

Name: _____ Date: _____ Bell: _____



Activity: Earthquake Triangulation Lab

Background: An earthquake is the sudden release of energy due very large pieces of rock moving around and against each other. This energy release results in waves traveling through the rock, which geologists use to locate earthquakes. By analyzing seismograms, scientists are able to record three types of seismic waves: P-waves, S-waves, and surface waves. P-waves, or primary waves, have the greatest velocity, and will reach a seismogram first. S-waves, or secondary waves, move slower and are observed after the P-waves. The time that passes between P-waves and S-waves is helps scientists to determining the epicenter, the location on the surface above which an earthquake originated.

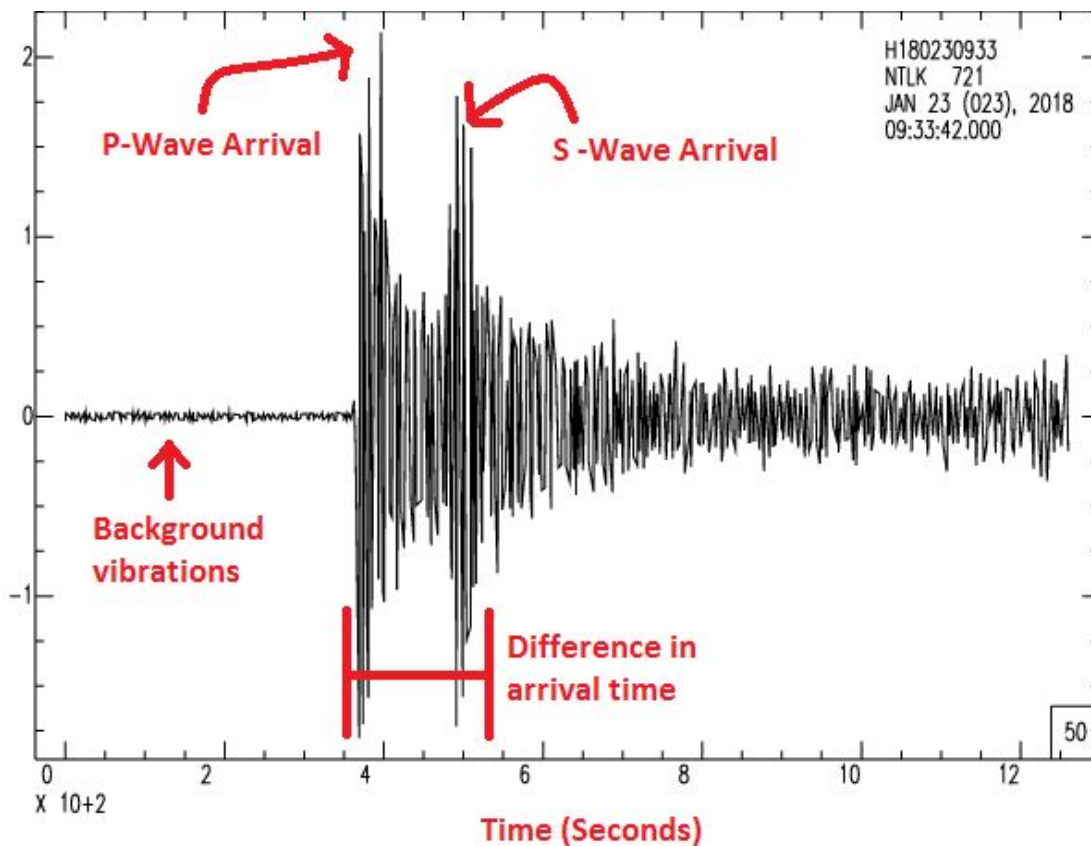


Figure 1. Result of a Seismogram

Source: [Incorporated Research Institutions for Seismology](#)

For this activity, you will locate the epicenter of an earthquake using a method called **triangulation**. Triangulation determines the location of earthquakes using distance information from three seismic stations. On the map below, there are three unique circles. The circles are drawn around the seismic station and the radius of the circle represents the approximate distance from the seismic station to the earthquake. The point where the three circles intersect shows the location of the earthquake.

