

Major Earthquake in Turkey **99/08/17 00:01:38 40.64N 29.83E 10.0 7.4Ms**

Warning--Provisional report, subject to revision

UPDATED The following is a News Release by the United States Geological Survey, National Earthquake Information Center: Update on the 17 August 1999 Izmit, Turkey, Earthquake.

USGS ADJUSTS THE MAGNITUDE OF TURKEY EARTHQUAKE

On the basis of additional data, the U.S. Geological Survey (USGS) has updated the magnitude of the destructive earthquake that struck western Turkey early Tuesday, to 7.4. The initial preliminary magnitude, of 7.8, was based on recordings of seismic waves from a limited number of global stations that rapidly transmit data to the U.S. Geological Survey's National Earthquake Information Center (NEIC) in Golden, Colo. Scientists at the NEIC have since received additional data that permit a more accurate determination of the earthquake's location, magnitude, and depth.

The Izmit earthquake occurred at 00:01:39.80 UTC (3:01 a.m. local time), and was centered at 40.702 N., 29.987 E., which places the epicenter about 11 kilometers, or seven miles, southeast of the city of Izmit. This location indicates that the earthquake occurred on the northernmost strand of the North Anatolian fault system. The earthquake originated at a depth of 17 kilometers, or about 10.5 miles, and caused right-lateral strike-slip movement on the fault. Preliminary field reports confirm this type of motion on the fault, and initial field observations indicate that the earthquake produced at least 60 kilometers (37 miles) of surface rupture and right-lateral offsets as large as 2.7 meters, or almost nine feet.

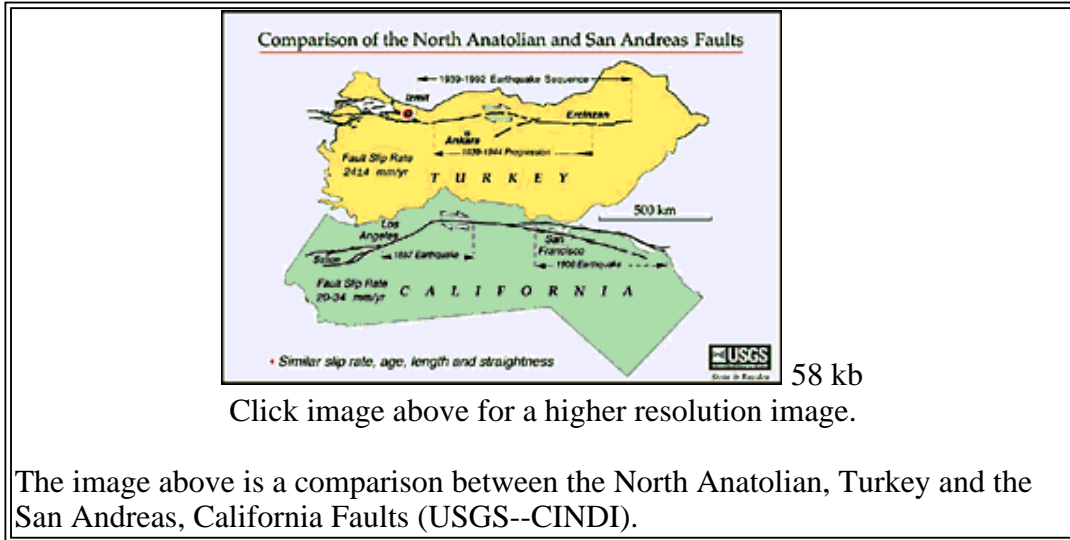
Additional field studies by U.S. and Turkish scientists will refine details of the geological effects and seismological parameters of this major earthquake.

