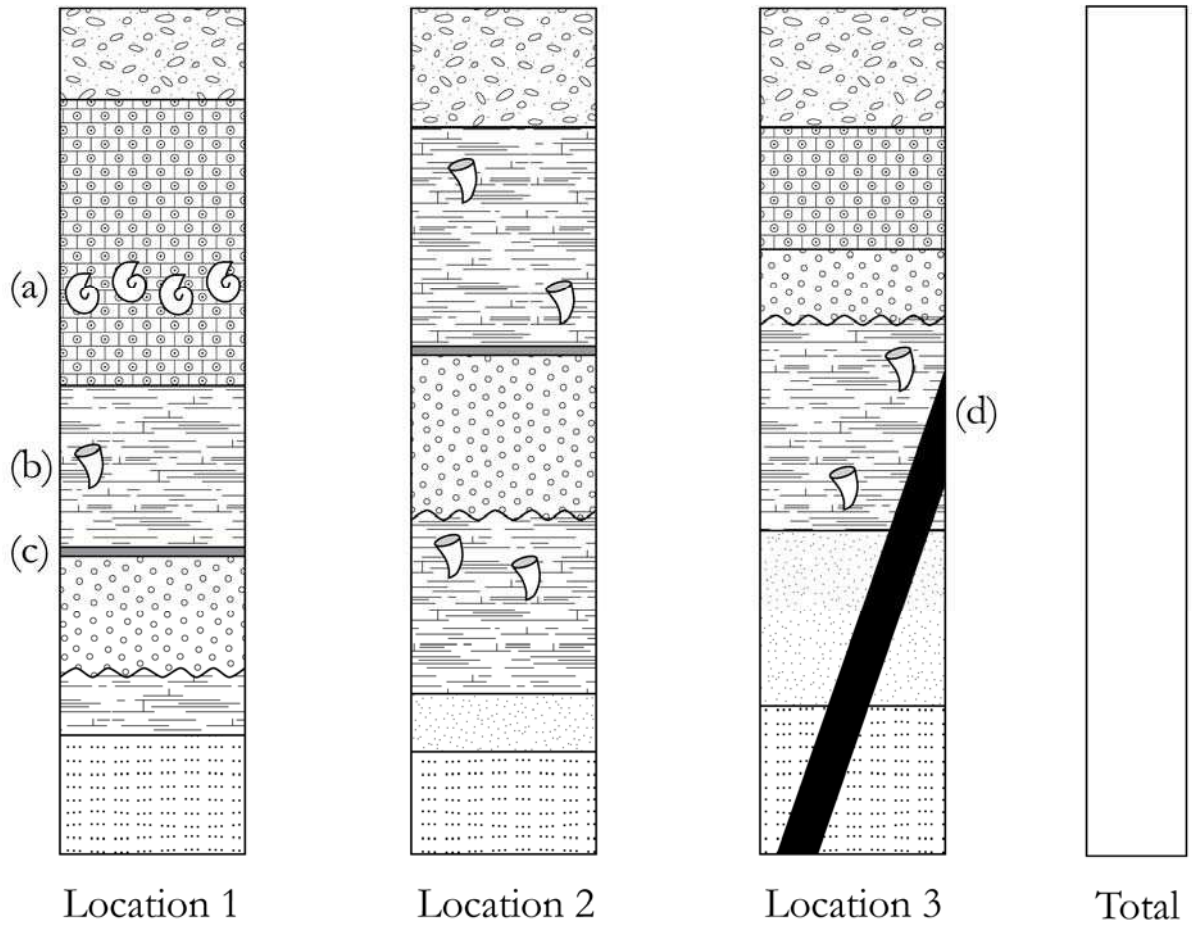
Stratigraphic Correlation (Geology Exercise)

EARTH 125

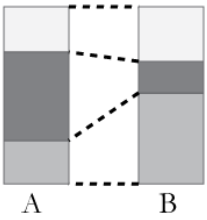
You are a geologist working on a regional stratigraphy. On visits to three different locations in the region, you have produced the three stratigraphic columns above, in which different rock types are indicated by different fill patterns and fossils are indicated by cartoons.

