EWCE 203

Geology and Geomorphology

Structural Geology-2

Joints and faults

- Masses of rocks **may be broken with or without the movement** along the **cracks**.



Joints

- If there is **no slippage along the fractured surface**, the **crack** is known as a **Joint**.

Fault

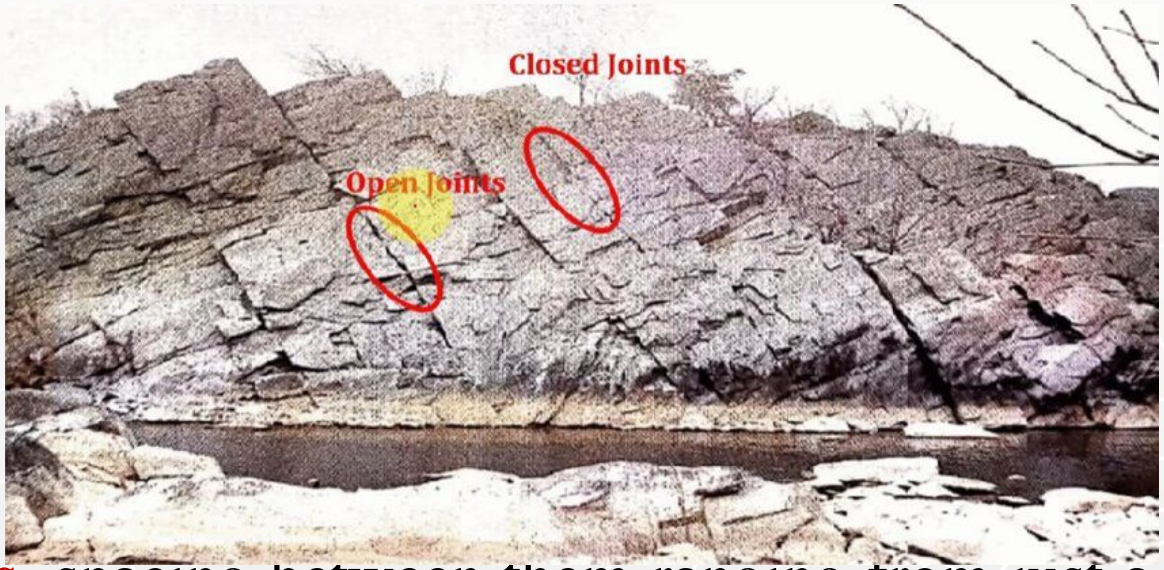
- If there has been **displacement along the fractured surface**, the structural feature is called a fault.


Joints



Joints are Found:

- In **all kinds of rock** and are the most common features where **rocks are exposed at the surface.**



- Usually **occurs in sets**, spacing between them ranging from just a **few cm to meters**.

- **Most rock masses** are **traversed by more than one set of joints**, often with two sets of intersecting at approximately at right angle.

- Such a combination of intersecting joint sets is called a **joint system**.

Development of Joint Sets

Different sets in joint system were **made at different times and under different condition.**

Sedimentary/Metamorphic Rocks

- One joint set could develop while the **rock was being compressed by weight of overlying rocks** during burial and consolidation.

- Another joint set could be **produced when pressure is released during unloading by erosion.**

Igneous Rocks:

- Join Sets were known to be **formed during cooling of magma** in **igneous rocks**.

- Joint sets may also be formed **during the movement of rocks**.

Faults

- A fault is a **fracture or zone of fractures** between two blocks of rock.
- Faults allow the blocks to **move relative to each other**.
- Movement may occur **rapidly**, in the form of an earthquake - or may occur **slowly,** in the form of creep.
- Faults may range in length from **a few millimeters** to thousands of kilometers.



Classification of Faults

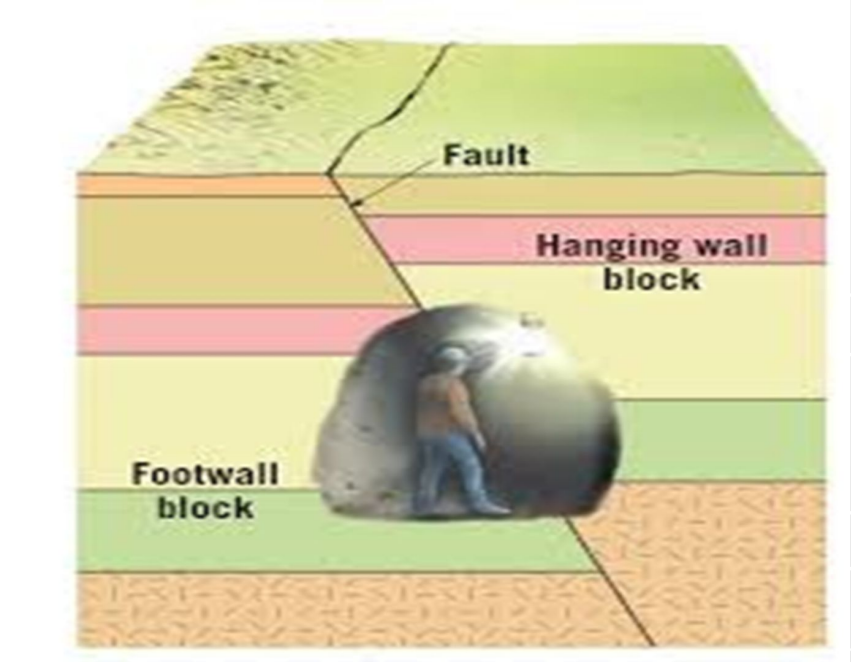
Basing on the relative movement of rock masses on the opposite sides of masses:

