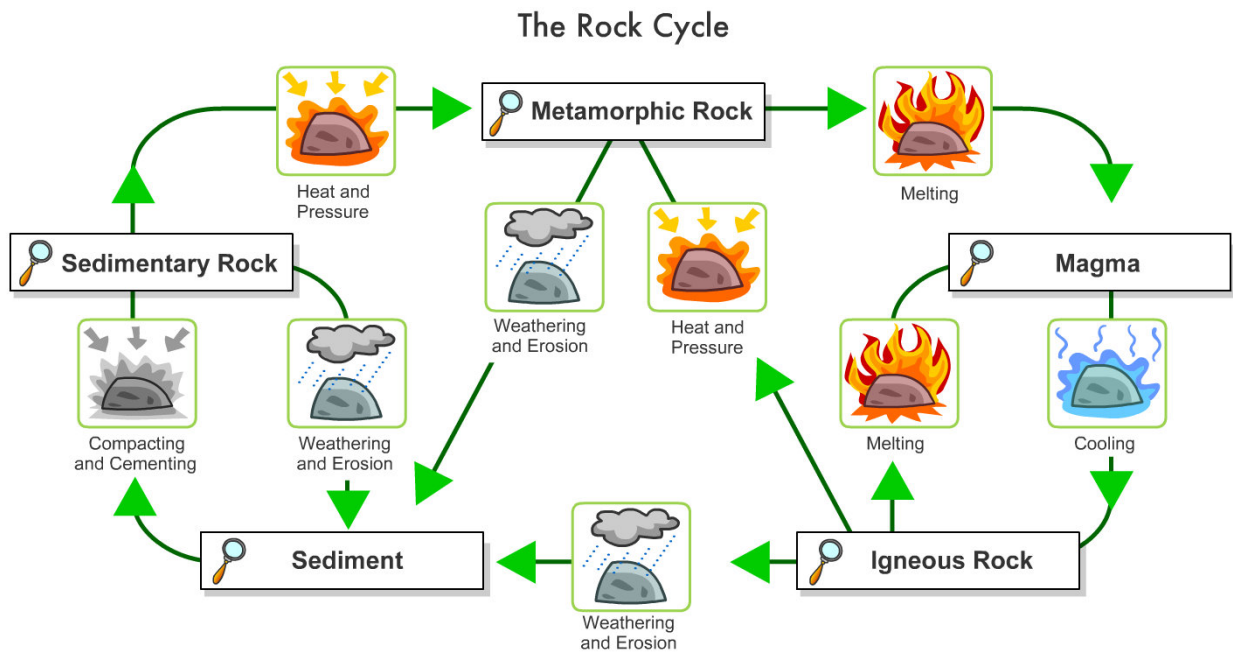


Rocks and Minerals

What is right under your feet?



Name: _____

Before you start...
What do you already know?

What is the difference between a rock and a mineral?

What are the three categories of rocks?

1. _____ 2. _____ 3. _____

Where are extrusive igneous rocks formed? _____

What are two rocks you might find going on a hike around Santa Fe?

1. _____ 2. _____

If you saw a rock that was made out of layers of what looks like red sand, what type of rock would you think you had found? _____

What is the difference between infiltration and runoff?

Draw the water cycle below.

Rock Walk

Today you are going on a short geological walk. Geologists often go into the field to collect rocks. Your goal is to find three rocks that you think are interesting. As you walk around your school, look for three rocks that are different in some way.

Guidelines:

- Collect three rocks
- The rocks should be different from one another
- All three rocks should fit on your palm

Back in the science lab...

Look closely at your rocks. You should brush off any loose dirt before beginning.

What do you notice about each rock?

Rock 1. _____

Rock 2. _____

Rock 3. _____

Compare your rocks to the rocks of the other geologists your group.
What do you notice?

Categorize your group's rocks three ways. Describe these categories below.

