



[cspg.org](http://cspg.org)

# THE MONTHLY MAGAZINE OF CANADA'S ENERGY GEOSCIENTISTS

# RESERVOIR

- 15 2017 CSPG Geological Calendar Wrap-up*
- 16 2016 CSPG Summer Student Field Trip - Canyon Creek*
- 17 Ontario Oil and Gas: 4. Unconventional Resource Potential of Ontario*
- 25 The Geology of Wine Tasting*
- 29 2016 Gussow Geoscience Conference*

RETURN UNDELIVERABLE CANADIAN ADDRESSES TO:  
CSPG - 150, 540 - 5th Ave SW Calgary, AB, T2P 0M2

\$4.00  
DECEMBER 2016  
VOLUME 43, ISSUE 11  
Canadian Publication Mail Contract - 40070050

Canada's Energy Geoscientists



# Start your year off right with the 2017 Geological Calendar



**Available NOW for 10 dollars!**

Office: 150-540, 5th Ave SW

Phone: 403.264.5610





cspg.org

# THE MONTHLY MAGAZINE OF CANADA'S ENERGY GEOSCIENTISTS RESERVOIR

DECEMBER 2016 – VOLUME 43, ISSUE 11

## ARTICLES

2017 CSPG Geological Calendar Wrap-up .....	15
2016 CSPG Summer Student Field Trip – Canyon Creek .....	16
Ontario Oil and Gas: 4. Unconventional Resource Potential of Ontario.....	17
The Geology of Wine Tasting .....	25
2016 Gussow Geoscience Conference .....	29

## DEPARTMENTS

Message from the Board .....	5
Rock Shop .....	7
Technical Luncheons .....	8
Division Talks .....	12

### CSPG OFFICE

#150, 540 - 5th Ave SW  
Calgary, Alberta, Canada T2P 0M2  
Tel: 403-264-5610  
Web: www.cspg.org

Please visit our website for all tickets sales and event/course registrations  
Office hours: Monday to Friday, 8:30am to 4:00pm  
The CSPG Office is Closed the 1st and 3rd Friday of every month.

### OFFICE CONTACTS

Membership Inquiries  
Tel: 403-264-5610 Email: membership@cspg.org  
Advertising Inquiries: Kristy Casebeer  
Tel: 403-513-1233 Email: kristy.casebeer@cspg.org  
Sponsorship Opportunities: Lis Bjeld  
Tel: 403-513-1235 Email: lis.bjeld@cspg.org  
Conference Inquiries: Candace Jones  
Tel: 403-513-1227 Email: candace.jones@cspg.org  
CSPG Foundation: Kasandra Amaro  
Tel: 403-513-1234 Email: kasandra.amaro@cspg.org  
Accounting Inquiries: Nancy Mosher  
Tel: 403-513-1232 Email: nancy.mosher@cspg.org  
Executive Director: Lis Bjeld  
Tel: 403-513-1235, Email: lis.bjeld@cspg.org

### EDITORS/AUTHORS

Please submit RESERVOIR articles to the CSPG office.  
Submission deadline is the 23rd day of the month, two months prior  
to issue date. (e.g., January 23 for the March issue).

To publish an article, the CSPG requires digital copies of the  
document. Text should be in Microsoft Word format and illustrations  
should be in TIFF format at 300 dpi., at final size.

### CSPG COORDINATING EDITOR

Kristy Casebeer, Programs Coordinator,  
Canadian Society of Petroleum Geologists  
Tel: 403-513-1233,  
kristy.casebeer@cspg.org

The RESERVOIR is published 11 times per year by the Canadian Society of Petroleum  
Geologists. This includes a combined issue for the months of July and August. The  
purpose of the RESERVOIR is to publicize the Society's many activities and to promote  
the geosciences. We look for both technical and non-technical material to publish.

The contents of this publication may not be reproduced either in part or in full  
without the consent of the publisher. Additional copies of the RESERVOIR are available  
at the CSPG office.

No official endorsement or sponsorship by the CSPG is implied for any advertisement,  
insert, or article that appears in the Reservoir unless otherwise noted. All submitted  
materials are reviewed by the editor. We reserve the right to edit all submissions,  
including letters to the Editor. Submissions must include your name, address, and  
membership number (if applicable). The material contained in this publication is  
intended for informational use only.

While reasonable care has been taken, authors and the CSPG make no guarantees  
that any of the equations, schematics, or devices discussed will perform as expected  
or that they will give the desired results. Some information contained herein may be  
inaccurate or may vary from standard measurements. The CSPG expressly disclaims  
any and all liability for the acts, omissions, or conduct of any third-party user of  
information contained in this publication. Under no circumstances shall the CSPG and  
its officers, directors, employees, and agents be liable for any injury, loss, damage, or  
expense arising in any manner whatsoever from the acts, omissions, or conduct of  
any third-party user.

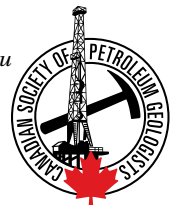
Printed by McAra Printing, Calgary, Alberta.



### FRONT COVER

*Continental Divide at the AB/B.C. Border.*  
Stratified glacial ice of Northover Glacier and Mount Northover.

Monika Silvia Enachescu





# CSPG CORE CONFERENCE

IN CONJUNCTION WITH GEOCONVENTION 2017



18-19 MAY 2017 | AER CORE RESEARCH CENTRE | CALGARY, AB



# Call for Abstracts

## WHAT IS THE CORE CONFERENCE?

If you haven't been to a Core Conference before, you are in for a treat! The conference will be held in the world-class AER Core Research Centre. This facility houses 20 million drill cutting samples of which the committee selects approximately 25 for your viewing. We also ship in Core from other countries. Posters also enhance the Core Conference experience.

Exhibitors provide scheduled talks summarizing their displays and remain with their core to discuss concepts and features. Displays will include both conventional and unconventional plays; siliciclastics, carbonates and evaporates, shales, oil sands, as well as some displays relating to carbon capture technology.

## SUBMIT TODAY

Information on abstract specifications and how to submit can be found online at [www.cspg.org/CoreConference](http://www.cspg.org/CoreConference)

**DEADLINE:**  
**JANUARY 17th, 2017**



cspg.org



# FINANCIAL OVERVIEW OF THE CSPG 2016 FISCAL YEAR

By Scott Leroux

## CSPG BOARD



**PRESIDENT**  
Greg Lynch • Shell Canada Ltd.  
president@cspg.org Tel: 403.384.7704



**PRESIDENT ELECT**  
Mark Cooper • Sherwood Geoconsulting Ltd.  
presidentelect@cspg.org



**PAST PRESIDENT**  
Tony Cadrin  
pastpresident@cspg.org



**FINANCE DIRECTOR**  
Scott Leroux  
directorfinance@cspg.org



**FINANCE DIRECTOR ELECT**  
Shelley Leggitt • NAL Resources Ltd.  
directorfinanceelect@cspg.org



**DIRECTOR**  
Mark Caplan  
conferences@cspg.org



**DIRECTOR**  
Jen Russel-Houston • Osum Oil Sands Corp.  
jrusssel-houston@osumcorp.com Tel: 403.270.4768



**DIRECTOR**  
Eric Street • Jupiter Resources  
estreet@jupiterresources.com Tel: 587.747.2631



**DIRECTOR**  
John Cody • Statoil Canada Ltd.  
industryrelations@cspg.org



**DIRECTOR**  
Ryan Lemiski  
yppg@cspg.org



**EXECUTIVE DIRECTOR**  
Lis Bjeld • CSPG  
lis.bjeld@cspg.org Tel: 403.513.1235

The CSPG 2016 fiscal year ran from September 1, 2015 through to August 31, 2016.

From bad to worse. It is a simple, yet accurate way to summarize the latest year for not only the CSPG, but our entire industry. 2016 has been one of the toughest years in decades (not seen since the 1980s) and the decline has been felt across almost every facet of our society. It has not been the easiest year to assume the role of Finance Director, however I have learnt a lot in these challenging times and have enjoyed working with an exceptional team both in the office and on the volunteer board.

The CSPG has had another tough year, however, thanks to years of profits, savings, and the wisdom of past executives and staff we are still in sound financial shape for 2017. We are budgeting again for another loss but we will make it through to the other side and continue to thrive.

As the executive warned in our June Reservoir issue, we were tracking a loss greater than the \$306,048 approved by the board of directors last year. Our audited financials show that the estimated loss was \$ 407,863 compared to a loss of \$229,126 in 2015 fiscal year. Savings during profitable years has positioned the CSPG with an Internally Restricted Rainy Day fund of \$1.02 MM and an unrestricted fund of \$ 756K at year end. Our portfolio continues to be conservatively invested with an asset mix of approximately 80% Fixed Income and 20% Equities. Operationally, we brought in \$1.3 MM in Revenue (down from \$1.9 MM last year) and had \$1.7 MM in Expenses (also down from \$2.2 MM in 2015). Most of this year's budget shortfall was the result of, a GeoConvention Partnership loss of ~\$12,000 and a minimum pre-negotiated profit from the ACE conference. In most years, both events would have been huge income generators; however, this year

they both tracked well under the budgeted predictions (the CSPG did not operate either event). Other factors that severely affected the budget was lower attendance at all of our events, reduced sponsorship as well as a declining membership. Overall, total membership numbers have declined again this year by 20% while the "in transition" number is up dramatically from 2015 (from 37 to 251). On a positive note, student membership is up 10% from last year. We have made operational cuts to minimize our losses and this year the CSPG will not be making a contribution to the CSPG Foundation. As in previous years, our fully audited Financial Statements will be available on the cspg.org website by the end of November.

Since the CSPG is a Not-For-Profit society our success is not measured by our profits. It always good to remind ourselves that we are a Technical Society and that the mission of the CSPG is to **advance the professions of the energy geosciences – as it applies to geology, foster the scientific, technical learning and professional development of its members; and promote the awareness of the profession to industry and the public.** We believe that we have done an excellent job adhering to our mandate and don't mind running a deficit in the lean years as our profits in the good years are typically higher than our deficits. It is the work of our volunteers and the success of all the events that defines who we are as a society. Some highlights of our activities from 2016:

- 10 Technical Luncheons, Fall and Spring Education Week & a Gussow Conference on Fine Grained Reservoirs
- The GeoConvention Partnership ran GeoConvention for the second year (partnered with the CSEG and CWLS)
- The CSPG partnered with AAPG for ACE

(Continued on page 6...)



cspg.org

**CORPORATE SPONSORS**

**SAMARIUM**  
CSPG Foundation

**DIAMOND**  
geoLOGIC systems ltd.

**TITANIUM**  
Alberta Energy Regulator  
Tourmaline Oil Corp.  
AGAT Laboratories

**PLATINUM**  
University of Calgary  
Weatherford Canada Partnership

**GOLD**  
Imperial Oil Resources  
Progress Energy Ltd.

**SILVER**  
Repsol Oil and Gas Canada Inc.  
MEG Energy Corp.  
Nexen ULC  
Core Laboratories  
Shell Canada Energy

**BRONZE**  
Geomodeling Technology Corp.  
Schlumberger Canada Ltd.  
Chinook Consulting Services  
Seitel Canada Ltd.  
Canada Brokerlink Inc.  
Husky Energy Inc.  
Belloy Petroleum Consulting  
MJ Systems  
Murphy Oil Company Ltd.  
Tony Cadrin  
Tuya Terra Geo Corp.  
Geoscience BC

As of November 9, 2016

**MESSAGE FROM THE BOARD**

where it made its once/decade stop here in Calgary. The CSPG ran the very successful International Core Conference following the meeting.

- 4 sporting events
  - ♦ Road Race & Fun Run, Squash Tournament, Mixed Golf and Classic Golf Tournaments

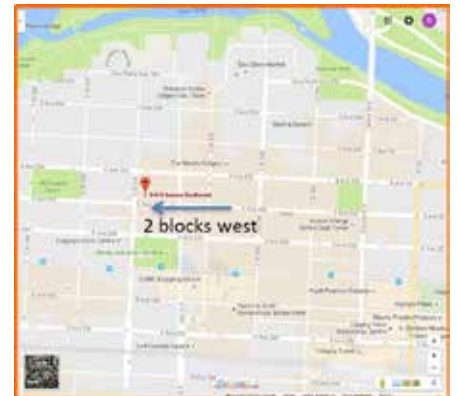
Looking forward into the 2017 Fiscal Year we are looking at ways to further adapt to the challenging environment we are in.

Many of the changes/savings instituted in 2016 will be fully realized in the upcoming year, which included office staff reductions, Technical Luncheon venue changes and the recent office move. Shelley Leggitt will be assuming the Finance Director role in 2017 and will continue to keep a watchful eye on the bottom line as we look forward towards the light at the end of the tunnel. 🍁

# WE'RE MOVING!

The CSPG office is relocating to:

Suite 150 - 540,  
5th Ave SW  
Calgary, AB T2P 0M2



*The office move will be taking place during the beginning of December.*

Check [www.cspg.org](http://www.cspg.org) for more information on potential service interruptions



# Rock Shop

It's always better to be  
part of a group.

Ask us about our preferred rates for members.  
Call us today for a free insurance quote.