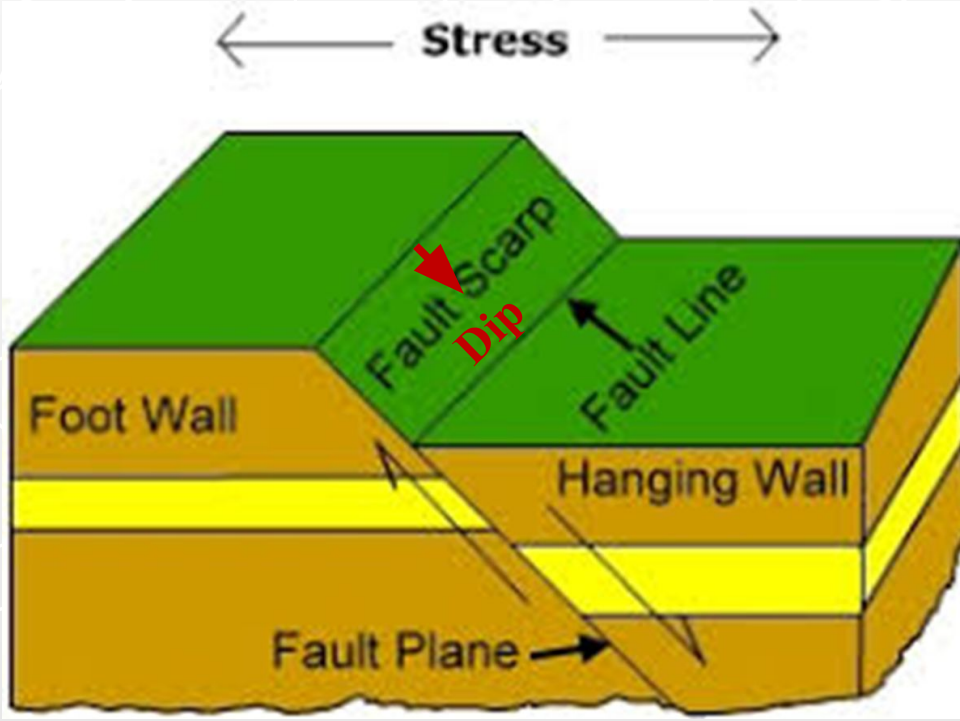
Deep-slip Fault:

- If the displacement of rock masses is **in the direction dip**.

Section separated by the faults are named as:

- **Hanging wall**: block that is overhead
- **Foot wall**: block that is beneath.



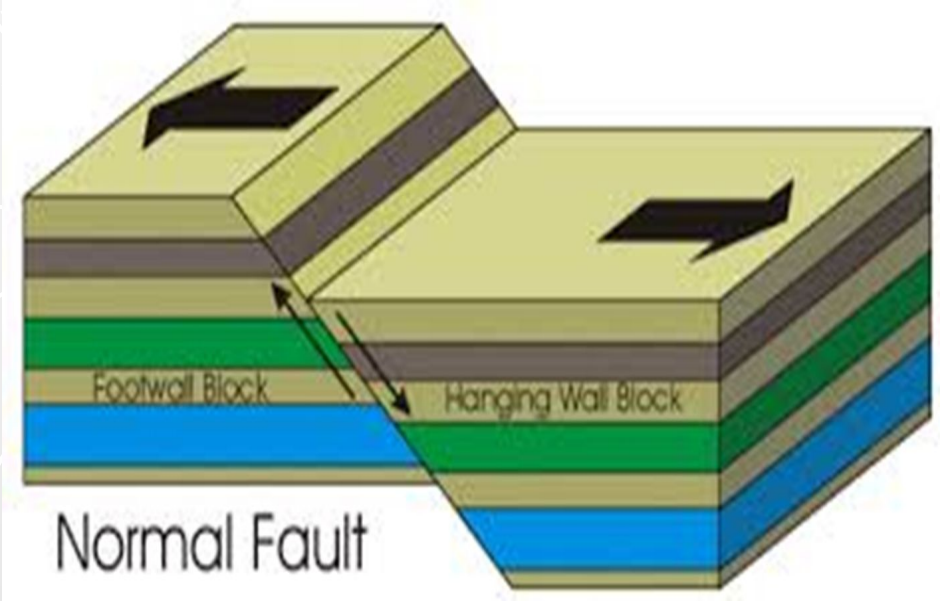


Classification of Dip-slip Fault

Normal Fault:

- If **hanging wall seems to have move downward** in relation to the footwall.

