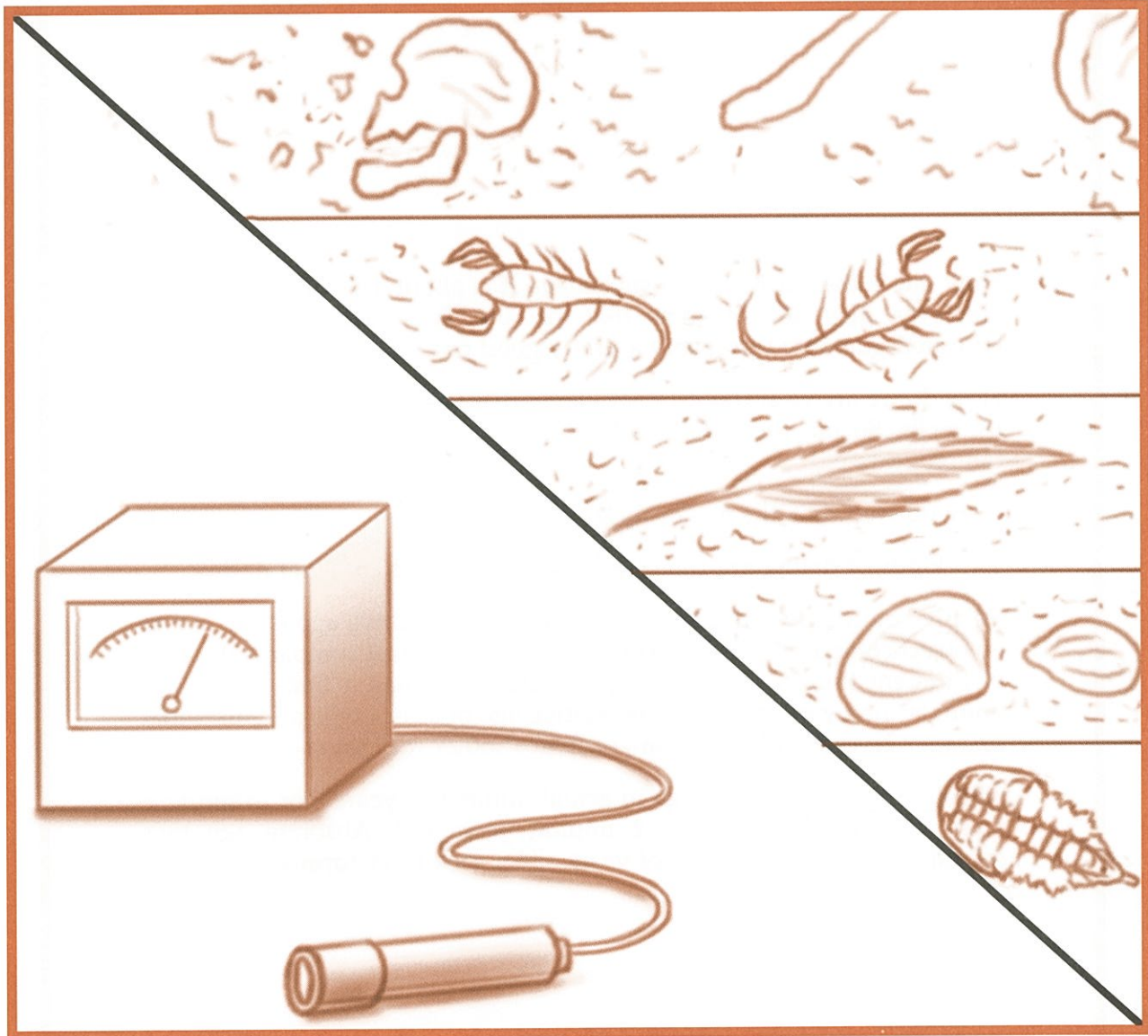


What is relative age? What is absolute age?



KEY TERMS

relative age: age of an object compared to the age of another object

absolute age: specific age of a rock or fossil

fossil: remain, or trace, of a living thing that lived long ago

LESSON

30

What is relative age? What is absolute age?

How old is the earth? Scientists believe it is about $4\frac{1}{2}$ billion years old. However, they do not know that for sure. It is just an estimate, an educated guess, but probably a pretty good one.

