

**Garden of the Gods Visitor & Nature Center**  
City of Colorado Springs  
Parks, Recreation & Cultural Services  
(719) 219-0108



## **Geology**

**We look forward to meeting you and your students for our Garden of the Gods Education Program.**

### **Checklist BEFORE you arrive:**

- ◆ **Secure your transportation early!** We would not want your field trip cancelled for lack of transportation. Do you need permission slips?
- ◆ **Plan your travel time; indoor facility space is for 45 minutes only. Please be on time.**
- ◆ **Dress for the weather. Students may bring water bottles.**
- ◆ **Please do not pre-group your students** for the guided outdoor walk; we will arrange groups depending on our volunteer numbers.
- ◆ **Advise us in advance of students with special needs (i.e., wheel chair, hearing-impaired, medical issues, etc.).**
- ◆ **Parental leaders are not required. Parents who choose to come will be asked to observe, rather than participate, and will be charged \$2. No siblings or pets, please.**
- ◆ **Payment is due the day of your trip. Please provide cash or check payable to Friends of Garden of the Gods (FOGG). Teachers and paid aides are free. Sorry, we cannot accept credit cards.**

**Please note that since we schedule more than one school program on a given day, you should plan to have lunch and other self-guided activities away from the Visitor Center itself. Health code rules do not permit outside food to be brought into the café. If you would like ideas on other areas in the Park suitable for your needs, please check with our staff.**

## Garden of the Gods Education program description: Geology

**Goal: To introduce students to geology through the unique features found in Garden of the Gods Park. We cover the three rock types, three geologic processes, and three rock formations found in the Park. Program meets Colorado State Life Science Standard 3.**

### Program Agenda

- ◆ Program presentation days are Wednesday & Thursday, September through May. Program duration 2 hours: Time slots: **9:15-11:15**, and **11:55-1:55**
- ◆ Bus arrives at the Visitor & Nature Center (1805 N. 30<sup>th</sup> St., Co Sp., CO 80904) at the designated time; park parallel to the sidewalk under the large American flag north of the main entrance. Students unload and walk up the curved ramp entering the Visitor & Nature Center on the east side back door of the second floor. Bus remains at this location. **2 minutes, no bathroom breaks before movie.**
- ◆ Students enter the Visitor & Nature Center and proceed to the theatre to view a 14-minute movie: "How did those Red Rocks get There?" Following the movie is a hands-on activity reinforcing State Life Science Standard 3. **40 minutes.**
- ◆ Return to bus and travel to north main parking lot in the Park. Unload at trail head. **18 minutes. This time can include a bathroom break at the Visitor & Nature Center before guided nature walk.**
- ◆ Staff will assign small groups of students to trained volunteer/staff guides for your guided nature walk in the Garden. **45 minutes.**
- ◆ Return to trail head to reload onto bus, exit from Garden of the Gods Park. **15 minutes.**
- ◆ If you are using **parent drivers**, please have car pools arrive slightly earlier, park on the north side of the building and **bring students to the sidewalk under the large American flag.** When all students have arrived, we will escort them into the building at the designated time.



## **Geology: Preparation for Field Trip**

This program is designed for 3rd-6th grade students. Our introductory activity uses the theme of 3s. Three rock types (igneous, sedimentary, and metamorphic). Three geologic processes (uplift, faulting and erosion). Three rock formations found in Garden of the Gods Park (White Lyons sandstone, Red Lyons sandstone and Fountain conglomerate). We conclude our program outdoors for the students to experience the Park first-hand with a guided nature walk. Your visit is motivational as a unit "kick off" or effective as a culminating activity in your instructional plans.

