ME-463

PETROLEUM ENGINEERING

Md. Hasibul Islam

July 8, 2023

Quamrul Islam Sir

Contents

1 Lecture 01: Introduction

Date: 03/06/2023

Booklist

Introduction of Petroleum Geology & Drilling

Published by BUET

Basics

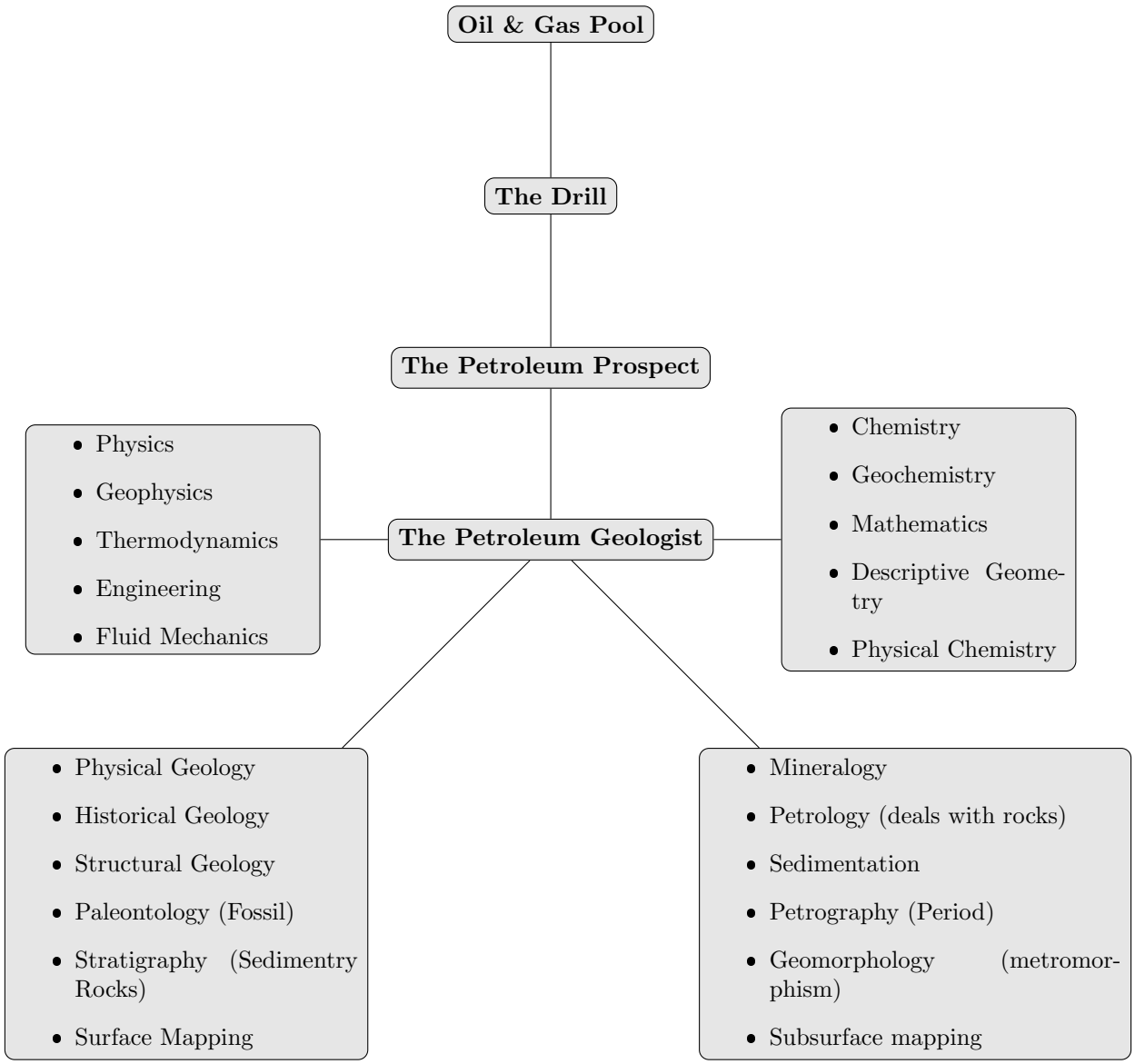
Latin: **Petra** → Rock or Stone
Latin: **Oleum** → Oil
So, Petroleum basically means "Rock Oil"

Petroleum occurs widely in the earth as gas, liquid, semi-solid or solid, or in more than one state in a single place.