These three locations have many of the same rocks, but not all, so in order to find the relative age of all of these rock units you will need to use stratigraphic correlation.

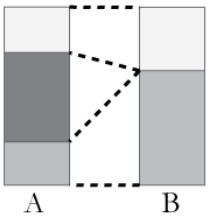
The strata are in original orientation (i.e. not tilted or overturned), and you have no access to radiometric dating.



1. Look at the two kinds of fossils marked (a) and (b).
    a. Are the fossil ammonites at (a) useful for correlation by fossils? Why or why not?
    b. What about the fossil corals at (b)? Why or why not?
2. Correlate the stratigraphic columns from the three locations.
    a. First, draw lines between the columns (between 1 and 2 and between 2 and 3) connecting the top and bottom of each layer that you think is the same:



    b. Some layers will not appear in every column. Draw lines that indicate where it would go in the adjacent column if it were present:



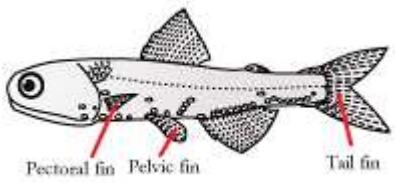
    c. Now you have the relative ordering for all eight rock units across all three locations. Construct an overall regional stratigraphic column that includes all the rock units, in the box marked Total.
3. When you get back from your field trip, you send samples of the volcanic ash layer at (c) and the basalt dike at (d) away for radiometric dating. They return dates of 105 million years and 140 million years, respectively.
    a. Mark the absolute date for (c) on your Total regional stratigraphic column.
    b. What do you now know about the ages of the other seven rock layers in your column? (Hint: Think about superposition and cross-cutting relationships!)

Museum Lab Exercise: Comparative Vertebrate Anatomy

EARTH 125 | Discussion Section | Week 8

Walking

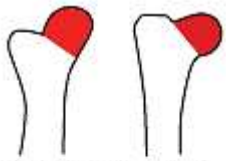
Compare the fossils of *Eusthenopteron*, *Plioambystoma*, and *Diplomystus*, paying special attention to the bones of the pectoral and pelvic fins.

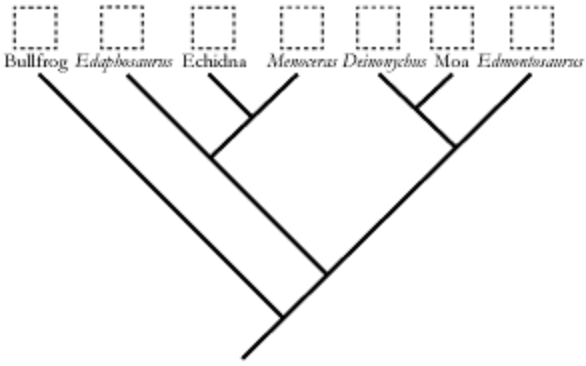


- Anatomically, why do we think that vertebrates arose from sarcopterygians (lobe-finned fishes) and not actinopterygians (ray-finned fishes)?

Running

For the six specimens on the phylogenetic tree below, observe the difference in the proximal condyle of the femur and its effect on posture and Carrier's constraint, as discussed in class. Mark posture (sprawling vs. upright) on the tree for all six listed taxa, based on the shape of the proximal head of the femur.


Proximal condyle of femur highlighted in red.
The left shape corresponds to a **sprawling** posture, the right to an **upright** posture.



- Why do we think that upright posture evolved separately in dinosaurs and mammals?

Swimming

Compare a fossil actinopterygian (*Diplomystus*, for example), the icthyosaur fossil (*Stenopterygius*), and the modern bottlenose dolphin skeleton (*Tursiops truncatus*), paying special attention to the orientation of the tail fin or fluke.

