Google Earth Geology Field Trip

GRADE LEVELS	2nd-7th; California Content Standards for 2nd, 4th, 6th, and 7th
SUBJECTS	Earth Sciences
DURATION	Preparation: 20 minutes Activity: 45 minutes – 1 hour
SETTING	Classroom; Computer Lab

Objectives

In this activity, students will:

1. learn about California geology.
2. learn about common rocks, including how they are formed and some of their uses in everyday life.

Materials

3 rock samples: 1 sedimentary, 1 igneous, 1 metamorphic (optional, but helpful when reviewing the rock cycle)
California Geology Flight kmz file
computer and projector (or many computers for students to work in groups – suggested for older students)
Geology Field Trip Worksheet (1 per student)
Geology Field Trip Worksheet Teacher Version

Vocabulary

- geology: the scientific study of the origin of the earth along with its rocks, minerals, land forms, and life forms, and of the processes that have affected them over the course of the earth's history
- sedimentary rock: rock that has formed through the deposition and solidification of sediment, especially sediment transported by water (rivers, lakes, and oceans), ice (glaciers), and wind
- igneous rock: rock formed by the cooling and solidifying of molten materials
- metamorphic rock: rock that was once one form of rock but has changed to another under the influence of heat, pressure, or some other agent without passing through a liquid phase
- subduction: a geologic process in which one edge of one lithospheric plate is forced below the edge of another

Teacher Background

California is situated on the boundary between the North American Plate and the Pacific Plate, a location that gives rise to significant tectonic activity and complex geology. California is an amazingly diverse state in terms of geology. It is full of current dynamic geologic processes (earthquakes, landslides, and volcanoes), and it is full of rocks that tell us about geologic processes of the past.

Without traveling all around the state, it can be difficult to imagine all these different types of rocks and geologic formations. Google Earth is a unique tool that allows users to see the unthinkable. It lets us fly around the planet, viewing the world, its rocks, its oceans, and its cities, from a perspective impossible without technology.

In this lesson, we use the tool of Google Earth to take students on a virtual field trip around California. We start close to home in the Bay Area, looking at two types of sedimentary rocks (sandstone and limestone) and two types of metamorphic rocks (marble and serpentine). Then, we move to the Sierra Nevada where we see one sedimentary rock (conglomerate), one metamorphic rocks (slate), and three igneous rocks (obsidian, scoria, and granite).

By flying around the Bay Area and then to the Sierra Nevada, students can compare the environments in which these different types of rocks are formed.

For background information on these rocks please see the teacher version of the worksheet.

Activity

Preparation

1. Print enough copies of the worksheet for each student to have one.
2. Print one copy of the worksheet (teacher version) and review it.
3. Download Google Earth for free: **http://earth.google.com/**
4. Put the CD in your computer and download the kmz file entitled "California Geology Flight."
5. Open the kmz file. Google Earth should automatically launch.
6. On the left-hand side of the window, under the "Temporary Places", you will see California Geology Flight.
7. Practice using Google Earth so that you can run the tour with your students and help them with questions they might have.

Introduction

1. Review the rock cycle with your students. There are three different types of rocks: sedimentary, metamorphic, and igneous. Remind students how these different rock types are formed.
2. Pass around the rock samples (if you have them) and ask for student observations.
3. Ask students the following questions.
    - Which rock types would you expect to find on a field trip to the beach? *(Mostly sedimentary rocks because sand builds up on the beach and over time can form sedimentary rocks.)*
    - Which rock types would you expect to find near the volcanoes in the Sierra Nevada? *(Mostly igneous rocks because they are formed when molten material from volcanoes cools and hardens.)*
    - Where in California would you expect to see metamorphic rocks? *(You can find metamorphic rocks anywhere where rock has been changed by heat and pressure. This could be near the coastline, where two plates once collided and now move in opposite directions along a series of faults*

including the San Andreas Fault. You could also find them in the mountains where mountain building could have caused serious heat and pressure.)