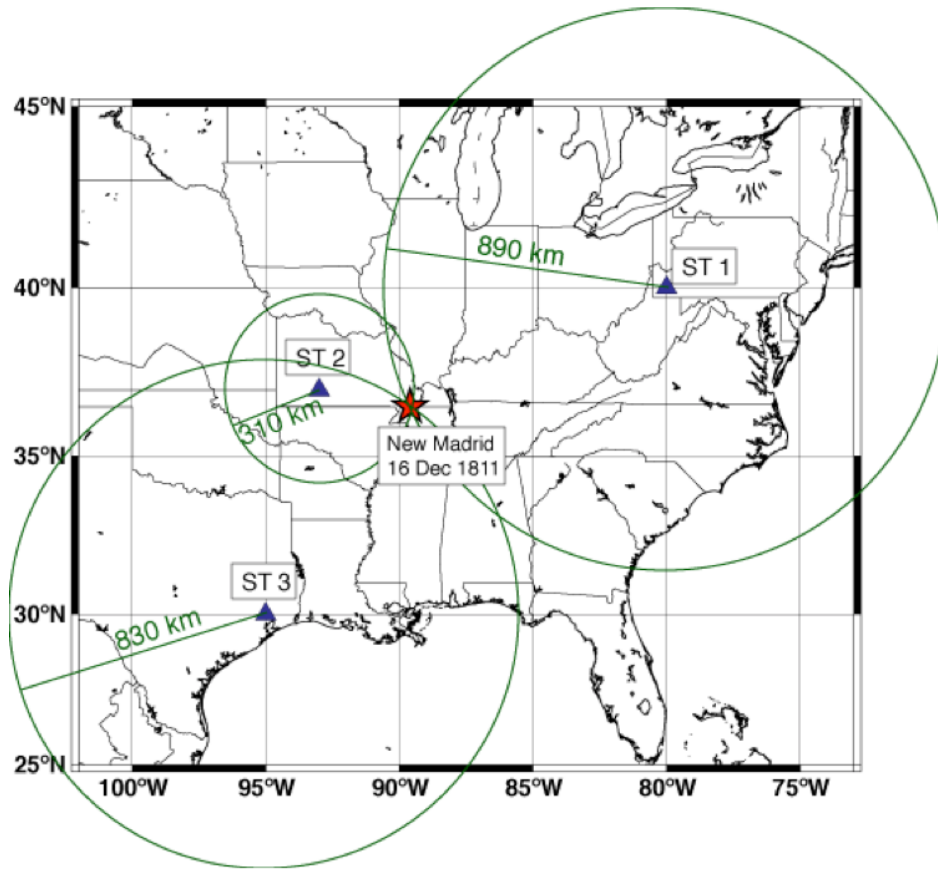
