Fractured Intrusion and Extrusion Reservoirs in Mature Basins; Play Concept and Hydrocarbon Potential

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ABSTRACT

Fractured intrusion and extrusions of tectonic origin form prolific reservoirs with substantial hydrocarbon reserves in many mature basins. Fractured basement reservoirs are commonly thick with irregular porosity and permeability distribution. A proper study of these reservoirs begins by recognizing the stress regimes, diagenesis processes and attributes of the matrix and fracture networks.

Fields of hydrocarbon production from fractured basement are well known in numerous basins that are generally formed and dominated by convergent stresses of strike slip tectonics and related structures. Strike-slip fault related fractures associated with dissolution porosities formulate the permeability and storage capacity of granitic reservoirs in Bach Ho, Ran dong, La Paz, Habban and Bongor oil fields. Extensional tectonics is responsible of creating normal-fault related fractured reservoirs in El Zeit bay and Augela-Nafoura oil fields. Production from fractured extrusion rocks has been established in West Java basin, Deccan play over west India, and Neuquén basin- South Argentina. Fields of fractured extrusion reservoirs include Jatibarang, Padra, Lumas Las Yeguas, loma La lata and Aguada San Roque oil fields.

It has been found that fracture geometry faithfully depicts the stress regime that dominated the fracturing process. The rock facies and ductility control the vertical fracture density and the areal distribution of discrete fracture networks. The vertical density is highly biased by the resolution of measuring tools, well diameter, fracture dip and the trajectory of boreholes. Since open fractures are mostly vertical, deviated wells drilled normal to fracture planes are likely to intersect more fractured than a vertical one. Defining the areal distribution of discrete fracture network over the field or the reservoir is extremely difficult. Hydrocarbon migration pass ways, the entrapment mechanism and seal vary between basins as the geologic setting differs. Structural bounding faults in hard rocks tend to be open which facilitates hydrothermal solution and overlying aquifers to invade and percolate the fractured reservoirs. Dissolution effect and diagenesis processes tend to alter the permeability of fractures and the productivity of oil fields. When depleted fractured reservoirs may drain juxtaposed hydrocarbon and water bearing formations. Hydrocarbon resources can be estimated using volumetric calculation at early stages of development. After a certain period of production, material balance calculation tends to provide more reliable results. This presentation offers insight on integration approaches that applied on fractured reservoirs in fields with distinct structural styles and facies.