

A photograph of a rugged, layered rock cliff, likely in Antarctica. The rock face is dark and shows distinct horizontal geological strata. Patches of snow are scattered across the upper and lower parts of the cliff. A thin waterfall is visible on the left side of the cliff face. The sky is overcast and hazy.

AAPG

EXPLORER

SEPTEMBER 2013

Southern Exposure

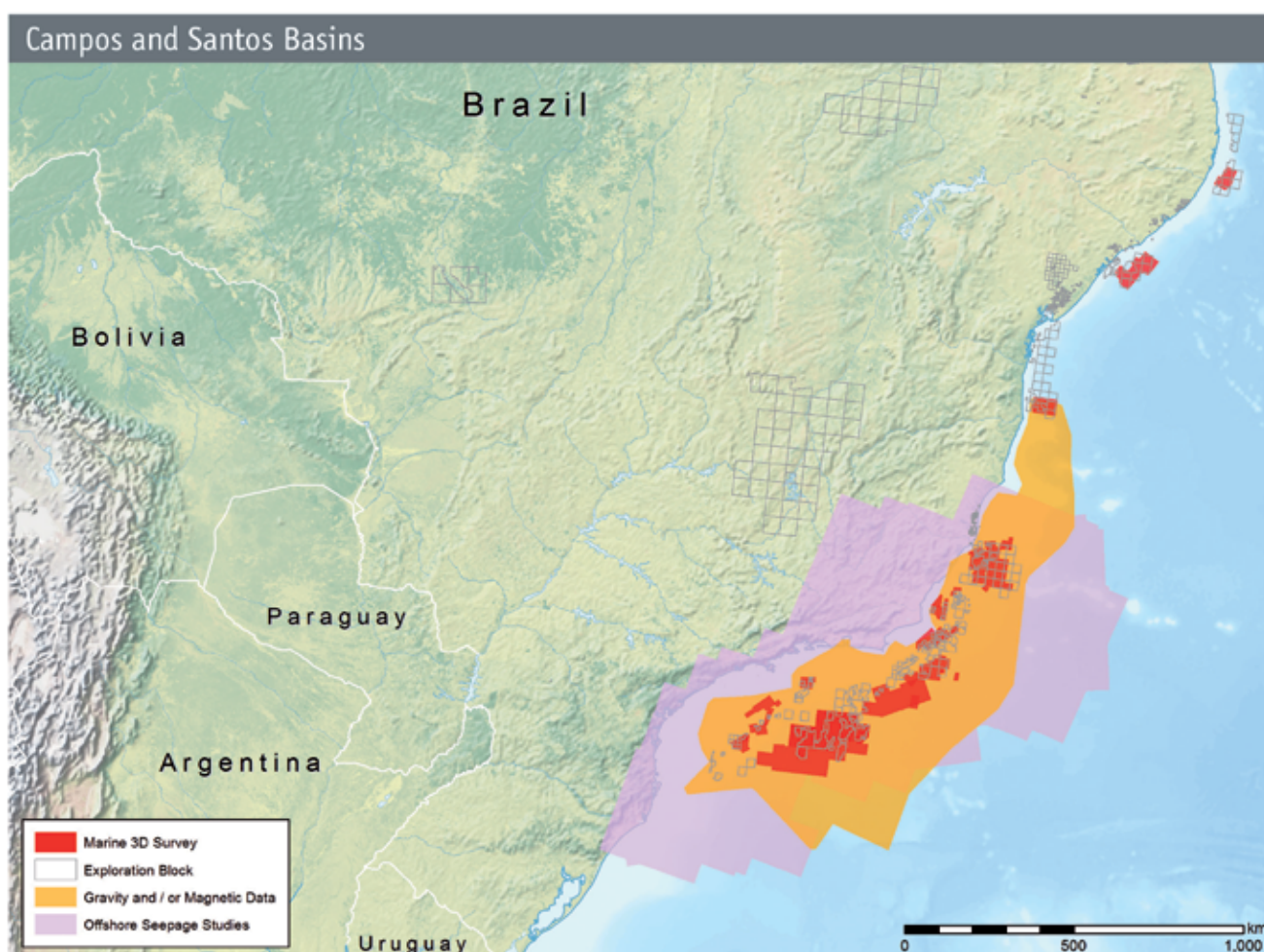
Geologists make a trek to Antarctica

See page 32



Covering Brazil

Pre-salt expertise



CGG can give you the competitive edge of first movers' advantage with our multi-disciplinary data library and expert knowledge of Brazil's hydrocarbon provinces and geopolitical environment. Combine geophysical and geological information to assess the 11th round acreage in greater detail and mitigate exploration risk.

- 63,400 sq km of high-quality 3D seismic PSDM data
- 13,760 sq km of broadband 3D seismic PSDM data utilizing proprietary **BroadSeis™** technology
- Robertson geological experience in both pre- and post-salt plays together with insight from the conjugate margins
- Satellite Seepage Study (246 weather screened and interpreted radar images)
- Potential field products including over 1 million line km of gravity and magnetic data

Contact us for more information today:
Geomarket Director, Luiz Braga
+5521 21361650 - luiz.braga@cgg.com

Visit us during AAPG International in Cartagena at booth #98

cgg.com/multi-client



PRESIDENT'S COLUMN

Doing What We Say We Do:

Inclusivity – Integrating Geoscience and a Global AAPG

BY LEE F. KRYSSTINIK

AAPG has a long heritage – in fact, ever since our inception in 1917 – of sharing excellent petroleum geoscience with an ever-broadening circle of geoscientists.

Today AAPG has grown into a global association, now on the verge of starting our second century, and we continue to focus on inclusivity at many levels as we work to maintain the delivery of excellent geoscience, professional development and service to our members around the world – as well as providing service and innovation relevant to our ever more interrelated global society.

You might ask: What are we actually doing to broaden and continue to grow that circle of increasing knowledge and inclusivity during this time of transformational change in the way petroleum geoscience information is gathered and transmitted?

The answer would include:

▶ With our **Sections**, we are looking for new ways to partner with them to generate more geoscience product of both local and global interest.

▶ In our **Regions**, we are looking for ways to make the membership application process less challenging. Also, the Regions now are more directly involved in the selection of Distinguished Lecturers who will visit their local areas.

▶ With our **younger geoscientists**, who represent our future, numerous activities are under way to help integrate and connect them with their peers, further expanding the global community that is AAPG.

An example of this initiative that I want to congratulate is the Rocky Mountain Section's decision to have a group of **Young Professionals (YPs)** organize its



KRYSSTINIK

2014 meeting. To this I say BRAVO!

▶ As I mentioned in my first column (July EXPLORER), we are calling upon each part of the Association – Divisions, committees, Regions and Sections – to assess whether the financial resources they currently are spending are directly aimed at the key strategic goals that together we're pursuing as AAPG.

Inclusivity and working together are critical parts of actually achieving these strategies, and this is an ongoing process as we work toward ever better focus.

The long-arc goal: For AAPG to be a global leader in providing geoscience that has relevance and utility in plays around the world.

* * *

In the near term, it is a pleasure to report there is a lot of movement toward enhanced science delivery within a context of ever-greater inclusivity:

▶ As I write this column we have just finished AAPG Leadership Days, where I had the opportunity to meet a remarkably diverse group of enthusiastic and hard-working geoscientists who brought their unique perspectives with them to help AAPG plot out a course going into the next

century of the organization.

▶ Geologists headed for Denver in mid-August to attend the inaugural Unconventional Resources Technology Conference (URTeC), a meeting that combined the talents and scientific expertise of AAPG, SPE and SEG members (see related story and photos, page 46).

▶ This month geoscientists from around the globe will have the pleasure of joining our Latin American colleagues at the AAPG International Conference and Exhibition (ICE) in Cartagena, Colombia.

▶ We also have just launched "INTERPRETATION," a new journal in partnership with SEG.

Each of the above examples represents key aspects of where AAPG is headed as we aim toward our second century: inclusiveness, integration and partnership.

URTeC, for example, is a collaborative effort between AAPG, SPE and SEG

[See President, next page](#)

Earth Science Week Theme: 'Mapping Our World'

"Mapping Our World" is the theme of Earth Science Week 2013, an annual event that promotes scientific understanding of our planet.

A poster promoting activities being held Oct. 13-19 is inserted in U.S. addresses of this issue at page 17.

The ESW 2013 theme promotes awareness of the many exciting uses of maps and mapping technologies in the geosciences.

Among the events scheduled are three national contests including:

▶ A visual arts contest, "Making Maps Through the Ages," is open to students in

grades K-5. Imagine yourself as an Earth scientist and make a map displaying locations of land, water, air and living things.

▶ An essay contest focusing on "How Geoscientists Use Maps" is available for students in grades 6-9. Discuss how maps are used to monitor interactions among Earth systems, or how maps help us meet challenges and maximize opportunities in areas like energy, agriculture, environment, natural disasters and community planning.

▶ A photography contest is open to the general public with the theme "Mapping My Community." The goal: In a photo, show how maps are used in your community.

The ESW program, launched by the American Geological Institute in 1998, encourages a "grass roots" effort for the geosciences community to publicize the event, distribute teaching materials and provide guidance for those interested in participating in ESW.

Earth Science Week is organized annually by AGI with support from the AAPG Foundation, U.S. Geological Survey, NASA, U.S. National Park Service, ExxonMobil, ESRI and others.

For more information go to www.earthsciweek.org.

STAFF

AAPG Headquarters:
1-800-364-2274 (U.S. & Canada only)
others 1-918-584-2555

Managing Editor

Vern Stefanic
email: vstefan@aapg.org

Communications Project Specialist

Susie Moore
email: smoore@aapg.org

Graphics/Production

Matt Randolph
email: mrandolph@aapg.org

Advertising Coordinator

Steve Praytor
P.O. Box 979
Tulsa, Okla. 74101
telephone: (918) 560-2647
(U.S. and Canada only: 1-800-288-7636)
(Note: The above number is for advertising purposes only.)
fax: (918) 560-2636
email: spraytor@aapg.org

CORRESPONDENTS

David Brown
Louise S. Durham
Susan Eaton

Barry Friedman
Christopher Stone

TABLE of CONTENTS

6 Up close and personal: Videos of the **AAPG officer candidates** – recorded in a new format – are available online.

16 It takes a village: **Integrated approaches and technologies** are proving their worth in the seismic world.

18 It's old, it's rough, it was SO last century. And that's why new seismic work in the famed **Permian Basin** is so exciting.

28 Geology Without Limits: The complex and tectonically challenging **Caribbean Plate** is about to be the target of a three-year international seismic investigation.

32 Southward bound: A team of geoscientists – including EXPLORER correspondent Susan Eaton – headed to **Antarctica** to research planetary processes on the world's last remaining wilderness.

36 Does it, or doesn't it have an effect on earthquake activity? Various geoscientists take a look at the world of **induced seismic** activity.

REGULAR DEPARTMENTS

Spotlight On.....	42
Regions and Sections	54
Historical Highlights	62
Policy Watch	66
Geophysical Corner	68
Foundation Update.....	70
Readers' Forum.....	75
Classified Ads	76
Director's Corner	78
Divisions Report (DEG)	78

ON THE COVER:

EXPLORER correspondent Susan Eaton recently made a third scientific trip to Antarctica (her report begins on page 32), and on the journey saw this sight: A thrust contact at Godthul, South Georgia (of "Good Harbor" to the Norwegian whalers), mapped by geologists from the British Antarctic Survey, between the overlying Cumberland Bay Formation turbidites (which contain Aptian-Albian fossils) and the underlying Sandebugten turbidites. Photo courtesy of Jonathan Goodmacher.

Left: Geologists investigate volcanic ash deposits at Deception Island (an ocean-filled volcanic crater and a smaller cinder cone are in background). Located in the South Shetland Islands, Deception Island last erupted in 1970. Photo courtesy of Susan R. Eaton.



Scan this for the mobile version of the current web Explorer.



Advisory: A New Way to Get AAPG Updates

By VICKIE DAWKINS-KERSEY, AAPG Market Development and Integration Advisor

By now, most of you have received the debut edition of the AAPG Advisory, a new electronic communication designed to deliver Association information in a convenient, easy-to-access manner.

The Advisory combines important information about all of AAPG's products, services, events, programs, conferences and publications into one communication piece that will be delivered on a regular basis to computers, tablets and mobile devices.

Readers will enjoy the freedom to choose the news categories that apply to their individual interests, with the ability to forward news items by email,

print, Twitter, Facebook or LinkedIn.

"As AAPG expands its presence around the globe, our goal is to provide our members and customers with effective tools to stay on top of the many ways the Association and its members are advancing the world of petroleum geosciences," said AAPG Executive Director David Curtiss. "The Advisory is our latest effort to deliver the information you need, when you need it."

The AAPG Advisory is designed to offer categories of interest that include News, Science, Education, Events, Datapages, Sections and Regions, Divisions, Store, Member Services and Foundation – with relevant information

in all categories, for all members.

Current plans call for the Advisory to be distributed twice monthly, with an "Advisory Alert" distributed between issues to remind visitors of deadline-driven events and opportunities.

For more information about the AAPG Advisory – or, for non-members, to subscribe now – contact Advisory@aapg.org.



President from previous page

to create a truly integrated technical conference that addresses a wide diversity of challenges within unconventional resource identification, discovery and optimized recovery.

This conference is a major departure from the usual product on the market dealing with dominantly business-related content. By partnering with SPE and SEG, the URTeC conference will bring geoscientists as well as vendors together to discuss the technical state of the art in unconventional resource capture.

This type of integrated partnership offers excellent value to our respective members – and I hope it will be a model for future co-operative joint ventures.

This year's ICE in Cartagena is another great example of people from many nations coming together to share excellent geoscience insights and advances, as well as best practices in the international oil and gas arena.

A product that AAPG delivers in remarkable abundance – even though we don't often address it – are the interpersonal connections that come together at meetings like this. ICE provides an avenue for cross-pollination amongst companies and nations that normally would not be sharing with one another.

We're building communities. And this is a great example of something we don't often say we do, but is in fact happening a lot because of AAPG – much to the betterment of geoscience and our industry.

The new journal *INTERPRETATION* is focused on the integration of geological, geophysical and other data into unified subsurface interpretations. SEG originated the concept and AAPG is excited to join them as a partner, to expand dissemination of our science and to better display the integrated efforts of our colleagues as they push forward new frontiers by integrating the excellent vertical resolution geologists have with well logs with the far better horizontal resolution of geophysics.

As most of us know by now, the results can be quite powerful. I am excited about the potential of *INTERPRETATION* to impact exploration and production around the globe.

The long-arc goal for all of these things is for AAPG to be a global leader in providing geoscience that has relevance and utility in plays around the world.

Consequently, this requires input and contributions from around the world. This in turn implies that we are able to communicate our value proposition to those potential contributors. The student and young professional leaders from all over the globe, along with their more experienced colleagues at AAPG Leadership Days, gave me great confidence that this part of our future is in great hands.

There is much more progress to make, but we are off to a great start!

Of course, there always is room for improvement – please provide your suggestions on how you believe AAPG could be more inclusive to better serve you, your Section/Region, our science and society.

Feel free to "ping" me at lee.krystinik@aapg.org to help us to do more of what we say we do at AAPG!

MORE THAN MAPPING CAN YOUR SOFTWARE WITHSTAND A FLOOD OF INFORMATION?

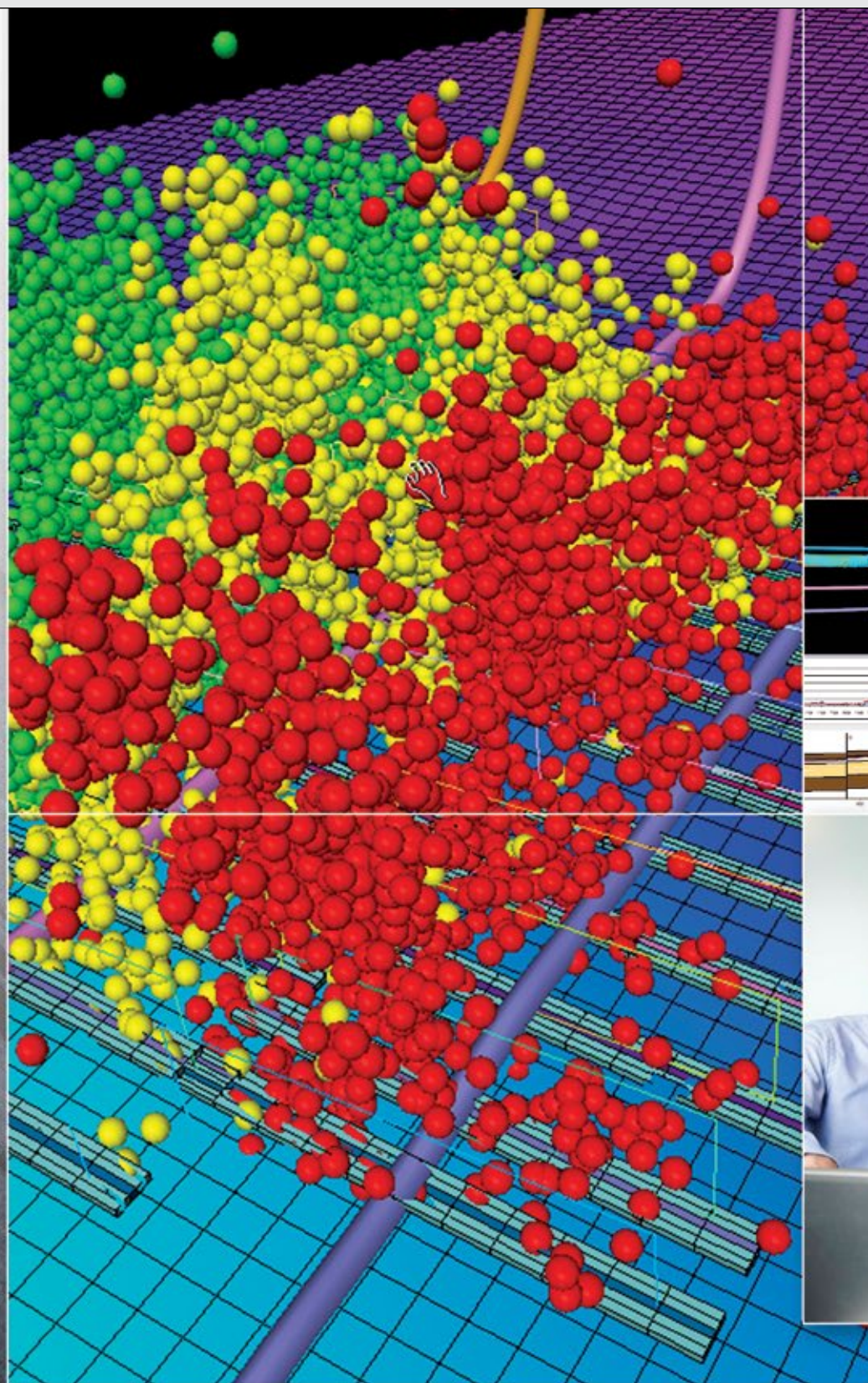


As the most dynamic data aggregator in the industry, Petrosys keeps your workflow moving.

SOFTWARE SERVICES CONNECTIVITY DATA MANAGEMENT

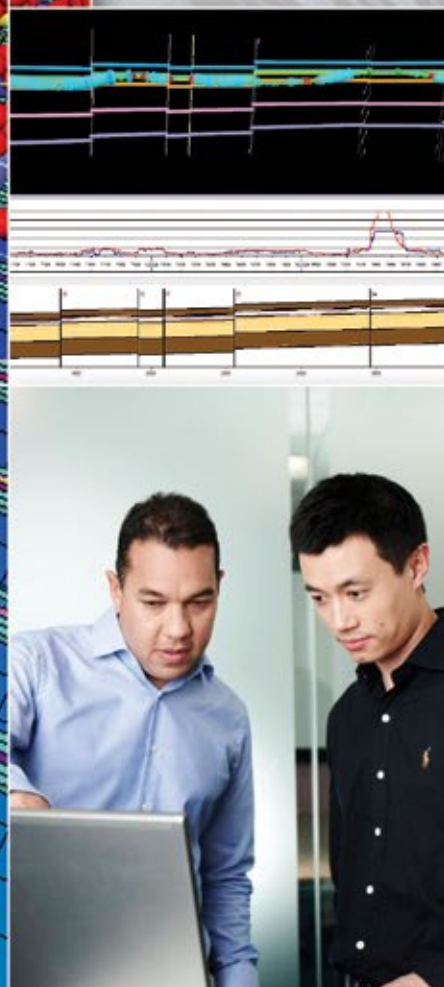
Only Petrosys' powerful suite of software effortlessly navigates the overflow of data from multiple sources and disciplines. Our industry-leading dynamic data aggregation, integration and surface modeling capabilities enable you to identify, refine and resolve issues more quickly. Dedicated technical support and service offer expert solutions when needed. And with our clear, logical interface, even getting started is smooth sailing. Start achieving exploration and production targets at a lower cost and in a shorter time frame with Petrosys. To learn more go to www.petrosys.com.au/transcend.

 PETROSYS



Petrel

E&P SOFTWARE PLATFORM



Truly understand your shale development— using integrated analysis.

In shale wells 50% of the cost goes into completions. With the Petrel® E&P software platform, you can unite a wealth of data to characterize heterogeneity and stresses, geosteer to stay in zone, model hydraulic fractures, and engineer completions—to accurately target your fracturing and stimulation.

www.slb.com/Petrel

Schlumberger

*Mark of Schlumberger. © 2013 Schlumberger. 1246-0224

Upclose and personal

Officer Candidate Videos Now Available Online

Videos of all six AAPG officer candidates for the 2013-15 Executive Committee are now available online, where they will remain through the election season.

Also available will be biographies and individual information for the candidates.

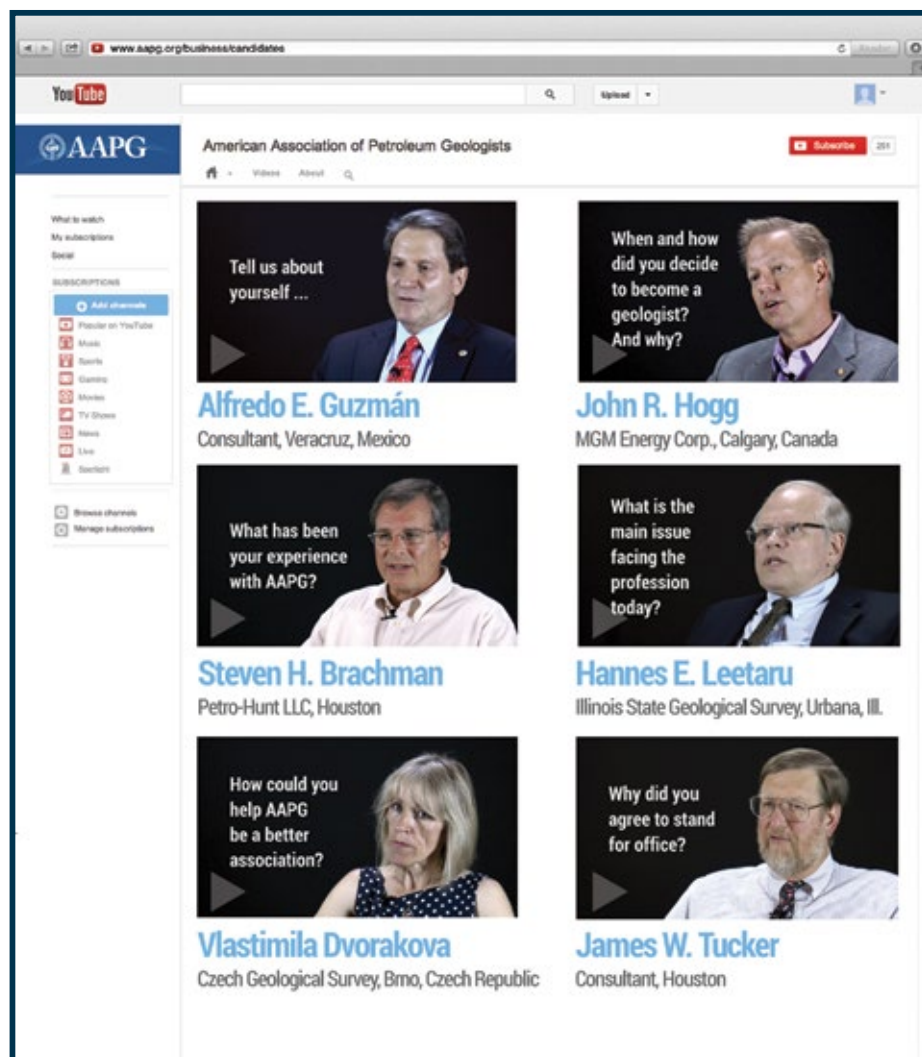
The candidates were videoed during the recent Leadership Conference in Tulsa. In a new format, all are shown responding to six questions, intended to allow members around the world to have a better introduction to those running for office.

Those questions include:

- ▶ When and how did you decide to become a geologist – and why?
- ▶ What has been your experience with AAPG?
- ▶ What is the main issue facing the profession today?
- ▶ How could you help AAPG be a better association?
- ▶ Why did you agree to stand for office?

Printed information on the candidates also will be included in an EXPLORER in early 2014. Ballots will be mailed and online voting will begin in spring 2014.

The person voted president-elect will serve in that capacity for one year and



will be AAPG president for 2015-16. The terms for vice president and treasurer are two years.

To view the videos, go online to www.aapg.org/business/candidates/. The slate is:

President-Elect

- ☐ Alfredo E. Guzmán, consultant, Veracruz, Mexico.
- ☐ John R. Hogg, MGM Energy Corp., Calgary, Canada.

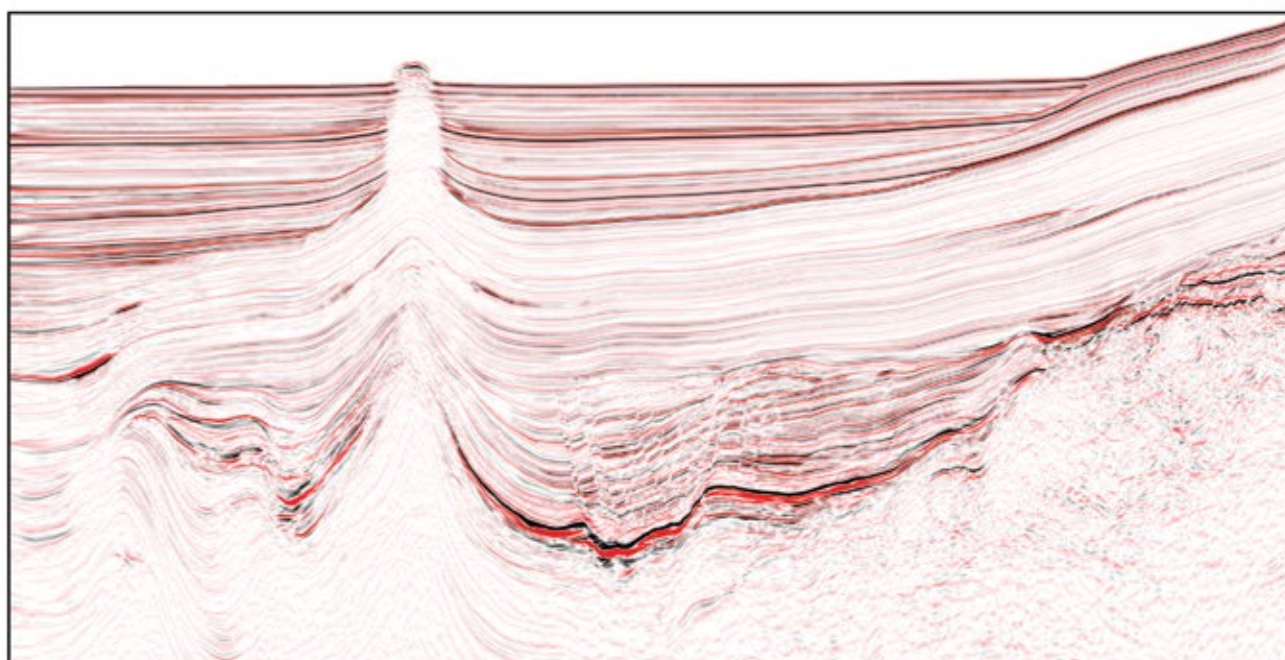
Vice President-Sections

- ☐ Steven H. Brachman, Petro-Hunt LLC, Houston.
- ☐ Hannes E. Leetaru, Illinois State Geological Survey, Urbana, Ill.

Treasurer

- ☐ Vlastimila Dvorakova, Czech Geological Survey, Brno, Czech Republic.
- ☐ James W. Tucker, consultant, Houston.

MultiClient Geophysical



Offshore Barbados

MCG has available 6,876 km of

- New Seismic,
- Gravity and
- Magnetic Data

offshore Barbados.

The data covers all 26 blocks open for bidding.

For further information please contact:

Tom Wolden — Oslo
+47 66 98 41 18

Kenneth Mohn — Houston
+1 713 485-9696

John Whitcomb — Singapore
+65 63 27 97 44

www.mcgeophysical.no



GeoGraphix®

www.lmkr.com/geographix

Discover Your Potential

By unleashing the power of GeoGraphix



Geology

Make this well better than your last through integrated multi-dimensional geological interpretation

Geophysics

Maximize your reservoir understanding through seamless interpretation of seismic and geological data

Field Planning

Optimize your field development efficiency with quick and easy field planning tools

Visualization

See where your next BIG opportunity lies with state of the art mapping & 3D visualization

LMKR is a petroleum technology company with an extensive solutions portfolio that includes reservoir-centric interpretation, modeling and analytics software, mobile technology solutions, E&P data services as well as geoscience and information management consulting solutions



GeoGraphix | Geoscience Services | GeoTechnology Applications | Information Management

GeoGraphix® is a registered trademark of Landmark Graphics Corporation. LMKR is a trademark of LMKR Holdings. All other company and product names are trademarks of their respective owners.

MIL POWER LTD

Delivering Battery Performance

MIL Power has specialized in the design and manufacture of high performance batteries and chargers for military communications, police, oceanographic, oil and gas and other demanding applications for over 15 years.

Recognized globally for our battle tested and proven battery designs - we provide our customers with safe, reliable, high quality manufactured products. We know what it takes to keep your equipment powered under any conditions. We build mission-critical solutions engineered to exceed military and industry specifications.

MIL Power set the standards others follow

A World Leader in High-Tech Seismic Batteries

Our proprietary Lithium Polymer, Lithium Iron Phosphate, and Lithium Ion cells are built into batteries with internal bespoke electronics to protect the cells from abuse and to ensure maximum battery performance.



MIL Power's Seismic batteries can be fitted with interchangeable output leads for various data acquisition units. Our batteries are small, ultra lightweight with an excellent power-to-weight ratio.

We understand that cost is key to the success of our batteries. We also know that our customers cannot afford to compromise reliability and safety simply to reduce cost.

MIL Power IS Your Number One Battery Choice

MIL Power has Deployed 135,000 Batteries Worldwide

Our Seismic Recorder batteries are operational in all environments - hot and humid South American jungles, frigid Siberian tundra, searing hot Middle Eastern deserts and Alaskan permafrost.



MIL Power's range of Lithium Polymer batteries for the GSR & GSX recorders



USA Office (California) Tel: +1 973 668 2928

www.milpower.co.uk

Email: jack.stone@milpower.co.uk

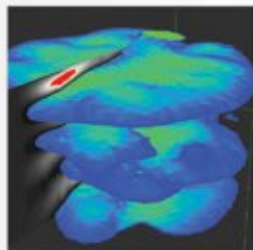
COMPELLING

360° Views of Your Subsurface Assets.



COMPELLING OUTCOMES FROM COLLABORATIVE GEOPHYSICS

- Increase exploration success and optimize production with full azimuth seismic imaging and characterization
- Improve seismic imaging accuracy with sealed structural and stratigraphic velocity models
- Reduce project timeline up to 50% with Modeling While Interpreting
- Lower IT cost of ownership with one interpretation solution serving conventional and unconventional assets
- Enhance image and model clarity with multi-core CPU/GPU implementations



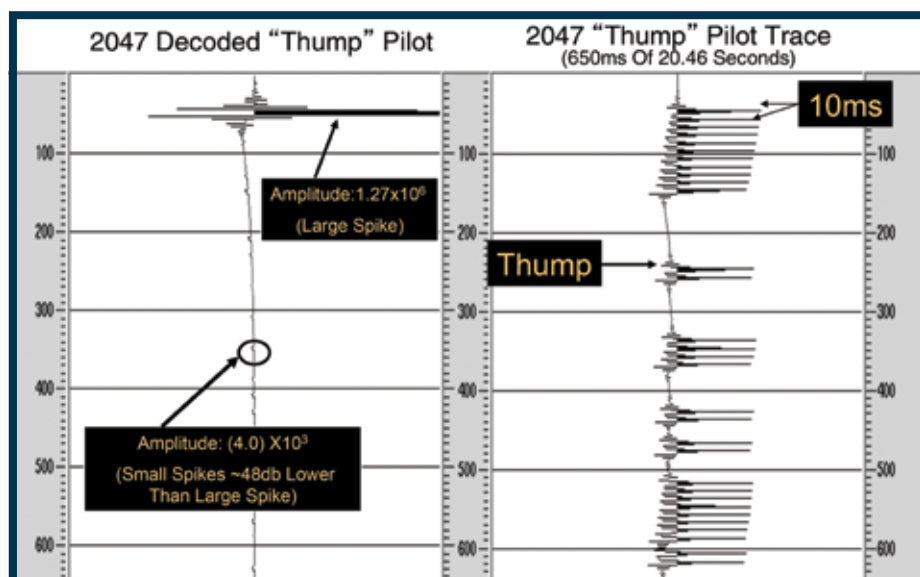
A full azimuth angle gather from the Barnett Shale visualized in 3D

Get **compelling** results.

Find out how at pdgm.com/SEG2013

SEG Houston 2013 Booth 2842

Paradigm®



Impulsive seismic

Second Time's a Charm

By LOUISE S. DURHAM, EXPLORER Correspondent

Oil industry technology is ever-evolving, owing to the ongoing challenges to find and produce hydrocarbons safely, efficiently and economically.

Many new ideas come and go. Some are relegated to the trash bin, while others get fast-tracked from the get-go.

And certain promising ones may be put on the back shelf until new technology comes along that can turn them into viable methodologies.

In the esoteric realm of seismic data acquisition and processing, Galcode coded-sweep methodology comes to mind.

Galcode is made up of co-called seismic "chirps," blended with the coding scheme devised by Bill Currie and detailed in the Texaco patent (now expired) "Coding Seismic Sources."

Both techniques were developed about 20 years ago, yet neither was routinely applied in the field at that time, owing to implementation and processing issues.

Today, thanks to major advances in seismic vibrator electronics, recording systems, computing systems and more, simultaneous seismic data acquisition based on the alliance of these two independent technologies can be used to improve data acquisition productivity in select 2-D or 3-D vibroseis and impulsive source seismic surveys.

Additionally, component data can be efficiently extracted from the composite records, according to Tom Thomas, chief technology officer at Dawson Geophysical Co.



THOMAS



JURICK

Chirps and Hammers

Galcode methodology garnered praise when five comparable 3-D seismic surveys using diverse acquisition techniques were acquired over a common surface area of 6.25 square miles located 14 miles northwest of Midland, Texas, in the Permian Basin.

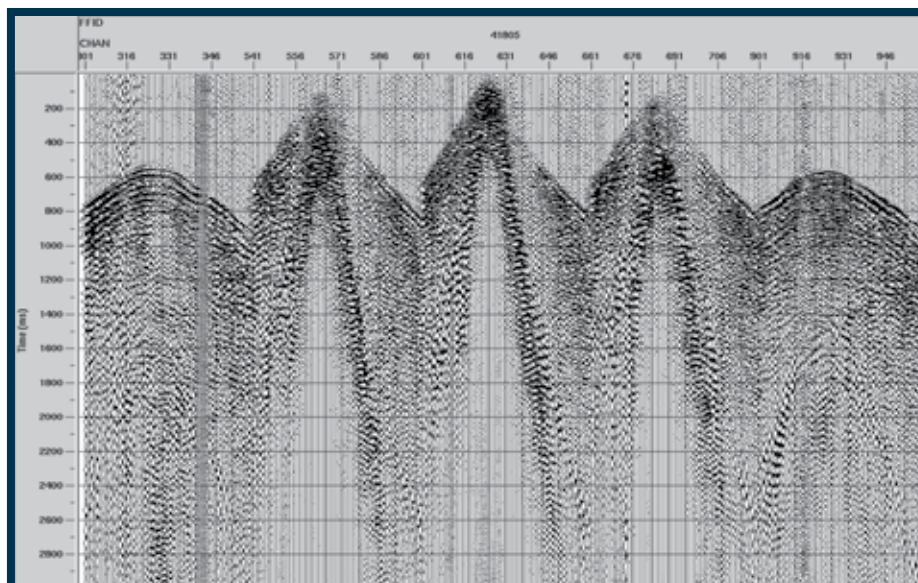
Dawson and Devon Energy acquired and processed the surveys on land provided by Fasken Oil and Ranch Ltd.

The tests included the simultaneous sourced Galcode, the single sweep, low energy, high common midpoint (CMP) fold technique, and the high effort multi-sweep per vibrator source point (VP) conventional method.

The recording strategy enabled comparisons on data sourced with one or two vibrators per source point.

"Two of the three coded source scenarios tested the simultaneous chirp

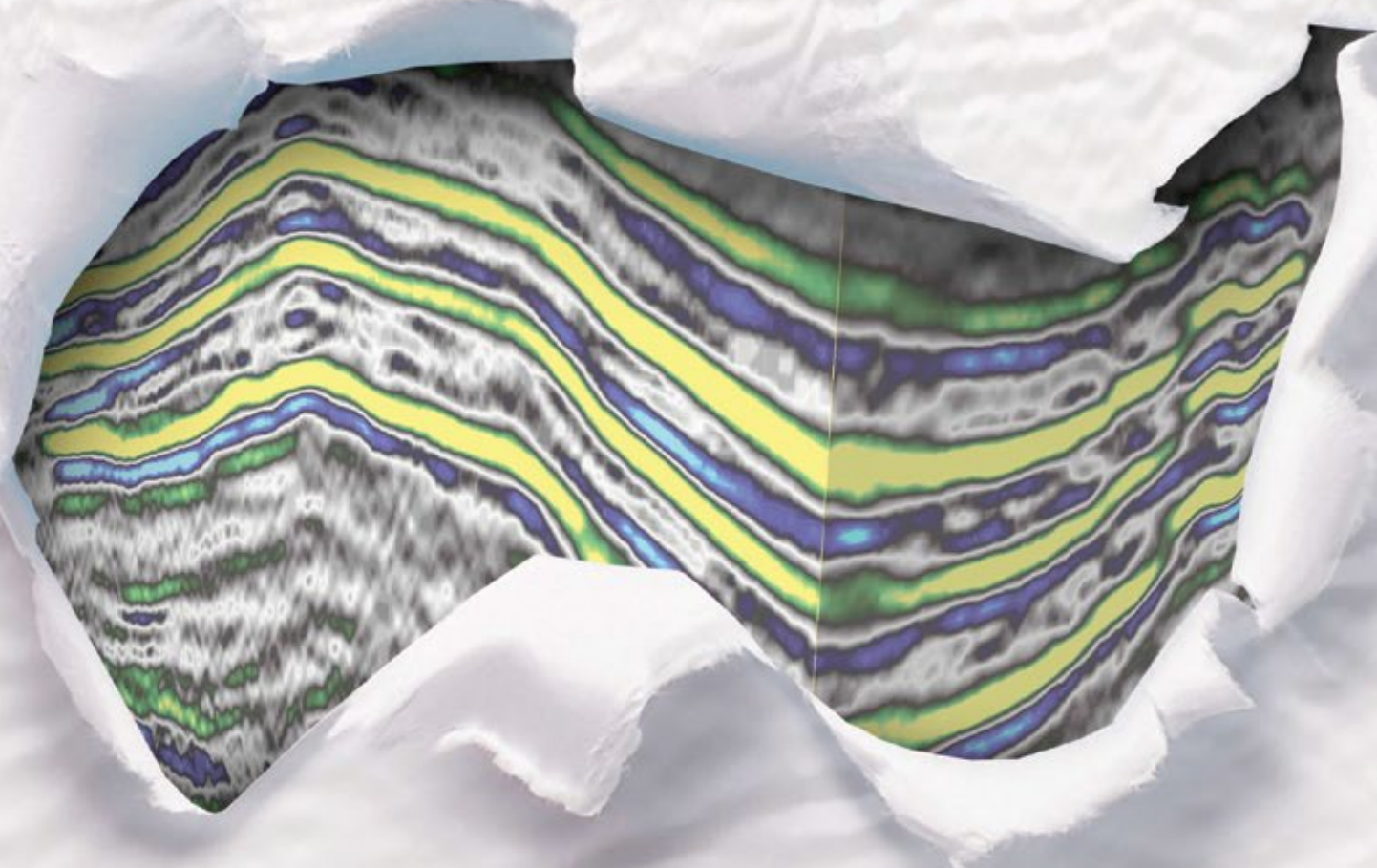
See **Impulsive**, page 12



Test 2 – Galcode "chirp" simultaneous source gather (1 vib/set, 7 point code, 7 flags, 5 second chirp length)

see us at
SEG ANNUAL MEETING
Hall E • Booth #954
AAPG ICE 2013
Booth #6

discover more



...with Spectrum's Multi-Client seismic

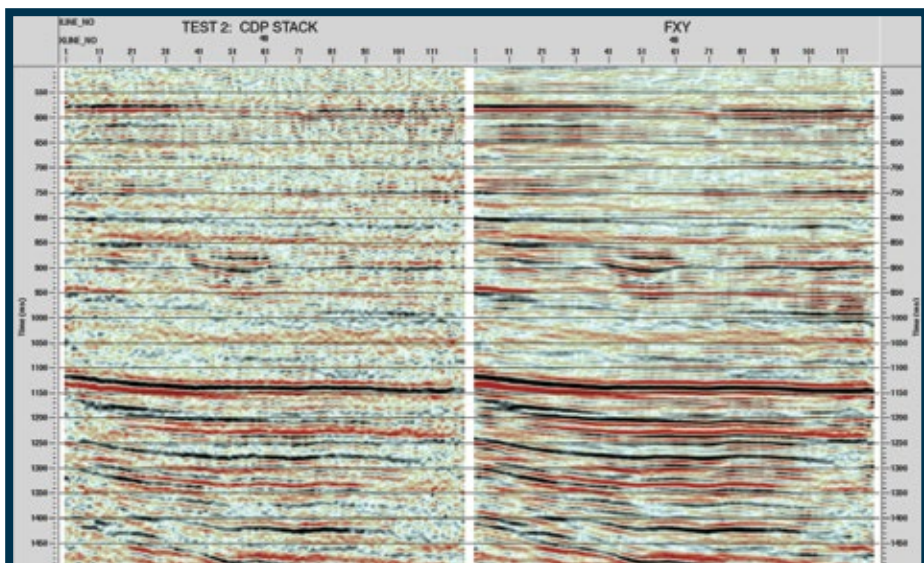
More than just data...

