(Geology)

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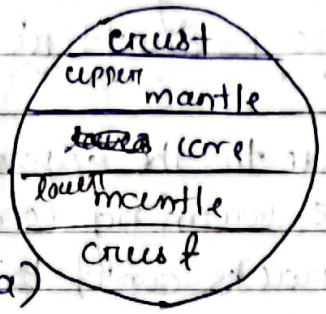
Geology is the branch of science which in-cludes in deals with the study of earth.

The layers of earth is divided into three types.
(i) Crust
(ii) Mantle (largest area)
(iii) core



Mineral :-

It is homogeneous solid material which are definite chemical composition and fixed crystal str.

Hema - Fe_2O_3
Magne - Fe_3O_4

colour :
streak :- The colour is powdered form

cleavage :- → less cleavage
→ largest cleavage.

lustre :-
Flours - Fauna

Weathering :- It is the break down of larger rock to smaller rock it is known as weathering.

Exogenic Agent (बाहरी बल)

Endogenic Agent

=> It is under dividing into three types.

(i) Physical weathering
(ii) chemical weathering
(iii) organic weathering

Frost shattering :-

The break down of rock due to the expansion of water which enters de-forming core on rock. which induce cracks and breakes of the original rock. it is known as Frost shattering.

Chemical composition :-

The breakes larger rock into small rock due to the action of chemical agents.
ex :- carbonation, oxidation, reduction, hydration etc.

Organic weathering :-

when the roots of trees passes through the body of rock which exerts de-forming forces on rock, which is breakes the forming of larger rock.

Erosion :-

(i) River
(ii) Rain water
(iii) wind

moraine :-

Accumulation snow + melting snow

moraine are three types
⇒ lateral moraine
⇒ medical moraine
⇒ Terminal moraine (mas value high)

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Weathering :-

The rocks breack and down under the influence of atmospheric agents like wind, sun, water and organism. and this phenomenon is called weathering.

EROSION :-

Erosion is a process which includes the destruction existing rock and the removal of the product from the side of destruction.

Transportation is the important aspect the erosion. It is usually, river, wind, water ice etc.

V.I

Weathering divided into three types :-

(1) physical weathering :-

The physical weathering involips application of mechanical process. In physical weathering a rock branched into smaller pieces without any chemical chain.

Imp

Frost-shattering :-

when water freezes, which expands about 9% rock its volume. In nature water enters into the cracks of rocks. on freezing It explants and exerts great pressure on the rocks crack as a result the rock makes into pices. this process is called frost - shattering.

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Climatic action :—

Daily & cycle of chemical temp. change on season change. weaken rocks particularly in thant regions, heating a rock causes to explant and coling causes contacts. The repeted expansion contraction end to develop craks and rocks.

Chemical weathering :—

Chemical weathering is a process in which rocks are brokes by chemical decay minerals, during a chemical weathering a set of chemical reaction acts on rock which changes minerals to more stable forms. The principle agents of chemical weathering its water and organism. Reaction involps in chemical weathering are oxidation, Reduction carbonation, hydration.

* Organic weathering :—

Many organic acid producen a delay this acids increases the solvent power of water, Gum example, The solubility of silica, alumina, iron, is much greater in the presents of organic acids.

Erosion BY WIND :—

What is wind :—

(Air is motion is called wind)

The wind is an important agent of erosion, transportation and deposition. wind does erosion is three ways.

(i) Deflaction
(ii) Abrasion
(iii) Attraction

(i) Deflaction :-
Letting and removal of loss material is called deflaction.
Arid
Semi Arid
by this process the land surface will gradualy lowered in many deserved area deflaction produces below medulase on beans in which their

Abrasion :-
During the dust storm the wind carryoes minute grains of sands in sapension and sand called agrest the exposed rock masses and caused erosion.

Rock
↓
Boulders (256 mm & 64 mm)
↓
cobbles (64mm - 256mm)
↓
pebbles (2mm - 64mm)
↓
sand (0.0625 mm - 2mm)
↓
silt (0.002 - 0.0625)
↓
clay (less than 0.002)

This process in which sands grains are used as tools for grading rock.

Attrition :—

The particles travel with wind collied agents one another, This mutual collision lead to there further break down and the process is called Attrition.

Imp

Erosional creatures :—

The Important creatures of wind erosion are policing of rock base, and formation of ventifacts rock and pedestal rock.

Ventifacts :—

Wind mixed with sand abrades rocks near the ground surface this is called sand blasting, where pebbles and boulders are subjected to sand blasting large side and sharp edges, If the stones contains coarse crystal or on equal hardness they become pitted, such stones which are polised, pitted and containes sharp edges are called Ventifacts.

Pedestal :—

pedestal rocks are undercut vertical columb of rock which are wider top and narrow base, when wind blows the sand particles may be in heavy travelling near the surface and undercutting rock bases.

deposition of wind :—

wind deposition are commonly called aeolian deposit. The rock particles in the Eolian deposites are generally well rounded and sborted according to theris size and weight.

wind deposites are two types —

(i) accumulation of sand called sand dunes.

(ii) deposited or accumulation of silk occurs on is called when a particular village is called loess.

(long question)

Sand dune

The wind generally deposites sand in mounts are called sand dunes. The sand travelling as bed load in wind accumulates. It meats in any obstraction such as mountain or a bush. (Fig 9.1)

Sand dunes are four types —

(1) Transvers dune :—

Transvers dunes are they are longer axis at right angles to the direction of wind they are called in areas with strong wind where small sands are available.

(2) Barchan :— Crescent

Barchans are Crescent shaped dunes the convenier side faces the wind direction the horn and wing or ascent point in the direction of the wind flow.

Barchan are formed where wind is nearly uni directional. They occures in areas of greatest sand supply. The high large dunes

don't exceed 30m to point to point length is generally 300m.

(iii) Longitudinal dune :-
Longitudinal dune which are elongate in the wind direction are called longitudinal dune. This dune is usually developed at strange wind in areas where small amount of sand is available, the longitudinal dune may reach height of 100m.

* Erosion action by river :-

(V.II)
Wind loess :-
The suspended is load transformated by wind consist mainly of silt and dust particles, when it is settled it forms a blanket deposite of silt known as loess.
The deposits are grease on yellowish colour loess is a compost of mainly many mineral including Quartz, Hornblende and calcite.

* Erosion acting by river :-
River cause of erosion by way's.
(i) chemical action
(ii) Hydraulic action
(iii) Abrasion action
(iv) Attrition action.

* (Plunge) :- (River quantity)
It is angle form between horizontal plane

(i) Chemical action :—

It includes the solvents and chemical action of water one country rock, the chemical decay.

(ii) Hydraulic action :—

The swiftly flowing water hammours the uneven surface of rocks being process of erosion is called hydraulic action.

(iii) Abrasion action :—

The flowing Boulders uses of rocks fragments such as pebble and sand as for scratching and grandeng the size of the flow valley, give a this process of erosion is known as abrasion action.

(iv) Attriction action :—

It is the breaking transported materials them selfs, theire colliding A Glyser is a thick mass of ice with move over the ground under the action of gravity.

Glycer erosion :—

Glycer caused erosion in 3 way,

(i) plucking erosion

(ii) Abrasion erosion

(iii) Frost-wedging erosion.

(1) plucking erosion :—

The glyser while flowing over a jointed rock surface, pull them out and carry themout.

(ii) Abrasion Erosion :—

The moving ice grinder and polish the rock surface with the help of rock fragments which are help firmly with in the body glycer Apologize surface form when the Greycer performed abrasion by find silt side sediments.

(iii) Frost-wedging Erosion :—

Freezing of factors in cracks and jointed of rock break than by ~~wedge~~ wedege action.

(Structural Geology)

Horizontal

Inclined bed

Dip :— when horizontal bed is deformed from its original states and inclineds against the horizontal bed than it said to be dip.

Strike :—

It is an line formed by the intersection of inclinded bed and horizontal bed. strike is a scalar quantity. It has only directions no magnitude.

Angle of Dip :—

Angle of subtends by the inclined bed with the horizontal bed is known as angle of dip. angle of dip varies from 0° to

* Rock is property of ductility

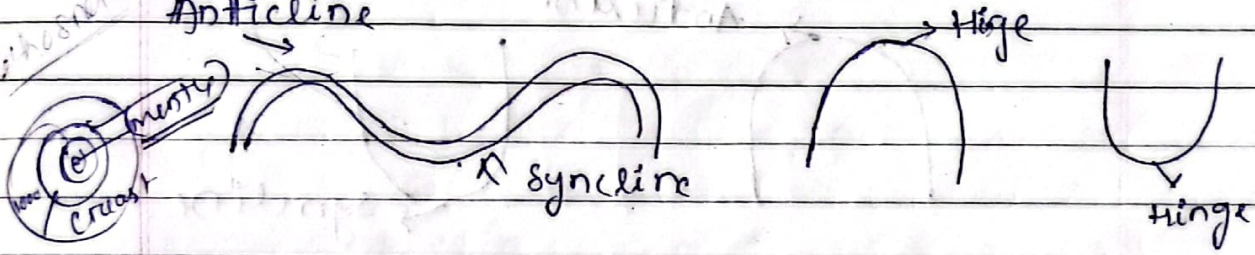
90° when angle is zero it is said to be horizontal bed when the angle is 90° it is said to be vertical.