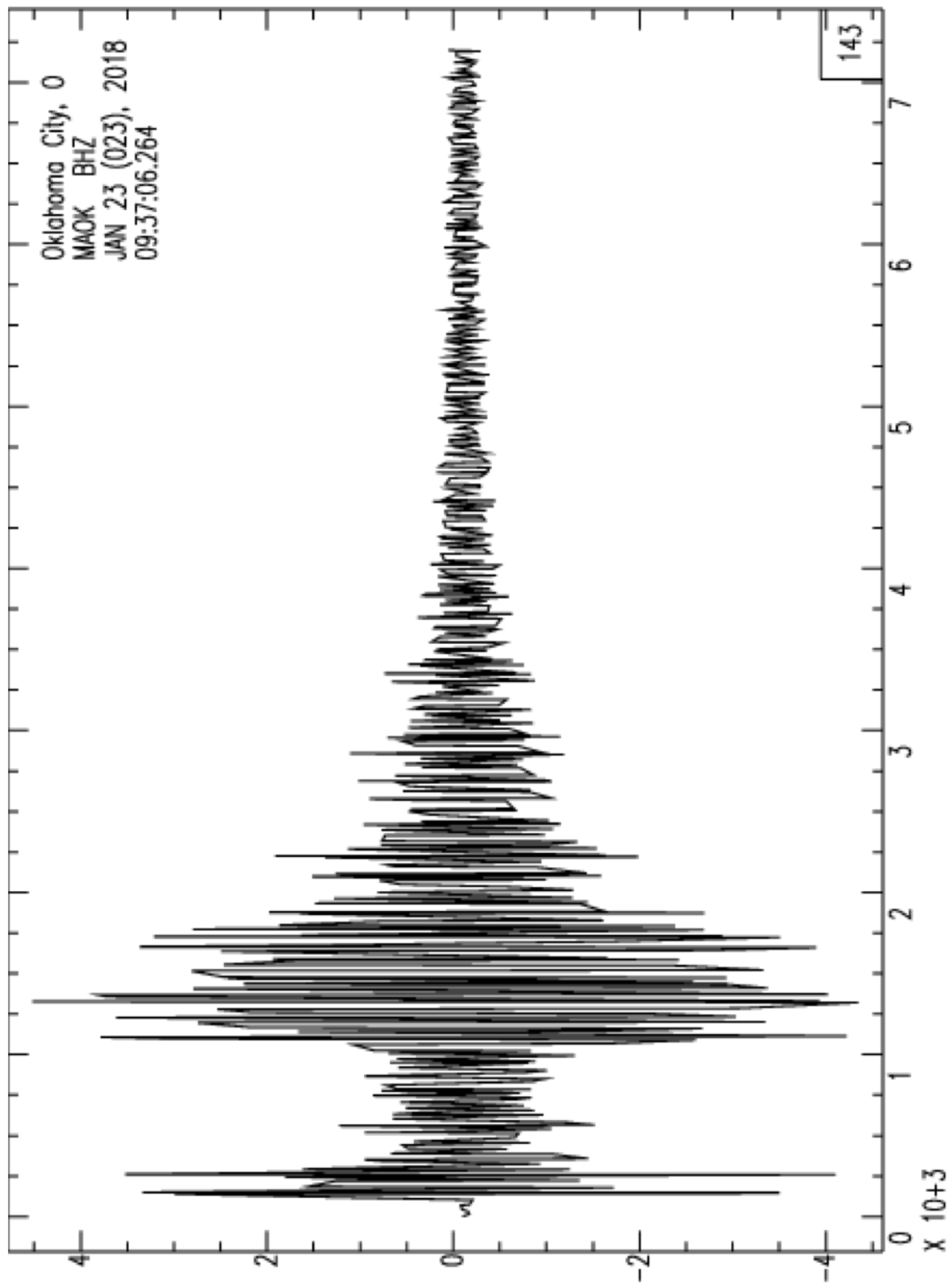


