

# Earthquake Myths: Earthquakes don't happen in Oklahoma!



## Lesson Two

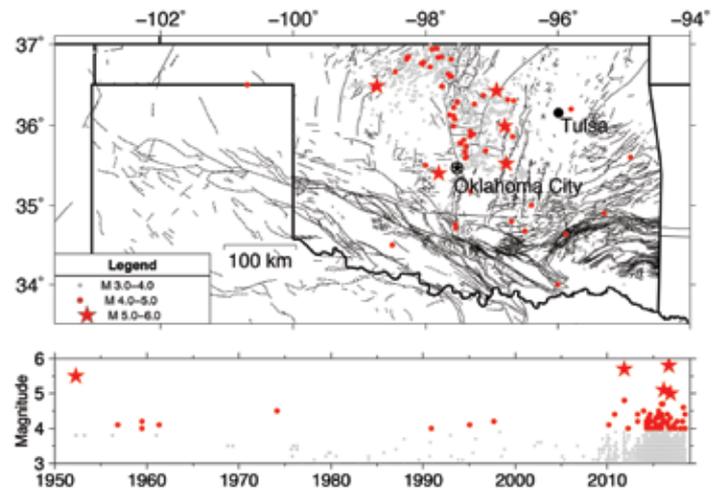
Until a decade ago, people probably didn't think about earthquakes when they thought about Oklahoma's natural disasters. Oklahoma is well-known to most folks across the country for weather-related hazards such as tornadoes and hail. Large earthquakes occur more often on plate tectonic boundaries such as the San Andreas fault in Southern California, but this does not mean that Oklahoma cannot have damaging earthquakes.

On November 6, 2011, a magnitude 5.7 earthquake occurred about 40 miles east of Oklahoma City near Prague, Oklahoma, and was the largest earthquake to occur in recent times in Oklahoma until a magnitude 5.8 earthquake occurred on September 3, 2016 near Pawnee, Oklahoma. Hundreds of buildings and homes were damaged. These earthquakes were not the only earthquakes to cause damage within Oklahoma. On April 9, 1952, a magnitude 5.4 earthquake occurred about 25 miles west of Oklahoma City and did damage to buildings in Oklahoma City. All these earthquakes were felt over very large regions of the central U.S. and are considered moderate earthquakes. Thankfully there have been no deaths associated with earthquakes in Oklahoma. These earthquakes occurred in the midst of a 200-fold increase in the frequency of smaller earthquakes with magnitudes large enough to be felt but not do major damage (M 4.0 and lower).

What led to the sudden increase in Oklahoma earthquakes? In the early 2010s, oil companies began horizontal drilling and hydraulic fracturing layers of rock. These formations contained substantial amounts of ancient saltwater locked up in those rocks, in addition to valuable hydrocarbons. This mostly occurred throughout Central Oklahoma. To dispose of this saltwater, those companies utilized a decades-old method of pumping the wastewater deep underground into the Arbuckle Group, which lies directly above crystalline basement in Oklahoma. These rocks can be seen when driving along I-35 just north of Ardmore, they are visible due to mountain-building processes (large-scale movements of the Earth's crust).

It is widely recognized by the scientific community and state agencies that wastewater injection into the Arbuckle Group led to the state's most recent large earthquakes. As a result, the Oklahoma Corporation Commission has taken measures to reduce the water volumes that can be injected. They continue to monitor this activity, with technical guidance from the Oklahoma Geological Survey.

Luckily these earthquakes did not lead to any fatalities, but those events and others, including the 2016 M 5.0 Cushing earthquake, have led to significant damage to buildings and homes. In developing countries, earthquakes of this size can do considerable amounts of damage, destroying thousands of buildings and injuring or killing many people. One such example would be a magnitude 5.7 earthquake that struck San Salvador in 1986 resulting in 1,500 fatalities and 10,000 injuries. Modern building codes and methods within the U.S. help protect people during moderate to large earthquakes. Because frequent, smaller earthquakes still occur, the seismic hazard in Oklahoma remains very high. Therefore, it is important for Oklahomans to know what to do in an earthquake in case a large one occurs in the near future.



**Figure 3** Map of Oklahoma showing major population centers and some of the largest historical earthquakes as red stars (greater than Magnitude 5.0). Locations of earthquakes with magnitudes between 4.0 and 5.0 are shown as red circles and faults mapped by OGS are shown throughout Oklahoma.