EPEX 2022

Energy Prospectors Expo

OPI 59th Conference and Trade Show

May 31st,
Virtual & Ramada by Wyndham, London, Ontario

WHAT IS EPEX?

EPEX highlights the multifaceted nature of Ontario's oil, natural gas and salt industries and how they fit into Ontario's energy landscape. EPEX identifies opportunities to help other energy sectors. After all, we're all doing the same thing but in different ways -- and that is why the OPI and OGSR Library wanted to bring everyone together.

ENERGY PROSPECTORS EXPO

Each one of you is an important collaborator in this conference and your participation highlights the multidimensionality of our energy sector in Ontario.

The EPEX logo is a tesseract, a four-dimensional shape with 24 faces, chosen to represent the complexities and multiple layers of energy production in Ontario.

EPEX is about more than prospects – it's about exploring.

Join us in the plenary session and let's start generating collaborative energy!

Social Media #epex2022

We're live online, in more ways than one this year. Join the conference using the webinar link below and follow the conference, post pictures, and ask questions on twitter using the hashtag: **#epex2022**

Webinar link:

https://us02web.zoom.us/j/83071904841?pwd=aGFoZFROL0NYUnBtemNUMEs5Wml0UT09

Help us improve the conference for 2023 by filling out an in-person **survey** or **poll** in the webinar.

Schedule of Events

Day 1 - **Tuesday, May 31st – Hybrid Event**

Live at the Ramada by Wyndham, London, ON + Virtual on Zoom Webinar (9:30AM – 4:00PM)

Length	*Time*	*Event*	*Presenters*
30 min	**8:30**	Breakfast & Networking	
30 min	**9:00**	**Trade Show Opens**	Trade Show Exhibitors
5 min	**9:30**	Official Conference Opening	Welcoming remarks
25 min	**9:35**	**Plenary – OPI Presents State-of-the-Industry 2022**	Scott Lewis, Peter Budd; OPI
30 min	**10:00**	Networking Break and Coffee	Trade Show Exhibitors
		BLOCK 1: DEVELOPMENTS IN GEOLOGY	
15 min	**10:30**	*Geologic controls on porosity and permeability in the Silurian Lockport Group and Salina Group A-1 Carbonate, southwestern Ontario*	Shuo Sun, Western University
15 min	**10:45**	*Subsurface Correlation of the basal Silurian Medina Group, Southwestern Ontario*	Rhys Paterson, Western University
15 min	**11:00**	*Grab hold of your data -- Workflows for turning virtual models into 3D Prints*	Jordan Clark; Oil, Gas and Salt Resources Library
15 min	**11:15**	*A 3-D bedrock hydrostratigraphic model of southern Ontario*	Terry Carter, Carter Geological Services
15 min	**11:30**	***Block 1 Panel Discussion***	
105 min	**11:45**	Networking Lunch	Trade Show Exhibitors
		Industry Lightning Updates	
	1:00	NWMO Activity Update	Andrew Parmenter, Nuclear Waste Management Ontario
	1:05	IPS Services	Jeff Luckovich, Integral Pumping Services

		BLOCK 2: ENVIRONMENTAL	
15 min	**1:30**	*Flowing wells in the Big Creek Valley, Norfolk County – History, Conditions and Remediation Options*	Cam Baker, Matrix
15 min	**1:45**	*Methane and hydrogen sulfide emissions from oil and gas wells in Ontario*	Khalil El Hachem, McGill University
15 min	**2:00**	*Playing Nice in the Sandbox – multiple energy projects on the same land*	Dan Silber, Elexco
15 min	**2:15**	***Block 2 Panel Discussion***	
30 min	**2:30**	Networking Break and Coffee	Trade Show Exhibitors
		BLOCK 3: INDUSTRY DEVELOPMENTS & HISTORY	
20 min	**3:00**	*Oil Springs and Petrolia, A glimpse at the early years of Canada's Oil Industry*	Allan Phillips, Clinton-Medina Group Inc.
10 min	**3:20**	*CAES Update*	Evan Tummillo, Tanya Mackie; Bedrock Energy Corp.
15 min	**3:30**	*Moving into a Hydrogen Economy: The role of Carbon Sequestration*	Phil Walsh, Toronto Metropolitan University
15 min	**3:45**	***Block 3 Panel Discussion***	
5 min	**4:00**	Closing Remarks ***Submit your post-conference survey to help us build EPEX 2023!***	Trade Show Exhibitors
55 min	**4:05**	Wine and Cheese Networking Reception	Thank You for Attending!
	5:00	Trade Show Closes/Tear-down	

