

Stratigraphy



- Stratigraphy deals with the study of any layered (stratified) rock, but primarily with sedimentary rocks and their
 - ✦ **composition**
 - ✦ **origin**
 - ✦ **age relationships**
 - ✦ **geographic extent**

Stratified Sedimentary Rocks



Commonly used Terms in Stratigraphy



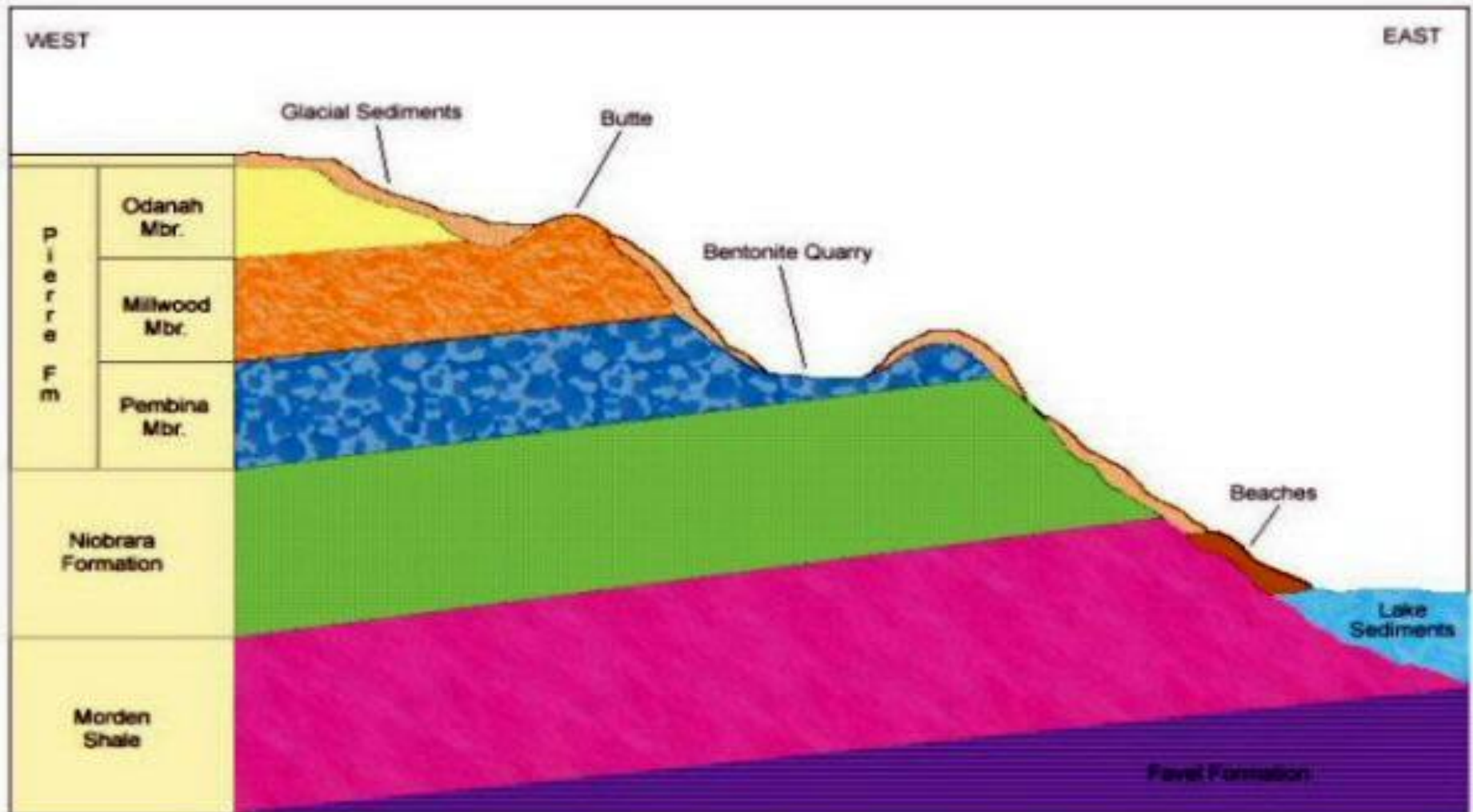
- Formation
- Member
- Bed
- Group
- Lithology
- Sedimentary Facies

Formations



- Formations are the basic building block of lithostratigraphy, in effect the unit that can be mapped in the field
- They are defined as any unit that can be recognized according to its lithologic character
- Over short distances, lithologic formations can commonly be correlated between stratigraphic sections
- Distinctive units that occur over wide distances, such as volcanic ash beds, provide particularly useful correlations

Formation



A cross section of the Manitoba Escarpment showing the rock formation composing it.



