

# Fractured Reservoirs

There are two fundamental properties of a reservoir rock that they impact of effectiveness of the formation to transmit the hydrocarbon to the wellbor and control the volume of the hydrocarbon in place, these are:

a) Porosity

b) Permeability

Both properties resulting from the rock characteristics in terms of its:

physical composition

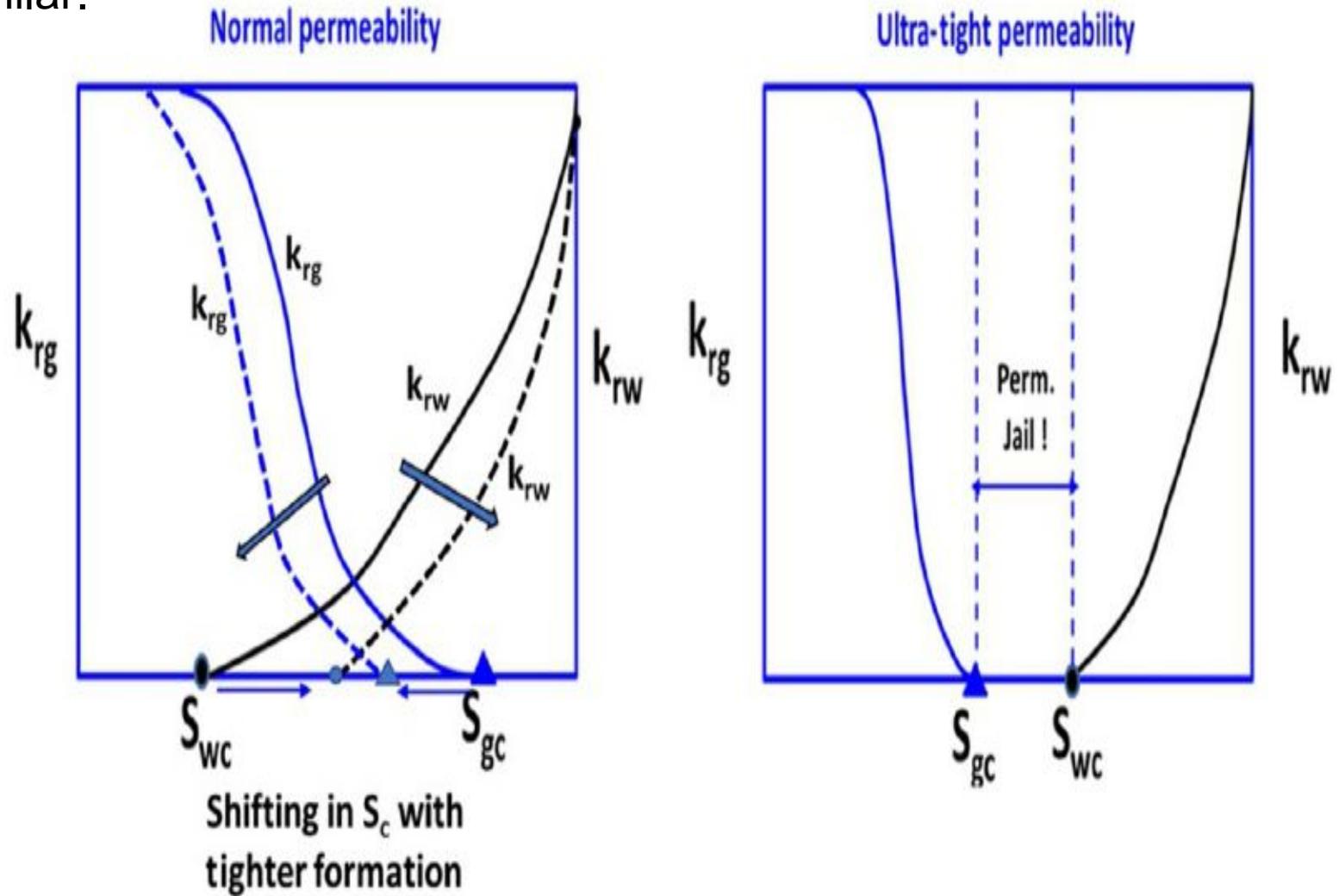
textural properties

geometric properties such as the sizes and shapes of the rock grains

in low-permeability reservoirs, the impact of partial brine saturation and overburden stress on reservoir performance is significant. In low-permeability gas reservoirs, it is not unusual for the effective permeability to gas to be one to three orders of magnitude less than routine permeability. Similarly, effective permeability to brine is such that for many low-permeability reservoirs, water is essentially immobile even at high water saturations.

The relative permeability behavior of low-permeability reservoirs is characterized by redefining the traditional concepts of critical water saturation  $S_{wc}$  (the water saturation at which water ceases to flow), critical gas saturation  $S_{gc}$  (the gas saturation at which gas begins to flow), and irreducible water saturation  $S_{wirr}$  (the water saturation at which further a increase in capillary pressure produces no additional decrease in water saturation).

a schematic illustration of the relationship between capillary pressure and relative permeability in traditional and tight gas reservoirs. The illustration indicates that in traditional reservoirs, irreducible and critical water saturations are similar.



In tight gas reservoirs, however, irreducible and critical water saturations can be significantly different. In traditional reservoirs, there is a wide range of water saturations at which both water and gas can flow. On the other hand, in low-permeability reservoirs, there is a broad range of water saturations at which neither gas nor water can flow. In some lowpermeability reservoirs, there is virtually no mobile water phase even at high water saturations.

The saturation region across which there is negligible effective permeability to either water or gas. Failure to fully understand these relationships and associated concepts has led to widespread misunderstanding of how hydrocarbon systems are manifested in low-permeability reservoirs.

There are two types of production systems are:

- 1- Naturally fractured reservoirs
- 2- Hydraulically fractured wells