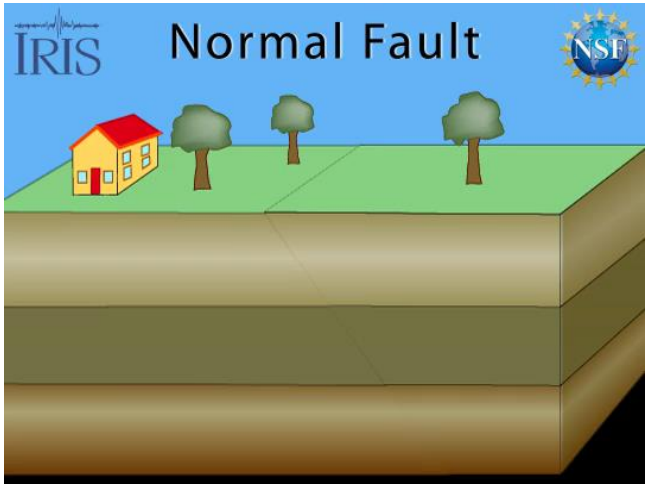
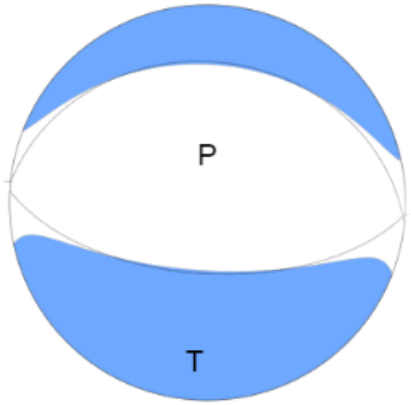
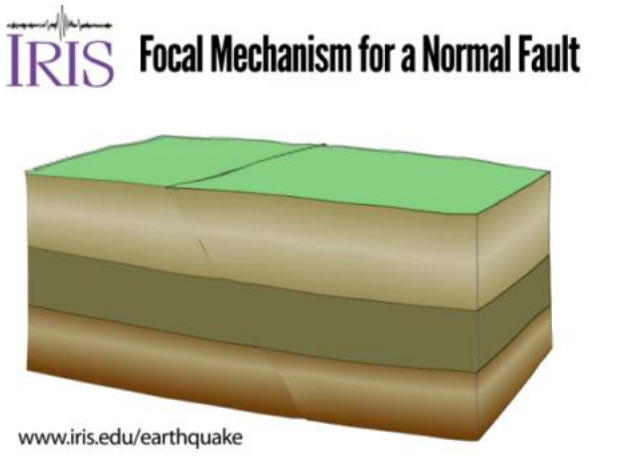
Two animations to explore the motion of normal faults, and how normal faults are represented in a focal mechanism.

Remember, this was the focal mechanism solution for this earthquake. It was estimated by an analysis of observed seismic waveforms, recorded after the earthquake, observing the pattern of "first motions", that is, whether the first arriving P waves break up or down.





