3.2 TEXTURES AND STRUCTURES OF ROCKS

Texture:

Texture of a rock is defined as the mutual relationship and packing arrangement of different mineral grains and glassy matter present in a rock.

Structure:

Structure refers the form are shape of the rock, developed during its formation.

Texture of Igneous rock / Textural classification:

1. **Crystallinity:** It refers the amount of crystal or glassy matter on both present in a rock.

It is further classified into

i. **Holocrystalline**: When a rock is completely made up of crystals. (.E.g.) Granite.

ii. **Holohyaline**: When a rock is completely made up of glass. (.E.g.) Obsidian.

iii. **Hemi / Merocrystalline:** When a rock is partly made up of crystals and partly of glass. (E.g.) Granite porphyry.

2. **Granularity :** It refers the grain size and dimension of grains present in a rock (visible to naked eye or not)

Granularity is classified into:

i. **Phaneric or phanerocrystyalline:** When mineral grains areable to be identified with naked eye. E.g. Granite.

- **Coarse grained** : When grain size > 5mm
- **Medium grained** : When grain size 1mm –5mm
- **Fine grained** : When grain size < 5mm

ii. **Aphanitic**: When crystal grains are unable to be identified with naked eye. E.g. Basalt.

iii. **Microcrystalline**: When crystal grains are able to be identified only under microscope. E.g. Slate.

iv. **Crypto crystalline**: When even under microscope, very difficult to identify mineral grains. E.g. Flint, Cherts, etc.

3. **Shape of crystals :** It refers grain size of crystals present (bigger / smaller) in a rock (whether equal or unequal in size)

It is studied under,

i. **Euhedral**: Crystal faces perfectly developed. When a rock is totally made up of Euhedral crystals, the texture is termed Pan Idiomorphic. E.g. Granite.

ii. **Subhedral**: Crystal faces partially developed. When a rock is totally made up of Subhedral crystals, the texture is termed Hypidiomorphic.

iii. **Anhedral**: Crystal's faces undeveloped. When a rock is fully made up of anhedral crystals, the texture is called Allotriomorphic.

4. **Mutual Relations of crystals:** It refers the presence of smaller and larger grains and their relationships.

This texture is classified into:

i. **Porphyritic**: When larger grains surrounded by smaller ones in a rock. E.g. Granite, Syenites, etc.

ii. **Poikilitic**: When smaller grains surrounded by or enclosed in larger ones. E.g. Dolerite.

Structure of igneous Rocks:

1. **Extrusive forms:** the forms developed upon the surface of earth (eg) volcanic rocks
2. **Intrusive forms:** the forms developed below the surface of earth (eg) Silt, Dykes, etc.
3. **The block and ropy lava:** (When magma comes out of the surface of earth, it becomes lava.)

Block lava: The surface is rough & irregular with broken & fragmental appearance, due to highly viscous lava undergoing little movement

Ropy lava: Smooth surface of structure, due to very mobile lave, moving considerable distance.

4. **Flow structure:** Development of parallel or nearly parallel layers of minerals, due to flow of lava.
5. **Pillow structure:** Overlapping pillow like structure.
6. **Spherulitic structure:** Made up of thin minerals fibres.
7. **Orbicular structure:** Concentric shell like.
8. **Columnar:** column like –rhombic, square, hexagonal shapes (eg) Columnar Basalt
9. **Sheet structure:** Made up of separable sheets, due to weathering (eg) Granite
10. **Vesicular structure:** Escape of gases within the lava gives rise to several empty cavities on cooling within the consolidated rock. This structure is termed vesicular structure.
11. **Rift and grain:** this structure indicates two separate directions, along which when quarrying, the rock will split.(Eg) granite can be broken with a comparative ease, due to rift and grain. The directions of rift and grain are at right angles to each other.

Other structures of igneous rocks:

1. **Concordant forms:** eg sill

The igneous intrusion that has been injected parallel to the bedding planes of host rocks are called concordant forms Eg sills

2. **Discordant form:** eg Dyke

The intrusion that cut across the bedding planes is called discordant forms. Dykes is a discordant plane.

