



Magnitude 6.8 MOROCCO

Friday, September 8, 2023 at 22:11:01 UTC

Latitude 31.110° N
Longitude 8.440° W
Depth 18.5 km

A magnitude 6.8 earthquake occurred late Friday evening local time 71km (44 miles) southwest of Marrakesh, the fourth largest city in Morocco, at a depth of 18.5 km (11.5 miles).

Early reports indicate damaged buildings, over 1000 casualties, and disruption to power and phone services.

Reports on damage and casualties often take time to filter in after earthquakes, particularly those that occur in the middle of the night.



A cracked mosque minaret stands in Moulay Brahim village, near Marrakech, Morocco, Saturday, Sept. 9, 2023. A rare, powerful earthquake struck Morocco late Friday night, killing more than 1000 people and damaging buildings from villages in the Atlas Mountains to the historic city of Marrakech. But the full toll was not known as rescuers struggled to get through boulder-strewn roads to the remote mountain villages hit hardest. (AP Photo/Mosa'ab Elshamy)

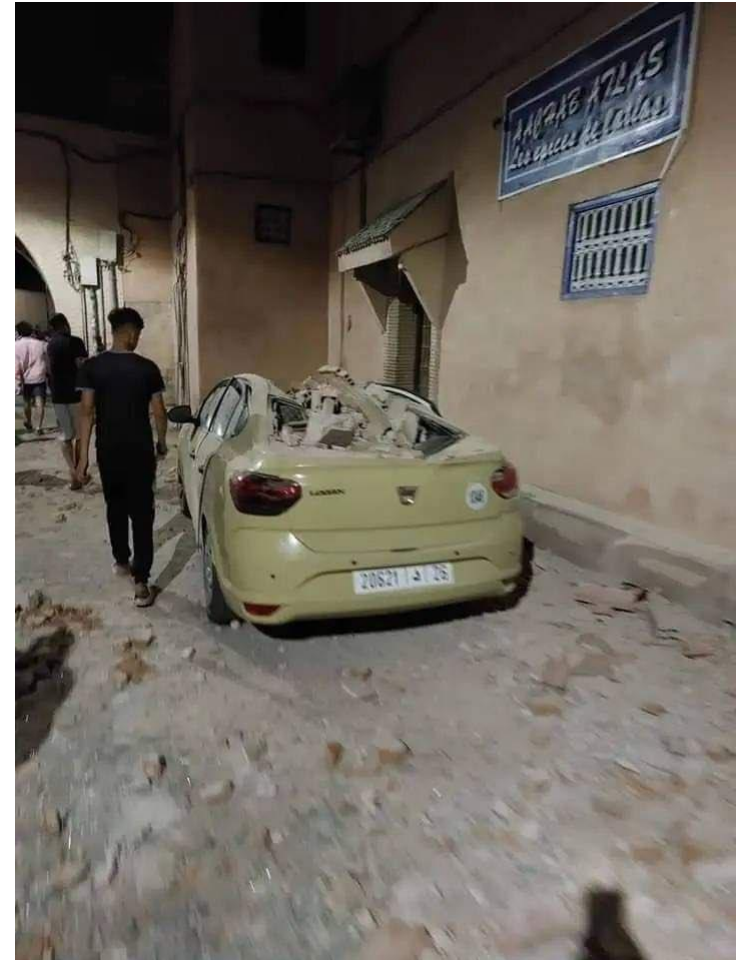


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Reports of damage have emerged on social media from Marrakesh, Morocco. The extent of the devastation is not immediately known.

Founded in 1070-1072, Marrakesh was, for a long time, a major political, economic and cultural center of the western Muslim world and is an UNESCO world heritage site.



