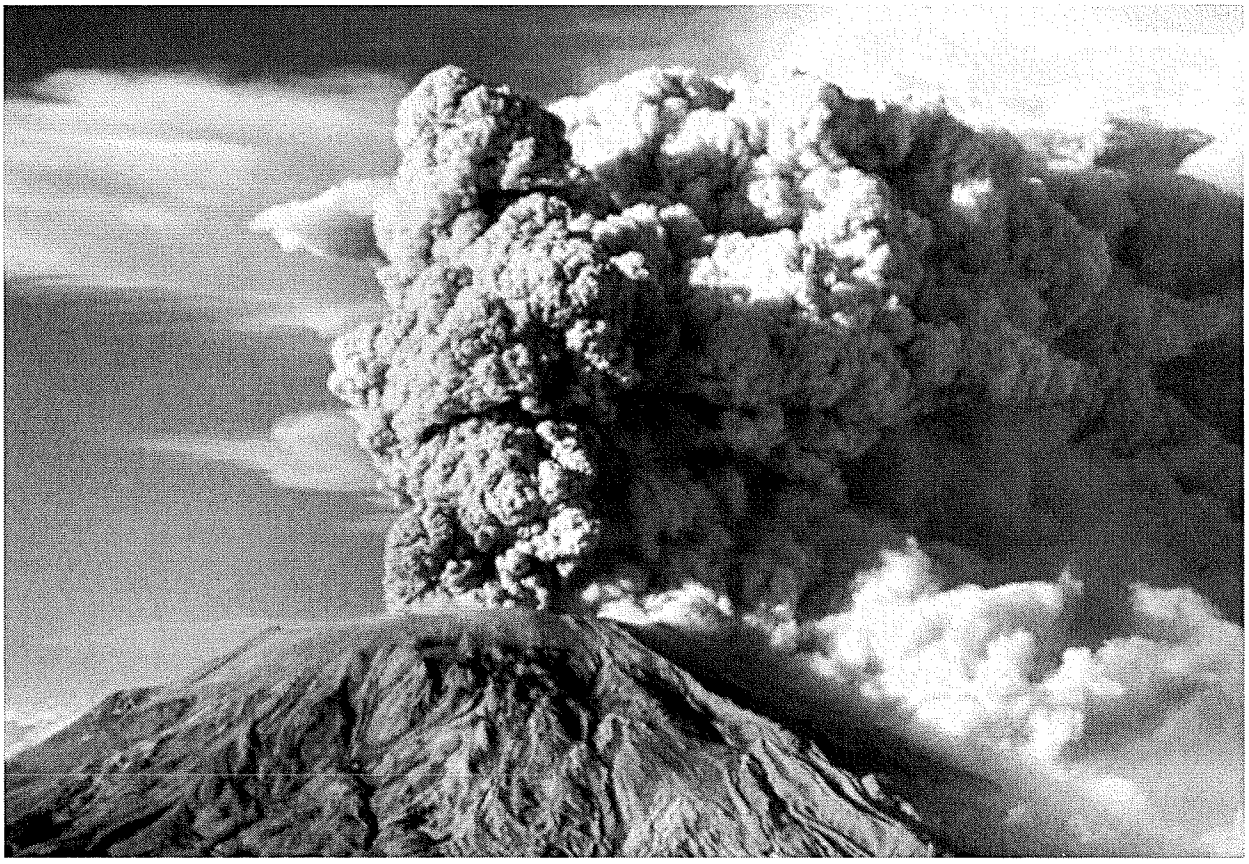
Name: _____

Period: _____

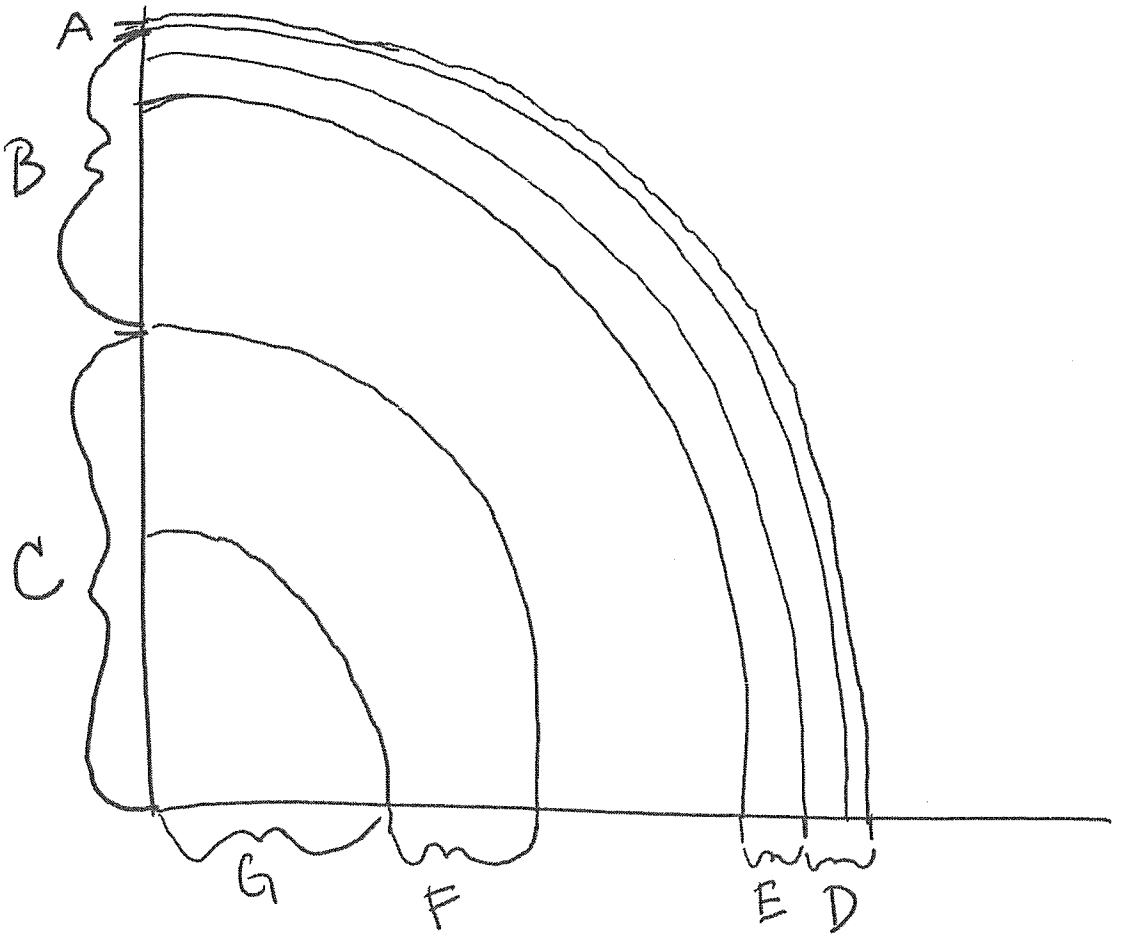
Earth Science 11

Plate Tectonics and Earth's Interior



Mount St Helens erupting explosively!

Notes: Earth's Layers



Earth's Magnetic Poles

What causes the magnetic field of the Earth?

Pole Reversals:

Question:	**Your researched answer:**
What does "pole reversal" mean?	
How do scientist know they happen?	
How often do they happen?	
What is the cause of pole reversals?	
When is the next pole reversal expected?	
How would a pole reversal affect us?	

Evidence for Plate Motion: Research online to find evidence and descriptions.

Evidence:	Description of why it helps prove the tectonic plates move:

PLATE TECTONICS Worksheet

p. 233-239

1. Define: Plate tectonics. What is a "theory? Why is Plate Tectonics called a theory?

2. Which plate do you live on? Which plates are east and west of you? south of you?

3. Which layer of the earth are the plates made of? How thick is this layer?

4. Which layer of the earth is thought to be responsible for the movements of the plates? What part of that layer?

5. What is a convection current? How does it move?

6. What is Mesosarus? When did it live? Why is it involved in plate tectonics?

7. What are other pieces of evidence for plate tectonics? Explain why each supports the Plate Tectonic theory.

8. How can the belts of volcanoes and of earthquakes be explained with plate tectonics?

Earthquake Waves

Wave	P	S	L
Name?			
Wave Type? (body/surface)			
Materials travelled through?			
Relative speed?			
Order of arrival?			
Compression or shear?			
Particle Motion vs wave motion			

Earthquake Waves (practice)

Wave	P	S	L
Name ?			
Wave Type ? (body / surface)			
Materials travelled through ?			
Relative speed ?			
Order of arrival ?			
Compression or shear ?			
Particle Motion vs wave motion			

Name _____ Date _____

6-8 Locating the Epicenter

Introduction: An earthquake may occur anywhere along a fault line. Rocks may slip within a small area or release energy over several miles. Rock slippage extending over 150 miles occurred along the San Andreas Fault during the San Francisco earthquake.

