



# Well Logging

## Introduction to Well Logging

**Mining Engineering Department/ 3<sup>rd</sup> Year**

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# Basic Well Logging

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## **CONTENTS for Course -1**

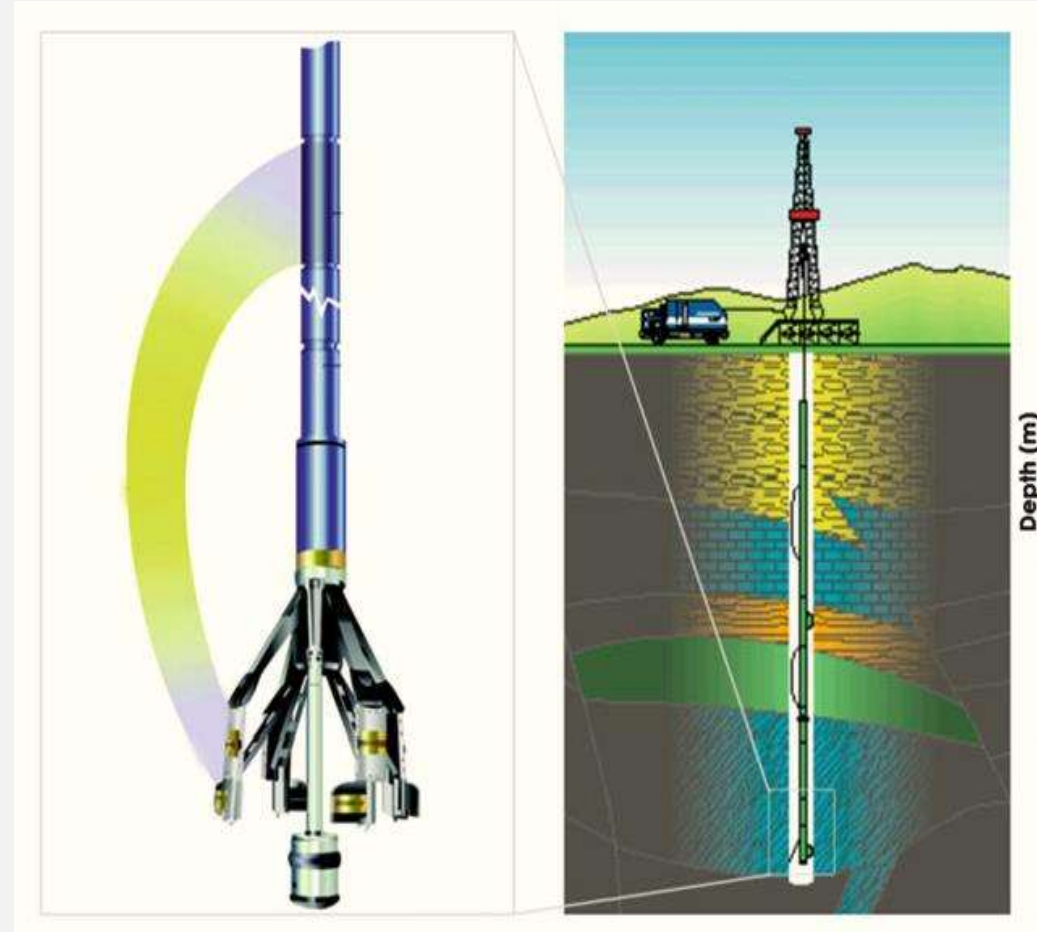
- Introduction
- Basic Rock Properties
- Borehole Environment
- Well-Logging Techniques
- Well-Logging Methods
- Caliper Log
- Spontaneous Potential
- Gamma Ray

# What Is Well Logging

**Well Logging:** is the process of recording various physical, chemical and electrical properties for the geological formations and it's fluid contents during the drilling of a borehole.

**Wireline:** Measurements that done with a sonde containing one or several sensors that lowered on cable and retrieved from the well by a winch.

