



Garden of the Gods Park
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Garden of the Gods Geology 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 inside the Garden of the Gods Park at our **North Main Parking Lot (Lot #2)**.
- Your field trip ends at the Garden of the Gods Visitor & Nature Center **1805 N. 30th St. Colorado Springs, CO 80904**. Maps are available in the Visitor and Nature Center. Our staff will coordinate with your bus driver on the pick-up location the day of your visit.
- This is a large group event intended for one class to participate together. Our posted maximum of 30 students is flexible. Details can be addressed at registration.
- All attending students should be prepared to walk roughly three miles on a mix of dirt, gravel, and paved surface during their visit. Students should carry water with them. Restroom facilities will be available at the beginning and end of your visit.
- Check the weather forecast and dress appropriately! This is a two-hour, outdoor experience. We will end your adventure early if students are improperly dressed for the weather conditions.
- 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 save to take pictures or videos. Taking photos 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 recommended. Please, make checks out to:

Garden of the Gods Visitor and Nature Center

Garden of the Gods Geology Program Description

We align with National STEM standards for grades 6-12 Earth Systems and Earth and Human Activity

We align with Colorado State Standards for Science: Earth Systems Science

Goals:

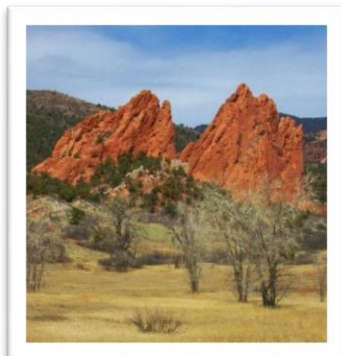
- Students become invested in understanding and caring for the exceptional wonder of the Garden of the Gods and the world around them
- Students gain an understanding of the various forces at work that shape and color the natural world
- Students gain an understanding of how humans use and shape natural surroundings
- Students understand the geological timeline of the region and how ancient events impact today's world and can be used to predict future outcomes

Schedule:

- Field trips run Tuesday thru Thursday from 9:30-11:30 AM or 12:00-2:00 PM. We will not start earlier or run later than scheduled times.
- Programs are available September 25, 2018 through May 9, 2019. Homeschool groups are welcome March 19-21, 2019.
- 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:

- Your program begins at the Park's North Main Parking Lot (lot #2) off Juniper Way Loop. Staff will direct your bus driver where to park.
- Your program ends at the Visitor & Nature Center, 1805 N.30th St. in Colorado Springs. Teacher is escorted inside to complete payment for the program.
- After a brief orientation, your class is guided into the Park where staff and volunteer docents will address the area's geological complexity and student questions. This is a walking tour on concrete and gravel surfaces with an elevation change of less than 100 feet.



- The format is very open, allowing students to engage at their interest level.

- If you need to depart the Garden earlier than your scheduled time, please let us know as soon as possible and we can adjust your program accordingly.

Garden of the Gods Geology: Overview

- Ideal for students in grades 6-12 engaged in Earth Science coursework
- We guide students in exploring the vast educational resource that is Garden of the Gods Park with its one billion years of geological history, plate tectonics, rock formations, geological forces, fossils, climate change, and human impact
- At registration, teachers may request specific emphasis on topic areas (i.e. a focus on stratigraphy or geomorphology, etc.)
- The program takes place entirely outdoors. You are welcome to arrive early or stay late to let students explore the Visitor and Nature Center.
- Please call ahead if you need to cancel due to inclement weather. We will not cancel a scheduled program on our own unless the Visitor and Nature Center closes. District closures due to weather will result in cancellation of your trip.
- Should students prove inappropriately dressed for weather conditions, we reserve the right to end your visit early and return students to their bus/cars.

Teacher Reference Guide:

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 mountain building events in the geological history of this area:

1. *The Ancestral Rockies* (290-320 million years ago). The erosion of these first Rocky Mountains formed the sedimentary Fountain Formation and the Lyons Sandstone layers.
2. *The Laramide Orogeny* (70-40 million years ago). This process uplifted the Front Range. The layers seen in the Garden were forced upright as the land broke apart creating the Rampart Range Faulting System. These mountains still exist as the upper half of mountains along the current Front Range.
3. *Late Tertiary Uplift* (5 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 layers of sediment nearly a mile thick. Students will explore some of these:

Pierre Shale (73-70 million years old): Formed when Colorado was beneath the Western Interior Seaway. Composed primarily of shale with layering of sandstone and clay in certain regions. Natural and artificial fracturing (fracking) has produced hydrocarbons in Fremont and Boulder Counties and the Raton Basin, Colorado. Pierre Shale exists in our Park between the Visitor and Nature Center and Rattlesnake Ridge.

Niobrara Formation (88-70 million years old): Also formed beneath the Western Interior Seaway of the late Cretaceous at a time of deepening seas. Composed primarily of limestone and chalk sometimes separated by layers of shale. Holds excellent examples of marine fossils. Exposed in our Park along Niobrara Ridge and Rattlesnake Ridge.

Dakota Sandstone (112-100 million years old): Shallow marine formation from river deltas, beaches, etc. as the Cretaceous Seaway was forming. Composed primarily of sandstone with layers of shale and limestone in areas. Differs in composition from Dakota Group found in the Midwest (eastern side of Cretaceous Seaway). Exposed in the Park between Rattlesnake Ridge and Juniper Way Loop.

Lyons Formations (300-260 million years old): 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 (upper member and lower member). 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.

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.

There are other rock formations in the Park, including the Lykins and Morrison Formations, and the Benton Group. However, these exist in parts of the park that will not 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.
- Collect pictures to identify geological specimens from the Garden of the Gods.
- Create a geological timeline of the Pike’s Peak region.
- Complete artwork or creative writing projects based on your experience in the Garden of the Gods.
- Write a thank you letter to the staff member or volunteer who led your adventure.
- Address letters to: Garden of the Gods Visitor & Nature Center

ATTN: Bowen Gillings
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Colorado Springs, CO 80904

Additional Resources:

Chronic, Malika and Felicia Williams. *Roadside Geology of Colorado*. Mountain Press Publishing, Missoula, MT; 2014

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

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

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

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

www.usgs.gov