

Endogenetic and Exogenetic forces (Geomorphic Process)

Geography Optional

Paper - 1



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Geography Optional by Subhodeep Das

Process responsible for the **formation and alteration** of the **earth's surface**.

Physical and Chemical interactions

B/w

Earth's surface & the natural forces acting upon it



Produce landforms

Processes are determined by **natural environmental variables** as geology, climate, vegetation and base level.

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Process

Resultant leads to



Earth Movement.



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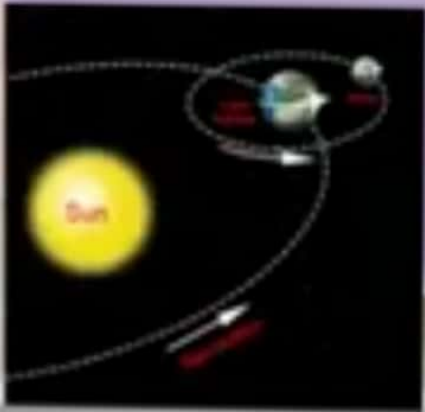
Movement of Earth

Earth Movement.

Movement of Earth

Movement of Earth as an Entity.

Eg. Revolution &
Rotation of Earth.



Earth Movement.

Movement of a part of Earth within Earth itself.

Eg. Landslides
Plate tectonics.



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Geomorphic Process

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Endogenetic Forces

Derive their **Energy** from **Earth's Interior**.

Eg. Radioactivity.

Expansion / Contraction
Displacement of molt-
-en magma.

Exogenetic Forces

Derive their **Energy** from **Atmosphere**.

Eg. Wind

Glacier

River.

...Endogenetic Forces

Creates Land ,so called **Creative Forces**.

Causes **2 Type of Movements:**

- 1. Horizontal**
- 2. Vertical**

Examples – mountain building ,earthquakes etc.

...Exogenetic Forces

Destroys Land created by Endogenetic process, so called **Destructive Forces**.

Examples of exogenic processes – weathering, erosion etc.

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The actions of exogenic forces result in wearing down (**degradation**) of relief/elevations and

filling up (**aggradation**) of basins/ depressions, on the earth's surface.

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The phenomenon of wearing down of relief variations of the surface of the earth through erosion is known as **gradation**.

Endogenetic Forces

...On Basis of Intensity

Slow Movement
(Diastropism)

Sudden Movement

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...Endogenetic Forces

...On Basis of Intensity

Slow Movement
(Diastropism)

Sudden Movement

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Vertical

Epirogenic /
Continental
Building

Horizontal

Orogenic /
Mountain
Building

...Endogenetic Forces

Epirogenic

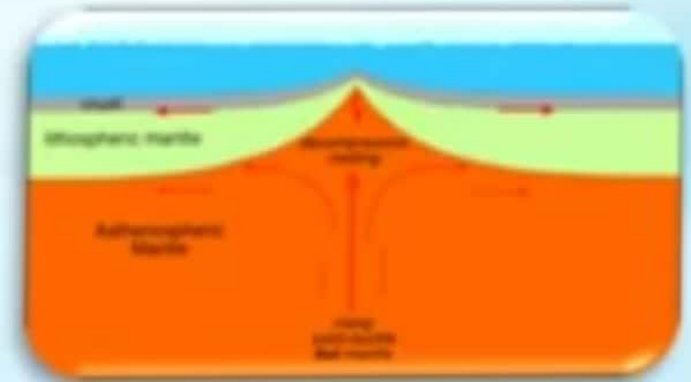
Land

Origin

✓ Slow Movement
(Diastropism)

Vertical
Epirogenic /
Continental
Building

Horizontal
Orogenic /
Mountain
Building



Upliftment and Subsidence of continental mass through
Upward and **Downward** movements Respectively.

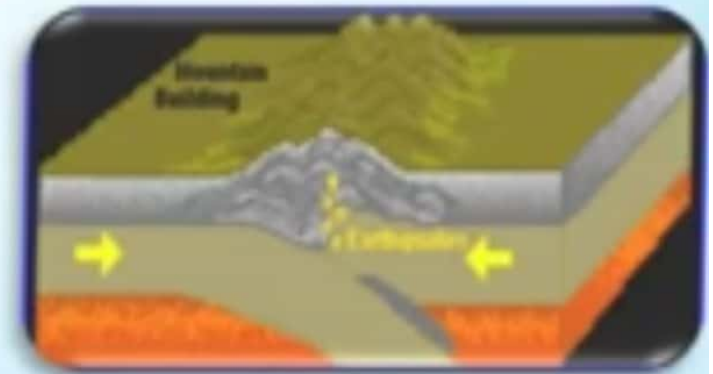
Acting Tensional Forces – creates Faults.

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...Endogenetic Forces

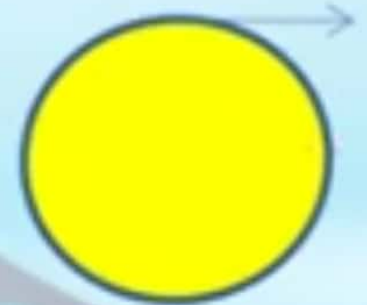
Orogenic
Mountain Origin

Slow Movement
(Diastropism)



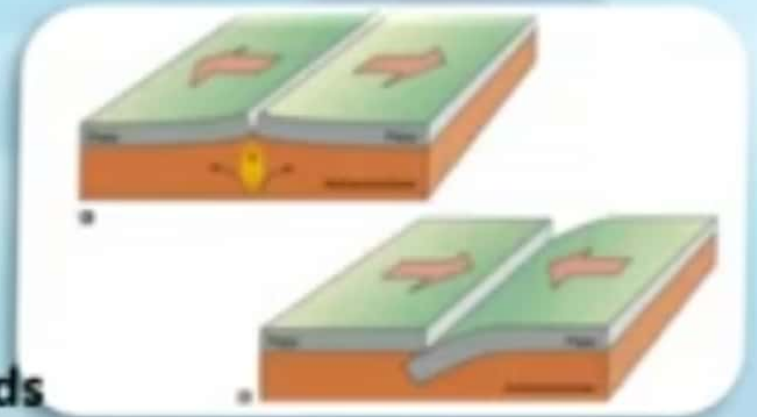
Vertical
Epirogenic /
Continental
Building

Horizontal
Orogenic /
Mountain
Building



Tensional Forces.
Rupture, **Faults** etc.

Compressional Forces.
Crustal Bending -> Folds



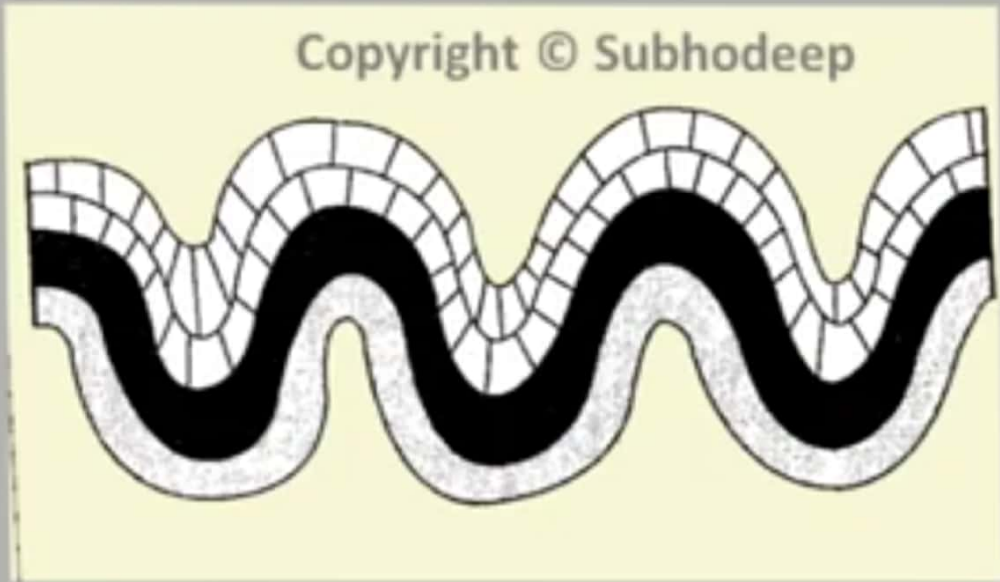
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Crustal Bending

2 Ways →

- 1. Warping.
- 2. Folding.



1. Warping
↳ Upwarp
↳ Downwarp

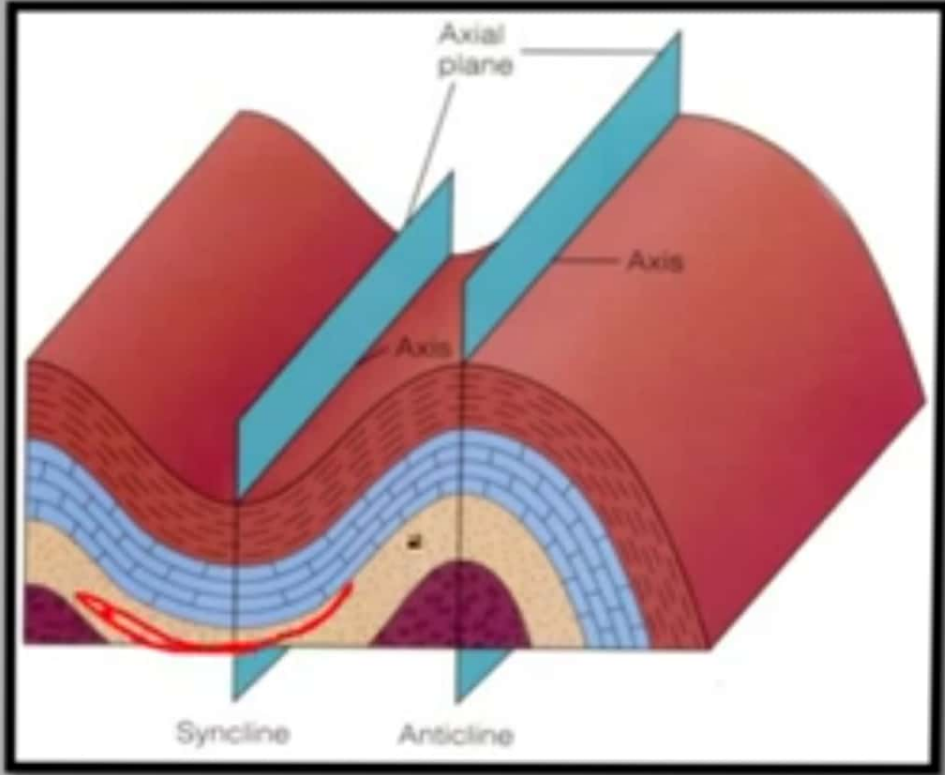
When warping Affects Large Area, resultant mechanism called BroadWarping.