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Speaker Biographies and Abstracts

Block 1 – Developments in Geology

Shuo Sun

Western University

Shuo Sun is an industrial postdoctoral fellow in Oil, Gas and Salt Resources Library and University of Western Ontario. His postdoctoral project (2019 to present), supported by MITACS research funds, is the study of geologic controls on the porosity and permeability of the Silurian Lockport Group, southwestern Ontario. It involves geographic analysis on the variations in porosity and permeability in the Lockport Group at formation level, relating these variations to lateral depositional and diagenetic facies changes, in order to more accurately represent the continuity/discontinuity of bedrock pore systems, relationships to hydrocarbon traps and groundwater flow patterns in southern Ontario.

He has obtained his PhD degree in the Earth Science Department, Western University, in March 2018. His PhD project (2013 to 2018) is on the revised stratigraphy of the upper Silurian-Middle Devonian stratigraphy in southwestern Ontario. His work involves core logging, outcrop section mapping integrated with hundreds of wells with geophysical data and drill cuttings.

NOTES

Shuo Sun - Abstract

Geologic controls on porosity and permeability in the Silurian Lockport Group to A-1 Carbonate, southwestern Ontario

Sun, Shuo [1, 2]; Frank R. Brunton[1,3], Terry Carter[4], Jisuo Jin[1]

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2 Oil, Gas and Salt Resources Library, 669 Exeter Rd, London, ON N6E 1L3

3 Ontario Geological Survey, Ministry of Energy, Northern Development, & Mines, Natural Resources & Forestry, 933 Ramsey Lake Road, Sudbury, ON P3E 6B5

4 Geological consultant, 35 Parks Edge Cres, London, ON N6K 3P4

The Lockport Group comprises stacked carbonates in ascending order: Gasport, Goat Island, Eramosa, and Guelph formations. These carbonates are amongst the most economically significant sedimentary rocks in southern Ontario because in the deeper subsurface they are significant oil/gas plays and natural gas storage reservoirs. This succession is overlain by the evaporitic-carbonate Salina Group strata that comprise, in ascending order: A-1 Unit (A-0 Carbonate, A-1 Evaporite, A-1 Carbonate), and overlying A-2 Carbonate, forming a self-sourcing hydrocarbon play together with the Lockport Group. New mapping results indicate that pinnacle structures and inner-pinnacle karst in this carbonate succession developed in a broad inner ramp transitioned east- and southeast-ward into mid-ramp and more open marine environments.

Porosity and permeability analyses are examined from 150 cored petroleum wells stored in the Oil, Gas and Salt Resources Library (OGSRL), including three located in the subsurface of inter-pinnacle karst zone, 54 within the pinnacle structures in carbonate ramp and 93 in the restricted to open marine, inner-middle carbonate ramp. The datasets comprise 11,759 validated porosity and vertical and/or horizontal permeability analyses, derived primarily from the dolostones of Guelph Fm and dolostones/limestones of A-1 Carbonate. Dolomitization is interpreted to have been caused by circulation of hyper-saline marine water prior to the deposition of A-2 Anhydrite.

Regional porosity and permeability distribution trends indicate strong correlation with lithofacies, paleo-karstic zones and dolomitization. Carbonates in the inter-pinnacle karst have relatively high porosity and permeability with pore systems dominated by irregular, karstic vugs and interparticle and intercrystalline microporosity resulting from fabric-preserving dolomitization and/or paleo-karstification. Calcite-cemented dolostone as karst rubbles are very common in the Guelph Formation with sharp and irregular contact with the highly dolomitized mudstone matrix. Although these dolostones have non-fabric selective vugs, pores appear to be effective for fluid flow by the enclosing microporosity systems, as indicated by their relatively high permeability. Within pinnacle structures, the dolostones in Guelph and A-1 Carbonate formations show wide variation in porosity and permeability possibly due, in part, to the heterogeneity of lithofacies and diagenetic fabrics. Porosity types include irregular, cm-sized vugs along karstic conduits and interparticle and intercrystalline micro-porosity enhanced by dolomitization. These carbonates show good porosity-permeability correlation. In the variably karstic carbonate bank and platform settings, porosity-permeability in Guelph to A-1 Carbonate show a general decrease from southwest to northeast. In oil/gas pools in western Lake Erie, the higher porosity is controlled by biohermal facies and dolomitization of the Guelph and Goat Island formations. Cavities, vugs and intercrystalline porosity dominate the system. The fabric-preserving dolomitization may have been controlled by diagenetic fluids (modified marine water). Northeastwards, the relatively lower porosity may indicate fabric destruction during early diagenesis under open-marine conditions.

