Lecture 13

Relative Dating

Steno's Laws

Cross-Cutting Relationships

Inclusions

Unconformities

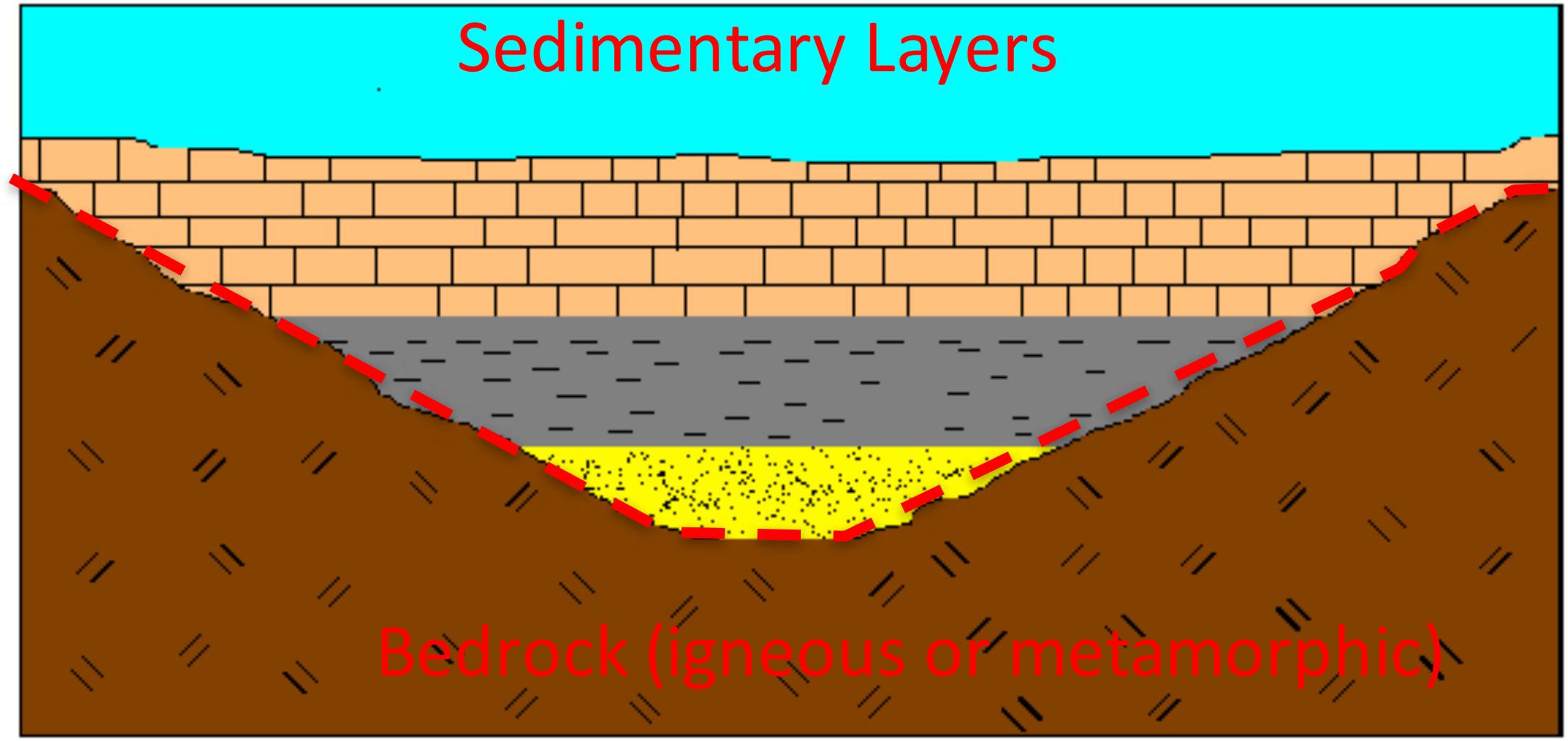
Correlation

Steno's Laws

Q: In what orientation are sedimentary layers originally deposited?

A: Horizontally

Principle of original horizontality



Steno's Laws

These layers are in their original orientation

Steno's Laws

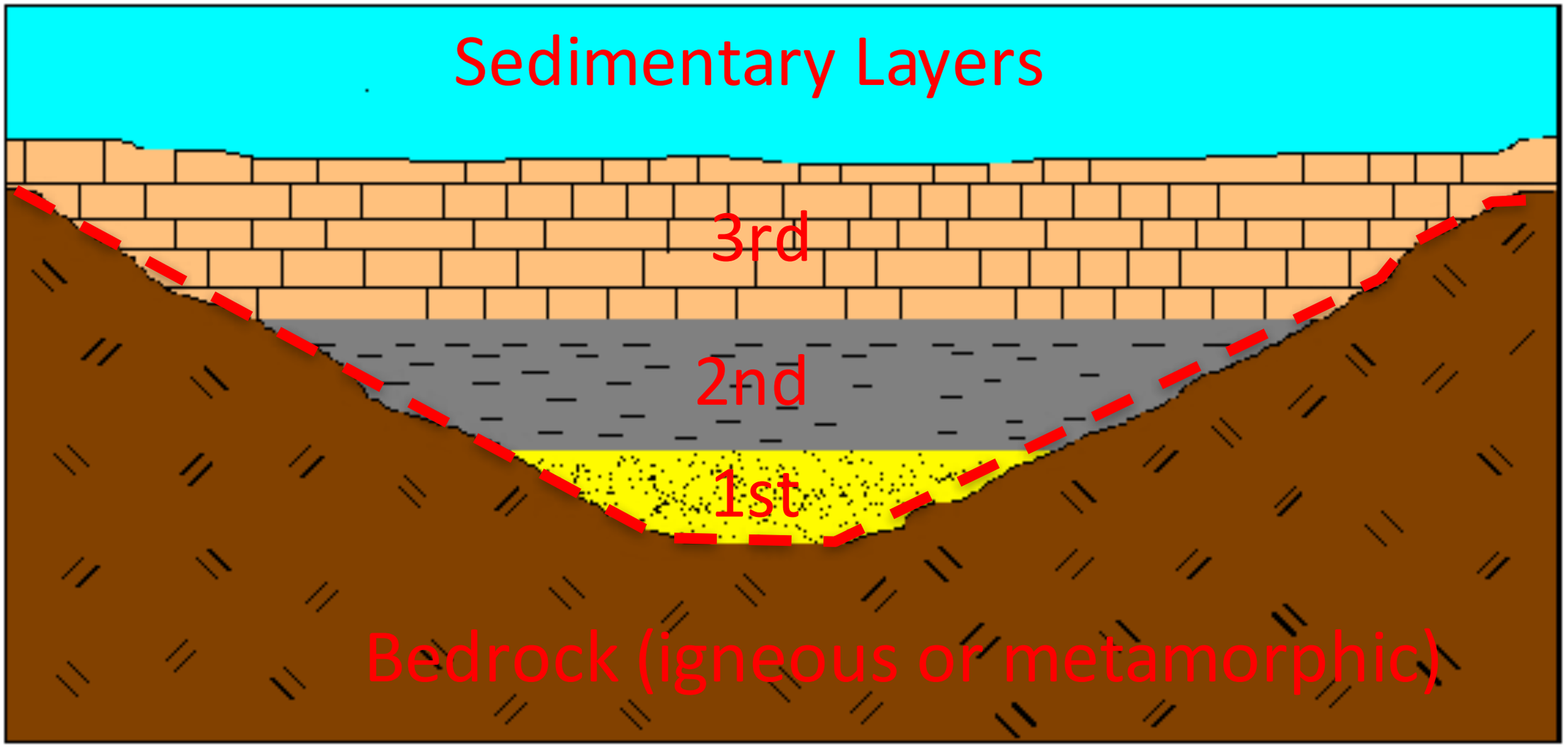
Folding or tilting (deformation) occurs after rocks are deposited

Steno's Laws

Q: What is the oldest sedimentary layer?