Procedure

1. Tell students that they are going to go on a virtual geology field trip to see some places where they can find sedimentary, metamorphic, and igneous rocks in California.
2. Open the kmz file entitled "California Geology Flight." This will open the Google Earth application.
3. Start by double clicking on "California." This view will show a cluster of points in the Bay Area and a cluster in the Sierras. Explain to the students that your virtual field trip will involve looking at geology close to home and then further away in the Sierras.
4. Then, double click "Bay Area." This will zoom into a view of only the Bay Area. Tell students that you will look at four different rocks in the Bay Area.
5. Explain that the Bay Area is located on a fault line and near the ocean. Both of these geographic features greatly affect the types of rocks that are distributed around the Bay Area.
6. Start with the first rock, sandstone, and proceed to give your students a tour of the four Bay Area rocks.
7. To fly to each rock, double click on the Academy logo next to each rock type on the left panel.
8. Once you reach the location, you can click on the logo once more to bring up the balloon of photos and information. (Note that you can also click on the name of the rock type on the left –in blue. This will bring up the balloon of photos and information. A double click will fly you to the appropriate location.)
9. Read the balloon text out loud to your students and have a discussion about how each rock type was formed. (Use the information from the teacher worksheet to flesh out what is written in the balloons.)
10. For each rock location, you can pause to discuss relevant issues such as how the visible topography was formed, what rocks are used for in everyday life, how and why rocks are mined, and the environmental issues associated with mining.
11. At each location have students fill in the appropriate section on their worksheet.
12. After visiting the four Bay Area rocks, double click on "Sierra Nevada." This will zoom into a view of the Mono Lake area of the Sierra Nevada. Tell students that you will now fly to the mountains and look at 5 rocks from this region.
13. Double click on "Mono Craters." This will fly you in closer to a view of the volcanic landscape.
14. Discuss how the Sierras were formed: Today, California's faults are mostly transform faults (where plates grind past one another), but there used to be a subduction zone off the coast of California. At subduction zones, oceanic crust is subducted beneath the continental crust. When oceanic crust subducts, it melts, causing large plumes of magma to rise. In California, these large plumes of magma resulted in mountain building and volcanoes. When the magma cooled, it formed the igneous granite that comprises the base of the Sierras. As volcanoes

erupted, mountains formed, rivers were born, and other geologic processes occurred in this area. Many metamorphic, igneous, and sedimentary rocks formed.

15. Explore the five Sierra rocks as you did with the Bay Area rocks. Have the students continue to document what they are learning on their worksheets.

Wrap-Up

Discuss with the students:

- What surprised you about your virtual field trip?
- Why are there so many different types of rocks in California? *(California is tectonically active and showcases a variety of different geologic processes including sedimentation, metamorphism, and volcanic eruptions.)*
- What questions do you have about California geology?

Relate your virtual field trip to the specific standards for your grade. The Google Earth tour can serve as a visual cue to remind students of many important geologic concepts.

Extensions

With older students, spend time flying over California's major geologic features. Have students take turns explaining some of the features that you can see.

References

United Stated Geological Survey, Menlo Park Campus, kindly supplied the rocks and many of the rock and location photos for this lesson.

Farndon, J. (2008). *The illustrated encyclopedia of rocks of the world.* London: Southwater.

Sloan, D. (2006). *California natural history guides: Geology of the San Francisco Bay region.* Berkeley: University of California Press.

Hill, M. (2006). *California natural history guides: Geology of the Sierra Nevada.* Berkeley: University of California Press.

Correlated California Content Standards

Grade Two

Earth Sciences

3e. Students know rock, water, plants, and soil provide many resources, including food, fuel, and building materials, that humans use.

Grade Four

Earth Sciences

5a. Students know some changes in the earth are due to slow processes, such as erosion, and some changes are due to rapid processes, such as landslides, volcanic eruptions, and earthquakes.

5c. Students know moving water erodes landforms, reshaping the land by taking it away from some places and depositing it as pebbles, sand, silt, and mud in other places (weathering, transport, and deposition).

Grade Six

Earth Sciences

1f. Students know how to explain major features of California geology (including mountains, faults, volcanoes) in terms of plate tectonics.

2a. Students know water running downhill is the dominant process in shaping the landscape, including California's landscape.

2b. Students know rivers and streams are dynamic systems that erode, transport sediment, change course, and flood their banks in natural and recurring patterns.

2c. Students know beaches are dynamic systems in which the sand is supplied by rivers and moved along the coast by the action of waves.

Grade Seven

Earth Sciences

4a. Students know Earth processes today are similar to those that occurred in the past and slow geologic processes have large cumulative effects over long periods of time.

4c. Students know that the rock cycle includes the formation of new sediment and rocks and that rocks are often found in layers, with the oldest generally on the bottom.