Rhys Paterson
Western University

Rhys Paterson is a geologist-in-training, residing in London, Ontario. She studied Environmental Geoscience at Brock University and received her B.Sc. in 2019. She is currently completing her M.Sc. at Western University under the supervision of Jisuo Jin, Frank Brunton and Allan Phillips. Rhys' interests are in the Paleozoic stratigraphy of Ontario, GIS mapping and sustainability.

NOTES

Rhys Paterson - Abstract

Subsurface Correlation of the basal Silurian Medina Group, Southwestern Ontario

The lowest Silurian (Rhuddanian) Medina Group stratigraphy in southwestern Ontario and adjacent USA includes, in ascending order: the Whirlpool, Manitoulin,, Cabot Head/Power Glen, Devils Hole, Ball's Falls, Grimsby, and Thorold formations. The interplay changing paleogeography and paleoenvironments and provenance of sediments, and regional tectonics and sea level fluctuations has resulted in the accumulation of a complex suite of mixed siliciclastic-carbonate strata. The subsequent burial and diagenetic history of these strata also influenced the distribution of natural gas plays in eastern Lake Erie.

This study recognizes four major sedimentary packages in the Medina Group in the subsurface of southwestern Ontario by combining detailed study of 47 cored or partially cored wells in combination with geophysical borehole logs (gamma-ray and neutron). The Manitoulin carbonate and Whirlpool siliciclastic facies comprise a thin package but with laterally consistent thickness, overlying the peneplaned uppermost Ordovician Queenston Formation. Sitting disconformably on these strata are the Cabot Head red/green shale changing locally into the Devils Hole pink/grey, slightly dolomitic medium to fine grade sandstone and Power Glen dark grey/green shale and sandstone. The overlying Grimsby Formation is characterized by interbedded red and green sandstones, siltstones and shales, with multiple, thin beds of bryozoan biostromes in the western part of the study area. The Thorold Formation represents topmost sandstone of the Medina Group. It commonly comprises light grey quartz arenites, by may change to burrowed and chaotically bioturbated lithologies locally. Two phosphate marker beds are useful for subregional stratigraphic correlations. The results of this study will help improve the regional 3D lithostratigraphic model of southcentral and southwestern Ontario.

Jordan Clark

OGSR Library

Jordan has over 15 years of experience aggregating and publishing Ontario's petroleum industry data at the Oil, Gas and Salt Resources Library. Jordan's current focus at the Library is exploring the delivery of content in new formats such as 3D printing and virtual reality.

NOTES

Jordan Clark - Abstract

3D Printing for Geologists and Subsurface Explorers – Turning the Abstract into Reality.

Clark, Jordan K1; Matthew A Dupont[1]; Maryrose N D'Arienzo[1]; Charles E Logan[2]; Hazen A J Russell[2]
1Oil, Gas and Salt Resources Library, 669 Exeter Rd, London, ON N6E 1L3
2Geological Survey of Canada, Natural Resources Canada, 601 Booth St, Ottawa, ON K1A 0E8

Tactile three-dimensional (3D) printed models of subsurface geological formations offer a way to hold and view modelled geology naturally. The ability to hold and rotate a physical model allows the viewer to focus on analysing the geometry from a geological perspective in a situation where the shape is intuitive. As an introduction to the geology of southern Ontario, a four-layer model was printed from the new lithostratigraphic model of southern Ontario (Carter et al., 2021).

Two types of 3D printers are available for desktop manufacturing at an affordable price point. The most common and affordable type of printing is fused deposition modeling (FDM). In FDM printing, a model is built on a platform from a spool of filament fused layer by layer with heat. The second type of common desktop printer uses stereolithography (SLA). In SLA printing, a model is built on a platform lowered into a tray of resin that is cured in layers using ultraviolet light. Both types of printing were found to produce good results with each having noteworthy advantages. FDM printers offer the largest size and lowest cost for most projects. The models are durable and do not require post processing; however, printing can be inconsistent and fine details may not be reproduced with accuracy. SLA printers can offer the highest quality, most consistent prints, with preservation of fine details on the model surface. Models require washing, curing, and post processing.