2. Folding → Compressive Horizontal Force + Squeezing of crustal Rocks → Folds

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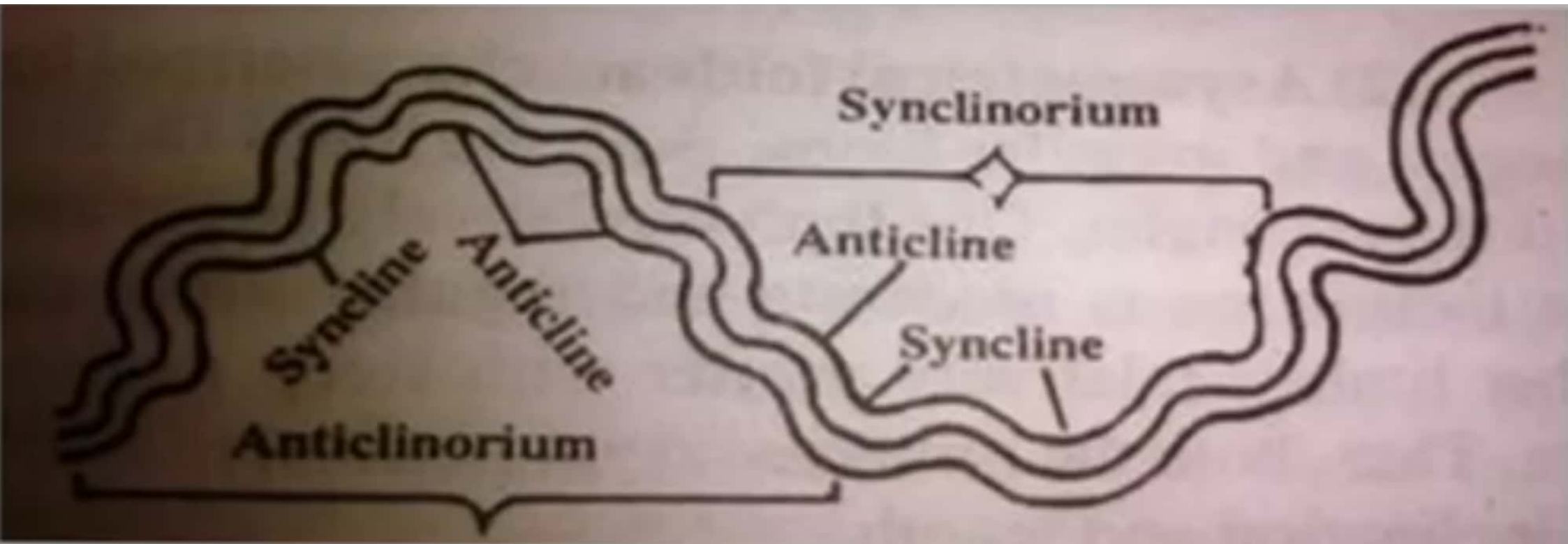
Folds :



If Rock : Soft + elastic → Intense fold
Hard + Inelastic → Less Intense

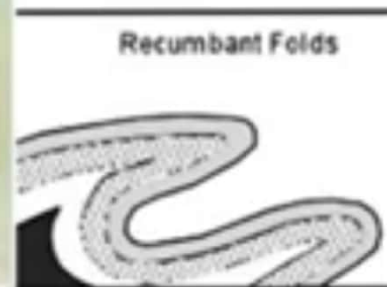
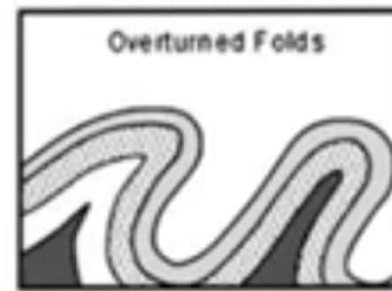
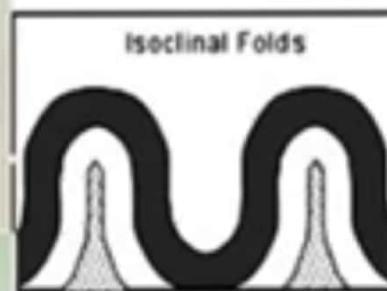
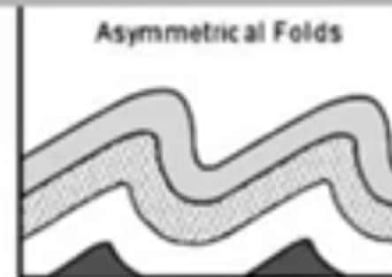
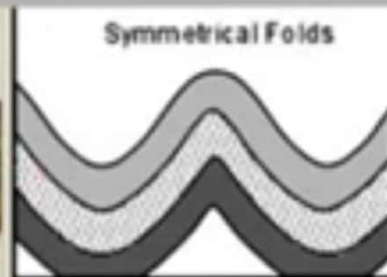
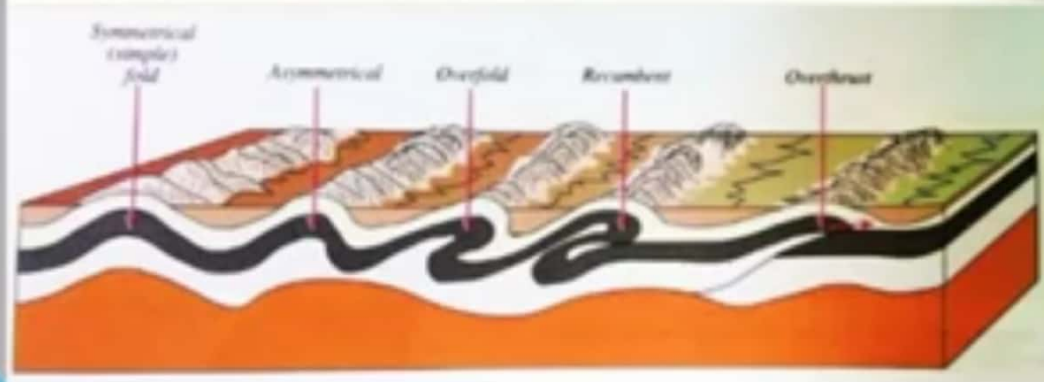
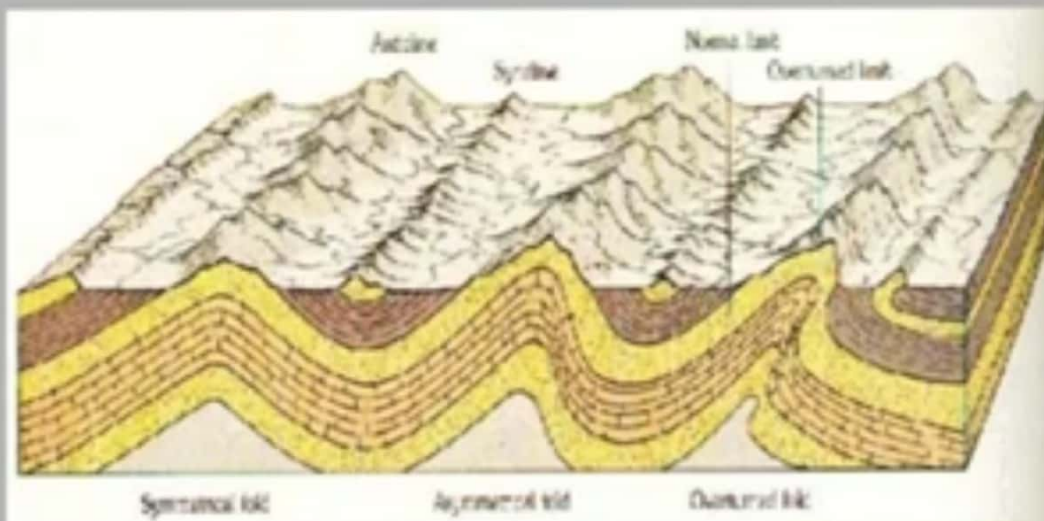


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Folds Types :

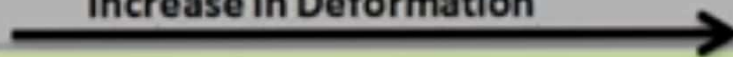
Based on amount and Intensity of compression.



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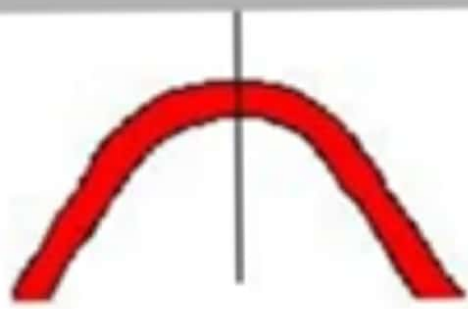
Increase in Deformation



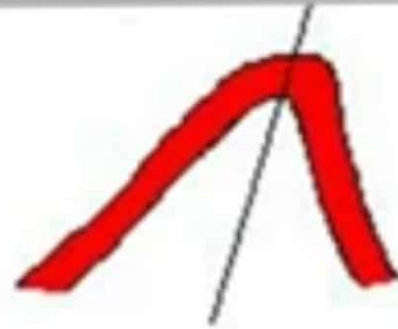
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SYMMETRICAL FOLDS

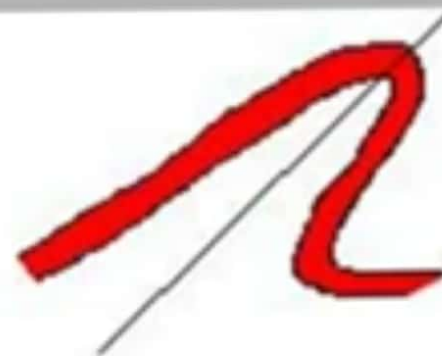
To be symmetrical, the limbs of the fold must dip at the same angle away from the fold axis.



