

ROCKS

Rocks - Agglomeration of minerals.

Agglomeration of minerals that forms a mass or less definite units of the earth's crust. A rock does not possess a definite composition like that of a chemical compound.

Multani mat. - loose. (mini soil)

but it is mixture of various minerals. The materials of the crust or lithosphere are generally called as rocks. The word lithosphere means 'lithosphere' as the literal meaning of 'lithos' is 'Rock'.

Classification of Rocks:-

The rocks of the earth's crust are of many kinds. The crustal rocks are classified on several ground, eg:- mode of formation, physical & chemical properties, locations etc. They differ from one another in colour, texture, composition, origin etc. On the basis of their mode of formation, they may be classified into 3 groups namely: Igneous, Sedimentary & Metamorphic.

Igneous Rocks - It is formed by the solidification of the molten matter or magma, which lies in the interior of the earth. It is poured out on to the surface

of the earth as in volcanoes, it cools when it stops & becomes a solid rock. Eg:- Basalt, Granite etc. ♀

Igneous rocks are of two types :-

A. Intrusive igneous rock

B. Extrusive igneous rock.

A) Intrusive igneous rock - when the molten material of the interior of the earth's crust find its way through cracks or spaces that it has made by pushing the surrounding rock apart, & does not reach the surface, it solidifies below the surface. This is called as Intrusive Rock. Intrusive igneous rocks are also formed when the rising magma during a volcanic activity do not reach the earth's surface rather they are cooled & solidified below the surface of the earth. This rocks are further sub-divided into two major groups - Plutonic Intrusive igneous rock & Hyabysal Intrusive igneous rock. When the solidification of magma takes place at a slower rate the crystals ^{that} are formed in the rock are fine. But at a greater depth, where the rate of cooling is much slower large size crystals are formed, such kind of ~~long~~ deep seated rocks of large sized crystals are known as Plutonic Rocks. Granite is the best example of this category.

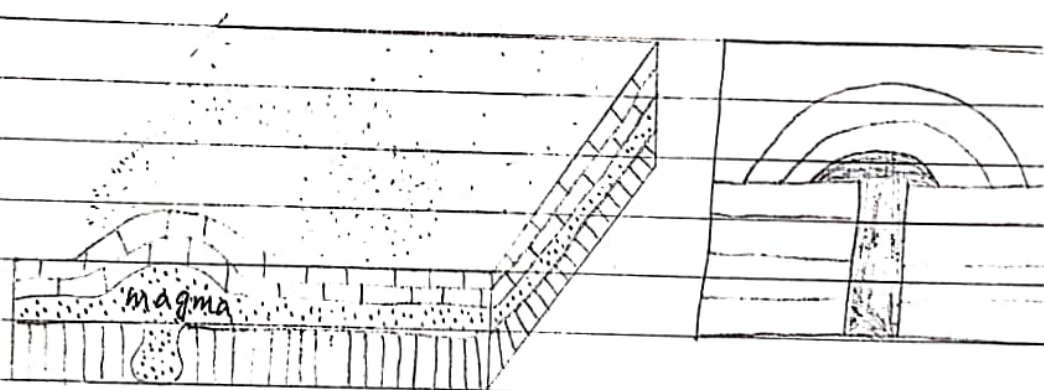
Hyabysal Intrusive Igneous Rock - Dykes

At 1. This rocks are formed due to cooling & solidification of rising magma during volcanic activity in the cracks, ^{pores} crevices & hollow places just beneath the earth's surface. The resultant rocks are called Hyabysal Rocks. The magma are solidified in different forms depending upon the hollow places such as batholiths, ~~batoliths~~, ~~facoliths~~, phacoliths, ~~poroliths~~, ~~dykes~~ etc. It should be remembered that this shouldn't be taken as the types of igneous rocks because these are different shapes of solidified magma.