Objects from the lithostratigraphic model of southern Ontario were created using Leapfrog Works and exported as Wavefront object (OBJ) files. Any GIS or CAD software that can export an OBJ or Standard Triangle Language (STL) file format will be compatible with most 3D printing software. Some 3D printing software, like Cura for FDM printers, will also support PNG or JPG formats, enabling the printing of digital terrain models using pixel brightness as the model height.

Model objects were edited for printing using Blender, a common and powerful 3D modelling software. Title text, scales, and model features were created as 3D objects and combined with existing model layers to form a solid 3D geometry that can be printed as one solid part. Edited objects must then be passed to print slicing software to prepare printer specific instructions. For SLA prints, PreForm software from Formlabs was used. For FDM prints, Cura was used.

A detailed four-layer model of southern Ontario's geology was printed on a Formlabs Form 3 printer (SLA). This model consists of Precambrian, Ordovician-Cambrian, Silurian, and Devonian layers that snap together. Each layer was printed with label text as a single part, using a coloured resin corresponding to the geological age. Holding and rotating the geology of southern Ontario immediately reveals regional features such as the Chatham sag, Algonquin Arch, and major faults.

Carter, T R; Logan, C E; Clark, J K; Russell, H A J; Brunton, F R; Cachunjua, A; D'Arienzo, M; Freckelton, C; Rzyszczak, H; Sun, S; Yeung, K H. 2021. A three-dimensional geological model of the Paleozoic bedrock of southern Ontario. Geological Survey of Canada, https://doi.org/10.4095/328297.

Terry Carter
Carter Geological Services

Terry R. Carter, MSc, P.Geo.

Terry is formerly the Chief Geologist, Petroleum Operations, of the Ontario Ministry of Natural Resources and is now a Consulting Geologist in London, Ontario. Terry specializes in mapping, modelling and interpretation of the Paleozoic bedrock geology of southern Ontario, its oil, gas and salt resources, and regional bedrock aquifers.

Terry is co-author of the book Subsurface Paleozoic Stratigraphy of Southern Ontario, published by the Ontario Geological Survey in 2010 and is project coordinator on an ongoing project to produce 3D geological and hydrostratigraphic models of the Paleozoic bedrock of southern Ontario.

Terry Carter, Consulting Geologist

Terry.carter@cartergeologic.com

NOTES

Terry Carter - Abstract

A 3-D Bedrock Hydrostratigraphic Model of Southern Ontario

Carter, Terry R.[1], Charles E. Logan[2], Hazen A.J. Russell[2], Jordan K. Clark[4], Elizabeth H. Priebe[3], and Shuo Sun[5]

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Large volumes of groundwater occur in the Paleozoic bedrock of southern Ontario. At shallow depths this groundwater is fresh and is an important source of potable water for domestic, agricultural and industrial supply, a ground-source heat pump storage-exchange resource, as well as supporting aquatic habitats by groundwater discharge to streams and wetlands. At greater depths groundwater is increasingly saline yet still has a variety of practical uses. Deep saline aquifers are utilized for disposal of saline oilfield water produced as a by-product of petroleum production operations and, in the past, for disposal of liquid industrial wastes. In some parts of southern Ontario saline aquifers are being considered for CO2 sequestration. Hydrochemical and isotopic zonation of groundwater also provides supporting scientific knowledge to develop a safety case for long-term isolation of nuclear wastes in low-permeability geological repositories. At intermediate depths groundwater aquifers in southern Ontario contain dissolved H2S generated by a diverse but poorly understood microbial ecosystem dominated by sulphur proteobacteria. This “sulphur water” is a known corrosion hazard for unprotected steel and concrete in subsurface infrastructure such as tunnels, mine shafts, petroleum wells and foundations, especially in the Lucas-Dundee Aquifer. In parts of southern Ontario this aquifer is artesian and is a drilling hazard where it contains H2S.

