Module 22A
Geological Laws

GEOLOGIC LAWS

Geologic Laws

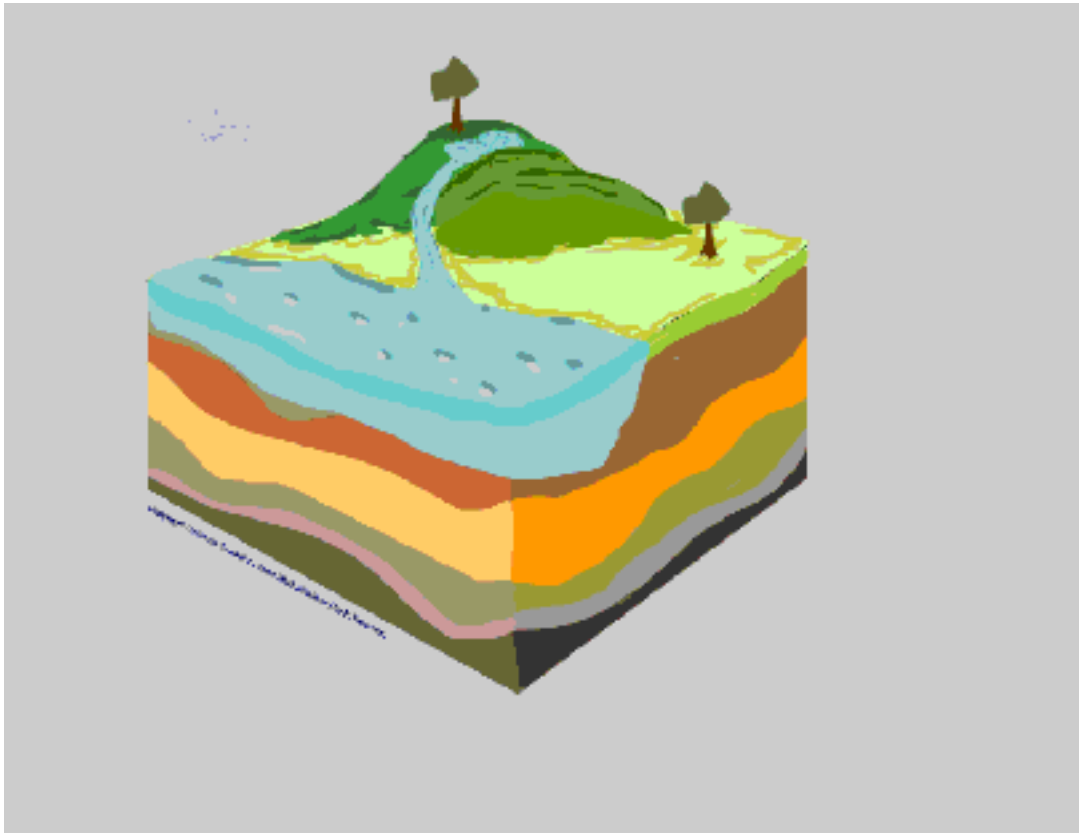
- Superposition
- Original Horizontality
- Original Continuity
- Uniformitarianism
- Cross-cutting Relationship
- Inclusions
- Faunal Succession

Missing strata

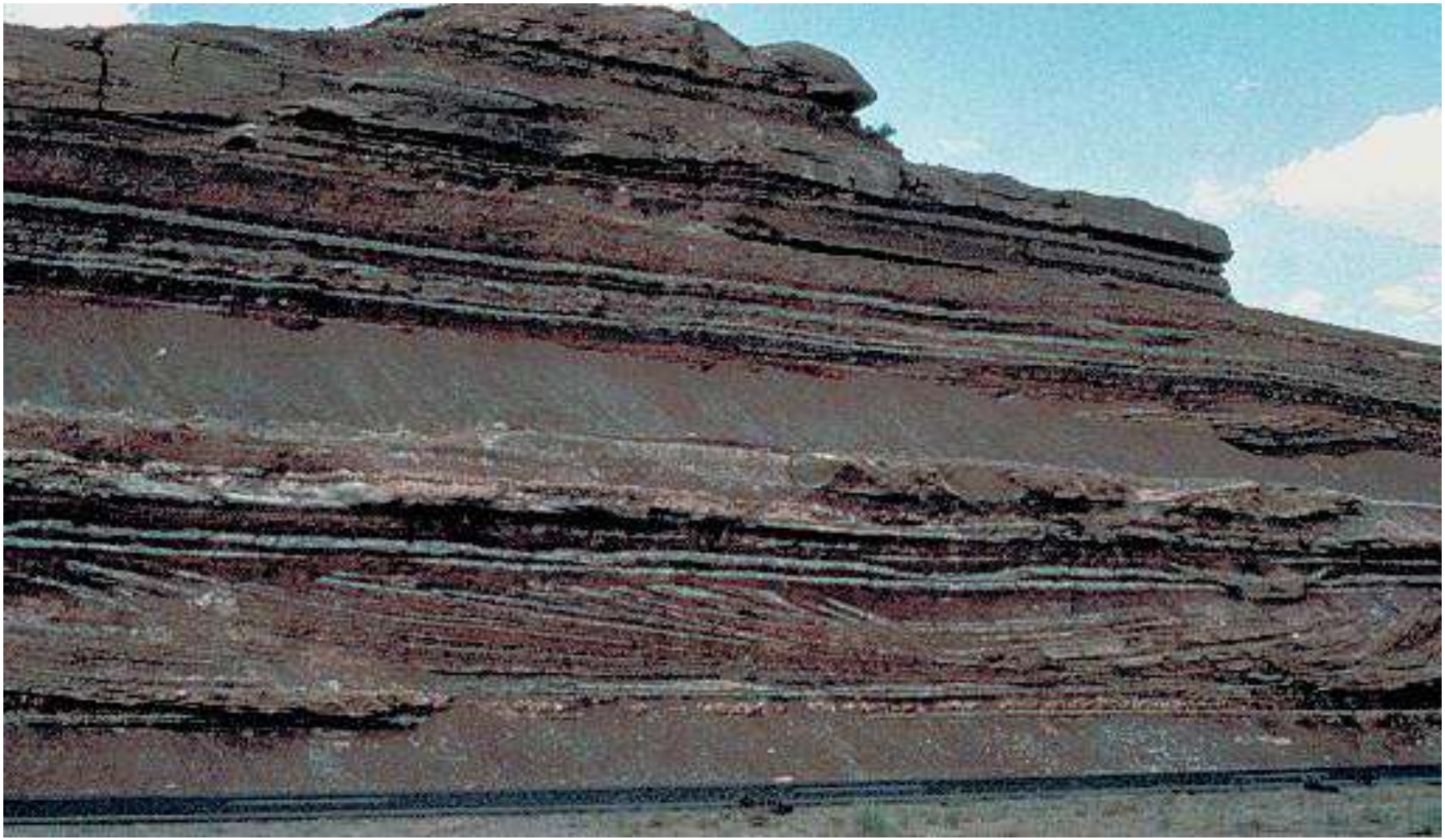
- Unconformity
- Correlation

Law of Superposition

- In an undisturbed rock sequence, the bottom layer of rock is older than the layer above it, or
- The younger strata at the top in an undisturbed sequence of sedimentary rocks.



Law of Superposition



Undisturbed strata

Law of Superposition

Disturbed strata

Law of original horizontality

- **Sedimentary rocks are laid down in horizontal or nearly horizontal layers, or**
- **Sedimentary strata are laid down nearly horizontally and are essentially paralel to the surface upon which they acummulate**

Horizontal Layers of Sedimentary Rock

Law of Original Continuity

- **The original continuity of water-laid sedimentary strata is terminated only by pincing out againts the basin of deposition, at the time of their deposition**

Law of Original Continuity

Law of Original Continuity

B

Photo by Diane Carlson

Law of Original Continuity

NOTE:
This law is considerable oversimplification. The last discoveries indicate that the termination is not necessarily at a basin border. Facies changes may terminated a strata.

