The Recognition and Exploitation of Fracture Systems in a Carbonate Reservoir

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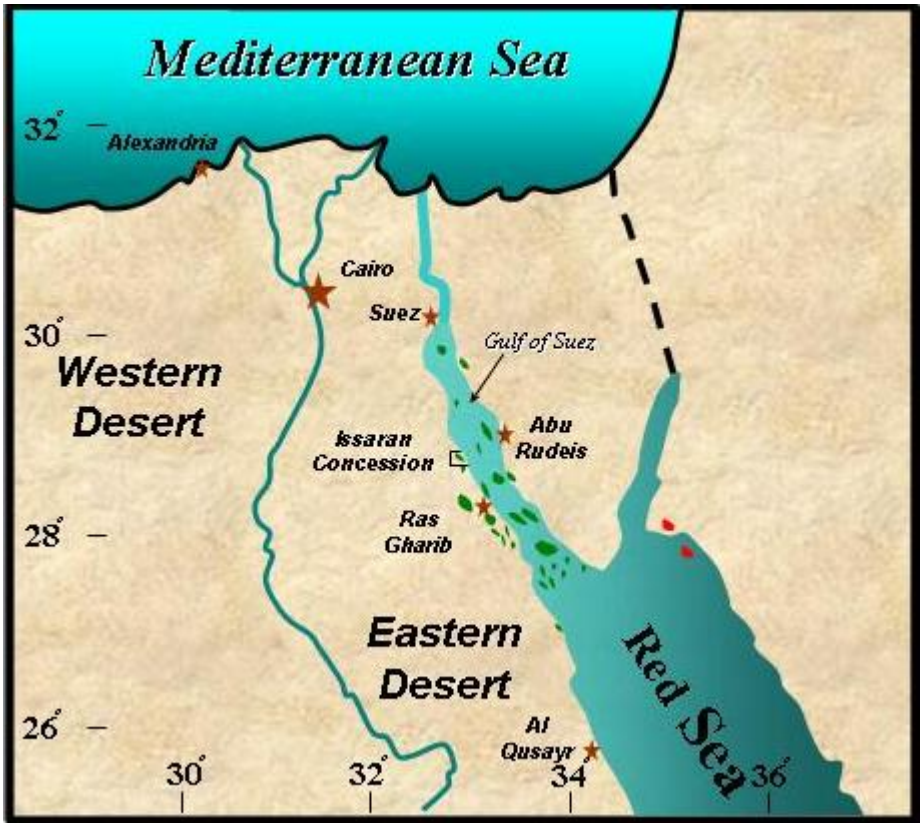
The Issaran Oil Field is located in Egypt on the west coast of the Gulf of Suez along the western flank of the Suez extensional system. The field is a heavy oil deposit (8-12 ^{o} API) within a thick succession of Miocene aged carbonate rocks. The field is trapped by a series of down-to-the-west normal faults that formed as part of a large antithetic system associated with the down-to-the-east basin bounding fault, which forms the western edge of the Suez extensional system.



The fault history of the area is complex and formed as a series of extensional releases throughout the Eocene and Miocene epochs. Growth structures and fault linkage episodes are common in the area. The oldest Miocene strata are displaced by different fault patterns than the younger Miocene strata. Faults form the lateral seals for the entrapment of hydrocarbons. The sealing properties of the faults are created by the juxtaposition of tight impermeable strata next to the reservoir rock and also by fault gouge or smear along the fault plane. Small scale faults (tens of meters of displacement), which do not place tight rock against reservoir strata, behave as permeability barriers within the reservoir.

Despite the sealing characteristics of the faults, the most prolific wells within the field are in close proximity to the faults. Fractures associated with the faulting enhance the permeability of the reservoir and greatly increase the productive capacity of the wells. Early development of the field did not recognize the influence that the fracture systems have on the petroleum production from specific wells. With the identification that the reservoir contains important natural fracture systems, the drilling and completion techniques have been modified to enhance the productive capability of the wells. As a result of these changes the production from individual wells has increased by a factor of several times and the total field production has increased from 1500 BOPD to in excess of 6000 BOPD.

The fracture systems also control the production of water from the field and the oil water ratio from specific wells. The most likely fluid migration into the reservoir appears to be vertical along fracture systems that plumb into the deeper Eocene and Cretaceous section. This vertical migration improves the exploration potential for hydrocarbons in deeper zones and has widespread connotations to the fluid migration along the western flank of the Suez Basin.