GEOect's Discover Colorado's Geology Teacher Professional Development Learning Outcomes

This field experience has been developed to provide you with multiple opportunities to learn about the varied geology in Colorado. It is a wonderful location to learn about numerous geologic topics. During this trip, we will use an inquiry-based approach to examine rocks, minerals, fossils, the Rio Grande Rift, relative dating techniques, glacier features, horses and grabens, and stratigraphy. By using observations and inferences, you will piece together Colorado's geologic history and you will be able to describe how the Rocky Mountains formed. Time is set aside for you to collect rocks, minerals and fossils for you to take back to your classrooms.

This course is designed to incorporate a mixture of field excursions, min-field lectures, and classroom time where you will learn new activities to enhance your classrooms. Additionally, we will reflect as a group on what we are learning and discuss ways that we can "bring the field to the classroom."

Summary of Daily Learning Outcomes

Arrival Day- Introductions, overview, logistics, dinner and class

Class- we begin by using a KWL chart to assess teacher's prior knowledge on Colorado geology. We then move into our first rock lesson. This lesson will cover the rock cycle and sedimentary rocks. Using thin sections and rock samples, teachers will make classify each rock type (igneous, sedimentary, and metamorphic) based on observations that are discovered. As we move towards sedimentary rocks, teachers will relate sedimentary rocks with the past environment in which it formed. Teachers will also begin identifying sedimentary rocks. Time is devoted to determining where sedimentary rocks are placed within the plate tectonic cycle.

Topics-

- Rock Cycle
- Sedimentary Rocks
- Sedimentary Features

Day 1-

Field excursions- We start the day with a hike in Chautauqua Park. We will make 3-4 stops along the trail. At each stop, teachers will record observations and inferences

on the rocks that they see. They will discuss with other teachers what they notice and will attempt to put the story together. By the end of the hike, teachers will have a deeper understanding on the events that took place to form the Ancestral Rocky Mountains. The rocks that they see today, will be viewable at many stops over the next several days.

Our second stop is at Red Rocks Amphitheater. Here teachers will learn about gaps in time.

Our third stop takes us to Roxborough State Park. Teachers will determine which rocks are older and then draw a basic stratigraphic column.

Our final stop for the day is at Garden of the Gods. Here teachers will watch a short video (approximately 15 minutes) that enables people to visualize the rise and fall of the Rocky Mountains. We then will tour the park and relate the features at this park to the previous stops from today.

Topics

- Rock Identification
- Inferring Past Events
- Geologic History
- Stratigraphy
- Relative Dating Principles

Day 2-

Field Excursions- we begin the day at Florissant Fossil Beds National Monument. A park ranger will take the teachers to several stops and at each stop, she will give them rock samples to observe and analyze. As a group, teachers will piece together the events that took place that allowed the Florissant fossils to form. Teachers will also complete a stratigraphic column for this park.

Next to the Monument is a fossil quarry where teachers are able to split shale and look for fossils. Any fossil that they discover that is not of scientific interest is theirs to keep.

Next, teachers will view a road cut where they will describe the significance of this rock in relationships to Florissant Fossil Beds.

The final stop for the day will allow teachers to examine weathering processes and conditions necessary for different types of weathering that occur.

Class- Today's class will focus on igneous rocks. Using thin sections and rock samples, teachers will compare and contrast the characteristics that igneous rocks have and then classify them based on shared characteristics. Time will be spent on practicing rock identification and determining past events. We will also discuss how igneous rocks are tied to the plate tectonic cycle.

The second topic for class today will focus on Pikes Peak. We will discuss different ways in which magma forms, failed rift systems and how both are related to Pikes Peak forming.

Topics-

- Fossils
- Volcanic Products
- Stratigraphy
- Fossil Formation
- Past Climates
- Relative Dating
- Fossil Formation
- Igneous Rocks
- Weathering Processes
- Formation of Magma
- Failed Rift Systems
- Pikes Peak Formation

Day 3-

Field Excursions- the Bureau of Land Management will join us for today at the Community College, Skyline Drive and select quarries in the area.