A: The one on the bottom

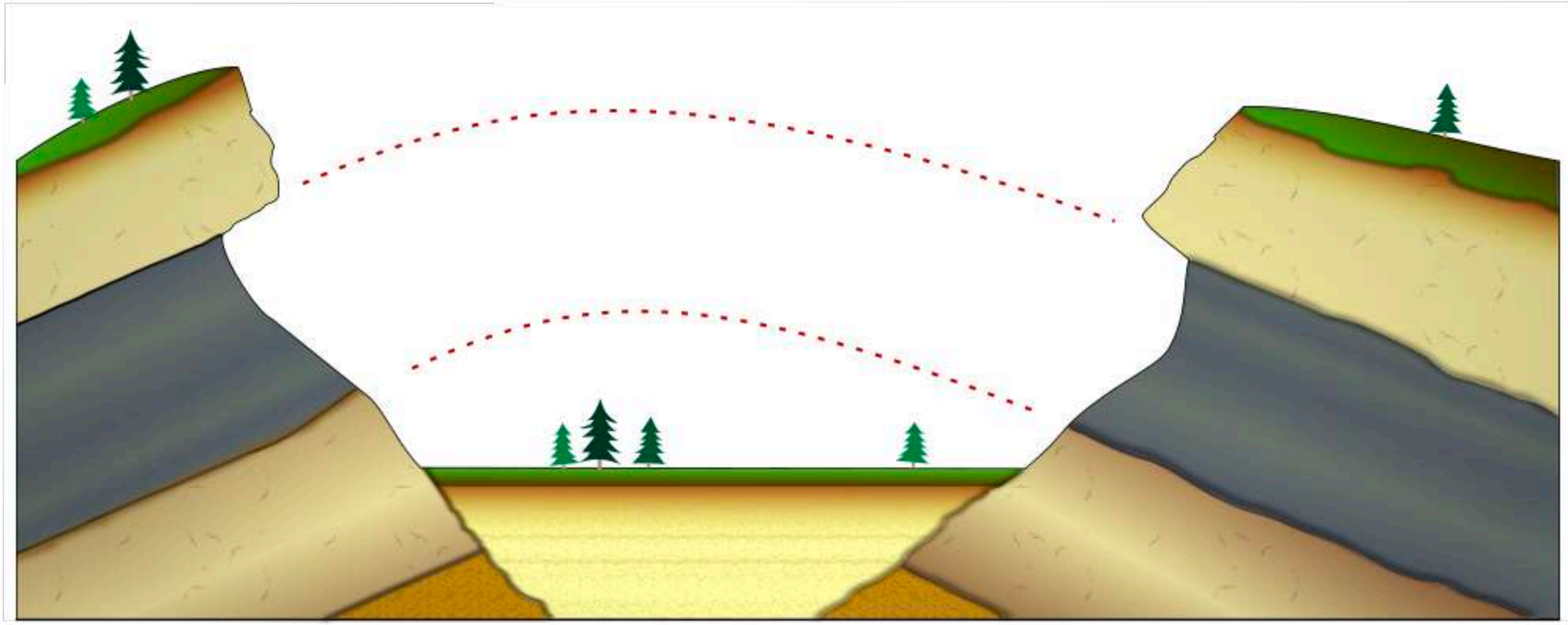
Principle of superposition



Steno's Laws

Principle of lateral continuity

Sedimentary beds are continuous, extending in all directions until they grade into a different type of sediment



Cross-Cutting Relationships

Q: Which rock is older, the red sedimentary rock or the igneous dike?

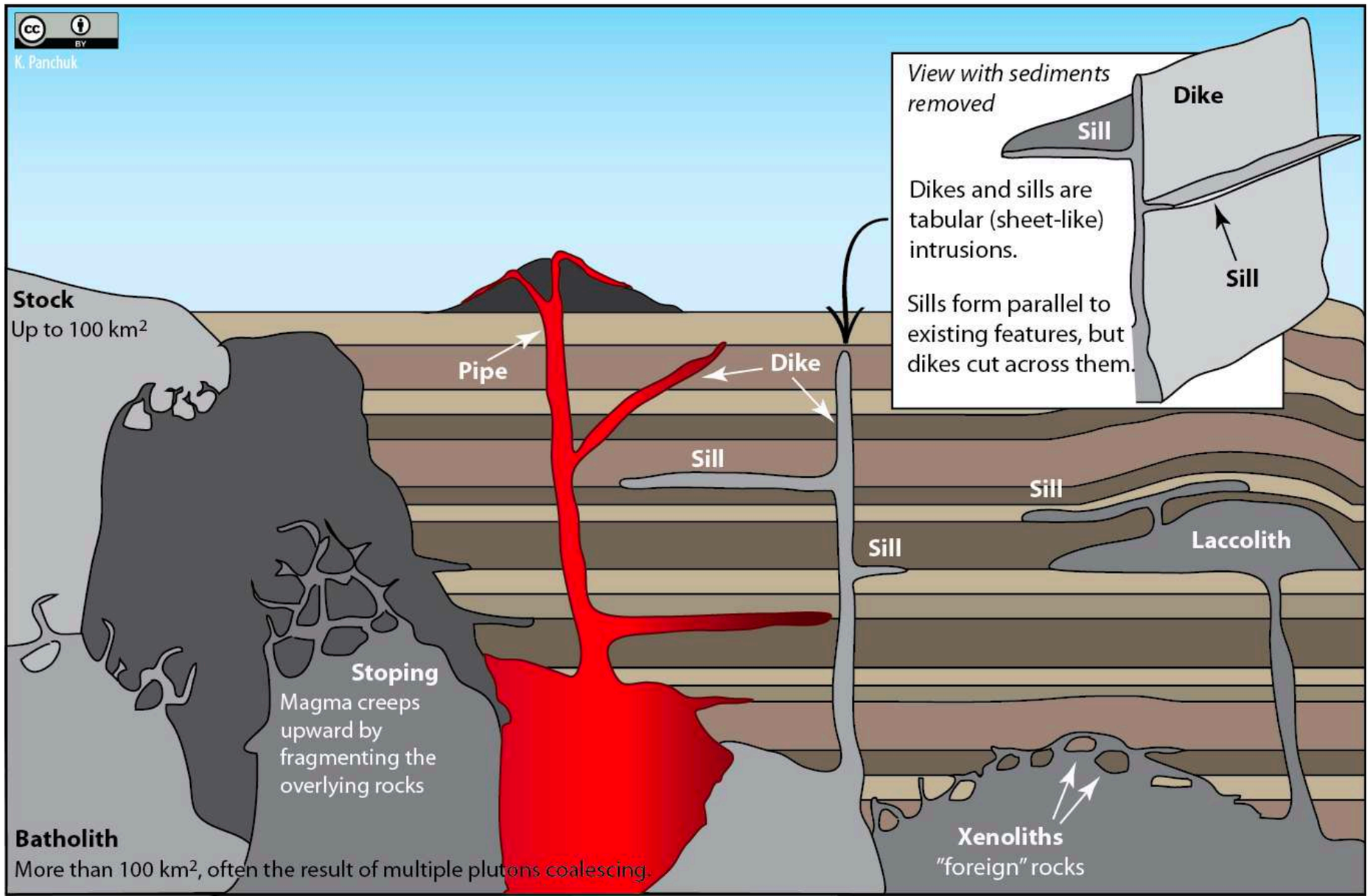
A: The red sedimentary rock

Principle of cross-cutting relationships, rocks that do the “cutting” are younger than those being cut

Cross-Cutting Relationships

Dike - Vertical intrusion of magma that cross-cuts layers of rock

Sill - Horizontal intrusion of magma in between layers of sedimentary rock



Cross-Cutting Relationships

Q: Which is younger, the fault or the sedimentary rocks?

A: The fault – Cross-cutting relationships

Inclusions

Q: Which rock is older, the inclusion or the granite surrounding it?