1.855.771.9438

BrokerLink.ca



Services available in Alberta through Canada BrokerLink Inc.™ BrokerLink & Design is a trademark of Canada BrokerLink Inc. used under license. © Copyright 2016 Canada BrokerLink Inc. All rights reserved.



**PROGEO**  
LAB & ANALYTICS

PETROGRAPHY AND THIN-SECTION ANALYSIS / X-RAY  
FLUORESCENCE - IN LAB AND PORTABLE / X-RAY DIFFRACTION /  
CORE & SAMPLE STUDIES / RESERVOIR CHARACTERIZATION

info@ProGeoConsultants.com  
ProGeoConsultants.com 403-262-9229

## Moh & Associates

**Oilfield consultants Ltd.**

Since 1980

Moh Sahota, B.Sc (Hons), M.Sc.  
President  
Ph: 403.263.5440  
Email: info@mohandassociates.com

Geological Consulting Services for 35 years  
Wellsite geological supervision and coring  
Geo-steering, Petrographic and Sample Studies  
Conventional & Heavy Plays | SAGD Projects  
*Domestic and International Operations*  
[www.mohandassociates.com](http://www.mohandassociates.com)



**T.I.H. Consulting Ltd.**

Geologic Well-Site  
Supervision

1602 – 5<sup>th</sup> St N.E.  
Calgary, AB. T2E 7W3  
Phone: 403-233-7729  
[www.tihconsulting.com](http://www.tihconsulting.com)  
e-mail: tih@shaw.ca

## Independant Wellsite Consultants

Highly Skilled Competent Consultants  
Extensive Industry Experience (18 yrs +)  
Wellsite & Remote Supervision & Geosteering  
All Types of Conventional & Unconventional Wells  
Core, Chip Samples & Thin Section Studies  
International & Domestic

Email: indwellcons5@gmail.com Tel: (403) 540-8496

**Advertise HERE!**

**Contact us today!**

Email: [Kristy.casebeer@cspg.org](mailto:Kristy.casebeer@cspg.org)

phone: 403.513.1233

# 2016 HONORARY ADDRESS LUNCHEON

## Managing the Earthquakes Risk Associated with Oil & Gas Development and CO<sub>2</sub> Sequestration

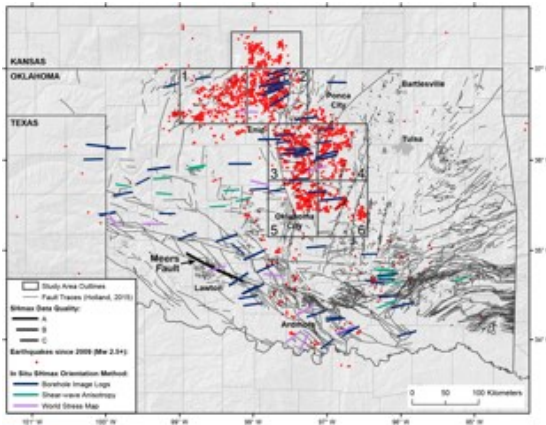
Mark D. Zoback | *Professor of Geophysics Stanford University*

DECEMBER 13TH | TELUS CONVENTION CENTRE

**Member Price: 50.00**

**Non-Member Price: 55.00**

*\*Price Includes Holiday Social*



No state has experienced more seismicity associated with oil and gas activities than Oklahoma. We have shown that the increases in seismicity in Oklahoma are due to very large increases in the volume of produced water being injected into a deep saline aquifer laying immediately above crystalline basement. In this talk I will review the seismicity associated with oil and gas development in the central and eastern U.S., outline steps that can be taken to significantly reduce the risks associated with them.



### **Biography**

Dr. Mark D. Zoback is the Benjamin M. Page Professor of Geophysics at Stanford University and Director of the Stanford Natural Gas Initiative. Dr. Zoback conducts research on in situ stress, fault mechanics, and reservoir geomechanics with an emphasis on shale gas, tight gas and tight oil production. He currently directs the Stanford Natural Gas Initiative and is co-director of the Stanford Center on Induced and Triggered Seismicity. He is the author of a textbook entitled Reservoir Geomechanics published in 2007 by Cambridge University Press and the author/co-author of over 300 technical papers. Dr. Zoback was the founder of GeoMechanics Intl., a software and consulting company that was acquired by Baker Hughes in 2008.

*\*\*\*Full Biography available online*





Join us prior to the Honorary Address Luncheon for the annual

# *geoLOGIC Holiday Social*

Wine & Appetizers 10:30-11:30  
Honorary Address Luncheon 11:30 - 1:00



## A Geoscience Outreach Exhibition

- ✓ OPEN TO THE PUBLIC
- ✓ HANDS ON EXPERIENCE
- ✓ FAMILY FRIENDLY
- ✓ FREE ADMISSION

**March 19-21, 2017**  
**Big Four Building**  
**Stampede Park**

Sunday, March 19  
11:30 am – 5:00 pm

Monday, March 20  
8:45 am – 2:45 pm

Tuesday, March 21  
8:45 am – 2:45 pm

Earth Science for Society (ESFS) is a fun, educational, and dynamic geoscience outreach event in which students, families, youth groups, and the public are given an opportunity to explore Earth Science fundamentals. Visitors will enjoy a variety of interactive activities, including gold panning and a fossil hunt.

- Panning for Gold with Yukon Dan
- Fossil Station
- Scavenger Hunt



Join us on Sunday March 19<sup>th</sup>, when the Geo-Theatre will showcase a variety of Geoscience talks!

For more information or to volunteer go to [esfscanada@gmail.com](mailto:esfscanada@gmail.com) or [esfscanada.com](http://esfscanada.com)

Hosted by:



# FROM THE ARCHIVES



1975

Jack and Kaye Pullen show off the good ol' days



Linda Shepheard and Alasdair Fergusson obviously enjoying the band



Left: 2016 ACE Social at the Glenbow Museum  
Below: 2003 Mixed Golf Tournament



CSPG's mission to advance the professions of the energy geosciences is the key driver of our Society, but that's never stopped CSPG members from having fun! From Gala dinners to drinking around the fire, from golf tournaments to dance parties, CSPG has always been a great place to meet people and have a great time!



1976 Party, with Clay Riddell, Mike Chernoff and Roy Stewart



2005 Gala Dinner in the Calgary Tower



1976 Dessert table



Check out all the different glasses on the table at the 1980s era party



2006 Core Meltdown



UPDATE '75 BARBEQUE

... and some serious business to be taken care of!



# Rum Smugglers and Runoff: How Salinity Stress Affects Neo-Ichnology in a Microtidal Estuary

**SPEAKER**

Anton Wroblewski, ConocoPhillips

**11:45 am**  
**Thursday, January 12th, 2017**  
**Marriott Hotel |**  
**Kensington Ballroom**  
**Calgary, Alberta**

**Please note:** The cut-off date for ticket sales is 1:00 pm, five business days before event. [Thursday January 05, 2017]. CSPG Member Ticket Price: \$45.00 including GST. Non-Member Ticket Price: \$55.00 including GST.

Each CSPG Technical Luncheon is 1 APEGA PDH credit. Tickets may be purchased online at [www.cspg.org](http://www.cspg.org)

**ABSTRACT**

The combined Trinity-San Jacinto-Galveston Bay (TSGB) complex is a microtidal, wave-dominated estuary along the Texas coast that provides an excellent opportunity to examine the relative influences of freshwater runoff, tidal circulation, storm events, and sedimentation on incipient traces. The TSGB conforms to proposed ichnological models of microtidal estuaries in some aspects, but includes some novel and unexpected features. While the average size of burrow diameters decreases with proximity to areas of freshwater fluvial input, ichnotaxonomic diversity does not. This is because during periods of drought and minimal freshwater discharge, salinity can reach 12-15 ppt on the Trinity bay head delta, allowing colonization by *Lepidophthalmus* (mud shrimp), *Taegelus* (razor clams), and a variety of crabs, bivalves, and polychaetes which construct incipient *Siphonichnus*, *Ophiomorpha*, *Thalassinoides*, *Skolithos*, *Polykladichnus*, *Psilonichnus*, *Cylindrichnus*, *Paleophycus*, *Arenicolites*, and *Planolites*. When freshwater runoff increases, as it did dramatically during the spring of 2016, catastrophic stress extirpates most of the benthic organisms that are not tolerant to such hostile physicochemical conditions. Sampling in March, 2016 resulted in the



recovery of only dead bivalves (*Taegelus*) and empty shrimp and crab burrows, although polychaetes (especially *Glycinde* and *Glycera*) were still present in the 0 ppt waters of the delta front. Populations of crustaceans and bivalves will rebound as salinity levels rise again, but the next episode of extreme freshwater runoff will result in another mass death. Sediment accumulation rates are slow enough that these repeated colonization/extirpation events result in moderate to high bioturbation indices and a moderate to high diversity of traces in the delta front deposits. If viewed in the rock record, the Trinity bay head delta might be interpreted as a more open-coast delta, and the full magnitude of its annual and semi-annual salinity fluctuations could easily be lost in the ichnological signal. The opening of Rollover Pass (a manmade tidal inlet where smugglers used to roll barrels of whisky and rum across the narrowest portion of the barrier spit) on Bolivar Peninsula in 1955 has resulted in an increase in average salinity in the southeast corner of East Galveston Bay, but its influence does not reach the main body of Trinity Bay, or the delta. These observations suggest that bay head deltas in microtidal estuaries can be more complex and difficult to recognize

than previous studies have indicated.

**BIOGRAPHY**

Anton Wroblewski got his PhD in clastic stratigraphy and sedimentology from the University of Wyoming (2002) and moved to Chicago, where his wife attended grad school at U of C, and he worked first as a barista, then as an undergrad lecturer at Northeastern Illinois University. In 2006, he joined ConocoPhillips in Houston as a stratigrapher in Upstream Technology and has since worked in exploration, and currently Applied Geosciences. His specialty is shallow marine and fluvial clastic systems, with a helping of ichnology on the side and he is currently working on Canadian Oil Sands, Rocky Mountain tight reservoirs, Alaskan deltaic reservoirs, and anything else that comes down the pike.🌸



## GEOMODELLING DIVISION

### *A Framework for Assisted History Matching and Robust Optimization of Low Salinity Waterflooding under Geological Uncertainties*

#### SPEAKER

##### Zhangxing John Chen

Professor, NSERC/AIEES/Foundation  
CMG Chair and AITF (iCORE) Chair  
Director, Foundation CMG/Frank-  
Sarah Meyer Collaboration Centre  
Director, Global Initiative in Research on  
Unconventional Oil and Gas: Beijing Site  
Department of Chemical &  
Petroleum Engineering  
University of Calgary, AB T2N 1N4, Canada  
[http://schulich.ucalgary.ca/  
profiles/zhangxing-john-chen](http://schulich.ucalgary.ca/profiles/zhangxing-john-chen)  
<http://ucalgaryreservoirsimulation.ca/>

**Joint work with Cuong Dang, Long  
Nghiem, Ngoc Nguyen, Chaodong  
Yang and Quoc Nguyen**

**Time: 12:00 Noon**

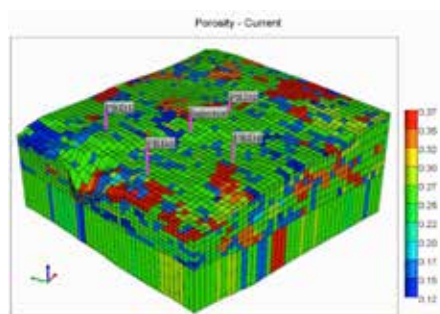
**Date: Tuesday, Dec. 6th, 2016**

**Location: Husky Conference Room  
A, 3rd Floor, +30 level, South Tower,  
707 8th Ave SW, Calgary, Alberta**

#### ABSTRACT

Low Salinity Waterflooding (LSW) is an emerging Enhanced Oil Recovery (EOR) method that is simple to implement and has been shown to yield a substantial increase in oil recovery over conventional waterflooding, especially in oil-wet sandstone reservoirs. The major mechanism for increased oil recovery is a wettability change from oil-wet to water-wet, which is induced by ion exchange between the injected fluid and the clay surface.

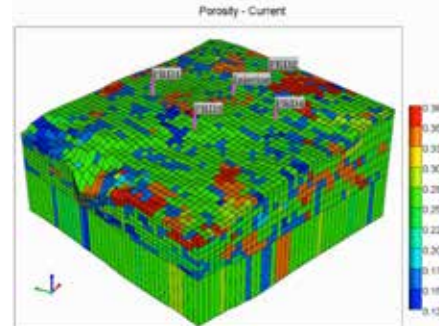
This talk presents a framework for field scale modeling, assisted history match, and robust optimization of LSW under geological uncertainties that has rarely been discussed in the past. To handle this complex recovery process, a comprehensive ion-exchange model has been implemented, fully coupled with geochemistry specially designed for the modeling of LSW physical phenomena in an EOS reservoir simulator. This model is capable of accounting for the critical role of



the properties, quantity, and distributions of clay minerals.