Symmetrical
fold



Asymmetrical
fold



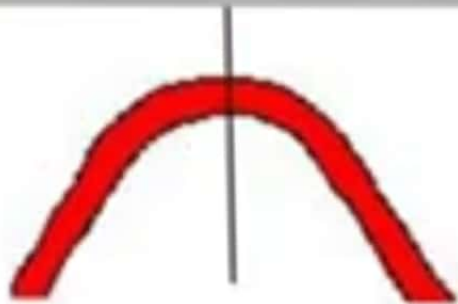
Overturned
fold



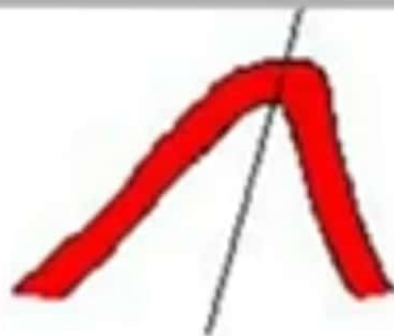
Recumbent
fold

ASYMMETIRCAL FOLDS

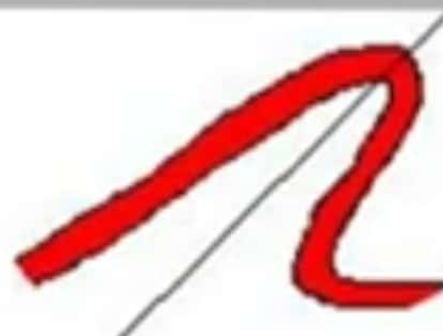
To be asymmetrical, the limbs of the fold must dip at the different angles away from the fold axis.



Symmetrical
fold



Asymmetrical
fold



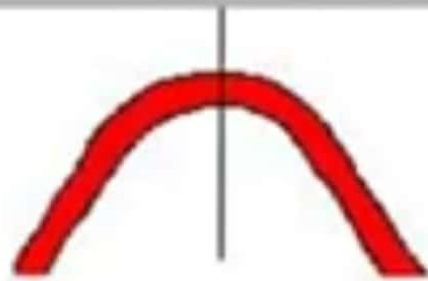
Overturned
fold



Recumbent
fold

OVERTURNED FOLD

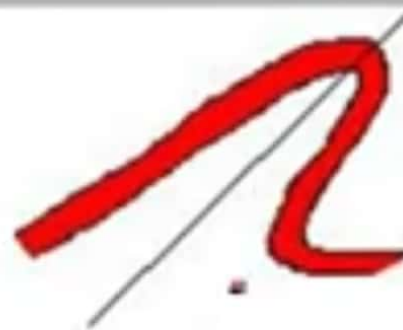
If the **limbs** of a fold are rotated past vertical



Symmetrical
fold



Asymmetrical
fold



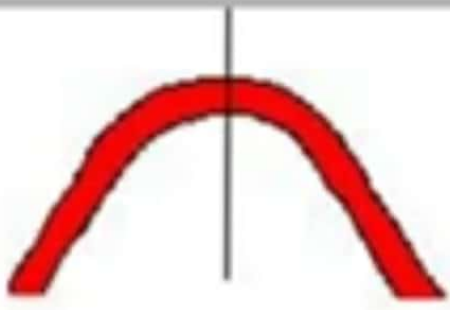
Overturned
fold



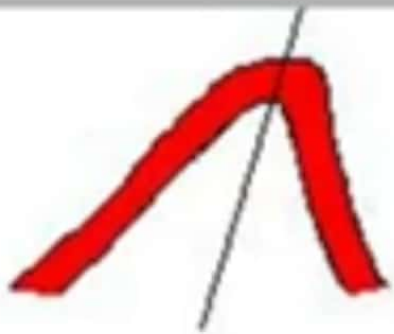
Recumbent
fold

RECUMBENT FOLD

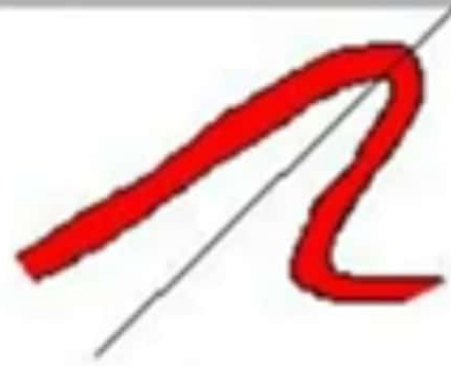
If the **axial plane** tilts to near horizontal or horizontally.



Symmetrical
fold



Asymmetrical
fold



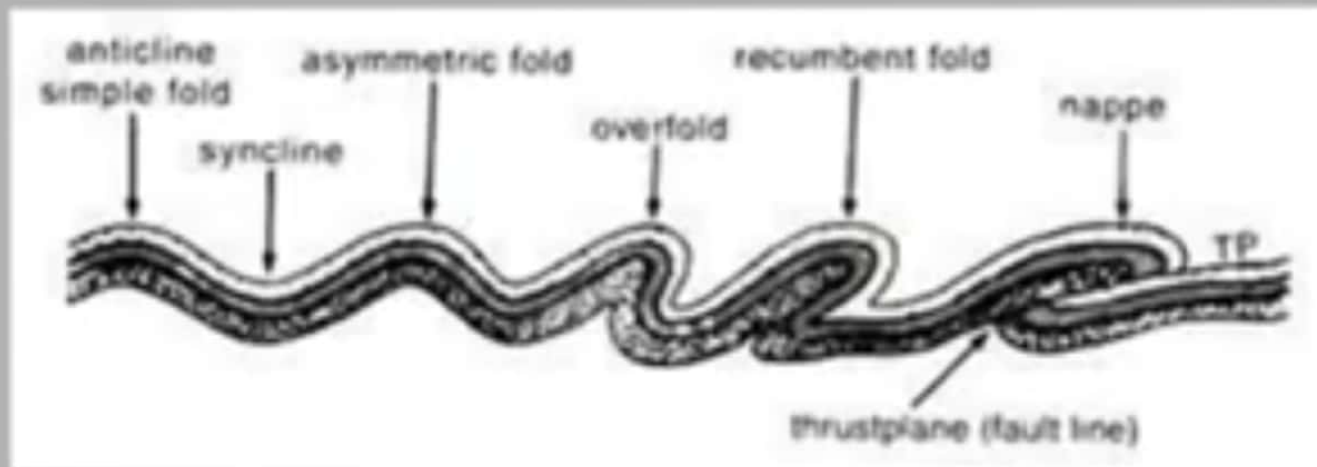
Overturned
fold



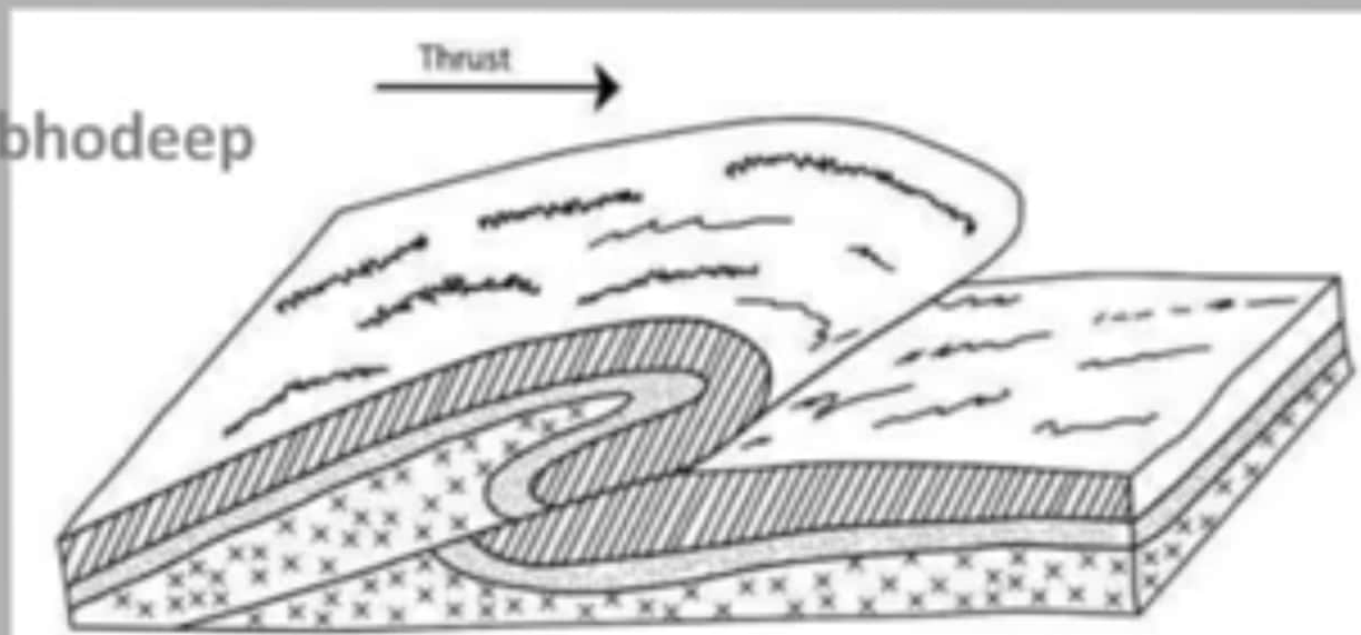
Recumbent
fold

Nappe FOLD

Faulting / folding / both.



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Isoclinal Fold



Parallel ; Not Horizontal

Monoclinial Fold

Monocline – like a carpet draped over a staircase.

