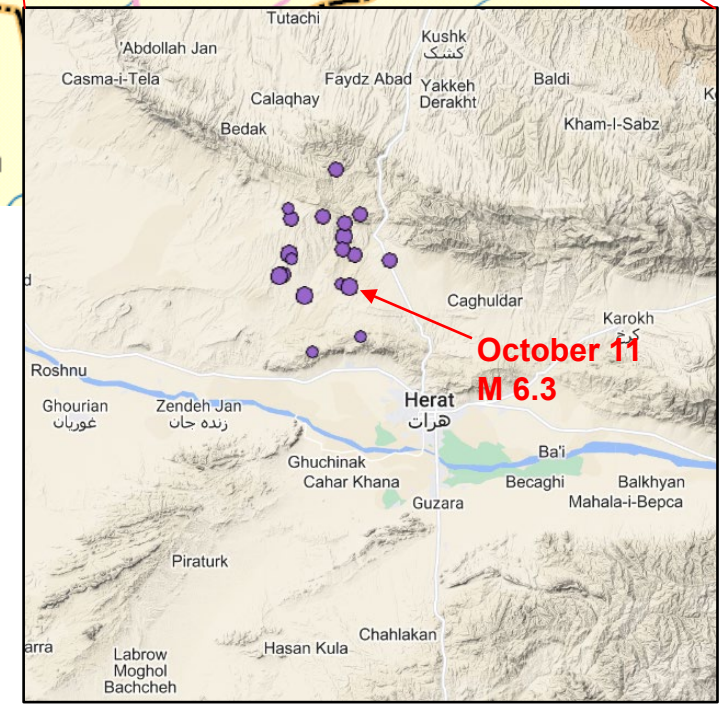
Magnitude 6.3 AFGHANISTAN

Wednesday, October 11, 2023 at 00:41:56 UTC

Latitude 34.557° N
Longitude 62.045° E
Depth 9 km

Another magnitude 6.3 earthquake has struck western Afghanistan, the 3rd M 6.3 earthquake in a sequence of 19 earthquakes that have occurred since October 7, 2023. The October 7th earthquakes killed more than 2,000 people and flattened whole villages in Herat province in what has become the most destructive earthquakes in the country's recent history.



Early reports indicate an additional death has been recorded along with 120 injuries. Fewer people were injured because many have been sleeping in tents fearful of the continuing aftershocks. More structures in the region were damaged in this earthquake. Overall, nearly 2,000 houses in 20 villages have been destroyed. Additionally, this earthquake triggered a landslide that blocked the main Herat- Towrgondi highway.

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A general view of the ruined Chaahak village after an earthquake in Zenda Jan district in Herat province, western Afghanistan, Wednesday, Oct. 11, 2023. Another strong earthquake shook western Afghanistan on Wednesday morning after an earlier one killed more than 2,000 people. (AP Photo/Ebrahim Noroozi)

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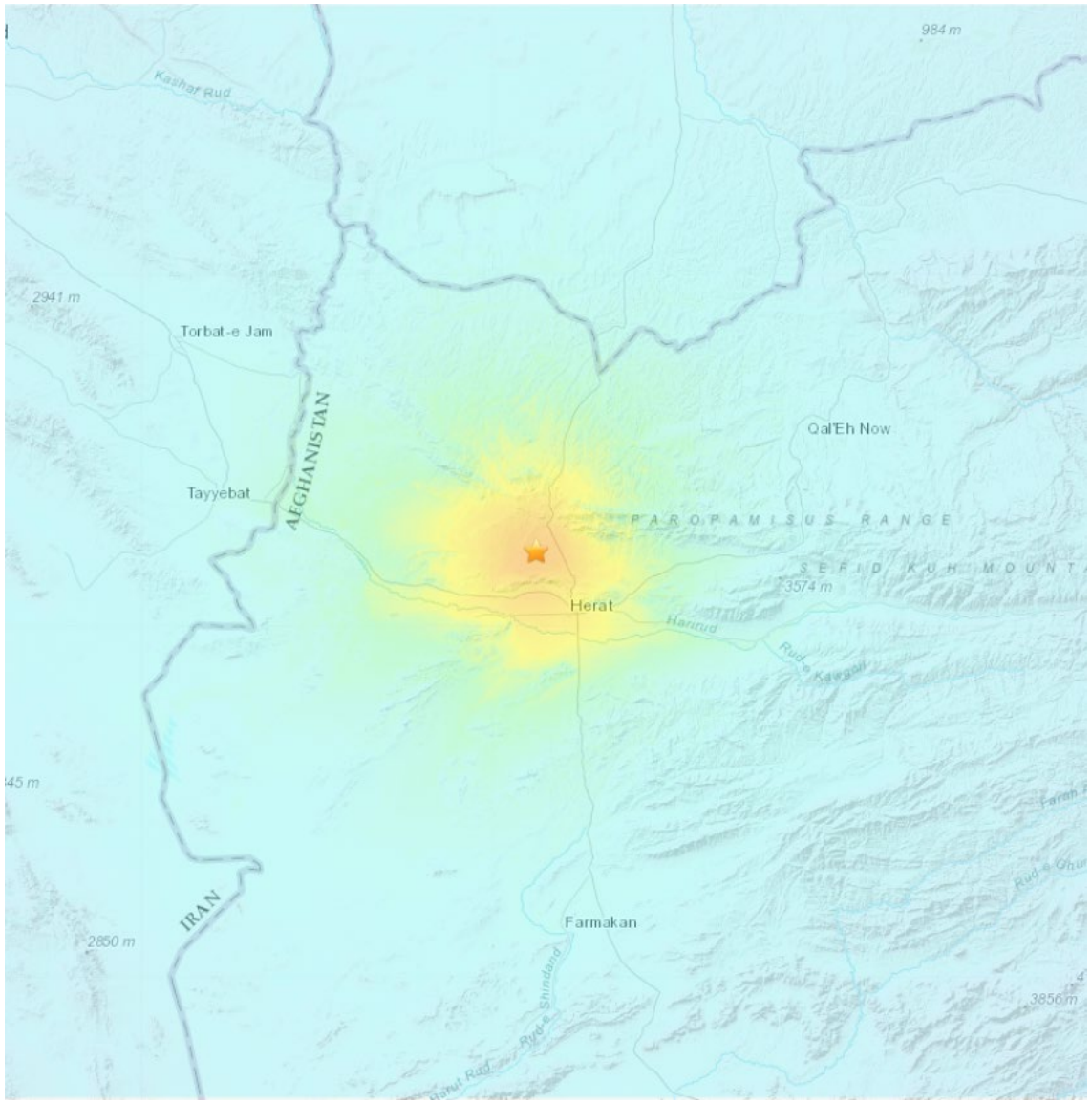
The Modified-Mercalli Intensity (MMI) scale is a ten-stage scale, from I to X, that indicates the severity of ground shaking. Intensity is based on observed effects and is variable over the area affected by an earthquake. Intensity is dependent on earthquake size, depth, distance, and local conditions.