Seismotectonic Summary for the MS 7.8 Turkish Earthquake of Aug. 17, 1999

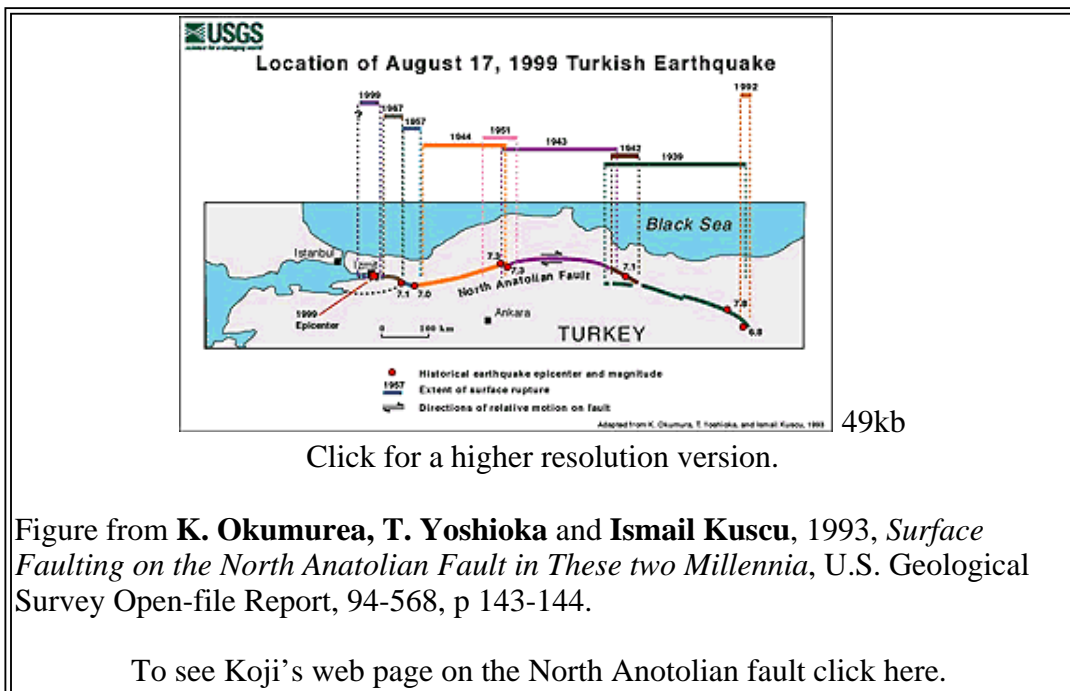
The earthquake likely occurred on a branch of the North Anatolian fault. Although this is the largest earthquake in the epicentral region in this century, the region of the earthquake has a long history of destructive earthquakes. In 1967, a magnitude 7.1 earthquake caused extensive damage along the North

Anatolian fault just east of the current shock.

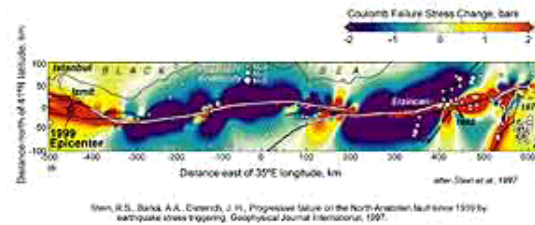
The 900 km-long North Anatolian fault has many characteristics similar to California's San Andreas fault. These two faults are right-lateral, strike-slip faults having similar lengths and similar long-term rates of movement. If a person is looking across a right-lateral, strike-slip fault during such an earthquake, that person would see the opposite side move to the right.



The North Anatolian fault has produced seven large (MS (7.0) earthquakes in the period from 1939 through 1999. These earthquakes have ruptured the fault progressively from east to west, as shown in the next figure.



In the following figure, areas shown in red were estimated in 1997 to have enhanced levels of stress owing to past earthquakes, and therefore to be potential locations for future large earthquakes. The North Anatolian Fault System, shown in white, has now been the location of 11 earthquakes with magnitudes greater than 6.7 since 1939. In 1997 U.S. Geological Survey scientists and Turkish colleagues estimated 12% probability for the subsequent 30 years for a large earthquake south of Izmit.



Click image above for a higher resolution image (202kb).

