My Planet Diary

Posted by Owen

Location Tacoma, WA

A couple of summers ago, my dad took me rock climbing for the first time. I went to a place called Frenchman Coulee in central Washington. It was really cool because the rock was basalt, which forms in giant pillars. It starts as lava, and then cools and you can see the different lava flows in the rock. Another cool thing is that Frenchman Coulee, which is a canyon, was gouged out by huge Ice Age floods.

Communicate **Discuss the question below with a partner. Then answer it on your own.**

How do you think scientists figure out the age of the basalt layers at Frenchman Coulee?

PLANET DIARY **Go to Planet Diary to learn more about the age of rock layers.**

How Old Are Rock Layers?

If you found a fossil in a rock, you might start by asking, "What is it?" Your next question would probably be, "How old is it?" The first step is to find the age of the rock.

Relative and Absolute Age

Geologists have two ways to express the age of a rock. The relative age of a rock is its age compared to the ages of other rocks. You have probably used the idea of relative age when comparing your age with someone else's. For example, if you say that you are older than your brother but younger than your sister, you are describing your relative age.

Lesson 2 - Relative Age of Rocks

Geologists have 2 ways to express the age of rock

Relative Age - age compared to the age of other rocks

Absolute Age - the number of years that have passed since the rock has formed

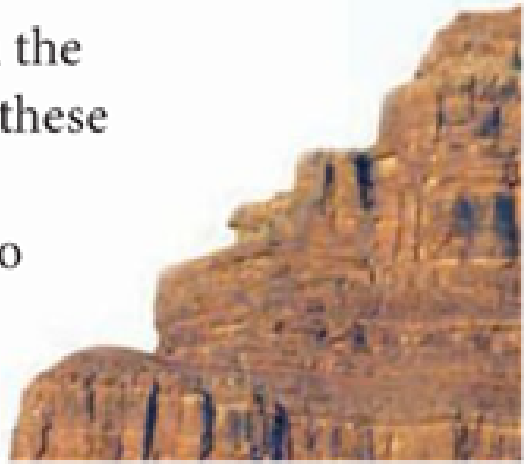
impossible to know exact age so geologists use both ways

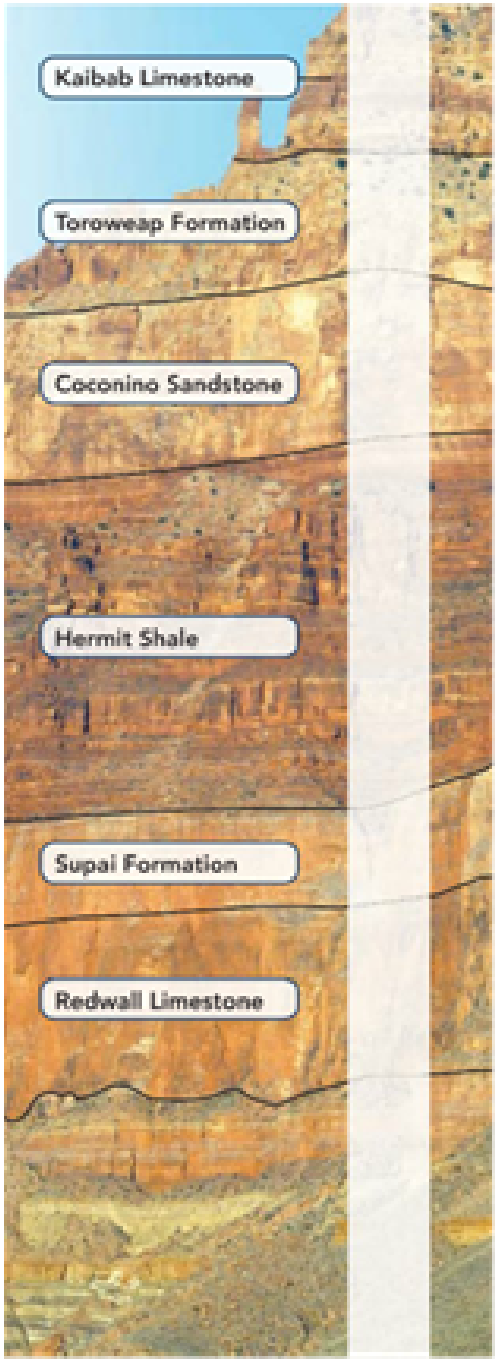
The relative age of a rock does not provide its absolute age. The absolute age of a rock is the number of years that have passed since the rock formed. It may be impossible to know a rock's absolute age exactly, so geologists often use both absolute and relative ages.

