

# Engineering Geology

## Lecture-1

# Course Outline

- **Introduction.** Introduction to Geology. Importance of Geology in civil engineering projects.
- Sedimentary, igneous and metamorphic rocks. Volcanic activity. Internal structure of the Earth. Engineering and physical properties of rocks.
- Identification of common rock forming minerals Classification of Rocks and Minerals. Colour of grain with respect to rock colour Chart of Geological Society of America. Identification of grains (coarse, medium and fine) of sedimentary rocks. Hardness classification (very soft, soft etc) with respect to simple field tests and uniaxial compression strength.
- Identification of rocks by megascopic studies. Identification of subordinate constituents in rock samples
- Structural Geology. Introduction to structural Geology and plate tectonics.
- Causes and effects of earthquakes. Protective measures against earthquakes. Sequence and principles of stratigraphy, earthquake zoning for Pakistan. Land-sliding and its causes
- Hydrogeology: wells, springs, streams and ground water conditions. Causes of glaciers and their types.
- Geology in Civil Technology. Role of geology in selection of sites for dams, reservoirs, tunnels and other important civil engineering structures, such as highways, airfield and bridges
- Ground subsidence: Mining subsidence due to alteration of fluid levels. Methods of avoiding mine collapses.
- Introduction to blasting. Engineering geology of tunnels, geological survey prior to tunneling, lining of tunnels and its section. Selection of tunnel site and its requirements, case histories, brief introduction to local geology

# Recommended Books

- 1. Blyth, F G H, “A Geology for Engineers”, 7th Arnold International student edition
- 2. Legget, R F, “Geology and Engineering”, 3rd edition McGraw Hill
- International edition
- 3. Krynine, D P m “Principles of Engineering Geology and Geotechniqcs”, 1st
- Edition McGraw Hill International edition.

# Course Assessment Details

- Credit hours
  - Theory = 2, Lab = 0
- Total Marks = 100
  - Assignment No. 1: 5
  - Quiz No. 1: 5
  - Mid-Term: 30
  - Assignment No. 2: 5
  - Quiz No. 2: 5
  - Final Term: 50

# Introduction to Geology

- Geology is the science of the earth
  - GEO=Earth, LOGY= Study/knowledge
- It deal with the study of Origin, age, interior structure, and history of earth
- Evolution and modification of various surface features like rivers, mountains and Lakes.
- Materials that make ups the earth.

# Main and Allied Branch of Geology

Main Branch	Allied Branch
Physical Geology	Engineering Geology
Mineralogy	Mining Geology
Petrology	Geophysics
Structural Geology	Geohydrology
Historical Geology	Geochemistry
Palaeontology	
Economic Geology	

# Physical Geology

- Physical Geology deals with the different Physical feature of the earth such as Mountain, rivers, lakes, glaciers and volcanoes.
- It also deals with different changes which occur on earth surface like formation or disappearance of rivers, spring and lakes.
- Natural phenomena like land slides, earth quake and weathering.
- Geological works of wind, glaciers, rivers, oceans, ground water and their role in constantly molding of earth surface.

# Minerology

- This deals with the study of minerals.
- Mineralogy deals with the detailed mode of formation, composition, occurrence, types, associated properties, uses etc .



# Petrology

- Petro = Rock, Logos = Study/knowledge.
- Petrology deals with study of Rocks .
- The earth crust is also called as lithosphere, is made of different types of rocks. Petrology deals with the their formation, structure, texture, composition, occurrence, types etc.

# Structural Geology

- The rocks which form the earth's crust undergoes various deformation, dislocations and disturbances under the influence of tectonic plates forces.
- The result is the occurrence of geological structures like folds, faults, Joints and unconformities in the rocks.
- The detailed mode of formation, causes, types, classification, importance etc.,

# Historical Geology

- The earth surface was always suitable condition for the deposition of sediments at some place or other. Therefore, there are sedimentary rocks on the earth representing the entire period of the earth history. proper investigation of this rocks reveals the chronological sequence of formation of rocks, evolution ,migration and plants and animals life during different period of the earth history.
- These kind of studies of the earth's history through sedimentary rocks is called historical geology.