Subdivisions of Formations:

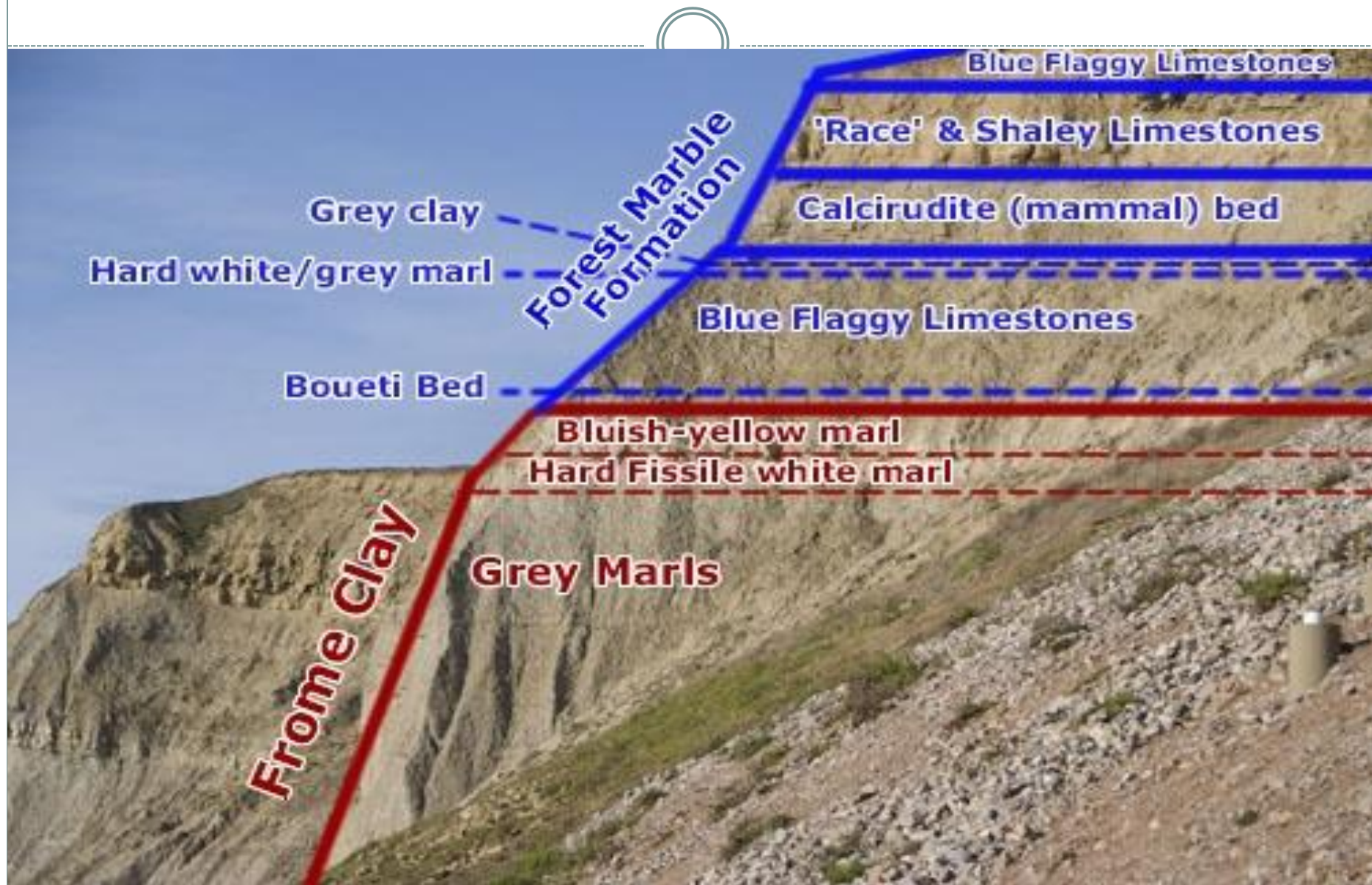
- **Member** - rock unit that have a limited lateral extent and are consistently related to one formation
- **Bed** - if the bed has particularly distinctive lithology, fossil content or chemistry it may be given a name within the formation

Member



ERA	PERIOD	SOUTHWEST MANITOBA			
MESOZOIC	CRETACEOUS				
		Boissevain Formation			
		Pierre Shale	Coulter Member		
			Odanah Member		
			Millwood Member		
			Pembina Member		
			Gammon Ferruginous Member		
		Carille Formation	Boyne Member		
			Morden Member		
		Favel Formation	Assiniboine Member		
			Keld Member		
		Ashville Formation	upper	Belle Fourche Member	
				Fish Scale Zone	
			lower	Base of Fish Scale marker	
				Westgate Member	
				Newcastle Member	
		Skull Creek Member			
		Swan River Formation			

Beds





- **Groups** – are related formations
- **Lithology** - field characteristics of a rock, description of rock composition (what it is made of) and texture
- **Sedimentary Facies:** Lithology or group of lithologies characterizing by a specific set of depositional conditions or environment.

