



Geophysical Society of Pittsburgh And the Pittsburgh Association of Petroleum Geologists



Proudly Presents Thursday, February 22, 2024

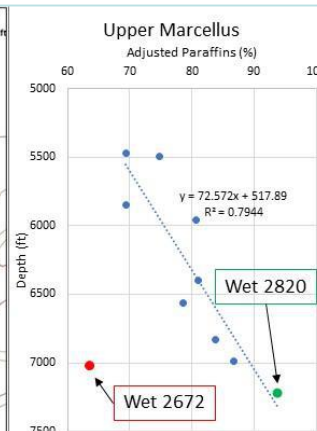
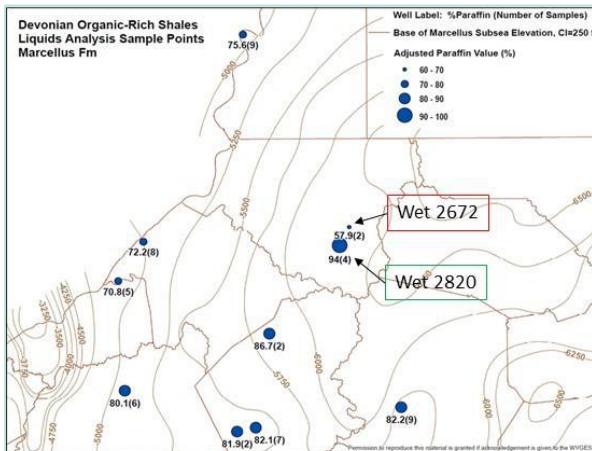
At Seneca Resources Auditorium,
2000 Westinghouse Dr., Suite 400

Cranberry Twp., PA 16066

Understanding the Devonian Shales of the Marcellus Liquids Fairway in West Virginia via the Analysis of Volatiles Entrained in Legacy Cuttings; Insights into HC Content, Composition, and Production

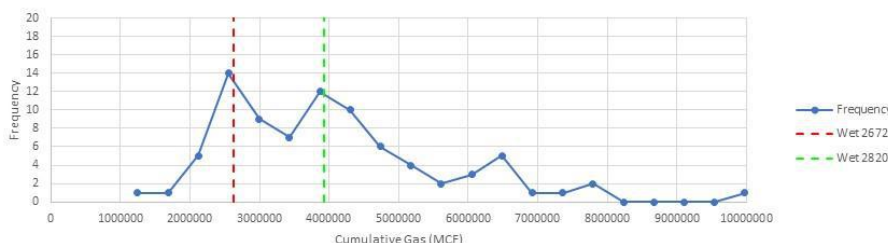
Presented by:

Dr. Christopher Smith
Senior Chemist



Ratio of alkanes to alkanes+cycloalkanes in HC liquids entrained in Marcellus cuttings establishes a clear trend related to thermal maturity throughout the study area (Adjusted Paraffins), Wetzel 2672 stands out as an outlier impacted by processes other than thermal maturity – these processes have also led to an adverse impact on the economics of the Wetzel 2672 lateral both compared to its offsets and another Wetzel well analyzed by RVS, Wetzel 2820 with the wells in the 29th and 62nd percentiles of production respectively over a 74 month period and a normalized lateral length difference in production of 17%. Map produced by WVGES and upper two figures originally shown at URTEC 2021 (URTEC ID Num. 5540)

Histogram of Cumulative Gas Production of Wetzel County Offset Wells after 74 months of Producing Operation



Please RSVP using the PayPal link on the Geophysical Society of Pittsburgh website at: www.thegsp.org
Cost: \$35 Members, \$40 Non-members (\$5 for Students). Meeting Location: Seneca Resources Company LLC, 2000 Westinghouse Dr., Suite 400, Cranberry Twp., PA 16066, 412-548-2536

Abstract.

