Two Ways to Date Geologic Events

1. Relative Dating [eg. Unconformities, structures (Faults, folds)]
2. Absolute Dating [eg. Isotopic Dating (carbon 14 dating), Tree Rings]

Amount of Time Required for Some Geologic Processes and Events
Figure 9.1
**Principle of Superposition** - In an undeformed sequence of stratified rocks (sedimentary and volcanic), the oldest rocks are at the bottom and the youngest are at the top.

**Principle of Original Horizontality** - Stratified rocks are assumed to have been originally deposited horizontal. Any deviation from horizontality would then be the result of post-depositional deformation.

**Principle of Lateral Continuity** – Layered rocks are deposited continuous contact.

**Principle of Cross-cutting relationships** - A fault, intrusion, or erosional surface is younger than any feature it cuts.

**Unconformity** - An unconformity is a “buried surface of erosion”. It records a period of missing time within the geologic record.

**Three Types of Unconformities** –

**Disconformities** – An unconformity where the beds below the erosional surface are parallel to the beds above the erosional surface.

**Angular Unconformities** – An unconformity where the beds below the erosional surface are at an angle to the beds above the erosional surface.

**Nonconformities** - An unconformity where the buried erosional surface is developed on exposed plutonic or metamorphic rocks.
Reconstructing Geologic Events

What was the last event To occur?

Is Dike B and its associated sill older or younger than Dike A?
Geologic Time Scale

• Divisions in the worldwide stratigraphic column based on variations in preserved fossils

• Built using a combination of stratigraphic relationships, cross-cutting relationships, and absolute (isotopic) ages

It divides the Earth’s 4.6 Ga history into different units and provides a meaningful time frame within which the events of the geologic past are arranged.
Paleontology - The study of life in the past based on fossilized plants and animals.
Fossil: Evidence of past life
Fossils preserved in sedimentary rocks are used to determine:
1) Relative age
2) Environment of deposition

Absolute Dating (Geochronology)

- Add numbers to the stratigraphic column based on fossils.
- Based on the regular radioactive decay of some chemical elements.

Radioactivity – the emission of energy from an atom due to the spontaneous decay of its nucleus
Half-Life – The time required for one-half of the unstable parent isotope to decay to its stable daughter isotope.
Isotopic Dating

- Radioactive elements (parents) decay to nonradioactive (stable) elements (daughters).
- The rate at which this decay occurs is constant and knowable.
- Therefore, if we know the rate of decay and the amount present of parent and daughter, we can calculate how long this reaction has been proceeding.

<table>
<thead>
<tr>
<th>Isotopes Frequently Used in Radiometric Dating</th>
<th>Table 8.1 (T&amp;L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radioactive Parent</td>
<td>Stable Daughter Product</td>
</tr>
<tr>
<td>Uranium -238</td>
<td>Lead -206</td>
</tr>
<tr>
<td>Uranium -235</td>
<td>Lead -207</td>
</tr>
<tr>
<td>Thorium -232</td>
<td>Lead -208</td>
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<tr>
<td>Rubidium -87</td>
<td>Strontium -87</td>
</tr>
<tr>
<td>Potassium -40</td>
<td>Argon -40</td>
</tr>
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