Principles of Stratigraphy



- Principle of Original Horizontality
- Principle of Superposition
- Principle of Lateral Continuity
- Principle of Uniformitarianism
- Principle of Cross-Cutting Relationship
- Principle of Faunal Succession
- Principle of Inclusions
- Principle of Intrusions

Principle of Original Horizontality



- Proposed by the Danish geological pioneer Nicholas Steno (1638–1686)
- This principle states that layers of sediment are originally deposited horizontally under the action of gravity
- The principle is important to the analysis of folded and tilted strata

Principle of Original Horizontality

SAND

GRAVEL

CLAY

LIMESTONE

Lake water

Silt settling through
the water

Youngest layer of silt

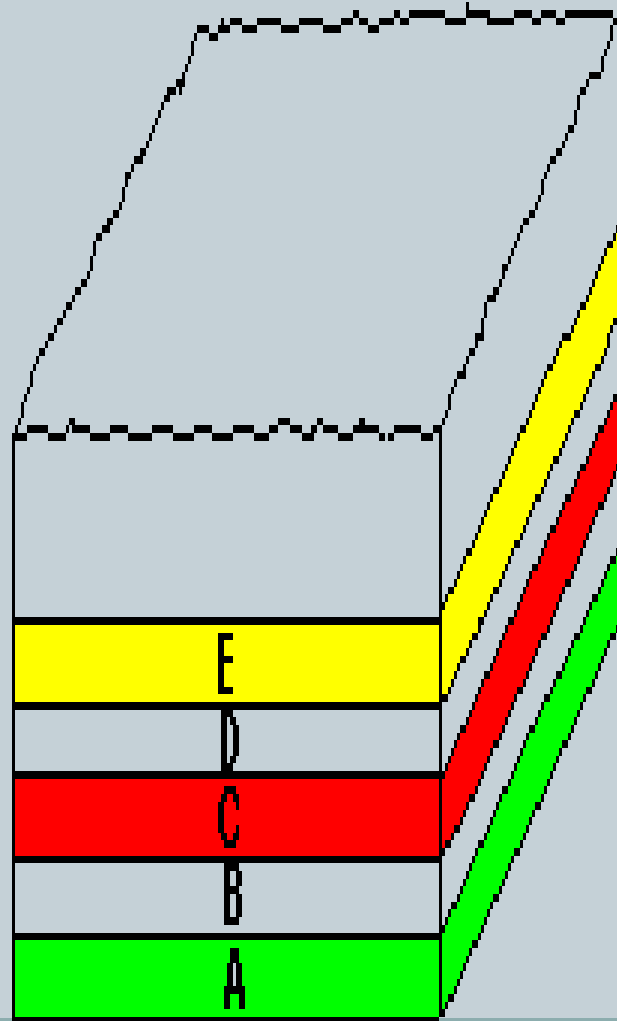
Oldest layer of silt

Principle of Superposition



- Sedimentary layers are deposited in a time sequence, with the oldest on the bottom and the youngest on the top
- The law was formulated in the 17th century by the Danish scientist Nicolas Steno

