# Pre-Visit Activity: What kind of geologist am I?

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| **GRADE LEVELS** | Grade 2-5; California Content Standards for 2nd to 5th grade |
| **SUBJECTS** | Earth Sciences; Language Arts |
| **DURATION** | Prep: 30 minutes  Activity: 45-60 minutes |
| **SETTING** | Classroom |

## Objectives

By sharing brief first person narratives, students will:

1. learn about six of the many branches of geology.
2. become familiar with tools used by geologists to study and collect the Earth's resources.

## Materials

Large Geology Careers sheets (set of 6 sheets, one set per class)
Small Tool/Location cards cut to size (set of 30 cards, one set per group)
What kind of geologist am I? worksheet (one per student)

## Vocabulary

- **field work**: to study and collect information in a geographical place. For example, field work for a volcanologist would take place on or in an area affected by a volcano.
- **fossil**: remains or traces of a plant or animal preserved in rock. This can include shells, bones, wood, and footprints.
- **geology**: the scientific study of the structure of the Earth, especially its rocks and what these reveal about the changes to the Earth past and present; a person who studies geology is a geologist.
- **hydrology**: the scientific study of water on the Earth, in the Earth and in the atmosphere; a person who studies hydrology is a hydrologist.
- **laboratory**: a controlled environment to study and collect information, often in a building, but includes temporary structures for field work.
- **mineralogy**: the scientific study of minerals; a person who studies mineralogy is a mineralogist.
- **paleontology**: the scientific study of fossils in order to learn about ancient plant and animal life; a person who studies paleontology is a paleontologist.
- **seismology**: the science of measuring the propagation of and trying to understand the causes of seismic waves in geological materials, such as earthquakes in the Earth's crust; a person who studies seismology is a seismologist.
- **volcanologist**: the scientific study of volcanoes; a person who studies volcanoes is a volcanologist.

## Teacher Background

Geologists are scientists who study the physical aspects of the earth. They study the forces that shape the earth's landscape, including earthquakes, volcanoes, floods, landslides, tectonic forces, glaciers, and water erosion. They also locate and study mineral resources, oil, natural gas and water. In this lesson, students will be introduced to six of the varied roles a geologist might play. Information below will give you a greater context for each role, but do not aim to impart all of these details to students.

**Hydrologist**
Hydrology is the study of the water on Earth and in the atmosphere as it travels through the water cycle. A hydrologist is the person who studies how the water moves through the cycle and often tries to help solve or monitor issues of quantity, quality and availability of water. In order to follow water through its cycle, hydrologists often work in the field to collect flow and water quality data; they then move into an office where they use computers, Geographic Information System (GIS) software and hydrographic models to help them to answer their questions. For example, hydrologists may: maintain municipal water quality or monitor the snow pack and reservoir levels in the Sierras to ensure there is enough water to supply both farmers and the city of San Francisco for the next year. A hydrologist might also work on a wetland restoration project in San Francisco Bay by studying the groundwater flowing through the site to ensure it is not contaminated with heavy metals dangerous to human and animal health that might result from digging up sediments.

Tools include: Buckets, Dissolved Oxygen Meter, Microscope, Shovel, GPS Device, Maps, Notebook, Pencil, Compass, Camera, Flashlight, Tape measure, Computer, Satellite and Core Drill.

Locations include: Underground, Office, Laboratory, University, Outdoors in the Field

Related Lesson: Earth's Water: A Drop in Your Cup
http://www.calacademy.org/teachers/resources/lessons/earths-water-a-drop-in-your-cup/

**Mineralogist**
Mineralogy is the study of minerals (the building blocks of rocks), gems, and precious stones. There are over 4,000 known minerals and every year, around 50-60 new minerals are described. In order to identify a mineral, or even describe a new one, a mineralogist might go out into the field to collect rock specimens. He or she might test the rock outside where the rock was found, or take it back to the lab for further study.