Uniformitarianism

- **James Hutton (1726-1797) Scottish geologist developed the laws of geology**
- **Uniformitarianism is a cornerstone of geology**
- **Considered the Father of Modern Geology**

Uniformitarianism

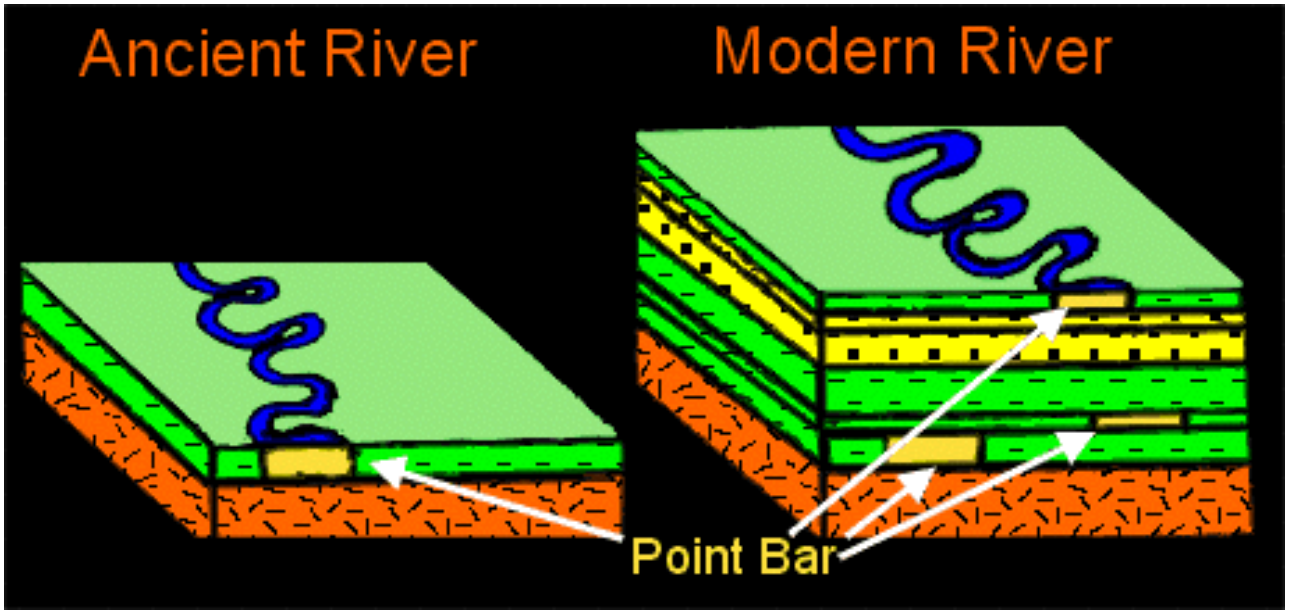
- ***Uniformitarianism*** **is based on the premise that:**
  - **the physical and chemical laws of nature have remained the same through time**
  - **present-day processes have operated throughout geologic time**
  - **rates and intensities of geologic processes, and their results may have changed with time**
- **To interpret geologic events from evidence preserved in rocks**
  - **we must first understand present-day processes and their results**

Uniformitarianism is a cornerstone of geology

Uniformitarianism

MODIFIED STATEMENT

"The present is the key to the past"



- **The processes (plate tectonics, mountain building, erosion) we see today are believed to have been occurring since the Earth was formed.**

Uniformitarianism

The uniformitarianism states that processes which operate at present also operated in the past, and produces the same results.

These processes need not have operated at the same rate, nor at the same intensity.

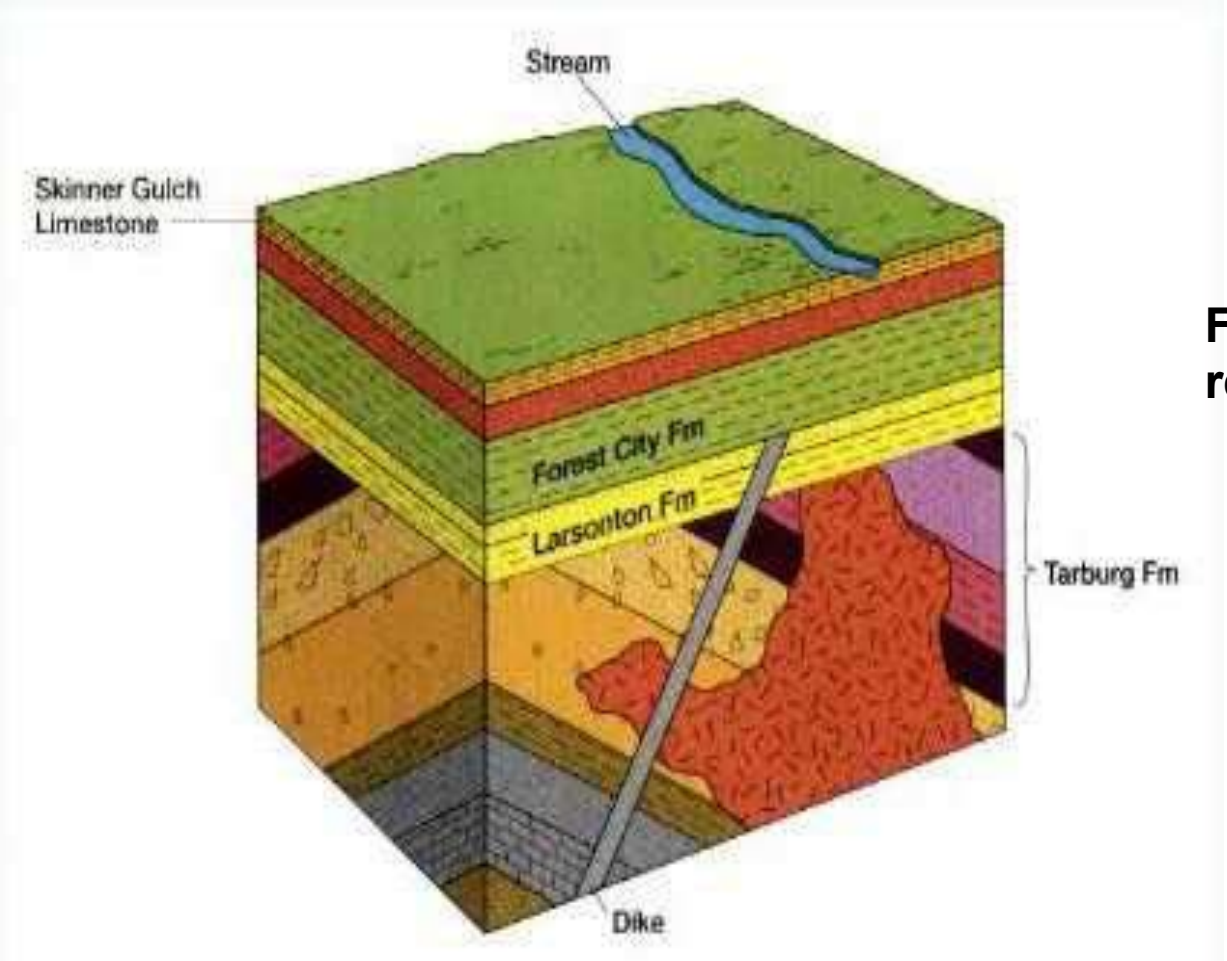
Saying *"The present is the key to the past",* which is commonly offered as a 'definition' of uniformitarianisme, is considerable oversimplification.

The degree of correlation between ancient and modern processes decreases as the time interval increases, e.g. in eras prior to the emergence of land vegetation, weathering and erosion must have been different in character and intensity compared with today

Whitten, DGA and Brooks, JRV. 1977. *The Penguin Dictionary of Geology*. Middlesex: Penguin Books. p. 466.