Seismologists are scientists who study earth movement. They work in seismographic stations throughout the world. When these stations detect earth movement, they compare their records of the time and type of waves and, from that information, determine the epicenter of an earthquake.

Seismograms are the records taken on a seismograph. When an earthquake occurs, seismographic stations at different areas record the disturbance. The seismograms show both the duration and severity of the shock. Seismologists determine the location of the epicenter. If three widely separated seismograph stations report their findings, the location of the epicenter can be detected.

Objective: To show how an earthquake's epicenter can be located through seismogram records.

Materials: Earthquake maps 1, 2, and 3, compass, pencil and paper.

Procedure: Do the following:

1. Examine map 1. There are three seismograph stations—A, B, and C—and three areas marked with an X (labeled A, B, and C).
2. Begin by placing the compass point on Station A. Set the pencil point on the area marked AX. Draw an arc through the AX area. Now move the compass point to Station B, place the pencil point on the area marked BX, and draw an arc through the BX area. Do the same thing for Station C and area CX. Circle the point where all lines meet. This will be the earthquake's epicenter.
3. Repeat the procedure for map 2.

Answer these questions:

1. How may seismograph stations come in handy *prior* to a major earthquake?

_____

_____

2. How may seismograph stations benefit earthquake victims *after* the damage occurs?

_____

_____

3. Do you think seismograph stations should be located near known fault zones only? Why or why not? _____

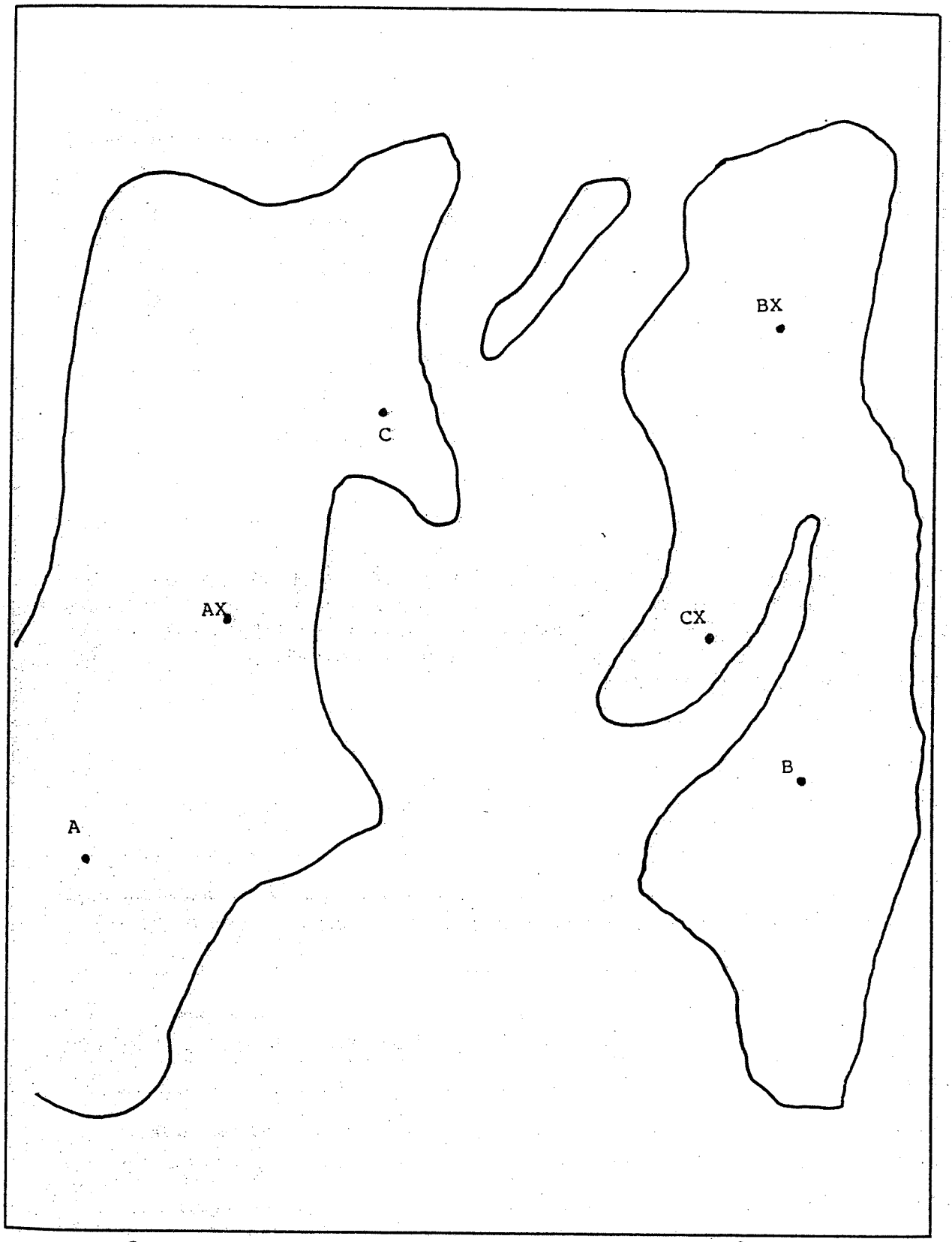
_____

4. In your opinion, where is the most unlikely place to locate a seismograph station? Why do you think so? _____

_____

5. Explain, in detail, how station A came up with the distance to AX using a seismograph.

Locating the Epicenter: Map 1



A, B & C are the stations = center of circles
AX, BX & CX are along the edge of the circles (put your pencil on the X points)

8

EARTH SCIENCE 11. GEOLOGY.

EARTHQUAKES

URPOSE: To study the the distribution of earthquake focii at depth in the lithosphere..

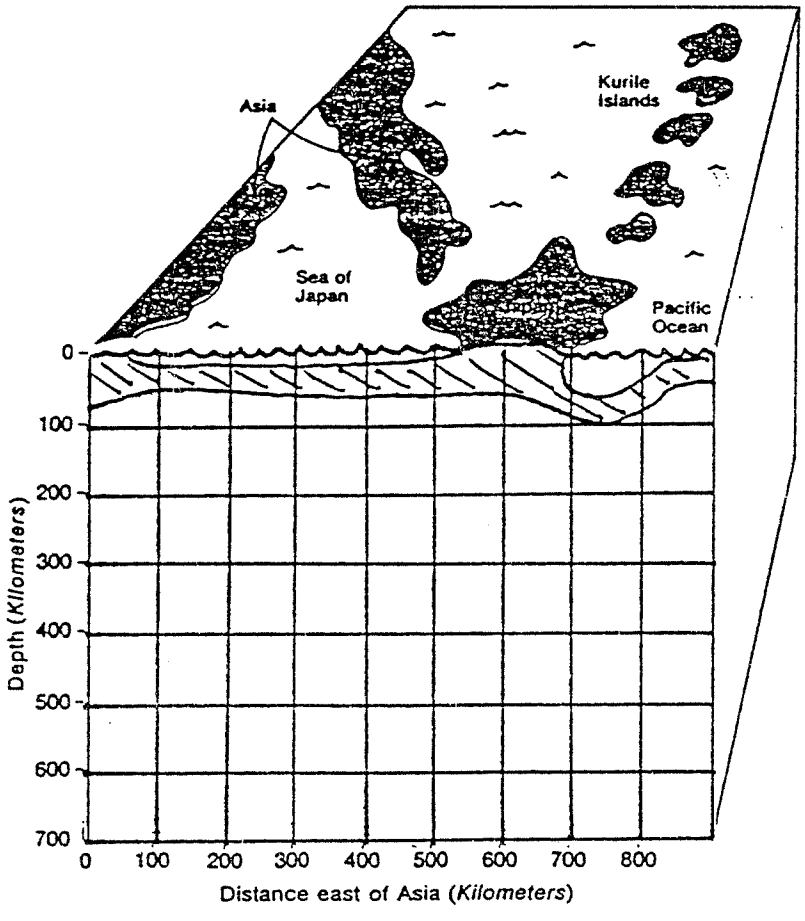
PROCEDURES:

The data below represents the location of 20 earthquake focii under Japan as measured in depth and distance east from Asia. Use a dot to indicate the location of each focus. Can the dots be joined with one line or are they in a collection rather than a line?

DATA:

Focii of Earthquakes under Japan

DEPTH (km)	DISTANCE EAST (km)	DEPTH (km)	DISTANCE EAST (km)
55	600	125	650
300	490	280	520
375	425	410	400
405	350	75	625
240	625	60	675
500	60	300	300
305	375	100	700
150	625	40	650
305	400	410	425
75	625	50	825



Questions:

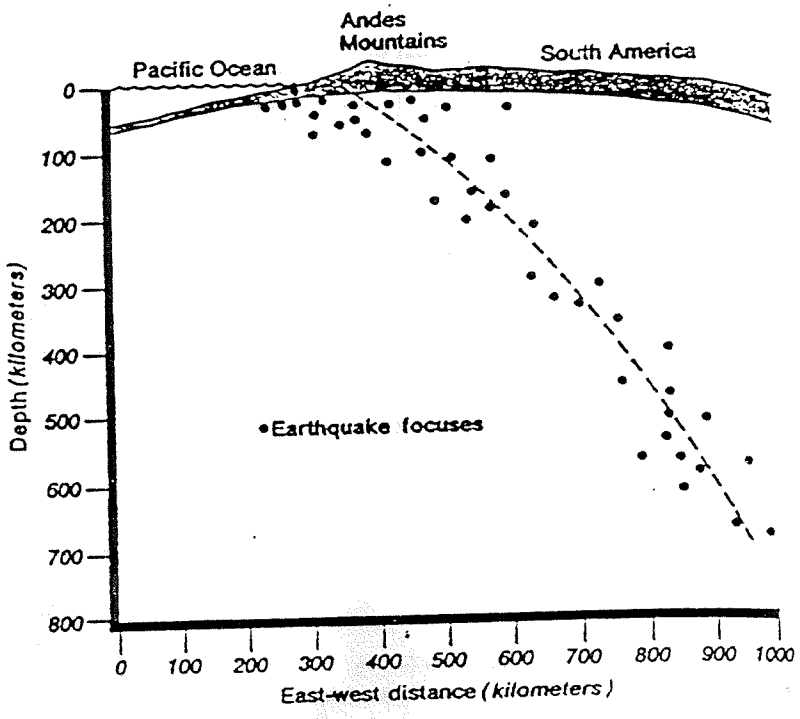
1. Describe the pattern of the focii.

2. Which focii are most likely to cause damage to cities? Explain your answer.

3. Suggest a reason for the pattern of focii. What must be happening in this region of the Earth?

4. Are all of the focii in the lithosphere? What questions does this raise about tha interior of the Earth?

5. The diagram below represents the earthquake focii under South America. Compare this pattern to the one you just plotted. Compare in terms of: direction, angle, curvature, land forms, etc.



The focuses of earthquakes under South America seem to trace out a line.

Native Stories of The Pacific Northwest

Thunderbird & Whale

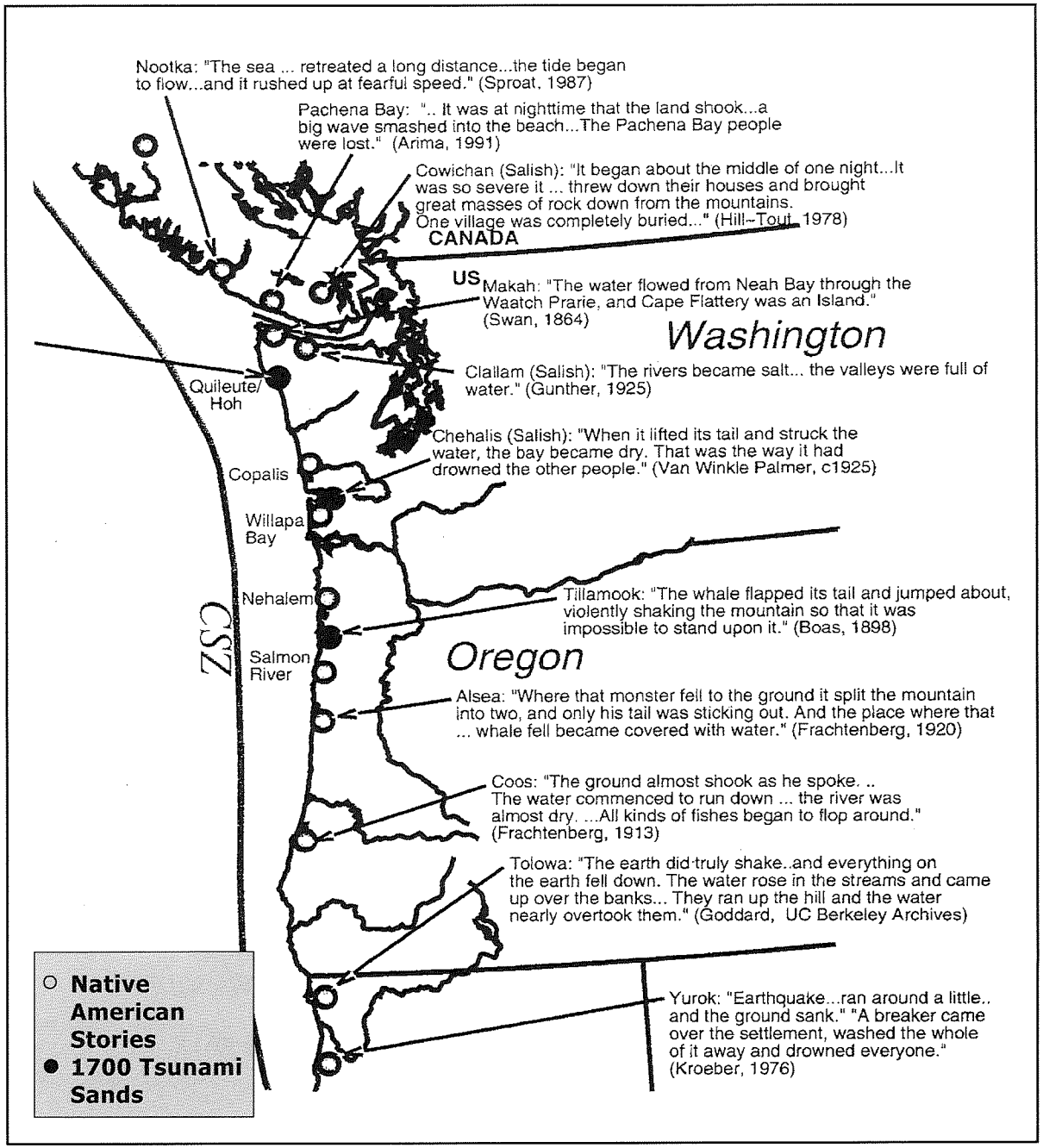
Thunderbird soared far out over the placid waters and waited for Whale to come to the surface. As quick as a flash the powerful bird darted and seized it in her flinty talons, lifting it and soared over the land areas.