Principle of Superposition

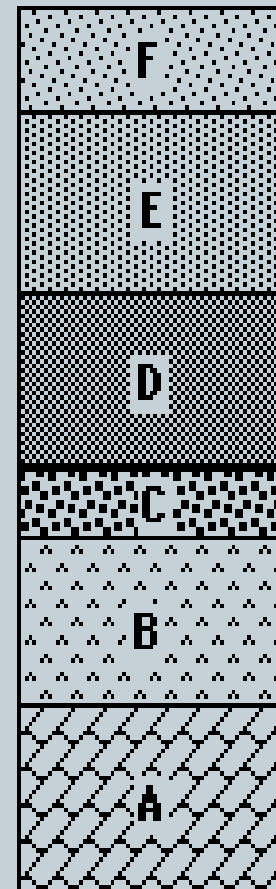


← Youngest layer

← Oldest layer

Stratigraphic Column

↑ Younger
↓ Older



Recent Beach Sand

Pleistocene
Beach Sand

Mudstone

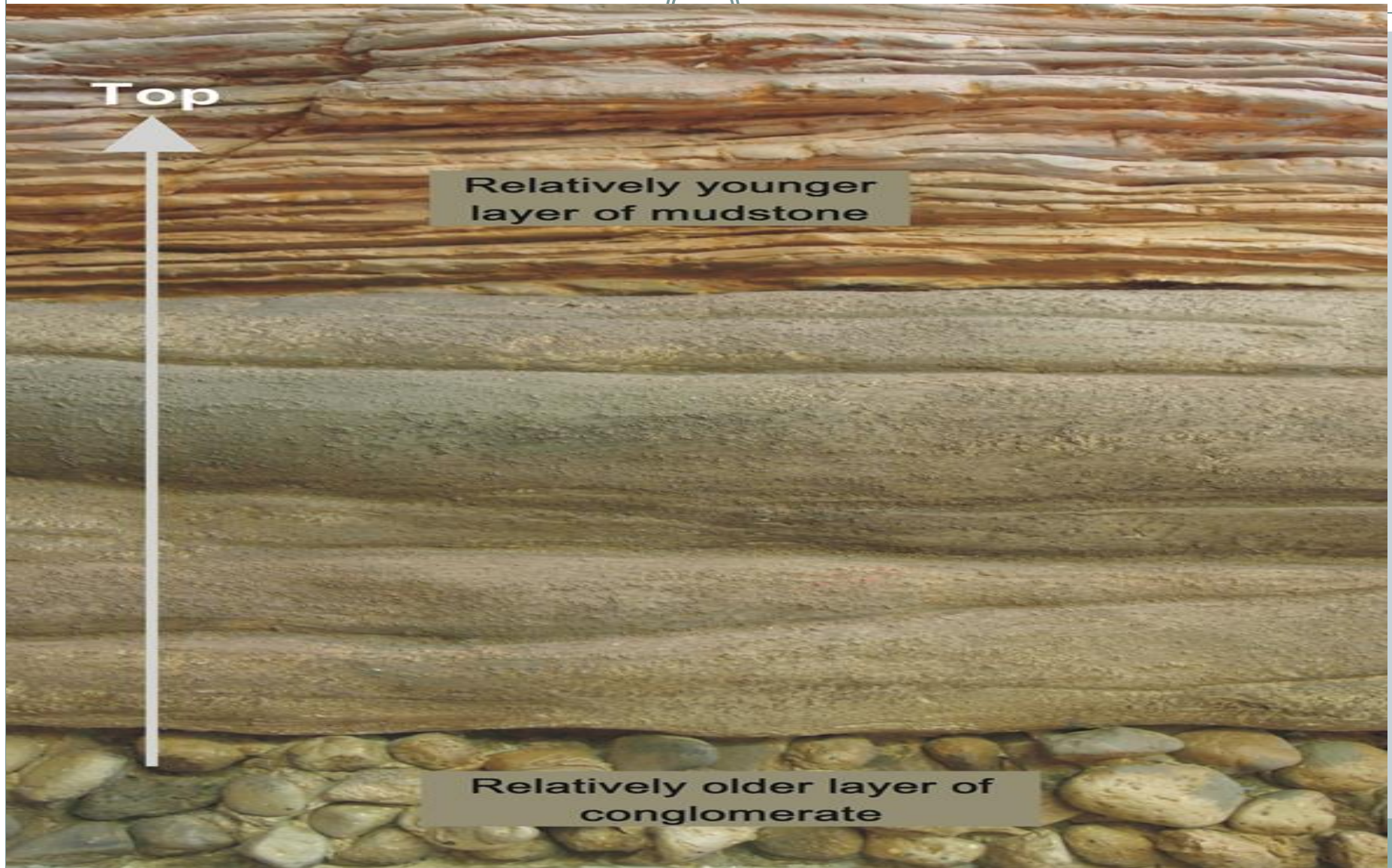
Basalt

Limestone

Dolomite

Layer F (younger) is vertically superior to Layer E (older).

Principle of Superposition



Principle of Lateral Continuity



- States that layers of sediment initially extend laterally in all directions
- In other words, they are laterally continuous.
- As a result, rocks that are otherwise similar, but are now separated by a valley or other erosional feature, can be assumed to be originally continuous.

a bed will extend laterally until:

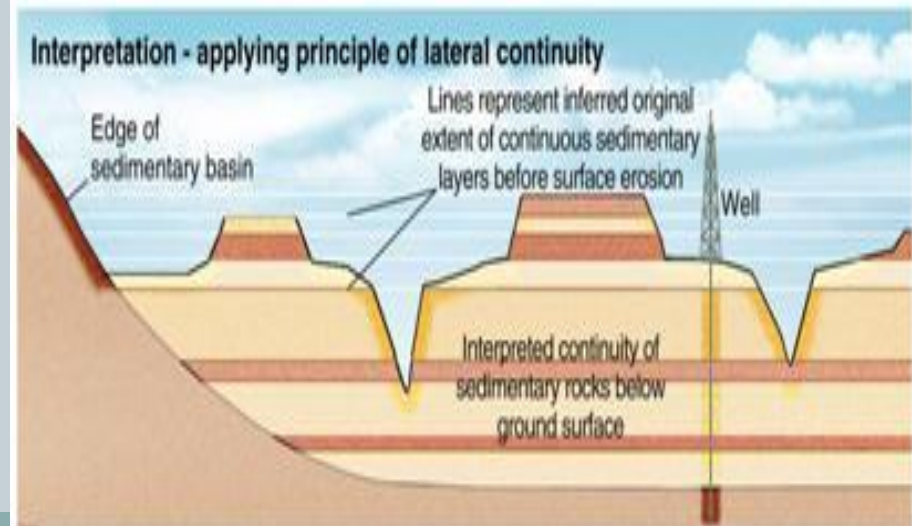
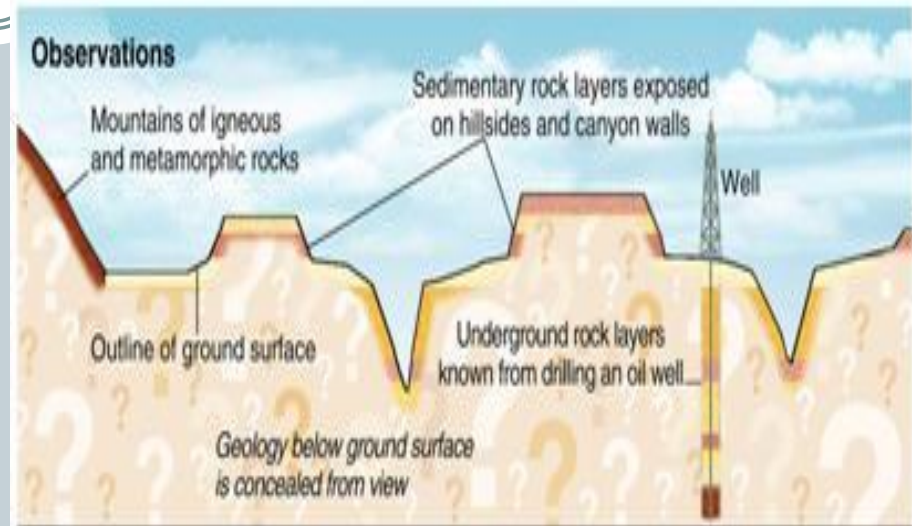
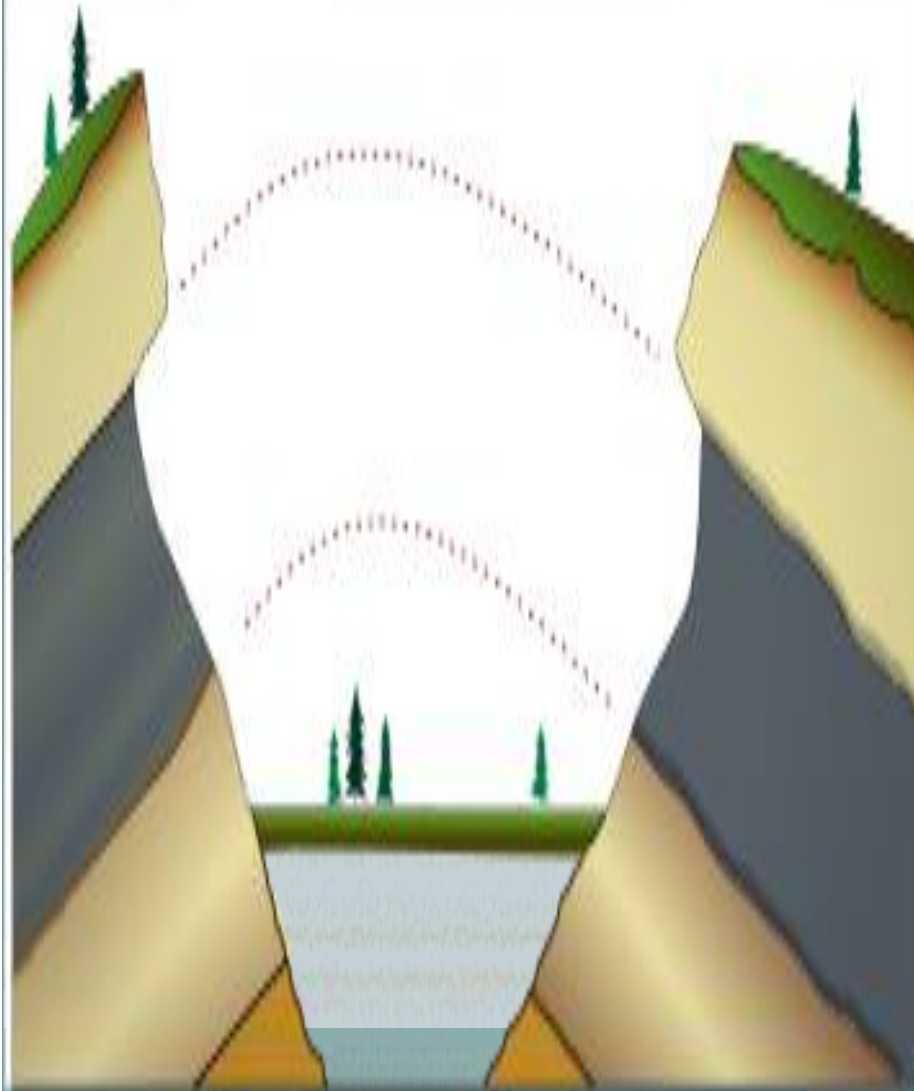
Pinches out.

Abuts against older rock.

Truncated by erosion.

Cut by fault.

Principle of Lateral Continuity



Principle of Uniformitarianism



- Uniformitarianism is the assumption that the same natural laws and processes that operate in the universe now have always operated in the universe in the past and apply everywhere in the universe.
- “The present is the key to the past”
- Uniformitarianism has been a key principle of geology and virtually all fields of science

