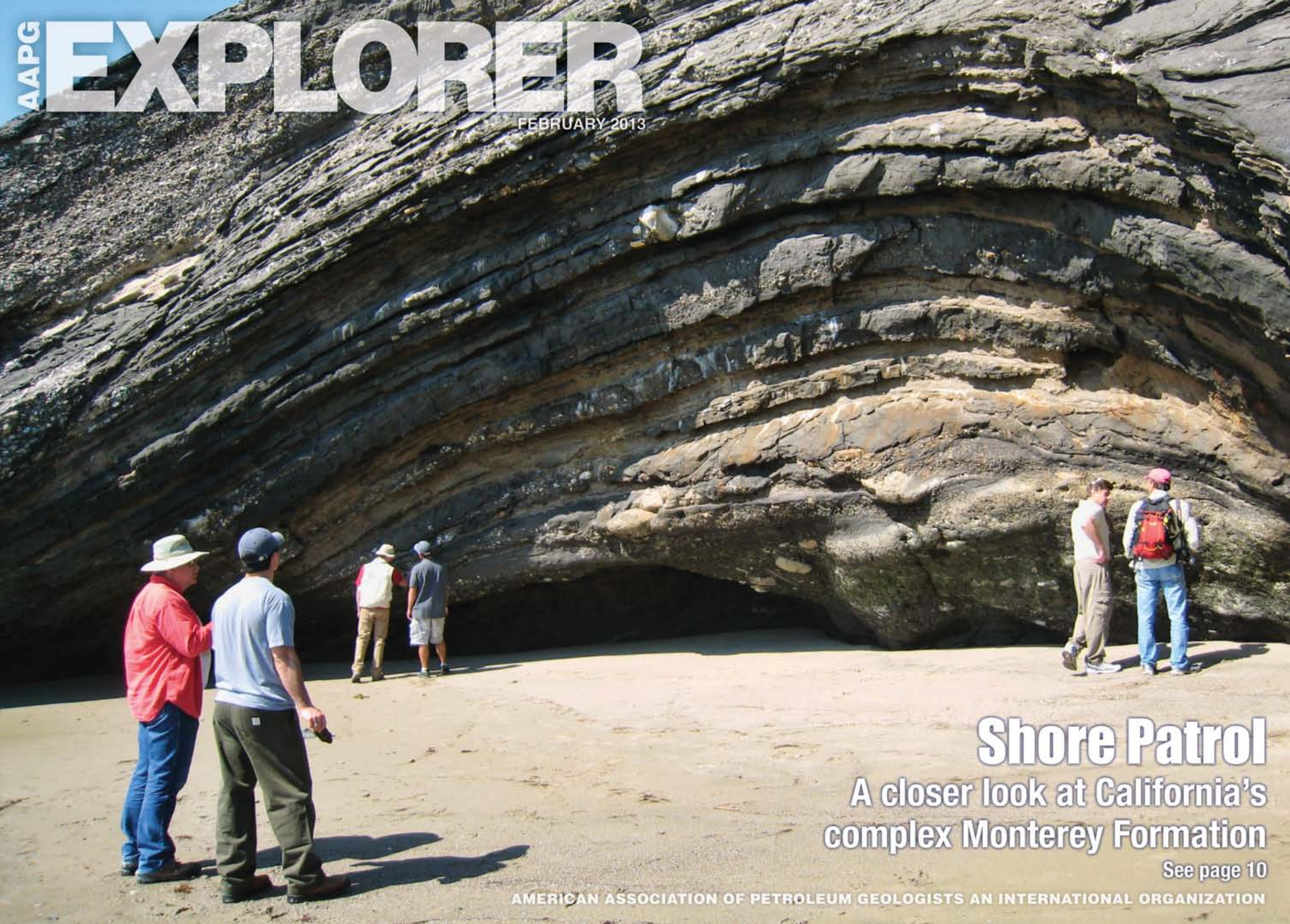
AAPG
EXPLORER
FEBRUARY 2013



Shore Patrol

A closer look at California's complex Monterey Formation

See page 10

AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS AN INTERNATIONAL ORGANIZATION

Vol. 34, No. 2
February 2013

AAPG EXPLORER

PRESIDENT'S COLUMN

Ready or Not, Changes Will Keep Coming

By TED BEAUMONT

"My concept of reservoirs has completely changed."


BEAUMONT

I actually heard an engineer say these words – last summer, while attending a technical conference of geologists and engineers – and he was referring to the rapidly evolving concepts of reservoirs generated from shale gas reservoir research.

At the time it struck me that it was very unusual for an engineer to say this because, in my experience, engineers are sometimes more resistant to change than geologists.

Thinking of shales (or more correctly, mudstones) as reservoirs, however, is an example of a significant evolution of thinking – a progression also known as a paradigm shift.

For example, geologists of my generation learned that shales can act as source rocks when they contain abundant organic matter *and* as seals when they cover porous and permeable sandstones or carbonates.

Thinking of a shale as a reservoir, then, is a sometimes-difficult paradigm shift for geologists of my age.

* * *

Paradigm shifts occur from time to time – and, clearly, they can profoundly affect how petroleum geologists work. Exploring for gas shales, oily source rocks or tight oil reservoirs is profoundly different than exploring for more conventional reservoirs.

	Conventional	Unconventional
Preferred Trap Type	Structural	Stratigraphic
Common Reservoir Lithology	Sandstones and Carbonates	Shales, Tight Sandstones and Tight Carbonates
Reservoir Permeability	Millidarcies	Nanodarcies
Aerial Trap Size	Small	Huge
Geological Risk	High	Low
Drilling Risk	High	Low
Well Type	Vertical	Horizontal
Completion Expense	Low	High

This table compares conventional exploration plays to unconventional plays.

The accompanying table compares conventional exploration plays to unconventional plays – and as the table shows, exploring for shale gas, shale oil or tight oil reservoirs requires a different mindset.

Trap areas can cover many thousands of square miles or square kilometers; permeability is measured in nanodarcys – one billionth of a darcy – and the limit of permeability is determined by the size of the pore throats and the size of the molecules that can flow through them.

Not long ago, petroleum geologists were confronted by another non-geologic paradigm shift – using personal computers to manage and map geologic data. In the years since we first started using them, personal computers allowed petroleum geologists to be much more productive. One geologist now does what it used to require several geologists to do. Today, geologists work with more information and process it much more rapidly.

Some geologists, however, refused to make the transition to using computers to do geology. Those geologists are rare today and probably don't work in larger companies! Using computers is not absolutely necessary but it is hard to imagine being competitive and surviving without them.

There are other examples: Sequence stratigraphy, for example, was a revolutionary method for interpreting patterns of strata caused by sea level fluctuation and basin tectonics. It created a prodigious lexicon of "seq-speak" – and inevitably left non-adopters in its wake.

* * *

To survive and prosper, geologists must evolve along with our science. We need to learn more about source rocks – for example, what is the relationship of pore creation to kerogen maturation.

The investigation of tight rocks is being achieved by technology we need to embrace: pulse decay perm, high resolution CT scanning and ion-milled samples with SEM imagery, for example.

We also need to learn more about completion technology, something that only engineers worried about in the not-too-distant past.

AAPG provides information to help you evolve and you should take advantage of that information. I suggest that during the coming year you consider:

- Attending an AAPG conference or a Geoscience Technology Workshop.
- Taking an AAPG school or online training course.
- Really reading the AAPG BULLETIN or the EXPLORER.
- Surfing *Search and Discovery* or AAPG Datapages.

Paradigm shifts require a response from us. We can refuse to learn about them and become extinct, or we can let our concepts and approaches evolve, allowing us to survive and thrive.

(Special thanks to AAPG member John McLeod, senior geologist for SM Energy Company in Tulsa, for his ideas and edits for this column.)

Ted Beaumont

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
Courtney Chadney
Louise S. Durham
Barry Friedman

TABLEofCONTENTS

REGULARDEPARTMENTS

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

ON THE COVER:

Visitors are traveling far to view the tar-saturated, submarine channel or slope gully deposits at Gaviota Beach near Santa Barbara, Calif., where they see a history of bathyal hemipelagic sediment deposition, burial, diagenesis to chert and dolomite, tectonic uplift to above sea level, erosion, transport and redeposition at bathyal depths all during deposition of the middle to upper Miocene Monterey Formation. In other words, besides providing a fun day at the beach, the outcrops offer some important clues to the complex formation that is both alluring and intimidating to explorers. See story, page 10. Left, an example of detachment fold and chertification. Both photos by AAPG member Richard Behl.

Vol. 34, No. 2

The AAPG EXPLORER (ISSN 0195-2986) is published monthly for members by the American Association of Petroleum Geologists, 1444 S. Boulder Ave., P.O. Box 979, Tulsa, Okla. 74101-3604, (918) 584-2555. e-mail address: postmaster@aapg.org. Periodicals Postage Paid at Tulsa, OK and at additional mailing offices. POSTMASTER: Please send address changes to AAPG EXPLORER, P.O. Box 979, Tulsa, Okla. 74101. Canada Publication Agreement Number 40063731 Return undeliverable Canadian address to: Station A, P.O. Box 54 • Windsor, ON N9A 6J5 • E-mail: returnsIL@imex.pb.com

Advertising rates: Contact Steve Praytor, AAPG headquarters. Subscriptions: Contact Veta McCoy, AAPG headquarters. Unsolicited manuscripts, photographs and videos must be accompanied by a stamped, self-addressed envelope to ensure return. The American Association of Petroleum Geologists (AAPG) does not endorse or recommend any products or services that may be cited, used or discussed in AAPG publications or in presentations at events associated with AAPG. Note to members: $6 of annual dues pays for one year's subscription to the EXPLORER. Airmail service for members: $55. Subscription rates for non-members: $75 for 12 issues; add $72 for airmail service.

Statements, Bios Available Online

Video statements from all AAPG Executive Committee officer candidates continue to be available online at www.aapg.org.

The candidates were filmed responding to the statement, "Why I accepted the invitation to stand for AAPG office." Biographies and individual information for candidates also remains available online.

Ballots for the election will open in spring 2013.

The slate is:

President-Elect

❒ **Randi S. Martinsen**, University of Wyoming, Laramie, Wyo.

❒ **Kay L. Pitts**, Aera Energy, Bakersfield, Calif.

Vice President-Regions

❒ **István Bérczi**, MOL Hungarian Oil and Gas, Budapest, Hungary.

❒ **John G. Kaldi**, Australian School of Petroleum, University of Adelaide, Adelaide, Australia.

Secretary

❒ **Richard W. Ball**, Chevron Upstream, Southern Africa SBU, Houston.

❒ **Sigrunn Johnsen**, independent consultant, ProTeamAS, Stavanger, Norway.

Editor

❒ **Colin P. North**, University of Aberdeen, Aberdeen, Scotland.

❒ **Michael Sweet**, ExxonMobil Production, Houston.


BLAKEY


JACKSON


STONEBURNER


RIESE

Lecturers Set for February

By COURTNEY CHADNEY, EXPLORER Correspondent

AAPG's Distinguished Lecture program will have a high profile in February, with four speakers set for engagements as plans continue for the inaugural Shell Distinguished Lecturer tour.

The speakers who are booked for February are **Ron Blakey**, **Chris Jackson**, **Richard Stoneburner** and AAPG Ethics Lecturer **Rusty Riese**.

Art Saller, previously announced as the Shell Distinguished Lecturer, will be making his first tour in that capacity this spring. His first tour as a North American DL was completed in January, when he spoke to several groups in western North America.

The Shell Distinguished Lecture Program is a new addition to AAPG's DL program, and was made possible through a generous contribution last year by Shell to the AAPG Foundation. It will endow one speaker annually who will focus on topics in the area of petroleum geology related to Canada, Latin America and Southeast Asia.

"The Shell DL program's content, topics and location of tours are more specific and dedicated to enhance certain topics important to particular regions," said Ole Martinsen, senior adviser of exploration at Statoil ASA and co-chair of the DL program.

In other words, the Distinguished Lecture program now has three components:

- A North American roster that provides eight to 10 speakers annually.
- An international roster of two or three speakers each year.
- One Shell Lecturer.

A factor in the creation of the Shell initiative was the prior success of the other two parts of the AAPG DL programs, according to Martinsen.

The "solid, working system of the DL programs," plus the "absolutely top speakers industry and academia can offer ensures quality in the Shell program, and our established cooperation with the international Regions ensures that successful tours can be run," he said.

The DL tours set for February are:

- Blakey will tour Feb. 25-28, speaking to groups in Rolla and Columbia, Mo., and Ottawa, Canada.

His lecture is Using Paleogeographic Maps to Portray Phanerozoic Geologic and Paleotectonic History of Western North America.

- Jackson, this year's Allan P. Bennison lecturer, will tour Feb. 26-March 5, speaking to groups in Golden, Colo.; Billings, Mont.; Casper, Wyo.; Walnut Creek, Calif.; and Bismarck, N.D. He offers two topics:

✓ 3-D Seismic Reflection and Borehole Expression of Tectonically Controlled Deep-Marine Reservoirs; Examples from the Northern North Sea Hydrocarbon Province.

✓ The Impact of Igneous Intrusions and Extrusions on Hydrocarbon Prospectivity in Extensional Settings.

- Stoneburner, this year's Haas-Pratt lecturer, will tour through Feb. 8, speaking to groups in Denver; Casper, Wyo.; Billings, Mont.; and Calgary, Canada.

His lecture is The Exploration, Appraisal and Development of Unconventional Reservoirs: A New Approach to Petroleum Geology.

- Riese will give his ethics lecture Feb. 12 in Bismarck, N.D., and Feb. 20 in Lafayette, La. It is titled Oil Spills, Ethics and Society: How They Intersect and Where the Responsibilities Reside.

New plays, big plays, surprising plays

South America Exploration Earns Hot Reviews

By DAVID BROWN, EXPLORER Correspondent

Scorecard for South American exploration:

The up-and-coming play you've heard about, the big plays you know about, a key company you might not be familiar with and a couple of play areas just evolving.