Passing beyond the oceans she was compelled to alight and rest her wings, and each and every time the bulky beast was allowed to reach solid land there was a terrible battle, for it was powerful and fought for its life with terrible energy. High into the air the bird carried the beast over the land, dropping it to the surface.

The great Thunderbird finally carried the weighty animal to its nest in the lofty mountains, and there the final and terrible contest was fought. There was a shaking up and trembling of the earth beneath, a rolling up of the great waters.

The waters receded and again rose. The water of the Pacific flowed through the swamp and the prairie westward from Neah Bay on the Strait of Juan de Fuca to the Pacific, making an island of Cape Flattery. Again the waters suddenly receded and numerous sea monsters and whales were left on dry land. Each time the waters rose, the people took to their canoes and floated off as the winds and currents wafted them, as there was neither sun nor land to guide them. Many canoes came down in trees and were destroyed, and numerous lives were lost.

(Composite of several stories from Reagan, 1934 and Reagan and Walters, 1933)



Other Effects of Earthquakes

Google other effects that are related to earthquakes and how are they dangerous.

Effect	What is the danger?
Example: Tsunamis	These are huge waves that form from sudden vertical shifting of the ocean floor. When the wave reaches land, it can wash away entire villages!

Earthquakes: Preparedness in BC

The internet is a wealth of information about a great deal of things, including earthquakes. Read the website found on the Blog and answer the questions below.

Questions (based on the website, in order of the website):

1. On Jan 26, 1700 at 9pm a magnitude 9 earthquake happened off the coast of BC. In the resulting tsunami, how many Loht'a residents were lost?

2. How many earthquakes happen in BC each year?

3. Where are the most at-risk regions in BC?

4. If you feel an earthquake starting, what should you do?

5. What should you do when the shaking stops?

6. Make a Plan: What are a few things that you can do to be prepared ahead of time? Optional, but a good idea: go to this website www.gov.bc.ca/PreparedBC to complete a plan with your family.