A: The inclusion

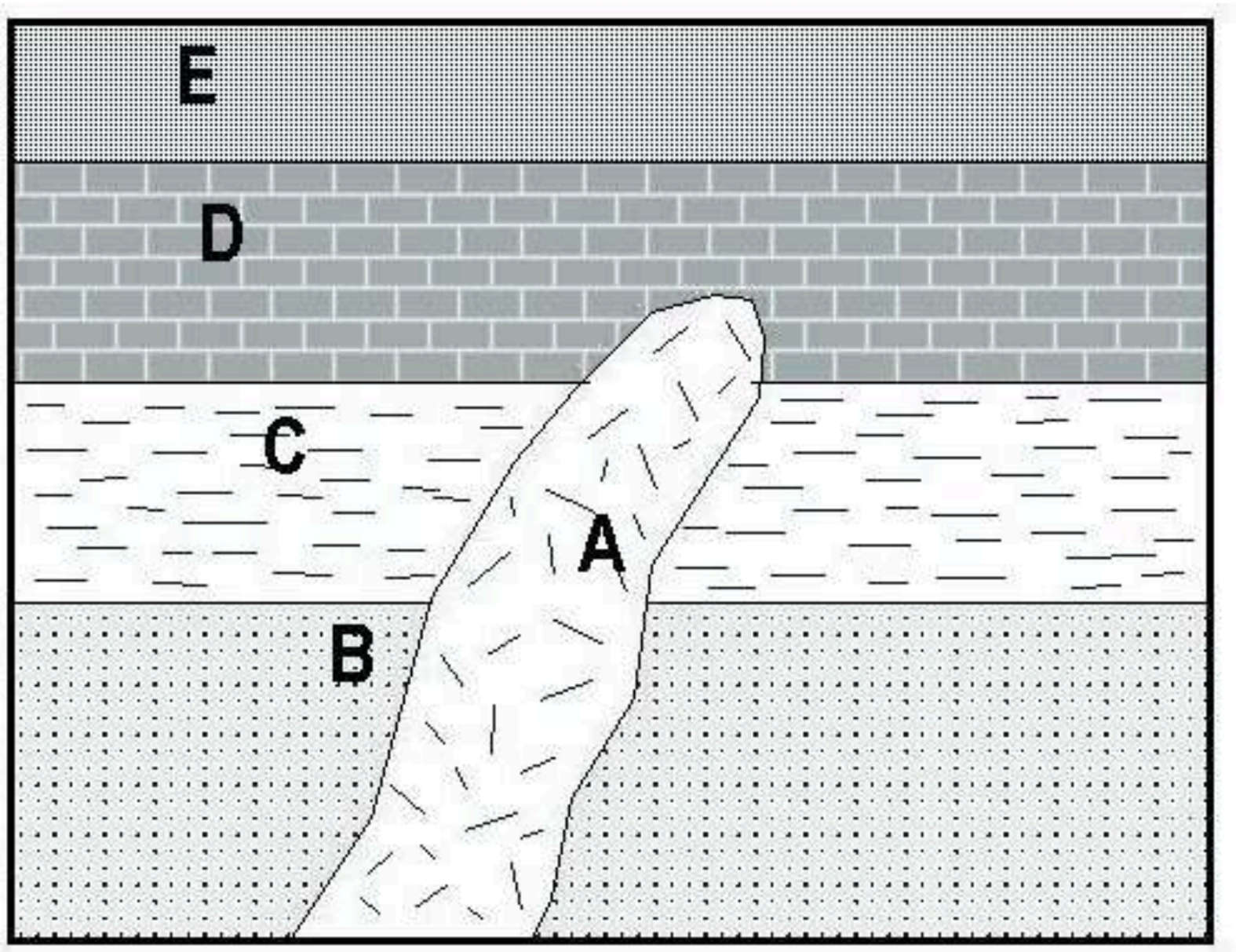
Principle of inclusions - inclusions are older than rocks they are included in

Xenolith inclusion in the granite at Enchanted Rock State Park, Texas

Inclusions

Principle of inclusions - inclusions are older than rocks they are included in

Using the principles we just discussed, place the order of events in the follow cross-section from oldest to youngest



Youngest

E

A

D

C

B

Oldest

Unconformities

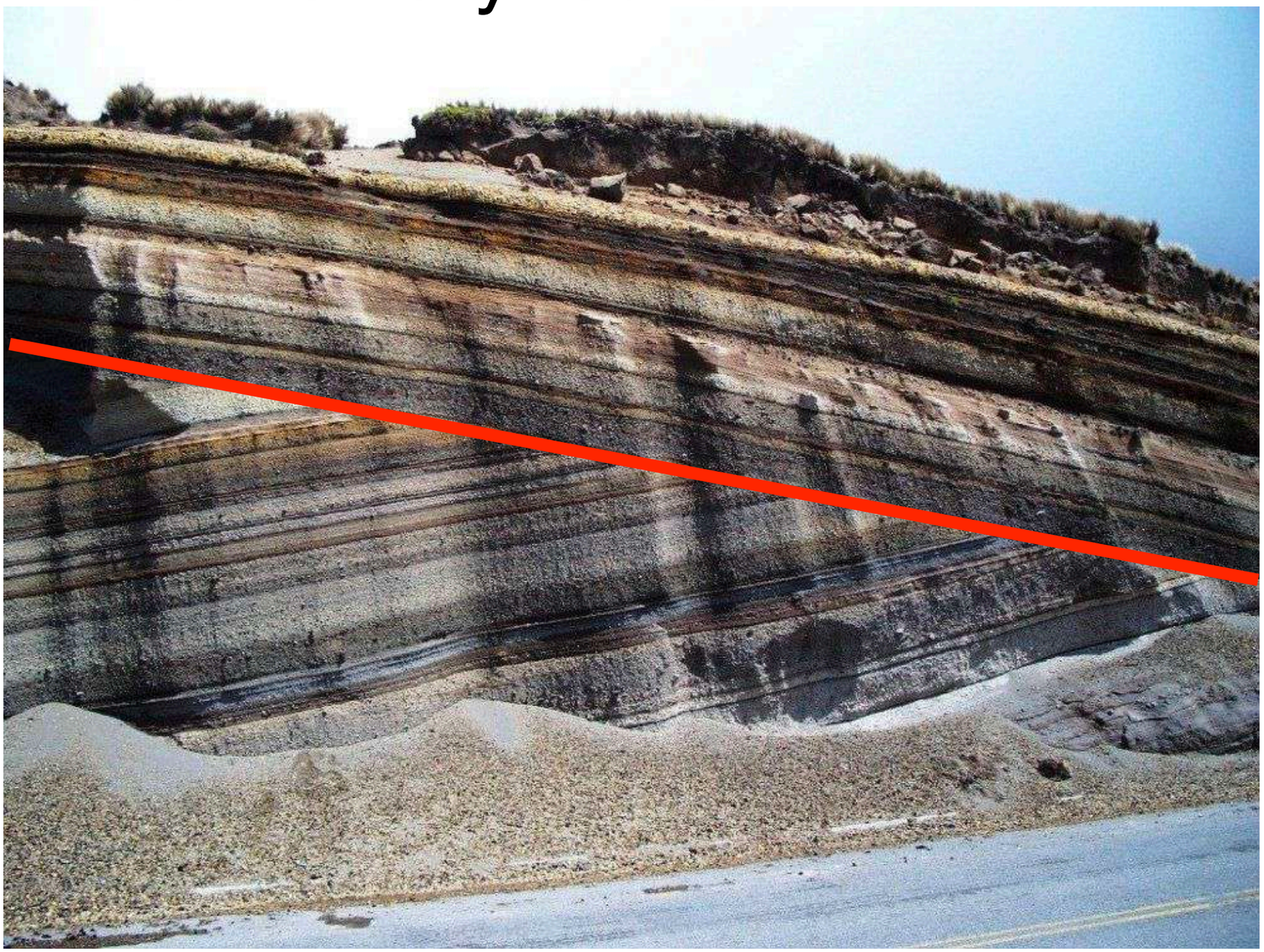
- An unconformity is an erosional surface
- Tells you that erosion happened and you are "missing" some of the rock record.

