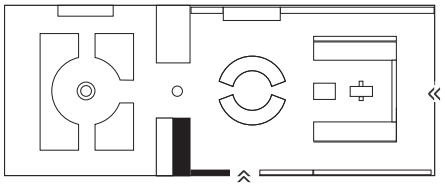
Team 1

Gottesman Hall of Planet Earth
STUDENT FIELD JOURNAL

MIDDLE AND HIGH SCHOOL

SECTION 1
HOW HAS THE EARTH EVOLVED?



What Do You Know?

How do you think the Earth formed? And why do you think that?

Questions to Explore:

Go to → HOW DID THE EARTH FORM?

1. What was the probable sequence of events that lead to the formation of the early Earth?

2. Sketch the layers of the Earth. How did the layers of core, mantle, and crust evolve?

3. Try lifting samples 4 5 6 7 that represent these layers. What does this experiment tell you about the organization of the Earth's layers?

SKETCH
Layers of the Earth

Go to → THE EARTH'S CRUST

4. How does oceanic crust typically differ from continental crust? Describe the oceanic crust sample 8 and one of the continental crust samples 9 10 11 as fully as possible.

5. Find and describe the sample of the Earth's oldest rock 12. Based on how it was formed, what major rock group does it belong to?

For Further Investigation

How would you develop a model or project to illustrate how the Earth formed?

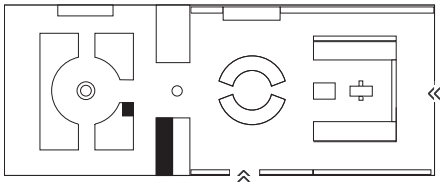
Team 2

Gottesman Hall of Planet Earth
STUDENT FIELD JOURNAL

MIDDLE AND HIGH SCHOOL

SECTION 1

HOW HAS THE EARTH EVOLVED?



What Do You Know?

How do you think the Earth's atmosphere formed? What makes you think that?

Questions to Explore:

Go to → A SPECIAL PLANET

1. Has the atmosphere changed over time?

2. Find the Ontario banded iron formation 15. What clues does this sample provide about how the atmosphere changed over time?

3. Find the stromatolite from Mauritania 14. What additional evidence does this sample provide about the changes in the atmosphere?

Go to → VOLCANIC GASES

4. Find the sulfur 1. What does this sample tell us about the ongoing process, in addition to life, that is changing the atmosphere?

For Further Investigation

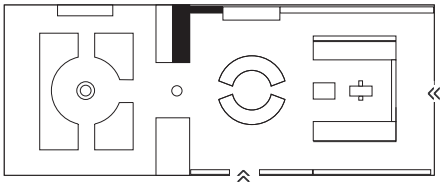
What are the processes that are working together to affect the atmosphere today? Design a field study to pursue this question.

Team 3

Gottesman Hall of Planet Earth
STUDENT FIELD JOURNAL

MIDDLE AND HIGH SCHOOL

SECTION 2
HOW DO WE READ THE ROCKS?



What Do You Know?

What do you think rocks can tell you about the Earth's history?

Questions to Explore:

Go to → READING THE ROCKS

1. Who was James Hutton? Why is he called the "father of geology"?

Go to → THREE TYPES OF ROCKS

2. Look at the samples of igneous, metamorphic, and sedimentary rock ❹ ❺ ❻ ❼ ❽ ❾ ❿ ⓫ ⓬. Choose a sample from each major rock group. Draw a picture of it. Tell how it formed. What can it tell us about how the Earth works?

SKETCH
An Igneous Rock

SKETCH
A Metamorphic Rock

SKETCH
A Sedimentary Rock

For Further Investigation

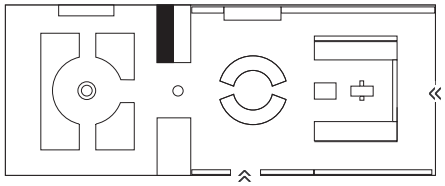
What are the different ways that scientists can determine the age of rocks?

Team 4

Gottesman Hall of Planet Earth
STUDENT FIELD JOURNAL

MIDDLE AND HIGH SCHOOL

SECTION 2
HOW DO WE READ THE ROCKS?



What Do You Know?

What do you know about the Grand Canyon and why it is important?