Images courtesy of X



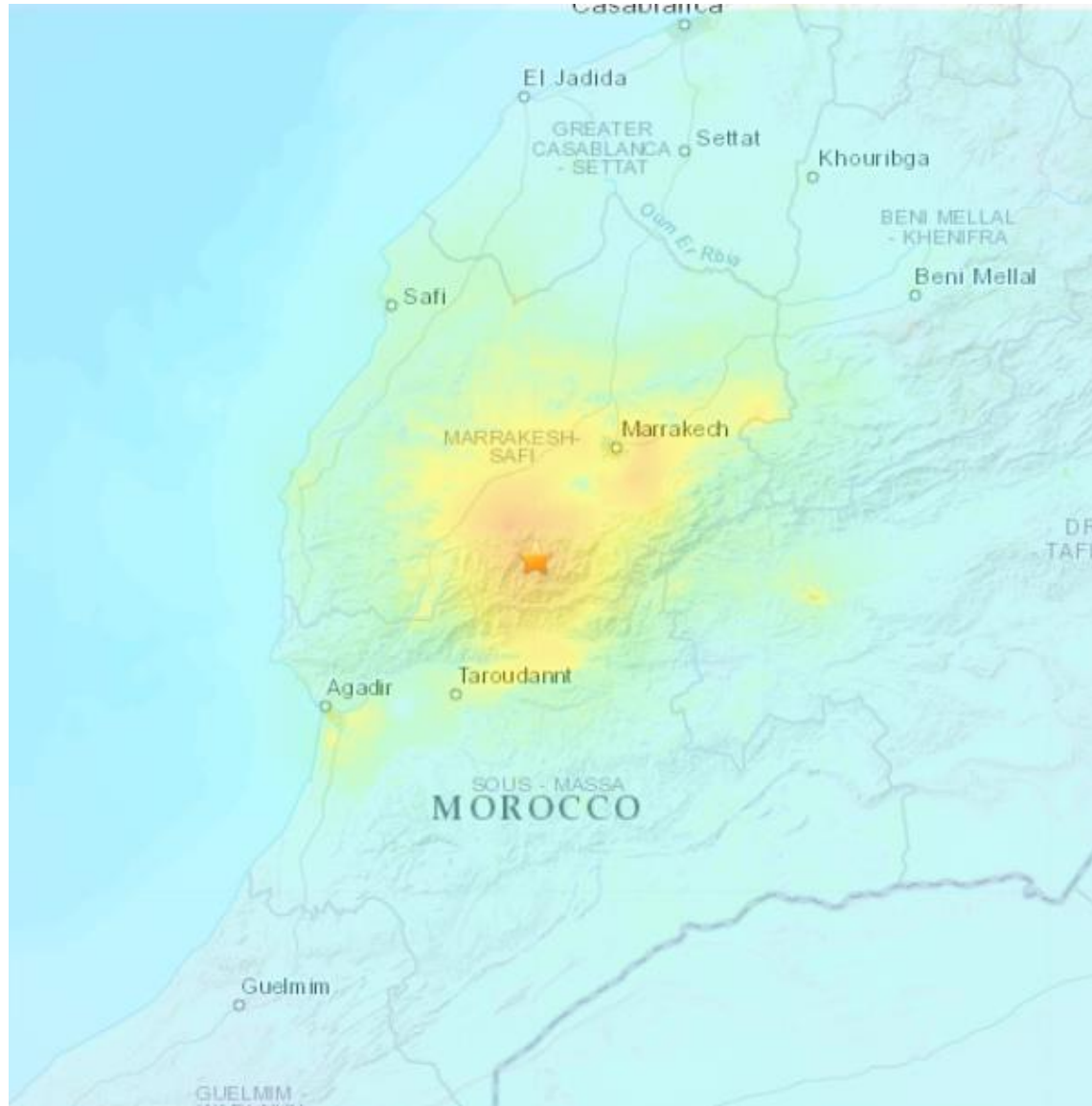
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The Modified-Mercalli Intensity (MMI) scale is a ten-stage scale, from I to X, that indicates the severity of ground shaking. Intensity is based on observed effects and is variable over the area affected by an earthquake. Intensity is dependent on 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 6.8 Earthquake