How do we arrive at this number? The earth's age is estimated by dating its rocks. So far, the oldest rocks that have been found are about $4\frac{1}{2}$ billion years old.

How do we know the age of rocks?

Two kinds of dating are used—**relative dating** and **absolute dating**.

Relative dating does not give us an exact age. Relative age is the age of an object compared to the age of another object. It just compares the ages of different things. For example, you are older than a first-grader, but younger than your parents. The relative age of a rock tells scientists that one rock layer is older or younger than another rock layer.

Absolute dating gives an age in actual number of years. For example: 3 years old, 1,000 years old, 2 million years old. Absolute age tells scientists the actual number of years ago a rock layer formed.

UNDERSTANDING RELATIVE AGE

To determine the relative age of rocks, scientists use a simple law of science. It says that younger rocks are found on top of older rocks.

Figure A below shows six rock layers. Study the layers. Then answer the questions below the diagram.

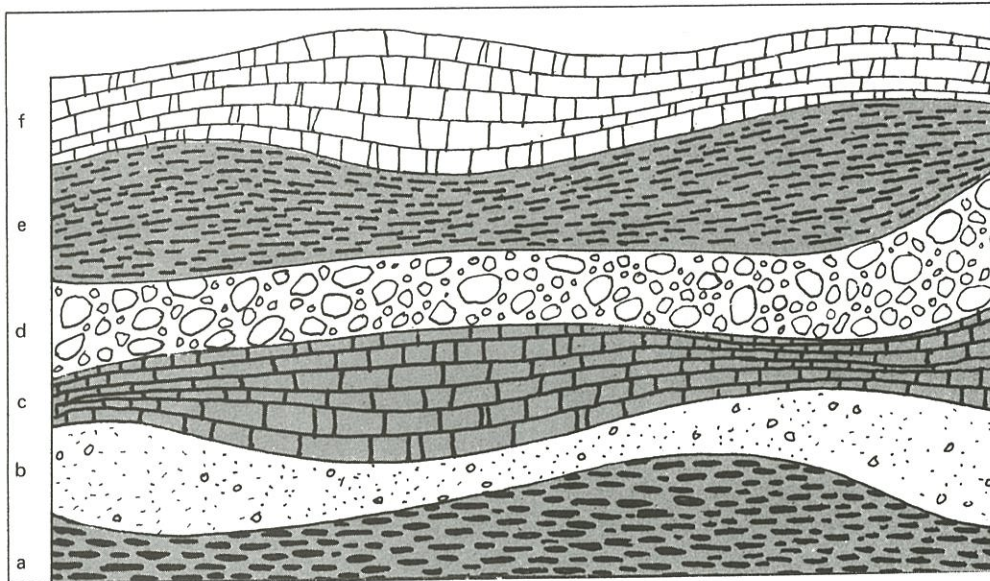


Figure A

1. Which is the oldest rock layer? _____
2. Which is the youngest rock layer? _____
3. Which layer was laid down last? _____
4. Which layer was laid down first? _____
5. Name the layers in order in which they were laid down. _____
6. Name the layers that are younger than layer d. _____
7. Name the layers that are older than layer d. _____
8. This method of dating rocks and fossils is _____ .
absolute dating, relative dating
9. Relative age _____ tell age in precise "number of years."
does, does not
10. What kind of rock is shown in the figure? _____

MORE ABOUT RELATIVE AGE

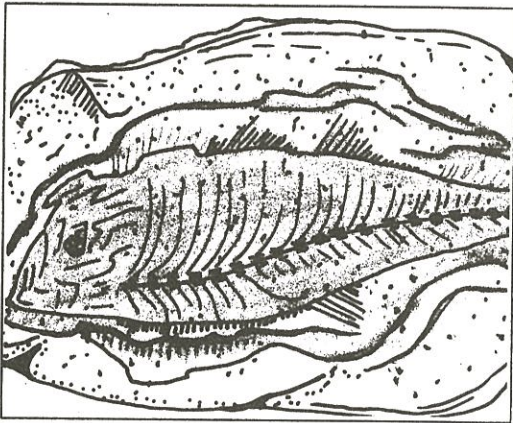


Figure B *Fossils*

Scientists also use **fossils** to help find the relative age of rock layers. Fossils are the remains, or traces, of living things that lived long ago. A fossil can be a bone, a footprint, a shell, or even the whole body of an organism that no longer lives on the earth.