Spectrum's experienced teams of geoscientists use seismic interpretation to evaluate the hydrocarbon potential of the basins we work in, target key plays and solve imaging challenges. This enables our clients to make better decisions with the data they buy.

Find out more at:



www.spectrumasa.com



Galcode "chirp" simultaneous sourcing
(460 fold, 1 vib/set, 7 point code, 7 flags, 5 second chirp)

Impulsive from page 10

method," Thomas said.

"Chirps are defined as conventional vibroseis sweeps that replace the '1's in the matrix of the binary code," he noted.

"With a vibrator, you can do chirps, which are little sweeplets that are normal conventional sweeps but a series of offs and ons – like sweep six seconds then wait six seconds for example," he said. "They have the same bandwidth as conventional sweeps.

"But with thumps, you're actually trying to make the vibrator hit the ground like a hammer hit, similar to what a dynamite source would be, but the vibrator hits with very small force," Thomas said. "Thumps are short duration vibroseis pulses lasting about five milliseconds (ms).

"The idea is we can get a lot of little hammer hits and code them so we can do simultaneous sourcing, which can be a big productivity uplift," he emphasized.

He noted that vibrators are not actually designed to thump but must be made to do so.

"The vibrator is a repeatable source – you can time it with other vibrators so you can put more units out acting as one," he noted. "There are a lot of advantages to using these machines to make these thumps."

Thomas emphasized that even though simultaneous sourcing is the big advantage of the coded chirp mode, the thump mode also can be leveraged during simultaneous sourcing.

"But the main reason to go after thump technology is the potential to use the broad bandwidth seismic energy generated by the vibrator as an impulse source," he noted.

Good First Steps

Upon completion of the acquisition testing program, the companies were pleased with the Galcode method.

But it might not be ready for prime time just yet.

"It's a technique or methodology we can use that deserves testing and analysis in any given area," said Dana Jurick, a geoscientist at Devon Energy during the program and currently team leader of the advanced interpretation group in geophysical technology at ConocoPhillips.

"The results we saw from the project showed its potential using what we call distributed simultaneous sources," Jurick said. "It showed good reason to believe the Galcode type of approach produced as good or better quality than standard conventional techniques.

"We think in some areas it could provide uplift in production, productivity and in data quality," he noted.

"The Galcode technique allows you to increase the fold of your data significantly, and there's a known relationship between increased fold and increased data quality," Jurick said. "For that reason, this is an important technology.

"People do simultaneous sourcing in different ways, but Galcode is kind of an innovation," he emphasized.

Jurick lamented the lack of a well in the middle of the test area to tie in with, which would have removed any subjectivity from the conclusions, making their work even more definitive.

"Oftentimes we take baby steps in the way we advance our science and our ability to produce better data," he noted. "This was a step in that direction, where the capabilities of modern equipment allowed us to take that next step and assess it.

"There were no red flags that said it wasn't working; quite the contrary, we think the results looked positive."

Thomas gave the Galcode approach equally high marks.

"We think the program results were very positive and proved the technology is feasible," he said. "Since then, we've been trying to optimize it.

"I think over time, it may well change the way we do seismic acquisition on land with vibroseis," Thomas emphasized.

For now, Jurick cautioned that in a new area the Galcode method should be tested against the tried-and-true conventional techniques developed over 50 years or so.

"Going into a new area," he professed, "I don't assume I know the best way." ■

Warning: Our data has gone mobile (You may never return to the office)



Now, get **geoLOGIC**'s value-added data almost any place, any time, any way you want it. Available through **gDCweb** on your tablet, smartphone or computer.

With 30 years of data experience behind it, **gDC** is the source for high quality, value-added well and land data from across Western Canada and the Northern United States. Another plus – our data is accessible through an expanding range of industry software utilizing our own easy-to-use **gDC GIS** and our **geoSCOUT** software.

View, search, import and export well, land and production data, documents, logs and more from almost anywhere. For more information visit our website at www.geoLOGIC.com



Leading the way with customer-driven data, integrated software and services for your upstream decision-making needs.

geoSCOUT | gDC | petroCUBE at www.geoLOGIC.com

SEE THE ENERGY

TGS gives you a complete view of the key mature, emerging and frontier offshore and onshore hydrocarbon basins around the world.

- Extensive high quality global 2D and 3D multi-client seismic libraries
- Advanced processing and imaging services to help resolve complex challenges
- Industry's largest global database of digital well data and regional interpretation products
- Innovative and complete Permanent Reservoir Monitoring solutions

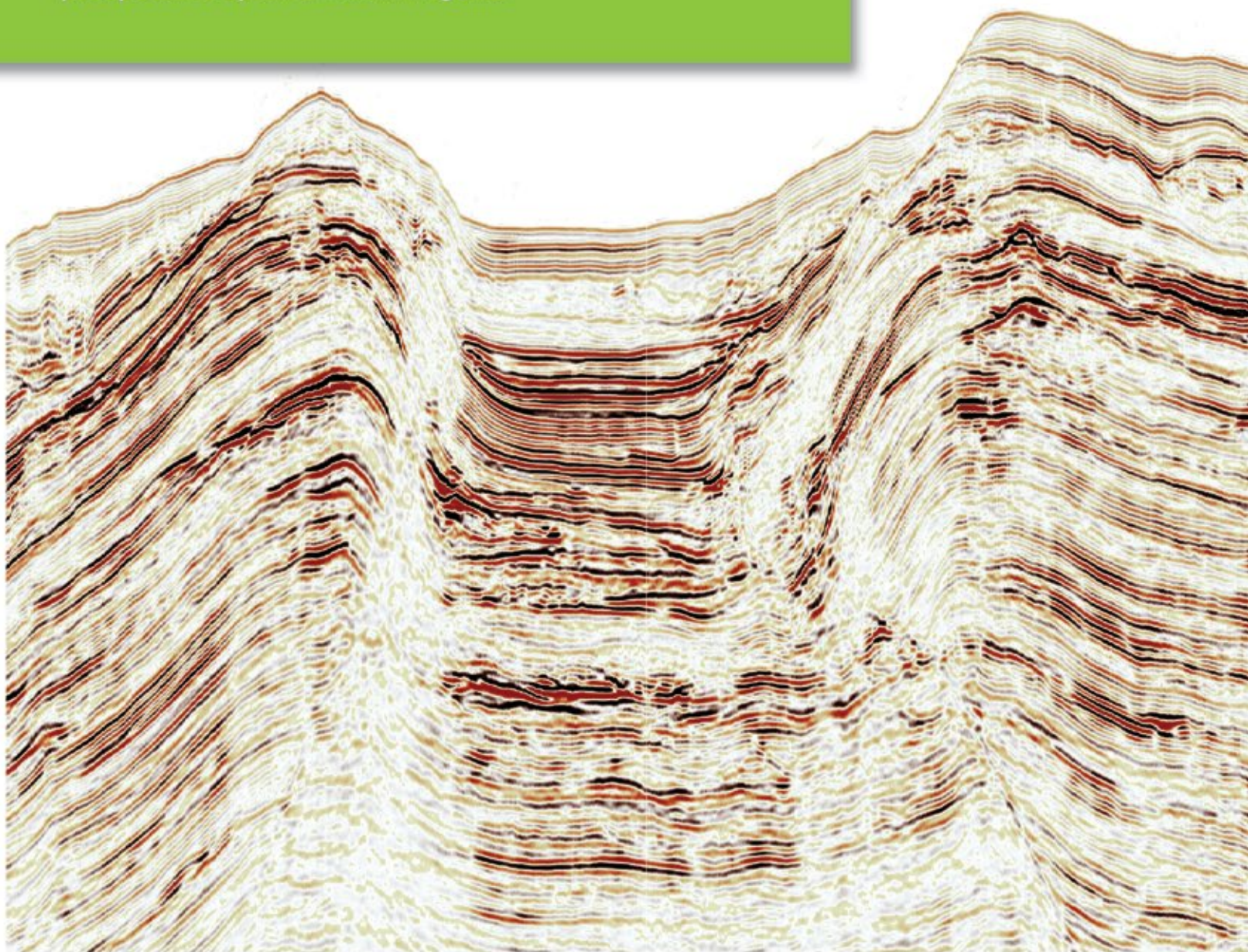


WWW.TGS.COM

Nigeria Deepwater

Polarcus Multi-Client 3D Data

Polarcus Nigeria Limited has exclusive rights from the Department of Petroleum Resources to broker an extensive modern 3D seismic database of over 11,000 sq. km, covering large tracts of the most prospective open areas in Nigeria.



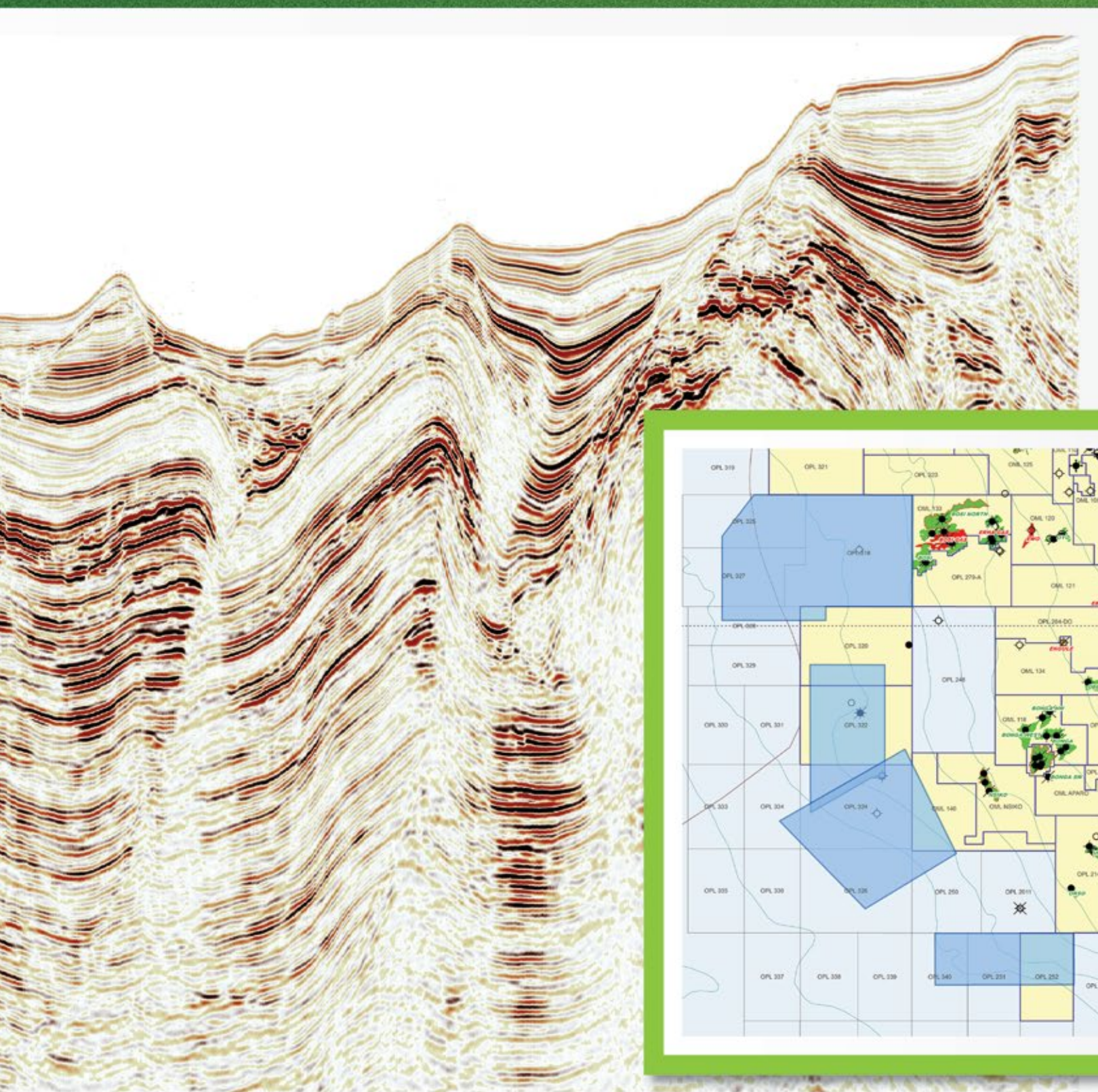
For more information contact:

John Balch
john.balch@polarcus.com
+44 7554 444822

Albert Esiri
albert@ash-bert.com
+234 803 305 5949

www.polarcus.com/mc

er Renaissance



Department of
Petroleum Resources



WESTERN CANADA EMERGING PLAYS AND EXPLORATION OPPORTUNITIES

TWO-DAY IN-HOUSE SEMINAR



Need to understand key drivers for Resource Play opportunities?

Canadian Discovery's applied exploration and development oriented seminar provides:

- » Regional basin overview of 30+ resource plays
- » Detailed review of six specific client-selected plays
- » Ranking of emerging plays
- » High level economic metrics

For more information and to book your seminar

Contact Cheryl Wright
cwright@canadiandiscovery.com | 403.269.3644

Canadian Discovery Ltd. (CDL) offers a complete suite of solutions for companies wanting to assess oil and gas opportunities in Western Canada. From E&P intelligence products through in-house seminars and multi-client studies to custom geoscience consulting, CDL's **Strategic @ Services** can provide detailed knowledge on current and emerging opportunities, along with efficient and dependable risk and upside analysis.

canadiandiscovery.com



Integrated seismic Value in a Team Effort

BY LOUISE S. DURHAM, EXPLORER Correspondent

Despite the huge volumes of oil and gas being produced from shale deposits, there's still much to learn about these unconventional reservoirs, which have the added role of being source rocks.

They persist in challenging even the most experienced geoscientists and operators.

Unfortunately, quantitative seismic interpretation workflows continue to be immature for these reservoirs, compared to carbonates and clastics.

"With unconventional shale gas and oil, you have to know the rock quality, whether the rock is brittle or not in order to fracture the reservoir," said Gabino Castillo, North America services and software manager at CGGVeritas in Houston.

"Also," he continued, "if it's brittle, we need to know how the fractures will propagate."

Surface seismic data and microseismic data both are key assets for many companies producing from unconventional resource plays.

And there's good news in that recent advances in pre-stack seismic data analysis yield attributes that appear to correlate to lithology, rock strength and stress fields in the formation, according to Castillo.

"Knowledge and proper utilization of these attributes may prove valuable in the optimization of drilling and completion activities," he said.

Tweaking With Purpose

Castillo has been involved in a number of projects to hone his expertise in the newest techniques to characterize and understand unconventional reservoirs. Much of this work has focused on the well-known Haynesville shale gas play in North Louisiana.

Evolving out of this study effort is an integrated seismic approach based on pre-stack azimuthal seismic data analysis, microseismic and well log information to identify sweet spots, estimate geomechanical properties and in-situ principal stresses.

With a tweak or two, the technology approach garnered from the studies can be applied to other formations – given that the challenges to be resolved are the same, more or less.

"The weight we put on each individual technology is different," Castillo said. "Sometimes the most important is TOC, sometimes brittleness, sometimes fracturing – it depends on the case."

He noted the importance of properties such as Young's Modulus (measure of elasticity of a rock or other material) and Poisson's Ratio (measure of how a rock is going to deform in one area relative to another).

"These may provide valuable information for facies identification, mineral content and rock strength," Castillo emphasized. "From these, we may infer preferential sweet spots."

He gives high marks to the opportunity for validation and calibration of the work.

"We have inversion, all the elastic attributes, anisotropy, etcetera, etcetera," he noted. "The one piece that was always missing before was the validation, calibration, the microseismic."

"I had microseismic data, cuttings, SEM mineralogy analysis. So I had textural mineralogical data we used to estimate brittleness, which is useful for well completions," Castillo said. "We had the opportunity to calibrate all the seismic properties with hard data."

Gabino Castillo, North America services and software manager at CGGVeritas in Houston, will present the paper "Integrated Seismic Approach and Key Technologies for Shale Gas Characterization," at this month's AAPG International Conference and Exhibition in Cartagena, Colombia.

The paper will be presented at 10:50 a.m. Wednesday, Sept. 11.

Castillo also is a co-chair, with Gervasio Barzola of Pioneer Natural Resources, of an AAPG/EMD session titled "Unconventional Resources: Evaluation Tools and Methodologies." That morning session will begin at 8:30 a.m. Tuesday, Sept. 10.

"On top of that, with microseismic data I found interesting correlations between size of the stimulated reservoir volume and Young's Modulus," he added. "So I found a positive correlation in that."

"Integration between surface seismic, microseismic data, mineralogy, production data – how to put everything together – is essential for unconventional reservoir characterization."

Putting It Together

Castillo assembled a summary sketch of the key ingredients for shale reservoir characterization.

"Integration between surface seismic, microseismic data, mineralogy, production data – how to put everything together – is essential for unconventional reservoir characterization," he said.

He elaborated further.

"The way I see it, you have seismic data and it gives you pre-stack inversion, azimuthal attributes, fractures."

"From the microseismic you have location of event, magnitude and the stimulated reservoir volume."

"With the mineralogy, you have reservoir quality, geomechanical properties."

"Using production data, you have, for example, sweet spot maps, which are really important. ■"



NEFTEx EARTH MODEL: RESERVOIR AND SEAL MODULE

Reduce Your Subsurface Risk

A new product within the Neftex Earth Model product suite, our Reservoir and Seal Module enables you to access millions of pieces of rock property data from around the world. Each piece of data is coded for spatial enablement and by age within a sequence stratigraphic model, providing a high resolution temporal framework for the data to be effortlessly integrated into a complete and accurate analysis of risk at a variety of scales.

The Module also provides an extensive suite of analogue data to support your exploration strategy in both conventional and unconventional plays worldwide.

Contact us today to find out more:

Website: www.neftex.com

Email: enquiries@neftex.com

Tel: +44 (0)1235 442699

Facebook: www.facebook.com/neftex

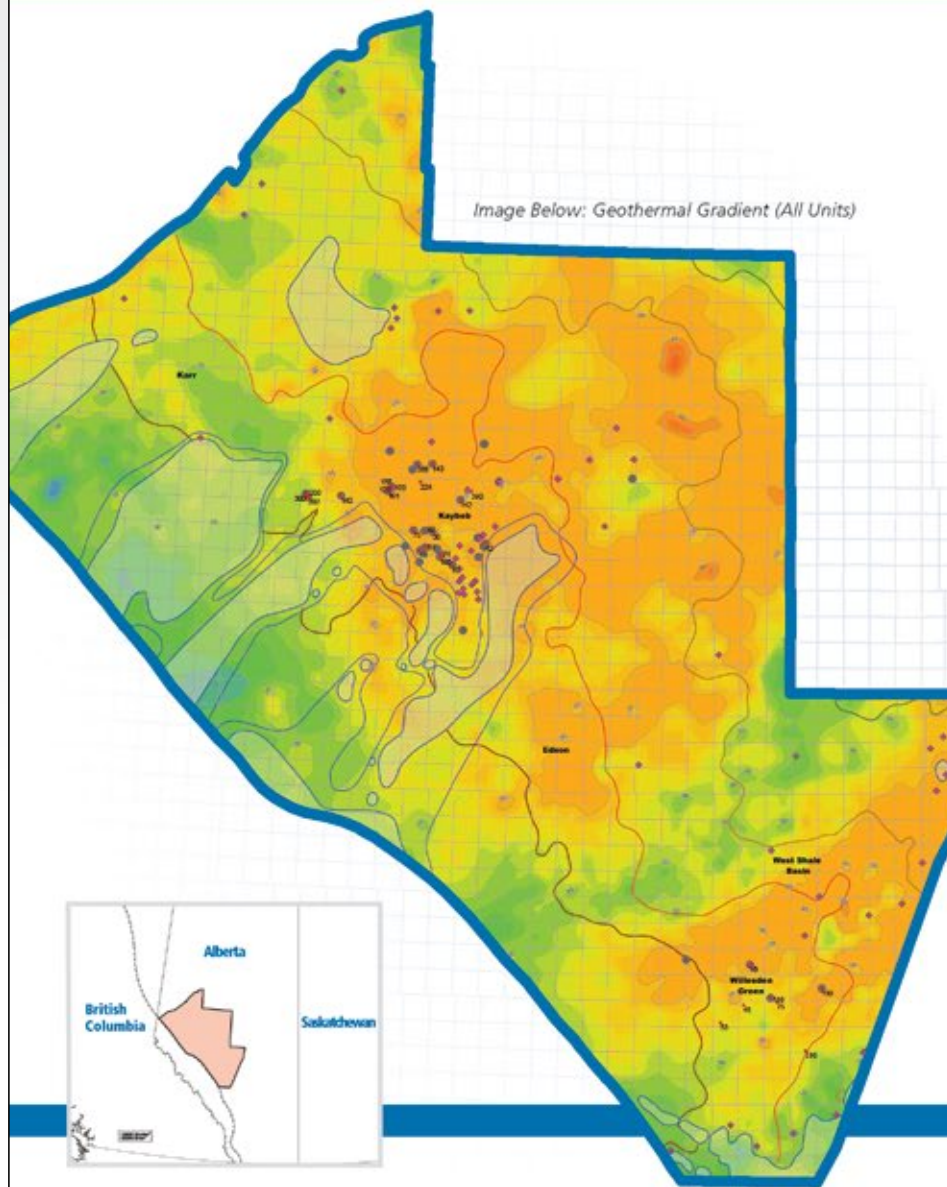
Neftex • 97 Jubilee Avenue • OX14 4RW • UK

Now Explore



THE DUVERNAY PROJECT

Geomechanics, Hydrocarbon Systems, Geological Setting



Canadian Discovery Ltd., in partnership with Graham Davies Geological Consultants and Trican Geological Solutions launch a new multi-client study evaluating the Geomechanics, Hydrocarbon Systems and Geological Setting of the Devonian Duvernay Formation in the Kaybob to Wilsden Green Area. Interim deliverables available December 2013.

The study will include:

- » Implications of stress regime on drilling, completions and productivity
- » Hydrocarbon phase distribution and the relationship to geochemistry and thermal history
- » Characterization of the Duvernay reservoir

Subscribe now and qualify for pre-completion pricing

Contact Cheryl Wright
cwright@canadiandiscovery.com | 403.269.3644



Photos and graphics courtesy Global Geophysical Services

Seismic crews worked the tough terrain in the University Lands area.

Permian Basin seismic

Old Area, New Efforts

By LOUISE S. DURHAM, EXPLORER Correspondent

The renowned Permian Basin has long been an oil producer's dream, always rising anew after one of those nasty downturns that come about when commodity prices tumble into the dumpster.

A raft of formation names are in the limelight lately, including Bone Spring, Wolfcamp, Spraberry, Strawn and even Strawberry, which actually is a commingling of production from the latter two.

Much of the basin is a rough-and-tumble, ragged landscape running the gamut from nearly flat terrain to near vertical crags.

Even so, the wide-open, sparsely populated parts of the region offer opportunities for relatively unhindered application of innovative technologies – particularly in the seismic business.

When one considers the intense competition in the basin overall, it's no surprise that operators are digging deep into their technology stash to use only the best available, particularly when it comes to acquiring seismic data.

A Challenge Accepted

The basal Permian-age packed-limestone Wolfcamp was the target of a fairly recent 3-D seismic shoot dubbed "The University Lands" survey, located on the northern flank of the Ozona Arch, which separates the Midland and Val Verde basins.

The Wolfcamp sits 6,000 to 8,000 feet deep in the survey area.

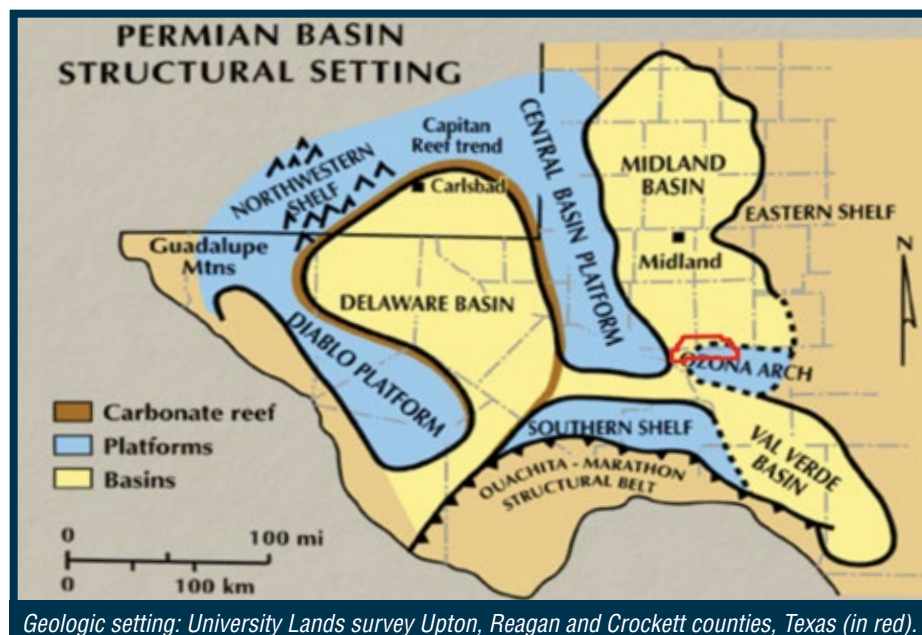
Global Geophysical Services implemented the multi-client survey, which was a very demanding undertaking.

"... They (clients) didn't want a normal speculative survey, but one with different parameters."

"The client emphasized that this was a very difficult area and they didn't want a normal speculative survey, but one with different parameters," said Tom Fleure, senior vice president of geophysical technology at Global. "They wanted substantially higher fold and a more detailed survey."

"This was a bad data quality area," he emphasized, "and typical parameters

See [Permian Basin](#), page 20



Geologic setting: University Lands survey Upton, Reagan and Crockett counties, Texas (in red).

Stay ahead of the Pack



ISIS Petroleum Consultants

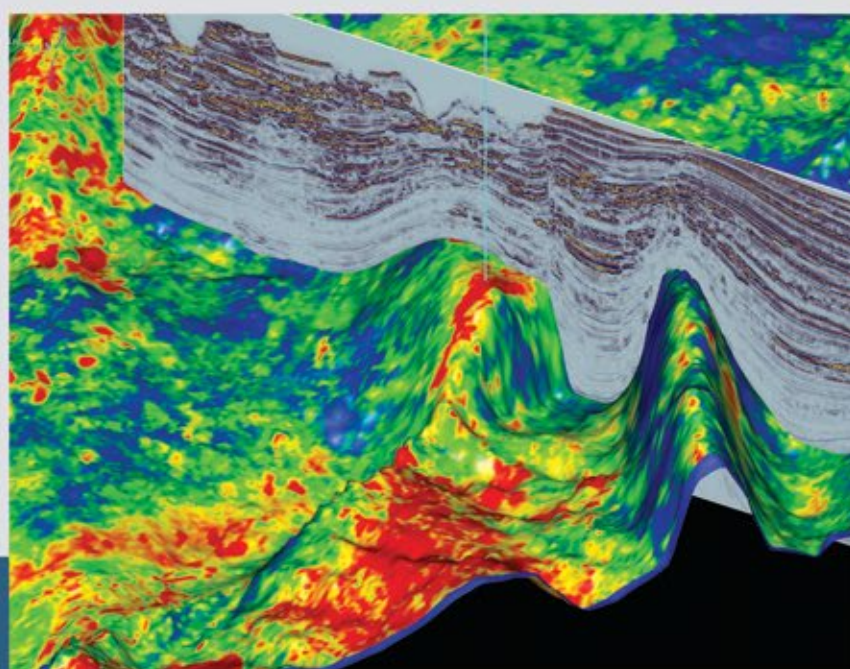
Provides expertise to the Oil and Gas industry by assisting our clients with all aspects of exploration and production

- Seismic Interpretation, Geology and Geophysics
- Reservoir Modelling, Reservoir Engineering, Economics and Facilities Engineering
- New Ventures, acquisitions and farm-out reviews
- Pre-FID projects due diligence and Integrated Development Planning
- Asset Valuation and Economic Modelling
- Reserve Certification, IPO Listings and Independent Expert Reports

We have delivered:

- Over 800 projects
- In 50 different countries
- In over 100 basins worldwide, with specific expertise in East Africa, SE Asia, Australia, PNG and Middle East

Contact ISIS today to discuss how we can assist with your next project



Dr. Enrique Carballido
Chief Operating Officer

ISIS Petroleum Consultants Pty Ltd
Ground Floor, 47 Colin Street
West Perth, Western Australia 6005
Australia

Tel: +61 8 9226 4610
Fax: +61 8 9226 0999
Email: ecarballido@isispetroleum.com.au
Website: www.isispetroleum.com

WOLFCAMP & BONE SPRINGS PROJECT

Unlocking the potential of the Permian Delaware Basin

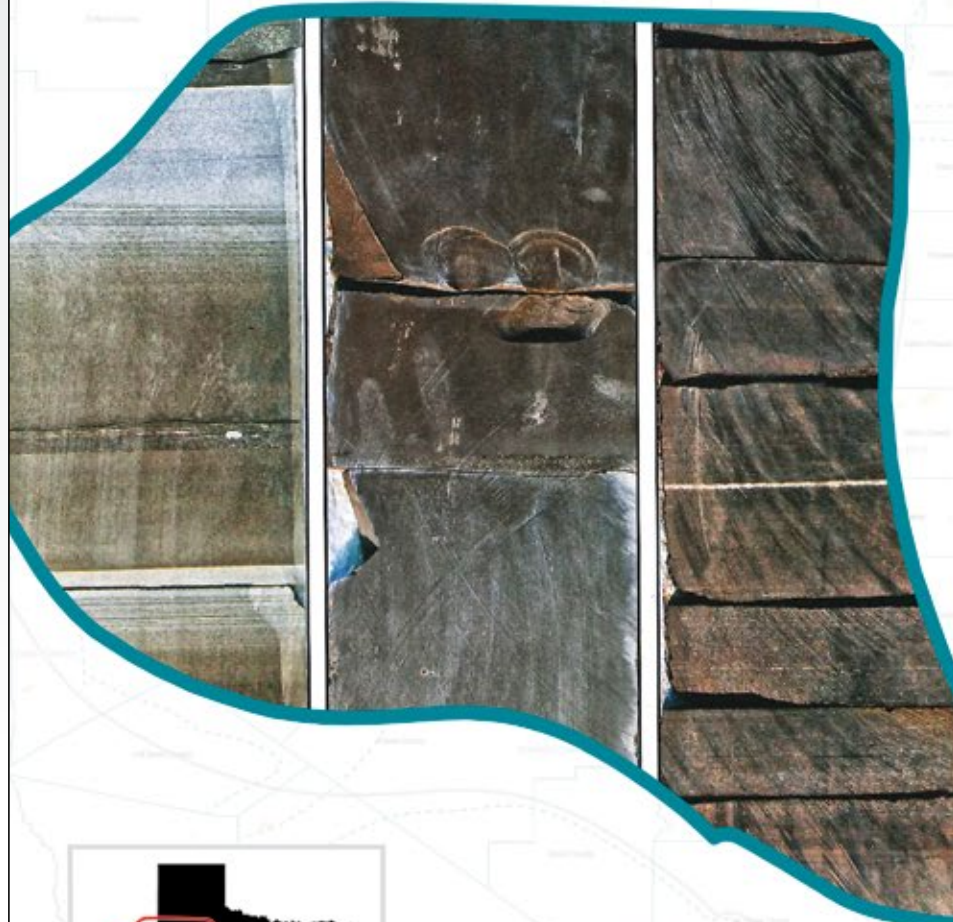


Image Above: Figure 31. Core photographs. Hamlin, H. & Baumgardner, R., 2012, Retrieved from Report of Investigations No. 277, BEG

Canadian Discovery Ltd., in partnership with TGS, Graham Davies Geological Consulting and Trican Geological Solutions, is proposing a fully-integrated reservoir characterization study in the Delaware Basin of West Texas.

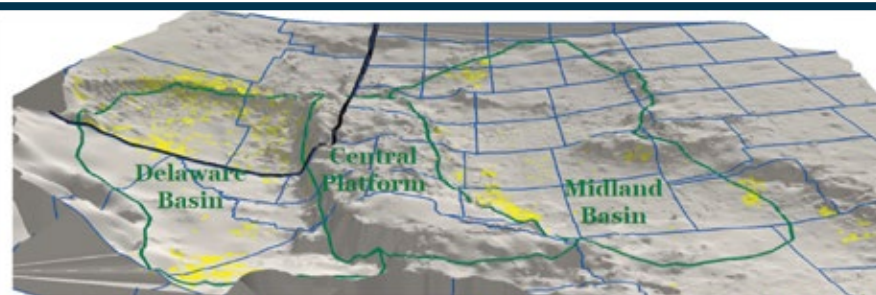
The study will include:

- » Geology
- » Subsurface pressure setting
- » Geochemistry
- » Reservoir characteristics

For more information and to pre-subscribe*

Contact Cheryl Wright
cwright@canadiandiscovery.com | 403.269.3644

*Six primary sponsors are required to proceed with the study.



PERIOD	SERIES	DELAWARE BASIN FORMATION	PERIOD	SERIES	CENTRAL PLATFORM FORMATION	PERIOD	SERIES	MIDLAND BASIN FORMATION
LEONARD	GUADALUPE	LANIER HILL CONGLOMERATE	LEONARD	GUADALUPE	TANSHILL	LEONARD	GUADALUPE	TANSHILL
		CHERRY CANYON			YATES			YATES
					REDFORD			REDFORD
					GRAYBURG			GRAYBURG
					SAN ANTONIO			SAN ANTONIO
					GLORIA			GLORIA
					PALMOK			PALMOK
					HUNTER			HUNTER
					JULIE			JULIE
					DRINKARD			DRINKARD
					ABO			ABO
					BRITTON			BRITTON
					WOLFCAMP			WOLFCAMP
					PENNSYLVANIAN			PENNSYLVANIAN

Base of the Wolfcamp Formation (from Concho Resources website).

Permian Basin from page 18

wouldn't suffice to get the data.

"Geologically, there are a bunch of carbonates on the surface (of the formation) and they trap a lot of energy on the surface," Fleure noted. "That's not data; it's just noise to us."

"The energy from the vibrators rings in that top layer of carbonates and tends to obscure the reflection energy that's coming up that you want," he said. "So that makes it pretty bad."

Push-Pull Shooting

To accommodate the expressed needs of the client in a cost-efficient and timely manner necessitated going wireless.

The equipment used was the Autoseis® HDR-1 autonomous nodal recording system. The system has no interconnecting cable and no complex radio links to or between the nodes, according to Fleure.

"We could have gotten increased fold and tighter receiver spacing with cable, but the costs would go way up," Fleure said. "For example, it would be very expensive to fly 26,000 cables by helicopter, but you can fly 26,000 channels of Autoseis around far less expensively because they weigh a lot less."

A typical survey design might entail a 165-foot or even a 220-foot receiver point interval, but this program went much tighter, using a 55-foot interval.

"We shot on both sides of the spread rather than the middle, so it's called push-pull," Fleure said. "Push-pull shooting reduced the number of live channels by about half, which in turn reduces the capital costs for the recording equipment."

"For this survey, a 26,000-channel recording system was deployed," he said. "Using the equivalent template-centered patch would have required 52,000 channels and would have taken far more time to record the same density of traces."

What's Your Hurry?

Push-pull aside, it also was hurry-hurry.

Each Autoseis unit has about three weeks of battery life, meaning it was imperative to roll through the spread quickly.

"Because we used offset-separated slip sweep, it allowed us to shoot a lot of shot points faster," Fleure noted. "By shooting on both sides of the spread, we shoot every point twice and roll through quickly, so we could pick up those (recording) units in two, maybe two-and-a-half weeks."

"If we shot in the center and put out twice as many lines, then that spread would have run about twice as long, taking four or five weeks and requiring us to go in and change batteries," he said.

The offset-separated slip sweep was one of the innovative aspects of the program.

"When you slip sweep, you start one vibrator fleet (two vibrators), and while it's still shaking, you start another fleet," Fleure noted. "Before the first fleet finishes, you start the second fleet."

"To avoid some of the complications, some of the noise generated by slipping, we're offset-separating that," he said, "so that only the vibrators that were further apart than 15,000 feet would actually start right after each other."



"One of the tricky parts of the design is we have six fleets spread out, and because we have them on both sides of the spread and all up and down the survey, they're separated typically by 10 to 15 feet," Fleure noted. "But some of them are 30,000 to 40,000 feet apart, and that way we can essentially vibrate them at the same time without interfering with each other."

This combo of lightweight nodal recording systems and offset-separated slip sweep vibrator methodology is the first survey of its kind in the Permian Basin.

When all was said and done, over two billion traces were recorded over 355 square miles in about five months.

Fleure said the increased acquisition effort clearly improved the quality of the prestack time migrated results.

An eight-fold increase in traces per bin was achieved – with only a 58 percent increase in acquisition cost. ■



أرامكو السعودية
Saudi Aramco

5:25PM

CAPITALIZING ON SOME DOWNTIME
OUT ON THE COURSE

9:25AM

CAPITALIZING ON A VAST,
HYDROCARBON-RICH ENVIRONMENT

GEOSCIENCE PROFESSIONALS

Join a multidisciplinary team of experienced geoscience professionals evaluating conventional and unconventional resources at Saudi Aramco. Seize the opportunity to work on frontier basins with source rock and tight reservoirs associated with the largest oil and gas fields in the world. Utilize cutting-edge technology to manage and produce reserves in a diverse environment. Experience truly rewarding day-to-day activities. Beyond work, enjoy a flexible schedule that offers a chance to explore the wealth of activities offered in the Kingdom. Saudi Aramco provides a work-life balance and a chance to do it all.

DREAM BIG at www.Aramco.Jobs/EX

Energy Policy Forum Set for RMS Annual Meeting

An energy policy forum dealing with issues that significantly impact oil and natural gas exploration will be held at this year's Rocky Mountain Section annual meeting, set Sept. 22-24 in Salt Lake City.

This forum looks at the "Environmental, Economic and Cultural Impacts of Unconventional Oil and Gas Development," and it will be held at 1:20 p.m. Monday, Sept. 23. Edith Allison, director of AAPG's GEO-DC office and the monthly columnist of the EXPLORER's popular "Policy Watch," will be the moderator.

The session will focus on an inescapable fact: As unconventional oil and gas production expands into new

regions, or exploration and production activity swells in historic producing areas, non-technical concerns increase.

The general theme for the RMS meeting will be "Energy Elevated," and the technical program consists of more than 130 oral and poster presentations, including a special session that will provide historical and geological overviews of the older-but-still-producing great oil and gas field in the Rockies.

Other highlights include:

► Rebecca Williams, senior scientists with the Planetary Science Institute, will be the All-Convention Luncheon speaker, talking on "Roving the Red Planet: A Field Geologist Explores Gale Crater."

► Rick Allis, director of the Utah

Geological Survey and the state geologist, will be the DPA Luncheon speaker, talking on "Our Transforming Energy Sector – A Utah Perspective on Trends and Changes."

► Four short courses, including a core workshop titled "Microbial Carbonate Reservoirs from Utah."

► ... and five field trips, including "The Greatest Story Ever Told by Nine Miles of Rock: Exploring the Geology of Little Cottonwood Canyon, Wasatch Mountains," plus a trip to the Great Salt Lake and Pleistocene Lake Bonneville that is free for students and Young Professionals.

For more information visit the RMS website at www.rmsaapg2013.com.

Po Seismic Gets Hybrid Approach

By LOUISE S. DURHAM,
EXPLORER Correspondent

Selecting the seismic data acquisition system that's best for the job at hand doesn't necessarily entail an either-or decision.

This was aptly demonstrated via a 3-D program implemented in the Po Valley in northern Italy.

The seismic survey was conducted under the aegis of Eni S.p.A.

The Po Valley is a major geographic feature in Italy, extending about 400 miles from the western Alps to the Adriatic Sea.

The area is a combo of flat to hilly, sometimes mountainous, terrain. Besides the abundance of features that appeal to nature lovers, it's home to major cities, including Turin and Milan.

During the Po Valley seismic program, both wireless and cable acquisition systems were deployed concurrently to simultaneously record two independent data sets covering an area of 22.5 square kilometers. This resulted in a total 4,707 cableless receiver points and 2,770 shots.

The seismic source used was dynamite.

The survey was carried out in an area of plain ground but densely inhabited. It is characterized by the presence of little towns, several small rivers and watercourses.

A large gas storage plant sits in the middle of the area, along with farms, warehouses and cattle sheds.

Toss in differing networks of underground pipelines over the entire field of operations, and the need to be creative with such a seismic survey becomes obvious.

Best of Both Worlds

There were no significant differences in the quality of both raw and processed data acquired with the two different technologies.


Yet such a combination would be pointless in many locales.

It's widely known in the industry that wireless would not add value if you're shooting out in an open desert. To the contrary, if your program is in the deep jungle then you consider a total wireless spread.

"In every place where an area is spread with obstacles because of nature or human activity, we would consider wireless to be useful for sure," said Michele Pellegrino, geophysicist at Eni.

With regard to survey areas where obstacles occur only randomly, the option to use a hybrid spread can be highly advantageous for a number of reasons. For example, hybrids can mitigate the myriad kinds of external noise sources that occur frequently in certain locales.

"The standard acquisition mode may be more valid from an economic point of view," Pellegrino said. "But it's good to have the possibility to integrate wireless where you need to work softer and in a more efficient way."

The results of the seismic test in the Po Valley highlight the opportunity to exploit a hybrid spread incorporating both wireline and wireless systems to optimize recording operations with regard to field efficiency and data quality. 

Get **More** from your **Core**



With reservoirs becoming increasingly complex, you need the most accurate information you can get to better understand your reservoir.

Weatherford Labs helps you get more from your core by combining an unsurpassed global team of geoscientists, engineers, technicians and researchers with the industry's most comprehensive, integrated laboratory services worldwide. From core analysis, sorption, geochemistry and isotopic composition to detailed basin modeling and comprehensive data packages, we provide you with real reservoir rock and fluid information that hasn't been distilled by a simulator or iterated by software.

We call it "The Ground Truth"™ – giving you the accurate answers you need for better reservoir understanding. You'll call it a better return on your reservoir investment. To learn more, contact TheGroundTruth@weatherfordlabs.com.



Weatherford
LABORATORIES

weatherfordlabs.com

Unearth the full potential of your geomechanical data.

Now you can access powerful 3D gridding and meshing technology to create realistic and accurate representations of your reservoir.

