

3: Explosive Ideas!

Based on the Oregon quarter reverse



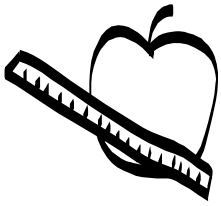
OBJECTIVE

Students will describe and demonstrate ways the Earth's layers interact to cause changes in the Earth's surface. They will explore volcanoes and earthquakes and their effects. They will present an argument using research.



MATERIALS

- 1 overhead projector (optional)
- “Oregon Quarter Reverse” page
- 1 class map of the United States
- “Our Changing Earth” pages
- 1 copy of any variation on the Klamath Indian legend about Crater Lake, such as those available at:
 - www.nps.gov/crla/hrs/hrsae.htm
 - craterlake.wr.usgs.gov/history.html
 - www.outdoors.net/magazines/outdoors/camping/nationalparks/craterlake/clnp-his.asp
- 1 hard-boiled egg
- 1 copy of an age-appropriate text that relates to the structure of the planet Earth, such as:
 - *Magic School Bus: Inside the Earth* by Joanna Cole
 - *What's Under the Bed?* by Mick Manning
 - *How to Dig a Hole to the Other Side of the World* by Faith McNulty
 - *Structure: Exploring Earth's Interior* by Roy A. Gallant
- 1 copy of information about Continental Drift (Pangaea), such as those available at:
 - pubs.usgs.gov/publications/text/historical.html
 - pubs.usgs.gov/publications/text/dynamic.html
 - cddis.gsfc.nasa.gov/926/slrrecto.html
- “Tectonic Puzzle” page
- Scissors
- Small plastic bags
- Appropriate research materials and/or Web sites relating to volcanoes
- Appropriate research materials and/or Web sites relating to earthquakes
- “Presentation Rubric”
- 2.5" x 4" pieces of drawing paper
- Colored pencils



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PREPARATIONS

- Make copies of the following:
 - “Oregon Quarter Reverse page (1 per student)
 - “Our Changing Earth” pages (1 set per student)
 - Any variation on the Klamath Indian legend about Crater Lake (1 per student)
 - “Tectonic Puzzle” sheet (1 per small group)
 - “Presentation Rubric” (1 per student)
- Make an overhead transparency (or photocopy) of the “Oregon Quarter Reverse” page.
- Cut and assemble the “Our Changing Earth” pages into booklets (1 per student).
- Make 1 hard-boiled egg.
- Reserve computer lab time for research (optional).
- Locate an age-appropriate text that relates to the structure of the planet Earth (see examples under “Materials”).
- Cut the “Tectonic Puzzle” pages along the dotted lines and places all the pieces from each sheet in a small plastic bag before Session 3.
- Gather appropriate research materials and/or Web sites relating to volcanoes (see examples under “Materials”).
- Gather appropriate research materials and/or Web sites relating to earthquakes volcanoes (see examples under “Materials”).
- Cut 2.5" x 4" pieces of drawing paper (about 10 per student).



GROUPINGS

- Whole group
- Small Groups
- Individual work



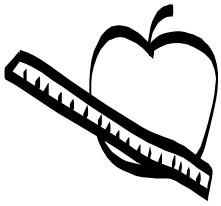
CLASS TIME

Five 45- to 60-minute sessions



CONNECTIONS

- Science
- Social Studies
- Language Arts
- Art



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TERMS AND CONCEPTS

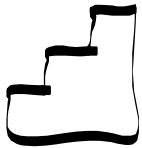
- Quarter
- Structure
- Crust
- Hypothesis
- Reverse (back)
- Earth
- Tectonic plates
- Crater
- Core
- Earthquakes
- Legend
- Mantle
- Volcanoes



BACKGROUND KNOWLEDGE

Students should have a basic knowledge of:

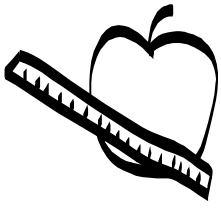
- The Earth
- Note taking
- Research skills
- Cooperative learning