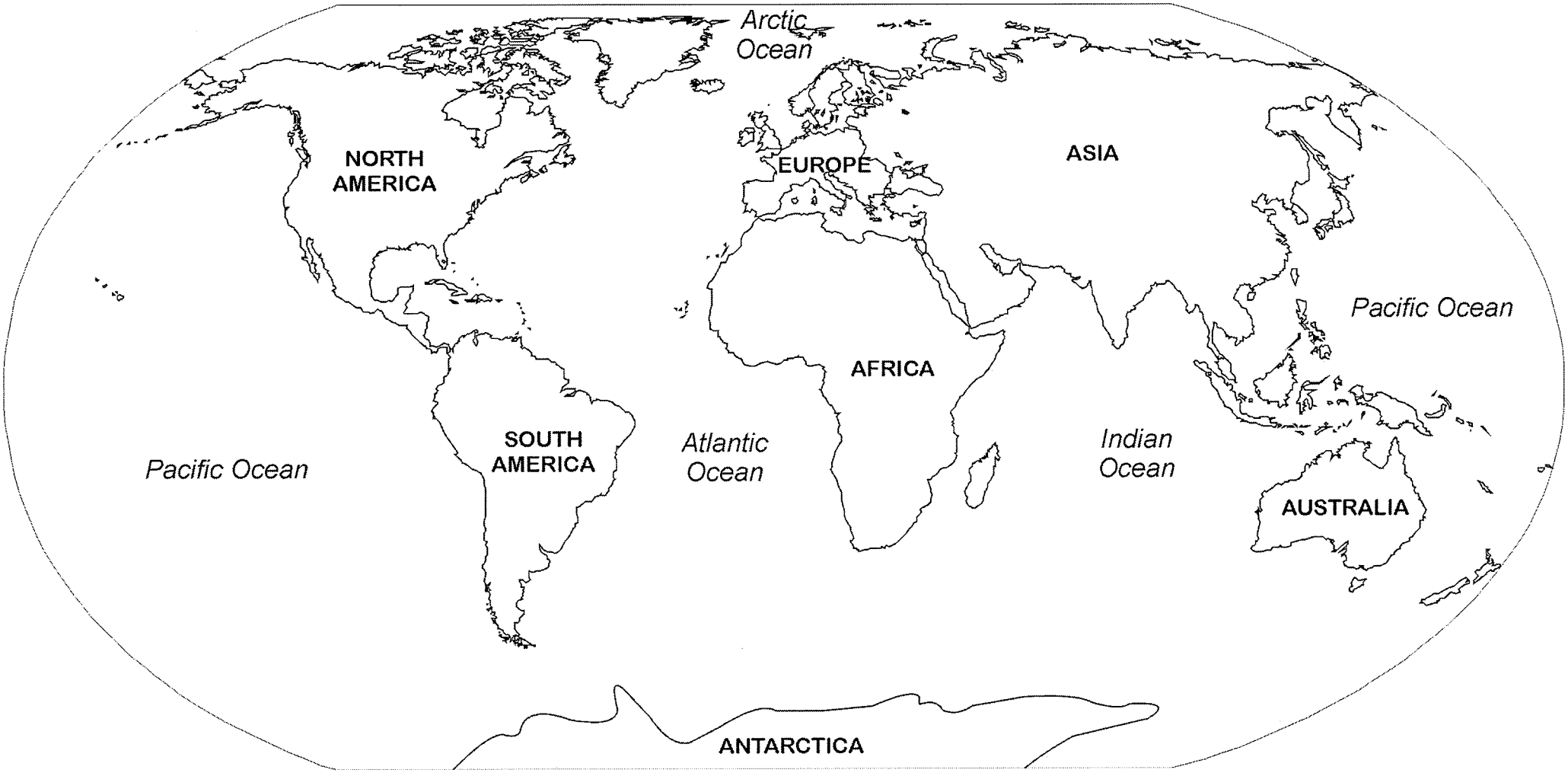
7. What should you do *now/today* to help your home survive earthquake shaking.

8. What should you turn off in the event of leaks?

9. List 11 items that should be in your basic emergency supply kit.

10. What areas are at risk for tsunamis? If you live in one of these areas, what should you do after you Drop, Cover and Hold On?

Be prepared, not scared!!


Arctic Ocean
NORTH AMERICA
EUROPE
ASIA
Pacific Ocean
AFRICA
SOUTH AMERICA
Atlantic Ocean
Indian Ocean
Pacific Ocean
AUSTRALIA
ANTARCTICA

Chapters 13 to 16 Wordsearch with Clues

Z R A I K L O B C S H A D O W Z O N E X Y D L
C T S N E E A N H L I P E N I L C I T N A E L
L I T H O S P H E R E Z E I N C I W I C S L Y
K U H J U R A S R I S S E N A R R E T P O L L
L A E N R A T H J N K A E T A N N O R A H A O
R E N T L X D H U C O N V E R G I N G J S I T
B A O C A I M R A A D A E P W T R O R E B M A
H E S A M L L Y N M N N N H D E P R I M A R Y
E I P C R A T S D A E D L R T O P S T O H L M
M A H R O I O N E R M R A A L M L O O U H C A
T N E A N C M A F I C E I I N O A T U N L I G
I C R X L I E N U S E A I C O N V E C T I O N
I K E M P O Q S C U H S P A A R A G O A M S I
P A S O I L F Z A J E F G E C N A Y W I U S T
G H J Z H Q O U A C K A D F H J L N P N R T U
J C L U N O P S X B O U N D A R I E S B E A D
H P A R G O M S I E S L N I M R Y A R F W D E
D P L U T O N I C V O T N K E D O O G Y R E V
Y L U F I T U A E B E H S E C O N D A R Y U H