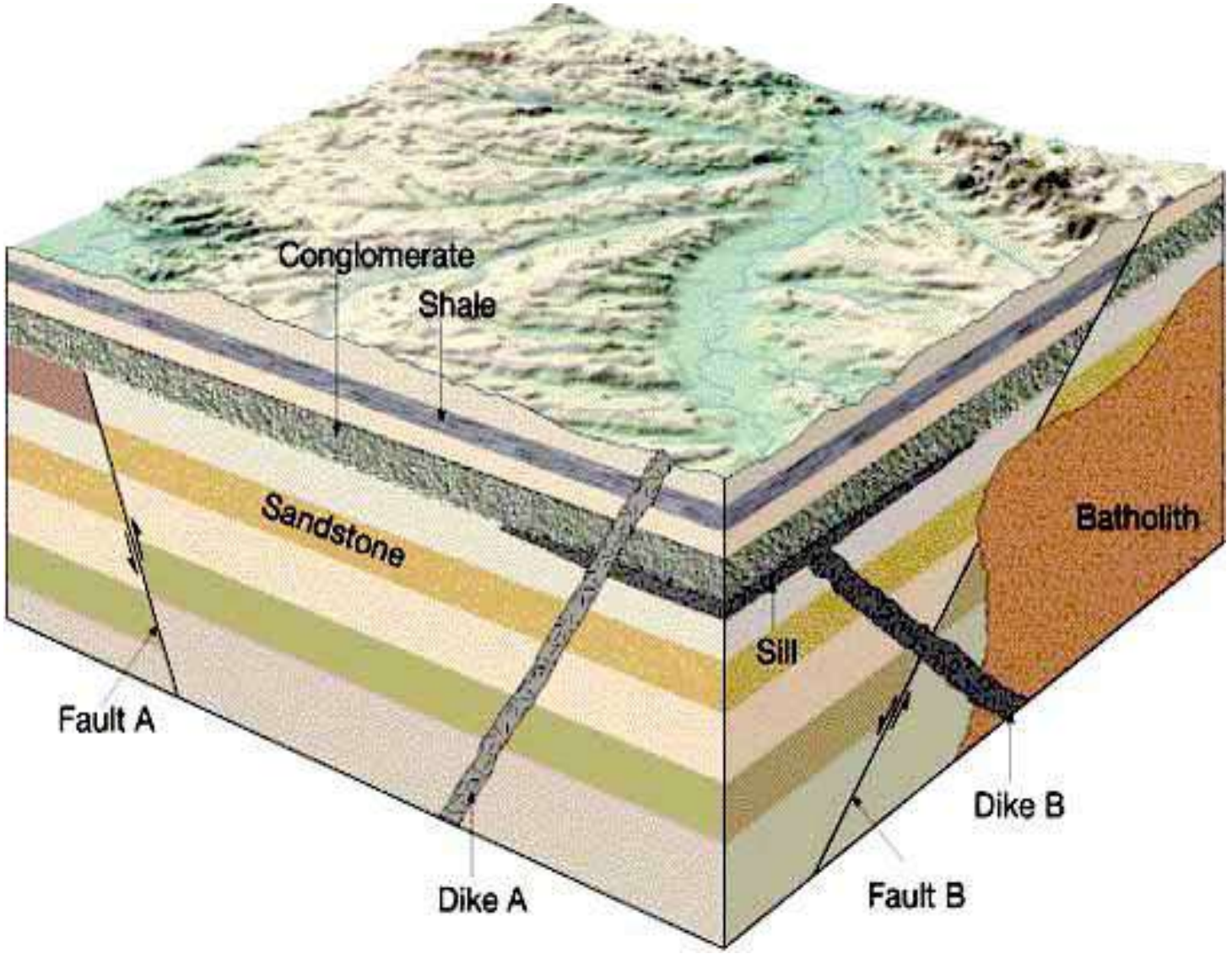
Law of Cross-cutting Relationship

- **The thing doing the cutting is younger than the thing being cut.**



Find out the cross-cutting relationship!

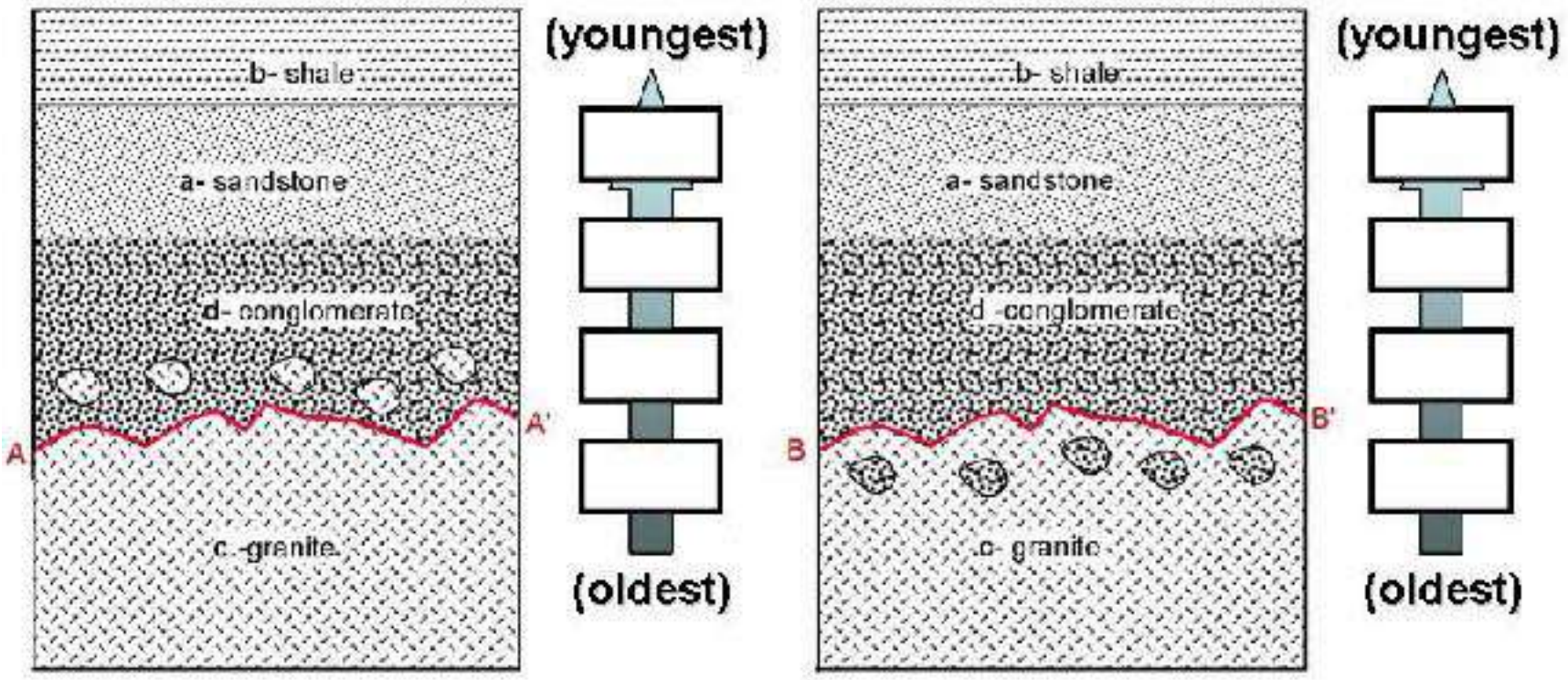
Law of Cross-cutting Relationship



How many cross-cutting relationships are there?