A systematic study has been performed to evaluate the critical effects of geology on large scale LSW performance. Numerous geostatistical realizations of a five-spot LSW pattern have been generated to evaluate the effect of clay on LSW. The numerical simulation results indicate that LSW's performance depends critically on the reservoir geological characteristics. Based on the integrated modeling approach presented, multiple geological realizations can be automatically generated from a large-loop approach that is needed for fast and accurate HM (history matching) and optimization of LSW. The key parameters for successful field scale LSW HM include: clay distribution/quantity associated with different facies, relative permeability modification, wettability alteration thresholds, reservoir minerals, geochemical reactions, and operating conditions. More importantly, LSW HM by tuning reservoir parameters may only lead to poor prediction results, while the integrated modeling approach provides much better forecasting results to true history data.

Finally, a new concept for LSW robust optimization under geological uncertainty is introduced and demonstrated with reservoir simulation. As there are uncertainties associated with the geological modeling of the clay distribution, this talk shows how robust optimization can be applied to reduce uncertainties in the LSW optimization through well placement



#### BIOGRAPHY

Dr. Zhangxing (John) Chen is a Professor in the Department of Chemical and Petroleum Engineering, currently holds the AITF (iCORE) Industrial Chair in Reservoir Engineering and NSERC/AI-EES/Foundation CMG Industrial Research Chair in Reservoir Simulation and is Director, iCentre for Simulation & Visualization, University of Calgary. His Ph.D. (1991) is from Purdue University, USA. He was a professor and reservoir engineer at Xi'an Jiaotong University, Peking University, University of Minnesota, Texas A&M University, Mobil, and Southern Methodist University (SMU).

He held the Gerald J. Ford Professorship at SMU, Dallas, Texas, USA. Other significant appointments include Director of the Center for Scientific Computation, SMU, Director of the Center for Advanced Reservoir Modeling and Simulation, Peking University, and President of the Chinese Association of Science and Technology in Texas. He has published and/or edited 15 books and 556 research papers, and has given over 346 invited (plenary and keynote) presentations worldwide. He has received numerous prestigious awards such as NSERC's Synergy Award for Innovation, The Outstanding Leadership in Alberta Technology Award, IBM Faculty Award, Imperial Oil University Research Award and Gerald J. Ford Research Fellowship Award. His research interest is in Reservoir Engineering and Numerical Reservoir Simulation for conventional and unconventional oil and gas reservoirs. 🍁

# INTERNATIONAL DIVISION

## The Wildest Plays on the Planet

**SPEAKER**

Jon Noad, Sedimental Services

**Time: 12:00 Noon**

**Date: Wednesday,  
December 14, 2016**

**Location: Buzzards,  
140 10 Ave SW Calgary AB**



**ABSTRACT**

The vast majority of the world's hydrocarbons have historically been discovered in what are termed conventional settings. These are often structural closures into which oil or gas has migrated, becoming trapped in layers of porous, reservoir sandstone or limestone beneath an impervious cap rock. Stratigraphic traps in which similar reservoirs are encased in shales make up a smaller proportion of successful hydrocarbon plays, and in recent years we have seen the rise of a variety of unconventional plays. But beyond these accumulations lies a subset of truly "unconventional", simply wacky plays, where the geologist definitely needs an open mind to appreciate the "wildest plays on the planet".

Let yourself be carried away by crazy plays

ranging from those hosted in granitic, volcanic or metamorphic basement, to those contained within astroblemes and craters. Other unusual reservoirs include hydrates, diatomites, diapirs and glacial deposits. Unexpected traps such as caves, synclines and the craters mentioned above are complimented by seals that include tills, tar mats and lava flows. There are also a variety of commercially viable, non-hydrocarbon gases: helium, nitrogen and carbon dioxide to name but three, all of which can be produced directly from the subsurface. There are even a few gas-related animal sacrifices to share. These are the kind of plays that would have your manager laughing you out of the room, yet they host some of the world's largest hydrocarbon reserves. See this talk and I guarantee that you will gain new insights into ways to think waaaay "outside the box" when you get back to the office.

**BIOGRAPHY**

Jon is an exploration geologist with 18 years of experience in the oil industry. After graduating in 1985, he worked for five years in South Africa as a mining geologist, and then as a marine geologist, analyzing cable routes, leading to an MSc and PhD. in Sedimentology, the latter working in eastern Borneo on shoreface systems and fossil mangroves.

He then joined Shell International, exploring across the Middle East before moving to Canada in 2006. He was with Shell Canada, then with Murphy Oil as Exploration Manager, before joining Husky as Geological Specialist in 2012. Since February this year he has worked as a geological consultant and trainer at Sedimental Services. Outside the office he loves running, rocks and experimenting with cooking very spicy dishes. 🍁

Canada's Energy Geoscientists



## 2017 Membership Renewal

**Many CSPG memberships expire December 31\***

Watch your email for a link to renew online



*\*membership is on an annual, individual basis; you may have a different expiry date\**

# STRUCTURAL DIVISION

## A Festive Look at Fractures and Fracing “The Fractures Strike Back”

**SPEAKER**

Dr. Steve Rogers, Golder Associates

**Date: Wednesday, December 14, 2016**  
**Location: Schlumberger, Second Floor of the Palliser One Building, 125 9th Ave. Calgary T2G 0P6**

**ABSTRACT**

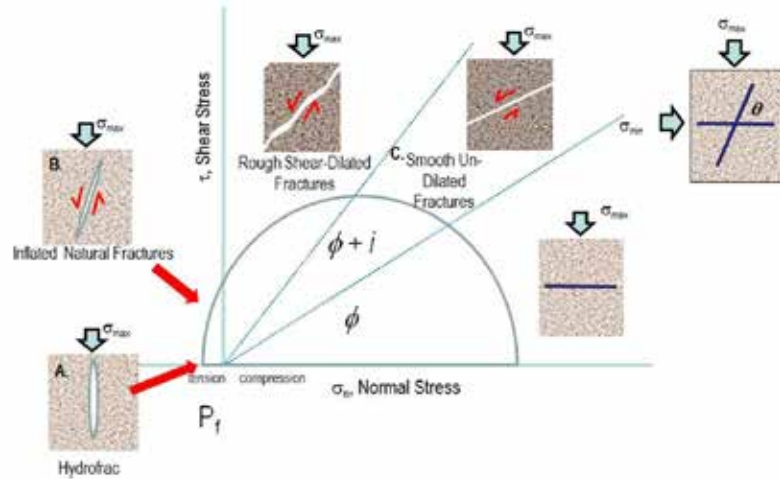
Some people think fractures are important in Shale plays, others definitely not. But as the fractures can't speak for themselves, Steve is going to provide some evidence and thoughts in support of fractures and other structures and their role in both influencing the actual stimulation and subsequent production. Can we find some common ground? He'll take a look at a very efficient Discrete Fracture Network (DFN) based approach to simulating hydraulic fracturing and how we can easily identify the different components of the stimulation including the

hydraulic fracture, propped natural features and shearing structures.

**BIOGRAPHY**

Dr Steve Rogers is a principal consultant at Golder Associates specialising in the characterisation and modelling of both naturally and hydraulically fractured reservoirs. He has a degree in Geology from Keele University and a PHD in Rock Mechanics from the University of Nottingham, both in the UK. He initially worked for the British Geological Survey

working primarily on the UK radioactive waste disposal programme, characterising the fractured basement host formations. Since 2000 he has worked for Golder Associates both in the UK and Canada, helping operators understand the behaviour of fractured reservoirs and has considerable expertise in the application of Discrete Fracture Network (DFN) modelling to reservoir problems. He has worked on projects in Western Canada (including the Horn River and the Montney), The US, Europe and the Middle East. 🇨🇦



# 2017 CSPG Squash Tournament

## Registration Open!

**When:** February 2-4th, 2017  
**Where:** Bow Valley Club | 250 6 ave SW Calgary

**For more information and to register online go to [www.CSPG.org](http://www.CSPG.org)**

**Registration deadline is**  
**Wednesday January 25th @4:00pm**



## 2017 CSPG Geological Calendar Wrap-up

Markus Ebner

**Y**ou will find the 2017 CSPG Geological Calendar is included in December's issue of *The Reservoir*. This annual favorite is a collection of 12 amazing geological images that have been contributed from our society's members. Interest in this project seems to keep growing year after year. This year our members submitted a total of 145 pictures for judging - no easy task narrowing it down to 12 finalists.

The 2017 Calendar is sprinkled with content from all corners of the globe. The cover photo (voted Best Photo) by Wes Waddell, gives us an amazing aerial shot on home soil of Virginia Falls, N.W.T. Far flung locals such as Zekai Jia's photo of Mt. Qomolangma National Park, Tibet, highlight striking fold geometries while perennial contributor, Mike Lam, gives us an otherworldly image of the Emerald Lakes from Tongariro National Park, New Zealand. This year's subcategory of Best Mineral (micro or macro) Photo was well appointed with many quality entries, making the final judging difficult. The winner of the 2017 sub category is Jim Renaud with his microphotograph of fossiliferous limestone of the Georgian Bay Formation from Manitoulin Island.

I would like to thank Clint Tippett for his help on the judging committee for the



Best Photo Winner - Wes Waddell

selection of this year's winners as well as his role in the editing of the geological descriptions and final product. Emma MacPherson, our Publications Coordinator, is thanked for making this project come together year after year.

The continual increase in quality submissions from our members has allowed us to keep on producing better

calendars year after year. We would not be able to have such a great calendar without the time and efforts our members take to submit their work, and we thank you for that. We hope that you are all pleased with the 2017 CSPG Geological Calendar and wish that it gives inspiration to continue to capture the beauty of the geological world around you in the year ahead. Enjoy! 🍁



December 31 is the deadline for making a charitable contribution for the year. Support programs that inspire and advance education, foster technical excellence and encourage awareness of petroleum geoscience; make a donation to the CSPG Foundation today to ensure you receive your charitable tax benefit for 2016.

Visit [www.cspg.org/foundation](http://www.cspg.org/foundation) and click **DONATE NOW.**

## 2016 CSPG Summer Student Field Trip – Canyon Creek

Jane Marzetti & Chad Glemser, University Outreach

This year's CSPG Summer Student Field Trip was led by Murray Gilhooly (Husky Energy) and John Weissenberger (ATW Associates). The field trip ran on Tuesday, July 12 to Canyon Creek - Moose Mountain area in the foothills southwest of Calgary near Bragg Creek. 16 students attended the field trip that consisted of learning about the Mississippian depositional environment with relation to the regional paleogeography, sequence stratigraphy, lithofacies and hydrocarbon importance. The trip consisted of a short hike up the Canyon Creek road to examine outcrops of Mississippian-aged carbonates belonging to the Turner Valley, Pekisko, Shunda and Banff Formations. At each stop students were briefed on the fundamentals of Mississippian carbonates and asked to work in groups to describe the outcrops. Thin-section photos and a photopan of the outcrop were provided to assist the students with determining the correct lithofacies, potential reservoir quality and interpretation of sequence stratigraphic surfaces. At the end of the day, the field trip was wrapped up with a log interpretation exercise to illustrate the facies associations observed and correlation between outcrop descriptions with those from core and wireline taken from a nearby well. In the



afternoon, however, a thundershower rolled through the area soaking all involved. It did cut the last remaining outcrop visit short, but everyone used the time to network and ask any questions they may have had from earlier in the day. Thank you very much to Murray Gilhooly and John Weissenberger for volunteering their time. They led an excellent field trip and provided everyone with a comprehensive overview of the Mississippian carbonate system in Western North America through well illustrated poster displays and personal expertise. Thank you to the CSPG Foundation for providing financial support and to all of the students who participated. 🍁





# ONTARIO OIL AND GAS:

## 4. Unconventional Resource Potential of Ontario

Phillips, A.<sup>1</sup> ; Carter, T.R.<sup>2</sup>; Fortner, L.<sup>4</sup>; Clark, J.<sup>5</sup>; Hamilton, D.<sup>2</sup> ; Dorland, M.<sup>3</sup>; Colquhoun, I.<sup>2</sup>

<sup>1</sup> Clinton-Medina Group Inc., Calgary, AB,    <sup>2</sup> Geological consultant, London, ON  
<sup>3</sup> Geological consultant, Woodstock, ON    <sup>4</sup> Ontario Ministry of Natural Resources and Forestry, London, ON  
<sup>5</sup> Ontario Oil, Gas and Salt Resources Library, London, ON

### Introduction

This paper is the fourth of a four-part series. Part 1 summarized the exploration, production and geology of southern Ontario. Part 2 summarized the conventional oil and gas plays of the Cambrian and Ordovician strata of southern Ontario. Part 3 described the conventional oil and gas plays in the Silurian and Devonian strata of southern Ontario. This paper will provide a review of the unconventional resource potential of Ontario.

Ontario, or more correctly, Canada West prior to Confederation, was an unconventional oil producer as early as 1859. The Craigeith Oil Shale Works began production in a quarry outside Collingwood and would produce up to 1000 gallons a day of lamp and lubricating oils from 30-35 tons of black Ordovician shale in cast-iron retorts (Dabbs, 2007). The discovery and development of conventional oil production from the Oil Springs and Petrolia Oil Pools in Lambton County, 200 miles to the southwest, proved cheaper and the oil shale operation closed down in 1863.