https://mediaplayer.pearsoncmg.com/assets/WDOYMl1MTWZx2N59LurusmQEH_v855uX

http://www.wwnorton.com/college/geo/egeo2/content/animations/10_4.htm

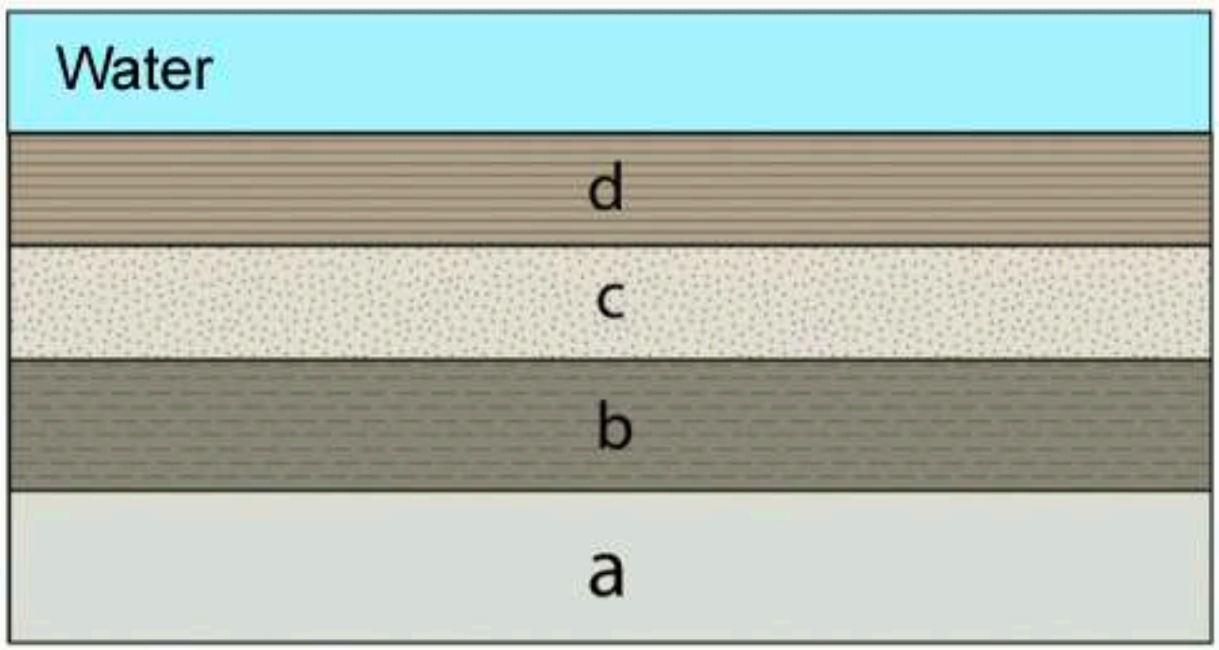
Unconformities

- **Angular unconformity** has horizontal sedimentary rocks on top of tilted or folded sedimentary rocks