The stop at the Community College allows teachers to view a geologic time scale that they walk. It is similar to the one at Florissant.

At Skyline Drive, teachers will see and touch dinosaur footprints as well as trace fossils. They will be given a chance to participate in several activities that they can use in their

classrooms related to dinosaurs and other fossils. These activities incorporate math and language arts. While at Skyline Drive, teachers will compare the geologic formations to the formations in Boulder. Some are the same and new formations are found here. They will once again put the formations in order from oldest to youngest. They will discuss the geologic events that took places here. The last part of this stop allows teachers to examine the geologic displays at this site. This is a great spot to discuss how students can use art to create their own display or geologic time scales. These are great alternative and authentic assessments. One final neat aspect about Skyline Drive is that teachers will drive over a hog back. It allows them to experience a geologic feature in a very unique way.

We then will visit Marsh Quarry, one of the main dinosaur sites in the U.S. during the 1800's. Numerous dinosaur fossils were discovered here and several are now on display in some of the world's most famous museums. Once again, teachers will record observations and inferences before discussing with the groups the factors that would allow for so many dinosaurs to be discovered here.

Our final stop for the day is at Royal Gorge. Here we will examine the pegmatites and discuss what clues they provide for the Ancestral Rocky Mountains. We will also discuss how canyons form and compare this canyon to the Grand Canyon.

Topics-

- Dinosaur Fossils
- Trace Fossils
- Determining Behavior from Fossils
- Hog backs
- Geologic Time
- Stratigraphy
- Relative Dating
- Canyon Formation
- Mineral identification
- Metamorphic Rocks
- Pegmatites
- Island Arcs

Day 4-

Field Excursions- The Chalk Cliffs will be our first stop for the day. Here we will determine what the Chalk Cliffs are composed of and how the regional geology impacts the rocks at this site. We will also discuss and identify xenoliths.

Sugarloaf Mountain is the next stop. Teachers will make observation amend inferences prior to discussing with the group the significance of this site. It is a very unusual site, but it provides evidence for the Ignimbrite Flare-Up that occurred in Colorado. We will also discuss how this site is related to Florissant. This is an excellent spot to identify minerals.

While we are at Sugarloaf Mountain, we will discuss the regional geology. This area is located along the Rio Grande Rift and it is a textbook location to discuss horst and graben geology.

We then move on to examine the glacier features in this area. Twin Lakes is the site that we will visit to identify several glacier features.

Our last stop of the day is at Mt. Princeton Hot Springs. Here, we will investigate the geothermal waters along Chalk Creek. We will be able to feel where the hot water exits the ground to form hot springs.

Class-

Our first lesson for the day covers metamorphic rocks. We will classify them based on characteristics seen in rock samples and thin sections. Time is set aside for teachers to identify metamorphic rocks. As with the other rock groups, we will determine where metamorphic rocks fit within the tectonic cycle. We then move into a review activity covering all of the rock groups. Our next activity has teachers creating a geologic timeline in Colorado's geologic history. Finally, we will complete a lesson in Bowen's Reaction Series (mineral formation) and discuss ways that this activity can be used at various grade levels.

Topics-

- Mineral formation (Bowen's Reaction Series)
- Metamorphic Rocks
- Ignimbrite Flare-Up
- Geothermal Activity and Alteration

- Glacier Features
- Horst and Grabens
- Rio Grande Rift
- Igneous Rocks
- Relative Dating
- Geologic Time
- Colorado's Geologic Events

Day 5-

Class- we will visit the USGS Ice Core Laboratory to view and touch ice cores from around the world. A discussion will take place on how ice cores are gathered and the data they contain. We will then discuss the evidence they provide for global climate change.

Our final activity will be the KWL. Teachers will share what questions were answered thought the week and what they learned on this trip.

Please note, the itinerary will change based on weather, unforeseen events and logistical considerations. We may modify the program to add additional activities or to drop others.

For questions about the trip, please contact Davida Buehler at *dbuehler@kent.edu*.

Davida Buehler

Trip Leader

Part-time faculty, Kent State University

Doctoral Candidate