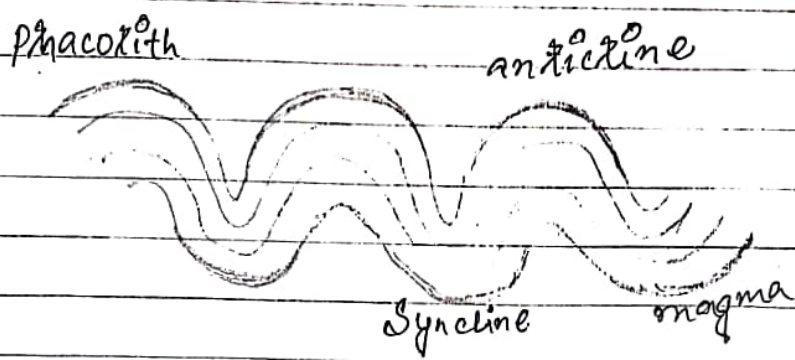
↳ Batholiths:- are long, irregular & undulating forms of solidified magma. They are usually dome-shaped and their side walls are very steep, almost vertical. The upper portion of batholiths are seen when the superincumbent cover is removed due to continued denudation but their base are never seen because they are buried deep ~~between~~ the earth. when exposed to the surface they are subjected to intense weathering & erosion & hence their surfaces becomes highly irregular and corrugated. Numerous batholithic domes were found below the Shalwanian Sedimentaries in many parts of the peninsular India. Many of such batholithic domes have now been exposed well ^{above} among the surface in many parts of the Chotanagpur plateau of India.

namely, Rachi Plateau, where such batholith domes are called as Rachi Batholiths.

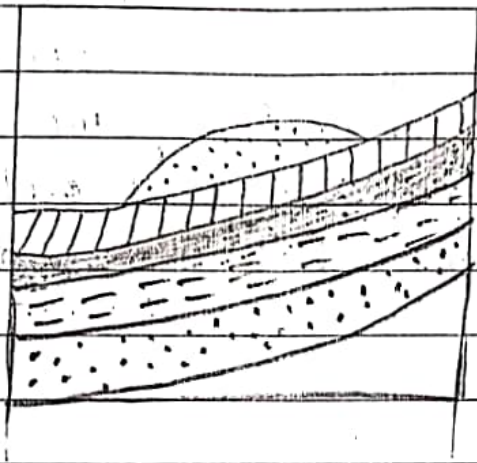
Laccoliths :- The word laccoliths has been derived from the German word 'Laccos' which means 'rocks'. They are formed due to injection/^{intrusion} of magma along the bedding planes of horizontally bedded sedimentary rocks. The laccoliths are mushroom shape having convex summital form. The ascending gases during a volcanic eruption force the upper strata of the flat layered sedimentary rocks to arch out up in the form of a convex arch or a dome.



Phacoliths :- They are formed due to injection of magma along the anticlines and synclines in the regions of folded mountains.



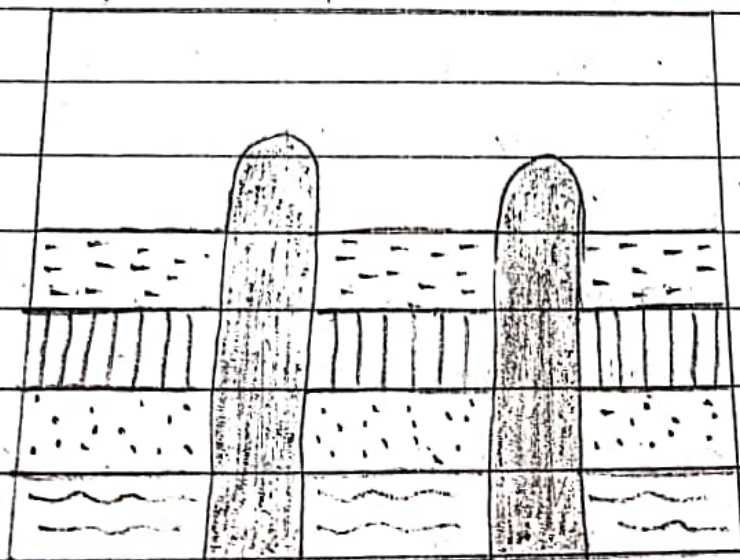
Copoliths :- It has been derived from the German word 'Kopas' meaning thereby a shallow basin or bowl shaped body. When magma is injected & solidified in a concave shallow basin whose central part is sagged downwards, the resultant form of solidified magma is called a copolith.



