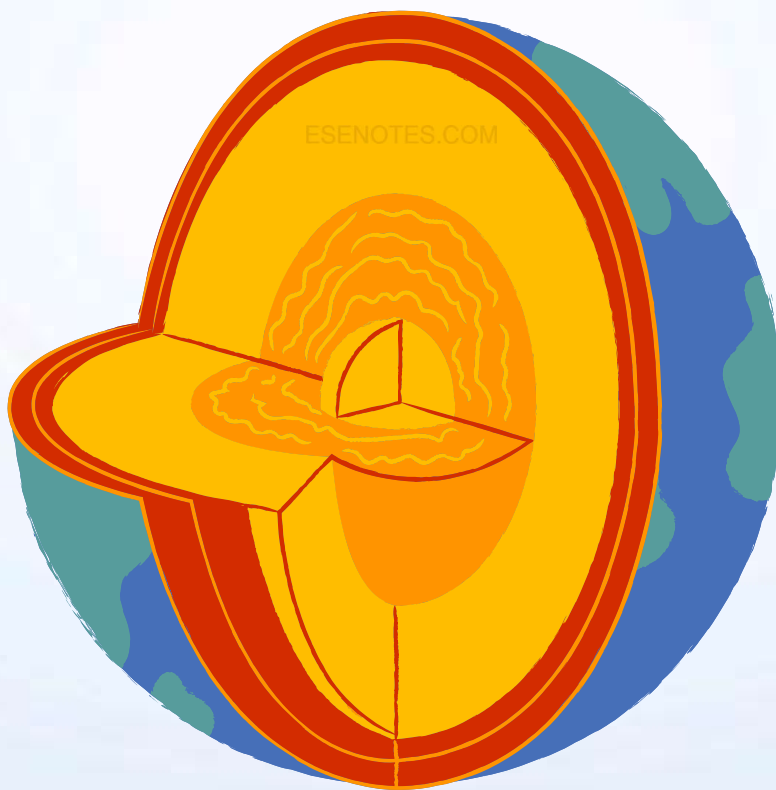


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ENGINEERING

GEOLOGY



BY JASPAL SIR

ENGG. GEOLOGY

Engg. geology is a application of geological knowledge to the siting, design, construction operation and maintenance of civil Engg structures.

Geology:- Here geology essentially involves studying of different aspects or different process involving different parts of earth.

Application:- in structures, mining, hydroelectricity, laying, Roads, Railway, pipeline etc., earthquake, stability of slopes.

Remote Sensing & geological mapping:-

Remote sensing is used as a tool to extract the information about the land surface structure, composition and subsurface. but is often combine with other data for complementary information.

Geological application of Remote sensing:-

- (a) Subsurface mapping
- (b) Structural mapping
- (c) Mineral exploration
- (d) Environmental mapping
- (e) geobotany
- (f) sedimentation mapping
- (g) event mapping
- (h) marine mapping

MINEROLOGY :-

It is the study of chemistry, crystal structure, physical properties, geographical distribution, formation, classification of mineral.

★ Minerals are natural occurring, inorganic, solid, crystalline substance which has a fixed structure and a chemical composition which is either fixed or may vary within a certain range.

Aggregate of one or more minerals is termed as ROCK.

NOTE

- Study of rock is termed as RETROLOGY.

- Artificial mineral (like ^(organic) Diamonds, chitin) are termed as MINERALOIDS (inorganic)

Rocks are broadly classified into three category:-



- (A) Igneous Rock
- (B) Sedimentary
- (C) metamorphic.

(A) Igneous Rock → Formed by the solidification of magma.

(i) Extrusive Igneous Rock:-

- ^(Solidification) Cooling done on the surface.
- Properties change
- Comparatively Fine grained Structure.
- Ex - Basalt, Andesite, scoria etc

(ii) Intrusive Igneous Rock:-

- ^(Solidification) Cooling done below the surface.
- Comparatively Coarse grained Structure.
- Ex! - Granite, Pegmatite etc.

(B) Sedimentary Rocks:-

These Rocks are formed by erosion of existing Rocks and deposition either in sea or on land.