Following are data for the seven large earthquakes that have progressively ruptured the North Anatolian fault:

- 1939.12.26. Magnitude (MS) 7.9 - 8.0. 30,000 deaths. Fault length about 360 km. Initiated the eastward migration of significant earthquakes on the North Anatolian fault. (Termed the 1939 Erzincan earthquake.)
- 1942.12.20. Magnitude (MS) 7.1. Fault length about 50 km. (Termed the 1942 Erbaa earthquake).
- 1943.11.26. Magnitude (MS) 7.6. Fault length about 280 km. (Termed the 1943 Tosya earthquake.)
- 1944.02.01. Magnitude (MS) 7.3. Fault length about 165 km. (Termed the 1944 Bolu-Gerede earthquake.)
- 1957.05.26. Magnitude (MS) about 7. Fault length about 30 km. (Termed the 1957 Abant earthquake.)
- 1967.07.22. Magnitude (MS) 7.1. Fault length about 80 km. (Termed the 1967 Mudurnu Valley earthquake.)
- 1999.08.17. Magnitude (MS) 7.8; MW 7.4-7.5)

Earthquakes on the North Anatolian fault are caused by the northwards motion of the Arabian plate against the

Eurasian plate, squeezing the small Turkish microplate westwards. Also, compression in this region is due to the northwards motion of the African plate, which produces subduction at the Cyprus and Hellenic arcs. The small Turkish microplate is bounded on the east by the East Anatolian fault zone (EAFZ), on the north by the North Anatolian fault zone (NAFZ), on the west by a diffuse zone of deformation surrounding the greater Aegean region, and on the south by the Hellenic and Cyprus arcs.

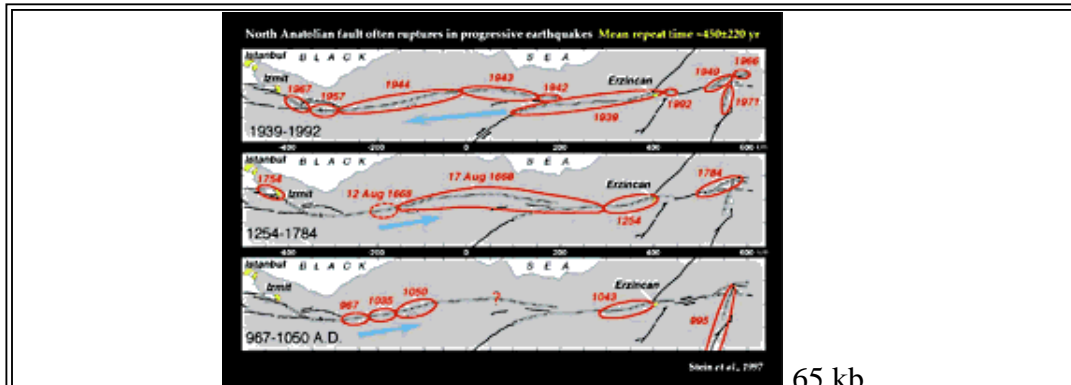


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**More on the Turkey Earthquake at the
United States Geological Survey
National Earthquake Information Center**

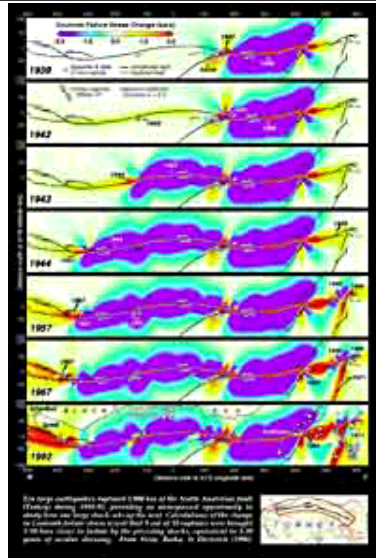
The following earthquake information is from the USGS Earthquake Information Team from Menlo Park, CA.



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Rupture zones for large historical earthquakes along the North and East Anatolian faults (Ambraseys & Finkel, 1988; Ambraseys & Finkel, 1995; Barka, 1992; Ikeda et al., 1991). Zones for earthquakes before 1939 are based largely on isoseismals, and are thus approximate. Earthquake progressions, indicated by arrows, occurred during three sequences but in different directions and rates.