Rock Layers

Fossils are most often found in layers of sedimentary rock. Geologists use the law of superposition to determine the relative ages of sedimentary rock layers. **According to the law of superposition, in undisturbed horizontal sedimentary rock layers the oldest layer is at the bottom. Each higher layer is younger than the layers below it.** The deeper you go, the older the rocks are.

Figure 1 shows rock layers in the Grand Canyon. Rock layers like these form a record of Earth's history. Scientists can study this record to understand how Earth and life on Earth have changed.





Law of Superposition - layers of sedimentary rock - higher layer is younger than layers below it (relative age)

scientists can study the layers to understand how the Earth and life has changed over time

Scientists also use Igneous rocks, extrusions, intrusions, faults, and index fossils to determine relative age

Clues From Igneous Rock

There are other clues to the relative ages of rocks besides the position of rock layers. To determine relative age, geologists also study extrusions and intrusions of igneous rock, faults, and index fossils.

Molten material beneath Earth's surface is called magma. Magma that reaches the surface is called lava. Lava that hardens on the surface and forms igneous rock is called an **extrusion.** An extrusion is always younger than the rocks below it.

Magma may push into bodies of rock below the surface. There, the magma cools and hardens into a mass of igneous rock called an **intrusion.** An intrusion is always younger than the rock layers around and beneath it. **Figure 2** shows an intrusion.

Clues From Faults

More clues come from the study of faults. A **fault** is a break in Earth's crust. Forces inside Earth cause movement of the rock on opposite sides of a fault.

A fault is always younger than the rock it cuts through. To determine the relative age of a fault, geologists find the relative age of the youngest layer cut by the fault. **Figure 3** shows a fault.

Vocabulary Prefixes How does knowing the prefixes *in-* and *ex-* help you remember the difference between an intrusion and an extrusion?

The diagram below shows rock layers found at a site.

1. Circle the area on the diagram that shows an intrusion.

2. Shade the oldest layer on the diagram.

3. **Infer** What can you infer about the relative ages of areas B and E?

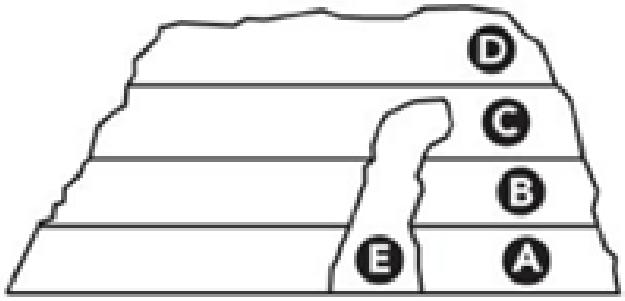


FIGURE 2

Intrusion

An intrusion cuts through rock layers.