(i) clastic Sedimentary Rock:-

- The fragments of pre-existing rock or minerals deposit to form these rocks

(ii) Non-clastic Sedimentary Rock:-

- These Rocks occurs when minerals are precipitated directly from water or organic matter.

(C) Metamorphic Rocks:-

These are formed by the application of high temp. and pressure over the existing rocks.

(i) Foliated:- These Rocks have distinct plane of weakness caused by Re-alignment of mineral due to application of Temp & Pressur.

(ii) Non-Foliated (Granular):- These rocks consist of interlocking granular of one or more mineral.

FEATURES OF ROCK:-

Following features of the Rocks helps in its identification of a particular type of Rock.

(a) TEXTURE:- It refers to shape, arrangement, distribution of minerals within the Rock and does not refers to roughness of the surface of the Rock.

(b) STRUCTURE:- It refers to broader aspect of identity of rocks such as its bedding plane, foliation etc.

NOTE

TEXTURE and STRUCTURE collectively referred to as fabric of the rocks.

(c) GRAIN SIZE:- It refers to the size of individual mineral crystals in a rocks.

(d) MINERALOGY:- It refers to the mineral present within the rock and there relative proportion.

(e) OTHER FEATURES:-

- Colour
- Hardness
- Strength
- Sp. gravity

also helps in identifying the Rocks.

GEOLOGICAL AGENTS:-

The Surface features of the earth are results of various geological agents.

Here surface features refers to mountain hills, valleys, plane, etc. and these are formed by EXOGENOUS or ENDOGENOUS Process.

The Process which derived there energy from external sources (Sun) like:- blowing wind, running water, sea wave, glaciers etc are termed as EXOGENOUS PROCESS.

On the other hand ENDOGENOUS PROCESS are those which is originates within the earth crust.

Example:- Earthquake, volcanic eruption etc.

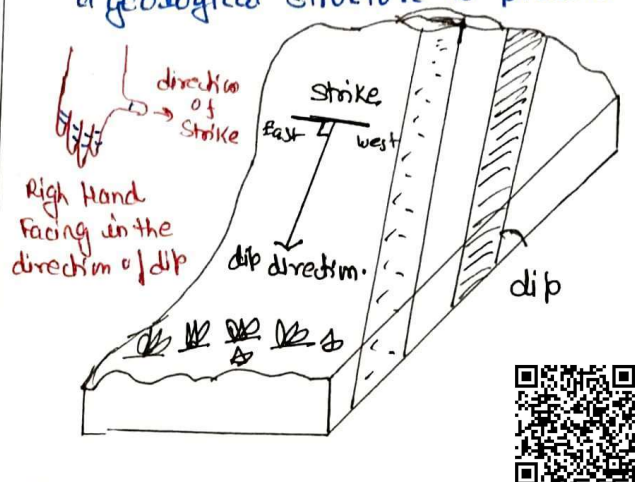
STRUCTURAL GEOLOGY:-

It is the study of factors such as origin, occurrence, type, classification effects of various secondary structure like —

STRIKE, DIP, UNCONFORMITY
FOLDS, FAULTS,
OUTLINER, INLINER etc.

(a) STRIKE:-

It refers to the direction in which a geological structure is present.



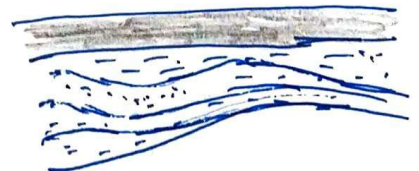
(b) DIP:-

It refers to the slope of structure. It is expressed both as direction and amount.

The dip direction is the direction along which the inclination of the bedding plane occurs.

(c) UNCONFORMITY:-

- An unconformity is a contact b/w sedimentary Rocks that are significantly different in age or b/w sedimentary rock and older igneous or metamorphic Rocks.



(d) HIATUS:-

An unconformity which represents a long geological period during which break in sedimentation has occurred is termed as HIATUS.



② JOINTS :-

A Joint is a fracture dividing rock into two sections that have not moved away from each other.

