NAME: _____ DATE: _____ PERIOD: _____

EARTHQUAKES ALONG SUBDUCTION ZONES

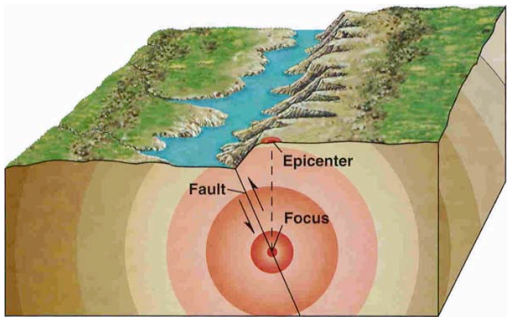
INTRODUCTION

As you've learned in this unit, the uppermost crust of the Earth is believed to be made up of a series of plates. The rocks that make up the continental plates are less dense than the rocks that make up the oceanic plates. Earthquakes and volcanoes are the result of the interaction of the rocks that make up these plates, and the kinds of earthquakes and volcanoes produced depends on whether the plates are coming together, spreading apart, or sliding past each other.

The theory of plate tectonics has been widely accepted because of the many pieces of evidence that support it. You have already discussed some of the evidence in this unit. Like solving a jigsaw puzzle, scientists look for the best explanation that fits all the data available. In the following lab, you will be looking at earthquake data and determining if plate tectonics can explain what you find.

EARTHQUAKES AND FAULTS

Earthquakes and faults are caused by the movement of the earth's crust as it is pushed together or pulled apart. As the movement occurs, the rocks will often break and grind together, releasing vibrations of energy into the ground. The plane along which the rocks break and move is called a fault (see image). This fault can occur near the ground surface where humans can actually see it, or deep below the ground. The technology we use to detect earthquakes can actually tell us exactly where the faulting has occurred below the surface. The image on the right shows two blocks of earth that are sliding against each other. The location at which the rocks actually break during a single event is called the **focus** of the earthquake. The point on the earth's surface that is directly above the focus is called the **epicenter**. This is the area where the most violent shaking will occur because it is directly above the actual rock movement.



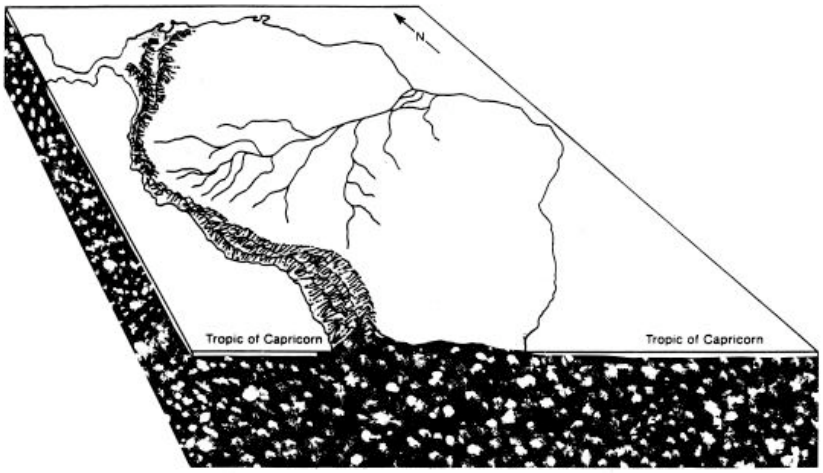
PROCEDURE

On the data table below, you will find information on earthquakes near the west coast of South America. Provided are the latitude, longitude, depth and magnitude (how strong the earthquake was) of each earthquake.