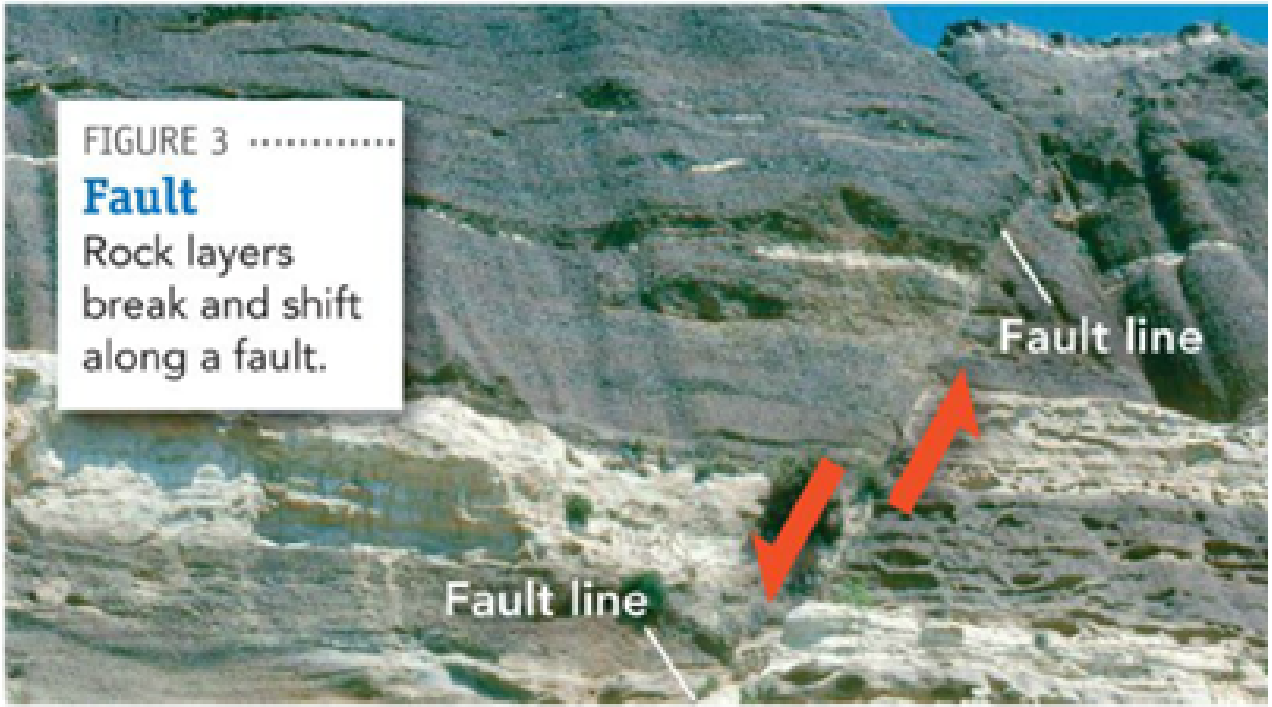


FIGURE 3

Fault

Rock layers break and shift along a fault.

Extrusions - lava that hardens on the surface of the Earth

Intrusions- magma cools in a mass of igneous rock below the Earth's surface -

extrusions and intrusions are always younger than the rock around them

Fault is a break in the Earth's crust - a fault is always younger than the rock layer it cuts through

How Do Fossils Show Age?

