

Engineering Geology

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UNIT - I INTRODUCTION

- * Geology is the science of the earth (geo = earth, logos = study (or) science).
- * It deals with different aspects of the earth as a whole such as :-
 - (i) origin, age, interior structure & history of earth.
 - (ii) evolution & modification
 - (iii) Materials

→ Main & Allied Branches of Geology: -

Main Branches: -

- * Physical geology
- * Mineralogy
- * Petrology
- * Structural geology
- * Historical geology (stratigraphy)
- * Palaeontology
- * Economic geology

Allied Branches: -

- * Engineering geology
- * Mining geology
- * Geophysics
- * Geo hydrology
- * Geo chemistry

- * Physical geology deals with the different physical features of the earth such as mountains, valleys, rivers etc.
- * Mineralogy deals with the study regarding different types of minerals.
- * Petrology deals with the study of rocks.
(Petro = rock, logo = study)

* Structural geology is the study of various types of deformations & dislocations which occurs on the surface.

Ex:- Tremors of Earthquake.

* Study of the earth's history through the sedimentary rocks is called historical geology.

* Strata = a set of sedimentary rocks
geography = description.

* Palaeontology is the study regarding different types of plants.

* Economic Geology is the study regarding the economic minerals like diamond, gems, graphite etc.

* Mining Geology is the study regarding the extent of occurrence of ores, depth, direction (strike), inclination (dip).

* Geophysics deals with the study of physical properties like density & magnetism of the earth.

* Geo hydrology can also be called as hydrogeology as it deals with occurrence, movement, nature (quality & quantity) of ground H₂O in an area.

* Geochemistry deals with the occurrence, distribution of different elements in the earth's crust.

→ Importance of geology in Civil Engineering:-

* The civil engineers aim at safety, stability, economy & life of the structures that they construct.

* Civil engineering constructions like dams & bridges will have their foundations on geological formations of the earth's surface, so their stability & safety depend on the competence of the in-situ rocks.

* Foundation rocks should be at a shallow depth for huge constructions like dams etc.

* Building materials are required in very large quantities near the site, otherwise the cost of construction will increase.

* These are some failures of constructions like

i) with reference to Dams

ii) with reference to Reservoirs

iii) with reference to Tunnels

iv) with reference to Bridges

v) with reference to Roads & Railways.

i) with reference to Dams:-

The following are a few examples of failures of dams they are:-

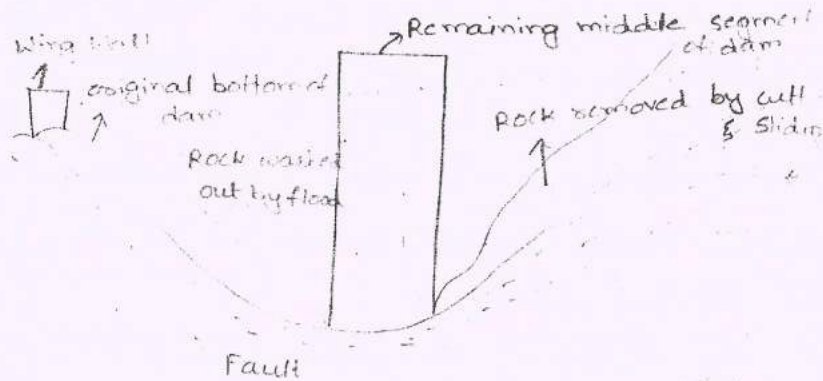
a) St. Francis dam of California.

b) Lafayette dam of California.

c) Austin dam of Texas.

a) Failure of St. Francis dam of California:-

- * It was a concrete gravity dam.
- * Constructed in 1926 in California.
- * Failed in 1928.
- * Duration:- 2 years.
- * Reason:- Failed due to existence of weaker rocks below the dam.



b) Failures of Lafayette dam of California:-

This dam was constructed on weak formations. Therefore it could not bear the heavy weight so it leads to settlement & sinking of dam by 6 meters.

c) Failure of Austin dam of Texas:-

- * It was a masonry dam of 68 ft ht.
- * Height 1090 ft long & 66 ft wide at base.
- * Constructed in 1892.
- * Failed in 1900.
- * Duration:- 8 years.

- * Reason:- Failed due to incompetent geological rocks.

WEATHERING

→ Weathering of rocks:-

The deteriorating effect of weather, climate (or) atmospheric agencies on rocks may be described as weathering of rocks.

- * The rocks which are formed under different conditions undergo disintegration & decay when exposed to the earth's surface.

- * The rocks which are affected by weathering will lose their strength, stability so they become unsuitable for the use of foundation & construction material.

- * Weathering of rocks is responsible for the formation of soils, laterites, economic mineral deposits, ground H₂O occurrence etc.

- * Weathering process of rocks are important for ^{engineers} civil construction purpose.

