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"STUDIES OF CARBONATED WATER IMBIBITION USING MRI"

I. ABSTRACT

Oil recovery from naturally fractured, dual porosity reservoirs presents a special problem. Oil is easily produced from the fracture portion of the system. However, oil located in the matrix blocks is not readily displaced by either solution gas drive, natural water influx, or by any external drive displacement mechanism.

Spontaneous imbibition uses the effects of capillary forces to displace oil from low permeability matrix blocks but is usually very time dependent. CO_2-enriched water imbibition has been suggested as a method to accelerate and improve oil recovery from dual porosity reservoirs.[1] Spontaneous water imbibition and the effects of including CO_2 into the water being imbibed were studied using MRI techniques. Images of several processes taking place inside actual rock samples support facts that help to understand fluid movements due to water imbibition and the existence of preferential paths followed by oil in its way out to the rock surface. Dissolved CO_2 is carried into the rock porous spaces by the water being imbibed into the rock, alters rock and fluid properties, and after oil production has been completed a decrease in pressure -below the CO_2 mixing pressure- creates a gas drive that increases oil production. The location of dissolved gas, as well as the regions producing oil due to the localized gas drive were mapped. MRI allowed to observe that CO_2-enriched water imbibition is a process that prevails close to the rock-fracture face. Usually this distance is less than one inch. Drastic changes in oil saturation and fluid properties occur within a short distance of the rock-fracture surface. Conventional core analysis would have failed to identify these drastic changes, leading to erroneous conclusions. MRI has proven to be a very powerful core analysis tool. Oil from the rock matrix and oil that was adhering to the face of the rock was forced out by the localized gas drive. These amounts were quantified, and proven to be significant.