Law of Inclusions

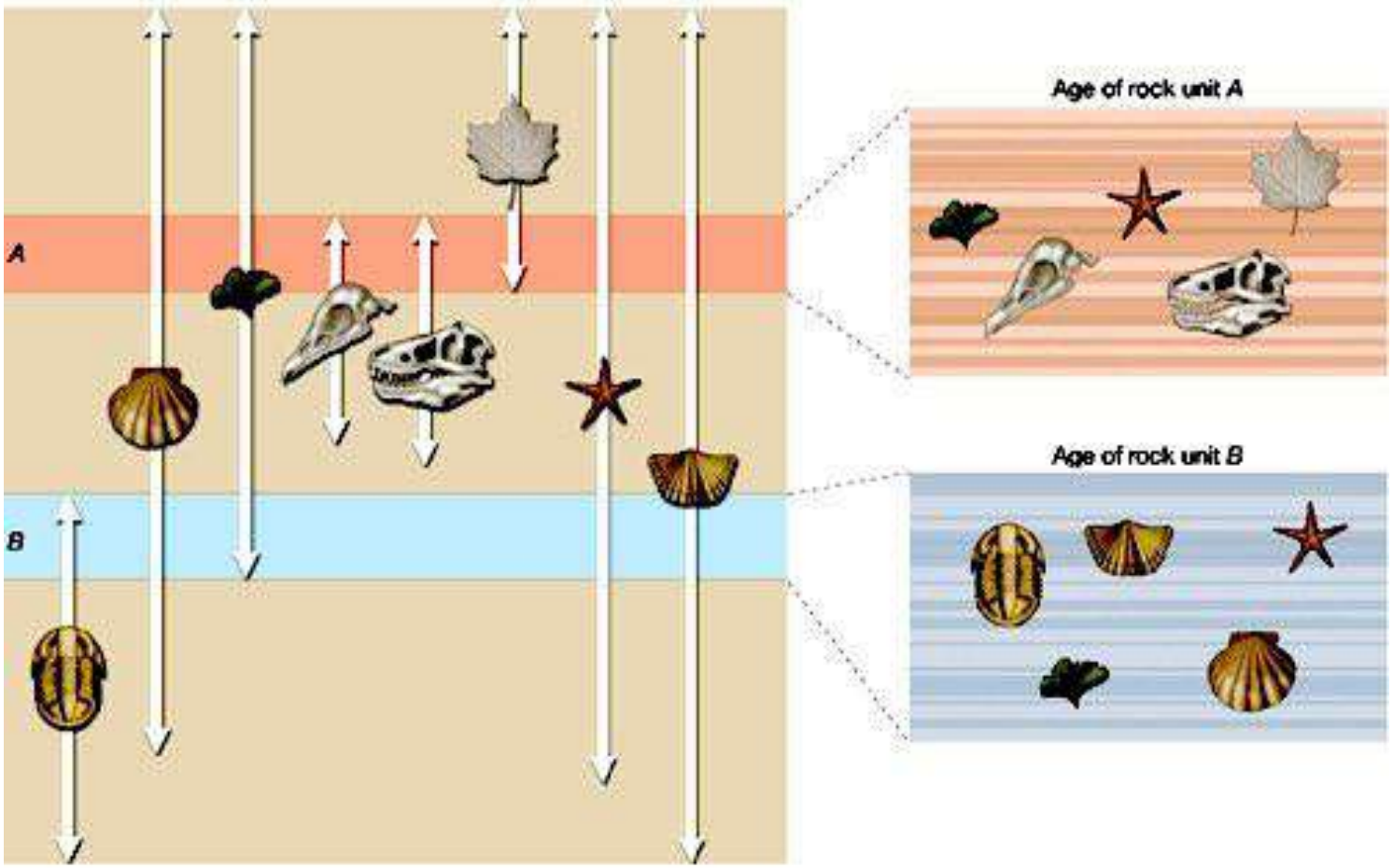
❑ **The included rock is older than the rock around it**



1. State the principle of inclusions
2. In the above diagrams list the strata, their order of occurrence from oldest to youngest
3. What is the nature of the contact A-A'?
4. What is the nature of the contact B-B'?

Law of Faunal Succession

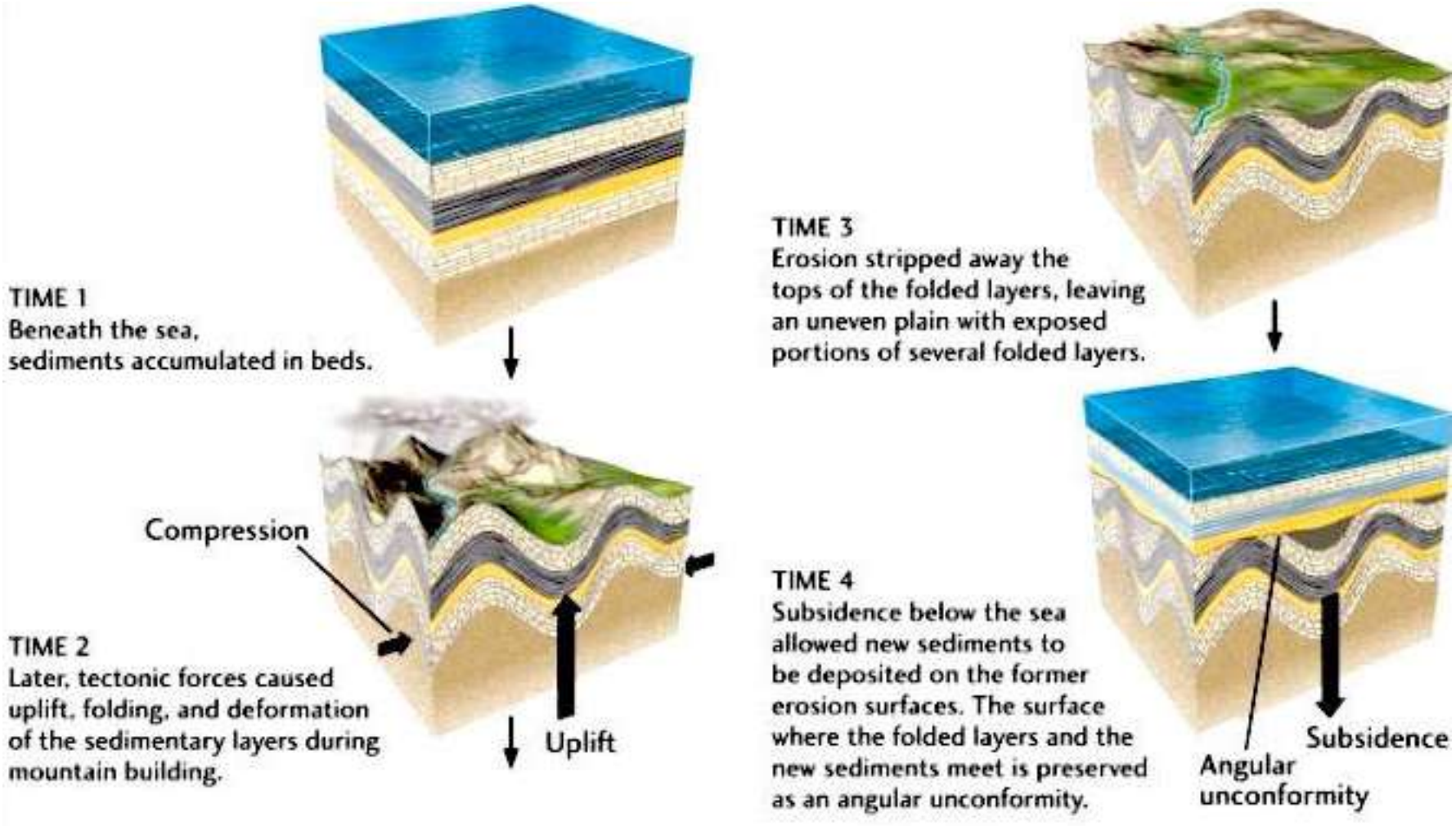
- **Fossils occur in a definite, invariable sequence in the geologic record.**