USGS W-phase Moment Tensor Solution



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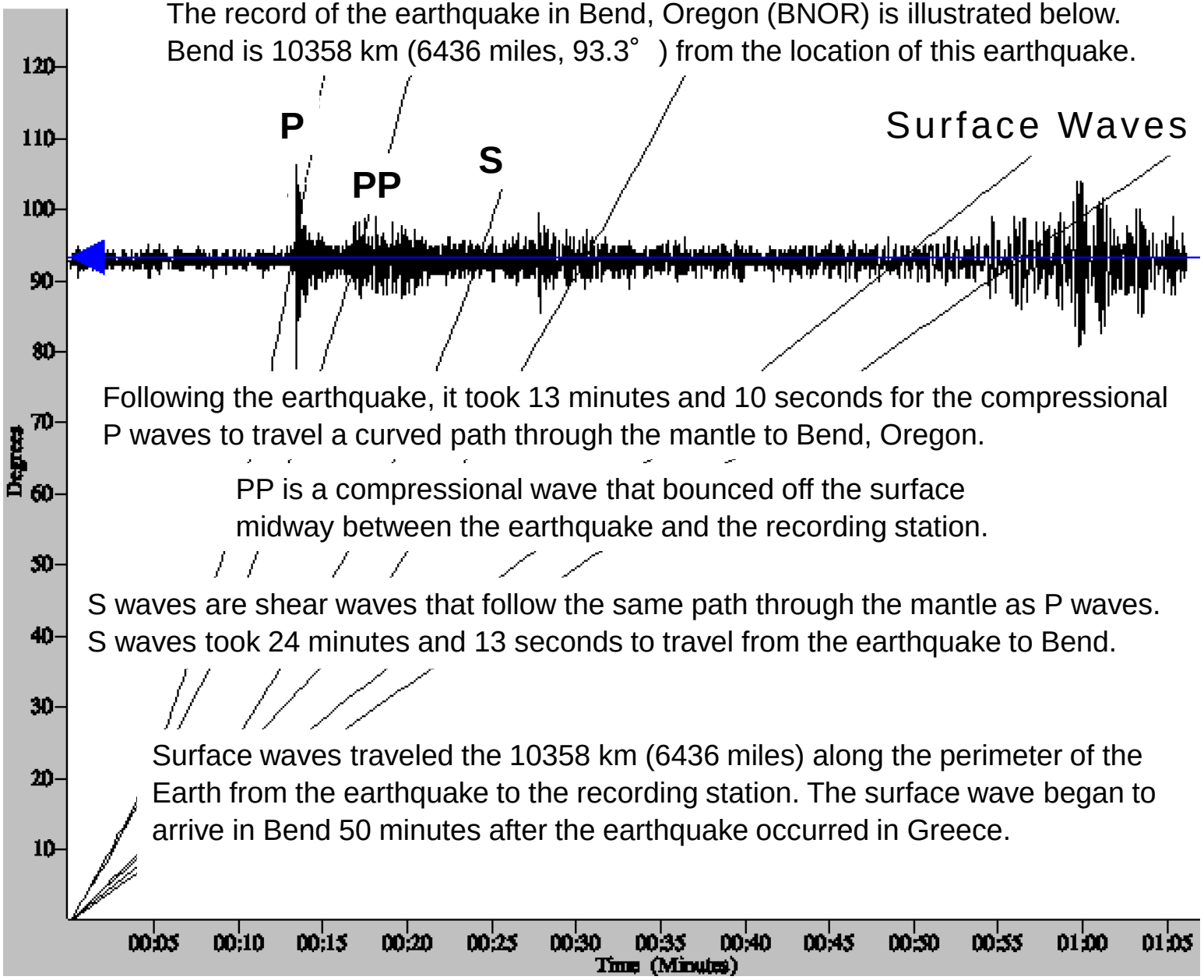
The record of the earthquake in Bend, Oregon (BNOR) is illustrated below. Bend is 10358 km (6436 miles, 93.3˚) from the location of this earthquake.



Following the earthquake, it took 13 minutes and 10 seconds for the compressional P waves to travel a curved path through the mantle to Bend, Oregon.

PP is a compressional wave that bounced off the surface midway between the earthquake and the recording station.

S waves are shear waves that follow the same path through the mantle as P waves. S waves took 24 minutes and 13 seconds to travel from the earthquake to Bend.

Surface waves traveled the 10358 km (6436 miles) along the perimeter of the Earth from the earthquake to the recording station. The surface wave began to arrive in Bend 50 minutes after the earthquake occurred in Greece.