(Imp)

Fold morphology :-

Fold :-

Fold are like wave undulating formed when compressive force act at the the opposite end and a direction fold are also in opposite direction.



Creast :-

The highest point of an anticline is called creas

Through :-

The lowerst of a syncline is called through

Hinge :- The point of maximum curvature in anticline and syncline

Inflection point :- (through)

The point of the zero curvature it is known as inflection point

Hinge line :-

Hinge line the line which joint in the hinge point of the fold is known as Hinge line.

Inflection line :-

It is line which jointed all the inflection point in a fold known as Inflection line.

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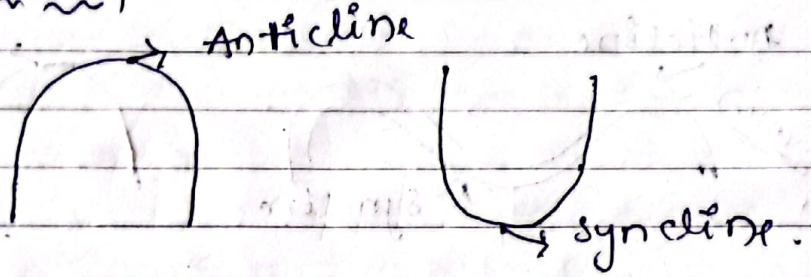
Fold axis / axial line :-

It is a line which is formed by the intersection of axial line and fold.

Limb :-

It is the portion of fold extend from hinge line to inflection line.

Types of fold :-

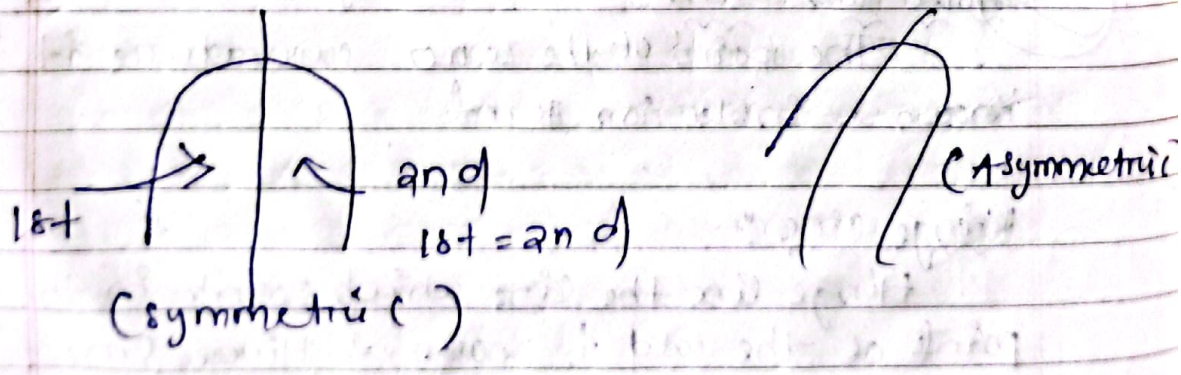


(1) on the basis of arching direction it is divided into two types.

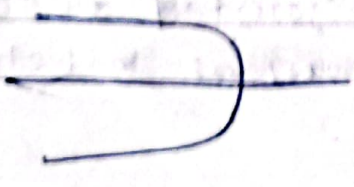
(2) on the basis of symmetric of fold is divided into two types.

(i) Symmetric

(ii) Asymmetric

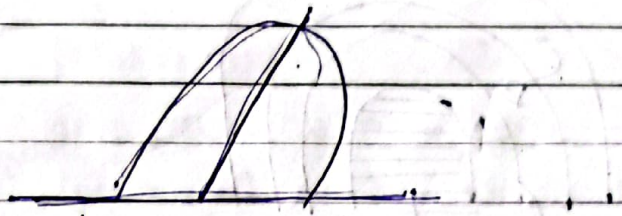


(3) on the Basis of axial line



(i) Recumbent fold :-
when the axial plane of a fold lies parallel to the horizontal plane this type of fold is called Recambent fold.

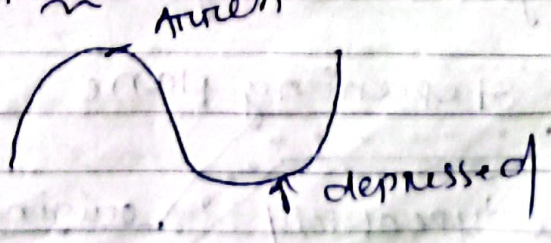
(ii) Inclined fold :-
when the axial plane of any fold makes some angle with respect to the horizontal plane it is known as inclined fold.



limb angle :-
The angle makes by two limb of a fold at its joint is known as limb angle.
⇒ limb angle should be grater than 20° less than 180°

(iii) on the basis of inter limb angle :-
(i) isocliner fold
(ii) tight fold
(iii) blows fold
(iv) open fold
(v) gentle fold

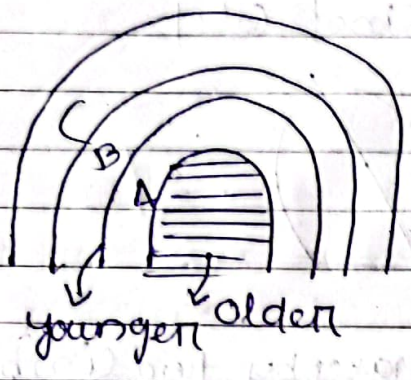
Trough plate :-



The trough is a line occupied the lowest part of the fold. The plane contains such the line are called trough plate.

Anticline :-

It is generally convex upward of concave downward where the limbs commonly slop away from the axial line.

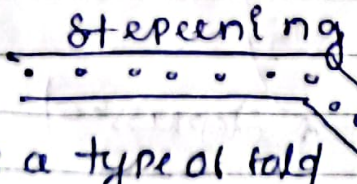


Syncline :-

It is a fold which is concave upward and commonly dipped towards the axial ~~line~~ plane. Successive younger beds are found towards the centre curvature of the fold.

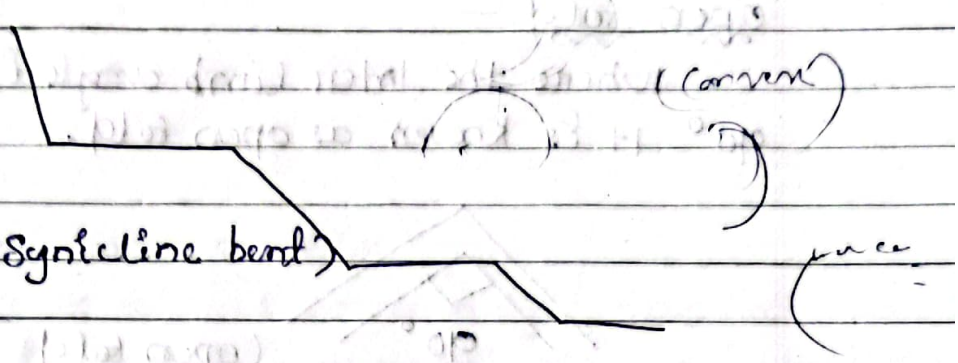
* Monocline / Anticlinal bend :-

⇒ It is formed due to local stepping of a bead where there occured the sudden increase in the top of a ~~bed~~ bend. which is originally horizontal to near a vertical position, But the original beading remanes are below.



⇒ It is a type of fold where one limb dips is sharply on the other hand another limb dips is gently with the horizontal It is due to the steepening of fold in which of inter limb angle between two limb.

Syncline bent :—
In case of syncline bent one limb remains at its position and other limb dip towards trap plane this type is known as syncline bent.



(V.I) Geo syncline or synclinorium :—
It is a large syncline with a secondary fold of a smaller size development on it.

(V.I) Geo Anticline or Anticyclone :—
It is a large anticline with secondary folds a smaller size development on it.

Thickness of limb :—
parallel or concentric :—
→ Thickness of the layers are same.
→ Radious gradually increase in a particular constant
→ Syncline becomes sharper with depth, but broader and mark open upward. where as anticline is broader with depth and sharper upward.

Small err :—
In this case the shape of folds may vary along the axial plane and Right angle to the fold axis. This case of crest and the thick where limbs are thick.

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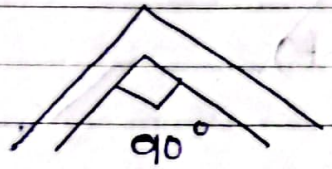
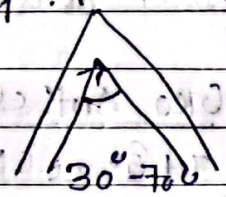
Symmetrical fold :—
In this case the crest are thick where the trough are Inter limb angle.

open fold :—
Where the Inter limb angle is greater than 90° it is known as open fold.