Unconformity and Conformity

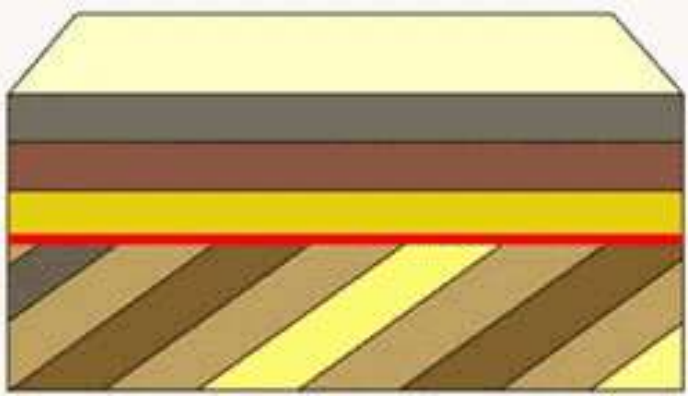
Unconformity

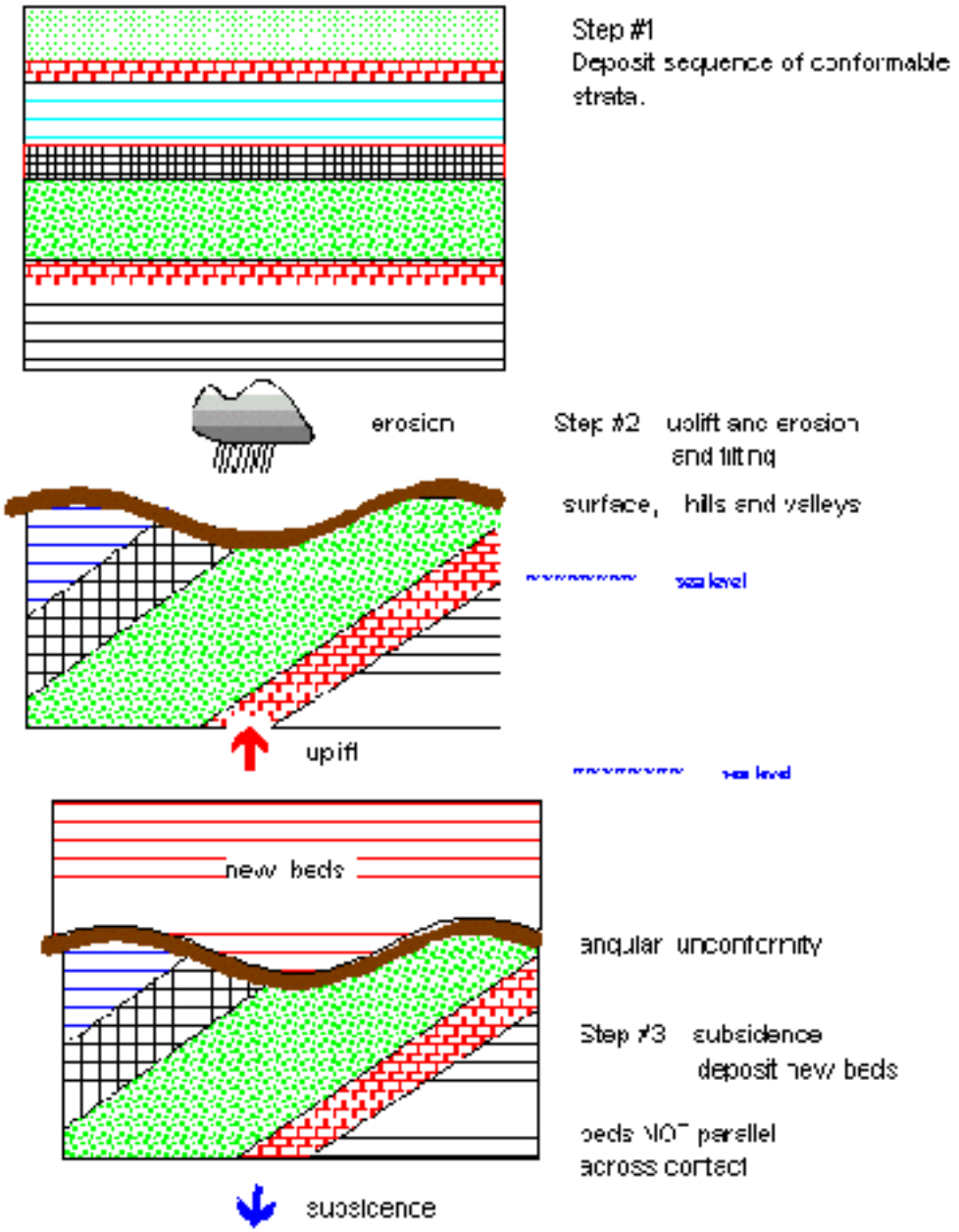
- Gaps in the rock record caused by weathering, erosion, and volcanic action.