Fold with only 1 steep limb- "a 1/2 fold"

Due to "blind" faults in subsurface rock

Displacement folds overlying rocks



Monocline

What a geologist imagines

Chevron Fold



Fig. 17.17 Chevron folds

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Fan Fold

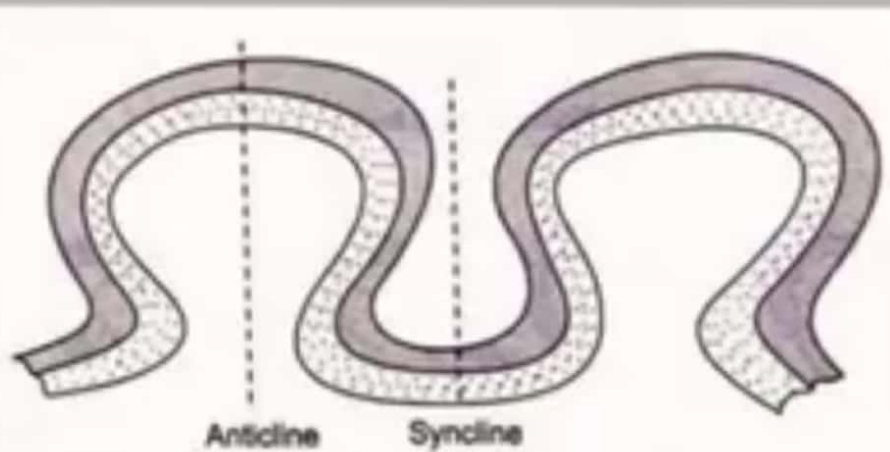


Fig. 17.25 Fan Fold

Open Fold

$$90 < \theta < 180$$

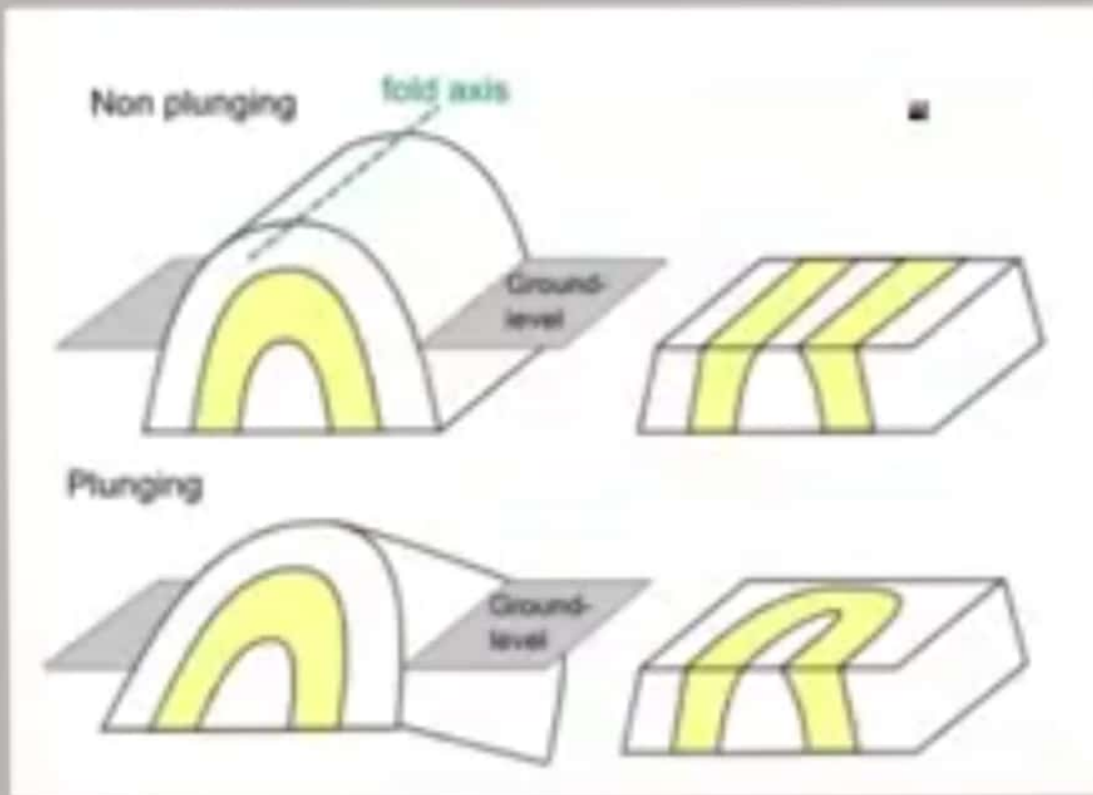
Closed Fold

$$0 < \theta < 90$$



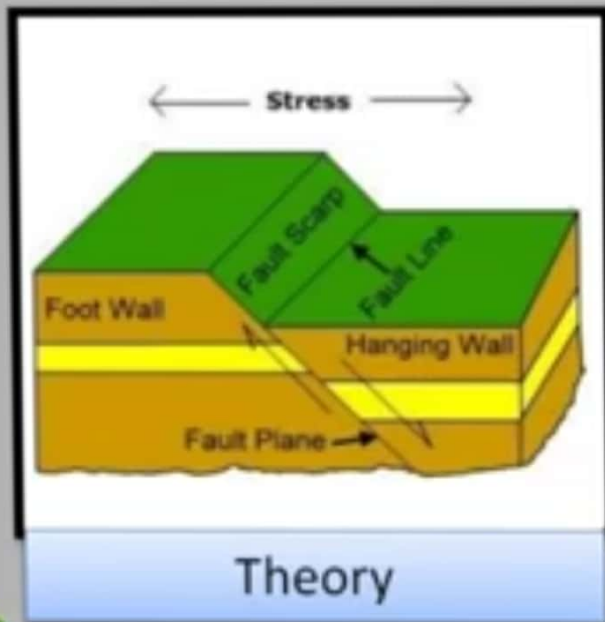
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Plunge Fold

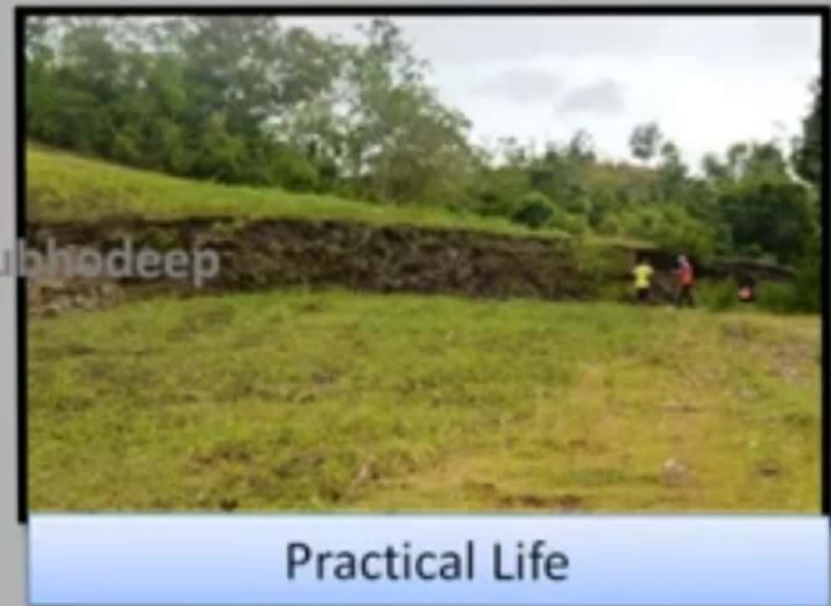


Faulting

Fracture in the crustal rock wherein the **rocks are displaced along a plane**. (due to increased intensity of fracture)



