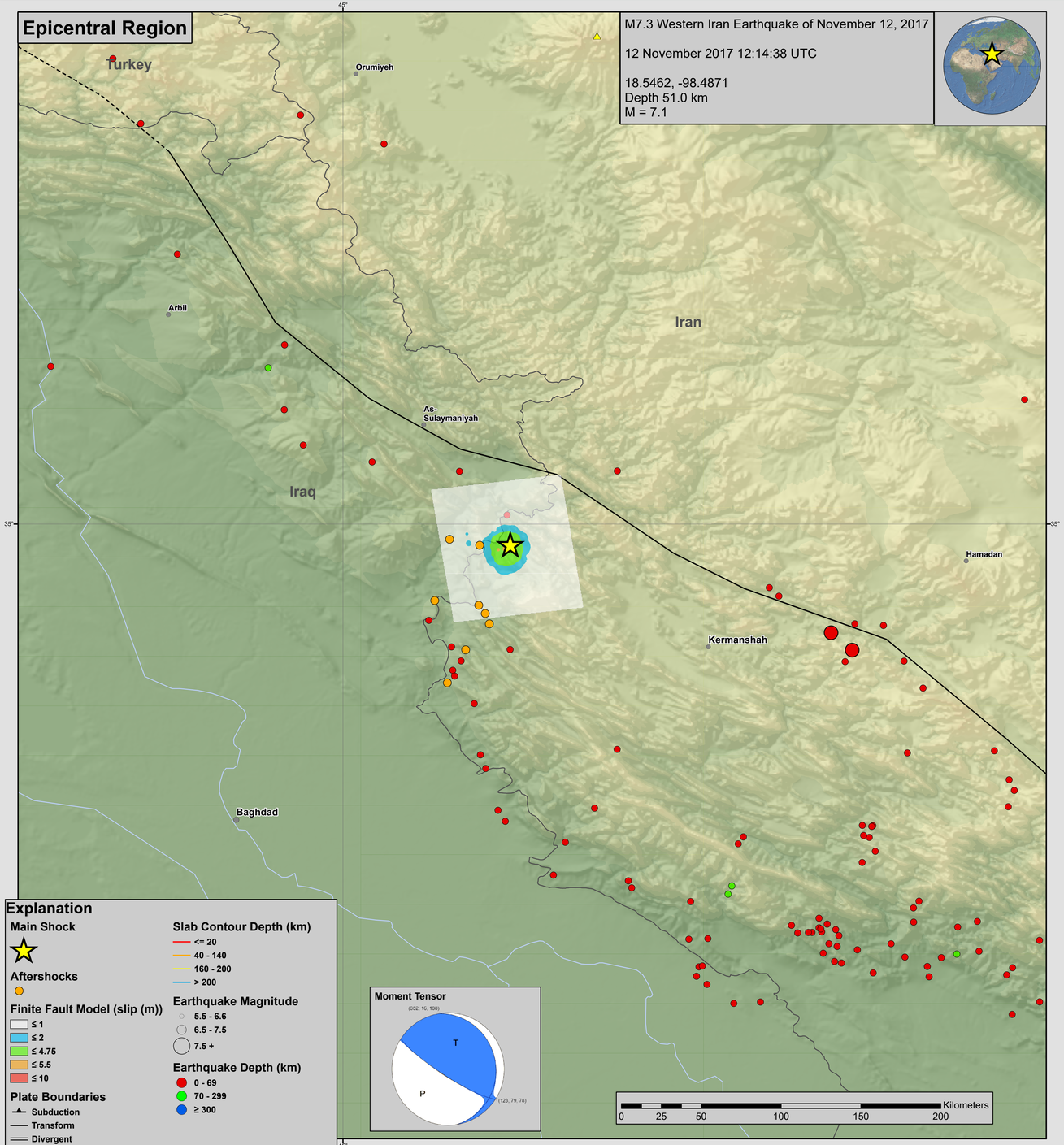
U.S. Department of the Interior
U.S. Geological Survey

M7.3 Western Iran Earthquake of November 12, 2017

Earthquake Summary Map
prepared in cooperation with
the Global Seismographic Network