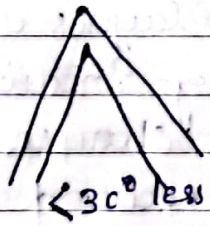
(open fold)

closed fold :—
where the Inter limb angle is bet'n 30° to 70° it is known as closed fold.



(closed fold)

Tight fold :—
The Inter limb angle is less than 30° it is called tight fold.



(Tight fold)

Attitude of fold :—
Plunging fold :—
In this case the axis of fold is not horizontal.
Double plunging fold :—
when the fold is reversible in direction of plug with in the limit.

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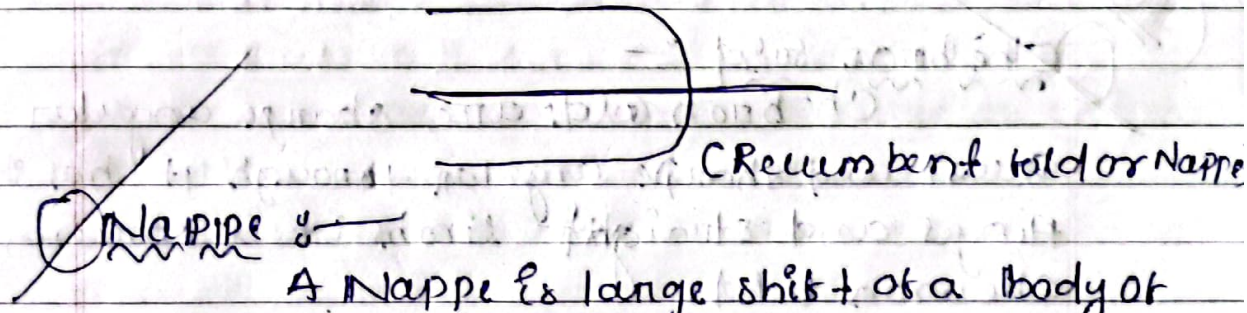
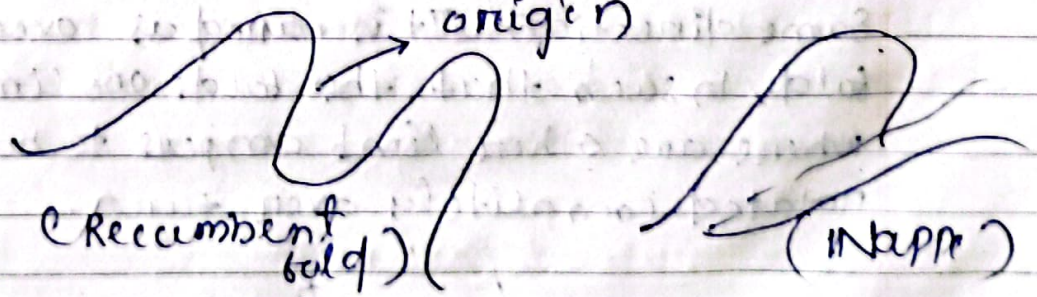
Dome :—
It is a anticlinal fold which plunging all the direction thus forms a umbrella structure.

Basine :—
It is a synclinal depression with dips in all the direction.

Recumbent fold or nappe :—
When the fold is so much over turned that its axial plane is horizontal or nearly horizontal it is known as Recumbent fold or Nappe.



Nappe :—
A Nappe is large shift of a body of rocks that is moved from the origene position. Nappe is formed during continental plate collision. When folds are sheared so much that they fold back over themselfs and break apart the resulting str. is a large scale recumbent fold.



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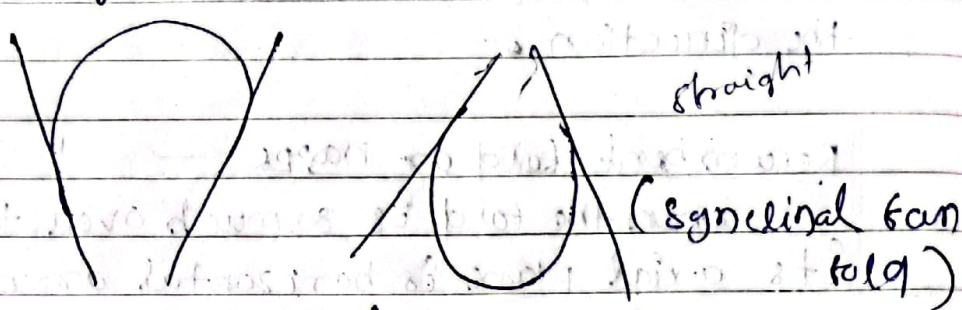
Fan fold :—

If in any fold both the limbs over turned In the anticlinal fold two limbs deep toward each other. In synclinal Fan fold two limbs deep away from each other.



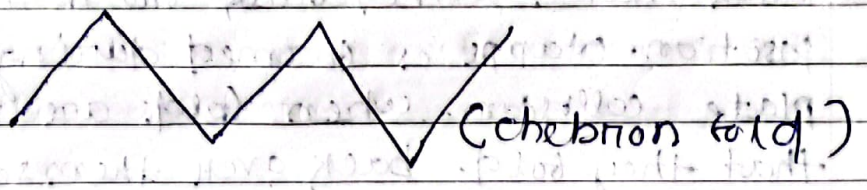
(Synclinal fan fold)

(Anticlinal Fan fold)

(IMP)

Chebron fold :—

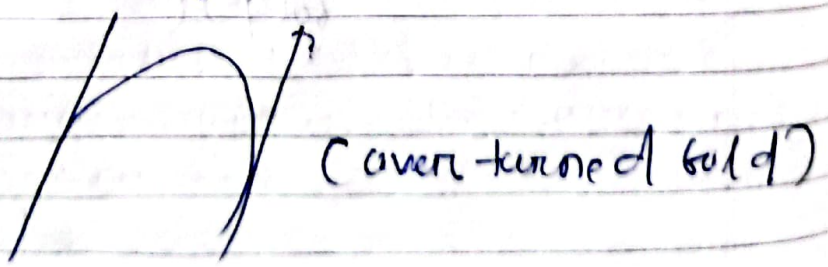
Chebron folds are sharpe angular crest and sharpe angular through it has sharp Hinges and straight limbs It is known as Chebron fold.



(Chebron fold)

Over turned fold :—

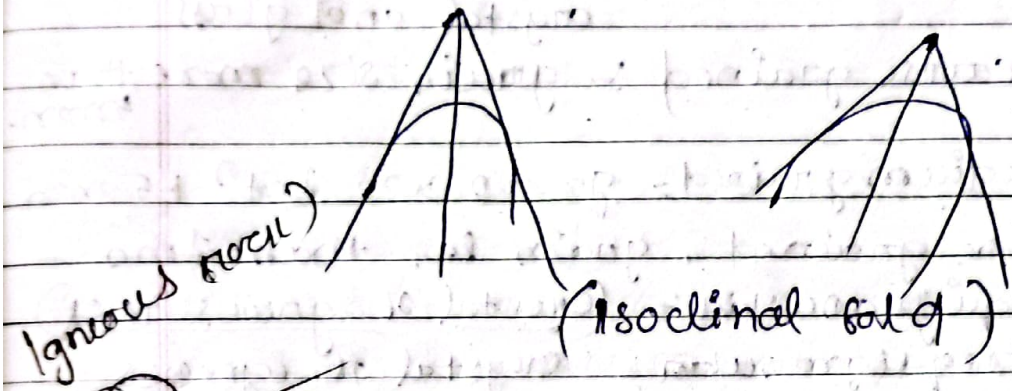
If in any fold both the limbs are in same direction. It is called as over turned fold, In such that the folds one limbs occures where are other limb appears to have been rotated completely over turn.



(over-turned fold)

Isoclinal fold :—

If a any fold to the amount of over turning be such that both the limbs are same amount of deep in the same direction the str. is known as isoclinal fold.



Classification of Igneous ROCK on Basic occurrence

(1) Extrusive rock :—

Rock form due to solidification of lava on surface called extrusive rocks. volcanic igneous rock. Above the surface.

(1) Instructive rock :—

Instructive rock form when magma crystallized beneath surface depending on depth of formation instrusive rocks are divided in two groups—

(a) Hypabyssal igneous rock :- below earth surface upto depth of 12 k.m.

(b) Plutonic Igneous rock :- these rocks are formed at greater depth from magma.

Texture of Igneous rock :—

The term texture is defined as the mutual relationship of different mineralogical constituent in rock. It is determined by the size, shape, and arrangement of these constituents within body of rock.

(Magma :- Liquid Rock in molten state)

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To study of texture of Igneous rock following terms are important to understant texture.

(i) Holo crystalline :- Rock made of crystal only

(ii) Holo hyaline :- Rock made of glass only

(iii) Crypto crystalline :- The rocks made of both crystal and glass.

(iv) Coarse grained :- grain size more than 5mm.