Sills :- The sills are usually parallel to the bedding plane of sedimentary rocks. They are formed due to injection & solidification of magmas between the bedding planes of sedimentary rocks. Thick beds of magma are called sills whereas the thin beds of magma are called sheets.



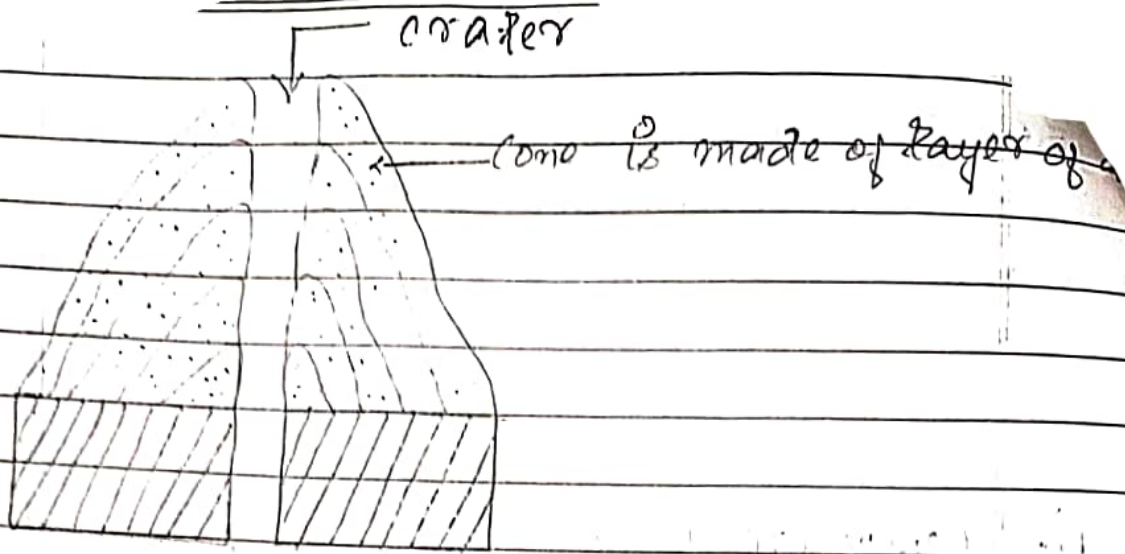
Dykes :- Dykes represent a wall-like form of SiO_2 solidified magma. They are usually perpendicular to the beds of sedimentary rocks. The thickness of dykes range betⁿ a few cms to several 100 ms. The relative resistance of dykes in comparison to the surrounding rocks helps in the formation of some features. For eg :- \uparrow If the rocks of dykes is weaker & less resistant than the country rocks, the upper portion of dykes is more eroded than the country rocks, with the results of a depression being formed. When this depression is filled with water, it is called a Dyke Lake. \uparrow If the rocks of dykes are more resistant than the country rocks, upstanding ridges & hills are formed because of more erosion of the country rocks ^{with} the rocks of dykes and country rocks are of uniform resistance, both ^{are} the uniformly dissected and hence no significant landforms are developed but the height is gradually reduced.