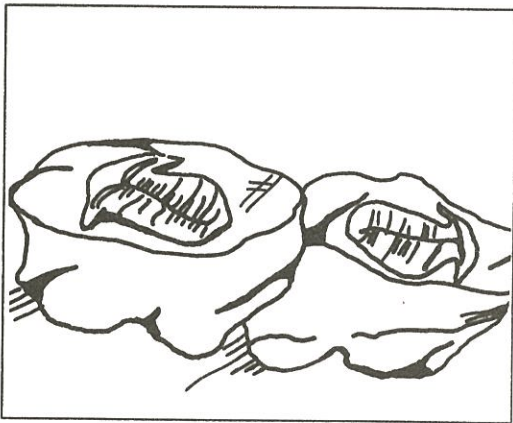


Figure C

Most fossils are found in sedimentary rock layers. Certain fossils can be used to help find the relative age of rock layers. These fossils are called index fossils. To be an index fossil, an organism must have lived only during a short part of the earth's history. Many fossils of the organisms have to be found in rock layers. The fossils must be found over a wide area of the earth.

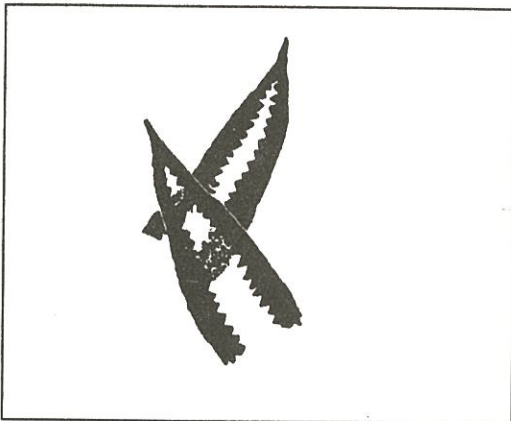


Figure D *Graptolite* (ancient plant)

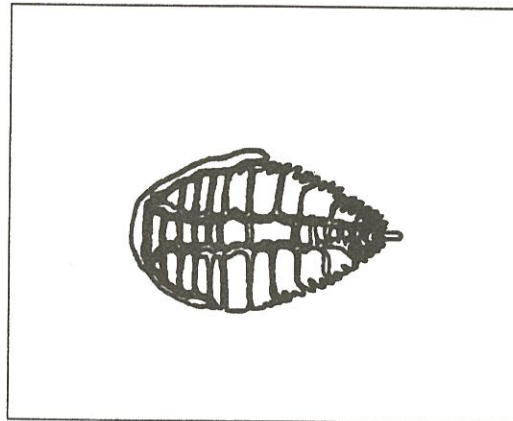


Figure E *Trilobite* (ancient animal)

Graptolites [GRAP-tuh-lites] and trilobites [TRY-luh-bites] are two index fossils. These two organisms lived in the oceans. Graptolites lived 350–450 million years ago. Trilobites lived 500–600 million years ago. If scientists find a rock layer with trilobite fossils in it, they know that the rock layer is older than any layer with graptolite fossils.

Study the rock layers and fossils in Figure F. Then answer the questions below the diagram.

