Garden of the Gods Park
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Geology of the Park Program

Welcome! We look forward to sharing the Garden of the Gods with you and your students. Here are a few things to bear in mind as you prepare for the field trip:

- Your field trip begins at the Garden of the Gods Visitor & Nature Center.
  1805 N. 30th St. Colorado Springs, CO 80904
- Secure your transportation early. Getting a bus on short notice can be problematic.
- Plan ahead. Arriving on time maximizes the experience for your students.
- Check the weather forecast and dress appropriately! Docents can end a walk early if students are improperly dressed for the weather.
- Please, DO NOT PRE-GROUP your students. We will work with you to determine group size for the outdoor walk on the day of your field trip. Group size is based on docent availability. If you have students that must stay together for medical or disciplinary reasons we can easily adjust to your needs.
- Please, let us know in advance if you have any students with special needs (e.g. wheelchairs, crutches, medical conditions, etc.).
- Parent chaperones are welcome, but not required.
- Please, no pets or student siblings allowed.
- Students, chaperones and teachers are asked to silence cell phones during the field trip. Students should refrain from using any electronic device during the field trip. Taking photos on the outdoor walk is acceptable provided it is not distracting.
- Payment is due the day of your trip. Cash, credit card, and checks accepted. The cost is $2 per student. No cost for adults, but donations are welcome. Please, make checks out to:

  Garden of the Gods Visitor and Nature Center

Geology of the Park Program Description

We align with National STEM standards for grades K-6 Earth and Space Science and Colorado State Standards for Science: Physical, Life and Earth Systems

Goals:

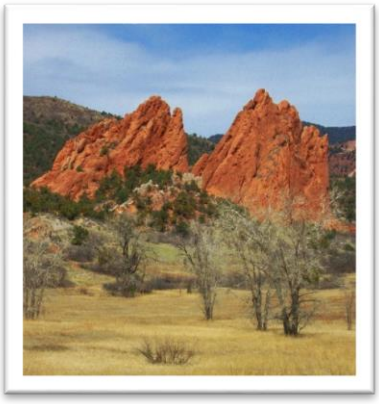
- Students gain a broad understanding of and appreciation for the science of geology.
- Students recognize the exceptional geological wonder of the Garden of the Gods.
- Students identify the three rock types and the three geological processes.
- Students identify the three rock layers experienced in the in the Park, their ages and composition.

Schedule:

- Field trips run Tuesday thru Thursday from 9:30-11:30 AM or 12:00-2:00 PM.
- Programs are available September 27, 2016 through May 11, 2017.
- We follow Colorado Springs School District 11 schedule for Holiday and Spring Break closures. There are no programs offered in January and February.

Daily Agenda:

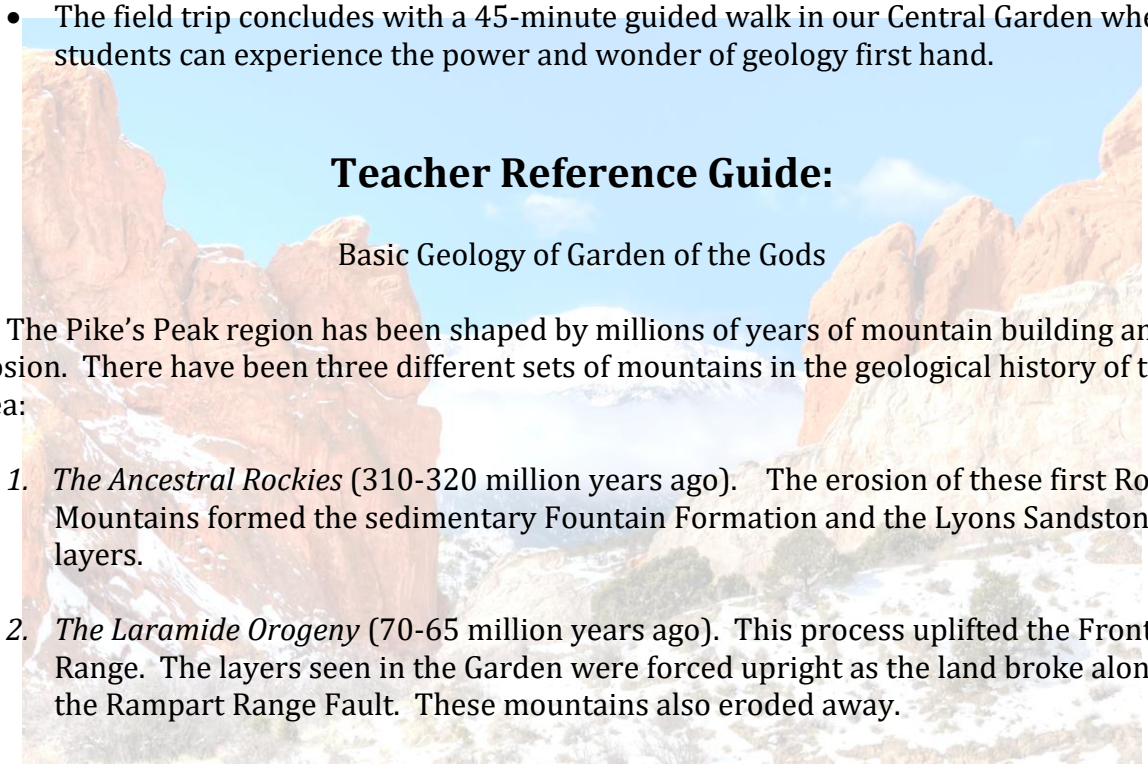
- Staff members will greet you outside the Visitor & Nature Center. Depending on the number of students, your group will be divided in half (approximately).
    - One half is guided through our interactive gallery
    - The other half enters our Red Rocks Room for a hands-on program and movie
- Groups rotate between these two sites after approximately 25 minutes in their first location.
- Following the indoor portion, students are led back to your transportation for the drive into the park. If you arrived by bus, a staff member accompanies you on the drive to the North Main Parking Lot inside the Garden. If you carpool, we provide a map and directions to the parking lot.
- Students are divided into small groups by our staff. The number is determined by docent availability.