Mineralogists use a specific set of characteristics to describe and categorize minerals:

- Hardness: the ability of the mineral to resist scratching. Hardness is measured by the Mohs Hardness Scale where 1 (Talc) is the softest and 10 (Diamond) is the hardest.
- Luster: the way a mineral reflects light

- Color: many factors can affect color (such as weathering, the chemical composition of the specific mineral, etc) therefore the same mineral can come in different colors
- Cleavage: minerals tend to break along a preferred plane depending on the type of mineral
- Streak: the color of the streak left behind when the mineral is scraped on unglazed porcelain (a streak plate)
- Specific Gravity: the ratio between the weight of a mineral and the weight of an equal volume of water

Minerals have a variety of uses in our everyday life. A number of everyday items are made from minerals such as clocks (quartz), fingernail files (corundum), aluminum foil (bauxite), and toothpaste (fluorite).

Tools include: Acid, Streak Plate, Hardness Tester, Rock Hammer, Shovel, Magnifying Glass, Microscope, Computer, GPS Device, Maps, Notebook, Pencil, Compass, Camera, Flashlight, Tape measure, Computer, Satellite and Core Drill.

Locations include: Underground, Laboratory, Office, University, Outdoors in the Field

Related Lesson: A lesson from our Geology Classroom Kit, Mineral Match, explores everyday uses of minerals
http://www.calacademy.org/teachers/erk/erk_detail_classroom.php?id=geology_2-5

**Engineering Geologist**
An engineering geologist is a cross between a civil engineer and a geologist, as he/she studies the interaction of man-made structures with the earth. Think of all the places where that happens: roads, building foundations, tunnels, mines, dams, bridges, piers, drilling platforms in the ocean, and pipelines are just a few. Engineering geologists also help to prevent or correct damage that can occur at those places that could be caused by landslides, erosion, earthquakes, ruptures, subsidence, water seepage or even volcanoes. They can be called in to help with wetland and habitat restoration of sites, places where man-made structures might warrant removal. And they can help when non-rippable rocks are in the way of construction and need to be blasted out of the way. Engineering geologists also do a lot of mapping of the rocks, soils, ground water and other sub-surface fluids (like oil) in an area, which helps them to write reports or recommendations for construction or environmental impact assessments.

Tools include: Shovel, Dissolved Oxygen Meter, Hardness Tester, Computer, GPS Device, Maps, Notebook, Pencil, Compass, Seismograph, Camera, Flashlight, Tape measure, Computer, Satellite and Core Drill.

Locations include: Underground, Office, University, Outdoors in the Field

**Seismologist**
Early seismologists studied earthquakes, but the profession has expanded to include research into the internal structure of the earth. Seismology is a branch of geophysics, and seismologists primarily use computer models and seismographs to measure the propagation of waves generated by earthquakes, explosions or mechanical devices within the earth. Seismologists set up monitoring stations: permanent ones to listen for large earth movements and temporary ones if they are in an area doing field surveys. Their computer models even enable them to find conditions which may indicate the presence of oil, so many seismologists now work for oil companies.

Tools include: GPS Device, Maps, Notebook, Pencil, Compass, Seismograph, Camera, Tape measure, Computer.

Locations include: Underground, Office, University, Outdoors in the Field

Related Lesson: Plotting Earthquakes
http://www.calacademy.org/teachers/resources/lessons/plotting-earthquakes/

**Paleontologist**
Paleontologists study more than just dinosaurs; they study the history of all kinds of life on Earth as found in the fossil record. They often study both biology and geology, as paleontologists needs to know about both. Some specializations include fossils of animals with backbones, animals without backbones, single-celled organisms, and plants; how fossils form and are preserved; the vertical distribution of fossils in rocks and ancient ecosystems and how they developed. Paleontologists can spend many hours in the field working to slowly uncover a precious fossil with small brushes, but their initial work may involve jackhammers to remove bigger chunks of earth. Back in the laboratory, paleontologists continue to clean the dirt away from their fossils so that they can take many measurements and photographs; if the fossils are tiny, like diatoms (single-celled organisms), they will use powerful microscopes. Once their data is collected, it's time to head to the computers to graph their measurements and find correlations between their differing fossils.