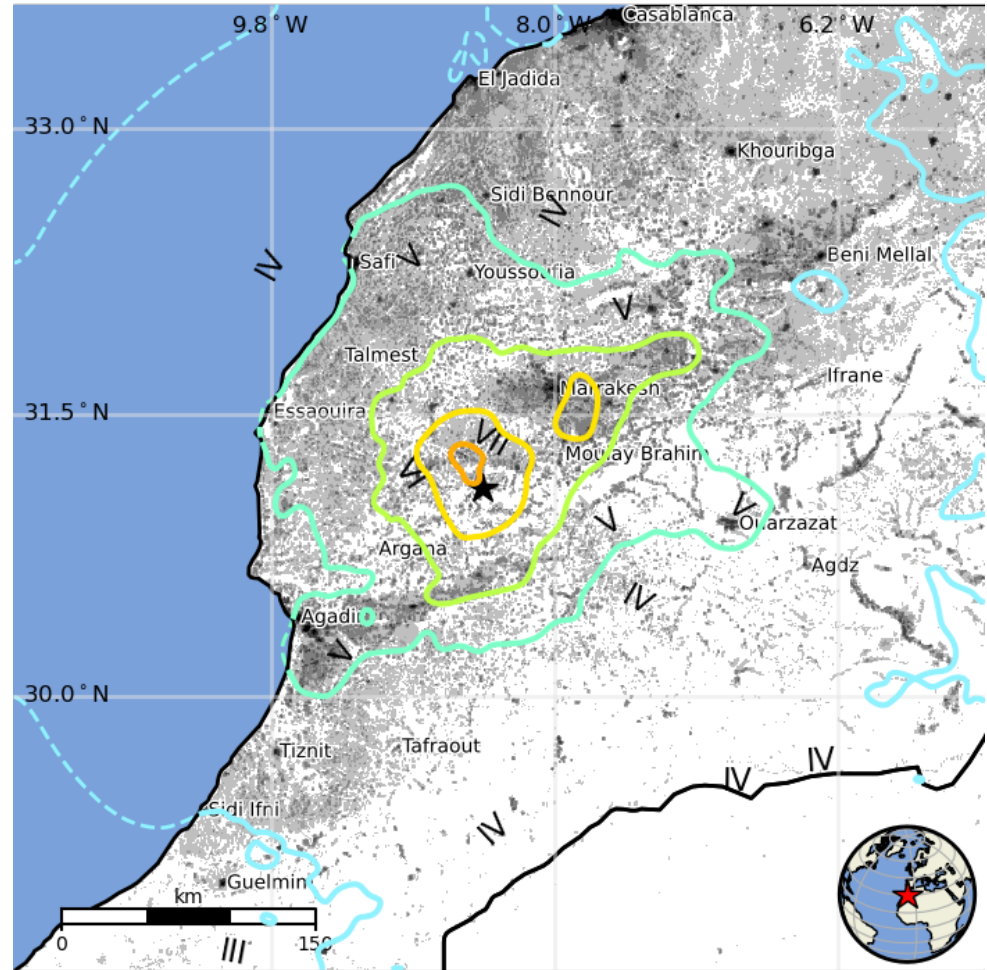


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The USGS PAGER map shows the population exposed to different Modified Mercalli Intensity (MMI) levels. The USGS estimates that 49,000 people felt severe shaking from this earthquake.

I	Not Felt	0 k*
II-III	Weak	550 k*
IV	Light	11,163 k*
V	Moderate	4,369 k
VI	Strong	2,800 k
VII	Very Strong	403 k
VIII	Severe	49 k
IX	Violent	0 k
X	Extreme	0 k



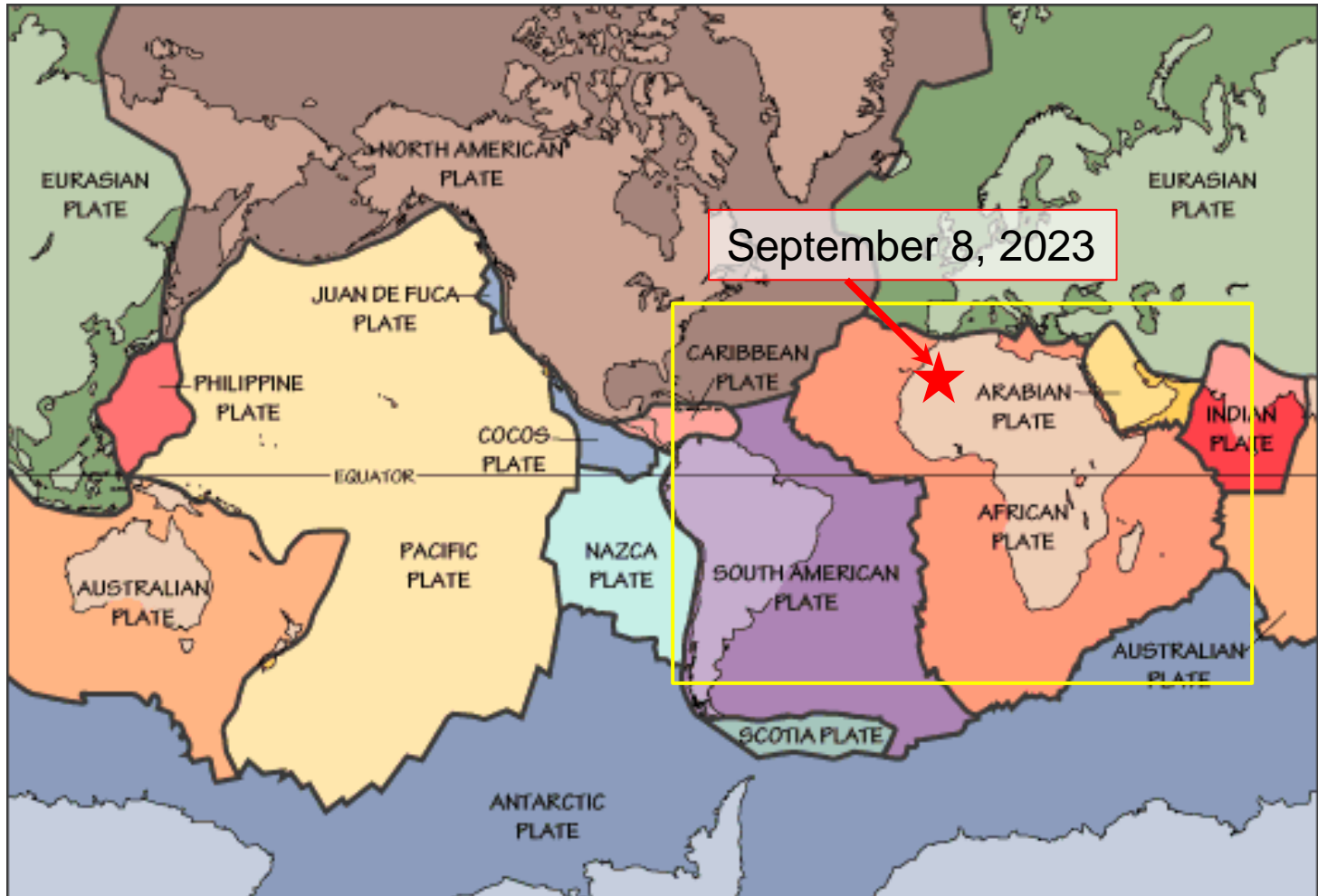
The color-coded contour lines outline regions of MMI intensity. The total population exposure to a given MMI value is obtained by summing the population between the contour lines. The estimated population exposure to each MMI Intensity is shown in the table.