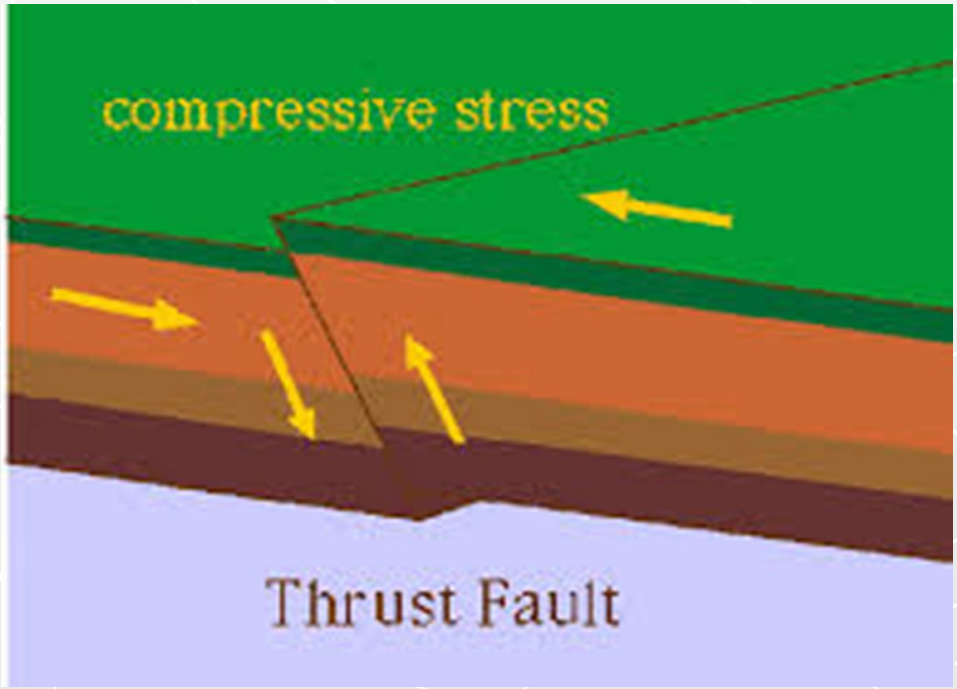
- Normal fault occurs when the **vertical stresses is greater** than the horizontal stress.





Thrust Fault:

- **Hanging wall appears to have moved upward** in relation to the footwall.
- With a **shallow dip angle**
- Results due to **largely horizontal compressive stresses**.
- **Occurs** when one tectonic plate is forced beneath another.