Definition

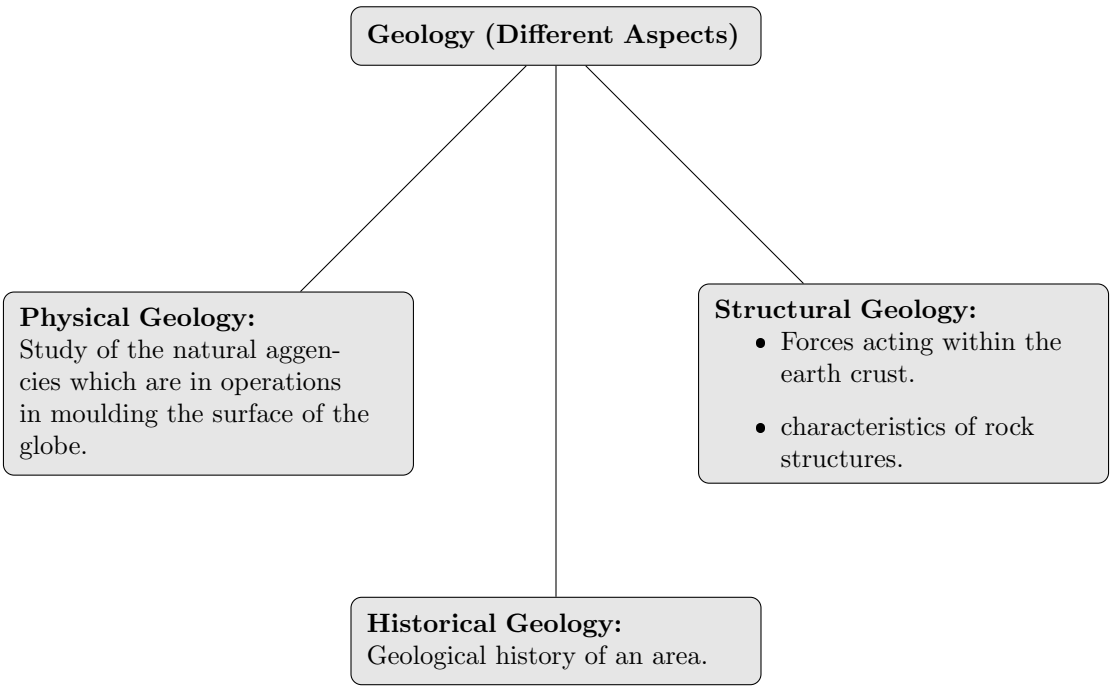
Chemically, any petroleum is an extremely complex mixture of hydrocarbon (hydrogen and carbon) compounds with minor amounts of nitrogen, oxygen, and sulfur as impurities. The weight percentage of petroleum is as follows:

Elements	**Amount**
Carbon	85%-90%
Hydrogen	10%-15%
Sulfur	0.2%-5%
N_2	0.1%-2%
O_2	0.6%-2%



Petroleum Geology

Geology is the sciecne that deals with the history and structure of the earth and its life forms. It is used to credit where oil accumulation might occur. Geology is based on observation and the knowledge derived from mant others sources.



Petroleum Geologiest (activities)

- Observes the rock and rock formations.
- Reconstructs the geological history of an area
- Determines whether the formations contains petroleum in the reservoirs.

2 Lecture 2: Petroleum Classification

Date: 17/06/2023

A petroleum deposit must be commercially valuable. it depends on some factors:

1. Amount recoverable
2. Expected production rate
3. Cost of drilling and producing well

✓ if there is fire in well, then another well should be dug nearly to reach there.