### **Primary geology and history of the Garden of the Gods Park – Teacher's Reference Guide**

The story of the rocks seen in the Garden of the Gods Park begins over 300 million years ago when a different set of Rocky Mountains existed here. This first set of Rocky Mountains is known as the Ancestral Rockies, which were composed of the same granite (igneous rock type) that Pikes Peak is made of today. Pikes Peak granite has been dated at 1.6 billion years in age using geologic radiometric dating methods. This means that the granite that composed previous mountains, and our current Pikes Peak, formed during the Pre-Cambrian age as a large batholith, known as the Pikes Peak Massive. This batholith of granite gets pushed up (uplifted) during mountain building episodes, called orogenies, which are caused by forces of plate tectonics. There have been 3 mountain building periods in the Pikes Peak area:

- 1. The Ancestral Rockies occurred approximately 300 million years ago. The erosion of these first Rocky Mountains formed the sedimentary Fountain Formation conglomerate layers, and the Lyons sandstones.***
- 2. The Laramide Orogeny occurred approximately 70 – 80 million years ago. This phenomenon was caused by plate tectonics. The Pacific Plate dove under the North American Plate, causing the continent to buckle, and uplifted the Front Range, giving us a second set of Rocky Mountains. These also eroded away.***
- 3. Pikes Peak was uplifted during a third mountain building time approximately 10 million years ago. It is currently being eroded by many factors, particularly ice. The bowls on Pikes Peak were scoured out by glaciers during the last Ice Age that ended 10,000 years ago.***

The Garden of the Gods Park is composed entirely of sedimentary rock layers, and is unique because the rock layers have been tilted upright and exposed in dramatic fashion. Each ridge and valley represents a different period of environment from the past 65 to 300 million years of Earth's history. Erosion has sculpted these rocks into fascinating shapes. The main rock formations are described here:

**The Fountain Formation (300-280 million years old):** Nearly a mile thick, this sedimentary rock is composed of sand, gravel, and mud that washed

down from the Ancestral Rockies. Eventually these mountains were eroded flat, leaving thick deposits of stream sediments. These sediments eventually compacted and cemented into the Fountain Formation conglomerate, found on the west side of the Park. Balanced Rock, Siamese Twins, and Three Graces are some of the rock formations in the Park comprised of Fountain Formation conglomerate.

**Lyons Formations (280-245 million years ago):** After the stream deposited Fountain formation sediments built up, the local climate and landscape changed to that of a desert, and sand dunes covered the area. The fine-grained, well sorted sands of the Red and White Lyons Formations are Aeolian (wind deposited). The red color is from iron, which helps cement the grains together. The Lyons formations are the tallest hogbacks in the Park, and our most famous feature, the Kissing Camels, is part of the Red Lyons sandstone.

**Lykins and Morrison Formations, Dakota Sandstone, Benton Group, Niobrara Formation, and Pierre Shale (144 – 66 million years ago):** The Garden of the Gods Park area underwent primarily erosion episodes during the first part of the Mesozoic era from 245 - 200 million years ago. Thereafter, the area was inundated with several sea invasions. Sedimentary deposits show evidence of swamps, lagoons, sand bars, and sea mud. The rock formations listed above represent this time in Earth's history, and are located on the east side of the Park. Dinosaurs also roamed the area, and the skull of a unique dinosaur named *Theiophytalia kerri* was found in the Garden of the Gods in 1886 by a visiting Colorado College Professor, James Kerr. The dinosaur fossil has been dated from the Cretaceous Period, 135- 70 million years ago, and is an herbivore found nowhere else in the world.

All the various sedimentary layers were gradually compacted and cemented into rock. During the Laramide Orogeny (about 65 million years ago), these layers were broken and tilted upright. Erosion has exposed the ridges and carved out the valleys to what we see today.

The Geology Program guided walk along the Central Garden trail is among the older rock formations (Fountain conglomerate, Red Lyons, and White Lyons sandstones). The younger rock formations are not visible during the walk, but may be discussed. The 3 rock types (igneous, sedimentary, metamorphic), 3 main geologic processes (uplift, erosion, and faulting), and the 3 rock formations seen along the hike (Fountain, Red Lyons, and White Lyons) are introduced during the indoor program, and reinforced during the guided walk.

