

18B Relative Dating

How does relative dating tell a story?

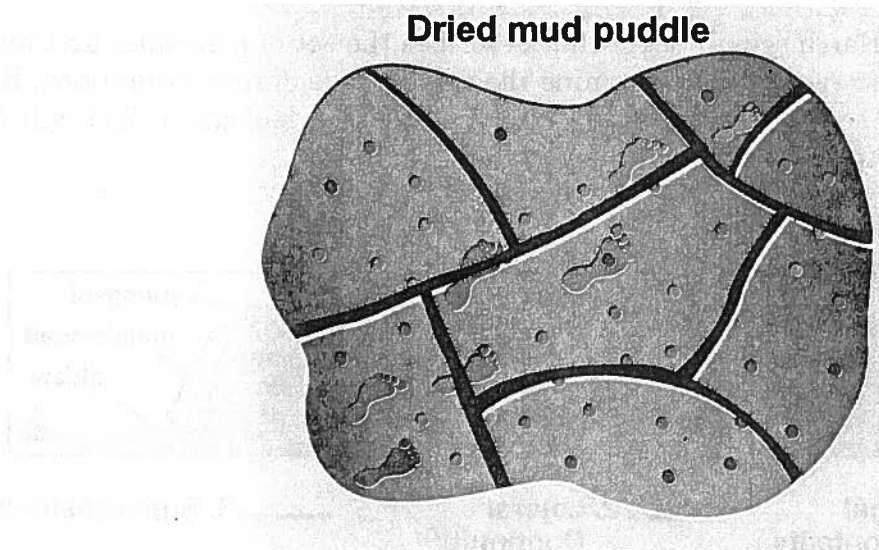
Earth is very old and many of its features were formed before people came along to study them. For that reason, studying Earth now is like detective work—using clues to uncover fascinating stories. The work of Earth science researchers is very much like the work of forensic scientists at a crime scene. In both fields, the ability to put events in their proper order is the key to unraveling the hidden story.

Materials

- None required

1 Sequencing events after a thunderstorm

Carefully examine this illustration. It contains evidence of following events:

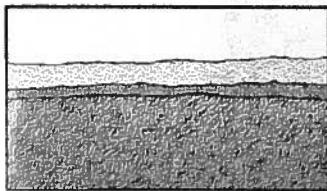


- The baking heat of the sun caused cracks to form in the dried mud puddle.
 - A thunderstorm began.
 - The mud puddle dried.
 - A child ran through the mud puddle.
 - Hailstones fell during the thunderstorm.
- a. From the clues in the illustration, sequence the events listed above in the order in which they happened.

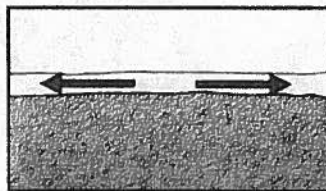
- b. Write a brief story that explains the appearance of the dried mud puddle and includes all the events. In your story, justify the order of the events.

2 Determining the relative ages of rock formations

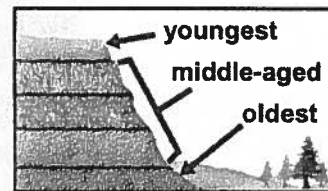
Relative dating is an Earth science term that describes the set of principles and techniques used to sequence geologic events and determine the relative age of rock formations. Below are graphics that illustrate some of these basic principles used by geologists. You will find that these concepts are easy to understand.



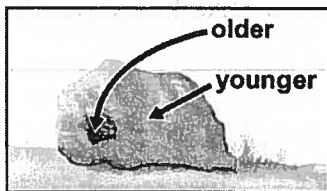
1. Original Horizontality



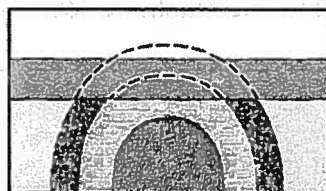
2. Lateral Continuity



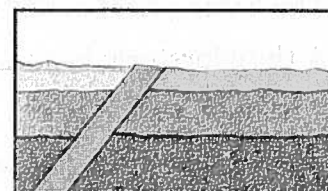
3. Superposition



4. Inclusions



5. Unconformities



6. Cross-Cutting Relationships

Match each principle to its explanation. Write the letter of the explanation in the space provided under each graphic.

Explanations:

- A. In undisturbed rock layers, the oldest layer is at the bottom and the youngest layer is at the top.
- B. In some rock formations, layers or parts of layers may be missing. This is often due to **erosion**. Erosion by water or wind removes sediment from exposed surfaces. Erosion often leaves a new flat surface with some of the original material missing.
- C. Sediments are originally deposited in horizontal layers.
- D. Any feature that cuts across rock layers is younger than the layers.
- E. Sedimentary layers or lava flows extend sideways in all directions until they thin out or reach a barrier.
- F. Any part of a previous rock layer, like a piece of stone, is older than the layer containing it.

