

Tuesday, November 17, 2015

Southwestern Energy Conference Center, 10000 Energy Drive, Spring, TX 77389
Social 11:15 a.m., Luncheon 11:30 a.m.

Cost: Active/Associate Members - \$30, Emeritus/Life/Honorary - \$25
Students who are members of HGS - \$10, Non-members - \$40

To guarantee a seat, pre-register on the HGS website & pre-pay by credit card.

Pre-registration without payment will not be accepted.

Walk-ups may pay at the door if extra seats are available.

HGS Northsiders Luncheon Meeting

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Houston, TX

HGS Northsiders Luncheon Meeting

Quantifying Variability of Reservoir Properties from a Wolfcamp Formation Core

The Wolfcamp Formation has emerged as a major unconventional resource play in the Permian Basin of West Texas and shows a wide range of oil and water production. The application of Digital Rock Physics (DRP) technology to a slabbed core can help to understand the wide variability in rock types, porosity, and permeability, all factors which greatly affect water cut and oil production.

Using a detailed workflow especially designed for shale characterization, it is possible to obtain direct information about rock properties such as mineral composition, pore volume, pore size distribution, and computed log properties. The first phase is a dual energy X-ray CT imaging at a resolution of about 0.25 mm/voxel. From this imaging, two continuous high resolution logs were computed: bulk density (RHOB), an indicator of porosity and organic matter, and photoelectric factor (PEF), an indicator of mineralogy. In the second phase, plugs are X-ray CT imaged at a resolution of 40 microns/voxel. Based on the CT volumes, subsamples are scanned with an electron microscope (SEM). The SEM high resolution images were digitally analyzed to quantify the amount of organic matter, porosity, and high density minerals present in the samples. In the third phase, 3D image volumes are obtained from FIB-SEM (focused ion beam combined with scanning electron microscopy) at a resolution of about 10-15 nanometers. Their segmentation and analysis allows us to quantify organic matter, total porosity, connected porosity, and porosity associated with organic matter (PA_OM). Also permeability is calculated using a Lattice-Boltzmann method.

The Wolfcamp Formation has not only a large variability in porosity and permeability, but organic porosity and inter-granular porosity are both commonly observed. If we assume that the porosity hosted by organic material is primarily filled with oil or gas and that water resides mainly in the inter-granular pores, then this data may help explain why some completions result in greater water cut than others. It also suggests that a good strategy might be to select landing zones for greater PA_OM, not just higher porosity in general. A standard petrophysical model is included in the study which is the result of the integration and upscaling of the dual-energy X-ray CT, plug scale mineralogical

and SEM analysis, and the final porosity and permeability from the 3D FIB-SEM data. ■

Biographical Sketch

DR. JOEL WALLS is currently Director of Unconventional Technology at Ingrain, Inc. He is a geophysicist and entrepreneur with extensive experience in the research, development, launch and sale of advanced technology products and services for the upstream oil and gas industry. He joined Ingrain in 2010 with the responsibility for developing and commercializing services focused on shale and other unconventional reservoirs.



Dr. Walls was a co-founder and the first president of the Society of Core Analysts, and is a member of multiple additional professional associations. He is the author of many professional publications and holds four U.S. patents in the fields of digital rock properties and seismic reservoir characterization.

Dr. Walls holds an MS and PhD in geophysics from Stanford University, and a BS in physics from Texas A&M University, Commerce.