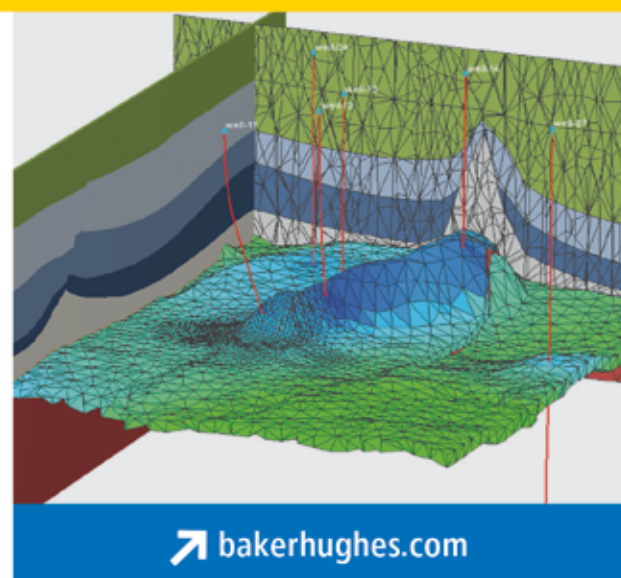
Improve reservoir insight and cut substantial time from your interpretation workflow.

Bring all of your geomechanical data into one application with the new Baker Hughes JewelSuite™ geomechanics software.

Create one-dimensional well models from offset wells, upscale them to 3D reservoir models, and then apply the results to predict the behavior of your wells in one dimension. And update your forecasts in real-time while drilling.

Baker Hughes pioneered petroleum geomechanics software...and now our latest version allows you to evaluate your reservoirs with even greater confidence.

Advancing Reservoir Performance



bakerhughes.com





Photo courtesy of wikipedia.org

Huevos Island (center) and Second Boca in Trinidad and Tobago. Island behind Huevos is Chacachacare. Landform in the distance on the right is Venezuela.

The quest for hydrocarbons continues

Seismic Provides New Look at Trinidad Geology

By CHRISTOPHER STONE, EXPLORER Correspondent

Thoughts of Trinidad and Tobago conjure up visions of carnival, frosty rum libations adorned with tiny umbrellas, fun times in general.

Yet this alluring Caribbean region is way more than a lush, fab playground for tourists – and locals as well.

To the oil crowd, anyway, it's all about big deposits of natural gas and other hydrocarbons.

Geophysical surveys first got under way in the southern Tobago Trough (Basin) offshore Trinidad's north coast in the late 1960s, continuing into the early 1970s when operators were first granted exploration concessions.

In May 1971, a shallow water new field wildcat well drilled in the southern Tobago Basin reached basement total depth at 2,740 meters. Bright, Mio-Pliocene sandstones that appeared on seismic were the objectives.

The well tested dry gas and was abandoned.

But this belies the fact that it was a winner, in that it had discovered the Patao-KK gas trend in the Tobago Trough.

The play harbored 2P recoverable reserves of 935 MMboe within Trinidad's North Coast Marine Area and 1,206 MMboe within eastern Venezuela's Marsical Sucre field complex, according to Rick Roberson, senior geoscientist at PGS, sighting IHS 2011 data.



ROBERSON

The Basin's Geology

The Tobago Trough is a modern marine forearc basin in the southeast Caribbean Sea between the Lesser Antilles Arc and Barbados Accretionary Prism.

"The basin is bound on the north by the St. Lucia Ridge and to the south by the Araya-Tobago metamorphic basement of the Araya Peninsula, Venezuela and the Northern Range, Trinidad," Roberson noted.

Most hydrocarbon reservoirs offshore Trinidad and Tobago are located in Tertiary shelf and shelf-edge deltaic depositional systems, including the highly productive Patao-KK fields.

PGS has been a presence in the area acquiring seismic surveys, including a multi-client 2-D survey over the Tobago Trough, in conjunction with the Ministry of Energy and Energy Affairs of Trinidad and Tobago. The survey was

In fact, the abandoned well was a winner in that it had discovered the Patao-KK gas trend in the Tobago Trough.

implemented to provide imaging of the Upper Miocene and Lower Pliocene deltaic sandstones and possible deeper turbidite sandstones.

The Tobago Basin holds up to 14 kilometers of Cenozoic sedimentary fill with thick sequences of Mio-Pliocene sediments. About 2,448 kilometers of modern seismic data have been acquired and processed over the Tobago Trough, according to PGS, who describe the basin's geologic history this way:

The Tobago Basin formed through an initial phase of collision tectonics between the Caribbean Arc and South American continent and evolution to an oblique transform margin with transpressional tectonics governing the Paleogene and transtensional tectonics dominating the Neogene. The age and origin of the basin's basement is unknown, but evidence suggests that it is Late Cretaceous and of arc affinity.

Principal structural features in the

southern Tobago Basin are the North Coast Fault Zone (NCFZ) and the Hinge Line Fault Zone (HLFZ), principal components of a broad zone of east/northeast-west/northwest trending faults associated with the southern wrench fault boundary of the Caribbean plate and controlling the basin's structural and sedimentological evolution.

The majority of clastic sediment deposited in the basin was sourced from the south as the Caribbean plate moved eastward along South America's passive margin. Slow slab rollback during the Paleogene created broad flexural subsidence across the forearc and controlled Paleogene deposition in the basin.

Flexural and thermal subsidence concluded in the middle Eocene producing a wide, deep-marine forearc basin with approximately eight kilometers of Paleogene sedimentary fill of predominately deep-marine pelagic shales and siltstones and deepwater turbiditic sandstones (Aitken, 2005).

Steady eastward advancement of the Caribbean plate brought it to oblique convergence with the South American plate during the Late Oligocene to Middle Miocene. Clinoforms in the basin indicate north-northeast progradation of the distal Proto-Orinoco delta in response to forced regression during Miocene uplift of the Northern Range in Trinidad and the

See [Trinidad](#), page 26

USGS Offers Assessment of the Tobago Trough's Carupano Basin

By LOUISE S. DURHAM, EXPLORER Correspondent

The Carupano Basin, or sub-basin, is a biogenic gas producing area occurring in the far southern area of the Tobago Trough.

Its significance is underscored by inclusion in the USGS World Petroleum Assessment 2000.

AAPG member C.J. Schenk, a geologist with the U.S. Geological Survey in Denver, described the Carupano Basin assessment unit (AU) as being defined by a wide zone of faulting associated with the southern wrench fault boundary of the Caribbean plate.

The northern boundary is the shelf slope break.

USGS Province: Tobago Trough
Total Petroleum System: Lower Cruse
Assessment Unit: Carupano Basin Gas

About 25 TCG gas have been discovered in the AU.

The assessment report included a concise overview of salient features in the AU:

► **Source rocks** – Postulated to be prodeltaic mudstones contemporary with the Miocene-age Lower Cruse formation, much like the Columbus Basin of Trinidad directly to the south.

► **Maturation** – Mudstones within the Lower Cruse are asserted to have attained maturity during the Pliocene, subsequent to the deposition of several kilometers of sediment during Miocene and lower Pliocene time.

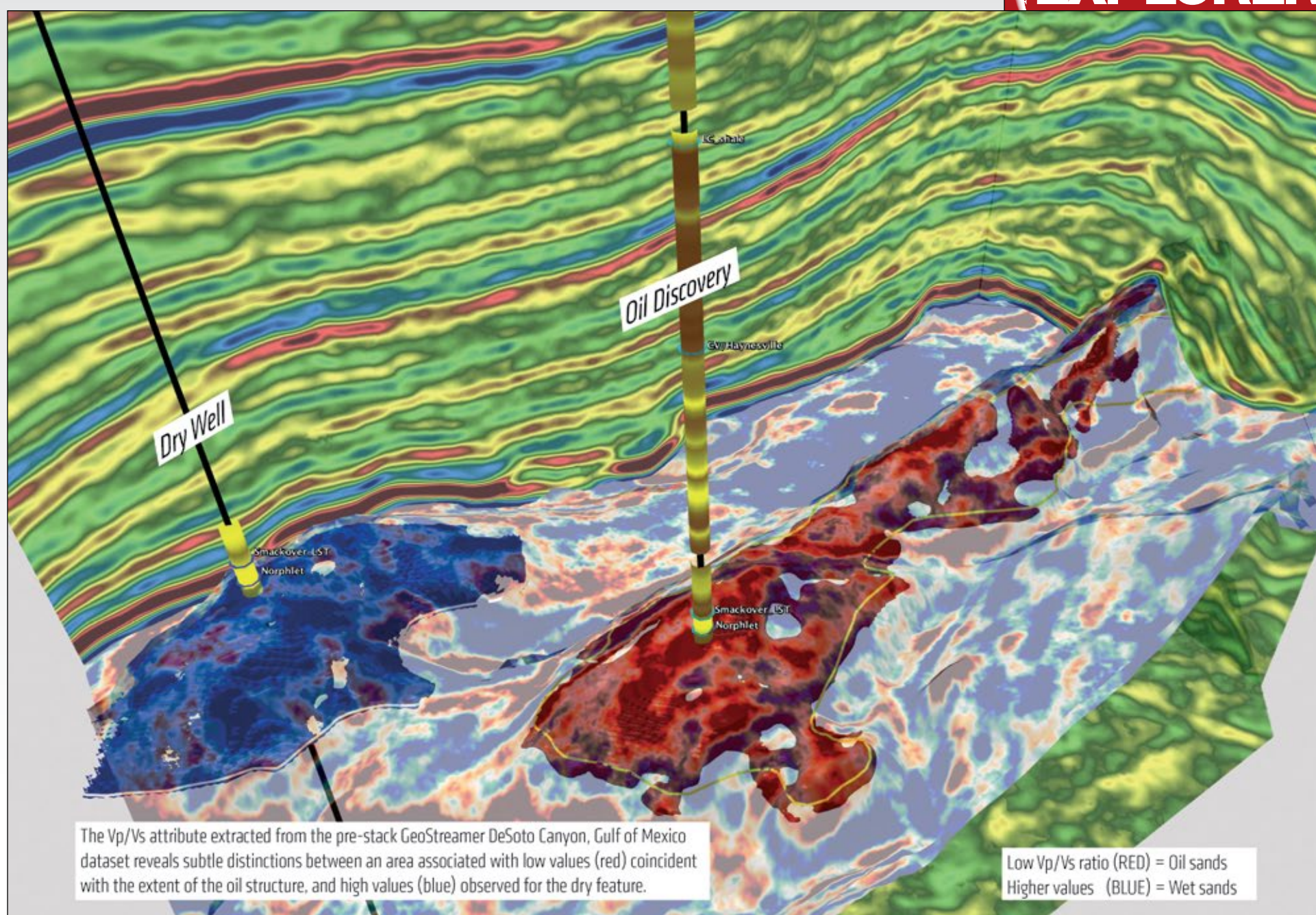
► **Migration** – Hydrocarbons migrated from the Lower Cruse in an essentially vertical path along faults associated with the wrench fault zone. The faulting occurred in Late Pliocene and Pleistocene times.

► **Reservoir rocks** – Reservoirs are principally Lower Pliocene deltaic sandstones. Deeper turbiditic

sandstones sourced by the ancestral Orinoco River may be present as well. The reservoir at the giant Patao gas field in the basin is said to be turbidite sandstones.

► **Traps and seals** – Traps are structural for the most part, with normal fault traps formed by trans-tension linked with wrench faulting along the 150 kilometer-wide fault zone of the southern margin of the Caribbean plate. Also present are traps formed in transpressional segments of the fault zone.

Seals are generally intraformational mudstones of the Pliocene deltaic section. ■



PGS MultiClient TECHNOLOGY

Pioneering technology for greater opportunities

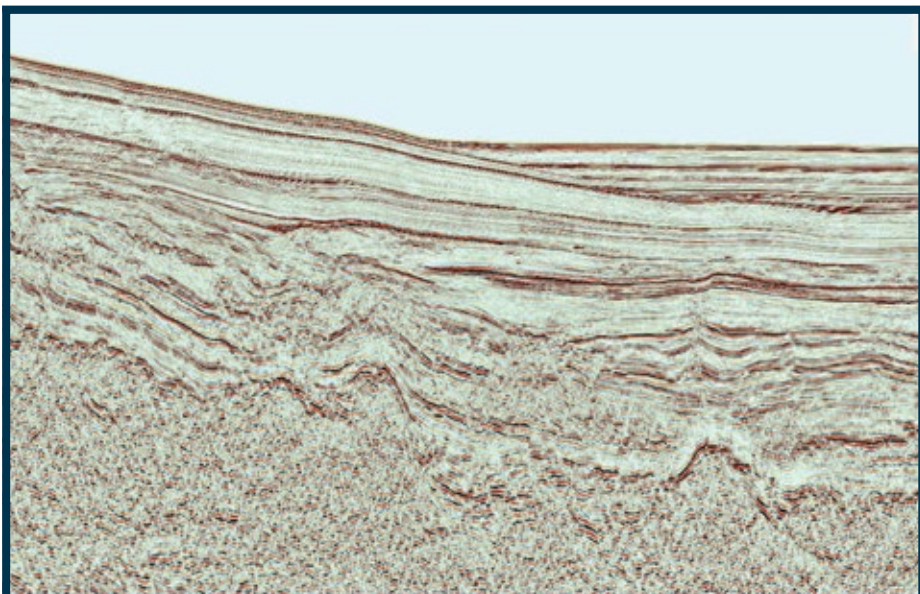
PGS GeoStreamer® and GeoStreamer GS™ technology set the benchmark in seismic data quality and resolution, providing a new level of geological understanding in the world's most complex basins. Much of the PGS MultiClient data library since 2007 has been acquired using GeoStreamer technology, and is thus some of the most sharply-defined and accurate MultiClient data available. PGS has established a reputation for pioneering technology that gives you the insight needed to explore and better define prospects in both frontier and proven hydrocarbon regions. When it's time to find oil faster, let us help you see the difference.

Supporting your exploration success

globalmc@pgs.com

A Clearer Image | www.pgs.com





Dip seismic section Tobago Basin, Trinidad and Tobago.

Trinidad from page 24

Paria Peninsula in Venezuela. Sediment thickness of the early Neogene section below the Middle Miocene unconformity is approximately 3.5 kilometers.

Pliocene sediments deposited along the shelf and slope of the Tobago Basin are predominantly silty claystones with thin interbeds of fine-grained sandstones, conformably overlying Top Miocene and reaching thicknesses about 1,200 meters. Pleistocene sediments are primarily shales with interbeds of deltaic sands and reefal limestone conformably overlying Top Pliocene. Sediment thickness above the Middle Miocene unconformity is approximately 3.5 kilometers.

Support for the Premise

The majority of hydrocarbon reservoirs offshore Trinidad & Tobago found to date are in Tertiary shelf and shelf-edge deltaic depositional systems, according to PGS, and Patao-KK fields are no exception.

Reservoir, trap and seal for the Patao-KK petroleum system reside within the Upper Miocene and Lower Pliocene progradational shelf and shelf edge deltaic depositional systems of the Tres Puntas and overlying Cubagua formations. These sediments were deposited within actively deforming basins in shallow marine settings along South America's northern margin.

Patao-KK gas is very dry and assumed to be either autochthonously sourced from prodeltaic mudstones coeval with Mio-Pliocene reservoir units (Schenk, 2000) or the product of anaerobic bacterial decomposition of thermogenically derived hydrocarbons sourced from deeper in the Tobago Basin.

Condensate production, higher in Patao-KK fields nearest the shallowing basin axis in Venezuela, confirms a thermogenic system functioning in the deeper Tobago Basin.

Reservoirs are Upper Miocene-Lower Pliocene fine-grained deltaic sandstones and siltstones with porosities ranging from 13-29 percent and permeabilities ranging from 10-1,100 mD. These sands are highly unconsolidated with interstitial clays and interbedded shales. Some reservoirs within Mariscal Sucre are rumored to be turbiditic sandstones. Seals in the play are formed by intraformational argillites and shales.

Petro-Canada executed field discoveries Cassra and Sancoche in 2008, extending the Patao-KK biogenic gas play northeastward on what appear to be gentle combination traps unrelated to traditional structural mechanisms of the HLFZ. Cassra currently is under appraisal.

Comprehensive 2009 2-D seismic coverage of the deeper West Tobago Basin and Tobago Platform suggest Mio-Pliocene reservoirs exist along the Tobago Ridge northeast of the island, and extending northward from Sancoche into the deeper Tobago Basin.

Roberson noted that condensate tests from the giant Hibiscus natural gas field in the Carupano Basin, or sub-Basin and the southernmost part of the Tobago Trough, indicate only Tertiary contribution.

Carupano is the biogenic gas-producing region in the Trough. The largest field there is the Patao field in Venezuelan waters, according to the U.S. Geological Survey's World Petroleum Assessment in 2000.

"A colleague and I were considering potential for Late Cretaceous sediments in the basin," he said. "But hopes were dashed when no Cretaceous fingerprints were found in condensate samples reviewed to date, indicating that production is purely Tertiary sourced in support of Aitken's earlier conclusions."

"Back in '08-'09, we shot half of the Tobago Basin with 2-D, which addressed the Trinidad side of the Tobago Trough," he noted. "The other is to the west and belongs to (island country and commonwealth) Grenada."

A bid round was ongoing at press time, and Roberson noted that interest was apparent from the block nominations.

At the end of the day, the quest to establish a commercially viable thermogenic petroleum system in the Tobago Basin continues.

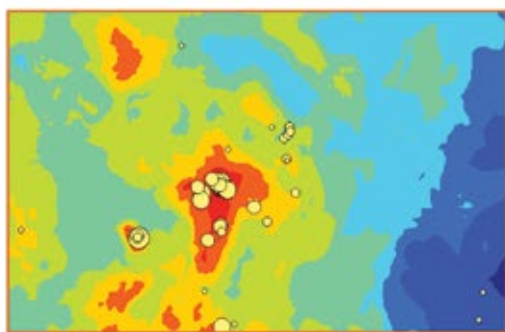
Roberson thinks there is reason to be optimistic given the structural and sedimentary disposition of the deeper basin.

UNLOCK THE POTENTIAL IN YOUR FIELD | #1 IN A SERIES

SEPTEMBER 2013

Nowhere to hide in Tioga County

Multi-measurement imaging reveals secrets of the elusive Marcellus



Sweet spot map (zoom) over a roughly 200-square-mile area in Tioga County, Pennsylvania. Hot colors indicate areas most similar to best producing wells in the region. Circles are sized to the first six months of production for all horizontal wells.

Thanks to unconventional drilling and extraction techniques, the Appalachian Basin has experienced a multi-billion dollar economic resurgence. In Tioga County, Pennsylvania, a methodology called Multi-measurement Interpretation (MMI) has been introduced by NEOS GeoSolutions to provide a better understanding of the basin.

NEOS acquired airborne geophysical data – magnetic, electromagnetic (EM), radiometric, gravity, and hyperspectral – over 1,000 square miles of Tioga County. These data were integrated with existing geophysical, geochemical, and seismic measurements from various public domain and third-party sources and interpreted by NEOS and operator geoscientists. This low-impact,

environmentally friendly approach revealed subsurface features from the basement to the surface, helping explorationists pinpoint the sweet spots and avoid shallow gas geo-hazards in the play.

Using hyperspectral analysis, which classifies substances on the surface based on unique spectral signatures associated with the reflectance and absorption of both visible and invisible light, interpreters located numerous oil seeps and gas plumes. Of these, 90% were verified by geo-technicians on the ground. The seeps and plumes were then traced back into the subsurface along various pathways, including faults that had been mapped using an analysis of magnetic, seismic, log, and EM data.

Airborne EM resistivity measurements provided insights into both lateral and vertical resistivity variations throughout the geologic column, down to roughly 10,000 feet. When the EM voxel was depth-sliced at the Marcellus interval, geoscientists noted that resistive hot spots in the Marcellus corresponded to many of the county's 'best well' locations.

In addition to analyzing the airborne datasets, geoscientists on the project also incorporated more traditional geophysical measurements into the interpretation. Well logs were analyzed to enhance structural control and to calibrate the airborne EM data. Seismic data were incorporated into the regional structural model and, in combination with the magnetic and EM data, provided insights into how faults were creating pathways for hydrocarbons to migrate toward the surface.

Finally, a cutting-edge geostatistical technique called predictive analytics was applied. The technique allowed geoscientists to mine all geo-datasets for subtle patterns and correlations that corresponded to the best wells, and to then pattern search for similar 'correlative attributes' in areas that had yet to be drilled. This helped the project's underwriters to optimize their leasing, drilling, and hydraulic fracturing programs and to target future ground-based geophysical acquisitions in the most promising areas.

MMI has captured the attention of the region's major E&P producers. Since the early surveys in Tioga, NEOS has undertaken additional projects in Pennsylvania, compiling nearly 5,000 square miles of available regional data that are delivering unique, cost-effective insights into the Marcellus and Utica shale plays.

▶▶▶ To learn more about this project or others in the *Unlock the Potential* series, visit: www.ThePotentialUnlocked.com

HIGHLIGHTS

KEY TECHNOLOGIES:

- MAGNETIC
- PASSIVE-SOURCE EM
- RADIOMETRIC
- GRAVITY
- HYPERSPECTRAL
- PREDICTIVE ANALYTICS

AREA: Appalachian Basin, Pennsylvania

CUSTOMER: Supermajor

FOCUS: Regional Mapping

TYPE: Unconventional

KEY INTERPRETIVE PRODUCTS:

- Regional resistivity voxels down to 10,000 feet
- Maps of lineaments, fault networks, and intrusives
- Maps of regional prospectivity derived via predictive analytics

CUSTOMER BENEFITS:

Cost-effective regional insight depicting the most (and least) prospective areas for leasing, drilling, or further geological and geophysical (G&G) study.

The Evolution of Log Printing is Here!

Neuralog has been developing purpose built well log printing solutions for the O&G industry for 10 years. Our printers are designed to operate seamlessly and require no add-on software for automatically sensing top of form printing. The NeuraLaserColor II will change your expectations of well log printing.

What's New?

- Record setting speeds - 11 inches per second
- Precision printing - On-the-fly length calibration
- Increased efficiency - 20,000 page yield toner
- Operational versatility - Native PDF support

What's the Same?

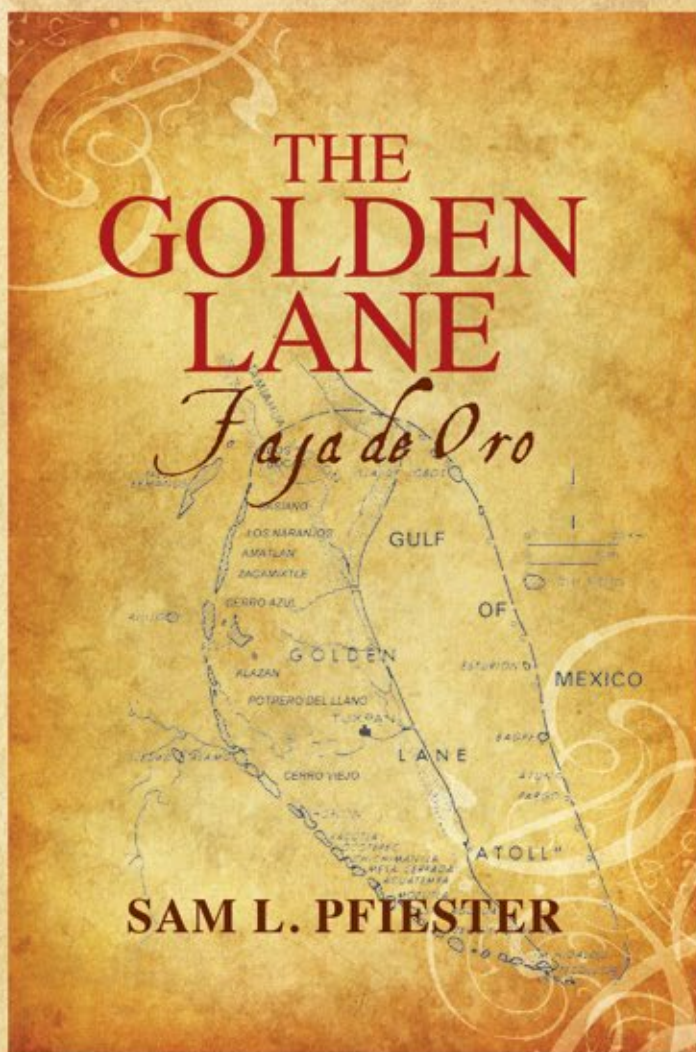
- Customer focused support
- One year warranty included
- Log viewing and editing software included
- Cost effective consumables and operation



For More Information
www.NeuraLaserColor2.com



© 2013 Neuralog • www.neuralog.com • sales@neuralog.com • 1.281.240.2525 • 1.800.364.8728



The Golden Lane is a true story about the Tampico Oil Boom from 1909-1914. All the characters were real people. Most of the events happened as described. The story follows the early career of Everette DeGolyer.

"Sam Pfiester's strong sense of geology and the oil business, and his love of Mexico and its history, weave a magnificent tale. I couldn't put the book down."

Clayton W. "Claytie" Williams
Oilman/Wildcatter

Available at Amazon.com in
paperback & for Kindle



Figure 1. Planned seismic survey, approximately 30,000 km.

'Geology Without Limits' Seismic Project Sets Caribbean Investigation

By KEITH H. JAMES, NICKLOLAY AMELIN, LASLO MILES and EUGENE PETROV

The so-called "Caribbean Plate" is one of the most complex and tectonically interesting regions of our planet.

Despite numerous studies, this area of several million square kilometers remains poorly understood – especially in its interior, where crustal structure is known only from sparse survey lines.

The good news: A major, three-year regional study will commence there at the end of this year.

It's being led by "Geology Without Limits," an international scientific consortium based in Moscow that undertakes regional, holistic, deep investigation of the world's marine basins.

The Caribbean Plate investigation's main objective is to study:

- ▶ Interrelationships of blocks of continental and oceanic crust.
- ▶ The role of rifting, shear and thrust tectonics in the regional structure of the basement and sedimentary cover.
- ▶ Controls of the distribution and structure of carbonate platforms.

"Geology Without Limits" integrates organizations and specialists of states bordering the basins and employs the latest technology – and the resulting dialogue leads to exchange of ideas and better understanding.

The consortium completed a major survey in the Black Sea in 2011-12, and

others are under way in the east and west Russian Arctic, Laptev, east Siberian, Chukchi, Barents and Kara seas. Others also are planned for the Caspian and Bering seas.



JAMES

An international consortium will undertake a major, three-year regional study of the Caribbean, beginning later this year.

The Consortium includes a number of Russian scientific organizations (government JSC "Soyuzmorgeo," Moscow State University Geological Department, the State Geological Institute of the Russian Federation Academy of Sciences and the Schmidt Institute of Physics of the Earth of the Russian Federation Academy of Sciences).

It also will include geological institutions, state geological surveys and services of Caribbean countries – once their governments agree to participate.

See **Caribbean**, page 30

Nickolay Amelin, Laslo Miles and Eugene Petrov are scientist managers of the Geology Without Limits project: "Investigation of Lithosphere Deep Structure of the Caribbean Region by Seismic Methods."

AAPG member Keith H. James (khj@aber.ac.uk) is a consultant on the project's Scientist Board. He is a Fellow of the Institute of Geography

and Earth Sciences, Aberystwyth University, Wales, and also lectures at the Venezuelan Hydrocarbon University. With Shell International he worked in Gabon, Spain, Venezuela, the U.K., the Netherlands and the United States. He then joined Conoco as chief geoscientist, international studies, Houston.

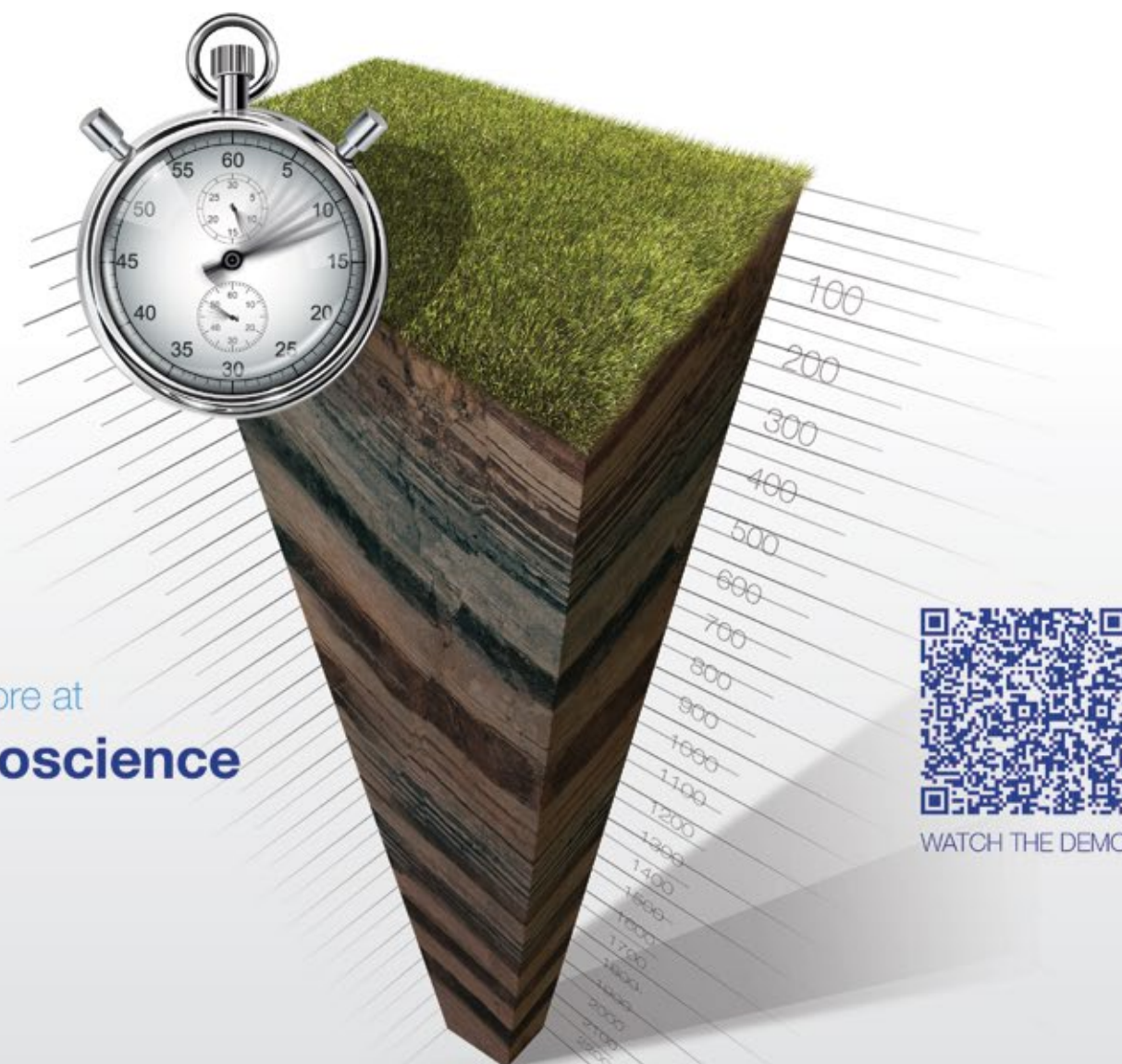
This article was largely abstracted from the detailed program proposal.

NEED MORE TIME?

SEISMIC TIME-TO-DEPTH CONVERSION IN SECONDS

IHS Kingdom® comes through for your most time-consuming challenges.

Causing an industry paradigm shift, Kingdom's unrivaled **Dynamic Depth Conversion** simply yet scientifically converts time data to depth data in **seconds** — allowing operators to plan wells faster and more effectively make adjustments while drilling to stay in zone.



Learn more at
ihs.com/geoscience

SIMPLY
SCIENTIFIC



IHS KINGDOM®
**DYNAMIC DEPTH
CONVERSION**

Caribbean from page 28

Seismic Operations

The investigation will begin with regional synthesis of existing information and current understanding.

Leading scientists from participating countries will be invited to join the project, and oil companies with experience in the area will be consulted. At this stage existing problems and data blank spots will be identified and the survey will be modified appropriately.

The program will employ marine, deep 2-D CDP reflection seismic surveys, bottom and buoy-based seismic acquisition for reflection-refraction and OBS-refraction surveys, electrical,

The scientific results will be published and presented at international conferences and will describe the model of evolution of the area as agreed by all participants.

magnetic and gravity surveys, heat flow measurements, geochemical investigations, seabed sampling and stratigraphic drilling and environmental monitoring of offshore areas.

Over a period of 10-12 months a Russian-flagged research vessel will acquire some 30,000 kilometers of new reflection and refraction seismic data along an irregular grid with line spacing of about 250 kilometers (figure 1).

The lines are mainly located in deepwater, over the most poorly studied part of the area. They will tie together the region's major geological structures – and integrated with existing geophysical data they will allow construction of a comprehensive model of area's evolution.

Specially designed long offset reflection and refraction field acquisition and state-of-the-art processing will achieve the desired depth of investigation (45-60

kilometers). Joint acquisition of reflection and refraction data will permit computation of a combined wavefield.

A special feature of the survey will be the use of floating seismic systems (sonobuoys, deployed and recovered by a support vessel) to record refracted waves at offsets exceeding 50 kilometers. The data set will allow recording of reflections and construction of a detailed velocity model of the earth's crust.

Funding will come from purpose-oriented programs of participating countries, international organizations and oil companies. Those providing significant funds will be able to influence the program plan, to be represented during program execution and will receive data and results.

Profile Targets

The Work Performance Area covers the Caribbean Sea and neighboring areas.

Five regions are defined:

- ▶ The Bahamas.
- ▶ The Lesser Antilles.
- ▶ The Greater Antilles.
- ▶ Central America.
- ▶ South America.

The planned seismic profiles cross waters of Colombia, Venezuela, Panama, Costa Rica, Nicaragua, Honduras, Belize, Cuba, the Cayman Islands, Jamaica, the Commonwealth of the Bahamas, the Turks and Caicos Islands, Haiti, the Dominican Republic, Puerto Rico, the British and U.S. Virgin Islands, Anguilla, Saint Kitts and Nevis, Montserrat, Guadeloupe, Martinique, Saint Vincent and the Grenadines, Trinidad and Tobago, and the Leeward Antilles (Aruba – Blanquilla).

They are designed to cross all major geological and tectonic elements in the area.

Working Together

Interpretation and analysis of the new data will be carried out by the consortium workgroup that will include representatives of participant countries.

Programs of this kind have the highest academic value when local geological institutions collaborate. The joint interpretation and analysis of geological and geophysical information by the international scientific workgroup will be organized on the basis of a distributed-access system. This will provide access to a geological/geophysical database combining existing data with the new geophysical information.

Regular roving seminars will facilitate exchanges of opinion and formulations of intermediate decisions of the workgroup.

Several field trips will familiarize the workgroup with the geology of the region.

The scientific results will be published and presented at international conferences and will describe the model of evolution of the area as agreed by all participants.

Finally, the model may become the basis for further joint operations of geological surveys and scientific institutions of the participant states.

The major hydrocarbon provinces of the Gulf of Mexico and northern South America bracket the Caribbean. In these areas, and elsewhere in the world (e.g., Brazil, east and west Africa, India), industry is moving increasingly into distant and deep waters, finding significant new hydrocarbon reserves and geological surprises.

The survey planned by "Geology Without Limits" in the Caribbean can be expected to provide major learnings and reasons to explore more widely in the area. ■

How do we ensure that every Weatherford mudlogger performs at the same high standards around the globe?

They all have to get past
our man Wayland.



**EXCELLENCE
FROM THE
GROUND UP™**

Weatherford is passionate about training, and that's where Wayland comes in. His mudlogging training program begins with hands-on classroom instruction and ends with rigorous tests at the wellsite. We call it Competency-Based Training. You'll call it another benefit of working with Weatherford. With courses for basic and advanced mudlogging, as well as for specialized services, Wayland's program helps mitigate hazards and enhance data accuracy. It's just one more way Weatherford Mudlogging is committed to Excellence from the Ground Up.

SURFACE LOGGING SYSTEMS

www.weatherford.com/surfacelogging
mudlogging.services@weatherford.com



VISIT US AT THE SEG

SUCCESS FAILURE

The Difference Is a Thin Line.
Quantitative Knowledge Defines It.

.....
KNOW BEFORE YOU GO. Success *IS* predictable...when you have accurate, trustworthy knowledge to go on. And that comes from hard science, specifically, quantitative and integrated rock physics, geopressure, geomechanics and regional studies. Measurable, repeatable predictions. Ikon Science, *the* geoprediction company, has the smart software assessment tools and a global technical support infrastructure that allow you to drill with confidence. Now you know. www.ikonscience.com
.....



The Present And Future Of GeoPrediction



Member returns to Antarctica

Plate Tectonics, Geology, Climate ... and Life

By SUSAN R. EATON, EXPLORER Correspondent

Geology field schools can be tough – and sometimes they can be hazardous. During a recent geology field school in Antarctica, I became adept at running the gauntlet of lunging fur seals and lumbering elephant seals, their oversized proboscises flared outwards, exposing shiny pink mouths and sizeable teeth.

The old adage, “their bark is worse than their bite,” doesn’t ring true in Antarctica. Our seasoned guides cautioned us that a bite from a fur seal or an elephant seal would require the immediate administration of intravenous antibiotics.

Admittedly bitten by the polar bug, earlier this year I returned to the Bottom of the World, participating in my third science-based expedition in three years, a geological field expedition titled “Antarctica, South Georgia and the Falkland Islands Scotia Arc Tectonics, Climate and Life.”

The world’s last remaining wilderness, Antarctica represents an outstanding outdoor laboratory to research planetary processes, including the interplay between solid earth dynamics, climate change and ocean change. During the past 50 years, the Western Antarctic Peninsula has warmed three degrees Celsius, triggering a cascading series of geological and biological changes in this fragile ecosystem that have global implications.

Thanks in part to funding from the AAPG Foundation (making me its unofficial Antarctic Explorer-in-Residence), I traveled to the Southern Ocean with an intrepid group of 100 explorers from 15 nations – 50 percent of the group was female – aboard the *MV Akademik Ioffe*, a 117-meter-long, Russian ice-



Photo courtesy of Hunter Carr

AAPG Student Member Hunter Carr at St. Andrew’s Bay in South Georgia. Carr stands in front of a vista of King Penguins (chicks have brown plumage). The chicks hang together in groupings or crèches which look like brown ribbons. Comprised of more than 150,000 breeding pairs, the colony contains close to half-a-million birds when the juveniles, non-breeding adults and recently hatched chicks are included. Below: Glacially striated outcrop.

strengthened vessel.

The group included 70 earth scientists (ranging in age from early 20s to late 70s) representing more than 20 specializations – structural geologists, igneous and metamorphic petrographers, mining geologists, petroleum geologists, seismic interpreters, geophysicists, sedimentologists, hydrogeologists, environmental geologists, paleotsunami experts, glaciologists and oceanographers, to name just a few.

In fact, there were enough doctorate geologists on the expedition to staff four or five university earth science departments!

A Mission to Share

The *MV Akademik Ioffe* departed from the Falkland Islands and sailed to South Georgia and the Western Antarctic Peninsula (these three areas constitute the “Scotia

Arc”). Along the way, we experienced numerous Serengeti-like moments, witnessing some of the largest concentrations of wildlife on the planet.

In addition to the AAPG Foundation’s ongoing support during the past three years, I’ve also received continued support from many other partners and sponsors: The Canmore Museum and Geoscience Centre, the Association for Professional Engineers and Geoscientists of Alberta, the Canadian Society of Petroleum Geologists, the Canadian Society of Exploration Geophysicists, the Houston Geological Society, the Association for Women Geoscientists, the Calgary Herald and Ammonite Resources.

“We’re proud to be a sponsor of Susan’s Antarctic expeditions together with the AAPG Foundation and other organizations,” said AAPG Honorary member G. Warfield “Skip” Hobbs, president of Connecticut-based Ammonite Resources.

“I truly believe that the future of the energy and mineral industries requires that we do a better job at explaining our science to the public and its relevance to their quality of life, including how geological and human processes are involved in climate change,” said Hobbs, a former AAPG secretary and a past-

Editor’s note: During the past three years, AAPG member and EXPLORER correspondent Susan R. Eaton has participated in three science-based Antarctic expeditions. Funded in part by the AAPG Foundation (making her the unofficial Antarctic Explorer-in-Residence), Eaton has blogged from the Bottom of the World, enabling AAPG members to experience, in real time, these voyages of exploration and discovery.

Translating lessons from Antarctica, Eaton has reached out to AAPG’s diverse stakeholders (K-12 students, university students and the general public), empowering them to formulate scientifically driven global solutions for today’s social, economic, energy and global sustainability challenges.

This report, the first of two-parts, describes the expedition’s mission and offers a glimpse of some of the scientists who participated.

president of the American Geosciences Institute (AGI).

“We need to encourage students to consider careers in the earth sciences,” he added, calling Eaton “an outstanding ambassador for the AAPG.”

Diverse Participants, Common Pursuits

Organized around the Geological Society of America’s 125th anniversary, the Scotia Arc Expedition featured a world-renowned group of earth science professors from the Jackson School of Geosciences, Stanford University, Pennsylvania State and the Federal University of Rio de Janeiro.

Led by Ian Dalziel, professor of geological sciences at the Jackson School of Geosciences at the University of Texas at Austin and a Fellow of the Geological Society of America (GSA), the expedition focused on the interplay between geology, geophysics, glaciology, plate tectonics, climate and life.

Before our departure for Antarctica, George H. Davis, regents professor (emeritus) of the University of Arizona and GSA’s then-president, bid us bon voyage, saying: “Given where Earth and human

Continued on next page

Continued from previous page

society stand at this moment in time, we know that this trip, at its core, has a certain gravitas. Antarctica is symbolic of rare international cooperation and Earth stewardship.

"But as we speak, issues of climate change and sea level rise rivet attention on Earth's polar regions," he continued, "with marked focus on physical changes taking place and the projected impact of these changes on ecological systems.

"In this respect, you head out as participant explorers and you return as ambassadors in underscoring to others the preciousness of what you observed, experienced, discussed and concluded while venturing into the Southern Ocean," he said.

* * *

AAPG member **Sharon Mosher** is the dean of the Jackson School of Geosciences (JSG), current president of AGI and chair of the GSA's 125th anniversary celebrations.

Mosher started planning the JSG-led geology field trip in 2008. She and her spouse, **Mark Helper**, also on faculty at the JSG, participated in the Scotia Arc Expedition. It was Mosher's first visit to the mysterious continent, which is recognized for its environmental, aesthetic and scientific value and protected against future development, including resource extraction.

"I think that scientific advances will come out of the Scotia Arc Expedition," Mosher said. "I got a much better understanding of how everything fit together – glaciers, ice shelves, oceans currents, the atmosphere and plate tectonics. I think the trip gave us all a better understanding of climate change and Antarctica's role in climate change, opening the potential for new ideas.

"From a plate tectonic and mineral resource perspective, there were certainly a lot of intense discussions," she said. "All of a sudden, people started seeing that there were connections across the globe."

* * *

For **Abdulaziz Abdullah bin Laboun**, professor of petroleum geology at the King Saud University in Riyadh, Saudi Arabia, these global connections materialized on the outcrops. Laboun was struck by the parallels (and timing) between the opening of the Red Sea and the Scotia Sea.

"The ophiolites in Antarctica are similar to those on the Arabian Plate, in terms of the mechanism of opening, subduction and volcanic activity," Laboun said.

Laboun was delighted to see big ice in action, observing glaciers and icebergs carving into the bedrock – in real time – of South Georgia and the Western Antarctic Peninsula.