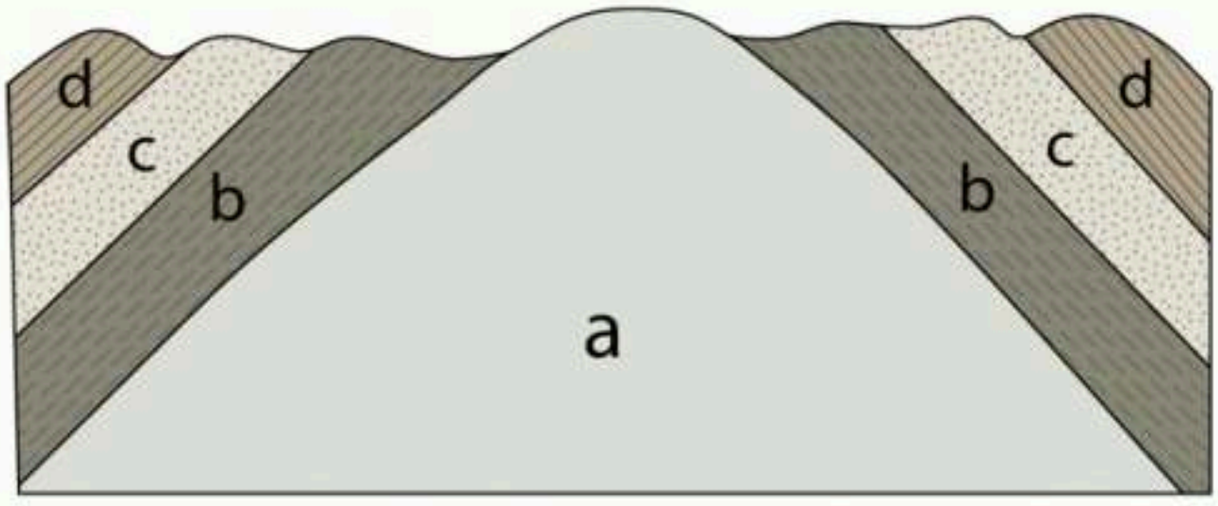


Unconformities

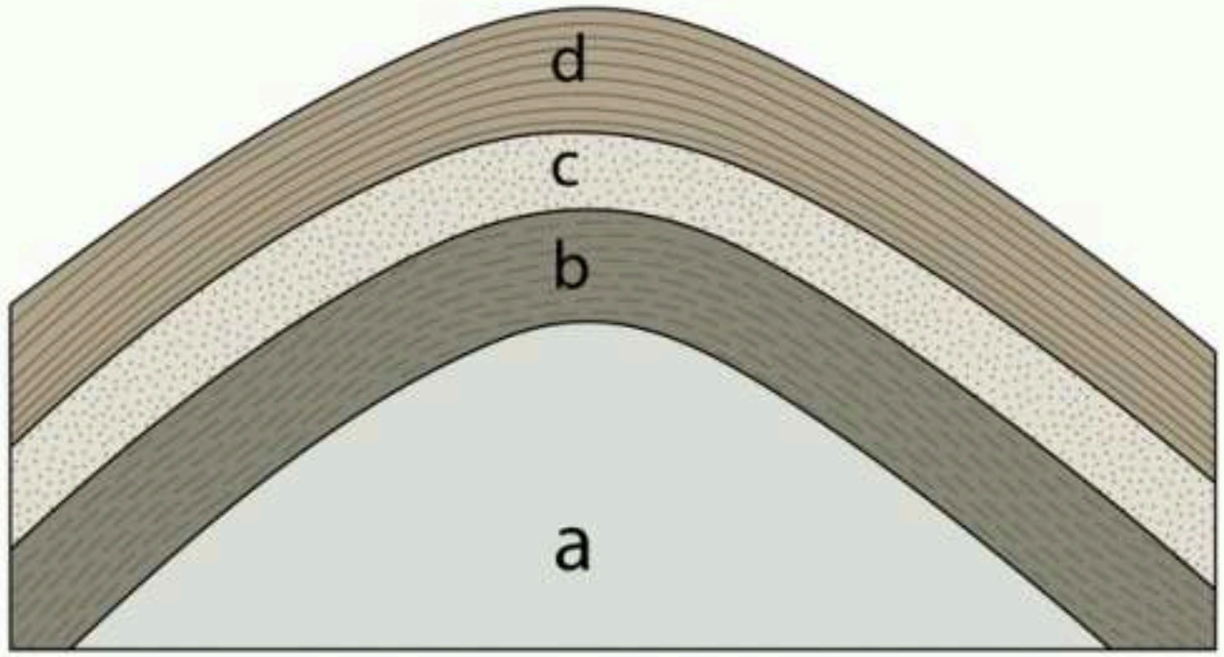
Evolution of an Angular Unconformity



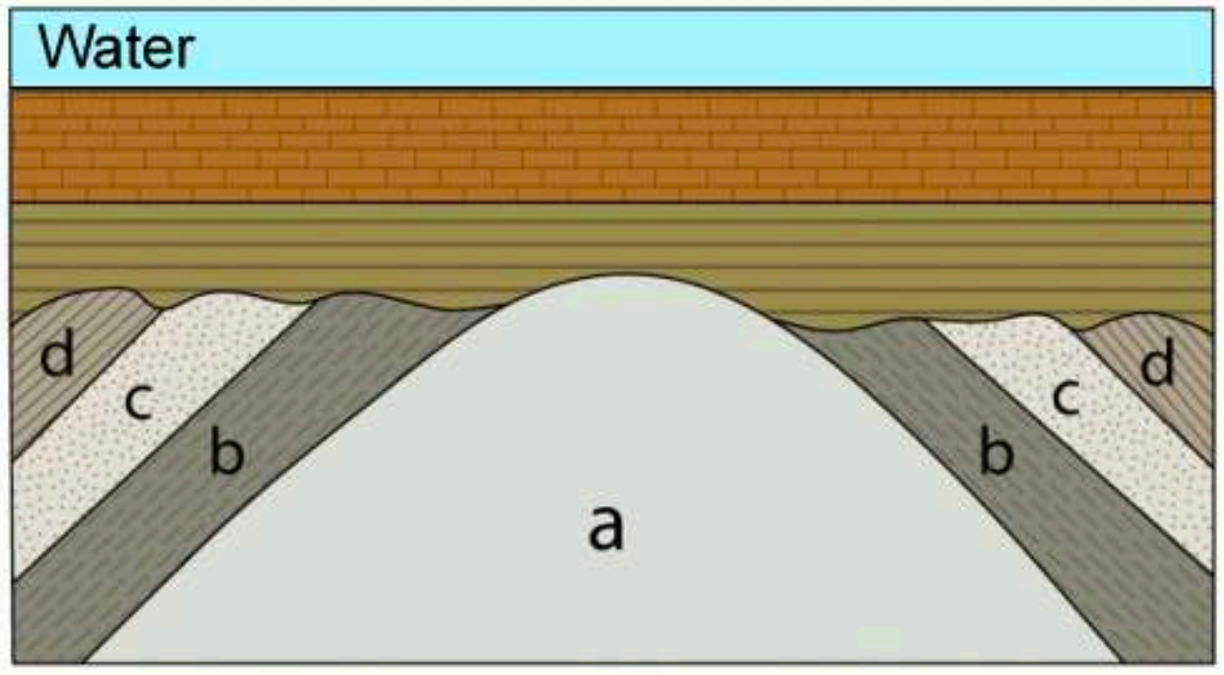
1. Deposition



3. Erosion



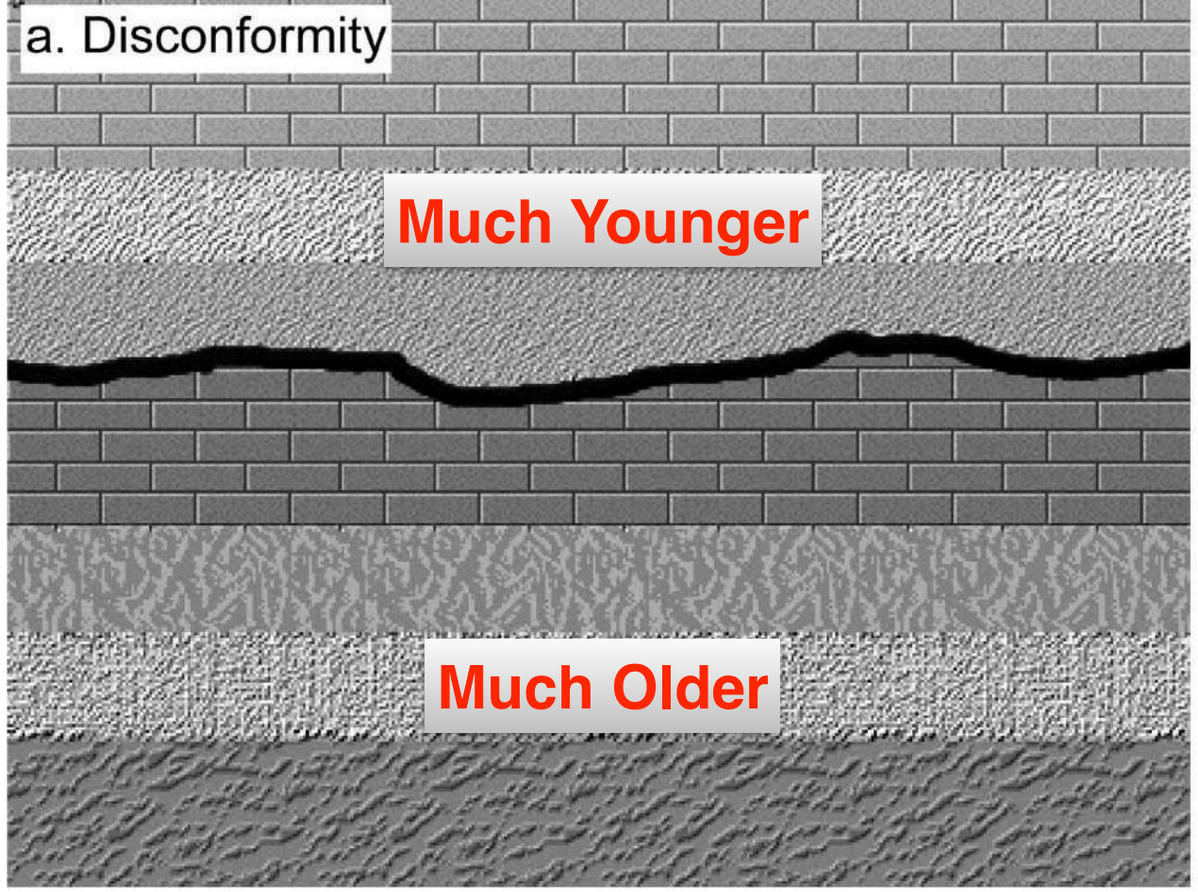
2. Deformation



4. Renewed deposition

Unconformities

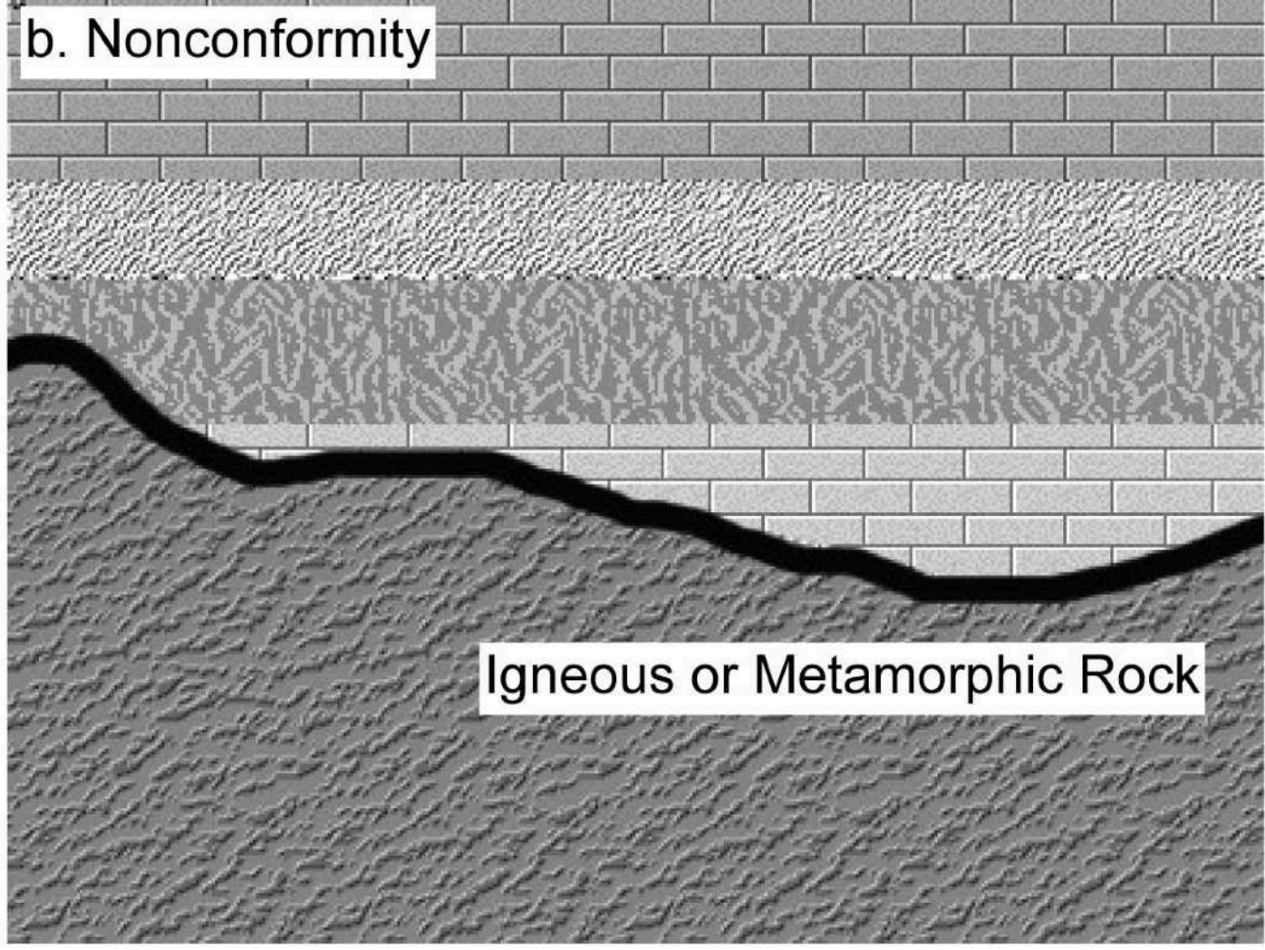
Disconformity - Young sedimentary rocks on top of very old sedimentary rocks, “middle-age” rocks are missing