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



USGS estimated shaking intensity from M 6.3 Earthquake

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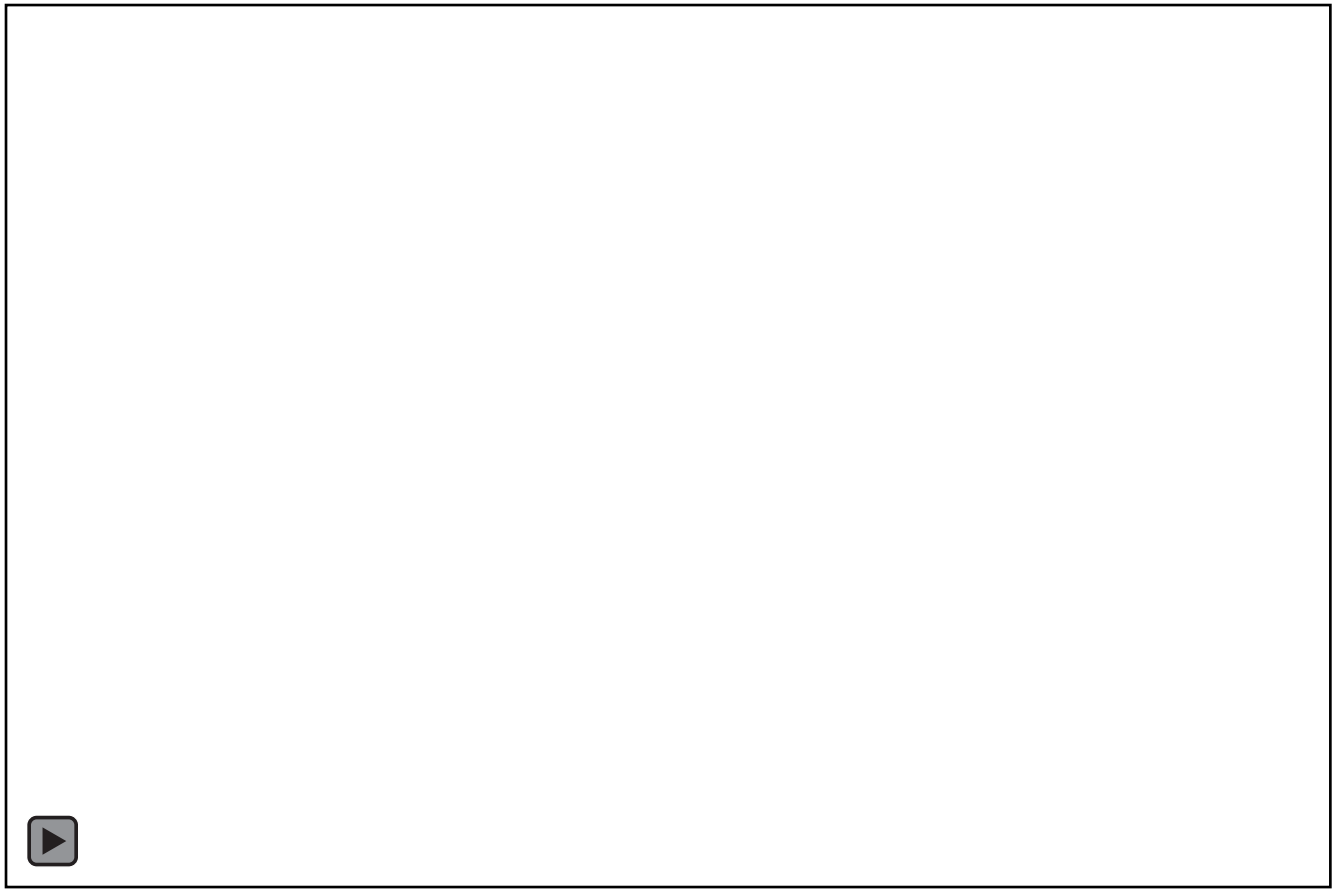
Animation of the full earthquake sequence including the three M 6.3 earthquakes, as well as the 16 smaller aftershocks.