Category 1. _____

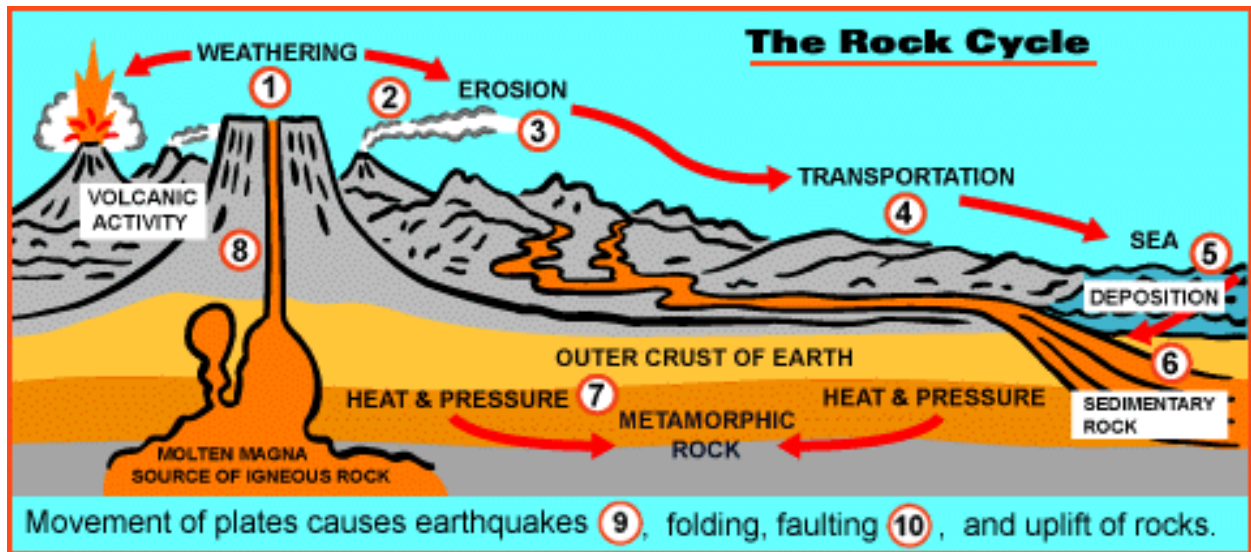
Category 2. _____

Category 3. _____

Keep your rocks in a bag with your name on it for future investigations.

The Rock Cycle

You may have heard of a life cycle, but rocks go through a cycle as well. Rocks are constantly being made and destroyed. Rocks are made in many ways. **Volcanoes** create rocks as liquid rock from inside the Earth hardens. This can happen below the ground or in a volcanic eruption. **Weathering** breaks rocks apart. Wind, rain, freezing and thawing, and other processes slowly break rocks into smaller pieces. These pieces of rock are broken into smaller and smaller sizes. This forms pebbles, gravel, and finally sand. Rock can also be destroyed through melting at a high temperature. If rocks are buried deep beneath our feet, about 25 miles beneath a continent or 5 miles below the ocean, they will begin to melt. This process recycles the rock, allowing it to resurface as new rock in a volcano.



Raisin Mining Rock or Mineral?

Challenge: The ingredients in this raisin bread are:

- Sugar
- Butter
- Flour
- Eggs
- Salt
- Raisins

You have 5 minutes to separate the bread into all of the original ingredients using a toothpick as your tool. For example, eggs should be in one pile and raisins should be in another. Wait for your teacher to say “Go!” to start.

Results: I found this much of every separate ingredient:

Teaspoons Sugar	Teaspoons Butter	Teaspoons Flour	Number of Eggs	Teaspoons Salt	Number of Raisins

Did you notice that it was possible to separate the raisins out of the bread, but that the other ingredients were mixed together and were impossible to separate?

Rock are like Bread, Minerals are like Ingredients

Rocks are made of one or more minerals mixed together. Minerals are the ingredients that make up rocks. Minerals do not have smaller stable parts. Granite is one of the most common types of rock found all around Santa Fe. The minerals that make a rock of granite are mica, feldspar, and quartz. These are mixed together, and sometimes you can see the ingredients, like the raisins in the bread. Sometimes the ingredients are mixed together and become a different color or texture, like the flour, butter, eggs, and sugar in the bread.

Igneous Rocks

Think about it...

Have you ever had chocolate melt in your hand?