MONTGOMERY

Ruaraidh Montgomery is senior analyst for the Latin America Upstream Research Team in the Houston office of the global research and consulting firm Wood Mackenzie.

He provided an overview of the current E&P picture in South America.


Photo courtesy of PetroNova

Several factors, ranging from improving work conditions to new geologic understanding of the country's potential, are making Colombia a hot play in South America.

Argentina

The new play on everyone's lips in Latin America right now is Vaca Muerta. That's somewhat unfortunate, since Vaca Muerta is Spanish for "dead cow."

The beef about this play isn't geology or production potential, but politics.

"In terms of geology, so far so good with this particular play," Montgomery noted. "The results have been positive."

Vaca Muerta is an extensive, shale, unconventional resource play in the Neuquen Basin in west-central Argentina. State-owned oil company YPF SA said the total play could hold more than 21 billion barrels of oil equivalent.

Major players in addition to YPF are praising Vaca Muerta's potential – a good sign, according to Montgomery.

Exxon, Shell, EOG Resources, Total and Apache are among the herd of companies who've been active in the area, he said.

"At this early stage, it looks like this is a world-class shale resource for Argentina," Montgomery observed.

"The challenges are all above ground," he added.

Economic problems led Argentina to default on most of its public debt at the end of 2001. The government decided to suppress oil and gas prices through price controls, hoping to use cheap energy to help fuel economic growth, Montgomery said.

Butchering returns caused industry to steer clear of energy investment.

"What they've imposed on the oil and gas industry is a constrained pricing environment," he explained. "As you can imagine, that's very good on the demand side. But on the supply side, it didn't help."

Now, through YPF, the government has direct exposure to its own pricing structure – and a tightened supply-demand picture has brought higher prices, Montgomery said.

But the future development of Vaca Muerta depends on companies having confidence that their investment will be respected, he noted.

The integrated Spanish oil and gas company Repsol SA acquired YPF in 1999. Argentina's government voted to re-nationalize control of YPF in 2012, leaving Repsol to stew over compensation issues, not yet worked out.

"They're not going to reverse things overnight." Montgomery said, "It's going to take time for those higher prices to feed back into investment."

On a more positive note, the Neuquen Basin is a long-established producing area with good infrastructure and excess pipeline capacity. Proppant for hydrofracturing has had to be imported and technical support is limited, but as

See **South America**, page 8

An updip view of the Vaca Muerta, an extensive, shale, unconventional resource play in the Neuquen Basin in west-central Argentina.

South America

from page 6

Montgomery said, "where there's money to be made, the service companies will go there."

Brazil

Subsalt discoveries offshore Brazil have dominated oil exploration news in South America.

"The hottest area (in Latin America) is offshore Brazil. In the offshore, it's been the hot exploration play in the world for the past five or six years," Montgomery said.

That multi-year record of success should take the country toward five million barrels a day of production by the end of this decade, moving Brazil from a major producer to a significant exporter of crude oil, he said.

Home-grown Petrobras has dominated the exploration activity, but a handful of other companies, including BG and Repsol, have been able to participate in the action.

"These people had the good sense to partner with Petobras when opportunities were available," Montgomery noted.

Industry can't expect any favorable terms in the pre-salt play, however. Production now is well established, and the Brazilian government has a habit of using energy policy to support domestic programs.

"As often happens in Latin America, a big resource is developed, it looks good, and then the government changes the rules," Montgomery said.

"That reduces the size of the prize. They're introducing a new set of fiscal terms, which inevitably weights the return in favor of the government," he added.

Colombia

Montgomery called Colombia the "leading light of investment" for industry in Latin America, primarily because of the pragmatism of the country's politicians.

"Companies investing in Colombia have a lot of confidence, when they sign that contract, that their investment has real good protection," he said.

Also, Colombia has been able to dampen the threat from guerrilla rebels and other violence in recent years. Exploration opportunities in the country attract numerous "junior-type companies," Montgomery noted.

"You've seen a lot of companies from Canada – a lot of these companies are headquartered in Calgary – moving into Colombia over the past decade and scoring good exploration success," he said.

"The Llanos Basin is where they like to get involved. There's a lot of targets for them, albeit on the small side," he added.

Industry has found success in developing heavy oil resources with bustling work and some significant discoveries on the eastern side of the basin.

"Ecopetrol, the state oil company, has done good work there," he said. "The main driver behind it is a company called Pacific Rubiales."

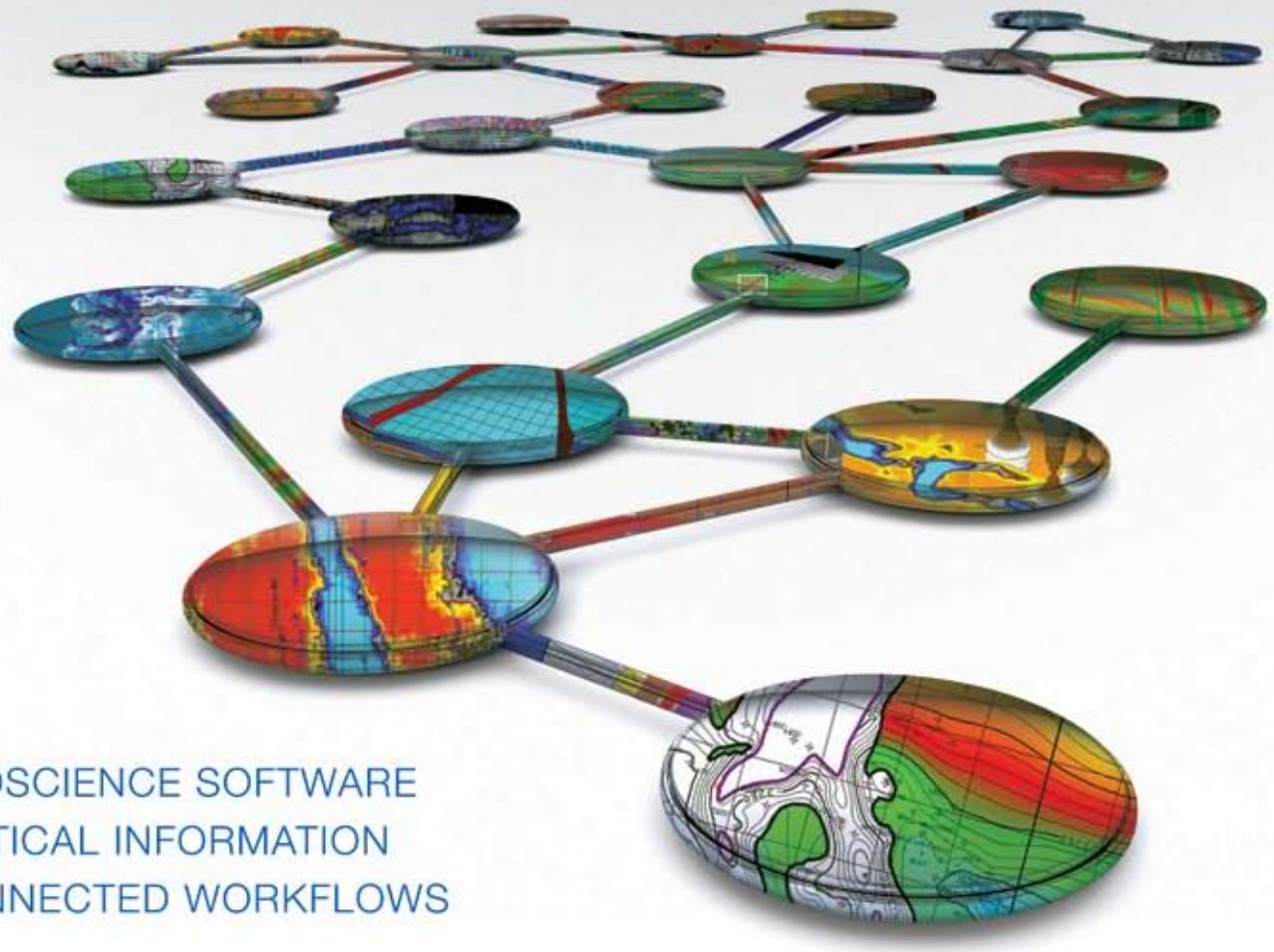
Montgomery described Pacific Rubiales as a company created and operated by former PDVSA employees. Not well-known outside Latin America, it has become the largest independent in Colombia, with operations expanding into Peru and Guatemala.

Earlier this year, Pacific Rubiales announced that it expects to spend $1.7 billion on exploration and development in 2013, with plans to drill about 35 exploration wells and a target of 15-30 percent growth in average daily production.

An improved oil-production picture worldwide hasn't hurt the demand for heavier crude. Montgomery observed that Pacific Rubiales has gotten a premium for its heavy oil from U.S. refiners.

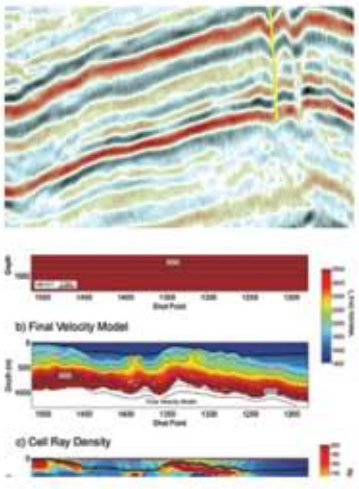
"The heavy oil coming out of Colombia has found a ready market on the U.S. Gulf Coast," he said, "so it has backfilled, especially as Mexico's oil production has declined."

See **Frontier Plays**, page 24



> GEOSCIENCE SOFTWARE
> CRITICAL INFORMATION
> CONNECTED WORKFLOWS

CONNECTED AT EVERY TOUCH POINT



Streamline data transfer and simplify project sharing with IHS geoscience software and critical O&G information.

The IHS suite of geoscience software—which includes IHS Petra®, Kingdom®, LOGarc™ and GeoSyn™—is designed to seamlessly connect to the industry's leading source of critical Oil & Gas information, eliminating the need to move data manually from source to source and project to project. With this powerful new combination, users can streamline data transfer, enhance database performance and simplify project sharing. The result? Workflows that connect like never before.

Connected workflows mean that IHS customers spend less time looking for data and more time looking for the next big opportunity. It's just one of the many ways that IHS helps to advance the decisions that advance the Oil & Gas industry.

Find out more at IHS.com/geoscience

IHS

Out-of-phase detachment folds and low-angle faults in the Monterey Formation at "the Boathouse" section, Vandenberg Air Force Base.

California play full of complexities

Monterey Shale Continues to Tempt and Tease

BY LOUISE S. DURHAM, EXPLORER Correspondent

Environmental activism is essentially synonymous with California.

It has a very public profile. A major Hollywood film actor, for example, is starring in a newly released movie focused on hydraulic fracturing – and it's not the first film of this type.

But Californians often appear to be unaware of something that petroleum geologists and others connected to the industry know to be true: The state has been producing oil – and a lot of it – for more than 100 years.

The bulk of these hydrocarbons originated in the Miocene-age Monterey shale in southern California.

The Monterey has sourced almost all of the oil in the state. This includes producing giant fields such as the Kern River, Elk Hills and Midway-Sunset among others.

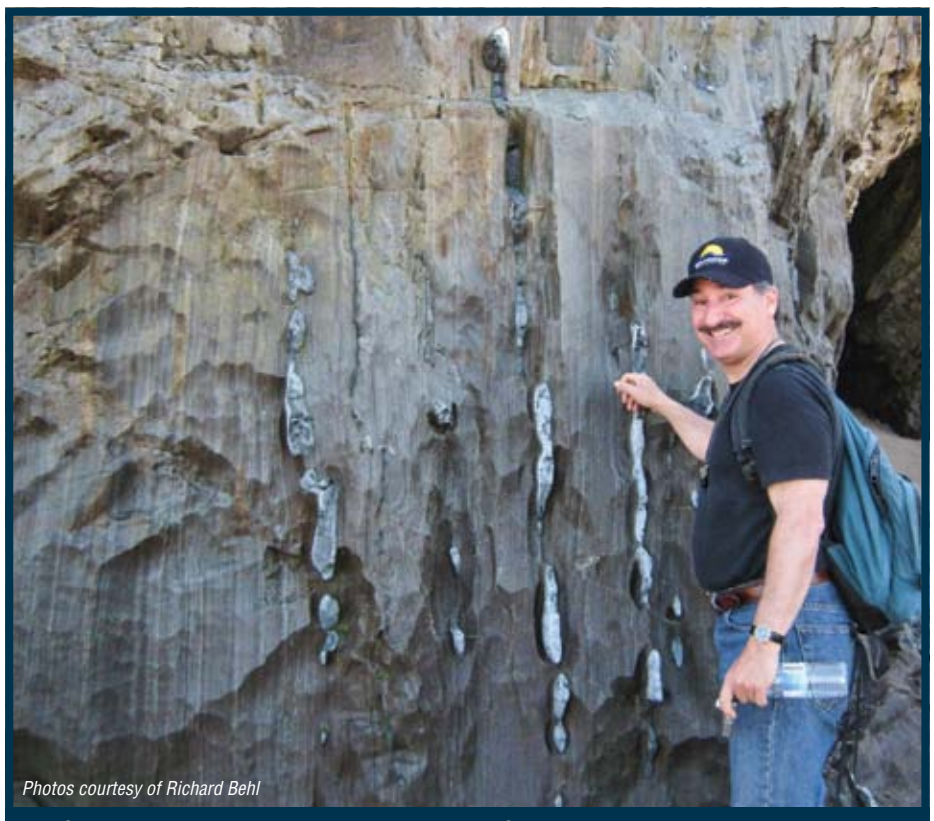
This formation has been estimated to contain more than 500 billion barrels of oil-in-place. Production is from both conventional reservoirs and from the shale itself.

An all-out effort to ramp up E&P in this humongous resource likely would go far to assuage the state's considerable unemployment rate and ongoing budget shortfalls.