A hydrostratigraphic model has been developed based on grouping lithostratigraphic model layers from a previously developed 3-D geologic model into 14 hydrostratigraphic layers. Layers are expressed as either aquifer or aquitard based principally on hydrogeologic characteristics in the intermediate to deep groundwater regimes below the influence of modern meteoric water. Hydrostratigraphic aquifer units are sub-divided into up to three distinct hydrochemical regimes: brines (deep), brackish-saline sulphur water (intermediate), and fresh (shallow). The hydrostratigraphic unit assignment provides a standard nomenclature and definition for regional flow modelling of potable water and deeper fluids. Included in the model are: 3-D representations of oil and natural gas reservoirs which form an integral part of the intermediate to deep groundwater regimes, 3-D water level surfaces for deep Cambrian brines and the fresh to sulphurous groundwater of the Lucas-Dundee regional aquifer, inferred shallow karst, base of fresh water, Lockport Group TDS, and the 3D lithostratigraphy. Like the lithostratigraphic model, the hydrostratigraphic model is constructed using Leapfrog Works at 400 m grid scale and will be distributed in a proprietary format with free viewer software as well as industry standard formats.

Block 2 – Environmental

Cam Baker

Matrix

Cam Baker, M.Sc., P.Geo.

Senior Geologist, Matrix Solutions Inc.

Mr. Baker is a senior geologist with over 35 years of professional geoscience practice in consulting and government. He has a wide-ranging background in the environmental and mineral exploration sectors having directed numerous projects in the fields of: surficial and Paleozoic mapping; terrain evaluation; groundwater assessments; aggregate inventories; and geochemical sampling. Cam has extensive professional experience in materials characterization and landform assessment, having been responsible for several Ontario Geological Survey mapping and environmental focused programs. He has overseen investigations across Ontario in addition to investigations on the hydrogeologic conditions of southern Ontario.

Mr. Baker has a demonstrated history of developing and implementing innovative geosciences project plans addressing the needs of industry, government, and public agency clients. He is experienced at leading multidisciplinary teams investigating the natural and human impacted environment.

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NOTES

Cam Baker, Louis-Charles Boutin and Steven Shikaze – Abstract

Matrix Solutions Inc.

Flowing wells in the Big Creek Valley, Norfolk County – History, Conditions and Remediation Options

In Big Creek valley area of Ontario there are hundreds of active, inactive (i.e., suspended and/or legacy wells of unknown status), and plugged (i.e., abandoned) petroleum wells. Some of these wells have the potential to contribute to discharge of sulphur-rich waters at ground surface or in the subsurface and present a significant risk to local ecosystems and human health.

To investigate a flowing abandoned gas well in the Big Creek valley on property owned by Norfolk County, adjacent to the Forestry Farm Road, a study was undertaken with the objectives of:

- improving the understanding of geological and hydrogeological conditions that result in wells flowing sulphur-rich water at surface in the valley, particularly in the vicinity of the County well (Licence #F006207)
- assessing possible future remediation options

The measured water levels in the upper bedrock can be interpreted as meeting the definition of an artesian zone in Big Creek valley, in which water levels are higher than ground surface elevation. The review of 278 OGSR well library records located within 500 m either side of an interpreted artesian zone allowed Matrix Solutions Inc. to summarize their status and revealed that: 209 (~75%) of the wells have been plugged/abandoned; 32 (~11%) are active; 13 (~5%) are suspended; and the status of 24 (~9%) is unknown. This exercise also allowed for a characterization of the plugging age, which is the main indicator that was used to define potential well integrity conditions.

Through discussion with landowners in the vicinity of the project area, a timeline of historical flowing conditions of the petroleum wells was compiled, with a range of estimated flow rates at each location. The geological and hydrogeological understanding was advanced through the analyses of well records held by the Oil, Gas and Salt Resources Library, integration of site-specific information, review of regional geological maps of the bedrock, field investigation, and the construction and application of a numerical model of groundwater flow.

A numerical model of groundwater flow was constructed, based on existing hydrogeological studies. The modelling tool was calibrated and deemed to adequately represent measured hydraulic heads in the overburden and the Dundee Formation aquifer, and historical estimated flow rates at known flowing and recently plugged wells. The numerical model was used to assess the radius of influence from historical well plugging, estimate the relative risk between petroleum wells, and assess the potential impacts of different remedial scenarios that were identified through a workshop with the Norfolk County technical project team.

Four remediation options affecting the County well (F006207) were assessed as corrective measures to the release of hydrogen *sulfide* in the air, and stresses to the vegetation in Big Creek valley. Those remediation options span from well abandonment to capture and treatment of sulphur-rich groundwater. Through this assessment, the time and cost of each option was estimated to help inform decision makers.