- Each small group is led by a staff member or volunteer docent through the Central Garden. Walks last approximately 45 minutes.
- If you need to depart earlier than the scheduled time, please let us know upon arrival and we can adjust our program accordingly.

Geology of the Park: Overview

- Ideal for students in grades K-6 as either a kick-off or capstone event for your school's geology unit.
- We use a theme of **3**'s:
    - **3** rock types (igneous, sedimentary, and metamorphic).
    - **3** geologic processes (uplift, faulting and erosion).
    - **3** rock layers experienced on the field trip (White Lyons sandstone, Red Lyons sandstone and the Fountain Formation).
- The program begins indoors with hands-on activities in our new interactive geology gallery. Grades 4-6 will experience a 15-minute film *How Did Those Red Rocks Get There?*
- The field trip concludes with a 45-minute guided walk in our Central Garden where students can experience the power and wonder of geology first hand.



Teacher Reference Guide:

Basic Geology of Garden of the Gods

The Pike's Peak region has been shaped by millions of years of mountain building and erosion. There have been three different sets of mountains in the geological history of this area:

1. *The Ancestral Rockies* (310-320 million years ago). The erosion of these first Rocky Mountains formed the sedimentary Fountain Formation and the Lyons Sandstone layers.

2. *The Laramide Orogeny* (70-65 million years ago). This process uplifted the Front Range. The layers seen in the Garden were forced upright as the land broke along the Rampart Range Fault. These mountains also eroded away.

3. *Pikes Peak Uplift* (20-15 million years ago). Ongoing erosion and uplift has spread Pike's Peak granite throughout western Colorado Springs. Pikes Peak granite has been dated at over 1 billion years in age using geologic radiometric dating methods. The erosion of this time period exposed the upright fins (hogbacks) seen in the Park today. 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 of sedimentary rock layers. They are geologically remarkable due to their vertical and in some cases beyond vertical positions. This allows study of rock that in other areas has been buried by nearly a mile of sediment. Our program touches on the concept of rock formations. Students will explore two of these:

The Fountain Formation (320-300 million years old): Composed of sand, gravel, and mud that washed down from the Ancestral Rockies in alluvial fans. These sediments compacted and cemented into the conglomerates, sandstone, and mudstone (shale) of the Fountain Formation. This layer is over 4,500 feet thick. Formations in the western part of the Garden are made up of Fountain Formation: Balanced Rock, Three Graces and Sentinel Spires.

Lyons Formations (300-260 million years ago): The local climate changed and this part of Colorado became a windswept desert filled with sand dunes. The formation is composed of three layers, two of which are visible in the Park (Red Lyons and White Lyons). The red color is from iron becoming iron oxide (rust), which helps cement the grains together. The Lyons formations are the tallest rocks in the Park and include: North Gateway Rock, South Gateway Rock, White Rock and Gray Rock.

There are other rock formations in the Park, including the Lykins and Morrison Formations, Dakota Sandstone, Niobrara Formation, and Pierre Shale. However, these exist in the eastern part of the park and cannot be experienced close-up during this field trip.

All the various sedimentary layers were gradually compacted and cemented into rock. Beginning about 70 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.

Fossil evidence of dinosaurs and ancient marine animals has been found in the Park. The skull of a dinosaur named *Theiophytalia kerri*, a type of iguanodon, was found in the Garden of the Gods in 1878 by Colorado College Professor, James Kerr. The fossil dates to the early Cretaceous period and is the only evidence this species found anywhere in the world

Supplemental Activities:

- Replicate ice wedging by conducting an "ice power" experiment: Have students fill plastic bottles with water. Seal the bottles and freeze them. What happens? The freezing water may crack the bottles. This shows what the freezing and thawing of water can do to the rocks in our Garden.
- Complete the *Geo-Journal* worksheet included with this packet.
- Complete artwork or creative writing projects based on your experience in the Garden of the Gods.
- Write a thank you letter to the docent who led their guided walk.
- Address letters to: Garden of the Gods Visitor & Nature Center
  ATTN: Bowen Gillings
  1805 N. 30th St.
  Colorado Springs, CO 80904

Bibliography:

Johnson, Kirk R. and Robert G. Reynolds. *Ancient Denvers*. Denver Museum of Nature and Science, 2006.

