

Reading 5.2 – Environmental Change

Think about the area where you live. You may see changes in the landscape in that area over a year. Some of those changes are weather related. Others are due to how the living things interact, grow, hibernate, and reproduce. Some changes are man made, such as when new construction alters the landscape. Thousands of years ago, before people settled where you live, the area may have looked much different. And if you can imagine what this area might have looked like millions of years ago, you might picture even greater differences.

Question #1: What are some ways that you think the climate may have changed in the area where you live over the past million years?

Question #2: What are some things you think may have caused those changes?

Climate Changes

To learn about events like droughts, floods, or periods of bitter cold that occurred over the past thousand years, scientists sometimes study the journals people have written. But for learning about events millions of years ago, no written records exist.

Scientists, however, have been able to find other sources of evidence to give them clues about what the Earth's climate was like in the distant past. To understand how climate has changed in the distant past, scientist use multiple sources of physical and biological data.

Question #3: What could be a useful source of physical or biological data that would help scientists determine what the Earth's climate was like before there were scientific instruments and regular record keeping?

Here are some sources of evidence that scientists have used to discover patterns of change in the climate of Earth.

Source of evidence	Data that can be collected
Glacial Ice Deposits	Measuring gas bubbles trapped in glacial ice can provide evidence of the state of the atmosphere when the gas was trapped.
Deposition in caves	Measuring the layers of deposition in stalactite and stalagmites in caves,
Biotic Marine Sediments	Measuring they amount and type of fossilized marine plants and animals.
Abiotic Marine Sediments	Measuring the amount and type of clay and dust deposited in the bottom of lakes and oceans.
Fossilized Tree Rings	Measuring the size of annual tree rings

Through these sources of data, scientists have discovered that during most of Earth's history, global temperatures were probably 8 to 15 °C. warmer than they are today. And they also discovered that there were times when Earth's global temperatures became very cold -- cold enough to form glaciers that extended from the poles to very close to the equator.

In the last billion years, ice ages (periods of extensive glaciation) have occurred on and off with some regularity. The last major glacial period ended about 14,000 years ago, when large sheets of ice that covered much of North America, Europe and Asia began melting. At present, glacial ice covers only 10% of Earth's land surface, but at the height of the last ice age it was 30%.

In addition to these climate changes, Earth's geology has also changed over the past million years.

Geological Changes

Question #3: What are some ways that you think the geology may have changed in the area where you live over the past million years?

Question #4: What are some things you think may have caused those changes?

Some parts of the Earth show evidence of erosion from water, leading to creation of deeper and deeper canyons over thousands or millions of years.



Image credit
http://en.wikipedia.org/wiki/File:Grand_Canyon_view_from_Pima_Point_2010.jpg



Image credit
<http://en.wikipedia.org/wiki/File:French-canyon.jpg>

The Grand Canyon in the southwestern United States formed from water erosion over millions of years French canyon in Starved Rock State Park, Illinois formed from water erosion over thousands of years.

Other parts of the Earth show evidence of wind erosion over millions of years. And other parts of the Earth show evidence of erosion from glaciers.

In addition to erosion, the geology of the Earth also changes when new mountains are created and land is lifted upward.

Question #5: Why do you think mountains tend to form in some parts of the world more than others?

Two of major processes that cause new land to form are volcanoes and uplift. Both of these processes are driven by heat and pressure from the mantle of the Earth. Heated liquid rock from the inside of the Earth, rises to toward the crust. When the liquid rock pushes through the crust, lava comes out. This occurs when volcanoes erupt and it happens in the deep sea.

Most of the locations where these phenomena occur are where there are major cracks in the Earth crust. These cracks can be found at the edge of tectonic plate boundaries. Tectonic plates are thick slabs of solid, cooled crust. This diagram shows the major tectonic plates and the edges between them.

Over time, these plates are pushed into each other, over each other, and other each other. This leads to the formation of mountains at the edge of these plates.

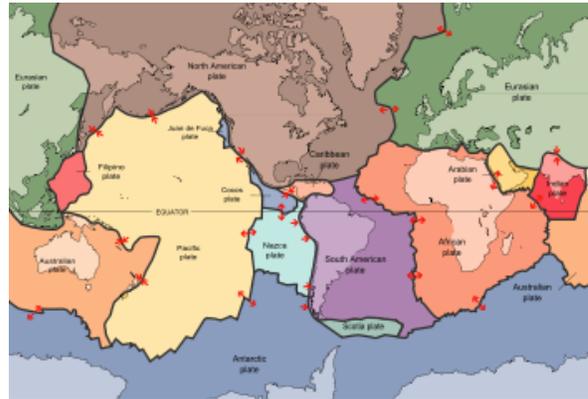


image credit: http://en.wikipedia.org/wiki/File:Plates_tect2_en.svg

It also leads to the gradual movement of the continents over thousands of years.

Over millions of years, the continents move a considerable distance. Scientists have determined that about 200 million years ago, oceans did not separate the current continents. Instead, they were joined into one super continent, called Pangaea. A representation of that joined continent is shown on the right. Notice how the America's were pushed up against Africa.



image credit: http://en.wikipedia.org/wiki/File:Pangaea_continents.svg

Erosion, mountain formation, and continental movement aren't the only geological changes that occur, but they are some of the most dramatic. Deposition of eroded material, for example is another major geological change. Over time it can lead the gradual "filling in" of lakes and rivers.

Deposition of eroded material buries the organisms (or the dead bodies or organisms) that live in the water. Deposition of mud, ash, dust, and sand can also gradually cover areas on land. This deposition process traps organic materials. This trapping helps form fossils of organisms that lived long ago.

Since younger rocks tend to be found in rock layers closer to the surface of the Earth and older rocks tend to be found in rock layers deeper beneath the earth, scientists can determine whether fossils of a particular organism can be found in older or younger rocks.

Biological Changes

Question #6: If you examined fossils from rocks all around the world, what do you think the fossils in rocks from millions of years ago would show you?

- a) All of the types of organisms that lived long ago can still be found alive today.
- b) Some of the types of organisms that lived long ago can no longer be found alive today.
- c) None of the types of organisms that lived long ago can be found alive today.

Question #7: What else do you think these fossils would show you?

- a) All of the types of organisms alive today also lived long ago.
- b) Some of the types of organisms that are alive today also lived long ago.
- c) None of the types organisms that are alive today also lived long ago.

Scientists have found rocks with fossils in them that are almost 3.5 billion years old. The only fossils found in these rocks are of single celled bacteria. They have also found fossils that are only a few thousands of years old. From these fossils and all the fossils from times in between, they have formed a good picture of the types of organisms that lived on Earth at different times.

While you may not be surprised to learn that some types of organisms that lived long ago are now extinct, you might be surprised to learn that many types of organism that live today were not alive long ago.

For example, billions of years ago there were no horses on Earth and never had been before that, but there were other animals alive at that time. There was also a different time in the past when there were no birds on Earth and never had been before that, but there were other cold-blooded egg laying organisms. There was also a different time in the past when there were no flowering plants on Earth and never had been before that, but there were other types of plants. The same is true for flowing fish, bugs, coral, and humans.

In class and in this reading you have thought about some of the types changes that have occurred in Earth past. You have considered both abiotic and biotic changes. The driving question for the unit you are studying is “How Do Populations Change?”

Question #8: What new ideas or new questions do you now have that you may want to add to the driving question board when you return to class?