STEPS

Session 1

1. Describe the 50 State Quarters® Program for background information, if necessary, using the example of your own state, if available. Then display the transparency or photocopy of the Oregon quarter reverse. Locate Oregon on a classroom map. Note its position in relation to your school's location.
2. With the students, examine the coin design. Have the students identify the images and writing in this design, including the words "Crater Lake," the water, the trees, and the land.
3. Distribute an "Our Changing Earth" booklet to each student. Direct each student to write his or her name on the booklet's cover.
4. Discuss the meaning of the word "crater." If necessary, explain that a crater is an indentation in the Earth in the shape of a bowl. Instruct the students to write a definition for this word in their booklet.
5. Give the students some examples and then direct them to independently brainstorm a few ways in which nature can change the Earth (such as erosion, earthquake, fire, etc.). The students should list these thoughts in their booklets and then share their ideas as a class. The students should add peer responses to their lists in their booklets.
6. Guide the students to brainstorm ways in which a crater could be formed. Ask the students to hypothesize about how this lake came into existence. Direct each student to write his or her thoughts about the lake's formation in his or her "Our Changing Earth" booklet.
7. As a class, discuss the fact that our planet changes all the time; sometimes because of natural events and other times because of the actions of the Earth's inhabitants.

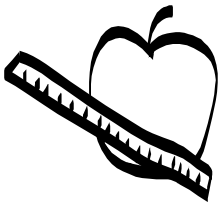


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8. Explain that, the American Indians who lived in the area surrounding the lake created legends to explain how the lake was formed.
9. Place the students in small groups and distribute a copy of the Klamath Indian legend about the creation of Crater Lake to each student.
10. Direct the students to read this legend independently. Explain that the groups will discuss what type of natural phenomenon this story could possibly be describing. Direct the students to enter their thoughts in their booklets.
11. Explain that, over the next few days, the students will be exploring the natural phenomena that caused the creation of this lake.

Session 2

1. Revisit the image of the Oregon quarter and ask the students to recall what they discussed relating to the coin's design. The students should recall that the coin features a lake that was created by a natural change in the Earth. Explain that, today, the students will begin their exploration of our changing planet.
2. Show the students a hard boiled egg and ask them to hypothesize about a connection between this egg and the planet Earth. Record student comments on the chalkboard or on chart paper.
3. Introduce the students to the selected text about the Earth's structure. As a group, preview the text and illustrations to generate observations about what is occurring at different points in the text.
4. Read the selected text to the class and attend to any unfamiliar vocabulary. Stop reading periodically to draw the students' attention to information about the Earth's layers and tectonic plates. As the students are listening to the text, direct them to take notes in the appropriate section of their booklets.
5. As a class, discuss what the students can recall and, in their booklets, record pertinent information about the composition of each of the Earth's layers. Guide the students to understand the following information about the Earth's layers:
 - **Core:** Solid in the center, but surrounded by liquid.
 - **Mantle:** Solid, but gel-like. Takes up the most space of any layer. Heat and pressure inside the earth can cause this layer to move. Nearly liquid areas of the mantle are known as magma.
 - **Crust:** The very thin outermost layer of the Earth. The rocks in this layer are cool and brittle (easily broken).
6. As a class, discuss what the students learned about the Earth from this text. Again, ask the students to hypothesize about a connection between the egg and the planet Earth. Peel and separate the layers of the egg. Guide the students to draw connections to the Earth's layers; the crust, the mantle, and the core.

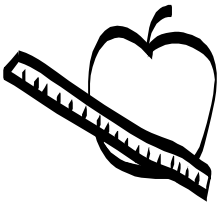


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7. Direct each student to draw and label a diagram of the Earth's three main layers in his or her "Our Changing Earth" booklet.