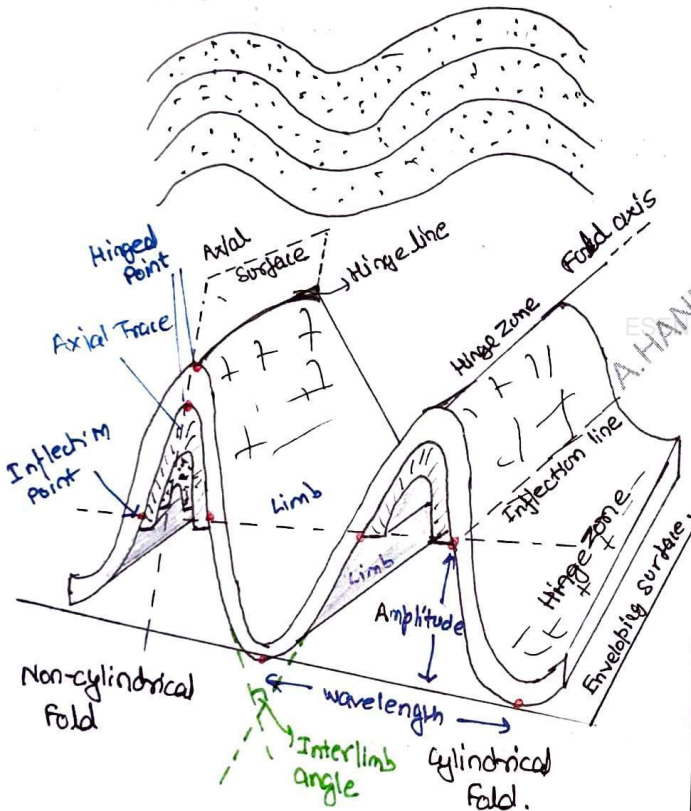
It may be described as cracks in the rocks.

③ FOLD :-

These are the most common geological structure which are found in rock.

Due to the tectonic moment, when a set of horizontal layers are subjected to compressive forces, they bend either upward or downward.

These bends in the rocks are termed as FOLD.

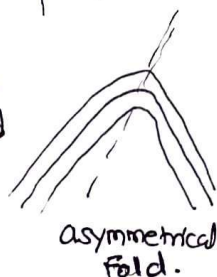


Folds are classified as follows :-

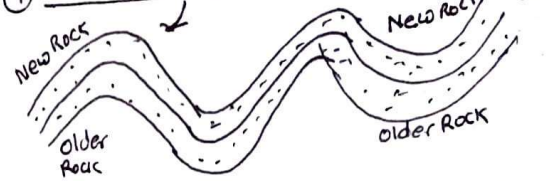
(i) Symmetrical Fold :-

When the axial surface divides a fold into two equal halves in such a way that one half is the mirror image of the other one, it is termed as symmetrical fold or else it is termed as

(ii) Asymmetrical Fold :-



(i) Anticline Fold



- When the beds are bent upward, the resulting fold is called ANTICLINE FOLD.
- Anticline fold is convex upward and older bed occurs in concave side and new beds occur toward convex side.
- SYNCLINE FOLD are just opposite of Anticline fold.

PLUNGE LINE :-

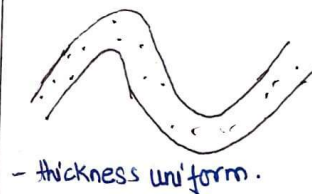


Fold axis parallel with ground surface
 $\theta = 0^\circ \Rightarrow$ Non-plunging Fold



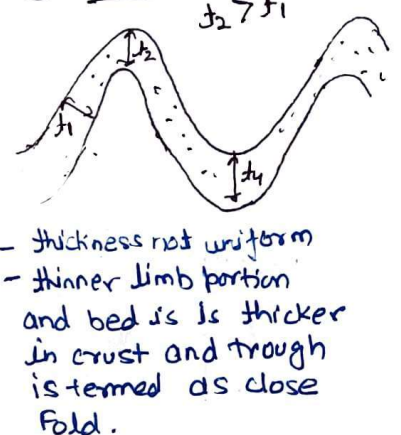
Fold axis make some angle with horizontal called Plunging Fold.