Image courtesy of the US Geological Survey



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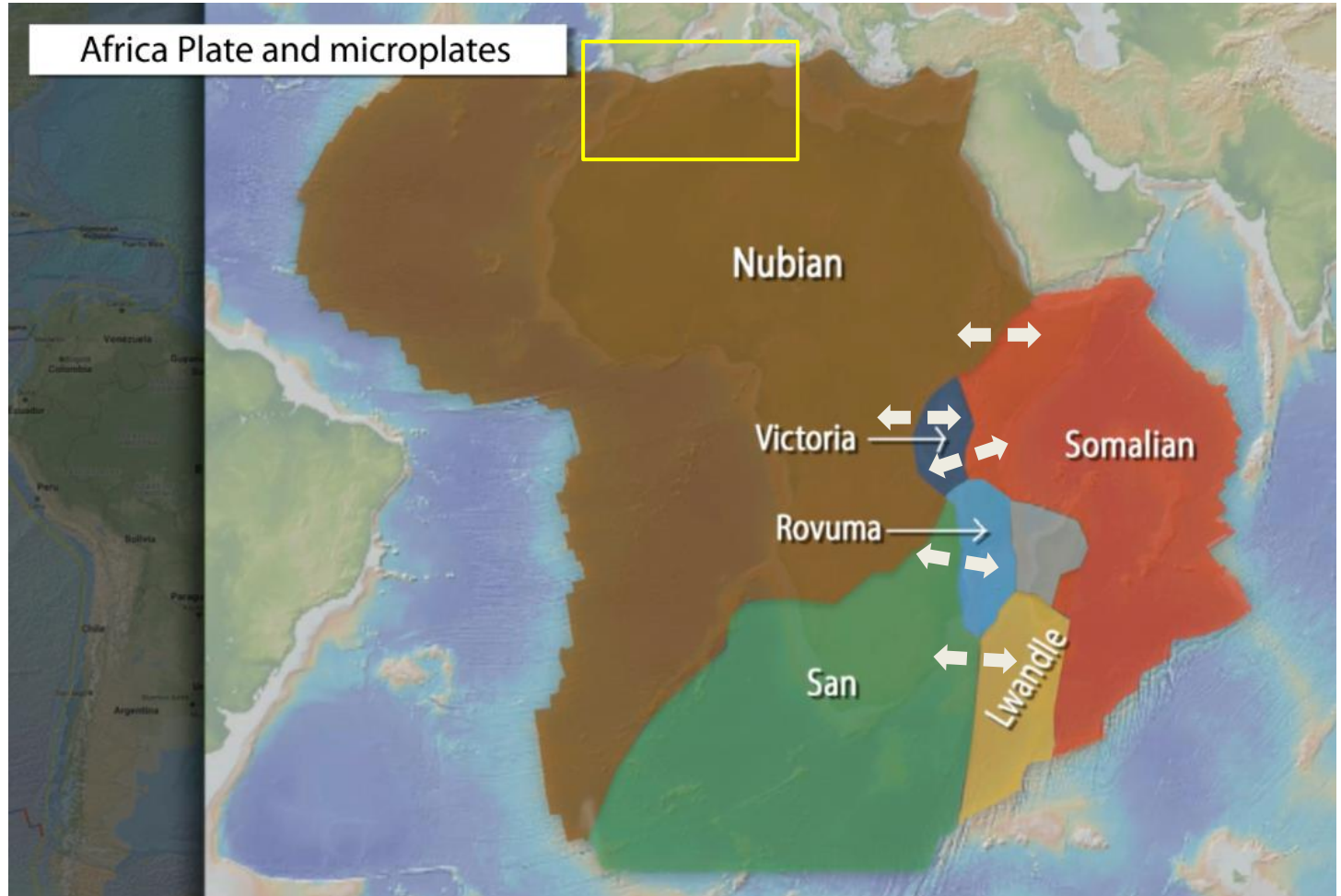


On simplified world maps, the “African Plate” contains the African continent and surrounding oceanic plate, shown in orange, on the west, south, and east sides of the continent. The next slide shows a more detailed view of plates and microplates within the region outlined by the yellow rectangle.