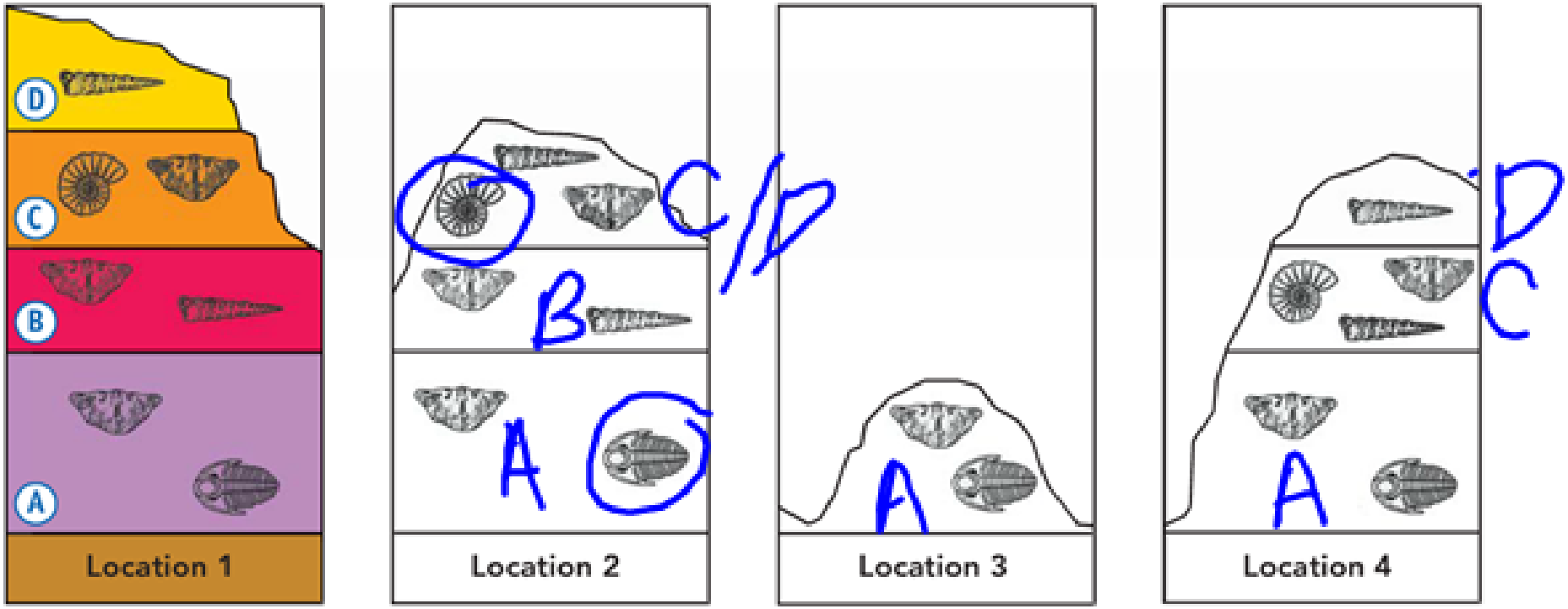
To date rock layers, geologists first find the relative age of a layer of rock at one location. Then they can match layers in other locations to that layer.

Certain fossils, called index fossils, help geologists match rock layers. To be useful as an index fossil, a fossil must be widely distributed and represent an organism that existed for a geologically short period of time. **Index fossils are useful because they tell the relative ages of the rock layers in which they occur.** Scientists infer that layers with matching index fossils are the same age.

You can use index fossils to match rock layers. Look at **Figure 4,** which shows rock layers from four different locations. Notice that two of the fossils are found in only one of these rock layers. These are the index fossils.

Scientists use index fossils to match rock layers.

Interpret Diagrams Label the layers to match the first area shown. Circle the fossil or fossils that you can use as index fossils. What can you infer about the history of Location 4?



zone Through Core Samples.

Assess Your Understanding

1a. Explain In an area with several different rock layers, which is oldest? Explain.

b. Infer How could a geologist match the rock layers in one area to rock layers found in another area?

got it?

○ **I get it!** Now I know that you can find the relative age of rocks by

Index Fossils- help geologists match rock layers

-to be an index fossil - the fossils must be widely distributed and the organism must have lived for a geologically short period of time

-scientists can infer that rock with the same index fossils are the same age

Unconformity - gap in the geologic record

How Can Rock Layers Change?

The geologic record of sedimentary rock layers is not complete. In fact, most of Earth's geologic record has been lost to erosion.

Gaps in the geologic record and folding can change the position in which rock layers appear. Motion along faults can also change how rock layers line up. These changes make it harder for scientists to reconstruct Earth's history. **Figure 5** shows how the order of rock layers may change.