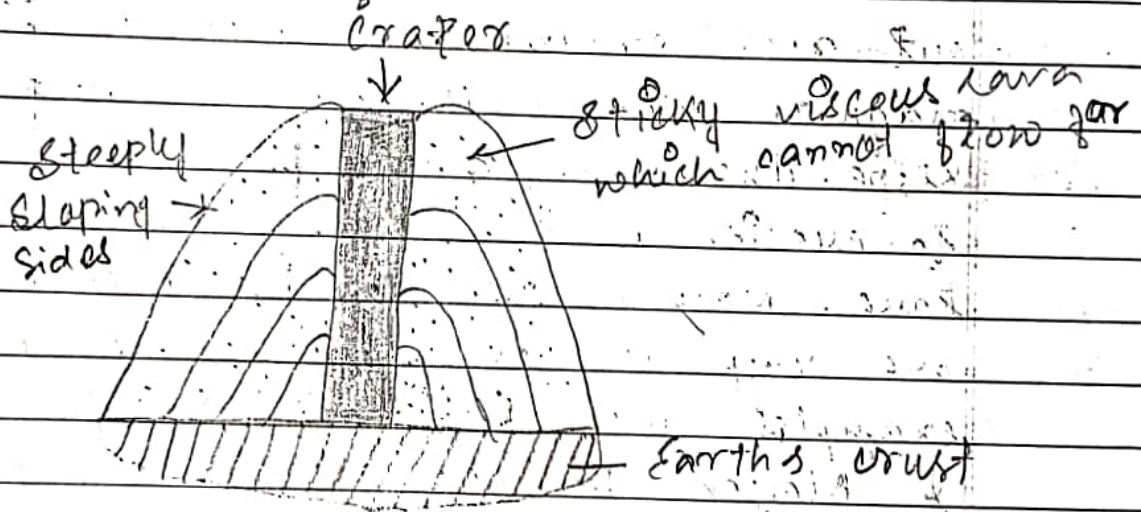
Extrusive Igneous Rock :-

The igneous rocks are formed due to cooling & solidification of hot & molten lava at the earth's surface are called extrusive igneous rock. They are generally formed due to fissure eruptions of volcanoes resulting into fluid basalts. These rocks are also called volcanic rocks. Extrusive rocks are generally fine grained or or glassy basalt, because lavas after coming over the earth's surface are quickly cooled & solidified due to comparatively extremely low temperature of the atmosphere & thus there is not enough time for the development of grains or crystals. The different forms produced by extrusive igneous rocks are as follows :-

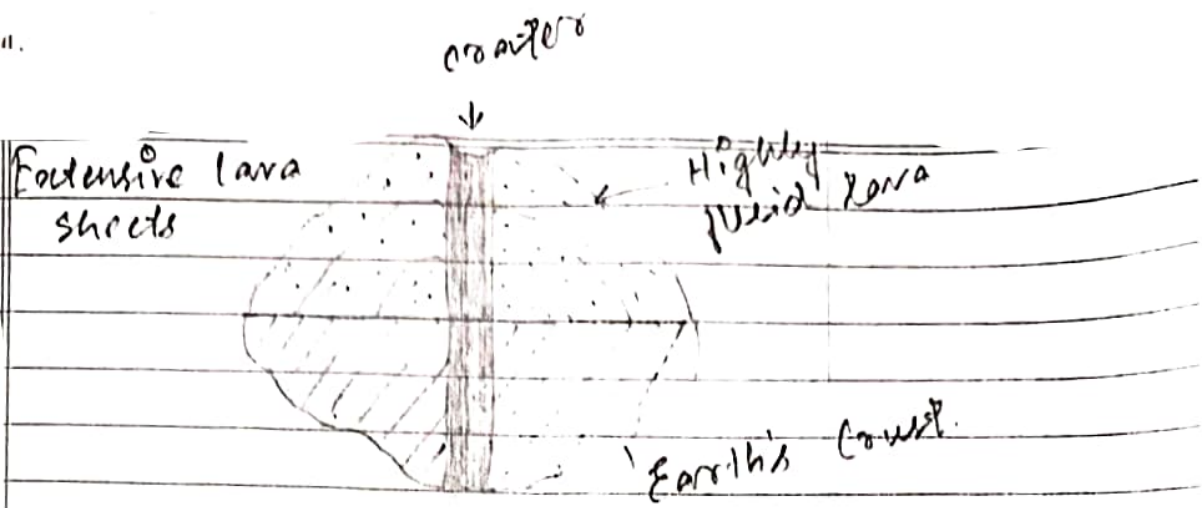
Cinder or Ash cones - They are usually of low height & are formed of volcanic dust & ash. Cinder cones are built entirely of small pieces & fragments of solidified lava ~~through~~ thrown from a central vent. When the lava ejected from a central vent, its pieces & fragments solidified around the vent to form cone. This is known as the Cinder Cone. Near the summit, the fragments and pieces are coarser & formed a steeper slope, whereas fine particles (or ash) come to rest lower down & formed a less steep slope. Most cinders are less than 150 m high & 1 km in diameter.