Long Beach-based consulting geologist and AAPG member Don Clarke commented that every oil and gas sector job supports four additional jobs.

"The potential is enormous for jobs to be had in the LA Basin," he noted.

Money does talk.



Photos courtesy of Richard Behl

AAPG member Richard Behl, with uppermost opal-CT chert lenses in diatomite at Mussel Rock.

California Gov. Jerry Brown caused quite a kerfuffle in an apparent effort to ease some of the more stringent regulations placed on the industry in this green-leaning state, where some segments of the populace consider fossil fuels to be somewhat less desirable than a deadly plague.

The governor dismissed a top state regulator and his deputy over a dispute wherein the official refused to honor Brown's request to ease key requirements for companies wanting to produce oil in California. Reportedly, every injection project is no longer subjected to a "microscopic" review before obtaining a permit.

"The regulatory area looks much better than it used to be," said geologist Richard Behl, an AAPG member and professor in the department of geological sciences at California State University Long Beach (CSULB).

"There's been some incredible progress," he said. "The companies might have to work hard with the government on regulations and permits, but they are getting permits."

Huge Potential …

Behl heads the industry-sponsored MARS consortium (Monterey And Related Sediments) at CSULB.

The current renewed interest in the Monterey is evident to Behl, who said that even as a professor he receives numerous calls from landmen and companies who want to talk about getting into the Monterey.

He attributes the increased interest in large part to a report issued by the United States EIA in 2011. The report stated the Monterey/Santos play in southern California is estimated to hold 64 percent of the total technically recoverable shale oil resources in the onshore Lower 48 states.

"The numbers probably were overblown, but it was a simple method and had an essence of truth," Behl said. "The truth is the Monterey has long been famous as an organic source rock for oil in California and, in many places, a naturally fractured reservoir.

"It's much thicker than all other shale plays in North America, and the volume

See **Monterey**, page 12

Folded and brecciated chert in exhumed oil reservoir at Lompoc Landing, Vandenberg Air Force Base.

Geoscientists tour and study the phosphatic shale and dolostone found at Lions Head, Vandenberg Air Force Base.

Monterey

from page 10

makes it huge," he noted. "When you do simple calculations using organic content, volume, possible reserves, you come up with gigantic numbers.

"Most shale targets in North America are much less than 200 feet thick at the most, and I was at a place recently where the Monterey is 6,000 feet thick," Behl said. "If there are places there where the organic matter and the rocks are buried deeply enough to generate (oil) and the rocks are not fractured enough to expel oil to be lost at the surface or into other traps, then that's a vast area of targets."

… But A Complex Challenge

The current spate of renewed interest might be a no-brainer, but the Monterey play is no slam-dunk.

"The main uncertainty compared to a lot of the other plays is that the Monterey is highly deformed, and we don't know how extensively fractured the rocks may be off of the tectonic structures where companies have been producing for years," Behl emphasized.

"If it's as fractured as the rocks in the higher parts of structures, maybe the oil is lost already and we're too late," he noted. "What this means is large areas of the Monterey formation that aren't associated with the known structural and stratigraphic traps are now open to exploration.

"It's up to us to come up with a model to find the places where the oil is still there."

To say California geology is complex is an understatement.

In this region so deformed naturally by tectonic forces, oil is free to migrate, whereas it hasn't migrated all that much in other shales.

The Monterey is an unconventional rock, yet so much of its historical production has been conventional in that the oil has been expelled via the fractures to migrate into conventional traps, e.g. sandstone.

Behl noted that in the Los Angeles area, the Monterey and its equivalent are the primary source of oil, but the reservoirs are much younger turbidite sands.

In other words, the formation is both a resource of migrated oil for conventional production and a reservoir for unconventional production. The reservoir rock itself produced in the Santa Maria Basin as far back as 1900.

Another unique feature of the relatively young Monterey is that it currently is generating oil with large areas being in the peak oil generation window. Some of the older Monterey fields have been in existence for fewer than one million years.

Detachment folds, Sweeney Road

Technology and Transparency

It all sounds promising – but what about hydraulic fracturing needed to get at the unconventional targets, you ask?

We're talking California, after all.

"The current state government has been specifically willing to work with industry, but this doesn't mean everyone is on board with enhanced techniques like fracing," Behl noted, "or that all are writing off environmental responsibility.

"California is not unlike everywhere else where people are very concerned about what to them is the new concept of fracing and what it means," he said.

"The general public is poorly informed and very concerned, and they need to understand what this actually entails," he said. "They need to be convinced there is a proper amount of oversight and regulations for this, and that it's not a scary new technology that's going to ruin everything.

"I think the industry will deal with that ultimately."

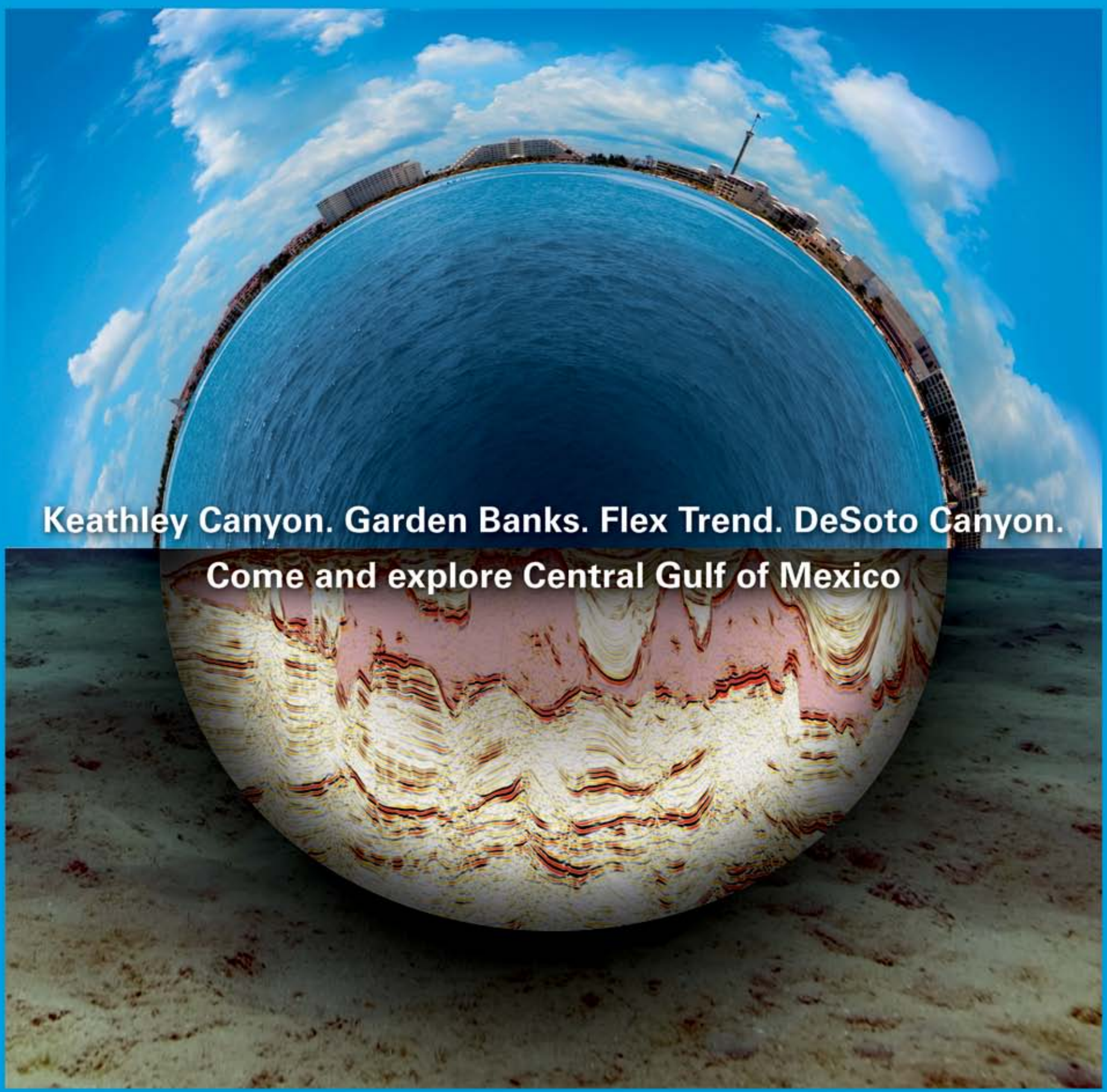
Wells have been hydraulically fractured in California – including the LA Basin – over the years. The "new" entails multi-stage fracturing commonly used/needed to economically produce shale zones.

"If you do a resource play, say, in the L.A. Basin, you would have to do multi-stage fracturing to make the basin really produce," Clarke said, "and you would be very visible.

"There are seven million people living in the greater Los Angeles area, and you cannot be hidden," he emphasized. "The industry will have to be very transparent, very visible."

Interest in the Monterey continues to grow, as evidenced here by the attention and attendance for an AAPG core workshop, held at California State University Long Beach.

Is it geology, or a genuine work of art? Recumbent, chevron folds found at Crystal Cove State Park, near Laguna Beach, Calif.



PGS MultiClient GULF OF MEXICO

Take a fresh look at the Gulf of Mexico for Lease Sale #227

We can provide the data and expertise which will help reveal opportunities and offer new geological insight in this highly prospective region. Our leading edge technology can help to define your search and give you the focus to support your exploration needs. We're ready where you are and committed to providing the right data in the right place at the right time.

Supporting your exploration success

A Clearer Image
www.pgs.com

PGS

gominfo@pgs.com

Field engineers pose with the lid for an EarthScope Transportable Array vault.

'A better look' below

Array Unlocks Sub-Secrets

By BARRY FRIEDMAN, EXPLORER Correspondent

You could think of USArray as being a continental-scale cosmic observatory, except rather than looking up at the sky it looks down into the earth – a CAT scan of the subsurface.

That's because USArray delves, both literally and figuratively, into the most complex and diverse parts of the planet – those parts that contain the oldest rocks and, therefore, record the planet's early formation and evolution.

WOODWARD

And in doing so it gives us, according to Bob Woodward, director of instrumentation services for USArray, "A better look at what we think is there."

The key word is "better," because for geologists, Woodward said, the program will continue to "provide a consistent, synoptic image of the crust and upper mantle beneath the United States."

The USArray (www.usarray.org) is a component of EarthScope (www.earthscope.org), which is funded by the National Science Foundation. Since its first steps a decade ago, it was and is designed to provide a foundation for integrated studies of the continental lithosphere and deep Earth structure.

It comprises four components:

- The **Flexible Array** – a pool of portable seismic instruments (2,146 in total), which are available to the research community for customized targeted studies.
- The **Reference Network** – a dispersed, permanent network of seismic instruments that provides a long-term reference frame for comparison of observations.
- The **Magnetotelluric Array** – a collection comprising both permanent and portable elements that measure naturally occurring electric and magnetic fields. And even though there's not a lot to see, Woodward says, "People take care of them."
- The **Transportable Array** – a network of 400 high-quality broadband seismographs that have been placed in temporary sites (spaced approximately 70 kilometers apart) across the conterminous United States.

It is this fourth element that is yielding the most striking results.

Linking the Old With the 'New'

The Transportable Array seismographs were first placed in the western states – California, primarily – and then, following a two-year period of operation, each instrument gets picked up and moved to the next carefully selected location on the array's eastern edge.

See **Array**, page 16

A field engineer prepares to install – with precision – a broadband seismometer at the bottom of a Transportable Array vault; a fiber optic gyroscope is used to accurately align the sensor.

Transportable Array station K50A, near Lake St. Clair in Casco, Mich. The vault is covered with a mound of dirt to provide thermal insulation, and solar panels recharge the batteries that power the station. A high-performance barometer and an infrasound sensor (located between the vault and the solar panels) measure atmospheric conditions.

Array
from page 14

And there's a reason why USArray started west before moving east: "All the action is in California," Woodward said, laughing.

And because of the data that's been collected scientists now can link geologic structures detected from earlier (and earliest) stages of continental formation to current known and potential geologic hazards (e.g., earthquakes, volcanoes, landslides).

When completed, nearly 2,000 locations will have been occupied during this program.

Where are these locations?

Some are on government facilities, but mostly the stations are located on private property. They're unobtrusive – and like those who place Neilson boxes on home televisions to monitor TV programming, USArray officials want people to forget they're even there.

And even though there's not a lot to see, Woodward says, "People take care of them."

The approach must be working.

"We have had essentially no vandalism," he says. "In fact, people have a certain pride of ownership involving the stations."

And, incidentally, nobody receives a fee for hosting the equipment.

On the Move

The entire USArray observatory was acquired with funds from the National Science Foundation (the Transportable Array part of the budget alone was $30 million).

The program had three phases:

- The construction, which included buying station components, equipment and moving them to their initial locations.
- Maintenance.
- Transportation – as in, moving them eastward.

And while the process began in the early part of the last decade, it wasn't until August 2007 that the first footprint of 400 stations was completed.

Of his total budget – of that $30 million from NSF – Woodward says he's satisfied: "It was enough."

He then immediately laughs when reminded he may be the only scientist to ever say that about funding on a project from the federal government.

The Transportable Array stations consist of a three-component broadband seismometer with associated signal processing, power and communications equipment. In the early phase of the experiment, significant effort was devoted to the design of the temporary vaults to house the instruments, which resulted in a configuration that provides both high-quality data and a data return of greater than 98 percent.

Data from each station are continuously transmitted in near real-time to the Array Network Facility at the University of California, San Diego, where initial operational and quality checks are performed, and then sent to the IRIS Data Management Center, where all the data and associated metadata are archived and then distributed completely openly and without restriction.

The costs, Woodward said, could have been prohibitive if not for something as simple as the market place.

"When designed, the cellphone and data plans were not available."

But now they are, and USArray uses the same technology to move its information as you do when using your phone or tablet to check movie times.

