

EFFECT OF HOT WATER ON THE PETROPHYSICAL PROPERTIES OF HEAVY OIL BEARING CARBONATES

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The Grosmont Formation and associated platform dolomites contains 200×10^9 m³ of heavy oil, accessible only by thermal enhanced recovery. A laboratory programme was established to study the effect of 0.1 M NaCl at 175°C upon the petrophysical properties of selected carbonates. The samples were in two groups, clay-rich dolomites and clay-poor to clay-absent dolomites. Both groups showed porosity increases after 14 days but the air permeability increased in the clay-poor samples and decreased in the clay-rich samples. Examination of pre- and post- test samples using scanning electron microscopy, thin sections, mercury injection and X-ray diffraction indicates that changes in the pore throat structure have caused the observed differences. The clay-rich samples showed a reaction from dolomite plus kaolinite to smectite, with smectite being mainly in pore throats. This reaction is responsible for increasing porosity and decreasing permeability in the clay-rich samples. Duplicate cores were cut for the clay-poor samples and mercury imbibition tests were also performed before and after hot water treatment. In the sample with the largest porosity and permeability increase the mercury recovery efficiency doubled. In addition to obvious petrophysical changes the mineral reaction in the clay-rich sample produces CO₂ which, by reducing viscosity, may assist in hydrocarbon recovery.