(v) medium grained :- grain size bet^n 1-5 mm

(vi) Fine grained :- grain less than 1mm

(vii) Equigranular :- (Crystal of igneous rock)

(viii) Inequigranular :- Crystal of Igneous rock are not equal.

(ix) phaneric :- Mineral present in rock identify by naked eyes.

(x) Aphanitic :- size of Mineral present in rock are very fine.

Texture of Igneous rock depend upon mutual relationship bet^n glassy matter and crystalline matter.

Some Important Textures of Igneous rock :-

(a) Granitic Texture :-

If it is holocrystalline, equigranular and medium grained, present in plutonic acid Igneous rock.

(b) porphritic Texture :-

When smaller crystal or glass or both enclude large crystals. The large crystal called pheno crystals and small crystal are ground.

Fold type of Rock → ① sedimenta
② Igneous
③ Metamorph)

(c) Poikilitic Texture :—
When smaller crystal enclosed with bigger crystal without common orientation.

(d) Ophitic Texture :—
Special type of poikilitic texture in which bigger crystal of augite enclosed smaller laths of plagioclase. eg Hypabyssal rock.

(e) Directive Texture :—
Texture produce as a result of flow of lava during their consolidation. are called Directive Texture.
(i) Trachytic Texture
(ii) Hyalopilitic Texture

(f) Inter growth Texture :—
The intergrowth quartz and orthoclase may take place when they crystallize simultaneously these type of texture observation hypabyssal and plutonic acid rock.
(g) Equigranular Texture
(h) Inequigranular Texture.

(Imp)

Structure of Igneous Rock :—
The physical appearance of igneous rock, usually influenced by process of formation result in typical structural characteristics. These structure are use in field identification of rock.

(Plutonic (ଆଗ୍ନେୟ ଗଭୀର ଶିଳା) ଆଦି [illegible]
[illegible]

(i) Flow Banding :—

New lava from magma chamber reaches surface and overlies the previous flow before years at layer of cool lava from rock layer this resulting str. resembles flow bands.

(ii) Vesicular :—

When lava reaches surface the atmospheric pressure acting on lava solidity immediately. As a result cavities are formed and the gases escape through these cavities leaving behind empty cavities called vesicles.

(iii) Amygdales :—

When the interconnect gas cavities in vesicular basalts are filled with secondary minerals like quartz, zeolites, calcite, etc, The resulting str. is called pore amygdales. The basalt in which amygdales are present is called as amygdales basalt.

(End)

:- (Mineralogy and petrology) :-

Mineralogy : Introduction :-

Mineralogy is the branch of Geology deals with the scientific study of mineral.

→ Mineral formed below surface endogonic origi. Minerals formed at the surface - exogonic origin.

→ Mineral having same chemical composition but different atomic arrangement is responsible for variable properties of crystal such Minerals called : polymorphe.

→ Physical properties are when vary with chemical composition then minerals called Isomorph.

→ Identification of Mineral in field achive by studying its physical properties.

Physical properties of Minerals :-

→ Physical properties of Minerals can be determined readily by simple test because the physical properties are determined in hand Specimans they are important in the recognition of mineral in field.

(1) **Colour :-**

colour is a light dependent property It is appearance of particular object in light some mineral passes characteristics Bainly constant colour.

(a) Lead - Grey

(b) Galena - Brass - yellow

Presence of small amount of impurities can give verity of colour to white to colourless.

(a) Moon stone - Brick red

(b) Quartz - pink, Rosy, milk.

(ii) Streak :—
The colour of mineral powder is called streak. It is constituent reliable than the body colour of the mineral transparent mineral show coloured streak.

(iii) Lustre :— It is defined as shine of minerals or general appearance of mineral surface in reflected light.
Various type - metallic lustre; sub metallic lustre, Admatine lustre, vitreous lustre pearly lustre.

(iv) Hardness :— Resistance of mineral to abrasion or ~~search~~ scratching.

(v) Cleavage :— If a mineral breaks along flat surface it is said to possess a cleavages and of breaks with an irregular surface is said to show fracture.

(vi) Fracture :—
Mineral which do not exhibit cleavage breaks with irregular surface the not creat this broken surface is called fracture.
Types conchoidal fracture, even, uneven fracture Hackly fracture.

(vii) Form / Habit :—
Mineral often occur in characteristics body form or physical shape i.e tabular, Bladed Radiating, crystalline crystalline Amorphous.

(m1)

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Rock forming Minerals :—

Rock forming minerals, one mineral that occur widly in a bundance in all type of rocks of earths crust. Rock Forming Minerals contain silica called silicates Minerals not containing silica called Non silicates Rock forming minerals, Quartz, feldspar, Mica, Pyroxene, olivine, epidote, talc.

Rock forming Minerals

- Silicates
  - (i) silica group
  - (ii) Feld spar group
  - (iii) Mica group
  - (iv) Amphiboles group
  - (v) pyroxene group
- Non silicates
  - (i) carbonate
  - (ii) oxide
  - (iii) sulphur
  - (iv) phosphates.

Ore forming minerals :—

Some minerals have limited mode occurance different minerals containing particular metal occur together in deposit ore referred as ore forming minerals.

Ore forming Mineral are mineral which contain a metallic element in a quantity than can be extracted for use economically

- Hametite, magnetite, Bauxite } ore of iron
- ore of aluminium

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Primary minerals :—

As the time of volcanism when magma erupts and flows it starts cooling as soon as it comes in contact with atmosphere, which crystalized form magma are called primary minerals.

Important primary Minerals :—

Quartz, orthoclase, plagioclase, Muscovite, Biotite, Hornblende, Augite, olivine

Secondary minerals :—

Minerals which crystallize during weathering of primary minerals are called secondary minerals once mineralisation of primary minerals takes places. these start undergoing geological process due to sunlight rain waters, wind called weathering resulting into secondary minerals.

Important Secondary minerals :—

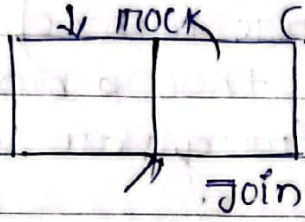
(i) Clay minerals e.g :- montmorillonite, kaolinite.

(ii) Non silicates eg :- oxide, carbonates, sulphate.

Joint :—

A joint is defined as a fracture in a rock but the side of which there know observable relative movement. There are present in most consolidated (Solid rock) rock of Igneous, metamorphic

Sedimentary origin joint may form as a result of either contraction or Diastrophism



Diastrophism :—

Diastrophism is large scale deformation of earth crust by natural process which leads to the formation of constituent and ocean basin.

Description of joint :—

(i) A series or parallel joint is called joint sets. Two or more joint intersecting each other producing (joint system).

(ii) Two set of joint at nearly or right angle two another produce by the same stress is known as conjugate system.

(iii) A persistent joint may be horizontal or vertical are called master joint.

Classification of joint :—

Petrology :—

petrology consist of a study by all available methods of natural history of rock including their origin present conditions alteration decay etc.

Main division of rock :—

(i) Igneous Rock

(ii) sedimentary Rock

(iii) Metamorphic rock.

1M

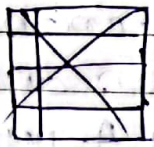
classification of joint :—

(i) Tension joint :— Tension joint are those which are formed as a result of tenside force these joint are relatively open Rocks of irregular surface.

(ii) Shear joint :—

Shear joint those which are formed due to applicating of compressive force shear i.e. stresses these joints are clean cut and tightly closed, shear joint occuring a sets and intersect at a High angle to formed conjugate line.

(iii) Mural joint :— Garnel shows 3 sets of joint mutualy at right angle to each other which divide to rock mass into more or less cubical blocks.



(iv) Sheet joint :—

Sheat joints are often sine in exposures the Granel. This joint is running in horizontal direction.

(v) columnar joint :—

columnar joint are formed in tablen igneous masses such as dykes, sills & lava flows. These joint divided the rock Masses in to Exagonal culams.

(vi) Master Joint :-

On sedimentary rocks the joint usualy joint in two direction at nearly write angle one set of joint run parallel to the dip direction other parallal to strike of these one set of joint commonly more strongly develop than the other and extent the for long distance.

Unconformity :-

An unconformaty is the plane of disconformaty separates two rocks strata which differe in formation it. The younger of this rocks are nearly always sedimentary origin and have it deposited on surface of older rock which is a surface of erosion.

why this structure formed ?

This types of str. formed is cause in deposition of sediments and erosion of upper surface take place.

The formation of an unconformaty may be activated 3 main process.

(i) erosion
(ii) Deposition
(iii) Tectonic activity
(iv) Technotic activity

The stages of development invols -

(i) The formation older rock
(ii) uplifments and subarial erosion of the older rock.
(iii) The formation of younger sedimentary of base above the surface of erosion.