Data in 3-D

So what's being uncovered?

Since the Transportable Array is providing a consistent, synoptic image of the crust and upper mantle, Woodward says of particular interest are the three-dimensional structures within geologic terrains and nature of the boundaries and interactions between them.

That would include:

- ✓ The San Andreas system.
- ✓ The West's Basin and Range region.
- ✓ High Lava Plain.
- ✓ Colorado Plateau.
- ✓ Snake River Plain.

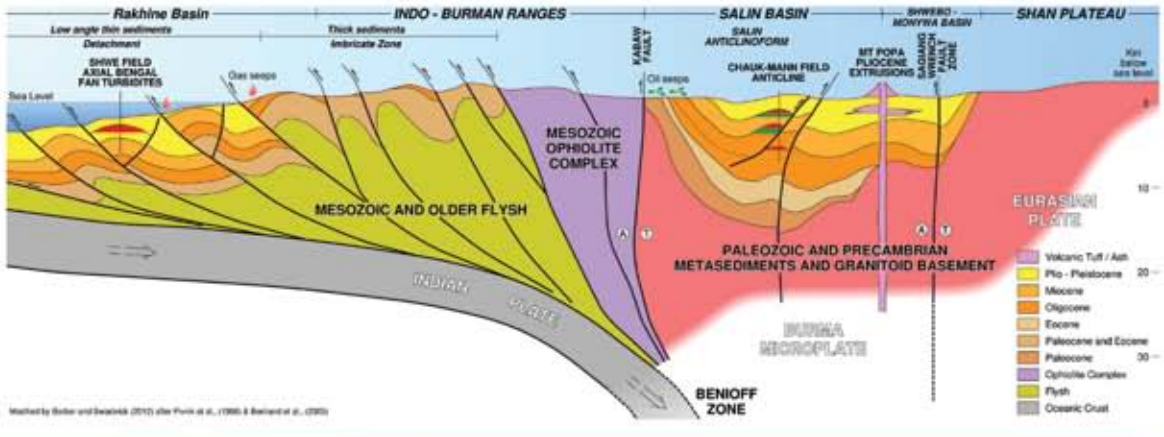
See **Earth Probe**, page 24

Myanmar

Multi-Client Hydrocarbon Prospectivity Study

The Myanmar Hydrocarbon Prospectivity Study

- The Multi-client Hydrocarbon Prospectivity Study of Myanmar is a joint venture project between Searcher Seismic and ISIS that integrates the geology, basin analysis, hydrocarbon habitat, petroleum systems and play fairway trends of Myanmar. The study helps to assess the hydrocarbon potential of the Myanmar region.
- ISIS has extensive knowledge of Myanmar having worked in and around the basins of the region for 10 years across a multitude of different projects. Combining ISIS' deep knowledge with Searcher's multi-client expertise has enabled the joint venture to produce a quality study that will help companies interested in entering the Myanmar region to explore for oil and gas.
- Key content includes analysis of chronostratigraphic and paleographic evolution, key petroleum systems, exploration potential, potential field data interpretation, economics models, block ranking and critical exploration success factors.
- The principal focus basins are the Central Burma Super Basin, Offshore Rahkine Basin / Bengal Fan, Offshore Moattama Basin, Mergui Basin, Mepale Basin and Pre-Tertiary Basins.



Where in the world is ...?

Database Gets Explorers Where They Need to Be

By DAVID BROWN, EXPLORER Correspondent

As the flood of data becomes a tsunami in the Information Age, the question is not:

"Does the information I want exist somewhere in the world?"


SOLLER

The real question is:

"How in the world can I find the information I need?"

That's exactly the question the U.S. Geological Survey addressed when it revised and updated its online National Geologic Map Database (NGMDB), accessible at the website ngmdb.usgs.gov.

Dave Soller is chief of the NGMDB project for the USGS in Reston, Va.

"When you have a website that started 16 or 17 years ago, it's obviously overdue for an update," Soller said. "But we didn't want to go with an update of just the look and feel."

Instead, the Survey took a user-based approach to creating a graphical MapView search interface, a map catalog, a guide to stratigraphy and a separate map interface to locate geological mapping in progress by the USGS, state geological surveys and universities.

A surprising amount of the redesign and update effort was aimed at aiding the non-geologist, non-industry, private citizen.

The U.S. Geological Survey's new National Geologic Map Database provides a wealth of online information for everyone – but is particularly valuable to geoscientists who need to quickly find some geologic and geographic data. Here, a look at the graphical MapView search interface.

"I've had the fewest contacts with my (USGS) colleagues down the hall." Soller said. "They already know where the maps are."

Congressional Mandate

It's fair to call the task daunting. The online map catalog contains references to over 91,000 maps and related products – a majority from the USGS and state geological surveys, but also from more than 600 other agencies, universities, societies and private publishers.

Search results from the NGMDB site can be both impressive and surprising in detail.

A search of map resources in the vicinity of Wood County in Oklahoma uncovered a reference to an extent map of the Mississippi Chat Tonkawa Sandstone contained in a 1953 master's thesis.

And a search on northwest Pennsylvania retrieved several hundred citations relevant to the area's economic geology, including coal resources and the Marcellus Shale.

Congress required the USGS to create a map database with the National Geologic Mapping Act of 1992, specifically mandating a national archive of spatially referenced geoscience data, including geology, paleontology and geochronology.

In addition, the act stipulated that new information added to the database had to adhere to the scientific and technical standards developed under the project.

Given the scope of the mandate, Soller said the description geologic map database is "a little bit of a misnomer – it was given to us by Congress." It was left up to the USGS and the Association of American State Geologists to interpret exactly what Congress wanted in collecting and standardizing geological information.

"What that meant was taking long-developed standards in the paper map world, which were developed going back to the 1800s, and bringing those standards into the digital map world," Soller said.

In addition, the database designers wanted to provide a standard lexicon of geological names – not an easy pursuit, Soller noted, since "everybody uses stratigraphy in different ways, especially industry."

New Look for a New Era

Redesign of the original site started about three years ago and involved merging separate databases into one master database in order to manage all the information, he said.

The website then got a cleaner look with a task bar and four major "buttons" for Map Catalog, Stratigraphy, the

See **Maps**, page 20

You Say Tomato, I Say … Cumquat?

Exploration geologists apparently LOVE making up their own geological terms.

Sometimes they don't even mention a specific unit, saying things like "We're chasing the extension of those Morrowan channel sands," or "We're targeting a zone on top of the Oxhide."

When exploration geologists talk about a play, they often invent names.

✓ In Texas, the "Eaglebine" doesn't exist as a geological unit. That play combines the Eagle Ford and Woodbine formations.

✓ The "Wolfberry" isn't a formation; it's a combination of plays in the Wolfcamp shale and Spraberry sandstone.

✓ Today's hot Mississippi Chat play? "Mississippi" is a loose descriptor and "chat" isn't a geological term at all. It's an oblique reference to weathered chert, limestone and dolomite.

Pity those trying to develop a lexicon of terms used by industry geologists.

"It's frustrating for us because we want to get you the information you need to do what you do best," said Dave Soller, chief of the U.S. Geological Survey's National Geologic Map Database Project.

You won't find these invented geological names on USGS maps.

"A lot of names in the last 30 years are only described in a borehole, or are not really mappable," Soller said.

So don't worry the next time you hear the name of an unfamiliar geological descriptor. It's probably just the exploration geologists making stuff up again.

– DAVID BROWN

Maps
from page 18

MapView interface and Mapping in Progress.

"Really fancy websites don't always mean they're well supported and the users get what they need," Soller observed.

The map catalog itself has both a keyword search interface with drop-down menus and a map interface where areas can by defined using bounding coordinates. Users also can limit a search to a specific state or county.

In addition to a search interface for the USGS Geologic Names Lexicon database, or Geolex, the stratigraphy section includes AAPG's North American Stratigraphic Code.

The initial release of the updated NGMDB website came before all the elements could be completed. The MapView interface includes a map overlay, which recently covered almost the western half of the United States. It looked a little like the United States was being invaded from the left-hand side, but with Kentucky and Virginia already captured.

"What we released last Oct. 19 was the initial version of the new interface," Soller said. "Basically, we have not finished the catalog search. In the next few months we need to clean it up."

The Big Challenge Is …

The geological lexicon database also was a work in progress, with about 75 percent of unit names from the USGS Geologic Names Committee card catalog already included and several thousand unit names remaining to be checked and entered.

Efforts to build and maintain a stratigraphic lexicon tool and other ancillary resources for the maps database added a special degree of difficulty to the project.

Those are "clearly ongoing," Soller noted. "We're not going to declare victory any time soon."

He said gathering and managing content were among the biggest challenges to creating the unified online NGMDB site.

"There's the obvious challenge of information technology. That's a given. But I think really the big challenge is content, bringing together the various resources, things like the maps from the state geological surveys," Soller said.

"You have content issues you think wouldn't exist. But they do," he added.

Users also can find relevant reports and papers cited along with the map search results.

"It's very challenging to bring other resources into the system. Keywords and boundary boxes are not often part of the bibliographic references that librarians use. More frequently, now, but not always," Soller said.

"It all comes down to who you know and the people who want to work with you," he added. "To me it comes down to working with the collaborators and customer service. It's not the technology."

Result Oriented

Today, the general information searcher has grown accustomed to intuitive interfaces, quick results, Google searches and desktop downloads.

"What people are increasingly looking for is downloads of maps and information in pdf form and that sort of thing," Soller said.

"I remember going to a meeting 15 years ago in Canada, a meeting sponsored by the mining industry. The guy from the industry said, 'I appreciate what you're doing, Dave, but I just need to know if you've published a map in the area,'" he recalled.

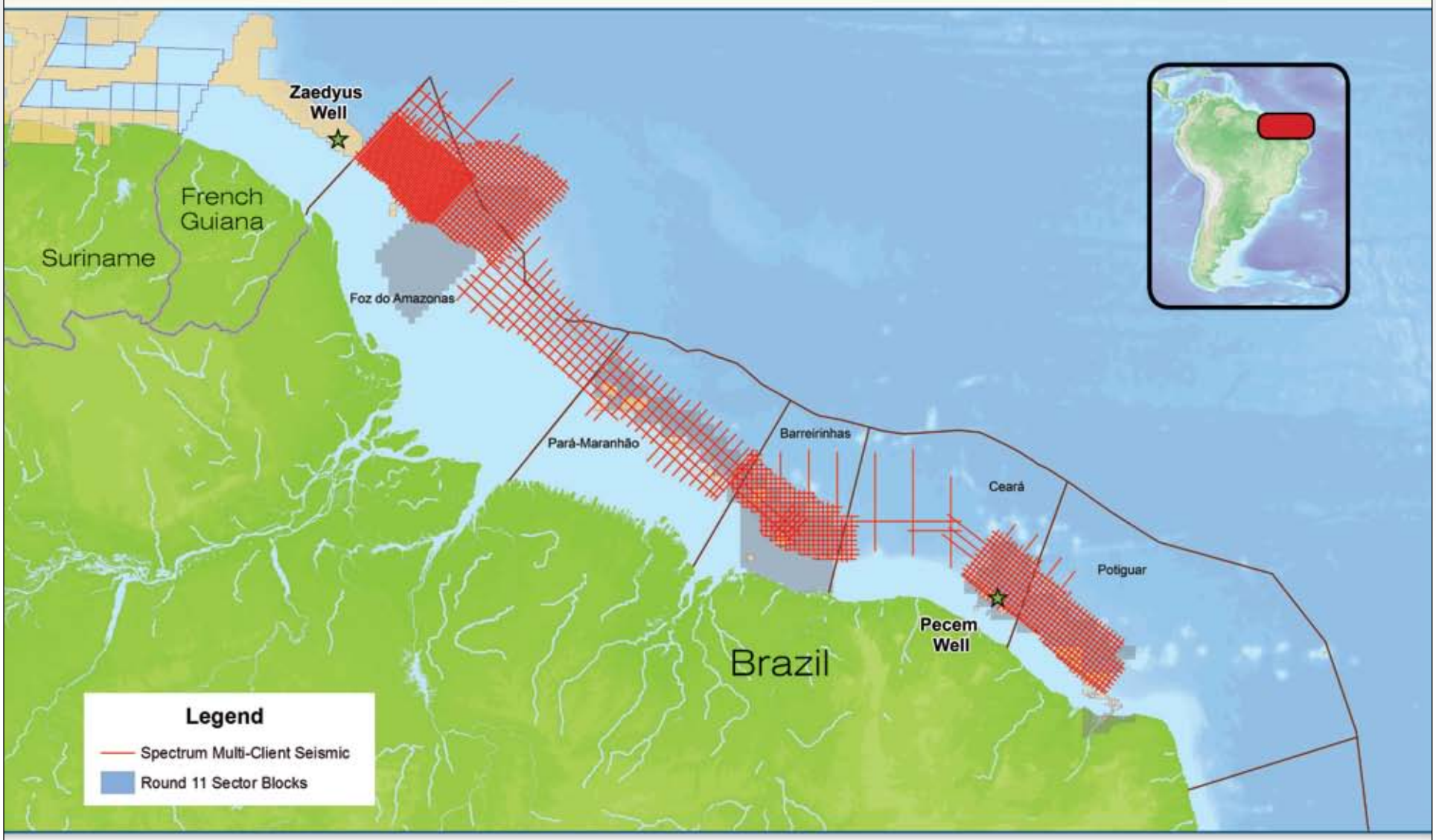
So ease of locating information has guided the USGS approach to the maps project. No matter how valuable a geological information resource might be, it isn't useful if you can't find it.

