

# **GEOLOGY**

**Notes by-**

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## Kinds/ Types of metamorphism:-

- ① Heat is Predominant  $\Rightarrow$  Contact
- ② Pressure  $\Rightarrow$  cata-classic
- ③ Heat & Pre. both  $\Rightarrow$  Dynamothermal
- ④ Heat & Uniform pre  $\Rightarrow$  Plutonic

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Rock Weathering:- The rock weathering may be defined as "change in physical & chemical properties of rock" due to action of atmospheric agent's.

physical change  $\Rightarrow$  disintegration  $\Rightarrow$  No change in chemical composition.  
chemical change  $\Rightarrow$  decomposition.  $\Rightarrow$  change in chemical composition.

disintegration & decomposition are simultaneous process but if,  
warm, moist, low lying region  $\Rightarrow$  Decomposition predominant.  
cooler, drier, Higher region  $\Rightarrow$  Disintegration predominant.

### Dis Decomposition:-

- ① Oxidation
- ② Hydration
- ③ Carbonation
- ④ Chemical Reactn.

### Disintegration:-

- ① Cooling & heating of rock.  
i.e. contraction & expansion.
- ② Freezing the water.  
ice  $\Rightarrow$  Increased vol.
- ③ Wind.

## STRUCTURAL GEOLOGY

Structural Geology deals with the large scale features of rock masses such as their size, shape, their attitude in space, their relationship with each other as seen in the field in their outcrops i.e. portion of rock formations which are exposed at the surface.

Sedimentary rocks are deposited in beds, lying one over other, which can be distinguished from each other because of diff. in their physical properties. Two successive beds are separated from each other by a plane surface which is called as bedding plane.

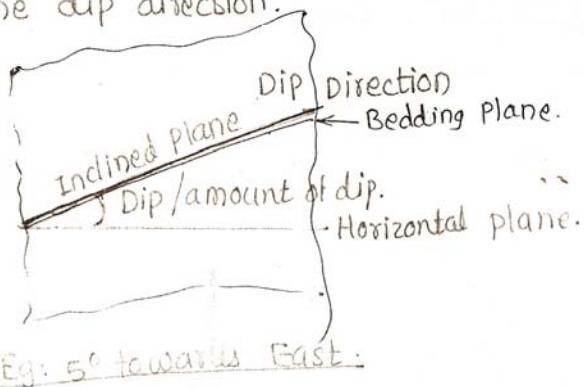
\* Horizontal bedding Plane:- Sedimentary rocks are deposited in horizontal layers. If uplift force acts such that their horizontal altitude does not disturb, & bedding planes are horizontal.

\* Dip:- The bedding plane in case of sedimentary rock may be inclined due to uplift pressur. such beds are said to be "dipping".

The position of dipping plane is accurately described as-

- ① direction in which planes are inclined.
- ② Angle with which plane make with horizontal.

The angle that a bed makes with horizontal is called as its "dip" or "amount of dip" & the direction in which it dips is called the dip direction.



Eg:  $5^{\circ}$  towards East:

\* strike:- If a horizontal line is drawn on an inclined bedding plane it will run in the direction at right angles to the dip direction (& represents the "strike" or "strike direction" of the bedding plane. Strike & Dip are always at right angles to each other.

#### \* Apparent dip:-

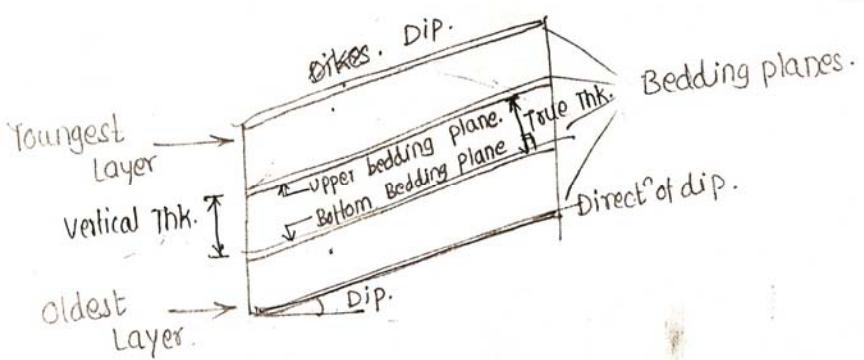
Amount of dip of any bed can be directly measured by "clinometer" if suitable exposures are available e.g. vertical sections in slope of vertical cuts. But when dip is measured like this, this may not be 'True dip'.

