Idaho Seismic Belt Graphic Organizer

***Putting Down Roots*, pp. 8-13**

Idaho State Standards:

Earth Science 1.2.2, 1.8.1

Objectives:

Students will:

- Design a graphic organizer (concept map, mind map) that will allow them to understand and organize information.
- Use the graphic organizer to interpret maps, write summary reports, and communicate information.

RATIONALE

Graphic organizers are visual representations of knowledge, concepts, thoughts, or ideas. They are sometimes referred to as Concept Maps or Mind Maps and have been used to organize bits of data in easy-to-understand formats, such as charts, tables, graphs and as a way of taking notes. Graphic organizers are used as a way of helping students to organize their thoughts or information. They are known to help relieve learner boredom, enhance recall, provide motivation, create interest, clarify information, and promote understanding (Buzan, 2000). In this activity, students will generate a graphic organizer that will display information about the four Intermountain Seismic Belts in Idaho.

FOCUS QUESTION(S):

- What would be the best way to organize the data presented on pp. 8-13 in the Earthquake booklet?

TEACHING CLUES AND CUES

Putting Down Roots in Earthquake Country has a wealth of information, much of which would be overwhelming to students if not broken down into understandable bits. To accomplish this, atype of graphic organizer can be used. Mind maps are usually done with different colors as a way to take notes. The main idea is placed in the center of the page and then built outward. If this is the first introduction to Mind Mapping, the teacher may want to complete it as a class project, with different groups of students finding the information and then reporting out. The teacher displays or builds the map at the front of the room and the students then copy the information. Allow students to use their designed graphic organizer during a quiz to emphasize its practical use. This technique of note taking will allow students to access the information quickly. Note: Other activities on the accompanying CD-ROM use the information from this section of the booklet.

Various educational graphic organization software programs are available on the market, such as Inspiration®, Kidspiration®, SmartDraw®, etc. If you have access to one of these programs, this may be an appropriate time to incorporate it into the lesson.

MATERIALS:

- *Putting Down Roots in Earthquake Country* booklet for each student
- Paper and colored pencils (4)
- *Optional* - Graphic Organizer Software

PROCEDURE:

Teacher Preparation

Explain to students how mind maps are structured and provide them with the booklet and colored pencils.

A. Introduction

Tell students that they are to design a mind map that displays the information found within pp. 8-13 of the *Putting Down Roots in Earthquake Country* booklet. The key concept is "Seismic Zones in Idaho." For their maps, direct students to find the following information in the publication:

- Name of seismic zones
- Geographic location
- Names of major faults and orientation
- Major Cities or towns (5)
- Water features (rivers, reservoirs, lakes)

B. Lesson Development

1. Describe how and why mind maps are designed.
2. Use a different color of pencil to emphasize the ideas requested.
3. On the chalkboard or whiteboard, list the information that students are to find within the publication

C. Conclusion

Have students place their mind maps in their notebooks to be used for future reference.

A Model of Three Faults

***Putting Down Roots*, pp. 3-4, Idaho and the Intermountain West are Seismically Active**

Idaho State Standards:

Earth Science 1.2.2, 1.3.1, 1.3.3, 4.1.3
8th Mathematics 2.1.1, 2.2.1
9th Mathematics 1.1.1, 2.1, 2.4.1

Objectives:

Students will observe, identify, take measurements, and interpret fault movements on a model of the earth's surface.

RATIONALE

The topographical expression of the earth's surface is the result of geologic processes. These processes result in the formation of mountains, valleys, cliffs, waterfalls, canyons, river beds, etc. Over a long period of time, movements along a fault line contribute to the formation of these geological features. In this activity, the use of a model can help students to vizualize and understand faulting. Models are a three-dimensional configuration of layers, concrete rather than abstract descriptions or diagrams, can be manipulated by the students, and can show the motions of the faults through time.

FOCUS QUESTION(S):

- Can you name a famous fault?
- What happens when giant fractures develop on the Earth and the pieces move relative to one another? Answer: earthquakes occur.
- What type of forces or stress is necessary for movement along a fault? Answer: tension, compression, shearing.

TEACHING CLUES AND CUES

Teachers may want to enlarge (8 ½ x 11) the model before copying. They may also want to have the model enlarged for themselves so that it can be used for classroom demonstration . To create a large model for class demonstrations, have it enlarged onto poster sized paper at an office products store or copy center and glue to foam core or poster board before construction.