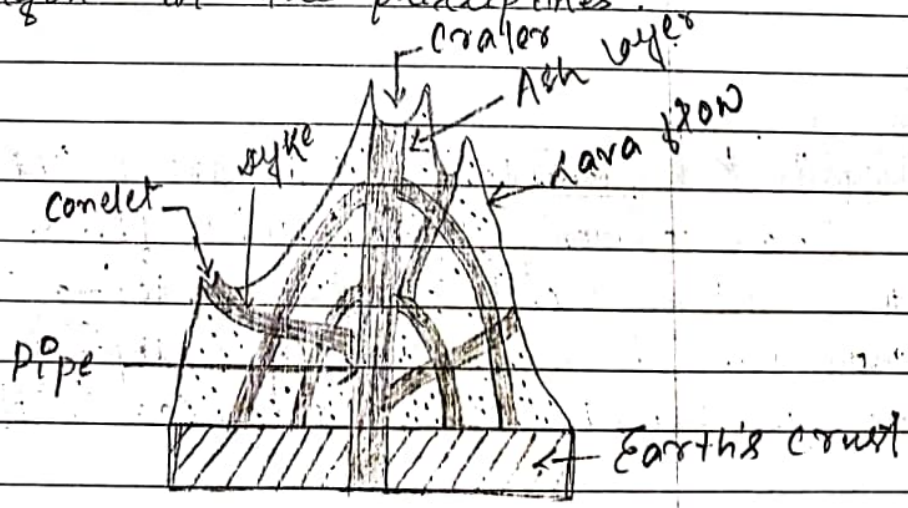
Acid lava cone - This is formed when ^{low} viscous lava solidifies quickly & gives rise to steeply sloping cones. Sometimes the lava is so viscous that it solidifies quickly within the cone. This is known as the spine or plug. Sometimes these spines or plugs are exposed by denudation.



Basic Lava shields:- These are built of very fluid lava, commonly basic, which flows far out from the central vent before hardening & thus builds a mountain broad & gently sloping in proportion to its height. Eg:- Mauna Loa in Hawaii Islands.



Composite Cones :- Volcanoes of composite cones are built of layers of cinders & ash, alternating with layers of lava. They are the highest of all volcanic cones. These are formed due to accumulation of different layers of various volcanic materials & hence these are also called **Strato Cones**. They are composed of more than one vent. The growing cone throws out rock fragments but at the same time magma escapes through opening down the slope. The cones becomes comparatively resistant to erosion if it is coated by a thick layer of lava. Most of the world's greatest volcanoes are composite cones. Among the outstanding examples are **Fujiyama** 'Fujiyama' in Japan & 'Mayon' in the Philippines.



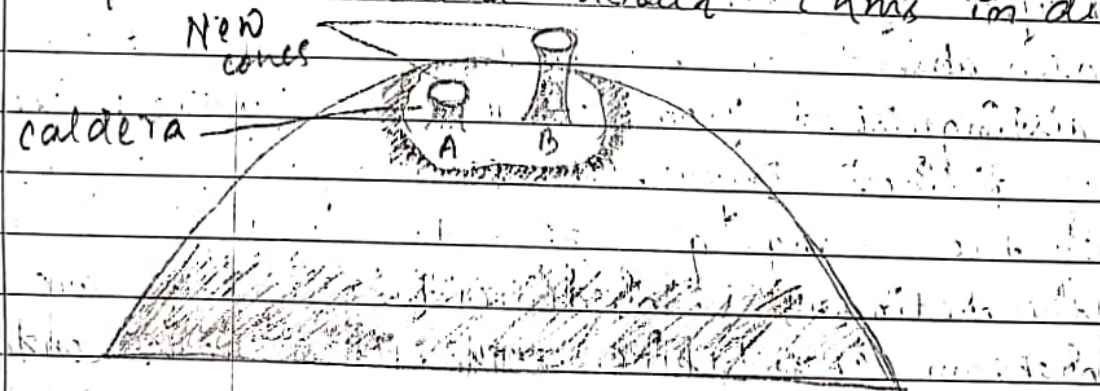
Lava domes:- They are large & more extensive in size than shield cones. These are formed due to accumulation of solidified lavas around the volcanic vents. Based on the mode of origin and the place of formation, lava domes are divided into 3 categories:

Plug dome - Formed of lavas due to filling of volcanic vents.