Principle of Uniformitarianism

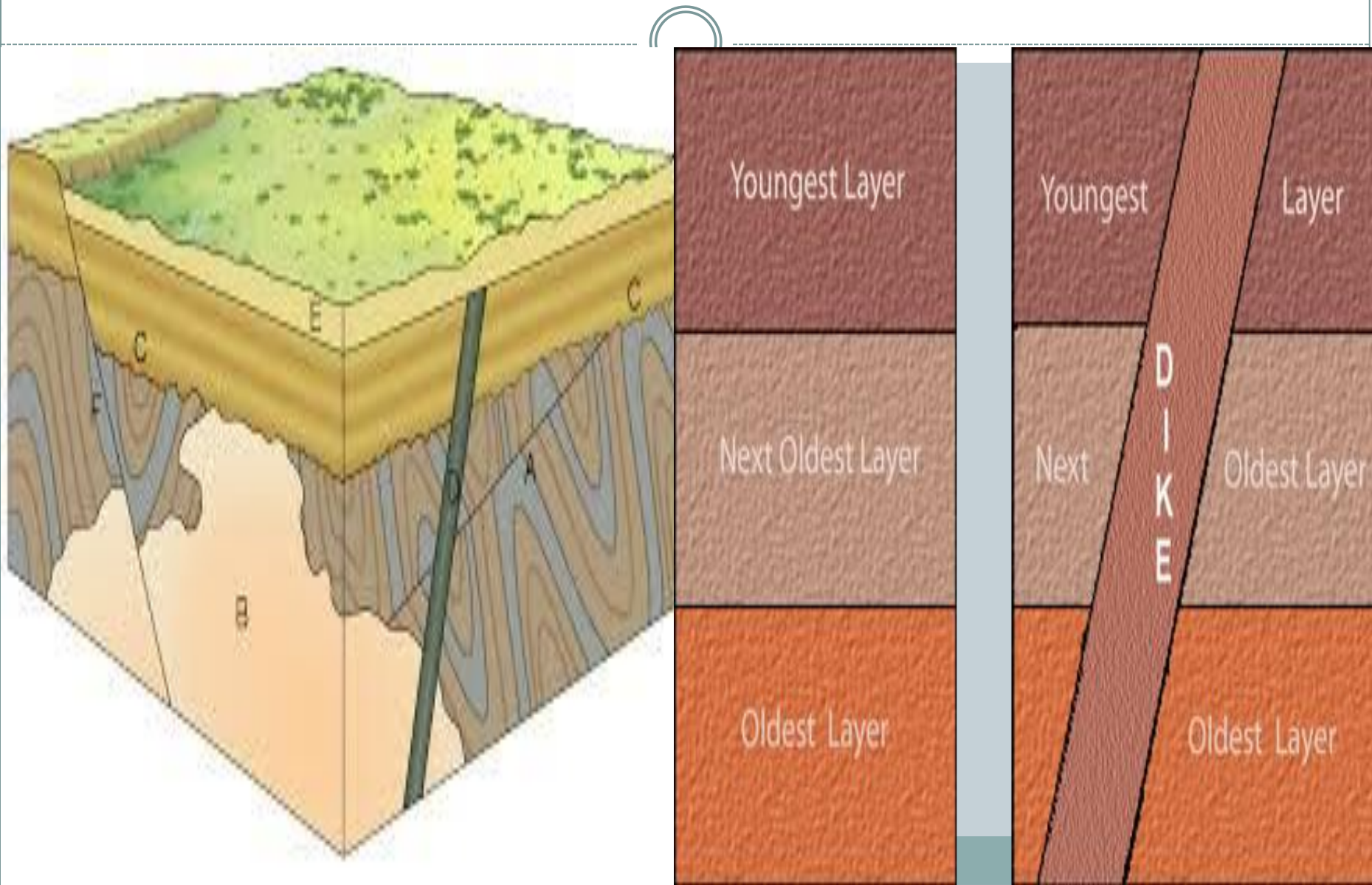


Principle of Cross-Cutting relationships



- States that the geologic feature which cuts another is the younger of the two features.
- Several basic types of cross cutting relationships:
- Structural relationships may be faults or fractures cutting through an older rock
- Intrusional relationships occur when an igneous pluton or dike is intruded into pre-existing rocks.