Petroleum Reservoir characteristics

A good reservoir must have:

- Right shape or configuration to hold the oil and some kind of seal or trap to keep it from escaping
- it must be large enough usually 10 ft thick or more.
- About 10% porosity or pore space in needed.
- It must be permeable, that is, pores must be connected so that, oil, gas and water can flow through it from one pore to another.

✓ Sandstone → Porous

Petroleum Classification

The petroleum and petroleum like substance may be classified as follows:

1. **Petroleum** : An almost infinitely complex mixure of saturated hydrocarbon with relatively small amounts of S, N_2, O_2 and many other lesser constituents in combination. Petroleum occurs in solid, liquid and gaseous forms as follows :
   (a) Asphalt or tar, paraffin waxes, brittle bitumen etc.
   (b) Crude oils (liquids)
   (c) Natural Gas
2. **Tar Sands**: Semi-solid petroleum bearing sands
3. **Oild Shales**: These are fine grained sediments sometimes known as kerogen shales.
4. Torbanites, boghead and cannel coal etc all are rich in bitumen

✓ Fishing → If drill bit is broken inside well
✓ Catwalk → pipe movement through crane

Age of the earth (Structure of the earth)

it is very difficult to ascertain the actual and exact of the earth.

- Darwin fixed the age of the earth at 57 billion years on the basis of the concept of separation of the moon from the body of the earth.
- Through the study of the history of cooling of the earth, calvin estimated that our planet should be as old as 20 to 40 million years
- Study of radioactive naterials in meteorites indicate that the members of the solar system must be as old as about 4500 million years
- Modern theory is that the earth is thought to have formed about 4.6 billion years ago out of a cosmic dust. As the planet was pulled together due to its own gravity, the heat of compression and of it's radioactive elements caused it to become molten. The heaviest components form the core. Lighter minerals form the thick mantle. The lighter elements form the thin rocking crust.

3 Lecture 3: Internal Structure of the earth crust

Date: 17/06/2023

Internal structure of the earth consists of the followings:

1. Earth crust
2. Mantle
3. Core

Earth Crust (Lithosphere)

Outer envelope of shell of the earth is known as earth crust. This crust consists of solid rocks. The thickness of earth crust ranges from 5 to 70 km.

Two part of earth's crust:
i) Outer crust
ii) Lower crust

The earth's outer crust mainly consists of sedimentary rocks.
Outer crust:
i) Continental crust (30 km thick, average specific gravity 2.8, high over 0.2 to 0.3 km above sea)
ii) Oceanic crust (5km thick, average specific gravity 2.9, 4 to 5 km sea level)

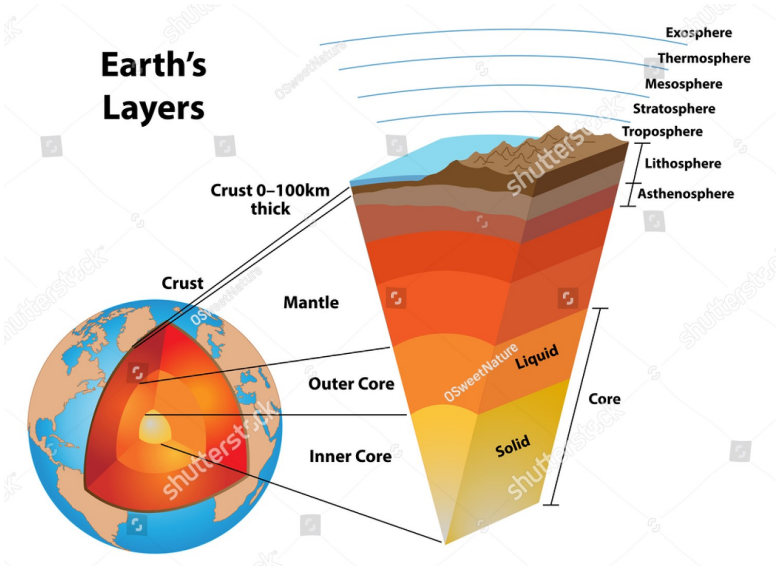


Figure 1: Cross section of Earth

The lower part of earth crust has two envelopes.
Lower crust:
i) Granite Layer
ii) Basalt Layer

The average thickness of each of this layer ranges from 15 to 20 km.