- How did the change from sprawling to upright gait in land mammals affect how cetaceans swim, compared to the other two?

Chewing

For the following pairs of animals with similar diets, compare the dentition of the mammal and the archosaur.

- What was the most likely diet of these two animals?
- How many different kinds of teeth does the mammal have for processing that food?

Allosaurus | *Smilodon fatalis*

Phytosaurus megalodon | *Maiacetus inuus*

Edmontosaurus | *Mammut americanus*

Optional: Look at the teeth of the placodonts and *Dimetrodon*. These are not mammals (and placodonts are not even direct ancestors of mammals), but their teeth are differentiated -- they have different sizes and functions.

- How are their teeth similar to those of mammals? How are they different?

Vestigial organs

For the three fossil specimens in the whale exhibit (*Maiacetus inuus*, *Dorudon atrox*, *Basilosaurus isis*) and the modern dolphin (*Tursiops truncatus*), describe and/or sketch the bones of the limbs and pelvis.

- What were each of these animals using their front legs for?
- What about their back legs?

Diagram 1

Describe a series of events that could produce the following geological cross-section. Possible events include:

- Deposition of a sedimentary rock
- Intrusion of an igneous rock (not present in this section)
- Erosion
- Folding
- Faulting (normal or reverse)

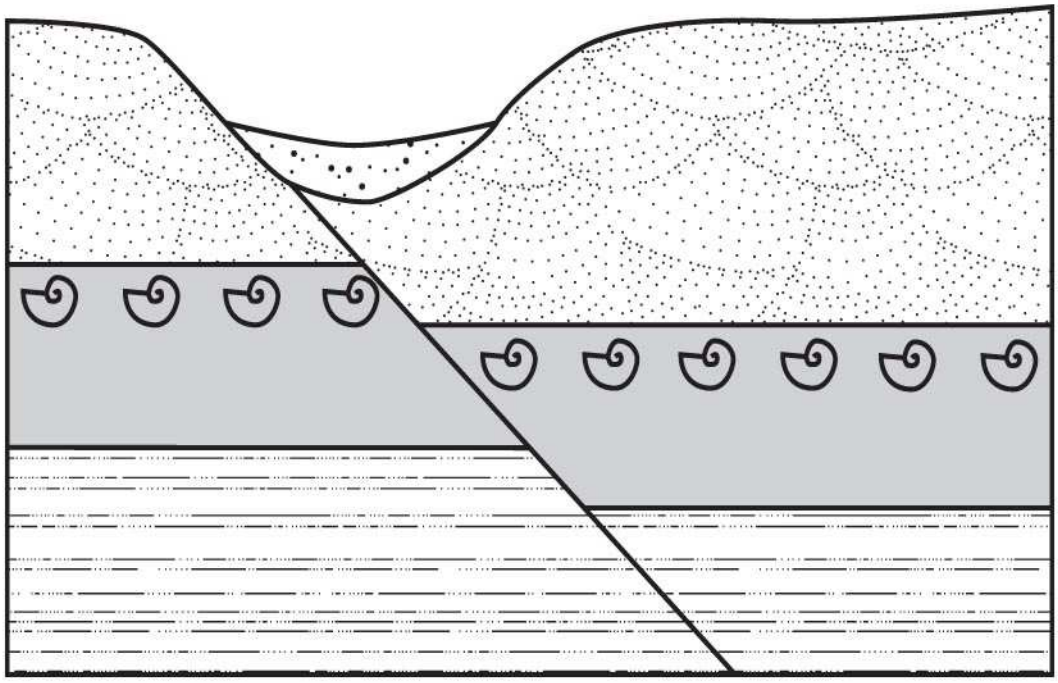


Diagram 2

Describe a series of events that could produce the following geological cross-section. Possible events include:

- Deposition of a sedimentary rock
- Intrusion of an igneous rock (indicated by black)
- Erosion
- Folding
- Faulting (normal or reverse)

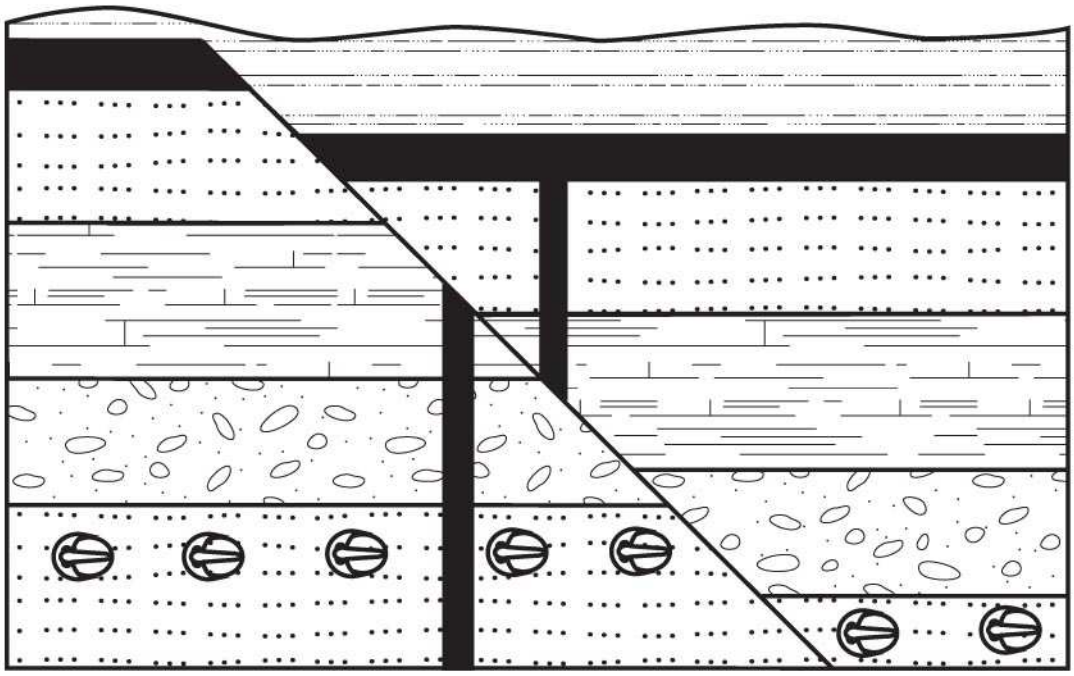


Diagram 3

Describe a series of events that could produce the following geological cross-section. Possible events include:

- Deposition of a sedimentary rock
- Intrusion of an igneous rock (not present in this section)
- Erosion
- Folding
- Faulting (normal or reverse)

