New York State Museum
EARTH SCIENCE WORKSHOP

Interpreting the Sequence of Geologic Events

by Paul A. Scott

An outcrop is an exposure of bedrock in which the rock layers are visible at the surface. Geologists (or stratigraphers) can use outcrops and the exposed bedrock to determine the sequence of geologic events for that locality. This is done by making observations of the following features of the rock: the rock type, the thickness of the layers, the attitude of the bedding, the presence/absence of folding and faulting, and the presence/absence of fossils. These observations and the Principles of Stratigraphy are used to determine how the layers of rock were formed and the events that occurred since their creation. The following exercise is a review of the Principles of Stratigraphy that we discussed in class.

Purpose: Using schematics of geologic cross-sections you will infer a logical sequence of geologic events and establish a probable relative age for a series of rock layers.

Define the following terms:

Principle of Uniformitarianism

Principle of Original Horizontality

Principle of Superposition

Law of Effect or Cross-cutting

Crustal Subsidence

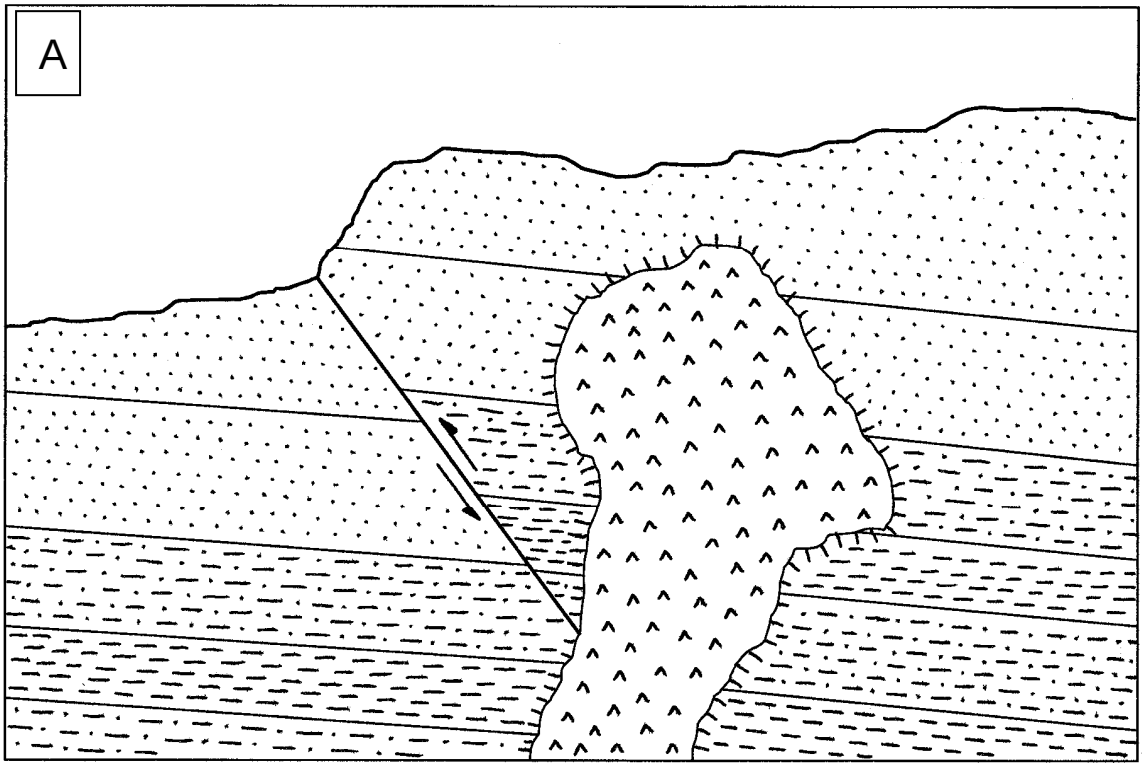
Crustal Emergence or Uplift

Contact Metamorphism

Erosional Unconformity

Procedures:

1. For each outcrop diagram on the following pages, determine the sequence of geologic events.
2. Start with the formation or deposition of the oldest layer.
3. Briefly describe the events in numbered steps.
4. When describing the creation of the different rock layers keep the following in mind:
    a. sedimentary rock layers are formed by the deposition of sediments or the precipitation of minerals.
    b. metamorphic rocks are created by heat and pressure
    c. igneous rocks are created by the cooling and solidification of molten rock
5. Be sure to indicate whenever crustal emergence (uplift) or crustal subsidence occurs. Weathering and erosion always follows crustal emergence (uplift) whenever another rock layer lies above it.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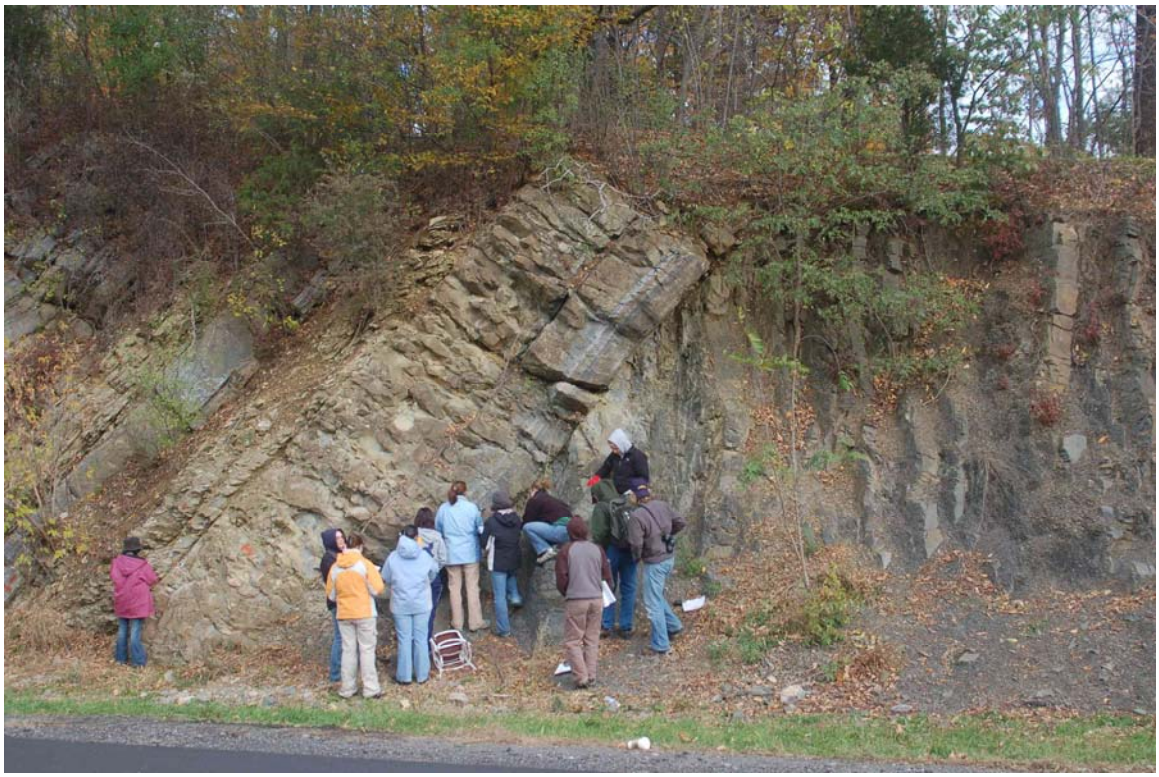
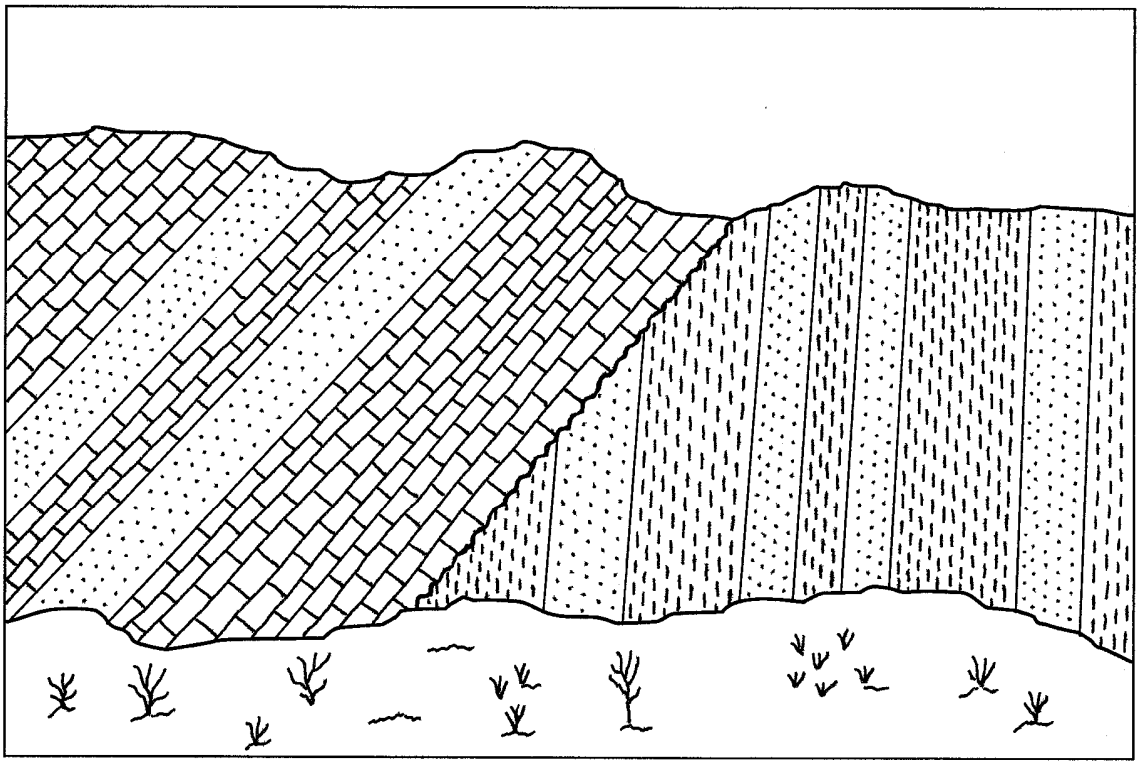
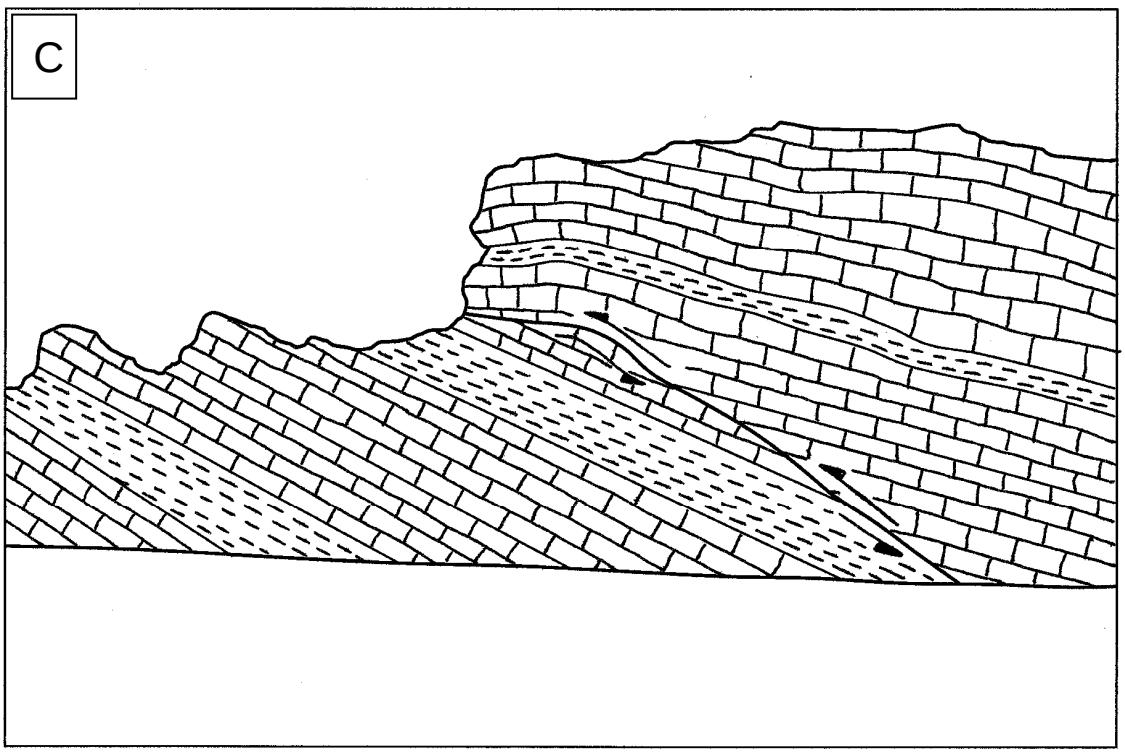


