STUDENT WORKSHEET
Detecting the Layered Earth

INSTRUCTIONS:

1. **Work in groups as requested by your teacher.**
2. **Use complete sentences when answering questions.**
3. **Refer to Student Instructional Guide page for assistance in running GEE software. This page is available under the "Instructions" tab of this module.**

ENGAGEMENT

1. This lesson will involve using earthquake waves as a tool to look into the interior of the Earth. If the earthquake used is a recent, newsworthy event, describe what you know about it (where it occurred, what magnitude, how much damage and/or deaths, etc.)

EXPLORATION

1. Select and start the module "Detecting the Layered Earth" within the Global Earthquake Explorer. Using GEE, your teacher will show you a map of the recent earthquake or a classic earthquake and station locations. Where did the earthquake occur?

2. Many stations recorded this earthquake. The specific stations you will be using in this exercise are shown in RED. How would you expect the P-wave arrival time at these stations to vary?

3. Using GEE, your teacher will show you a Seismic Record Section for this earthquake. The seismograms for the stations that you will be using are shown in RED. Examine the seismic record section. Do your findings support what you expected to find? Explain your answer.

4. Use the Global Earthquake Explorer to work your way through several seismograms and construct a table of: Station Name, Distance (km), Origin Time, P-wave Arrival Time, P-

wave Travel-Time, using the data table provided. Be sure to measure the time of the FIRST arriving P-wave energy.

CONCEPT DEVELOPMENT PHASE

1. Construct a time-distance graph using the three closest stations. You should be able to construct a "best-fit" line through these three data points.

2. What is the slope of this line?

APPLICATION PHASE

1. Now that you have estimated the P-wave velocity, PREDICT the arrival time for the next most distant station. Compare this to the observed time. Discuss the differences in the predicted and observed time.

2. Once the prediction method is understood, continue their exercise with increasingly distant station. Do the predictions and the observations vary systematically with distance?

3. How might we explain this analysis?

4. How could we tell the possible explanations apart?

5. What kind of generalization do seismologists make about changes in velocity measured at various distant stations?

6. Do you remember from middle school how the structure of the Earth changes with depth? Describe or sketch below the Earth's structure.

7. Describe the paths that the P-wave might take through the Earth.

8. Define: refraction of seismic waves

EXTENSION

1. Find a pair of earthquakes in either the SCEPP or IRIS archives that demonstrate that the higher velocities calculated from distant stations cannot be simply a local effect.