MECHANISM OF TRANSVERSE PETROLEUM MIGRATION

by

Henry David Olson

Rice University M. A. thesis, 39 p., May, 1965

ABSTRACT

The transverse, "vertical," migration of petroleum is investigated to determine a mechanism which explains the occurrence of barren (water-filled) reservoirs interspersed between hydrocarbon-bearing reservoirs within the same oil or gas field, especially when the intervening shales are not petroleum source rocks.

Application of fundamental hydrodynamic theory to observed subsurface conditions discloses that a rectilinear increase of hydrostatic pressure with depth does not usually exist--pressures appreciably above and below the nominal hydrostatic pressure may occur in different subsurface formations. The subsurface fluids are flowing very slowly in a complex, dynamic, three-dimensional pattern; water in response to pressure gradients and hydrocarbons in response to potentiometric gradients.

Geochemical evidence and physical considerations indicate that transverse migration of hydrocarbons through the bulk of low-permeability beds is quite unlikely. Therefore, the migration must occur principally along fractures and faults. Fractures and faults, a common and abundant feature of the earth's crust, are indeed observed to be avenues of migration and accumulation of subsurface fluids, both water and hydrocarbons, although in some cases faults are also barriers to fluid migration.

A barren reservoir will occur if it is at a higher potential than the hydrocarbons migrating through a conduit in a fault or fracture intersecting the reservoir. The hydrocarbons will just pass on through the reservoir and continue along the conduit until they are trapped at a location of minimum potential energy, or until they reach the earth's surface as a seep.