These earthquakes, northwest of the city of Herat, caused strong ground shaking in Herat and throughout the smaller towns that surrounded the epicenter.



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Map generated from the Interactive Earthquake Browser (www.iris.edu/ieb)

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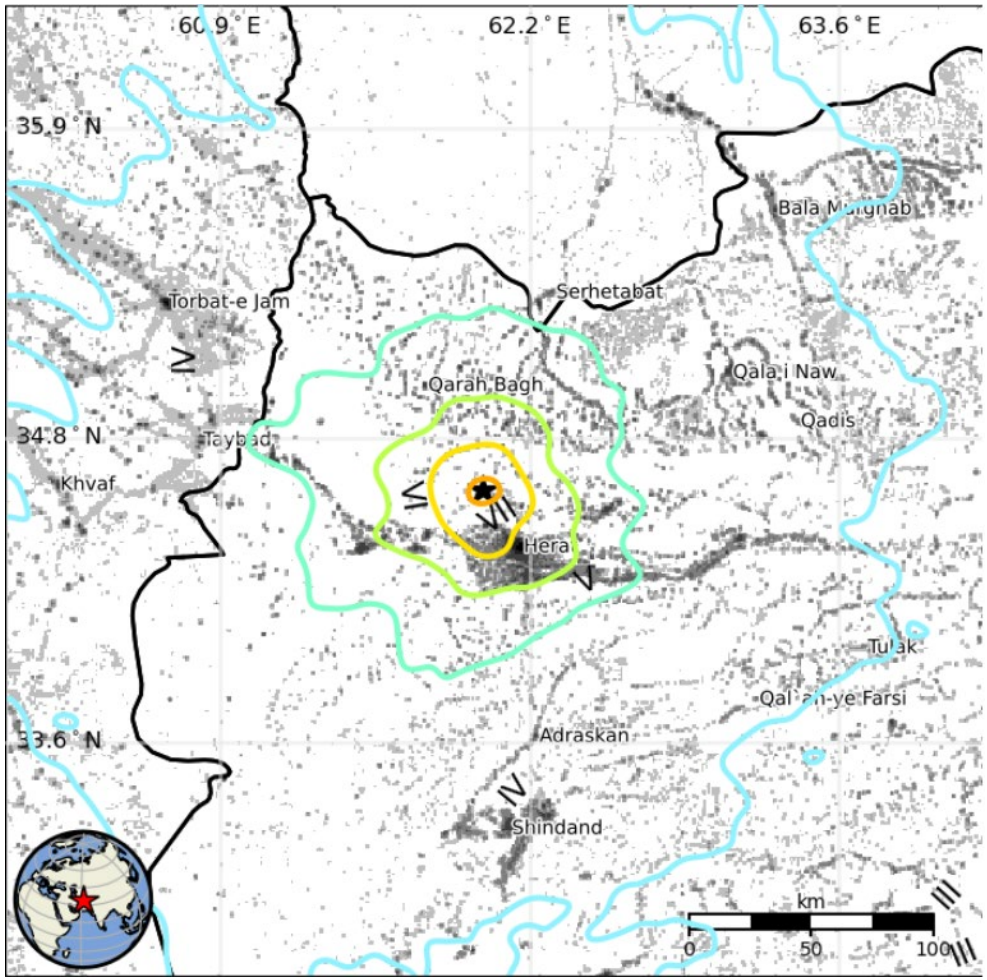
The USGS PAGER map shows the population exposed to different Modified Mercalli Intensity (MMI) levels. The USGS estimates that 4,000 people felt severe shaking from this M 6.3 earthquake.