# Palaeontology

- **Palaeontology** is the study of prehistoric species, mostly ones that are extinct. It focuses primarily on fossil data, using a variety of physical, chemical and biological techniques to analyse them.
- If , under favourable condition, animals and plants life gets embedded in sediments , it will be preserved partly or completely. Such remnants of ancient life preserved in rocks by natural processes are known as Fossils.
- Details of mode of formation of fossils, their types, occurrence etc. form the subject matter of palaeontology

# Economic Geology

- Minerals can be grouped into rock forming mineral and economic minerals. some of the economic minerals like talc, graphite, mica, asbestos, gypsum, magnetite and diamond are useful as raw materials in some industries.
- Some others like hematite, chromite, galena and Pyrolusite are used for ore extraction of various metals.
- The prosperity of a nation depends to a large extent of rich reserves of economical minerals deposit. Gulf countries are rich because of their oil deposit; South Africa is rich because of its gold and diamond deposits.
- It deals with the mode of formation, occurrence, classification, association, varieties and concentration, properties and uses. etc

# Engineering Geology

- This deals with the application of geological knowledge in the field of civil engineering for execution of safe, stable and economic construction like dams, bridges and tunnels.



# Mining Geology

- This deals with the application of geological knowledge in the field of mining. A mining engineer is interested in the mode of and extent of occurrence of ores, their tenor, properties etc.,
- It is also necessary to know other physical parameters like depth, direction (strike), inclination (dip), thickness and ore bodies.



