Presentation on

## PETROLEUM TRAPS (Structural, Stratigraphic and Mixed traps)

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**INTRODUCTION**

**Petroleum is the general term used for all the natural hydrocarbons found in rocks.**

**Petroleum refers only to the liquid oil. Gaseous varieties are called “natural gas” and highly viscous to solid varieties are called “bitumen”.**

**The source rocks of petroleum are generally shales, silts and limestone. Petroleum migrates from the source rock (fine grained muddy sediments in which petroleum originates) into adjacent porous and permeable rocks and accumulates there to form pool. Such permeable rocks are called “reservoir rocks”.**

**PETROLEUM TRAP:**

**Petroleum - trap, is subsurface reservoir of petroleum. The oil is always accompanied by water and often by natural gas; all are confined in porous rock, usually such sedimentary rocks as sandstone, arkoses and fissured limestone. The natural gas being lightest, occupies the top of the trap and is underlain by the oil and then the water. A layer of impervious rock, called the roof rock, prevents the upward or lateral escape of the petroleum.**

**Diagram

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**(FIG- 1)**

**TYPES OF TRAPS**

A hydrocarbon reservoir has a distinctive shape or configuration, that prevents the escape of hydrocarbons that migrate into it.

Geologist classify reservoir shapes or traps into the following types.

1. Structural traps

2. Stratigraphic traps

3. Mixed traps

**1.STRUCTURAL TRAPS**

Structural traps are created when the seal or barrier is concave upward. The geometry is formed by tectonic processes after deposition on the reservoir beds involved. This concave nature may be due to local deformation as a result of folding, faulting or both of the reservoir rocks.

Some of the important structural traps are as follows.

**Diagram

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**(FIG- 2)**

1. **FOLDS** (**Anticlines, Dome, Monocline, Syncline**):

Upfolds giving rise to anticlines and domes, are the main source of oil so far produced. Folds with gentle dips (Monocline) offer larger areas for oil accumulation. Free gas is at the top, oil lies beneath and water below, e.g. Ventura, California. In deep wells where pressure is high, gas is contained with the oil and is liberated only upon drilling. Syncline in a few cases serves as an oil trap where water is absent. These types of traps are often found adjacent to mountain ranges.

Diagram

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**(FIG- 3)**

**(B) FAULTS:**

Faults traps are formed by the movement of rock along fault line. In incline beds an impervious shale may be faulted against the up-dip continuation of an oil sand causing an effective seal and permitting oil accumulations beneath it.

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**(FIG- 4)**

**(C) SALT DOMES:**

This kind of trap originates when salt is deposited by shallow seas. Later, a sinking seafloor deposits organic rich shale over the salt, which is in turn covered with layers of sandstone and shale. Deeply buried salts tends to rise unevenly in swells or salt domes, and any oil generated within the sediments is trapped where the sandstones are pushed up over or adjacent to the salt dome. This create an excellent trap for oil where uptrend edges of sandstone beds are sealed against the salt. e.g. Gulf coast of Texas and Luisiana. In some cases arched beds above salt dome or porous cap rocks also serve as reservoir.

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**(FIG- 5)**

Diagram

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**(D)TERRACES, FISSURES IGNEOUS INTRUSIONS:**

These also form oil traps. In Mexico igneous intrusions in the form of volcanic necks, dikes and sills have similarly upturned and sealed petroliferous beds to give rise to oil traps.

**2. STRATIGRAPHIC TRAPS**

The main trap making element in a stratigraphic trap is some variation in the lithology or stratigraphy, or both of the reservoir rock. The variation may be facies change, variable porosity and permeability or an up – structure termination of the reservoir rock.

Some of the stratigraphic traps are as follows.

1. **UNCONFORMITIES :**

**U**nderlying titled sand beds may be sealed at the unconformity by overlying beds to form oil trap. Angular unconformities are more effective e.g. Oklahoma oil field.

1. **ANCIENT SHORELINE:**

**S**ands deposited on the low lying submerged coastal plains, tapering in shore and deeper offshore may be covered by clays and form suitable oil reservoir.

1. **SANDSTONE LENSES:**

**T**hese are bodies of sand enclosed within shaly beds.

1. **UP-DIP WEDGING OF SAND AND UP-DIP POROSITY DIMUNITION:**

**T**hese become fine grained impervious offshore or grade into shale and form an oil reservoir.

1. **REFLECTED BURRIED HILLS:**

**orthe** granite ridge of Texas where projected parts received a mantle of sediment, thick on planks and thin out on the top, simulating anticline and forming overlap in the form of oil trap.

1. **BURRIED CORAL REEFS:**

**T**hese are found to form excellent oil reservoir in the offshore region.

**3. MIXED TRAPS**

The mixed traps are combinations of structure and lithology. In such traps, a stratigraphic element may be the cause for the permeability of a reservoir rock. A structural element caused by deformation may combine with the stratigraphic element to give rise to a trap. Additionally, the down-dip flow of formation water may increase the trapping effects. A great variety of traps, which are combinations of structural & stratigraphic traps, is associated with intrusion of deep-seated rocks into overlying sediments.

A common trap that would be an example of a mixed trap is a salt dome. The great majority of such traps are in sediments associated with rock salt intrusions, traced in the Gulf coast region, U.S.A, orthern Germany, The north-sea and in Russia.

Oil pools associated with them are known as salt-dome or salt plug pools.

When salt plugs rise through soft sedimentary rocks, they affected the stratigraphy and structure of adjacent rocks and traps for the accumulation of petroleum are created. This has been well observed in the Gulf coast, Texas, Louisiana and Missisipi, where the plugs are still moving.

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**FIG- 7**

**CONCLUSION**

**P**etroleum/oil is found in reservoir in sedimentary rock. It is composed of compressed hydrocarbons and was formed millions of years ago in a process that began when aquatic plant and animals remains where covered by layers of sediments (particles of rock and minerals). As bacteria and chemicals broke down the organic plants and animal material, increasing layers of sediments settled on top. Heat and pressure transformed the layers of sediments into sandstone, limestone and other types of sedimentary rocks, and transformed the organic matter into petroleum. Tiny pores in the rock allowed the petroleum to seep in. These “reservoir rocks” hold the oil like a sponge, confined by other non-porous layers that form a trap.

In India, reservoirs of petroleum and natural gas are found in the belts of tertiary rocks of Assam, Gujarat, Offshore regions of Bombay high, and in the Cauvery and Godavari deltaic areas.

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