I	Not Felt	0 k*
II-III	Weak	453 k*
IV	Light	2,295 k
V	Moderate	606 k
VI	Strong	900 k
VII	Very Strong	373 k
VIII	Severe	4 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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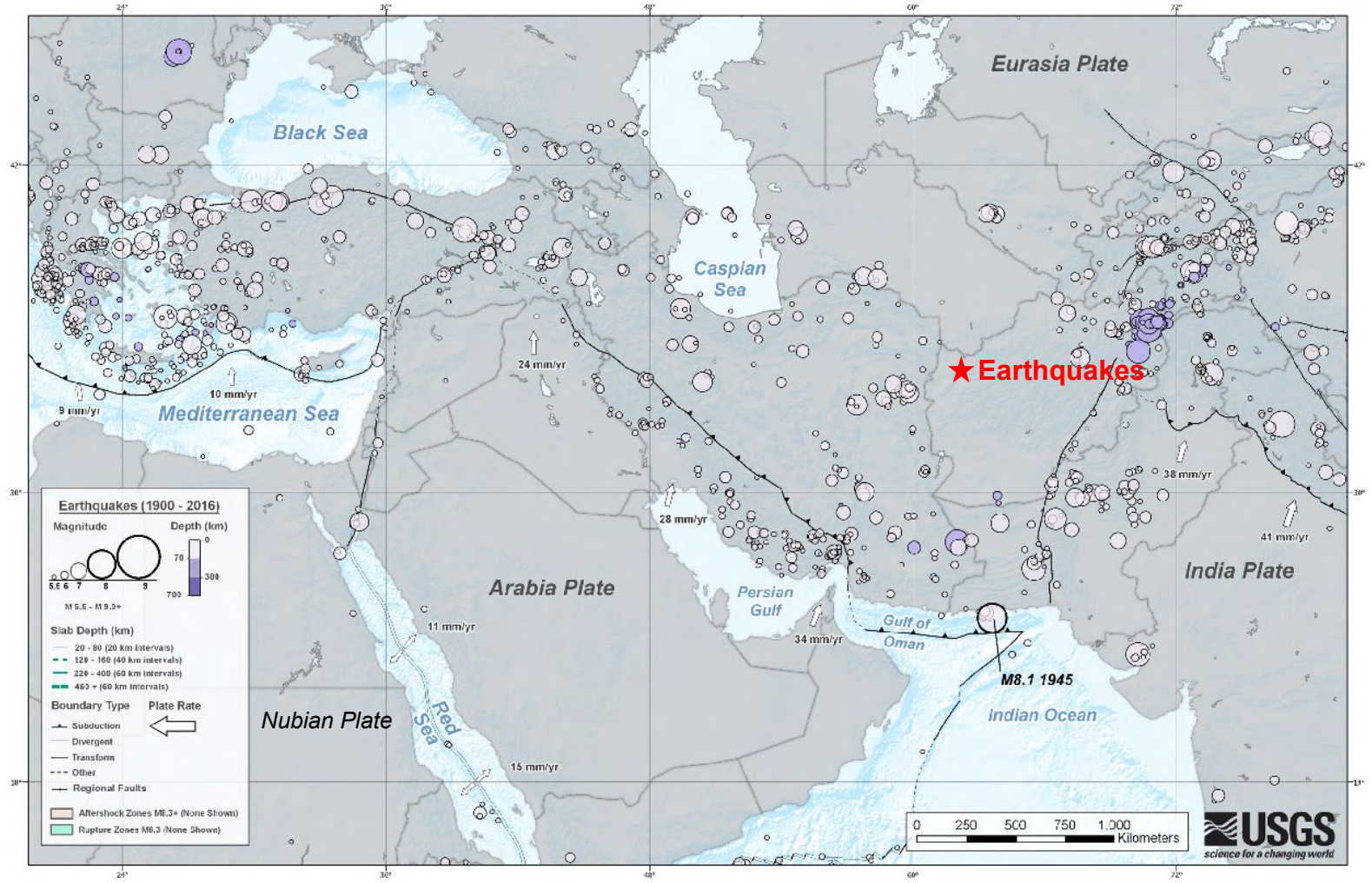
Middle East tectonics and earthquakes result from the interaction of the Eurasia, Arabia, India, and Nubian Plates. This regional tectonics map shows plate motions with respect to the Eurasian Plate. The location of the earthquakes is shown by the red star.



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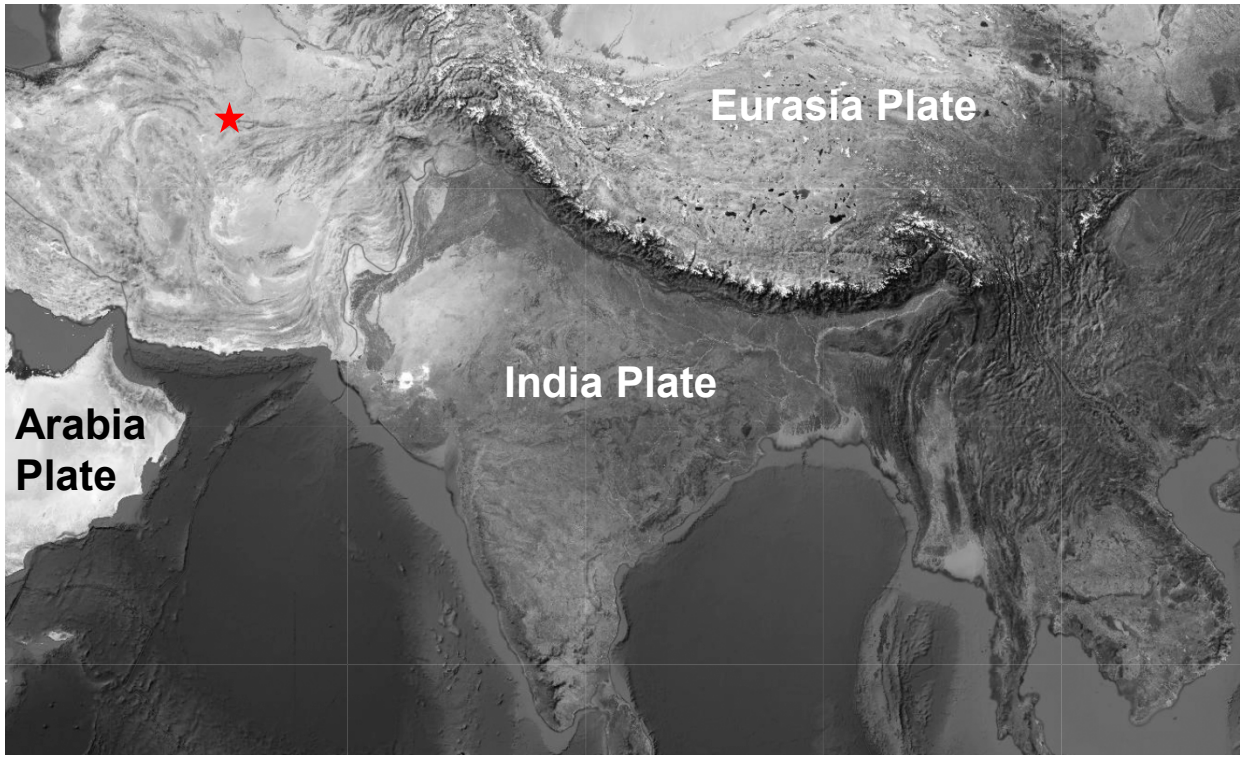
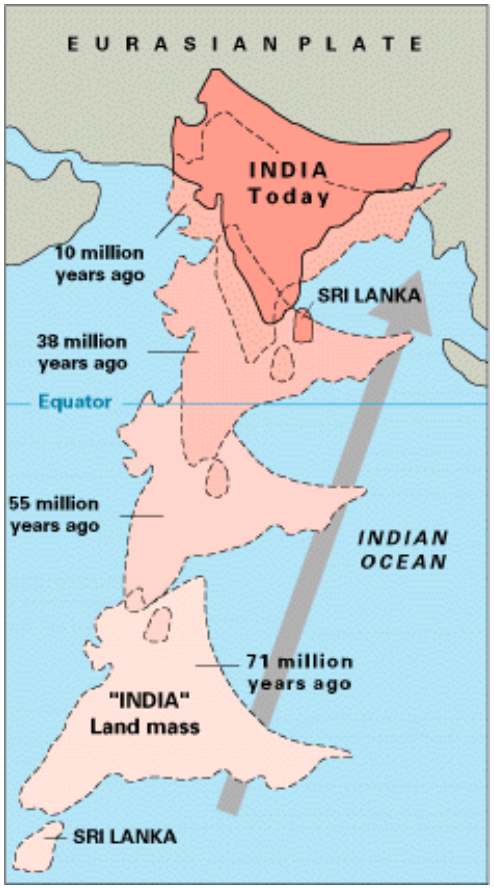
The northward-moving India plate is colliding with southern part of the Eurasian plate at a rate of about 1.7 in/yr (43 mm/yr). This collision has created the world's highest mountains and causes slips on major faults that generate large, often devastating earthquakes.