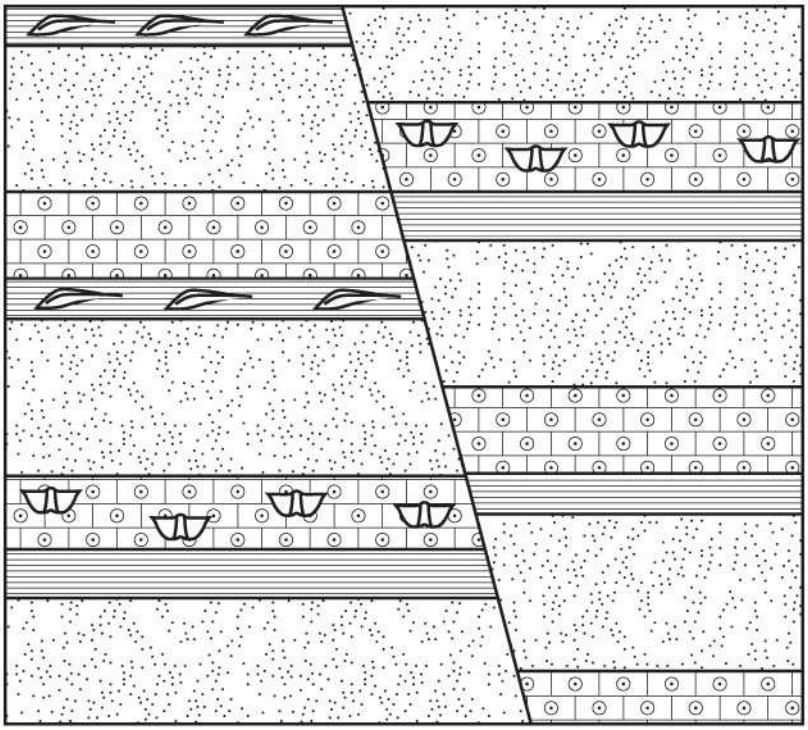


Diagram 4

Describe a series of events that could produce the following geological cross-section. Possible events include:

- Deposition of a sedimentary rock
- Intrusion of an igneous rock (not present in this section)
- Erosion
- Folding
- Faulting (normal or reverse)

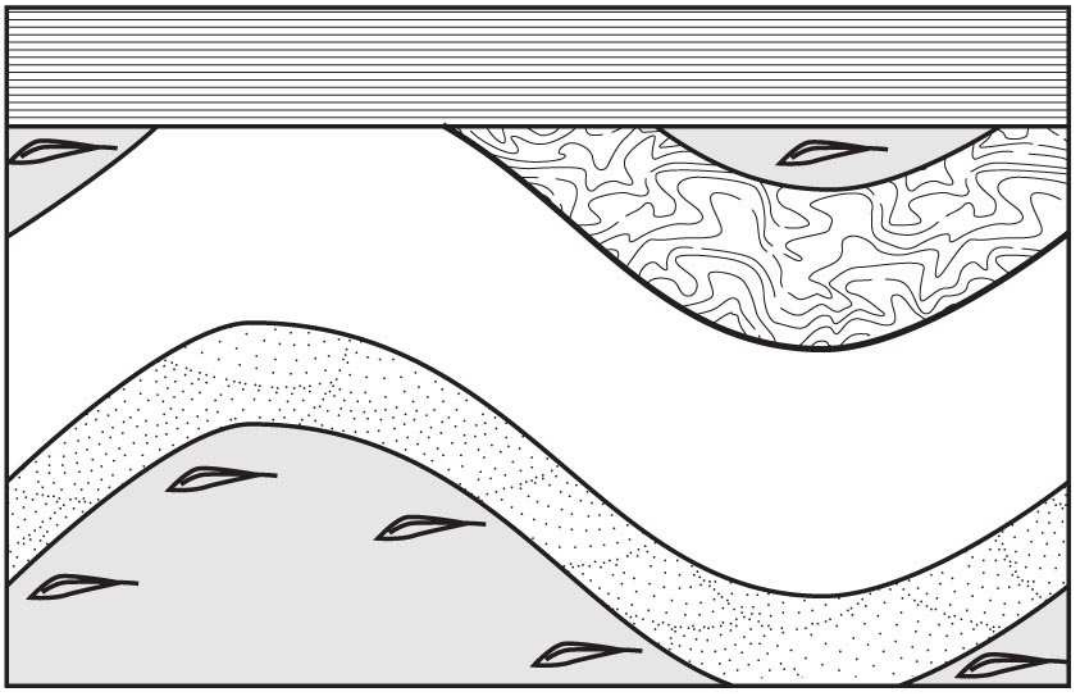


Diagram 5

Describe a series of events that could produce the following geological cross-section. Possible events include:

- Deposition of a sedimentary rock
- Intrusion of an igneous rock (indicated by black)
- Erosion
- Folding
- Faulting (normal or reverse)