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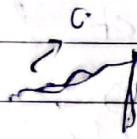
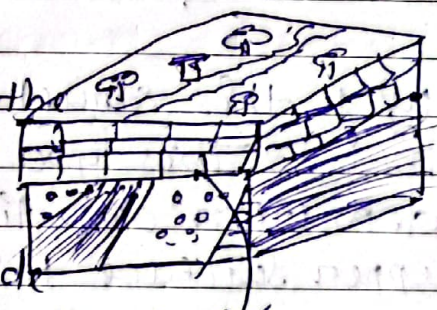
Types of unconformity :—
(i) Angular unconformity
(ii) Disconformity / parallel unconformity
(iii) Local unconformity
(iv) non conformity / Hetero unconformity
(v) Blended unconformity.

(i) Angular unconformity :—
If the beds beneath of the erroded surface are rotated and tilted show that there is angular discordence betn among the older and younger beds occurs and the intersection line is called angular unconformity.



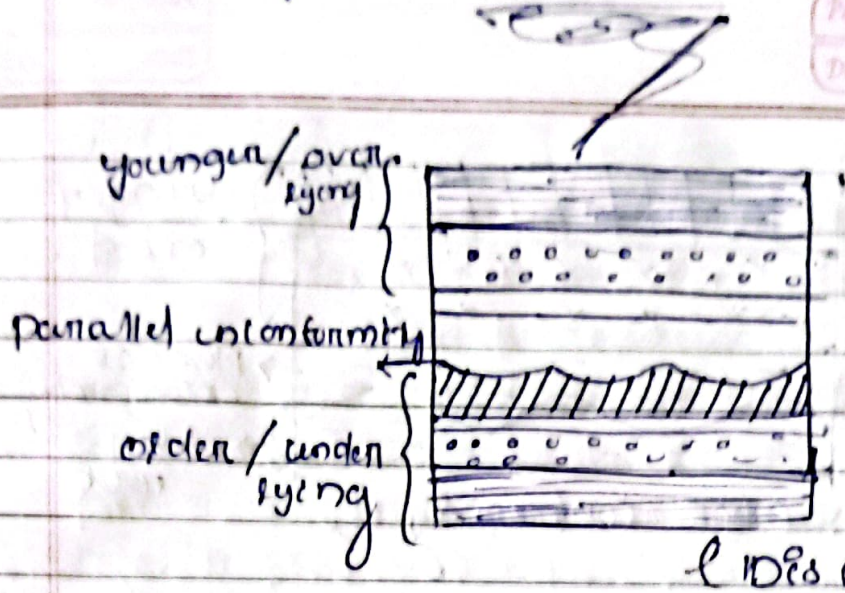


In this case both the younger and overline are sedimentary origin and the attitude of rock above and below the unconformity differs from each other.

[Angular unconformity]

(ii) Disconformity / Parallel unconformity :—
It is also known as parallel unconformity in view of fact that the beadding above the below the plane unconformity dip at a same angle and same direction. This type of unconformity formed there is a lesser magnitude disturbance of two section.

plutonic Rock = granite



(Dis conformity)

(iii) Local unconformity :—

It is also known as known depositional unconformity. It is similar to the dis conformity but it is local in extent and the time of formation to upper and lower rocks is very short. Hence it is represent short period of sediment deposition.

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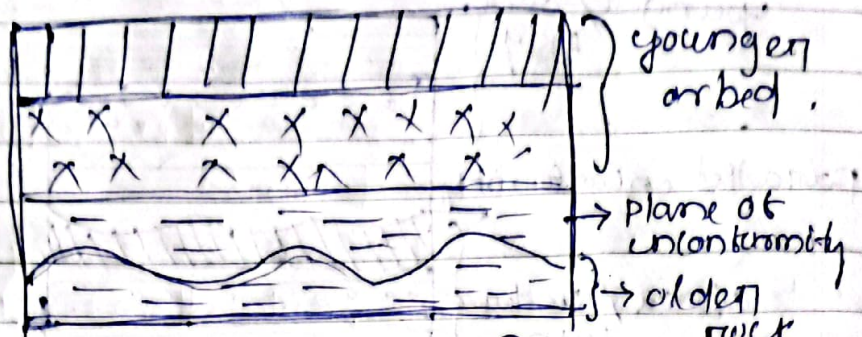
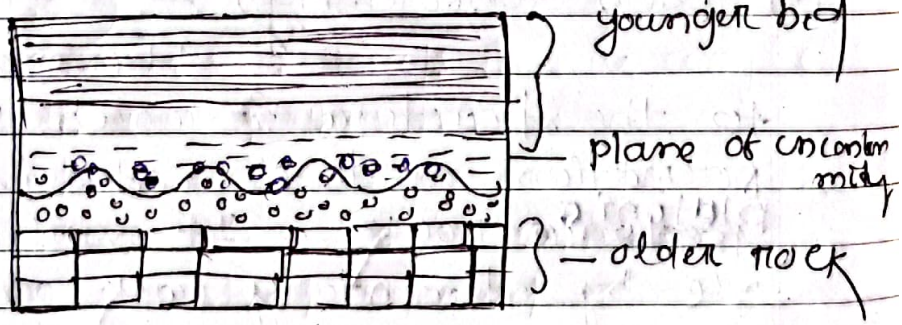
(iv) Non-conformity :—

It commonly applied to the structure in which the older formation made of extensively of plutonic rock. It overline unconformable by sedimentary rock or lava flow.



(non conformity)

(V) Blended unconformity :— It is a surface of erosion which may be thick residual soil that grades in to under line rock. The younger sediment deposited above the surface may ~~inclu~~ included some of the residual soil and a sharpe contain may be laking ~~sua~~ Such a Formetn contain may be called blended unconformity.



Blend (-mixture)

⇒ An unconformity having no disting surface of separation ~~earth~~ & erosional surface that was originally covered by thick residual soil with ~~blende~~ graded down ~~to~~ th into underline rock

Subsidence
avalanche

FAULT :—

Faults are cracks along well defined which the rock masses on either side have relative displacive. The strike of faults are defining terms of there strike and dip. The strike and dip of the faults are measured as for bedding.

Classification of fault :—

There are mainly classified into two part -

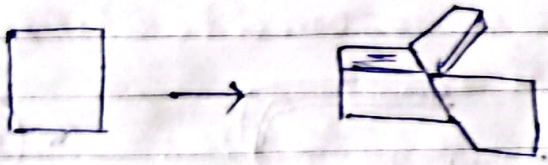
1. Geometrics classification
2. Genetic classification

① Geometric classification :—

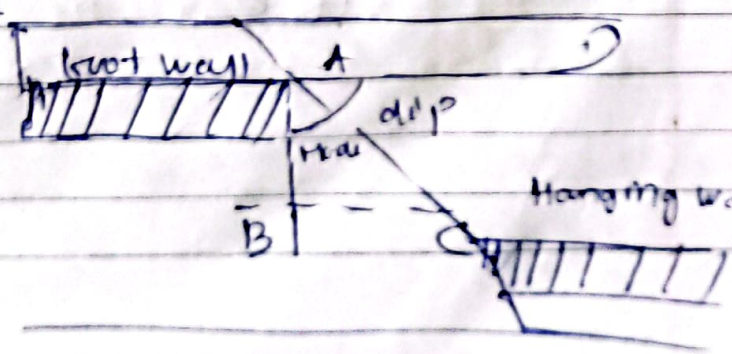
Classification is strightly based on the altitude of the fault. There are five faults based on geometric classification of ~~fault~~ fault.

Fault :—

A fault is defined as a fracture (crack) along which blocks of rocks have been displaced relative to each other



Terms :—



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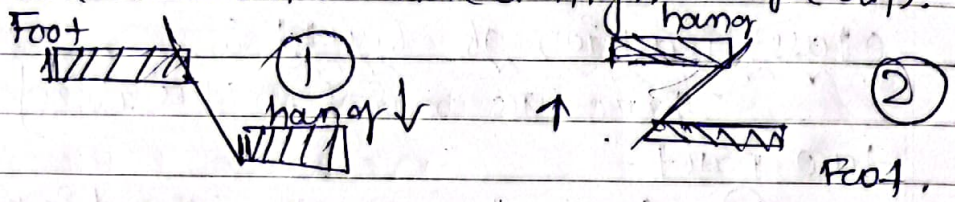
Types of Fault :—

① On the basis of apparent movement :-

① Normal fault :—

Normal fault is one in which hagging wall moves downward relative to footwall. Fault plane dips towards down through side (Gravity fault) produced by tensional forces and indicate lengthening of earths crust. have a high angle dip.



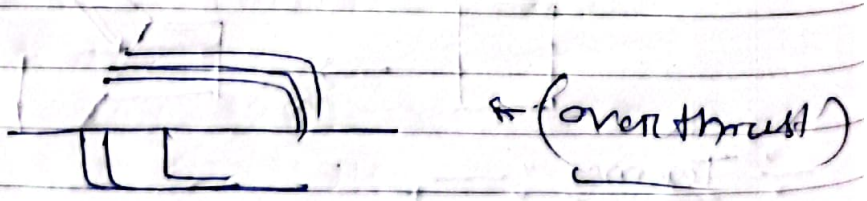
② Reversed fault :—

is one which hanging wall appears to have moved upwards relative to foot wall. Fault plane dips towards upthrown side, produced by compressional forces, high angle of fault (dips $\geq 45^{\circ}$)

⇒ Intense compression results in low angle reverse faults called "Thrusts".