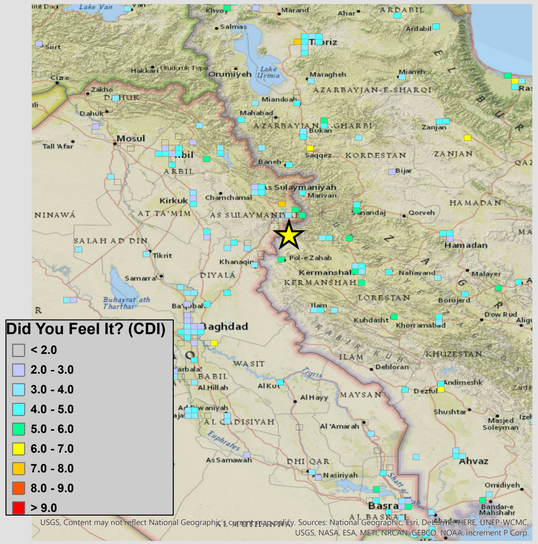
Tectonic Summary

The November 12, 2017 M 7.3 earthquake near the Iran-Iraq border in northwest Iran (220 km northeast of Baghdad, Iraq) occurred as the result of oblique-thrust faulting at mid-crustal depth (~25 km). Preliminary focal mechanism solutions for the event indicate rupture occurred on a fault dipping shallowly to the east-northeast, or on a fault dipping steeply to the southwest. At the location of this earthquake, the Arabia plate is moving towards the north with respect to Eurasia at a rate of about 26 mm/yr. The two plates converge along a northwest-striking plate boundary in the general vicinity of this earthquake, driving the uplift of the Zagros mountains in Iran. The location of the event and the shallow, northeast-dipping plane of the focal mechanism solution are consistent with rupture of a plate boundary related structure in this region.

While commonly plotted as points on maps, earthquakes of this size are more appropriately described as slip over a larger fault area. Oblique-thrust-faulting events of the size of the November 12th, 2017 earthquake are typically about 65x25 km (length x width).

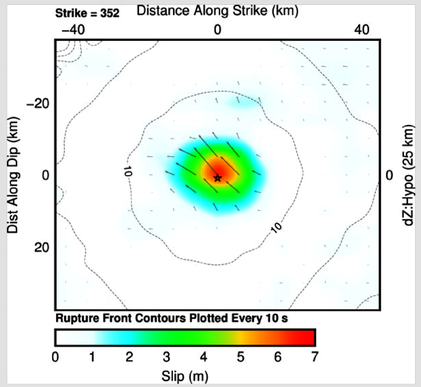
Over the preceding century, the region within 250 km of the hypocenter of the November 12, 2017 earthquake has experienced 4 other M6+ earthquakes. The most recent of these was a M 6.1 earthquake about 100 km to the south of the November 2017 event in January 1967. In the late 1950s and early 1960s, a cluster of M 6.0-6.7 earthquakes occurred along the plate boundary about 200 km to the southeast of today's earthquake. In November 2013, a pair of M 5.6 and M 5.8 earthquakes occurred about 60 km south of the November 2017 event. They are not known to have caused significant damage or fatalities. A M 7.4 earthquake in June 1990, 400 km to the northeast of the November 12, 2017 event, caused between 40,000-50,000 fatalities, more than 60,000 injuries, and left more than 600,000 homeless in the in the Rasht-Qazvin-Zanjan area of Iran.

Did You Feel It?



Finite Fault Model

Distribution of the amplitude and direction of slip for subfault elements of the fault rupture model are determined from the inversion of teleseismic body waveforms and long period surface waves. Arrows indicate the amplitude and direction of slip (of the hanging wall with respect to the foot wall); the slip is also colored by magnitude. The view of the rupture plane is from above. The strike of the fault rupture plane is 352° and the dip is 16°E. The dimensions of the subfault elements are 6 km in the strike direction and 5 km in the dip direction. The rupture surface is approximately 35 km along strike and 20 km along downdip. The seismic moment release based upon this plane is 1.2e+27 dyne.cm.