Tools include: Brush, Magnifying Glass, Microscope, Shovel, GPS Device, Maps, Notebook, Pencil, Compass, Camera, Flashlight, Tape measure, Computer, Satellite, Pencil.

Locations include: Underground, University, Laboratory, Outdoors in the Field

**Volcanologist**
Volcanologists, sometimes called vulcanologists, study volcanoes. They study what is currently happening at a volcanic site, or what has happened in the past. Many geological events take thousands to millions of years to occur, but a volcano can build and be destroyed mere hours to years. Volcanologists start by reading current journal articles written about volcanoes. Those articles usually trigger a lot of questions, which a volcanologist then seeks to answer by visiting a volcano. At a volcano, scientists take detailed observations of the lava or plumes, collect

samples of lava rock or gases, and record measurements of distances and volume of flows. They then take this information back to their lab and office to analyze for the publication of their own journal articles. Some volcanologists use remote sensing techniques such as satellites that measure ash plumes in the atmosphere or use computers to analyze seismic tremors in the vicinity of the volcano, so they never have to leave the office.

Tools include: Rock hammer, Seismograph, Microscope, Shovel, GPS Device, Maps, Notebook, Pencil, Compass, Camera, Flashlight, Tape measure, Computer, Satellite, Pencil

Locations include: Underground, University, Laboratory, Outdoors in the Field, Office

**Questions These Scientists Might Ask**

Scientists often start their research with a big "wonder" question. It's a question that they and other scientists would like to answer. Often a wonder question is too big for just one scientist to answer with a single experiment. So a scientist will try to answer just one tiny part of the wonder question, taking human knowledge one step closer to an answer of the big question. If lots of scientists answer lots of little, testable questions, we can sometimes end up with an answer to our great big wonder question. Typically students have many big wonder questions, but they may not know that scientists break those questions down into small testable questions. For teacher reference, below we provide a list of questions that geologists have recently tried to answer.

Hydrologists Wonder:

- How do the water inputs and outputs for an individual river relate to the inputs and outputs of an entire region's river system (comprising multiple rivers)?
- How do glacial deposits, which overlay a chalk aquifer, prevent surface water and potential contaminants from reaching the aquifer?

Mineralogists Wonder:

- What causes triple-chain silicates to form?
- How can we detect trace elements in quartz below 100 parts per million?

Engineering Geologists Wonder:

- Is there a correlation between the sawability of popularly mined stones and the relatively cheap and simple indentation hardness test?
- Are the existing soils appropriate as a road base for the proposed Trans-Sahara highway in Nigeria?

Seismologists Wonder:

- Which mathematical equation from the set of Ground Motion Prediction Equations is best at predicting peak ground accelerations at a site in India?
- What data can we compile in order to make a comprehensive database of strong ground-motion recordings obtained during subduction-zone events in Central America, so that others can then assess existing predictive models for subduction-type events in Central America?

Paleontologists Wonder:

- By looking closely at the morphology of the body parts of a couple of crustacean fossils found in China, can we figure out if they are brand new animals or ones that other paleontologists have found?
- By looking at ammonite fossils from Chile, can we find evidence that the Tethys sea and the Pacific Ocean were once connected?

Volcanologists Wonder:

- If we use a CT scanner to look at the internal structure of volcanic rocks, can we tell if there is a preferred orientation for the bubbles and crystals inside?
- Does the rate of degassing during lava dome extrusion indicate an explosion is about to occur?

## Activity

### Preparation

1. Print out one set of Geologist Careers Sheets. There are 6 geology-based professions available, which you will distribute among student groups. You can choose the ones you'd like to introduce or use them all!
2. Print out one set of Tool/Location cards per group.
3. Print out one What Kind of Geologist am I? worksheet per student.