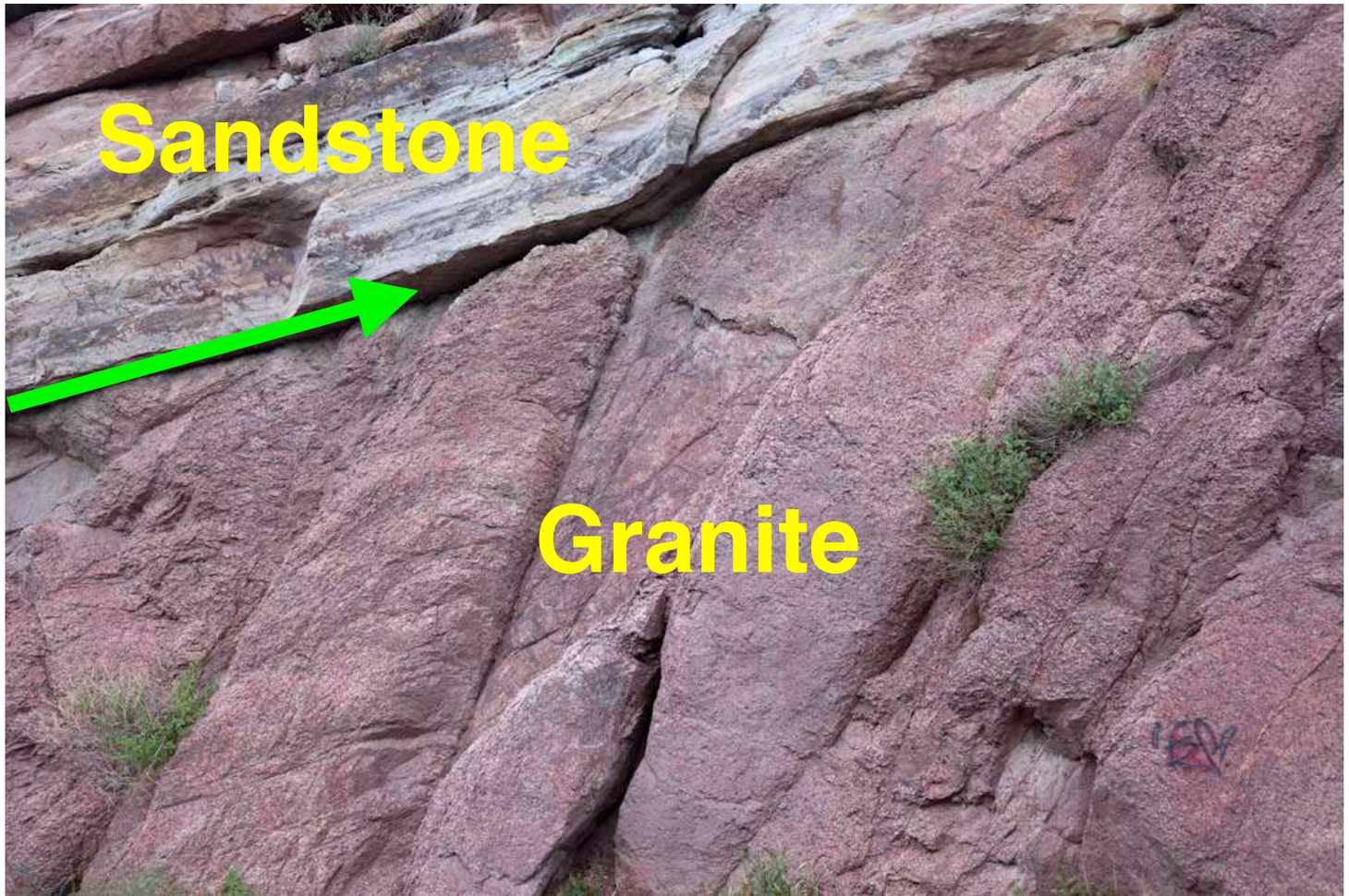


“Middle-age” rocks were eroded, then new sediment was deposited in its place

Unconformities

Nonconformity - Sedimentary rocks directly on top of eroded igneous or metamorphic rocks





Unconformities

Q: Which type of unconformity is shown here?

A: Angular unconformity

Unconformities

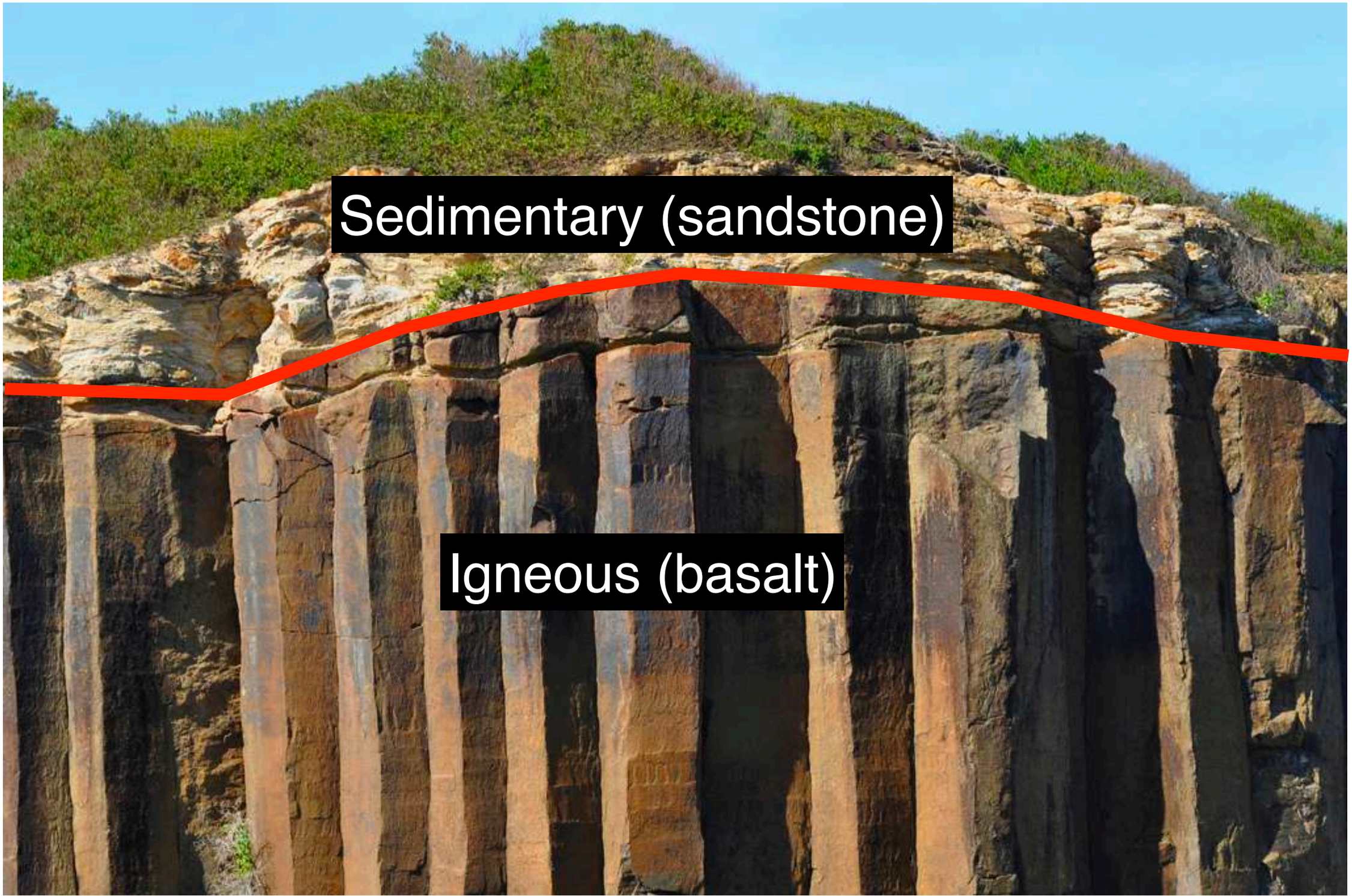
Q: Which type of unconformity is shown here?

A: Disconformity

Unconformities

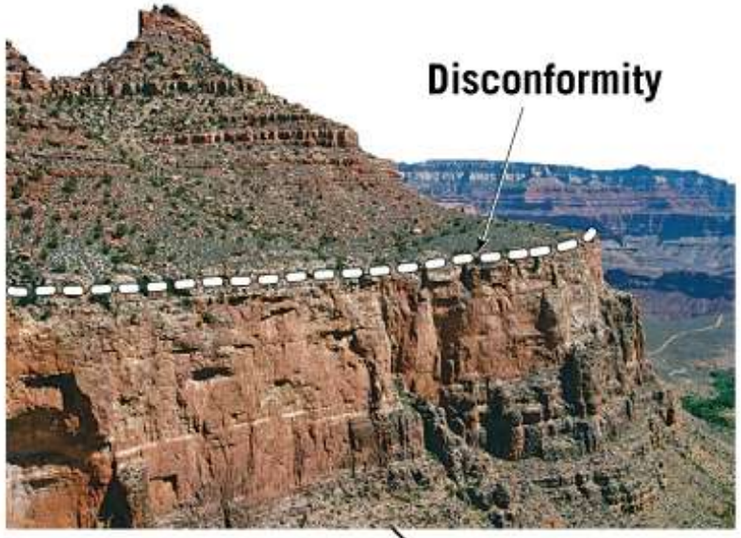
Q: Which type of unconformity is shown here?