Rock volatiles stratigraphy (RVS) has been pioneered and developed over the last decade by Advanced Hydrocarbon Stratigraphy (AHS) to provide actionable information to oil and gas operators based on detailed geochemical analysis of volatile components present in geological samples though recently this has expanded to include helium exploration, geothermal, and carbon capture storage applications. Samples analyzed are typically cuttings and core, but muds and produced fluids are also analyzed on the same instrumentation allowing for direct comparisons. RVS has been used in the Devonian (including the Marcellus), the Utica, and the Point Pleasant shales throughout West Virginia, Pennsylvania, and Ohio since the early 2010s when these shales/plays were initially being developed and the relevant pay zones, resource content/composition, and effects of structure along laterals needed to be understood through to today with additional applications like resource allocation from geochemical finger printing of cuttings vs produced gas and identifying and quantifying parent-child interactions.

The RVS technique applies vacuum extraction to rock samples to provide quantitative information on entrained hydrocarbons (HC), organic and inorganic acids, noble gases, air components, various sulfur compounds, and water among others. Two vacuum extractions, at 20 and 2 mbar, are applied to the same rock sample to obtain readily extracted and more tightly held compounds. Analytes are concentrated on liquid nitrogen cold traps (CT). When the CT is warmed after collection the analytes are released by sublimation point to a mass spectrometer for analysis. Non-condensable gases like methane and helium are analyzed prior to warming. Analysis at different vacuum extraction pressures allows for calculation of relative permeability indices, understanding surface/fluid interactions, and evaluating environments where compounds reside.

In 2020 an 11 well study across 6 counties in the West Virginia panhandle in the Marcellus liquids fairway was carried out in cooperation with the West Virginia Geological and Economic Survey. Legacy cuttings from 1953 to 2013 were analyzed by RVS from above the Middlesex to below Onondaga. The HC liquids content in not just the Marcellus but these shallower Devonian shales significantly supports the WVGES's model that in the West of the state where the Mahantango and Tully are thin or not present production comes not only from the Marcellus but from laterals accessing these shallower shales. At the same time clear trends in the liquids content and composition vs depth were observed across the upper and lower Marcellus, the Geneseo, and West River shales with compositional trends that relate to thermal maturity having an excellent linear relationship, $R^2 \geq 0.8$ in each of these shales. Other clear trends relating to rock strength with burial depth and non-HC volatiles providing stratigraphic markers for different shales were identified too. With the development of regional trends for these different shales it was noted that there were some outliers. One of the most interesting was Wetzel 2672 drilled in 2012 by EQT, the cuttings from the pilot showed an abnormal distribution of HC liquids and composition (as did those from the Marcellus lateral), notably less than would be expected and significantly heavier in the Marcellus and Geneseo but significantly more and lighter in the West River/Middlesex compared regional trends. Based on experiences in both other conventional and unconventional plays this was likely due to evaporative fractionation where migrating gas strips volatile liquids leaving behind heavier HCs and emplacing the lighter HCs elsewhere as a condensate – both processes can be observed in Wetzel 2672 with some evidence that the gas may have come from the Utica. These results stand in contrast not only to the regional trends but to the RVS analysis of cuttings from Wetzel 2820, drilled 3 miles away by EQT in 2013. This process appears to have negatively impacted the production of Wet 2672 when compared to offset Marcellus laterals drilled from 2011 to 2014; Wet 2672 was in the lower 33 percentile after 24 months of production vs Wet 2820 (66 percentile). Normalizing for lateral length Wet 2672 had 15% less production over the same time frame and 18% less over the lifetime of Wet 2820. These results not only provide important insights into the petroleum system and the Devonian shales in West Virginia, but demonstrate an important link to the potential economic performance of wells encountering such phenomenon. In addition to these RVS data from West Virginia the talk will be supplemented with other examples from the Marcellus and Utica as well as examples from the North Slope of Alaska, the Midland basin, and the Williston basin.