Questions to Explore:

Go to → DECIPHERING THE GRAND CANYON

1. Examine the rock samples 18 19 20 21 22 and the display. Describe the colors and textures of each rock.

2. Sketch a vertical section of the canyon. Indicate the major rock type at each level. Also identify the oldest rocks and the youngest rocks in the canyon.

3. Choose a rock from one level of the canyon. Describe the rock in as much detail as you can. Provide information about the rock's age and about the geological period in which it formed.

SKETCH

Vertical Section of the Grand Canyon

For Further Investigation

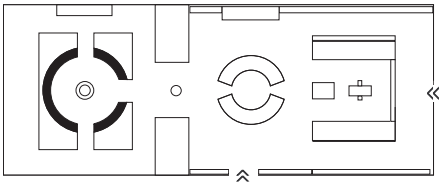
How would you develop a model or project to illustrate how the Grand Canyon formed?

Team 5

Gottesman Hall of Planet Earth
STUDENT FIELD JOURNAL

MIDDLE AND HIGH SCHOOL

SECTION 3
WHY ARE THERE OCEAN BASINS, MOUNTAINS, AND CONTINENTS?



What Do You Know?

Why do you think there are ocean basins, mountains, and continents?

Questions to Explore:

Go to → PLATE TECTONICS

1. How do these displays explain the theory of plate tectonics? Sketch the process of convection as it is thought to occur within the Earth.

SKETCH
Process of Convection

2. Find the interactive computer station showing continental drift. How does plate movement effects the continents over millions of years? Why?

Go to → WHEN PLATES MOVE PAST EACH OTHER

3. What happens when tectonic plates slide past each other? Sketch and explain.

Go to → WHERE PLATES SEPARATE

4. What happens when tectonic plates move apart? Sketch and explain.

Go to → WHERE PLATES COLLIDE

5. What happens when tectonic plates collide? Sketch and explain.

SKETCH
Slip
Spreading
Collision

For Further Investigation

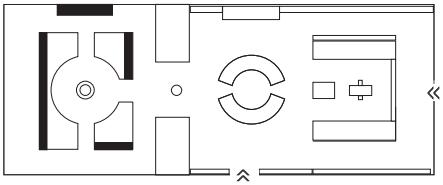
How did the idea of plate tectonics develop into a theory? How would you research this question?

Team 6

Gottesman Hall of Planet Earth
STUDENT FIELD JOURNAL

MIDDLE AND HIGH SCHOOL

SECTION 3
WHY ARE THERE OCEAN BASINS, MOUNTAINS, AND CONTINENTS?



What Do You Know?

What do you think volcanoes, earthquakes, and mountain building have in common?

Questions to Explore:

Go to → GRANITES AND PLUTON, THE CASCADE RANGE AND THE RING OF FIRE, and MEDICINE LAKE VOLCANO

1. Describe three of the rock samples ❷ ❸ ❹ ❺ ❻ ❼ ❽ ❾ ❿ that come from an explosive volcano.

2. How would you describe the major features and typical behavior of an explosive volcano? Make a sketch of an explosive volcano.

SKETCH
An Explosive Volcano
An Effusive Volcano

Go to → THE HAWAIIAN HOT SPOT and INTRUSIVE ROCKS

3. Describe three of the rock samples ❶ ❷ ❸ ❹ ❺ ❻ ❼ ❽ that come from an effusive volcano.

4. How would you describe the major features and typical behavior of an effusive volcano? Make a sketch of an effusive volcano.

Go to → MONITORING EARTHQUAKES DAILY

6. Find the worldwide earthquake display and the seismograph. Where do earthquakes occur? What information do earthquakes provide about the Earth and plate tectonics? How do scientists predict earthquakes?

Go to → HOW MOUNTAINS FORMED

7. Find the Mountain Building sand model. Why do scientists build models like this one?

For Further Investigation

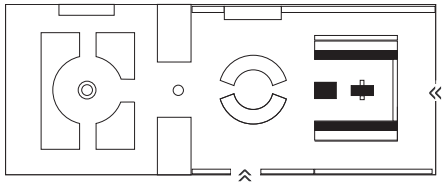
Where on the Earth do earthquakes, volcanoes, and mountain building occur? Relate your explanation to plate tectonics.