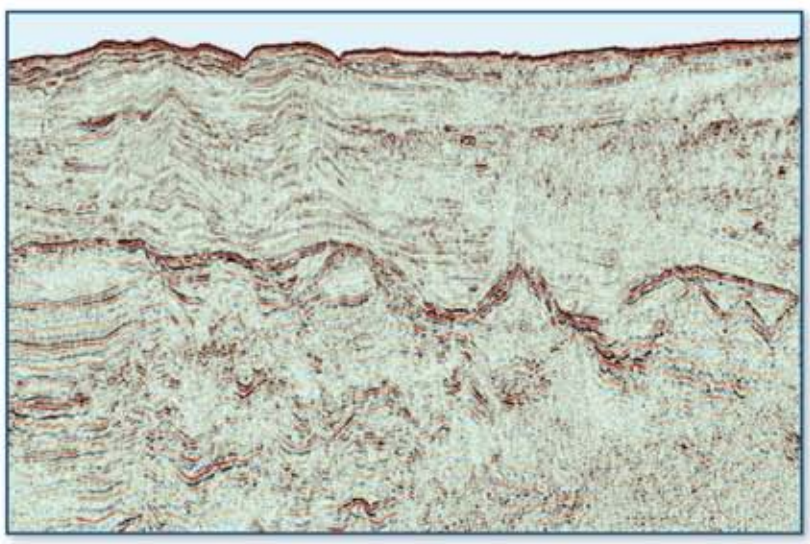
"It's very, very satisfying that we've had good comments from the users, especially of this MapView tool," Soller noted.

"We do the best we can do to make sure people come away from the site with what they're looking for," he said.

Equatorial Margins Brazil

Multi-Client Seismic - Amazonas, Ceara and Barreirinhas Basins





Canyon Features from Foz do Amazonas Survey (Phase I)

Spectrum is active in five basins along the Equatorial Margins of Brazil. We have PSTM and PSDM data available for each of the Foz do Amazonas, Barreirinhas and Ceara surveys all of which were acquired with 10,000m offsets and 13 second record lengths. In addition we have completed acquisition of a 4,200 km survey in the Potiguar basin and fast track migrated stacks are now available for this survey. Final data from the Potiguar survey will be available in April.

Spectrum has also started reprocessing 26,000 km of recently released public domain data from the Foz do Amazonas, Para-Maranhao, and Barreirinhas basins which will be available in Q2 2013.

Our Multi-Client team is committed to delivering high quality data in advance of the upcoming Round 11. Companies participating in Spectrum's programs will have a competitive advantage in this round.

Spectrum

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

U.K. Tackling the Pros and Cons of Shale Plays

By LOUISE S. DURHAM, EXPLORER Correspondent

As shale gas E&P morphed from boomlet to outright boom in the United States, shale deposits around the globe began attracting considerable interest for potential production of hydrocarbons.

Europe, in general, appeared poised to go all out to develop certain known shale beds.

Speculation was rife that the Silurian-age shales in Poland would prove to be a major supply of highly desired natural gas from the homeland.

Some companies quickly began to focus on exploring and drilling these shale zones, but regulatory issues and some disappointing drilling results soon tempered the initial enthusiasm.

France placed a total ban on hydraulic fracturing, which is crucial to shale development. The United Kingdom initially followed suit with its own ban.

The good news, however, is that the U.K. Department of Energy and Climate Change (DECC) lifted the moratorium in December.

The DECC also announced it would establish an "Office for Unconventional Gas and Oil" to assist with expediting regulations, including those related to hydraulic fracturing.

The rumor mill is churning, and there's even mention of tax breaks to encourage shale gas development.

It all sounds promising, but it likely will be a bumpy road between here and there.

Yes, the fracturing ban was lifted, but other obstacles – environmental assessments, public consultations and more – likely will restrict new drilling activity to a snail's pace for some time to come.


STEPHENSON

> "Britain is less used to oil and gas exploration onshore activity, and these very small tremors caused so much alarm."

Blackpool's Allure

One area attracting operators' attention in the United Kingdom is the region enveloping the coastal resort town of Blackpool in northern England's Lancashire County.

The area lies within the Carboniferous Northern Petroleum System (NPS), which is one of the United Kingdom's two major petroleum systems. The other is the Mesozoic Southern Petroleum System.

The NPS is a complex, multi-faulted array of carboniferous basins and uplifted highs for the most part, according to the U.S. Energy Information Agency's "World Shale Gas Resource: An Initial Assessment of 14 Regions Outside the United States – January 2011."

The NPS boasts a 100-plus-year history of hydrocarbon exploration. The result: Several large oil fields have been discovered, reportedly containing more than two billion barrels of oil-in-place.

The main source rock is the marine Namurian Bowland Shale, which has an average depth of 4,800 feet in the prospective area. It's organically rich, with total organic content ranging from 1 percent to 10 percent and averaging 5.8 percent, the EIA 2011 assessment noted.

Cuadrilla Resources received a license to explore in this region in 2008, ultimately discovering gas in the Bowland shale close to Blackpool at a depth of 4,000 feet.

Trouble soon came knocking.

The initial hubbub – and ensuing ban – surrounding hydraulic fracturing in the United Kingdom was triggered when a couple of minor earthquakes occurred in this area in the spring of 2011 coincident with fluid injection into a nearby well being operated by Cuadrilla.

"These were very tiny seismic tremors, and only 50 people felt the larger one," said Mike Stephenson, head of energy for the British Geological Survey (BGS) and director of the Nottingham Centre for Carbon Capture and Storage.

"But Britain is less used to oil and gas exploration onshore activity," he noted. "and these very small tremors caused so much alarm."

Stringent Controls

Stephenson emphasized that the recent lifting of the hydraulic fracturing ban is conditional on a number of highly stringent controls. One of these entails use of a triggering mechanism indicating whether a well causes an event above a certain size, dictating that the operator must cease the fracturing procedure.

Cuadrilla estimated there may be as much as 200 Tcf of shale gas waiting to be tapped in this region – but more drilling is needed to determine how much of this resource might be recoverable. The company essentially has been waiting for the fracturing regulations to change.

Various outlets reported that the BGS attributes 300 Tcf to the Bowland Shale in the Bowland Basin east of Blackpool.

Not so, according to Stephenson.

"That number was just made up by the press and is just speculation," he said. "Essentially, we'll produce a range of figures because of the uncertainties involved."

The definitive word will be available soon.

At press time the DECC was readying to release a report on the shale gas reserves.

Given the big resource numbers being tossed around, it's to be expected that big players appear eager to stake a claim.

ExxonMobil is chatting with United Kingdom hydrocarbon producer Igas Energy about possibly taking a stake in Igas' Bowland Shale gas project in Lancashire.

Don't be surprised to see a bidding war given that other large players are said to be eager to muscle their way in as well.

Another view of the Vaca Muerta, an extensive, shale, unconventional resource play in the Neuquen Basin in west-central Argentina that is among South America's hottest plays.

Frontier Plays
from page 8

Other Activity

A line of basins hugs the eastern flank of the Andes down the length of South America. The Middle Magdalena Valley Basin in northwest Colombia is a rare resource-play prospective basin on the west side of the Eastern Cordillera.

"It's the basin where Colombia's oil and gas industry started, so it's a fairly mature basin," Montgomery said.

Players see a very attractive above-ground picture and a promising prospect in the La Luna shale.

"Shell and Exxon have quietly been building up positions in this basin," Montgomery noted.

"But very few wells targeting the shale have been drilled. Very few fracs, if any, have been done," he said.

An emerging equatorial margin play runs along the entire northeast coast of South America, from the eastern Venezuela coast, along Guyana, Suriname and French Guiana, to the northern coastal area of Brazil.

"What they're hoping to replicate there is the exploration success seen in West Africa. So this is your mirror-image theory. There are a lot of geological similarities," Montgomery said.

He noted that Brazil will hold a licensing round for the northern offshore. Given the extreme frontier nature of the play, industry can expect a favorable shake.

"Hopefully, after quite a few years of delay, we'll see them start to lease this area," he said. "We expect bidding for that acreage to be pretty intense."

Earth Probe
from page 16

✓ Yellowstone National Park region.
✓ The Rocky Mountain front range.
✓ The Colorado Plateau.

"Seismic combined with magnetotelluric and geodetic data from EarthScope's Plate Boundary Observatory are providing new insights into deformation and fluid content in Pacific Northwest, as well as higher resolution Flexible Array studies of targets of special geological interest that can be carried out with more dense arrays of instrument deployments," he added.

"In contrast to the Transportable Array's fixed geometry of 70-kilometer spacing and two-year recording with broadband instruments, the geometry, duration and instrument type used in these Flexible Array experiments can be tuned to fit the specific geological targets under study.

"It is giving us," he concluded, "a much more complete picture of the continent."

Surprises Yet to Come

The project is unique in many respects – not the least of which is how it began.

Usually when a funding proposal is presented for a project, Woodward said, the proposal includes a hypothesis.

"What's different about EarthScope – and the Transportable Array, in particular – is that the project laid out a systematic survey," he said. "People didn't know what they would find."

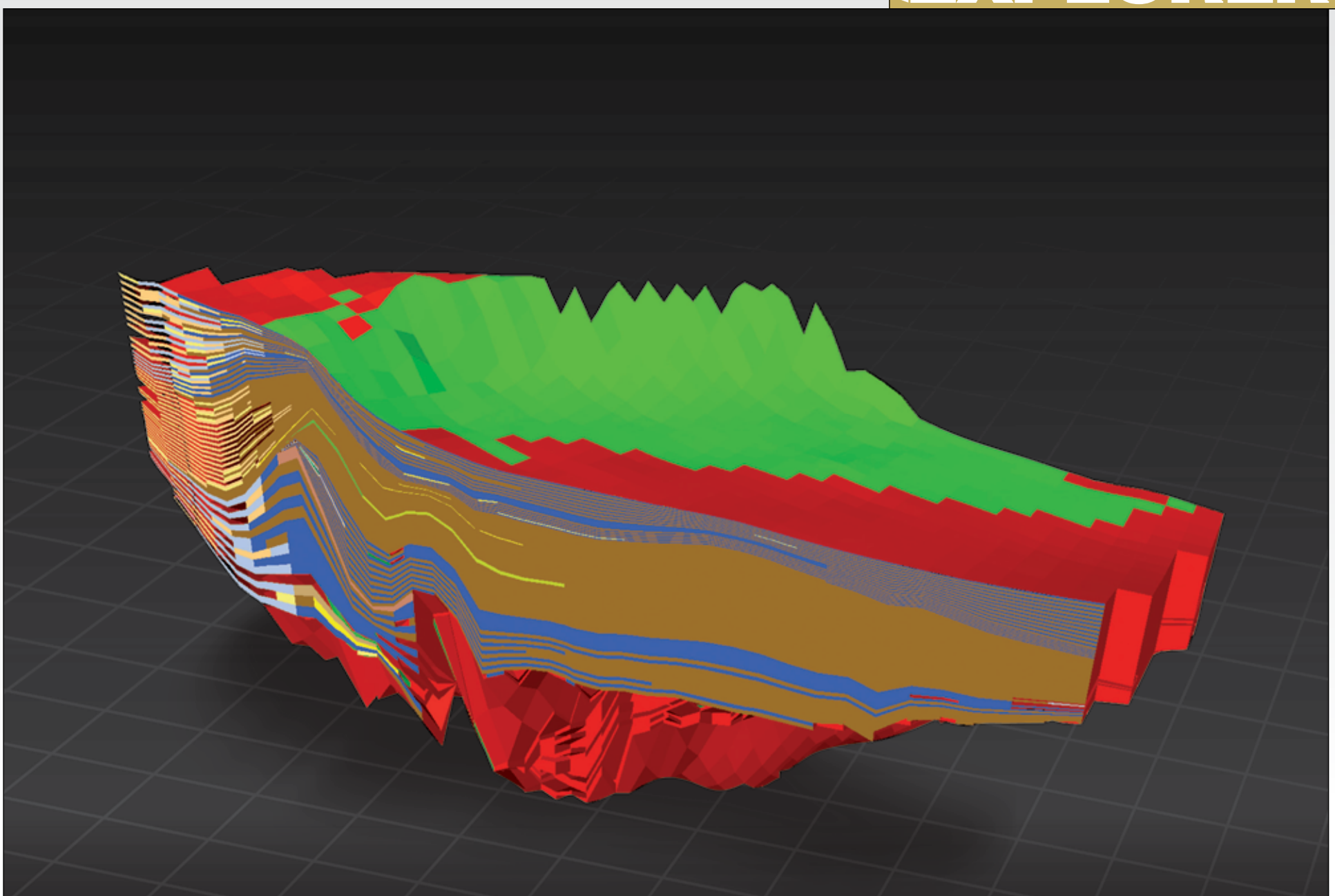
In the future, Woodward said he's looking forward to the Transportable Array's move from along the eastern side of the Mississippi River to the mid-Atlantic and northeastern regions, as well as the work planned for Alaska and Canada, which should start in 2014.

"On second thought," he says, "if we had more money, we'd be buying more instruments and leaving them in place."

* * *

For more information about USArray, visit www.usarray.org, or email usarray@iris.edu.

EarthScope facilities are funded by the National Science Foundation and are being operated and maintained as a collaborative effort by UNAVCO Inc. and the Incorporated Research Institutions for Seismology, with contributions from the U.S. Geological Survey and several national and international organizations.



Fracturing vs. mining

Is One Technology Better Than the Other?

By LOUISE S. DURHAM, EXPLORER Correspondent

Hydraulic fracturing versus surface coal mining: Is one safer for the environment than the other?

A new study is attempting to provide some data for the debate.

First, some background on the reason for the question – it goes beyond the fact that Hollywood actor Matt Damon just made a movie about the subject.

Hydraulic fracturing technology may have shed some of its many outspoken foes, but it's still an uphill struggle to gain acceptance in many areas.

New York, for example, continues to say no to the technology, while neighboring states such as Pennsylvania are on board, helping to boost the domestic energy supply while enriching the state coffers considerably.

Proponents claim that even though hydraulic fracturing entails underground high-pressure injection of great volumes of water mixed with proppants and various chemicals, it's been used safely by the industry for many years. Critics claim it does indeed contaminate ground water, although they've yet to prove their case conclusively.