AHS would like to acknowledge and thank our friends and partners at the West Virginia Geological and Economic Survey and Baker Hughes for their assistance on this great study and we look forward to the opportunity to share it with GSP and PAPG next month in Pittsburgh.



Biography: ***Dr. Christopher Smith, Senior Chemist***

Christopher Smith has been a Senior Chemist with Advanced Hydrocarbon Stratigraphy (AHS) since January 2019 and recently moved to Midland working on data analysis, instrumentation, client engagements, and business development. Most of his analysis work focuses on the North Slope in Alaska, the Delaware Basin, the Anadarko and Arkoma basins in Oklahoma, and the Marcellus.

Prior to working for AHS, he received his PhD in analytical chemistry from the University of Arizona in the Winter 2018 term with focuses on instrumentation, data analysis programming, spectroscopy, electrophysiology, surfactants, and surface modification chemistries. He also completed a MA in history at the University of Tulsa as a Henneke Research Fellow in 2012. He completed his undergraduate work cum laude in 2011 with degrees in chemistry, history, and biochemistry also from the University of Tulsa.

Thursday February 22, 2024
Agenda:

11:15 to 11:45 Social Half Hour

11:45 pm Lunch Buffet

12:00 pm Lecture

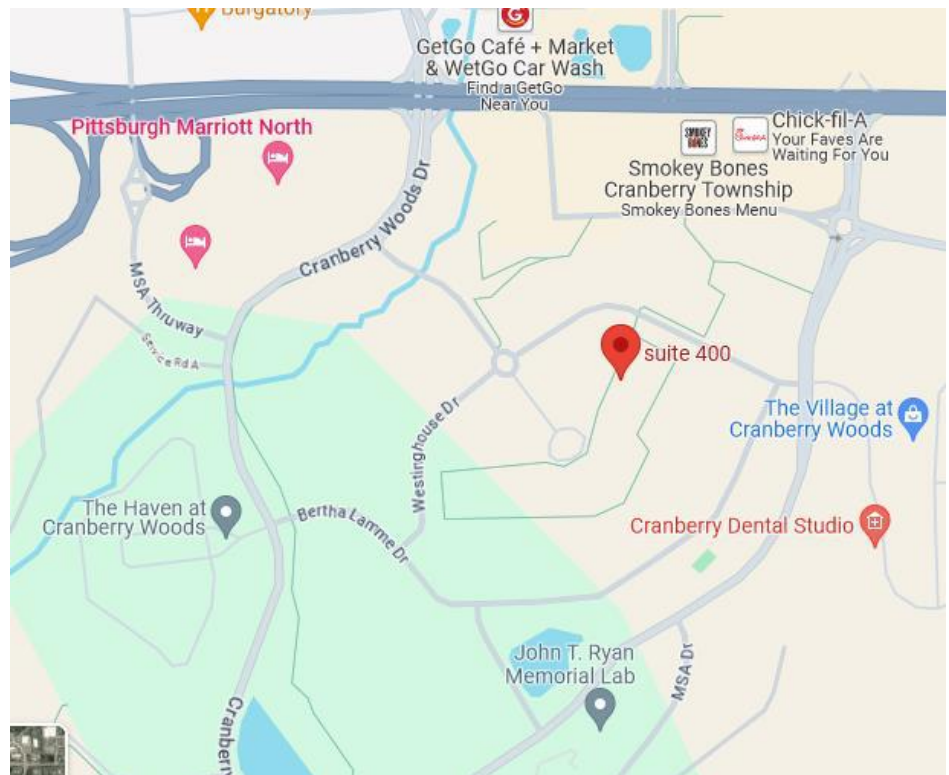
\$25 for members,
\$40 for non-members,
\$5 for students.

The auditorium we booked is in building 3000. However, to avoid the main building security check and make it easy, all registrants must first come to Seneca office at Building 2000 first and then walk down to building 3000. We will have Seneca people assisting the direction to the auditorium on the meeting day.