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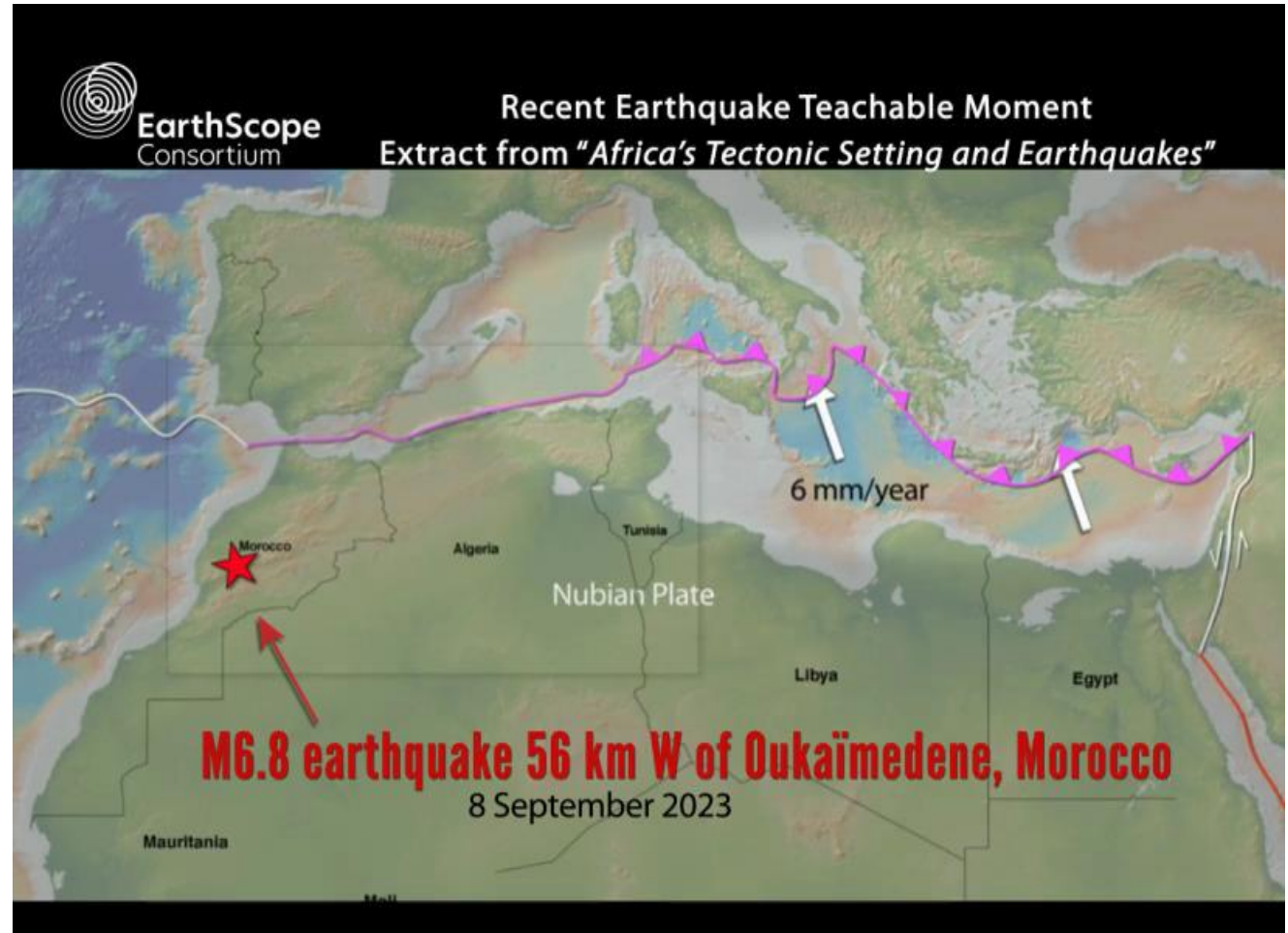
The East African Rift System cuts roughly north – south across eastern Africa. Tectonic extension along the rift system is breaking the “African Plate” into at least six smaller plates. The largest of these is the Nubian Plate that contains the western and northern parts of the African continent. The next slide contains an animation describing major structures in northern Africa, within the yellow rectangle, that are related to the boundary between the Eurasian and Nubian plates.