Figure 2. [Gabi Laske](#)

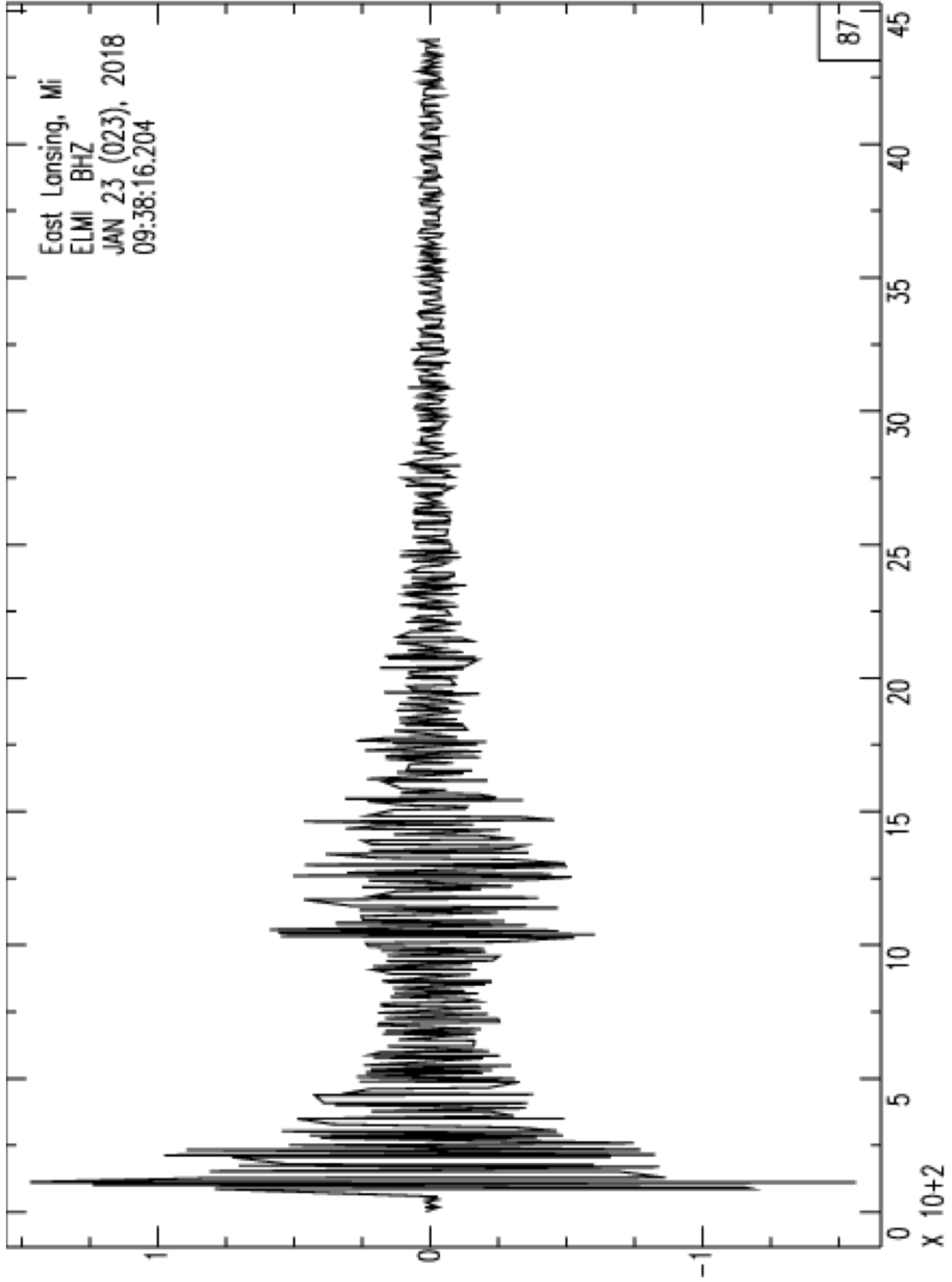
Directions:

1. Using the seismograms, determine the arrival time of the P-wave and S-waves for each station . Record the measurements in the data table.
2. Once you have the measurements for P and S waves, calculate the difference by subtracting the P-wave arrival time from the S-wave arrival time. Record the measurements in the table.
3. Using the difference in arrival time, determine the distance from the seismic station from the earthquake for each city. Do this by **multiplying the difference in time by 5 miles/sec.** (distance = time * speed). Record the distances.
4. Draw a circle around the each station, using the distance of the earthquake as a radius. Repeat for the East Lansing and Holland stations.
5. Find the point where all three of the circles intersect. That point is the estimated epicenter of the earthquake. Record the epicenter of the earthquake.