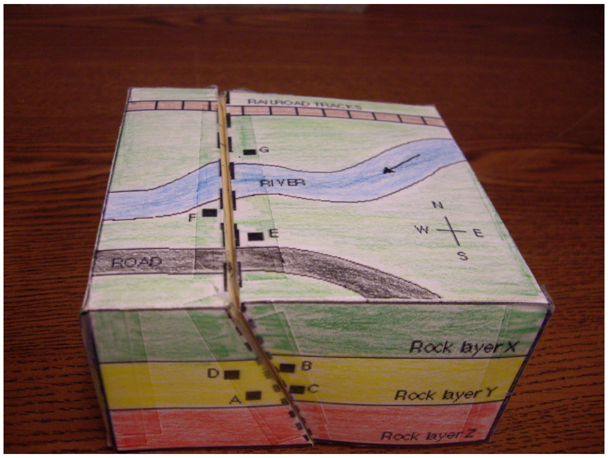
The making of a classroom set of these models is an appropriate use of time. Save the best one from year to year to reuse in the classroom. They can also be used as a manipulative for a quick one-on-one assessment with students.

MATERIALS:
for teacher

- Physiographic map of the world
- Student copies of the Fault Model sheet, p. 23
- Student copies of the student worksheet, pp. 30-33
- Teacher Background, pp. 24-29
- Demonstration model (enlarged or Foam version), p. 23
- Computer and projection system to show videos and/or animations
  Fault models Lecture
  http://www.iris.edu/hq/programs/education_and_outreach/videos#F
  What are the 4 basic classes of faults?
  http://www.iris.edu/hq/programs/education_and_outreach/animations
- Answer Key, pp. 34-35

for the students: (work in pairs)

- Copy of the Fault Model sheet, p. 23
- ½ Manila file folder
- Crayons or colored pencils
- Scissors
- Glue or tape
- Metric ruler
- Copy of the student worksheet, pp. 30-33



PROCEDURE:

Teacher Preparation

Make enough copies of the Fault Model sheet and the student worksheet for the students. Have the student glue their paper model on the ½ sheet of manila file folder before they color and cut. This makes it easier to manipulate and construct.

A. Introduction

Not all faults are associated with plate boundaries. There is a broad range of faults based on type, linear extension, displacement, age, current or historical activity, and location on continental or oceanic crust. However, they can be categorized according to one of the three basic types of faults--normal, reverse, or strike-slip. The stresses and strains in the earth's upper layers are induced by many causes: thermal expansion and contraction, gravitational forces, solid-earth tidal forces, etc. Faulting is one of the various manners of mechanical adjustment or release of such stress and strain. Normal faults are associated with tensional stress, reverse faults with compressional stress, and strike-slip faults with shearing stress.

B. Lesson Development

1. Glue the model to the ½ sheet of manila file folder to provide stability.

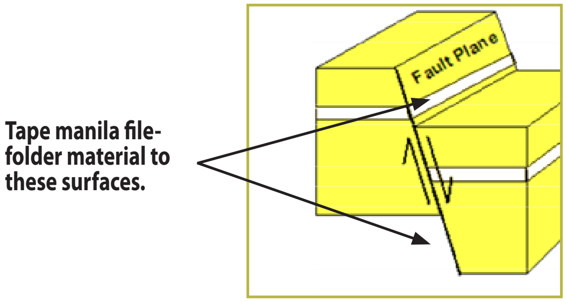
2. Color the model following the key.

3. Cut out the Fault Model. Fold along solid lines. Use a ruler and edge of scissors to score the lines for a clean, sharp fold.

4. Tape the corners together. This box is a three-dimensional model of the top layers of the Earth's crust.

5. The dashed lines on the model represent a fault. Carefully cut along the dashed lines. You will end up with two pieces.

6. *Optional*--tape the manila-folder paper to the "faces" of the fault planes so students realize they represents rock material and are not merely blank area. Make two rectangles the width and height of the box and tape to the faces after coloring and cutting along the dashed line. This step also helps the two surfaces to slide easily and keeps the model more stable when working with it.



C. Conclusion

Help students to understand that the movements along fault lines result in the formation of surface features. It is not shown on the models but with guidance they may be able to understand how mountains form by repeated uplifting or how the presence of waterfalls may indicate fault movement along a rivers course. Local examples would enhance understanding.

Adaptations and Extensions

1. Have students use their hands to generate the forces necessary for compressional, tensional, and shearing forces. Push their palms together to feel compressional force, lock the fingers and pull to feel the tensional force, and have them place palms together and slide to feel shearing force. These kinesthetic movements further reinforce the motions associated with faulting.

2. Assign groups of students to write a poem, song, rap, etc., that reflect the lesson learned.

3. Ask students to explain the type of faulting associated with Basin and Range faulting. Is the land being compressed or are tensional forces being applied? Where is the energy coming from to generate this movement?

4. Have students compare a relief map to the geologic map of Idaho. Faults are important in mineral and petroleum exploration as they may either seal or act as a barrier to fluid flow (e.g., due to smearing of mud or shale along them), or may be important conduits for the migration of petroleum or mineralizing fluids. Many mineral deposits are fault and fracture controlled (e.g., Idaho's hard rock mining industry such as the Coeur d'Alene Mining District in northern Idaho or Thompson Cyprus Mine of southeastern Idaho). Recognition of faults is also important in hydrogeological studies as fracturing along faults may produce hard-rock aquifers or pathways for geothermal or carbonated water for which Idaho is known (e.g. Boise and Soda Springs).