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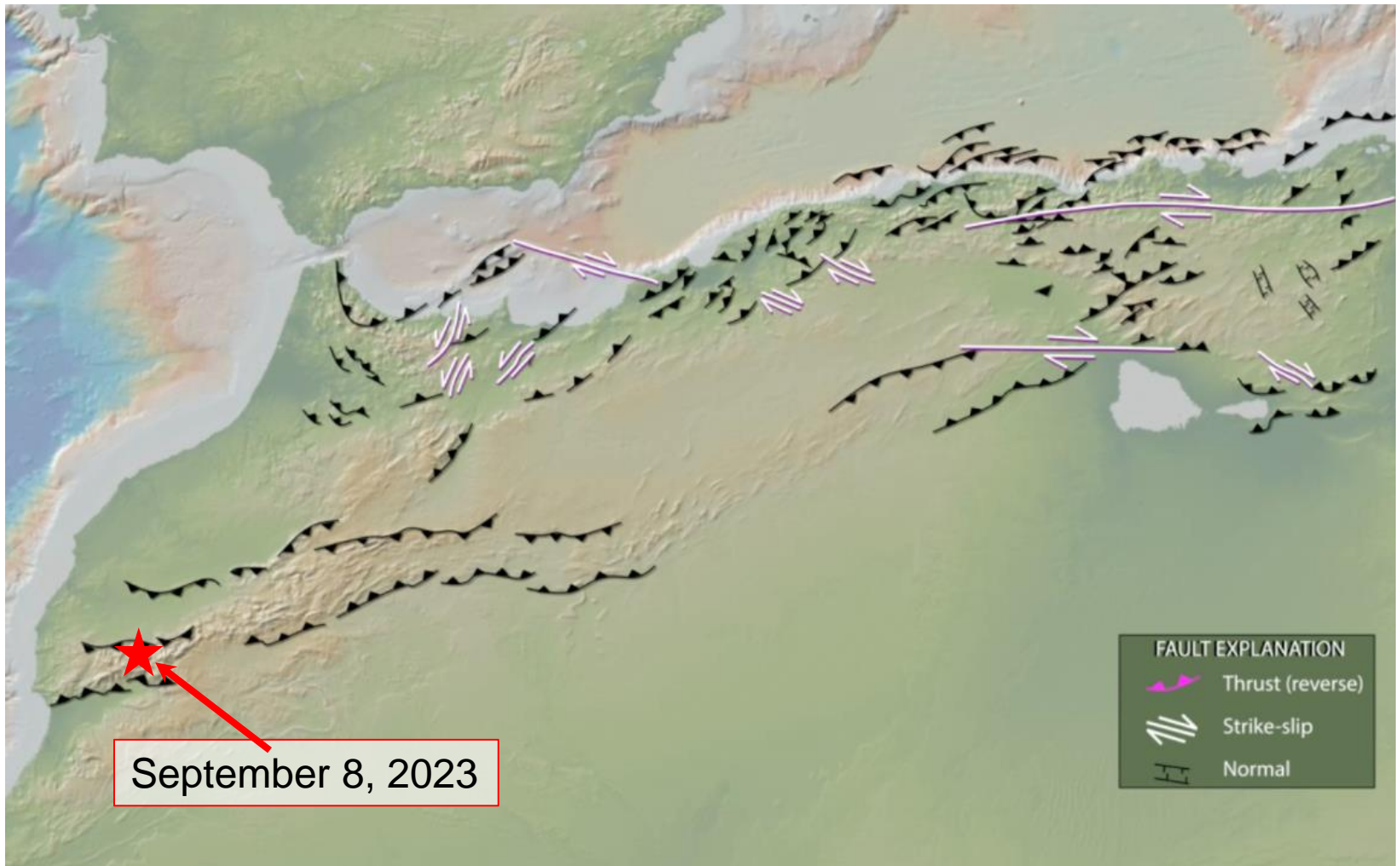
An animation exploring the regional tectonics of the Moroccan High Atlas Mountain range and historical earthquakes in this region of Africa.





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The epicenter of the September 8, 2023 earthquake is shown by the red star on this map summarizing regional tectonic features of north Africa. Consistent with the thrust-faulting focal mechanism, the September 8 earthquake occurred on or near east – west oriented thrust faults of the western Atlas Mountains.

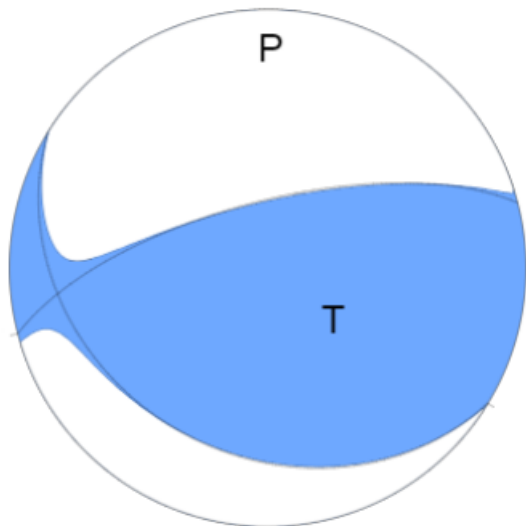


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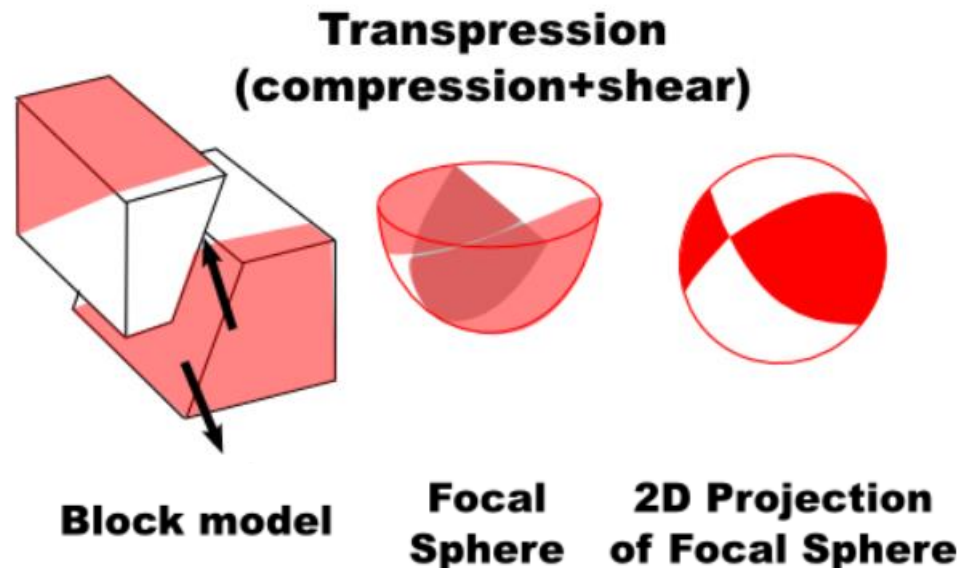
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Shaded areas show quadrants of the focal sphere in which the P-wave first-motions are away from the source, and unshaded areas show quadrants in which the P-wave first-motions are toward the source. The letters represent the axis of maximum compressional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