(i) Open Fold



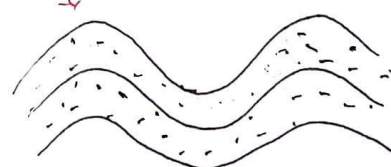
- thickness uniform.

(ii) Close Fold



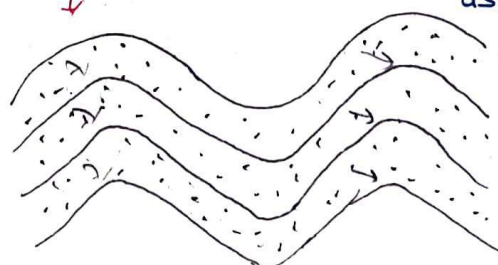
- thickness not uniform
 - thinner limb portion and bed is thicker in crest and trough is termed as close fold.

(E) (i) Similar Fold OR (ii) Parallel Fold

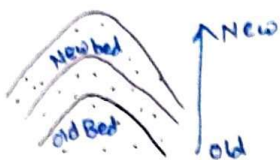


Shape of fold remain same with depth it is termed as similar fold but if crest and trough become pointed with depth it is termed as pointed fold.

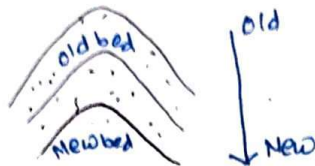
(ii) Pointed / Angular fold :-



⑥ Overturned Fold



Normal Fold

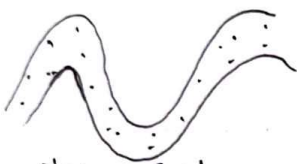


Overturned Fold

In normal fold the limb shows the order of superposition, but when one of the limb is overturned, the order of superposition is ~~Reverse~~. of the bed in that limb will be in Reverse order that is older bed over the younger bed. This fold is termed as overturned fold.



⑦ Chevron Fold :-



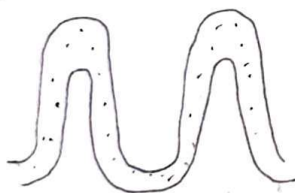
Normal fold



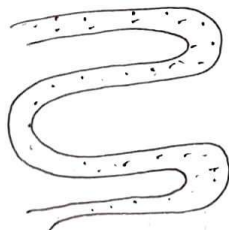
chevron fold

Normally the crest and trough of beds are smoothly curved, but some folds have sharp bent or angular crest and troughs such folds are termed as CHEVRON FOLD.

⑧ Isoclinal Fold :- ^{Limbs not inclined} ⑨ Recumbent Folds



Isoclinal fold



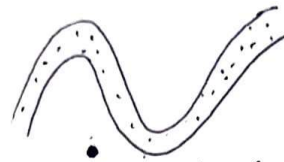
Recumbent Folds

- Normally the folds have inclined limbs i.e. limbs will be mutually diverging or converging with respect reference to axial planes.
- But in some folds the limbs are mutually parallel to great extent, such folds are called ISOCLINAL FOLDS.
- These Folds may be Vertical, inclined or horizontal.

P.T.O

- The horizontal isoclinal folds are termed as Recumbent Folds.

⑩ Fan Folds :-



Normal anticline/syncline fold



Fan Fold.

- In normal anticline and syncline fold, limbs dip away from one another and towards each other respectively. But in case of Fan Fold, this trend is just the opposite.

⑪ Domes & Basin :-



Domes



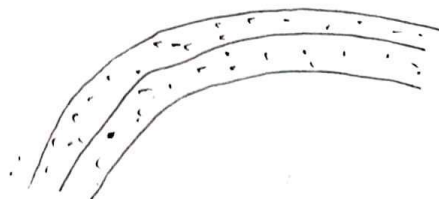
Basin.

In normal folds limbs can be differentiated easily, but some folds do not have any such specific limbs and appears as beds locally pushed up or down.

Their shape appears as Domes or Basins.