Theory

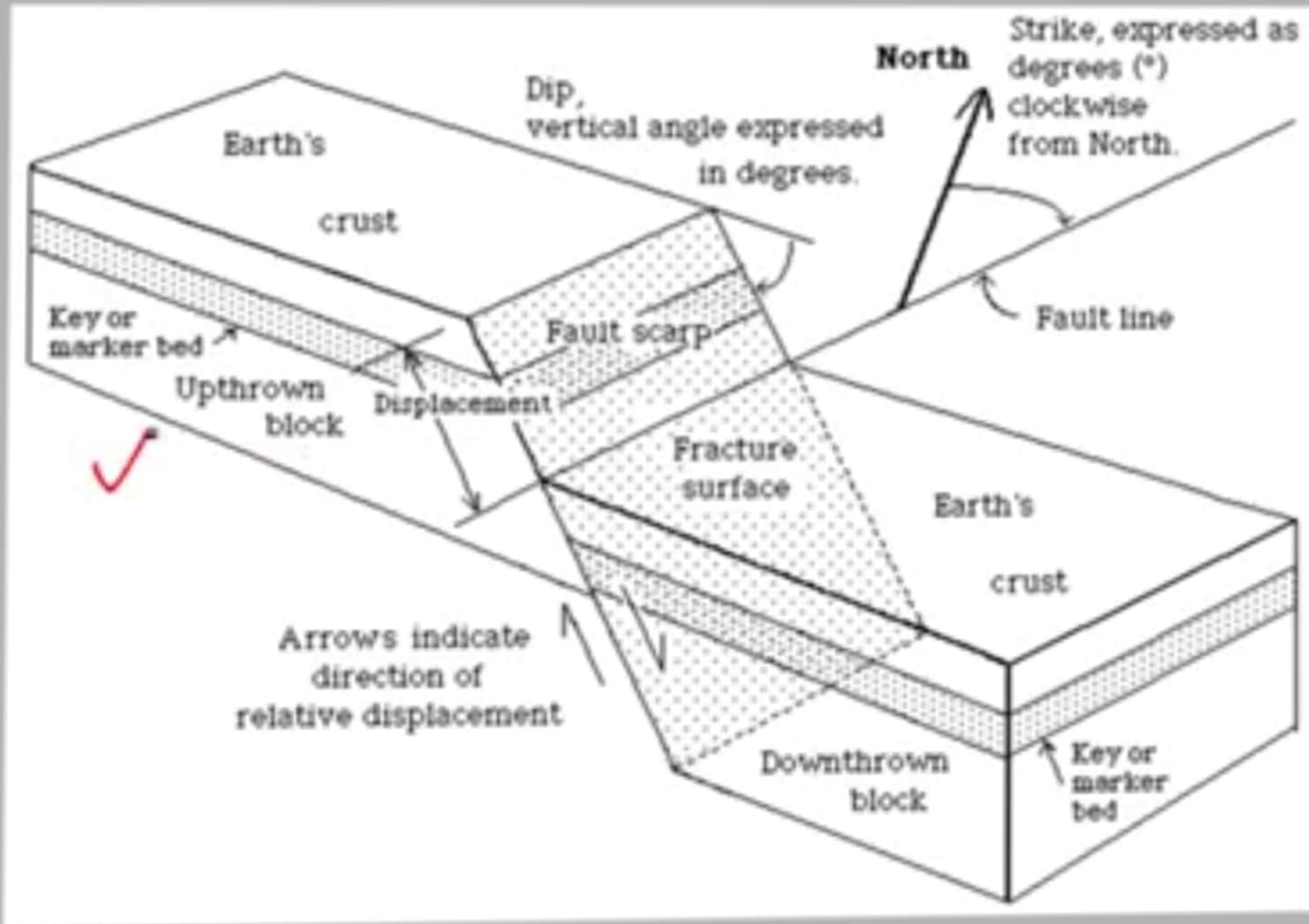


Practical Life

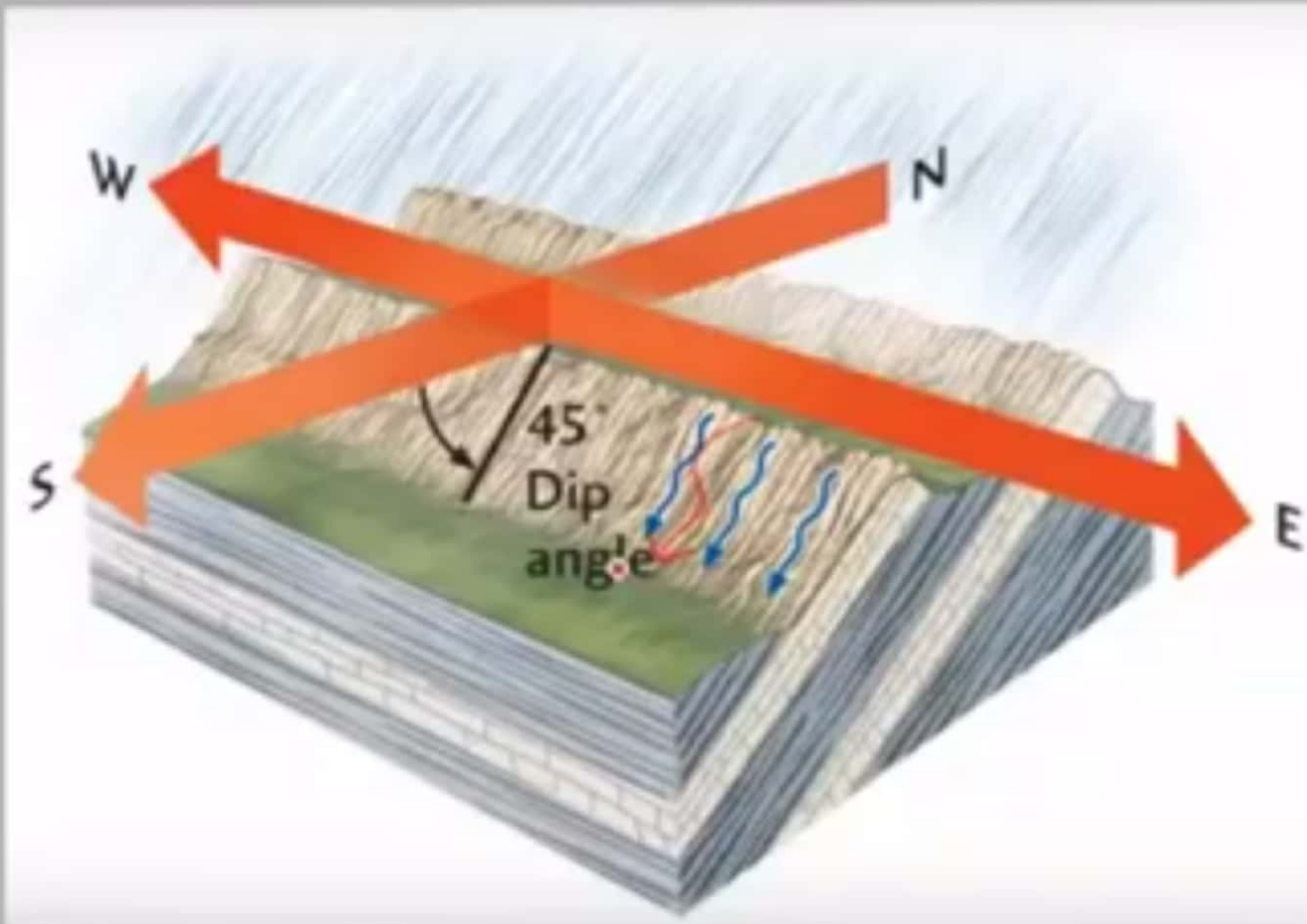
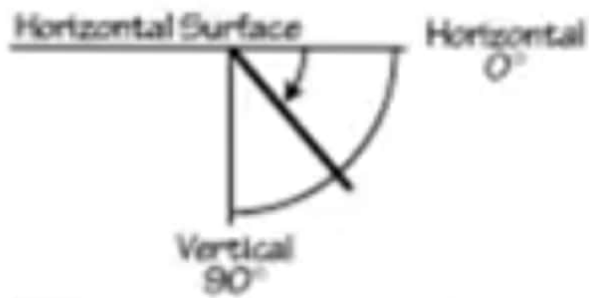
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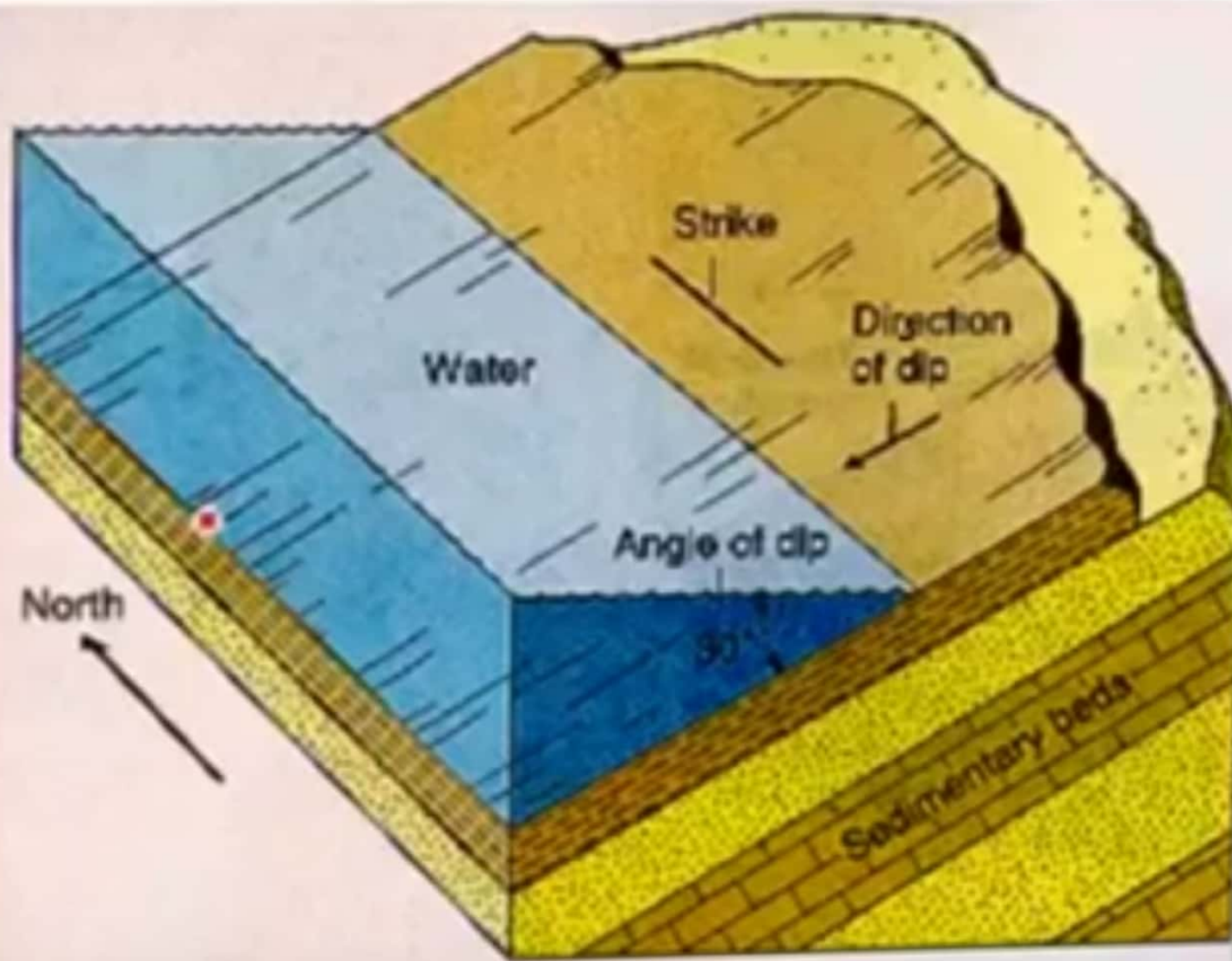