→ Geological Agents:-

The natural forces which are responsible for the changes on the earth's surface are called as geological agents. These are of two types they are:-

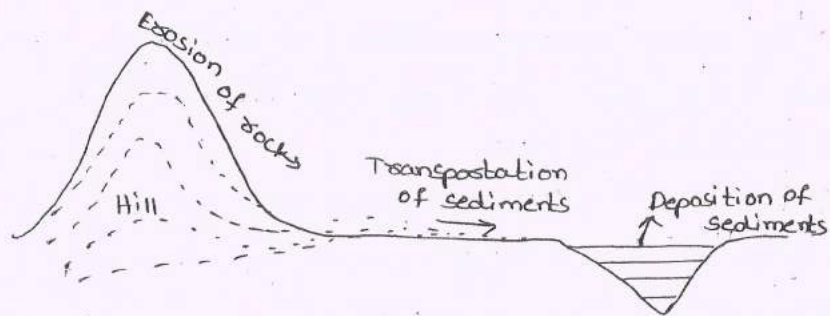
1) Exogenous (or) Epigene geological agents.

2) Endogenous (or) hypogene geological agents.

1) Exogenous geological agents:-

These agents originate on the earth's surface work slowly but steadily & erase topographic irregularities i.e. ups & downs on the surface.

* Geological work in a way is systematic commences with erosion & is followed by transportation & deposition.



* In hills due to erosion, rocks are broken down into smaller pieces, which are transported & deposited in depressions (lakes or sea).

* Due to erosion, the height of the hill & depth of the river decreases and levelled ground appears.

2) Endogenous geological agents:-

* The nature, origin & function of endogenous geological agents are in opposite to those of exogenous geological agents. Ex:- Earthquakes etc

→ Weathering process of rocks:-

The deteriorating effect of weather, climate (or) atmospheric agencies on rocks is known as weathering of rocks.

* This happens due to different physical, chemical & biological factors of nature.

* Due to weathering, rocks become smaller.

* The disintegration of rocks under wind, rivers, glaciers, crashing waves & tides of the sea etc comes under physical factors.

* The disintegration of rocks under hydration, reduction, oxidation, carbonation etc comes under chemical factors.

* The disintegration of rocks under plants, animals & man is known as the biological factors of nature.

→ Weathering process of rivers:-

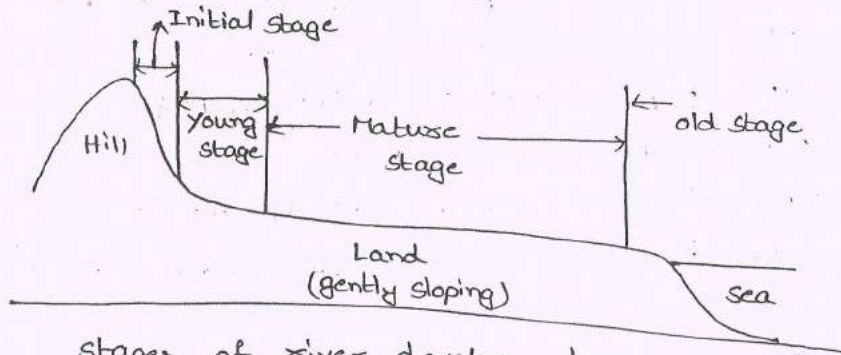
Rivers, glaciers, wind, tides & waves of the sea are the common exogenous geological agents.

→ Development of the rivers:-

* Rivers originate in mountains because mountains have higher altitude, cold climate & good vegetation.

* The annual precipitation is 30,000 cubic miles.

- * The development of a river has four stages:-
 (i) initial stage (ii) youth stage (iii) mature stage
 (iv) old stage.



Stages of river development

→ Initial stage:-

- * In initial stage the water flows as small streams.
- * In initial stage river is having active erosion & no deposition.

→ Young stage:-

- * In young stage there will be more erosion & less deposition.
- * In this stage the H₂O flows as small tributaries.

→ Mature stage:-

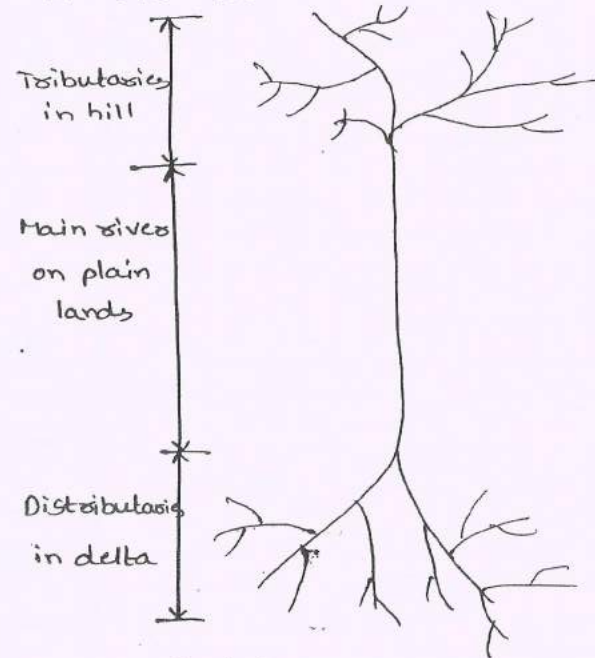
- * In mature stage there will be more deposition & less erosion.
- * In this stage the H₂O flows as tributaries

→ old stage:-

- * In mature old stage, deposition occurs without erosion.

- * In this stage the water will reach to the end point.

- * The flow of the river is represented in the form of "dendritic" (like tree)



Dendritic appearance of a river