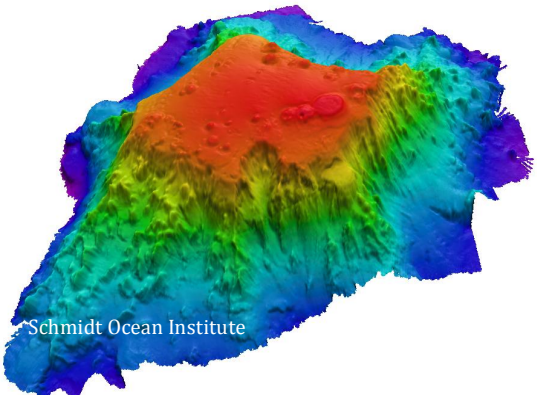
Lesson Plan: Contours



Focus: The ocean is vast and largely unexplored. Although satellite data gives us a rough idea of large features on the ocean floor, detailed mapping can help scientists better understand the geologic history and biological potential of submarine areas. Mapping the ocean floors provides the groundwork for future studies as the scientific world strives to better understand deep sea geology and biology and how climate change and deep sea mining will affect these unique ecosystems.

Learning Objectives: Students will use R/V *Falkor* mapping data to recreate three-dimensional sea floor features using (foam or three dimensional printer). They will research their type of ocean floor feature and create a viable story surrounding its history and formation. They will use the layers to sketch a contour/produce a two-dimensional map of the area. The final outcome will be a poster including the two-dimensional, colored contour, story, and the three-dimensional structure.

Grade Level: 7-8 (Earth Science/Life Science) or 9-12 (Oceanography/Marine Science), depending on concept focus and depth of research

Next Generation Science Standards:

HS-ESS2-1. Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features. [Clarification Statement: Emphasis is on how the appearance of land features (such as mountains, valleys, and plateaus) and sea-floor features (such as trenches, ridges, and seamounts) are a result of both constructive forces (such as volcanism, tectonic uplift, and orogeny) and destructive mechanisms (such as weathering, mass wasting, and coastal erosion).] [Assessment Boundary: Assessment does not include memorization of the details of the formation of specific geographic features of Earth's surface.]

National Science Standards:

Content Standard D: Earth and Space Science • Structure of the Earth system

Ocean Literacy

Essential Principle: The Earth has one big ocean with many features. *Fundamental Concept b.* An ocean basin's size, shape and features (such as islands, trenches, mid-ocean ridges, rift valleys) vary due to the movement of Earth's lithospheric plates. Earth's highest peaks, deepest valleys and flattest vast plains are all in the ocean.

Essential Principle: The ocean and life in the ocean shape the features of the Earth. *Fundamental Concept e.* Tectonic activity, sea level changes, and force of waves influence the physical structure and landforms of the coast.

Essential Principle: The ocean is largely unexplored. *Fundamental Concepts: a. The ocean is the last and largest unexplored place on Earth—less than 5% of it has been explored. This is the great frontier for the next generation's explorers and researchers, where they will find great opportunities for inquiry and investigation; b. Understanding the ocean is more than a matter of curiosity. Exploration, inquiry and study are required to better understand ocean systems and processes; d. New technologies, sensors and tools are expanding our ability to explore the ocean. Ocean scientists are relying more and more on satellites, drifters, buoys, subsea observatories and unmanned submersibles; f. Ocean exploration is truly interdisciplinary. It requires close collaboration among biologists, chemists, climatologists, computer programmers, engineers, geologists, meteorologists, and physicists, and new ways of thinking.*

Materials: Contours of various ocean features (guyot, seamount, ridge, trench) ~ 10 to12 layers each, Foam board or other "building" material, access to the internet for research, poster paper for 2-dimensional contour and story

Teaching Time: 2 class periods (45-55 minutes).

Notes: Students should work in pairs or groups. Groups are each given one of numerous ocean features (table tops, seamounts, ridges)

Learning Procedure:

1. Provide students with patterns for (7 to 10) layers in one ocean feature. Students should trace each layer onto foam and cut out.
2. Noting alignment marks, students should stack the foam layers to build a three-dimensional model of their ocean feature.
3. Groups should describe the general shape of their ocean feature and any specific details they see.
4. Groups research their individual ocean feature using leading questions such as: How are these types of features formed? What does this feature say about the geologic history of the area? What might the composition of the ocean floor be? What might have been going on in the rest of the world when this feature was formed? Do you think there was much life on or around this feature? Keywords/research topics include: volcanic activity, sea level, crust age, plate movement, landslides, crust composition, manganese nodules. Using the results of their research, students will create a viable story surrounding its history and formation of their feature.
5. Starting with the bottom layer, students will separate the layers and trace them onto the poster one at a time, noting alignment marks, to create a contour map of the feature. Students should color the contour and include a key for depths (note units).
6. Finalize posters by adding story and three-dimensional model.