To receive a CEU certificate from this lecture please contact Bill Harbert

This month's lecture will be held at :

Auditorium
Seneca Resources
Company LLC
2000 Westinghouse Dr.
Suite 400
Cranberry Twp., PA
16066
Office: 412-548-2536



We would like to thank our 2023-2024 Corporate Sponsors. Please contact Joel Starr if you are interested in sponsoring the GSP

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Sponsorship Opportunities



The Geophysical Society of Pittsburgh offers sponsorship opportunities. Our monthly meetings occur each first Tuesday of every month beginning in September through May.

Since our inception in 2010, meetings have been very well attended by industry professionals, averaging well over 50 attendees per meeting, peaking at more than 100 for our most highly attended meeting. Not only do our meetings offer exceptional technical presentations in the field of geophysics, but they provide an outstanding networking opportunity for oil and gas industry professionals working in the Appalachian basin.

Your generous donations will help in the following ways: 1) helping to bring in distinguished lecturers; 2) offsetting part of the cost of the monthly meeting venue; and 3) enabling a Scholarship Program for future Geophysicists to be awarded each year to an outstanding student enrolled in a Geophysics program at one of our local universities.

Your company logo will be boldly displayed during the social hour of each meeting on the front screen, as well as on all meeting announcements and on our website. We are offering corporate sponsorship opportunities at several levels this year, as well as opportunities to sponsor our social hour during the meeting. Please note that a secure payment link is now available on our website for your added enrollment convenience.

Please click [HERE](#) to download more information, then return to this page to enroll as a sponsor.



Geophysical Society of Pittsburgh

The Geophysical Society of Pittsburgh successfully hosted the first and second Appalachian Basin Geophysical Symposia (ABGS). The events were huge successes with great speakers covering the latest innovations in geophysical research, technology and perspectives of the Appalachian Basin. We thank all our generous sponsors, speakers and organizers who made this event possible.

The positive feedback received from our community has prompted the GSP board to make the ABGS an annual event. With the addition of this yearly symposium, *it was determined that the monthly meetings should be reduced to a quarterly basis.*

The goals of this change are twofold:

1. Boost attendance numbers at our general meetings;
2. Focus Appalachian Basin centric talks for the ABGS.

Two of the quarterly meetings will occur in the fall and the other two during the spring. The ABGS will still be held around the beginning of June in tandem with the golf outing. This ensures that our members still have the opportunity to network on a semiregular basis.

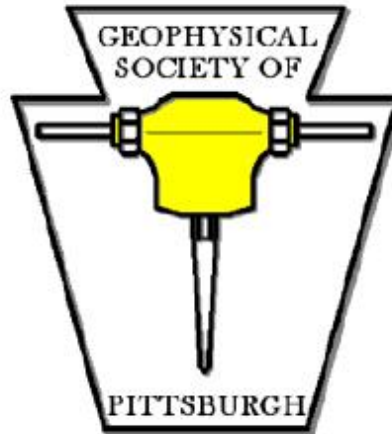
We hope these changes help enhance the GSP's ability to promote the science of geophysics as well as promote the fellowship and cooperation among its membership. We look forward to seeing everyone at the first meeting this September.

Sincerely,

The GSP Board

2023-2024 GSP OFFICERS

President: Scott Gorham <https://www.linkedin.com/in/scott-gorham-9556a129/>
Vice President: Jianli Yang <https://www.linkedin.com/in/jianli-yang-81152914/>
Treasurer: Joel Starr <https://www.linkedin.com/in/joel-starr-27788ab7/>
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Your Dues and Sponsorship in Geophysical Society of Pittsburgh go toward:

- *Outstanding Monthly Lecture Series*
- *SEG Distinguished Lecturers*
- *Annual Scholarship Awards*
- *Annual Golf Outing*
- *Short Courses*

Please contact Scott Gorham, Jianli Yang, Joel Starr or Bill Harbert for Sponsorship Opportunities.
