



Relative Dating and Stratigraphic Principles

Relative dating is determining the order of events rather than exactly when they happened. The names and order of time periods on our geological timescale (Figure 1) were determined through relative dating.

The basic rules used to the order of rock layers are known as **stratigraphic principles**. These are:

- *Original horizontality* – sedimentary rocks are laid down horizontally
- *Superposition* – younger sedimentary rocks are deposited on top of older rocks
- *Uniformitarianism* – geological processes have been the same over Earth’s history
- *Faunal succession* – fossils are found in a definite order in rock strata
- *Cross-cutting relationships* – rock or geological features that cut others are younger than what they have cut

These rules allowed geologists to determine the relative age of rocks around the world. Faunal succession allowed scientists to match time periods in different locations using fossils found in many locations (index fossils). Thus, the geological timescale was developed, although it did not have any numbers until the advent of absolute dating.

Absolute Dating

The numbers on the geological timescale came with the development of radiometric dating techniques in the early 20th century.

Radiometric dating relies on the natural decay of radioactive elements, using the decay rate as a clock to determine the absolute date at which an igneous rock formed. Scientists determine the ratio of parent to daughter isotopes to calculate the age of a specimen. Recent biological material is often dated using the decay of carbon-14, which has a half life of 5 730 years. Uranium is most helpful for dating geological materials because its isotopes have a variety of half lives. Uranium-238 has a half life of 4.5 billion years, whilst uranium-235 has a half life of 700 million and uranium-234 has a half life of 25 000 years.

Rock Type Matters!

Sedimentary rocks are needed if you are going to match rock layers based on fossils. Igneous rocks provide the appropriate material for radiometric dating. Fortunately, the stratigraphic principles can

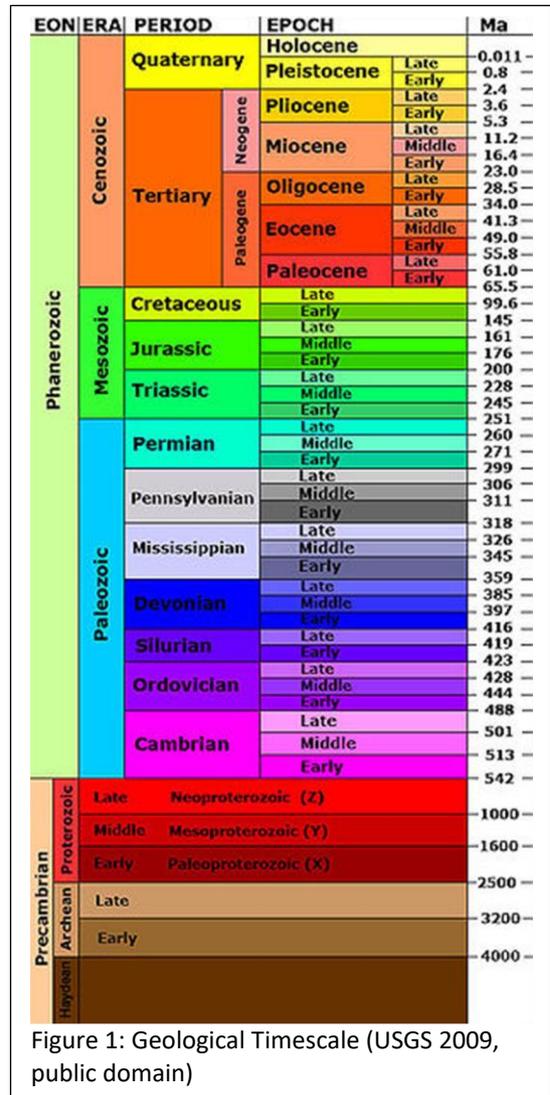


Figure 1: Geological Timescale (USGS 2009, public domain)



often be used to determine the age of metamorphic rocks.

Questions

1. List the relative age of the rocks in Figure 2 with oldest first. _____

2. What stratigraphic principles did you use to determine the age of the rocks in Figure 2? _____

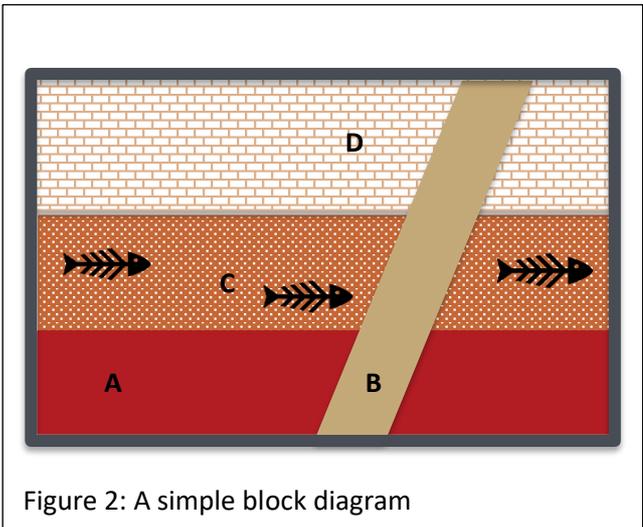


Figure 2: A simple block diagram

3. If layer A is 418 Ma and layer B is 388 Ma, what geological Period(s) are layers C and D likely to be from? _____

4. Layer C contains fish fossils.

a. Circle the rock type for layer C. **Igneous** **Sedimentary** **Metamorphic**

b. Explain how the fish fossils could be used to determine the date of rocks elsewhere. _____

c. Outline possible reasons why the other layers do NOT contain fossils. _____