Earthquakes in Afghanistan are most abundant in and near the northeastern part of the country where the effects of the plate collision between India and Asia are most pronounced.





However, earthquakes in western and central Afghanistan are primarily influenced by the northward movement of the Arabia Plate relative to the Eurasia Plate.

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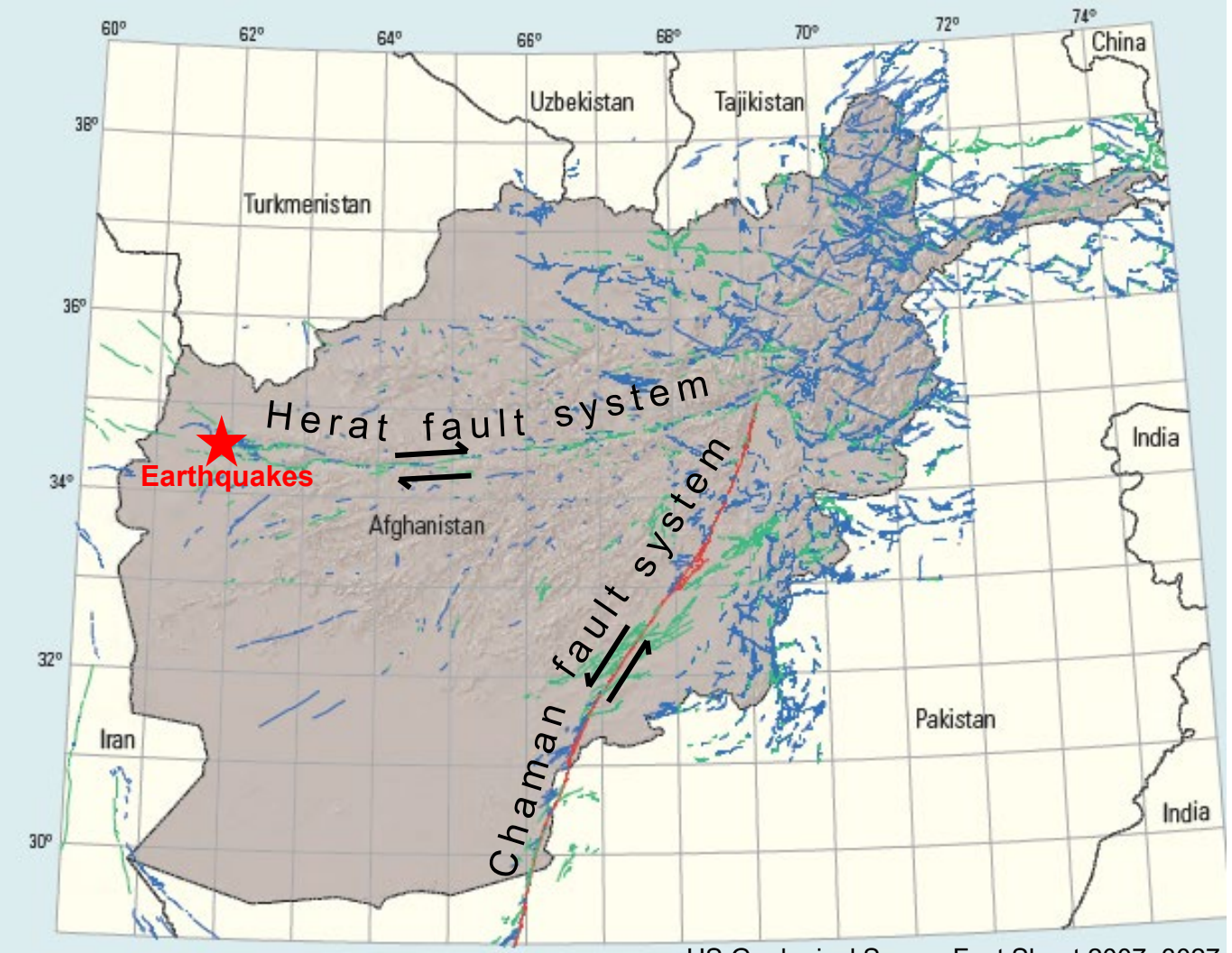
This map of Afghanistan shows locations of features thought to young crustal faults. The left-lateral strike-slip Chaman fault system, shown in red, is thought to be the most active and hazardous fault. The right-lateral strike-slip Herat fault system, shown in green, is thought to have lower slip rate and be less hazardous. Faults shown in blue are considered even less active.