⑫ Monocline :-

- Normally every fold has two limbs, each one is common to the adjacent folds.
- But when beds show a simple bend with similar altitude on either side of it, such a fold appears to have only one limb and is termed as MONOCLINE.

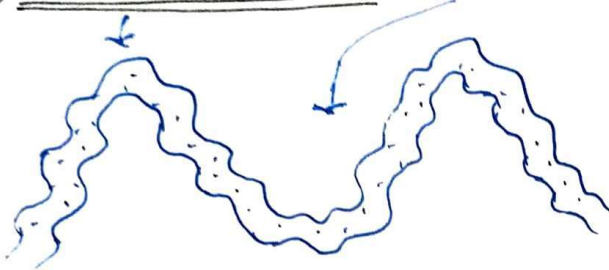


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① Geanticlines and Geosyncline:-

The anticlines and syncline with a normal shape but a very large magnitude are termed as geanticline and geosyncline.

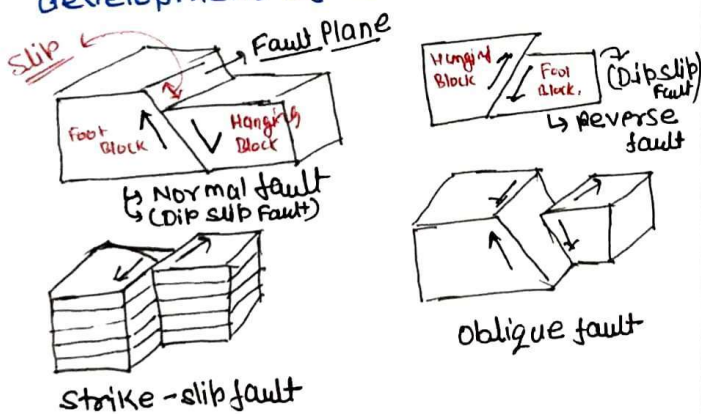
② Anticlinorium and Synclinorium:-



- when the limbs of the fold are not plan but characterised by the presence of other minor folds on them is termed as anticlinorium and synclinorium.

③ FAULTS (structural geology)

- It is the surface or narrow zone along which one side has moved relative to the other in a direction parallel to the surface or zone.
- These faults are generated due to development of shear stresses.



- These faults are characterised by following element.

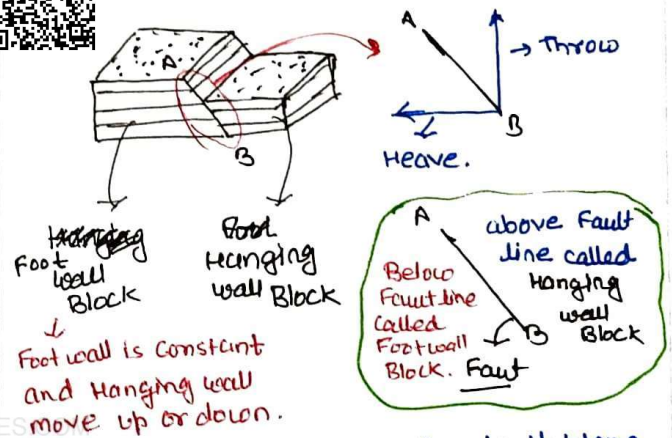
① Fault Plane:- It is the plane or surface along which the block moves with respect to each other.

② Fault Block:- The two portion of the rocks separated by the fault plane is termed as fault block.

③ Slip:- The relative displacement that occurs during faulting is termed as slip.

It may along the strike direction or in the direction of dip or both.

- Horizontal Component of this displacement is termed as Heave and Vertical Component is termed as Throw.



- The fault block above the fault plane is the hanging wall block.

- The block below the fault is Footwall Block.

- The fault in which such strata are displaced mainly in a horizontal direction, parallel to the line of fault is termed as strike slip fault.

- If a fault displacement is inclined it is termed as dip-slip fault. and it is further classified as:-

④ Normal fault:- when the hanging wall drops down in relation to the foot wall, it is termed as normal fault.

⑤ Reverse fault:- when the hanging wall moves up in relation to the foot wall, it is termed as Reverse Fault.