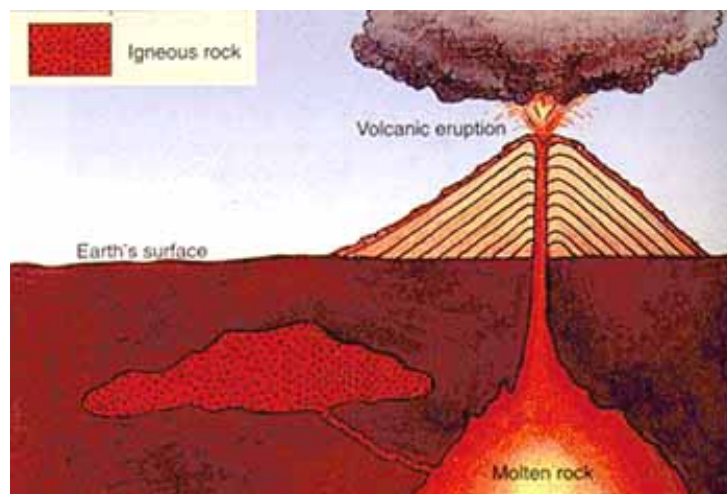
What happens when it cools down?

What happens when you cool water in the freezer overnight?

What is Igneous rock?

Igneous rocks are formed when liquid rock cools until it “freezes” or becomes a solid. Sometimes you can watch this happen. When volcanoes erupt, they allow liquid rock to flow above the ground. The liquid rock above the ground is called **lava**. As the rock comes in contact with the air, it quickly cools. This is called **extrusive** igneous rock. Extrusive rocks are often a single color. They frequently cool so quickly that gas bubbles are trapped in the rock, making the rock look almost like a sponge or swiss cheese.

Sometimes the liquid rock cools before it reaches the surface of the Earth. Liquid rock below the surface of the Earth is called magma. When **magma** cools, it is called **intrusive** igneous rock. This rock cools slowly. As it cools, the minerals can separate, creating crystals. Intrusive rock is often filled with small or large crystals. A common intrusive rock in Santa Fe is called granite. It is a pinkish rock that can have quartz crystals visible in it.



Look back at your rocks...

Do you see a rock with lots of holes or bubbles? It might be an extrusive rock.

Do you see a rock with visible crystals and no layers? This might be an intrusive rock.

Metamorphic Rocks

Think about it...

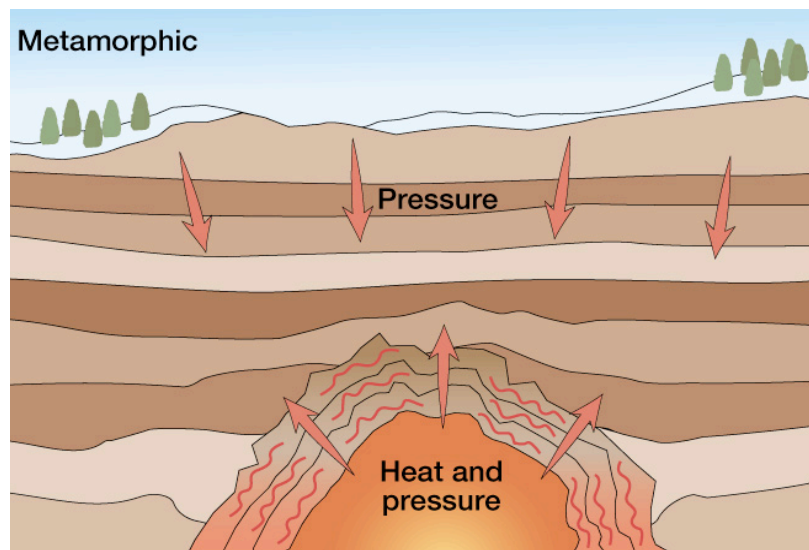
Imagine you put your sandwich under an iron, pressing and heating the sandwich.

What happens to the sandwich?

Imagine that you leave your bag of candy in the sun until it becomes soft. Then you accidentally sit on it. What will the candy look like?

What is metamorphic rock?