Picture of the Taconic Angular Unconformity along Route 23 near Catskill, NY. The Silurian-aged Rondout and Devonian-aged Manlius lie above the near vertically dipping Ordovician-aged Austin Glen. Picture taken from a University of Rochester Structural Geology field trip (http://www.earth.rochester.edu/structure/Hudson/hudson.html)

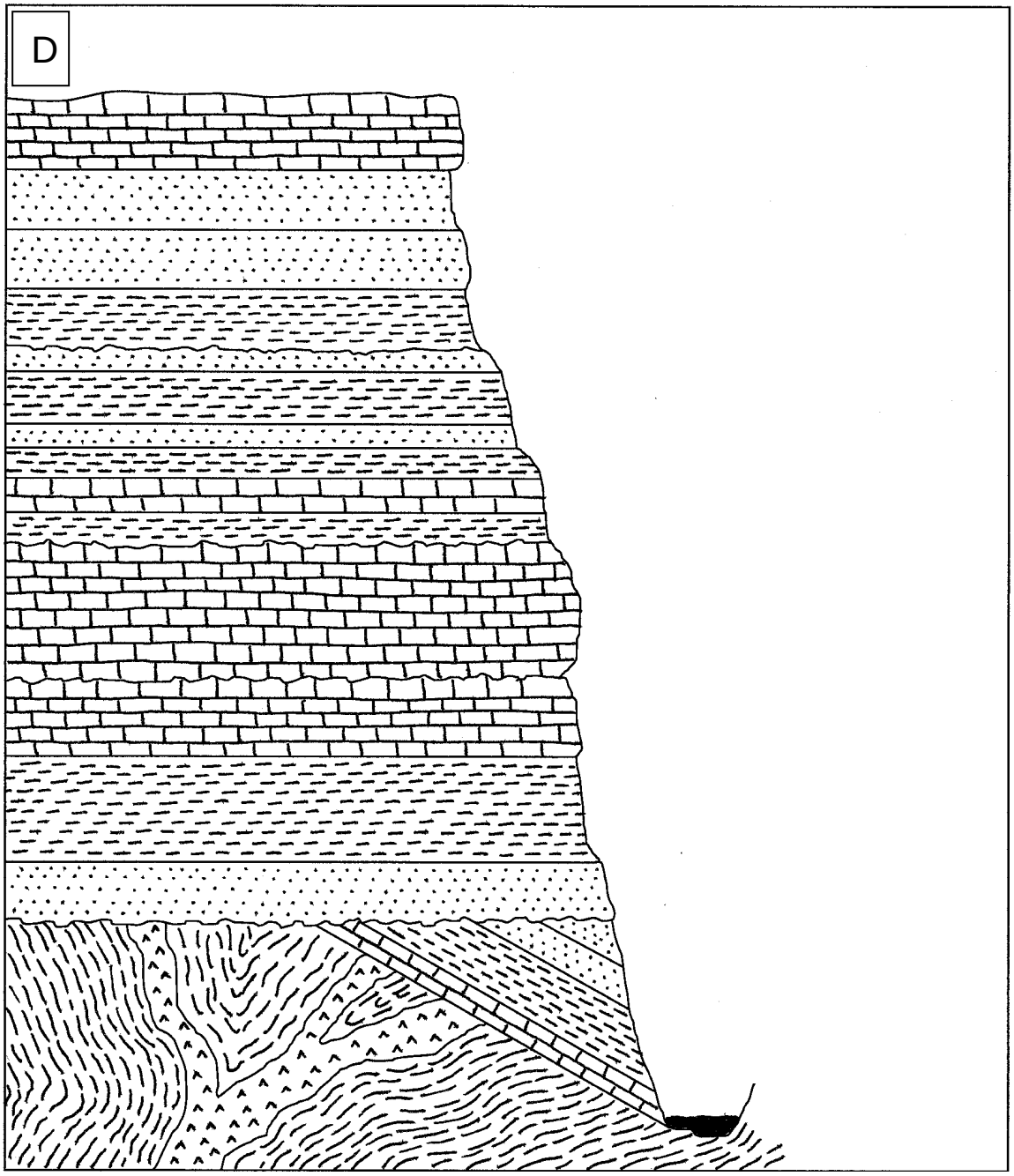


SEQUENCE OF EVENTS FOR OUTCROP B

A low-angle thrust fault indicative of the thin-skinned deformation of the Hudson Valley Fold and Thrust Belt. Devonian-aged Manlius of the hanging wall has been thrust up onto Devonian-aged Kalkberg of the footwall. Picture taken from a University of Rochester Structural Geology field trip. (http://www.earth.rochester.edu/structure/Hudson/hudson.html)



SEQUENCE OF EVENTS FOR OUTCROP C



A stratigraphic column of the one of the most impressive exposures in the United States, the south rim of the Grand Canyon. The Grand Canyon has nearly 5000 feet of exposed bedrock from the Proterozoic-aged Vishnu Schist to the Paleozoic-aged Kaibab Limestone.

SEQUENCE OF EVENTS FOR OUTCROP D

Conclusions:

1. How does the age of an igneous intrusion or fault compare to the rock layer it intrudes or cuts? **Explain**.

2. **Describe** how contact metamorphism occurs?

3. What is an erosional unconformity and what causes it?

4. When you look at an outcrop of rock which is sedimentary, what assumption must you make before you can say that the rock layer on the bottom is the oldest?

5. The rock layers on the right side of Outcrop B are nearly vertical. What could a geologist look for in the rock layers to determine which is the top and bottom of the bed?