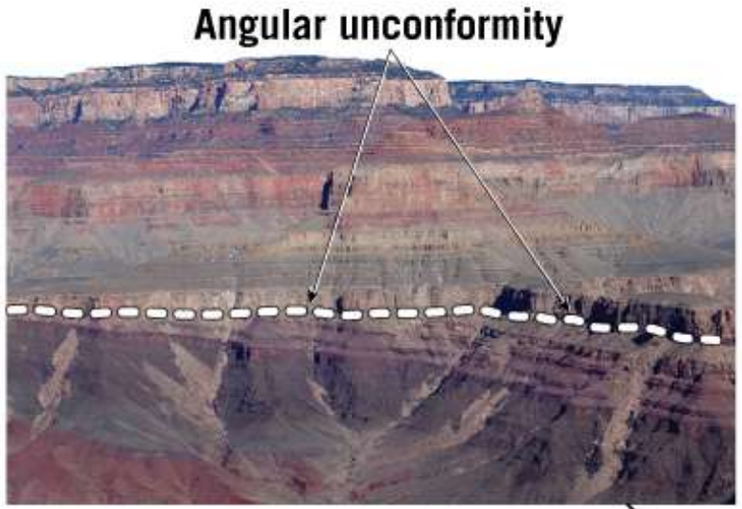
A: Nonconformity

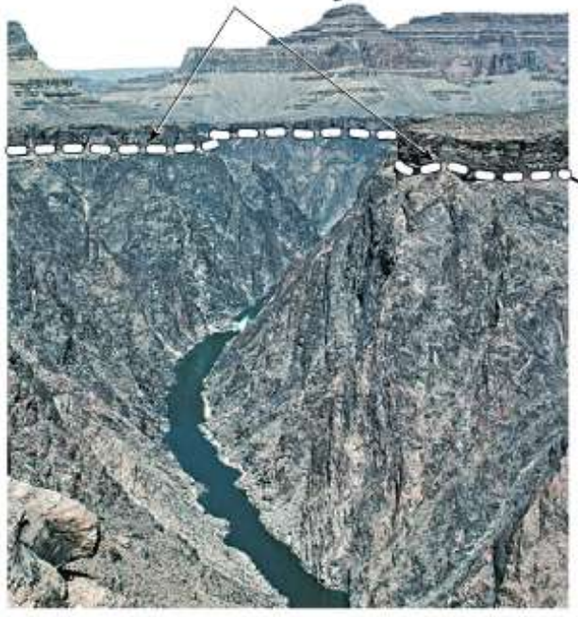


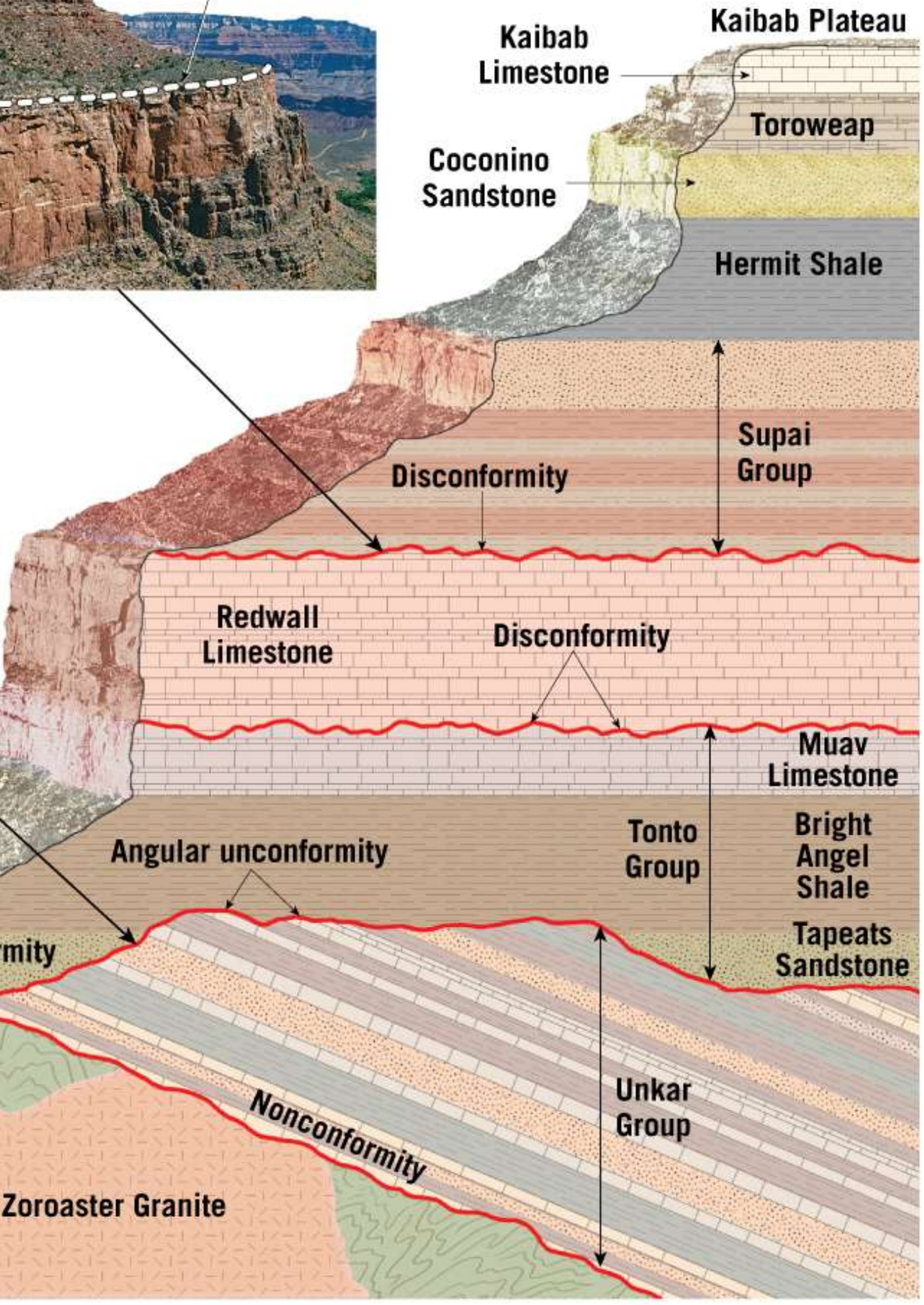
Unconformities

Unconformities







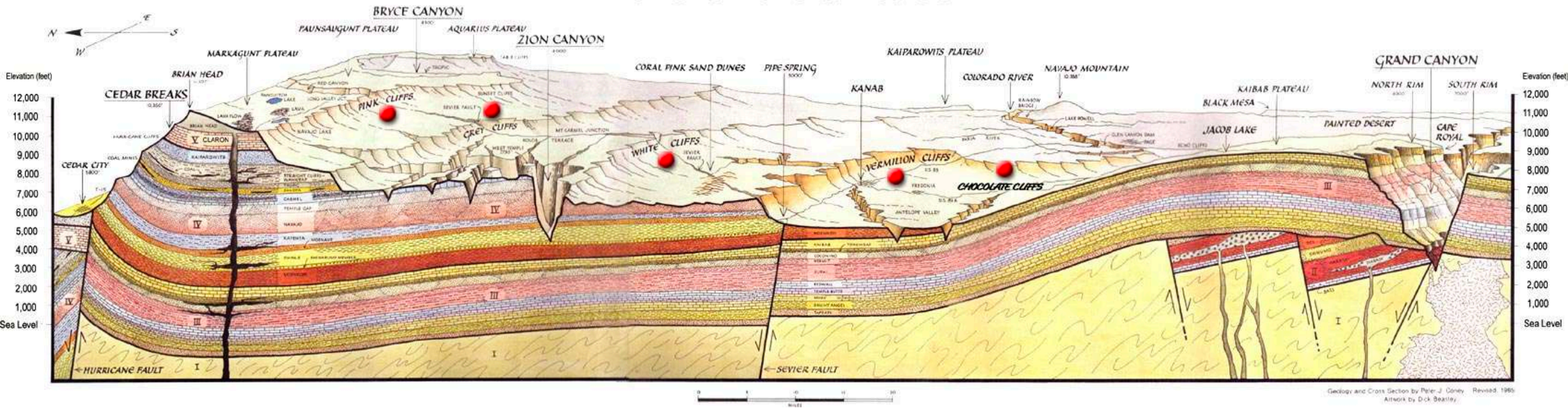


© 2017 Pearson Education, Inc.