Metamorphic is a geological term composed of two root words. *Meta* is a Greek word meaning “to change.” *Morphos* means “shape” in Greek. Metamorphic rock is rock that changes shape. This process happens deep beneath the surface of the Earth. A rock ten miles below your feet is in an intense position. It is not quite warm enough there to melt. However, it is still very hot and has ten miles of rocks pressing down on it from the earth above. Extreme heat and pressure flatten rocks into layers. Sometimes this flattened, dense rock is lifted to the surface of the Earth, where we can see it.



Look back at your rocks...

Do you see a rock with layers and crystals? It might be a metamorphic rock.

Sedimentary Rocks

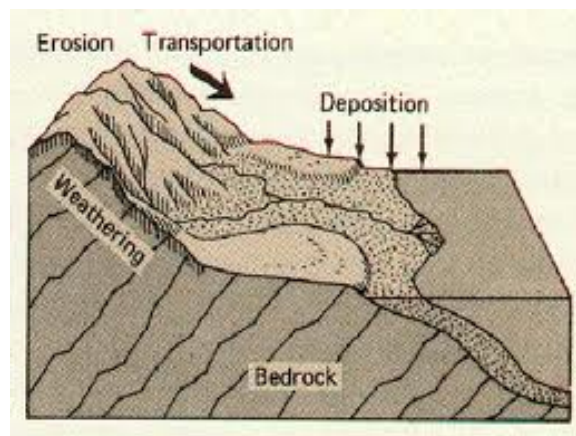
Think about it...

Have you ever buried something in sand or dirt?
What would happen if you left it there for the next million years?

What is sedimentary rock?

Sedimentary rock is made of small bits of other rock that have been naturally cemented together. After rock has been weathered and broken into smaller pieces, these pieces are often carried downhill through runoff, wind, and gravity. The sand, pebbles, and rocks are called **sediment**. The sediment settles in low areas. Over time, the sediment is buried under layers of sand, gravel, or rocks. Slowly, the grains are cemented together. Over time this becomes a new rock. One of the common sedimentary rocks in New Mexico is sandstone. Sandstone is sand that has been hardened into rock over thousands of years. It looks like grains of sand that have been layered and cemented together.

Sedimentary rock is the only type of rock that can contain fossils. Sometimes, as the sediment collects, plants or animals are trapped in the layers. This can be as small as a shell or a leaf. Some of the most famous fossils are much larger. These fossils are the remains of large reptiles that roamed the Earth millions of years ago, called dinosaurs. There are many fossil beds in New Mexico. In the past, much of New Mexico was covered by ocean. The shells and other sea life fell to the ocean floor and were covered by sediment. Overtime their bodies were replaced by minerals and hardened into sedimentary rock. This is why you can find shells and evidence of ocean life in the rocks in landlocked New Mexico.



Look back at your rocks...

Do you have a rock that looks like layers of sand? It might be a sedimentary rock.
Do you have a rock with fossils? It is a sedimentary rock.

Re-Categorize your Rocks

Now you are an expert in the three categories of rock, igneous, metamorphic, and sedimentary. Go back to your group's collection of rocks from the first day of this study. Look at the rocks and use what you know to categorize them into these groups.

Things to look for:

- Layers
- Holes or bubbles
- Crystal structure
- Consistent color
- Fossils
- Texture
- What else?

Which type of rock was the most common?