3. **Batholiths:**

The extensive body of igneous intrusion (generally more than 100 Km^2 in area) which is discordant in nature and unable to trace its depth is known as batholiths.

4. **Stock and boss:**

   When the surface area of batholiths is less than 100 Km^2, it is said to be a stock and stock with circular outline is termed boss

Texture of sedimentary rocks:

The texture of sedimentary rocks is broadly classified as

i. **Texture based on origin:**

1. Clastic texture and
2. Non Clastic texture

Clastic texture: it is mechanically formed texture.

Non clastic texture: it is chiefly found in rocks that have precipitated chemically from water (chemical sedimentary rocks).

i. Texture based on shape:

1. Angular, sub angular (Eg) Breccias.
2. Rounded, sub rounded (Eg) conglomerates.

ii. Texture based on Grain size:

1. Coarse grained : average grain size > 5mm
2. Medium grained : average grain size 1mm to 5mm
3. Fine grained : average grain size < 1mm

Structure of sedimentary rocks

i. **Stratification:** The layered arrangement of strata in sedimentary rocks is called stratification. Each layer may be few cm to several meters thick and may extend for several maters or kilometers.

ii. **Lamination:** In a layered structure, if the individual layer is less than 1 cm thick and appears to be very thin, then it is called lamination.

iii. **Graded bedding:** In a stratified rock, the component grains of bedding are sorted and symmetrically arranged, coarsest to finest from top layer to bottom layer, then it is termed as graded bedding.

If the beddings show cross-cutting relationship with each other, not showing parallelism & gradation of grains, then the graded beddings becomes cross bedding.

If gradation of particles is followed in a cross bedding, it becomes torrential bedding.

iv. Concretionary structure:

If the sedimentary rock made up of concretions of various shape, like, rounded or sub rounded, quite small or quite large, like fish egg or walnut, then the structure is termed as concretionary structure.

v. Oolitic & Pisolitic structure:

These are examples of concretionary structures.

In oolitic structures, the concretions are of the size range 0.1 to 1.00 mm.

In Pisolitic structure, the individual size of the concretion is like that of a peanut, greater than 1mm. Eg: oolitic and Pisolitic limestones.

Texture of Metamorphic rocks

i. **Crystalloblastic:** This is a metamorphic texture equivalent to Holocrystalline texture of igneous rocks.

ii. **Porphyroblastic:** Equivalent to Porphyritic texture of igneous rocks.

iii. **Palymsest texture:** This is the remnant of igneous texture, after metamorphism. To indicate this, ‘blast’ is used as prefix.

Blastophitic: Remnant of ophitic texture is left over, after metamorphism.

iv. **Granoblastic:** Equivalent to equigranular texture, made up to equidimensional grains.

v. **Xenoblastic:** Crystal faces well developed (equivalent to Panidiomorphic)

vi. **Idioblastic:** Crystal faces not fully developed.

Metamorphic Structure

i. **Cataclastic Structure:** Characterized by extreme fineness of grains. Eg. Slate, crush breccias.
ii. **Schistose structure:** Parallel arrangement of platy/flaky minerals. Eg. Schist.
iii. **Gneissose structure:** Alternate color bands of dark colored and light colored minerals. Eg. Gneiss.
iv. **Granulose structure:** Minerals- granular in characters. Eg. Marble, quartzite.

Metamorphism

Metamorphism is defined as the process of alteration & recrystallization of rocks due to the impact of temperature, pressure and chemically active environment.

Agents of Metamorphism: Temperature, pressure (stress & directed pressure) and chemically active fluids.

Types of Metamorphism:

1. **Thermal metamorphism / contact metamorphism:** Temperature is the dominating agent.
2. **Plutonic metamorphism:** High temperature and high pressure dominating.
3. **Dynamic metamorphism (load metamorphism):** pressure dominates.
4. **Dynamothermal or regional metamorphism:** Temperature, pressure and chemically active fluids dominate.
5. **Cataclastic metamorphism:** Stress dominates.