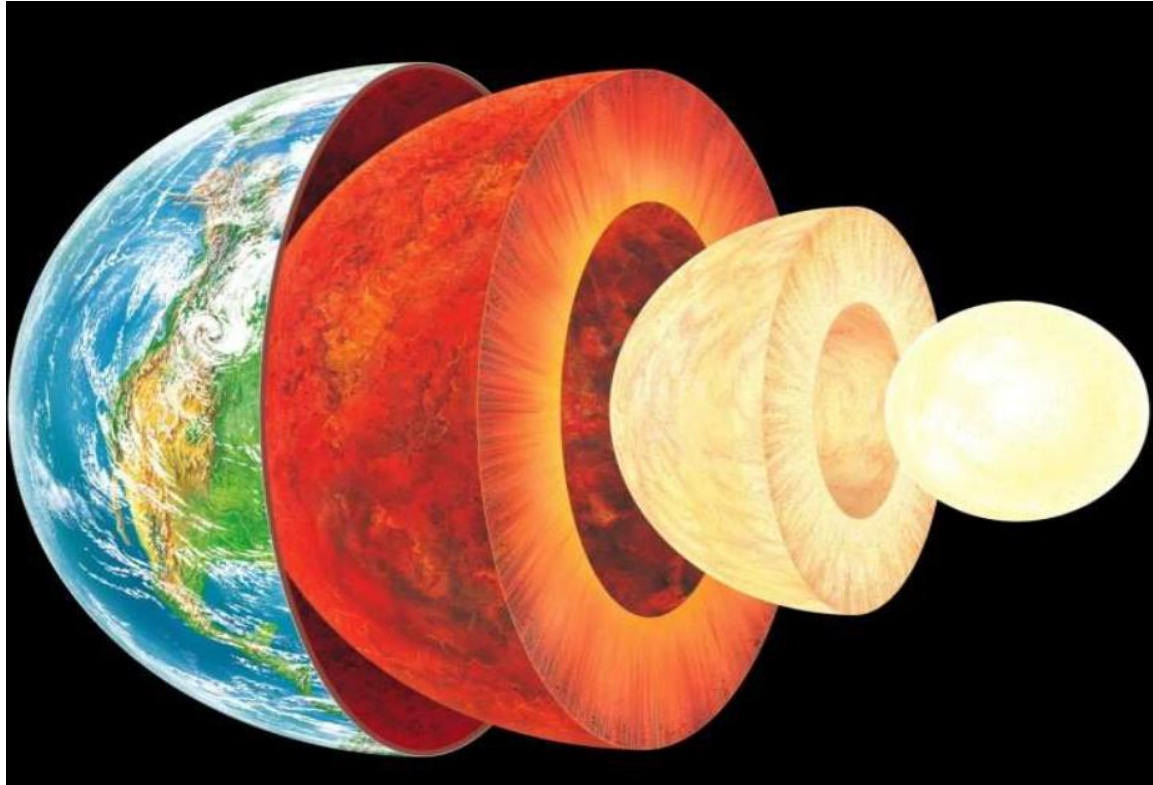




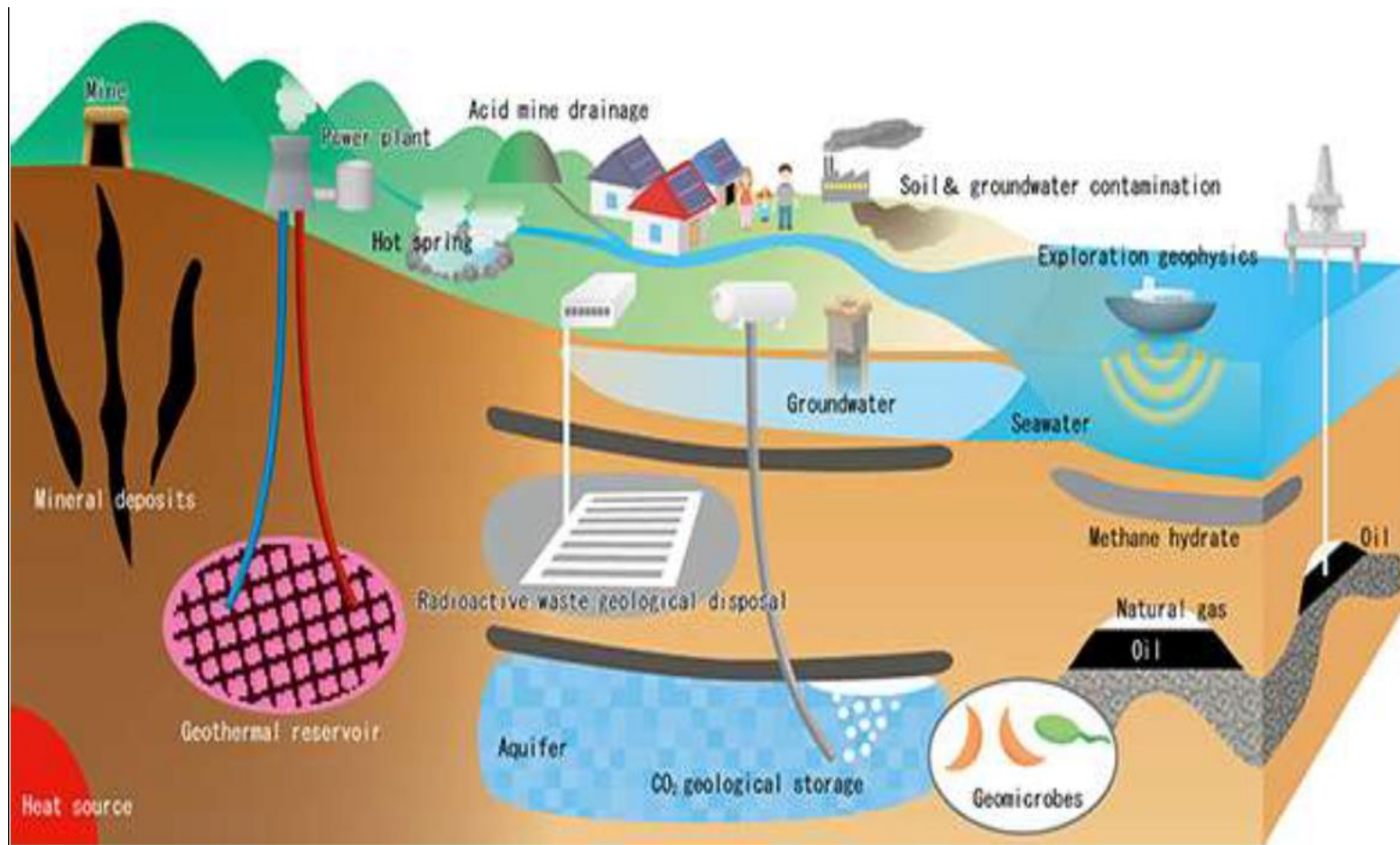
# Geophysics

- The study of physical properties like density and magnetism of earth. It is sub divided into Pure geophysics and Exploration geophysics.
- **Pure geophysics** deals with general aspects of earth as a whole and **Exploration geophysics** deals with the study of upper layer of the earths crust in order to solve civil engineering problem and locating oil, gas and ground water, explore and estimate the ore deposit.