The following one-page leaflets published by the Idaho Geological Survey support the Adaptations and Extensions section of this activity:

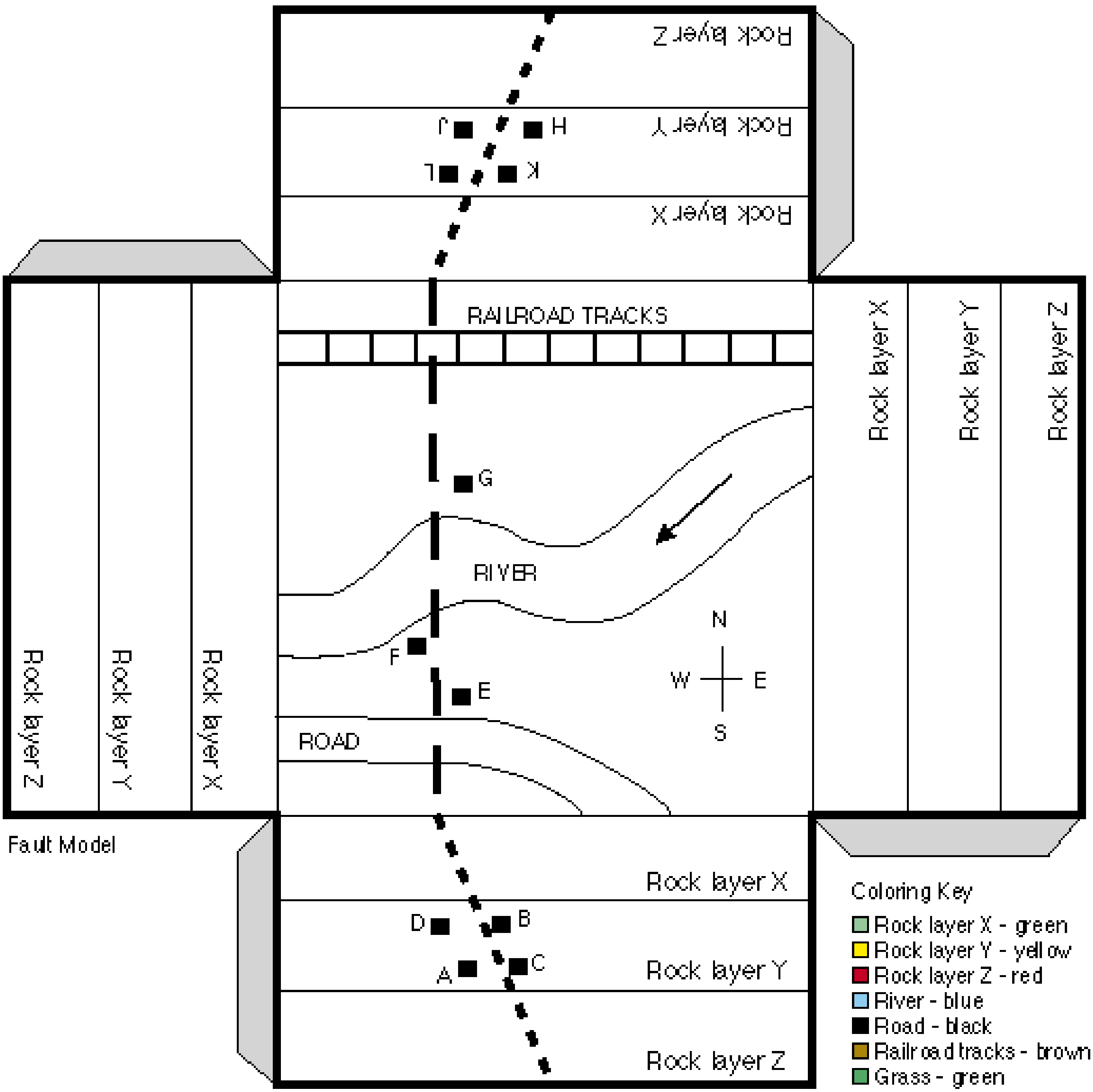
McLeod, J.D. "The Search for Oil and Gas in Idaho," Idaho Geological Survey, GeoNote 21, 1993. http://www.idahogeology.org/PDF/GeoNotes_(G)/geonote_21.pdf

Gillerman, V.S. "Idaho Mining and Geology," Idaho Geological Survey, GeoNote 40, 2001. http://www.idahogeology.org/PDF/GeoNotes_(G)/geonote_40.pdf

Gillerman, V.S. "Rare Earth Elements and Other Critical Metals in Idaho," Idaho Geological Survey, GeoNote 44, 2011. http://www.idahogeology.org/PDF/GeoNotes_(G)/GN44_Rare_Earth_Elements.pdf