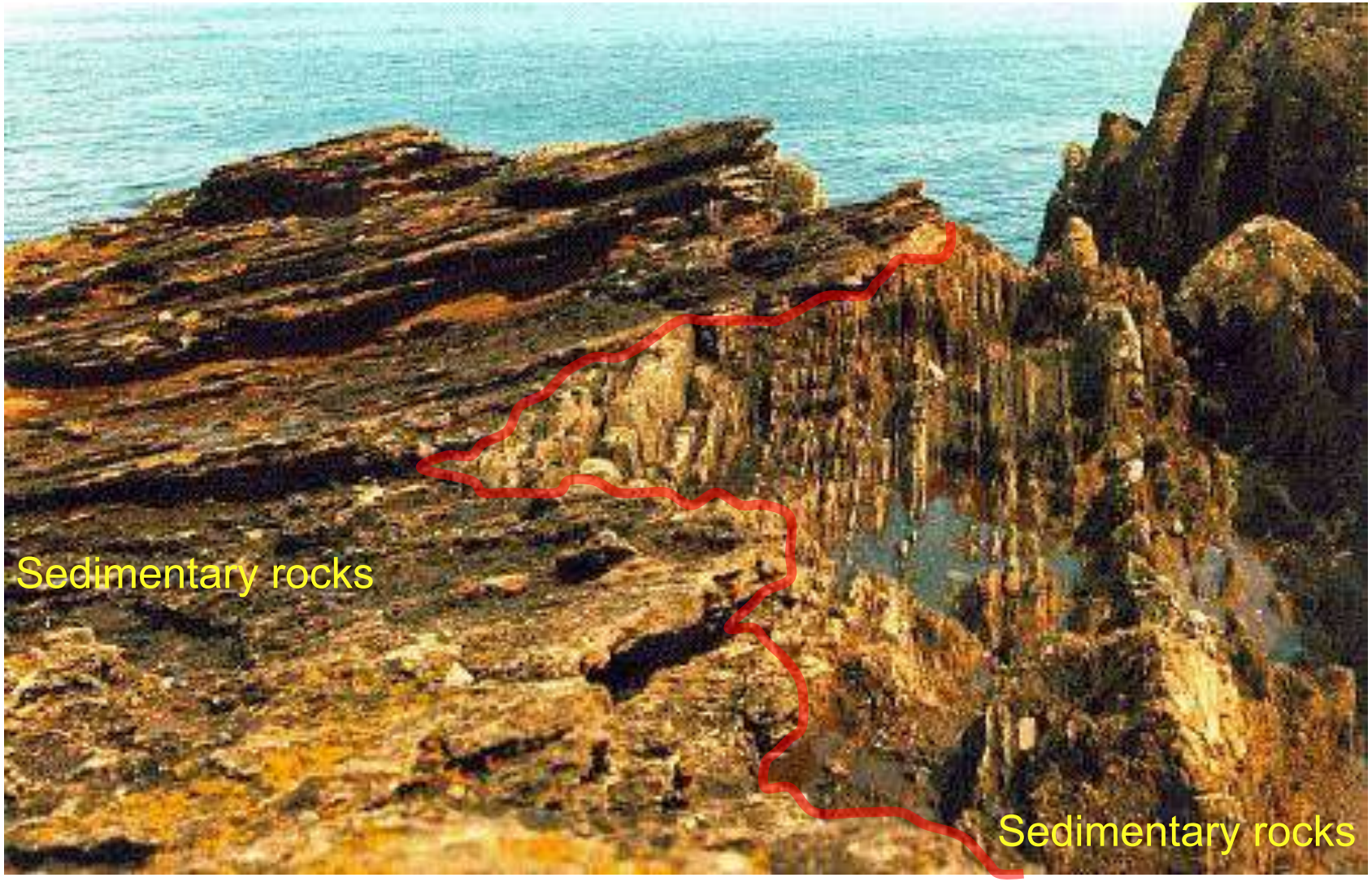
Unconformity: angular unconformity

Development of angular unconformity





Unconformity: angular unconformity



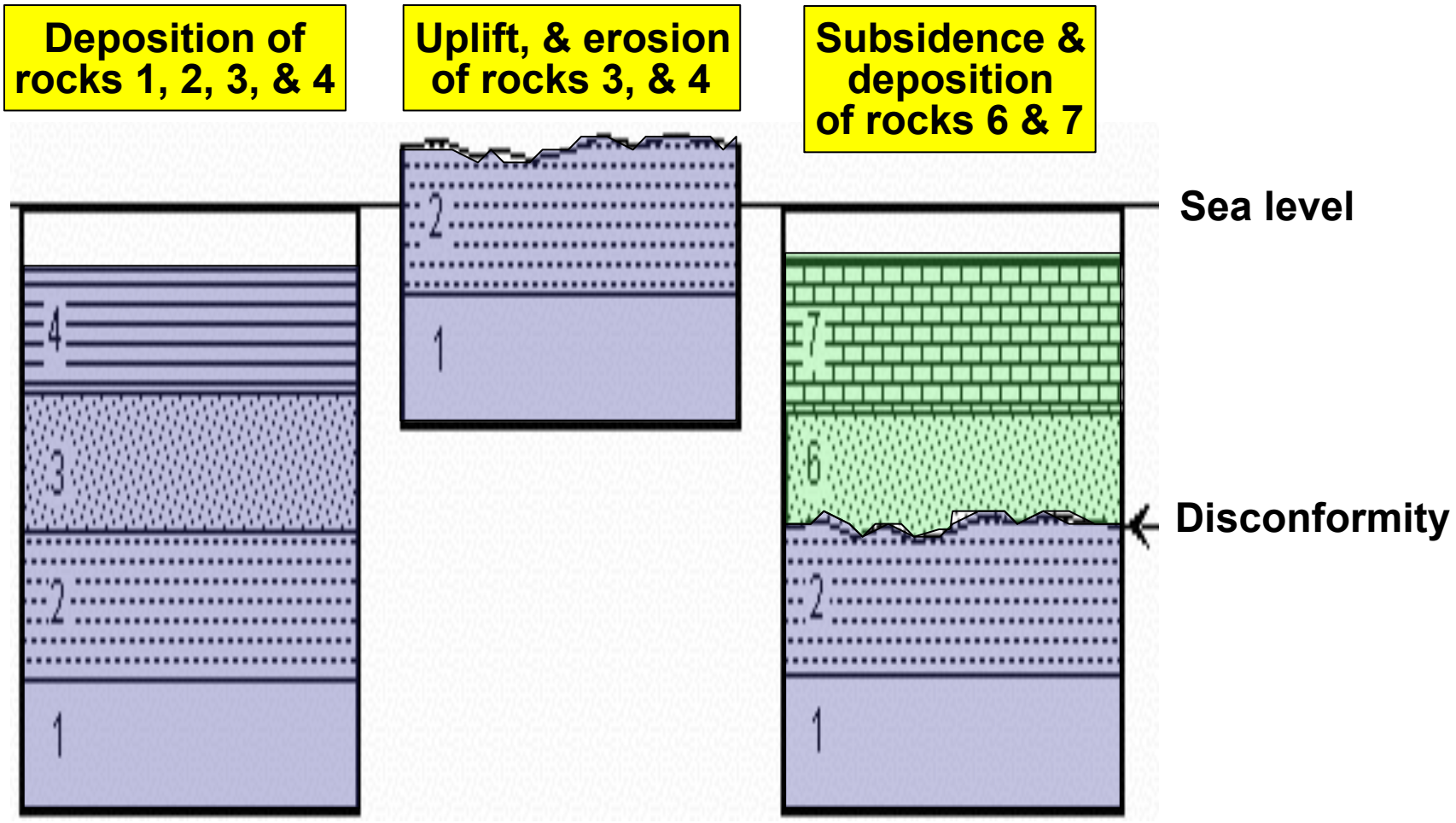
Unconformity: angular unconformity

E

Photo by C. C. Plummer

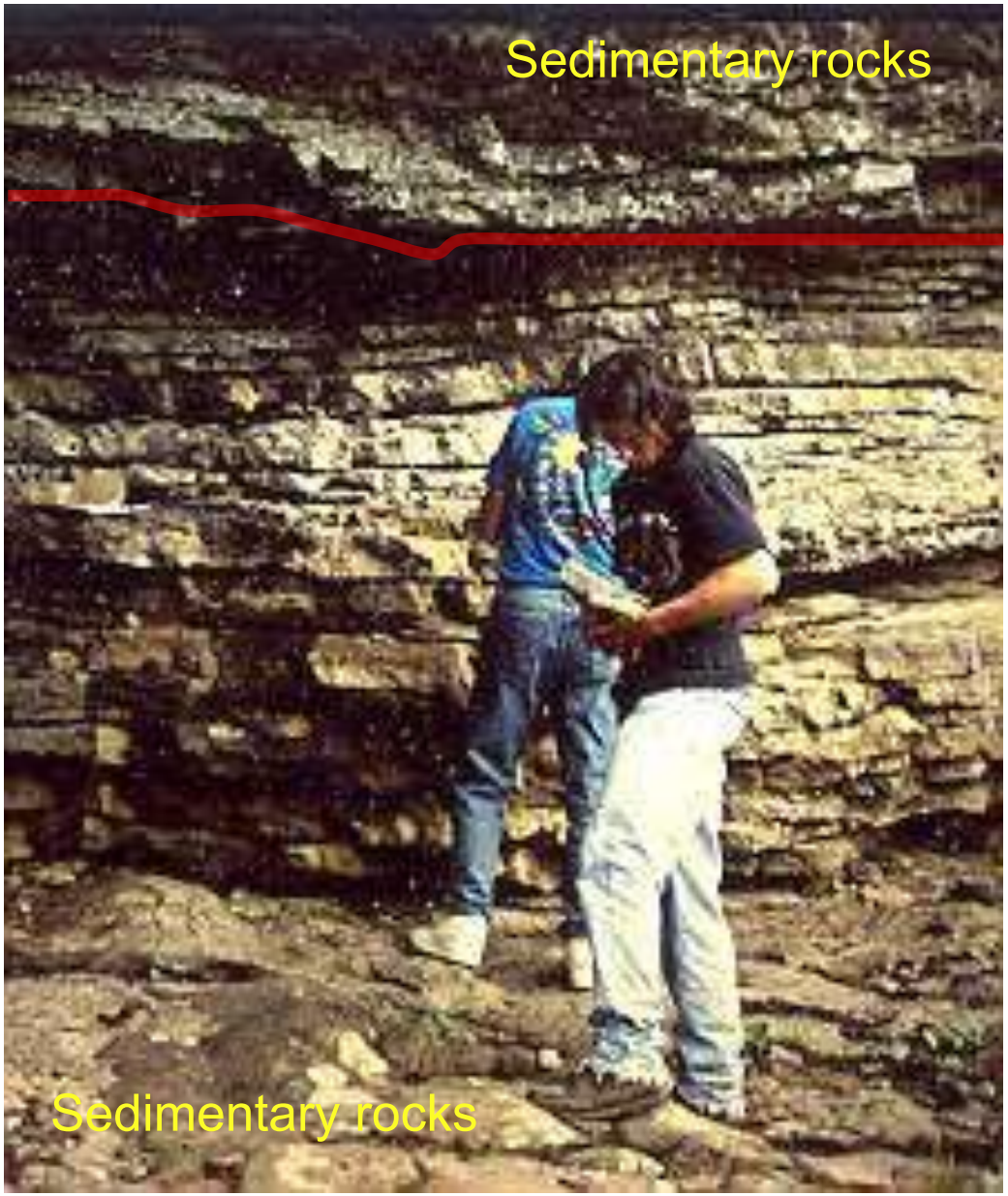
Unconformity: disconformity

Development of a disconformity