An inclined plane will show different angles of dip in diff. direction & the max. angle of dip is true dip of the plane which is seen in the dip direction. Therefore the angle measured in the field will represent the true dip, only if the section runs in the dip direction. The dip seen in any other direction is called as "Apparent Dip! Apparent dip is always less than 'True dip'.

#### \* conformable Series:-

When deposition of weathering goes continuously at a site, a sequence of beds will be formed all having same strike & dip. These layers having same dip & strikes are known as conformable series.

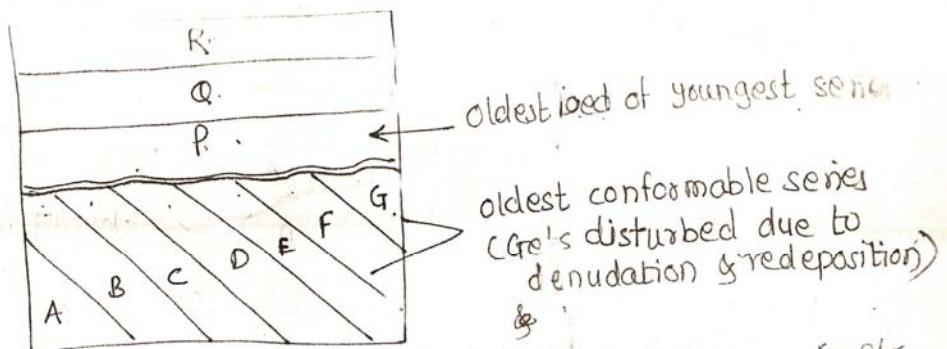
In undisturbed conformable series, lower bed is oldest; bedding plane & youngest will be the topmost plane.



### Conformable series.

Unconformity:- After deposition of a conformable series, it is uplifted by dry land & exposed to denudation, i.e. removal by the action of atmospheric agents & water. Due to denudation conformable series will be carved out into hills & valleys giving an irregular land surface. When submergence again takes place, deposition will start after a break & another conformable series will be deposited on the eroded surface of the series first deposited. Then the surface separating the two series will not be a plane surface but will have an irregular surface denoting that there has been a break in sedimentation. Such a break in deposition is called as "Unconformity" & the youngest series i.e. series deposited after the break is said to be "Overlie Unconformably" the older series - i.e. series that was first deposited.

In conformable series each bed can come in contact with only one bed below & only one bed above. But in case of unconformity the oldest bed of the younger series is deposited on the eroded surface of the older series & hence at bottom it is in contact with more than one bed of older series.

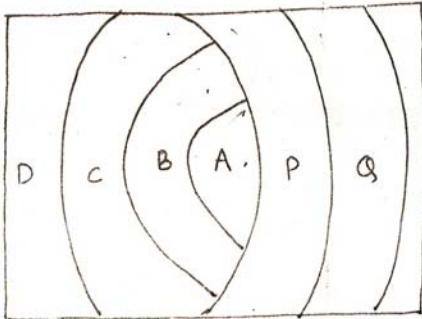


Bed of P is in contact with No. of beds of A, B, C, ... G, etc.

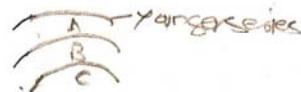
\* fa

As younger series is deposited on the older series, the outcrop of the older series are partly concealed by the younger series & therefore come to an abrupt end against the oldest bed of the younger series.