[https://www.youtube.com/watch?v=\\_3mzQTMwkV4](https://www.youtube.com/watch?v=_3mzQTMwkV4)

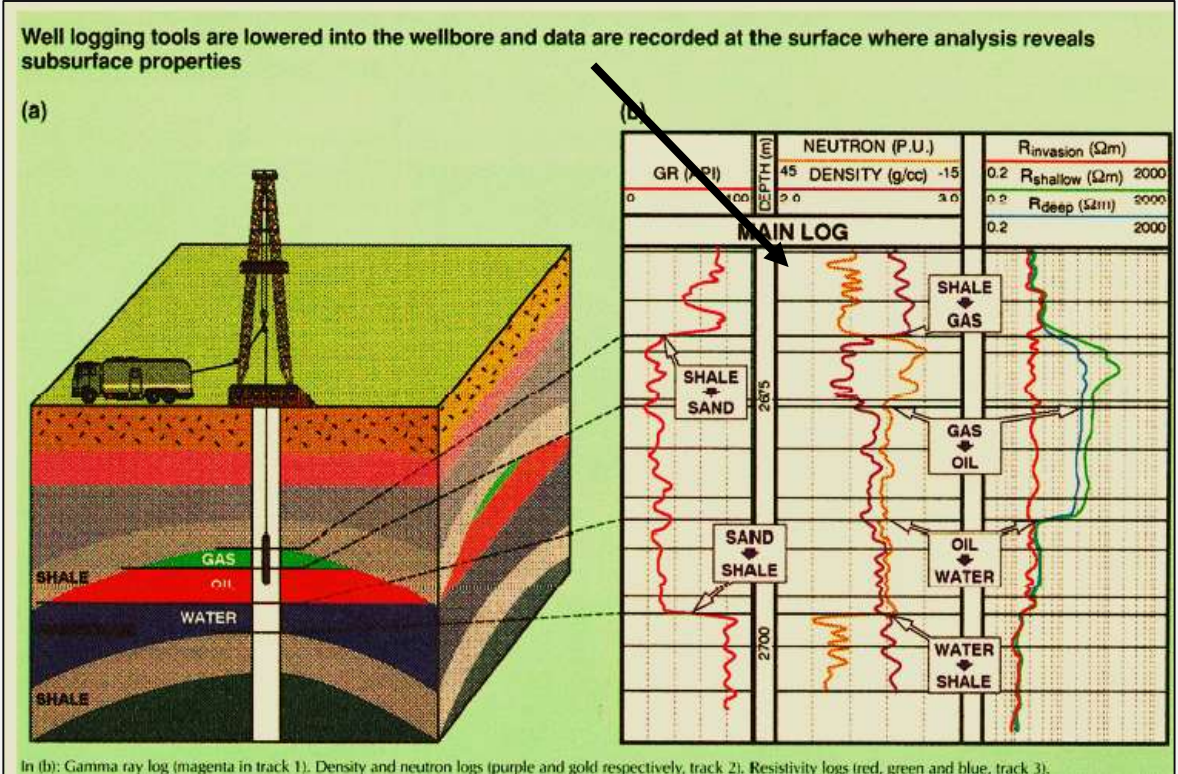




There is a wide range of instruments that are lowered down a borehole to record the various properties of rock, called *Logging Tools*



*Log:* is paper or digital continuous recording to physical property of the rock on one axis and depth on the other axis.