Disposal of the wastewater generated by the fracturing procedure also has come under attack by various individuals and organizations – and those criticisms are increasingly becoming a focal point in the dynamic.

In light of all of the fuss over the past couple of years, then, comes an ongoing project that seeks specifically to compare the potential harm of hydraulic fracturing to that of surface coal mining, which is yet another major power-generating fuel source.


LUTZ

> "This is about trying to put their environmental impacts into comparable units so that informed decisions can be made about our energy future."

Brian Lutz, who recently departed Duke University to become assistant professor of biogeochemistry at Kent State University, is busy at work on this issue.

"The work I do is sort of at the interface of energy extraction of the environment and understanding environmental impacts," Lutz said. "We've mostly been working on surface coal mining and hydraulic fracturing."

Getting the Whole Story

Just don't expect to get an either-or from this effort.

Lutz noted that rather than attempting to deliver a concrete answer to whether surface coal mining is better or worse than hydraulic fracturing, the work is more focused on how to develop a framework by which the environmental impacts can be put into comparable units in order to compare the tradeoffs.

"It's not a black and white message," he emphasized.

"It's essentially a back-of-the-envelope calculation we've performed using the general strengths of our existing knowledge," he said, "and substantial uncertainties remain in some key areas.

"It allows us to estimate total water pollution load that could potentially come from coal mining as well as from hydraulic fracturing, and then convert these to similar units of energy."

Natural gas has a much smaller greenhouse gas footprint, and Lutz noted that's a quantifiable framework that's pretty clear-cut.

The research team is trying to move environmental impacts of the extractive side to a similar framework where they can begin to put numbers to wastewater pollution loads of each of these resources.

"When thinking about the water quality impacts of each of these different energy extraction practices, they're very different," Lutz said.

"With hydraulic fracturing, the wastewater load is generated from the well and it's a containable wastewater volume," he noted. "But with surface mining, the wastewater load is generated in-situ from precipitation interacting with the mined spoil.

"In the mining landscape, you have precipitation every year, and in hydraulic fracturing you get a pulse of water back shortly after the well is turned on," Lutz said.

"There's a different temporal dynamic to each," he pointed out. "Hydraulic fracturing is much more of a one time deal, with mining generating this pollution load every year."

He did note that hydraulic fracturing produces less wastewater per unit energy than conventional natural gas production in the Marcellus region.

Lutz summarized the issue overall.

"Both mountaintop coal mining and hydraulic fracturing can have substantial environmental impacts," he emphasized. "Nevertheless, we must make decisions about what resources we are going to rely on to meet our energy needs.

"In doing this, we need to recognize that there are real tradeoffs between these different energy extraction practices," Lutz noted, "and we can't evaluate their environmental impacts in isolation.

"This is about trying to put their environmental impacts into comparable units so that informed decisions can be made about our energy future."

Will be honored in Pittsburgh

Michigan Educator Wins Teacher of the Year

By SUSIE MOORE, Communications Project Specialist

Chris Bolhuis, ninth grade earth science teacher at Hudsonville Freshman Campus in Hudsonville, Mich., has been named 2013 AAPG Earth Science Teacher of the Year.

Bolhuis, a 16-year teaching veteran at Hudsonville – who also teaches an elective geology course for juniors and seniors at the school – prefers inquiry-based learning for inspiring his students.

BOLHUIS

"In the classroom, I believe inquiry based learning is the key," Bolhuis said during the TOTY nomination process. "It helps students generate their own questions that are testable and important to them in the context of our studies."

He was nominated by AAPG's Eastern Section.

The AAPG TOTY award, funded annually by the AAPG Foundation, is a $6,000 prize that will be split into two parts: half will be designated for Bolhuis' personal use, and half goes to Hudsonville Freshman Campus for educational use under Bolhuis' supervision.

Bolhuis also will receive an all-expense paid trip to the AAPG Annual Convention and Exhibition in Pittsburgh, Pa., May 19-22, where he will be presented with his award at the All-Convention Luncheon.

An interview with Bolhuis will be featured in the May convention issue of the EXPLORER.

PROFESSIONAL newsBRIEFS

Steve Dorobek, to principal geologist, BHP Billiton, Houston. Previously carbonate sedimentologist/stratigrapher, BP, Houston.

Andrew Hanson, to associate dean, University of Nevada, Las Vegas (UNLV) Honors College, Las Vegas. Hanson will continue to direct the Salt Thermal Anomalies Research (STAR) consortium at UNLV.

Roger Humphreville, to senior director of government affairs-technology, BP, Washington, D.C. Previously head of chief scientist's office, BP, London, England.

S. Allen Hunter, to deepwater geophysicist, Stone Energy, Houston. Previously senior geophysicist, Nexen Petroleum, Plano, Texas.

Peter S. Joslin, to vice president-business development, Red Willow Production, Houston. Previously manager of joint ventures and business development, Swift Energy, Houston.

Kirk D. Kiloh, to consulting petroleum geologist, Broomfield, Colo. Previously senior geological adviser, Forest Oil, Denver.

Ross Peebles, to senior vice president-E&P services, Global Geophysical Services, Houston. Previously vice president of interpretation-E&P services, Global Geophysical Services, Houston.

Miguel Ramirez has retired from ExxonMobil. He will reside in Bogota, Colombia.

Steve Savoie, to senior geologist, Ally Exploration, Traverse City, Mich. Previously senior geologist-Michigan basin and the southeast Ohio Utica/Point Pleasant Play, Chevron North America, Traverse, Mich.

Erik Scott, to sedimentology/stratigraphy adviser, Talisman Energy, The Woodlands, Texas. Previously geology specialist-reservoir characterization, Marathon Oil, Houston.

Lawrence "Larry" Scott, to vice president, Global Microseismic Services, Houston. Previously vice president-microseismic, Global Microseismic Services, Missouri City, Texas.

Yusak Setiawan, to country manager, Murphy Oil, Indonesia. Previously exploration manager Murphy Oil, Indonesia.

John Smoot, to owner, geologist, Smoot 4D GeoViz, Kennewick, Wash. Previously senior geologist, PRC, Richland, Wash.

"Professional News Briefs" includes items about members' career moves and the honors they receive. To be included, please send information in the above format to Professional News Briefs, c/o AAPG EXPLORER, P.O. Box 979, Tulsa, Okla. 74101; or fax, 918-560-2636; or e-mail, smoore@aapg.org; or submit directly from the AAPG website, www.aapg.org/explorer/pnb_forms.cfm.

Edith Allison, director of AAPG's Geoscience and Energy Office in Washington, D.C., can be contacted at eallison@aapg.org; or by telephone at 1-202-643-6533.

POLICYWATCH

EPA Fracturing Study Moves Forward – Slowly

By EDITH ALLISON, GEO-DC Director

The Environmental Protection Agency (EPA) released its "Study of the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources: Progress Report" in late December. The progress report depicts a complex study that is making slow progress.

EPA also reports that the study has added additional public participation through:

✓ Technical roundtables and workshops.

✓ A large and diverse panel of nominees for the EPA Science Advisory Board (SAB) panel on hydraulic fracturing.

✓ Federal Register requests for information on advances in industry practices and technologies.

The study encompasses the full lifecycle of water used in hydraulic fracturing: water acquisition, chemical mixing, well injection, flowback and produced water, and wastewater treatment and disposal.

Congress asked the EPA for this study in 2010, and the final report is not due until 2014. This interim report is lengthy – over 250 pages – but lacks information about how far various study elements have progressed.

The report also lacks interim research results and provides no information about what will be in the final report.

The EPA press release states, "While this progress report outlines the framework for the final study, it does not draw conclusions about the potential impacts of hydraulic fracturing on drinking water resources, which will be made in the final study."

ALLISON

Congress asked the EPA for this study in 2010, and the final report is not due until 2014.

Study Status

The progress report suggests that most of the study elements have started but may be far from complete. In addition, EPA has modified or eliminated a few planned studies.

To date:

- EPA currently is evaluating well construction and hydraulic fracturing procedures at 333 wells drilled by nine different operators in major shale gas basins. This effort will assess the effectiveness of current industry practices to contain liquids and gases during and after hydraulic fracturing.

- EPA is collecting and evaluating data on the chemical composition of hydraulic fracturing fluids using the FracFocus chemical disclosure registry and information that EPA requested on 25,000 fracturing treatments conducted by nine service companies.

The addition of FracFocus data to the study reflects the importance of industry-provided data. The FracFocus website, hosted by the Ground Water Protection Council and the Interstate Oil and Gas Compact Commission, currently holds data on about 35,000 wells.

- EPA is analyzing water samples and modeling hypothetical scenarios to evaluate the potential for hazardous chemicals occurring in public water supplies located downstream from facilities that treat hydraulic-fracturing wastewater.

- Also in progress is computer modeling of potential ways in which hydraulic fracturing chemicals or reservoir fluids could migrate from shale gas formations to aquifers.

- Other computer modeling will predict the impacts of water used for hydraulic fracturing on drinking water supplies in the upper Colorado River and Susquehanna River basins.

- EPA also is compiling data on the chemistry and toxicology of over 1,000 chemicals used for hydraulic fracturing.

- EPA is compiling information on the causes and volumes of spills of hydraulic fracturing and wastewater fluids using state and national databases of chemical spills.

- EPA has completed multiple rounds of retrospective water sampling at five case study locations in Colorado, North Dakota, Pennsylvania and Texas. EPA collected multiple samples from 70 domestic water wells, 15 monitoring wells and 13 surface water sources near previously completed wells and expects to collect additional samples in the future.

The progress report does not provide any sampling results or water analyses.

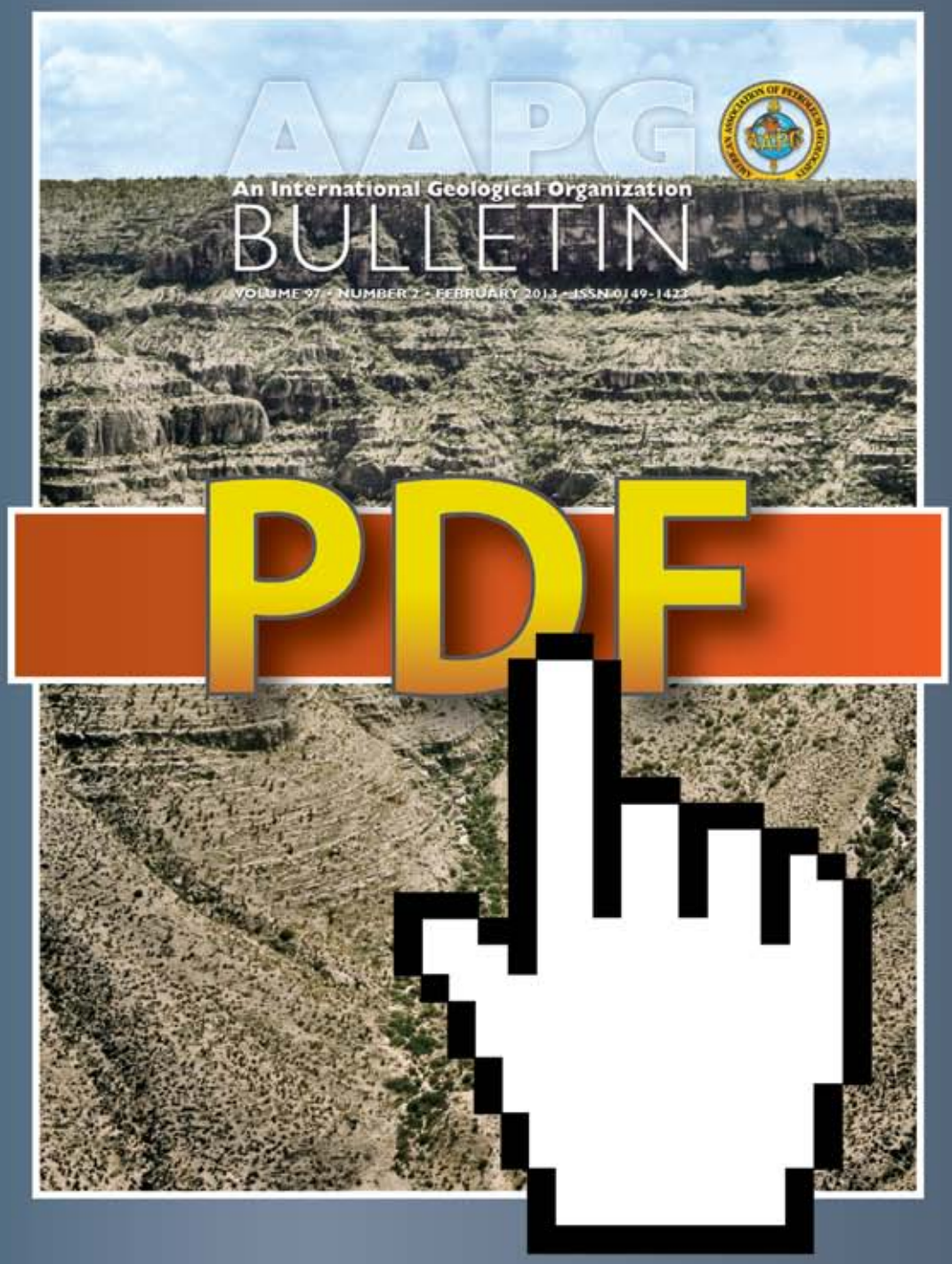
- EPA plans prospective case studies, collecting water samples before, during and after hydraulic fracturing operations, at locations not yet chosen. A planned study in De Soto Parish, La., has been dropped.

- EPA has decided to not study the interactions between hydraulic fracturing fluids and various rock formations, noting that the U.S. Department of Energy National Energy Technology Laboratory and Pennsylvania State University are conducting similar work.

See **EPA Study**, page 34

DOWNLOAD

Your NEW February 2013 Bulletin Now!



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.