These earthquakes, indicated by the red star, occurred along or near the western end of the 1100-km-long Herat fault system. In this area, the Herat fault system splits into smaller faults with vertical displacements that formed the Herat basin. Indeed, the focal mechanisms of these earthquakes indicate that they were produced by thrust faulting.



US Geological Survey Fact Sheet 2007–3027

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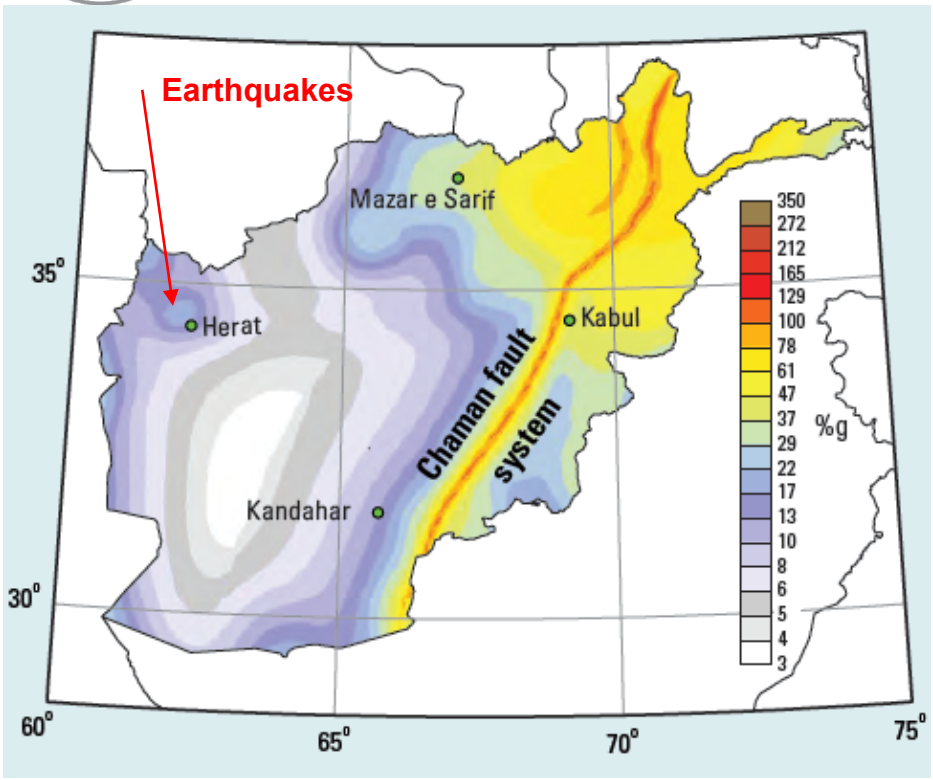

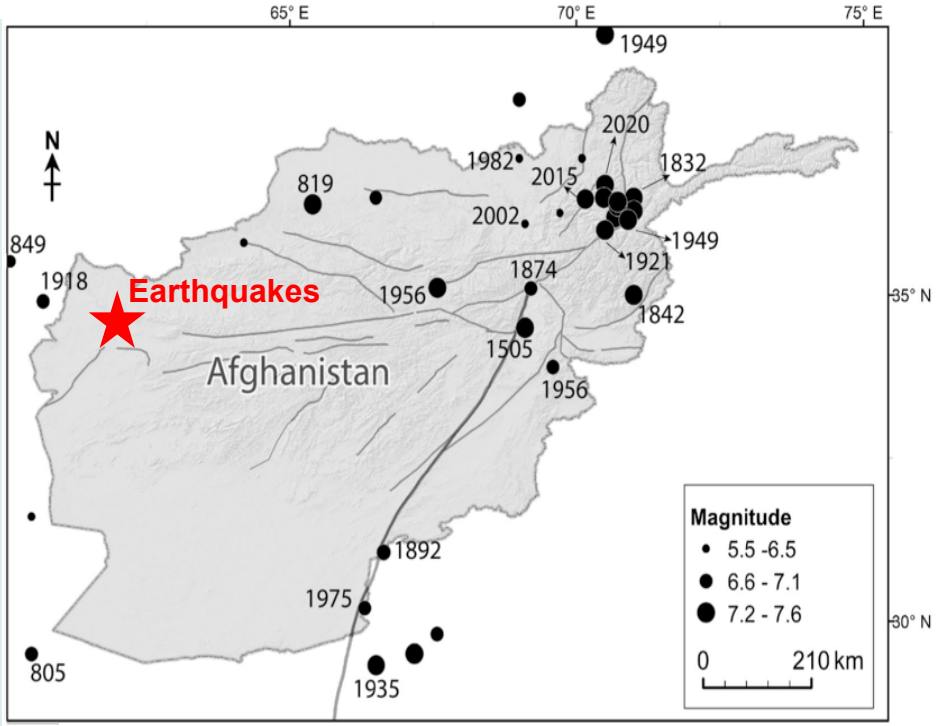

From: Z. Shnizai, Journal of Seismology, v. 24, p. 1131–1157, 2020

US Geological Survey Fact Sheet 2007–3027

A generalized seismic-hazard map of Afghanistan is shown on the left with hot colors indicating highest hazard and cooler colors indicating lower hazard. A map of damaging historic earthquakes is shown on the right. Eastern and particularly northeastern Afghanistan are the regions of highest seismic hazard and most frequent occurrence of damaging historic earthquakes. These earthquakes, shown by the red star, occurred in western Afghanistan where seismic hazard is thought to be lower and damaging earthquakes have occurred less often. These observations demonstrate that infrequent but shallow strong ($6.0 \leq M \leq 7.0$) earthquakes in areas of structures vulnerable to earthquake ground shaking can result in considerable damage, injuries, and fatalities.