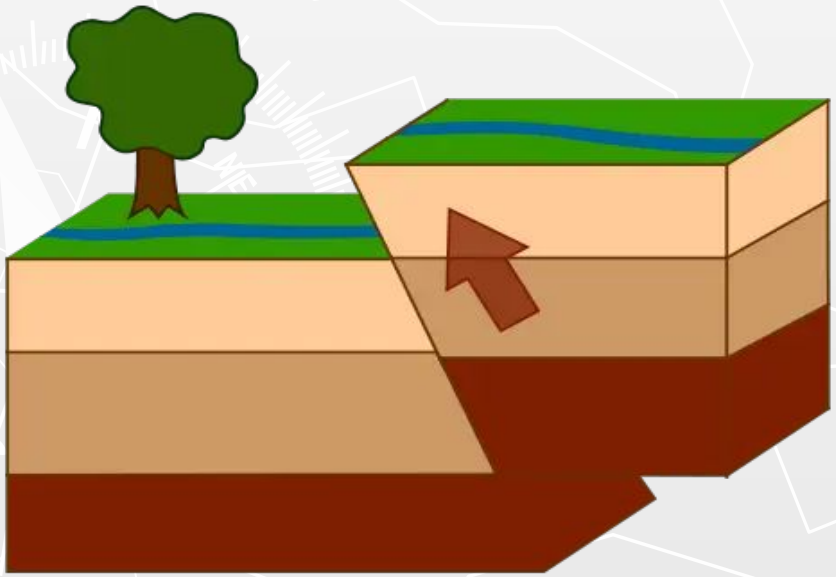




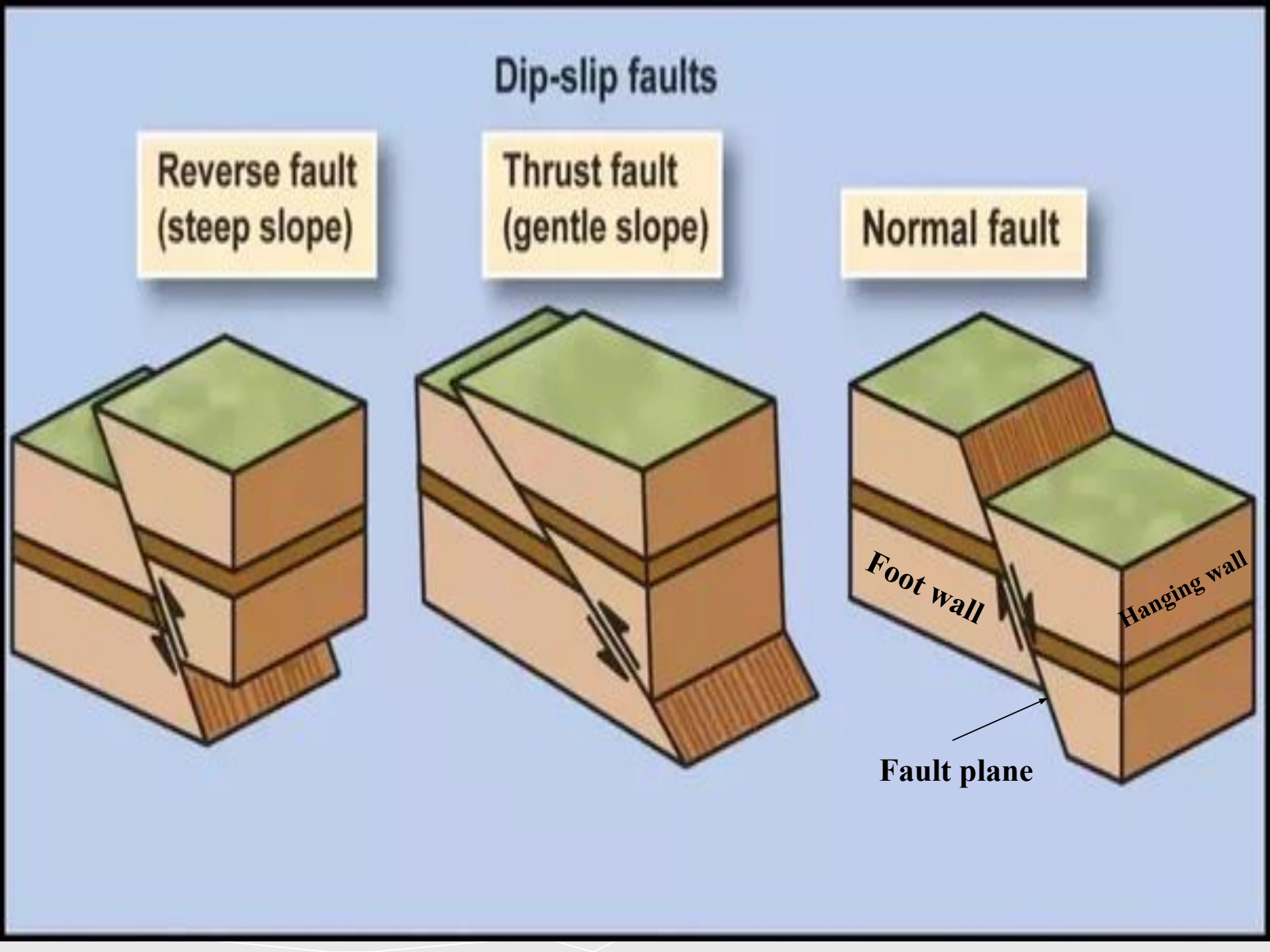
Reverse fault:

- If **the angle of dip of thrust fault is high**, generally when the dip of the fault plane is shallow **thrust fault is called reverse fault**.

- Such fault is common **in areas of compression**, such as regions where one plate is being subducted under another






Dip-slip faults
Reverse fault
(steep slope)
Thrust fault
(gentle slope)
Normal fault
Foot wall
Hanging wall
Fault plane