Gillerman, V.S., Bennett, E.H. "Idaho Mining and Exploration, 2009," Idaho Geological Survey Staff Report 10-5, June 2010. http://www.idahogeology.org/PDF/Staff_Reports_(S)/2010/Mining_and_Exploration_S-10-5.pdf

Fault Model Pattern



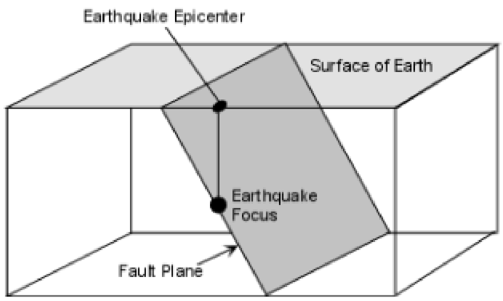
Teacher Background-Types of Faults

The fault models shown here illustrate relatively simple motions and geologic structures. Although these models are accurate representations of real Earth faulting and plate tectonic structures and motions, the spherical shape of the Earth and the complexity of geological features caused by varying rock types and rock properties and geological development over many millions or hundreds of millions of years result in significant complexity and variability of actual fault systems.

Table 1: Faults, Plate Boundaries and Relative Motions

Relative Motion of Layers or Plates	Fault Names	Plate Boundary Descriptions	Related Tectonic and Geologic Features
Extension	Normal	Divergent (extensional, moving apart, spreading, construction - because new lithosphere is generated in the extended zone)	Rifts, grabens, sometimes volcanism, regional uplift but local downdropped fault blocks, shallow earthquakes (Examples: Basin & Range NV, ID, Owen Valley, CA, East African Rift, Mid-ocean Ridge)
Compression	Reverse or Thrust	Convergent (compressional, collision, subduction, moving together, destructive - because one plate is often thrust into the mantle beneath the other plate)	Folded mountain ranges, uplift, reverse faults, volcanic arcs (usually andesitic composite volcanoes), deep ocean trenches, shallow and deep earthquakes in subducted slab (Examples: Himalayan, Alps, Andes and Rocky Mts.)
Translation or horizontal slip	Strike-slip	Transform (horizontal slip, translation)	Linear topographic features, offset stream channels, lakes in eroded fault zone, pull-apart basins and local uplifts along fault bends or "steps" between offset fault segments, oceanic fracture zones, offsets of mid-ocean ridges (Examples: San Andreas, Transform faults of the Ocean,

A **fault** is a fracture or zone of fractures between two blocks of rock. Blocks move relative to each other along the fault plane. This movement may occur rapidly, in the form of an **earthquake** or may occur slowly, in the form of creep. Faults may range in length from a few millimeters to thousands of kilometers. Most faults produce repeated displacements (movement) over geologic time. During an earthquake, the rock on one side of the fault suddenly moves with respect to the other. The fault surface can be **horizontal**, **vertical,** or **oblique** (horizontal and vertical displacement).



Strike-slip Faults

Strike-slip faults develop when rocks are subjected to shear stress. In strike-slip faults, the movement is purely horizontal with no up-and-down displacement. We classify strike-slip faults as either right lateral or left lateral. Imagine yourself standing on one side of a strike-slip fault, so that you are facing the fault. If the block on the other side is displaced to your right, the fault is a right lateral strike-slip fault (Figure 1). If the block on the other side of the fault is displaced to your left, the fault is a left lateral strike-slip fault.

Notice that pure strike-slip faults do not produce fault scarps. There are other tell-tale changes in the landscape that signal strike-slip faulting. The zigzag effect (offset) of the creek channel is the result of movement along the fault (Figure 1). As you might guess, where the two massive blocks on either side of a strike-slip fault grind against each other, rock is weakened. Streams flowing across strike-slip faults are often diverted to flow along this weakened zone.

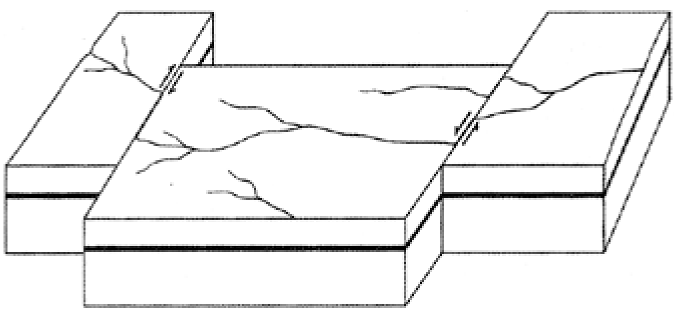


Figure 1. **Right and left lateral** strike-slip faults

Dip-Slip Faults

When distinguishing between the types of dip slip faults, we define the block of rock above the fault plane as the **hanging wall** and the block of rock below the fault plane as the **footwall** block (Figure 2). The terms “hanging wall” and “footwall” are old mining terms. The hanging wall block was the block of rock where miners would hang their lanterns; the footwall block was where miners would walk. It is easy to determine which side of the fault is the hanging wall if you imagine a miner standing on the fault plane. The hanging wall will be the block above the miner's head; the footwall will be the block below the miner's feet. Strike-slip faults are horizontal and thus do not have hanging walls or footwalls. If rocks break under tensional stress, the hanging wall will move down relative to the footwall and a **normal fault** forms (Figure 2). In this situation, the crust actually extends and lengthens.