### Introduction

1. Brainstorm with your students what a geologist might study. Students may come up with: 'Earth,' rocks, minerals, etc. Write these ideas up on the board.
2. Then ask them where they might go to study these things. Students may come up with: mountains, lakes, rivers, ocean, beach, caves, volcanoes, forests, etc.
3. Point out that there are many different kinds of geologists who study specific things and may go to specific places to study them. For example, there is a kind of geologist that studies water, called a hydrologist. Of the ideas on the board, where might a hydrologist study? Try to make connections between as many of the 6 different kinds of geologists (paleontologist, seismologist, volcanologist, mineralogist, hydrologist, and engineering geologist) in this lesson as you can and the locations/words that the students came up with in their brainstorm.
4. You may wish to write the names of the '-ologists' on the board as you say them with your students.
5. Tell your students that each group will become a certain type of scientist studying geology. Each group will study one of the following: fossils (paleontologist), earthquakes (seismologist), volcanoes (volcanologist), minerals (mineralogist), lakes and rivers (hydrologist), or natural resources, such as oil and coal (engineering geologist). The groups will each receive a set of Tool/Location cards. Within their group they will discuss which tools their profession will need and at which locations they should work.

**Procedure**

1. Give each group one Geology Careers Sheet and a set of Tool/Location cards.
2. Encourage students to work as a team to decide which Tool/Location cards match their profession. They can select more than one. For each tool, students should be able to explain why they chose it. Draw the following table on the whiteboard and have the students come up to populate it with their ideas for their given Geology Career, or ask each group and write their ideas in the table.

| My Specialty | Professional Name | What I Study | Where I Work | My Tools |
|---|---|---|---|---|
| Hydrology | Hydrologist | Water | Outdoors in the field, Office, Laboratory, University | Buckets, Dissolved Oxygen Meter, Computer, Tape measure, Flashlight, Camera, Compass, Pencil, Maps, Notebook, GPS Device, Microscope |

3. Then, instruct students to write about their field of study and how they work. They can write their own mini-narrative in their science journals or fill in the provided worksheet. For example:

   "My name is Cindy and I work as a hydrologist. I study rain, lakes and rivers. What I do is important because people need clean water to drink and wash their clothes. I use buckets and shovels when I work. A question that I'd try to answer is: Why is the water in this river dirty?"

4. Add a Column "Questions I try to answer" to the above table. Then come together as a class. Select at least one student representative from each group to read the Geology Careers sheet aloud and share their narrative with the rest of the class. Write their questions in the table on the board.

**Wrap-Up**

- Do a *Think-Pair-Share* with your students. Propose the questions below (you may wish to write them on the board). Have them *think* about the answers and turn to a partner (*pair*) to *share* their ideas. Give them a minute or so to discuss their responses with each other. Then have volunteers share what they talked about in their pairs with the whole class.
  - What do you notice about the table?
  - Are there any similarities?
  - Are there differences?
  - Would they choose one of these geology careers for themselves?
  - Which question(s) would they like to one day find the answer to?
- Students should begin to see that while there are very different kinds of geologists studying different things, they may overlap in their study locations and tool use, while others have very unique environments and tools.

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## Correlated California Content Standards

### Grade Two

Earth Sciences

3d. Students know that fossils provide evidence about the plants and animals that lived long ago and that scientists learn about the past history of Earth by studying fossils.

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

English Language Arts: Writing

1.1 Group related ideas and maintain a consistent focus.

### Grade Three

English Language Arts: Writing Strategies

1.1 Create a single paragraph:

a. Develop a topic sentence.
b. Include simple supporting facts and details.

### Grade Four

English Language Arts: Reading

1.4 Know common roots and affixes derived from Greek and Latin and use this knowledge to analyze the meaning of complex words (e.g., international).

**Grade Five**

English Language Arts: Reading

1.4 Know abstract, derived roots and affixes from Greek and Latin and use this knowledge to analyze the meaning of complex words (e.g., controversial).