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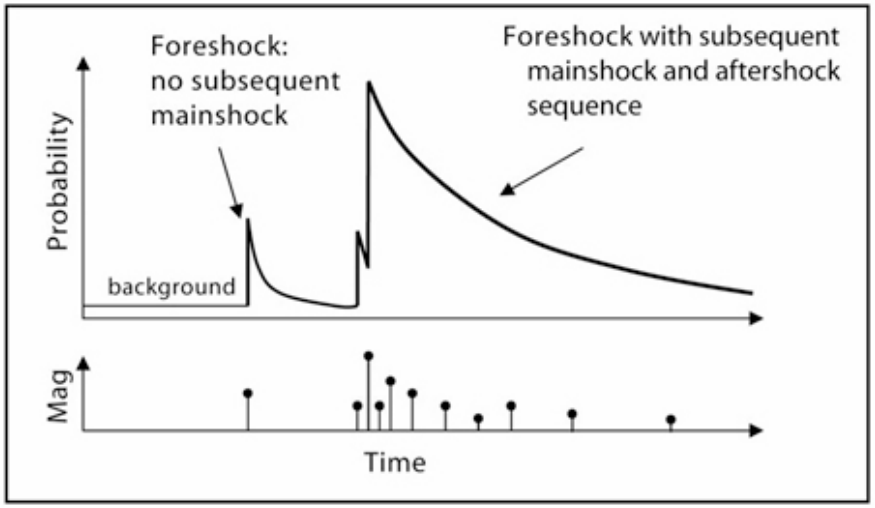
A **foreshock** is a smaller magnitude earthquake that precedes the mainshock. There are no special characteristics of a foreshock that let us know it is a foreshock until the mainshock occurs.

A **mainshock** is largest magnitude earthquake during an earthquake sequence.

Aftershocks are smaller earthquakes occurring after a large earthquake as the fault adjusts to the new state of stress.

The M 6.3 October 11 earthquake is within the cluster of aftershocks of the two M 6.3 October 7 earthquakes. On that basis, the M 6.3 October 11 would be considered an aftershock. However, it is an unusual aftershock in having a magnitude equal to the mainshock.



The graph shows how the number of aftershocks and the magnitude of aftershocks decay with increasing time since the main shock. The number of aftershocks also decreases with distance from the main shock.

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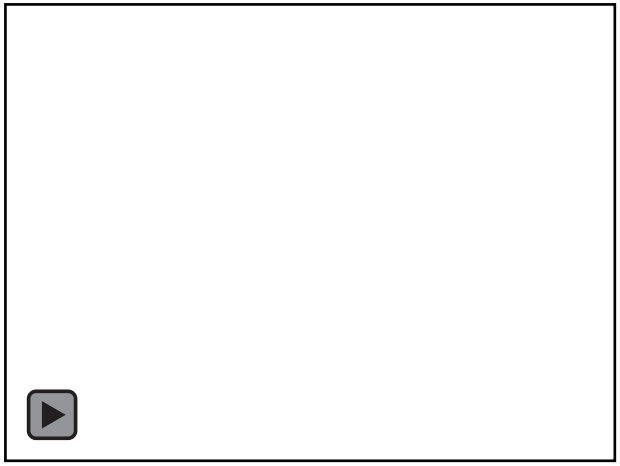
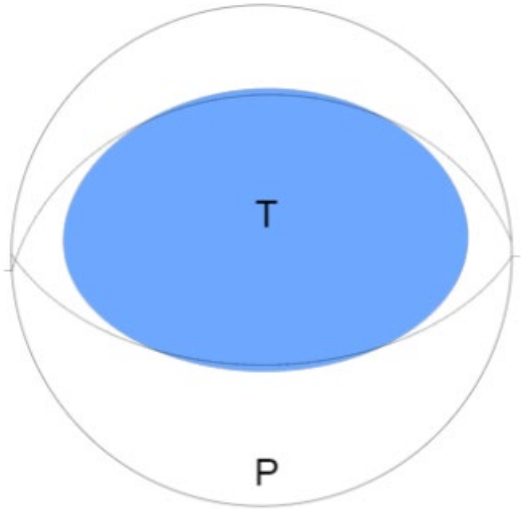
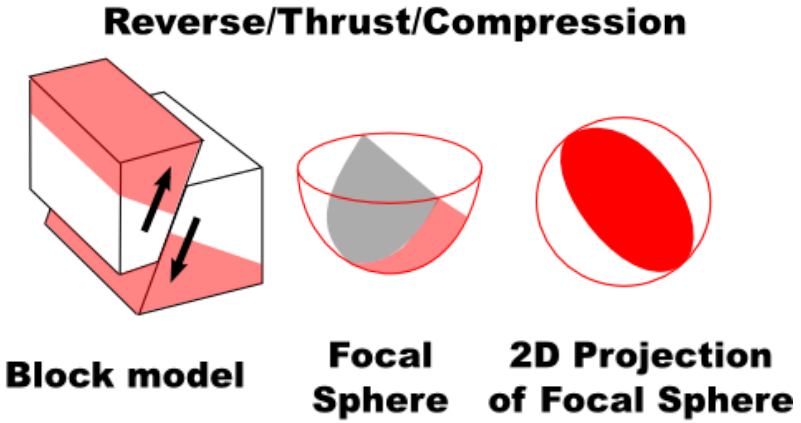
The focal mechanism of this earthquake is consistent with the previous earthquakes in this sequence. The location, depth and focal mechanism indicate rupture occurred as the result of thrust faulting at shallow depths near the far western terminus of the Hindu Kush mountain range.





