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Controls on Recovery Factor in Fractured Carbonate Reservoirs: Lessons Learned from Fractured Analog Reservoirs Worldwide

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Forty fractured carbonate oil reservoirs from around the world were evaluated to determine how ultimate recovery was affected by intrinsic reservoir and fluid properties, such as porosity, permeability, viscosity, wettability, and drive mechanism vs choice of reservoir management strategy. Fractured reservoirs were divided into four groups. Type I reservoirs have little matrix porosity and permeability. Fractures provide storage capacity and fluid-flow pathways. Type II reservoirs have low matrix porosity and permeability. Matrix provides some storage capacity and fractures provide fluid-flow pathways. Type III (microporous) reservoirs have high matrix porosity and low matrix permeability. Matrix provides storage capacity and fractures provide 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.

Recovery factor is controlled by different factors in each reservoir type. Recovery factors for 16 Type II reservoirs averaged 26.5% and are sensitive to aquifer-drive strength and optimization of flow rate. Type II reservoirs are easily damaged by excessive production rates, but some achieve good recovery without need of enhanced recovery programs. Recovery factors for 13 Type III reservoirs averaged 25.4% and are affected by intrinsic rock and fluid properties, particularly matrix permeability, API gravity, wettability, and fracture intensity. Choosing the proper EOR technique is essential for optimal recovery. Recovery factors for 11 Type IV reservoirs averaged 33.6%, but varied dramatically with drive mechanism. Recognition of differences in recovery factor between different types of fractured carbonate reservoir should lead to better choices of exploitation strategy.