Johnson, Kirk R. and Richard K. Stucky. *Prehistoric Journey*. Denver Museum of Nature and Science, 1995.

Noblett, Jeffrey B. *A Guide to the Geological History of the Pikes Peak Region.* Colorado College Department of Geology, Colorado Springs, Colorado, 2011.

Official Guide to Garden of the Gods and Rock Ledge Ranch Historic Site. 2012.

Geo-Journal

Name _____

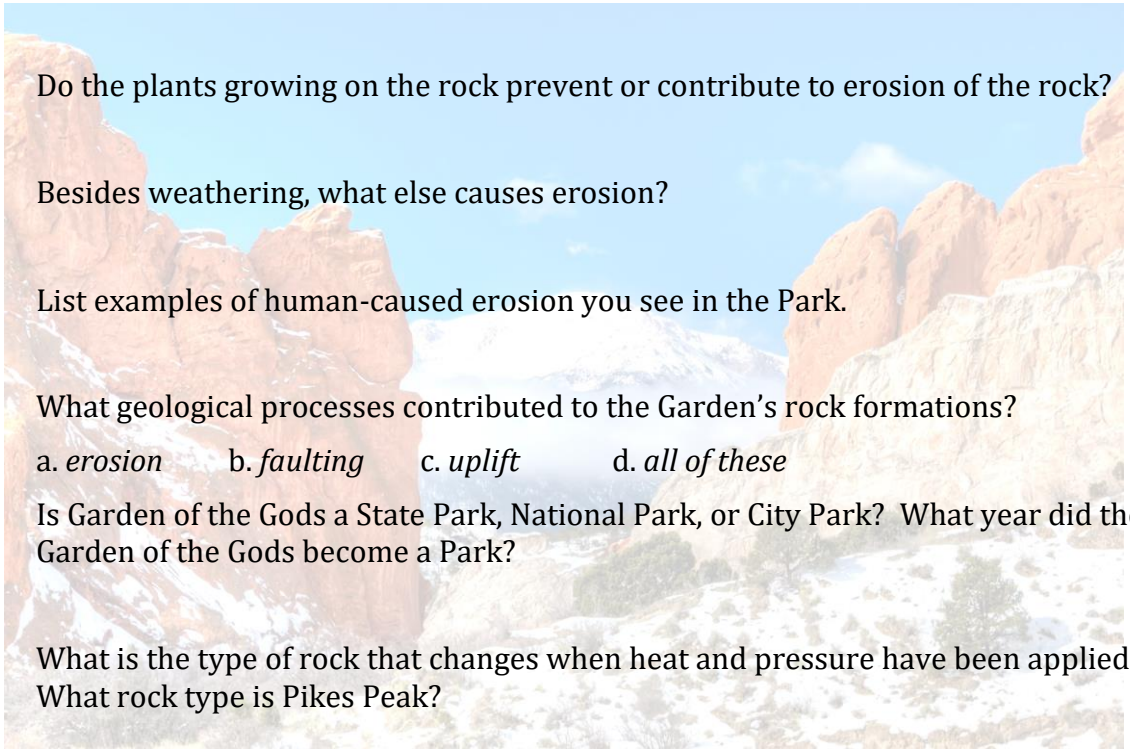
Garden of the Gods

Geology of the Park

1. Name the three rock types. Garden of the Gods rock layers are which rock type?

2. What causes holes to form in the rock formations?

3. Which is older, Lyons sandstone or the Fountain Formation?



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. *uplift* d. *all of these*

8. Is Garden of the Gods 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? What rock type is Pikes Peak?

10. What do we call a break in the earth's crust along which movement has occurred?

11. What unique dinosaur was found in the Garden of the Gods Park?

    a. *Rockasaurus redikus* b. *Theiophytalia kerri* c. *Stegosaurus*

12. What caused horizontal sedimentary rock to become vertical?

On the back, draw your favorite rock, plant, or animal from the Garden of the Gods.

Geo-Journal Answer Key

Garden of the Gods

Geology of the Park

1. Name the three rock types. Garden of the Gods rocks are which rock type?
   Sedimentary, igneous, metamorphic. GOTG rocks are sedimentary
2. What causes holes to form in the rock formations?
   Water seeps into the rock, freezes, cracks inside, repeats this, and eventually begins dripping out of a soft place (ice wedging)
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, 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?

   d. all of the above
8. Is Garden of the Gods 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? What rock type is Pikes Peak made of?

   Metamorphic. Igneous (granite)
10. What do we call a break in the earth's crust along which movement has occurred?

    Fault
11. What unique dinosaur was found in the Garden of the Gods Park?

    b. Theiophytalia kerri
12. What caused horizontal sedimentary rock to become vertical?

    Uplift and faulting