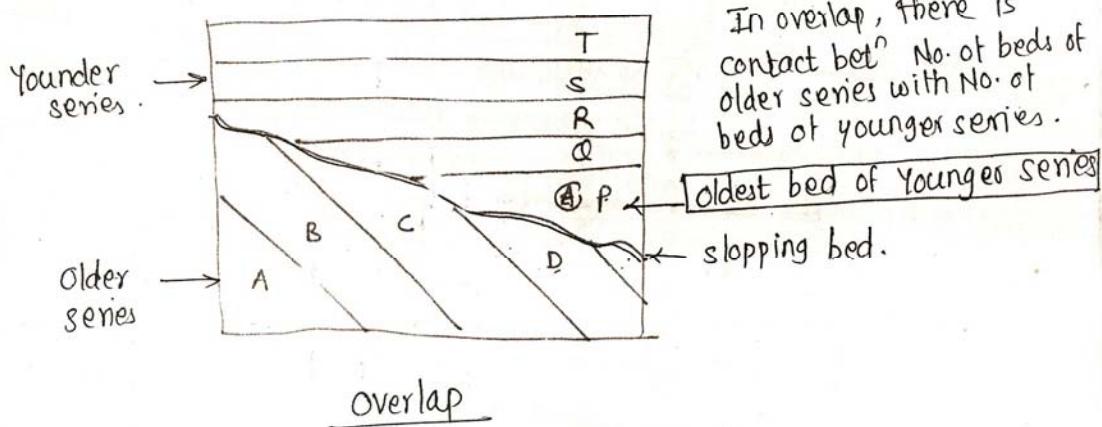
Unconformity therefore can be recognised in the field or in geological map when a bed is seen coming in contact with more than one bed on one side & the outcrop on this side are seen to come to an abrupt end against this end which is the oldest bed of the younger series.



Inconformity as seen in a map.  
Outcrops of series ABCP come to an abrupt end against 'P'.  
Therefore ABCP is older series &  
P is older bed of younger series.



Overlap:- In a normal unconformity, only the oldest bed of the younger series comes in contact with the older series. But when the site of deposition is a basin or a sloping surface, two or more beds of the younger series come in contact with the older series. This is called as "Unconformable Overlap" or "Unconformity with Overlap" or simply "Overlap".



In overlap, there is "contact bet" No. of beds of older series with No. of beds of younger series.

②  
③

\* Faults :- अक्षराता फॉलों के।

Tensional fissures develop in beds when they are subjected to tensional forces. A bed is divided into two parts by the fissure & one part may move vertically downward along the fissure relative to the other part under the action of gravity. Such fissures along which relative movement has taken place is known as fault.

The plane along which movement of bed has taken place is known as fault plane which may be vertical or inclined & according to that fault is known as vertical fault or inclined fault.

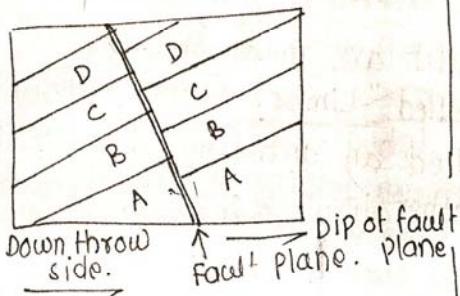
Types of faults:-

- ① Vertical Fault: Fault plane is vertical.
- ② Inclined Fault: Fault plane is inclined.
- ③ Dip Fault :- Fault is running in dip direction.
- ④ Strike Fault :- Fault running in strike direction. (Lar to dip)
- ⑤ Dead Fault :- No future movement is possible.
- ⑥ Live Fault :- Future movement is possible.
- ⑦ Normal Fault :- Dip of fault plane is in the same direction of down-throw side.
- ⑧ Reverse Fault :- Dip of fault plane is in opposite direct.

\* Down-Throw Side :- The side on which beds have slipped down is called as down-throw side.

#### Normal Fault

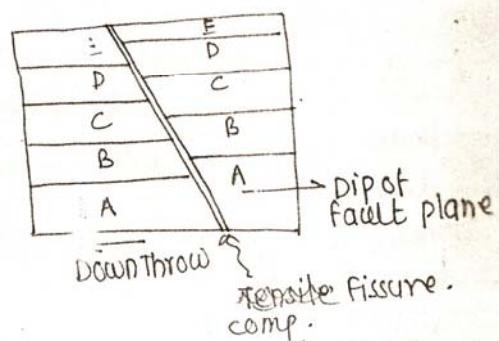
- ① Dip of fault plane is in the direction of down throw side.



- ② Fault plane is steep.
- ③ It is result of tensile forces.

#### Reverse Fault

- ① Dip of fault plane is in opposite direction.



- ② Fault plane is gently dipping.
- ③ Formed due to lateral compressive forces.