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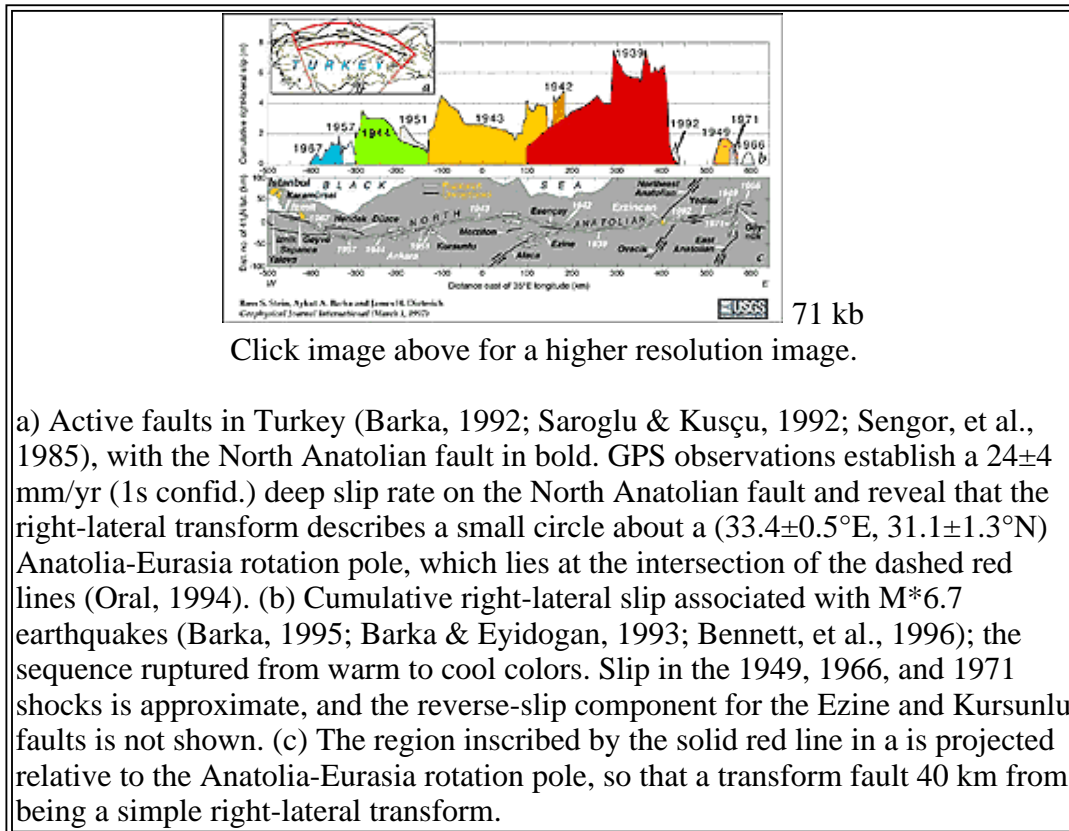
[Click image above for a higher resolution image.](#)

[Click here for an animated version of the above image--345 kb.\)](#)

Cumulative stress changes caused by large earthquakes and steady deep slip on the North Anatolian fault since 1939. In each panel, the epicenter of the next earthquake to rupture is circled. All but the 1943 epicenter lie in regions where the stress rose significantly, typically by 2-5 bars, owing to the foregoing shocks and deep fault slip. Relocated ISC earthquakes (Engdahl, et al., 1996) are shown in g, with the 1992 Erzincan aftershock sequence removed. Calculations are made in an elastic halfspace with a shear modulus of 3.15×10^{11} dyne-cm⁻² and Poisson's ratio of 0.25. Earthquake slip is assigned as in Fig. 1b, assumed to be uniform over 0-12.5-km depth. The fault was digitized and stress was sampled at 5-km increments, and is projected as in Fig. 1c so that the regional stress maintains nearly a fixed angle to the fault.

CINDI--Center for Integration of Natural Disaster Information.

Slideshow sequence showing steady deep slip on the North Anatolian fault since 1939.



Detailed 'technical' information on the August 17, 1999 earthquake near Izmit, Turkey and relevant issues.

- Kandilli Observatory & Earthquake Research Institute Bogaziçi University, Istanbul.
 - Kandilli Observatory & Earthquake Research Institute Bogaziçi University, Istanbul (English Text).
 - Middle East Technical University, Ankara, Turkey, Disaster Management Implementation and Research Center.
 - Severe EQ in the Marmara Sea Region and Izmit - latest report. Edited by Prof. Polat Gulkan - Director of the METU DMI&R Center.
 - Seismic Hazard Maps of Turkey.
 - A Comment on Material Strength Requirements and Related Basic Policies for the Design of Buildings.
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Comments and feedback: *Webmaster*

Page URL: http://geohazards.cr.usgs.gov/html_files/turkey.html

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