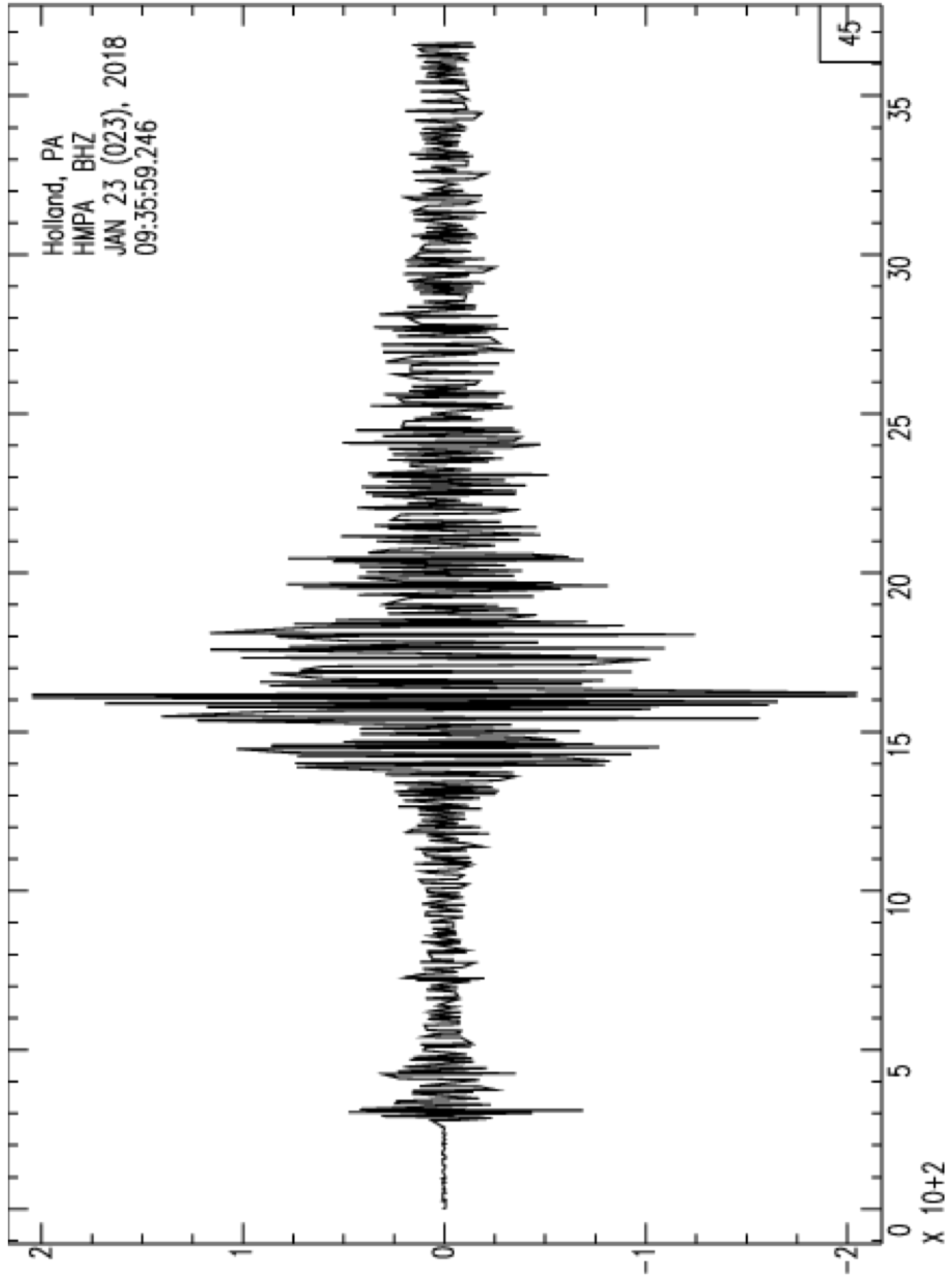


Source: [Incorporated Research Institutions for Seismology](#)

