CASE STUDY

HALLIBURTON

Middle East

FastSCAL® digital special core analysis overcomes LRP challenges and improves resource estimates

A customized corelog program with a Digital Rock Physics solution at the center helped an operator reduce uncertainty and prove a previously overlooked reservoir

CHALLENGE

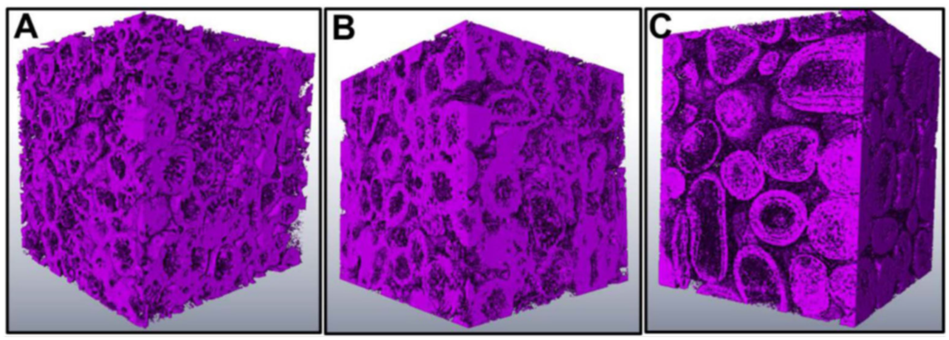
- Highsalinity microporosity attenuated resistivity logs resulted in overestimated water saturation
- Complex multimodal pore system complicated physical laboratory testing and challenged evaluation

SOLUTION

- Designed a core analysis program that featured FastSCAL® PcRI simulations to overcome laboratory challenges
- Developed a new resistivitysaturation transform to improve on traditional SHM interpretations

RESULT

- Achieved 50% uplift in oil saturation
- Avoided water production amid formation testing
- Confirmed LRP zone
- Validated digital SCAL results



MicroCT volume segmentation of three rock samples revealing oolitic structures with substantial intergranular porosity indicative of high reservoir potential.

Overview

A major operator in the Middle East collaborated with Halliburton to address interpretation challenges in a complex carbonate reservoir that exhibited Low Resistivity Pay (LRP) behavior. Halliburton deployed a Digital Rock Physics (DRP) workflow that used FastSCAL® digital special core analysis simulations to deliver a rapid, scalable, and accurate solution, which allowed the operator to refine initial models and maximize asset value.

Challenge

The customer's oolitic reservoir presented two primary challenges. First, highsalinity water within microporous structures attenuated open hole resistivity, which caused traditional logbased models to significantly overestimate water saturation. Second, the reservoir's complex pore systems rendered conventional Capillary Pressure & Resistivity Index (PcRI) experiments impractical due to prolonged equilibration times, which limited the availability of timely and reliable core data needed to calibrate and validate the affected saturation models.

Solution

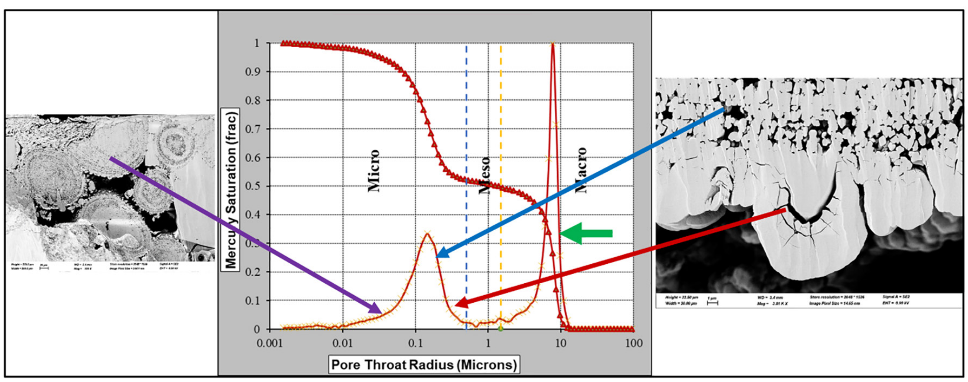
To overcome these issues, Halliburton implemented a novel workflow that integrated traditional core analysis and FastSCAL® digital special core analysis simulations with advanced resistivity modeling. The solution included whole core dualenergy CT scanning to identify representative rock types and establish a framework to upscale subsequent properties. In addition, porescale MicroCT and FIBSEM imaging built digital twins of each rock type. Lastly, Digital PcRI simulations derived variable saturation exponents and developed a new resistivitysaturation transform. The solution delivered properties tailored to each rock type's unique pore structure, which accurately refined saturation interpretations.

Result

This integrated digital workflow yielded substantial improvements in reservoir characterization. Digital imaging and quantitative analysis confirmed the operator's hypothesis that the fine concentric laminae of the ooids attenuate resistivity readings.

With the ability to map and measure properties in both the macro- and microporous structure of this reservoir, the operator could overcome formation evaluation challenges.

Oil saturation in the LRP interval increased from 0.4 to 0.6, which represented a 50% uplift. This provided a significant boost to the original logbased estimates. More notably, subsequent formation testing did not produce water, which validated the revised interpretation and confirmed the presence of producible hydrocarbons in zones previously considered marginal.



» **FIGURE 1 -** Scanning Electron Microscope image of ooid cross sections showing well connected microporosity within the concentric oolitic laminae. Digital capillary pressure experiments of these pore structures yielded high irreducible water saturations, which explains the low resistivity response from openhole wireline and delivered the necessary data to correct the saturation model for this reservoir.

For more information, contact your local Halliburton representative or visit us on the web at www.halliburton.com

halliburton.com

HALLIBURTON