"In Saudi Arabia," he said, "we see the end result of glacial activity – pavement grooves, pluck marks and drop stones in fine sediments." In the field, Laboun was able to compare modern-day geological processes in Antarctica with the Arabian Peninsula's geologic past.

And, he was lucky enough to discover (and photograph) a meteorite entombed in an iceberg and presented, for examination, in cross-section.

According to Laboun, there have been four documented episodes of glaciation on the Arabian Peninsula, as evidenced by glacial deposits including paleovalleys containing boulders and tillites, which are oil bearing.

In 2011, Laboun published an article in the Arabian Journal of Geosciences, about a fifth episode of glaciation that he'd documented east of the Gulf of Aqabah. The article was titled "Did Glaciers Exist During the Pleistocene in the Midyan Region, Northwest Corner of the Arabian Peninsula?"

Later this year, Laboun's textbook detailing all five episodes of glaciation will be published in Saudi Arabia.

Laboun entered academia in 2002, after a career with the Arabian Oil Company (Japan) and Saudi Aramco.

"I'm known in Saudi Arabia as being a field geologist," he said. "I believe that the 'field' is the real geology, as opposed to modern-day 'computer' geology."

Describing the JSG-led trip as a "floating university," Laboun said that he learned a lot, including climate change and oceanography, two subject areas that are new to him.

Inspired, Laboun is thinking about obtaining funding, in the hope of returning to Antarctica with a group of Saudi geologists.

* * *

Expedition leader **Ian Dalziel** is a self-described "old-fashioned" structural geologist, who has more than 40 years of Antarctic field experience in plate tectonics and volcanism.

His body of Antarctic research involves studying the interaction between plate tectonics and the environment. Increasing levels of atmospheric carbon dioxide, he said, translate to ocean warming. Acting as a global heat sink, the ocean transports this extra energy to the ice shelves and glaciers in the Weddell and Ross seas.

"Climate change is happening," Dalziel said. "There are uncertainties, and we're trying to quantify them.

"One thing that earth scientists bring to the table is the dimension of time," he added.

Describing Antarctica and the Scotia Arc as the "nexus of the world's great climate engine," Dalziel said, "You can't understand the climate unless you understand the solid Earth. Things happening in the interior of the Earth can impact the surface of the Earth in a way that biology cannot."

At the Drygalski Fjord Ophiolite Complex on South Georgia, Dalziel explained the relationship between the Scotia Arc tectonic plate and climate change in the geological record. The formation of the Scotia Arc tectonic plate and the later opening of the Drake Passage, some 34 million years ago, he said, created "oceanic gateways" on the sea floor that influenced bathymetric movements of the cold waters of the Antarctic Circumpolar Current (ACC).



Photo courtesy of Seva Egorov

Above: Rudolph Trouw of the Federal University of Rio de Janeiro is greeted by an elephant seal at Gold Harbour, South Georgia. Below: Pillow basalts being cut by dikes in Drygalski Fjord, southern South Georgia. The Late Jurassic Larsen Harbor Formation is comprised of pillow lavas, dikes and gabbros.

Geology Boot Camp

Our days at sea were spent in a geology boot camp of sorts: We attended lectures on plate tectonics, island arc systems, igneous and metamorphic rocks, glaciers, sea ice, oceanography, sea level rise and climate change.

We also received a primer from the Cheesemans' Ecology Safaris staff on the region's fragile ecosystem, including its unique assembly of sea birds, marine

mammals, fish and krill, a small, shrimp-like animal that anchors the Southern Ocean's food chain.

During the expedition, I delivered my lecture, titled "A Geoscientist in Antarctica: Following in Shackleton's Footsteps One Hundred Years Later," waxing poetically about the historic role that earth scientists have played (and continue to play) in exploring this mysterious continent.

– SUSAN EATON

"The ACC is the world's biggest current, by volume, and it plays a major role in global climate," Dalziel said.

Sometime between 34 million to 10 million years ago, Antarctica was thermally isolated by the west to east circulating ACC, and the planet moved into the "Ice House Earth" phase of its geologic history, which was marked by the development of glaciers on most continents.

Once connected to the southern part of South America, today the micro-continent containing South Georgia sits some 2,000 kilometers due east of South America's Cape Horn. Plate tectonic movements, on the order of 6.5 millimeters per year, continue to transport the micro-continent toward Africa.

"This ophiolitic sequence of rocks at Drygalski Fjord helps us identify where the South Georgia micro-continent originated in continental South America," Dalziel said. "Here, we see similar rocks of a similar age in a similar tectonic setting, in a place where there is, clearly, a missing piece of the South American continent."

* * *

For **Darcy Juday**, a retired AAPG member living in Longmont, Colo., participation in the Scotia Arc geology field trip was like coming full circle in her geological career.

Before entering the petroleum industry in 1978, Juday completed a Master's thesis on hydrothermal manganese deposits in the Mid-Atlantic Ridge, at 26 degrees north latitude. Thirty-five years later, she said, the theories of plate tectonics had changed dramatically from "ridge push" to "slab pull."

Through lectures delivered by the world's leading experts in plate

tectonics, oceanography and glaciology, Juday discovered the role that plate tectonics plays in global climate change:

"I was fascinated to learn about the strong influence that ocean bottom topography has on climate change," she said. "The global climate system is very complicated, and there's an intricate set of feedback loops.

"The lectures were simply fascinating," she said. "I think that I enjoyed the lectures even more than the outcrops."

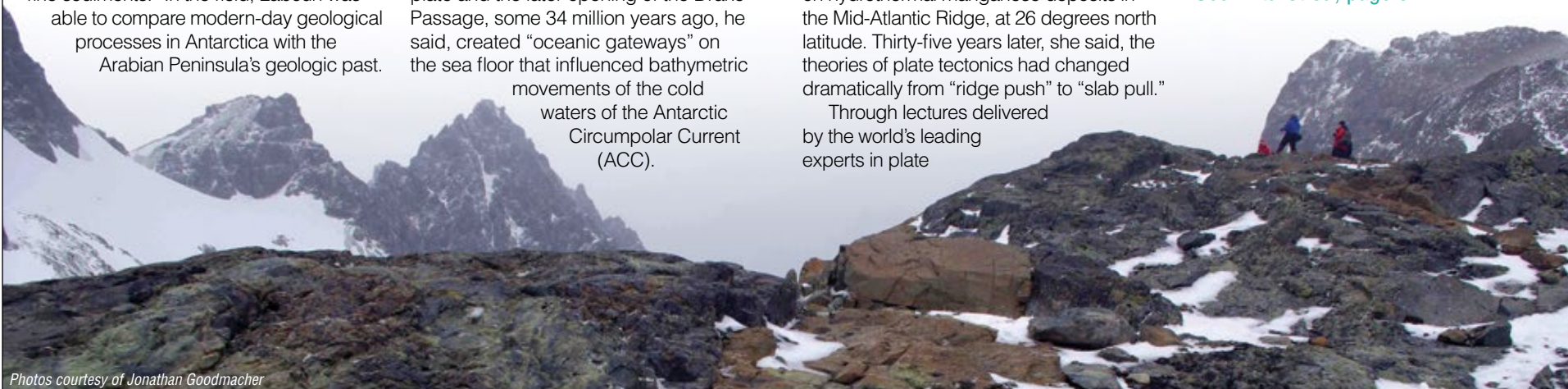
However, she added, "After working in the Gulf Coast for so many years – with 15,000 feet of barely consolidated rocks – it was a pleasure to see outcrops for a change! Certainly the turbidites (on South Georgia) were very interesting to me."

Juday's been busy since retiring from the petroleum industry 15 years ago. In 2008, she received a doctorate in soil and crop science from Colorado State, and today she sits on Longmont's volunteer water board where she deals with many issues including hydraulic fracturing in horizontal wells.

(An epilogue: Inspired by her geology field trip to the Scotia plate – and buoyed by the latest theories in plate tectonics – Juday made the pilgrimage, in June, to Iceland.

"I was able to stand on the mid-Atlantic Ridge, for the first time, and compare and contrast it to what I had observed in Antarctica," she said, jokingly adding that "I had all the right (winter) clothes for the trip!")

See Antarctica, page 34



Photos courtesy of Jonathan Goodmacher



Photo courtesy of Susan R. Eaton

Abdulaziz Abdullah bin Laboun, petroleum geology professor at the King Saud University in Riyadh, Saudi Arabia, compared modern-day geological processes in Antarctica with the Arabian Peninsula's geologic past.



Photo courtesy of Darcy Juday

A cascading glacier at King Haakon Bay on the Island of South Georgia, the first landfall that Sir Ernest Shackleton made after sailing 1,300 kilometers from Elephant Island.

Antarctica from page 33

AAPG student member **Hunter Carr** hails from Tyler, Texas, and he jumped at the “opportunity of a lifetime” to participate in the JSG field trip led by “a group of geologists and climatologists who have changed our understanding of the world” – even if it meant returning to the University of Georgia with the spring semester already in full swing.

One of five geology students who participated in the expedition, Carr made up for “lost” time in Antarctica, completing the summer semester and picking up a couple of missed courses. He also received one research credit for participating in the GSA geology field trip.

“The GSA field trip taught me how to observe the geology of an area because I was mostly learning from Ph.D. geologists, all specialists in their various disciplines,” Carr said. “Listening to how they approached a problem observed in outcrop was like absorbing 10 geological papers, all at once.”

“I was able to see how they dissected an outcrop, discussed it amongst themselves and reached a consensus,” he said. “Within five to ten minutes, they had an outcrop completely figured out.”

In September, Carr enters the final year of his bachelor's degree in geology. His senior thesis will investigate sulfur isotopes of a volcanogenic massive sulfide deposit, an ancient sea floor smoker in Turkey, that's subsequently been uplifted.

“Picture yourself on the sea floor, and you have all of these sulfide metals precipitating out,” he said. The GSA geology field trip, with its emphasis on sea floor spreading and plate tectonics, inspired him to undertake this senior thesis in economic geology.

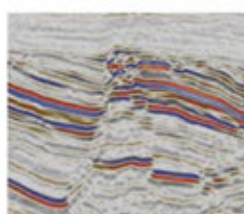
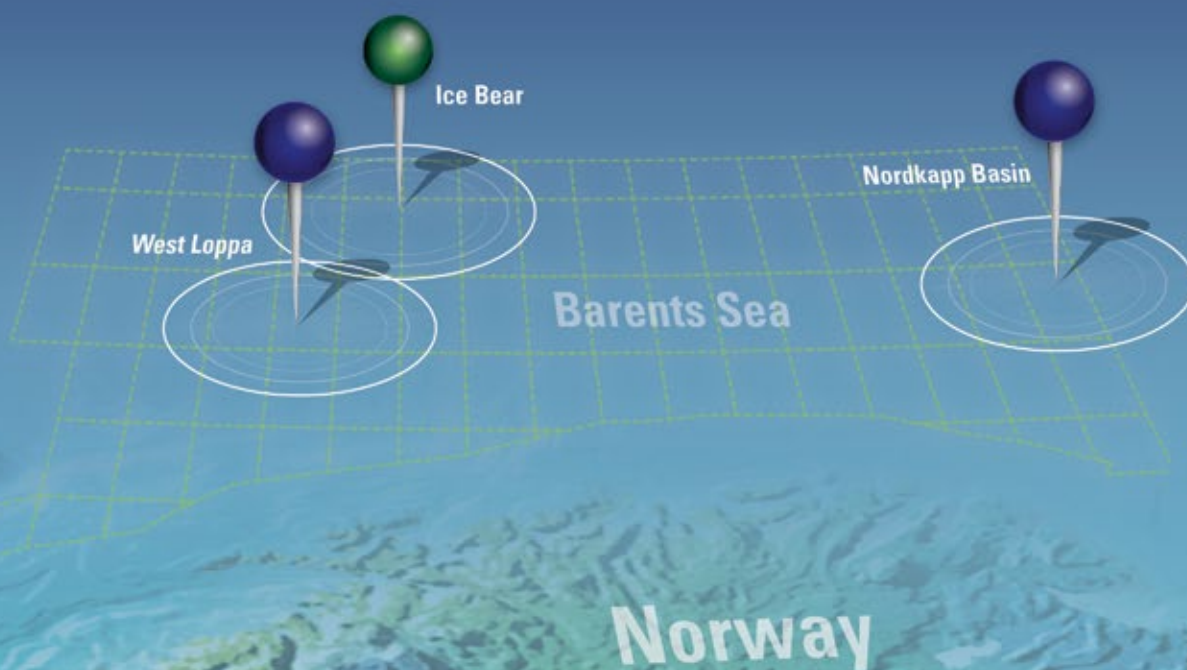
But oil and gas exploration comes as second nature to Carr, a Texan who was raised by a petroleum geologist (his father also is a member of AAPG).

“I'm going through this debate,” he said. “Should I follow the petroleum or the mining route? I guess that it really depends upon the job market when I graduate.”

“Antarctica did change me,” he added. “It was such a humbling experience to see nature, life and geology in its purest form. I really discovered a passion that I don't think most people find at my age.”

“The experience lit a fire under me, to continue learning, in all aspects of life, uncovering the secrets of the world.”

Multiclient Services



Our success speaks volumes in the Barents Sea.

Having been at the heart of recent discoveries in this area, WesternGeco continues to acquire multiclient seismic data in the Barents Sea to deliver the most accurate images of the subsurface using the latest high-resolution seismic acquisition technologies.

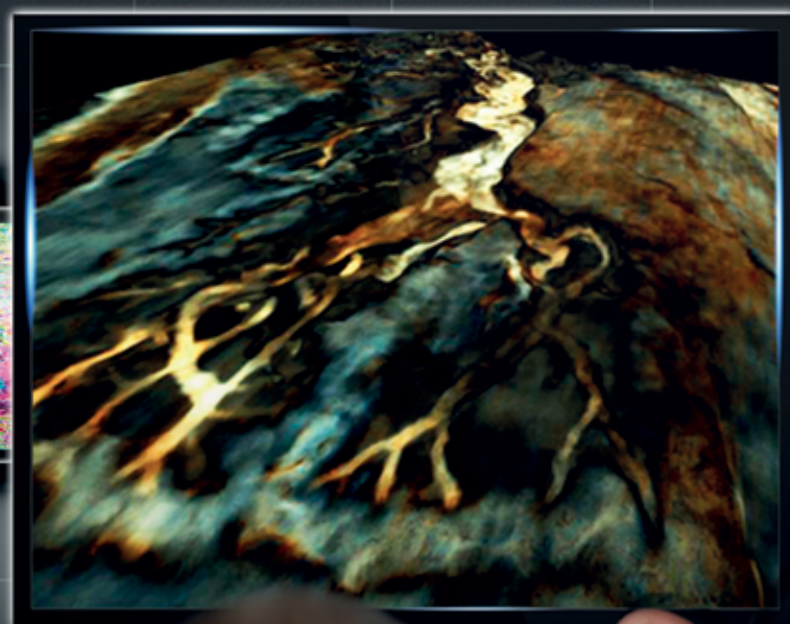
Write your own success story with our multiclient data.

slb.com/multiclient



© 2013 Schlumberger 13-SE-0001

The evidence to succeed is now in your hands



**GeoTeric® empowers your interpretation to reduce uncertainty,
explore alternative scenarios and accelerate decisions.**

Whether you seek a more accurate representation of intra-reservoir faulting, reservoir morphology, or potential hydrocarbon migration pathways – GeoTeric puts a wealth of geological details directly into your hands.

Based on a best-in-class approach at every stage, GeoTeric's robust and reliable Geological Expression workflows empower you to decide – and succeed – sooner.

Make contact now: email power-on@GeoTeric.com or visit www.GeoTeric.com

poweron with GeoTeric



What is hydraulic fracturing's role?

Scientists Look Deeper Into Induced Seismic

By DAVID BROWN, EXPLORER Correspondent

Is up to 10 percent of increased earthquake activity in the central United States related to hydraulic fracturing?

And does that present a risk for oil and gas operators?

Hydraulic fracturing could have contributed to the dramatic increase in Oklahoma's earthquake activity in recent years, said

Austin Holland, seismologist for the Oklahoma Geological Survey in Norman.

Holland said earthquake activity in the state has increased about 80-fold since he joined the Survey in January 2010. That reflects a general increase in mid-continent earthquake activity dating back to 2009.

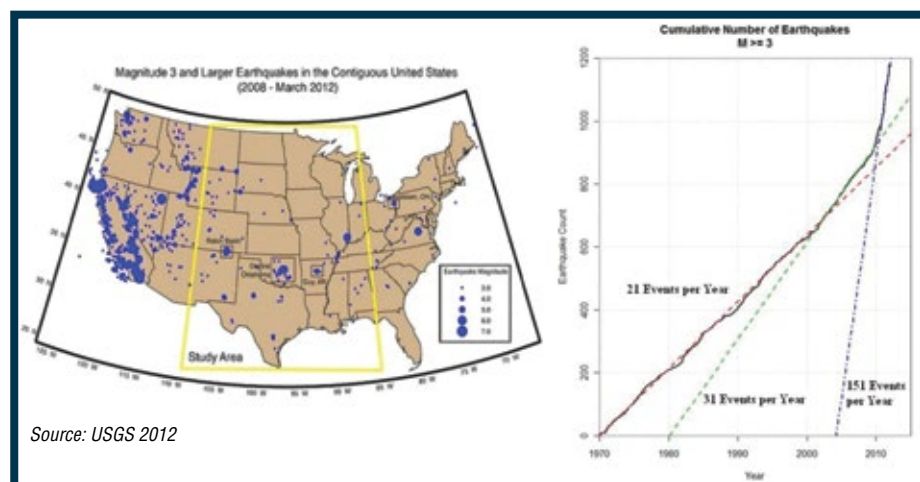
He said his preliminary analysis of Oklahoma quake data indicated that hydraulic fracturing might have been a factor in as much as 10 percent of the activity, although he noted the actual percentage could be lower.

"It may not be as rare as once thought to have these felt earthquakes resulting from hydraulic fracturing," Holland said.

The strength of the earthquakes potentially related to hydrofracturing ranged up to 3.6 magnitude, Holland said, which generally agrees with the findings of other scientists who have



HABIGER



Source: USGS 2012

been researching recent quake activity in the central United States.

That level of earthquake is just strong enough to be felt, but not strong enough to cause meaningful damage.

If a magnitude of 3.6 was the actual, upper limit for the induced quakes, it would eliminate any direct tie between hydraulic fracturing and the much stronger earthquakes that shook Oklahoma in 2011.

Maybe Yes, Maybe No

Rob Habiger is a consultant for Spectraseis Inc. in Denver and serves on the company's board of directors. He has a doctorate in physics and worked

in geophysics for Phillips Petroleum and ConocoPhillips for 28 years.

Habiger also served as a member of the National Research Council committee on "Induced Seismicity Potential in Energy Technologies." That committee issued a report in 2012 identifying wastewater injection wells as a much more likely source of induced seismic events than hydraulic fracturing operations.

"There's always a discussion around these issues," he said, "but despite those discussions, there are going to be consequences any time induced seismicity is connected to operations."

Induced seismicity can be defined as earthquakes and tremors resulting from

human activity that alters stresses in the earth. Links between hydraulic fracturing and induced seismicity do carry risks for operators, including potential regulatory limitations on hydrofracturing activities.

Most operators aren't capturing information relevant to any seismicity induced by their operations, Habiger noted. That can leave the industry vulnerable when questions arise about hydraulic fracturing and earthquakes.

"They don't have the data to answer those questions," he said. "Then they're stuck."

Holland said operators can monitor to what extent their activities might be causing induced seismicity, and alter their operations accordingly.

"The things we know can be problematic are the things you want to keep track of" in assessing the likelihood of subsurface failure and resulting quakes, he said.

"If you start monitoring a field when you begin developing it, and you see this (induced seismic) activity start happening, you might look at what you're doing and see that as a sign of failure," he said.

Needed: More Data – Daily

Brad Artman, chief technology officer for Spectraseis, designs surveys for

[See Induced Seismic, page 38](#)

Australian unconventional plays | expertise and data

Database

Australia's most comprehensive exploration database

- All available wells with associated well header and downhole analysis data
- All available 2D seismic lines and 3D seismic surveys with associated survey header data
- National well and seismic reports and raw data library with spatial searching capability
- Wireline and seismic master projects in Kingdom
- Geological interpretations
- ArcSDE database built on industry standard PPDM data model with AWT additions

Contact us today about data for your project

T: +61 7 3505 4500
E: contactawt@awtinternational.com
W: awtinternational.com

AWT
INTERNATIONAL

AWT is a leading independent subsurface and well engineering consultancy providing complete project lifecycle solutions to the upstream oil and gas industry

Expertise in unconventional reservoirs

AWT's recognised expertise and data products have helped facilitate substantial farm-in agreements to Australia's unconventional plays.

Transaction Value - 2010-2013 activity

Basin

Geoscience

Drilling and Completions

Data Products

Well Services and Interventions

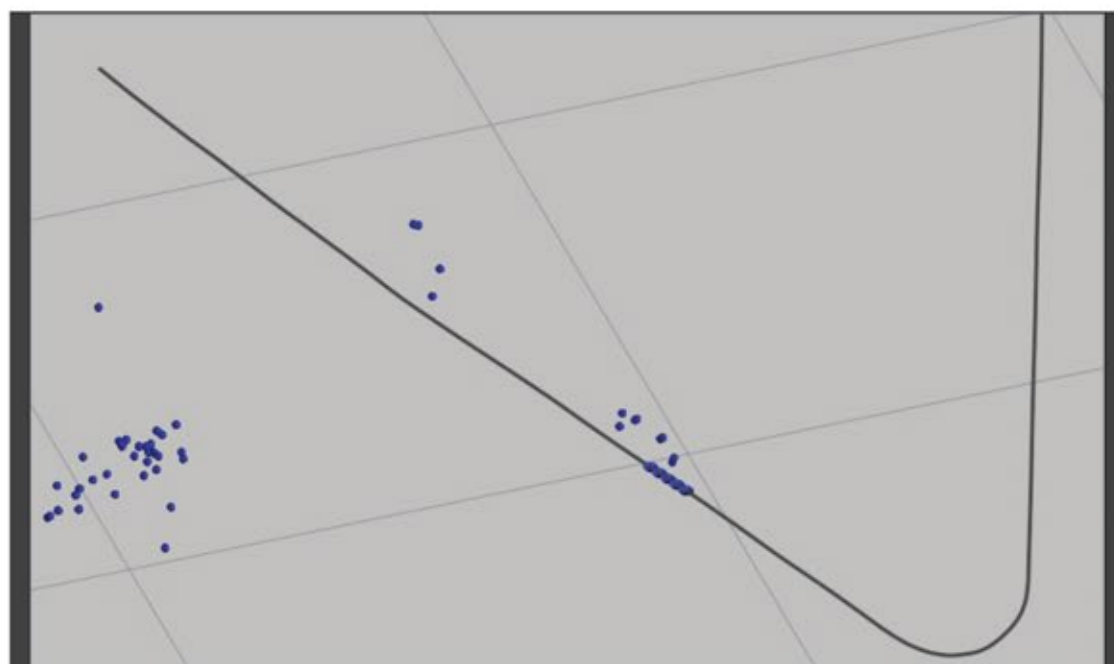
Petroleum Engineering

Project Management

H S & E

Product Sales

Recruitment and Consulting



hypocenter

TFISM!



Get the Picture?

Tired of trying to figure out how all those dots in a box relate to fractures in your reservoir? Global's patented **Tomographic Fracture ImagingSM (TFISM)** technology directly maps both natural and induced fractures in your reservoir at each stage of your stimulation program.

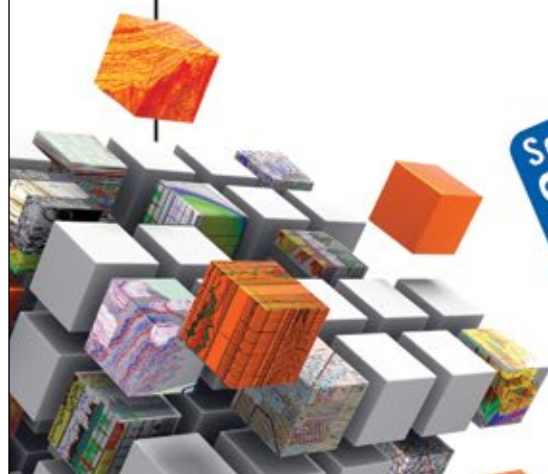
Take the guesswork out of interpreting microseismic.

Global Microseismic Services[®]

GAIN *InSight*

See us at
SEG'13
#1043

Global Microseismic Services, Inc.
a Global Geophysical Services Company
13927 S. Gessner Road • Missouri City, TX 77489
tel +1 713-972-9200 www.globalgeophysical.com



Induced Seismic from page 36

operators to monitor induced seismicity.

"What we want the operators to do is to use the data on a daily basis to look for trends," he said. "If a magnitude 4.0 quake will shut down operations, you want to know how many 2.0 and 3.0 quakes are happening."

Spectraseis uses equipment and processes that will capture information to augment data gathered by government and academic seismic arrays, Artman said.

"There are so many issues about equipment compatibility," he noted. "You can go out with a little geophone that might be convenient, but it won't be

compatible."

At the same time, operators will have much more subsurface information about a specific lease area than academic or governmental groups, Artman said.

"Our solution is meant to be as precise as possible and to utilize all of the information the operator has at its disposal," he said. "One of the biggest risks for operators is ambiguous answers."

Lack of sufficient seismic data for evaluation is a common lament at the state level. Holland has been gathering more data to rework his study on earthquake activity and hydraulic fracturing in Oklahoma.

"We clearly don't have enough permanent monitoring stations in the state," Holland said. "Our aim is to get to a point where when we have a felt earthquake we can say with some level

of confidence where it's occurring, and to say something about this felt or damaging earthquake."

Oklahoma is now refurbishing its seismic monitoring capability and will be adding eight new stations, Holland said.

The Oklahoma Geological Survey sponsored a workshop on "Fluid Injection Induced Seismicity" in July. A goal was to develop best practices for industry, with feedback gathered from participants, Holland said.

"Right now we're putting this feedback together in a document and then sending that back to the people who attended the workshop," he said. "Then we will put together a document for public comment. OGS has never sent out a document for public comment before, so we are breaking new ground."

Any resulting list of best practices will be issued as guidelines or suggestions,

because the Survey is not a regulatory agency.

Induced seismicity typically produces seismic activity – tremors and quakes – of low magnitude, although some stronger, damaging events have occurred.

"We don't want to be fear mongers," Habiger said. "We just want to lay the facts out."

Because of the possible connection between hydraulic fracturing and induced seismicity, some oil and gas operators that utilize hydrofracturing are beginning to monitor seismic activity in their operating areas, he noted.

"Sometimes the technical people bring it up," he said. "Sometimes the board of directors brings it up because they're worried about the risk side."

The Big Picture

A series of small but noticeable earthquakes in the Dallas-Fort Worth area five years ago first touched off speculation about a connection between oil and gas operations and induced seismicity (October 2010 EXPLORER). Now other states are looking at induced seismic events.

"We see Texas as different from Oklahoma, because there's not that much interest in it in Texas. Oklahoma is much more seismically active," Habiger said. "Canada, on the other hand, is very tuned into this, because of activity in the Horn River Basin and other areas."

Artman said operators should define their risks from induced seismicity, then decide whether to implement monitoring.

"The most important thing for us as a service company is for an operator or group of operators to figure out their needs, and then to have me sit down and figure out how to meet those needs," he said.

Over the past three years, the focus on induced seismicity in oil and gas producing areas has shifted away from hydraulic fracturing and toward injection wells. But trying to identify a connection between injection wells and earthquakes in Oklahoma is difficult, Holland said.

In studying a potential connection, scientists have looked at quake origins within five kilometers of an injection well. Oklahoma's seismic monitoring system has a 10-kilometer uncertainty in identifying the location of a quake origin, according to Holland.

"If you draw a 15-kilometer circle around every injection well in the state, you're going to cover 80 percent of the state," he said.

Put another way, any earthquake that occurs in Oklahoma is likely to have an origin near an injection well.

In July, researchers at the Lamont-Doherty Earth Observatory in New York released findings that seismic events in the United States could be triggered by major earthquakes thousands of miles away, and cited increased risks from injection-well induced seismicity.

Holland said the remote-triggering effect "has long been recognized, and it doesn't just happen around injection wells."

With so much current speculation about the causes of induced seismicity, the oil and gas industry's attention has expanded beyond geophysical analysis of prospects to the geophysics of the planet itself.

"The oil and gas industry today," Habiger said, "is rediscovering global geophysics, meaning earthquakes and how they happen, and how you measure them." ■

UNCONVENTIONAL INSIGHTS



Optimize unconventional plays with a focused, integrated portfolio of technologies. Weatherford can partner with you from start to finish, helping you identify where to drill, how best to secure your wells, where to frac and how to maximize production. And you can count on us to deliver exclusive innovations like the SpectralWave™ spectral azimuthal gamma ray—a proven technological advantage that locates "sweet spots" to help keep you on target and in the pay zone.

Weatherford delivers best-in-class expertise through our multidisciplinary Unconventional Resource Team. We provide an integrated workflow of sophisticated logging, leading-edge laboratory analysis, comprehensive stimulation, multizone completion design and production technologies.

Contact and collaborate with our Unconventional Resource Team at unconventional@weatherford.com.

NEW RESOURCE PLAY MULTI-CLIENT 3D

Delbert 3D, CO



Simpson Draw, WY



Newport, OK



Blackwell, OK



Millerton 3D, LA

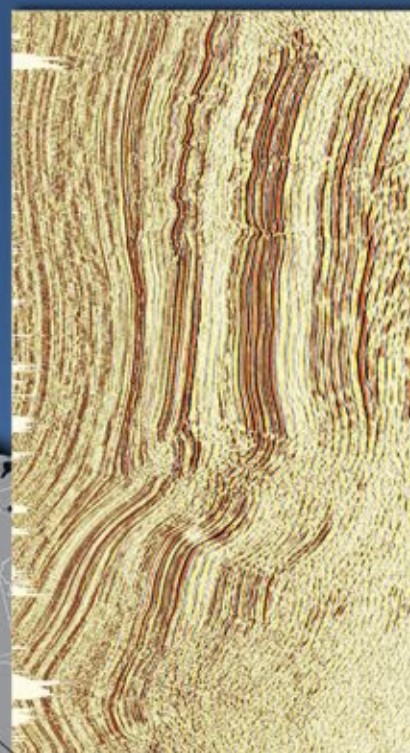


- Completed
- Newly acquired

Delbert 3D: DJ Basin



Newport 3D: Ardmore Basin

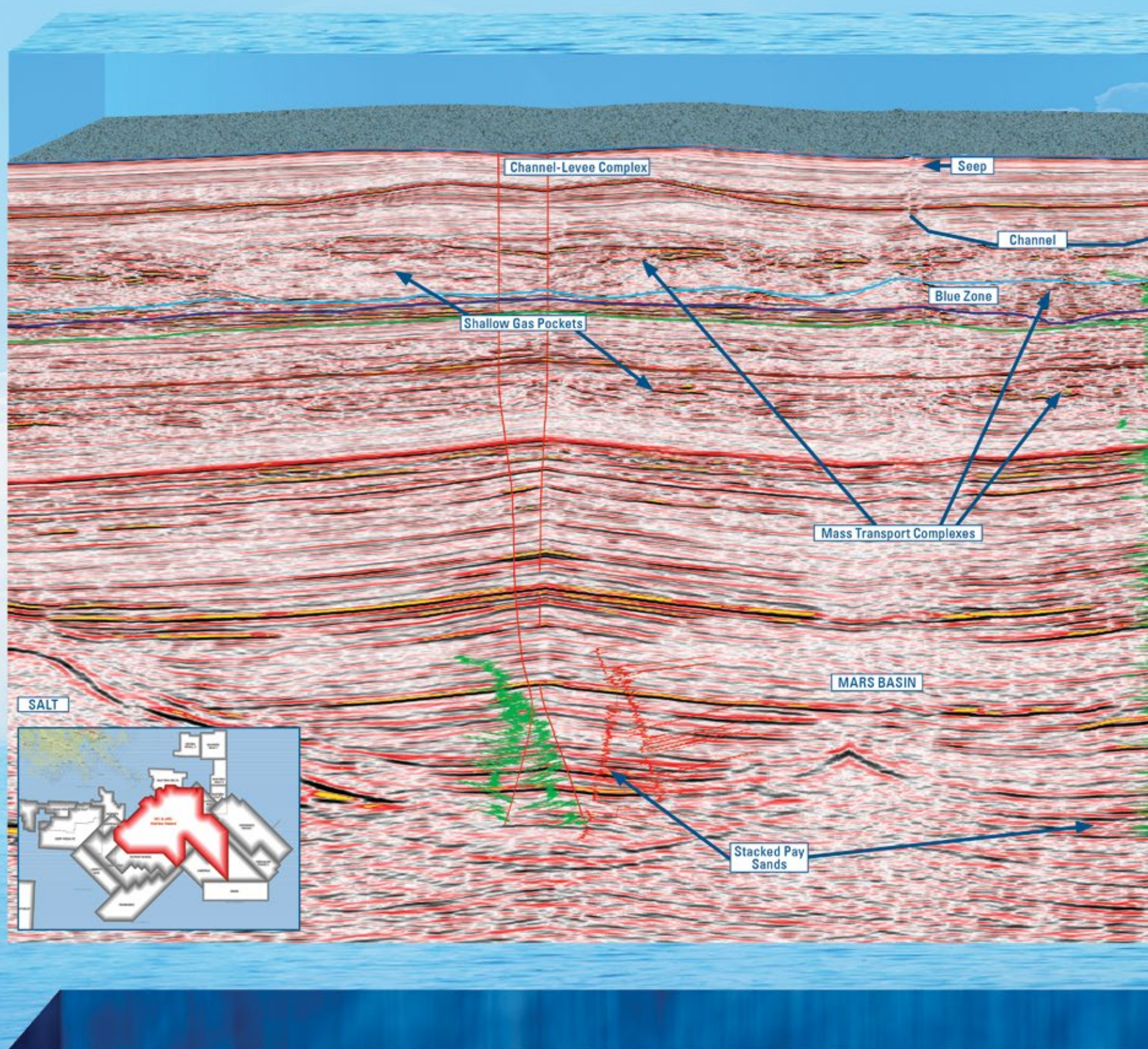


Geokinetics in
partnership with
GEOPHYSICAL **Gr** **PURSUIT, INC.**



Contact: sales@geokinetics.com
geokinetics.com

KNOWLEDGE REVEALED. PURPOSE DRIVEN.



SEE THE ENERGY SHALLOW HAZARDS AND PROSPECTS IN HIGH RESOLUTION

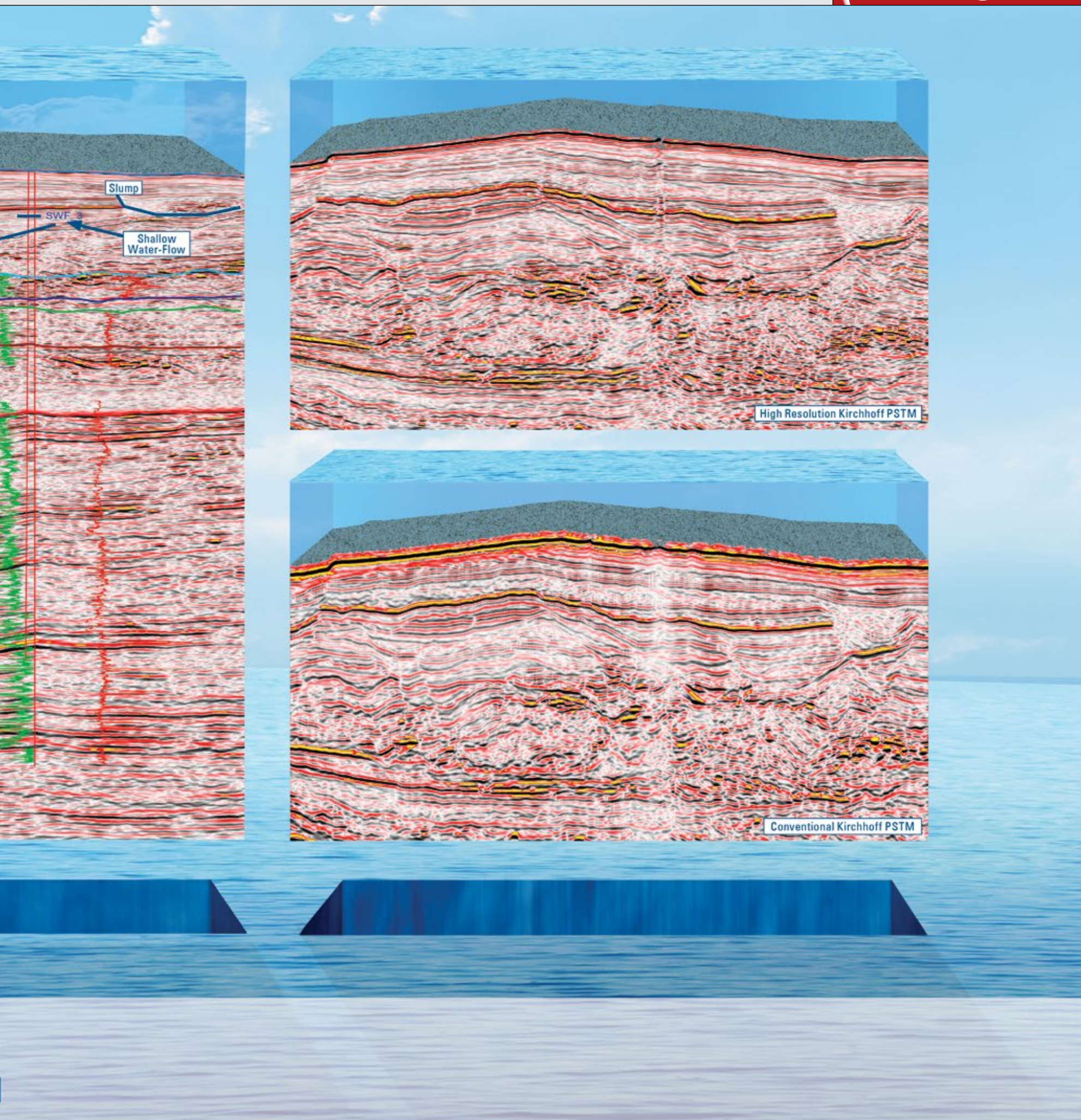
TGS offers the Mississippi Canyon, Gulf of Mexico in high resolution.

Shallow hazard interpretation:

- Seabed depth horizon
- Seabed amplitude extraction
- Three-sub-sea depth horizons
- Shallow water flow map
- Shallow gas attribute map
- Drilling hazard map
- Shallow geologic horizon map

Processing highlights:

- Over 888 outer continent shelf blocks
- 2 ms Kirchhoff PSTM
- Stretch to depth volume (2 m depth step)
- High density velocity volume
- TAME™ (3D SRME)
- PSTM Kirchhoff gathers



For more information, contact TGS at:
 Tel: +1 713 860 2100
 Email: info@tgs.com

TGS  See the energy.
WWW.TGS.COM

Template matching technique is timely

Ohio Experiences Fuel Award-Winning Paper

By BARRY FRIEDMAN, EXPLORER Correspondent

Stephen Holtkamp probably would have been featured in these pages had he simply won the award for best student paper at an AAPG Annual Convention and Exhibition.

And he certainly would have had a story written about him if he was awarded the Matson Award for best oral paper presented by anyone at the ACE.

But Stephen Holtkamp, an AAPG member, won both at the same meeting, for the same paper.

Nobody's ever done that before.

A story, at that moment, was a given.

"I am absolutely honored and excited to receive these awards," says Holtkamp, a recent Miami of Ohio Ph.D., of the awards announced at the conclusion of



HOLTkamp

"... It seems like the earthquake risk associated with hydraulic fracturing operations is exceedingly small."

this year's ACE in Pittsburgh.

His paper, co-written with AAPG members Brian Currie and Michael R. Brudzinski, both professors at Miami, and titled "A More Complete Catalog of the 2011 Youngstown, Ohio, Earthquake Sequence From Template Matching

Reveals a Strong Correlation to Pumping at a Wastewater Injection Well," opened up more than just a few eyes.

And kept them open.

"In my presentation, I tried to showcase the advantages of the technique I've been working on,"

The best paper at the AAPG Annual Convention and Exhibition in Pittsburgh will have an encore presentation this fall.

The authors will be giving the same paper in a special session at the Geological Society of America's annual meeting – the group's 125th anniversary meeting – set Oct. 27-30 in Denver.

The paper will be part of the session titled Cutting Edge Applied Geoscience in Exploration: The Best of AAPG.

Holtkamp said, "which is a multiple-station (or network) matched filter (or 'template matching') technique to

See Holtkamp, page 44

Shhh ... Best Paper Award Winner Has a Secret Story or Two to Share

By BARRY FRIEDMAN, EXPLORER Correspondent

Stephen Holtkamp, this year's winner of both the top student award and the AAPG Matson Award for best oral paper at an AAPG annual convention, has a confession to make.

"This was my first AAPG meeting," says the earthquake seismologist/geophysicist.

Holtkamp received a master's degree from Cornell on InSAR and seismicity analysis, and after the AAPG ACE, before completing his doctorate from Miami

University in Oxford, Ohio.

How he got here is a good story.

Just ask him.

"I'm glad you asked about my research steps for this paper, because it's a pretty good story," he said.

"The first two parts of my Ph.D. were concerning earthquake swarms, which are temporary increases in seismicity rate that aren't accompanied by a triggering main shock."

He says, instead, they are triggered by

something else, such as slow fault slip or fluid/magma movement in the crust.

The third part of his doctorate – and here's the story – was supposed to be utilizing the template matching technique to study an earthquake swarm in southern Mexico, where his dissertation adviser, AAPG member Michael Brudzinski, has a regional network of seismometers.

Unfortunately, they had not collected the appropriate data from the seismometers yet, so instead of waiting

around for it, they decided to build and test the technique on some sequence here in the states.

"Being from Ohio, we had heard about the recent Youngstown earthquakes, so we decided to test it on that."

It's why, in part, he has a doctorate.

"We were amazed by the results enough to make it the final chapter of my dissertation, when we never really expected it to be anything more than a tool to calibrate our code and move on."