On the south shore of Lake Erie in Fredonia,

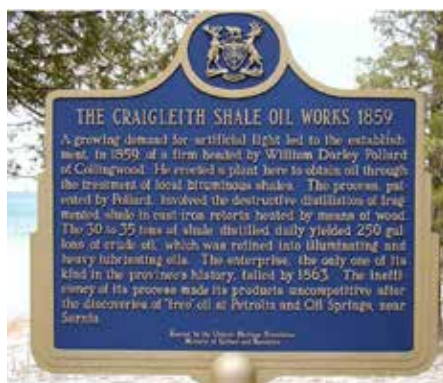


Figure 1. Ontario Heritage Foundation roadside marker near the gate of Craigeith Provincial Park.

New York, natural gas was being produced from shale 38 years earlier in 1821 (Curtis, 2002). William Hart dug a 27 foot well into the Devonian shales along Canadaway Creek and by 1825 the natural gas was supplying light for two shops, two stores and a grist mill (Harper and Kostelnik, 2007). These two early discoveries proved the existence of unconventional oil and gas production in the area. By the 1860's cheaper conventional oil and gas production became the dominant product and it would be over 100 years before unconventional resources would come back into the picture.

In late 1982 the Ontario Geological Survey (OGS) initiated the Oil Shale Assessment Project to evaluate the resource potential of Ontario's Paleozoic black shales. The multi-phase project saw the drilling of core holes in the Province through the 1980's with additional drilling and testing continuing to the current decade. The Geological Survey of Canada (GSC) has also published a preliminary inventory of Shale Gas possibilities in Canada which included seven organic-rich units in Ontario (Hamblin, 2006). These efforts, in

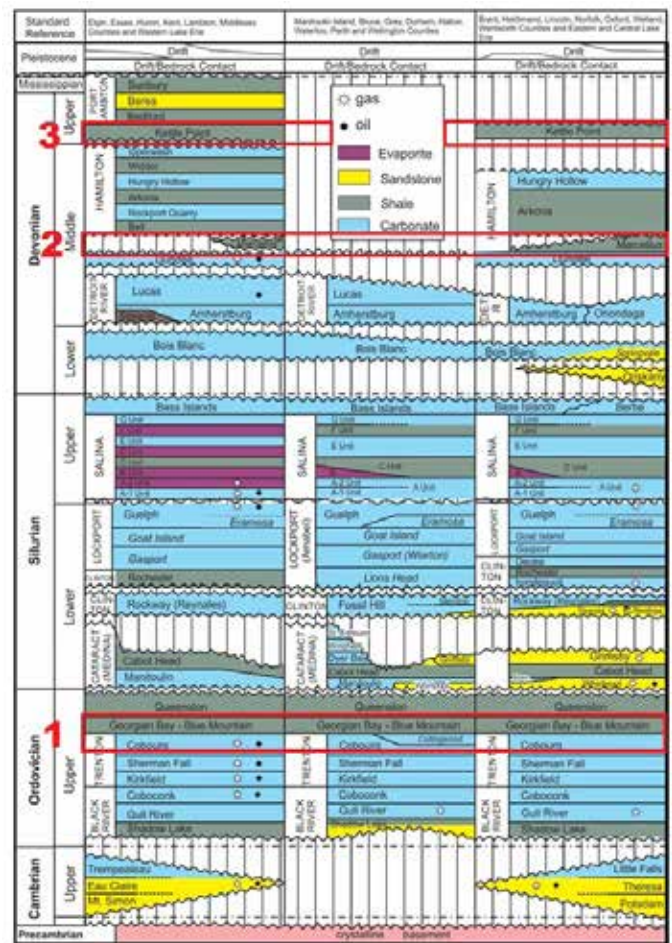


Figure 2: Stratigraphic columns of southern Ontario with highlighted organic-rich black shale intervals. Modified from Armstrong and Carter (2010).

combination with recent shale oil and gas discoveries in surrounding jurisdictions (Pennsylvania, Quebec, Ohio and Michigan) in the Appalachian and Michigan Basins has re-focused attention to Ontario's unconventional potential. Three of those units in southern Ontario will be examined herein; the organic-rich black shales and mudstones of the Ordovician Collingwood-

(Continued on page 19...)



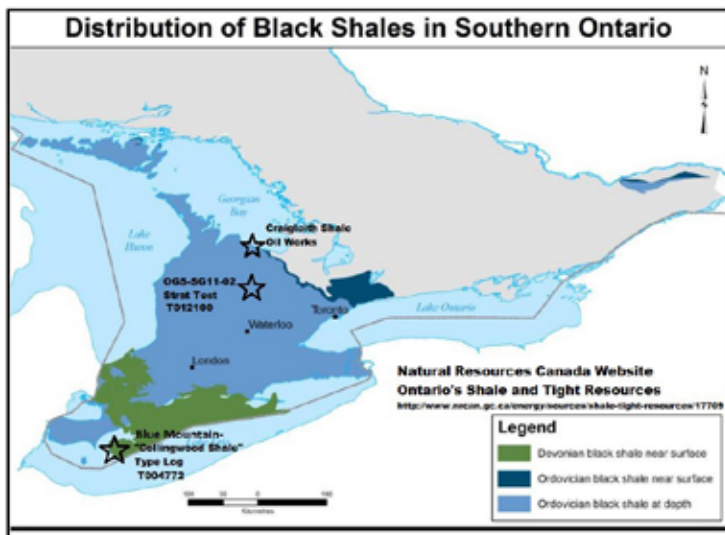


Figure 3: Ordovician black shale distribution (blue) in Southern Ontario. (NRCAN website)

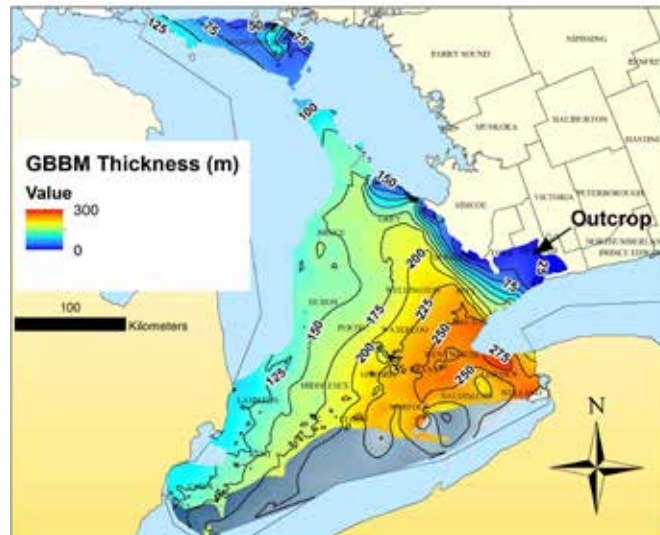


Figure 4. Isopach of the combined Georgian Bay and Blue Mountain (GBBM) formations, showing thickening from northwest to southeast into the Appalachian Basin. Organic-rich facies of the Rouge River Member comprise only the lowermost 2 to 50 metres, also thickening to the southeast.

Blue Mountain (Utica), the Devonian Marcellus, and the Devonian Kettle Point formations (Figure 2).

**Ordovician Collingwood-Blue Mountain “Utica”**

The black, organic-rich upper Ordovician shales and mudstones that overlie the Trenton-Black River carbonates in southwestern Ontario have a complicated nomenclatural history (Armstrong and Carter 2010). The widespread dark grey to black shales seen in oil and gas wells in the subsurface traditionally was called the Collingwood Shale (Sanford, 1961). Those working the outcrop belt and shallow subsurface consider only the transitional shaly limestone section at the top of the Trenton-Black River carbonates to be the Collingwood Member of the Lindsay Formation (Russell and Telford, 1983). The Lindsay Formation is the outcrop equivalent of the Cobourg Formation (Armstrong and Carter, 2010). The thick dark-coloured organic shales above would be the lower part of the Blue Mountain Formation. Recent work by the Ontario Geological Survey (Russell and Telford, 1983; Béland-Otis, 2012) and Sweeney (2014) place these shales into the Rouge River Member of the Blue Mountain Formation. Regardless of which name

is used these shales all form part of the distal portion of the larger “Utica Black Shale Magnafacies” (Lehmann et al, 1995; Hamblin, 2006). These organic-rich strata were deposited under anoxic conditions prior to and during initial deposition of the upper Ordovician siliciclastics in the Appalachian Basin.

The Rouge River organic-rich shales are the lowermost documented facies of the Blue Mountain Formation which in turn is conformably overlain by the Georgian Bay Formation. The two formations are grouped together in the Ontario petroleum well database due to the difficulty of making a consistent formation top pick for the Blue Mountain. The Blue Mountain Formation is dominantly composed of soft, laminated, non-calcareous grey to dark grey shale with only minor interbeds of limestone and siltstone. The proportion of limestone and siltstone beds increases gradually upwards into and within the Georgian Bay Formation. The Georgian Bay-Blue Mountain clastics form a wedge that thickens gradually from northwest to southeast into the Appalachian Basin (Figure 4). Organic-rich facies of the Rouge River Member comprise only the lowermost 2 to 50 metres, also thickening to the southeast. Depth to the top of the Rouge

River ranges from outcrop in the northwest to over 900 metres beneath parts of Lake Erie.

The drilling and testing program conducted by the Ontario Geological Survey to evaluate the resource potential of these black shales has yielded some critical geochemical data (Barker, 1985; Obermajer et al, 1999; Béland-Otis, 2015). These data indicate that some of these black to dark grey mudstones are good to excellent Type II organic-rich source rocks which are thermally mature over a large area in the subsurface of southwestern Ontario (Figure 5). Moving deeper in the basin these organic-rich units thicken.

Figure 6 displays an overlay of the sonic and resistivity log of a well drilled in west central Lake Erie in 1978. This Delta Log R technique (Passey et al, 1990) identifies shales with source rock potential. The green highlighted separation between the sonic and resistivity curves is an indicator of good source rock potential. The presence of low velocity kerogen will lower the  $\Delta t$  values on the sonic curve and the higher  $R_t$  values on the resistivity curve indicate the presence of generated hydrocarbons in mature source rocks. The wellsite geologist reported oil shows and staining in the

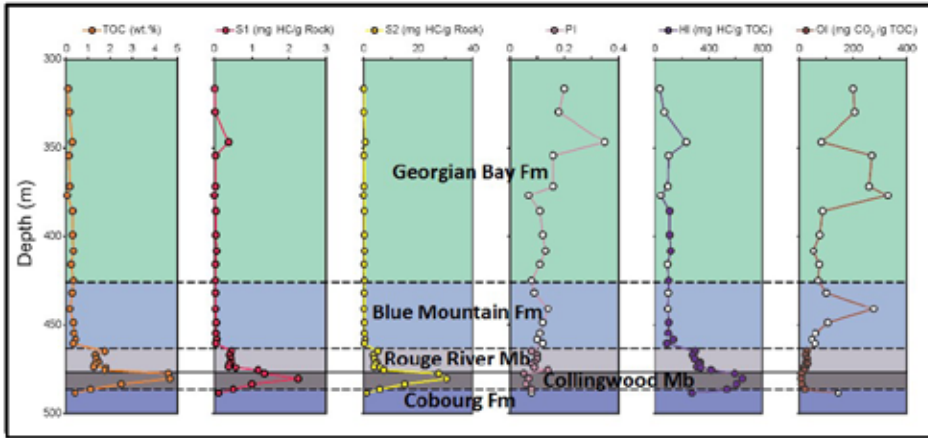


Figure 5: OGS SG11-02, Arthur 4-6-V (T012100) Strat Test. Rock-Eval®6 pyrolysis logs (TOC, S1, S2, PI, HI, OI) from core samples (Béland-Otis, 2015). White-filled dots represent questionable data due to low TOC, S1 and/or S2.

shale samples through this interval. The shaded cross-over on the Delta Log R plot indicates over 160 feet (48.8m) of source potential in the lowermost Blue Mountain interval. Unfortunately, very few wells in southwestern Ontario have associated resistivity logs. Historic wells in Ontario traditionally did not include wireline logs or only included a GR-Neutron logsuite at best, with many wells predating this technology entirely. This makes identification and correlation of these organic-rich units more challenging. Elsewhere in the “Utica” play operators have landed their horizontal wells in the more brittle transitional facies of the upper Trenton Group and steered the horizontal leg up towards the overlying shale contact. In Ohio the Point Pleasant zone is the target. In Encana’s discovery well in Michigan, Petoskey State Pioneer 1-3-HD1, the Collingwood Member at the top of the Trenton was the horizontal landing point and the 5304’ horizontal leg was steered up to the Utica Shale contact (Phillips, 2016).

**Resource Potential**

In the northeastern United States the Utica Formation is the subject of intensive exploration and evaluation as an unconventional source of natural gas and crude oil. The United States Geological Survey (USGS) has assessed the unconventional oil and natural gas resource potential of the Utica Formation (Kirschbaum et al, 2012) in an area covering parts of Maryland, Ohio, New York, Pennsylvania, Virginia

and West Virginia. They estimate a mean resource volume of 940 million barrels of “technically recoverable” oil and 939 billion cubic feet of associated natural gas within the Utica Shale Oil Assessment Unit (AU) at the 50% probability level, with a range from 590 to 1,386 million barrels at the 95% and 5% probability levels respectively. An additional resource of 37 trillion cubic feet of natural gas and 200 million barrels of natural gas liquids is estimated to occur within the Shale Gas Assessment Unit.