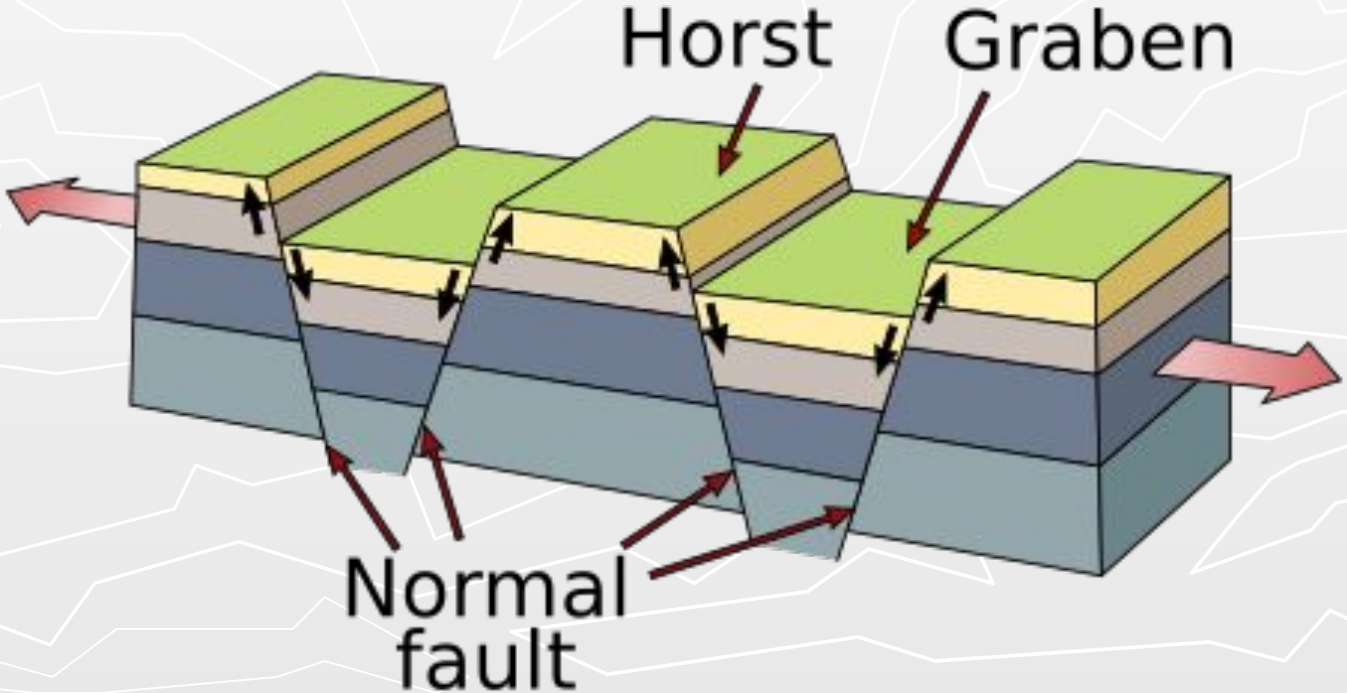
Graben and Horst

Graben:

- An **elongated**, **trench-like** **structural** form of rocks.

- **Bounded** **by the parallel normal faults**.

- Created when the **block that forms the trench floor** has **moved downward** **relative to the blocks that form the sides.**



Horst:

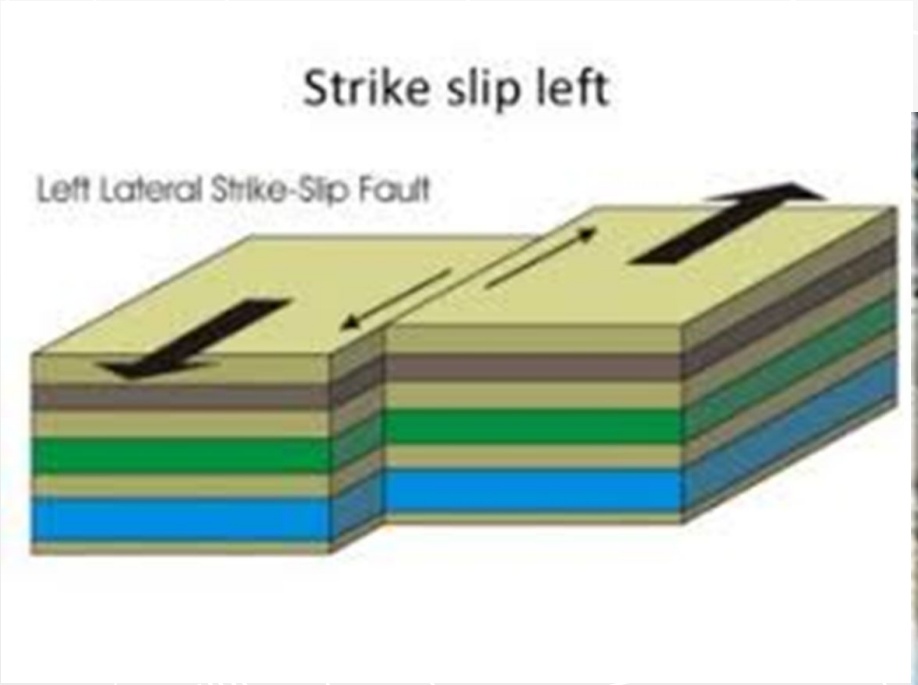
- An **elongated hillock like** structural form of block.

- Bounded by the parallel normal faults in such way that it **stands above** the blocks on both sides**.**



Strike-slip fault:

- A fault along which the **movement has been predominantly horizontal**.
- **Slippage has been parallel** to the **strike** **of the fault**.