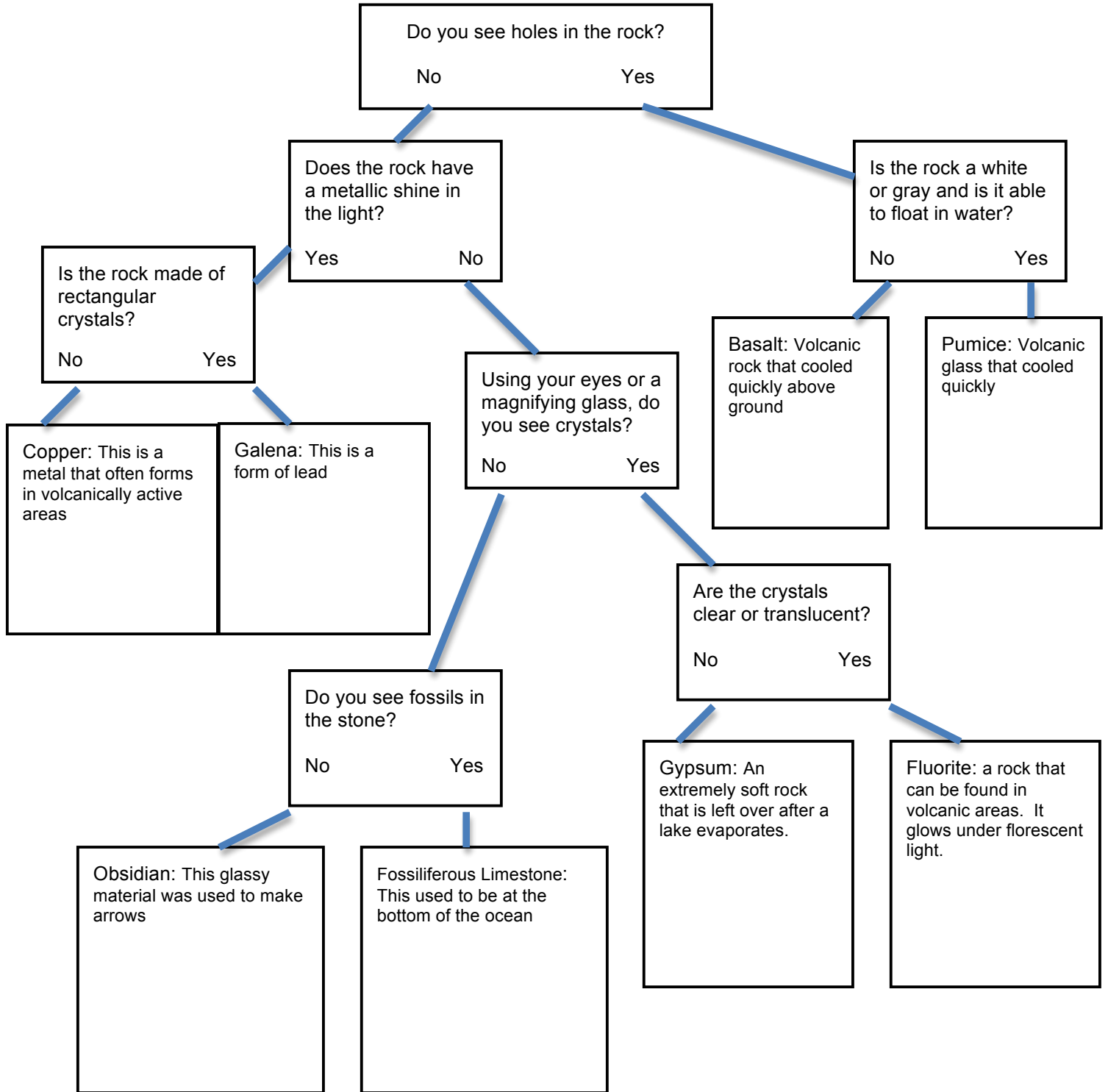
Why do you think that you found more of this type of rock?

Can you see where this rock came from? Can you find the larger rock from which your rocks came? If so, what does it look like?

What does this tell you, if anything, about how the area around Santa Fe was formed?