East Lansing, Mi
ELMI BHZ
JAN 23 (023), 2018
09:38:16.204

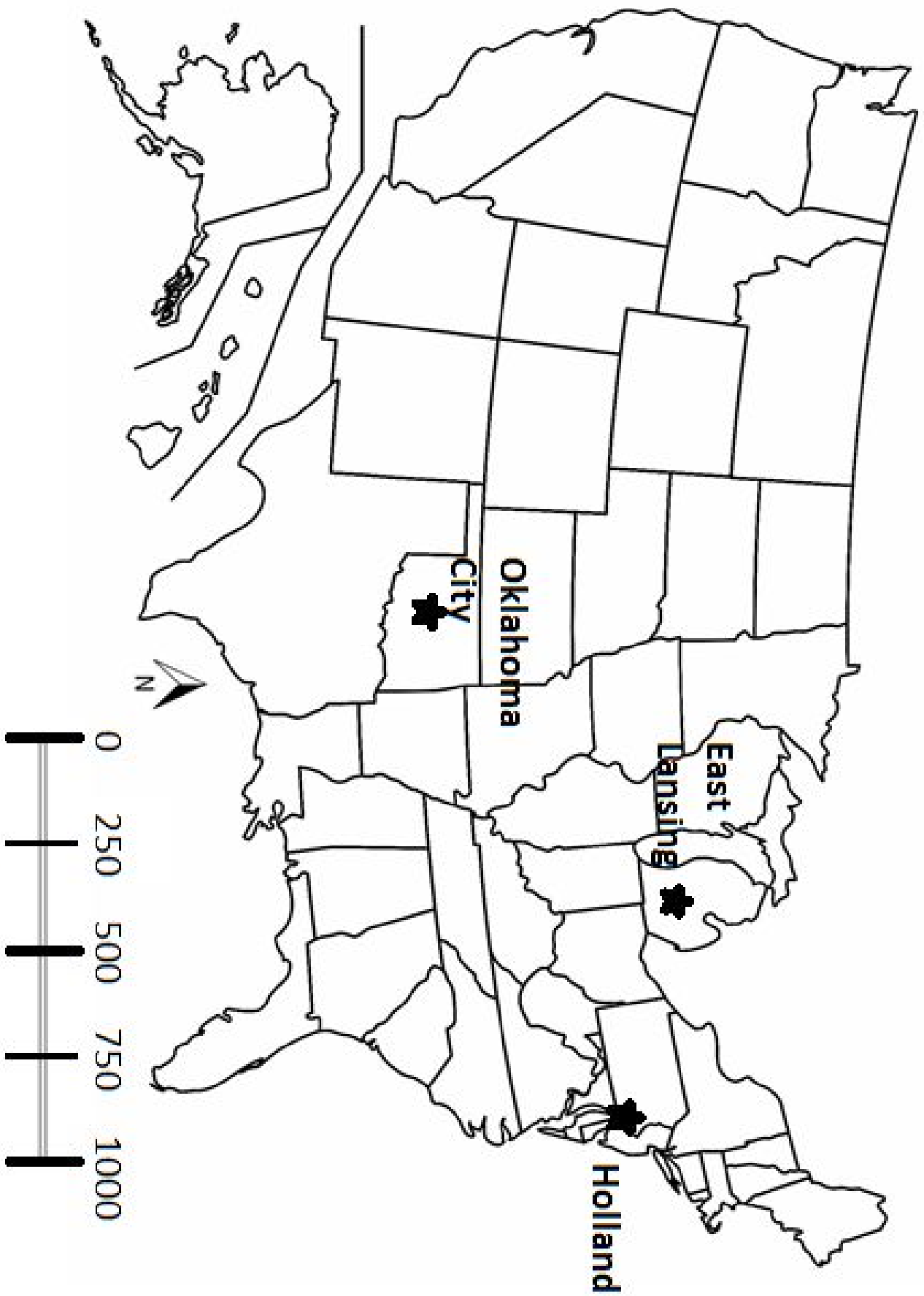


Holland, PA
HMPA BHZ
JAN 23 (023), 2018
09:35:59.246



Data Table:

<u>Location</u>	<u>P-wave (seconds)</u>	<u>S-wave (seconds)</u>	<u>Difference in arrival time (S-wave – P-wave)</u>	<u>Distance from station (milw=es)</u>
Oklahoma City				
East Lansing				
Holland				



Scale in miles

Analysis Questions:

1. Why would geologists need seismic data from three stations in order to calculate the epicenter of an earthquake? Why would they not be able to only use two stations?

2. Would you predict more earthquakes in areas where the Earth's tectonic plates are moving towards each other or where the plates are moving apart? Explain your reasoning.

3. Seismologists and geologists are not the only scientists who interpret seismic data. What other professions would use seismic data? What could they use it for?