Article highlights include:

Surprising Results of OM-Hosted Porosity

Kitty L. Milliken, Mark Rudnicki, David N. Awwiller, and Tongei Zhang

Most pores in the Marcellus Formation of Pennsylvania detectable by field-emission scanning electron microscopy are associated with organic matter (OM) rather than mineral matrix. These pores do not show any change in abundance or type that can be correlated with thermal maturity.

A New Dimension of Seismic Data

Hongliu Zeng

Thickness tuning and frequency tuning are two elements crucial to understanding the uncertainty in interpreting seismic data. Frequency-dependent seismic stratigraphic and facies interpretation of field seismic data can be achieved by selective use of frequency-dependent seismic attributes.

Ranking Geologic and Engineering Parameters

Faruk O. Alpak, Mark D. Barton, and Stephen J. Naruk

A detailed flow-simulation study has identified channel width, net-to-gross, degree of amalgamation, and parameters that describe the distribution of shale drapes, as influential stratigraphic architecture parameters that govern recovery factor behavior in channelized turbidite reservoirs/

Fluidized Sand

Anthony Scott, Andrew Hurst, and Mario Vigorito

This paper examines the relationship between sandstone intrusion distribution, sandstone-body connectivity, architecture, microtexture, porosity, and permeability in the Great Valley sequence, California, in a series of remobilized slope channel complexes and fluidized sand.

Members may access the AAPG Bulletin online at:
www.aapg.org/february_bulletin

Also, submit your next paper for consideration via www.aapg.org/bulletin

Online Registration Opens for ACE

Online registration for this year's AAPG Annual Convention and Exhibition is now available – and early registration means big savings on fees.

The 2013 ACE will be held May 19-22 at the David L. Lawrence Convention Center in Pittsburgh – the first time an ACE event has been held there, and the first time since 1986 for AAPG to hold its annual meeting in the eastern United States.

This year's theme is "Go Deep: Making the Play With Geotechnology."

Details of the meeting – including the complete technical program, field trips, short courses and various events – can be found in the official ACE announcement that accompanied the February EXPLORER.

Some of the highlights include:

- Sunday's opening session, featuring the bestowing of AAPG honors.
- James Palm, CEO of Gulfport Energy, who will talk about "Proving Up the Utica's Liquids Window."
- Jeff Ventura, president and CEO of Range Resources, talking about his company's involvement in discovery and commercialization of the Marcellus Shale.
- The Discovery Thinking Forum, this year built on the theme, "Important Discoveries Expanding Resource Play Concepts."

As in past years, a discounted fee schedule will be offered to those who register early for the meeting. For example, members who register on or before March 25 can save $200 off the full price.

To register, and for more ACE information, go to aapg.org/pittsburgh2013.

EPA Study

from page 32

Public Participation

EPA's hydraulic fracturing study is controversial with both proponents and opponents of hydraulic fracturing – and perhaps in response to highly charged public opinions, EPA recently announced additional opportunities for stakeholder engagement.

EPA stated goals of this enhanced engagement process are to improve public understanding of the study; ensure that the EPA is up to date on advances in industry practices and technologies; and obtain timely and constructive feedback on ongoing research projects.

Stakeholders and technical experts are being engaged through the following activities:

- **Technical roundtables**, with invited experts from diverse stakeholder groups to discuss the work under way to answer key research questions and identify possible topics for technical workshops. Five roundtables were completed in November, and additional ones may be held in 2013.
- **Technical workshops**, with experts invited to participate in more in-depth discussions and share expertise on discrete technical topics relevant to the study.
- **Information requests** through Nov. 9, 2012, Federal Register notice, requesting that the public submit relevant studies and data. Additional data requests are planned for 2013.
- **Periodic meetings** of the EPA Scientific Advisory Board, Hydraulic Fracturing Advisory Panel. A panel meeting is planned in March to review the 2012 progress report.

Technical Roundtables

EPA hosted five half-day roundtable meetings last November, addressing water acquisition, chemical mixing, well injection, flowback and produced waters, and wastewater treatment.

For each roundtable, EPA presented its work to experts nominated by the public and asked for input on specific topics to be included in future workshops. Summaries of the November meetings will be available at the EPA website.

Topics for future roundtables will be announced in 2013.

Technical Workshops

Technical workshops, which are expected to allow more detailed discussion than occurred in the roundtables, are planned in 2013. For each meeting experts will be solicited, and each workshop will be followed by a public webinar.

Planned technical workshops are:

- Analytical Chemical Methods, Feb. 25, at the EPA Campus in Research Triangle Park, N.C. (Nominations of experts were invited from Dec. 11 through Jan. 8.)
- Water Acquisition: Assessing impacts through modeling and other means (target date April).
- Wastewater Treatment and Modeling (target date April).
- Well Construction/Operation and Subsurface Modeling (target date early June).
- Case Studies (target date early June).

Science Advisory Board (SAB) Participation

The SAB panel on hydraulic fracturing, which will be responsible for reviewing the interim and final reports, should be diverse and balanced.

In late December over 140 experts were chosen as candidates for the panel. After a public comment period EPA will designate a smaller panel that will begin work in March with a review of the 2012 progress report.

Candidates represent the diversity of expertise and experience in hydraulic fracturing, including: academia, environment service companies, state regulatory agencies, federal government scientists, oil and natural gas exploration and production companies, and oilfield service companies.

* * *

Future Policy Watch columns will report on the progress of the EPA hydraulic fracturing study. In addition, GEO-DC blogs will alert AAPG members to opportunities to provide data or comment on study activities and interim reports.

UPCOMING EDUCATION SCHEDULE

LAST CHANCE

E-Symposium: Petrophysics of Carbonates **10:00 a.m. CST**	**February 21, 2013**
Winter Education Conference - 14 courses over 5 days! **Houston, Texas**	**February 11-15, 2013**

SHORT COURSES

Basic Well Log Analysis **Austin, Texas**	**April 15-19, 2013** ***Earlybird rates end March 18!***
Petrophysical Analysis and Integrated Approaches to the Study of Carbonate Reservoirs **Austin, Texas**	**April 16-18, 2013** ***Earlybird rates end March 18!***

FIELD SEMINARS

Field Safety Course for Field Trip Leaders **Houston, Texas**	**March 27-28, 2013** ***Earlybird rates end February 27!***
Modern Terrigenous Clastic Depositional Systems **South Carolina**	**April 5-12, 2013** ***Earlybird rates end March 8!***
Deep-Water Siliciclastic Reservoirs **Northern California**	**April 14-19, 2013** ***Earlybird rates end March 15!***
Clastic Reservoir Facies and Sequence Stratigraphic Analysis of Alluvial-Plain, Shoreface, Deltaic, and Shelf Depositional Systems **Utah**	**April 20-26, 2013** ***Earlybird rates end March 22!***

Registration and Information:

AAPG GEOSCIENCE EDUCATION

Toll-free (U.S. and Canada) (888) 338.3387, or (918) 560.2650 • Fax: (918) 560.2678 • email: educate@aapg.org
Download a registration form at http://www.aapg.org/education/index.cfm

AAPG EXPLORER
GEOPHYSICAL CORNER

The Geophysical Corner is a regular column in the EXPLORER, edited by Satinder Chopra, chief geophysicist for Arcis Seismic Solutions, Calgary, Canada, and a past AAPG-SEG Joint Distinguished Lecturer. This month's column deals with identifying fault reactivation with magnitude versus distance plots.

Micro MDPs Can Be a BIG Tool in Fault Finding

By CARLOS CABARCAS and OSWALDO DAVOGUSTTO

Microseismic technology is crucial these days for understanding reservoirs and planning development programs:

✓ Borehole microseismic is used to monitor seismic activity generated during hydraulic fracturing.


CABARCAS


DAVOGUSTTO

✓ The displacement of a rock along a shear wave is referred to as a fault, and the energy released by such a movement propagates as a seismic wave; a measure of this energy within the domain of microseismic technology is referred to as magnitude.

✓ The magnitude values of the recorded microseismic events are proportional to the size of the surface and the displacement involved in faulting. Assuming that surfaces and displacements associated with pre-existing faults are bigger than those of hydraulically induced fractures, during hydraulic stimulation, the registered higher magnitudes should characterize fault reactivation.

Magnitude is usually one of the parameters derived from borehole microseismic measurements. Additionally, microseismic recording sensors only detect microseismic events occurring within a certain radius from them – usually no more than a few thousand feet.

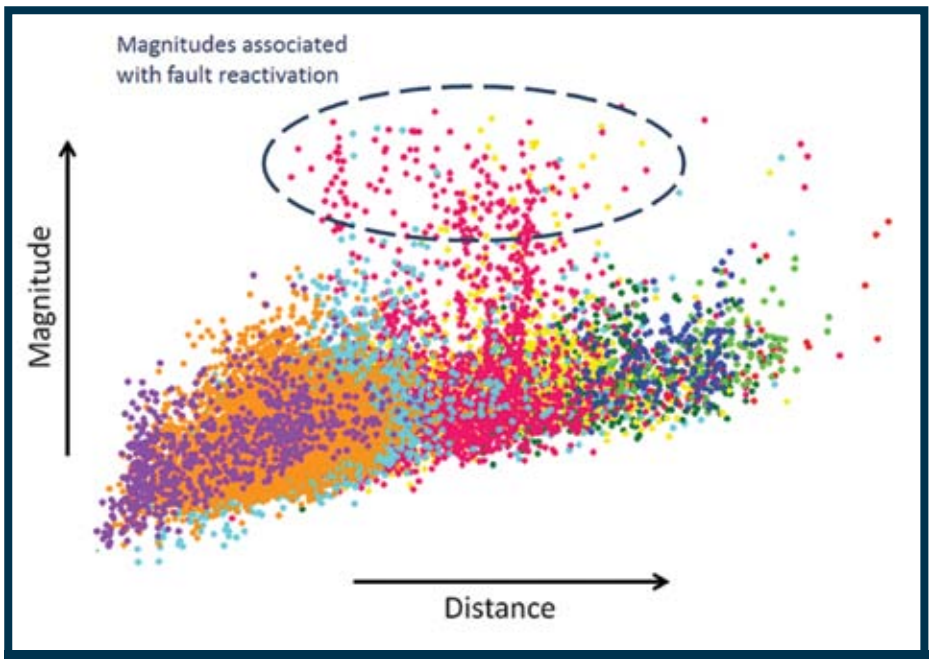


Figure1 – Magnitude vs. distance plot from a multi-stage hydraulic stimulation job monitored from a borehole for microseismic activity. Different colors represent event sets from different stages. Most of the stages generate microseismic event that predictably populate the graph (i.e. lower magnitude events can be detected near to the monitor well while farther away from the monitor well only relatively higher magnitudes event can be detected). Stages yellow, cyan and, especially, stage red suggest fault reactivation due to their higher magnitude, as compared to magnitudes from other stages. Magnitude and distance increase respectively in the direction pointed by the arrows.

One way to quantify this phenomenon is with a Magnitude vs. Distance Plot (MDP)." This plot shows the relationship between the energy associated with a particular event and its distance from the monitor well.

The MDP is a useful analysis tool in microseismic interpretation for all the information it summarizes on a simple graphic display.

Events with a combination of highest magnitude and highest distance away from the monitor well define the maximum detection distance, which can be used to plan the maximum distance for monitor well placement in future jobs. The rest of the recorded events populate the middle upper left portion of the MDP graph, forming a quasi-triangular pattern.

The presence of faults in the subsurface – and their reactivation during hydraulic stimulation – thus becomes noticeable on MDPs, because magnitudes of events associated with fault reactivation are usually higher than the rest.

* * *

We use the MDP technique to discern fault reactivation in this microseismic monitoring exercise, performed real-time during hydraulic fracturing operations.

▸ In figure 1, the higher magnitudes' events associated with possible reactivated faults are highlighted by a dotted blue circle.

When implementing the hydraulic stimulation no surface seismic data was available – and subsurface geologic maps, built solely on sparse wells information, did not foresee the possibility of a fault in the area.

This encouraging geologic model also supported the drilling and stimulation of the treatment well.

More than a year after the stimulation of the well associated with figure 1, newly available 3-D reflection seismic data provided a better image of the subsurface near the well. Unfortunately, due to resolution limitations, the broadband frequency data from this 3-D reflection seismic survey does not provide unequivocal evidence for the presence of a fault.

By coupling the 3-D seismic data with the microseismic events interpreted as the response of fault reactivation, however, we infer the presence of a fault in the seismic image.

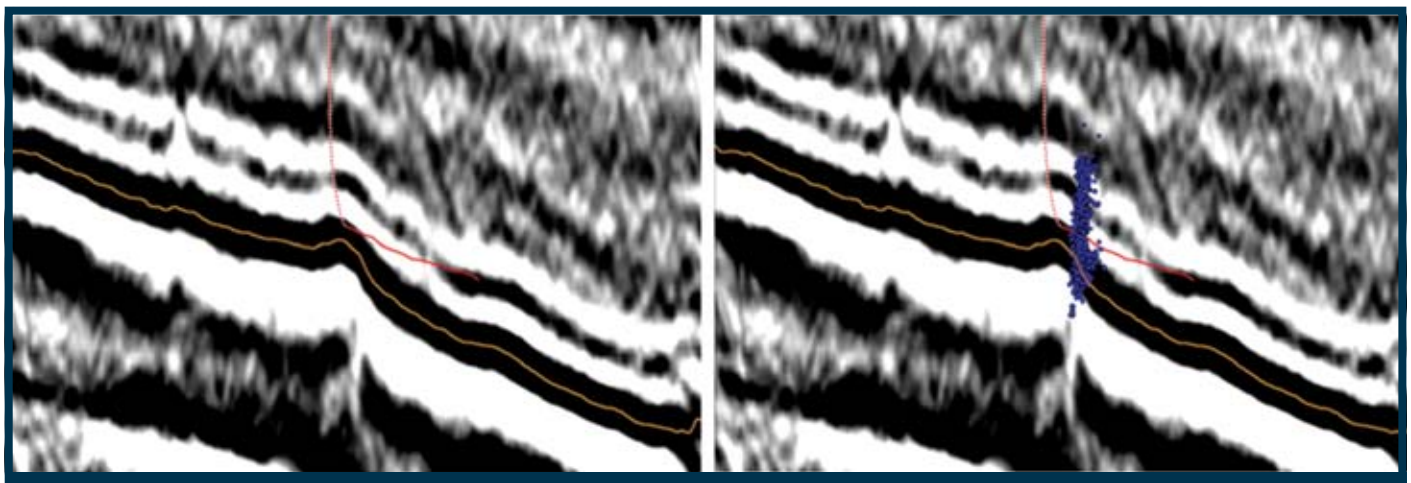


Figure 2 – (a) Vertical seismic section parallel to the azimuth of a treatment well monitored for microseismic activity (courtesy of Seitel Inc.); (b) Same seismic line overlaid by microseismic events from a stage interpreted as associated with a fault reactivation. Microseismic events align very well depicting the trace for an antithetic normal fault verging opposite to the inclination of the reflectors, beds and horizontal well.