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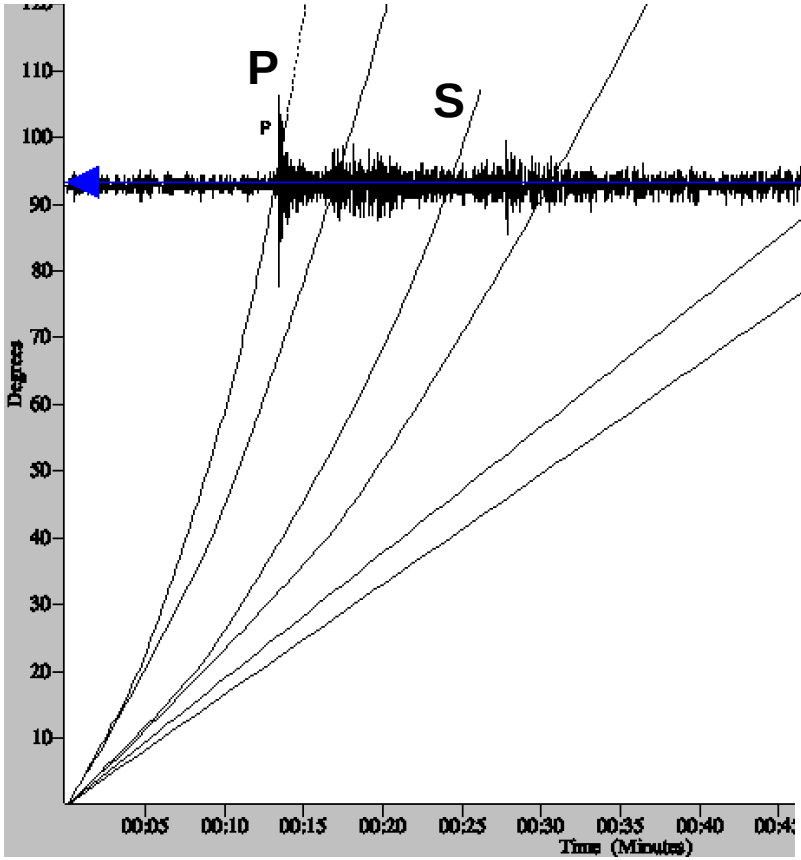
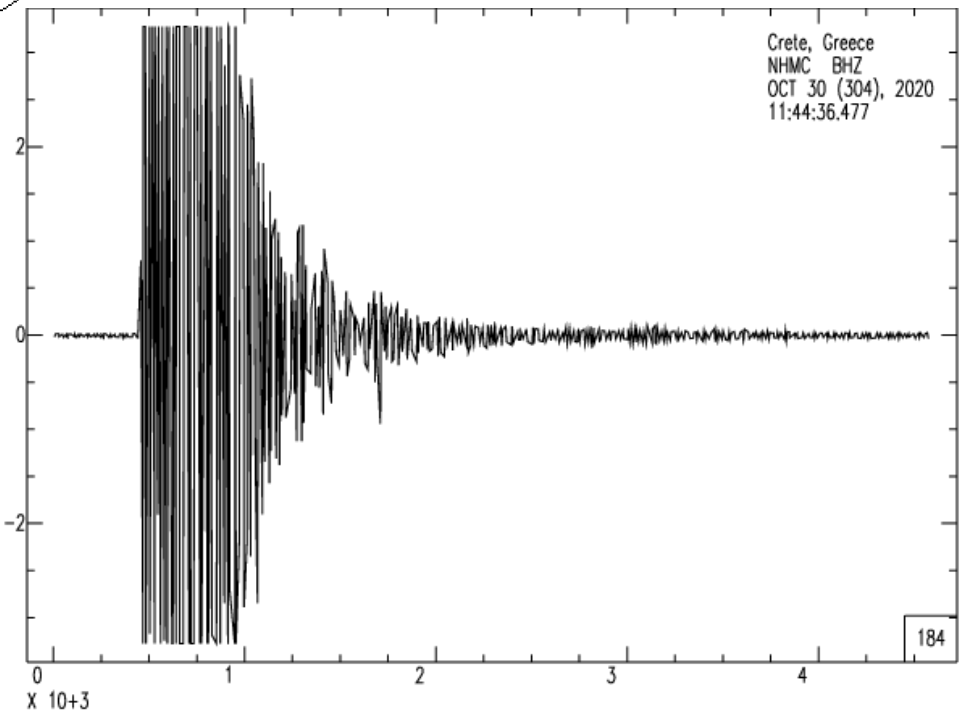
Compare the seismogram from the station in Bend, Oregon, United States, with station NHMC, the Natural History Museum of Crete in Crete, Greece.





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