17. Geologic Time I

Geologic Time

Sedimentary rocks consist of layer upon layer of sedimentary material that we call beds, or strata. Each bed was deposited by some sort of sedimentary process at the Earth’s surface.

What is the approximate length of time of the history of human civilization? ________________________

What thickness of sediments could have gotten deposited in this amount of time? ________________________

Based on these sedimentation rates, how long did it take surface geologic processes to make all the layers of rock in the Grand Canyon? ________________________

The Grand Canyon is just a miniscule portion of all the rocks that have formed in the Earth's crust. A far greater amount of time was needed to make the rest of the rocks in the Earth. How much time? (i.e., how old is Earth?) ________________________

What are the two ways in geology that we describe geologic time?

1. ________________________ - refers to exactly how old a rock is in millions of years

2. ________________________ - do not need to know the actual age of the rocks, but are instead interested in the relative order of geologic events

Relative Age

Relative age refers to the order in which geologic layers formed, and their ages relative to each other, or in other words, the ________________________.

What is the geologic discipline that is specifically concerned with relative ages of sedimentary strata? ________________________

With relative age, we don't worry about exactly when in Earth's history geologic events happened. It could have been 2 million years ago or 200 million years ago. All we are concerned with is the age of each feature relative to another one.

The relative ages or order of the layers is called the ________________________.

Stratigraphy

The three principles we use in stratigraphy are:

- principle of ________________________
- principle of ________________________
- principle of ________________________
Each of these is used to determine the order in which strata were deposited at some point in Earth’s geologic past.

**Principle of Original Horizontality**

**Definition:** Sedimentary beds are initially ____________________________.

Original horizontality occurs because the deposition of sediment is always controlled by the effects of ____________________________.

The horizontal nature of the layers may be preserved for a long time through geologic history.

Location example of horizontal layers: ____________________________.

BUT, if you see layers that are not horizontal (they may be bent or tilted), what does this tell you about what must have happened to the rocks?

_______________________________

**Principle of Stratigraphic Superposition**

Definition: _____________________________________________________________

The word superposition is derived from *super* (above) and *positum* (to place). With stratigraphic superposition, all we know is the relative ages, not the actual ages.

**Principle of Cross-Cutting Relationships**

Definition: Any undeformed horizontal layer must be ____________________________

So if a bed has an igneous intrusion going through it, which is older?

the bed OR the igneous intrusion?

If a bed has a fault cutting through it, which is older?

the bed OR the fault?

**Unconformities**

There may be long periods of geologic time when no sediment gets deposited on top of the existing sediment for some reason (i.e. a break in deposition). Or maybe sediment got deposited and then got eroded away again before the next layer got deposited.
What do we call rock layers that are deposited one on top of another with no major time break between each one being deposited?

- we say that the two beds are ________________________.

Such beds are typically separated by a ________________________.

If a boundary between two rock layers represents a major time break (so there is a gap in the geologic record), we call it an _________________.

This effect is very common in geology, which is why some parts of Earth's history are missing in the rock record in some places, but are present in other places. Some places may have a gap in the record, and others may not.

Is a bedding plane an unconformity? YES or NO

What are the three types of unconformities?

<table>
<thead>
<tr>
<th>TYPE</th>
<th>DEFINITION</th>
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<tbody>
<tr>
<td>1. ____________</td>
<td>- beds are parallel (often horizontal) above and below</td>
</tr>
<tr>
<td>2. ____________</td>
<td>- beds have different inclinations above and below</td>
</tr>
<tr>
<td>3. ____________</td>
<td>- rocks underneath the beds are igneous or metamorphic</td>
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When igneous rocks intrude into country rocks that were already there, the boundary between the two is not an unconformity. Instead, the boundary is called an: __________________________________________

Matching up Rock Layers Between Different Locations

Sedimentary beds often cover great distances or areas. We often try to match up beds in one location with corresponding beds in another location that formed at the same point in geologic time.

Matching beds from one location to another is called _________________.

Over very great distances, it may become difficult to accurately match beds, so we have to rely on evidence such as fossils that are common to the rocks in the two regions of rocks that are being correlated.

Use of Fossils for Correlation

Fossils are the remains of living organisms (plant and animal) that are preserved in rocks. The study of fossils is called _________________.

Most fossils represent plants and animals that no longer exist on Earth today. They are extinct. In fact, most species only existed on Earth for a relatively short period of geologic time. So if you see a rock with a certain type of fossil in it, you can narrow down the period of time in which the rock was deposited.
If a single bed contains a whole bunch of fossils, they represent a number of species that all existed together during the point in geologic time when the bed got deposited. This combination of fossils is called a _________________.

If we correlate rocks in different locations based on their identical fossil assemblages, we are using a technique called __________________.

What do we call the order of fossil assemblages throughout the rock record? _________________________

The fossil assemblage present in any particular sedimentary rock can tell us when in geologic time those rocks formed, by telling us where the rocks belong in the overall stratigraphy, which is the order of all rock layers everywhere.

Some fossils may appear in fossil assemblages in many rock layers, and some may only be found in a small portion of the rock record- maybe a single bed. It all depends on how long the species were around before going extinct.

Fossils of species that only existed for short periods of geologic time are called _________________ and are good indicators of actual ages of rocks that contain them.

We can find similar faunal successions all over the world. The faunal successions are simply showing us how life on Earth evolved through time in a consistent manner all over the world. So we can sometimes correlate rocks with similar ages all over the world based on the combinations of fossils present inside them.

**The Geologic Time Scale**

In geology, we try to get our minds around the vastness of geologic time by dividing it up into smaller segments of time, each with its own name.

That way, we can talk about small portions of geologic time by name, and know exactly what part of geologic time we’re talking about.

**FINAL QUESTION:**

The time scale that we use in geology is referred to as the: _________________________