Sessions 3 and 4

1. Divide the students into pairs or small groups and distribute a bag containing the "Tectonic Puzzle" to each group, making sure there is an even number of groups. In their groups, have the students put these pieces together.
2. Ask the students what they see when they have completed the puzzle. The students should recognize that the puzzle is a map of the world.
3. Direct the students to notice the specific way in which their puzzle pieces were cut, allowing them to compare the pieces with other groups. Have them share their findings. Accept a variety of responses.
4. Explain that, when the mantle started shifting around under the Earth's crust, it pulled chunks of the crust with it. These pieces of the crust and mantle are called plates. Explain that movements in the Earth's mantle greatly affect the surface of our planet, most notably through the production of earthquakes and volcanoes.
5. Show students the Web sites relating to Pangaea. Discuss the sites and attend to any questions.
6. Assign each small group one topic-either "earthquakes" or "volcanoes." Make sure that each topic has the same number of groups. Explain that, in the "Our Changing Earth" booklet, there are questions about these topics. In the students' small groups, they will research the answers to the questions for their assigned topics. The groups may decide how they will divide the research among the team members.
7. Explain that, after the students answer all of these questions, they will meet with a group that was assigned the other topic. Then, the students will share the information that they found. Based on the research that these groups did, they will need to decide whether they believe that Crater Lake was formed as a result of a volcano or an earthquake.
8. Provide each group with research materials appropriate for its topic or allow the students to visit the school library or computer lab in order to conduct their investigations.
9. Allow the students an appropriate amount of time to conduct their research and to discuss their findings with their topic groups.
10. Pair the groups with their topic counterparts (volcano groups with earthquake groups). Instruct these larger groups to share their findings and to discuss which natural occurrence they believe caused the creation of Crater Lake.
11. Distribute a "Presentation Rubric" to each group and review this rubric as a class.
12. Allow the students time to create a visual and oral presentation about the natural event that they believe caused this lake's creation. In this presentation, the students should also



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explain why this event resulted in the lake's creation. The students should also give examples and information about why the other natural occurrence could not have caused Crater Lake.

Session 5

1. Allow students to present their research to the class.
2. After all the presentations are complete, explain that Crater Lake was caused as a result of a volcanic eruption at the former site of Mt. Mazama.
3. Reread the Klamath Indian legend to the students and ask them to listen again for clues that the Klamath Indians witnessed a volcanic eruption.
4. Explain that this eruption was so great that it caused the top of the mountain to collapse, creating a large crater. When the eruption was over, the lava cooled off and hardened. In the years that followed, rain and snow filled this big crate with water, creating a lake.



ENRICHMENT/EXTENSIONS

- Direct students to create a flip book that shows the progress of the volcano's eruption that eventually led to the creation of Crater Lake as we see it today on Oregon's quarter.
- Conduct a class experiment to help the students visualize a real volcanic eruption: Create a model volcano and cause a chemical reaction to simulate lava (suggested ingredients include water, red food coloring, liquid detergent, baking soda, and vinegar).



DIFFERENTIATED LEARNING OPTIONS

- Minimize or add to the questions that groups must research.
- Allow students to word process or dictate the entries in their booklets.



CONNECTION TO WWW.USMINT.GOV/KIDS

Another way our Earth has changed over the years has been through the effects of glaciers. Help your students learn more about glaciers and how they created our country's Great Lakes by testing out the lesson plan "How to Make a Lake." (www.usmint.gov/kids/components/50sqLessonPlans/rtf/200423-1.pdf)

Our Changing Earth



What is a crater? _____

How do you think Crater Lake was formed? _____

List some ways that the Earth can change. _____

What natural event do you think the Klamath Indians spoke of in their legend about Crater Lake? _____