Development of the Utica shale in the United States did not begin until approximately 2010 (Geology.com, 2014). Since that time 1807 horizontal wells have been drilled into the Utica in Ohio alone (<http://oilandgas.ohiodnr.gov/shale#SHALE>, accessed on Oct.11, 2016). Daily production as of September 12, 2016 totals 3.6 billion cubic feet/day of natural gas and 69,000 barrels/day of crude oil (Energy Information Administration, 2016).

Total organic carbon content in the Utica Shale Oil AU ranges from 1 to 3%. In Ontario, Obermajer (1999) measured values from 0.74% to 2.69% in the Blue Mountain Formation and up to 7.5% in the Collingwood. In both areas, organic geochemical indicators show the presence of oil-prone Type II organic matter with a thermal maturity in the oil window.

A quantitative resource potential estimate for the Ordovician shales of southern Ontario has not been completed.

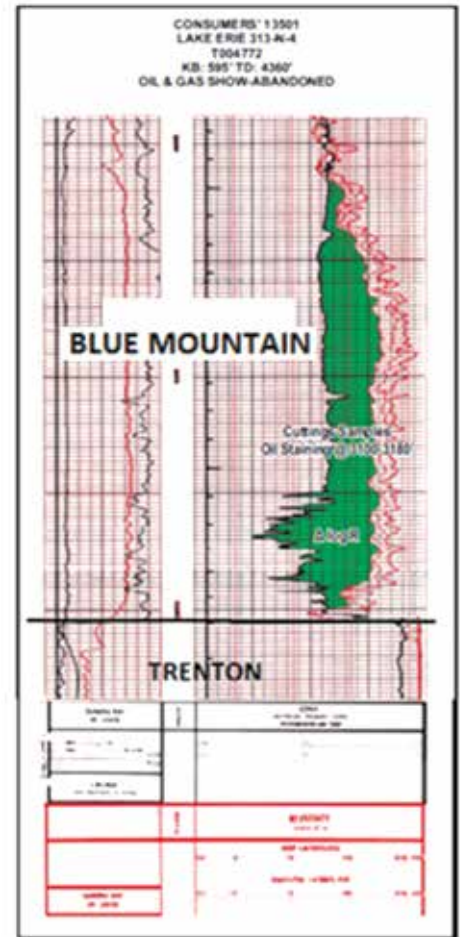


Figure 6: Consumers’ 13501 Lake Erie 313-N-4 (T004772) Δ Log R Plot, sonic-resistivity overlay through the lowermost 200 feet of organic-rich shales overlying the Trenton Group. (Phillips, 2014).

**Devonian Marcellus**

The thick Upper Devonian shale sequence of the Appalachian Basin has seen a lot of interest in recent years. The Marcellus shale gas play is the largest in the United States with proved reserves (to end of 2014) of 84.5 Tcf. The Marcellus also had the most reserves (22.1 Tcf) added in 2014 (EIA, 2015). The distal edge of the Marcellus Shale in the Appalachian Basin extends up into southwestern Ontario (Figure 7).

The Ontario Geological Survey included the Marcellus Shale in their resource potential evaluation in the 1980’s (Johnson et al, 1989). Initial mapping indicated that the sub crop edge ran very close to the north shore of Lake Erie and most of the potential

(Continued on page 20...)

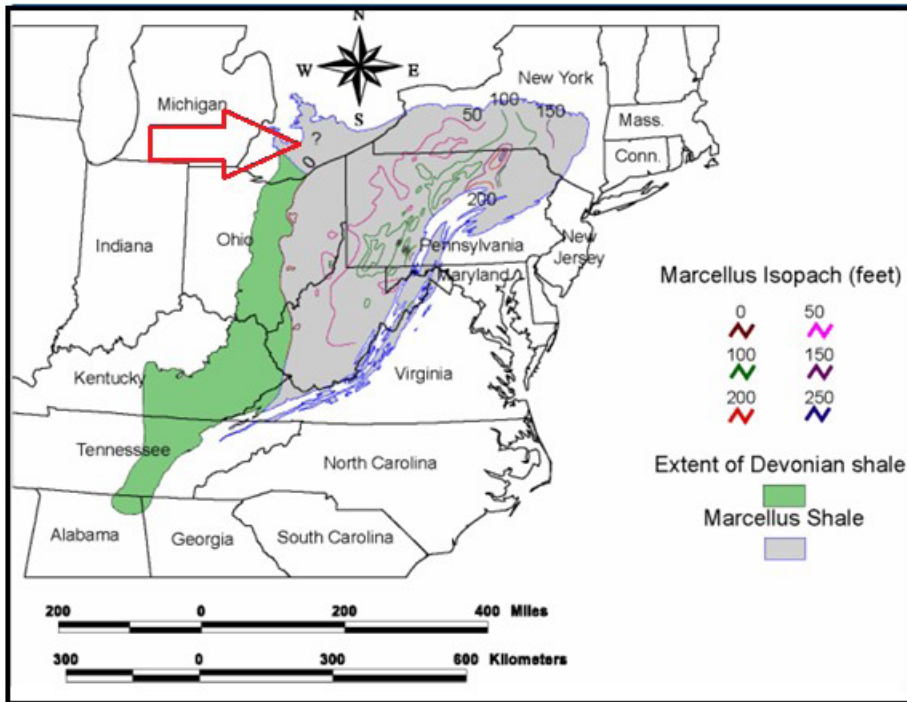


Figure 7: Marcellus Shale Isopach Map (Milici, 2005). The red arrow indicates the extension of the shales into southern Ontario.

would therefore be under the lake. This was confirmed with the drilling of five shallow core holes along the north shore of Lake Erie. Only three of the five shallow wells intersected Marcellus Shale. Geochemical analyses were performed on these three shallow cores, core from an industry well at Port Stanley and cuttings samples from several Lake Erie wells targeting deeper Silurian strata. The report concluded that the Marcellus contains a significant thickness of organic-rich Type II/III shale that is marginally mature to mature (Johnson et al, 1989; Hamblin, 2006).

The Devonian black shales have a long history of gas production along the south shore of Lake Erie in New York, Pennsylvania and Ohio. The USGS has grouped them into the Northwestern Ohio Shale and Marcellus Shale Assessment Unit (Milici and Swezey, 2006). The area to the north under Lake Erie is a natural extension to this play. With over 2000 wells drilled in the Canadian waters of Lake Erie a large number have recorded gas shows while drilling through the Devonian shale section. Figure 8 displays the open-hole logs from the Consumers' 13184 Lake Erie

154-M-4 well drilled in 1972. While drilling at a depth of 584' (178.0m) the well kicked gas at a rate estimated at 1 MMcf/d (28,320 m3/d). The well was killed with heavier drilling fluid and tested after reaching total depth. The gas rate on the test was reported as 50 Mcf/d (1,416 m3/d) with a shut-in pressure of 235 psig. The caliper log shows washout around the depth where gas was encountered. It is of interest to note the fractured shale unit that produced the gas show is not the lower Marcellus Shale but a more brittle overlying shale unit in the Hamilton Group. Range Resources noted that in their early Marcellus horizontal wells in Washington County, Pennsylvania, those landed in the lower Marcellus section had modest initial production rates averaging only 478 Mcfe/d. Subsequent drilling in the same area during which the horizontal legs were landed higher in the shale section saw significantly higher initial production rates averaging 3,527 Mcfe/d (Zagorski, 2015).

The Marcellus section has yielded a number of gas shows while drilling deeper Silurian gas wells in the central portion of Lake Erie and along the sub crop edge near the north shore of Lake Erie. In a small sampling of 89

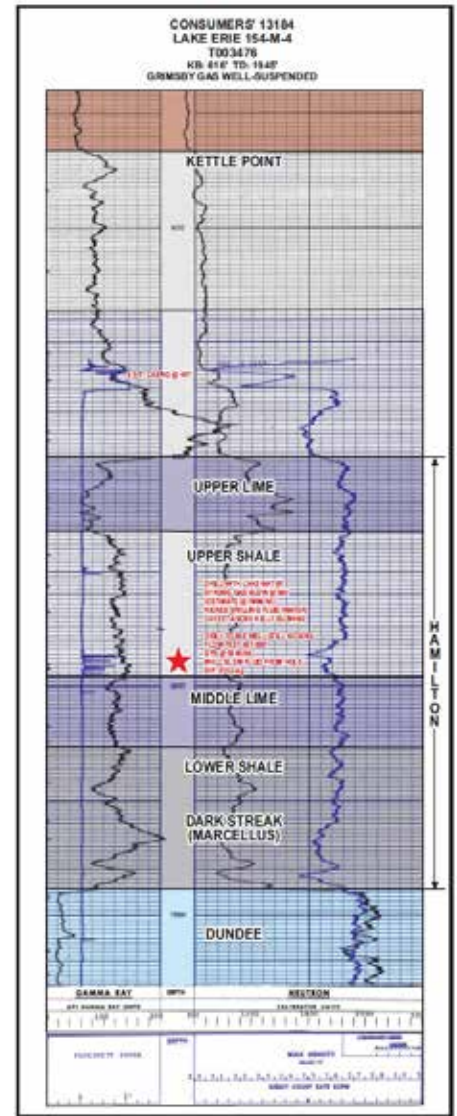


Figure 8. Open-hole logs Consumers' 13184, Lake Erie 154-M-4, showing the Devonian shale section from Kettle Point at 367 feet to top of Dundee Formation limestone at 689 feet. Driller terminology has been used to describe the formations of the Hamilton Group.

wells drilled on Lake Erie around the well shown in Figure 8, 26 wells (29%) had gas shows in the shallow Devonian section as reported by the driller (Phillips, 2014).

**Resource Potential**

The Marcellus shale gas play is the largest gas field in the United States with 84.5 Tcf in proved reserves at the end of 2014 (U.S Energy Information Administration,



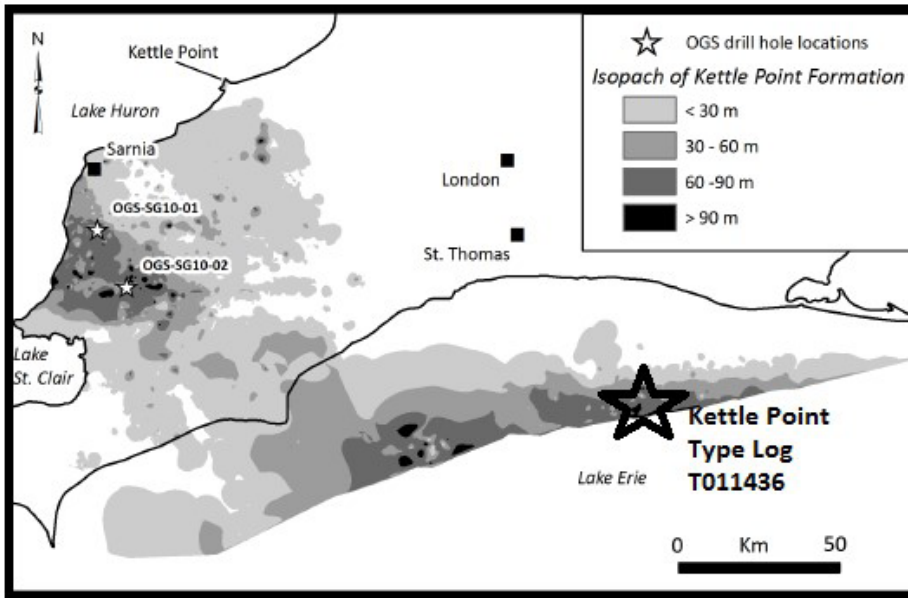


Figure 9. Isopach map of the Kettle Point Formation (Béland Otis, 2013). Well T003476 in Fig.8 is located 20 km east of well T011436.

2015) and a mean undiscovered natural gas liquids resource of 3.4 billion barrels (Coleman et al, 2011). Annual production in 2014 totaled 4.9 Tcf of natural gas. The Marcellus play underlies an area of over 72,000 square miles, occurring in a continuous accumulation encompassing most of Pennsylvania, West Virginia, Ohio, and New York, and parts of Maryland, and Virginia. Depths to the Marcellus vary from outcrop to nearly 11,000 feet (3350 metres), with most production occurring where the formation is 2,000 to 6,000 feet below sea level (<http://www.eia.gov/todayinenergy/detail.php?id=20612>). Thickness varies from less than 50 feet to 300 feet (15-90 m.) in most of the productive area, reaching even greater thicknesses feet in New York. Production is derived almost exclusively from horizontal wells completed with multi-stage high volume hydrofracture treatments. Hydraulic fracturing has been banned in New York State.

There have been no horizontal wells drilled in the Marcellus in Ontario and there is no production from this formation. No quantitative resource assessment has been completed.

### Devonian Kettle Point

The Upper Devonian Kettle Point

Formation overlies the Hamilton Group (which includes the Marcellus Shale) and is preserved through the central portion of southwestern Ontario in the Chatham Sag (Figure 9), underlying an area of over 4,000 square kilometres.