Learning in the Garden Rock Identification

Use this key to identify each rock. Draw the rocks in the space below the name



Learning in the Botanical Garden

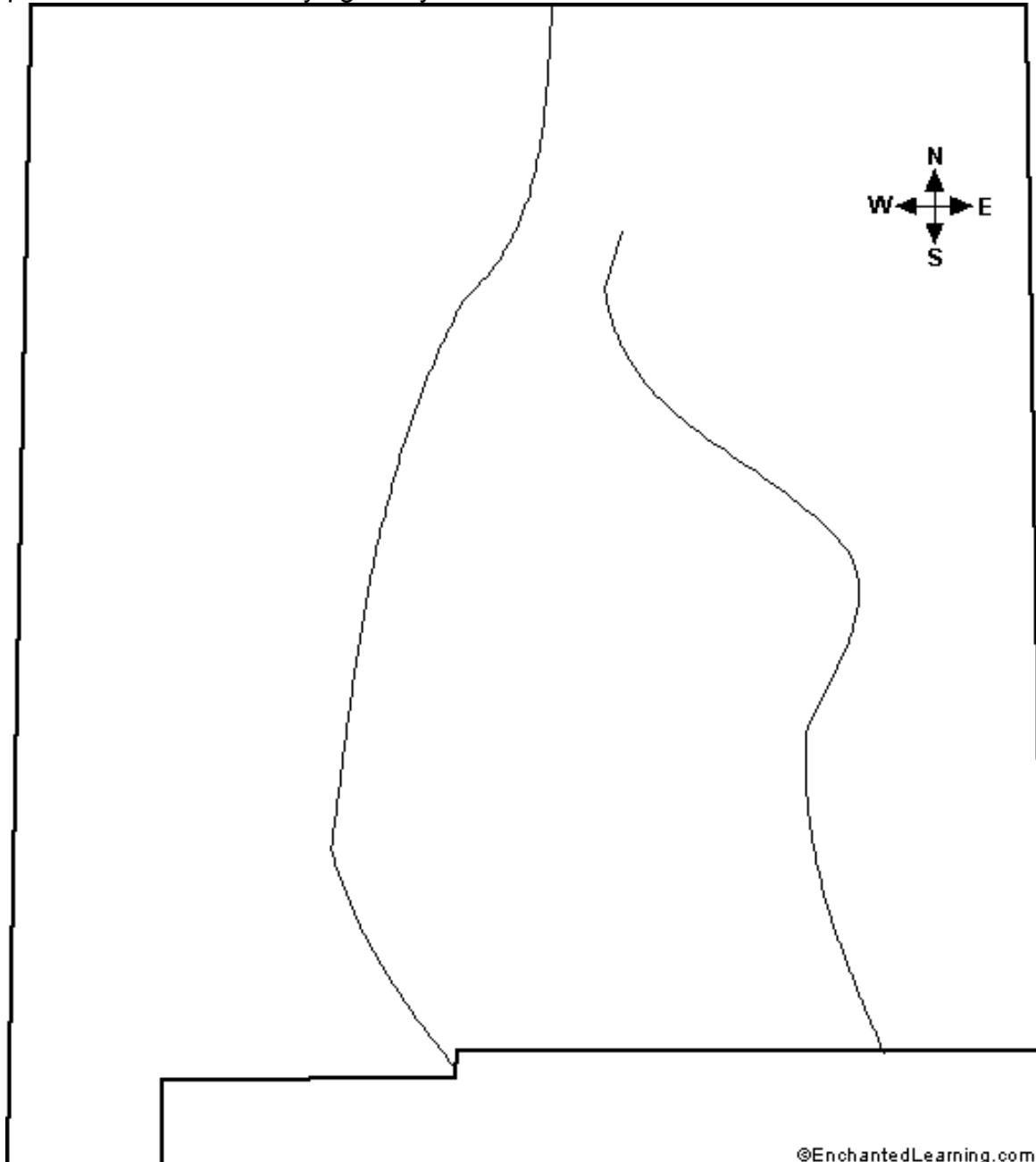
Santa Fe Geology

Where do we live?

What did it look like in the past?

How do we know?


Map the rocks we are studying today here.



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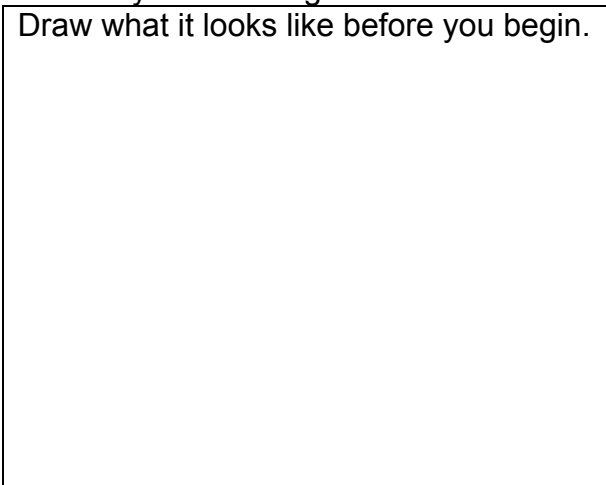
Learning in the Botanical Garden Erosion and Sedimentary Rock Exploration

Draw and label two ways that you see that erosion is being controlled in the garden.