### Fault zone :-

The enforced movement of rock masses against each other during faulting results in crushing & fragmentation of rocks around the fault plane. This gives rise to a zone of crushed & fragmented rock which is called a "fault zone".

Fault zones are zones of weakness because of the fragmentation of rocks. & they also provides passage for flow of water, which leads to further weakening & decomposition of rock.

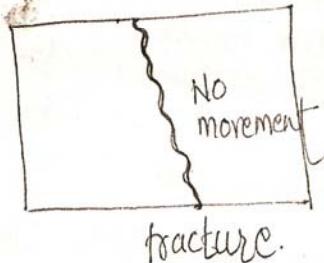


Eg:- Narmada at Navagam Dam site in Gujrath.  
Here river flows along a major fault with a fault zone of 13m wide.

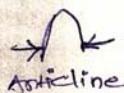
### \* Fractures :- ~~Fracture~~

When relative movement of beds takes place along a crack the structure is called a fault.

But when only cracks develops & there is no relative movement along the crack is known as fracture. [Eg: Hand fracture]  
As there is no movement along the fracture, there is no crushing of the kind that takes place during faulting.



### \* Folds :- ~~Fold~~



When beds are acted by lateral comp. forces, beds gets folded into arches & troughs which are made of two parts dipping in opposite directions, called "Limbs". When upfolded in to an arch, the structure is called an "anticline" because the two limbs dips away from each other in two opposite directions from the crest.

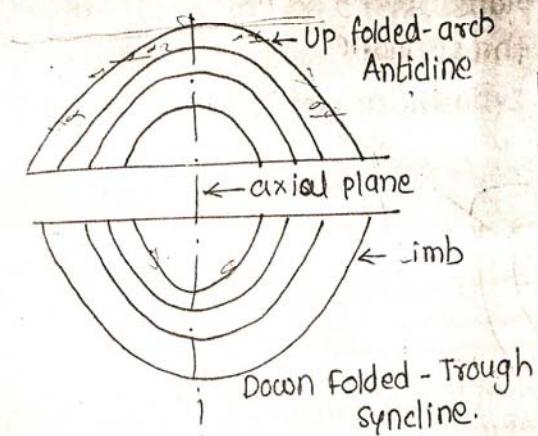
Thus,

\* Fold :- Lateral comp. force causes folding of beds in to arches & troughs  
 \* Anticline :- Limbs dips away from each other in opposite direct<sup>n</sup> to the  
 \* Syncline :- Limbs dips towards each other.



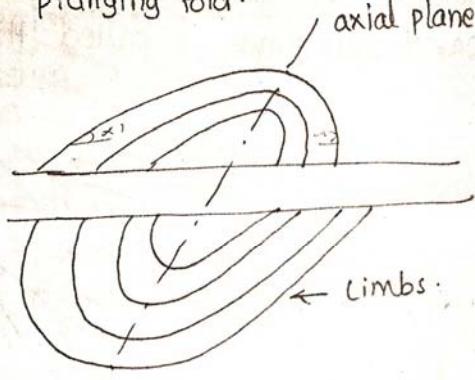
### Symmetrical Fold

- ① Limbs has same dip on both side of axis of fold.
- ② Axial plane is vertical.



