

## **GRAND CANYON GEOLOGY PROGRAM OVERVIEW FOR EDUCATORS/PARENTS**

<b>AGE/GRADE LEVEL</b>	This program is appropriate for Grades 4-8.
<b>DURATION</b>	Approximately 1.5 hours
<b>GROUP SIZE</b>	30 students plus one educator/chaperone for every six students.
<b>DOCENTS</b>	2 docents
<b>LOCATION</b>	Begin tour in Geology Gallery and continue to Branigar Chase for activities.
<b>BACKGROUND</b>	<p>This program should help students identify the three rock types the Earth is made of and to begin to understand that rocks are fascinating ways to discover information about their origin and that of the history of the Earth, as well. Most of the rock layers found at Grand Canyon are sedimentary, laid down over long periods of time by rivers and seas. A small amount of the sedimentary rock was deposited by desert winds. The oldest rock found at the bottom of the Canyon is metamorphic (rock formed by heat and pressure). Igneous rock, seen in the inner gorge and in the Western part of Grand Canyon, was formed by hot, molten rock called magma that cooled either below or on the Earth's surface (then called lava). The marvel of Grand Canyon is that its rock layers are so beautifully exposed. Although much is known about the age of the rock layers exposed at Grand Canyon and the environment at the time they were formed, scientists are still trying to solve how Grand Canyon itself was formed. The Colorado River carved it, but how the river got there and began the process remains a mystery.</p>
<b>ESSENTIAL QUESTIONS</b>	<p>By the end of the program, students should be able to answer the following questions:</p> <ol style="list-style-type: none"><li>1. Where do rocks come from? How do rocks differ from each other? Are all rocks formed the same way? What are the three types of rocks?</li><li>2. What was the Earth like when the rock layers of Grand Canyon were deposited? How do we know?</li><li>3. What do geologists learn from the study of rocks? Why is determining the age of rocks important to understanding the history of the earth? of Grand Canyon?</li><li>4. The layers of rock were in place long before the Grand Canyon formed. What would be strong enough to cut through all that rock to make a canyon? Is Grand Canyon finished growing and changing?</li></ol>

## KEY WORDS

Geology	Plate tectonics (grade 5-8)
Crust	Igneous
Mantle	Metamorphic
Core	Sedimentary
Colorado Plateau	Deposition

## ARIZONA ACADEMIC STANDARDS

## SCIENCE

### Strand 1: Inquiry Process

#### Concept 1: Observations, Questions, and Hypotheses

*Grade 4:* Observe, ask questions and make predictions

PO 2. Formulate a relevant question through observations that can be tested by an investigation.

PO 4. Locate information related to an investigation.

*Grades 5–8:* Formulate predictions, questions, or hypotheses based on observations. Locate appropriate resources.

PO 1. Formulate questions based on observations that lead to the development of a hypothesis

PO 3. Explain the role of a hypothesis in a scientific inquiry.

Related Questions:

1. Where do you predict the Earth's plates will be 100 million years from now? What are you basing your prediction on?
2. Where did all the rocks in Grand Canyon come from?
3. What was the Earth like when these rocks were deposited?
4. How do we know?
5. Why is it important for scientists to gather evidence to support their theories? Why might that be difficult in the case of Grand Canyon?

#### Concept 3: Analysis and Conclusions

*Grades 5–8:* Analyze and interpret data to explain correlations and

results; formulate new questions.

PO 2. Form a logical argument about a correlation between variables or sequence of events

PO 5. Formulate a conclusion based on data analysis

Related Questions

1. What are some of the possible explanations for the formation of the Grand Canyon?
2. How do you think it formed?
3. Is Grand Canyon finished growing and changing?
4. How do you know?

**Concept 4: Communication**

*Grades 4–8:* Communicate results of investigations

PO 1 (*grade 4*): Communicate verbally or in writing the results of an inquiry.

PO 5 (*grades 5–8*): Communicate the results and conclusion of the investigation

**Strand 2: History and Nature of Science****Concept 1: History of Science as a Human Endeavor**

*Grades 5–8:* Identify individual, cultural and technological contributions to scientific knowledge

PO 2 (*grades 6 & 7*): Describe how a major milestone in science or technology has revolutionized the thinking of the time (plate tectonics)

**Concept 2: Nature of Scientific Knowledge**

*Grades 6–8:* Understand how science is a process for generating knowledge.

PO 2. Describe how scientific knowledge is subject to change as new information challenges prevailing theories (plate tectonics).

**Strand 6: Earth and Space Science****Concept 1: Structure of the Earth**

*Grades 5–8:* Describe the composition and interactions between the structure of the Earth and its atmosphere.

PO 2 (*grade 7*): Describe the properties and the composition of the following major layers of the Earth:

- Crust
- Mantle

PO 3 (*grade 7*): Explain the following processes involved in the formation of the Earth's structure.

- Erosion
- Deposition
- Plate tectonics
- Volcanism

PO 4 (*grade 7*): Describe how the rock and fossil record show that environmental conditions have changed over geologic and recent time.

**Concept 2: Earth's Processes and Systems**

*Grades 4–8* Understand the processes acting on the Earth and their interaction with the Earth systems.

PO 1 (*grade 4*): Identify the Earth processes that cause erosion.

PO 2 (*grade 7*): Distinguish the components and characteristics of the rock cycle for the following types of rocks:

- Igneous

- Metamorphic
- Sedimentary

PO 3 (*grade 4*): Describe the role that water plays in the following processes that alter the Earth's surface features:

- Erosion
- Deposition
- Weathering

PO 3 (*grade 6*): Analyze the effects that bodies of water have on the climate of a region

PO 3 (*grade 7*): Analyze the evidence that lithospheric plate movements occur.

PO 4 (*grade 4*): Compare rapid and slow processes that change the Earth's surface, including:

- Rapid – volcanoes, floods
- Slow – wind, weathering

PO 4 (*grade 7*): Explain lithospheric plate movement as a result of convection.

PO 6 (*grade 4*): Analyze evidence that indicates life and environmental conditions have changed (e.g., fish fossils in desert regions).

- PO 6 (*grade 7*): Relate plate boundary movements to their resulting landforms, including:
  - Mountains
  - Faults
  - Volcanoes