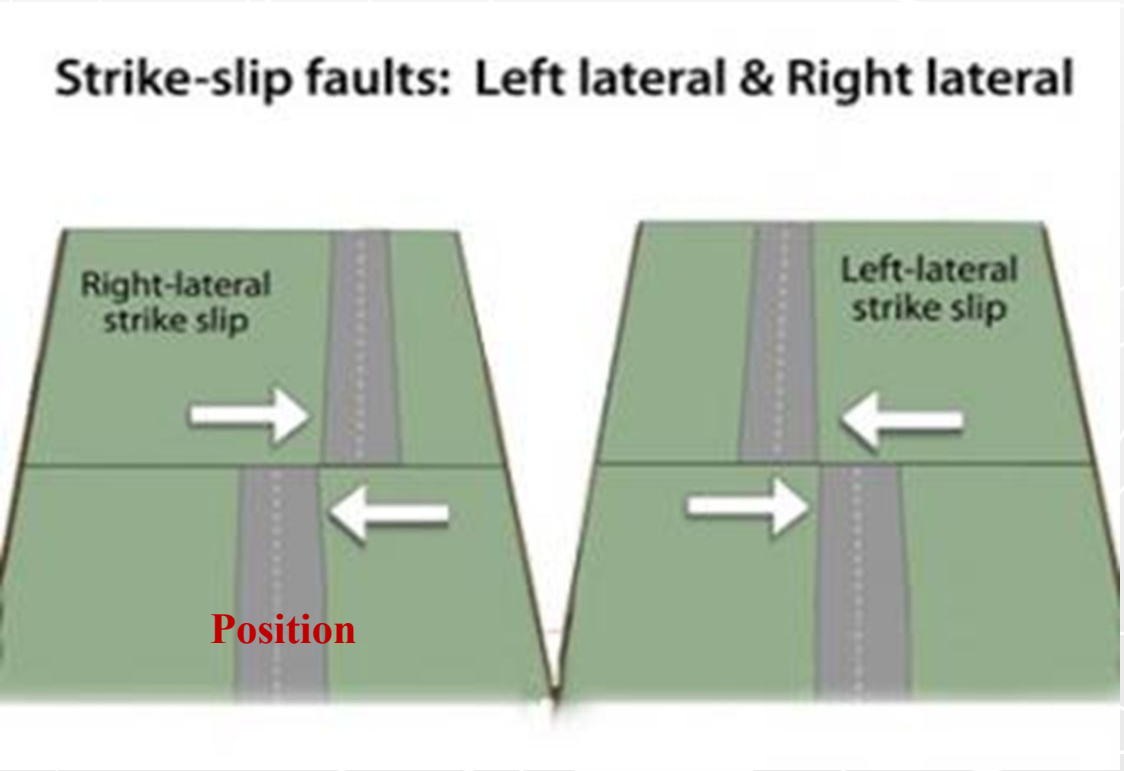


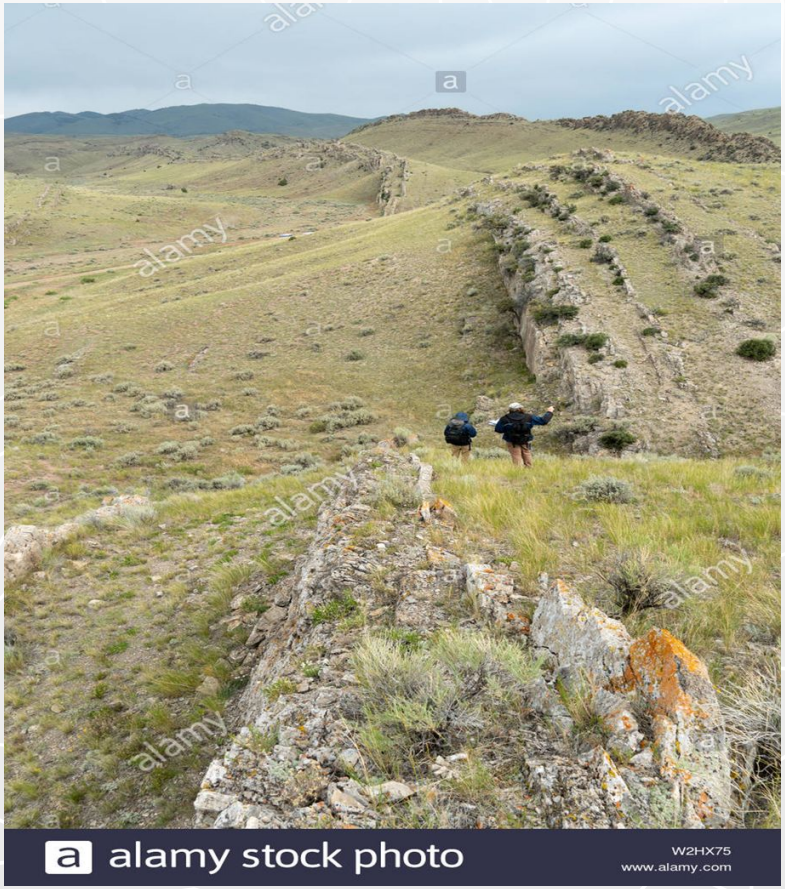


Classification of Strike slip fault

Right lateral: Ground opposite you appears to have **moved offset to the right** when stand facing the fault.

Left lateral: when offset to the left.