Typically, the Kettle Point Formation is overlain by Quaternary sediments, except for a small area south of Sarnia where Port Lambton Group shales and siltstones overlie the Kettle Point Formation. It is equivalent to the productive Antrim shale in Michigan and the Ohio shales in Ohio, Pennsylvania and New York (Russell, 1985). The Kettle Point succession of black organic-rich shales and grey-green organic-lean shales can exceed 100 metres thickness, but the preserved thickness is generally much less, averaging about 30 metres. The black shales within the sequence exhibit the highest organic content up to 15.1 wt.%, with thermal maturity data indicating these shales to be immature to marginally mature (Barker, 1985; Obermajer et al, 1997).

Drilled in the summer of 2006 eleven wireline recoverable cores (105.50-164.65m) were cut in the Kettle Point Shale and three wireline recoverable cores (186.50-209.00m) were cut in the Marcellus Shale interval. Total organic carbon values

in the Kettle Point were measured at 6.08 and 12.87 wt. % (Phillips, 2014). These values fall in line with those obtained from the Ontario Geological Survey onshore Ontario wells (Béland-Otis, 2013).

Early reports from the Geological Survey of Canada refer to the common seepage of natural gas from the thick sand and gravel deposits that overlie the Kettle Point Formation. Water well records commonly record the occurrence of natural gas in the groundwater in the same area (Singer et al., 1997, 2003) and petroleum well records document gas shows in the upper few metres of the Kettle Point (Carter et al, 2008). Many domestic water wells in areas underlain by the Kettle Point black shales must be vented outdoors to prevent methane from entering residences and farm buildings.

The Ontario Geological Survey drilled and cored 2 boreholes through the full thickness of the Kettle Point formation to collect core and gas samples (Béland-Otis, 2013). Drill core samples from the boreholes were analysed for gas content, gas composition, isotopic composition of methane, total organic carbon, oil, gas and water saturation, permeability, porosity, mineralogy, adsorption isotherms and rock mechanics. Both thermogenic and biogenic gas were identified. The stratigraphically-equivalent Antrim Shale Play to the west in central Michigan also includes a significant component of biogenic gas (Martini et al, 2003).

The open hole logs from the Talisman Central Lake Erie 157-V-4d (T011436) in Figure 10 illustrate the Devonian Kettle Point and Marcellus Shale section.

### Resource Potential

The Antrim Shale in Michigan has been developed by over 9000 wells, with cumulative production of 2.5 trillion cubic feet of natural gas to the end of 2006 (Goodman and Maness, 2008), and exceeding 3 Tcf of natural gas to date. Annual production at the end of 2006 totalled 140 billion cubic feet which declined to 95 billion cubic feet by 2014. Well depths range from 150 to 600 metres. Many wells have been on production for more than 30 years.

(Continued on page 22...)

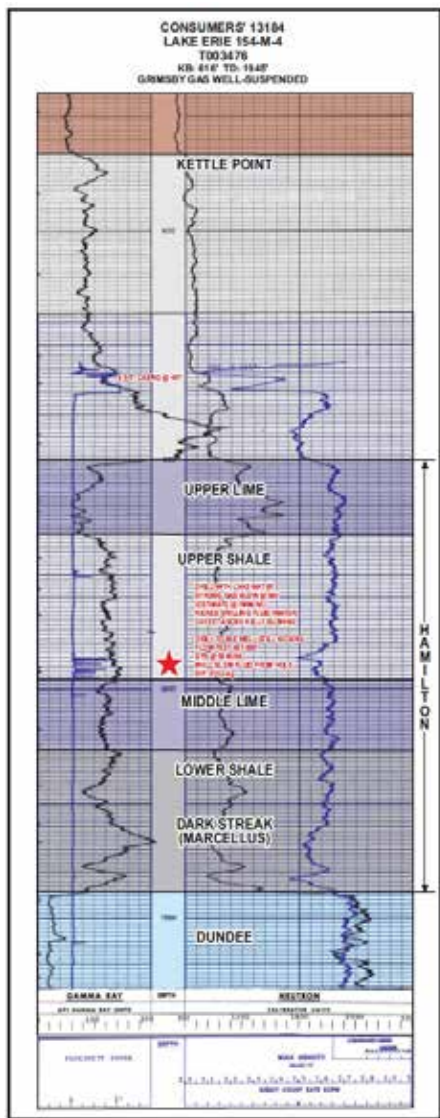


Figure 10. Kettle Point type well (Phillips, 2014), showing Kettle Point Formation from 82.5 metres to 156.2 metres. Driller terminology has been used to describe the formations of the underlying Hamilton Group.

A significant proportion of the natural gas in the Antrim has been produced by in situ microbial methanogenesis (Martini et al, 2003) of organic carbon. The identification of biogenic gas in the Kettle Point Formation suggests that the same play type may occur in southern Ontario.

No quantitative resource assessment of the Kettle Point Formation in southern Ontario has been completed.

**Summary**

To date only a handful of vertical wells have cored and tested the Ordovician and Devonian shales and mudstones in Ontario. Most of these data have confirmed hydrocarbon potential within these units. No horizontal wells have been attempted to test the resource potential of shales in Ontario. The shallow depths and proximity to large urban centres may present some unique challenges for future development, as well as opportunities.

**References**

Armstrong, D.K., and Carter, T.R., 2010. The subsurface Paleozoic stratigraphy of southern Ontario; Ontario Geological Survey, Special Volume 7, 301p.

Barker, J.F., 1985. Geochemical Analysis of Ontario Oil Shales; Ontario Geological Survey, Open File Report 5568, 77p.

Béland Otis, C., 2012. Shale Gas Potential for the Ordovician Shale Succession of Southern Ontario; Oral Presentation at the AAPG Eastern Section Meeting, Cleveland, Ohio, USA. Search and Discovery Article #50730 (2012).

Béland (Otis, C., 2013. Gas Assessment of the Devonian Kettle Point Formation; Ontario Geological Survey Open File Report 6279, 63p.

Béland Otis, C., 2015. Upper Ordovician Organic-Rich Mudstones of Southern Ontario: Drilling Project Results; Ontario Geological Survey Open File Report 6312, 59p.

Carter, T.R., Fortner, L., and Béland Otis, C., 2008. Shale Gas Opportunities in Southern Ontario – an Update. Oral Presentation at the 48th Annual OPI Conference and Trade Show, Sarnia, Ontario, Canada, November 11-13, 2008.

Coleman, J.L., Milici, R.C., Cook, T.A., Charpentier, R.R., Kirschbaum, M., Klett, T.R., Pollastro, R.M., and Schenk, C.J., 2011. Assessment of undiscovered oil and gas resources of the Devonian Marcellus Shale of the Appalachian Basin Province, 2011; United States Geological Survey, Fact Sheet 2011-3092, 2 p. available at <http://pubs.usgs.gov/fs/2011/3092/>.

Curtis, J.B., 2002. Fractured shale-gas systems; Bulletin of American Association of Petroleum Geologists, v. 86, No. 11 (November 2002), p. 1921-1938.

Dabbs, F., 2007. Craigleith Oil Shale Works, Ontario; Petroleum History Society Archives, Volume XVIII, Number 2.

Geology.com, 2014. Utica Shale - The natural gas giant below the Marcellus, accessed July 30, 2014 at <http://geology.com/articles/utica-shale/>.

Hamblin, A.P., 2006. The “Shale Gas” concept in Canada: a preliminary inventory of possibilities; Geological Survey of Canada, Open File Report 5384, 103p.

Harper, J. A., and Kostelnik, J., 2007. The Marcellus Shale Play in Pennsylvania Part 1: A Historical Overview, Pennsylvania Department of Conservation and Natural Resources, Pennsylvania Geological Survey, Marcellus Shale Play, Pennsylvania DCNR webpage

Johnson, M.D., Telford, P.G., Macauley, G., and Barker, J.F., 1989. Stratigraphy and oil shale resource potential of the Middle Devonian Marcellus Formation, southwestern Ontario; Ontario Geological Survey, Open File report 5716, 149p.

Kirschbaum, M.A., Schenk, C.J., Cook, T.A., Ryder, R.T., Charpentier, R.R., Klett, T.R., Gaswirth, S.B., Tennyson, M.E., and Whidden, K.J., 2012. Assessment of undiscovered oil and gas resources of the Ordovician Utica Shale of the Appalachian Basin Province, 2012: U.S. Geological Survey Fact Sheet 2012-3116, 6 p.

Lehmann, D., Brett, C.E., Cole, R. and Baird, G., 1995. Distal sedimentation in a peripheral foreland basin: Ordovician black shales and associated flysch of the western Taconic foreland, New York State and Ontario; Geological Society of America Bulletin, v. 107, p.708-724.

Martini, A.M., Walter, L.M, Ku, T.C.W., Budai, J.M., McIntosh, C., and Schoell, M., 2003. Microbial production and modification of gases in sedimentary basins: A geochemical case study from a Devonian shale gas play, Michigan

basin, *Bulletin of American Association of Petroleum Geologists*, v. 87, No. 8 (August 2003), p. 1355-1375.

Milici, R.C., 2005. Assessment of Undiscovered Natural Gas Resources in Devonian Black Shales, Appalachian Basin, Eastern U.S.A.; U.S. Geological Survey Open File Report 2005-1268, 31p.

Milici, R.C., and Swezey, C.S., 2006. Assessment of Appalachian Basin Oil and Gas Resources: Devonian Shale-Middle and Upper Paleozoic Total Petroleum System; U.S. Geological Survey Open File Report 2006-1237, 70p.

Obermajer, M., Fowler, M.G, and Snowdon, L.R., 1999. Depositional Environment and Oil Generation in Ordovician Source Rocks from Southwestern Ontario, Canada: Organic Geochemical and Petrological Approach; *Bulletin of American Association of Petroleum Geologists*, v. 83, No. 9 (September 1999), p. 1426-1453.

Passey, Q.R., Creaney, S., Kulla, J.B., Moretti, F.J., and Stroud, J.D., 1990. A Practical Model for Organic Richness for Porosity and Resistivity Logs; *Bulletin of American Association of Petroleum Geologists*, v. 74, No. 12 (December 1990), p. 1777-1794.

Phillips, A.R., 2014. Devonian and Ordovician Shale Correlations Under Lake Erie, Bridging the Gap; Oral Presentation at the AAPG Eastern Section Meeting, London, Ontario, Canada, September 27-30, 2014.

Phillips, A.R., 2016. North America's First Oil Shale Play, Ordovician Collingwood (Utica) Shale in Southwestern Ontario; Core Workshop, 54th Annual OPI Conference and Trade Show, London, Ontario, Canada, May 4, 2016, 47p.

Russell, D.J., 1985. Depositional Analysis Of A Black Shale Using Gamma-Ray Stratigraphy: The Upper Devonian Kettle Point Formation Of Ontario; *Bulletin of Canadian Petroleum Geology*, v. 33, No. 2 (June, 1985), p. 236-253.

Russell, D.J. and Telford, P.G., 1983. Revisions to the stratigraphy of the Upper Ordovician Collingwood Beds of Ontario - A potential oil shale; *Canadian Journal of Earth Sciences*, v.20, p.1780-1790.

Sanford, B.V., 1961. Subsurface Stratigraphy of Ordovician Rocks in Southwestern Ontario; Geological Survey of Canada, Paper 60-26. 54p.

Sweeney, S.N., 2014. Allostratigraphy of the Upper Ordovician Blue Mountain Formation, southwestern Ontario, Canada. MSc thesis, University of Western Ontario, electronic thesis and dissertation repository, Paper 2555, 301 p., <http://ir.lib.uwo.ca/etd/2555/>

United States Energy Information Administration, 2016. Drilling productivity report release date September 12, 2016 accessed Oct.11, 2016 at [www.eia.gov/petroleum/drilling/#tabs-summary-2](http://www.eia.gov/petroleum/drilling/#tabs-summary-2).

United States Energy Information Administration, 2015. U.S. Crude Oil and Natural Gas Proved Reserves, 2014; U.S. Energy Information Administration Report. 49p.

<https://www.eia.gov/state/print.cfm?sid=MI>

Zagorski, B., 2015. Marcellus Shale-Geological Considerations for an Evolving North American Liquids-Rich Play; Oral Presentation at AAPG DPA Playmaker Fourm, "From Prospect to Discovery", January 24, 2013, Houston, Texas. Search and Discovery Article #110183 (2015). 🇨🇦

**CHINOOK CONSULTING SERVICES**

Geological wellsite supervision • Remote geo-steering •  
 Coring Supervision • Operations geology •  
 Field Geochemistry • Petrographic studies •  
 International Services

{ Geological Services Excellence }

Office: 403 242 1522 • 742 Memorial Drive NW Calgary, Alberta T2N 3C7 • [ops@chinoookconsulting.ca](mailto:ops@chinoookconsulting.ca) • [www.chinoookconsulting.ca](http://www.chinoookconsulting.ca)





# THANK-YOU

to the all the participants, sponsors and volunteers of the  
28th Annual 10k & 5k Road Race and Fun Run!