Earth Sciences



OpendTect

Free seismic interpretation software

Open Source development environment

Commercial plugins game-changing functionalities

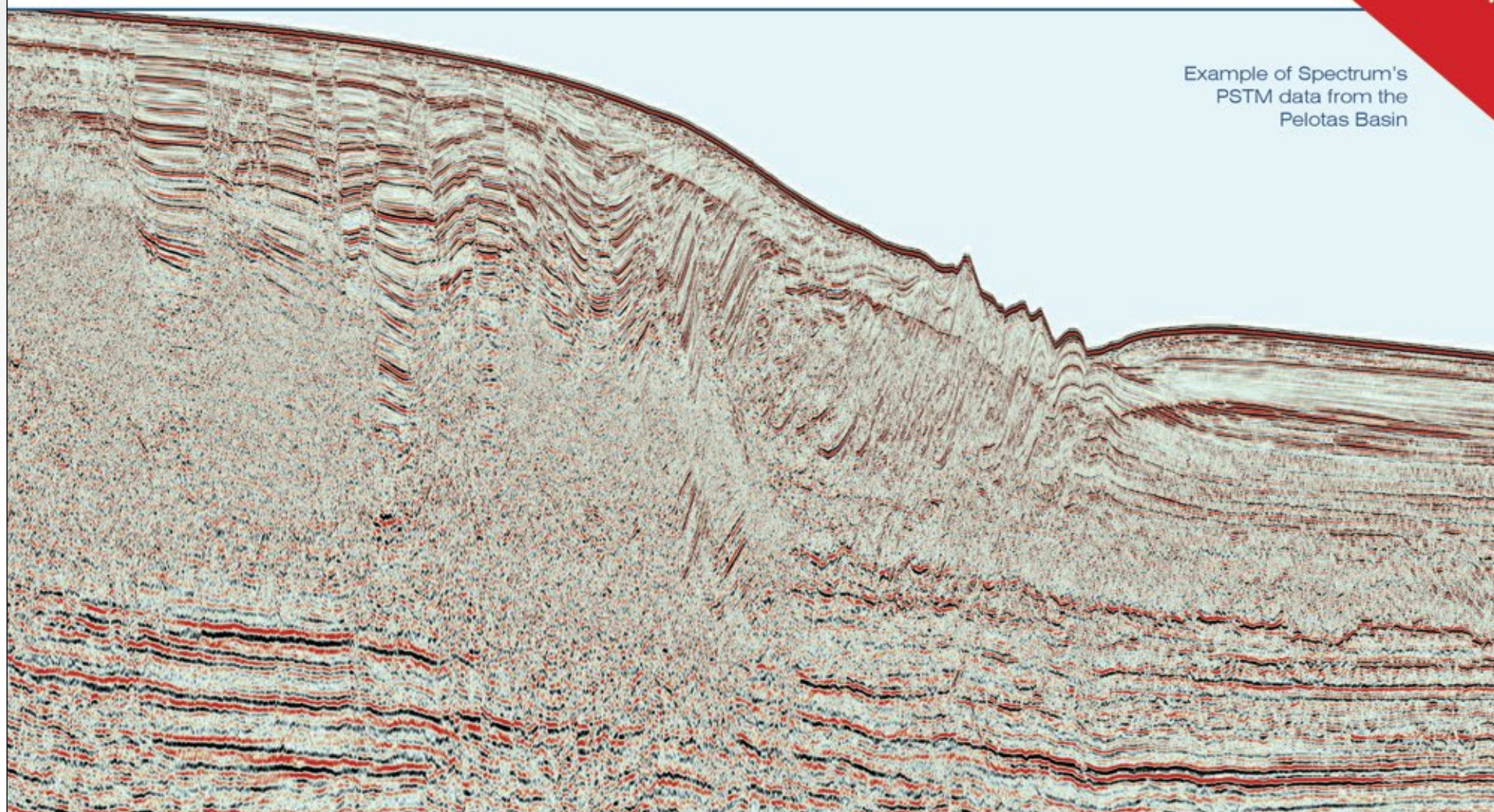


www.opendtect.org

Pelotas Basin Brazil

New 2D Multi-Client Seismic Available Q3 2013

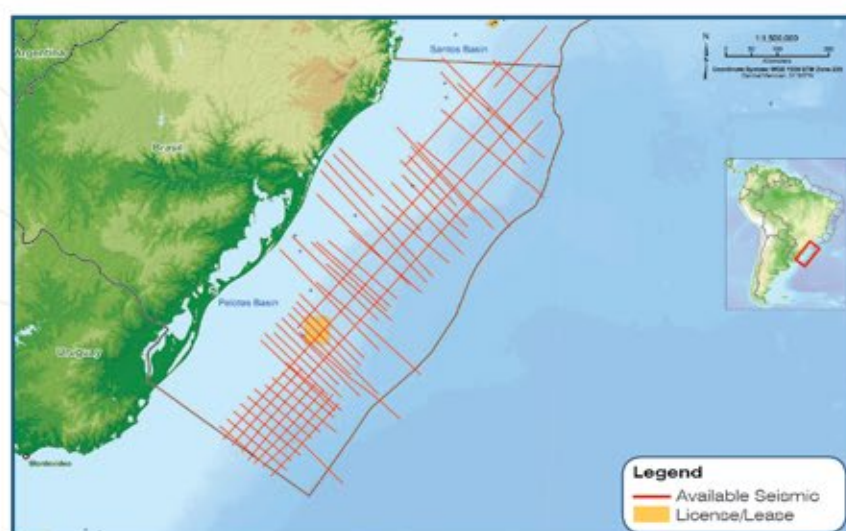
see us at
SEG ANNUAL MEETING
Hall E • Booth #954
AAPG ICE 2013
Booth #6



Example of Spectrum's
PSTM data from the
Pelotas Basin

Pelotas Basin in the southern most part of Brazil has not previously seen the same level of exploration as other basins in the region. However, Spectrum's new long-offset seismic shows promising indications of an active petroleum system in the Pelotas Basin.

The processing flow includes both pre-stack time and pre-stack depth migration. Deliverables are expected to be available to clients Q3 2013.



+1 281 647 0602
@mc-us@spectrumasa.com
www.spectrumasa.com



Award-winning member Stephen Holtkamp, doing some field work with some colleagues.

Holtkamp from page 42

consistently identify low level repeating signals in continuous seismic data.”

Traditional seismic techniques use these observations independently, usually by identifying P- and S- waves at each station, which requires that the signal be large enough at several stations to identify these phases.

Holtkamp’s actual waveform template provides information of the largest amplitude phases, and does so at multiple stations simultaneously.

“In stacking multiple observations of the same source signal, the signal-to-noise ratio increases and allows for more consistent detection and detection of smaller signals.”

Putting It to the Test

His lab was close to the action – literally. Like, right outside.

“We applied this technique to the Youngstown, Ohio, earthquake sequence, and did so using only regional seismic stations,” he said, “which are part of the backbone observational network in the United States and freely available online.”

He was able to turn what was a catalog of 11 located earthquakes into one of 282 earthquakes, a 25-fold increase.

What this did, he says, was allow him to test the hypothesis that injection, itself, was causing the earthquakes.

His findings:

- ▶ Earthquake rate changes mirrored the injected volumes, including before and after injection.

- ▶ There was a short delay (one to several days) in earthquake productivity from the time of injection to activity, indicating the amount of time it takes for the fluid pressure pulse to diffuse to the earthquake source region.

- ▶ A progression of earthquake locations along the fault plane from directly beneath the injection occurred throughout the course of the sequence.

“The biggest advantage of this technique is that it allows us to achieve results without relying on expensive and scientifically focused ‘emergency deployments’ of local seismometers, which are only deployed after there is indication that seismicity may be being triggered.”

This is important because there are hundreds of thousands of active wells throughout the United States, and it would be impossible to equip each one with its own network of seismometers.

“We feel,” Holtkamp said, “this technique can provide an inexpensive solution to this problem.”

First, You Have to Drill

As to those eyes that were opened, though, he understands why.

Two topics: Hydraulic fracturing, and earthquakes.

“It is controversial, but the two issues are commonly confused with each other and I think they need to be viewed differently,” Holtkamp said.

“Hydraulic fracturing uses high pressure fluid to create networks of small fractures in shale formations, but once the fracture network is established, they plug up and move on to the next location, commonly adjacent in the same well,” he explained.

His procedure, by comparison, uses as small a volume of fluid as possible.

“And we attempt to recover as much fluid as possible before extracting the gas.”

And he says, simply, that what he is doing isn’t the culprit – if such a culprit even exists.

“Most of the recent cited cases of potentially induced seismicity are related to wastewater disposal or other long-term fluid injection operations (for example, deep water circulation for hydrothermal power plants).”

He says he understands the concern, but thinks it may be misplaced.

“My personal conclusion is that the size of the earthquake that can be triggered depends on the size of faults immediately available for those fluids to flow in to.”

And this is part of the problem – determining it.

See Fault Zones, page 52

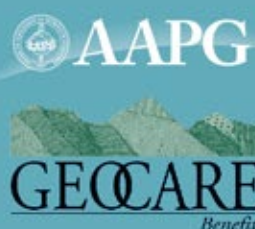
BECAUSE, WHEN SHE GOES AWAY TO COLLEGE, YOU’RE GOING TO BE THERE FOR HER.

THE GEOCARE BENEFITS TERM LIFE INSURANCE PLAN. PROTECTING YOUR FAMILY’S FUTURE...AND YOUR PEACE OF MIND. You have dreams for your family’s future. Make *sure* you have the financial resources to make those dreams a reality, even if you’re not there—help protect your family’s financial security with the GeoCare Benefits Term Life Plan. Apply for up to \$1,000,000 in coverage, at a very affordable group rate.



BE THERE FOR YOUR FAMILY, EVERY STEP OF THE WAY, WITH GEOCARE BENEFITS TERM LIFE PLAN COVERAGE. CALL 1-800-337-3140 OR VISIT US ONLINE AT WWW.GEOCAREBENEFITS.COM FOR MORE INFORMATION, INCLUDING ELIGIBILITY AND RENEWAL PROVISIONS, EXCLUSIONS, LIMITATIONS AND RATES.

GeoCare Benefits Term Life Insurance Plans, P.O. Box 9159, Phoenix, AZ 85068-9159, Email: geocarebenefits@agia.com. The Term Life Plan is underwritten by New York Life Insurance Co. (51 Madison Ave., New York, NY 10010). All coverage is subject to approval by New York Life.





At Chevron, you'll join a team with the technology to take on big challenges, the integrity to do it responsibly, and the drive to keep the world moving forward. Are you up to the job?

Chevron is hiring experienced geoscience professionals for positions in the U.S. and around the world.

To learn more about our positions and to apply, visit us online at chevron.com/careers

JOIN THE CHALLENGE.



Human Energy®

An equal opportunity employer that values diversity and fosters a culture of inclusion.
CHEVRON, the CHEVRON Hallmark and HUMAN ENERGY are registered trademarks of Chevron Intellectual Property LLC. © 2013 Chevron U.S.A. Inc. All rights reserved.



UNCONVENTIONAL RESOURCES TECHNOLOGY CONFERENCE

FUELED BY SPE • AAPG • SEG

Sequel already set

Inaugural URTeC a Hit

Official numbers are yet to be tallied and final reports are yet to be given, but the initial reports from the inaugural Unconventional Resources Technology Conference – URTeC – indicate the event was an extraordinary success.

More than 4,200 geoscientists and engineers attended the conference and exhibition, held Aug. 12-14 in Denver.

Jointly organized by SPE, AAPG and SEG, the conference examined 20 unconventional E&P topics in more than 340 technical presentations, interactive panels, topical breakfasts and luncheons.


Reporters from several media outlets provided coverage of the event, including documentary teams from Edmonton, Canada, and Paris, France.

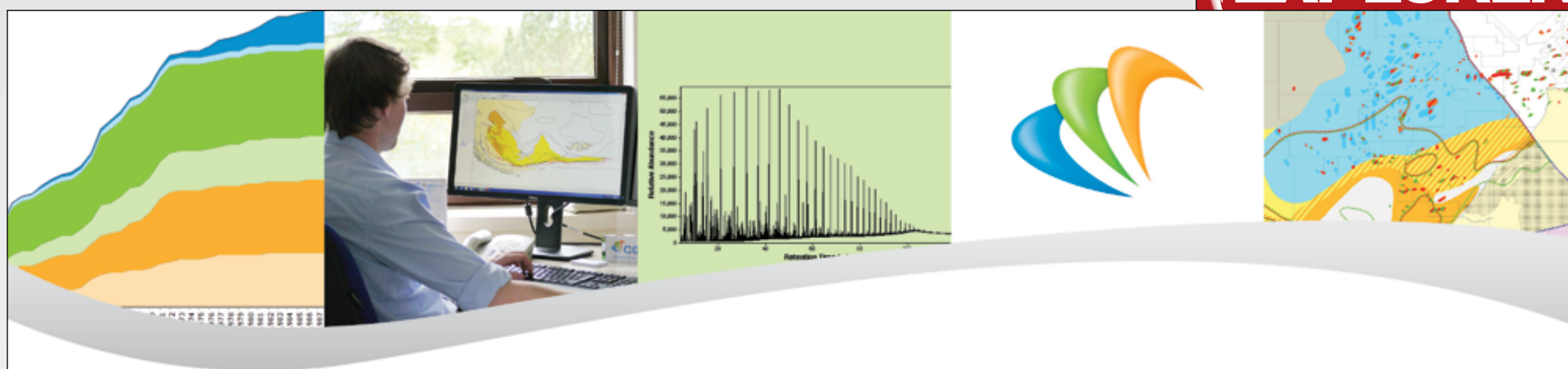
The opening plenary session, moderated by past AAPG president Scott Tinker, director of the Bureau of Economic Geology in Austin, Texas, was titled "Unconventional Resources:

Breakthrough Integration Changes Everything," and drew a standing-room-only crowd to the huge main ballroom.

The exhibition hall, a popular gathering place throughout the conference, boasted 173 companies showcasing their technologies and services.

Best yet, preliminary results of the exit interviews indicated 99 percent of the respondents said they were satisfied to extremely satisfied with the event, and more than nine in 10 indicated they plan to attend next year.

URTeC 2014 will return to Denver Aug. 24-25. 



Your Exploration Compass

Tellus points you towards successful opportunities



Tellus™ is the richest upstream geological and geochemical exploration database in the industry, bringing together everything you need for identifying prospective acreage and reducing risk in your exploration strategy. **Tellus** is fully supported by Robertson's unique library of regional exploration reports as well as data from over 10,000 references.

Tellus provides a global database of mapped proven and potential play fairway systems in an intuitive GIS environment:

- Over 4.1 million individual **FRogi** geochemical analyses
- Source rock distribution and hydrocarbon maturity
- Reservoir distribution - quality graded according to reservoir potential
- Seal presence and absence
- Over 33,000 source, reservoir, or seal data control points
- Data from more than 26,000 fields, related to over 43,000 individual reservoirs

Visit us during AAPG International in Cartagena at booth #98

Passion for Geoscience
cgg.com/robertson



ROBERTSON
A CGG Company

Cooperation with the community

Pastoral French Setting Adds a Taste of Seismic

By BARRY FRIEDMAN, EXPLORER Correspondent

There are approximately 40,000 acres of farmland and wineries near Pau, in the picturesque Pyrenees-Atlantique region of southwest France.

It is an area dotted by grapes, but also corn, zucchini, peas, fava beans, potatoes, spinach, carrots and radishes and, of course, French farmers.

It is a beautiful, transcendent area that holds "the world's most beautiful view of the earth," according to French writer Alphonse de Lamartine.

So, if you're going to perform 3-D seismic surveys in the area, moving heavy machinery close to fragile plants, you need to be careful – and you need to tell those farmers what you're doing and how long you'll be doing it.

"Our cable crews can react on demand either on direct calls by the farmers or by permit," says Rudiger Misiek, whose company, GmbH & Company, is doing just that.

"This allows a smooth cooperation with the local people," he adds.

Essen-based DMT GmbH & Company is doing the seismic acquisition work on behalf of a Canadian oil and gas producer Vermilion Energy, and its goal is to increase oil production from the existing Vic Bilh oil field, which lies north of Pau.

Misiek knows that, along with the technical and organizational challenges that face the company, there is something else equally important for him and his company: How not to affect the local environment and/



Photos courtesy of Bernard Blanc

France's picturesque Pyrenees-Atlantique region, dotted with farms and wineries, has been an area of seismic activity this summer. Here, a view near Bilhères en Ossau, Aquitaine.

or disturb local residents.

He says, "We must be able to react very quickly."

So Far, So Good

It's not like such an endeavor hasn't happened before. Such exploration first occurred in 1977 and then again in 1984, but all admit those projects failed to deliver sufficient data about the targeted structure and, by extension, the potential oil yield.

So, they're trying again.

"Data acquisition is running smoothly," Misiek said at about the project's halfway

point, "and probably will be finished in the beginning of September."

He is more hopeful about the findings, even if the timing of the project could have been better.

"Running such an operation during the vacation period in an area intensively used by the farmers" is a challenge, he said, and has been possible only because of the communication and trust between the locals and the company.

"Information is one of the key issues to run a smooth project," he said, "and Vermilion did a very good job so far in public relations."

And the public relations angle is not to be discounted – or subordinated. Large oil and gas concerns versus cinematic, quintessential French farmers in straw hats. Well, whom do you think would lose that PR battle?

"It is very important that the inhabitants trust our crew who stick to the agreements and are working in a safe and reliable manner."

He is a realist, though.

"It's inevitable that this kind of geological exploration causes some interference for the local resident and the environment, but thanks to our highly-experienced specialists and the latest technology, we are able to keep any encroachment to a minimum."

Cable-Based Operation

And that technology is a point to consider, as well.

"We are generating the seismic energy using three AHV IV vibrators (vibrois), and the data is being recorded with the Sercel 428 acquisition system," he said.

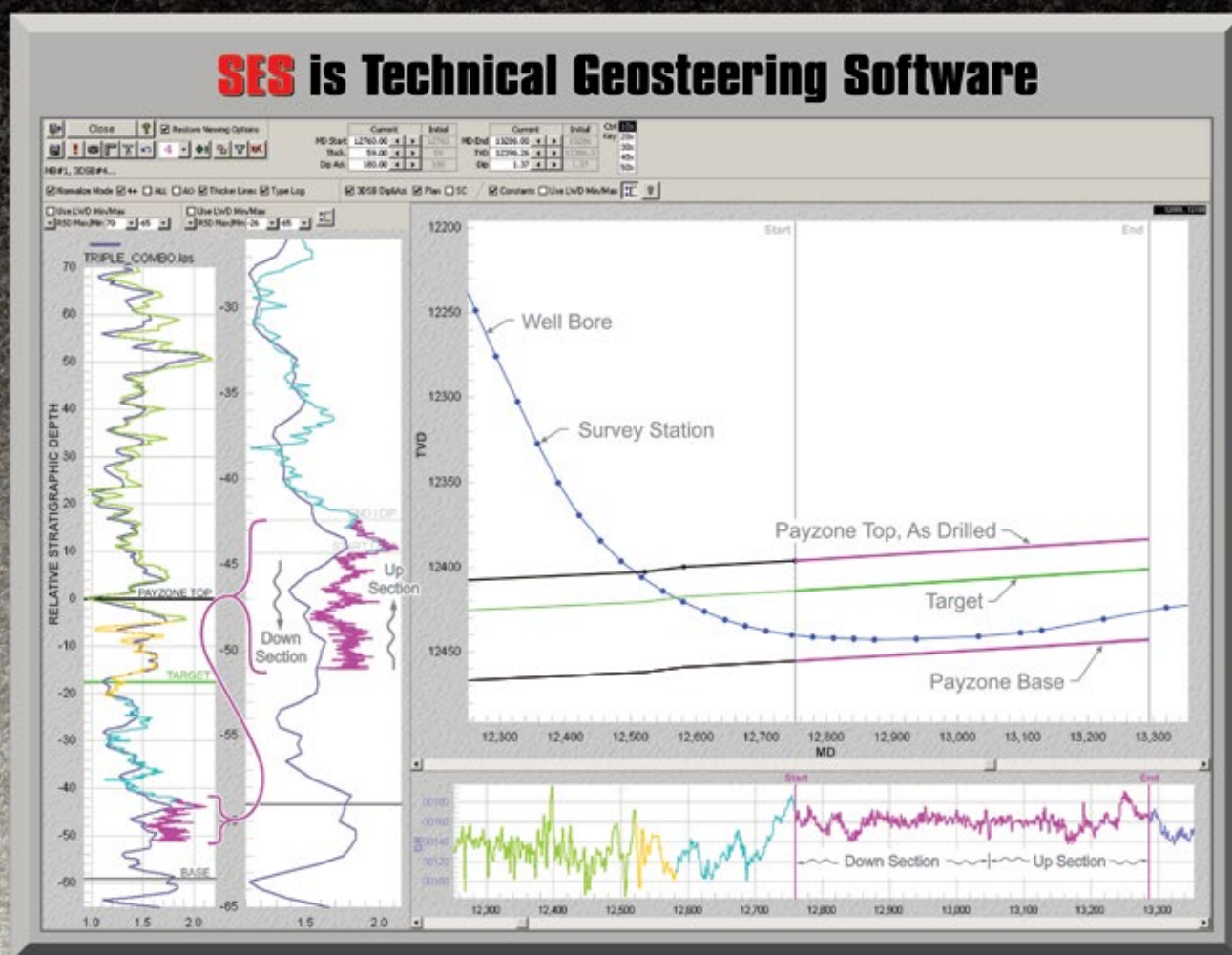
In other words, a cable-based system.

He says, somewhat surprisingly, this system in this location is preferable to wireless seismic – which provides seismic recordings wirelessly with real-time data transmission – for reasons specific to the area.

"In western Europe, the use of a cable

See A Scenic Shoot, page 52

Land your horizontal with *confidence!*



SES is for geologists who are dissatisfied with drafting or gridding-tool methods of geosteering horizontal wellbores. **SES** is 3D technical geosteering software that makes wellbore stratigraphic tracking quick-n-easy, accurate, and easily shared. Unlike any other geosteering software, **SES** provides a complete suite of software features to handle your horizontal drilling needs.

To learn more and get a free trial, please contact us at...

www.makinhole.com

Phone 720-279-0182
support@makinhole.com

★ Drill more horizontal pay! ★ Eliminate pilot holes! ★ 75+ clients and growing! ★ Free trial software and video!

Applied Geoscience Conference



INTEGRATED APPROACHES OF UNCONVENTIONAL RESERVOIR ASSESSMENT AND OPTIMIZATION

Please join us for the Houston Geological Society's premier technical Conference!

Our 2014 program includes:

- Eight (8) Session Oral Technical Program
- Student Posters / Industry support University Research
- Cores supporting Oral Technical Program

These sessions join our technical program of talks by invited experts.

The *Applied Geoscience Conference* offers you the latest breakthroughs, technical perspectives, and integrated approaches to unconventional reservoir assessment and optimization.

REGISTRATION IS NOW OPEN!

FOR MORE INFORMATION PLEASE VISIT WWW.HGS.ORG

February 17-18, 2014

WESTIN MEORIAL CITY • 945 Gessner Road • Houston, TX 77024
For special room rates call before February 1st: 281-501-4300



Equipment arrives for earthquake aftermath

Canadian Crews Survey Christchurch Faults

By DAVID BROWN, EXPLORER Correspondent

When a devastating earthquake struck Christchurch, New Zealand, in 2011, the University of Calgary responded with geophysical assistance.

This past August, the university was preparing to meet a geophysical challenge closer to home.

Even before the 2011 earthquake, researchers at the University of Calgary had planned to conduct a seismic study in New Zealand, said Don Lawton, professor of geophysics in the school's department of geoscience.

"I'm a New Zealander by origin so I have



LAWTON

a lot of contacts there," he said. "We'd been looking at taking our equipment down there because they have no high-capacity survey

"Seeing industry-specific equipment used for societal purposes got a very strong positive response."

equipment in the country at all."

New Zealand is highly active seismically, and Christchurch, the country's second-

largest city, already had seen a 7.1 magnitude quake in September 2010. That event caused serious damage but no loss of life.

The magnitude 6.3 earthquake in February 2011 resulted in 182 deaths and severe damage to buildings and other infrastructure already damaged by the 2010 quake.

Because of its history of earthquakes, New Zealand has an extensive system of seismic monitoring equipment, Lawton said. But it has no geophysical equipment to conduct large, industry-type seismic surveys for mapping subsurface faults.

Lawton explained that oil and gas seismic work in New Zealand has been conducted by out-of-country geophysical companies, usually from Australia.

By contrast, the University of Calgary is one of a handful of North American universities that have their own industry-standard seismic survey equipment. Located in a hydrocarbon-producing province and having close ties to the industry, the school wants its students to gain experience with state-of-the-art geophysical gear, Lawton said.

So Lawton and his colleagues already had prepared and sent a proposal for a seismic survey to identify faults in New Zealand, using the university's equipment.

The proposal "just sat there," Lawton recalled, until the February 2011 earthquake struck.

"A week later," he said, "we got a call saying they wanted the stuff down there."

Fault Finding

The New Zealand government arranged air freighting for the equipment, which included a 600-channel Aries recording system and an Envirovibe seismic source.

Some of the seismic-survey work was conducted within the urban area of Christchurch itself, leading to both logistical and practical problems. Lawton recalled working in heavy truck traffic bringing debris out of the city.

"Working in a city is not trivial at any time. And at this time, the downtown part of Christchurch had been severely damaged and the public was not let in, which was a good thing and a bad thing," he said.

One limitation was the care needed in conducting seismic operations near unstable heritage buildings in downtown Christchurch, Lawton said.

Fortunately, the program had the advantage of advance strategic planning.

"We had looked at it in a fair amount of detail," he said. "We'd actually planned out where we thought we could put the lines through the city."

A goal of the seismic program was to map previously unknown faults for hazard assessment. Data came from six 2-D lines – two within Christchurch and four in rural areas west of the metropolitan center. In total, about 42 line-kilometers of seismic data were recorded.

Despite the challenges, all of the seismic lines resulted in good images, Lawton said. Events were interpretable to a depth of about 1.5 kilometers, and numerous faults were imaged and interpreted in two groups.

The first was older faults that showed clear offset in reflections deeper than

International Conference & Exhibition

aapgice

Energy for Integration and Prosperity

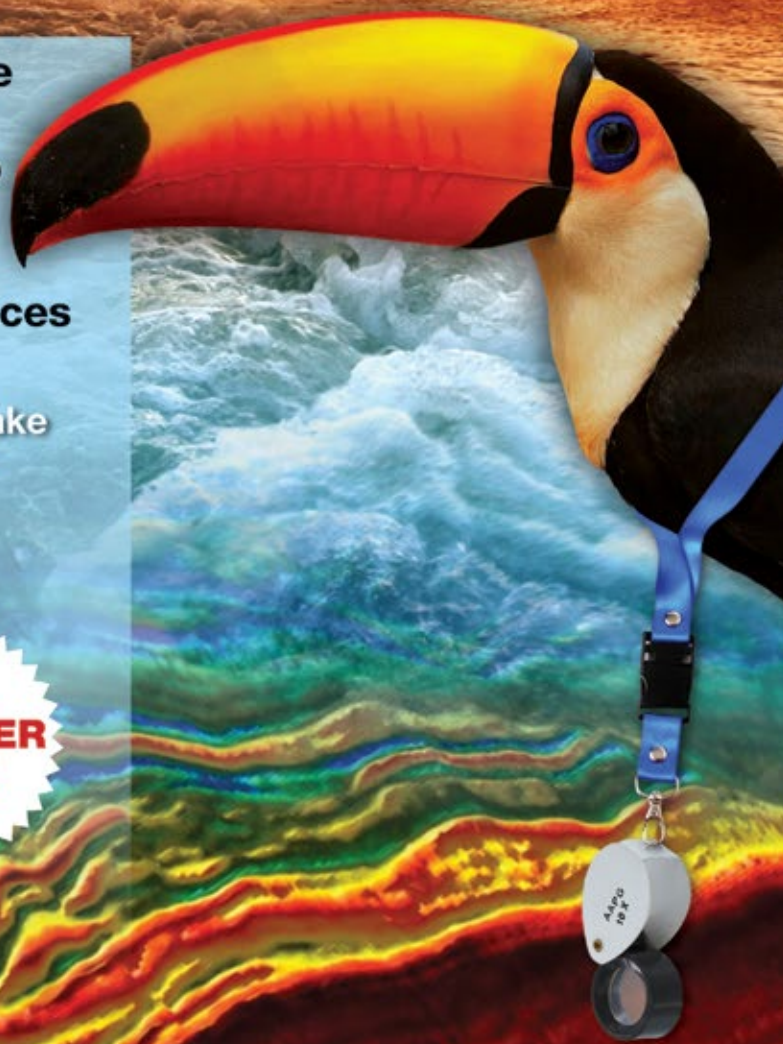
8-11 September 2013 / Colombia
Cartagena Convention Center

Geoscientists around the world will be attending this world-class event to broaden their horizons, expand their knowledge and share their experiences with others.

Register for ICE today and take part in these special events:

- Regulators Forum
- Special Country Sessions
- Field Trips
- Short Courses
- Luncheons
- Guest Tour

REGISTER NOW!



PRINCIPAL SPONSORS



HOSTED BY



AAPG.ORG/ICE



SEARCH

Because answers are rarely on the surface.

Our history can be traced back more than 100 years. While some companies might use that as an excuse to rest, we use it as an inspiration to work even harder to deliver energy in a safe, environmentally and socially responsible manner.

You will:

- Play an active role in determining your career path, working in a rewarding, collaborative environment
- Maintain a positive work-life balance at a company that encourages working hard and playing hard
- Have opportunities for continuing education and professional development, supported by proactive mentorship
- Enjoy the best of both worlds in a career that combines the stability of a global company with the agility of an independent

Houston-area available positions include:

- Domestic L48 Unconventional Exploration Geoscientist
- Gulf of Mexico Exploration Geologists/Geophysicists
- Gulf of Mexico Operated Assets Geologist/Geophysicist
- Gulf of Mexico Pore Pressure Geologist/Geophysicist
- Gulf of Mexico Exploration Maturation Geologist/Geophysicist
- Gulf of Mexico Operated Assets Shallow Hazards Specialist Geologist/Geophysicist
- International Unconventional Exploration Geologist/Geophysicist
- Development Geophysicists
- Senior Acquisition Geophysicist
- Senior Processing Geophysicist
- Microseismic Interpretation Geophysicist
- Development Geologist
- Operations Geologist – Horizontal Drilling/Unconventional Focus
- Exploration Petrophysicists
- Senior Research Scientist – Pore Scaling Imaging Laboratory
- Rock Mechanics Subject Matter Expert
- Reservoir Engineer – Subject Matter Expert, Core Lab Studies
- Geomechanical/Reservoir Engineer
- Senior Clastic Reservoir Quality Specialist
- Senior Carbonate Sedimentologist/Stratigrapher



We're looking for people who look harder.

CPGeoJobs.com/aapg

© 2013 ConocoPhillips Company. All rights reserved. EOE.

ConocoPhillips

A Scenic Shoot from page 48

system is the preferred option, as the control of all stations is very important.

"In such dense populated or intensively used agricultural areas the cable system allows to evaluate data quality of all stations at the spot."

Misiek knows there may be doubters.

"Vermilion has invited majors, local press and other VIPs to see the field work directly," he said. "Our crew is always open for visitors (with client approval, of course) and give support and information as much as possible."

Technically, as you'd imagine, such surveying needs to be well planned – it also has to be more successful than those previous efforts.


"The existing data are mainly from the '70s and '80s and older," Misiek said. "Hence most of the data is 2-D data and only a very small cube has been acquired."

He says this was too small to allow a full interpretation of the area of interest.

"Two-D data is a good start," he said, "but today it is no longer state-of-the-art for exploring an oil deposit in detail."

The next step: DMT Petrologic will process the data so geoscientists can see how much is there.

And even then, it's just a big first step.

"In a wine cellar," Jean-Jacques Mosconi, Total's director of strategy, whose company global headquarters are in the area, said, "you know exactly how much wine you have. For oil, it's different. You only know your final reserves once you run out." 

Christchurch from page 50

one kilometer. The second was younger faults showing displacement in shallow reflections; some of those were interpreted as associated with hypocenters of the earthquake aftershocks.

"The surprises were somewhat pleasant in data quality – the data quality was better than we expected. We would have liked to get a bit deeper," Lawton said.

"The shallowest focal depths are around two kilometers, so there's a slight gap," he said. "But we were able to identify where we could see faults coming from depth."

Lawton praised the government agencies in New Zealand for facilitating the seismic program. At one point, a seismic line crossed a major, six-lane highway. Authorities closed the highway at night and

trenched in the cables.

"That level of support," Lawton said, "was really good."

The Social Network

This year, Calgary had a natural disaster of its own. Heavy rainfall in the province of Alberta in June led to catastrophic flooding along a number of rivers, and more than 100,000 people in the region were displaced.

Parts of Calgary flooded and 26 neighborhoods were put under a mandatory evacuation order. Most of the city was without electricity for a period of time.

Afterward, the university decided to use its equipment to profile the flood-plain area in Calgary to assess mitigation strategies, Lawton said. He was preparing to get students involved in the project.

Lawton also is putting together a proposal to do another seismic project in New Zealand, this time a 3-D survey near Christchurch.

Funding for the initial project came from the New Zealand Crisis Management Centre, the Institute of Geological and Nuclear Sciences and the University of Canterbury.

Industry also contributed support for the first survey, including software for quality control and initial processing, and full processing of data from the initial phase of the project.

"The response we got from industry was very positive," Lawton said. "Seeing industry-specific equipment used for societal purposes got a very strong positive response." 

Fault Zones from page 44

"Unfortunately, we will never know the full extent of the fault/fracture network until we actually drill down into the formations."

A Small Risk

He talks of his own experiment.

"In the Youngstown case, there was a buried fault in the underlying ancient bedrock that was at least a kilometer long, which allowed for larger earthquakes to occur (the largest was a M4.0 on Dec. 31, 2011)," he said. "The disposal well responsible for these events was drilled 200 feet into the bedrock and finished open hole, allowing injected fluids direct access to this fault zone."

In contrast, he says, the shale formations that are subject to hydraulic fracturing typically only have networks of small joints, which generally don't exceed a few meters in length each – usually somewhere in the magnitude -2 to -3 range.

"Or about the energy released when you drop a textbook off your desk," he notes.


Wastewater injection also takes place over much longer time scales.

"It took one year of injection before the M4.0 earthquake, while most fracturing phases only last a matter of days at most," he observed.

"It's obviously something we should monitor, but it seems like the earthquake risk associated with hydraulic fracturing operations is exceedingly small."

His work may provide some of that monitoring.

"The techniques I presented in this paper could be used as a tool to investigate many more potential cases of induced seismicity in the country," he said, "not just ones that have local seismometers monitoring nearby."

Sounds like a good story idea. 

2014 ARCTIC TECHNOLOGY CONFERENCE

10-12 February
George R. Brown Convention Center
Houston, Texas

**Registration opens
late September**

ArcticTechnologyConference.org



The E&P Industry Event for Arctic Science and Solutions



Remarkable progress from remarkable people

The University of Oklahoma's Mewbourne College of Earth & Energy has made remarkable progress in the five years since our beginning, and our many achievements would not have been possible without the more than \$100 million in gifts from alumni and friends in the industry.

- Endowments of over \$14 million for student scholarships
- Petroleum engineering, petrophysics, and frontier shale laboratories
- Facilities, classrooms, computer installations, and library renovations
- An interactive drilling and well-control simulator
- A geology and geophysical field camp in Colorado
- The leading shale research program since the Barnett Shale

www.ou.edu/mcee

MEWBOURNE
COLLEGE OF EARTH & ENERGY
THE UNIVERSITY OF OKLAHOMA



Real education for the real world.

Student Chapters Show New Vitality in Canada

By CAROL MCGOWEN

AAPG Student Chapters in Canada first sprang up between 1998 and 2000 at three western Canada universities. Today, after an eight-year gap, five more chapters have emerged and taken root.

When the University of Regina Student Chapter of AAPG began in 1998, motivation and support from the Saskatchewan Geological Society made all the difference. Over the next two years, chapters were formed at University of Calgary in 1999 and University of Manitoba in 2000.

Between 2000 and 2008, the Canada Region experienced a hiatus in new student chapters being formed. The real cause for this break in the upward trend of new student chapters is unknown. It may be attributable to temporary global geopolitical instability or fears of reaching "peak oil." Or perhaps at the time, AAPG services and career benefits were simply unknown to the student population in Canada.

Whatever the reason, there certainly was no shortage of university graduates with geoscience degrees – at least not at the University of Alberta from the years 2005-07. During those years, the graduating undergraduate classes were the largest in the history of the school's Department of Earth and Atmospheric Sciences.

Following on the large undergrad graduating class of 2007, in December 2008 the upward growth trend in new student chapters resumed when the University of Alberta Student Chapter of AAPG became the second chapter in



Canadian AAPG Student Chapter leaders met with Canada Region Student Chapter Committee members at the AAPG Canada Region Student Chapter reception in Calgary May 6, 2013.

Alberta Province.

Ironically, this resurgence among AAPG's youngest members came about virtually in tandem with the Q4 2008 economic slowdown that some refer to as the "Great Recession."

But apparently despite the gloomy financial picture casting a shadow across much of North America, Europe, and parts of Asia that year, AAPG Student Chapters across Canada have asserted their vigor every year since. In fact, as of February 2013, Memorial University of Newfoundland became the Region's latest AAPG Student Chapter.

What follows are three stories of motivation – three stories of Canada Region AAPG Student Chapters and the motivated young leaders behind them.

* * *

Ryan Lemiski was an undergrad student in 2008 when he and master's student **Andrew Mumpy** initiated the University of Alberta AAPG Student Chapter.

That same year, after their team competed in the Imperial Barrel Award program, they were invited to attend the first-ever AAPG Student Chapter Leadership Summit (SCLS).

"Andrew and I returned to Canada educated and excited about AAPG, its services and how this organization could benefit every student," Lemiski remembered.

The previous year, Lemiski and Mumpy had attended the student reception held during the 2007 ACE in Long Beach.

Ryan Lemiski
 2008 – Joined AAPG as student member.
 2009 – Appointed to Student Chapters Committee.
 2009 – IBA Team Member, University of Alberta.
 2010 – Became Associate member.
 2011 – Became Active member; appointed to Young Professionals (YP) Committee; elected delegate to AAPG House of Delegates.
 2013 – Elected AAPG Canada Region Vice President/Treasurer.

"We wondered what was going on as IBA awards were being presented," Lemiski said. "When we figured out what the IBA competition was all about, I said to myself 'Our school could do that, and we'd place well!' IBA was something that we all wanted to be a part of."

The result of their passion for AAPG?

"We gave a presentation during a general meeting at the University of Alberta," he recalled, "and over 100 students registered as AAPG student members of our chapter."

For Lemiski, starting the AAPG Student Chapter was just the beginning. He was quickly appointed as Student Chapter Committee liaison for the Canada Region, which positioned him to inform other schools about the benefits of AAPG.

"That AAPG made it a priority to

See **Canada Students**, page 56

All Roads Lead to Vancouver, B.C.

GTW Canada: Hydrocarbon Charge Considerations in Liquid-Rich Unconventional Petroleum Systems

3 - 5 November 2013 • Vancouver, B.C.



Poster sessions will highlight aspects of the workshop theme, including commercial technologies available across the disciplines.

Hosted by: AAPG Canada Region
 Renaissance Vancouver Harbourside Hotel

View leading-edge technical program online.
www.aapg.org/gtw/2013/vancouver/index.cfm



Register before
15 September
 for best price.



AAPG

Geosciences Technology
 Workshops 2013

AAPG'S GEOCARE BENEFITS
PROUDLY INTRODUCES THE

MEMBERS' PRIVATE MEDICAL INSURANCE EXCHANGE

FOR AAPG MEMBERS AND THEIR EMPLOYEES

www.geocarebenefits.com | 877-739-7845

An exchange is simply a marketplace where you choose from the products available to you in your state much like choosing between Granny Smith and Golden Delicious apples. Choose from multiple insurance companies' plan designs, option, and premium rates that meet your needs and suit your budget. Talk with fully licensed medical insurance experts at our private exchange instead of under-trained navigators, non-navigator in-person assistants, or application counselors with questionable qualifications at the public exchanges managed by your state or federal government.

While the plan benefits may be similar, the real difference comes after enrollment. We will not turn you loose. We will continue to be there for you to answer questions and help with any disputes. As stated by two members of your Committee on Group Insurance, this private exchange is the icing on your cupcake and the gravy on your potatoes.

Now open for enrollment in medically underwritten medical insurance plans for effective dates between now and January 1, 2014. Open October 1 for enrollment in guaranteed issue medical insurance plans without exclusions for pre-existing conditions for an effective date of January 1, 2014.



AAPG



A joint publication of SEG and AAPG
Interpretation[™]
 A journal of subsurface characterization

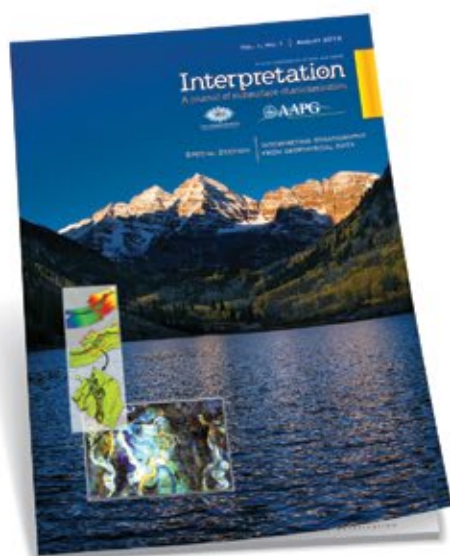


Society of Exploration
Geophysicists
The international society
of applied geophysics



Introducing Interpretation

A new peer-reviewed journal for advancing
the practice of subsurface interpretation



Offered by the Society of Exploration Geophysicists (SEG) and the American Association of Petroleum Geologists (AAPG), the journal will comprise papers directly related to the practice of interpretation of the Earth's subsurface for exploration and extraction of mineral resources and for environmental and engineering applications. The journal aims to accelerate innovation in interpretation for resource exploration, exploitation, and environmental stewardship.

Complimentary online access and print copies will be available through the end of 2013. Stay tuned for information on how to subscribe to *Interpretation* for 2014.

For complimentary online access,
visit www.seg.org/interpretation.

To request a complimentary print copy,
visit www.seg.org/freeissue.

Andrew Mumpy

2002 – Joined AAPG as Student member.
 2003 – Joined DEG.
 2004 – Became Associate member.
 2007 – Received AAPG Foundation Grants-in-Aid.
 2009 – IBA Team Member, University of Alberta; attended AAPG Student Expo.
 2008-10 – YP Committee.

Canada Students from page 54

globalize, focus on students and YPs (creating the SCLS and later the YPLS) and establish the IBA as its flagship competition, these are the main reasons I believe more student chapters were established," he said.

Once the SCLS and YPLS were started, "the marketing involved with those initiatives was very appealing to students in Canada and motivated them to be active participants in the organization," he concluded.

Recently, the University of Alberta and University of Calgary planned a joint field trip to visit Willapa Bay in Washington to study a modern estuarine environment – a popular trip for both members of industry and academia who work and study the McMurray Formation in Alberta, site of the world's largest oil sands deposit.

The Willapa Bay environment is used to explain some of the complex depositional environments within the McMurray oil sands.

Lemiski, currently is working as a petrophysicist, technology management, northeast British Columbia shale gas, with Nexen Energy ULC in Calgary.

Andrew Mumpy is now living in Houston and works with Occidental Petroleum Corp.

* * *

Meriem Grifi started the first AAPG Student Chapter in Ontario as a young leader at the University of Western Ontario in London, Ontario, in 2009.