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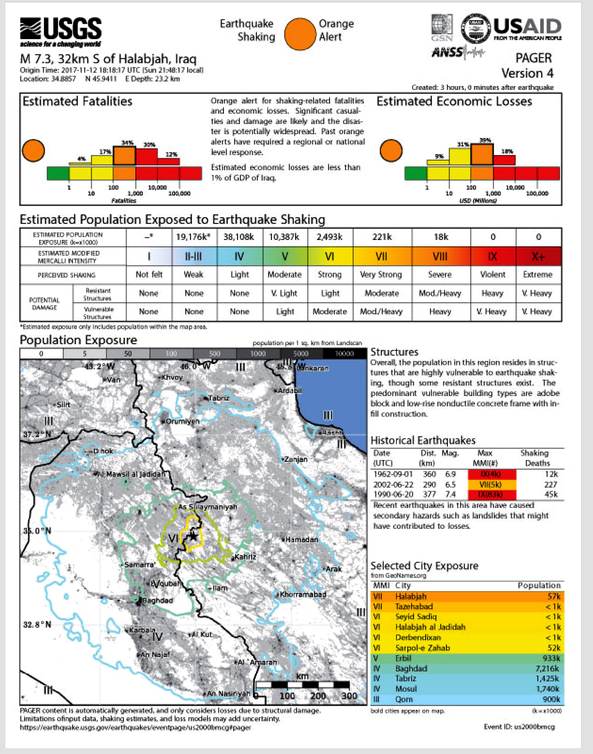

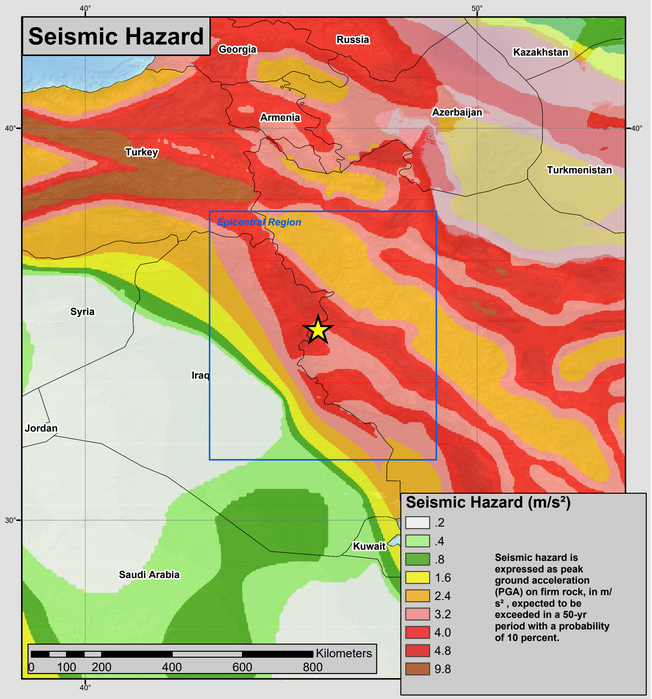

DATA SOURCES

EARTHQUAKES AND SEISMIC HAZARD
USGS, National Earthquake Information Center
NOAA, National Geophysical Data Center
IASPEI, Centennial Catalog (1900 - 1999) and extensions (Engdahl and Villaseñor, 2002)
EHB catalog (Engdahl et al., 1998)
HDF (unpublished earthquake catalog, Engdahl, 2003)
Global Seismic Hazard Assessment Program
Volcanoes of the World (Siebert and Simkin, 2002)

PLATE TECTONICS AND FAULT MODEL
PB2002 (Bird, 2003)
Ji, C., D.J. Wald, and D.V. Helmberger, Source description of the 1999 Hector Mine, California earthquake; Part I: Wavelet domain inversion theory and resolution analysis, Bull. Seism. Soc. Am., Vol 92, No. 4. pp. 1192-1207, 2002.
DeMets, C., Gordon, R.G., Argus, D.F., 2010. Geologically current plate motions, Geophys. J. Int. 181, 1-80.

BASE MAP
NIMA and ESRI, Digital Chart of the World
USGS, EROS Data Center
NOAA GEBCO and GLOBE Elevation Models

REFERENCES

Bird, P., 2003, An updated digital model of plate boundaries: Geochem. Geophys. Geosyst., v. 4, no. 3, pp. 1027-80.

Engdahl, E.R., and Villasenor, A., 2002, Global Seismicity: 1900-1999, chap. 41 of Lee, W.H.K., and others, eds., International Earthquake and Engineering Seismology, Part A: New York, N.Y., Elsevier Academic Press, 932 p.

Engdahl, E.R., Van der Hilst, R.D., and Buland, R.P., 1998, Global teleseismic earthquake relocation with improved travel times and procedures for depth determination;Bull. Seism. Soc. Amer., v. 88, p. 722-743.

DISCLAIMER

Base map data, such as place names and political boundaries, are the best available but may not be current or may contain inaccuracies and therefore should not be regarded as having official signifiance.

Map updated by U.S. Geological Survey National Earthquake Information Center
13 November 2017
http://earthquake.usgs.gov/
Map not approved for release by Director USGS