

NOAA Teacher at Sea Program Lesson Plan

Activity Title: Mysteries in the Ocean

Subject (Focus/Topic): Earth Science; oceanography

Grade Level: 3rd-5th Grade

Average Learning Time: 5 hours

Lesson Summary (Overview/Purpose): In this lesson students will learn about some of the features found on the ocean floor and that our knowledge of the ocean floor is due to exploration.

Overall Concept (Big Idea/Essential Question): Students will understand that there are similar features on the ocean floor that there are on land. Students will understand the importance and excitement of ocean exploration.

Specific Concepts (Key Concepts):

- The floor of the ocean is composed of plains, ridges, trenches and seamounts.
- Geologists and oceanographers make important discoveries through their exploration of the ocean floor.

Focus Questions (Specific Questions):

- What does the bottom of the ocean look like?
- How do we know what the bottom of the ocean looks like?
- Why is ocean exploration important?
- How is the ocean explored?

Objectives/Learning Goals:

- Students will recognize and be able to identify ocean floor plains, continental shelves, ridges, trenches and seamounts on bathymetric images.
- Students will create a model of the ocean that includes ocean floor plains, continental shelves, ridges, trenches and seamounts
- Students will learn about ocean exploration.
- Students will present their models and what they have learned.

Background Information:

The deepest valleys and the tallest mountains are found under the surface of the ocean. Landforms on the ocean floor are similar to landforms found on the continents. Early tools for measuring the depth of the ocean included lead weights that were lowered on marked ropes to the ocean floor. Now, we rely on sonar and satellite data and are able to create three-dimensional videos depicting the ocean floor.

In 2001, USGS oceanographer James Gardner said, "We know what the surface of the moon is better than we know what the surface of the sea floor is." A current estimation is that 95% of the Earth's ocean is unexplored. We can look at satellite maps of the Earth's ocean floor, but these maps can't see below the surface of the water. These maps can only give us clues to what it looks like and what living creatures we might find there.

Why should we continue to explore the ocean? Historically, explorers had a variety of motivations for exploring the ocean. Wealth, power, curiosity and the quest for knowledge were among some of the reasons. Those reasons still motivate humans to explore, but now there are other reasons too. Human health, ocean health, research, ocean literacy, climate change and energy exploration are among current motives.

➤ Web Resources

- <http://oceanexplorer.noaa.gov/history/timeline/timeline.html> Timeline of Ocean Exploration
- <http://oceanexplorer.noaa.gov/history/history.html> History of Ocean Exploration: Information about the history of ocean exploration
- <http://www.divediscover.whoi.edu/history-ocean/index.html> History of Oceanography: A timeline of ocean exploration
- <http://www.mos.org/oceans/planet/features.html> Physical Features of the Ocean: Overview of the physical features of the ocean, tides, currents, etc.
- http://www.education.noaa.gov/Ocean_and_Coasts/Ocean_Floor_Features.html Ocean Floor Features: Overview of ocean floors features, educational resources, images, videos, deep ocean fact sheets, etc. Click on "features found on the ocean floor" for a great PDF

Common Misconceptions/Preconceptions:

- The ocean is same depth everywhere
- Islands float
- The sea floor is flat
- The bottom of the ocean is shaped like a bowl and is a big sandy desert
- The ocean is shallower than it really is
- Deep sea exploration is too expensive to be "worthwhile"
- We have the technology to dive to any desired depth in the ocean

Materials: modeling clay, aquariums (or other large containers), toothpicks/Popsicle sticks, and bathymetric maps

Technical Requirements: computer, Internet, projector or interactive whiteboard, camera

Teacher Preparation:

1. For Part One, preview maps and videos on NOAA's Ocean Explorer website: <http://oceanexplorer.noaa.gov/gallery/maps/maps.html> Choose maps and videos that are applicable to your students and curriculum.
2. Locate bathymetric maps, diagrams, and images of ocean floor features for students to use in Part Two.
3. Preview Internet resources and books for Part Four.
4. Preview entire lesson to plan for Part Four in which students will submerge their models in water. If containers aren't available for this step, students can still build models and not submerge them.

Keywords:

plains: flat, nearly level areas that form much of the ocean floor

ridges: underwater mountain ranges

trench: narrow, very deep valley on the ocean floor

seamount: an underwater volcano that has not reached the ocean's surface

continental shelf: shallow, submerged part of the continent just off shore

Lesson Procedure:**Part One**

1. Ask students what they think the bottom of the ocean looks like. Individually, or in small groups, have them build clay models of what they think the ocean bottom looks like. (If it is not possible to create clay models, students can create drawings or models using other materials.) Take a photo of each clay model at the end of this step.
2. Explain to students that you will be showing them videos and/or maps to help them understand what the ocean floor looks like. While showing maps and videos discuss with students what features they are seeing on the bottom of the ocean. Ask them to describe them. Encourage them to compare them to features found on the continents.
3. Have students adjust their models based on their new knowledge. Take another photo of each clay model after adjustments are made.

Part Two

1. Explain to students that features found on the ocean floor have names just like features found on continents.
2. Introduce the following terms to students: plains, ridges, trenches, seamounts, and continental shelves. (You may add additional terms to this list.)
3. If possible, show students examples of these features using maps, videos, etc. Discuss how each feature is formed and where they are located around the world.
4. Have students use a bathymetric map to locate each feature that you discussed.
5. Ask students to include all of these features in their clay models and to label them using toothpicks, Popsicle sticks, or something similar. (If possible, labels should be waterproof.)

