

Monday, September 17, 2018

Live Oak Room • Norris Conference Center • 816 Town and Country Blvd #210
Social Hour 5:30–6:30 p.m.
Dinner 6:30–7:30 p.m.

Cost: \$40 Preregistered members; \$45 non-members/walk-ups

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.

If you are an Active or Associate Member who is unemployed and would like to attend this meeting, please call the HGS office for a discounted registration cost. We are also seeking members to volunteer at the registration desk for this and other events.

HGS General Dinner Meeting

Amanda C. Reynolds,

Ron J.M. Bonnie, Shaina Kelly

ConocoPhillips

Robert Krumm, James Howard

Premier Oilfield Group

HGS General Dinner Meeting

Joint Meeting with AWG (Association for Women Geoscientists)

Quantifying Nanoporosity: Insights from Parallel and Multiscale Analyses

Over the last decade, multiple studies have outlined the challenges of adapting core analyses to unconventional rocks, from challenges in measuring and modeling very small, high surface area pores to round robin discrepancies among laboratories. In addition, multiple authors have demonstrated the challenges characterizing mobility in nanoporous rocks: including the scale and variability of the pore systems, the change in fluid composition as it re-equilibrates to surface conditions, and uncertainties in wettability states. This study uses several different parallel and multiscale analyses to characterize the relationships between total porosity, pore size distribution, and fluid mobility in a broad variety of West Texas samples.

This study is designed to compare current core analyses for nanoporous rocks, to identify strengths and limitations of each analysis, and to design appropriate upscaling workflows to compare results from these analyses. We examined 50+ samples from West Texas with a broad range in mineralogy and organic matter content. The integration of SEM, N₂ adsorption, NMR, GRI, HPMI, and thin section data on each of these samples enabled an understanding of pore size distributions, pore types and connectivity and inferred wettability. Results from the analytical comparisons – both where they agree and disagree – reveal insights into unconventional pore systems. We find that total porosity is well constrained by a tight agreement (± 1 p.u.) between crushed rock helium porosimetry and plug NMR, confirming the validity of both methodologies for measuring total pore volume. Low-field NMR relaxation measurements at several laboratory-controlled liquid saturation states assist in understanding potential liquid volumes at reservoir conditions and the nature of the liquid-pore wall interactions that reflect wettability behavior. High resolution (SEM) imaging is used to calibrate the distribution of pores and organic matter at multiple scales. The wettability state of organic-rich low-permeability unconventional reservoir samples is unclear since many samples spontaneously imbibe both water and light oil. While this may signify a neutral wetting state, another

interpretation is that two pore systems, one water-wet and the other oil-wet, reside adjacent to each other in these rocks. This study focuses on whole rock samples rather than mineral/organic isolates and employs parallel and multiscale analyses to pinpoint how each method informs aspects of reservoir quality. Take-aways include a stronger understanding of analytical capabilities and upscaling in organic-rich unconventional reservoirs. ■

Biographical Sketches

AMANDA REYNOLDS is a Geoscience Coordinator for the Unconventional Resources Excellence team at ConocoPhillips. Previous to that role, she worked as a petrophysicist for 10 years in both conventional and unconventional plays first for ExxonMobil and then for ConocoPhillips. She received her PhD in Geosciences from the University of Arizona, her MS in Geosciences from the University of Pittsburgh, and her Bachelors in Geology from Indiana University (Bloomington) in 1998. Her thesis work involved quantifying weathering reactions from hinterland to basin using elemental ratios and strontium and neodymium isotopes to fingerprint climatic versus structural roles on weathering intensity.

RON J.M. BONNIE has joined ConocoPhillips in 2010 as a Petrophysical Fellow in the Technology organization, where he mainly focusses on unconventional resource plays and “anything NMR”. Before, Ron has worked 5+ years for Shell E&P in Houston on unconventional gas reservoirs (tight- and shale-gas) after 6+ years with Halliburton in the USA with positions in R&D for Numar and as Global Product Champion MRILWD for Sperry-Sun. The first 10 years of his O&G career were spent with Royal Dutch Shell in The Netherlands in various assignments in research, petrophysics, geophysics and operations. Ron is an industry-wide recognized expert on NMR technology and provides support for high-profile NMR projects in ConocoPhillips. Ron is very well published and holder of several patents. He has a BSc and MSc in physics from the University of Amsterdam and a PhD in physics from Twente University (both in The Netherlands).

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SHAINA KELLY is a petrophysicist in ConocoPhillips' Subsurface Technology organization currently working on pore-scale/sub-well log characterization and upscaling projects. Shaina received her PhD and MS degrees in petroleum engineering from the University of Texas at Austin and a BS degree in environmental engineering from the University of Florida. Shaina enjoys outdoor activities, especially hiking and running.

ROBERT KRUMM earned his PhD in Chemical Engineering from the University of Utah focusing on the interactions between fluids and micro-porous media as they relate to unconventional reservoirs,

gas adsorption, reactive transport, and phase equilibria. His professional background is centered on hands-on laboratory-based research and development. In 2014, Robert joined ConocoPhillips Subsurface Technology in Bartlesville, OK where he investigated methods for characterizing flow through unconventional reservoir rock, specifically using NMR and Micro-CT to quantify saturation changes. Robert has been with Premier Oilfield Labs since January 2017 where he took the role of Area Technical Manager. Robert is actively working the fields of shale petrophysical properties, shale relative permeability, digital rocks, and Special Core Analysis.