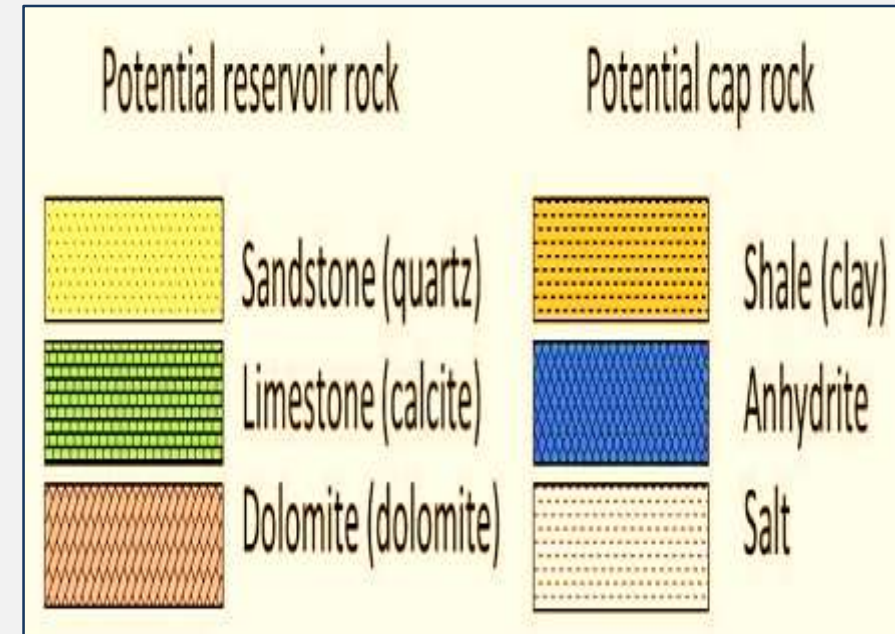


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# Basic Rock Properties:

**Reservoir Rock:** porous and permeable subsurface rock that contains accumulation of hydrocarbons (oil and / or gas), usually sandstone, limestone, or dolomite.

**Cap Rock (Seal Rock):** a rock seal that is sufficiently impermeable to prevent (inhibit) escape of hydrocarbons from a trap.



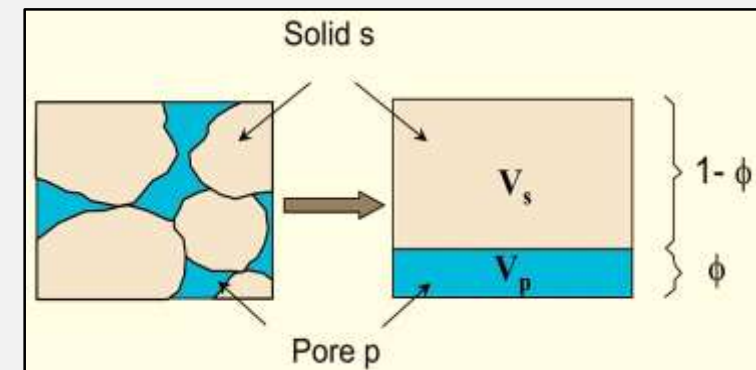
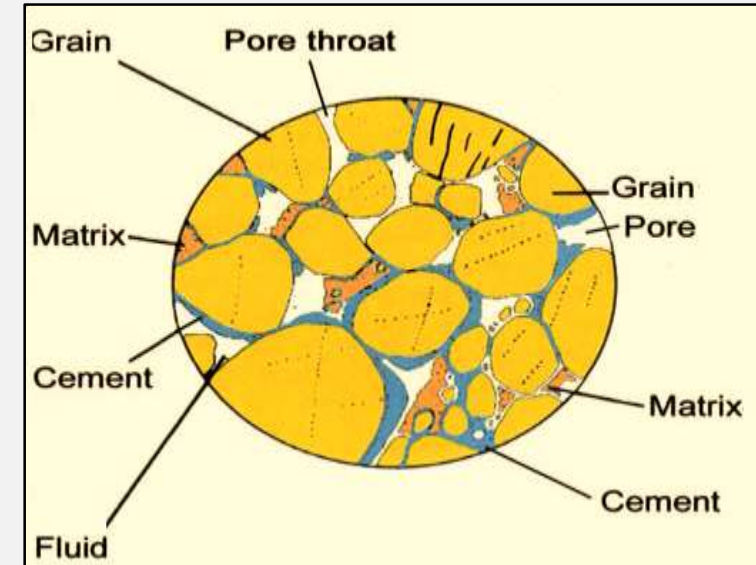


# 1- Porosity

*Porosity is the percentage of voids to the bulk volume of rock. It is measured as a percentage and has the symbol  $\phi$ . The porosity of a rock is a measure of its capacity to contain or store fluids*

$$\text{Porosity} = \frac{\text{Pore Volume}}{\text{Bulk Volume}} \times 100$$

$$\text{Porosity (Total porosity)} = \frac{\text{Pore Volume}}{\text{Pore Volume} + \text{Solid Volume}} \times 100$$



# Example:

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Core sample has bulk volume (9.9 cc), and the volume of grains (7.7 cc). What is the porosity of this sample?

