**Project Title:** Seismic Characteristics of Mining Blasts in Indiana  
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**Hypothesis to be Tested:**  
The seismograms produced by mining blasts are influenced both by blasting practice and wave propagation path.

**Background:**  
The wiggly lines we call seismograms are shaped by a combination of the seismic source (e.g., an earthquake!) and seismic wave propagation effects between the source and the recording seismograph. Industrial blasting produces signals very much like those associated with earthquakes. These recordings are of interest when the blasts may have some military, industrial, or societal significance (e.g., nuclear explosions, industrial blasts, terrorist attacks). And the signals have an added benefit—they can be used to study the structure of the Earth's crust through which the waves propagate.

Blast signals are known to vary strongly from mine to mine and from station to station. However, blasts from the same source recorded at the same station are often nearly identical. We can predict that this same phenomenon will be observed for mining explosions recorded on the Indiana network, but this hypothesis has never been verified experimentally in this region. The primary goal of this group will be to test this hypothesis experimentally and attempt to clarify what controls the character of blast records in our area. Some scientific questions that will need to be addressed are:

1. How do seismograms from a single blast vary as a function of distance and wave path to different stations?
2. What are the characteristics of seismic waves (period, velocity, amplitude) produced by blasts? How can they be distinguished from earthquakes?
3. How do seismograms recorded at a single station vary as a function of blast source? How similar are records from different mines at a common distance? If the Earth were simple (which is isn’t!), we would predict theoretically that observed signals would not depend strongly on actual location, but only the distance from the source to the receiver.
4. Does blasting practice change what we record on seismographs? That is, mines use explosives for different purposes. Sometimes they are trying to move rock and other times just break it up. The way they actually fire the explosives, or the “blasting practice”, depends on their objective. How strongly do the observed data vary with blasting practice?
5. How strongly do signals depend upon the precise location of the explosives within a single mine?

**What you will be doing:**  
Groups with active mines or quarries near their school will be asked to contact the mine and assemble information on recent and planned explosions. These people will share the information they obtain with other schools. Each school group can independently take this information and compare data for these explosions at your local station. We will encourage groups to exchange data and see if what they find depends upon location. Added information on blasting practice can help address some of the other questions raised above and yield new hypotheses to be tested.

**Added benefits:**  
- Improve computer skills
- Improve your math skills
- Gain experience in working with a group of people outside your school
- Learn about how mines operate
Figure 1. Comparison of two blasts with similar waveforms. The data shown were recorded at PPBLO on two different days in 2000. The waveforms are very similar suggesting they may be from the same quarry. The mining explosion project will address this issue directly by making measurements like this and validating them against ground truth information from mines and quarries.