The next year, the AAPG chapter and the CSPG student chapter (founded in 2008) combined – and based on CSPG's and AAPG's shared goals, the Petrolia Pioneers Society emerged.

To this day, the Petrolia Pioneers Society is sponsored by the Ontario Ministry of Natural Resources. The society gets its name from nearby Petrolia, Ontario. The city boasts the world's oldest oil company and home of North America's first oil boom.

From Grifi's perspective, the importance of an involved industry mentor or faculty member in student chapter success cannot be overstated.

"If the faculty is not willing to support the student chapter, it makes it very difficult for students to organize events where people are willing to attend," she said.

Burns Cheadle represents the best of both worlds. Cheadle came to the University

of Western Ontario after having worked over 23 years in the oil and gas industry in Calgary. Cheadle currently is professor of petroleum geology and student chapter faculty adviser.

"I am not sure I would have been as active and involved with AAPG had we not received Burns Cheadle as our petroleum geology professor in the department," Grifi said. "He came to our school and got a team together for the IBA competition in 2010, of which I was proudly a member!"

The "huge eye opener" for Grifi occurred when she attended AAPG Leadership Days in 2010. It was there that she met other student chapter leaders from around the world who, like her, were trying to run good student chapters.

"I didn't realize just how seriously some of the student chapter leaders took their work," she remembers.

Inspired, Grifi organized a mini-Student Chapter Leadership Summit (SCLS) at Western in November 2011. The mini-SCLS included lectures from professors, an industry representative from the Ontario Petroleum Institute and tour of the oil, gas and salt library in London, Ontario.

According to Grifi, students were invited from seven other Ontario schools with earth science departments and were encouraged to start their own AAPG chapters.

(One participant apparently went back to Queen's University and started a student chapter there; the Queen's University Student Chapter began in June 2012 but since has gone inactive, according to AAPG records.)

Grifi's motivation to help out with the AAPG student chapter program didn't end when she completed her master's in sedimentology and moved to Calgary.

After going to work with Husky Energy, she eventually joined Kevin Jackson, Canada Region liaison to the AAPG Student Chapter Committee, as vice liaison. Most recently, Grifi and Jackson organized the AAPG Canada Region 2013 Student Chapter reception during the annual CSPG convention in May.

"Schools with active AAPG chapters are spread out all over Canada," Grifi said. "We took advantage of the fact that students were in Calgary in May for the start of summer industry jobs, as well as to attend the annual CSPG convention."

Even more, she added, "it was fantastic to have them all in one room to meet each other" – and as Student Chapter liaisons, "It was a good way to get a feel for how the chapters are doing."

Grifi thinks it's easy being part of an organization that cares about its members.

"The AAPG student chapter program helped me a lot in terms of developing my people skills, network of industry people I know and support for my research through the Grants-in-Aid program," she said.

"In return," she added, "it's a pleasure

See Memorial SC, page 58



Meriem Grifi

2009 – Started AAPG Student Chapter at University of Western Ontario.
 2010 – Joined AAPG as Student Member; attended Student Chapter Leadership Summit (SCLS) and AAPG Leadership Days; received AAPG Foundation Grant-in-Aid; IBA team member, University of Western Ontario.
 2011 – Received AAPG Foundation Grant-in-Aid; organized mini-SCLS with participants from seven schools.
 2012 – Bridged to Student/Young Professional member.
 2013 – Organized AAPG Canada Region Student Chapter reception.

What's going on, what's coming up, what's happening now.

services

resources

CEOs

science

members

conferences

students

programs

professors

news

store

engineers

events

publications

consultants

young
professionals

geoscientists

non-members

education



All things AAPG in a twice-monthly electronic communication delivered right to your computer, tablet, or mobile device.



Because News Doesn't Happen at a Geological Pace.



Frank Ryan
2012 – Joined AAPG as Associate member; IBA team captain, MUN; YP Lead for eastern Canada.
2013 – Advanced to Active member status.

Memorial SC from page 56

giving back by reaching out to the AAPG student groups in Canada.”

Grifi currently is a geologist-in-training in the oil sands business unit, Sunrise Energy Project, with Husky Energy in Calgary.

* * *

In the same year, **Frank Ryan** joined AAPG and stepped into the spotlight as captain of Memorial University's IBA team, taking first place in the Canada Region competition and heading for the global IBA event at the 2012 ACE in Long Beach, Calif.

His IBA team's NE-SW traverse from St. John's, Newfoundland, to Long Beach would have been head-spinning enough. But he wanted to further accelerate his

advancement in AAPG.

“At the event, my friend Tiffany Piercey took me along to a YP event, and there I was asked to start something on the east coast of Canada,” Ryan said. “And so, my title for the AAPG Canada Region became YP Lead for Eastern Canada.

“As it happens, there are very few Young Professionals out here,” he said. “In order to have any events or impact, I decided to become more involved with MUN (Memorial University of Newfoundland).

“At first, the senior students at MUN who had internships or full-time jobs starting this summer were my target audience to hook into our section,” he recalled. “I tossed out the idea to a handful of them to start a Student Chapter, so we could get some funds to do more exciting things – and before we knew it we were a certified SC.”

He also was the industry associate for the MUN IBA team.

The MUN AAPG Student Chapter held eight lectures last winter in its inaugural semester. The first few lectures were attended only by Student Chapter members and other earth science undergraduates, totaling about 10 people.

“By lecture eight we hosted a combination of engineering and earth science, professors, graduate students and undergrads (including the IBA team) totaling about 25 people interested in learning about the oil and gas industry,” he said.

“We saw this as a huge success and look to grow this fall.”

Harry Fowlow and Ryan himself gave the bulk of the lectures, with help from Angie Dearin (geoscientist, Exxon Mobil). Ryan started by lecturing on theory and interpretation methods, and Fowlow would continue with a combination of theory and explanation of field-based activities.

The lectures started with a history of the oil and gas industry, followed by an explanation of the components of a hydrocarbon system. Gradually they moved into types of hydrocarbon systems (conventional, unconventional), environments of deposition, seismic interpretation, log interpretation and an introduction to financials and the time value of money.

“Many evenings, we'd also open up the floor for discussion and to anyone in the audience who'd like to practice their class presentations,” he said. “Perhaps most interesting, they would tell us of the different scholarships and grants we could apply for, and introduce us to jargon of the industry.”

This effort started when one petroleum geology professor left for industry, and another professor took sabbatical.

“We were worried that the students would be left with no option to learn about or become interested in petroleum geology,” Ryan said. “We saw this as an opportunity for a win-win. We would build and give lectures enhancing our own skill and understanding, while the students would hopefully learn from us and be interested enough to research our topics discussed.”

Incidentally, the professor who left was Joe Macquaker, who was an AAPG Distinguished Lecturer last year; the one on sabbatical was IBA coach and AAPG member Elliott Burden.

This year, the Memorial University Student Chapter has reached out to past graduates and started a weekly guest lecture series where industry professional partners speak on reservoir characterization and hot topics in the local industry. The chapter also has put together a budgeting plan to be used as a model in Canada to generate fundraising ideas for field trips and social activities.

Today, Ryan works as a development geoscientist for Chevron Canada Resources in St. John's, Newfoundland. Fowlow is a logging engineer with Weatherford in Newfoundland.

* * *

Returning from the recent AAPG Leadership Days event in Tulsa, Canada Region president **Francois Marechal** encouraged all AAPG members when he said, “Help spread the word to young geologists and other scientists alike, about the value AAPG represents.

“Personally, I cannot help but be inspired by the energy and aspirations of our growing number of Young Professionals from their various international chapters,” he added.

“Visibly, AAPG is in the hands of a strong contingent of future geoscientists,” he said, “the kind that I looked up to as a new grad back in 1982.” 

OTC BRASIL 2013

AN EVENT ORGANIZED BY IBP AND OTC

29–31 October 2013
RIO DE JANEIRO

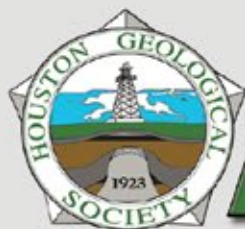


FROM NORTH TO SOUTH: A WEALTH OF OPPORTUNITIES

OTC BRASIL attracts the world's foremost experts and companies to share knowledge, make new contacts, and explore the latest technologies.

Register Now!
WWW.OTCBRASIL.ORG





Applied Geoscience Conference

Interdisciplinary Micro to Macroscale Geomechanics

November 4 - 5, 2013

WESTIN MEMORIAL CITY • 945 Gessner Road • Houston, TX 77024 • 281-501-4300

Register today
at
www.hgs.org



Geomechanical Approaches for Optimization of Unconventional Reservoirs

Presenters and attendees will represent a broad spectrum of industry professionals, including those in the disciplines of geology, geophysics, and engineering. The integrated topics will cover advantages of using geomechanical characterization to reduce difficulties in de-risking unconventional reservoirs.

Day 1 sessions will focus on:

- Play Scale Geomechanics
- Petrophysical & Geomechanical Integration

Day 2 sessions will focus on:

- Microseismic & Geomechanics
- Engineering & Geomechanical Integration

Speakers include technical experts from industry, government and university.

2013 AGC Geomechanics Technical Program Committee

Heather Davey, Co-Chair
Wintershall/CSM

Frank Walles
Talisman Energy

Robert Samuel Hurt
Baker Hughes

Mark Zoback
Stanford University

Kurt Wikel
Petrobank Resources

Gretchen Gillis
Aramco Services

Gang Han
Aramco Services

Shihong Chi
ION

Amy Fox
Canadian Discovery

Gang Li
Halliburton

Uno Mutio
Weatherford

Mike Erpenbeck
Consultant

Lans Taylor, Co-Chair
Talisman Energy

Mike Van Horn
NewField Energy

Scott Wessels
Statoil Gulf Services

David Brimberry
Marathon Oil

Crystal Alavarces
Weatherford

Patrick Hooyman
Baker Hughes

Colin Sayers
Schlumberger

Phil Holbrook
Force-Balanced Petrophysics

Roxana Irizarry
BHP Billiton

Lauren Cassel
Devon Energy

David Gray
Nexen Canada

Michael Redmond
Weatherford

Be a corporate sponsor!

For more information please visit

www.hgs.org

SPONSORED BY:



Weatherford®

No Room? No Problem for Camping Students

By BARRY FRIEDMAN, EXPLORER Correspondent

So a story idea comes in: A group of college geology students pile into a car, take a road trip and ultimately wind up sleeping in tents in a park. Are we interested?

Meh.

Students pile into cars all the time to take field trips, see concerts, head down to Mexico for spring break ... what's the big deal?

As it turned out, a group of students from California State University, Fresno, wanted to go to the AAPG Pacific Section annual meeting in Monterey, Calif., this past April, but, being students, had no money – certainly not for hotels. Not even, really, for the conference.

"We planned," said AAPG member Christopher Bowie, one of the students, "on taking a group to the conference as soon as it was announced in the fall."

Bowie, a graduate student at Fresno and now working at Devon in Oklahoma City as an intern, is talking about his seven friends, classmates, who all were planning to attend the event – even though that's about all they knew.

"We weren't sure how we were going to get there originally or where we would stay," Bowie said. "We didn't have the funds to get everyone a hotel room in downtown Monterey."

For starters, hotels there ran about \$200-plus a night. Time for Plan B.

They decided, instead, to pitch a tent in a nearby park and work for free at the conference to gain admission.

Repeat that to yourself next time you're worried about the future of the industry.

Home, Sweet Home

Even their plans, however, took some preparation – and some luck.

"Through contacting the conference volunteer coordinator," Bowie said, "I found out about a campground one mile from the conference center, and that was \$8 a person per night."

But even the campgrounds required reservations.

"Unfortunately, they did not take reservations and it was first come, first served," he said. "We had planned on getting there Friday night. We were a little nervous that the camp ground would be filled up when we got there."

A little?

"Okay, we were VERY nervous," he said, "and we did not have a back-up plan."

To hear Bowie tell it, he was the first to arrive and the first thing he did was call the others, en route, to tell them to hurry up and get there before the camp was filled.

The group eventually arrived.

"We were very happy and relieved," he said. "We had a place to stay for the next five days."

Something Special

For Bowie, this conference was special. He had been to others, but this was the first time he was presenting a poster.

"For many of the other students, it was their first AAPG conference."

And it was Bowie's idea to volunteer at the convention center.

"We had been corresponding with the student volunteer coordinators," he said, "so

we knew we would be reimbursed for most of our registration fees after our shifts."

The trip from Fresno to Monterey is about 160 miles – not a great distance, but impressive when considering why the students wanted to attend.

"Half of them made the trip just for the short courses," Bowie said.

And it was, in retrospect, totally worth it.

"The most rewarding part about these conferences is getting new students involved," he concluded.

And that can also be the toughest thing about them.

"The hardest part is getting new students to agree to come to an AAPG conference," Bowie said, "but upon their return, they are usually glad they went, inspired and want to get involved with the student chapter leadership."



AAPG Student Expo Season Starts in Three Locales

It's Student Expo season for AAPG, with three major events ready to go in the next several weeks.

The expos all offer geoscience students the opportunity to present their work in poster sessions, submit resumés with company officials, meet with industry representatives, participate in short courses and field trips and learn how to improve their networking skills.

Information on all Student Expos can be found online at students.aapg.org/expo.

► It all starts with the AAPG-SEG Fall

Student Expo, set Sept. 16-17 at the George R. Brown Convention Center in Houston.

Planners are hoping to build on last year's event, which attracted 660 attendees and representatives from 31 companies – the largest AAPG/SEG Student Expo to date.

► The annual AAPG-SEG Rocky Mountain Rendezvous of Geoscience Students and Employers will be held Sept. 27-30 at the University of Wyoming.

Students are encouraged to register early due to limited space; last year's even attracted about 300 geoscience students from across the country.

► The AAPG-SEG West Coast **Student Expo** will be held Oct. 3-6 at California State University, Northridge, Calif.

Among the activities will be a field trip to Occidental Petroleum's THUMS Island facilities at Long Beach, Calif.

CALL FOR ABSTRACTS NOW OPEN

2014 LIPE Forum & AAPG Northern Arabia Geoscience Conference and Exhibition

New Frontiers, New Challenges

27 – 29 May 2014

Hilton Beirut Habtoor Grand, Beirut, Lebanon

Submission Deadline: 31 October 2013

middleeast.aapg.org

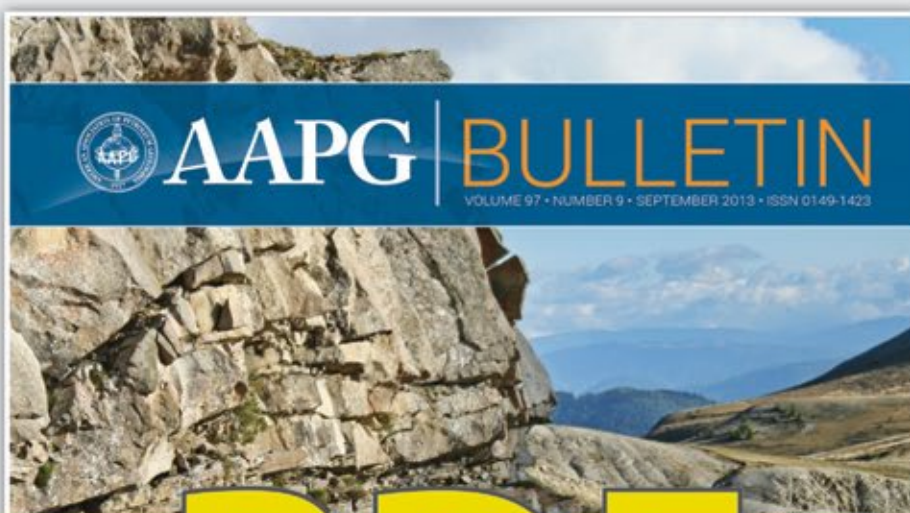


AAPG



DOWNLOAD

Your NEW September 2013 Bulletin Now!



PDF



The AAPG Bulletin is a technical journal that is recognized in the industry as the leading peer-reviewed publication for information on geoscience and the associated technology of the energy industry.

The link below takes you to the Members Only login page where, with a few key strokes, you can click on a link for the Bulletin Online, the current issue, or for the Bulletin Archives, all issues of the Bulletin to date. Online as searchable html and .pdf files, the current issue is always available by the first of every month.



Members may access the AAPG Bulletin online at:
www.aapg.org/september_bulletin

Also, submit your next paper for consideration via www.aapg.org/bulletin.

A NEW MODEL EXPLAINS PECULIAR FEATURES

Carlos L. Varela and Webster U. Mohriak

Halokinetic rotating faults are extensional faults that have been rotated along the evolution of a salt diapir. When partially filled with salt, they are often misinterpreted in seismic and well data. This appears to be the case in recent exploration in the deep-water regions of the Brazilian margin.



RIFTING AND LACUSTRINE BASINS

Shu Jiang, Sverre Henriksen, Hua Wang, Yongchao Lu, Jianye Ren, Dongsheng Cai, Youliang Feng, and Paul Weimer

This study addresses how tectonic activities influence sequence development and how they control reservoir distribution in lacustrine basins of East China. The distribution of lithology can be predicted from controls on basin evolution as well as sediment supply, transport and deposition.



A SUBSURFACE MODELING METHOD ON OUTCROP

Franck Gisquet, Juliette Lamarch, Marc Floquet, Jean Borgomano, Jean-Pierre Masse, and Bruno Caline

An outcrop analog was used to improve subsurface prediction for complex dolomite bodies. The goal of this study was to unravel composite dolomite bodies in a folded area and to produce a true three-dimensional geometric model using the Etoile massif complex ramp anticline.



PREDICTING GOOD RESERVOIRS

Cynthia C. Sawatzky and Georgia Pe-Piper

The Scotian Basin, offshore eastern Canada, was used to test the hypothesis that the source of quartz in sandstones may be a predictor of the availability of medium- to coarse-grained quartz sand from plutonic sources. This study suggests that this hypothesis works in frontier basins.



Eppo Oomkens and the Discovery of Groningen Gas

By KEN GLENNIE

The Netherlands is renowned for its giant Groningen gas field, which contains about 100 TCF of gas (figure 1) and has a total life expectancy of about 100 years. Discovered in 1959 by the Shell/Esso company NAM (Nederlands Aardolie Maatschappij), its huge size was recognized in 1963.

Important in this respect was a junior well-sitter named Eppo Oomkens.

Eppo, of course, did not decide where important wells were to be drilled, but his observations on cores and cuttings in 1963 were important in interpreting the desert facies of a key well. This well confirmed the Groningen field as Europe's biggest.

This is all the more remarkable because Eppo was company trained. After only one year at Delft University (mining engineering) in 1948-49 he was conscripted into the Dutch army. He then joined Shell and went to New Guinea, where he contracted malaria and was nursed back to health by Anneka, whom he married in 1957.

He subsequently joined Shell Research (KSEPL, 1957-68) as a geological assistant.

A tall man standing six-foot-six, Eppo's private transport was a Citroen Deux Chevaux, the only car with a roof high enough for him to sit in while driving. For



GLENNIE

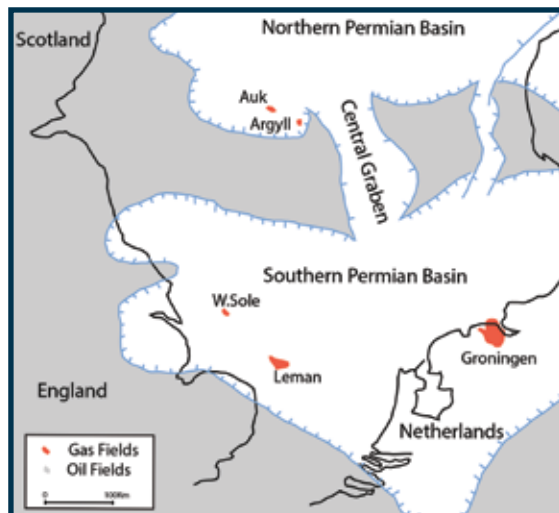


Figure 1 – U.K./Dutch Southern Permian Basin, showing the important early gas discoveries Groningen, West Sole and Leman, and later small fields Auk and Argyll of the Northern Permian Basin.



Eppo Oomkens, taken during a field trip with Glennie in 1964 to Libya, about 300 kilometers due south of Tripoli.

all other cars he had to sit half-sideways in the back seat.

First Impressions

Immediately after World War II, the occasional hydrocarbon discoveries in Netherlands were mostly confined to Jurassic and Cretaceous reservoirs. A 1952 wildcat in the greater Groningen area found 180 meters of water-bearing Permian Rotliegend (red layers) Sandstone, and four years later at Ten Boer (figure 2, page 64), the main target

in the area, the overlying Late Permian Zechstein dolomites had only gas shows.

It was presumed there were no prospects within or beneath the Rotliegend (figure 3, page 64).

The Groningen gas field was discovered by NAM in 1959 with the well Slochteren-1. At that time, it was considered too small to be commercially viable in a land where every small town had its own coal-gas plant.

With further drilling to the north, however, it was realized there was a gas column filling the entire 180-meter

thickness of the Rotliegend, and all its wells seemed to have the same gas-water contact at a depth of about 2,900 meters.

As that gas-water contact possibly enclosed an area approaching 1,000 square kilometers, it looked as if this gas field could be huge.

To check this observation, it was decided in 1963 to deepen the Ten Boer well (figure 2), which penetrated the reservoir near its gas-water contact and confirmed the size of the field.

Eppo then studied the Rotliegend cores and cuttings from this well – and not only did he suggest their desert origin, but he also noticed the depositional bedding dipped mostly to the west, thus indicating a possible extension of the reservoir sands beneath the North Sea (figure 1).

A study of modern deserts was considered essential, and although Eppo was obviously very clever, with no university degree he was not allowed to take charge of any geological research.

Rather unexpectedly, my involvement followed.

Making a Connection

By 1963 my early Shell career had taken me to New Zealand and the Canadian Arctic. In both areas I had come across a type of sea-floor sediment named "turbidites" in 1962 by the Dutch researcher (and eventual AAPG Sidney

[See Oomkens, page 64](#)

Advancing the Interpretation - Understanding the Prize

GTW T&T: Deep Horizon and Deep Water Frontier Exploration in Latin America and the Caribbean

8 - 10 December 2013, Trinidad & Tobago, Hyatt Regency Trinidad

Co-Hosted by: AAPG Latin America Region and Geological Society of Trinidad & Tobago (GSTT)



Four sessions will address key themes:

- Session 1: Cretaceous Exploration in the Caribbean
- Session 2: Is the Cretaceous an Effective Petroleum System?
- Session 3: Deepwater Frontier Exploration—Global Analogues
- Session 4: Drilling and Operational Challenges in High Pressure/High Temperature Environments



Register before
17 October
for best price.



AAPG

Geosciences Technology
Workshops 2013

Check Out One of These Upcoming Student Expos

Rocky Mountain Rendezvous

27-30 September 2013

Location: Laramie, Wyoming

The RMR is a three-day event with a vendor expo, onsite interviews, receptions, short-courses and field trips. Please visit the schedule page for more information.

Online student registration will close on Friday, September 13. Students are encouraged to register early, as space is limited.

West Coast Student Expo

3-6 October 2013

California State University, Northridge, California

Thursday, October 3 (tentative schedule)

7:00am-4:00pm – Field Trip(s)
4:00pm-5:00pm – Event Registration and poster set up
5:00pm-8:30pm – Student Poster Session and wine and cheese mixer (company and agency representatives and students)

Friday, October 4 (tentative schedule)

8:30am-11:30am – Short course, University tours, booth set-up
11:30am-1:00pm – Luncheon, Poster Awards
1:00pm-2:00pm – Round Table Discussion
2:30pm-5:30pm – Company Booth Exposition

Saturday, October 5

8:00am - 6:00pm – Company & agency student interviews (by company/agency invitation only)

If you are an undergraduate, graduate, or recently graduated geoscience student, check out an event near you.

students.aapg.org/expo



AAPG

Students



Corporate Supporter:



Call for Abstracts – Deadline 30 September 2013

Reducing Subsurface Uncertainty & Risk Through Field-Based Studies

The Value of Outcrops and Analogues in Hydrocarbon Exploration, Development and Production Implications for Global Exploration and Production

4-8 March 2014 (Field Trip 7-8 March)

The Geological Society, Burlington House, Piccadilly, London

Convenors:

Helen Smyth
CASP

Mike Bowman
University of Manchester

Tim Good
ExxonMobil

Simon Passey
CASP

Philip Hirst
BP

Colm Jordan
BGS



This meeting will provide a timely revisit and reappraisal of the value and impact of outcrop based fieldwork in hydrocarbon exploration, appraisal, development and production. In recent years we have seen a refreshed focus on frontier exploration, in increasingly difficult settings, and the challenges of new developments such as deepwater clastics and carbonates. This has led to the resurgence in the appreciation, use and need for outcrop based studies as analogues and benchmarks for the subsurface. This applies both to the overburden and the reservoirs. Digital technologies such as remote sensing and digital data capture have revolutionised field-studies, however traditional methods (e.g. mapping, logging and sampling) remains at the very core of any field study.

This meeting offers an exciting opportunity for key researchers and users of these datasets to come together, learn from recent advances and look forward to future directions and needs. A key objective is to engage industry groups and academia in a dialogue and knowledge sharing that reflects the current status and future potential of this important area.

Themes:

- Exploration: Reconnaissance-scale fieldwork
- Structural Analogues – regional to reservoir scale
- Applications to Reservoir and Field Appraisal, Development and Production: Outcrop-scale fieldwork
 - o Clastics
 - o Carbonates
- Unconventional Hydrocarbon Resources
- Health, Safety & the Environment and field studies
- Looking to the future

There will also be an optional field trip to BGS Core Store and relevant N England and Pennine outcrops taking place on the 7-8 March. Further details will be made available during registration for the conference. For more information or to submit an abstract please contact: Steve Whalley, The Geological Society, Burlington House, Piccadilly, London W1J 0BG. T:020 7434 9544 F:020 7494 0579



At the forefront of petroleum geoscience

www.geolsoc.org.uk/petroleum

Oomkens from page 62

Powers award winner) Arnold Bouma.

On leaving Canada I had spent the winter of 1962-63 walking the Himalayan foothills of Nepal with AAPG member Martin Ziegler. After a trip to Spain looking at turbidites in the spring of 1963, Shell decided that I should lead a turbidite research team.

On reporting for duty in my new role at the beginning of November, I was shocked to be told, "It is all changed – you are now our desert expert and had better learn fast."

Although Shell had worked in various desert countries over the previous 50 years, no one had studied their surface sediments – and a study of modern deserts was considered essential.

My experience of deserts was limited to 1947-48 army service in Libya.

We all felt the most efficient way to learn about deserts was to visit one. Shell had an operating company in Libya, and Eppo was allowed to join me on a visit.

I learned a lot from him there, as he recognized many sedimentary features seen in Groningen cores that we could now study in the field.

On returning to Shell Research, Eppo and I were told to take part in discussions with our partners Esso at the neutral locality of a hotel. Esso did not support NAM's interpretation of a desert origin for the Rotliegend reservoir rocks, preferring instead to follow that of their American consultant, a specialist on the Mississippi delta.

The meeting began with NAM's chief geologist presenting basic data, including photos of cores from one of the wells. Then the consultant took over. According to him, the Groningen reservoir sands were deposited in a delta of Mississippi type – and if not Mississippi then of Mackenzie, Ganges or Indus type.

It happened that I was the only person present who had ever seen the Mackenzie Delta – before going to Nepal I had spent two summers (1959-61) with Shell Canada mapping between the Arctic Circle and the Arctic Ocean, first in the Northwest Territories, which included the Mackenzie Delta, and then in the Yukon.

Borrowing a few slides from the two previous speakers, I compared them with photos taken during my trip with Eppo to the Libyan desert.

When I had finished, the consultant said that, although he did not believe me, it was clear that Esso had to learn something about deserts.

Other members of the Esso team, however, told me that I had won "hands down."

Six weeks later Eppo and I came across an Esso geologist in northeast

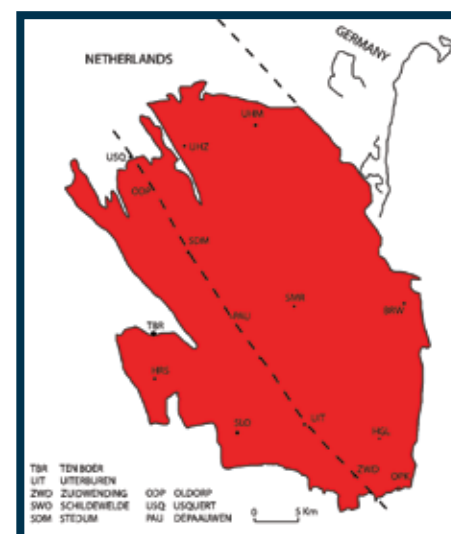


Figure 2 – Outline of 100 TCF Groningen gas field with locations of some key wells. TBR – location of Ten Boer well.

England studying the British equivalent of the Rotliegend. Although much more Rotliegend core has been studied since then, a desert interpretation for the upper part of the Rotliegend still stands.

Lasting Recognition

Following several months assisting in field research, Eppo's abilities eventually were confirmed:

► He was assigned to the United States (Ventura, Houston, New Orleans) from 1968-71.

► From 1971-77 he was an exploration team leader in London followed by time in Jakarta, Indonesia (1977-78), Perth, Australia (1979-80) and The Hague (1980-82).

► He was working for NAM in Assen when he retired in 1989.

He is known to have been living in Drouwen (south of the Groningen field), when he died in January 2012. ☞

Author's note: Thanks to Koen Weber and Willem Niewenhuis for adding some previously unknown details about Eppo's career (and to Caroline Hern for removing typing errors). Jenny Jones, at Aberdeen University, drew the figures for me.

Ken Glennie, an AAPG Honorary member in Ballater, Scotland, received the AAPG Sidney Powers Memorial Award in 2005 for his distinguished career as a researcher and geologist. During his career he literally worked around the world and was hailed as an expert on desert sediments and geologic environments. He also is the author of the classic book, "Petroleum Geology of the North Sea," which is popularly referred to as "the Glennie Bible."

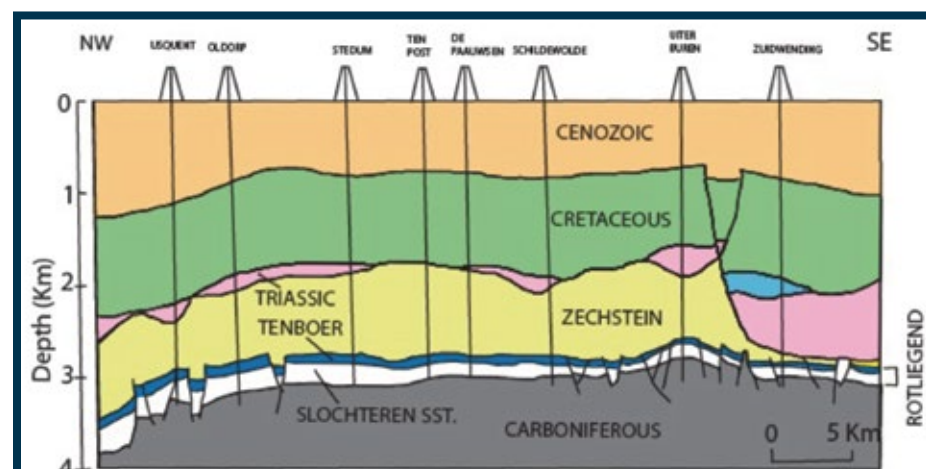


Figure 3 – Simplified cross-section of Groningen gas field along dashed line on figure 2.



AAPG - Rocky Mountain Section Annual Meeting

Salt Lake City, Utah
September 22-24, 2013

rmsaapg2013.com

Registration Now Open

Technical Program Highlights

- Lacustrine Basins
- Microbial Carbonates: Modern and Ancient
- Great Oil/Gas Fields of the Rocky Mtns.: A Historical Perspective
- Unconventional Resource Plays
- Carbon Capture, Utilization, and Storage
- New Resource Plays
- Geothermal Resources of the Rocky Mountains



Other Convention Events

- 5 Utah-based field trips and 4 short courses
- ACL: Roving the Red Planet: A Field Geologist Explores Gale Crater
Dr. Rebecca Williams, Mars Scientist, Planetary Science Institute
- Night at the new Natural History Museum of Utah
- Guest hospitality suite and 3 days of special activities

Unlock the Mysteries of the Horizontal Domain

AAPG's 8th Annual Fall Education Conference in Houston offers five enlightening days of geoscience courses led by today's most renowned experts—at one outstanding price. With four concurrent sessions each day, you choose the topics that interest you.

What's more, if you become an AAPG member, you'll save \$300 off the regular non-member price through Sept. 16. With buffet lunches and beverages included every day, there's never been a better opportunity to expand your knowledge and reveal your inner explorer.

The right source for the right education, right now. That's AAPG. Register today.

Geoscience in the Horizontal Domain - Applications to Current and Unconventional Resources

- ▶ Horizontal Well Stimulations in Tight & Unconventional Formations
- ▶ Hand-held XRF Strategies Applied to Stratigraphic Interpretations
- ▶ Applications for Chemostratigraphy in Horizontal Wells
- ▶ Geopressure Predictions and Exploration Risk
- ▶ Logging High Angle / Horizontal Wells
- ▶ Evaluating Well Performance and Determining "Best Practices" for Conventional and Unconventional Reservoir Fracture Treatments
- ▶ Log Analysis of Shaly Sand Reservoirs
- ▶ Log Analysis of Hydrocarbon-bearing "Shale" Reservoirs
- ▶ Tools and Techniques for Unconventional Assessment and Decision Making
- ▶ Improving Oil Recovery? Start with the Geology



AAPG | Fall Education Conference 2013

October 14-18 • Houston, Texas

Hosted by:

The Norris Conference Center

816 Town & Country Lane
Houston, Texas 74024
V: 713.590.0950
F: 713.590.0961

(Special AAPG Group Rates at Nearby Hotels)

Registration and Information

Call AAPG toll free in the U.S. and Canada at 888.338.3387 or 918.560.2650
F: 918.560.2678
E: educate@aapg.org
W: www.aapg.org

Tuition for the week	Price through Sept. 16	Price after Sept. 16
AAPG Members	\$1795	\$1995
Non Members	\$2095	\$2295
Individual Courses	\$500/day	\$550/day



AAPG | Fall Education Conference 2013

October 14-18, 2013 • Houston, Texas

President's Climate Plan Begins its Journey

By EDITH ALLISON, GEO-DC Director

The president's Climate Action Plan, released June 25, aims to slow the effects of climate change.

The brief, 21-page plan focuses on three areas of action:

- ▶ Reducing carbon emissions.
- ▶ Preparing for the impacts of climate change.
- ▶ Stimulating international efforts to reduce carbon emissions.

The president's plan aims to reduce greenhouse gas (GHG) emissions 17 percent below 2005 levels by 2020. The Environmental Protection Agency (EPA) reports that 2011 total GHG emissions were 6.9 percent lower than 2005 levels. This is on track to meet the goal, but carbon emissions from the energy sector declined at an even faster rate: an 8.1 percent reduction from 2005 to 2011.

President Obama does acknowledge the huge benefit the shale gas boom has provided in reduced greenhouse gas emissions. Rapid growth in wind, solar and geothermal power also has helped.

The plan would accomplish its goals through administrative regulation and rule making, working with states and local government, and spurring international action. Many of the activities already are under way, funded by existing budgets and the Hurricane Sandy Relief Bill.

New laws are not part of the administration's approach. This probably reflects the understanding that Congress is unlikely to pass any budget-increase or emissions-reduction legislation.



ALLISON

The plan would accomplish its goals through administrative regulation and rule making, working with states and local government, and spurring international action.

Climate change is an especially divisive subject: Members of Congress are sharply divided on whether climate change is caused by human activity and whether the federal government should act to reduce GHG emissions.

One element of the plan that may be difficult to implement is the call for federal agencies to accelerate permitting of clean energy installations, such as renewable energy generating facilities and electric grid refinements. Accelerated permitting will be hindered by recent and future budget cuts.

The plan reiterates the president's call to develop the first quadrennial energy review, a strategic roadmap to drive innovation in domestic energy sources. The White House Office of Science and Technology Policy will lead the review in coordination with federal agencies and outside stakeholders.

For many years, liberal and conservative politicians and scientists have complained about the lack of a national energy policy. The energy review

could answer this complaint – or merely highlight the sharp differences in public opinion about energy.

However, since the president's June announcement, administration officials have clarified that the quadrennial review probably will not be comprehensive, but focus only on energy infrastructure.

The climate action plan does not discuss the Keystone XL pipeline nor the presidential permit that the State Department is considering. While announcing the plan, the president did announce that he would only approve the pipeline if it does not "significantly exacerbate the problem of carbon pollution."

The two topics, however, are separate.

Reducing Carbon Emissions

The most impactful and potentially contentious element of the plan is the president's call for the EPA to expedite release of its carbon-emissions standards for new and existing power plants.

The EPA has moved quickly since release of the plan: The draft standards for new power plants went to the White House for review just days after Obama announced his plan.

The draft should be available for public comment in September. An earlier version of the draft, released in March 2012 and later withdrawn, set the same emissions limits for coal- and natural gas-fired power plants. The single standard essentially precluded construction of any coal-fired power plants, while imposing no restrictions on new gas-fired power plants.

The new version is expected to specify different emissions limits for coal- and natural gas-fired power plants, suggesting that new gas-fired power plants will face some emission-reduction requirements.

EPA plans to issue its potentially more-contentious standards for emissions from existing power plants next June. The draft emissions standards will be open for public comment for months and may be significantly revised based on public comments sent to EPA.

The climate action plan encourages investments to build and upgrade natural gas pipelines – because they increase American jobs and reduced emissions – and it urges federal-state-industry coordination to improve permitting for

Continued on next page



AAPG | FORUM

Learn from World-Class Reserves Experts

DPA/AAPG Reserves Forum & Short Course

October 31 - November 1, 2013 • Houston, Texas

Forum Overview:

Join leading experts to learn about important new developments making rigorous, consistent and statistically valid reserve estimations; the engineering component of reserve assessment, and compliance and reporting requirements.

Sessions include:

- Global Reserves Assessment
- Rigorous, Consistent and Statistically Valid Reserve Estimation
- Getting the Numbers Right, the Engineering Aspect of Reserve Estimation
- Compliance and Reporting

Short Course:

SEC Reserves Rules and Unconventional Resources - Dr. W. John Lee

www.aapg.org/forum/2013/reserves/index.cfm

For details contact educate@AAPG.org

Stay Focused and Energized

Reservoir Quality in Unconventionals

12-13 November 2013 • Austin, Texas

As the industry gains experience in developing shales, carbonates, and other unconventional reservoirs, optimization becomes critical. It is important to understand the key determinants of producibility, and the reservoir characteristics that allow pinpointing productive zones and determining the best completion, stimulation, and developmental strategies.

- Critical Attributes of High-Quality Unconventional Reservoirs
- Petrophysics and Reservoir Quality
- Seismic and Reservoir Quality
- Reservoir Fluids and Reservoir Quality

www.aapg.org/gtw/2013/austin/index.cfm



AAPG

Geosciences Technology Workshops 2013

For those who are interested in finding ways to get a message to Congress, here are two good ways to make it happen:

► Congressional District Visits Days, Oct. 13-19.

Here's a way to accomplish your mission without traveling to Washington, D.C.: Visit your senators or representatives at home in their districts.

Senators and representatives welcome visits with their constituents and appreciate information about how science and energy technology help their district.

Conveniently, these planned Congressional District Visits Days coincide with Earth Science Week, an annual event when geoscience activities will be taking place across the nation (see page 3). Leverage the week's science awareness with your

energy message.

AAPG, the American Geosciences Institute (AGI) and other sponsoring science organizations have designed the tools you need to develop your message and schedule a visit – even a webinar on how to conduct a successful visit. Go to the AGI website at www.agiweb.org and select “upcoming events” in the Public Policy web pages.

► If you have the time to travel, however, plan to join AAPG members and other geoscientists in Washington, D.C., for Geoscience Congressional Visits Days, Sept. 17-18.

AAPG staff will schedule your visits, provide training and help keep you from getting lost on Capitol Hill.

For more information, visit the GEO-DC page of the AAPG website, or contact Edith Allison at eallison@aapg.org or 202-643-6533.

Continued from previous page

pipeline projects. The Bakken Federal Executives Group is cited as a successful collaboration among government (state and federal) and industry for reducing natural gas flaring.

Separately, Sen. John Hoeven (R-N.D.) also cited the Group as a positive step in improving the permitting processes on federal lands.

The plan also calls for a 30 percent increase in funding for federal clean-energy technology such as biofuels, nuclear power and clean coal. Expected reductions in future federal budgets probably preclude this level of expansion.

Scattered throughout the plan are tributes to accomplishments in energy efficiency and emissions reductions during the first Obama administration.

Given the importance of state renewable portfolio standards and oil and gas industry's expansion of shale gas, we can argue who should take credit. Never-the-less, the increase in renewable energy and the reduction in GHG emissions have been spectacular: In 2012, carbon emissions from the energy sector were the lowest in two decades, and generation of electricity from wind, solar and geothermal more than doubled from 2008 through 2012.

Preparing for the Impacts Of Climate Change

The president's plan acknowledges that communities, cities and states are leading the effort to protect their infrastructure and residents from sea-level rise and an increase in the number and severity of extreme-weather events, such as droughts.

The plan identifies federal programs that will assist state and local governments to withstand the impacts of climate change. For example, the Department of the Interior's Bureau of Reclamation is providing grants and technical support to agricultural water users for more water-efficient practices to counteract the impacts of drought.

The plan also recognizes the importance of protecting vital assets from damage in extreme weather events, and is conducting assessments and developing plans for emergencies such as power-plant disruptions from drought-caused shortages of cooling water, and fuel delivery problems during severe storms.

Government agencies would also develop plans to protect their facilities from weather extremes.

Much of the federal effort to mitigate future impacts of climate change was funded by the \$50 billion Hurricane Sandy relief bill passed in January.

Stimulating International Efforts

Much of the proposed international effort would expand on existing multilateral and bilateral discussion and cooperation, which are focused on sharing best practices for natural gas production and nuclear power, technology development for clean coal and energy efficiency.

Financial resources also are available to stimulate the use of clean energy technologies. For example, the World Bank, the U.S. Agency for International Development (AID), the U.S. Trade Development Administration (TDA) and the Overseas Private Investment Corporation (OPIC) all support global development. The climate action plan proposes to direct some of these agencies' funding to clean energy projects.

The plan also proposes global free trade agreements for environmental goods that are similar to the existing Asia-Pacific Economic Cooperation (APEC) agreement. The 21 member-economies in APEC will reduce tariffs to 5 percent or less by 2015 on a negotiated list of 54 environmental goods, such as gas and wind turbines and catalytic converters.

* * *

This article has described only a few of the dozens of actions that the president proposes in his climate action plan. This last example would link domestic tax changes and international policy, and help pay for many elements of the plan.

The president calls for the elimination of U.S. oil- and gas-industry tax preferences, such as intangible drilling cost expensing.

