



Geophysical Society of Pittsburgh



Proudly Presents Tuesday, February 4th, 2014

At

Penn Brewery, Pittsburgh, Pennsylvania

Relative Permeability in La Luna Formation (Colombia) using Digital Rock Physics

by
Dr. Joel D. Walls

Abstract: As more organic rich mudstone resource plays are developed internationally, the need to understand flow potential and long term well performance increases dramatically. Many international locations have limited infrastructure for the economic development of these low permeability formations. Therefore, operators require comprehensive rock data and careful reservoir modeling to help reduce the risk of early-stage development. This paper describes the methods and results of a project designed to quantify the range of expected permeability and relative permeability in samples from the La Luna formation, middle Magdalena Valley, Colombia.

Porosity versus absolute permeability trends were determined for about 44 La Luna well samples using digital rock physics (DRP) methods. Results show rock quality that is equal or better than many prolific North American shales, including Marcellus and Eagle Ford. These samples average about 6% organic material content by volume. The total porosity range observed is from about 3 to 15%. For total porosity of 4% or above, the horizontal permeability is generally above 100 nanodarcy (nd). For porosity of 8%, horizontal permeability is typically 1000nd or more. From these 44 samples, several were selected for relative permeability analysis. All data was from 3D FIB-SEM imaging with a voxel size of 10nm.

Imbibition relative permeability computations (increasing fractional flow of water) were performed for oil-water systems for different scenarios including different contact angles ranging from oil to water wet, and different API values corresponding to different viscosity ratios. Also gas-water relative permeability computations were performed for increasing fractional flow of gas.

Observations and Conclusions

The key observations and conclusions from this fluid flow analysis using digital rock physics are:

- Rock quality is good to very good for an unconventional (shale) play, as determined by organic matter content, porosity, and absolute horizontal permeability.
- Organic matter and inter-particle porosity are both important.
- There is a wide range of pore sizes, from 50 to over 200 nm.
- Effects of changing wettability, oil API and viscosity ratios can have substantial impact of the shape and end points of the relative perm curves.
- Relative permeability curves in La Luna formation (Colombia) are similar to some major oil-producing unconventional resource plays in North America.



Biography: Dr. Joel Walls is a geophysicist focused on research, development, and commercialization of advanced technology products and services for exploration and production. While completing his doctoral work in the Stanford Rock Physics Project in 1982, he co-founded Petrophysical Services Inc. with Dr. Amos Nur. PSI was acquired by Litton Core Laboratories in 1984. He served as Director, Dallas Advanced Technology Center for Core Lab until 1990 when he formed the software company PetroSoft Inc., in San Jose, CA. PetroSoft became Rock Solid Images (RSI) in 1998. There he served in several executive positions, including VP of Business Development and VP of Technology. He joined Object Reservoir as VP of Shale

Ventures in 2008. In 2010, Joel joined Ingrain as Director, Unconventional Resources Technology with responsibility for developing and commercializing services focused on shale and other unconventional reservoirs.

Joel was a co-founder and the first president of the Society of Core Analysts, and is also a member of the Society of Exploration Geophysicists (SEG), Society of Petroleum Engineers (SPE), and Society of Petrophysicists & Well Log Analysts (SPWLA). He is the author of many publications in various geophysical and petrophysical journals, and holds two U.S. patents in the field of seismic reservoir characterization. Dr. Walls holds an M.S. and Ph.D. in geophysics from Stanford University, and a B.S. in physics from Texas A&M University, Commerce.

Tuesday, February 4th Meeting Menu

5:00 pm Social Hour

This month's social hour is proudly sponsored by
[Tesla Exploration Inc.](#)



Beer on Tap:

Penn Dark Lager Beer, European-Style Dark

Penn Gold Lager, Munichener Helles Style

Penn Pilsner, Vienna Style Pilsner

Also Available: Red & White wine

Hors D'oeuvres:

Side of Smoked Salmon with Pumpernickel, Cream Cheese, Chopped Eggs and Red Onions, and Capers

6:00 pm Dinner

Dinner Buffet

Black Forest Chicken

Beef Tenderloin Medallions

Baked Penne with Meatballs & Marinara

Fresh Veggie Medley

Mashed Potatoes

Tossed Green Salad

*Dessert: Apple and Cherry Pie
Coffee & Cream*

7:00 pm Lecture

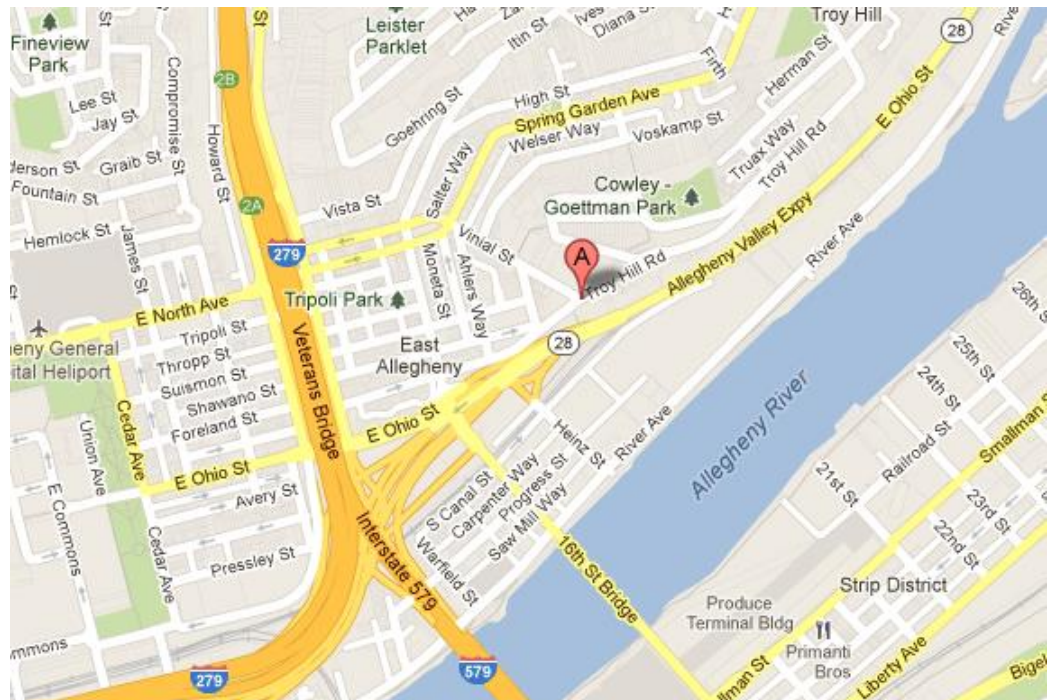
We are pleased to announce that this month's lecture will be held at :

Penn Brewery

800 Vinial Street

Pittsburgh, PA 15212 USA

412.237.9400



Please RSVP using the PayPal link on the Geophysical Society of Pittsburgh website at: www.thegsp.org

Cost: \$35 Members, \$40 Non-members (\$20 for Students). Meeting Location: Penn Brewery, 800 Vinial St., Pittsburgh, PA 412.237.9400