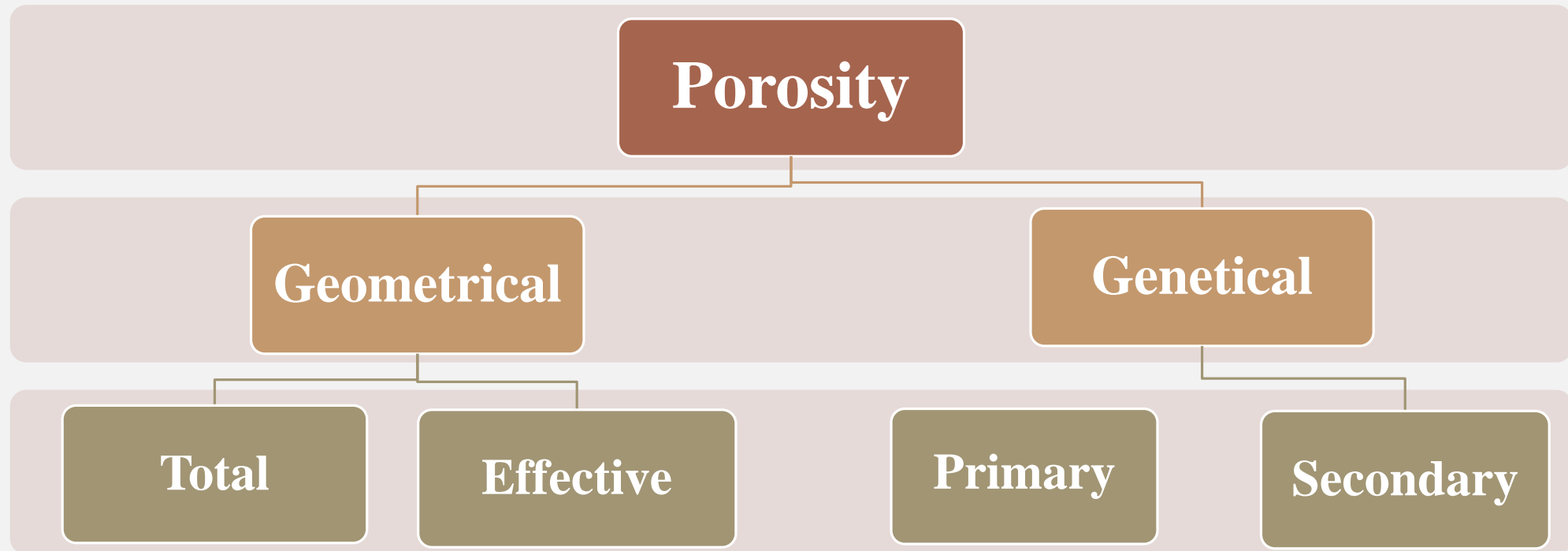




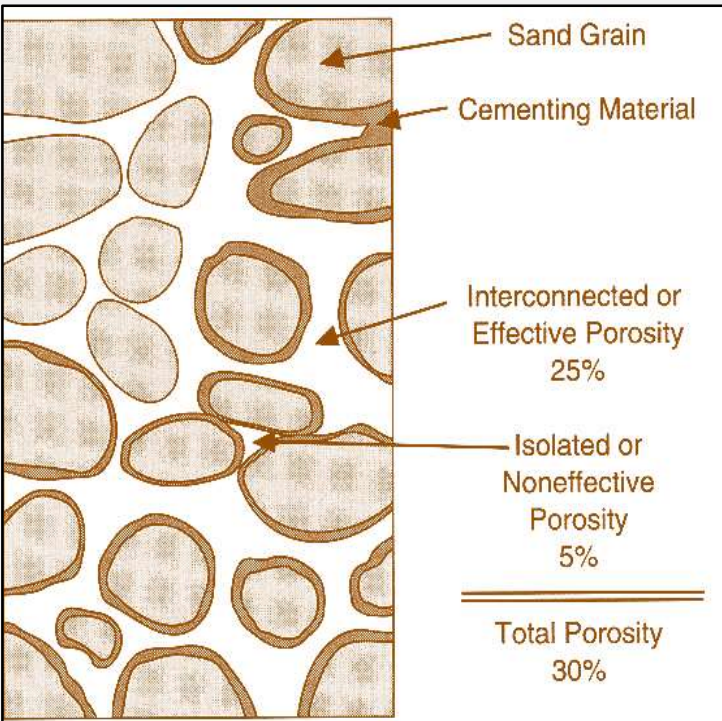
# Porosity Classification

