Name: _____ Date: _____ Class: _____

Determining Relative Age of Rocks Layers:

An Investigative Approach

The sediment that forms sedimentary rocks is deposited in flat layers. Over years, the sediment becomes deeply buried, hardens, and changes into sedimentary rock. At the same time, remains of organisms in the sediment may become fossils. These rock layers provide a record of Earth's geologic history. The relative age of a rock is its age compared to the ages of other rocks.

Geologists follow three main simple rules in order to determine the relative age of rock layers. First and foremost, they use the law of superposition to determine the relative ages of sedimentary rock layers. According to the law of superposition, in horizontal sedimentary rock layers the oldest is at the bottom. Each higher layer is younger than the layer below it.

There are two other rules that aid in determining the relative ages of rocks. Secondly, geologists study extrusions and intrusions of igneous rock. Igneous rock forms when magma or lava hardens. Lava that hardens on the surface is called an extrusion. The rock layers below an extrusion are always older than the extrusion. Beneath the surface, magma may push into bodies of rock. There, the magma cools and hardens into a mass of igneous rock called an intrusion. An intrusion is always younger than the rock layers around and beneath it.

The third rule comes from the study of faults. A fault is a break in Earth's crust. A fault is always younger than the rock it cuts through. The surface where new rock layers meet a much older rock surface beneath them is called an unconformity. An unconformity is a gap in the geologic record. An unconformity shows where some rock layers have been lost because of erosion.

To date rock layers, geologists first give a relative age to a layer of rock at one location and then give the same age to matching layers at other locations. Certain fossils, called index fossils, help geologists match rock layers. To be useful as an index fossil, a fossil must be widely distributed and represent a type of organism that existed for a brief time period. Index fossils are useful because they tell the relative ages of the rock layers in which they occur. Geologists use particular types of organisms, such as trilobites, as index fossils.

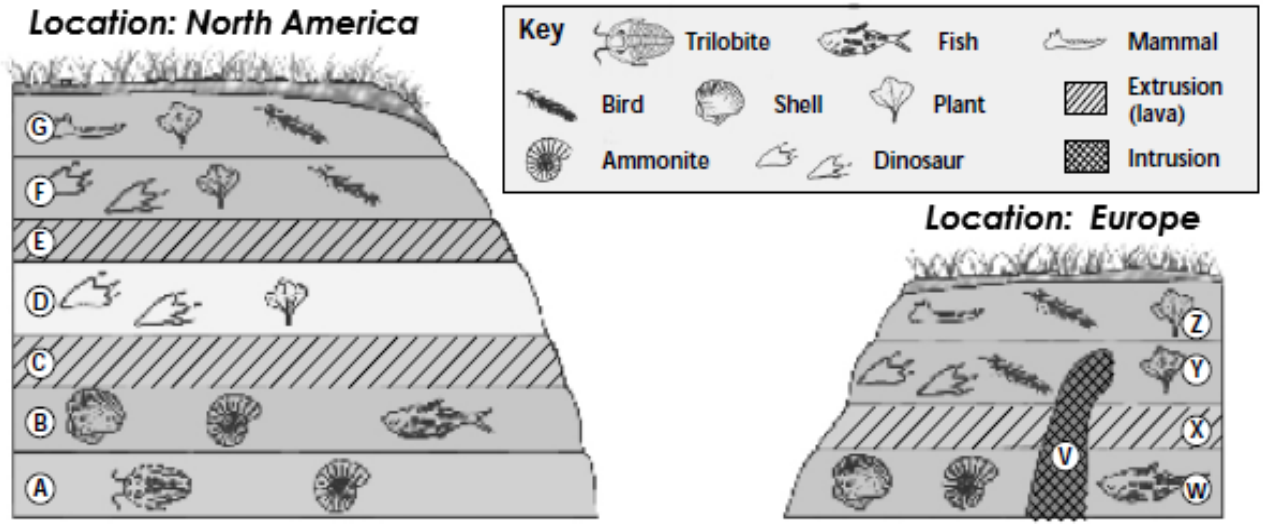
❖ Problem:

- ❖ How can you use fossils and geologic features to interpret the relative ages of rock layers?

❖ Procedure:

1. Study the rock layers at Sites 1 and 2.Write down the similarities and differences between the layers at the two sites.

2. List the kinds of fossils that are found in each rock layer of Sites 1 and 2.



❖ Analyze and Conclude:

1. In North America, what "fossils clues" in layers A and B indicate the kind of environment that existed when these rock layers were formed? How did the environment change in layer D?

_____
_____
_____
_____

2. In North America, which layer is the oldest? How do you know?

_____
_____
_____

3. Looking at North America, which of the layers formed most recently? Explain your reasoning.

_____
_____
_____

4. For North American layers C and E, why are fossils not present?

5. Again looking at North America, what kinds of fossils are located at layer F?

6. When comparing Europe to North America, which North American layer likely formed at the same time as European layer W? Give an explanation for your answer.

7. At the European location, what clues show an unconformity or gap in the horizontal rock layers? Which rock layers are missing? What might have happened to these rock layers?

8. At the Europe site, which is older, intrusion V or layer Y? How can you tell?

9. Match the North American layers to the European layers that formed under similar conditions/time.

10. Using the Geologic Time scale on Appendix A, which layers represent different time periods in Earth's history?

❖ Appendix A: Geologic Time Scale

Years Ago	Time	Event	Date *(if time was compressed to a calendar year)*
4.6 bya	Precambrian	Beginning of Earth	1/1/00 12:00 AM
3.8 bya	Precambrian	Oldest age – dated rocks on Earth	3/3/00 5:45 AM
1.5 bya	Ectasian Period	First multicellular organisms *(seaweed & algae)*	8/29/00 7:55 PM
505 mya	Cambrian Period	First fish	11/15/00 9:07 PM
470 mya	Silurian Period	First fossil evidence of land plants	11/18/00 8:46 PM
385 mya	Devonian Period	First insects *(beetles, scorpions, centipedes)*	11/25/00 4:07 AM
375 mya	Devonian Period	First land animals	11/26/00 2:38 AM
370 mya	Devonian Period	First sharks	11/26/00 10:04 AM
365 mya	Carboniferous Period	First seed plants	11/26/00 5:31 PM
228 mya	Triassic Period	First small dinosaurs	12/6/00 9:21 PM
115 mya	Cretaceous Period	First flowering plants	12/14/00 1:40 PM
70 mya	Cretaceous Period	Tyrannosaurs Rex & Velociraptor	12/19/00 6:57 AM
64 mya	Paleocene Epoch	First ancestors of dogs and cats	12/19/00 9:55 PM
55 mya	Eocene Epoch	First horses	12/20/00 12:43 PM
39 mya	Eocene Epoch	First monkeys	12/21/00 6:28 PM
4 mya	Pilocene	First human-like ancestors	21/24/00 1:26 PM
0.1 mya	Recent Epoch	First modern man	12/24/00 8:52 PM