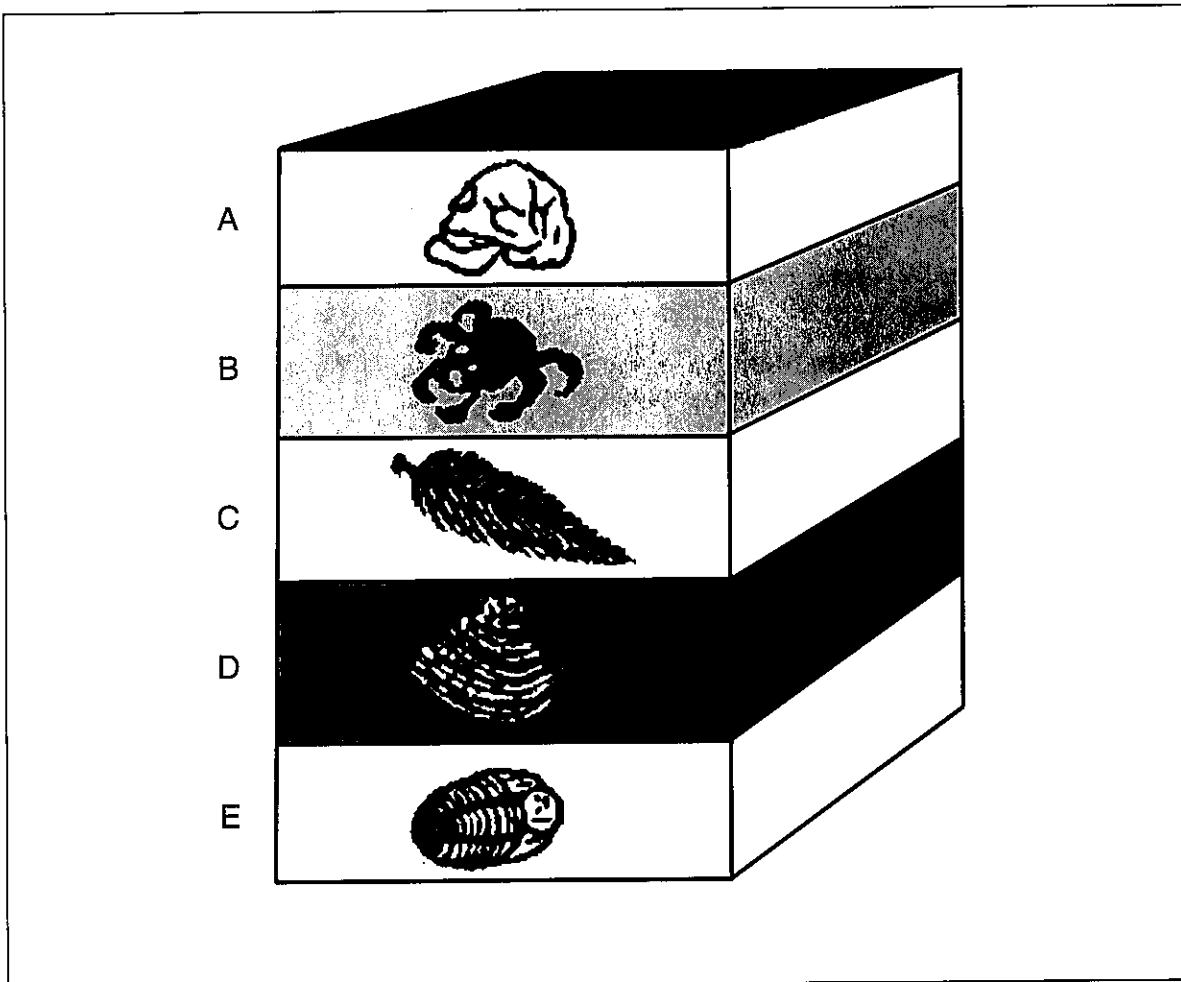


Figure F

1. Which rock layer is about 500–600 million years old? _____
2. How do you know? _____

3. Which rock layer is about 350–450 million years old? _____
4. How do you know? _____

5. What is an index fossil? _____

UNDERSTANDING ABSOLUTE AGE

There are several ways to find the absolute age of rocks and fossils. The most accurate way is the radioactive method.

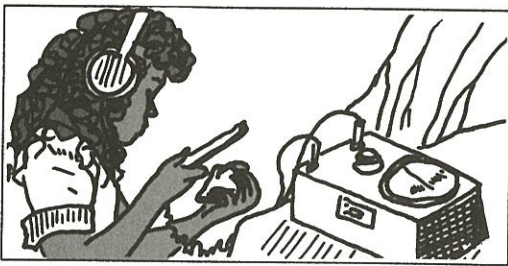
This is how radioactive dating works:

- Certain elements are radioactive. Radioactive elements give off particles and energy as they decay. As they do this, new elements form.
- Scientists know how long it takes for radioactive elements to wear down. So, they are like natural clocks.
- Radioactive elements are found in many rocks and fossils. We can find their ages by measuring how much these elements have worn down.

Most absolute dating is done by measuring the amount of radioactive carbon 14 or uranium 238 left in a rock or fossil.

Carbon 14 dates fossils of plants and animals that lived less than 50,000 years ago.

Uranium 238 dates rocks older than 50,000 years old.



This instrument is called a *Geiger* [GY-gur] *counter*. It measures radioactivity.