# Pure Geophysics

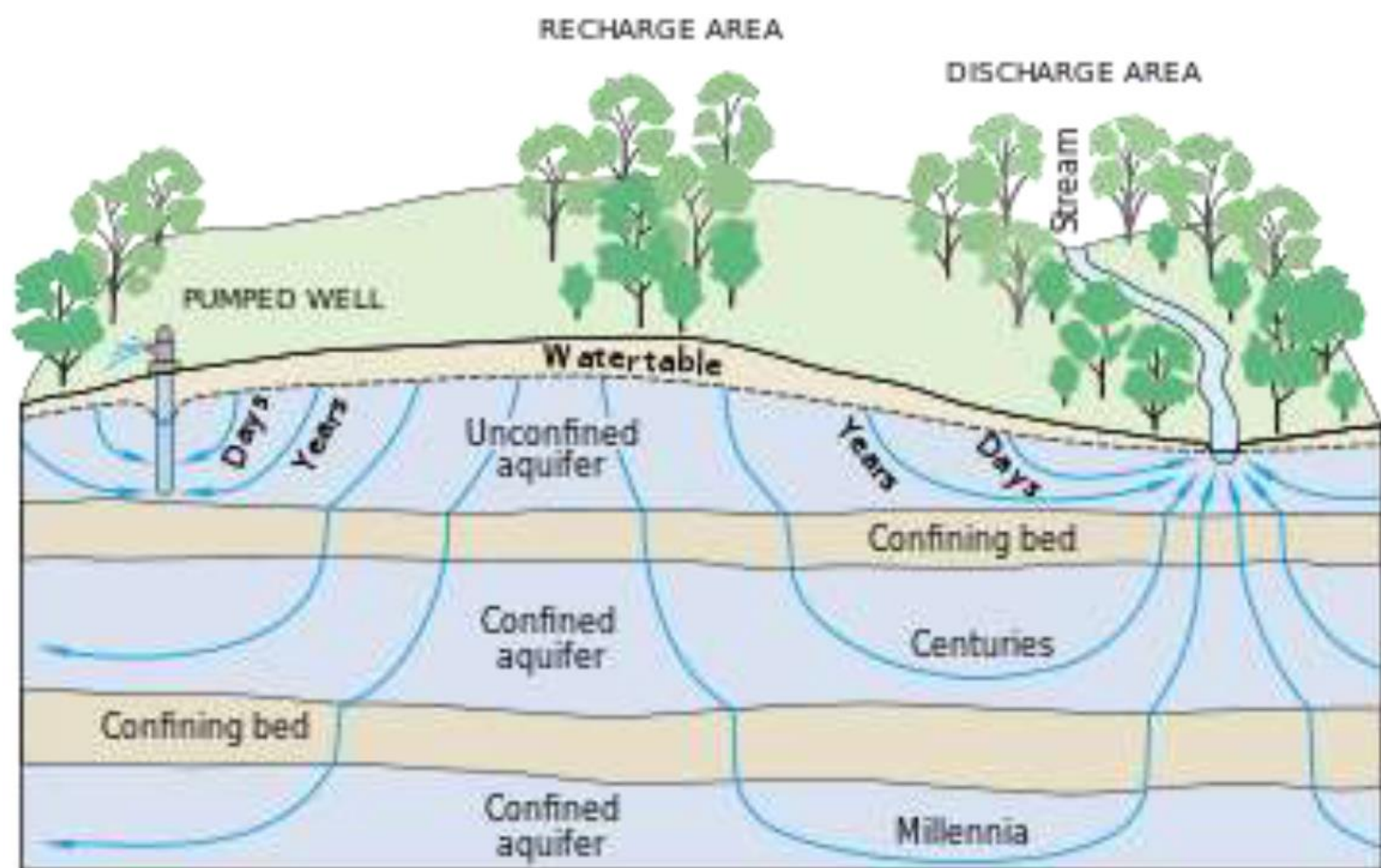


# Exploration Geophysics



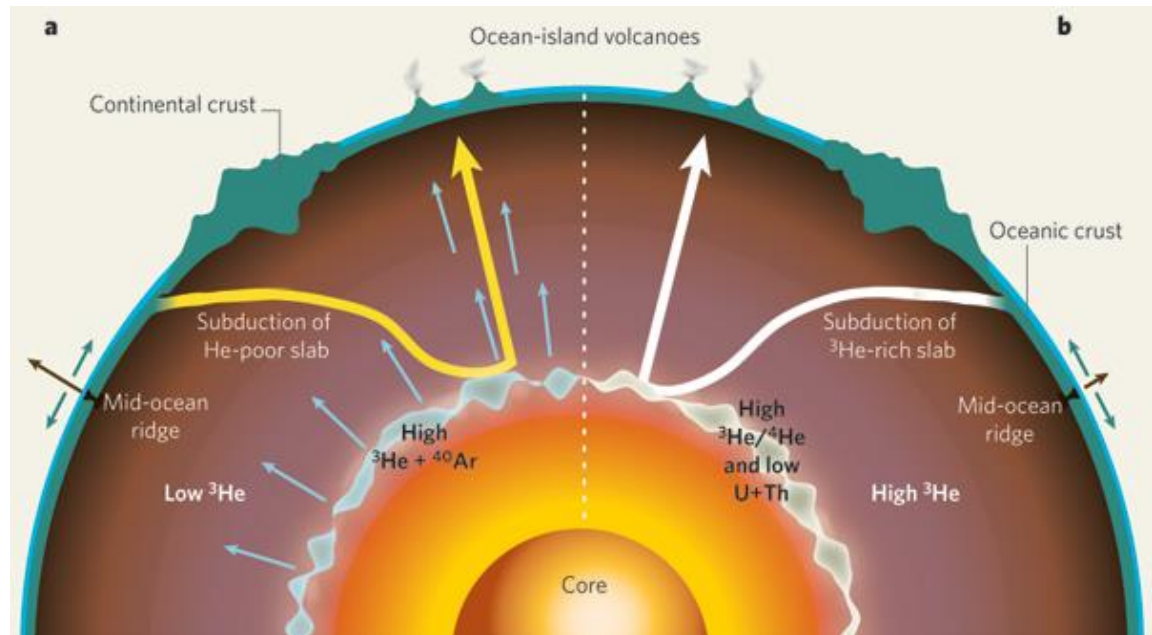
# Geo Hydrology

- This may also be called as Hydrogeology. It deals with occurrence, movement and nature i.e., (quality and quantity) of ground water in an area.
- This branch is closely related to geology because the existence & movement of ground water is directly related to porosity, permeability, structure, texture and composition of underground rocks.