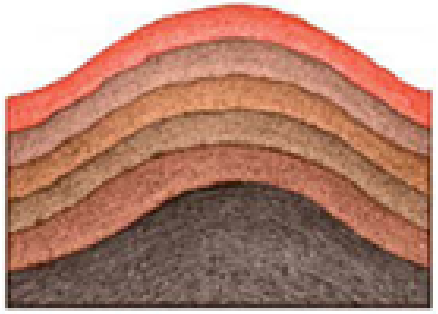
Gaps in the Geologic Record

When rock layers erode away, an older rock surface may be exposed. Then deposition begins again, building new rock layers. The surface where new rock layers meet a much older rock surface beneath them is called an unconformity. An unconformity is a gap in the geologic record. It shows where rock layers have been lost due to erosion.

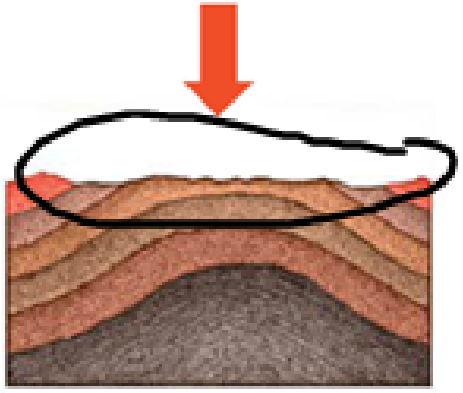
oldest and youngest layers in the last two diagrams. Label the unconformity. Circle the part of the fold that is overturned.

Sedimentary rocks form in horizontal layers.

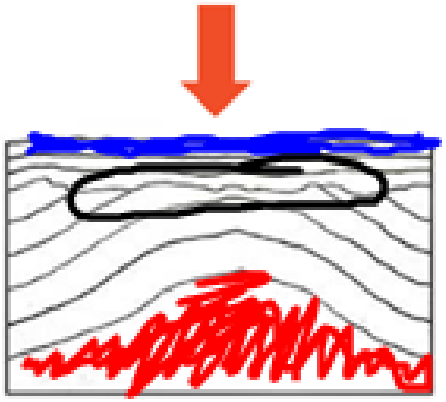
Unconformity



Folding bends the rock layer.

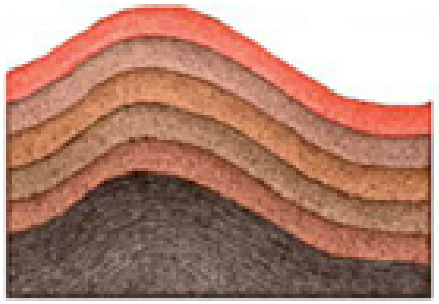


The surface is eroded.

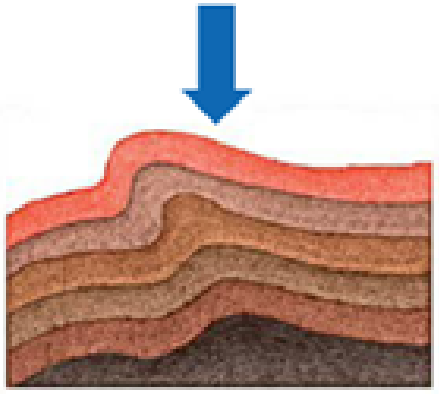


New sediment is deposited, forming rock layers above the unconformity.

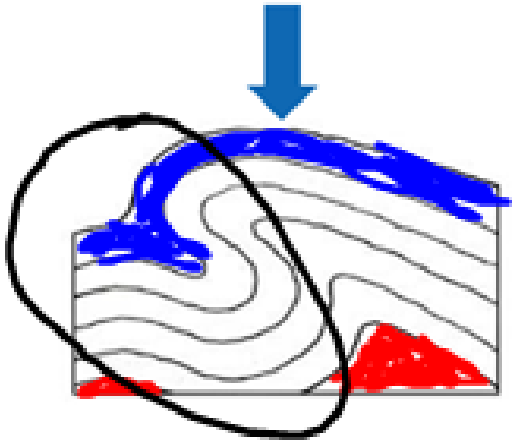
Overturned Fold



Folding bends the rock layer.