Team 7

Gottesman Hall of Planet Earth
STUDENT FIELD JOURNAL

MIDDLE AND HIGH SCHOOL

SECTION 4
WHY IS THE EARTH HABITABLE?



What Do You Know?

What do you know about sulfide chimneys and deep-sea vents?

Questions to Explore:

Go to → LIFE THAT LIVES OFF THE EARTH'S ENERGY

1. Sketch a sulfide chimney. Include the seabed, the chimney, and the plume that spews out of it. Add any other features that seem important to you.

SKETCH
A Sulfide Chimney

2. In what parts of the oceans are sulfide chimneys found?

Go to → DEEP-SEA HOT SPRINGS

3. How do sulfide chimneys form?

Go to → LIFE AT THE HYDROTHERMAL VENTS

4. What plant and animal life can be found on and around sulfide chimneys? Sketch three examples and name them.

SKETCH	SKETCH	SKETCH

5. What is the energy source for these organisms? Relate your answer to the theory of plate tectonics if you can.

For Further Investigation

What other "extreme" environments are found on our planet? How do these environments inform how we think about the possibility of life on other planets? Design a research project to pursue these questions.

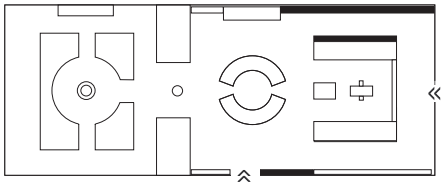
Team 8

Gottesman Hall of Planet Earth
STUDENT FIELD JOURNAL

MIDDLE AND HIGH SCHOOL

SECTION 5

WHAT CAUSES CLIMATE AND CLIMATE CHANGE



What Do You Know?

What do you know about greenhouse gases and how they effect the climate?

Questions to Explore:

Go to → FORCES THAT AFFECT CLIMATE AND HOW CLIMATE IS RECORDED

1. What kinds of information do ice cores, ocean sediments, and tree rings provide about the Earth's past climate? Examine one of the samples 6 7 10 11 12 13 . Summarize the evidence that it provides.

Go to → THE ATMOSPHERE

2. What are greenhouse gases? Name four such gases. Explain how greenhouse gases help warm the atmosphere. Draw a diagram to help your explanation.

SKETCH
Diagram of Greenhouse Gases

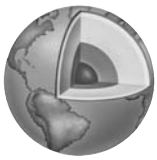
3. Find the graph that shows the changes of the average global temperature and measured carbon dioxide over the past century. Examine the graph and describe the relationship between changes in temperature and measured carbon dioxide. What might have caused this change?

Go to → CYCLE OF A LIVING PLANET

4. Find the carbon cycle diagram. Watch the introductory sequence of the nearby interactive computer station. Select the factory icon. Conduct an experiment using the simulation. Record your findings.

For Further Investigation

What strategies are scientists and policy makers considering in order to remove the carbon dioxide from the atmosphere, and reduce its impact on the warming trend?



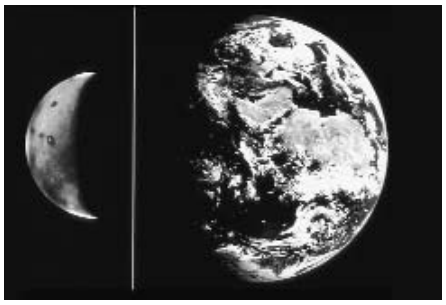
Back in the Classroom

Each student group should present the results of its in-depth studies to the class. This should occur as soon as possible after your return, while the visit is fresh. Use open-ended questions to encourage each presentation to give rise to a lively class discussion, with students sharing their understanding and their observations.

Field trips to local parks to look at rocks and glacial features are also great learning experiences. You might take your students around the neighborhood to look at building stones, if your area has an interesting assortment.