Dip Angle

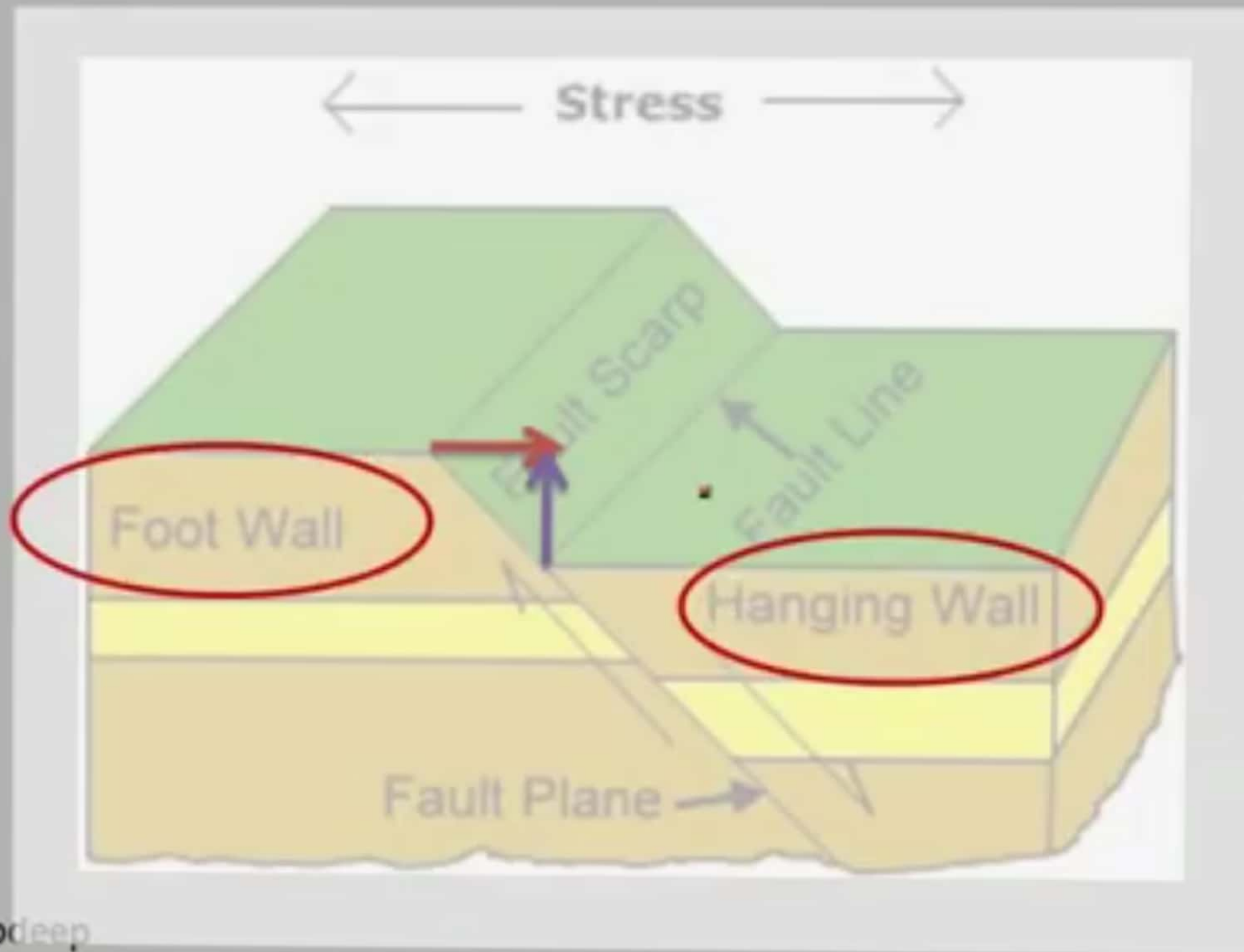


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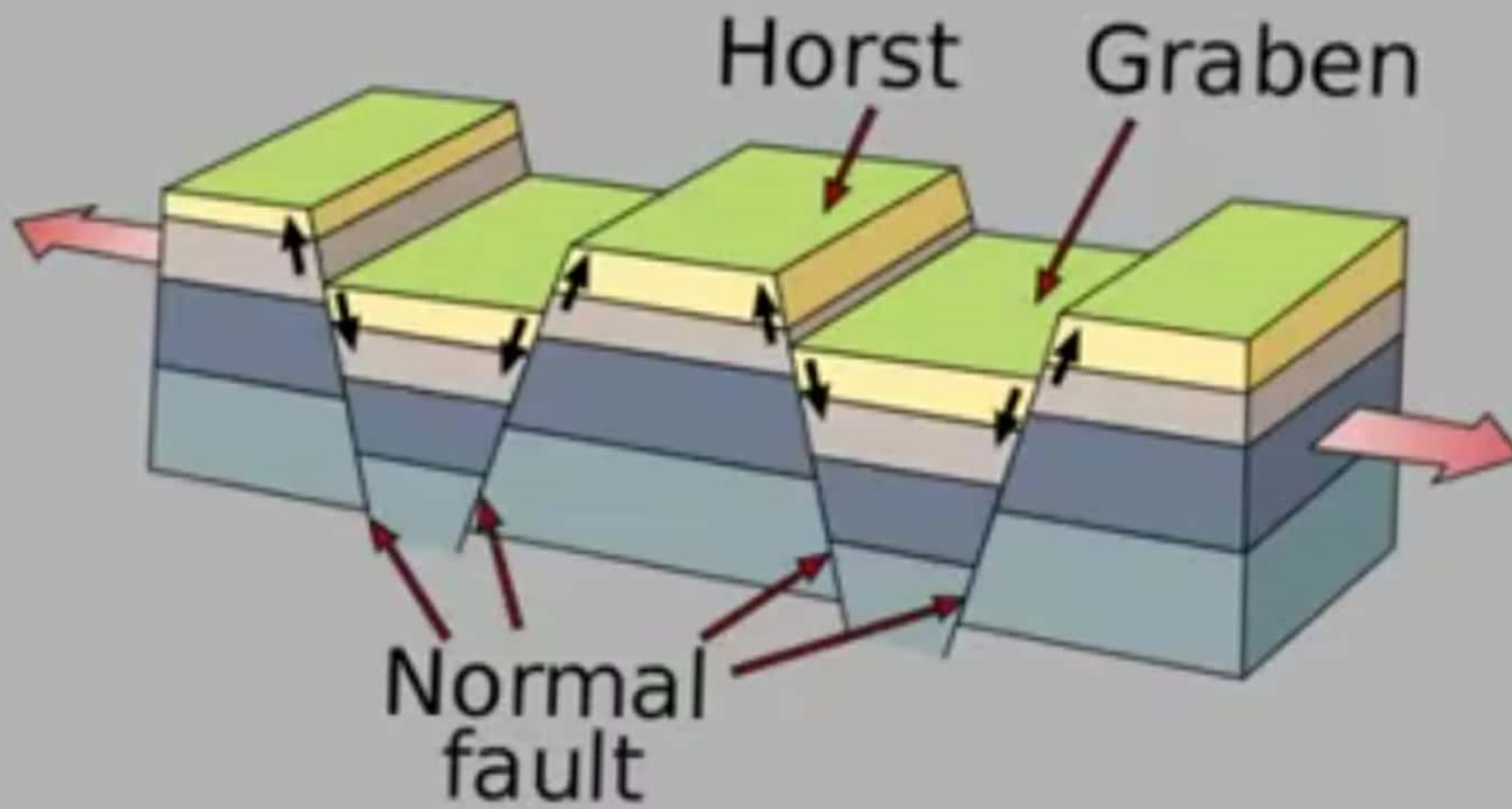
dip



Strike and Dip
Figure 15.8



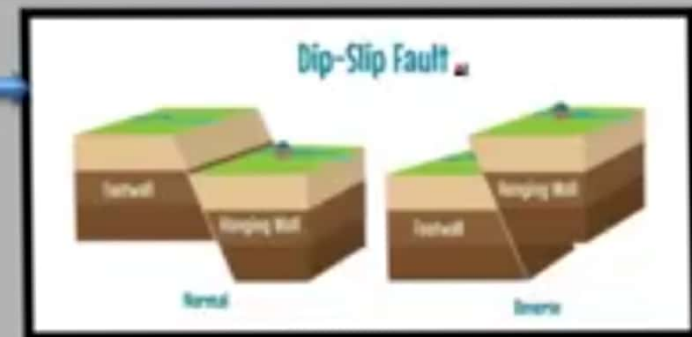
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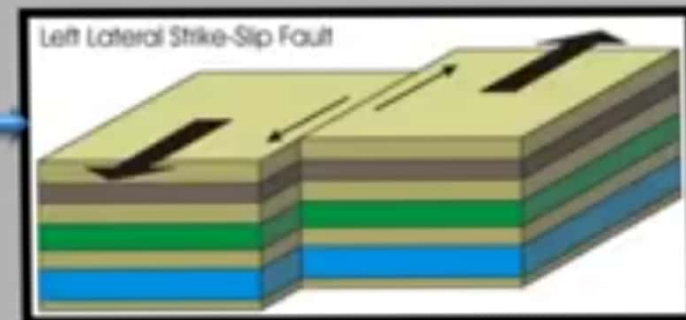
Types of Faults:

Faults can be broadly classified into two types :

1. **Dip Slip Fault** – vertical movement.