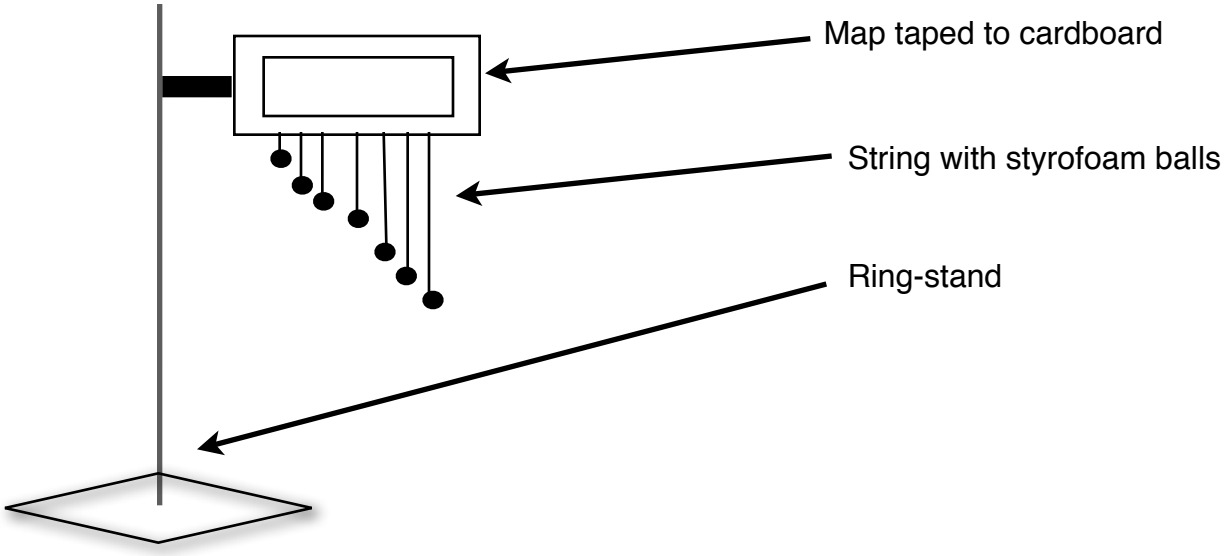
Your research will require you to take the data provided on earthquakes, construct a 3-D dimensional model of these events, and determine what type of pattern (if any) that the earthquakes create in the region.

STEP 1
Locate the epicenter of each earthquake and plot it on the map provided. Be sure and plot the number of the earthquake to avoid confusion later in the activity.

STEP 2
Tape the map on a piece of cardboard. Orient the map so that the boundary between the ocean and the continent is perpendicular to the side of the cardboard facing you, with the ocean on the left and the land on the right. The map represents the surface of the land, while the space below will represent your view of the crust beneath the surface. This view is called a cross-section view of the earth. The image on the right shows a cross-section of the area in South America that we are studying.



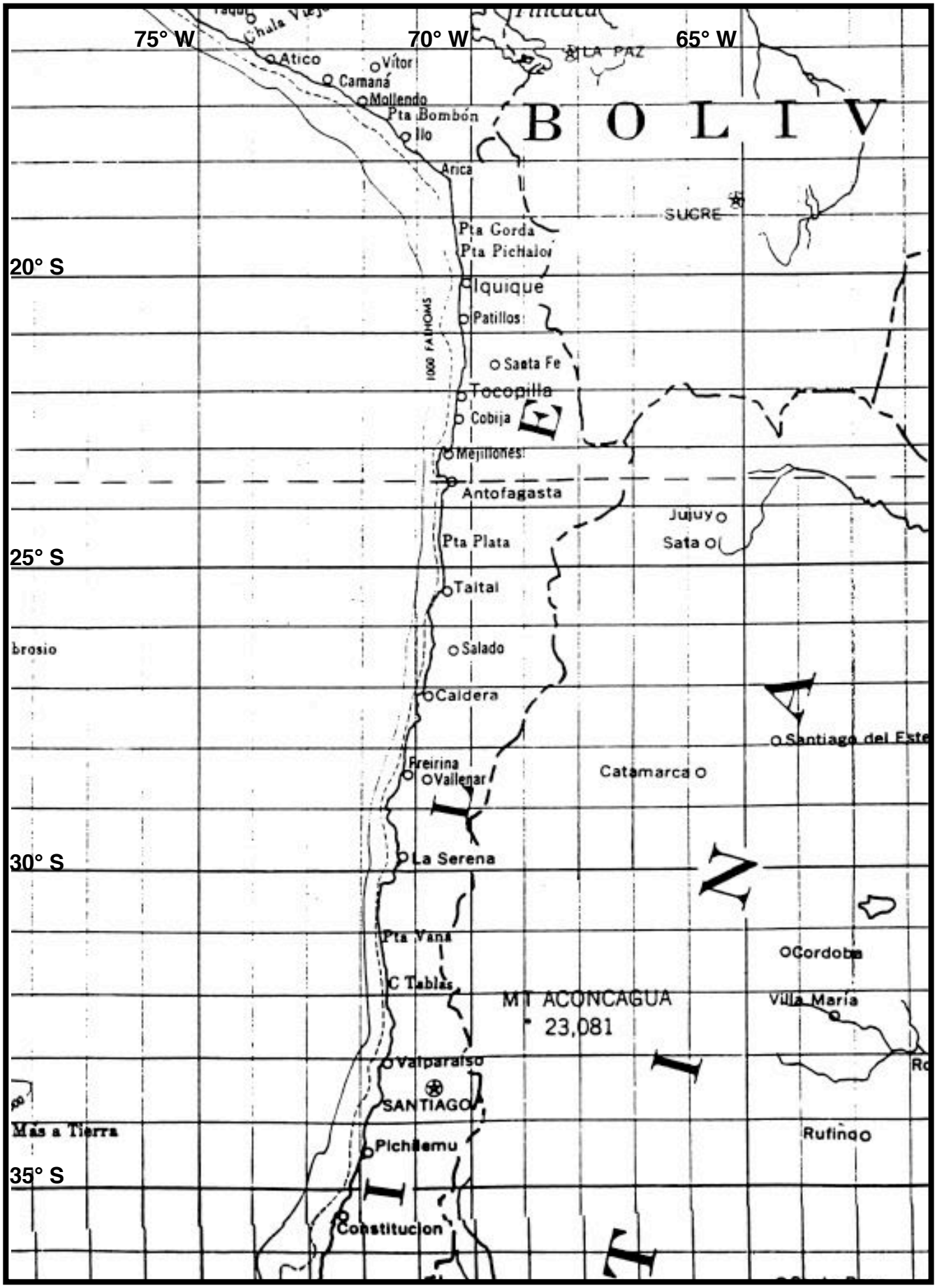
STEP 3
At each epicenter point, punch a hole with the pushpin through the map and cardboard. The hole needs to be big enough to push a piece of your thread through (but not too big!). Hang a Styrofoam ball so that it represent the focus of each earthquake: For each of your epicenters, you have information about the depth of the earthquake. To make a three-dimensional representation of the earthquakes in this area, you are going to use a Styrofoam ball to represent where the FOCUS of the earthquake is. From the epicenter, you need to hang a Styrofoam ball on a length of string that represents the depth of the earthquake. One centimeter of string should equal 10 km of depth (for example, hang the ball of an earthquake 250 km deep, on a piece of string 25 cm long). When you have strung the balls through the cardboard in the appropriate places, attach it to a ring-stand. See the image below for an example of what your model will look like.