Correlation

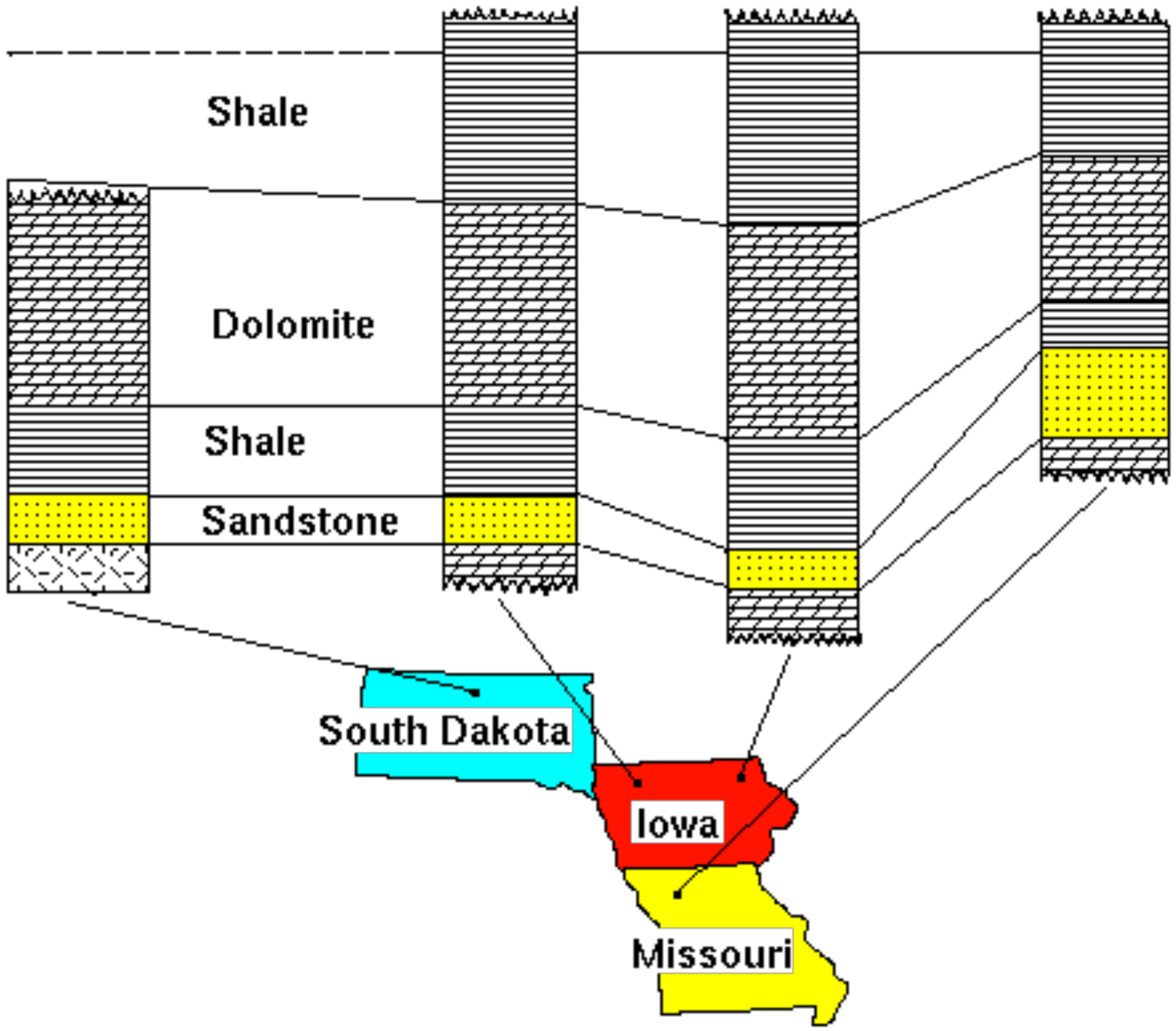
- Rocks can be correlated over long distances
- Rocks that make up the Grand Canyon are still buried beneath Zion and Bryce Canyons

The Grand Staircase



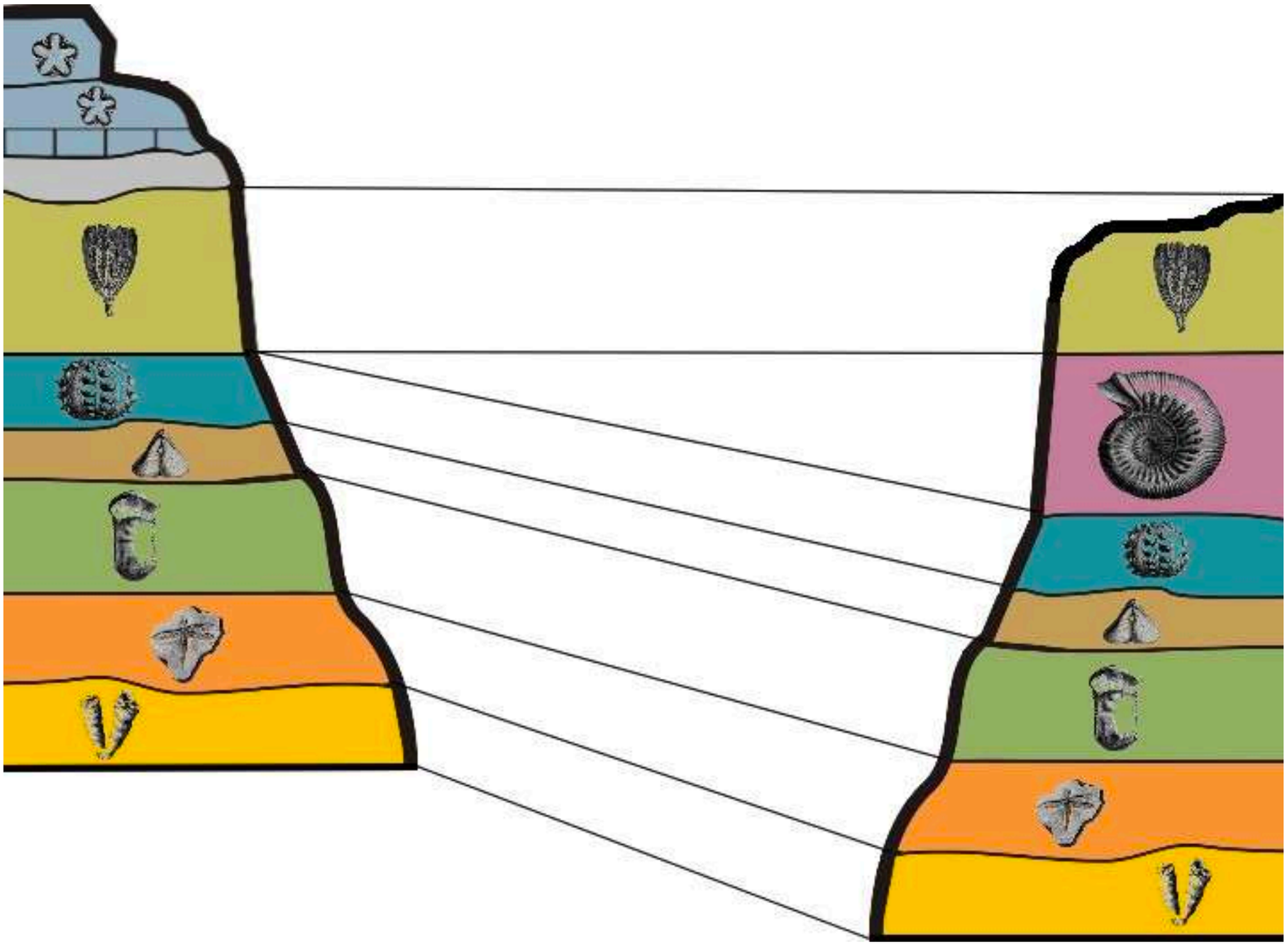
Correlation

Rocks can be correlated over long distances



Correlation

Rocks can be correlated with fossils



Correlation

Fossil assemblages can also be used