Endogenous dome - Formed of silica rich viscous lava.

Exogenous dome - Formed of silica deficient lava with high degree of fluidity.

Caldera - Sometimes when a tremendous eruption takes place, the entire ~~part~~ central portion of the volcano is destroyed. There remains only a great central depression or cavity. This has been termed as Caldera. One can never be certain whether the upper part of the volcano is largely blown outward or subsided into the ground beneath the volcano. Crater Lake in Oregon in USA occupies a caldera about 9 kms in diameter.





volcanic neck.

Lava plug - Lava plug are formed due to plugging of volcanic pipes and vents when volcano becomes extinct. These ^{vertical} columns of solidified lavas appear on the earth's surface when the volcanic cones are eroded away. Generally, the volcanic necks are cylindrical in shape & measures 50-60 m in height & 300-600 m in diameter.

SEDIMENTARY ROCKS 26/08/09.

Sedimentary rocks as the word implies, are formed by the particles, grains or fragments derived from ~~the~~ previously existing rocks known as the parent rocks. In their original state, these sediments are soft but in course of time they become hard & compact because of the pressure due to their own weight & cementation. Sedimentary rocks are also called as stratified or layered rocks because these rocks have different layers or strata of different types of sediments. Sometimes, layers are also absent in sedimentary rocks. They are distinguished from other rocks by the presence of distinct layers. These layers are formed by the changing size & the composition of the sediments. Sedimentary rocks are seldom crystalline rocks. These rocks contain fossils of plants & animals. The age of formation of a given sedimentary rocks may

Organically formed Sedimentary Rocks :-

The Sediments derived from the disintegration ~~and~~ decomposition of plants and animals are called organic Sediments. These Sediments after being deposited and consolidated form organic Sedimentary rocks. On the basis of time and carbon content these rocks are divided into three categories, eg,

- i) Calcareous rocks
- ii) Carbonaceous rocks
- iii) Siliceous rocks.

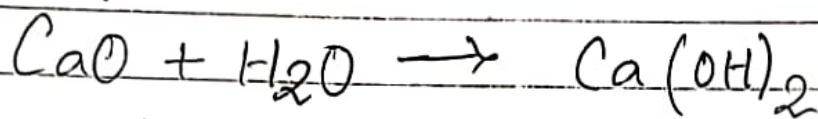
be determined on the basis of the analysis of fossils to be found in that rock. They are seldom found in original horizontal manner. The layers are generally deformed due to lateral compressive & tensional force. The beds are folded and are formed as anticlines & synclines. Sedimentary rocks may be well consolidated, ~~consolidated~~ poorly consolidated and even unconsolidated. The composition of the rocks are depend upon the nature of cementing elements and rock forming elements. They are characterized by different sizes of joints. These are generally perpendicular to the bedding planes.

Classification of Sedimentary Rocks

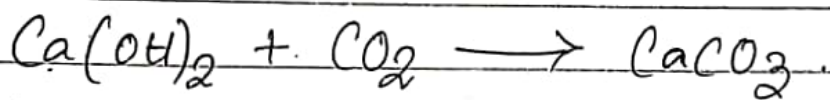
On the basis of the nature of Sediments, Sedimentary rocks may be classified into:-

(i) Mechanically formed Sedimentary Rocks:-
These rocks are formed from the agencies such as wind, Rain, ice and running water, disintegration of parent rock ~~and~~ produces ~~less~~ and broken fragments of all sizes, when these are deposited and cemented together, a rock is formed.
According to their texture, these kinds of rocks can be grouped as Shale, Silts, Sand Stone, Conglomerates and Breccia are also called fragmental rocks ~~and~~ are clastic materials which become source materials for the formation of clastic Sedimentary rocks.

Calcareous Rocks:- Since these rocks are formed due to the deposition and consolidation of the sediments derived from the ~~the~~ skeletons and remains of plants and animals they contain a larger portion of ^{lime} ~~lime~~. Limestone are formed when calcium oxide (CaO) reacts with water (H₂O) to form Calcium Hydroxide (Ca(OH)₂).