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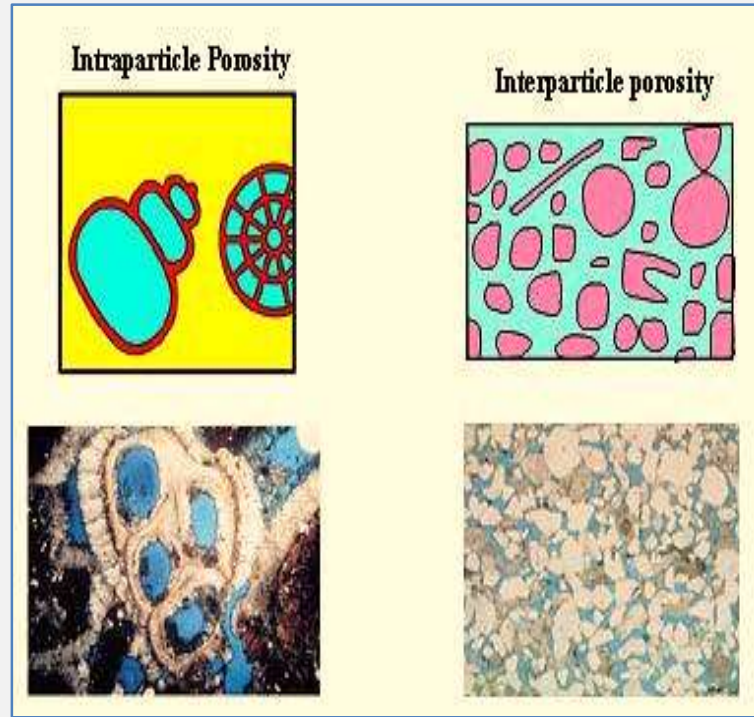
There are two main **Classifications of Porosity**:



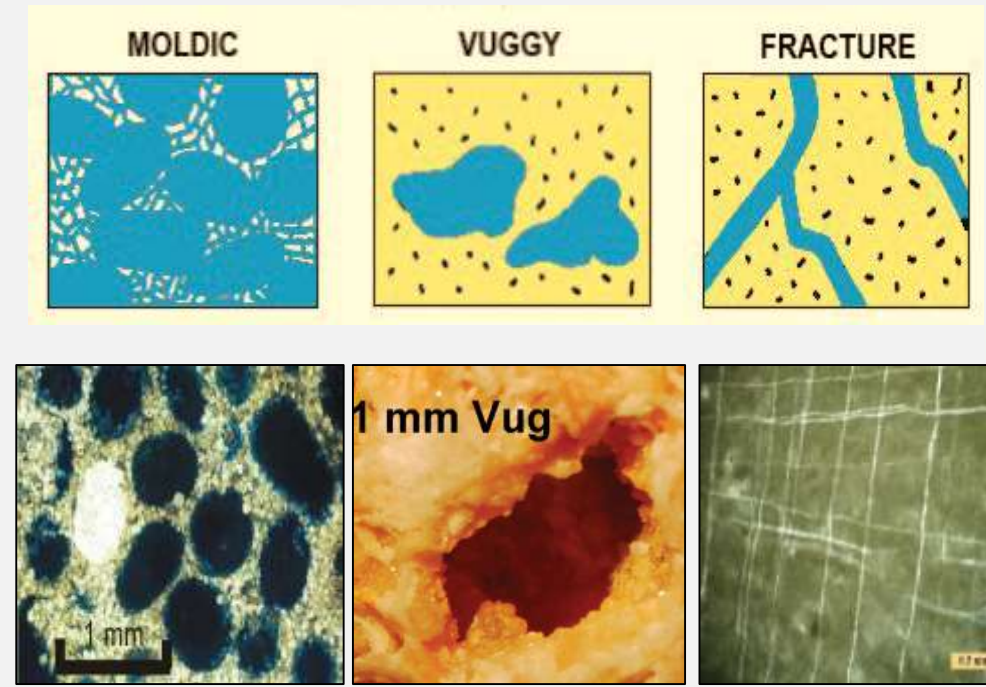
# Types of Porosity



1  
Total and Effective Porosity



2  
Primary Porosity



3  
Main Types of Secondary Porosity

# Measurements Methods

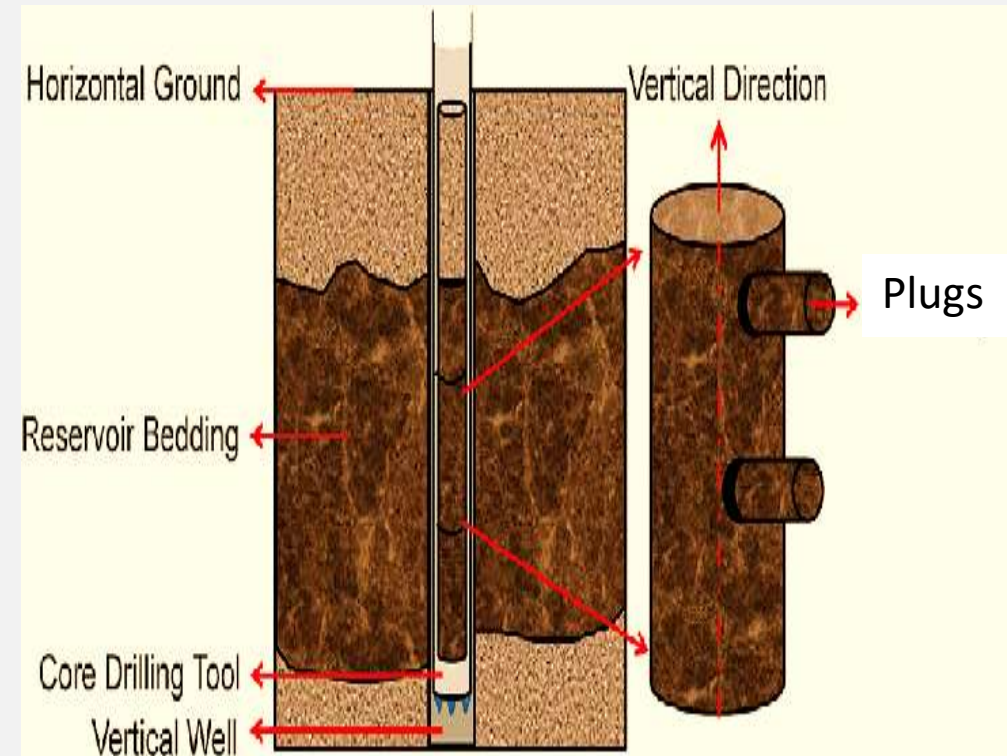
It is measured in two basic ways:

**1- Direct Methods** by laboratory measurements on cores or plugs.

**2- Indirect Methods** by wireline logs (Neutron, Density and Sonic logs).

**For more details about porosity, visit the following link:**

<https://www.youtube.com/watch?v=BgmIBmQUg-4>







# Summary Questions of Lecture one

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- **How can wireline measurements done?**
- **What are the main types of reservoir and cap rocks?**
- **According to your opinion What are the best types of porosity in petroleum reservoir?**