⇒ Horizontal low angle thrust fault with large displacement : i.e "Over thrust"

⇒ Sheet of rock moved forward along thrust plane is Nappe.



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Texture of SEDIMENTARY ROCKS :—

The word of texture refers to the size, shape, packing & Fabric of components of the rock.

⇒ Sedimentary rocks are broadly classify of
(1) Exogenetic or clastic texture
(2) Endogenetic or crystaline rock.

(1) Exogenetic or clastic texture :—

It includes elements like
(a) size, (b) shape, (c) sphricity
(d) packing (e) Fabrick

(a) Size :— The grain size is depend upon the-
(i) mode of weathering
(ii) Nature of the source rock
(iii) kind & distance of transport & Nature of deposition.

⇒ Broadly the size & character of the sediment are described by the coarse, medium & fine the size particles. In the went scale are indicated as follow:

Size	Name	Equivalent rock	
(i)	>256 mm in diameter	Boulder	Boulder, Cobble, pobble → Rudaceous rock
(ii)	64 mm - 256 mm	cobble	
(iii)	4mm - 64mm	pobble	
(iv)	2mm - 4mm	Granula	Granulestone, Sand stone → Arenaceous rock
(v)	2mm - 1/16 mm	sand	
(vi)	1/16 mm - 1/256 mm	silt	silt stone, clay stone → Angillaceous rocks.
(vii)	1/256 mm to onless	clay	

③ Shape :-

It is defined as the shapeness of corners and edges of a clastic fragment. According the shape may be angular, sub-angular, rounded, sub-rounded, well rounded etc.

④ Specificity :-

It is defined as the extend to which particle approaches upshore. It depend on

(i) Distance of transport
(ii) mode of transport
(iii) provenance

⑤ Packing :-

It is the manner of arrangement ~~hold together in place in the~~ of sedimentary grains, which are held together in place in the earth's gravitational field.

⑤ Non-clastick texture :-

It is the arrange ment of a result of deposition through chemical reaction. They are transported chemically by getting dissolved by transported media but reappear due to precipitation or evaporation.

⇒ It is also two types -

* Crystalline texture
* Non-crystaline texture.

(6) Fabrick :-

It is the arrangement of the clastick particles in sediment.

Imp Texture of (Meta)MORPHIC ROCKS :- (change)

The metamorphic str. are determine by definite mechanical conditions and also by re crystallisation.

Meta morphic str are of following types—

(1) cata clastic texture
(2) Maculose str
(3) schistose str
(4) Granulose str
(5) Gneissose str

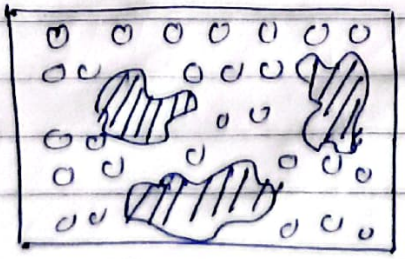
⇒ Meta morphic rocks derived from sedimentary rocks known as meta morphic rocks.

(1) cataclastic Texture :-

⇒ It is produced under stress and in absence of high temp. where by rocks are subjected to Shearing and Fragmentation.

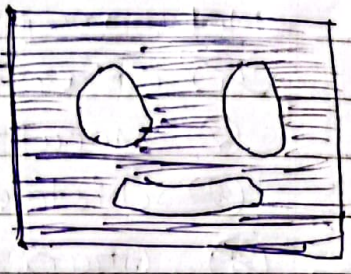
⇒ only the durable minerals partly survive the crushing force & less durable ones are powder.

⇒ Thus, when resistance mineral and rock Fragments stand out in a pseudo porphyrite manner in the linear materials. It is known as the porphyroblastic str.



(ii) Maculose str.

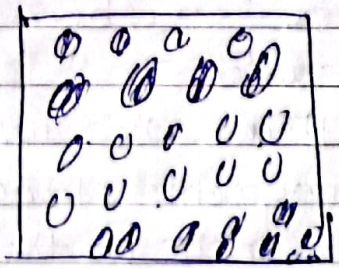
It is produced by thermal metamorphissive of argillaceous sediments on rocks like shales. Here larger crystals of any cardolorite, biotite are sometimes well developed giving a spotted appearance to the rocks. The well developed crystals are known as "Porphyroblasts".



(iii) SCHISTOSE str.

Here platy or flaky mineral like mican and other inequidimensional minerals shown as preferred orientation along a parallel plane. under the effect of the stress dominating during metamorphism. The longer direction are parallel to the direction of maximum stress.

Schistocity is property of a foliated rock where by it can be readily split along foliation plane.



(Crystallography)

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Crystal :- A crystal is defined as a solid body bounded by plane natural surface, which are the external expression of a regular arrangement, of its constituent patterns.

Crystal structure :- This is the orderly arrangements of atoms or group of atoms their constituents a crystal.

Lattice :- This is an imaginary three dimensional framework that can be referred to a network of regularly space of points. each of which represent the position or motive.

unit cell :- This is a pattern that yield the entire pattern, when translated repetedly without rotation in space.

Motive :- This is the smallest representative unit of a structure. It is an atom or group of atom when repetation by translation give rise to an infinite number identical regularly organised unit.

Interfacial angle (common)

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Crystal structure :- (lattices and unit cell)

A crystal is a three dimensional repetation of same unit of atom and molecules

Crystal shape :-

The Angle between crystal boundary are determined only by internal crystal structure. The relative size of the crystal boundary depend on the rate of growth the crystal boundary.

→ Example of crystal shape are :-

(i) cube
(ii) rhombohedral
(iii) trapezohedral
(iv) octahedral (regular)
(v) pyritohedron
(vi) Tetragonal
(vii) hexagonal
(viii) orthorhombic
(ix) monoclinic

Classification of crystal :-

There are mainly 6 system of crystal

(i) isometric system ($1 = b = h$)
(ii) Tetragonal system ($1 = b \neq h$)
(iii) Hexagonal system ($1 = b = h \neq c$)
(iv) orthorhombic system ($1 \neq b \neq c$)
(v) Monoclinic system
(vi) Triclinic system

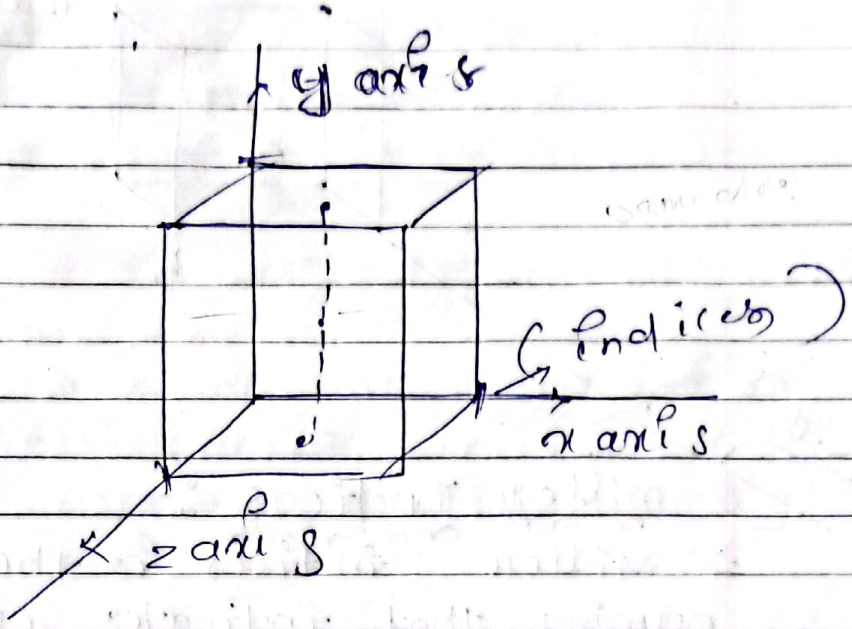
Plane of symmetry :—
It is an imaginary plane which devide crystal into two equal part in such a manner that one and half will be the mirror image of other this plane of symmetry may :—→
⇒ These plane of symmetry may be diagonally vertically and horizontaly.

(Not a plane of symmetry)

Centre of symmetry :—
It is a plane within a crystal through which a straight line can be drawn so that on either at the same distance from the centre of similar faces, edges and solid angle are intersected, is known as centre of symmetry.

Parameters and Indices :—
parameter of a plane or face consist of series of numbers which Express the relative intersect of that plane or face with the crystal graphic

with respect to standard face.

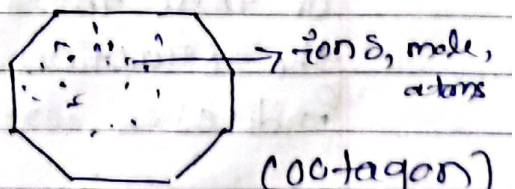


Indis :—

The reciprocal of parameters is called Indic. There are different type of Indic at the common type of Indics is known as miner Indic.