### Top 10KM

### Top 5KM

CSPG Female	Holly Ratzlaff	0:42:29.5	CSPG Female	Tina Donkers	0:26:48.1
CSPG Male	Darren Lazaruk	0:40:43.2	CSPG Male	Cameron Demmans	0:19:37.2
CSEG Female	Shannon Bjarnsason	0:48:59.5	CSEG Female	Jocelyn Frankow	0:27:09.6
CSEG Male	Darren Hinks	0:41:17.9	CSEG Male	Franck Delbecq	0:18:17.0
CAPL Male	Sean McLeod	0:42:59.2	CAPL Male	Ken Buckley	0:29:01.2



29th Annual Road Race and Fun Run  
Wednesday September 20, 2017



## The Geology of Wine Tasting

Jon Noad, Sedimental Services

I am sure that there are many geologists who take a keen interest in wine, and not just in drinking it. Explaining the vast diversity of quality, flavours and aromas is no simple task, and what fascinates me is the relative role of the geology, and the associated soils, in determining which vineyards are winners and losers. Many factors will influence the character of the wine, generally summarized under the French term “terroir”.

What is terroir? The term was developed in France in the late 1960s to encompass the totality of the setting, or the “sense of place”, in which the grapes grow. The term has some almost mystical connotations, but includes the climate and weather, the soils and geology, as well as the slope and aspect (direction in which the slope faces). All of these characteristics are thought to have a significant influence on the flavour of whichever grape species has been chosen for cultivation. After harvesting, the processes used by the grower to transform the grapes into wine will have a key influence on the flavour, and the wine will also change character through maturation after bottling.

### The impact of geology and soil

So how much influence does the geology have on the final product, compared to the climate? This topic was examined by James E. Wilson (a retired petroleum geologist) in 1998, in his book “The role of Geology, Climate and Culture in the making of French Wines”, and revisited in a series of articles by Simon Haynes of Calgary. Obviously a significant area of land is affected by broadly similar weather patterns, so the disparity in the quality of wines produced from adjacent vineyards, often at the same elevation and slope orientation, cannot be explained by differences in climate alone. This shifts the focus onto the geology and soil as key influences on the grape character.

The chemical analysis of wines confirms that the associated flavours are due to nutrient elements (typically metallic

cations) and only distantly related to geological minerals, which are complex crystalline compounds (Maltman 2013). Hence the chemical composition of the rocks will not directly influence the grapes, particularly as the actual concentrations of mineral elements are typically miniscule, in part because they are relatively insoluble. Almost all minerals are also flavourless, with the exception of halite, and our mouths are unable to taste them. They are also lacking in aroma, with a few unpleasant exceptions, such as sulphur. So it is clearly not the mineral composition of the rocks that affect the taste, but must be something else.

Geology directly affects the soil, in that soils form from the breakdown of bedrocks over time (Figure 1). It is suggested that a typical soil forms at around an inch every thousand years. Immature soils are not layered, and are little more than gravels overlying bedrock, but mature soils may be stratified with surficial organic debris, topsoil and gravelly subsoil. Once the soil has formed it will affect the vines in two significant ways: firstly the level of nutrients in the soil will nourish the vines to a certain degree. More importantly, the soil and the underlying weathered bedrock will act as a conduit, inhibiting or enhancing the flow of groundwater, as well as potentially acting as a reservoir for water to replenish the vine through its root system.

Grapes respond to both feast and famine; hardship in the form of arid soils will usually lead to smaller grapes with more concentrated flavours. However yields will consequentially be much lower in such environments. The presence of water, stored in fractures in the bedrock near the surface, may provide vines with a longer growing season. However in areas of thicker, porous soils, the roots of vines may have to extend more than 50 metres into the subsurface in the search for water, meaning that a great deal of photosynthetic energy may be expended. This may in turn adversely affect the quality of the grapes on the vine. In very fertile, damp soils, the grapes may become “flabby”, with softer flesh and more dilute

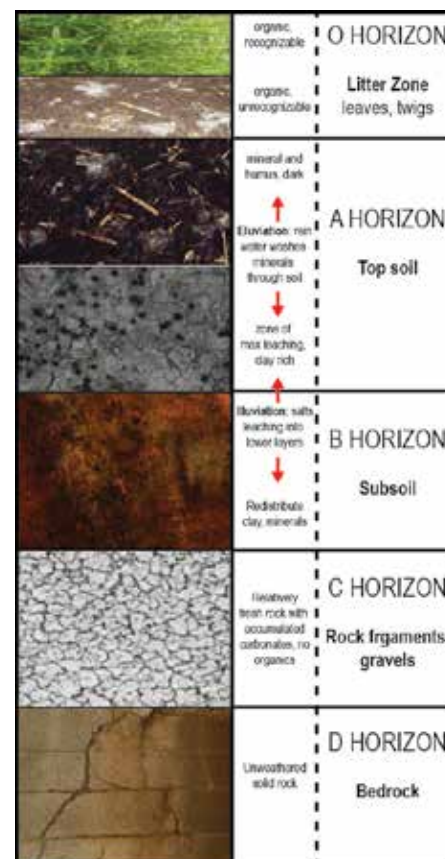


Figure 1. Typical soil profile (after a figure by Owais Khattak).

flavours.

Finally geology has a very obvious impact on the topography. Igneous and metamorphic rocks may weather to very rugged terrains, while softer (usually younger) sediments may lead to very flat, poorly drained areas, where vines will grow less successfully. The geology will also affect the degree and aspect of the slope. Very steep slopes drain effectively, but may lead to arid environments, with too little available water for the vines to suck up. Hence there are several ways in which the geology can impact eventual wine quality, and the right balance between adversity and plenty is needed to create the perfect wine.





Figure 2. The range of wines selected for the Geology of Wine tasting (part 1).



Figure 3. Soil profile showing gravel development, Marlborough region, New Zealand (www.glug.com.au).

### A flavourful case study

Working with a sommelier from the COOP, we recently put together a wine tasting event that explored a variety of terroirs, and the potential impact of the geology on the various wines offered for sampling. A mixed audience of geologists and wine fanciers were in attendance to evaluate the relative contributions of climate and geology. Below I have selected some of the chosen wines, in order to highlight the geological contribution to their character (Figure 2).

First up was a Sauvignon blanc from the Marlborough region of New Zealand. These dry, white wines are renowned for their extremely fruity flavours, which may come close to overpowering the wine. Most of the vineyards are located on older river terraces, which may feature a fine grained, river borne (silts and muds) or windblown (loess) component, in addition to poorly sorted river pebbles. The river gravels are often only a couple of metres thick, underlain by metamorphosed bedrock (Figure 3), but may reach 30 m in thickness, when they will require drip irrigation. These cannot really be described as soils.

This geology is little different to the geology of the Loire Valley, where some of the world's great sauvignon blancs (Sancerre, for example) are grown. However in France they are dry and "flinty" (a term relating to the acid hints in the wine only), rather than exceptionally fruity in character. Considerable scientific study of the Antipodean white wines (how would

you fancy a PhD. looking at the geology of wine?) indicates that the reason for this fruitiness is the presence of thiols, chemicals that impart the classic kiwi and peach notes to the wine. The thiol concentrations are enhanced by machine harvesting (which presumably bruises the grapes), by the presence of unique yeasts (thought to relate to the very high UV levels, around 30% above the norm) and by higher than usual temperature fluctuations. Hence the geology apparently plays less of a role than climate in determining the character of this wine, acting mainly as a conduit.

A fascinating comparison between a South African Chardonnay from Stellenbosch and a Chablis from Burgundy demonstrated that these very similar grapes produced more acidic notes when planted on French gravel scree slopes derived from weathering of Jurassic limestones, with water trapped by Kimmeridgian clays. In contrast the South African soils have been forming for around 65 million years, and are very depleted in minerals and nutrients. Lime and phosphate have to be added to the acid, granitic soils, and the chardonnay wine is softer and more "middle of the road" as a result of the additives.

### Rosés are Red

Provence is considered as the spiritual home of Rosé wines, and exhibits a striking spectrum of these wines ranging from pale pinks with a delicate taste, through to bold, almost ruby wines with a strong berry component. The reason is almost certainly

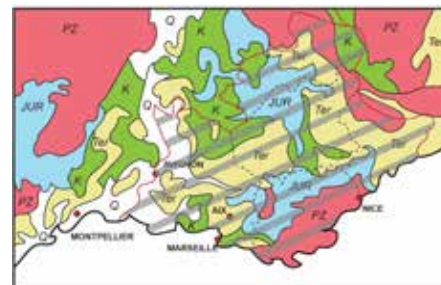


Figure 4. Geological map of Provence (shaded).



France Wine Locations



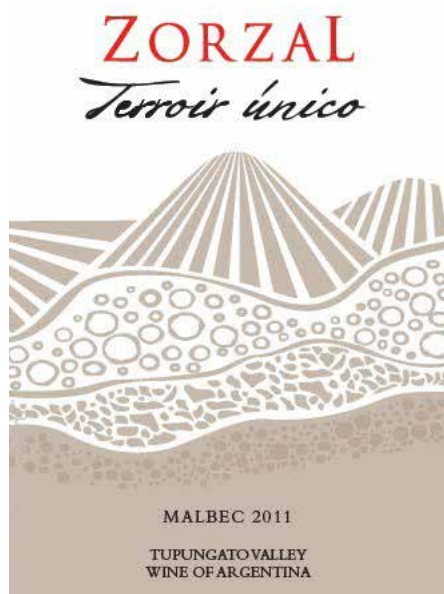


Figure 5. Geological Malbec wine label from Argentina.

the contrast between the arid, Cretaceous limestone soils, and the weathering products of the ancient crystalline massifs to the East (Figure 4). The grapes utilized include tight bunches of the tiny, strongly flavoured cinsault, which can be eaten from the vine.

Turning to the reds, the Malbecs of Argentina have a huge range in quality and taste. This relates directly to the geology, with a mix of outcropping volcanics and limestones, as well as alluvial gravels and silts (Figure 5). Such a diverse “rock garden” may be encountered at a single vineyard. The winemaker typically has to dig a series of pits across his property in order to evaluate where to plant the vines, and blending is employed to smooth out the localized vagaries in quality.

Next we chose the Priorat region of NE Spain for its unique terroir. The geology is striking, with very rugged topography and exceptionally stoney soils (Figure 6). Shards of dark grey, Carboniferous slate spall from the underlying bedrock, and form a poor soil termed as “llicorella” in the Catalan language. Associated mica in the top 50 cm, eroded from volcanic rocks, traps water beneath it. The yields are very low, with the Garnacha vines basically growing on weathered bedrock, their roots penetrating deeply in their search for water, but the



Figure 6. Llicorella slate soil and vines, Priorat (from catalanwine365.wordpress.com).

flavours are intense in what is one of the country’s best and most expensive wines.

### Classic wines on display

Bordeaux is justifiably one of the world’s most famous wine growing regions. The landscape and geology are very variable, meaning that different wines flourish in different settings (Figure 7). Vineyards southwest of the Gironde River are planted on poorly sorted, glacial derived, river terraces, the best wines (like Margaux and Medoc) harvested from terraces around 700,000 to a million years in age. The other side of the river includes St. Emilion, grown on Tertiary limestones, and Pomerol, also grown on river terrace gravels. The gravels host small, dark grapes, which are stressed and therefore rich in flavour, while the limestone related wines are softer and easy drinking.

Our final wine region is located around the town of Coonawarra, some 400 km south of Adelaide in South Australia. This area produces one of the world’s great Cabernet sauvignon wines, grown on terra rosa soils (Figure 8). These soils comprise insoluble red clays produced by the karstic weathering of limestone, colored by iron oxides preserved above the water table. The clay allows surprisingly good drainage, in an area with a maritime climate similar to the Bordeaux region. The wines are full of

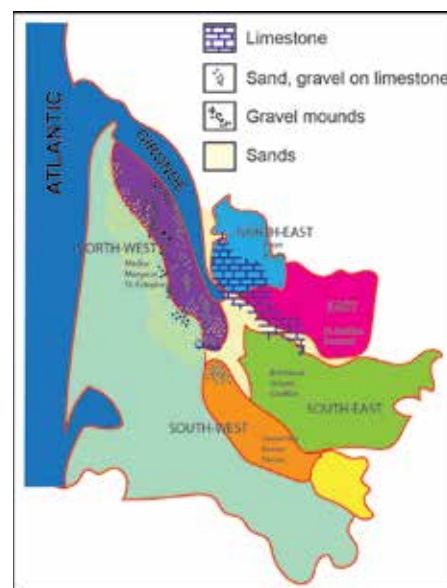


Figure 7. Map of Bordeaux wine region showing the soil and wine distribution.

plum and blackcurrant notes.

The terroir covers a narrow belt around 20 km long and only 2 km wide, located on a limestone ridge, located between two of a series of subparallel dune fields (Figure 9). The Coonawarra red soils formed just to the west of the beach rocks, and overlies rocks deposited on the edge of a lagoon. Using oil exploration methodology, one might hope to use the sweet spot at Coonawarra



Figure 8. Striking terra rosa soils overlying limestone at Coonawarra ([www.glug.com.au](http://www.glug.com.au)).

as a potential analogue for other terra rosa deposits between other dune fields (Figure 10). However this is a classic example of where a simple exploration play seems to work only once, although work continues to try and identify other areas where similarly spectacular wines could be grown.