When rocks break under compressional stress, the hanging wall moves up relative to the footwall, and a **reverse fault** forms (Figure 3). In a reverse, the crust is shortened. **Thrust faults** (Figure 4) are simply reverse faults in which the angle formed by the fault plane and the surface is quite shallow.

Commonly, the fault plane itself can become grooved and polished as one block of rock scrapes against the other. The scratches on the fault plane surface are called **slikensides**. Slickensides may record the slip orientation of the fault plane, and may even feel smoother in the direct of slip.

There is another relationship between rocks on either side of the fault plane that can be used in distinguishing normal and reverse faults and are seen in Figures 2 and 3. If the rocks are right side up, the normal fault brings down younger rocks over older rocks. Under the same conditions, the reverse fault moves older rocks over younger rocks.

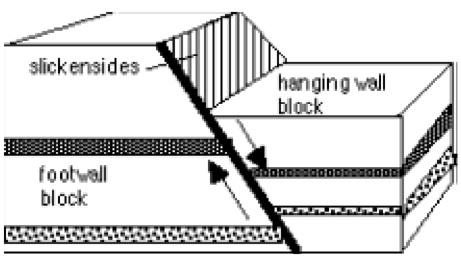


Figure 2. **Normal Fault**

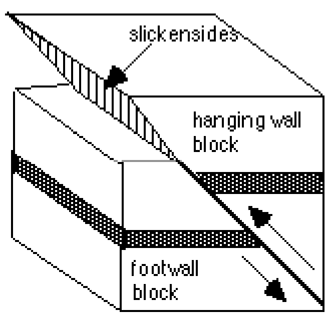


Figure 3. **Reverse Fault**

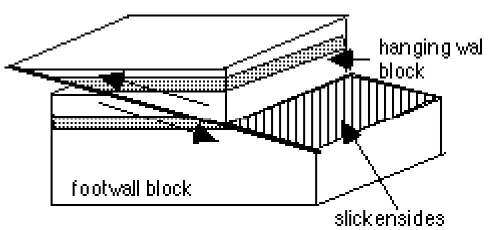


Figure 4. **Thrust Fault**

Teaching About Plate Tectonics and Faulting Using Foam Models

Materials:

- Pre-made foam block models
- Videos > / Fault Models http://www.iris.edu/hq/programs/education_and_outreach/videos#F

OR

- Foam (open cell, foam mattress type) “blocks” shown in Figure 1A
- Felt pens (permanent marker, red and black)
- Manila folders or thin poster board
- Rubber cement
- Closed cell foam (“sleeping bag pads,” camping equipment) as shown in Figures 3 and 5
- Pins
- Open cell foam as shown in Figure 3A
- Styrofoam core poster board, 0.6 cm (1/4 in) thick, as shown in Figure 3B
- Razor blade knife
- Metric ruler

Procedures:

Prepare block models as shown in Figure 1A. Cardboard (cut from manila folders or thin poster board) attached to both faces of the fault plane allows the blocks to slip easily along the fault as forces are applied to the blocks.

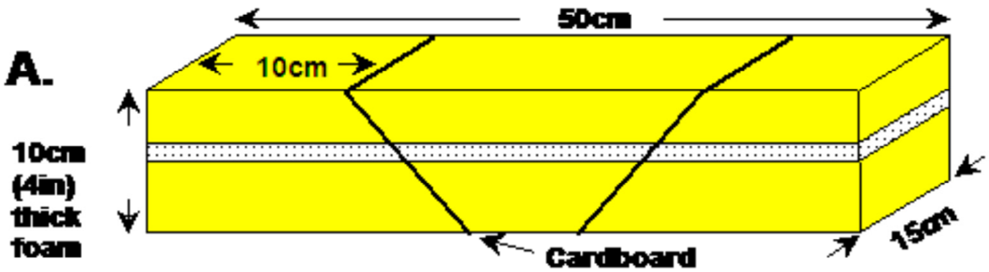
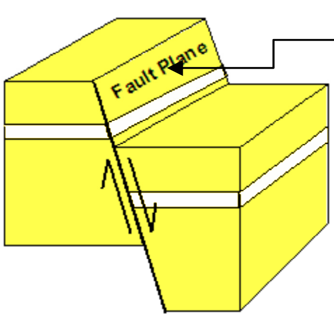


Figure 1A. Foam block model



Glue manila-folder paper to the faces of the fault planes so the blocks slip easily during extension and compression.