Khalil El Hachem
McGill University

Speaker biography

Khalil El Hachem is a Ph.D. Candidate in Civil Engineering at McGill University. His main research interests are environmental impacts of energy development, with a focus on methane and hydrogen sulfide emissions from oil and gas wells. In support for his Ph.D. studies, Khalil has won multiple awards such as the McGill Engineering Doctoral Award, Graduate Excellence Award, Lorne Trottier Engineering Fellowship, and Selia and Sue Hendler memorial prize. Previously, Khalil completed his M.Eng degree in Civil Engineering and Applied Mechanics at McGill University and his bachelor degree in Civil and Environmental Engineering at the Lebanese American University with honors. During his M.Eng., Khalil worked on numerical modeling of multi-phase leakage through faults. While an undergraduate student, Khalil worked on durability of different types of concrete in the Department of Materials at the University of Belgrade through the International Association for the Exchange of Students for Technical Experience Serbia.

Company biography

Founded in 1821, McGill University is one of Canada's best-known institutions of higher learning and one of the leading universities in the world. International students from more than 150 countries make up nearly 30% of McGill's student body, the highest proportion of any Canadian research university. McGill is recognized around the world for the excellence of its teaching and research programs. Today, McGill professors are building the new field of epigenetics, developing alternative energy sources from crop plants and driving human achievement in every field imaginable. In addition to a stellar faculty, McGill is known for attracting the brightest students from across Canada, the United States, and around the world. McGill students have the highest average entering grades in Canada, and McGill's commitment to fostering the very best has helped McGill students win more national and international awards on average than their peers at any other Canadian university.

NOTES

Khalil El Hachem - Abstract

Abandoned, active, and marginally producing (producing <1,700 m^3/day of natural gas or <1.6m^3/day of oil) oil and gas (O&G) wells emit methane (CH_4), a potent greenhouse gas, and hydrogen sulfide (H_2S), a highly toxic gas. Measurements of CH_4 emissions from oil and gas wells in Canada are missing in certain provinces such as Ontario, and measurements of H_2S emissions from oil and gas wells are lacking in Canada or elsewhere.

Here, we conduct 85 measurements of CH_4 and H_2S emission rates from 63 abandoned, active and marginally producing gas wells and a wetland area overlying a possible undocumented well in Ontario, the Canadian province with the longest history of O&G development. To study parameters affecting CH_4 emission rates, we compute Spearman and Pearson correlations between CH_4 emission rates and well attributes and between methane emission rates and meteorological factors. We also perform a Kruskal Wallis ANOVA test to determine if average methane emission rates vary according to categorical well attributes such as status, and producing formation. We conduct repeat measurements on 20 wells to assess seasonal variability in CH_4 emission rates measured in October 2020 and February 2021. We also analyze the concentration of ethane and the stable carbon isotope of CH_4 to determine whether the origin of the emitted gas is thermogenic or biogenic.

Our measurements show that abandoned wells emitting H_2S are some of the highest CH_4 emitters, followed by abandoned unplugged and marginally producing wells. Abandoned plugged and active wells are the lowest CH_4 emitters. Compared to inventory estimates, CH_4 emissions from marginally producing and active wells in Ontario are underestimated by a factor of 2.1, and emissions from abandoned plugged wells are underestimated by a factor of 920. H_2S emissions, currently not included in the Canadian Air Pollutant Emissions Inventory, average at 160 mg H_2S/hour/well.

In terms of parameters affecting CH_4 emission rates, we find a negative correlation between CH_4 emission rates and wells plugging status, where plugged wells emit at a lower rate compared to unplugged wells. The results of the Kruskal-Wallis ANOVA test show that the well plugging status and the well operational status (active, abandoned or marginal) affect CH_4 emission rates. We also find a positive correlation between CH_4 emission rates and the well densities, wells' longitudes and the measurement county (Haldimand or Norfolk) which may be related to geology. We find no correlation between CH_4 emission rates and well ground elevation, Kelly bushing elevation, total depth, latitude, operator, well type, target formation, average daily production volume, well age and plug age. We find negative Spearman correlation with the amount of daily precipitation, and no correlation with temperature, dew point temperature, relative humidity, station pressure and wind speed. Although the average emissions are different between October 2020 and February 2021, the results of the Kruskal-Wallis test indicate no statistical variation in the measurements.

Our findings highlight the importance of conducting measurements from all types of oil and gas wells including H_2S emitting wells to understand H_2S and CH_4 emissions and develop policies to reduce greenhouse gas emissions, improve air quality, and protect human and ecosystem health.

