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J.R. Allan[1] (1) C&C Reservoirs, Inc, Fullerton, CA

Controls on Reservoir Performance during Primary and Enhanced Recovery: Lessons Learned from 100 Fractured Giant Fields

One hundred fractured reservoirs from around the world were evaluated to determine how ultimate recovery was affected by reservoir properties, such as lithology, matrix heterogeneity, fracture distribution, fluid viscosity, drive mechanism, and wettability, vs choice of reservoir management strategy, such as optimization of production rate and type of EOR technique. Fractured oil reservoirs were divided into four groups. Type I reservoirs have little matrix porosity and permeability. Fractures provide both storage capacity and fluid-flow pathways. Type II reservoirs have low matrix porosity and permeability. Matrix provides some storage capacity and fractures provide the fluid-flow pathways. Type III microporous reservoirs have high matrix porosity and low matrix permeability. Matrix provides the storage capacity and fractures provide the fluid-flow pathways. Type IV macroporous reservoirs have high matrix porosity and permeability. Matrix provides both storage capacity and fluid-flow pathways, while fractures merely enhance permeability.

Type I and Type II reservoirs (ave. RF=21% and 26%) are easily damaged by excessive production rates. Many performed well under unassisted primary recovery when managed properly. In Type III reservoirs (ave. RF=24%), recovery factor is dependent upon lithology, wettability, and fracture intensity. The choice of proper EOR technique is essential for optimum exploitation. In Type IV reservoirs (ave. RF=34%), recovery factor is most sensitive to drive mechanism. Different factors controlled recovery efficiency in each fractured reservoir type. Fractured reservoirs can achieve recovery factors that compare favorably to those of conventional unfractured reservoirs when the correct exploitation strategy is chosen.