1) Normal Faulting (Extension)

Use the block models to demonstrate **normal faulting** as the two outer blocks are moved **apart** (Figure 1B). This procedure is best performed by holding the blocks "in the air" in front of you, supporting the model by the two outer blocks, rather than on a table. Note that as the two outer blocks are moved apart, the inner block drops downward or "subsides." This relationship between extensional motion of geologic layers and downdropped fault blocks (graben or rift valley if the downdropped block is bounded on both sides by normal faults, as in this block model) produces normal faulting. It also represents the extensional motion and resultant rift development associated with divergent plate boundaries (Table 1).

Examples of divergent plate boundaries, where extensional faulting is prominent, are the mid-ocean ridge system in which a narrow rift or graben (downdropped fault block) is commonly observed along the highest part of the ridge and the East African Rift in which extension has been occurring in the continental lithosphere for about 30 million years and the resulting rift system of normal faults is beginning to break apart the continent. In a plate-tectonic related, but not plate boundary environment, the Basin and Range area of the Western United States displays a prominent topographic signature of extensional faulting with many adjacent downdropped fault blocks or grabens and the topographic "high" areas between the grabens are called horsts.

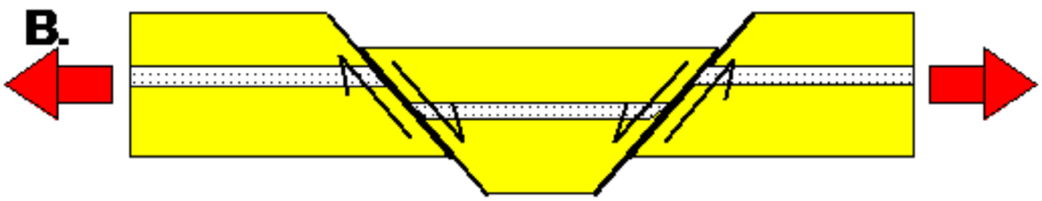


Figure 1B. Normal faulting using the foam model. Red arrows represent extension. Half-arrows along faults show direction of relative motion along the fault plane.

2) Reverse (Thrust) Faulting (Compression)

To demonstrate compressional motion and resulting **reverse** (also called thrust) faults, hold the foam block models as described above and then move the two outer blocks **together** as in Figure 1C. The inner block will be thrust upwards producing reverse faults and an uplifted block. In a plate tectonic setting, such compressional motion is associated with convergent plate boundaries (Table 1) where two lithospheric plates are moving together or colliding (see also section 3 below). Not surprisingly, these convergent zones are associated with mountain ranges (Himalayas, Alps, Andes, etc.).

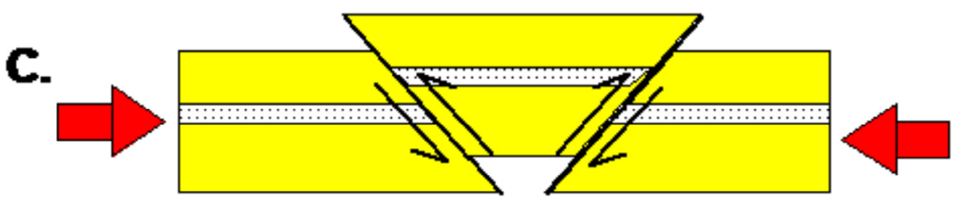
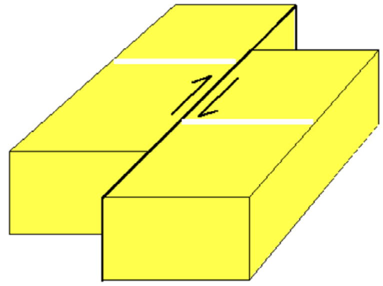


Figure 1C. Reverse faulting using the foam model. Red arrows represent compression. Half-arrows along faults show direction of relative motion along the fault plane.

3) Strike-slip or Horizontal slip fault motion (shear)

Note: This does not require the building of a second model as suggested here. This motion can be modeled by looking at the top of the foam block model used above. Coloring in a feature to be offset such as a road or river shows the lateral offset of strike-slip faulting.