Folding continues, further bending the rock layer.



Over time, the layers may fold completely over. This is called an overturned fold.

Folding Sometimes, forces inside Earth fold rock layers so much that the layers are turned over completely. In this case, the youngest rock layers may be on the bottom!

No one place holds a complete geologic record. Geologists compare rock layers in many places to piece together as complete a sequence as possible.

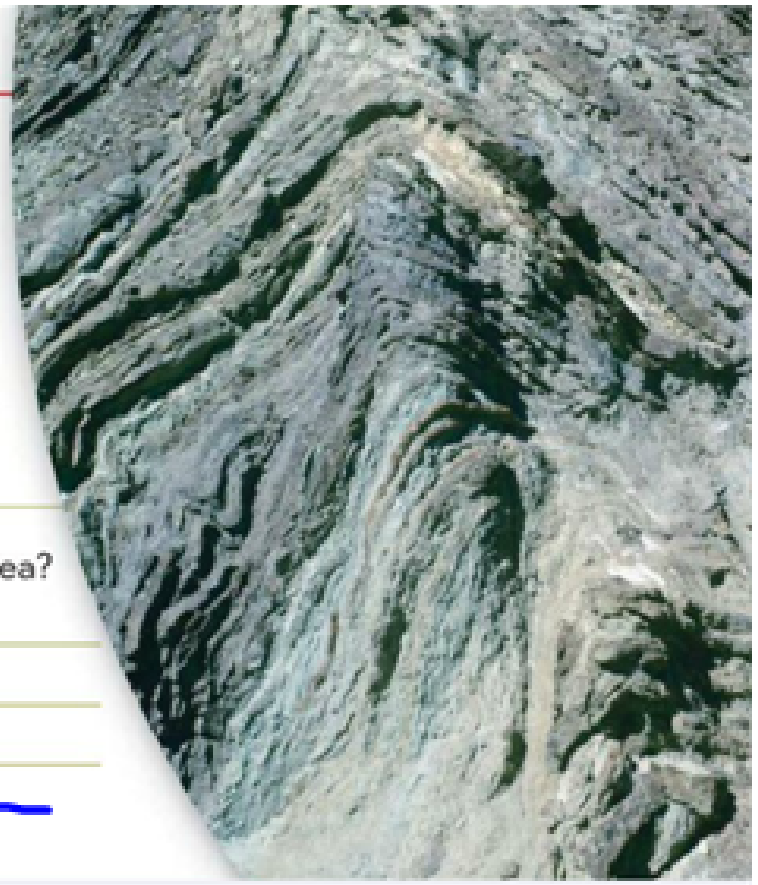
apply it!

Study the photo. Then answer the questions.

1. What does the photo show? (an unconformity/folding)

2. What evidence do you see for your answer to Question 1? layers are folded

3. CHALLENGE What can you infer about the history of this area? unstable area, earthquakes



zone

Assess Your Understanding

2a. List Name two ways rock layers can change.

b. Explain How does folding change rock layers?

c. Draw Conclusions Two locations include a layer of rock with a particular index fossil. In one location, the layer occurs in a higher position than in the other. What can you conclude about the history of the two areas?

got it?

○ I get it! Now I know that rock layers can change due to _____

Gaps and folding can change the position in which rock layers appear

ex. a rock layer can erode - then deposition occurs forming a new rock layer

Folding - forces in the Earth can fold rock layers
-layers can be turned over completely making youngest layers on the bottom

Geologists compare layers in many places to piece together as complete a sequence as possible (because of erosion most of the geologic record of sedimentary rock has been lost)