

NAME: \_\_\_\_\_ PERIOD: \_\_\_\_\_ DATE: \_\_\_\_\_

LAB PARTNERS: \_\_\_\_\_ LAB #18

## LOCATING AN EARTHQUAKE EPICENTER

### INTRODUCTION

Earthquakes are caused when accumulated stresses in the Earth's crust causes it to rupture along a fault. Vibrations called seismic waves travel away from the focus (point of origin) in all directions. Two of the main kinds of seismic waves are called P and S waves. Due to the different properties of P and S waves, and the ability of seismographs to record these waves, the distance to an earthquake epicenter can be calculated. In this lab you will use the seismic recording of P and S waves from three locations to determine the epicenter of an earthquake.

### OBJECTIVES

At the conclusion of this investigation you will be able to:

1. Record the arrival times of P and S waves from a seismogram.
2. Calculate difference in arrival times between P and S waves.
3. Use a graph to compute epicenter distance.
4. Use a compass and three epicenter distances to locate an epicenter.

### MATERIALS

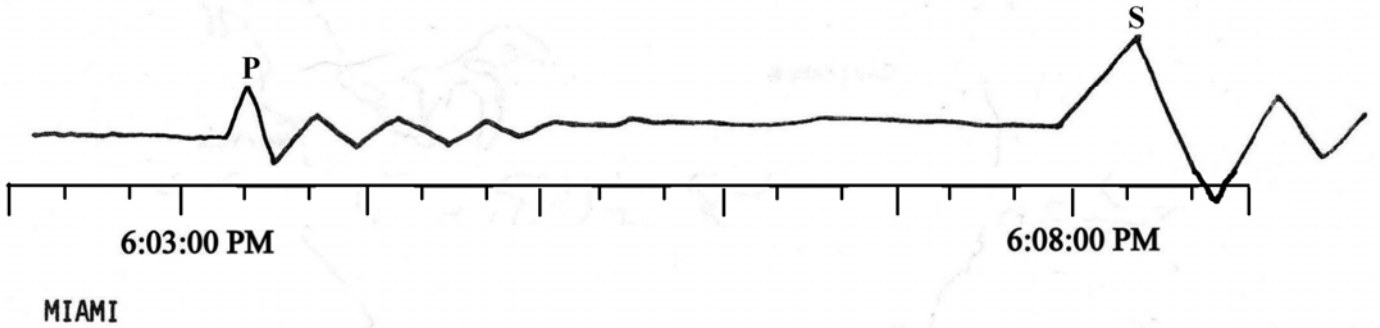
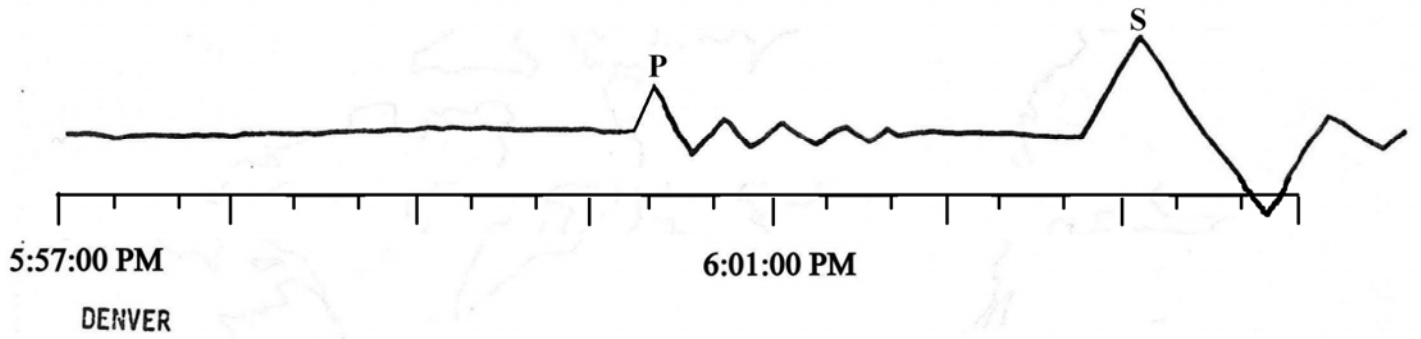
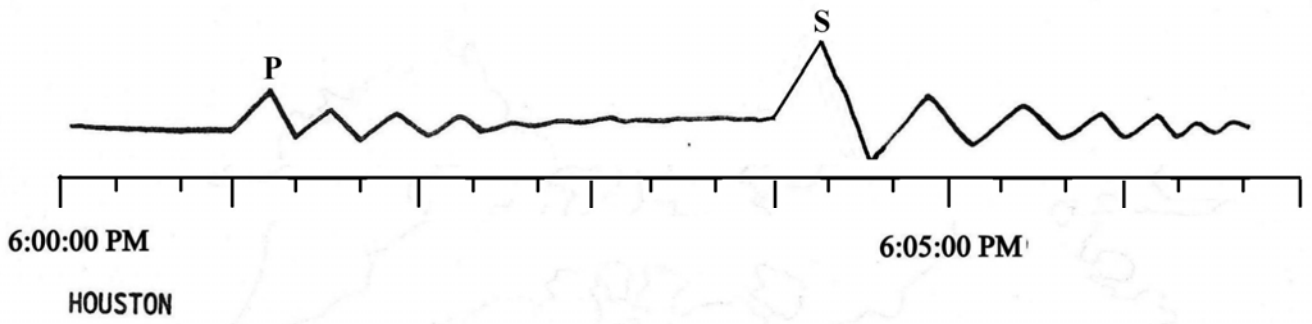
Pencil with eraser  
Scrap paper  
Earth Science Reference Tables  
Safety compass  
Colored pencils