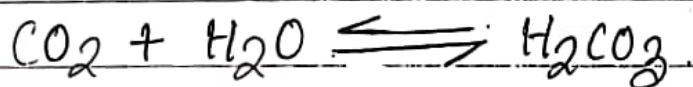


Calcium hydroxide reacts with carbon dioxide (CO₂) to ^{form} Calcium Carbonate or limestone.

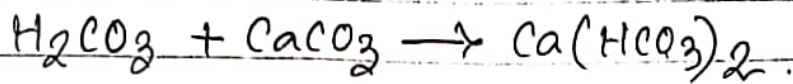


They are also known as carbonate rocks or carbonate. Limestone (CaCO₃), Magnesium Carbonate (MgCO₃), Dolomite (CaMgCO₃) are important carbonate rocks. Since limestone are formed of chemically soluble materials and hence they are most susceptible to chemical weathering. The chemical reactions are as follows:-

CO₂ after being dissolved in water forms carbonic acid (H₂CO₃).



Carbonic acid reacts with limestone to form calcium bicarbonate ($\text{Ca}(\text{HCO}_3)_2$).



Though limestone are very weak rocks in the humid regions but they become resistant rocks in hot and dry climate because they have homogenous structure and thus they are not affected due to differential temperature change. The rocks having the carbonates of both calcium and magnesium are known as dolomites which are less soluble than limestones. Chalk is another form of carbonate rocks but it is softer and more porous than limestone. Chalks are formed due to precipitation of carbonate materials which are derived from microorganisms like Foraminifera.

Carbonaceous rocks - These are dominated by carbonic materials which represents vegetation remains. They are formed due to transformation of vegetation because of their burial during earth movements and consequent weight and pressure of overlying deposits. The initial form of carbonaceous rock is peat which is of a dark, gray colour. Vegetation remains can be seen with the help of microscope. The other subsequent forms of carbonaceous rocks are lignite, bituminous, Anthracite coals with greater proportion of carbon and darker colour. Carbonaceous rocks are more important

METAMORPHIC ROCKS:-

Sometimes in some region, because of tremendous pressure & high temperature, both igneous & sedimentary rocks may be altered so greatly in appearance & composition that they entirely lose their original character, such rocks are known as metamorphic rocks.

The word 'metamorphism' has been derived from the word 'metamorphose' meaning change in form. Thus metamorphic rocks means the complete alteration of the pre-existing rocks due to change in minerals composition & texture through temperature & pressure. The metamorphic rock is harder & more compact than its original type. Some metamorphic rocks are crystalline like igneous rocks.

Example:- Marble (from limestone), Slate

Slate (from clay).

Gneiss (from granite).

Quartzite (from sand).

The change in form of rocks during the process of metamorphism takes place in two ways:-

Physical metamorphism \rightarrow relating to changes in textural composition of rocks.

Chemical metamorphism leading to changes in the chemical composition of rocks.

economically than geomorphologically.

Siliceous Rocks - They are formed due to dominance of silica content. They are also formed due to aggregation and compaction of wastes derived from sponge and radiolarian organisms and diatom plants.

Chemically formed Sedimentary Rocks :-

These rocks are formed due to by the evaporation of water from solutions containing minerals. Various kinds of salts precipitate from the water of shallow desert lakes (like the dead sea), where evaporation of the water is rapid. Running water sometimes contains chemical ^{materials} minerals in suspension when such chemically active water comes in contact with the rocks in its way soluble minerals are removed from the rocks. Such materials are called chemically derived or formed sediments. These chemical ^{materials} minerals after being settled down & compacted & cemented together to form chemical sedimentary rocks. Gypsum is the best example of this kind of rock. Several nitrates & potash are also chemically formed sedimentary rocks.

Different types of metamorphic rocks :-

The process of metamorphism can be classified on the basis of material based the nature of agents of metamorphosis & the place area involved with metamorphism.

On the basis of the nature of agents metamorphic rocks can be classified as thermal metamorphism, dynamic metamorphism, Hydro metamorphism & Hydrothermal metamorphism.

On the basis of place and area metamorphism can be classified as contact metamorphic and regional metamorphism.