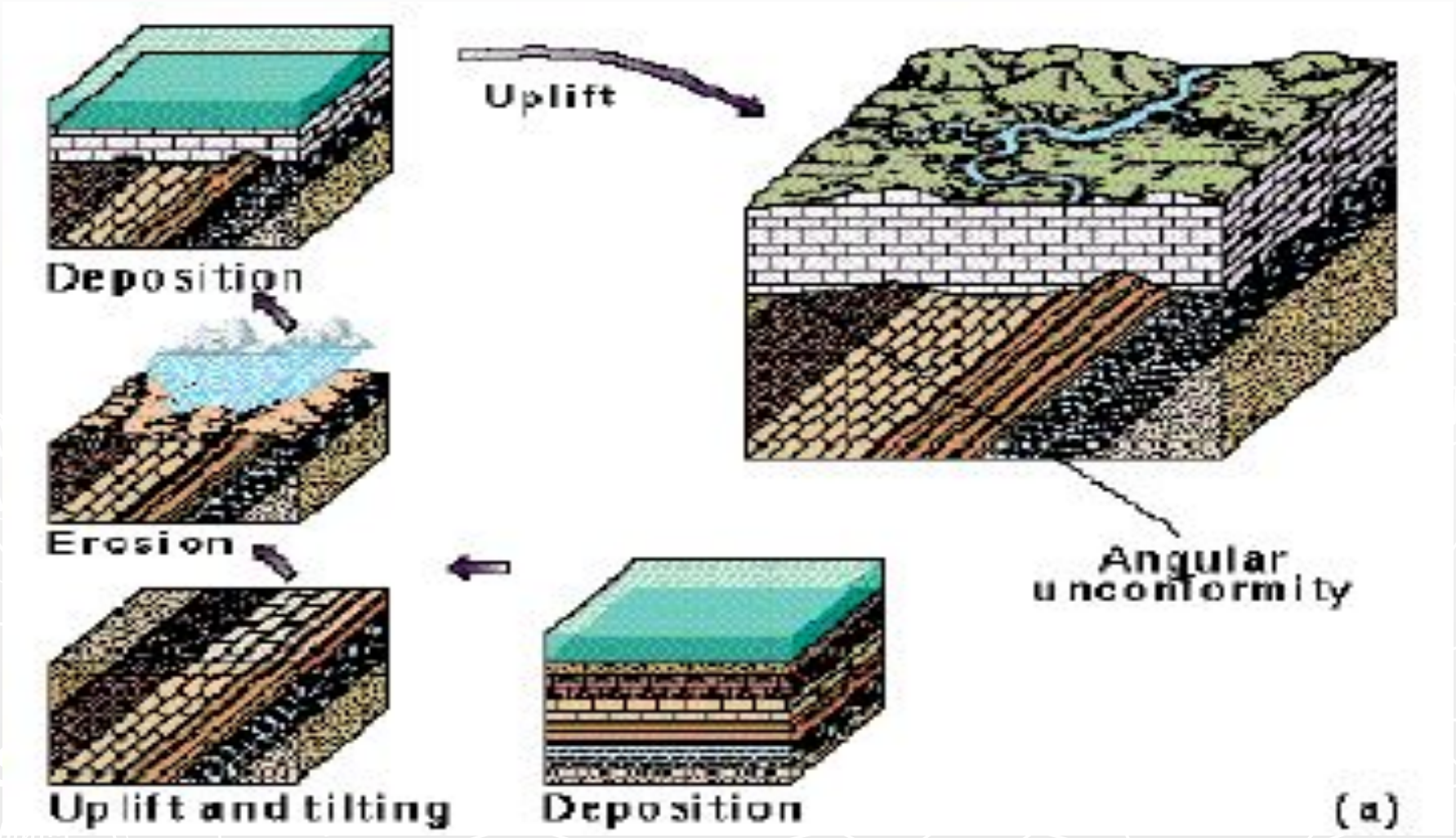
Unconformities

- A **buried erosion surface**, **separating two rock masses**.

- Of these twos, the **older one was exposed to erosion** for a long interval of time, **before the deposition of the younger** is called unconformities.

- Unconformities **represent gaps of a few thousand years** to 400 million years.