Dan Silber

Elexco

Dan Silber is a New York licensed attorney with a Juris Doctorate, and has been with Elexco for almost thirteen years. He has acquired significant experience in energy, utility and telecommunications projects in the northeast United States, as well as other parts of the United States and Canada. Dan's work on these projects include the acquisition of land rights, preparation of abstracts of title, due diligence, and related project management.

The Elexco Group of Companies consists of several organizations working together to provide unique Land Consulting and Land Administrative services to our clientele in North America. During its 46 years in business, The Elexco Group of Companies has gained the experience and infrastructure to provide development companies with industry-focused solutions to complex land-related issues. The Elexco Group provides comprehensive acquisition, title, mapping due diligence, and administrative services to its various clients. Whether the project requires just a few of our services or the entire suite, we strive for efficient and effective results on any and all assigned tasks.

NOTES

Dan Silber - Abstract

Playing Nice in the Sandbox – multiple energy projects on the same land.

This presentation will assess the relative rights of multiple projects on the same parcel of land. As conventional energy development, energy storage, and renewable energy development continue to cover more land, it is inevitable that two or more projects will seek to secure development rights on the same property. Can the projects co-exist? Most likely, especially where they utilize different areas of the surface and/or different strata. However, the relative rights of the parties will depend on two main factors: (1) which party secured the rights first, and (2) what specific rights were secured.

Block 3 – Industry Developments & History

Allan Phillips
Clinton-Medina Group Inc.

Allan Phillips is a consulting geologist and president of the Clinton-Medina Group. Just weeks after receiving his HBSc degree in Geological Sciences from Brock University he was working as a wellsite geologist in the middle of Lake Erie. Today his career has gone full circle and he is back working on the Paleozoic geology of southwestern Ontario. His career has spanned over four decades and allowed him to explore for oil and gas in several basins in Canada and northeastern United States. In his quest to better understand these complex reservoirs he has logged many miles (kilometres) of core and drill cuttings. Lithologically these rocks have been from traditional reservoirs in clastics and carbonates, to unconventional reservoirs in mudstones and shales. This career path has taken a detour in recent years and the reservoir evaluation studies are now also focused on storage potential. Today he is looking at putting carbon and other products back into underground reservoirs. Most recently he has been able to share his experience and expertise on the carbonate and clastic reservoirs in southwestern Ontario with the next generation of geoscientists as an adjunct research professor at the University of Western Ontario.

NOTES

Allan Phillips - Abstract

Oil Springs and Petrolia, A glimpse at the early years of Canada's Oil Industry

Prior to Confederation, Canada was the world's leading oil producing nation. The "gum beds" in the swampy backwoods of Enniskillen Township in Canada West, saw North America's first wells completed for crude oil production. James Miller Williams had a well dug beneath these surface seeps in the summer of 1858 that was reported to produce oil at a rate of 37 barrels in 10 hours (Gale, 1860). Two significant discoveries followed that would kick off an oil boom in this area. John Shaw's gusher in January 1862 flowed at an estimated rate of 5,000 bopd and turned Oil Springs into a boom town. Four years later Captain Bernard King's 265 bopd oil well pushed the oil rush northwest and expanded the oil play to Petrolia. The early development of the petroleum industry in Canada is drawn from fragmentary records and hence lacks widespread public attention. Just over one hundred years later, a half dozen or so wells were cored and logged in and around these historic oil fields allowing us a closer look at the geology of these early oil reservoirs. In the late fall of 1962, Imperial Oil cut several cores in two key wells in the heart of the original Oil Springs and Petrolia Oil Pools. These cored and logged wells give us a glimpse on the Middle Devonian carbonate reservoirs that hosted this historical oil production.

Situated on the southeastern flank of the Michigan Basin these shallow oil pools produce from the Middle Devonian Dundee and Lucas Formations at drilling depths of less than 500 feet (152m). The Devonian section is draped over deeper Silurian salt remnants forming anticlines that trap oil in the fractured limestones and porous dolomites of the shallower Devonian section. The fractured section over the crest of these salt remnants allowed oil to escape to the surface forming the surface seeps or "gum beds" that attracted attention to this area. The cores show the upper Dundee Formation carbonates to be the poorer of the two reservoirs. On the rare occasion a significant fracture was encountered it gave rise to the famous "flowing wells" or "gushers". The slightly deeper Lucas Formation is the superior reservoir if it is found high enough on the anticline to be above the oil water contact. These medium to fine grained dolostones have excellent porosity with good permeability. The Lucas dolostone reservoir typically hosts the longer lasting oil reserves. Case in point are the wells owned by the Fairbanks family that have been producing oil at Oil Springs and Petrolia for over four generations since 1861.