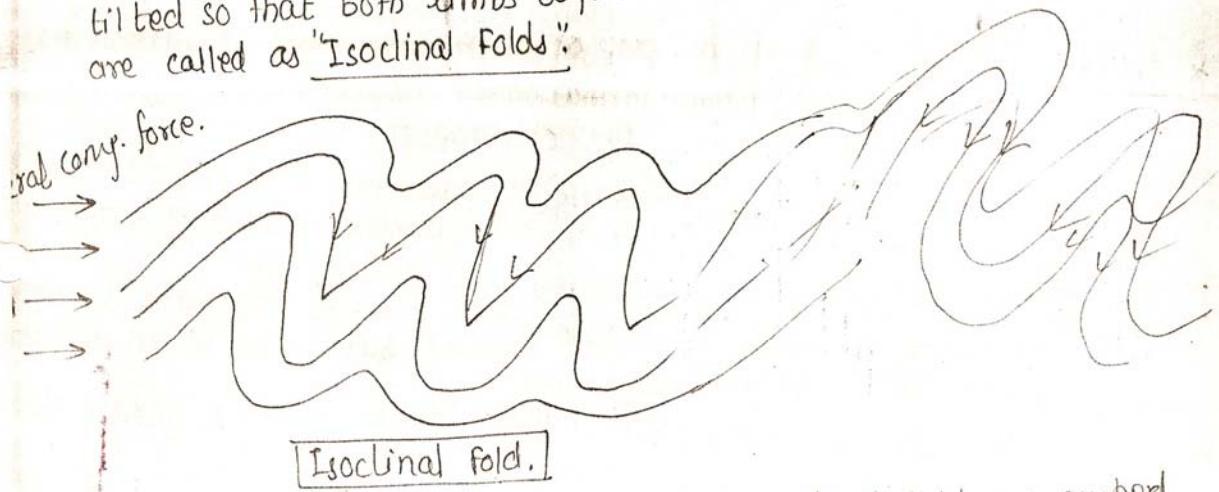
### Assymmetrical Fold

- ① one limb is steeper than other
- ② Axial plane is inclined. It is also called as pitching fold or plunging fold.



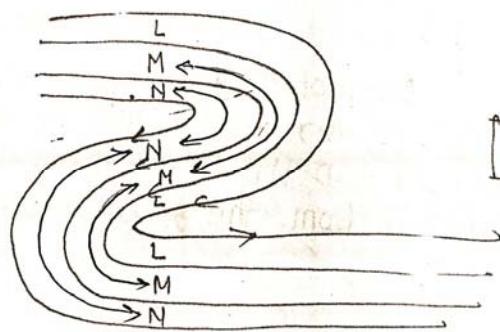
### Recumbent Fold

- \* Overthrust :- When lateral comp. force acts only from one side, beds would be first folded & then fold is pushed on one side & tilted so that both limbs dips in same direction. such folds are called as "Isoclinal Folds".



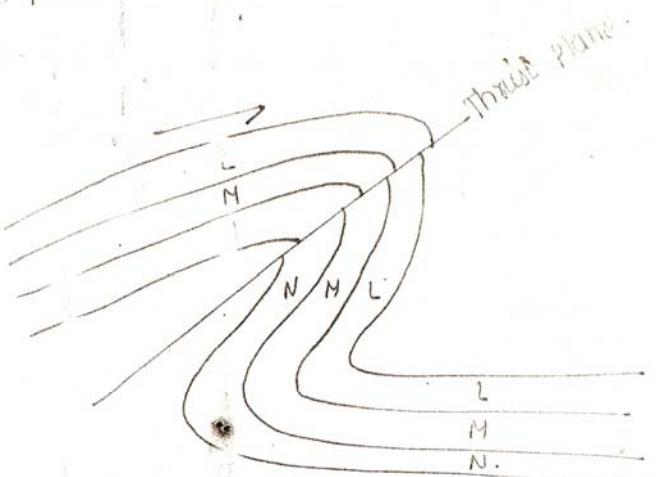
Isoclinal fold.

on further application of force, the isoclinal folds are pushed further until they lie on one side. such folds are called as recumbent fold



Recumbent fold

Finally when the elastic limit is exceeded, rocks are fractured along the axial plane & the upper part of the fold moves bodily along the plane of fracture over the lower part & is thrust upon them. This is called as "Overthrust or Thrust Fault". This is same as Reverse faults. The plane along which movement has taken place is called the thrust plane.



### Overthrust / Thrust Fault

\* Inlier:- An inlier is an outcrop of an oldest formation surrounded by on all sides by younger formation.

In fig. Outcrop of A is an Inlier.

following geological conditions can give rise to an inlier when denudation has proceeded deep enough.

- ① Unconformity.
- ② Strike fault with downthrow against dip.
- ③ Anticline eroded by a stream running at right angles to the axis.

- ④ At the centre of eroded structural dome  $\rightarrow$  structural dome is a str. in which beds are dipping outwards in all directions away from a central point.
- ⑤ In a valley in which slope is first steeper & then gentle further dips than d/s dips.

\* Outlier:- An outlier is an outcrop of a younger formation surrounded by older formations. An outlier will be formed on a hill which has slope steeper than the dip. It often is a detached portion of a bed separated from the main outcrop by denudation.