For additional information try these books:

**Roadside Guide to Colorado**, John Chronic

**Prairie, Peak and Plateau**, John and Halka Chronic

**Geology of the Pikes Peak Region, Colorado**, Richard Hubbard and Danny Wyatt

**Introduction to the Geology of the Colorado Springs Region**, Jeffrey B. Noblett

**Garden of God's**, Paul Nesbit

**Prehistoric Journey: A History of Life on Earth**, Johnson & Stucky

## A Pre and Post Activity Ideas:

- ◆ **Conduct an “ice power” experiment: Have students fill small plastic bottles with water. Seal tops and place in a freezer over night. What happens when the water freezes? The freezing water may crack the bottle. The freezing and thawing of water is one of the major forces of erosion in the Garden of the Gods Park.**
- ◆ **Complete the “Travel log”<sup>1</sup>.**
- ◆ **Have students do artwork or creative writing based on something that impressed them about their experience at the Park.**
- ◆ **Write a thank-you letter to the docent who led their guided walk.<sup>2</sup>**



Thank you! We had fun learning!

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<sup>1</sup> Travel Log sheet is included in packet download

<sup>2</sup> Send letters to Garden of the Gods Visitor and Nature Center  
Att: Bret Tennis  
1805 North 30<sup>th</sup> Street  
Colorado Springs, CO 80904

# Travel Log

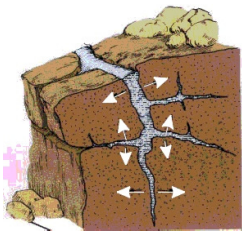
## Garden of the Gods - Geology

Traveler's Name \_\_\_\_\_

### Central Garden Area Walk



1. Is North Gateway Rock sedimentary or igneous rock?
2. What causes holes to form in the rock formations?
3. Which is older, Lyons sandstone or Fountain conglomerate?
4. Do the plants growing on the rock prevent or contribute to erosion of the rock?
5. Besides weathering, what else causes erosion?
6. List examples of human-caused erosion you see in the Park.
7. What geological processes contributed to the Garden's rock formations?  
a. erosion b. faulting c. uplifting d. all of the above
8. Are we in a State Park, National Park, or City Park? What year did the Garden of the Gods become a Park?



9. What is the type of rock that changes when heat and pressure have been applied?
10. What is Pikes Peak made of?

11. What do we call a break in the earth's crust along which movement has occurred?
12. What unique dinosaur was found in the Garden of the Gods Park?
13. What caused horizontal sedimentary rock to become vertical?

On the back of this paper draw your favorite rock, plant, or animal you saw at the Garden of the Gods today.

## Travel Log Answer Key

### Garden of the Gods – Geology

#### Central Garden Area Walk

1. Is North Gateway Rock sedimentary or igneous rock? **Sedimentary**
2. What causes holes to form in the rock formations? **Soft spots in the rock erode away.**
3. Which is older, Lyons sandstone or Fountain conglomerate? **Fountain conglomerate**
4. Do plants growing on the rock prevent or contribute to erosion of the rock? **Contribute**
5. Besides weathering, what else causes erosion? **People, animals, plants, lightning, pollution.**
6. List examples of human-caused erosion you see in the park. **Walking off a designated trail, carving on the rocks**
7. What geological processes contributed to the Garden's rock formations? A. erosion; B. faulting; C. uplifting; D. all of the above **All of the above**
8. Are we in a State Park, National Park, or City Park? What year did the Garden of the Gods become a Park? **City park, dedicated in 1909**
9. What is the type of rock that changes when heat and pressure have been applied? **Metamorphic**
10. What is Pikes Peak made of? **Igneous rock; granite**
11. What do we call a break in the earth's crust along which movement has occurred? **Fault**
12. What unique dinosaur was found in the Garden of the Gods Park? ***Theiophytalia kerri***
13. What caused horizontal sedimentary rock to become vertical? **Uplift and faulting**