Clues

1. Which plate do we live on? [13]
2. Which plate is subducting under us? [10]
3. What is the solid surface layer of the earth called? [11]
4. The plasticy layer is called the _____. [13]
5. _____[10] cells cause the plates to move.
6. The sliding boundary between the Pacific and N.A. plates is called the _____.[15]
7. Most earthquakes and volcanoes occur along plate _____. [10]
8. When two continents collide at a _____[10] boundary, high _____[8] ranges form.
9. The pieces of land that attached themselves to N.A., forming BC are called _____. [8]
10. Thin magma that flows more easily is called _____. [5]
11. Gasses in magma cause volcanoes to be _____. [9]
12. Magma that reaches the surface is called _____. [4]
13. Solid fragments of lava are called _____. [6]
14. Hawaii is an example of a _____ [7] volcano.
15. A pluton that cuts across sedimentary layers. [4]
16. Waves that can travel through any material. [7]
17. Particles vibrate at right angles to wave motion. [9]
18. Records earthquake waves. [11]
19. Strength of earthquake. [9]
20. Boundary between crust and mantle. [4]
21. If you receive neither P or S waves you are in the _____. [10]
22. Hanging wall slides down in a _____[6] fault.
23. An upfold in rock layers is a(n) _____. [9]
24. _____[8] domes are formed when rocks are pushed up by an igneous intrusion.
25. Your teacher's last name. [5]

Review Points

- Plate tectonics: mountains form when plates collide, plates move by convection currents in asthenosphere, jigsaw fit, rocks and mesosaurus fossils match on S.A. and Africa, plates move about 2-10 cm/year, most earthquakes and volcanoes occur along plate boundaries
- Diverging – plates moving apart, rifting, normal faults form, no folds
- Subduction – converging boundary, ocean plate dives down due to higher density (heavier), forms explosive composite volcanoes, trench forms between two plates → deep + shallow focus
- Youngest ocean floor rock along ridges where magma comes up, ~~deep~~ shallow focus earthquakes
- Youngest continental rock near active continental margins (where volcanoes are)
- Himalayan mts formed when India and Asia collided
- Rockies mts formed when terranes (volcanic islands) collided with west coast folding and faulting up the sedimentary layers
- Coast mts formed when those colliding volcanoes eroded away and roots rose up
- Cascade mts formed from subduction zone between Juan de Fuca plate and North American plate (I.E. Mount St Helens)
- Faults: normal(H.W. slides down), reverse(H.W. slides up), thrust(low angle reverse), strike-slip(horizontal motion only)
- Folds all produced by collisions: syncline(smile), anticline(ant hill), overturned
- Layers of Earth by physical state from surface: lithosphere, asthenosphere, mantle, core
- Moho – division between crust and mantle
- Outer core is liquid, asthenosphere plasticy, rest solid
- Seismograph measures ground motion and therefore magnitude and indirectly distance (using difference in P&S wave arrival time and distance time graph) to the earthquake (but not direction, need three stations to see where circles cross-) – doesn't measure intensity
- Intensity is a measure of damage done and how people described it
- San Andreas Fault in California is a strike-slip fault
- Review P&S wave chart, waves start at focus where earthquake starts, epicenter is location on surface directly above focus
- Richter scale measures magnitude and ground motion goes up by x10, energy released goes up by x30
- We live on the North American plate
- Lava has less gas and is on the surface, magma has more gas and is liquid rock under the surface
- Laccolith(causes rock above to bubble up), dike(cuts across sedimentary layers), sill(parallel to sedimentary layers)
- Volcano predictors – acid levels increasing, dead trees from carbon dioxide, earthquakes as magma moves up, sulfur dioxide emissions
- Earthquake predictors – ground elevation changes, electrical resistance changes, seismic wave speed changes, radon in well water
- Which way is up? Look at mud cracks, shell fossils, ripple marks, rain drop prints
- Hot spot volcano like Hawaii is a shield volcano; hotspot stays still, plate moves, oldest volcano form first and is furthest from hotspot
- Mafac lava flows, felsic lava blows
- Magnetism preserved at ridges: magnetic particles in the magma align with magnetic field lines and are stuck that way when solidifies; stripes formed tell us that poles have reversed
- Geyser – constricted tube, pressure builds, eventually water spews out