- Extension: Ask students to include other features such as: islands, atoll, continental land mass, etc.

Part Three

1. Ask students how and why scientists study the bottom of the ocean. Explain that scientists are only beginning to understand what is found on the ocean floor.
2. Share the quote given by USGS oceanographer James Gardner in 2001, "We know what the surface of the moon is better than we know what the surface of the sea floor is." Or, share a quote by Jean-Michel Cousteau; "We know more about the dead seas of Mars than our own ocean."
3. Ask students the following questions:
 - a. How can this be true?
 - b. Why should we explore the bottom of the ocean?
 - c. How do we explore the ocean?
4. Have students, individually or in small groups, to make a list of possible answers to these questions.
5. Share information about scientific deep ocean exploration with students. You may read a picture book such as, [The Deep-Sea Floor](#), or use the Internet. The following websites have current and archived information, photos, activities, videos, etc. about scientific expeditions exploring the ocean floor:
 - a. <http://oceanexplorer.noaa.gov/explorations/welcome.html>
 - b. <http://www.divediscover.whoi.edu/>
6. Ask students to return to their lists and use their responses in addition with information learned from the scientific expedition to answer the following questions in writing:
 - a. How do we know what the bottom of the ocean looks like?
 - b. Why is ocean exploration important?
 - c. How is the ocean explored?
 - d. How has our knowledge of the ocean floor changed our lives?

Part Four

1. Ask students to make final adjustments to their models based on information learned in Part Three. Take a third, and final photo of their model.
2. If possible, have students submerge their models in water. (Aquariums could be the most suitable container this.) Ask them to label the features with waterproof labels, or by drawing a diagram and labeling the features.
3. Ask students to present their models to each other, or other students.

Assessment and Evaluation:

Assess students based on their models, photos of their models, their written responses, and their presentations. Their models can be assessed based on the inclusion of all required features, the accuracy of their representation of the

features, and neatness/quality of work. Photos can be used to evaluate students' progress. Written responses can be used to assess students' understanding of the importance of ocean exploration. If desired, written responses can be used to assess students' writing skills. Assess students' knowledge of the features of the ocean floor based on their explanation of their models. If students worked in groups, students could also be assessed on how well they worked together. If desired, students could assess themselves on group participation.

Standards

National Science Education Standard(s) Addressed:

NEAS A: Understandings About Scientific Inquiry

NEAS G: Science as a Human Endeavor

Ocean Literacy Principles Addressed:

Principle One: The Earth has one big ocean with many features

- Fundamental Concepts a, b

Principle Two: The ocean and life in the ocean shape the features of the Earth

- Fundamental Concept a

Principle Seven: The Ocean is largely unexplored

- Fundamental Concept a

Alaska Standards Addressed:

Science Standards:

GLE SD2 Student develops an understanding of the forces that shape Earth

GLE SE3 Student demonstrates an understanding of how scientific discoveries and technological innovations affect our lives and society

Writing Standards:

GLE W.1 The student writes about a topic

Geography Standards:

A.2 Make maps, globes, and graphs

A.4 Use graphic tools and technologies to depict and interpret the world's human and physical systems

Additional Resources:

Books

- Cole, Joanna. The Magic School Bus on the Ocean Floor Scholastic Inc. New York. 1992
- Kunzig, Robert. Mapping the Deep W.W. Norton & Company. New York. 2000
- Stanitski, Diane. Teacher at Sea: Mrs. Armwood's Hydrographic Adventure on the NOAA Ship Fairweather. NOAA. Silver Spring, MD. 2007

- Wenzel, Gregory. The Deep-Sea Floor. Charlesbridge. Watertown, MA. 2003

Internet Resources

- <http://oceanexplorer.noaa.gov/gallery/maps/maps.html> A large database of videos and images from the ocean floor. Searchable by each ocean.
- <http://oceanexplorer.noaa.gov/history/timeline/timeline.html> Timeline of Ocean Exploration
- <http://oceanexplorer.noaa.gov/history/history.html> History of Ocean Exploration: Information about the history of ocean exploration
- <http://www.divediscover.whoi.edu/history-ocean/index.html> History of Oceanography: A timeline of ocean exploration
- <http://www.ceoe.udel.edu/deepsea/home/home.html> Voyage of the Deep: Information about deep-sea exploration aboard submersible, *Alvin*.
- <http://maps.grida.no/go/graphic/world-ocean-bathymetric-map> Printable Bathymetric Map
- http://www.gebco.net/data_and_products/gebco_world_map/images/gda_world_map_large.jpg Printable Bathymetric Map (Viewing on an interactive whiteboard is highly recommended!)
- <http://ocean.si.edu/> Smithsonian Ocean Portal: Includes many resources such as videos, photos, and stories about ocean science topics.
- http://www.montereybayaquarium.org/efc/efc_mbari/mbari_home.aspx Monterey Bay Aquarium website shows deep-sea exploration. Includes short videos and research podcasts.
- http://www.coast-nopp.org/visualization_modules/physical_chemical/basin_coastal_morphology/principal_features/deep_ocean/basins.html Features of Deep Ocean Basins: Includes a bathymetric modeler
- <http://www.mos.org/oceans/planet/features.html> Physical Features of the Ocean: Good overview of the physical features of the ocean, tides, currents, etc.
- http://www.education.noaa.gov/Ocean_and_Coasts/Ocean_Floor_Features.html Ocean Floor Features: Great overview of ocean floors features, educational resources, images, videos, deep ocean fact sheets, etc. Click on “features found on the ocean floor” for a great PDF

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