The International Energy Agency (IEA) has estimated that elimination of fossil fuel subsidies could reduce greenhouse gas emissions by 10 percent, but was referring to the practice of using government subsidies to keep the cost of gasoline and other fuels exceptionally low, not industry taxation. ■

A joint publication of SEG and AAPG
InterpretationTM
A journal of subsurface characterization



Society of Exploration Geophysicists
The international society of applied geophysics



AAPG
Advancing the World of Petroleum Geoscience

Complex Faults

Fault interpretation is critical to accurate mapping and trap assessment in seismic projects. In order to unravel the story of a prospective area or understand basin tectonics, seismic interpreters are challenged by complex faulted areas. This special section will be dedicated to case studies that show interpretation and solutions to all kinds of faulted areas: including thrust faults, transtensional complexes, strike-slip faults, and complex normal faulting (for example: over salt bodies). Interpretation of faulting is also integral to understanding hydrocarbon migration.

The editors of INTERPRETATION (www.seg.org/interpretation) invite papers on the topic “Interpretation of Complex Faulting” for publication in a November 2014 special section to supplement the journal's regular technical papers on various subject areas.

Here are some fault-related topics we are seeking for the issue:

- complex thrust faults detailed either by surface or subsurface data, including pop-up structures, duplex structures, etc.
- strike-slip fault complexes that impact hydrocarbon fields, or analog areas to fields
- complex normal faulting found in rift zones, horst and grabens, extensional basins, or uplifted areas related to shale or salt domes
- seismic imaging of fault zones, including areas affected by gas sags, or hydrocarbons moving along fault planes
- reconstruction of fault zones, fault modeling, explanation of fault deformation as seen on seismic, or in fault exposures
- interpretation of fracture zones, for example fractures in shales, or tight reservoirs, that would be instructional to geoscientists

Interested authors should submit for review no later than **15 January 2014** via the normal online submission system for INTERPRETATION (<https://mc.manuscriptcentral.com/interpretation>) and select the Complex Faults manuscript type.

The special section or supplement editors would like to receive a provisional title and list of authors as soon as possible. The submitted papers will be subjected to the regular peer-review process, and the contributing authors also are expected to participate in the peer-review process.

INTERPRETATION, copublished by SEG and AAPG, aims to advance the practice of subsurface interpretation.

The submissions will be processed according to the following timeline:

Submission deadline
15 January 2014

Peer review complete
1 July 2014

All files submitted for production
15 July 2014

Publication of issue
November 2014

Special section editors:

Linda R. Sternbach
linda.sternbach@gmail.com

John Jordan
John.Jordan@anadarko.com

Steven L. Getz
sgetz@sbcglobal.net

William A. Ambrose
william.ambrose@beg.utexas.edu

INTERPRETATION special section

CALL FOR PAPERS

Dense sets of seismic horizons

A New Approach to Stratigraphic Interpretation

By FARRUKH QAYYUM, NANNE HEMSTRA and PAUL de GROOT

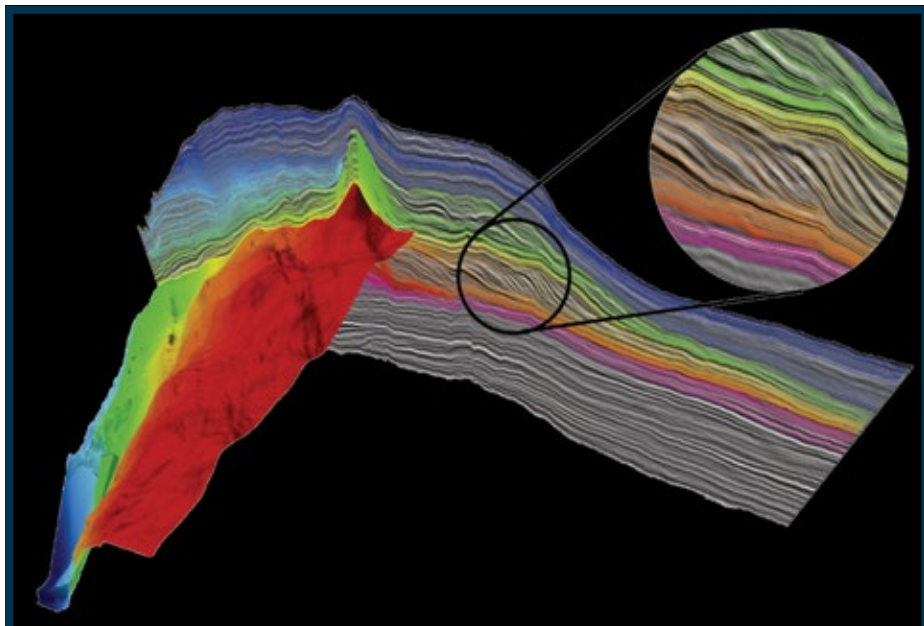


Figure 1 – A HorizonCube consists of a set of auto-tracked seismic horizons using a pre-computed dip volume. This is an exponent of an emerging group of global interpretation techniques.

This article introduces a new set of seismic attributes that play an important role in extracting detailed stratigraphic information from seismic data.

The attributes in question are derived from a HorizonCube, one of the emerging interpretation techniques that provide fully interpreted seismic volumes (figure 1).

In this particular technique, horizons are automatically tracked between a given set of framework horizons and faults. The tracking is done using a seismic dip volume.

Compared with conventional amplitude tracking, this algorithm is more robust in areas with low signal-to-noise ratio, where diachronous events can be tracked as well as events that are phase inconsistent.

As these horizons are guided by a continuous dip-field, they may converge and diverge according to the dip of a seismic reflector. In this

New Family of Stratigraphic Attributes

For the continuous set of seismic horizons, a new family of attributes can be computed that visualize geologic features previously hidden.

Attributes include:

► **Isochron thickness** – This attribute highlights not only sedimentary bodies but also picks up local pinch-outs, condensed intervals and local unconformities.

► **Curvature** – This curvature attribute tends to be smoother than the conventional volume curvature attribute, computed using the seismic dip volume without mapping.

► **HorizonCube density** – Events can be counted within user-defined time windows, with high-density values corresponding to horizon convergence and low density values corresponding to the horizon divergence.

The “HorizonCube density attribute” helps define the zones of pinch-outs, condensed sections and unconformities.



QAYYUM

Arbitrary layers

A dense set of seismic horizons can be separated into a set of arbitrary (stratigraphically uninterpreted) layers that divide the mapped seismic horizons into fix layers with a unique ID for each layer.

This plays an important role in quality control where visualizing hundreds of horizons can often be slow and laborious.

Derivatives

Finally, first or second derivatives on a



HEMSTRA



DE GROOT

set of horizon events can be extended to perform a derivative on an isochron between a given ranges of events. These attributes measure subtle geometrical changes and discontinuities.

From a stratigraphic interpretation standpoint, the mapped seismic horizons in truncated form can be sub-divided into sequence stratigraphic units through the co-visualization of a structural domain and a Wheeler domain in conjunction with well data.

In both domains various data, such as wells and seismic, can be combined to interpret a set of sequence stratigraphic units, such as systems tracts and sequences.

Typical attributes that are extracted using this sequence stratigraphic

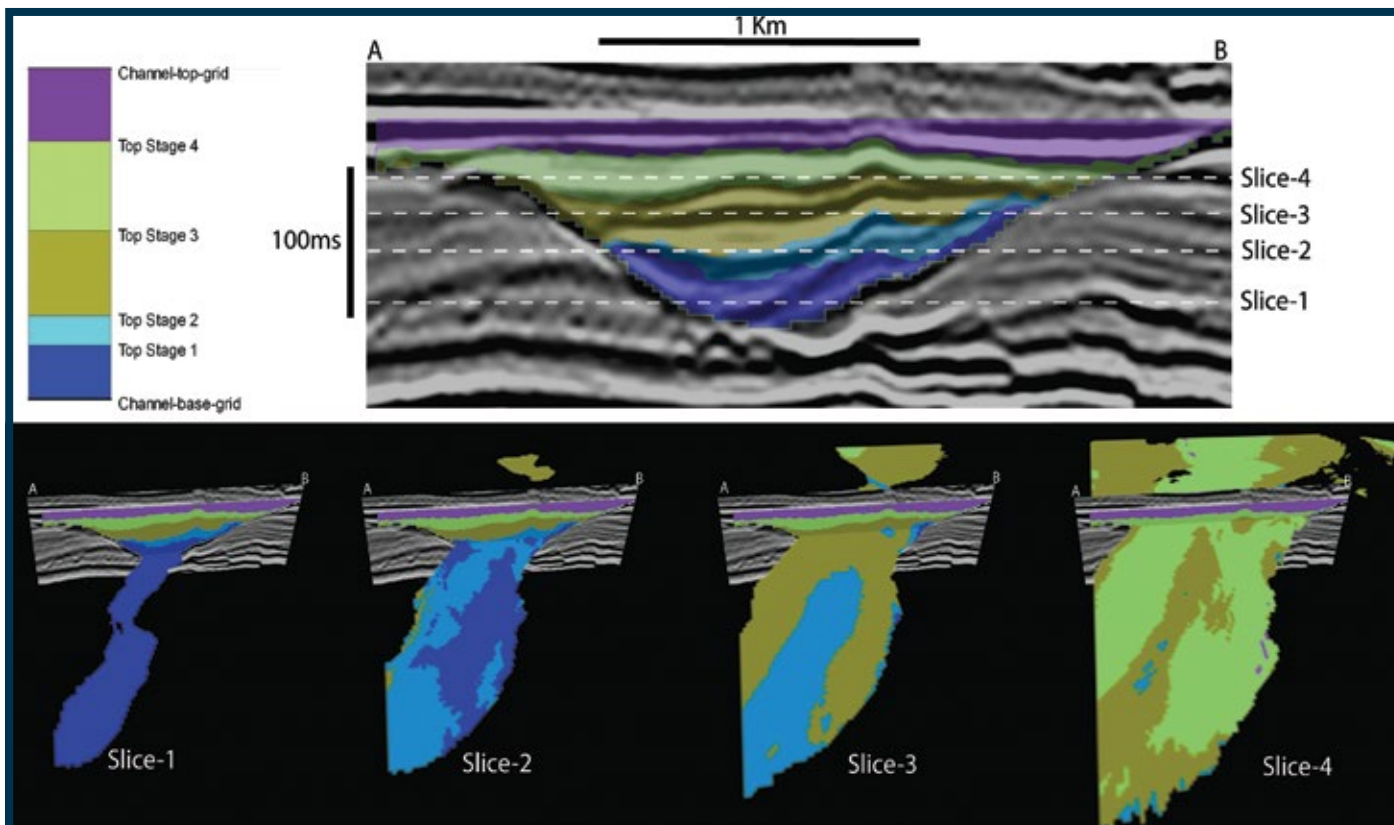


Figure 2 – A deepwater channel system of Australian Northwest Shelf is sub-divided into several channel stages attribute volume. Top: Color-coded channel stages are overlain on the seismic data. Bottom: Time-slicing through the channel stages in a flattened domain (channels top).

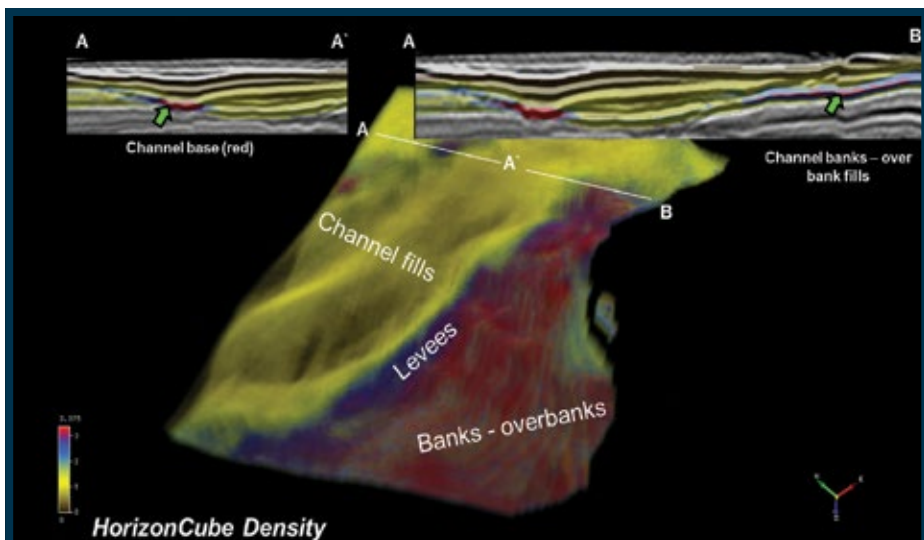


Figure 3 – Same channel systems are visualized using HorizonCube density attribute. Note that the locations of higher densities values mostly correspond to channel base, levees or over-bank regions.

way, the key geologic features such as unconformities, pinchouts and condensed sections are highlighted.

Horizons can be tracked in two different modes (figure 1):

► As continuous horizons that stay together when they converge and never cross each other.

Such horizons help identify unconformities and condensed sections – particularly useful in 3-D attributes visualization and reservoir modelling.

► As truncated horizons that may stop when they meet each other in space based on a user-defined threshold.

This helps to identify stratigraphic lapouts (onlaps, downlaps and top laps). These also are useful in Wheeler diagram creation and sequence stratigraphic interpretation.

Continued on next page

Continued from previous page

framework include stratigraphic unit IDs (identification number) and isochrons. The IDs of interpreted stratigraphic units can either be unique (each systems tract unit is assigned a unique identification number) or common (each identical systems tract is assigned a common number).

An isochron attribute calculated the thickness of a stratigraphic unit. The unit of this attribute depends on the seismic survey type (TWT or in depth). This is a key attribute to understand how sedimentation filled a sedimentary basin as a function of geologic time.

The relative rate of preservation – the ratio between an isochron volume and a known geologic time-span for a particular unit – also can be calculated with the results being relative measurements of

the rate of preservation per geological time unit.

Finally, an attribute can be generated that defines the difference between two isochron grids as a volume at a certain trace location.

Extracting Deepwater Channel Stages

During the Neogene period, Carnarvon Basin (Australian North West Shelf) comprised several deepwater meandering channelized systems. One of those systems is studied using the new stratigraphic unit ID attribute.

To our knowledge, this is the first study in which this attribute was used to define an unconventional set of stratigraphic units.

Convention nomenclatures are not adopted, as the interval may fall in one

systems tract. Therefore, a further sub-division of channel system requires a new sequence model.

In this case, a “channel stages” sequence model is defined. It contains a set of N stratigraphic units defined as channel stages. Each unit is defined by its own unique ID.

Upper and lower boundaries of the channel system were manually mapped to form an initial framework to process the densely mapped set of seismic horizons. Within such a framework, a data-driven collection of densely mapped seismic horizons was created.

These were then sub-divided into a channel stages model that contained a user-defined set of color-coded stages. The criteria of sub-dividing a channel system into its stages are based on observations of features such as crosscutting relationships, timing and

geomorphologic patterns.

Five channel stages can be seen in figure 2. The same interval also can be studied using the density attribute (figure 3), which clearly shows channel base, levees and banks of channel systems.

Workflows such as these support building better stratigraphic models to predict reservoir quality sands and to perform reservoir characterization.

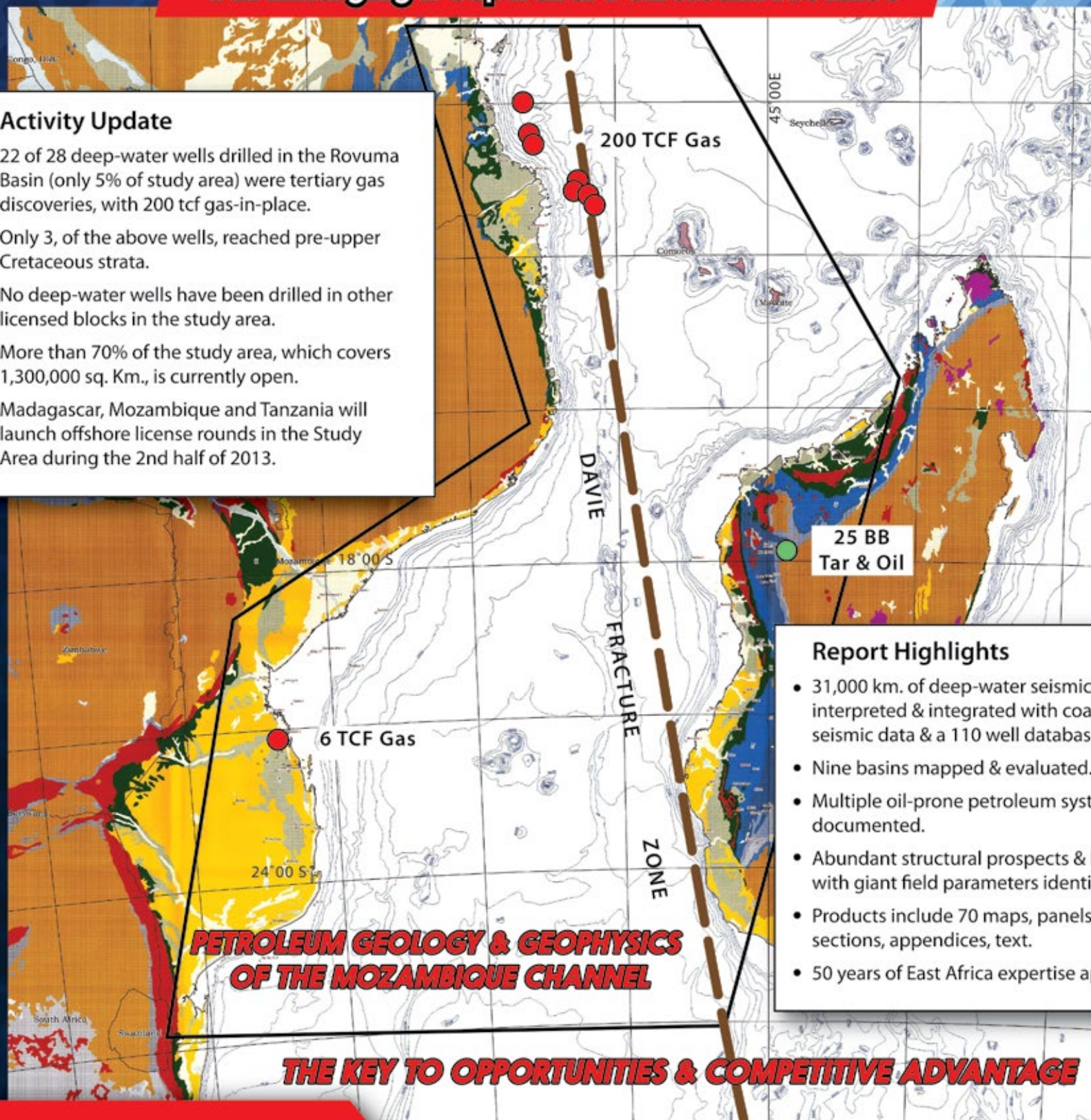
Dense sets of seismic horizons help in defining new stratigraphic attributes – and these attributes help in understanding stratigraphy and geomorphology, and can be used as a means of performing stratigraphic interpretation on seismic data. ■

(Editor's note: AAPG member Farrukh Qayyum, Nanne Hemstra and Paul de Groot all are with dGB Earth Sciences, Enschede, Netherlands.)

MOZAMBIQUE, TANZANIA, MADAGASCAR "An Emerging Deepwater Petroleum Province"

Activity Update

- 22 of 28 deep-water wells drilled in the Rovuma Basin (only 5% of study area) were tertiary gas discoveries, with 200 tcf gas-in-place.
- Only 3, of the above wells, reached pre-upper Cretaceous strata.
- No deep-water wells have been drilled in other licensed blocks in the study area.
- More than 70% of the study area, which covers 1,300,000 sq. Km., is currently open.
- Madagascar, Mozambique and Tanzania will launch offshore license rounds in the Study Area during the 2nd half of 2013.



Report Highlights

- 31,000 km. of deep-water seismic data interpreted & integrated with coastal seismic data & a 110 well database.
- Nine basins mapped & evaluated.
- Multiple oil-prone petroleum systems documented.
- Abundant structural prospects & leads with giant field parameters identified.
- Products include 70 maps, panels, cross sections, appendices, text.
- 50 years of East Africa expertise applied.

PETROLEUM GEOLOGY & GEOPHYSICS OF THE MOZAMBIQUE CHANNEL

THE KEY TO OPPORTUNITIES & COMPETITIVE ADVANTAGE

RUSK, BERTAGNE + ASSOCIATES
WWW.PETROCOMMUNICATORS.COM

DONALD C. RUSK
Phone: 281-893-8181
dcrusk@comcast.net

ROBERT G. BERTAGNE
Phone: 281-556-0097
rbertagne@comcast.net

BOOK DONATIONS NEEDED.



The **Publications Pipeline** program improves geoscience education in developing countries by sending used geoscience books and periodicals at no cost to university libraries and other libraries that request them.

Individuals may donate their books to the AAPG Foundation. Many overseas libraries are in need of basic library resources for use in higher education and training so important to continued development of their countries.

The AAPG Publication Pipeline committee collects, inventories, boxes, stores, and sends donated geoscience periodicals and books to university libraries and other libraries overseas for use by the students, faculty, and researchers. The AAPG Foundation receives donations of hardcopies only of periodicals, books, journals, and maps.

Publications donations are welcomed. Somewhere students and fellow geoscientists will benefit from your generosity. Technical publications in the sciences are our focus. Some topic examples include: biology, chemistry, geoscience or petroleum engineering.

For more information, visit
www.aapg.org/committees/pubs_pipeline/index.cfm.



AAPG Foundation • P.O. Box 979 • Tulsa, OK 74101-0979
USA 1-855-302-2743 • foundation.aapg.org

FOUNDATION UPDATE

Gibbs Takes the Reins

By NATALIE ADAMS, AAPG Foundation Manager

AAPG Honorary member **James (Jim) Gibbs** was elected chair of the Foundation Members of the Corporation during the Trustees' board meeting, held in Pittsburgh during this year's AAPG Annual Convention and Exhibition.

Gibbs, who has served on the Trustee board since 2006, replaces longtime chair and Honorary member **William (Bill) Fisher**, who stepped down after serving 12 years on the Trustees board – including the last six as its chairman.

Also at the meeting, AAPG Honorary member **M. Ray Thomasson** was elected secretary and **Lee Backsen** was newly elected to the board.

More information about the Trustee board can be found at <http://foundation.aapg.org/about/index.cfm>.

The AAPG Foundation Trustees also approved nominations for the new Trustee Associate Service Awards, presented to individuals or corporations who have distinguished themselves in beneficial long-term service to the AAPG Foundation through participation in the Trustee Associates.

The awards were officially established in 2012, but the selection process was only recently finalized – meaning, two awardees have been named.

The winners are:

► For 2012 – **Jack Martin**, of Lafayette, La., and Sun Lakes, Ariz., a Trustee Associate since 1980.

► For 2013 – **Ken Masters**, of Conroe, Texas, a Trustee Associate since 1994.

Both recipients – longtime active, consistent Foundation supporters – will receive their awards at the upcoming Trustee Associate annual meeting, set Sept. 22-26 in Cle Elum, Wash.

Nominations are open for the annual AAPG Foundation Teacher of the Year award. The deadline for application submittal is Oct. 15.

The K-12 Teacher of the Year recipient will receive a \$6,000 cash award for Excellence in the Teaching of Natural Resources in the Earth Sciences, presented at the AAPG Annual Convention and Exhibition, which next will be held April 6-9 in Houston.

To submit a nomination, view past recipients and learn about judging guidelines go to <http://foundation.aapg.org/programs/toty/k-12.cfm>.

Also now open is the online application process for the 2014 Grants-In-Aid process.

Last year more than 500 applications were received; the Foundation awarded \$175,500 to 92 of the geoscience graduate student applicants.

To learn more about the grants-in-aid program, visit <http://foundation.aapg.org/students/graduate/index.cfm>.

Finally, the AAPG Foundation Annual Report for 2012 is now available online. Read about the Foundation's progress, programs, management and funds that you can support, at <http://foundation.aapg.org/documents/AnnualReport2012web.pdf>.



Foundation Contributions for July 2013

General Fund	James M. Demarest II	Robert Mims Jemison Jr.
BP Foundation Inc.	Philippe Demeur	Glenden Fordice Johnson
Chevron Humankind	Matthias Raymond Densley	Thomas Johnson Joiner
Matching gifts/Richard Ball and Donald Medwedeff	Timothy R. Dever	Crandall Davis Jones
Shell Oil Company Foundation	Albert Charles "Chaz" Duc	Thierry Michel Kabbabe
Matching gifts/David R. Steele	Herbert David Duey	Paul David Kaminsky
Larry F. Adamson	Douglas Burton Dunn	Michael Dean Karvelot
Connie Ann Allen	Nader C. Dutta	Allen L. Kelley
Isaiah Allison	Jack P. Dvorkin	Patrick F. Kelly
Gregory John Ambrose	James William Eberhardt	Martin Charles Kennedy
Henry Sherman Anderson	Aniekam Effrom Edet	Tim Klibert
Sidney Bakken Anderson	Wendell Roy Edgell	Kerry Dan Knight
William Augustus Atlee	John Thomas Eggert	Abdul Kohar
Ariel D. Auffant	Andreia Regina Dias Elias	Robert Kowalsky
Nancy Auren	Mark H. Elliott	Marguerite C. Kremer
George Arnold Ball Jr.	Thomas Morgan Ellis Jr.	John C. Kuciewicz Jr.
Gregory Charles Bank	Olusanmi Olatunde Emmanuel	Byron R. Kulander
Charles W. Beierle	Daniela Carmen Erber	James Ade Kurfess
Michael William Bennett	Leo F. Fay	Trami Thuy Lam
Alex Benson	Robert Thomas Fettes Jr.	Leon Max Lampert
Ulrich Berner	Laura Stager Foulk	Steven M. Lanter
Frederick Michael Black	Leonard Samuel Fowler	Charles Christopher Lapeyre
Jelle F. Boels	Roger Alan Freidline	Wayne Lebsack
Albert W. Bondurant	Wayne Brian Freisatz	Kay Lani Lee
Max Louis Bordenave	Richard Dale Fritz	Sean Balee Lewis
Bonner Boyd Bowden	Weldon Goble Frost	Donald Ransom Lindsay
Jerry W. Box	James M. Funk	Thomas Jerome Linn
Dustin Boyd	John Duncan Galloway	J. Dennis Loren
Christopher Howard Bradley	Michael E. German	James Warren Lovekin
Philip Braithwaite	Ernest Gomez	Stephen Alexander Lubanko
Donald Lee Brehm	Charles Arnold Gorveatt	Sheila Lucas
Donald A. Brice	Harry L. Graham	George Raymond Macaulay Jr.
Janet Brister	Domingo Lorenzo Graneros	Jack Winston Marshall
Don M. Brown	Wilfred L. Gray	David Rolo Martin
James Alexander Brown Jr.	Billy Warren Gregory	James Patrick Martindale
David Rush Budge	Andree French Griffin	Miguel Angel Maruri Carballo
Jay Bee Oliver Burner	Yves Henri Grosjean	Roy Edgar Matthews
Brian S. Cabote	Stuart Grossman	John Reed Maxwell
William Sommerville Calkin	Jose Ignacio Guzman	David J. May
Richard Joseph Callaway	James Walter Hankla	Bruce McCommons
Dean Lynn Callender	Judith L. Hannah	Donald James McKenna
Jack Cleveland Cartwright	Kenneth Stanley Harding	Cameron Robert McLain
Jeffrey Dean Cassidy	William Elihu Harlan III	Van Dale McMahan
John Ernest Chatfield	James Donald Haynes	In memory of
Peggy Susie Clements	Jay Geiger Henthorne Jr.	Walter W. McMahan Jr.
Edwin Lee Colling Jr.	Janet Marie Heppard	David V. Meghreblian
Sheridan Caraway Conley	Henry Herrera	James Carl Melear
In memory of	Bernard Louis Hill Jr.	Richard Fastabend Meyer
William Eddy Richardson	In honor of Larry Funkhouser	In memory of Wallace DeWitt Jr.
Marvin Keith Conn	Roger Emerson Hively	Donald H. Michel
Sayda Katerin Contreras	William J. Hlavin	Edward George Mickel
Brian Stephen Cook	William Myrl Hoag	Steven Malcolm Millan
Douglas Lee Core	Dennis Peter Holler	Cesar Monterrubio-Najera Sr.
John Patrick Coughlon	James Michael Hollywood	Thomas Edward Moore
Caspar Cronk	G.B. Howard IV	Ian W. Moxon
Cindy Cummings	Byron E. Hummon Jr.	Edward C. Mozley
Kenneth Francis Cummings	Wilson Humphrey	Catherine Marie Murphy
Brendan Ciaran Curran	Wade D. Hutchings	James Clifton Musgrove
Jason Wellington Currie	Md. Latif Ibna-Hamid	Craig D. Nardone
M.A. Custer	William Jasper Imler	Ellen West Nodwell
Henry C. Dean Jr.	Peter Immerz	
Michael C. Dean	Kevin William Jackson	
	Timothy Joseph Janousek	

See Foundation, page 72

CELEBRATING 100 YEARS OF OIL TECHNOLOGY AT IMPERIAL COLLEGE

Registration Open

Imperial College
London



100 Years and Beyond: Future Petroleum Science & Technology Drivers



Date: 23-24 September 2013
Venue: Imperial College London

This 2-day meeting will celebrate 100 years of petroleum-related science and engineering education at Imperial College. With a list of distinguished speakers, we aim to mark this landmark achievement by looking forward to the next 100 years, with emphasis on discussing key future drivers and related energy supply issues. The meeting will be wide-ranging, with presentations covering global energy trends, future geoscience and engineering technologies, unconventional hydrocarbon resources, carbon sequestration and climate change.

We have an outstanding group of confirmed speakers, including:

- Richard Hardman CBE (past President, Geological Society)
- Lord Oxburgh of Liverpool
- Lord Browne of Madingley
- Professor Scott Tinker (Director, Bureau of Economic Geology, Texas)
- Dr Bruce Levell (VP Emerging Technologies, Shell)
- Malcolm Brown (Senior VP Exploration, BG Group)
- Dr Bryan Lovell OBE (past President, Geological Society)
- Professor Joe Cartwright (University of Oxford)
- Emeritus Professor John Woods (Imperial College & the 2007 Joint Nobel Peace Prize Winner)
- Dr Mike Daly (VP Exploration, BP)

The meeting is jointly convened by Imperial College London and by the Geological Society of London, supported by the American Association of Petroleum Geologists, the Society of Petroleum Engineers, the Petroleum Exploration Society of Great Britain and the European Association of Geoscientists and Engineers.

Further information and registration details:

Further information and registration details can be found at:
www.geolsoc.org.uk/oilcentenary13
or contact Steve Whalley at the Geological Society, using the following email address: steve.whalley@geolsoc.org.uk

SPONSORED BY



IN ASSOCIATION WITH



IMPORTANT DATES TO NOTE



October 15, 2013

Teacher of the Year Award- deadline for K-12 geoscience teachers to have their applications submitted to their respective geological societies. **NEW THIS YEAR** – Nominate the teacher that had a tremendous impact on your choice to enter the geosciences!

The Foundation will award \$3,000 to a teacher's school and \$3,000 for an individual K-12 teacher in the United States for Excellence in the Teaching of Natural Resources in the Earth Sciences. In addition, the winner will receive an expense-paid trip to the AAPG Annual Convention and Exhibition in Houston, TX from April 6 to April 9, 2014.

December 14, 2013

L. Austin Weeks Undergraduate Grant application deadline.

This grant will provide \$1,000 per qualified AAPG Student Chapter. Half of the grant (\$500) will be given to the qualified undergraduate student applicant. The remainder is for the geoscience department and is to be used to support educational activities of the AAPG Student Chapter. Attention students and alumni! Make sure your school is represented! Talk to the Student Chapter President today.

January 31, 2014

Grants-in Aid graduate student grant application deadline. Grants range from \$500 to \$3,000 each.

The purpose of the AAPG Foundation Grants-in-Aid program is to foster research in the geosciences. Grants provide financial assistance to graduate students (currently enrolled in Masters or Ph.D. programs) whose thesis research has application to the search for and development of petroleum and energy-mineral resources, and/or to related environmental geology issues.

February 18, 2014

Professorial Award nomination submission deadline.

This is the third year for this exciting new award. The Foundation will award \$1,000 in 2014 to an individual higher education professor for Excellence in the Teaching of Natural Resources in the Earth Sciences. Applicants should have a minimum of three years full-time teaching experience at any higher-education institution worldwide.

For more information, visit foundation.aapg.org



AAPG Foundation ■ P.O. Box 979 ■ Tulsa, OK 74101-0979
USA 1-855-302-2743 ■ foundation.aapg.org

YP Summit Produces Camaraderie, New Ideas

By NICK LAGRILLIERE, Young Professionals Committee Chair

For the fourth consecutive year, the Young Professionals Leadership Summit (YPLS) was organized prior to AAPG Leadership Days, which this year was held recently in Tulsa.

This year's event brought together 22 YPs from various Sections and Regions – and from a variety of companies – to discuss the way forward for YP initiatives in AAPG.

At the core of the YPLS program were the breakout sessions, in which the YPs discussed, with great enthusiasm, topics such as "AAPG's value proposition" and the "Young Professionals Committee mission, vision and goals."



LAGRILLIERE

The results of these were then carried forward as an answer to a question posed to the Young Professionals Committee by President Lee Krystinik at the AAPG Annual Convention and Exhibition earlier this year in Pittsburgh, when he petitioned the YPs to identify key issues they would like him to address.

The issues identified by the YPLS attendees were:

► The Association needs to improve its marketing strategy and keep abreast of new technology in order to stay relevant.

As AAPG Executive Director David Curtiss, commented, "Ensuring that AAPG



Back Row (from left to right): Jonathan Allen, Nick Lagrilliere, Tiffany Piercey, Kassandra Sendziak, Tilden McKean, Vaughn Thompson. **Middle Row** (from left to right): Cat Campbell, Meredith Faber, Hannah McKay, Jaclyn Carrington, Siobhan Prise, Antonio Velasquez, Miguel Nicho Pacheco, Greg Baniak. **Front Row** (from left to right): Aisha Bulushi, Reetu Ragini, Anwar Al-Beajji, Chun Hock Tan, Sean Kimiagar, Drew Kreman.

remains relevant is our primary focus, and the productive results from the YP Leadership Summit will help the Association do just that."

Providing targeted and consolidated email about AAPG events and services will help optimize information exchange.

► We currently do not have the tools for the job. We are struggling with our website

– which, fortunately, is in the process of being upgraded – and we need a more effective means of communicating with the membership.

► Most importantly, if we want to attract new members to AAPG and promote member status, we need to increase the value of membership and differentiate between Members and Associates.

Cooperation and Interpersonal Skills

To promote better alignment within the Sections and Regions, the young professionals and the students attending the Student Chapter Leadership Summit (SCLS) worked with Section and Region leadership in a joint session dedicated to identifying issues specific to each geographic area – and brainstorming ideas on how these could be resolved.

YPLS and SCLS attendees also participated in an insightful seminar with the SCLS attendees on personality types, and how these affect our relationships both at work and at home. The session was facilitated by Marla Sanchez from Spectrum Temperament Development Inc., and sponsored by Anadarko.


This was followed by another opportunity to interact with the students – and during an hour-long Q&A session, the YPs opened the floor for questions the students might have regarding early careers in the industry.

The YPs' efforts succeeded in making the transition into industry appear a little less daunting. As Joe Whearty of San Diego State University pointed out:



"As a student, it is intimidating when trying to figure out how to break into the industry," Whearty said, "but the YPs did a great job providing an example to follow and imparting valuable knowledge and advice."

A session on influence skills by Oklahoma State University professor

Continued on next page



Corporate Supporters:

Call for Abstracts - 14 February 2014

Operations Geology Conference

"The Life-cycle of a well"

26-27 November, 2014

The Geological Society, Burlington House, Piccadilly, London

Convenors:

Nick Pierpoint
BP Group - Chairman

Malcolm Brown
BP Group

Richard Smout
Eon - Secretary

Manoj Gaur
Cairn India

Gordon Holm
Tullow

Kirstin McBeath
BP North Sea

Joanna McKidd
BP North Sea

Pat Spicer
BP Angola

Louise Young
BP Azerbaijan

CALL FOR ABSTRACTS

Following the highly successful Operations Geology Workshop held in Aberdeen in October 2012, the Petroleum Group of the Geological Society are pleased to announce the dates for the next event, which will be held over two days in 2014. This is also the first call for abstracts. Operations Geologists play key integrating roles at all stages of the life cycle of a well. This conference will look at the life cycle of a well and the contributions of Operations Geology at each stage. It is the intention of the convenors that both oral and poster presentations will eventually be prepared for release in a Special Publication of the Geological Society of London. To that end we invite contributions to the programme sufficiently early to make it possible for Authors to gain necessary permissions to present and publish what we trust will be cutting edge material.

- Well Planning** - hazard identification (due to rocks, fabric, pressure, stress, geometry etc) and avoidance/mitigation, targeted data acquisition for all disciplines for life of field
- Execution** - real-time techniques, managing the drilling window, the acquisition and use of integrity test data, appropriate isolation of permeable zones in the overburden
- After Action Review** - NPT analysis and the learning loop, continuous improvement
- Emerging Technologies** - the next generation of needs and solutions – logging, formation and gas detection/analysis, real-time well bore stability analysis tools, PPGF tools
- Professional Competence** - the need to strengthen the available processes for training and the vetting of competence for OGs, particularly in safety critical areas


CALL FOR ORAL AND POSTER ABSTRACTS:

Abstracts of up to 300 words and up to three colour figures are requested. Abstract Deadline 14 February 2014.

Abstracts should be submitted to Nick Pierpoint and Laura Hayward. For further information, please contact Laura Hayward, Events Administration Assistant; +44 (0)20 7432 0983 or E-mail: laura.hayward@geolsoc.org.uk Nick Pierpoint E-mail: Nicholas.Pierpoint@bp-group.com

At the forefront of petroleum geoscience

www.geolsoc.org.uk/petroleum



P.O. BOX 1595, MIDLAND, TX 79702 432.683.1573 FAX 432.686.7827 Email: wrgs@wtgs.org Website: www.wtgs.org

2013 WTGS FALL SYMPOSIUM: SEPTEMBER 25-27, 2013

Re-Investigating the Permian Basin

Please plan to attend the 24th West Texas Geological Society Fall Symposium during the final week of SEPTEMBER. The two and one-half days of technical sessions will feature oral and poster sessions presented by outstanding authors showcasing current research, field studies, core analysis and other aspects of the Permian Basin, analogous areas and developing technologies. The symposium provides attendees with a chance to network with their peers in a technical setting that also provides opportunities for social interaction.

Keynote Speaker: Columnist and Author, Marita Noon, Executive Director of *Citizen's Alliance for Responsible Energy*.

Some of the submitted topics include:

- Sequence Stratigraphy – Pennsylvanian & Wolfcampian
- Regional Reconnaissance via Remote Sensing
- Log-Based Residual Oil Estimations in CO₂ Floods
- Understanding Reservoirs & Fracs via MicroSeismic
- Shale "Brittleness" / Natural Fractures and Tectonics
- Gas Detection in Horizontal Well Mud Systems
- Surface Chemistry & ChemoStratigraphy in Exploration
- Bone Spring & Wolfcamp Reservoir Characterization

The Fall Symposium will be held at the Midland Center in downtown Midland, Texas. Technical Sessions and Poster Sessions are on September 25-26th with a half day Core Workshop on September 27th. The symposium kicks off at 8:15 am Wednesday, September 25th (registration at 7:30 am). For more information, contact: WTGS Executive Director, Paula Mitchell Sanchez (432) 683-1573 / wrgs@wtgs.org; or General Chairman J. David Overton (432) 683-2715 / cal-monell@att.net. For technical session information, contact Tech Chair Michael Raines (432) 686-6772 / mike.raines@whiting.com or Vice Tech Chairs Jesse White (713) 369-9000 / jesse_white@kindermorgan.com (Houston Area) or Dave Nelson (972) 959-3810 / dave.nelson@pvd.com (Dallas / Fort Worth Area).

Space Exploration Session: WTGS, with support from AAPG's Astrogeology Committee, is hosting a session dedicated to Space Applications. Join speakers from Honeybee Robotics, XCOR, Texas Tech University, The Bureau of Economic Geology and Odessa College to hear the latest on Mars Rover Missions, Midland's newest spacecraft, Lunar Geophysics, Martian and Inner Solar System Ice / Water Research, and Asteroid Economics. This session will be open to the general public at a reduced rate! Contact Mike Raines at (432) 686-6772 for more information.

An **Ethics Luncheon** will take place on Thursday at the Midland Petroleum Club. The presentation will be given by Deanna Sullivan, founder of SullivanSolutions. This presentation meets the Ethics Requirement for Professional Development Hours for Geologists and Engineers licensed in Texas. Registration for the Ethics Luncheon is space-limited and is sold on a first-come / first-served basis to symposium attendees. If any tickets remain by Wednesday at 2:00 pm, those seats may be sold to non-attendees.

In addition to technical sessions, WTGS will also host a **Golf Tournament** Friday afternoon and a **Field Trip** to the Solitario of Big Bend State Park on Saturday and Sunday. Both of these events require separate registration, and are NOT included on this form.

To register for the technical session, mail completed form with payment to: WTGS P.O. Box 1595, Midland, TX 79702. Credit card payments may be faxed to (432) 686-7827 or mailed. (Do NOT send credit card information via electronic communication, due to security risks.) Pre-registration and cancellation deadline is September 13, 2013. Rooms have been reserved at several Midland hotels. Deadlines for the special "WTGS Fall Symposium Rate" at participating hotels range from August 24 to September 10. See the WTGS website for more details, including pricing (click on "Hotel List" from the banner at the top of the main page).

Members: _____ Symposium Pre-Registration \$200.00	Members: _____ Symposium on Site Registration \$225.00
Non-member: _____ Symposium Pre-Registration \$250.00	Non-member: _____ Symposium on Site Registration \$275.00
_____ Ethics Luncheon Presentation* \$25.00 _____ One-Day Registration \$125.00 (Members and Non-members) _____ Space Session Only \$75.00	

Name _____ Email _____

Company _____ Phone _____

Address _____

I cannot attend but wish to order _____ copies of the symposium CD. Cost (thru 8/30/2013) is \$35.00 per set plus \$8.75 tax, shipping and handling.

Cash, Check or Credit Cards Accepted. I authorize you to charge the above to my:
☐ Visa ☐ MasterCard ☐ American Express Exp. Date _____ Security Code # _____

Card number _____ Signature _____

APPEX Athens Set for November



Greece Minister of Energy Yannis Maniatis, left, meets with AAPG European Region director Jeremy Richardson after signing an agreement of support for the upcoming 2013 APPEX Regional, set Nov. 5-7 in Athens, Greece – the first time the country has played host to the event. Maniatis will address the delegates at the gala dinner, set in the prestigious Museum of the Acropolis on Wednesday, Nov. 6. More than 300 delegates and 35 exhibitors are expected to attend the event. For more information go to the AAPG Europe website at europe.aapg.org.