APPROXIMATE TIME 2 periods

### PROCEDURE

1. Determine the arrival time of the P waves at each of the three cities and record it in the data table.
2. Determine the arrival time of the S waves at each of the three cities and record it in the data table.
3. Determine the difference in minutes and seconds between the arrival times of the P and S waves for each the three cities and record it in the data table.
4. Using the "Earthquake P-wave and S-wave Travel Time" chart of page 11 of the Earth Science Reference Tables, determine the distance to the epicenter for each of the three cities and record in the data table.
5. Taking the epicenter distance determined in step 4, use the reference tables to determine the P wave travel time for each of the three cities and record in the data table.

6. By subtracting the P wave travel time from the P wave arrival time for each to the three cities, the time of origin of the earthquake can be calculated. Enter this time in the data table.
7. If you have done steps 1 to 5 correctly, the time of origin for all three cities should be very close to one another. If they are not, repeat steps 1 through 5 and check your work.
8. Using your compass and the map of North America in the lab, draw a circle around each of city with a radius equal to its epicenter distance.
9. Using a colored pencil put an **X** at the epicenter location.
10. Answer lab questions 1 through 13.
11. Write a **conclusion** on what you learned in this lab based on your observations and data. Be sure to include a description of how an earthquake epicenter can be located.

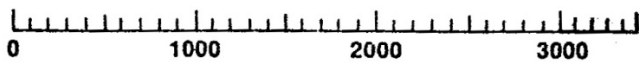
