Petrophysics Vol. 64 No. 3, June 2023

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DOI:10.30632/PJV64N3-2023a8

Experimental Time-Lapse Visualization of Mud-Filtrate Invasion and Mudcake Deposition Using X-Ray Radiography
Pierre Aérens, Carlos Torres-Verdín, and Nicolas Espinoza
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DOI:10.30632/PJV64N3-2023a9

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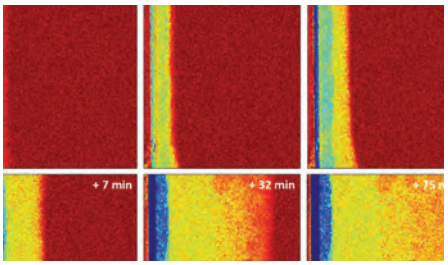
JUNE 2023 PAPER SUMMARIES

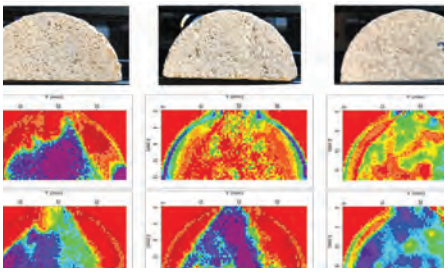


Aérens et al. **PAGES 448–461**

Experimentation is needed to accurately describe and quantify the effects of mud invasion on borehole geophysical measurements. The authors developed a new high-resolution experimental method to investigate these effects using 2D X-ray radiography and thin rectangular samples. The experimental method successfully examines the effects of rock heterogeneity, bedding plane orientation, and anisotropy on the spatial distribution of fluids and mudcake formation resulting from mud-filtrate invasion.

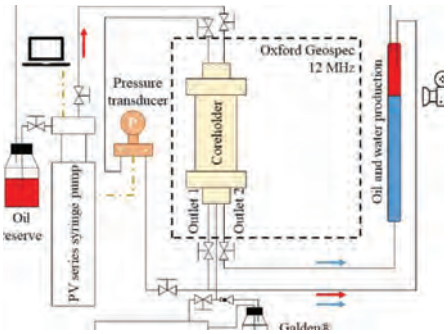
Danielczick et al. **PAGES 340–352**

Since 2021, the wireless resistivity index (WiRI) method allows the acquisition of capillary pressure and resistivity index in a matter of days. This paper examines the advantages and drawbacks of this method compared to two others: porous plate and ultra-fast capillary pressure and resistivity index.



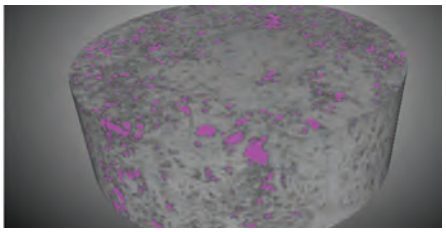
Eichmann et al. **PAGES 438–447**

This paper demonstrates a new workflow that leverages terahertz time-domain spectroscopy (THz-TDS) imaging to quickly map lateral variations in microporosity using the THz attenuation due to water-filled pores. By imparting preselected saturation states, tracking sample mass, and obtaining THz-TDS maps, the method measures the amount of microporosity while providing a map of the microporosity distribution in carbonate rocks.



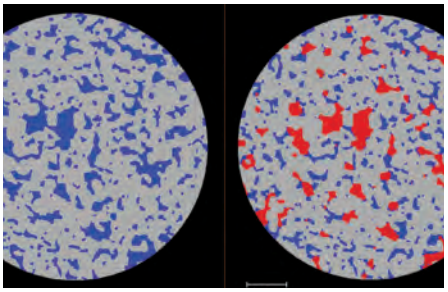
Fernandes et al. **PAGES 325–339**

When obtaining representative conditions of the reservoir regarding initial water saturation (S_{wi}), fluids distribution and saturation profile homogeneity are important parameters when initializing rock samples by the restored state method. Nonetheless, the classic techniques for setting S_{wi} present clear limitations in terms of profile homogeneity, experimental duration, and control of the target value of S_{wi}. Therefore, we propose a new Hybrid Drainage Technique that combines the advantages of the viscous oilflood and porous plate methods for performing primary drainage in significantly reduced experimental time, setting a uniform saturation profile at a targeted S_{wi}.



Funk et al. **PAGES 421–437**

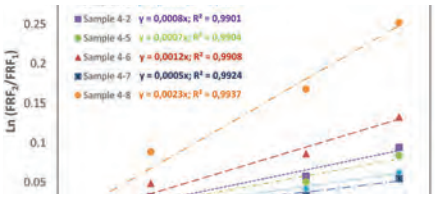
By viewing nuclear magnetic resonance and dielectric relaxation time distributions as comparable probes of molecular motion in porous media, a technique to map dielectric dispersion onto standard NMR T_2 distributions has been developed. The mapping approach is validated with micro-CT imaging and conventional petrophysical models for formation factor and NMR diffusion in conventional carbonate samples.



Gao et al. **PAGES 368–383**

To describe and measure the trapped gas saturation (S_{gr}) accurately, high-resolution X-ray computed tomography (micro-CT) imaging techniques are used to directly visualize the pore-scale processes during gas trapping. Our experimental insights show that due to ripening effects in the pore space, even for (outside of the rock) pre-equilibrated brine, the remaining gas saturation continually decreased with more (pre-equilibrated) brine injected and even after the brine injection was stopped, resulting in very low remaining gas saturation values at the pore-scale level.

JUNE 2023 PAPER SUMMARIES

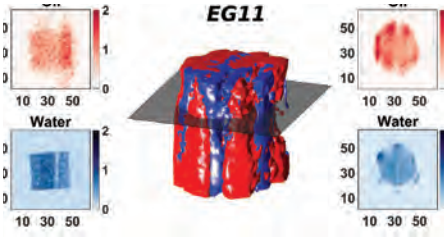


Nourani et al. **PAGES 353–366**

In order to predict the formation resistivity factor (*FRF*) and resistivity index (*RI*) under overburden pressure conditions, analytical models were developed based on rock resistivity modulus (RRM), true resistivity modulus (TRM), and Archie's equation. A variety of core data from sandstone and carbonate reservoirs has been used to validate the proposed *FRF* models.

Olszowska et al. **PAGES 402–419**

A new laboratory method is presented for characterizing short-range variations in elastic properties of reservoir rocks. This method involves ultrasonic angle-dependent measurements of reflected waves, allowing estimation of P- and S-wave velocity as well as density. The obtained measurements provide continuous descriptions of sample complexity.



Zamiri et al. **PAGES 384–401**

Application of magnetic resonance measurements for shale characterization has become increasingly common in the petroleum industry. However, the short magnetic resonance lifetimes of shale rocks prevent quantitative signal detection. In this work, FID-based methods were used to quantify water, oil, and kerogen in the shale samples and provide separate images of oil and water on the centimeter scale.