### It's all in the plumbing

In conclusion, geology and soils are critical in helping to develop flavours of grapes on the vine. However it is not the associated minerals that lead to the flavours, but rather the porosity and permeability of the soils. The soils act like a hydroponic tank, water typically running through a framework of gravels beneath the surface,

with an underlying storage medium made up of fractured bedrock. The geology also affects the nutrient levels in the soil, which may help or hinder vine growth, as well as controlling the topography of the vineyard. However when someone starts telling you that they can “taste the minerality”, you will know better!

### Note:

The CSPG is planning on hosting a Geology of Wine Tasting early in 2017. This is your chance to learn about the impact of terroir and “vini-geology” on flavour, while you taste some impressive vintages. Watch this space for further details! 🍁

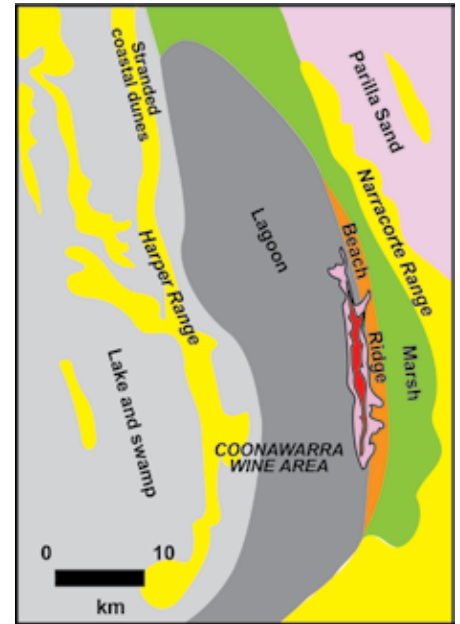


Figure 9. Geological sketch map of Coonawarra wine region ([www.glug.com.au](http://www.glug.com.au)).



Figure 10. Map of Pleistocene dunes around Coonawarra (after <http://sahistoryhub.com.au>)



## 2016 Gussow Geoscience Conference: Clastic Sedimentology: New Ideas and Applications October 11th to 13th, 2016, Banff, Alberta

Jon Noad, Conference Chair



This year's conference was held at the Banff Centre, and was, without any doubt, a resounding success. The conference co-chairs received universally positive feedback from all those who attended, both in terms of the venue and the outstanding quality of the talks. The hard work of the five conference co-chairs (Noad, Jablonski, Tye, Ranger and MacEachern), coupled with the outstanding efforts of the session chairs (Miall, Hasiotis, Dashtgard, Gingras, Fielding, Bann, Hubbard, Arnott, Slatt, and Plint) ensured a strong technical program filled with engaging presentations and poster displays.

The conference was split into five sessions, which followed a "source to sink" pattern, beginning with terrestrial (fluvial), passing through estuarine (paralic) and shoreface systems into deep water deposits, and finishing with a mud session. Each session commenced with an excellent introductory overview from the session chairs, all of whom stressed the rapid progress in their subdivision of the field of clastic sedimentology.

Talks in the terrestrial session examined existing models for alluvial facies (Fielding), as well as questioning the interpretation and abundance of braided channels deposits in the fossil record (Blum). The braided to meandering transition was also examined (Noad), and these fluvial



Photo by Jon Noad

themes generated animated discussion, which was great to see at the conference. We investigated preservation and geological time (Miall), and then looked at quantitative facies models (Colombera). The session concluded with a whirlwind tour of terrestrial trace fossils (Hasiotis) and their significance. Particularly striking were the Triassic crayfish beds of Utah.

After an evening where most of the attendees sampled the food and beverages of Banff, (as well as discovering a handy short cut back to the Banff Centre that skirted the cemetery), the following day kicked off with the paralic-estuarine session. We were treated to several discourses on facies models for transitions from fresh water fluvial channels, through estuaries and to the shoreline, with cosmopolitan examples from the Gironde of France (Fenies), Willapa Bay (Gingras) and the Sittaung River of Myanmar (Choi). Talks zoomed

in to look at the morphology of tidal bars (Schoengut) and distributary channels (La Croix), before a visit to some stunning riverside outcrops of the McMurray Formation (Jablonski) demonstrated how Lidar style data can be used in numerical analyses.

After lunch we moved to the fully marine shoreface, with three of the talks looking at deltaic deposits of the Wilrich (Bann), Viking (MacEachern) and the modern Fraser River Delta (Ayranci). Of particular interest was the way that trace fossil data was used to delineate subtleties of depositional settings. A sequence stratigraphic framework was employed to demonstrate both falling stage conditions and delta asymmetry in the Viking. A subsequent tidal facies talk showed facies criteria for identifying tidal signatures in shoreface settings (Dashtgard). We also looked at Permian deposits of Australia





cspg.org

#### CORPORATE SUPPORTERS

I H S Markitt  
Birchcliff Energy Ltd.  
Pro Geo Consultants  
RPS Energy Canada Ltd.  
Bannatyne Wealth Advisory Group  
Canadian Global Exploration Forum  
CMC Research Institutes, Inc.  
Encana  
EV Cam Canada Inc.  
Halliburton  
RIGSAT Communications  
RS Energy Group  
Schlumberger Canada Limited  
Cabra Consulting Ltd.  
Pulse Seismic Inc  
McDaniel & Associates Consultants Ltd.  
CAPL  
ConocoPhillips  
Earth Signal Processing Ltd.  
Mount Royal University  
Valeura Energy  
YaleCanada  
Compass Directional Services  
Integrated Sustainability Consultants Ltd.  
TAQA North Ltd.  
Navigator Resource Consulting  
Synterra Technologies  
Baker Hughes Calgary  
Roke Technologies Ltd.  
Signature Seismic Processing Inc.

As of November 9, 2016

(Fielding). The final talk gave us a beautiful synthesis of Late Albian allostratigraphic across Alberta (Plint and Drljejan), drawing from numerous graduate studies.

The conference dinner that evening was a great chance to network and discuss the ideas of the day. A more relaxed presentation on the Calgary Flood of 2013 (Noad) was preceded by thanks to the organizing committee and CSPG staff, as well as to the session chairs and speakers. It had been a great day, enhanced by the amazing weather, chilly yet with plenty of sunshine (see the photo from sunrise the following morning).

The final day of the conference began with the deep-water session. A fascinating presentation on a Nova Scotian impact crater (Deptuck) got everyone engrossed, followed by a talk on flow criticality in turbidites and its contrast in process style to open channel flow (Arnott) Bill impressed everyone by carrying on speaking through two power cuts that plunged the auditorium into complete darkness. The following talk on flow monitoring in BC fjords (Clarke) was similarly affected, but did not stop us seeing some great images of crescent-shaped dunes and channel migration year on year. The last three talks all looked at submarine channels, contrasting the meandering morphology of submarine channels with those in the fluvial realm. The modeling of these systems (Sylvester) is complex, and was complemented by outcrop studies focused on the Gulf Islands of BC (Hubbard) and Chile (Southern).

After lunch we waded into the mud,

beginning with a nice overview of Devonian mudstones (Harris). Talks on aggregate grains and their use in differentiating marine and terrestrial deposits (Cheadle, Pavan) were followed by an interesting discussion of condensed sections (Al-Mufti). A general overview on data analysis in unconventional shale deposits centred on the Woodford Shale (Slatt) set the stage for a presentation that showed how sequence stratigraphy could be related to brittle/ductile contrasts in the unit (Jing). The mud session concluded the conference

We must definitely mention the outstanding posters presented on diverse topics ranging from Cretaceous meander belts (Durkin, Broughton) to estuarine facies models of the McMurray (Fustic); deposition and diagenesis of mudstones (Percy) and sequence stratigraphy of Horn River mudstones (Ayranci); to dating of shelf margin evolution using zircons (Daniels) and deep-marine channel evolution (Arnott).

Overall this was a stunning conference. The number of participants (around 66) ensured a fairly intimate atmosphere that helped to generate discussion, while the presence of many world-class sedimentologists ensured that the data presented, and the talks themselves, were of the highest quality. The geological discussions over a few beers in the evenings were worth the entrance price on their own. If you were not able to attend, you missed a conference that will be talked about for many years to come. 🍀

# STUDENTS!

**Did you know there is over \$20,000 available  
in CSPG awards and scholarships?!**

<b>Scholarship/Award</b>	<b>Amount Available</b>	<b>Application Deadline</b>
<b>Regional Graduate Student Scholarships</b>	(\$2,500 x 4)	January 20, 2017
<b>Undergraduate Student Awards</b>	(\$1,000 x 4)	January 20, 2017
<b>Student Event Grants</b>	(\$1,000 x 5)	March 17, 2017
<b>Andrew Baillie Award</b>	(\$1,000 x 2)	GeoConvention 2017

**Please visit [www.cspg.org/students](http://www.cspg.org/students)  
for more information**

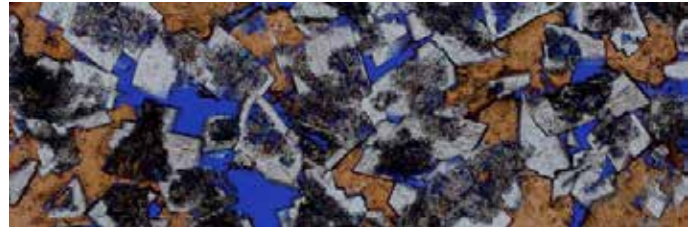
# 2017 MOUNTJOY CARBONATE RESEARCH CONFERENCE

The 2017 Mountjoy Conference sponsored by SEPM (Society for Sedimentary Geology) and CSPG (Canadian Society of Petroleum Geologists) will be held the week of **June 26-30, 2017** in Austin, Texas, at the University of Texas Commons Learning Center and the Bureau of Economic Geology Core facility.

The Technical Program Committee (David Budd, Gregor Eberli, Cathy Hollis, Don McNeill, Gene Rankey, Rachel Wood) on behalf of the SEPM and CSPG, is very pleased to announce that the **ABSTRACT SUBMISSION IS NOW OPEN** for the 2nd Mountjoy Carbonate Research Conference!

The theme of the meeting is "**Carbonate Pore Systems**".

The meeting will be a mix of oral and poster presentations (Monday and Thursday), an in-meeting fieldtrip (Tuesday), and a full-day core workshop (Wednesday). The meeting will provide abundant time for discussion and interaction with the technical presenters and attendees. Those attending the Conference will gain an improved understanding of porosity at variable scales in carbonate rocks. *Registration for the meeting opens in February, 2017 and is capped at 150 people maximum.* Details of the meeting, and the trips, are located at <http://www.sepm.org/MountjoyII>



In a glance, the technical sessions and session Chairs include:

## **Sedimentological, Stratigraphic, and Diagenetic Controls on Development of Carbonate Pore Systems**

Mike Grammer | Oklahoma State University James Bishop | Chevron David Budd | University of Colorado

## **Microporosity in Conventional and Unconventional Carbonate Reservoirs**

Steve Kaczmerak | Western Michigan University Gregor Baechle | Consultant, Houston, TX Bob Loucks | BEG University of Texas

## **Multiscale Prediction and Upscaling of Carbonate Porosity and Permeability**

Neil Hurley | Chevron Ralf Weger | University of Miami Beth Vandenberg | British Petroleum (BP)

## **Interactions in Multi-Modal Pore Systems**

Bob Goldstein | University of Kansas Charlie Kerans | BEG University of Texas Alex MacNeil | Osum Oil Sands Co.

## **Visualization, Quantification, and Modeling of Carbonate Pore Systems and Their Fluid Flow Behavior**

Paul M. (Mitch) Harris | University of Miami / Rice University Gregor Eberli | University of Miami Gareth Jones | ExxonMobil

The technical committee would also like to invite submission of abstracts for the all-day core. Cores representing a spectrum of geologic time and depositional settings, as well as unique diagenetic environments from some of the most significant producing reservoirs will be on display. The cores will be highlighted in a core preview display during the technical sessions on Monday. Wednesday will be the full core display and discussion with presenters at the **Austin Core Research Center (CRC)**, located adjacent to the University of Texas, Bureau of Economic Geology headquarters.

The core workshop represents a great way to see examples of all sorts of different reservoirs, and to get your hands on the rock. The core displays will demonstrate important aspects of reservoir quality of both conventional and unconventional carbonate reservoirs.



For any questions, feel free to contact the conference General Chair or any of the Technical Program chairs:

General Chair:	Paul (Mitch) Harris   <a href="mailto:pmitchharris@gmail.com">pmitchharris@gmail.com</a>
Technical Program Chairs:	Don McNeill   <a href="mailto:dmcneill@rsmas.miami.edu">dmcneill@rsmas.miami.edu</a> Gene Rankey   <a href="mailto:grankey@ku.edu">grankey@ku.edu</a>
Core Conf. Chair:	Laura Zahm   <a href="mailto:laz@statoil.com">laz@statoil.com</a>
Field Trip Chair:	Astrid Arts   <a href="mailto:astrid.arts@cenovus.com">astrid.arts@cenovus.com</a>