Strike-Slip Fault

To demonstrate horizontal slip or strike-slip fault motion, prepare foam blocks as shown in Figure 1D. Moving the blocks horizontally on a tabletop, as shown in Figure 1E, demonstrates strike-slip or horizontal slip fault motion. This motion along a plate boundary is also called **transform** (Table 1). The San Andreas Fault zone is a system of strike-slip faults that form the transform plate boundary at the western edge of the North American Plate. Transform faults also occur as oceanic fracture zones between segments of the mid-ocean ridge spreading zones

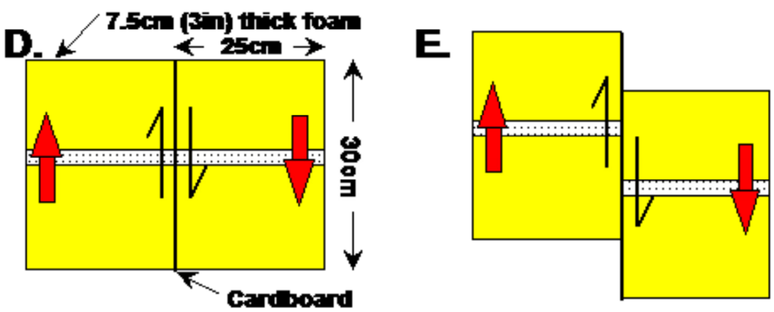


Figure 1D and 1E. Strike-slip faulting using the foam model. Red arrows represent shearing. Half-arrows along faults show direction of relative motion along the fault plane.

Student worksheet

Modeling the Faults

Name____Date___________________

Normal Fault

Locate points A and B on your model. Move point B so that it is next to point A. Observe your model from the side (its cross-section).

Draw the normal fault as represented by the model you have just constructed.

Questions

1. Which way did point B move relative to point A?
2. Place half-arrows on your diagram to show the direction of movement along both sides of the fault line.
3. What happened to rock layers X, Y, and Z?
4. Are the rock layers still continuous?

Normal Fault

5. What likely happened to the road? The railroad tracks?
6. Look at the direction of flow of the river. Describe what you think would likely happen to the rivers pathway?
7. Return your model to its original position. Using a metric ruler measure (mm) across the cross-section from one side to the other. ___________mm. Move point B next to point A and again take a measurement (mm). _________mm. Compare the two measurements.
8. Is this type of fault caused by compression, tension, shearing? Explain.
9. Many normal faults are found in Nevada and southeastern Idaho. This is because this location is in a region called the Basin and Range Province where the lithosphere is stretching. Did your model stretch (distance increase) when you moved point B next to point A? Explain

Reverse Fault

Locate points C and D on your model. Move point C next to point D. Observe the cross-section of your model.

Draw the reverse fault as represented by the model you have just constructed.

Questions

1. Which way did point D move relative to point C?

2. What happened to rock layers X, Y, and Z?

3. Are the rock layers still continuous?

4. What likely happened to the river?

Reverse Fault

5. Return your model to its original position. Using a metric ruler measure (mm) across the cross-section from one side to the other. ____________mm. Move point C next to point D and again take a measurement (mm). _________mm. Compare the two measurements.

6. Many reverse faults are found in southeastern Idaho. Did your model shorten (distance decrease) when you moved point C next to point D? Explain

7. Is this type of fault caused by compression, tension, shearing? Explain.

8. If the rock material of the uplifted block fell on top of the down dropped block would the relative ages of the rocks be younger rock on top of older or older rock on top of younger? Explain

Strike-Slip Fault

Locate points F and G on your model. Move the pieces of the model so that point F is next to point G.

Draw an **overhead** view of the surface as it looks after movement along the fault

Questions

1. If you were standing at point F and looking across the fault, which way did the block on the opposite side move?

2. What happened to rock layers X, Y, and Z?

3. Are the rock layers still continuous?

Strike-slip Fault

4. What likely happened to the river?

5. If the scale used in this model is 1mm = 2m, how many meters did the earth move when the strike-slip fault caused point F to move alongside point G? **(Show you calculations for full credit)**

   (Note that this scale would make an unlikely size for the railroad track!) If there were a sudden horizontal shift of this magnitude it would be about five times the shift that occurred in the 1906 San Andreas Fault as a result of the San Francisco earthquake.

6. Is this type of fault caused by tension, compression, or shearing? Explain

7. Is the strike-slip fault a right or left – lateral movement? Explain

8. Does it make a difference which side of the fault you stand on in naming the right-lateral or left-lateral strike-slip fault? Explain

9. The San Andreas Fault in California is a right-lateral strike-slip fault. Which block is moving to the right? The Pacific block or the North American block?

Reinforcement and Enrichment

1. Name and describe the type of faults that form in convergent margins. Explain why these types of faults form. Give an example of a convergent margin and use a simple diagram to illustrate your answer.

2. Name and describe the type of faults that form in a divergent boundary. Explain why these types of faults form. Give an example of a divergent boundary and use a simple diagram to illustrate your answer.

3. Name and describe the type of faults that form along a transform boundary. Explain why these types of faults form. Give an example of a transform boundary and use a simple diagram to illustrate your answer.

4. Research and classify three of the faults below. Be sure to cite the source of your information and the internet URL. Go to> http://earthquakes.usgs.gov/hazards/qfaults/ as a starting point. >**Quaternary Faults > Fault Maps – Static** click on **Idaho.** After the map completes loading scroll down to the bottom and click on **Database Search**. Then >**Identifiers > Name** (type in the "name of the fault") and then >**Geographic Characteristics** > **State** select "Idaho" >

   Provide the following information (>**Brief** under the fault name): Location (include map AMS sheet), Length, Age of most recent movement (deformation), Rate or movement (Slip-rate), Type of fault (Normal, Reverse or Thrust, Strike-slip), Seismic Zone or Belt.