According to the USGS, the preliminary location, depth and focal mechanism of the event indicate rupture occurred on a steeply dipping oblique-reverse fault striking to the northwest or a shallow dipping oblique-reverse fault striking to the east.



USGS W-phase Moment Tensor Solution

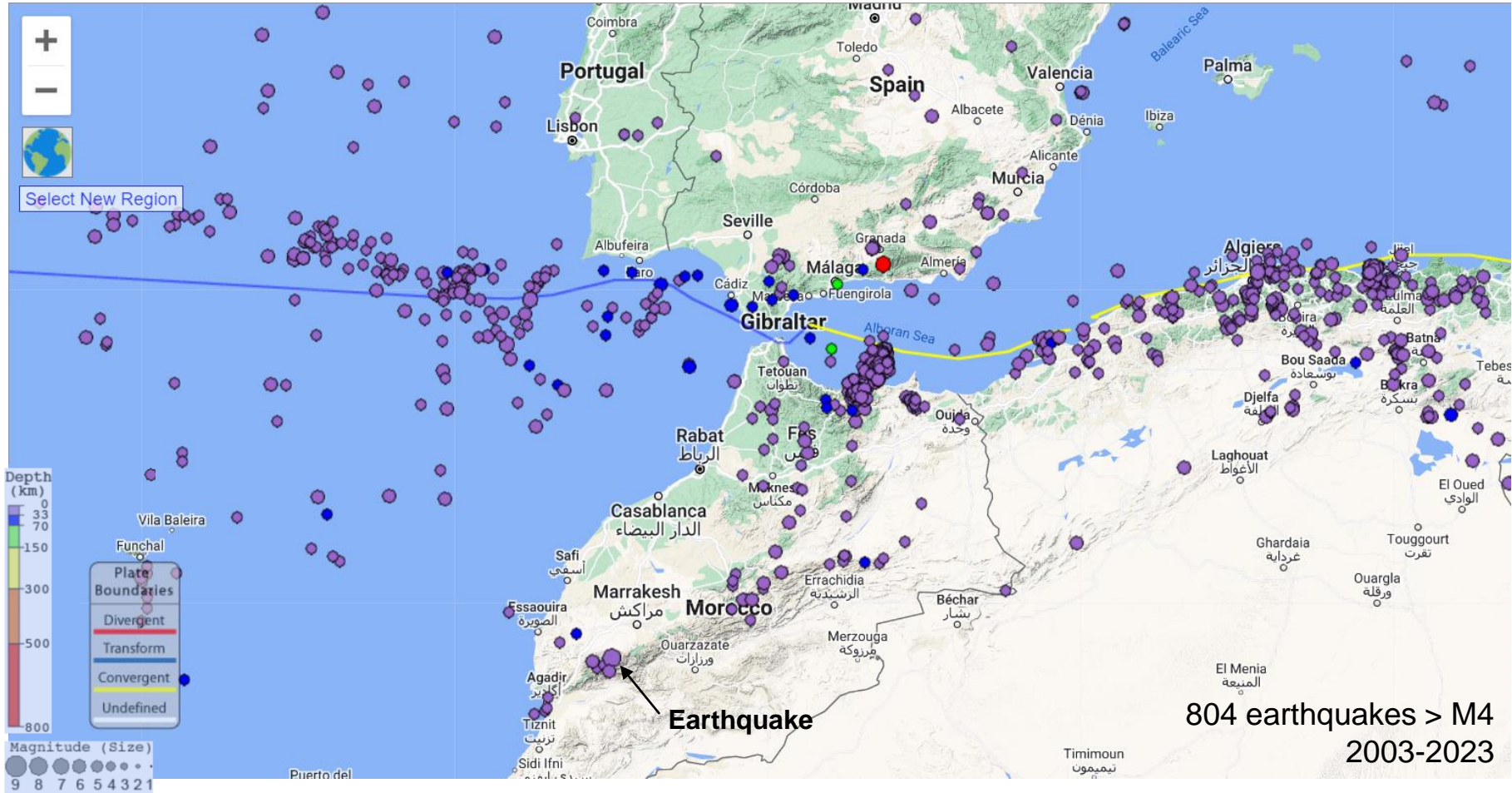




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Regional historic seismicity $>M4$ in this region (2003-2023) is shown. Since 1900, there have been no earthquakes $M6$ or larger within 500 km of this earthquake.