3 Sequencing events in a geologic cross-section

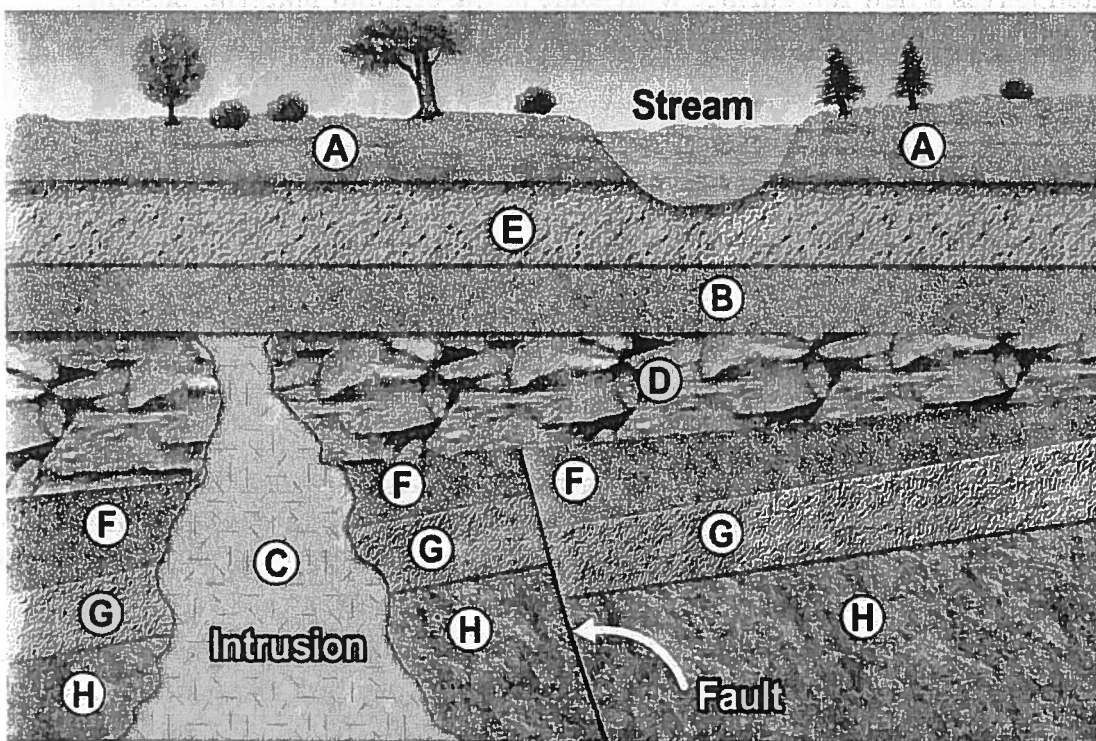
Understanding how a land formation was created with its many layers of soil begins with the same time-ordering process you used in Part 1. Geologists use logical thinking and geology principles like the ones described in Part 2 to determine the order of events for a geologic formation. Cross-sections of Earth, like the one shown below, are our best records of what has happened in the past.

Rock bodies in this cross-section are labeled A through H. One of these rock bodies is an **intrusion**. Intrusions occur when molten rock called **magma** penetrates into layers from below. The magma is always younger than the layers that it penetrates. Likewise, a fault is always younger than the layers that have faulted. A **fault** is a crack or break occurs across rock layers, and the term **faulting** is used to describe the occurrence of a fault. The broken layers may move so that one side of the fault is higher than the other. Faulted layers may also tilt.

- a. Put the rock bodies illustrated below in order based on when they formed.

- b. Relative to the other rock bodies, when did the fault occur?

- c. Compared with the formation of the rock bodies, when did the stream form? Justify your answer.



4 How do they know what is down there?

The cross section diagram from part 3 shows various geologic features present underground very clearly. But how do geologists know what is down there? To get a clear understanding of what is underground geologists extract core samples from the ground.

A core sample is a solid cylinder of the material that makes up the ground itself. Geologists obtain a core sample by drilling down into the ground with a large, hollow drill bit. The exposed layers in the core sample can be examined, identified, and labeled, showing geologists what is underground. By taking many core samples over a large area, geologists can get a fragmented “picture” of what is beneath the ground. The geologists fill in the missing spaces using principles of Relative Dating. Give it a try for yourself. Below are 15 core samples from

an area (these are oversized; actual core samples would be much thinner). They are labeled A–O. Use the diagram to answer questions a–d below.



- a. Do you see evidence of a fault in your core samples? Describe the evidence of any fault you see and list the letters of the core samples that you think show the fault.

- b. Do you see evidence of an intrusion in your core samples? Describe the evidence of any intrusion you see and list the letters of the core samples that you think show the intrusion.

c. Do your core samples reveal any evidence for a stream to have existed at one time? If so, describe how you can tell and where it may have been.

d. Which happened first, the fault or the stream? How can you tell?

e. Place the stream, fault, and intrusion in chronological order.