Tectonic Plates and Plate Boundaries

Lithosphere consists of spherical caps or plates. These plates are in relative motion to each other on the non-rigid asthenosphere.
There may be a -

- Collision

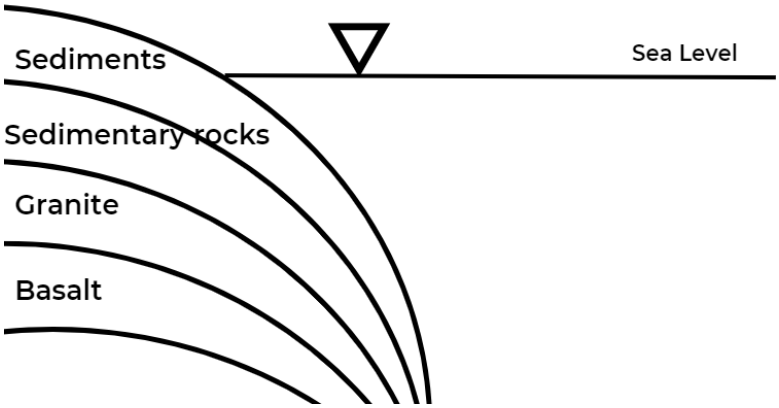


Figure 2: Outer crust & inner crust

- Pulling away
- Slide Past one another

The theory that explains this processes is called plate tectonic theory.

Plates may be -

- Continental (Eurasian Plate)
  - Thick and relatively light.
- Oceanic (Pacific Plate)
  - Thin and made up of wavy igneous rocks.

Mountain ranges, ocean basins, major features of earth etc are found due to the movement of plate boundaries.

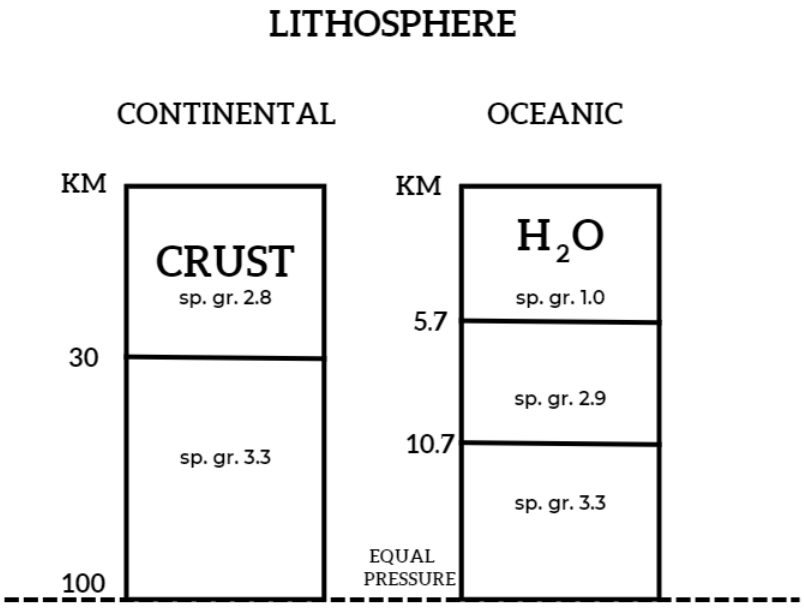


Figure 3: Plastic Higher Temperature Layer(Asthenosphere 100 to 200 km)
Lower part of earth's crust

Classification of Plate Boundaries

Three types of plate boundaries exist:

1. Divergent Boundaries
2. Convergent Boundaries
3. Transcurrent Boundaries