Notes from the reading: _____

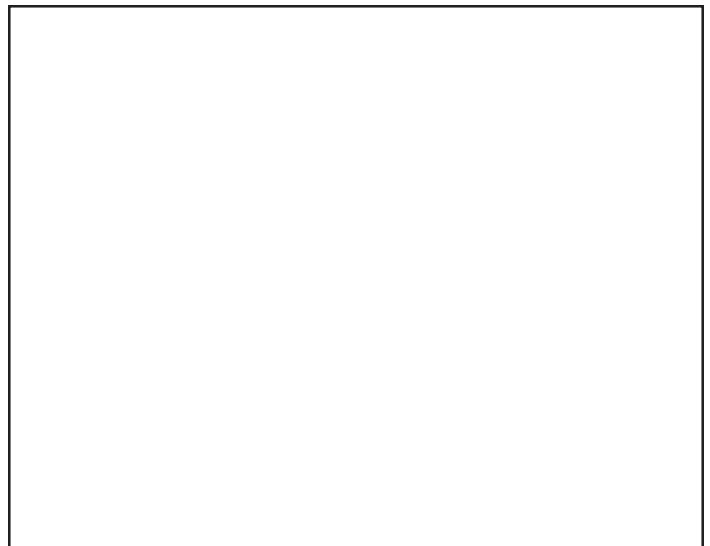
In this box, draw and label the Earth's three main layers.

Describe each of the Earth's layers:

Core: _____

Mantle: _____

Crust: _____



Volcanoes

What are plate boundaries? _____

What happens when two plate boundaries collide? What is this called? _____

What is a volcano's vent? _____

What is magma? How is it different from lava? _____

Draw a picture of two volcano shapes in the boxes.

Write the name of each shape below the boxes.

Describe what happens when a volcano erupts.

What is a caldera? _____

Additional notes: _____



Earthquakes

What is a fault (or fault line)? _____

Name and describe three types of faults. _____

What is the epicenter of an earthquake? _____

What is the focus of an earthquake? _____

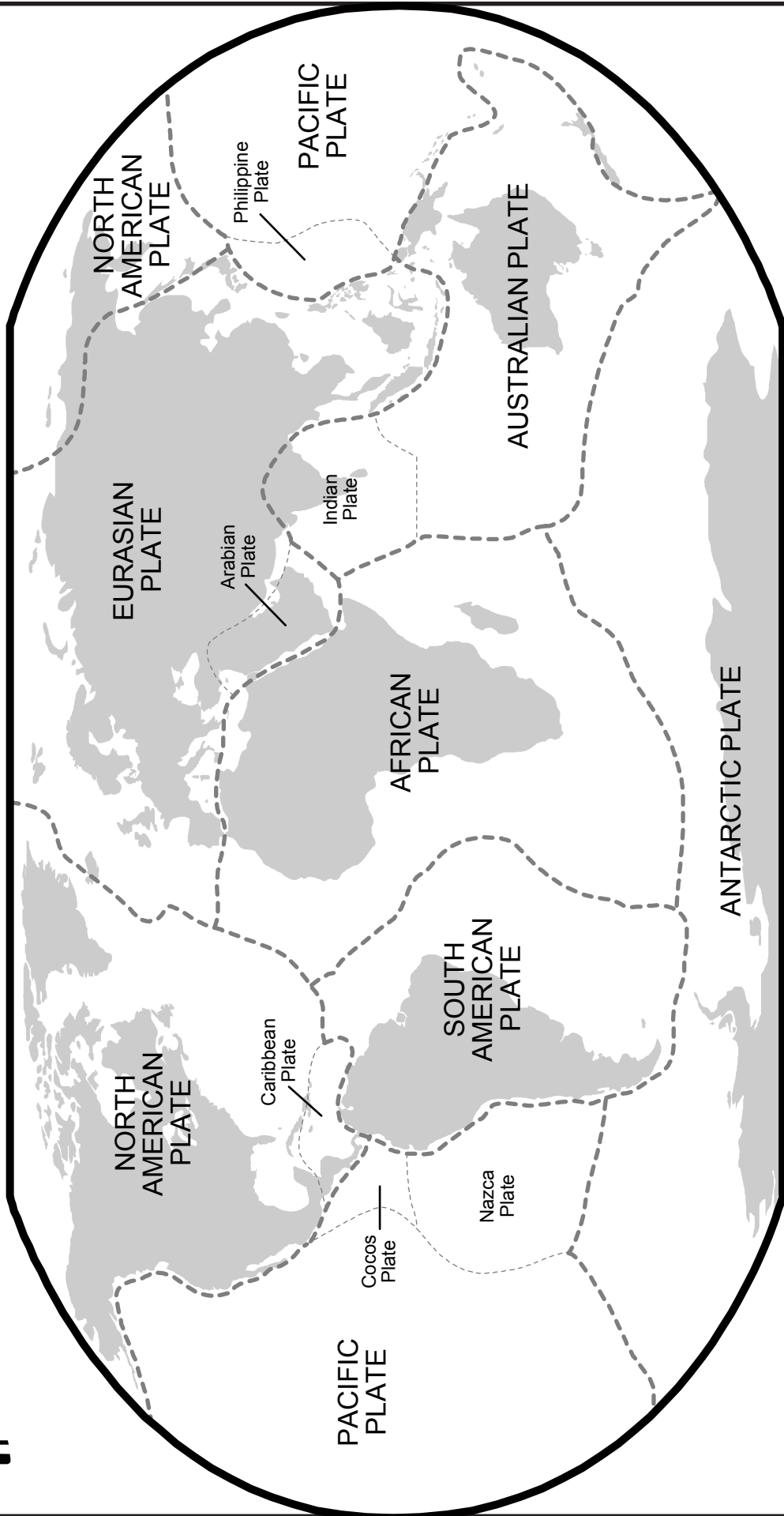
Describe what happens to the Earth during an earthquake. _____

