Fractures, In Situ Stress, and Production: Examples from the Mid-Continent of How Recent Advances Offer Improved Recovery

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In recent years, considerable progress has been made in improving log, core and seismic analysis techniques for detecting and characterizing natural fractures and in situ stress, and in predicting how their combined effects influence flow in hydrocarbon reservoirs, thereby significantly improving our understanding of production in fractured reservoirs. We now know how to distinguish natural from induced fractures in cores and on logs. We also know that surface fracture systems do not necessarily reflect subsurface systems even in the same formations in similar structural settings. Also the current in situ stress field, through its effects on fracture permeability, exerts a major control on flow anisotropy at the field and reservoir scale. A strong coupling among stress, fracturing, flow and elastic anisotropy is recognized, indicating there is considerable potential for remotely imaging fractures at the well and field scale using multi-component seismic techniques. Some new data using those techniques show that this coupling is dynamic; it can change over time with production. There is also a growing awareness that flow in many reservoirs is controlled by the larger structural elements such as faults and fractures that are properly aligned in the stress field. These advances offer numerous possibilities for locating bypassed hydrocarbons and for more efficiently producing reservoirs in the midcontinent. Case histories from the midcontinent will be presented.