2. **Strike Slip Fault** – Horizontal Movement



Normal Fault:

- Hanging wall slips downward relative to the footwall.
 - Occurs due to **stretching of rocks**.
 - The **throw** i.e. the vertical component of the movement **is large**.
 - Vertical Displacement.
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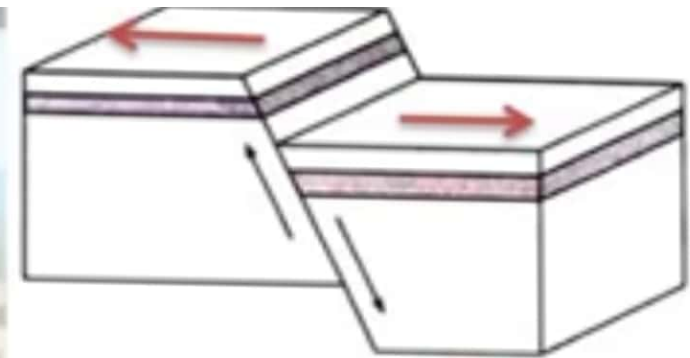


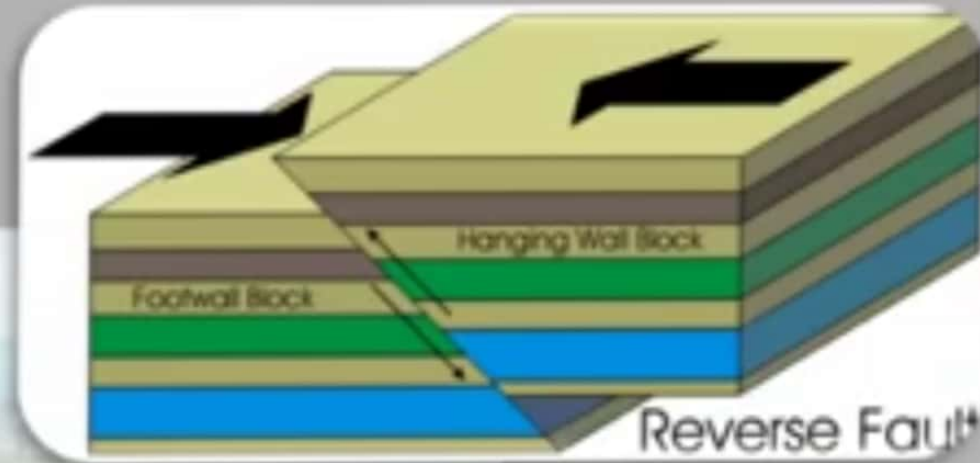
Fig. 17.29 Normal fault



Reverse Fault:

- Opposite of normal **faults** ; hanging wall rises relative to the footwall.
- Result of **severe compressive stresses**.
- Also called a **thrust fault**.
- Vertical Displacement.

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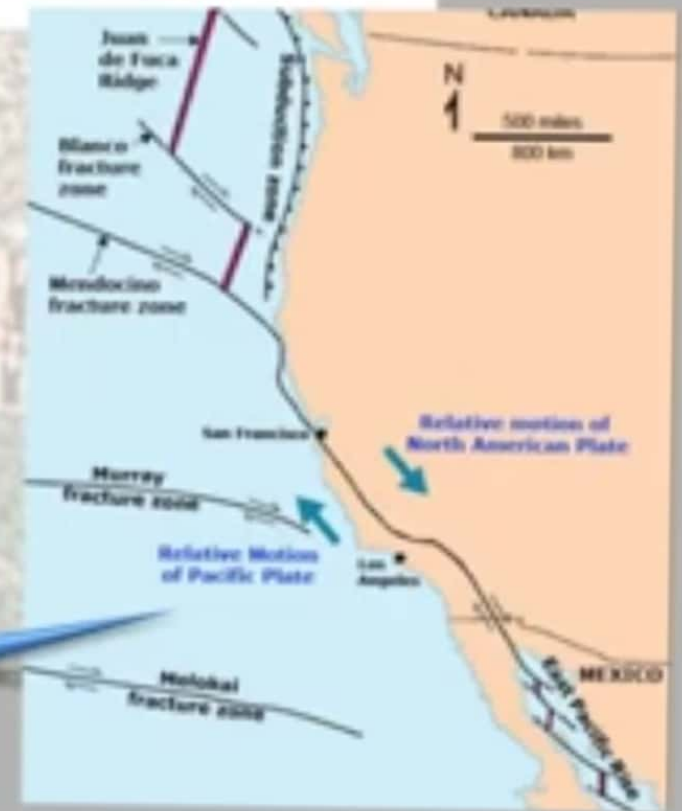
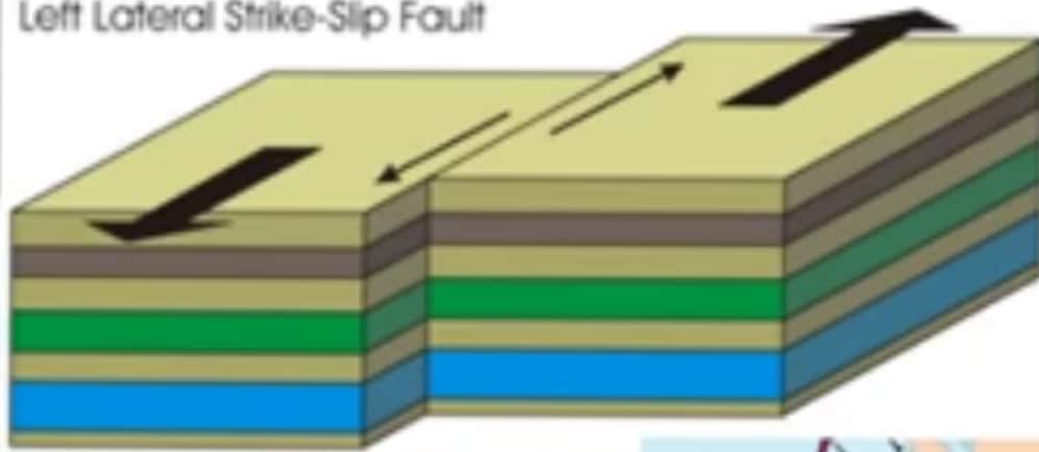


Strike-Slip Fault :

- Rock strata are displaced mainly in a horizontal direction, parallel to the line of the fault.
- **Also called** lateral fault, trans-current fault, wrench fault or tear fault.
- Horizontal Displacement.

San-Andrese fault , USA

Left Lateral Strike-Slip Fault



Step Fault:

- Consists of a number of faults with **parallel fault planes**.

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- The **separated blocks slipping** in the **same direction** along parallel planes giving a step-like feature.

- Vertical Displacement.

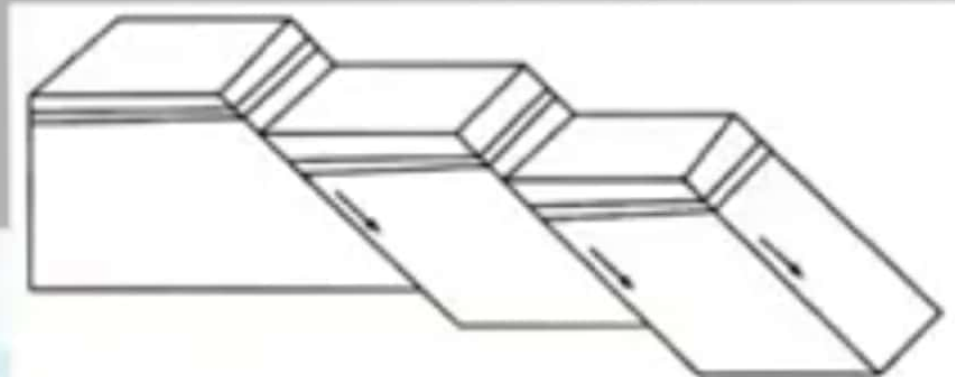
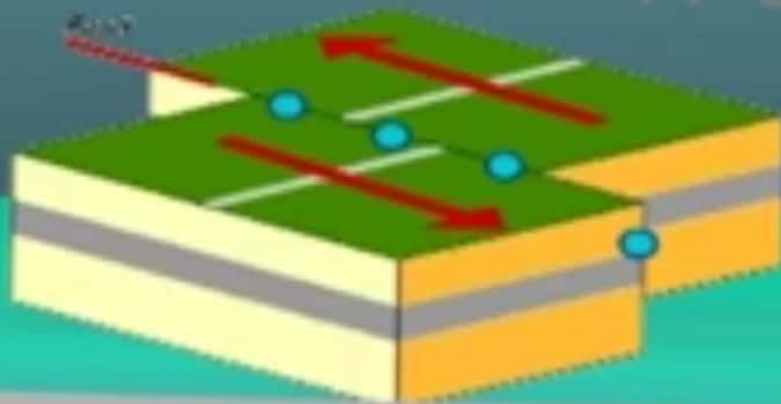


Fig. 17.33 Step fault

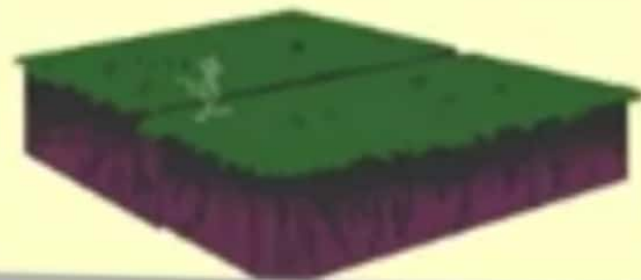
Tear Fault :

- A tear fault, also known as a transform fault, occurs when two tectonic plates slide in a lateral motion past each other.
- This type of fault causes the most severe earthquakes because they grind against each other. These earthquakes can either be shallow or deep and cause tremors over a short or long period of time.
- Tear faults can occur frequently, especially along the coast of California.