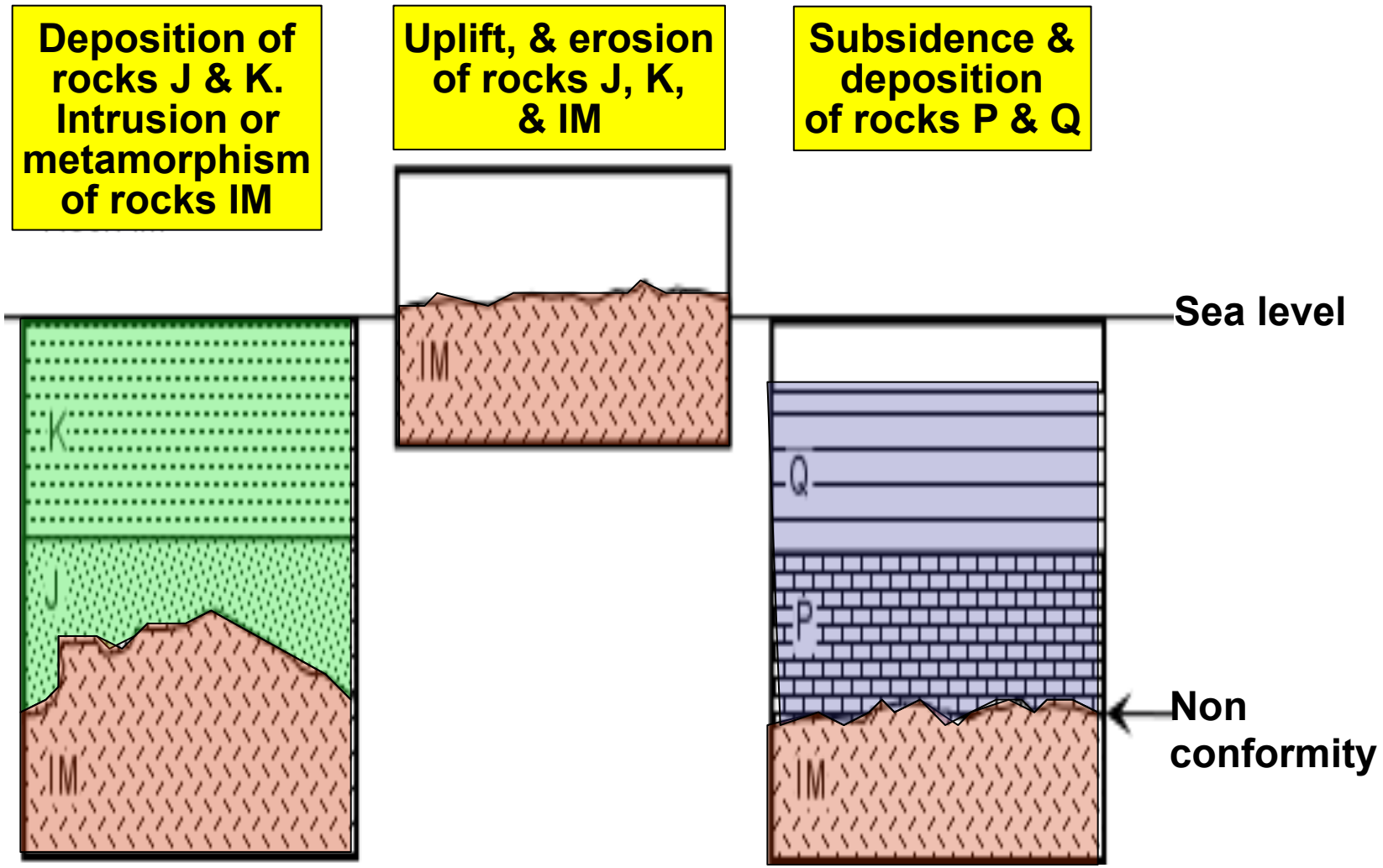
Unconformity: disconformity

Disconformity



Unconformity: Nonconformity

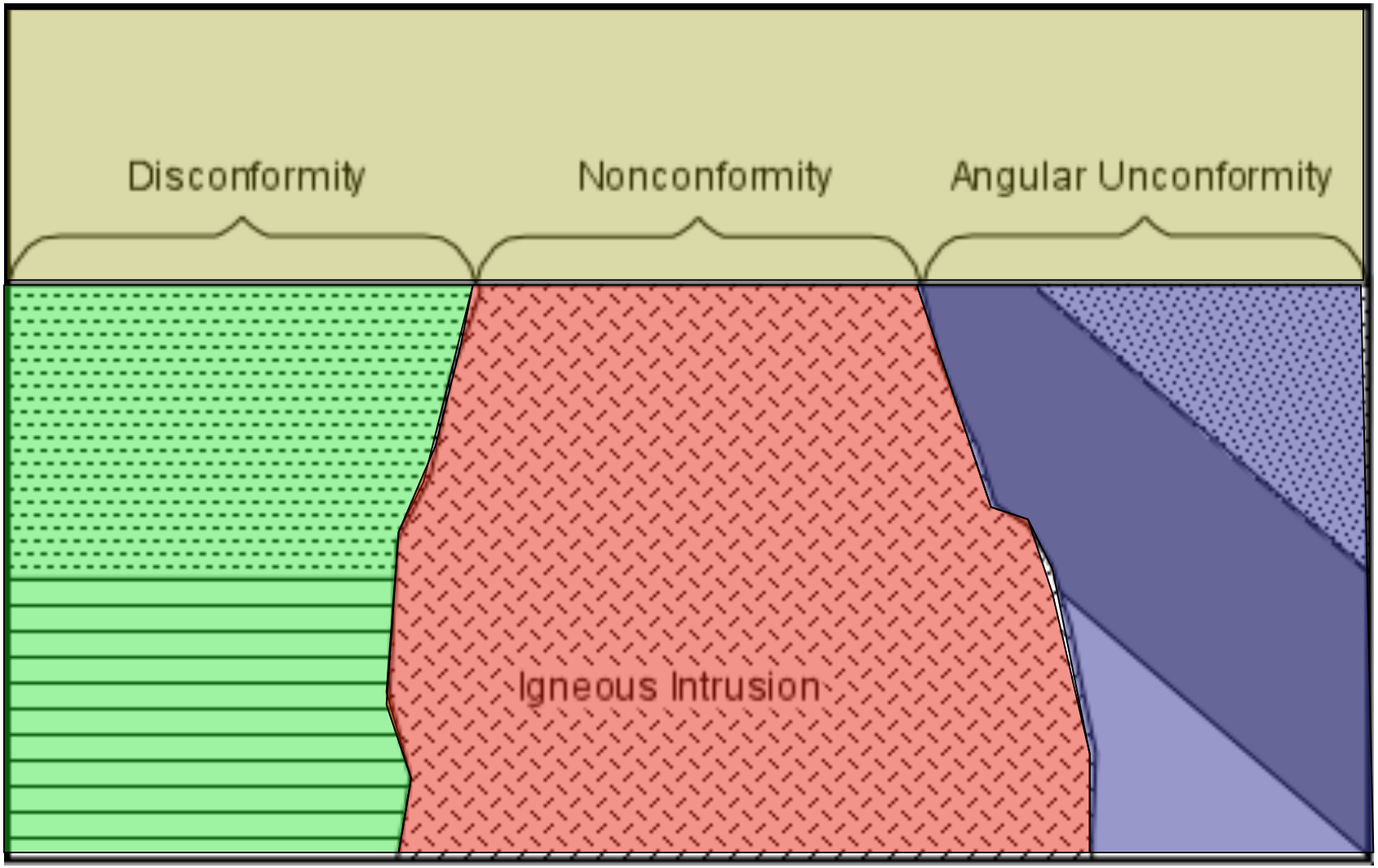
Development of a nonconformity



Unconformity: Nonconformity

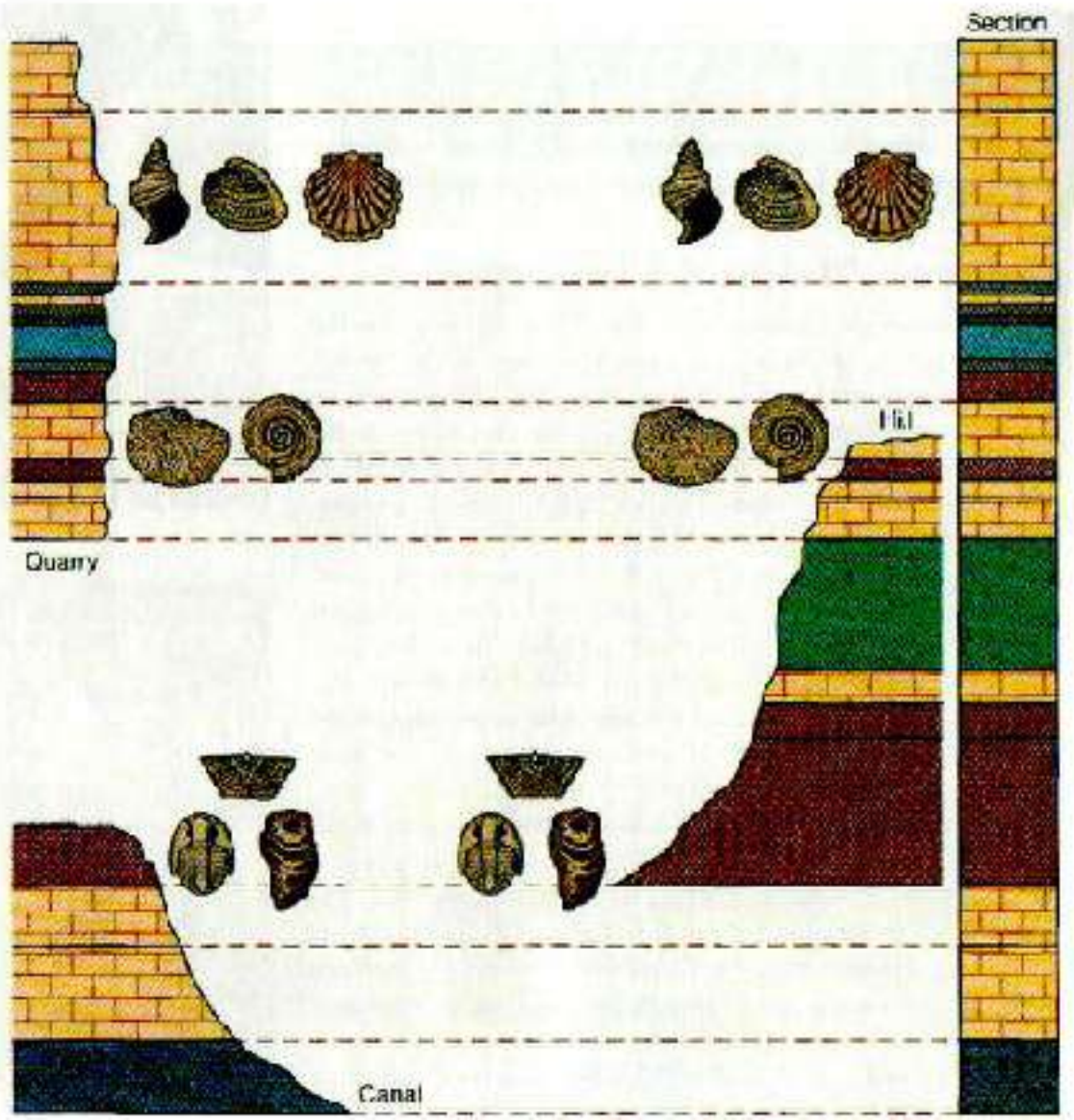
Nonconformity

Unconformity



Correlation

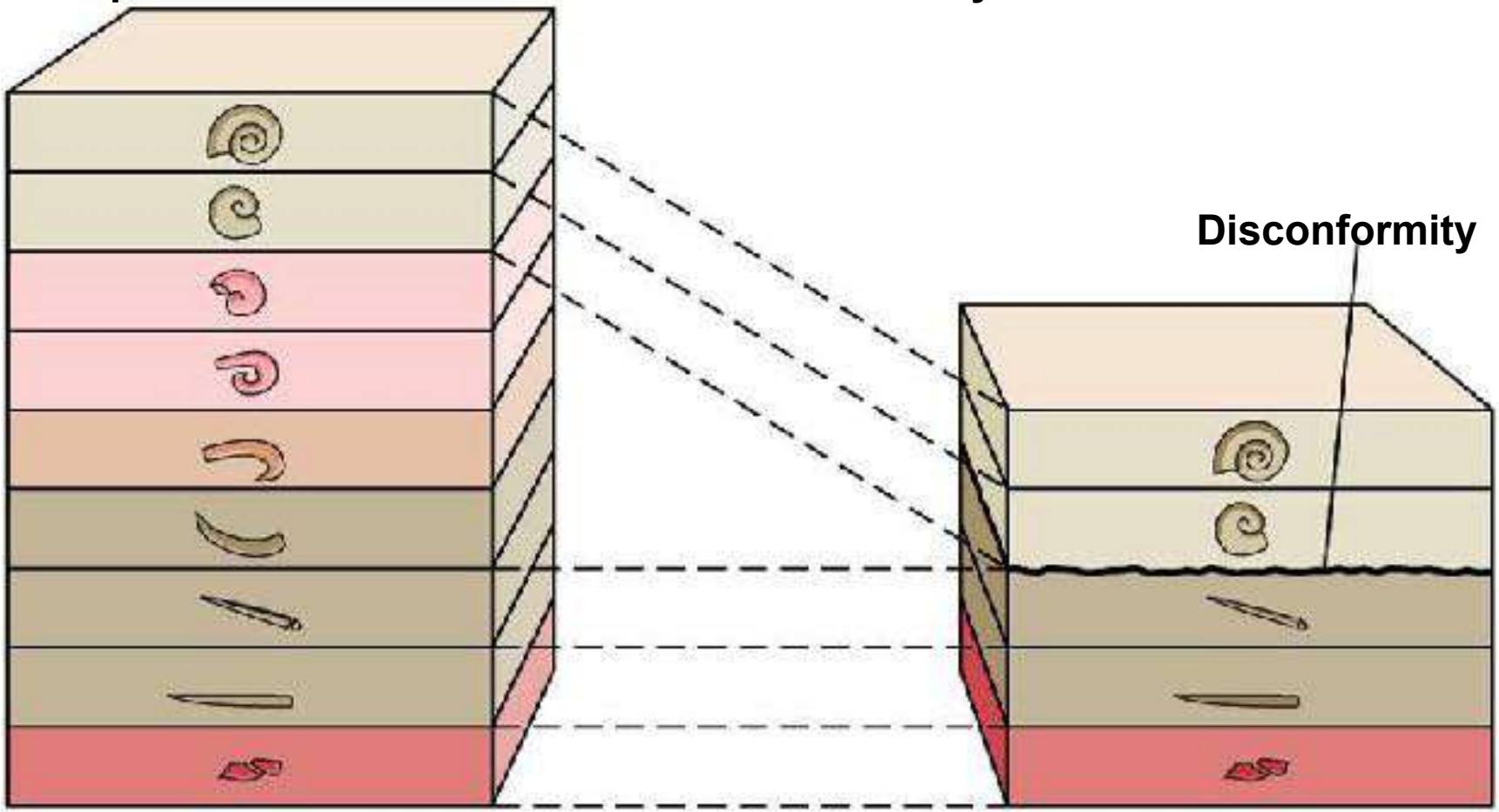
- The matching of rock outcrops of one region to those of another region.
- Geologists use fossils, unique rocks, or mineral features to match the layers.



Correlation

Sequence of sedimentary rock with complete record of deposition

Sequence shows a break in the record as indicated by correlatable fossils



Dashed lines indicate correlation of rock units between the two areas

Correlation