What can happen as a result of an earthquake? _____

Additional notes: _____



Tectonic Puzzle



Key

- Major plates (cut along these lines)
- Minor plates



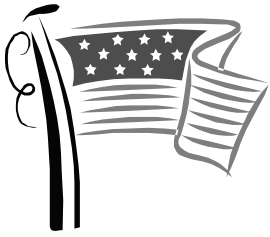
NAMES _____

DATE _____

Presentation Rubric

Directions: Compare each member's research and determine which natural event you believe caused the creation of Crater Lake. Support this belief with creative and factual arguments, which you will present to the class. You will be graded according to this rubric:

Parameter	4	3	2	1	Score
Strength of argument	Argument is completely supported by student research and is convincing.	Argument is mostly supported by student research and is somewhat convincing.	Argument is loosely supported by student research and is slightly convincing.	Argument is not supported by student research and is not convincing.	
Completeness and accuracy	Students have demonstrated an excellent and accurate understanding of the topic that they are presenting and include explanations and elaboration. Students include support for their argument for why they believe that this event resulted in the formation of Crater Lake. Students included support for why they did not select the other natural event.	Students have demonstrated a good and mostly accurate understanding of the topic that they are presenting, but fail to elaborate. Students include some support for their argument. Students briefly mentioned why they did not select the other natural event.	Students have demonstrated a fair and somewhat accurate understanding of the topic that they are presenting, but are able to answer only rudimentary questions. Students include minimal support for their argument. Students made no mention of why they did not select the other natural event.	Students have demonstrated a poor and inaccurate understanding of the topic that they are presenting, and cannot answer questions about subject. Students include no support for their argument.	
Organization	Students present the information in a logical, interesting sequence that the audience can follow.	Students present the information in a logical sequence that the audience can follow.	Audience has difficulty following the presentation because it is not in a logical order.	Audience cannot follow presentation because there is no visible order to the presentation.	
Originality of presentation	Students present their information in a creative way that helps express the ideas clearly to all students.	Presentation shows some original thought that helps express the ideas to all students.	Presentation shows little creative thought and does not help clarify the ideas being shared.	Presentation has no creative components to help students understand the information.	
Delivery	Students use clear voices and correct, precise pronunciation of terms, so that audience could hear well.	Students' voices are clear. Students pronounce most words correctly and are heard clearly.	Students pronounce terms incorrectly; audience has difficulty hearing presentation.	Presenters speak softly and indistinctly and mispronounce terms.	
Cooperative learning	Each member worked well independently, shared all findings with the group; each took part in the presentation's development and production.	Each Member worked well independently, shared some findings; most took part in development and production.	Some members worked well alone, shared some findings; only two members helped to develop and produce the report.	Few members worked well alone, shared few findings; only one member developed and produced the report.	
TOTAL					



Oregon Quarter Reverse