References

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Bedrock is an Ontario-based initiative that develops Compressed Air Energy Storage (CAES) solutions using proven, reliable technology. Our signature CAES project uses emission-free technology to support a sustainable future for Ontario, storing surplus green energy generated in periods of low demand and releases it back into the grid demand peaks. Bedrock's solution will save Ontarians money, create jobs, and further establish Ontario as a leader in sustainability.

NOTES

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Dr. Walsh is a Professor in Entrepreneurship & Strategy at the Ted Rogers School of Management. Prior to joining academia in 2003, he was an Exploration Geoscientist for a Canadian oil and gas company in Calgary and then in Ontario for a natural gas utility, eventually creating his own consultancy that provided geoscience services, strategic planning and policy services to energy companies, investment fund managers, and a number of governmental and municipal agencies. During that time, Dr. Walsh helped found a number of junior energy companies. He is an Advisor to the Clean Energy Zone at Ryerson's Center for Urban Energy, a researcher with Ryerson's Entrepreneurship Research Institute and the Institute for the Study of Corporate Social Responsibility, and is currently a Visiting Research Fellow at the University of Winchester's Center for Responsible Management. Dr. Walsh is a non-practicing registered professional geoscientist in the Province of Ontario and a member of the Society of Petroleum Engineers, the International Association of Energy Economics, and the Petroleum Exploration Society of Great Britain. He holds a B.Sc. (Hons) in Geological Sciences from Queen's University, an M.B.A from the Ivey School of Business, Western University, and a Ph.D. in Strategic Management from the University of Bradford, U.K. He is a co-author of Corporate Responsibility and Sustainable Development: An integrative perspective and the Canadian edition of the Foundations of Strategy.

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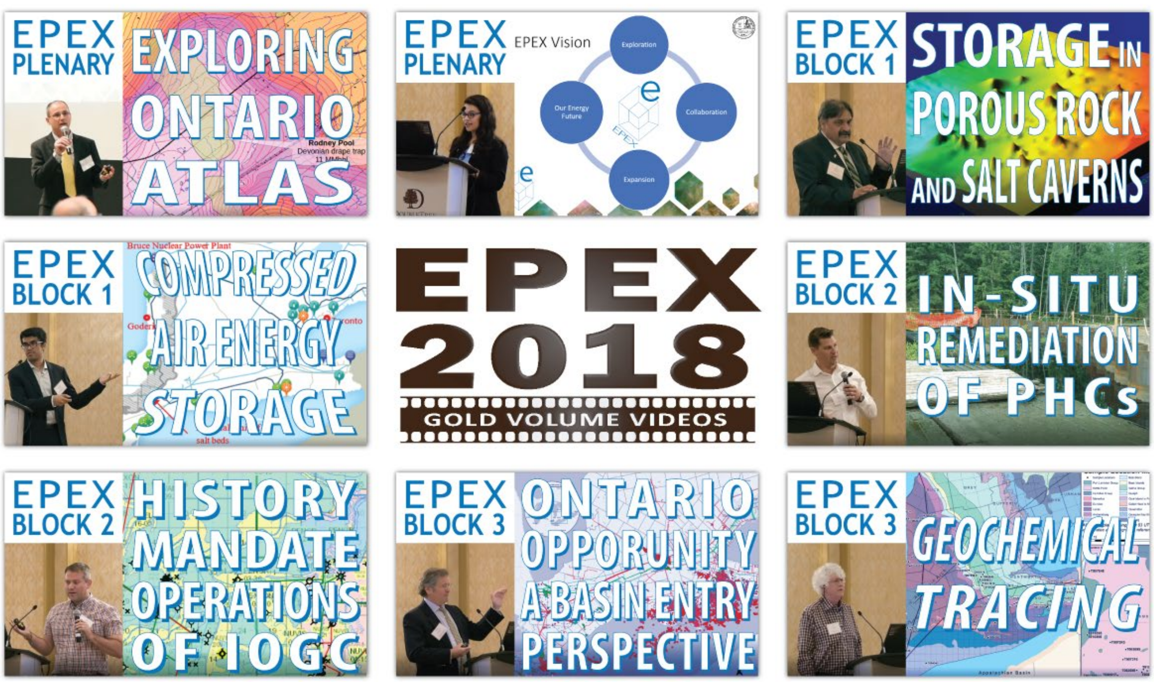

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