# Geo Chemistry

- This branch is relatively more recent and deals with occurrence, distribution, abundance, mobility, etc., of different elements on the earth crust.

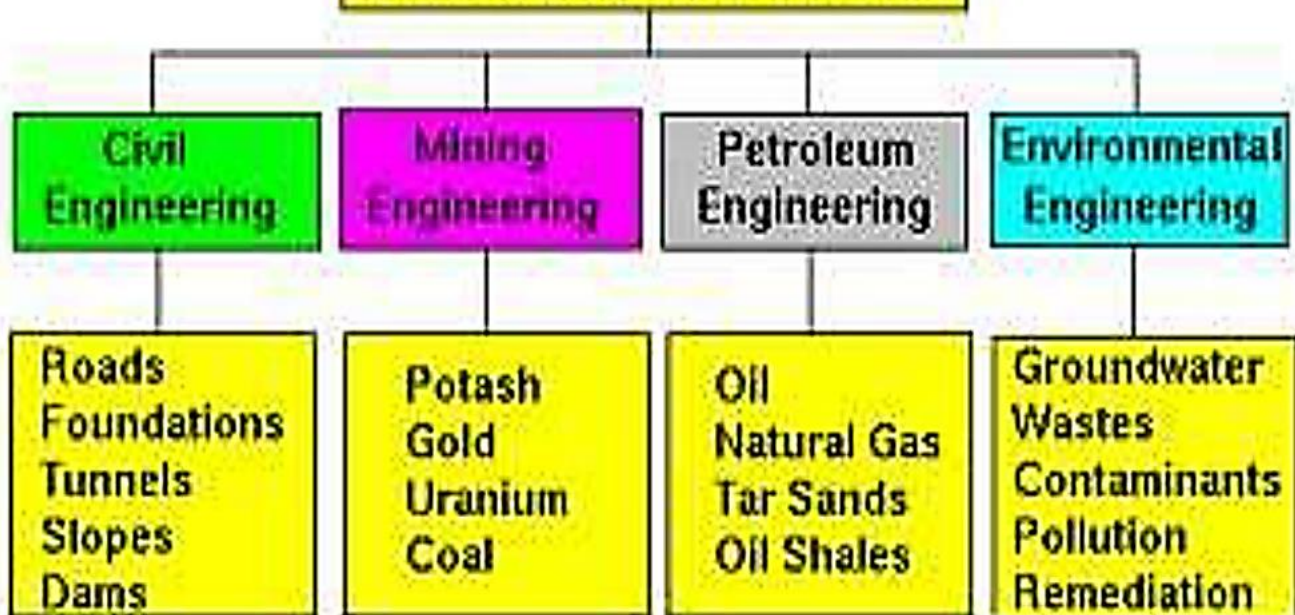




# Scope of Geology

- Geology is useful to know the method of mining of rock and mineral deposits on earth's surface and subsurface.
- Geology is useful for supply, storage and filling up of reservoirs with water.
- This is the subject which gives the information about the earth surface.

## GEOLOGICAL ENGINEERING





# Importance of Geology in Civil Engineering

- Before constructing roads, bridges, tunnels, tanks, reservoirs and buildings, selection of site is important from the point of stability of foundation.
- Geology provides a *systematic knowledge of construction materials and their properties*.
- The knowledge about the nature of the rocks in tunnelling and construction of roads.
- The *foundation problems* of dams, bridges and buildings are directly related with geology of the area where they are to be built.
- The *knowledge of ground water* is necessary in connection with excavation works, water supply, irrigation and many other purposes.

# Importance of Geology in Civil Engineering

- The knowledge of *Erosion, Transportation and Deposition* (ETD) by surface water helps in soil conservation, river control.
- Geological maps and sections help considerably in *planning* many engineering projects.
- If the geological features like faults, joints, beds, folds are found, they have to be suitably treated. Hence, the *stability of the rock* structures is important.
- Pre-geological survey of the area concerned reduces the *cost* of planning work.