Further trips to the Museum's vertebrate fossil halls, Cullman Hall of the Universe, Harry Frank Guggenheim Hall of Minerals, John Pierpont Morgan Hall of Gems, Arthur Ross Hall of Meteorites and the glacial features depicted in the Hall of North American Mammals are natural follow-ups to the Gottesman Hall of Planet Earth visit. You may wish to have your students select projects of their choice to build on their Museum experience. Some examples to the right:

- Research the history of the destruction of Pompeii. Read sections of Pliny the Younger's eyewitness account. Imagine that you were in Pompeii at the time, and write a story describing your experiences.
- Construct your own canyon with its geological history laid out step by step. Include several interesting geological events, and draw a poster-sized cross-section or make a model of your canyon showing its rocks and stratigraphy.
- Design your own energy system and set of life forms for an unusual ecological niche on this planet, or on another planet. Alternatively, do some research and find and describe the most bizarre ecosystem you've discovered on this planet.
- Sketch and explain the sequence of steps involved in the formation of a geological unconformity, and explain the importance of this feature in the history of the science of geology.
- Research volcanoes or earthquakes and write an account of the most amazing eruption or quake that you came across. Tie your earthquake or volcano in with the theory of plate tectonics.
- Take a field trip to a local park (the east end of the Turtle Pond in Central Park is a good location) and sketch and describe the glacial features and other geological features that you see there.
- Take a walk on the beach, note your observations, and ask yourself where the sediments came from, and what kind of rock could form from these sediments. Bring back some samples from the beach and present your findings to your class.
- Take an imaginary trip back in time to some period in the geological past and describe what it would be like to spend a day there. Be sure to bring all the things you will need to survive. Your account should be scientifically accurate.
- Find out how you and your classmates can help avert potential global warming, and give a class presentation on this topic.



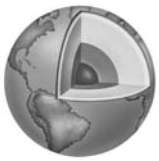
In addition, there are many experiments and demonstrations that can further advance students' understanding, especially younger students, who often need a concrete demonstration of a phenomenon. Each student might choose one of the following experiments and then present it in the classroom.

- The principles of convection in the mantle and of seafloor spreading can be illustrated by heating water in a large beaker with an alcohol burner, using a few potassium permanganate crystals as a marker dye.
- Folding peanut butter and jelly sandwiches illustrates folding, and deformation and faulting can be shown by distorting a substance such as cheddar cheese.

Younger students always enjoy making volcanoes that erupt when vinegar is added to sodium bicarbonate inside the vent.

Melting sugar and allowing it to cool and harden gives some idea of what happens when an igneous rock forms, and 'metamorphic cookies' are a big favorite (the idea is that metamorphism occurs at the cooking stage).

Building up layers of differently colored or textured sediments in a glass-sided box (some 'fossils' may also be included) will help students understand how a stratigraphic sequence builds up.



Related Web sites

For more information on the Earth and for Earth Science activities both in and out of the classroom, check out these Museum Web sites:

Resources for Learning: http://www.amnh.org/resources

This site is a free, easy-to-navigate online database of the Museum's extensive collection of scientific and cultural educational materials. Search the "Earth Science" topic for a variety of activities, curriculum materials, articles, evidence and analysis, exhibition materials, and reference lists. Access two middle school curricula—*Antarctica: The Farthest Place Close to Home* and *Deep Sea Vents*—in the site's Special Collections section.

Science Bulletins: Earth: http://sciencebulletins.amnh.org/earth/

This site features current Earth science—research and discoveries in the form of weekly updates, data visualizations, and feature stories for better understanding of some of the current research behind the science. Learning activities for educators found on the site optimize the content-rich essays, videos, and interactives.

OLogy—Earth: Our World in Motion: http://www.ology.amnh.org/earth/

OLogy, the Museum's science-rich Web site for kids ages 8–12, includes an Earth science content section for kids to explore. In *Earth: Our World in Motion*, kids can discover how the Earth is always changing, find out that every rock has a story to tell, and learn how to make rocks in a virtual lab. The site includes interviews with scientists, activities to do away from the computer, stories, games, and much more.

Creating the Gottesman Hall of Planet Earth: http://www.amnh.org/rose/hope/creatinghope/

This site is a great way to teach students about the challenges and excitement of creating a museum exhibition. Learn about the expeditions and the scientists who collected materials for the making of the Hall.

Black Smoker Expedition:
http://www.amnh.org/nationalcenter/expeditions/blacksmokers/

Learn all about black smokers and the mysterious life forms that exist deep below the surface of the oceans. Read the first-hand accounts of scientists and other experts in the expedition journal. Download curriculum materials and games for your classroom.

Young Naturalist Awards: http://www.amnh.org/youngnaturalistawards/

This scholarship program for students in grades 7–12 promotes participation and communication in science through the recognition of outstanding, expedition-based student writing and art. Winning entries receive cash awards and are published on the Web.