Crystal lattice :—

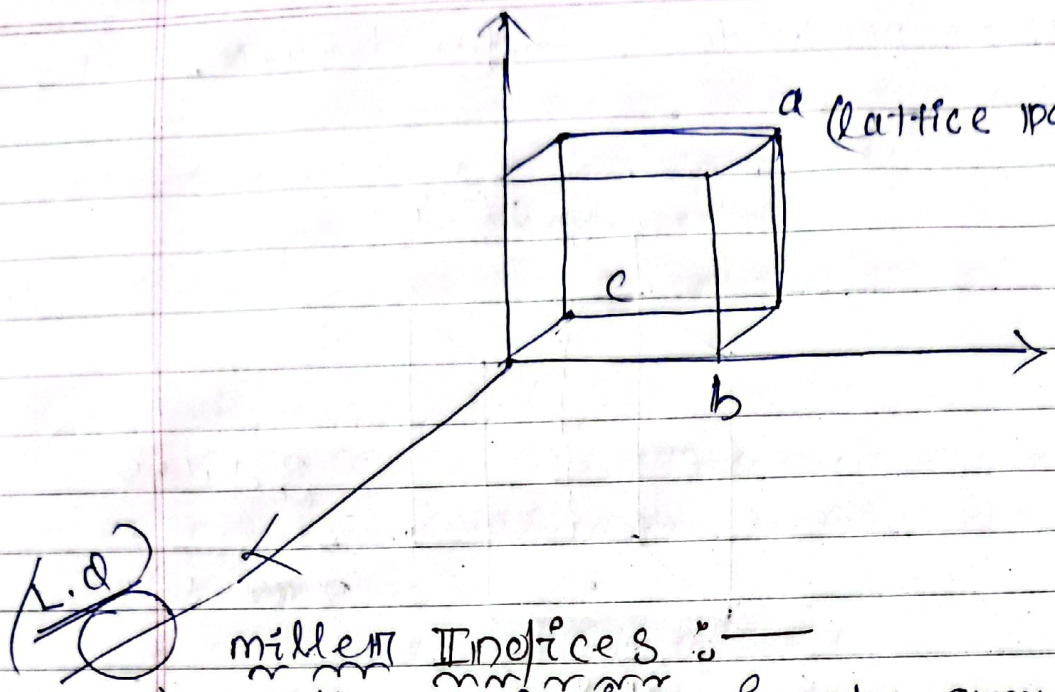
⇒ It is a three dimensional symmetric structure arrangement of atoms, molecules & ions in a crystalline solid.



(Octagon)

Lattice point :—

Lattice point are the constituent of a crystal lattice i.e atom molecules, ions



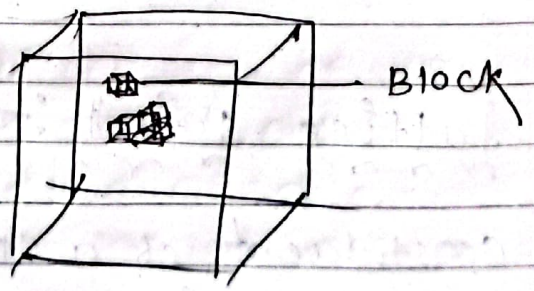
1.d

Miller Indices :—

⇒ Miller indices is the group of three number that indicates orientation of a plane or sate of parallel planes (position) of atoms in a crystal.

⇒ If each atom in the crystal is represented by a point and these points are connected by line which formed crystal lattice.

- which may be further divided into a number of identical block, That block are known as unit cell. The intersecting edges of one unit cell defined a shape of or crystalography axis. The recipolal of these intersect are calculated and the fraction are taken as three miller indices.



Chapter 1

h (length)
(x - breadth)
(L - height)

(Mineralogy)

Mineral :-

It is a branch of geology which deals with the study of all features of minerals. such as, physical properties, chemical composition, structure etc.

Mineral :-

Minerals are natural occuring inorganic substances which as definite chemical composition and fixed atomic structure

Physical properties of Minerals :-

Physical properties of minerals is depends upon colour, streak, lustre and hardness, degree of transparence, cleavage, form.

Form :- (shape - columnar)

Form is an important physical properties of mineral which represent the order of agregation of atoms.

(i) **columnar :-**

It is more or less parallel interbedded prismatic crystal.

ex :- amphibole,

(ii) **acicular :-**

It is a needle like structure.

ex :- pyrite

(iii) Fibrous :—

It is an aggrigate of coton like structure which mayor may not separation.

Ex :- Asbestos.

(iv) Botrioidal :—

These are the aggrigate of sphere (structure like group of grapes)

Eg :- silomilan

(v) Foliated :—

Mineral having thin and separable sheets.

Eg :- biotite; muscotite

(vi) Tabular :—

Minerals showing broad flat surface.

Ex :- Orthoclase - Feldspares

(vii) Bladed :—

Mineral having knife blade having.

Ex :- Kyanite.

(viii) Crystalline :—

Crystalline is the orderly arrangement of unit cell.

mineral that don't show crystalline there known as amorphous

Graphite, Diamond } made up Carbon Oyster (shell)
(Chalcopyrite ore of copper)

(iii) Colour :-

Colour of a mineral is determined by the absorbtion of spectrum of light and reflection of a particular light so it looks or appear.

Minerals :-		colour :-
(1)	Hemattite	(1) dark silly grey
(2)	orthoclase	(2) Fleshy red
(3)	Chalcopyrite	(3) Golden yellow
(4)	Galina (ore of lead)	(4) Lead Grey
(5)	Malachite	(5) Sea green
(6)	Pyrite	(6) brash yellow
(7)	Graphite	(7) Shiny black
(8)	Talc	(8) purely white
(9)	Mullcovite	(9) White
(10)	Biotite	(10) Brownise black
(11)	~~streak~~	

Streak :-

It is the colour of mineral in powder is called streak. Streak is determined by rubbing the mineral against a porcelain plate known as streak plate.

Rice Bran-

	Mineral	colour	Streak
①	hematite	→ dark still grey	→ cherry red
②	Chalcopyrite	→ Golden yellow	→ Greenish black
③	Pyrite	→ Brassy yellow	→ Brownish black
④			

Lustre :—
It is the appearance of surface mineral as reflected light.
⇒ Lustre is two types—
(i) metallic Lustre
(ii) Non-metallic Lustre.

(i) Metallic Lustre :—
Metallic lustre are shown by Gold, silver, Galina, Graphite, chalcopyrite, hematite.

(ii) Non-metallic Lustre :—
non-metallic lustre are again divided into following types
(i) Vitreous :—
It is the lustre of broken glass.
Ex :- quartz
(ii) Greasy Lustre :—
It is the lustre of an oily greasy.

(Resin- ಕನ್ನಡ)

(iii) Adamantine lustre :—
⇒ Lustre like diamond

(iv) Resinous Lustre :—
⇒ Lustre like Resin.
ex :- Spalentites.

(v) Silky Lustre :—
⇒ It is the Lustre of mineral Possesive of fibrous matter.
ex :- Asbestos.

(vi) Pearly lustre :—
⇒ It is the Lustre of pearls.
ex :- Talc, Gypsum, Kynite

(vii) Earthy lustre :—
It is a dull Lustre.
ex :- Chalk (Mineral)

Hardness :—
⇒ hardness of mineral is defined as resistance of abrasion or Scraching. The hardness of mineral is determined by rubbing the mineral of unknown hardness against agnaist a mineral of known hardness.

mohrscale of hardness

1. Talc
2. Gypsum
3. Calcite
4. Flourite
5. Apatite
6. Orthoclase / Feldspar
7. Quartz
8. Topaz
9. Carundum
10. diamond

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Cleavage :—

⇒ Cleavage may be defined as the tendency of a mineral that break easily with smooth surface in the plane of weak bonding.

Orthoclase ⟶ 2 sets of cleavage
calcite ⟶ 3 sets of cleavage
Quartz ⟶ absent of cleavage (Fracture)
Biotite ⟶ one site of cleavage perfect

Fracture :—

⇒ Fracture is defined as the nature of broken surface of the minerals other than cleavage direction.

Different type of Fracture :—

(i) Conchoidal :—

⇒ when Fracture with smooth, curve surface that resembled the interior of sea shell.