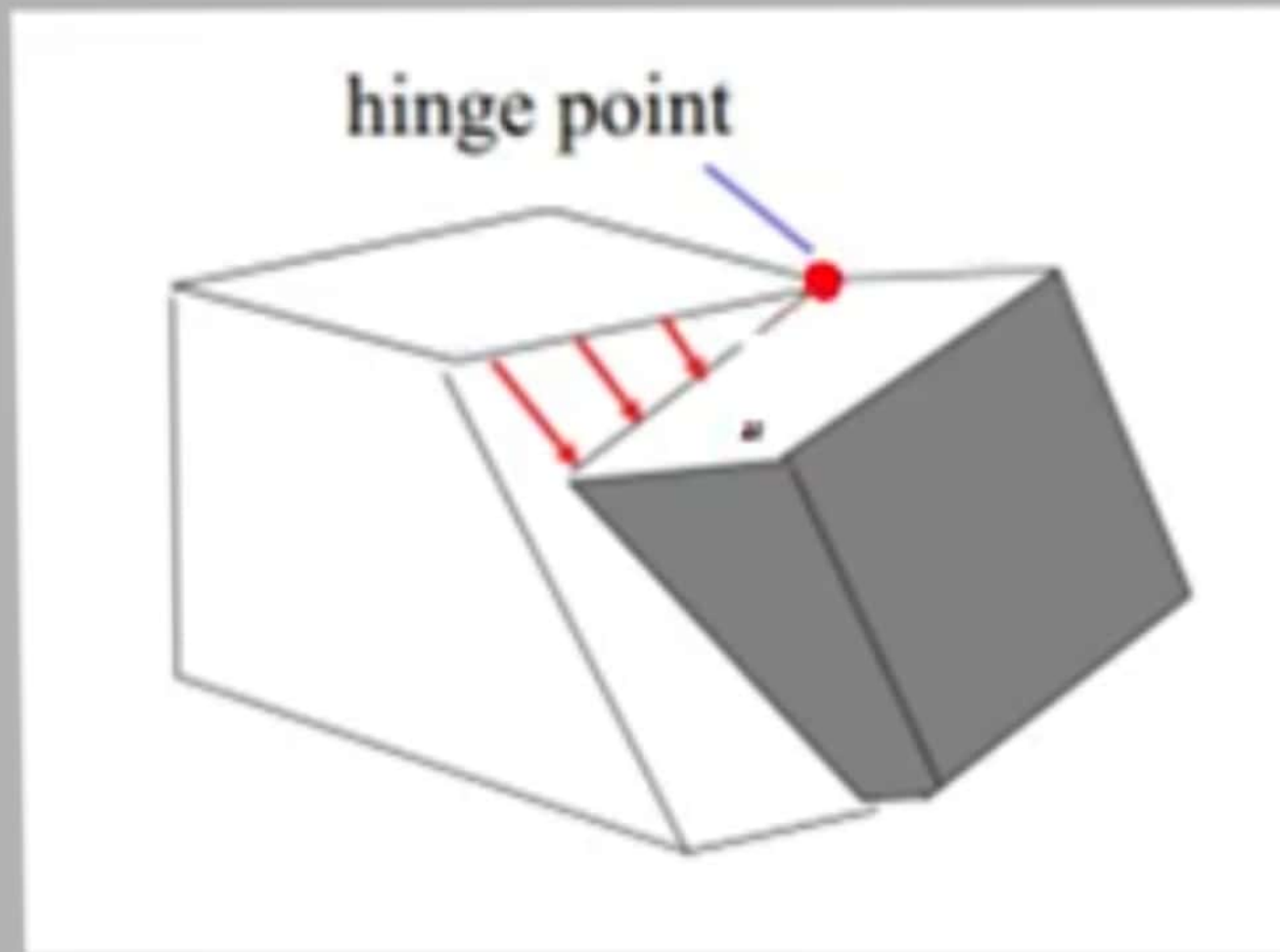
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Two plates slide laterally

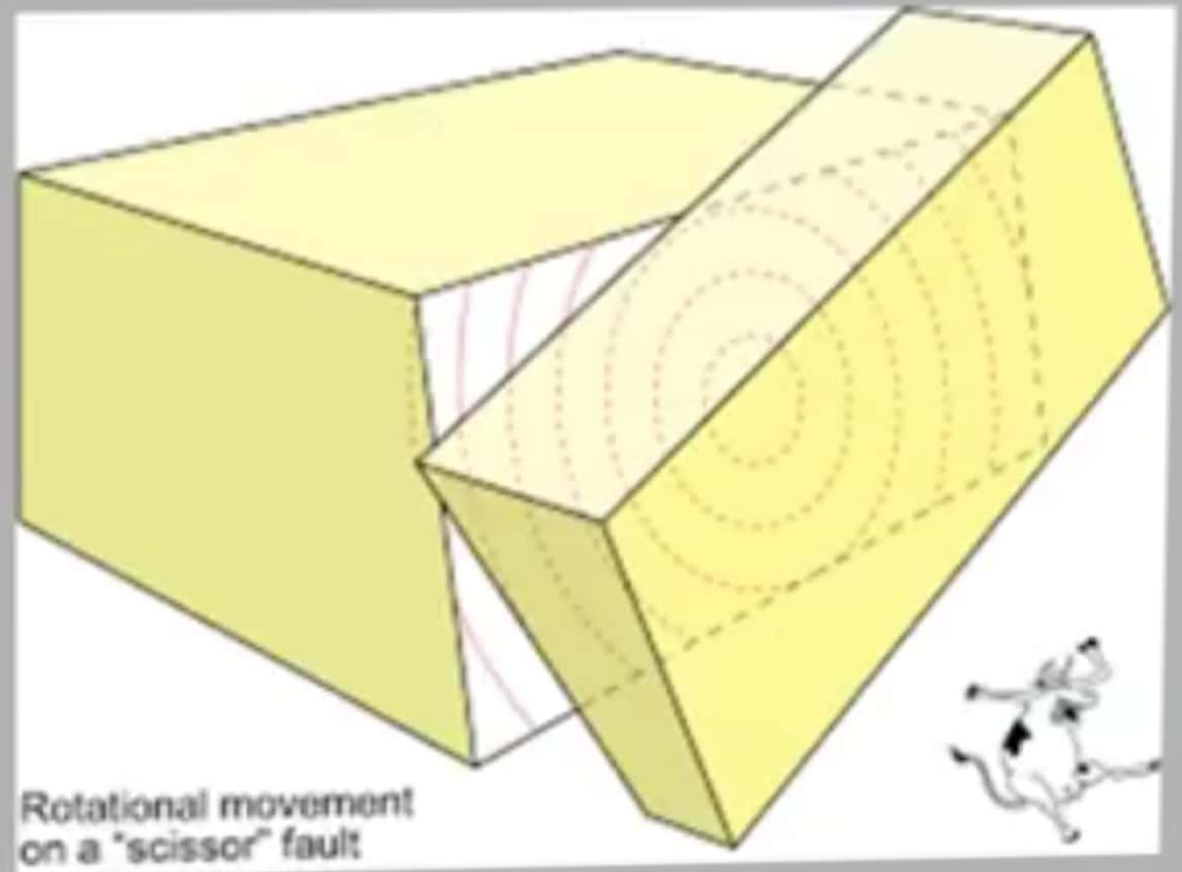


Hinge Fault :



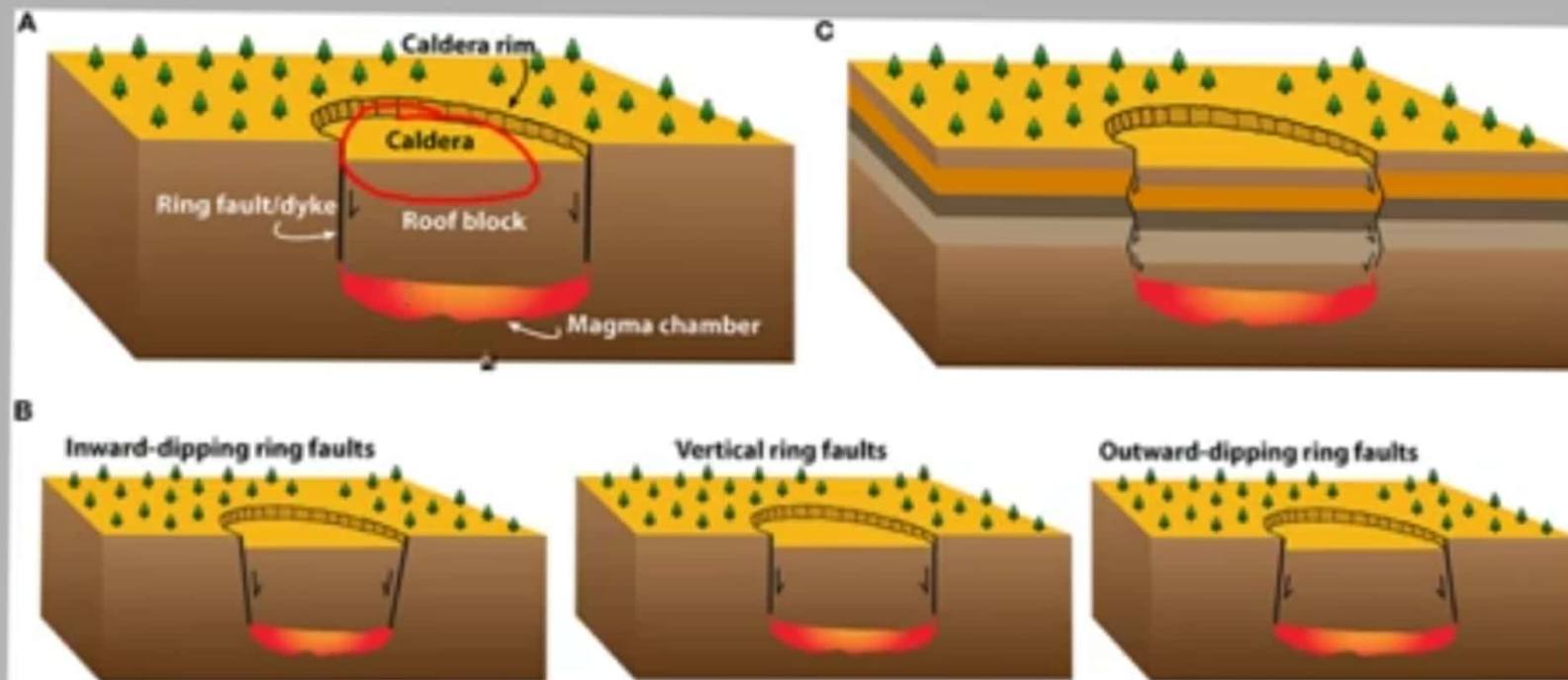
Rotation Fault :

Scissor Fault :



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Ring Fault :



Exogenetic Forces

- Disintegration & Breaking of rock w/o movement.
- Static
- In-situ

- ...with movement.
- Mobility.
- Ex-situ

Weathering ✓

- Physical / Mechanical (Temperature, pressure)
- Biological (Biotic community action)
- Chemical (Agent - water)

Erosion

- ← Ice
- ← Sea
- ← River
- ← Wind
- ← Undergro und water

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UPSC