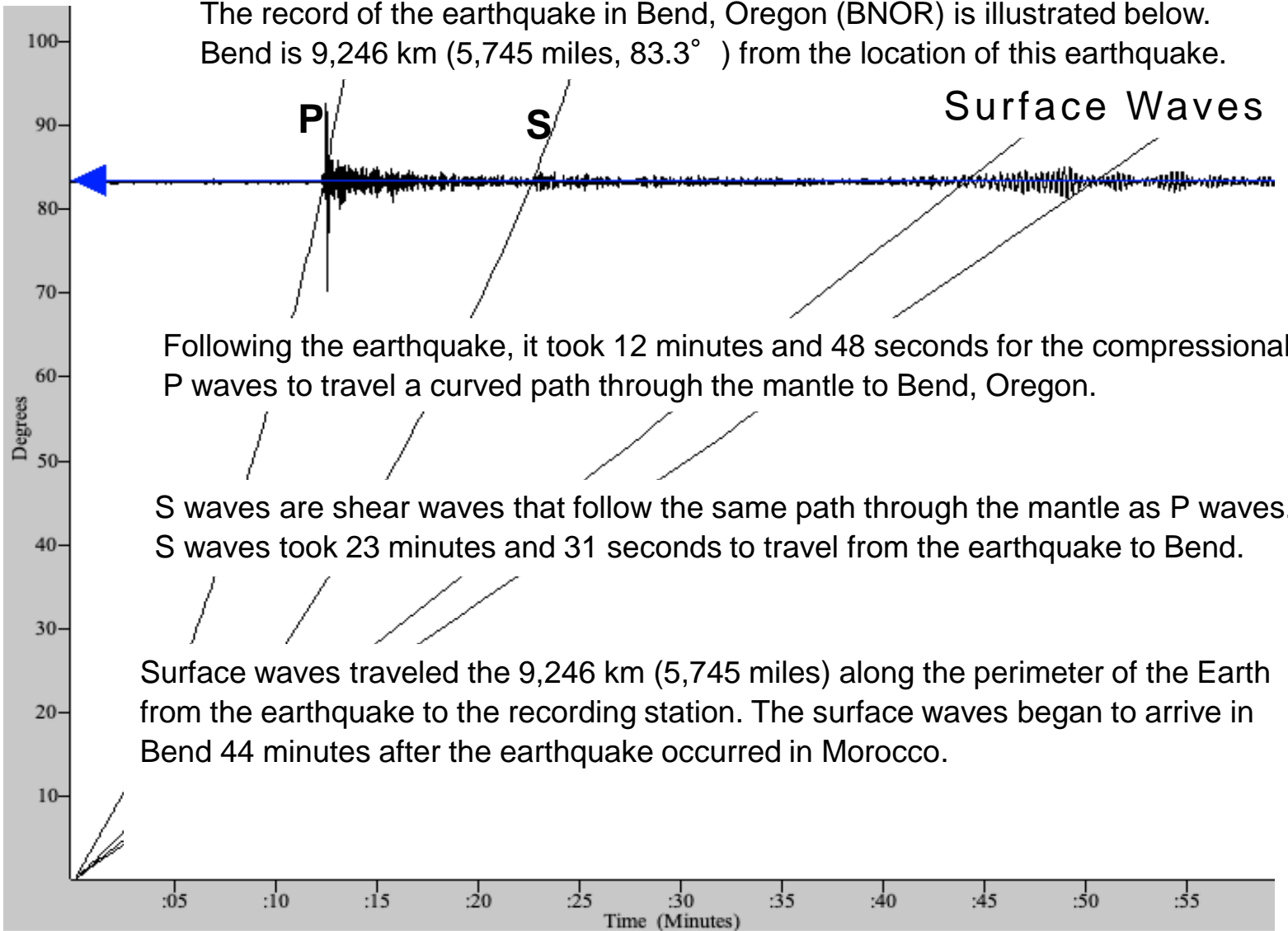
Map and cross section generated from the Interactive Earthquake Browser (www.iris.edu/ieb)



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The record of the earthquake in Bend, Oregon (BNOR) is illustrated below. Bend is 9,246 km (5,745 miles, 83.3°) from the location of this earthquake.



Following the earthquake, it took 12 minutes and 48 seconds for the compressional P waves to travel a curved path through the mantle to Bend, Oregon.

S waves are shear waves that follow the same path through the mantle as P waves. S waves took 23 minutes and 31 seconds to travel from the earthquake to Bend.

Surface waves traveled the 9,246 km (5,745 miles) along the perimeter of the Earth from the earthquake to the recording station. The surface waves began to arrive in Bend 44 minutes after the earthquake occurred in Morocco.

Teachable Moments are a service of

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