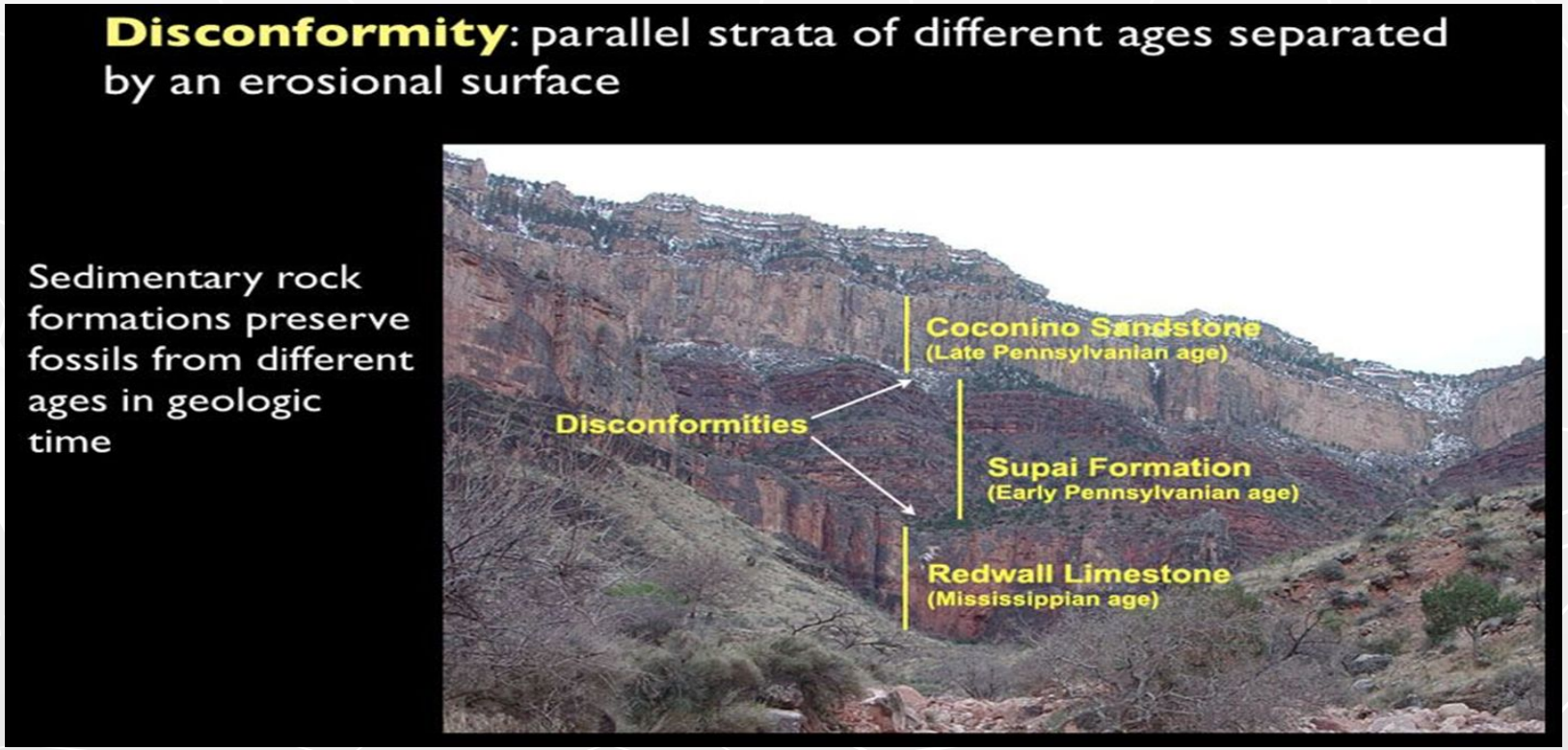



Uplift
Deposition
Erosion
Angular unconformity
Uplift and tilting
Deposition
(a)

Types of Unconformities

Disconformity:

- An unconformities **with parallel strata on opposite sides** is called disconformities.
- Formed when **layered rocks are elevated** exposed to erosion.
- Then **lowered to undergo further deposition** without being folded.

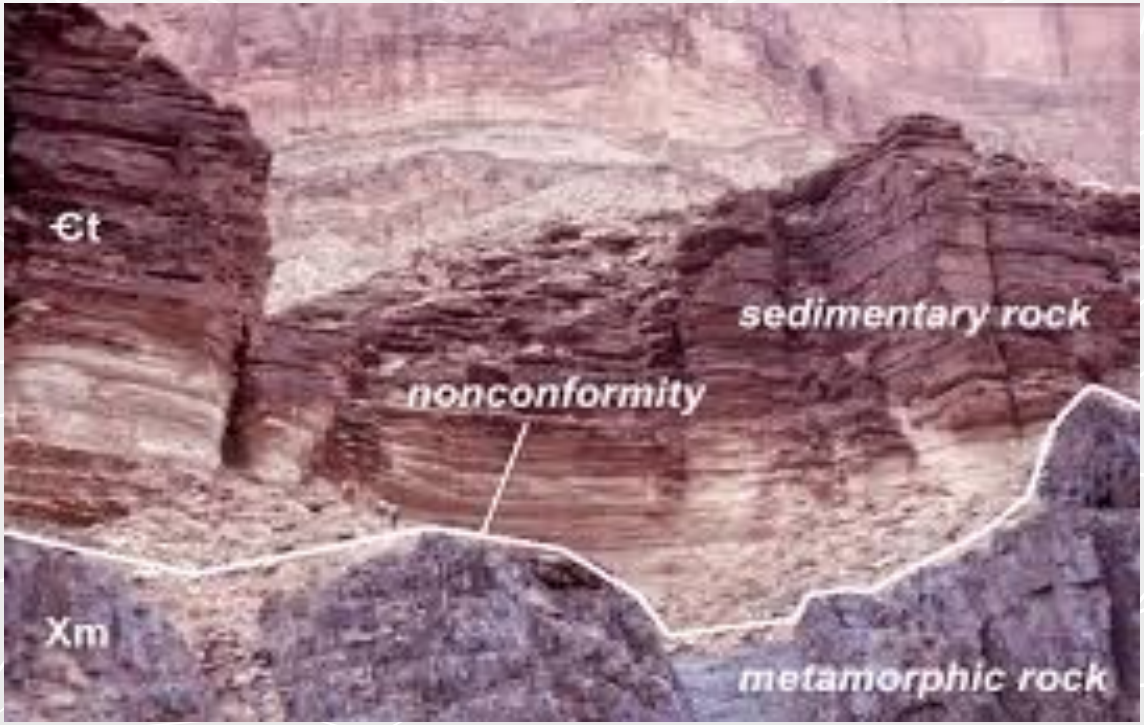


Non-conformity:

- An unconformity between **profoundly different rocks** is called non-conformity.

- Formed when **intrusive igneous rocks or metamorphic rocks are exposed to erosion.**

- Then are **down warped to be covered by sedimentary rocks**.



Thanks