Figure G

Answer these questions about absolute dating.

1. Radioactive dating gives the _____ of a rock.
relative age, absolute age
2. Radioactive dating _____ tell age in number of years.
does, does not
3. Name two radioactive elements. _____
4. Which radioactive element is used to date rocks? _____
5. Which radioactive element is used to date fossils? _____
6. Which radioactive element would you use to date the bones of an animal that lived less than 50,000 years ago? _____
7. Which radioactive element would you use to date a rock millions of years old?

8. Name an instrument that measures radioactivity. _____

FILL IN THE BLANK

Complete each statement using a term or terms from the list below. Write your answers in the spaces provided. Some words may be used more than once.

older
radioactive
does not
index

trilobites
relative
younger

compares
graptolites
absolute

1. The two methods of dating rocks and fossils are called _____ dating and _____ dating.
2. Relative dating _____ tell actual age.
3. Relative dating _____ the ages of different rocks.
4. Two words used in relative dating are _____ and _____.
5. Absolute dating gives _____ age.
6. Fossils used to help date rocks are called _____ fossils.
7. Absolute dating uses _____ elements.
8. Two index fossils are _____ and _____.
9. Top rock layers are _____ than layers below them.
10. Bottom rock layers are _____ than layers above them.

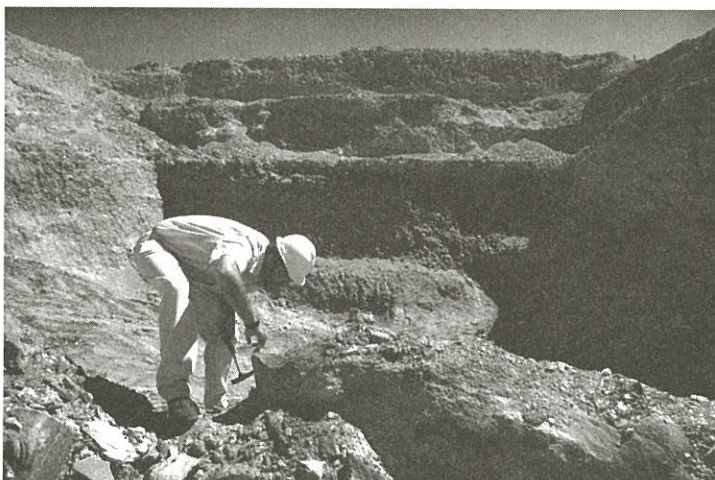
MATCHING

Match each term in Column A with its description in Column B. Write the correct letter in the space provided.

	Column A	Column B
_____	1. relative dating	a) gives age in "number of years"
_____	2. absolute dating	b) dates dead plants and animals that lived less than 50,000 years ago
_____	3. uranium 238	c) measures radioactivity
_____	4. carbon 14	d) age is described as "younger or older than"
_____	5. Geiger counter	e) dates rocks older than 50,000 years old

SCIENCE **EXTRA**

Geologist



Geologists are earth scientists. They travel all over the world to find the natural resources we depend upon. We use these resources to make our daily lives safer and more comfortable.

Geologists help find oil and coal that are used as fuels. They also help find metals such as copper. Copper may be used to make electrical wires.

Some geologists look for iron. Iron is used to make steel for our cars. Other geologists look for gold and silver. These metals are used to make jewelry.

Geologists study the structure of the earth. It is important to make sure that, in addition to buildings, dams and bridges can be safely built.

Some geologists study the environment. They look for methods to predict earthquakes. Others study hot volcanoes. They are trying to understand one of nature's most amazing events. Still others study the frozen ice of glaciers and ice sheets.

Paleontologists are geologists too. They study fossils. They want to

learn about the history of the Earth. Some of these scientists study bones of dinosaurs that lived millions of years ago.

Men and women who are geologists often work "in the field." They collect rock and mineral samples. These collections are taken into laboratories for further study.

Many geologists work for the government. Others work for museums. Some work for environmental engineering firms.

Each day we are using up our reserves of natural resources. As a result, there is a need for people to help find new sources of mineral wealth.

We also need people to help protect the environment. Earth scientists work to ensure that we have clean air and clean water.

Want to know more about geology or being a geologist? You can email questions to Ask-A-Geologist@usgs.gov. They will answer your questions.