Principle of Cross-Cutting relationships

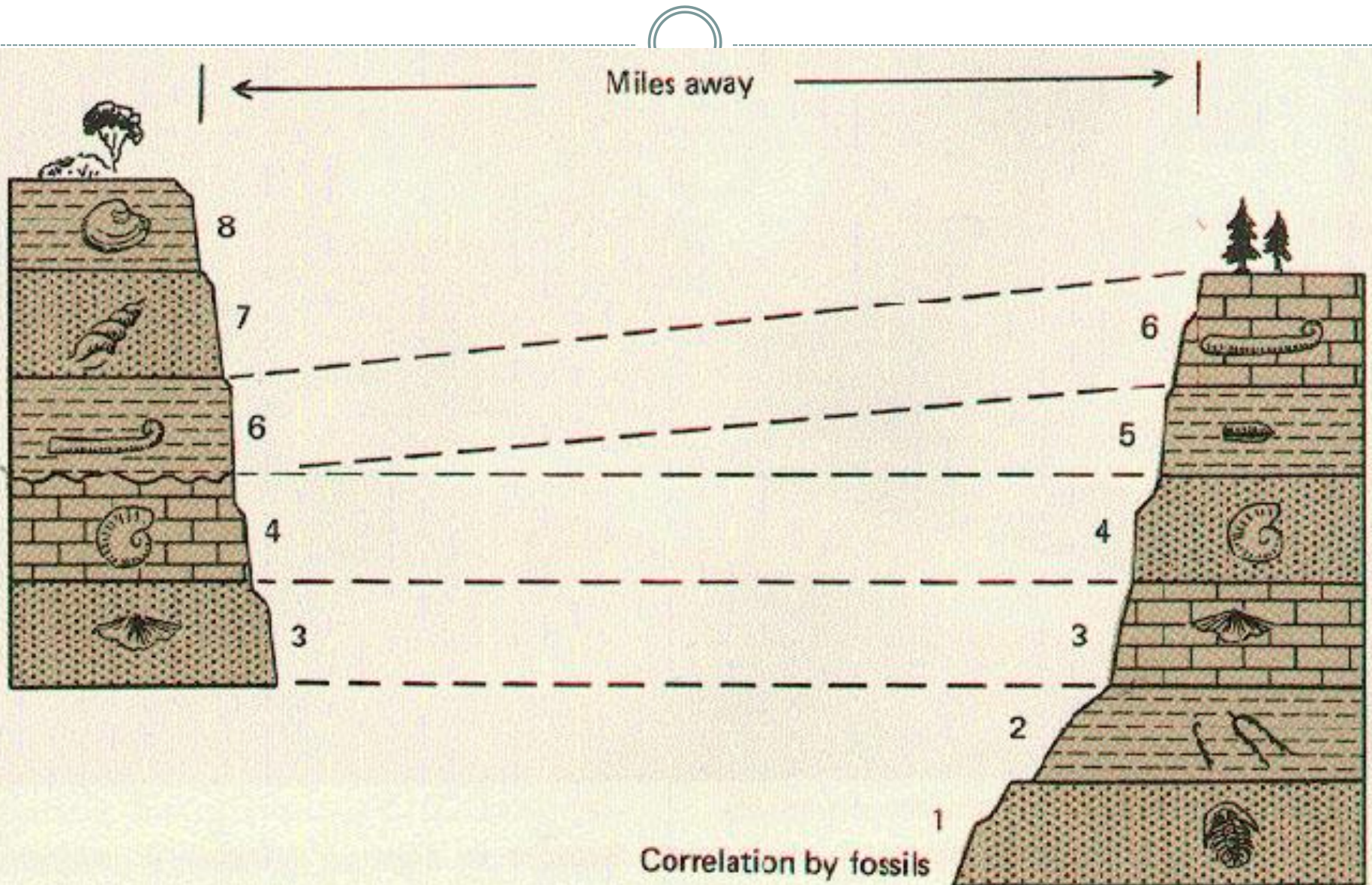


Principle of Faunal Succession

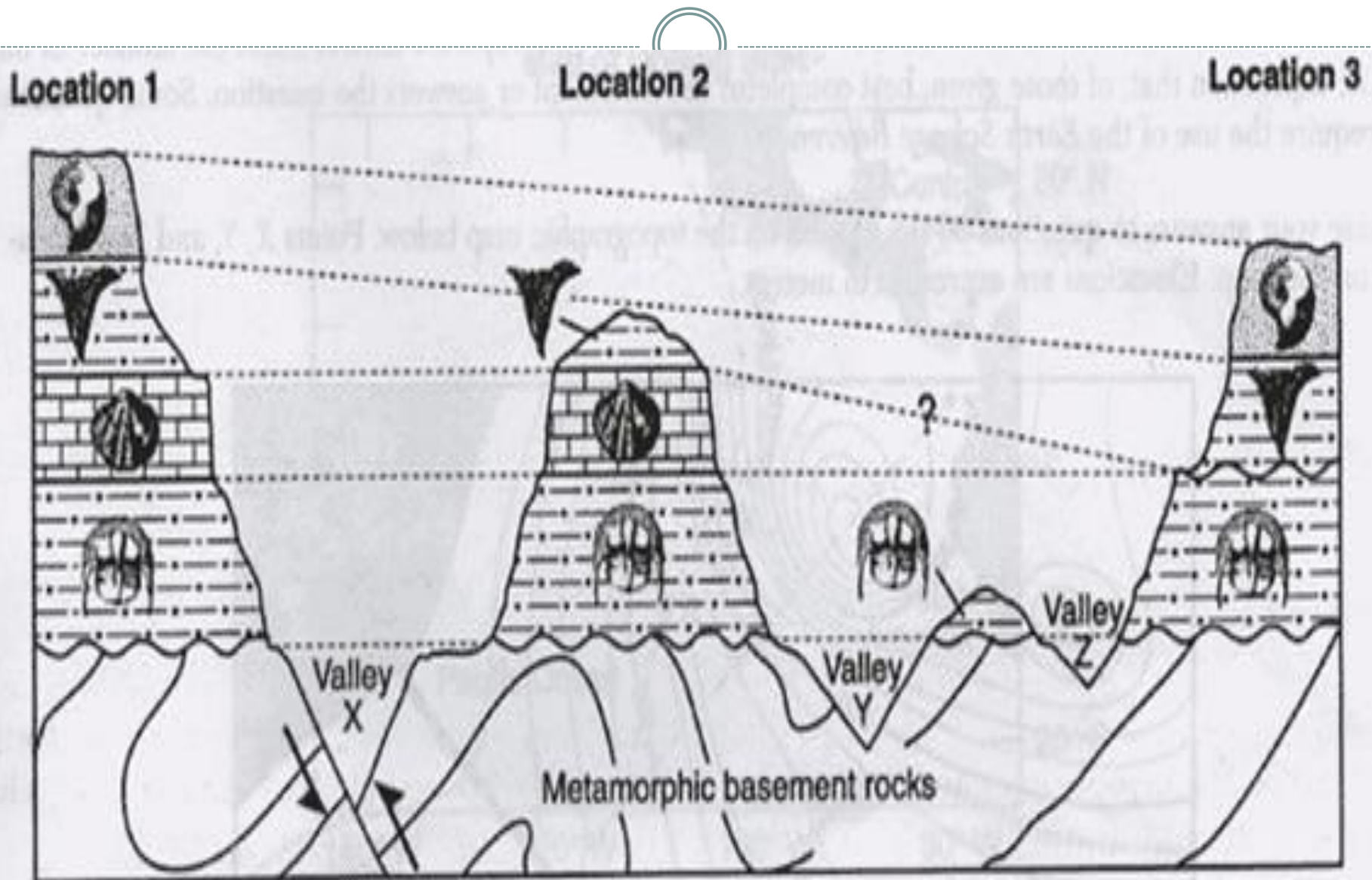


- Based on the observation that sedimentary rock strata contain fossilized flora and fauna, and that these fossils succeed each other vertically in a specific, reliable order that can be identified over wide horizontal distances.

Principle of Faunal Succession



Principle of Faunal Succession

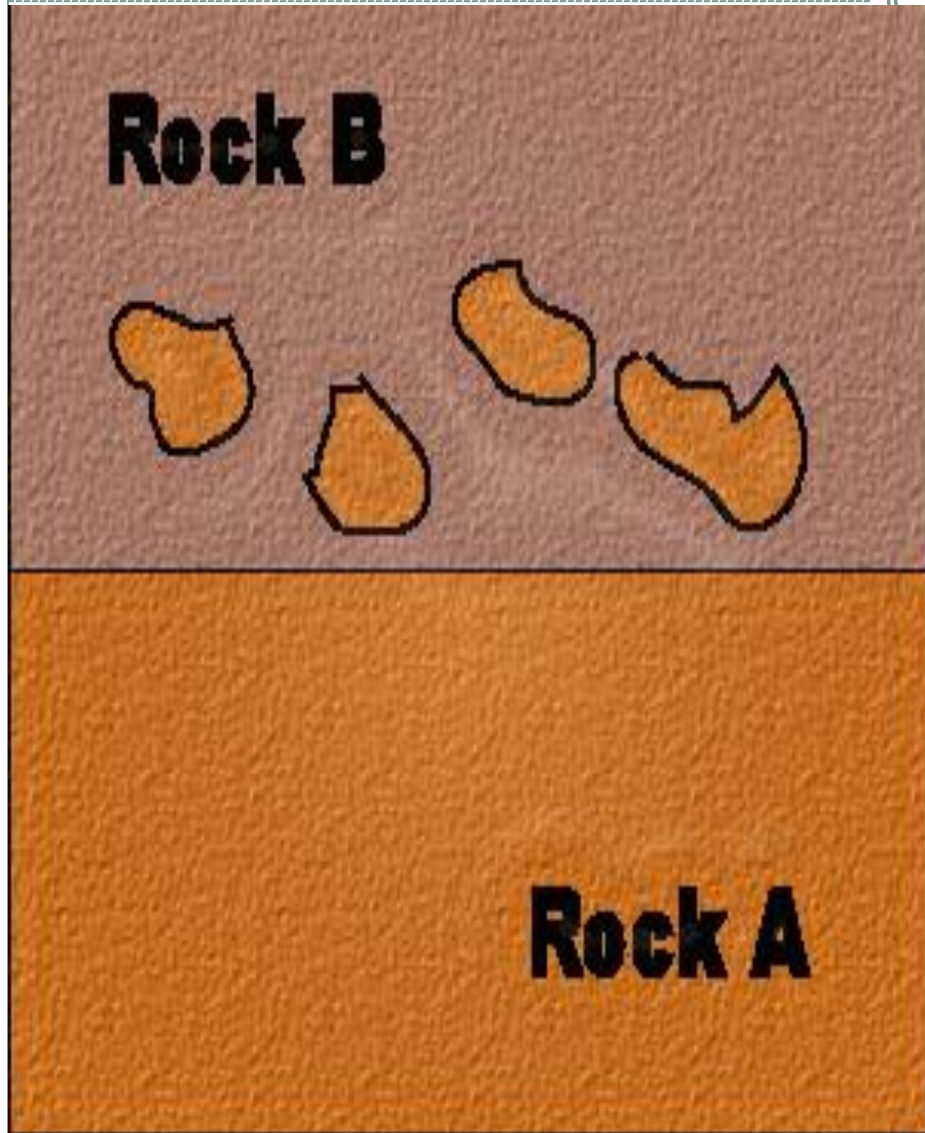


Law of Inclusions



- The Law of Inclusions was also described by James Hutton
- Stated that if a rock body (rock B) contained fragments of another rock body (rock A), it must be younger than the fragments of rock it contained
- The intruding rock (rock A) must have been there first to provide the fragments

Principle of Inclusions



Principle of Intrusions



- In geology, when an igneous intrusion cuts across a formation of sedimentary rock, it can be determined that the igneous intrusion is younger than the sedimentary rock
- There are a number of different types of intrusions, stocks, laccoliths, batholiths, sills and dikes.

Principle of Intrusions