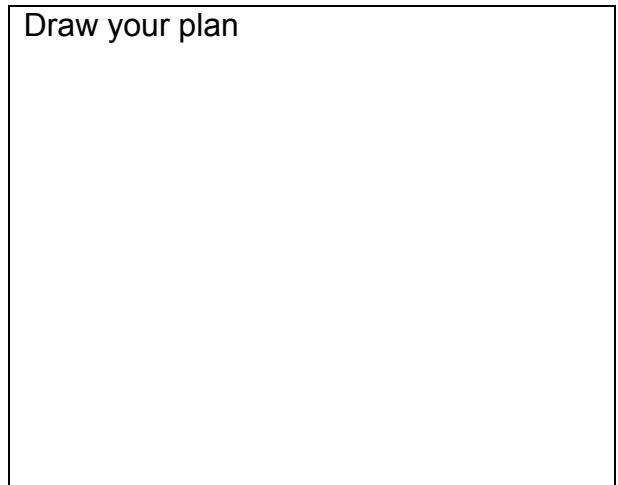


Challenge: Can you help us control erosion in this area?
Look at your challenge area.

Draw what it looks like before you begin.



Draw your plan



How did your plan work?

What would you do differently next time?

Water Cycle

Above, Across, and Below the Earth's Surface

We often only think about the water we can see in rain, snow, rivers, oceans, or our bathtub. However, much of the water in our environment is invisible. It is below our feet, invisible in the air, and flowing through the soil beneath rivers or streams. When you dump a cup of water on the ground, some runs off, some soaks into the ground, and some evaporates. This is all part of the water cycle. The water cycle is the way that water moves across, beneath and above the surface of the Earth. Use the image provided by your teacher to build or draw a model of the water cycle.



Schoolyard Water

Where does it come from, and where does it go?

As you have learned, water and erosion have a major impact on the shape of the land around us. These forces can weather rocks and move large amounts of soil and dirt. We can see **evidence** of these forces all around us. Often, architects of buildings and gardens think about how to move water around buildings and across the land.

Challenge:

Can you create a map of how water moves and erosion happens around your school?

Look for:

- Areas where rocks are being weathered
- Areas where sediment is being washed away
- Areas where sediment is being deposited
- Running water
- Arroyos
- What happens when water flows off the roof
- What happens at the edge of sidewalks, parking lots, or hard packed soil
- Other evidence of wind, water, or other forces that move rocks, soil, or sand

Think about:

What is working well in the way that water and erosion are controlled in around your school?

What are the challenges that you see around your school?

What do you think should happen to solve these challenges?

Infiltrate or Runoff?

Testing the Surfaces around your School

Question: Which areas around your school allow water to infiltrate? Which areas have more runoff?

The three surfaces I will test are _____, _____, and _____.

Hypothesis: I think that _____

_____ because

Materials:

- Measuring cup
- Water
- Ruler

Procedure:

1. Find your three surfaces on three inclines with a similar slope
2. Place your ruler on the ground, following the picture on the right
3. Pour the cup of water carefully at the 0 end of the ruler
4. Measure how far the water travels and record your results below

Results:

Surface 1: _____	Surface 2: _____	Surface 3: _____

Conclusion: I think this happened because _____

This is import to know because _____

What do you know now?

What is the difference between a rock and a mineral?

What are the three categories of rocks?

1. _____ 2. _____ 3. _____

Where are extrusive igneous rocks formed? _____

What are two rocks you might find going on a hike around Santa Fe?

1. _____ 2. _____

If you saw a rock that was made out of layers of what looks like red sand, what type of rock would you think you had found? _____

What is the difference between infiltration and runoff?

Draw the water cycle below.

Glossary

Extrusive _____

Fossil _____

Granite _____

Igneous rock _____

Intrusive _____

Lava _____

Magma _____

Metamorphic _____

Mineral _____

Pumice _____

Quartz _____

Rock _____

Sediment _____

Sedimentary _____

Volcano _____

Weathering _____