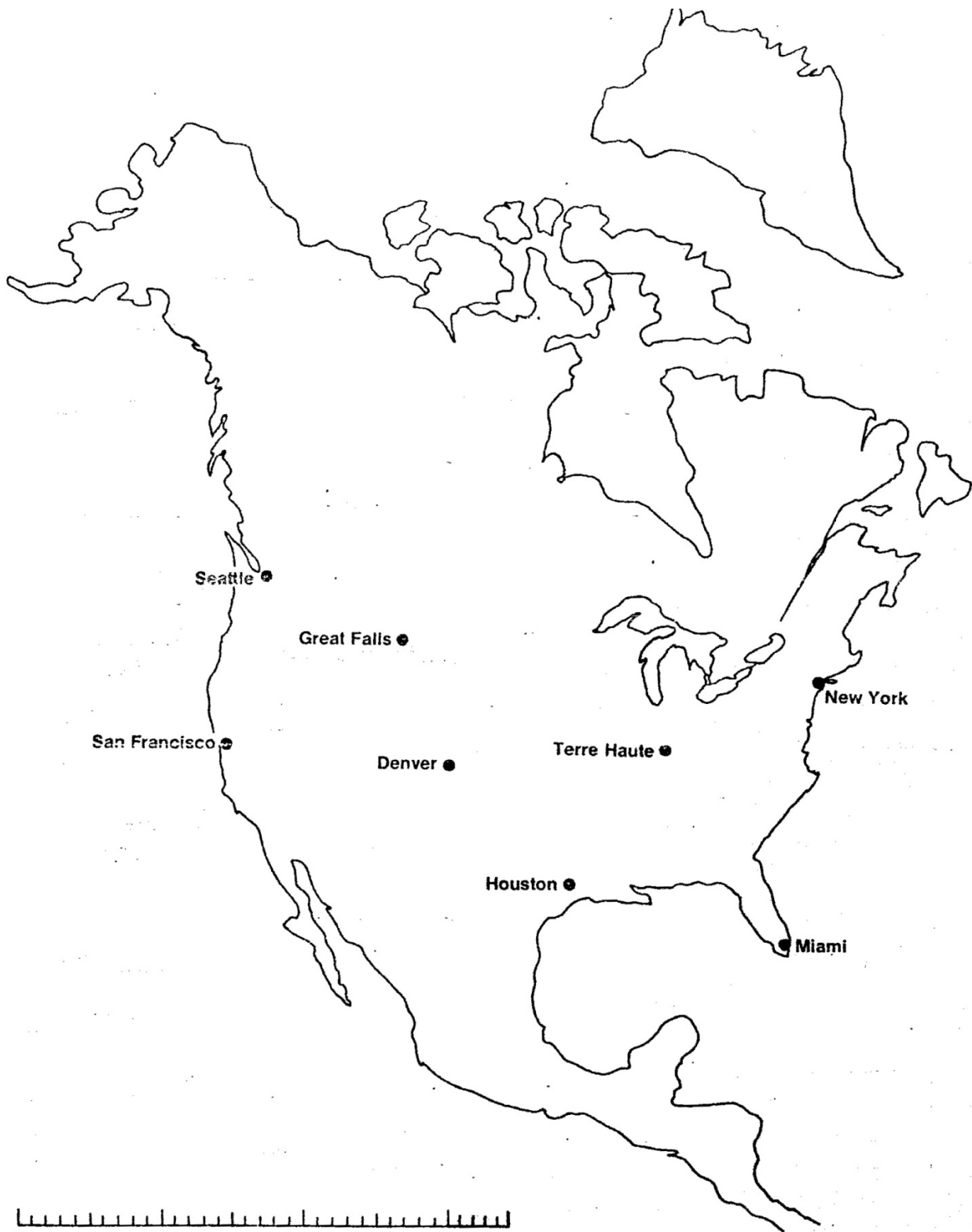


SEISMOGRAPH STATION	Arrival (clock time)		Difference in Arrival Time (min. and sec.)	Distance to Epicenter (km)	P Wave Travel Time (min. and sec.)	Time of Origin (hr., min., sec.)
	P wave	S wave				
HOUSTON						
DENVER						
MIAMI						

## LABORATORY QUESTIONS

1. What amount of time does each large division on the seismogram scale represent? \_\_\_\_\_
2. What amount of time does each small division on the seismogram scale represent? \_\_\_\_\_
3. Which seismic wave, P or S arrived first at all three stations? \_\_\_\_\_
4. Why would a seismograph on the other side of the Earth from the epicenter receive P waves but no S waves?  
\_\_\_\_\_
5. What amount of time does each line represent on the Travel Time chart in the Earth Science Reference Tables?  
\_\_\_\_\_
6. What amount of distance does each line represent on the Travel Time chart in the Earth Science Reference Tables?  
\_\_\_\_\_
7. How many earthquakes occurred in this investigation? \_\_\_\_\_
8. What is the only thing **ONE** seismograph station alone can tell about an earthquake epicenter?  
\_\_\_\_\_
9. What can three or more seismograph stations tell about an earthquake epicenter? \_\_\_\_\_
10. Where did the earthquake in this investigation occur? \_\_\_\_\_
11. Near what fault did the earthquake in this investigation occur? \_\_\_\_\_
12. What is the approximate time that this earthquake occurred? \_\_\_\_\_
13. What is the major cause of earthquakes on the Earth? \_\_\_\_\_
14. Why does the time between the arrival of the P wave and S wave become greater as you get farther from the epicenter?  
\_\_\_\_\_  
\_\_\_\_\_