Continued from previous page

Andrew Ulrich gave inspiration on how to establish and maintain a productive working relationship with both outside clients and among individuals within an organization.

These recently acquired skills were immediately put to good use during the Leadership Days activities.

For example, YPLS attendees actively contributed to the discussions around “Strategic Thinking for AAPG’s Second Century.”

President Krystinik put it this way: “One of the great highlights of Leadership Days for me was the pleasure of having the YPs involved. Their input markedly improved

the outcome of Leadership Days, and their enthusiasm and dedication give me great confidence in a bright future for AAPG as we head toward our second century.”

Want to become more involved with the YPs in your Section or Region? Visit our website at aapg.org/youngpros, and contact your Section or Region representative.

Nick Lagrillière, chair of the Young Professionals Committee, is a geoscientist on the exploration department's Maersk Oil Angola team based in Copenhagen, Denmark.

Foundation from page 70

Patrick James O'Connell
William Frank Oline
Francisco Olivares Perez
Botosan O. Ornatola
Ariana Osman
Arthur J. Pansze
Suresh George Patil
Jeroen Martien Peters
Benjamin Leland Peterson
Peter Phillip Pickup
Geoffrey R. Pike
Phillip Moore Pitzer
Robert Donald Price
Walter Carroll Pusey III
Donald L. Rasmussen
William Michael Raymond
Jess Perry Roach
A. Kirk Roberts
David Robert Kenneth Robertson
John William Robinson
Timothy Michael Ross
Matthew David Ruggeri
Kweku-Mensah O. Sagoe
Bedanta Prasad Sarma
Chakravarthy Sathasivam
Steven Schamel
Joan Lee Schindler
Joseph Bruce Schindler
J.L. Schneider
William B. Schroeter
Stephen Murray Scott
Stephen Harrison Secrest
Robert Edward Sharp
F. Carlton Sheffield
Mark William Shuster
Allen G. Siemens
Daniel Skomrowski
Guy Broadis Smith
Hannah Nichole Smith
Jerry M. Spalvieri
Philip Herald Stark
Mathew Stearns
Raymond W. Stephens Jr.
Linda Raine Sternbach
Robert Bidwell Suydam
Ronald E. Tepley
Robert Brinley Thomas
Charles H. Thorman
Jerry Edward Tochtermann Sr.
Harry W. Todd
David J. Tonner
Tyler M. Treece
John Stephen Troschinetz
Gregory F. Ulmshiek
John H. Van Amringe
Peter Varnai
Victor J. Veroda
Holly Rose Vescogni
George Henry Walbert Jr.
Robert Charles Weissmann
John Hills Weitz Jr.

Carrie Welker
Dietrich H. Welte
Delmar G. Westover
John Martin Wetzel
Carl Craig Wheeler
Jack Wiener
Heather E. Willems
Kenneth Oliver Williams
Robert Dean Williams
Ann O. Willis
William Wolodarsky
David Fricke Work
Xingquan Kevin Zhang

Amoruso Special Publications Fund

Jon P. Herber

Awards Fund

Teacher of the Year Award
Timothy Olaf Nesheim

Digital Products Fund

Uros Barudzija
Jason Dennis Chaytor

Distinguished Lecture Fund

Jack C. Pashin
Jeroen Martien Peters
Walter Charles Riese

J. Ben Carsey Distinguished Lecture Fund

Dorothy Carsey Sumner

Education Fund

Encana Cares (USA) Foundation
Matching gift/Mark Tobey
John Howard Bair
In memory of John H. Wrenn
David Jacob Entzminger
Gary Neil Polasek
Charles H. Thorman
Sandy Meyer

GIS-UDRIL Fund

Ellen West Nodwell

Grants-in-Aid Fund

Arthur A. Meyerhoff Memorial Grant
Guy Broadis Smith

Bernold M. “Bruno” Hanson
Memorial Environmental Grant
Dorothy Carsey Sumner
Jerry Edward Tochtermann Sr.

Eastern Section Named Grant
John L. Forman

Edward C. and Caroline Beaumont
Named Grant
Edward Arthur Beaumont

Fred A. and Jean C. Dix
Named Grant
James E. Briggs
Grants-in-Aid Committee
Named Grant

Andre Charles Klein
Rhonda A. Welch
Jason Dennis Chaytor
James M. Funk
Thomas N. Jordan Jr.

J. Ben Carsey Sr. Memorial Grant
Dorothy Carsey Sumner

James E. Hooks Memorial Grant
Dale Alan Fritz

R.E. McAdams Memorial Grant
Shell Oil Company Foundation
Matching gifts/Lawrence Gordon

Richard W. Beardsley Named Grant
Andrew D. Waggener

Robert K. Goldhammer
Memorial Grant

Wade D. Hutchings
Donald E. Rehmer
Sunday Kirk Shepherd

Wallace E. Pratt Memorial Grant
Dorothy Carsey Sumner

Imperial Barrel Award Fund
Charles A. Caughey
Tyler M. Treece

Military Veterans Scholarship Fund
M.A. Custer
William V. York

Boone Pickens
Digital Geology Fund
Ian W. Moxon

E.F. Reid Scouting Fund
Christopher Howard Bradley
Terri Duncan
Ronald L. Hart
Bryan Haws
Edwin Dean Britt Laudeman

Search and Discovery Fund
Kehinde Olafiranye

Visiting Geoscientist Fund
David Jacob Entzminger

L. Austin Weeks
Undergraduate Grant Fund
Elizabeth Johnson

The monthly list of AAPG Foundation contributions is based on information provided by the AAPG Foundation office.

Rose & Associates

Courses Consulting Software

Risk Analysis, Prospect Evaluation & Exploration Economics

Houston: Sept 23 – 27 Aberdeen: October 7 – 11
Calgary: Sept 16 – 20

Risk, Uncertainty & Economic Analysis for Resource Assessment & Production Forecasting in Shale and Tight Reservoirs

Houston: Oct 28 – 31 Calgary: Oct 7 – 10

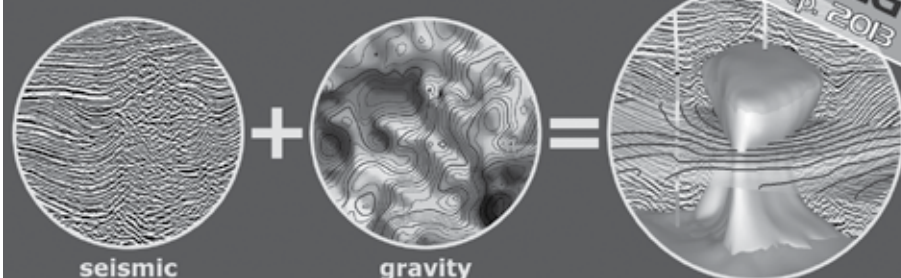
Play-Based Exploration: Mapping, Volumetric and Risk Analysis

Houston: Nov 18 – 20

<http://www.roseassoc.com/instruction>

Improving E & P Effectiveness

Pushing the seismic limits by



... integrating potentials

Integrated Gravity/Magnetic Interpretation | Software | Consulting | Environmental
USA | +1-713-893-3630 | Europe | +49-40-28 00 46-0 | www.terrasysgeo.com

TERRASYS
GEOPHYSICS

Be at the Epicenter...

AAPG-SEG

West Coast Student Expo

3 - 5 October 2013

California State University, Northridge

Student poster presentations, company interviews, networking, field trips, and more...

Interested Companies and Students see:
www.csun.edu/geology/aapg-seg.htm
for registration information



Corporate
Supporter:



Convenors:

Andy Sims
Merlin Energy
Resources Ltd

Matt Brettell
Premier Oil plc

Gwilym Lynn
Shell U.K. Limited

John Brint
Shell Global
Solutions
International

Conference
Sponsors:

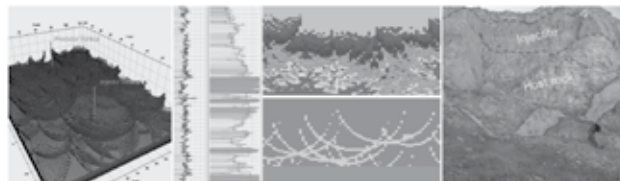


Call for Abstracts – 16 September 2013

Capturing uncertainty in geomodels: Best practices and pitfalls

11-12 December, 2013

Elphinstone Hall, University of Aberdeen



Over recent years, the static description of hydrocarbon fields has increasingly been undertaken via construction of 3D cellular geomodels. The model builder's toolkit is now extensive, incorporating sophisticated structural framework building capabilities, numerous gridding technologies and an ever-expanding, complex geostatistical data modelling resource. However, as we develop hydrocarbon fields and not the geomodels that are built to describe them, we must ask whether the modelling paradigm is robust and whether the models illuminate or hide uncertainty.

This two-day conference will explore how geomodelling tools should be used to best effect, and when such tools mislead or do not add value. The focus will be on methods and workflows for capturing uncertainty throughout the geomodelling process, and on how to carry this uncertainty into the dynamic modelling realms. Keynote presentations and discussion sessions are planned. We invite contributions covering all aspects of uncertainty management in geomodelling, from the philosophical "why" to the detailed "how". Examples of best practice and, particularly, on how to avoid pitfalls are particularly welcome.

Call for Papers:

Please email paper and poster contributions to steve.whalley@geolsoc.org.uk and Andy.Sims@merlinenergy.co.uk by 16 September 2013

For further information please visit www.geolsoc.org.uk/geomodelling13 or contact: Steve Whalley, The Geological Society, Burlington House, Piccadilly, London W1J 0BG. T:020 7434 9944 F:020 7494 0579

AAPG Profile Updates Are Important

By VICKI BEIGHLE, AAPG Member Services Manager

Is your online membership profile up to date?

A reminder: All members have the capability to update their contact information (address, phone, email, employer, etc.) at any time, everyday, via the profile page within our website's "Members Only" area.

This is an important responsibility – both for you and AAPG.

For you, having the correct current content information ensures that you won't miss any important communication that you'll need – everything from dues information to notification about the latest AAPG news.

For us, having accurate contact information enables us to fulfill our stated purpose: "... to foster scientific research, advance the science of geology, promote technology and inspire high professional conduct."

Incidentally, recent improvements to our database now allow members to input their education/training as well as biographical information – and, importantly, indicating if you are a military veteran.

By providing this data, you will allow AAPG greater opportunity for understanding of our demographics,

review of statistical information and expand your networking capabilities via your alma mater and/or military service.

Updating your personal profile is an easy process:

► Log in. (If you need help accessing your account and/or a reset of your password, contact AAPG Member Services via phone at (918) 560-9412, or email kdigges@aapg.org.)

► Select Review/Change my profile (from the left navigational bar.)

► Choose "Edit" from the gray buttons at the top of the page.

The option to indicate military veteran status is located under the Personal Information area (check the box, "I am a Veteran," located under the box to enter a FAX number).

To update/enter your education training, look for "Education Profile," then choose "click here to modify."

To enter a bio, click on the "Bio" button from among the gray buttons at the top of the page.

Our members are our greatest asset and we value and appreciate the contributions from each and every one. Thank you for your cooperation and keeping your profile current.

Commentary

'Bootstrap' a Good Read

By MARLAN W. DOWNEY

Imagine this: Your conversational partner is a wonderfully likable raconteur, someone who has spent a lifetime doing brilliant things with interesting people – and he's a geologist, too!

That's what you have within the covers of "Bootstrap Geologist," an absolutely delightful read of the life encounters of the clown prince of marine geology, longtime AAPG member Gene Shinn.

His gentle wit shines from every page, as he regales us with non-stop stories of weird and wonderful people that surrounded him as he careened through the Caribbean and the broader world for 50 exciting years.

Gene started his professional career as a lab assistant with Shell's pioneering Coral Gables Carbonate Research group, surrounded over the years by giants of carbonate geology; Bob Ginsburg, Mike Lloyd, Bob Dunham, Pete Rose, Duff Kerr, Jim Rogers, Ron Perkins, Mahlon Ball, Paul Enos ... the list goes on and on.

It is interesting to realize that each of these geologists was, at the outset, far better trained and more knowledgeable than Gene. Gene has energy, an open mind and an extraordinary level of curiosity. Gene had to learn by close observation. Those powers of observation, driven by fervent curiosity, have provided a host of unique and original insights into fields as diverse as origin and significance of beach holes, growth rate of corals, marine cementation and ecologic effects of intercontinental dust.

Gene Shinn has remembered what many of us have forgotten; truth is not found by citing authority, but by checking facts and making independent observations.

In reading this book, it is especially interesting to follow Gene's scientific growth and intellectual development, from boatman and lab assistant to the gentle guru of marine geology.

The wonderful humor that colors Gene's

stories should not mask the extraordinary scientific achievements of this modest man, with hundreds of formal and informal scientific publications, culminating in the award of SEPM's prestigious Twenhofel Medal in 2009, given for a lifetime of achievement.



Gene Shinn, signing copies of his book at the recent AAPG Annual Convention and Exhibition in Pittsburgh.

But it is the stories that give this marvelous book its character and special interest. Take the Atlantis incident:

"We donned our dive gear while most of the others did the opposite; clothes it seems hinder the force field true believers feel in this ancient spot. Soon we were being filmed by two naked women and observed by naked swimmers."

A story, a joke, an adventure and wise insight inhabit every page.

Read the book, and become a friend of a most remarkable man.

AAPG Honorary member Marlan W. Downey, a past AAPG president and Sidney Power medalist, is a Dallas-based consultant, Bartell Professor of Geoscience at the University of Oklahoma, chief scientist at the Sarkeys Energy Center and chairman of Roxanna Oil.

We believe... contracts should be honored.

What do you believe? Contract Disputes in Texas & Louisiana
Contingent Fee* | Hourly Fee | Hybrid Fee



LaGarde Law Firm, P.C.
Richard L. LaGarde
(713) 993-0660 | Houston, Texas
www.LaGardeLaw.com

* No fee if no recovery. Client is obligated for payment of court costs and expenses, regardless of recovery.

READERS' FORUM

Caribbean Origins

In the July EXPLORER's Historical Highlights column, James Pindell, a well-known advocate for the Pacific origin of the Caribbean Plate, closes his interesting article with the following sentence:

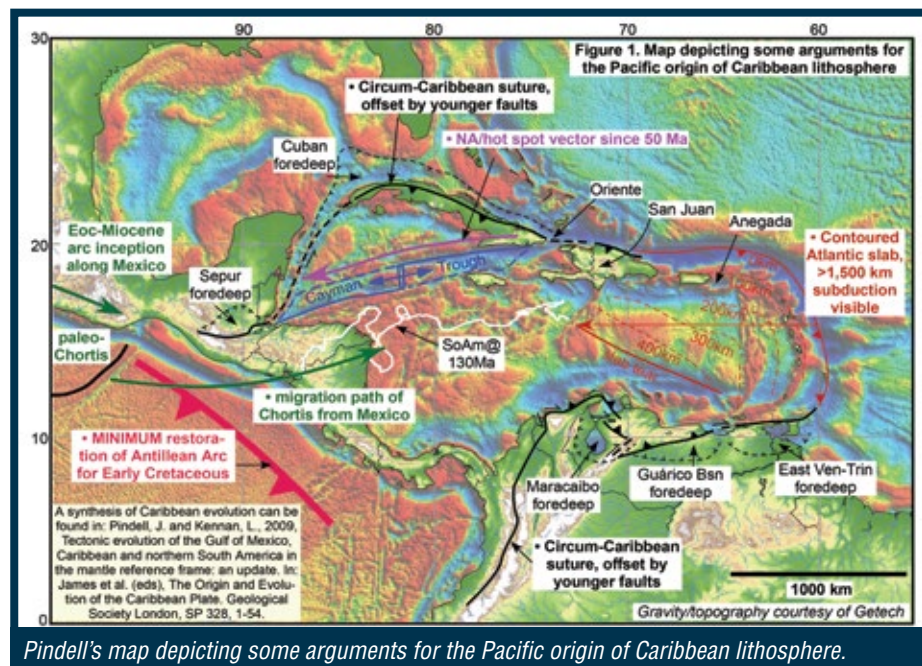
"Among the true paleogeographic questions today is not IF the Caribbean is Pacific derived, but HOW and WHEN west-dipping subduction of Proto-Caribbean crust began."

According to him, then, the debate about the origin of the Caribbean is closed, with no alternative geological interpretations or possibilities.

From a purely epistemological perspective, giving the nature of our science, Pindell's theory about the Caribbean sums up to an elegant and complicated model that represents only a single alternative, and is consistent with a series of observations in the northern part of the Caribbean, especially from Hispaniola to the Lesser Antilles and Venezuela.

However, this single model appears to lack some consistency when it comes to explaining some of the observed features found along the Caribbean coast of western Colombia, south of the Chimare Suture, from the Guajira Peninsula to Panama.

The so-called Great Arc of the Caribbean (GAC), the island arc produced by the subduction of the proto Caribbean underneath the Current Caribbean Plate, and that, according to Pindell's model, should be present in Colombia's west Caribbean region, is conspicuously absent along the entire



Pindell's map depicting some arguments for the Pacific origin of Caribbean lithosphere.

coast, or it is yet to be found.

From the Lower Magdalena Valley (LMV), the San Jacinto and Sinú belts (figure above), they represent a transition from the eastern continental crust below the LMV to an accretionary prism or thrust belt, depending on the author, without any clear presence of island arc-related lithologies. Further north, in the Guajira Offshore area, wells penetrated Cretaceous granites of continental affinity and Triassic Granodiorites that are hard to explain with Pindell's current model.

Furthermore, most gravity 2-D forward models in the area are

consistent with continental-affinity blocks that stretch out in to deeper parts of the offshore basin, and do not support the presence of the Circum Pacific Suture in the Guajira basin.

Far from been proved, the question about the Pacific affinity of Caribbean in western Colombia today is WHERE the GAC is, and WHY, if it exists, is not as pervasive and prominent as in the Northern Caribbean basins.

I found it problematic, to say the least, to declare the debate about the Caribbean plate closed when such a vast area with a complicated geological evolution has been subject to so little

detailed studies. Exploration activities in the southern Caribbean Basin are in their infancy, and nothing is more dangerous than to approach these frontier basins with a fixed model and a closed mind that, in many instances, condemn the prospectivity of what could become a new offshore petroleum province.

It simply is contrary to the very nature of our fascinating science

John Londono
Houston

Jim Pindell ("Origin of the Caribbean? Look Toward the Pacific," July EXPLORER) fails to acknowledge literature that contests the Pacific origin of the Caribbean, including the contents of a book (GSL Special Publication 328) that lists him as co-editor.

One can deny data and opinion, but they will not go away. Discussion and debate would be more constructive. I will address his arguments in a later article.

Meanwhile, see the important, upcoming program of Caribbean investigation described in September's Explorer.

Keith James
Covarrubias, Spain

(Editor's note: James' reference above is to an article he co-wrote on page 28 of this EXPLORER, dealing with a seismic project to investigate the Caribbean Plate. He also wrote the August 2012 Historical Highlights column, "The Caribbean: Is It From Here or From There?")

THE UNIVERSITY OF TEXAS AT AUSTIN



Professional staff openings

Director of Development & Alumni Relations

Serve as chief development officer for the school, working with key stakeholders and managing a professional staff in development and alumni relations.

Director of Outreach & Diversity Programs

Manage our award-winning GeoFORCE program and oversee other international and national outreach activities.

For information on these and other employment opportunities, visit www.jsg.utexas.edu/hiring.

Join a School on the Rise

58 Faculty, up 79% since 2005

90 Research scientists at the Bureau of Economic Geology, Institute for Geophysics, & other units

400 Research locations worldwide

90 \$90 million in annual funding, up \$37 million since 2005

No. 3 Graduate program for Geology, U.S. News

7 National young career awards for recent faculty

87% Growth in graduate enrollment since 2005

75% Growth in undergraduate population since 2005

The largest endowment and largest alumni network of any geoscience program in the world



Sedimentary Basin Analysis and Modeling Position, Berg-Hughes Center and Department of Geology and Geophysics, Texas A&M University

The Berg-Hughes Center for Sedimentary and Petroleum Systems and the Department of Geology and Geophysics at Texas A&M University invite applications from individuals for a non-tenure-track, three-year renewable contract position as a research professor (assistant to full professor ranks will be considered) in Sedimentary Basin Analysis and Modeling beginning January 1, 2014. This position will be a joint appointment with teaching, research and service responsibilities in the Berg-Hughes Center and Department of Geology and Geophysics.

The principal responsibility of this position is to spearhead the collaborative research and teaching programs in the newly established Chevron-TAMU /BHC Basin Modeling Center of Research Excellence in the Berg-Hughes Center and Department of Geology and Geophysics. This responsibility includes leading in the development of a robust externally funded research program in basin analysis and modeling that includes research collaboration with researchers in the petroleum industry; teaching integrative courses that introduce advanced concepts and technologies needed for unraveling the geohistory of sedimentary basins and the origin and distribution of unconventional and conventional petroleum resources inherent to sedimentary basins; and supervising graduate students and mentoring faculty in the use of sophisticated computational and applied research approaches and techniques to solve complex geologic problems.

We seek candidates who have had experience in sedimentary basin analysis and modeling and can serve as a team leader on multi-disciplinary research projects, and who have demonstrated the ability to develop and maintain an externally funded research program. Applicants must have a record of success in working collaboratively with researchers in academia and the petroleum industry and be enthusiastic about teaching integrative courses and supervising graduate students in basin analysis, basin architecture, basin modeling, basin geodynamics, and related areas.

Applicants must have an earned Ph.D. at the time of appointment. Successful applicants will be expected to teach effectively at the graduate level in basin analysis and modeling and related fields and in team taught courses, including classes in the Petroleum Certificate curriculum and to supervise undergraduate, M.S. and Ph.D. research, including students who are interested in pursuing careers in the petroleum industry. Applicants are expected to build and maintain a collaborative research program with colleagues in the College of Geosciences, the Berg-Hughes Center, the Department of Geology and Geophysics, the Department of Petroleum Engineering, and other energy related groups at Texas A&M University and the Texas A&M University System and with geoscientists and petroleum engineers in the oil and gas industry and other national and international research institutions.

Interested candidates should submit electronic versions of a letter of application, curriculum vita, statement of research vision, strategies to implement that vision, accomplishments, teaching philosophy, and the names and email addresses of at least three references to the Chair of the Basin Analysis and Modeling Search Committee (mcpope@geos.tamu.edu). Screening of applications for the position will begin September 1, 2013 and will continue until the position is filled.

The Berg-Hughes Center (berg-hughes.tamu.edu) and the Department of Geology and Geophysics (geoweb.tamu.edu) are part of the Texas A&M University College of Geosciences, which also includes the Departments of Atmospheric Sciences, Geography, and Oceanography; the Geochemical and Environmental Research Group (GERG); and the Integrated Ocean Drilling Program (IODP). Texas A&M University, a land-, sea-, and space-grant university, is located in a metropolitan area with a dynamic and international community of 172,000 people. Texas A&M University is an affirmative action/equal opportunity employer committed to excellence through the recruitment and retention of a diverse faculty and student body and compliance with the Americans with Disabilities Act. We encourage applications from minorities, women, veterans, and persons with disabilities. Texas A&M University also has a policy of being responsive to the needs of dual-career partners.

CLASSIFIED ADS

POSITION AVAILABLE

Pevehouse Chair in Geosciences Texas Tech University

The Department of Geosciences at Texas Tech University invites applications for the Pevehouse Chair in Geosciences. The purpose of this endowed position is to support innovative research and education that are broadly aligned with petroleum geosciences and may include geophysics, structural geology, geomechanics, sedimentology, petrophysics, and organic geochemistry. A Ph.D. in geosciences or closely allied field is required, as is a record of research as demonstrated by professional publications. The chair holder will conduct a vigorous, externally-funded research program, direct graduate student research, and teach undergraduate and graduate courses in his/her specialty. The position is expected to be filled at the tenured Full Professor level.

Texas Tech is a state-supported, graduate research-oriented university with over 32,000 students. The Department of Geosciences consists of twenty-four tenured/tenure-track faculty, with teaching and research emphases in solid earth geosciences, atmospheric science, and geography. It offers degree programs in solid earth geosciences at the BS, MS, and Ph.D. levels. The chairholder will join a dynamic, growing Department with more than 200 undergraduate majors and more than 60 graduate students. Texas Tech is committed to growth in disciplines aligned with hydrocarbon geology through addition of at least one junior faculty position.

The Department computer labs are equipped with GIS, geologic mapping/modeling, and seismic processing/interpretation software packages. Available experimental/analytical facilities include a stable isotope laboratory, XRD, XRF, analytical SEM, TEM, laser ablation ICP-MS, a heat flow lab, and remote sensing spectroradiometers. In addition, the Department of Petroleum Engineering maintains experimental and analytical facilities in petrophysics, drill fluids, cement, enhanced recovery, and reservoir simulation, as well as X-ray CT/nuclear magnetic resonance imaging lab.

Lubbock is located on the Southern High Plains in close proximity to the Permian Basin. The city has a population of over 225,000 and the semi-arid climate is conducive to outdoor activities. Cultural amenities include musical, theatrical, and sports events, and the city offers numerous options for shopping and dining. The city also offers the best healthcare facilities in the region, including the university's Health Sciences Center. The cost of living is low compared to national norms.

Applicants must first go to the employment website of the university at <http://jobs.texasstate.edu>. There, go to "Search Postings", search for requisition number 87107, and fill out necessary forms in applying for the position on-line. Then, applicants should submit a letter of application, curriculum vitae, a statement of teaching and research interest, names and contact information (including e-mail address) of at least 3 professional references. These documents should be uploaded to the employment website and we request that copies be emailed or sent directly to: Dr. Calvin Barnes, Pevehouse Chair Search Committee, Department of Geosciences, Texas Tech University, MS 1053, Lubbock, TX 79409-1053.

Additional information on the department can be found at website <http://www.depts.ttu.edu/geosc/>. E-mail questions regarding the position are received at cal.barnes@ttu.edu. Review of applicants will begin immediately and continue until the position is filled.

Texas Tech University is an affirmative action/equal opportunity employer, committed to excellence through diversity. Texas Tech welcomes applications from minorities, women, veterans and persons with disabilities.

Assistant Professor of Geosciences - Soft Rock Geology

The Department of Geosciences at Pacific Lutheran University invites applications for a tenure-track position in soft rock geology at the level of Assistant Professor to begin September 1, 2014. A commitment to excellence in teaching at a predominately undergraduate institution and a dedication to establishing a field-based research program that engages students are

expected. Teaching responsibilities will include stratigraphy and sedimentation, an upper division course in one's expertise, the gateway course for the major (GEOS 201), and topical lower division geoscience courses. Participation in extended field trip experiences, the general education program, and mentoring senior capstone research projects is also expected. Ph.D. in Geology or closely related field is required. ABD will be considered, but Ph.D. must be in hand by September 1, 2014.

PLU is a comprehensive university of 3500 students offering a curriculum integrating the liberal arts and professional programs. Located in a uniquely scenic region of the Pacific Northwest, the university's campus is 40 miles south of Seattle and 40 miles west of Mt Rainier near Tacoma, Washington. AA/EOE.

Submit application at <https://employment.plu.edu/postings/2573>. Required materials: cover letter, c.v., statement of teaching philosophy, unofficial undergraduate and graduate transcripts, and potential research plans with undergraduates. Three confidential letters of recommendation will also be requested by PLU upon application. Review of applications will begin October 1, 2013, but the position will remain open until filled. For questions or more information, please contact Dr. Jill Whitman, Chair of Geosciences at 253-535-8720 or whitmaj@plu.edu.

X-RAY DIFFRACTION SPECIALIST

An X-Ray Diffraction (XRD) Specialist will be one of the primary operators, analysts and data generators for the XRD lab. Responsibilities include Interpretation of XRD patterns for quantification of bulk and clay mineralogy, Overseeing all processes in the XRD procedure including sample preparation, sample loading, scanning and qc. Understanding of XRD principals and physics, especially with regards to rock and minerals analysis is essential. Qualitative interpretation of XRD patterns to determine types of bulk (whole rock) and clay minerals present. Quantitative interpretation of XRD patterns to determine relative amounts of bulk (whole rock) and clay minerals present.

Oversee XRD sample preparation procedures. Load XRD system and input proper scanning parameters.

Provide basic equipment maintenance. Understanding of XRD principles and physics, especially with regard to rock and mineral analysis. Make formal and informal presentations of same to clients on as-needed basis.

Meet all daily and monthly production requirements. Assist in training of XRD personnel including Lab Technicians. Know and understand Weatherford's Enterprise Excellence Process and the Quality Policy and comply with all requirements of the Quality Systems Manual, Operating and Technical Procedures and Workplace Instructions.

Chevron Energy Technology Company

Chevron's Basin Analysis Research Team has an immediate opening for an experienced Hydro and Sediment Transport Dynamics Specialist in its Houston office.

- The successful candidate work with the Basin Analysis Team to assist in the development and evaluation of physics-based sediment & stratigraphic models.
- Assist in teaching in-house courses on process sedimentology and stratigraphy.

The candidate should have:

- A PhD in an earth science related discipline.
- Extensive experience in sediment transport, stratigraphy and computational fluid dynamics.
- Expertise in advanced solutions for time dependent hydrodynamic flow & developing complex algorithms & implementing them in high performance computing environments is required.
- Ability for technology transfer, and advancing the science & workflow of stratigraphic interpretation.
- The ability to work individually and collaboratively with technical and operations teams. To apply or to learn more about this position, please go to our website: <http://>

Continued on next page

DEG from page 78

situation, yet we have the earth science expertise. Share knowledge and openly discuss issues where possible, and our natural character as environmentalists will shine through.

We can learn from advocates but also teach, because many concepts in geology and geophysics are not known, or not understood, by many who question what we do. Simple explanations using common thoughts and words can go a long way in promoting our industry and organization.

► Finally, stay current on the environmental issues that might impact oil and gas exploration and production. An ability to intelligently discuss various issues such as frac fluids, water use, fugitive methane emissions, CO₂ impacts, endangered species, induced seismicity, groundwater impacts or global energy needs can go a long way in showing your concern and your expertise in understanding the overall geologic situation.

The DEG is your AAPG Division to help with the environmental realities of global energy production. Join us and we will work together to support our AAPG and the ever-increasing and expanding future for environmentally friendly oil and gas exploration and development.

* * *

Please join me in welcoming to the DEG leadership team our new president-elect, **Jeffrey Paine**, from the Bureau of Economic Geology in Austin, Texas.

Joining Jeff on the DEG leadership committee are newly elected vice president **Jane Ellis-McNaboe**, EnviroTech Consultants, Bakersfield, Calif.; and secretary-treasurer **Steven Tischer**, ConocoPhillips, Midland, Texas.

I look forward to working with all of them, plus past-president **Tom Temples** and editor **Kristin M. Carter**, as we grow the DEG and the environmental face of the AAPG into the future.

Continued from previous page

www.chevron.apply2jobs.com/ and enter requisition #032231392. Applications are accepted online only. No phone, fax, or email inquiries, please, from candidates or external recruiters.

Chevron is an Equal Opportunity Employer

MISCELLANEOUS

SAMPLES TO RENT

International Sample Library @ Midland – Formerly Midland Sample Library. Established in 1947. Have 164,000 wells with 1,183,000,000 well samples and cores stored in 17 buildings from 26 states, Mexico, Canada and offshore Australia. We also have a geological supply inventory.

Phone: (432) 682-2682 Fax: (432) 682-2718

Eliminate pilot holes and drill more horizontal payzone with SES technical **GEOSTEERING SOFTWARE!** SES is for geologists who are dissatisfied with drafting-tool methods of geosteering. Free trial. www.makinhole.com. Stoner Engineering LLC.

OIL DRILLING

Drill 36 development wells within a large partially developed oil field and receive \$164,000,000 net income. The U.S. Government may provide financing and insurance against any loss or problems. If needed, U.S. contract drillers will do the drilling and well completion. The Jurassic is the target at 8,600 feet in depth, and the wells will go horizontal. Production rates per well typically are from 1,000 to 2,000 BOPD.

Phone Houston (713) 334-4464 or Austin (512) 927-3564.

LAND FOR SALE

Premium Colorado Land for sale by a Geologist, adjacent to National Forest in the Sangre de Cristo Mountains.

http://westcliffeland.blogspot.com
E-Mail: twila@haydenoutdoors.com
Phone: 719-371-4344

Newly launched; Beagle Geoscience is a multidisciplinary team dedicated to providing the E&P industry with high quality geological and geophysical consultancy services and products. Beagle is lead by six directors with over 30 years' experience each. The company combines the consultancy and technical support division of Exploration Geosciences with the talents of former Tullow geophysicist John Boucher and former Enterprise/Petro-Canada exploration manager Chris Brown. Joining from EGL are geophysicists Alan Edwards, Dave Rhodes and Mark Sawyers, geologists Alan Driscoll and Laura Eastwood, GIS specialist Matthew Dines, marketing manager Yvonne Drummond and office manager Ellen Neville. Beagle's staff have a proven track record in:

- Successful bid round evaluation and applications
- Geophysical and geological interpretation
- Farm-ins, farm-out and portfolio management
- Seismic survey design and processing QC
- Peer reviews
- Oil and Gas discoveries
- Exploration, appraisal and development wells
- Regional studies (proprietary and multi-client)
- Training and mentoring
- Technical Audit

Beagle Geoscience will continue to provide technical content and support for the United Kingdom Discovery Digest, the Norway Discovery Digest, and WHATMap Live!, under contract with Exploration Geosciences (UK) Ltd. "The Kentish Man or Man of Kent Evening" is a regular social drinks occasion hosted by Beagle. The next event is in Tunbridge Wells in November.

To register your interest please email ellen.neville@beaglegeoscience.com

Visit us in Kent or at: www.beaglegeoscience.com

CLASSIFIED ADS

You can reach about 37,000 petroleum geologists at the lowest per-reader cost in the world with a classified ad in the EXPLORER. Ads are at the rate of \$2.90 per word, minimum charge of \$60. And, for an additional \$50, your ad can appear on the classified section on the AAPG web site. Your ad can reach more people than ever before. Just write out your ad and send it to us. We will call you with the word count and cost. You can then arrange prepayment. Ads received by the first of the month will appear in the subsequent edition.



Graduate Fellowships in Sedimentary Basin Modeling

The Berg-Hughes Center (BHC) for Sedimentary and Petroleum Systems and the Department of Geology and Geophysics at Texas A&M University invite applications from outstanding students for graduate fellowships in sedimentary basin modeling. Two fellowships will be awarded beginning in the spring semester of 2014. These fellowships are for three years for Ph.D. students and for two years for M.S. students. The fellowships are \$30,000 per year.

The fellowships are an integral part of a robust research and education program initiated by the newly established Chevron-TAMU / BHC Basin Modeling Center of Research Excellence in the Berg-Hughes Center and Department of Geology and Geophysics at Texas A&M University. The Center was established to contribute to the advancement of science, technology and higher education through the teaching and mentoring of students and the supporting of independent academic research. The research focus of the Center is to further the understanding of the geohistory of sedimentary basins and the origin and location of unconventional and conventional petroleum resources inherent to sedimentary basins. Research will be conducted in collaboration with researchers at the University and geoscientists and petroleum engineers in the petroleum industry and is designed to solve complex geoscientific problems through integrated solutions.

Interested students should send a letter of application to Dr. Michael C. Pope (mcpope@geos.tamu.edu) by September 1, 2013.

The Berg-Hughes Center (berg-hughes.tamu.edu) and the Department of Geology and Geophysics (geoweb.tamu.edu) are part of the College of Geosciences, which also includes the Departments of Atmospheric Sciences, Geography, and Oceanography; the Geochemical and Environmental Research Group (GERG); and the Integrated Ocean Drilling Program (IODP). Texas A&M University, a land-, sea-, and space-grant university, is located in a metropolitan area with a dynamic and international community of 172,000 people. Texas A&M University is an affirmative action/equal opportunity employer committed to excellence through the recruitment and retention of a diverse faculty and student body and compliance with the Americans with Disabilities Act. We encourage applications from minorities, women, veterans, and persons with disabilities. Texas A&M University also has a policy of being responsive to the needs of dual-career partners.

Not So Fast – The End of This Era Isn't Close

By DAVID K. CURTISS, AAPG Executive Director

Every summer more than 50,000 opera fans make a pilgrimage to the city of Bayreuth, Germany. It is here that controversial and larger-than-life German composer Richard Wagner launched his Bayreuth Festival in 1876 – a festival that continues to this day.

The festival's centerpiece is a performance of a series of four operas known as "The Ring of the Nibelung," based on a medieval Germanic epic poem that is to German-speaking Europe what Beowulf is to English speakers.

It took Wagner 26 years to write the complete Ring Cycle: Das Rheingold (The Rhine Gold), Die Walküre (The Valkyrie), Siegfried and Götterdämmerung (The Twilight of the Gods). And it remains his most enduring work.

I should add that endurance is precisely what you must have to sit through one of Wagner's operas, let alone the entire cycle. A performance of Götterdämmerung lasts nearly six hours!

* * *

I'm no big opera fan, but the Ring came to mind as I read an article titled "Supermajordämmerung – The Twilight of the Supermajors," in the August 3 edition of The Economist.

In the article and an accompanying editorial, The Economist paints a dark picture of the future of integrated international oil companies, based on the oil peak it sees ahead.

But the peak they're referring to isn't peak oil in the sense of declining global oil supply. Instead they see global demand for oil peaking, pointing to the fact that for rich countries (OECD nations) demand peaked in 2005.

This stands in contrast to forecasts by the U.S. Energy Information Agency (EIA), which projects non-OECD liquids demand growing by 53 percent between



CURTISS

2013 and 2040.

Other forecasts show similar projections, reflecting an underlying assumption that developing nations growing their economies will increase oil consumption to fuel transportation.

The Economist argues, however, that many of these fast-growing economies, notably China, are themselves imposing the type of energy efficiency measures that are curbing OECD demand and evaluating emerging technologies to leapfrog the OECD development path.

They point to two trends driving this anticipated drop in oil demand:

► First, the abundance of natural gas being produced from unconventional reservoirs, as well as massive conventional discoveries, such as those off east Africa.

They see accelerating fuel switching from oil to natural gas throughout the transportation, petrochemical and power generation sectors.

► Second, the engines used to move vehicles of all shapes and sizes are becoming increasingly efficient – doing the same work with less energy input.

As this efficiency trend continues it will slowly but surely reduce total oil demand.

In addition to a drop in oil demand, the rise of dynamic, progressive national oil companies (NOCs) also has changed the competitive landscape. Frequently, they

Remember, reduced oil demand doesn't mean no oil demand. The industry needs to find and produce significant oil volumes just to stay even.

are the gatekeepers of their country's oil resources – and increasingly these firms are formidable competitors with IOCs outside of their home countries, often with government backing.

The shift of research and development from oil companies to the service industry has commoditized many of the new technologies required for success in both conventional and unconventional reservoirs. It's available to anyone off the shelf. And I heard fear expressed several years ago that service company resources could be fully consumed by NOC clients, or at least drive prices for services even higher.

* * *

This isn't the first time that The Economist has written splashy headlines about significant energy transformations. In fact, I once heard a fantastic talk by Adam Sieminski, former chief energy economist for Deutsche Bank and now head of the U.S. Energy Information Administration, on oil markets that was illustrated entirely by past covers of The Economist. As I recall, their reporting tended to follow rather than lead the market.

But I do appreciate The Economist's questioning the general consensus. The fact that non-OECD could potentially follow a less energy-intensive development pathway would – if true – have significant

impact on oil markets.

There is no doubt the industry is more competitive with the rise of the NOCs, and the prizes being sought are harder to find and more expensive to produce. We're also seeing companies like ConocoPhillips spin off its downstream operations, leaving two companies to each focus on its core activities.

Whether there will be massive fuel switching as The Economist predicts, especially in transportation, remains to be seen. Sure, we're seeing movement in this direction, but replacing entire fleets is not a rapid process. And widespread consumer adoption will require significant investments in refueling infrastructure.

Also remember that reduced oil demand doesn't mean no oil demand. In fact, when you look at the EIA forecasted liquid fuel requirements for rich countries through 2040 it is relatively constant at current levels. The industry needs to find and produce significant oil volumes just to stay even.

* * *

Oil remains essential to modern society. Finding and responsibly producing it in an increasingly competitive world will require talent, ingenuity and innovation. It's going to take smart science, new technology and business savvy.

The industry may not look the same in coming decades, but I believe the future is brighter than The Economist suggests.

Because the end of oil – much like the conclusion of a Wagnerian opera – is still a long way off.

David K. Curtiss

DIVISIONS REPORT

Energy, the Environment and the AAPG

By DOUG WYATT, DEG President

After just a couple of days back from our AAPG Leadership Days gathering in Tulsa, on a whim, I did a Google trend search on the terms "environment+natural gas" + "water," "energy+water" and "energy+environment."

The results were essentially identical with Google trend scores in the mid-70s (out of 100). These are pretty high scores, with most interest coming from North America, the U.K., Australia and Southeast Asia, India and sub-Saharan Africa.

What do they mean?

We could discuss, but, in general, I think all would agree that there is a very high global interest and concern in the environmental aspects of energy production.

* * *

In my experience, all geologists involved in exploration and production inherently understand this, and we all are environmentalists by nature. However,



WYATT

Most geologists I know routinely consider any potential environmental impact in whatever they are doing.

in the global concern about energy and the environment, how do we show – how do we demonstrate – our environmental knowledge and respect?

And how do we represent ourselves and the AAPG?

We each must make our own choices as to how we demonstrate our environmental concerns, but I believe there are a few approaches that can benefit us all, and our Association:

► As a first thought, don't be afraid to use the term "environmental" in your routine geospeak.

There have been times in the past

where an oil and gas geologist would look at an environmental geologist as one of "those" people not to be associated with. Now, every well location, drilling procedure, hydraulic fracturing job, seismic program, access road, cement job, etc., requires an environmental analysis.

Indeed, most geologists I know routinely consider any potential environmental impact in whatever they are doing. However, we often do not communicate well to the public that we have analyzed for environmental impacts as part of our routine work.

We cannot assume the public

knows we have used our considerable expertise and knowledge of the earth for environmental analyses as part of our investigation into energy production. In every written and verbal statement and reports, let the public know that you know, and have studied, the potential environmental impacts and are helping mitigate potential issues.

► A second thought would be to associate with those who have environmental concerns.

Too often it is an "us-versus-them"



See DEG, page 77

For any play...

SEITEL
THE Onshore Seismic Data Company

IsoMetrix
MARINE ISOMETRIC
SEISMIC TECHNOLOGY

First three IsoMetrix surveys acquired in ongoing program It's reading between the lines that sets our technology apart.

Since its mid-2012 launch, IsoMetrix® marine isometric seismic technology has acquired surveys in the North Sea, Barents Sea, and South Africa, with the program continuing in Canada.

IsoMetrix technology overcomes the sparse crossline sampling of conventional seismic methods. The returning wavefield is fully captured to deliver a 6.25m² grid of data, providing the clearest, most accurate images of the subsurface ever recorded.

slb.com/isometrix



*Mark 69 Schlumberger, © 2013 Schlumberger 13_sl_0003