STEP 4
Complete the conclusion questions at the end of this packet.

DATA TABLE: Actual South American Earthquakes from 1993-1994.

STATION #	LATITUDE (S)	LONGITUDE (W)	DEPTH (km)	MAGNITUDE
1	19.8	66.6	259	4.6
2	27.8	63.2	513	5.1
3	26.2	63.3	550	4.8
4	23.2	66.4	200	4.8
5	21.3	68.2	122	4.7
6	22.3	66.1	274	5.0
7	22.5	67.4	168	4.5
8	19.5	65.8	305	4.5
9	21.4	68.1	123	5.1
10	27	63	500	4.9
11	25.6	66	385	5.0
12	23.5	70.5	50	4.7
13	23.2	69.3	77	5.2
14	22.2	64.5	440	4.8
15	20.4	66	300	4.5


75° W
70° W
65° W
20° S
25° S
30° S
35° S
Atico
Vitor
Camaná
Mollendo
Pta Bombón
Ilo
Arica
Pta Gorda
Pta Pichalo
Iquique
Patillos
1000 FATHOMS
Santa Fe
Tocopilla
Cobija
Mejillones
Antofagasta
Pta Plata
Taltal
Salado
Caldera
Freirina
Vallenar
La Serena
Pta Vana
C Tablas
Valparaiso
SANTIAGO
Pichilemu
Constitucion
Mas a Tierra
MT ACONCAGUA
23,081
SUCRE
LA PAZ
Jujuy
Sata
Catamarca
Santiago del Este
Cordoba
Villa Maria
Rufino

Looking at the Results:

1. What information does an epicenter provide about an earthquake?

2. What is the difference between the focus and the epicenter of an earthquake?

3. What is happening to the rocks at the focus of an earthquake, and what do we call this?

4. What do you notice about the depth of the focus of the earthquakes as you go further inland from the coast of South America?

5. What appears to be happening to the two plates that meet along the west coast of South America, according to your model?

6. Draw and label a diagram or make a model showing what is happening to the plates along the west coast of SA as you described in question 5:

Making Conclusions:

1. Describe the type of plate boundary which you think is present along the west coast of South America.

2. Explain how your data supports your conclusions in question 1.

Extra Credit:

1. Consider the following: How is volcanism related to this type of boundary (study where it is in relation to the trench and plates)?

2. Mt. St. Helens is part of a volcanic belt formed under similar conditions as the Andes Mountains. Search the Internet of library for seismicity data regarding the Oregon/Washington coast of the United States. What is happening there? What are the differences between this area and the SA coast?