USGS W-phase Moment Tensor Solution



Shaded areas show quadrants of the focal sphere in which the P-wave first-motions are away from the source, and unshaded areas show quadrants in which the P-wave first-motions are toward the source. The letters represent the axis of maximum compressional strain (P) and the axis of maximum extensional strain (T) resulting from the earthquake.

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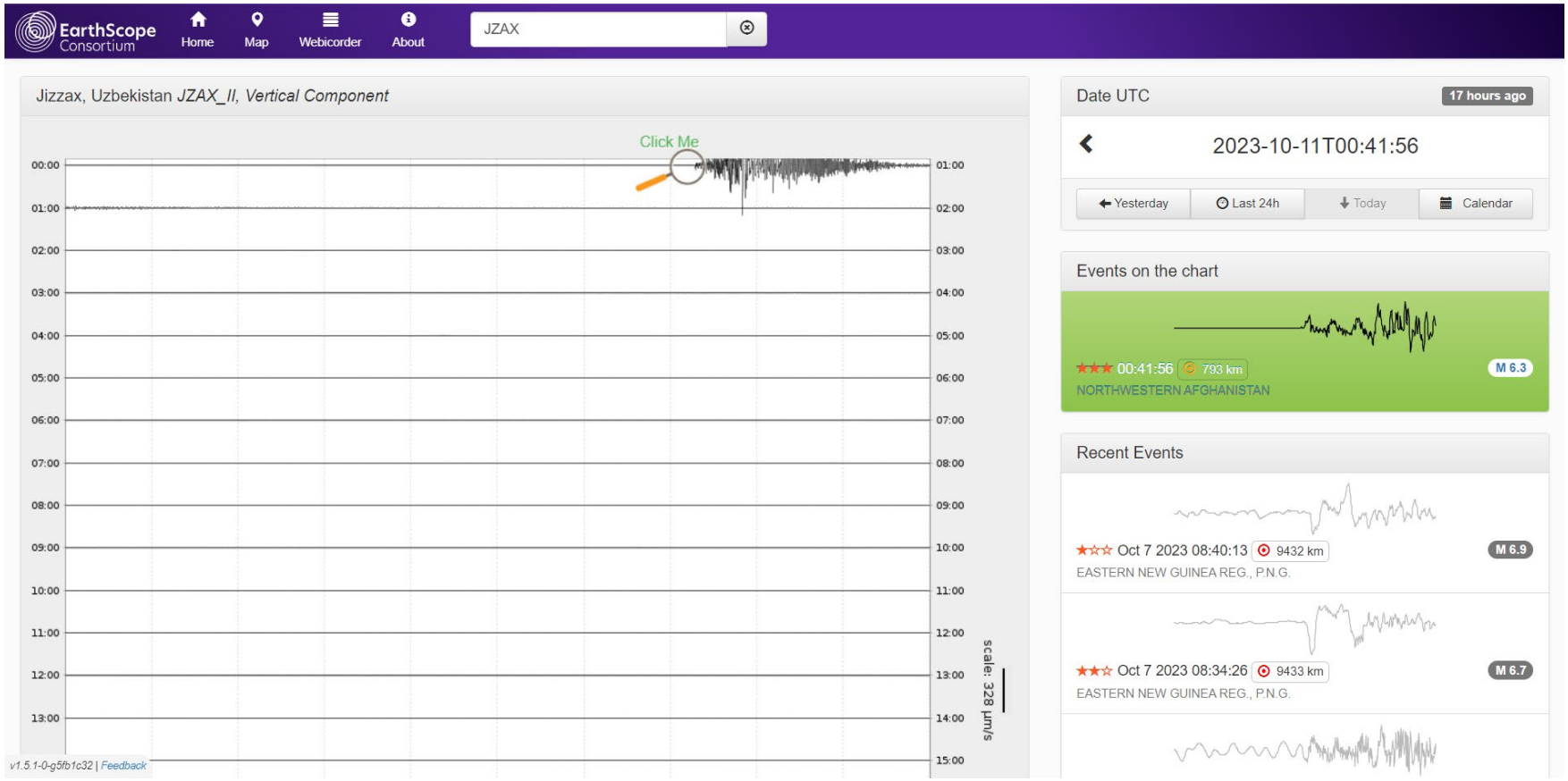
Explore the seismicity using the Station Monitor which provides access to continuous, real-time ground motion from hundreds of locations around the globe. This data, collected by seismometers, measures motion generated by earthquakes, volcanic eruptions, and other seismic sources.

See the recording of the recent and previous earthquakes in Jizzax, Uzbekistan.
https://www.iris.edu/app/station_monitor/#2023-10-11T00:41:56/II-JZAX/webicorder/II-JZAX|11755101



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