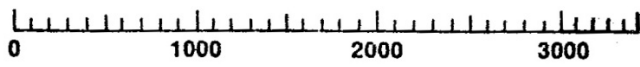
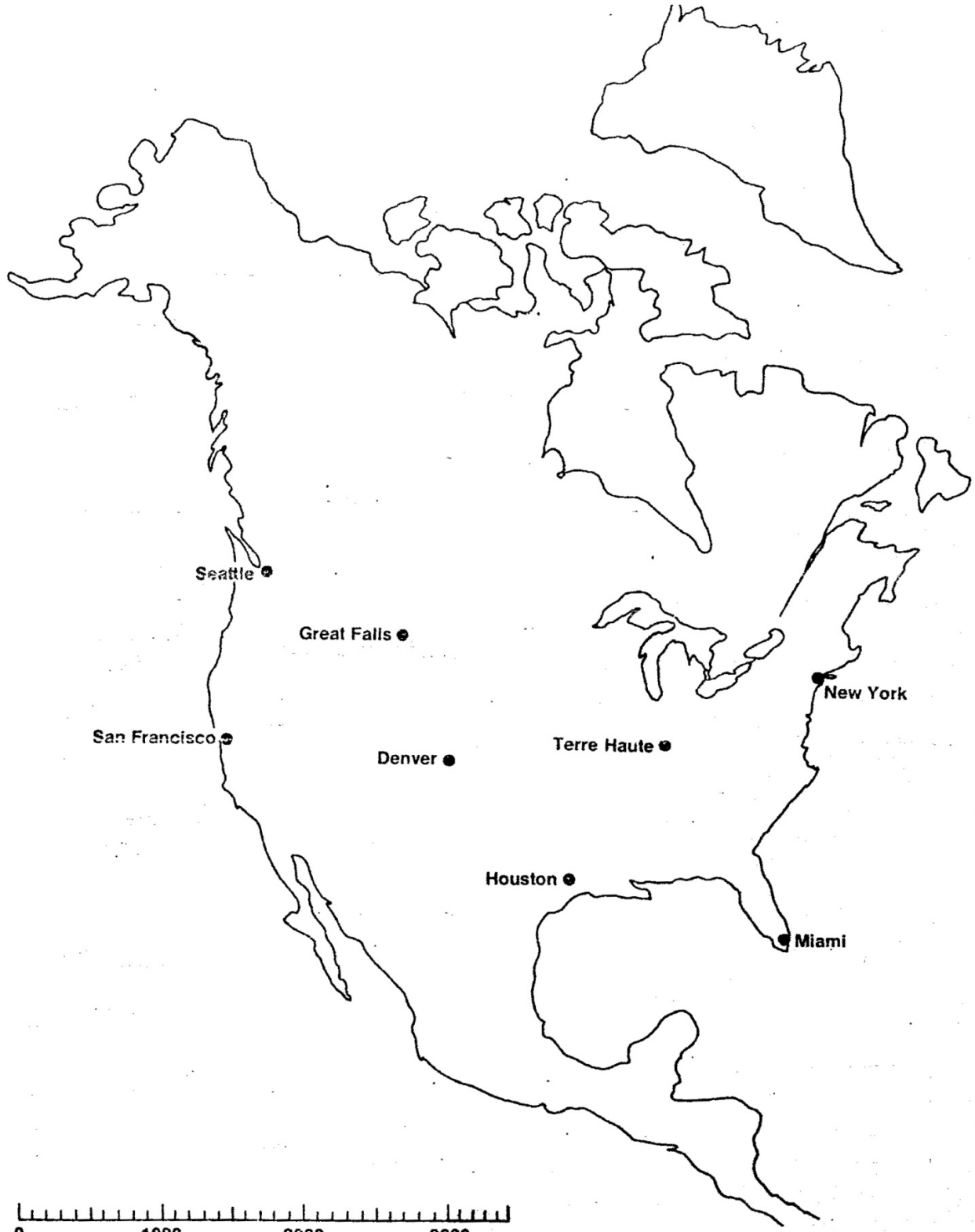
**USE A PENCIL!**



**KILOMETERS**

1000 km = 2.2 cm

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