(ii) Even Fracture :—

This fracture forming smooth and flat surface.

ex :- chalk, Flint

(iii) Uneven Fracture :—

⇒ when the fracture surface is rough ~~due to infinite~~ and random irregularities.

ex :- magnetite
Pyrite

Jagged - ಜಗ್ಗಿ

(iv) Hackley Fracture :-
⇒ It is jagged, sharp and not even.
Ex :- copper, silver

Specific Gravity :-
⇒ It is the ratio of the weight of the mineral to the weight of equal volume of water. The Specific gravity of a mineral can be determined by Walker steelid balance.
(1) Low specific gravity less than 2.5
(2) Medium specific gravity 2.5 to 3.5
(3) high specific gravity > 3.5
(4) very high specific gravity > 7

Physical properties :-
(1) Quartz :- SiO_2
Form : crystalline / Massive
colour :- whiteness, milky white, pinky, colourless
Streak :- colourless
Lustre :- vitreous (ಗಾಜಿನಂತೆ)
Hardness :- 7
Cleavage :- No. cleavage
Fracture :- conchoidal
Sp. gravity - High
Diagnostic properties :- Lustre, hardness, Fracture, colour

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② Olivins :- $(MgFe)_2 SiO_4$

Form - Crystalline / Motive
colour - Olivengreen
Lecture - vitreous
Streak - colourless
Hardness - 6-7
Cleavage - Imperfect
Fracture - conchoidal
Sp. gravity - High
Diagnotic properties - Hardness

③ Feldspar :-
Form - Orthoclase in monoclinic
colour - Fleshy red
Lustre - vitreous or pearly (মুক্তা চকচকে)
Streak - white
Hardness - 6
Cleavage - 2 set perfect cleavage
Fracture - Sub-conchoidal
Sp. gravity - Medium
Diagnostic properties - Lustre, Hardness, Cleavage, Fracture, colour

④ Pyroxenes :-
Form - Prismatic Crystal
colour - Nearly black or green
Lustre - vitreous
Streak - White
Hardness - 5 to 6
cleavage - 2 set Perfect Cleavage
Fracture - Conchoidal
Sp. gravity - Low
Diagnostic Properties - Hardness, Lustre, Cleavage, Fracture

(Imp)

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Petrology :-

(1) Igneous Rock

1. Granite
2. Basalt (Iron mixed)
3. pumice
4. Diorite
5. Rhyalite
6. Obsidian
7. tuff
8. Pegmatite
9. Andesite
10. Gabbro

(2) Sedimentary Rock :-

1. Limestone
2. chalk
3. clay
4. sandstone
5. Shale
6. coal
7. Quartz
8. chert
9. dolomite
10. breccie
11. conglomerate

(3) Metamorphic :-

1. Marbal
2. Schist
3. Slate
4. gneeiss
5. Serpentinite
6. phyllite
7. Quartzite
8. horenfel
9. Amphibolite
10. Granulite

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(Imp)

Physical properties :—

1. Form- It is the arrangement of constituent atoms of mineral
2. colour :- The reflection of a particular colour from spectrum light.
3. streak :- The colour of mineral in powder form
4. cleavage :- The tendency of mineral to break along parallel / smooth surface
5. Lustre :- The appearance of surface of mineral in reflected light.
6. Degree of transparency :- It allow the passes of light through it
7. hardness :- The resistance of Mineral to abrasion.
8. Specific gravity :- The ratio of weight of mineral to wt of the same volume of water.
9. Fracture :- The tendency of mineral to break along uneven surface
10. Texture :- The orientation of grains or crystal inside a Mineral.

(Imp) Moraine :— (Glacial)

Moraine is a deposition land form of glacier when glacial ice melts slide down it carries away all the boulder soil, silts plant debris. the lower part of the Mountain valley there forms new land form which is called Moraine.

⇒ Based on the position of this land fall there are 3 types of Moraine :-

1. Lateral Moraine
2. Medial Moraine
3. Terminal Moraine

(2) Medial moraine :—

⇒ Moraines are formed when to Glaciers meets to lateral Moraines from the different Glaciers are pushed together. This Material forms one line of Rock and dust in the middle new Biger Glaciers.

⇒ If a Glaciers Medial Moraine live behind will be long rise earth the meadle of the valley.

(3) Terminal Moraine :—

Terminal moraine in other wise known as end moraine it forms at the valley end of a Glaciers, all the debrige all the debrige that was pushed to the front of the Glaciers which deposited long clumb of rock, soils sediments.

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(1) Lateral Moraines :—

⇒ Lateral moraine form along the glacier side and consist of debris that falls horse slumb form the valley way or directly flow glacier surface.

(DIT).

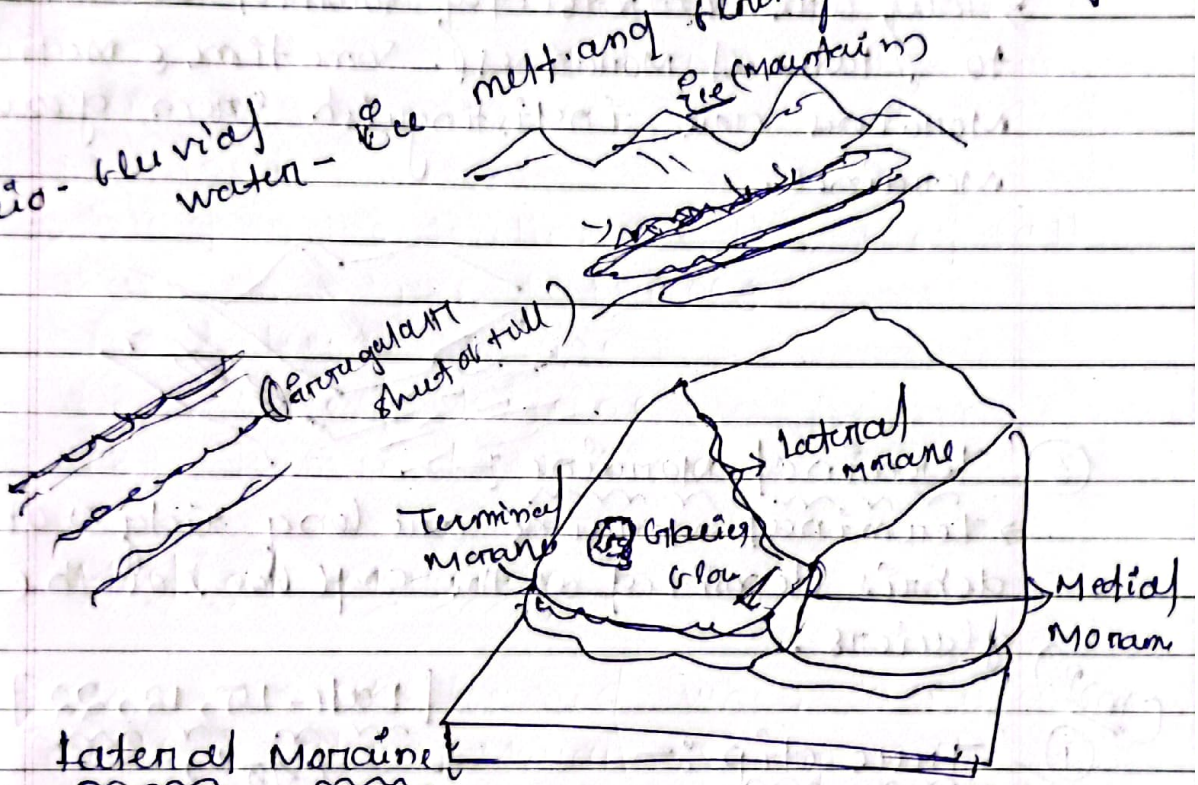
⇒ Lateral Moraine is formed along the edge of stream as the velocity of debris / sediments moving along side of stream is very slower than that of moving in the middle. The sediments leave behind along the side of glacial stream after the melting of ice is known as lateral moraine.

(IMP) Moraines :—

⇒ They are long ridges of glacial till.

Types of Moraines :—

glacio-fluvial water - ice melt and flowing over the valley.



(1) Lateral Moraine

⇒ Lateral moraine form along the sides parallel to the glacial valleys. The lateral moraines may join a terminal moraine a horse-shoe shaped ridge.

⇒ These moraines partly or fully owe their origin to glacio-fluvial waters pushing up materials to the sides of glaciers.

⇒ Many valley glaciers retreating rapidly leave an irregular sheet of till over their valley floors. Such deposits varying greatly in thickness and in surface topography are called ground moraines.

dip (vector)
strike (scalar)

(2) Medial Moraine :—

⇒ The Moraine in the centre of the glacier valley flanked by lateral Moraines is called Medial Moraine.

⇒ They are imperfectly formed as compared to lateral Moraines. Some time s Medial Moraines are indistinguish from ground Moraines.

(3) Terminal Moraine :—

⇒ Terminal Moraine are long ridges of debris deposited at the end (face) of the glaciers.

(Imp)

[Date- 15, 12, 22]

(1) True dip :— (45°)

⇒ The maximum slop along a dip is known as true dip.

(2) Apparent dip :—

⇒ All the dip in any direction other than the true dip is called Apparent dip.

(3) Glacier :—

⇒ when accumulation of snows becomes faster than the melting rate of snows on the ground then cementation of small pellets of snow forms a large bed of Ice is known as Glacier.

Accumulation = संचय)
(cementation = pasting)

⇒ When the accumulation of snows become faster than the melting rate of snows on the ground then cementation of small pellets of snow forms a large bed of ice known as Glacier.

(4) Ice berg :—

It is a large piece of ice mass that has been broken off from a bed of glaciers. It slides down from the surface of higher elevation to the lower level ground by gravitational pull is called Ice berg.