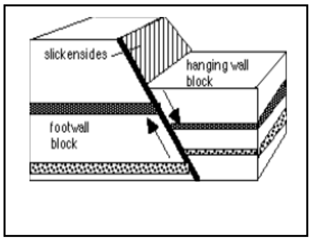
   - Long Valley Fault
   - Cascade Fault
   - Squaw Creek Fault
   - Grand Valley Fault
   - Wasatch Fault
   - Bear Lake Fault
   - Sawtooth Fault
   - Western Snake River Plain Fault
   - Jakes Creek Fault
   - Centennial Fault
   - Council Fault
   - Lemhi Fault
   - Beaverhead Fault

5. Research on which section/s of the Lost River Fault the 1983 Borah Peak earthquake occurred. Identify the names of the segment/s, location, length/s of fault segment/s that moved, and type of fault. What percent of the total Lost River Fault moved during the 1983 Borah earthquake? Go to> http://earthquake.usgs.gov/ at the top of the page select >**Hazards** from the side bar select >**Quaternary Faults** > **Database Search.** Then >**Identifiers > Name** (type in the "name of the fault") and then >**Geographic Characteristics** > **State** select "Idaho".

ANSWER KEY for Student Worksheet
Modeling the Faults

Normal Fault

Draw the normal fault as represented by the model you have just constructed.

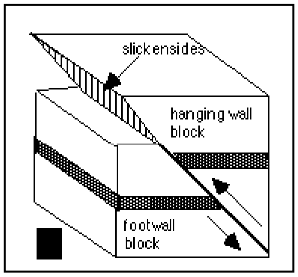


Questions

1. Point B moves closer to point A
2. See the diagram.
3. Rock layers X, Y, and Z get offset by the fault.
4. The rock layers are no longer continuous, they have been broken by the fault.
5. They were offset vertically. During that process they will be potentially broken.
6. The river could possibly be dammed up, until it found a new pathway. A temporary lake my form causing flooding to the area below the fault scarp. The river would follow the fault line until it could eventually reestablish its' route. The old river bed will dry up.
7. Measurement should be greater.
8. This fault is caused by tension. In order for point B to move opposite point A the two blocks needed to be pulled apart so that point B could move down to point A. Normal faults are caused by tensional forces.
9. The distance across the block increased by x mm. The stretching of the lithosphere is caused by horizontal extension (page 3, Putting Down Roots….). The source of this stretching is an upwelling of heat from the mantle associated with the N. American hotspot of Yellowstone.

Reverse Fault

Draw the reverse fault as represented by the model you have just constructed.

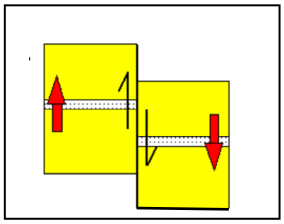


Questions

1. Point D moved closer to point C.
2. Rock layers X, Y, and Z get offset by the fault.
3. The rock layers are no longer continuous, they have been broken by the fault.
4. Perhaps a waterfall could have formed by the rising block.
5. Measurement should be less.
6. The distance became less. In order for point D to move opposite point C the two pieces had to be pushed together so that point D could be uplifted to point C.
7. This fault is caused by compression. Reverse faults are caused by compressional forces.
8. The collapse of the overhang or uplifted block would result in older rocks setting on top of younger rocks. The surface of block D would be covered by the rocks below the surface of block C.

Strike-Slip Fault

Draw an overhead view of the surface as it looks after movement along the fault.



Questions

1. The block on the opposite side of point F moved to the right.
2. Rock layers X, Y, and Z have not be offset vertically but they have been offset horizontally.
3. The rock layers are still continuous.
4. The rivers has been offset to the right (south). The river will likely follow the fault and reconnect with the old riverbed. This will cause the river to have a sharp 90 degree turn in its course.
5. *(Depending on how much the model has been enlarged will change these numerical values, but the overall ratio will not change.)* Approximately 48 meters
   1mm = 2 m; 24mm x 2 = 48m
6. This type of fault is caused by shearing. The two blocks are moving past one another in a horizontal motion with little vertical motion.
7. The fault is a right lateral strike-slip fault. The east side of the fault moves to the south or toward the right of point F
8. No, it does not matter which side of the fault one is standing on. Imagine yourself standing on one side of a strike-slip fault, so that you are facing the fault. If the block on the **other side** is displaced to your right, the fault is a right lateral strike-slip fault. If you were to step across the fault and then face the fault the block to your right would still be displaced to the right. See Figure 1 below.
9. The Pacific (block) Plate is moving to the right.

Figure 1.