▸ In figure 2 we show sections with and without the microseismic events.

The overlay of microseismic events on the 3-D seismic vertical section suggests the presence of an antithetic fault in the subsurface and its possible reactivation due to hydraulic fracture stimulation. The microseismic event set aligned very well in the direction of the interpreted fault plane.

By computing similarity on the 3-D seismic volume and extracting a surface slice from seismic data at the zone of interest, we interpret the presence of a fault crossing the path of the treatment well.

The good correlation between microseismic event lineaments and the extrapolation of similarity trends provides further evidence supporting our hypothesis of fault reactivation due to the hydraulic fracturing treatment – which we illustrate in figure 3.

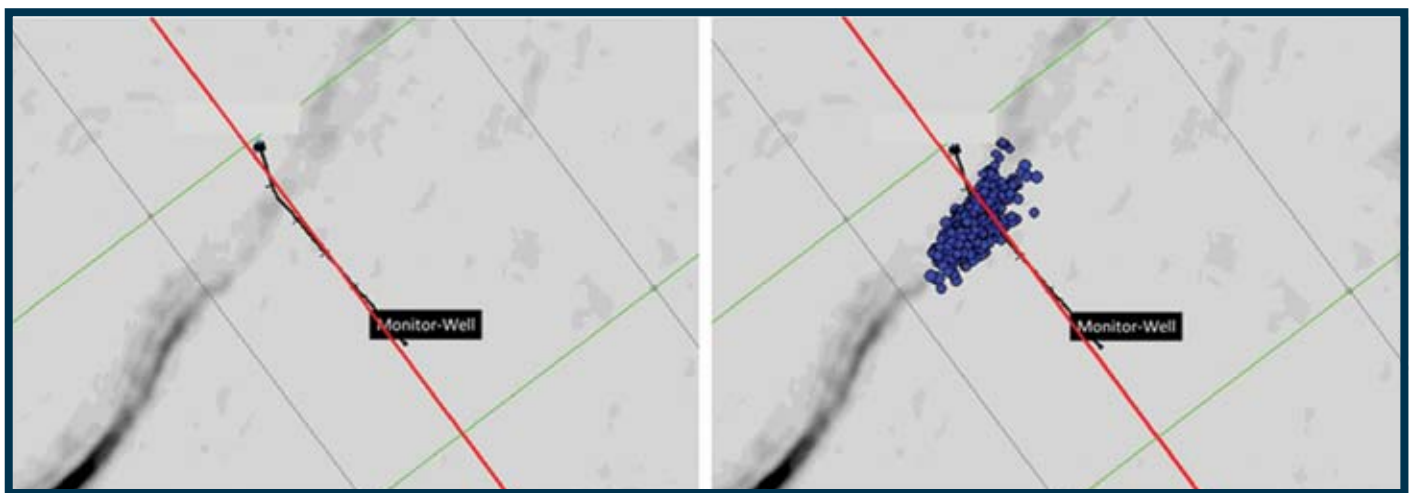


Figure 3 – Similarity horizon slice extracted along the stimulated zone of interest monitored for microseismic activity. (The original seismic data used as input into the similarity algorithm is the property of Seitel Inc.) Highly similar data is colored in grey shades while areas with low similarity values are tinted black as shown in the figure label. Microseismic events from the hydraulic stimulation stage believed to have reactivated a fault are aligned very well with a similarity anomaly that also represents a fault system trace. The treatment well is shown for reference purposes. The red line labeled A-A' represents the direction and length of the line shown in figure 2.

Continued on next page

IPTC Seeks Papers for 2014 Meeting

The call for papers continues to be open for the seventh International Petroleum Technology Conference (IPTC), which will take place Jan. 20-22, 2014, in Doha, Qatar.

The theme for the multi-society event will be "Unlocking Energy Through Innovation, Technology and Capability."

IPTCs are sponsored by four of the world's leading member-driven geoscience societies – AAPG, SEG, SPE and EAGE. The conferences were created to "further the advancement of scientific and technological knowledge related to the exploration, development, production, transportation and processing of oil and natural gas."

The event rotates yearly between Doha and the Asia Pacific region. The 2013 IPTC will be held March 26-28 in Beijing, China.

Nearly 50 session topics are being proposed for the 2014 meeting, grouped among eight main categories:

- E&P Geoscience Challenges.
- Reservoir.
- Drilling and Completion.
- Production and Operations.
- Engineering Projects and Facilities.
- Field Development.
- Mid-Stream Gas.
- Over-Arching Industry Issues – HSE, Security, Human Resources, Business and Social Challenges.

The call for papers deadline is April 12. To submit an abstract, or for more information, go to iptcnet.org.

Continued from previous page

Figure 3 also shows that the azimuth of the event cloud associated with the fault reactivation is different from the azimuth inferred from previous stimulation stages.

This characteristic, solely based on microseismic event location, provides another tool to derive subsurface geological information not generally emphasized.

We suggest that in the absence of additional supporting data, an azimuth change observed from microseismic sets – coupled with anomalously high magnitudes for the same events – could be interpreted as an indication of fault reactivation.

Moreover, when integrated with treatment pressure information, these microseismic observations could be used in the decision-making process of changing a predesign treatment job – and could significantly reduce completion costs.

The example presented here serves to validate and support the use of microseismic-derived MDPs as a tool to identify fault reactivation in the absence of additional subsurface data.

Moreover, when combined with other independent measurements, MDPs could unequivocally characterize the reactivation of a fault based on higher amplitudes and possible azimuth changes.

We also show that 3-D seismic is a powerful tool to mitigate drilling and completion risks as those encountered when faults are not anticipated along the well path. Availability of 3-D seismic data beforehand could have improved well placement and possibly resulted in lower completion costs and better well performance.

* * *

We would like to thank the management of Hilcorp Energy Company for permission to publish this work, as well as its support on the application of new technologies.

In addition, we would like to thank Seitel Inc. for permission to publish their seismic profiles, and Dawn Henderson for her help editing this document.

(Editor's note: Cabarcas is a geophysicist at Hilcorp and Ph.D. candidate at University of Oklahoma; Davogustto is a Ph.D. candidate at University of Oklahoma, working with Kurt J. Marfurt. All are AAPG members.)

YP Survey: They're On the Right Track

By NICK LAGRILLIERE, Young Professionals Committee Chair

For the second consecutive year, AAPG's Young Professionals (YP) Committee has conducted a survey to poll members on their perception of YP initiatives – and once again, it has allowed us to gauge our progress over the past year while providing a better understanding of our activities' impact.

Some of the key observations are summarized in this article – and the information will give direction to the committee for the coming year.


LAGRILLIERE

* * *

The most encouraging conclusion was that answers to almost all questions improved dramatically, with an average year-on-year increase of nearly 30 percent. This is a testament to the hard work of YPs at all levels of the organization.

The questions that have seen the greatest positive change were all featured in our EXPLORER columns. These articles, which mainly cover the global organization of the Young Professionals and the role they play in the Association, have thus proven to be a valuable communication tool.

There is a clear demand for grassroots activities – and, judging by the survey results, these will be crucial for membership retention. We will continue to focus the committee's efforts on this issue in the coming year by expanding our network of YP Chapters and by increasing our presence at Section/Region events.

People clearly are looking to the AAPG YPs for career advancement and networking opportunities. Our aim is to try and provide these where possible, such as at the ACE and ICE meetings.

* * *

Unfortunately, all of the results are not totally positive.

There is a powerful signal in the data that the value proposition of AAPG membership is not clear, nor is the classification transition from Student to Member.

It also became evident that our future focus needs to remain on the Sections/Regions – we need to make it more apparent how they are part of our global

Continued on next page

YP Survey Results

		2011		2012				
		yes	no	yes	no	% change	greatest change	highest score
1	Do you know what an AAPG 'Young Professional' (YP) is?	64	36	67	33	5	11	4
2	Have you ever heard of the AAPG YP Committee?	39	61	58	42	49	4	6
3	Do you perceive the YP Committee to be a cohesive, well-organized group within the AAPG organization?	38	62	54	46	42	6	7
4	Have you ever visited the AAPG Young Professionals Committee website?	13	87	19	81	46	5	12
5	Have you ever read the YP column in the AAPG Explorer?			49	51			
6	Do you consider yourself well-informed on the YP structure and the benefits afforded to you as a member?	9	91	17	83	89	1	13
7	Are you aware there is a YP representative in your Region/Section?	18	82	28	72	56	2	9
8	If given the opportunity, would you take the initiative to start a YP chapter in your city, country or region?	40	60	46	54	15	8	8
9	Have you ever provided your YP or SC representative with ideas for improvement?	9	91	11	89	22	7	14
10	Would you join a YP chapter (similar to the Student Chapters)?	75	25	83	17	11	10	2
11	Do you have a Facebook account?			74	16			
12	Are you a member of any AAPG YP Facebook Group and/or AAPG Group?			23	77			
13	Do you have a LinkedIn account?			71	26			
14	Are you a member of AAPG's LinkedIn Group?			50	50			
17	Do you believe that AAPG needs/requires more programs for YP members?	71	29	72	28	1	12	3
18	As a YP member of AAPG, do you feel like you play a role in the operations/decision-making of the organization?	21	79	24	76	14	9	11
19	Do you think AAPG can do a better job of defining/outlining the transition from Student membership to YP membership?	87	13	87	13	0	13	1
20	Are you aware that a YP (must be a Member) can run for a House of Delegates position?	16	84	24	76	50	3	10
21	Were you already aware of these requirements for Member?	64	36	60	40	-6	14	5

Editor's note: Regions and Sections is a regular column in the EXPLORER offering news for and about AAPG's six international Regions and six domestic Sections. This month's report is provided by Peter Baillie, president of AAPG's Asia Pacific Region council.

More than 1,000 in Islamabad

ATC Called Successful

By PETER BAILLIE


BAILLIE

More than 1,000 delegates attended the most recent Annual Technical Conference (ATC), a joint venture of the Pakistan Association of Petroleum Geologists (PAPG) and the Society of Petroleum Engineers, which was held in early December at Islamabad, Pakistan.

The conference's theme was "E&P Technologies, Innovations and New Frontiers."

A regular annual event in Pakistan, ATC drew participation from petroleum industry professionals, scientists, academics and members of the related business community.

Opening the conference was the Honorable Adviser to the Prime Minister on Petroleum and Natural Resources Asim Hussain.

Participants then heard 40 diverse technical presentations, a student paper contest and a panel discussion session on the conference's second day featuring a special focus on the Khyber Pakhtunkhwa and Balochistan provinces.

Although PAPG has been an affiliate of AAPG since 1994, this was the first time the Association was officially represented at the conference: Asia Pacific Region president Peter Baillie, CGGVeritas SVP business development adviser for CGGVeritas, Singapore, delivered a pre-dinner keynote address on the conference's first night.

Baillie also addressed students at the conference, noting that the industry's future now is in their hands and not his own generation.

The other keynote was delivered by Jonathon Craig, vice president and strategic exploration adviser for ENI in Milan, Italy, who spoke on the potential of "Unconventionals in Proterozoic Successions of the Sub-Continent."

The conference chairman, well-known explorationist Moin Raza Khan, with Pakistan Petroleum Ltd., ably led an organizing committee that is to be commended for running a highly successful event.

APPEX London Set for March 5-7

Online registration is open and sponsorship opportunities are available for APPEX 2013, the global Prospect and Property Expo that will be held March 5-7 in London, England.

This will be the twelfth APPEX event, hosted by AAPG Europe's London office, which provides a setting for principals, senior managers, business developers and new venture managers to network and do business with NOCs, governments and global E&P dealmakers.

Nearly 800 attendees from more than 40 countries are expected for the event, including more than 90 exhibitors.

The setting is designed to allow a relaxed atmosphere for exploring current and future trends in international business, the buying and selling prospects and properties, and networking.

In addition to daily "Prospect Forums," APPEX also offers a technical program featuring a comprehensive look at global exploration opportunities, challenges and technology, including talks on:

- Overcoming challenges of shale gas exploration.
- The revolution in exploration and its impact on global gas.
- Global M&A trends and deal metrics.
- The future of North Sea exploration.
- The challenge to unlocking Russia for independents.

For registration and more information, go online to appexlondon.com.

Continued from previous page

structure, because this is not currently understood.

Since the value proposition of AAPG membership is an issue that affects the Association membership as a whole, our findings will be conveyed to AAPG leadership. We hope to be able to highlight the benefits of membership more clearly in the near future.

To be sure, the transition from Student to Member is relatively straightforward. After graduation, the "Student-YP bridge" allows new graduates to continue paying student dues of $10 for an additional two years. By then, the one-year work experience required to upgrade to Member should have been accumulated.

Prospective Members also require three sponsors, two of which must be Members themselves.

As mentioned in previous EXPLORER articles, the Young Professionals Committee has representatives from all Sections and Regions. They can be contacted through the website (aapg.org/youngpros) or the AAPG Young Professionals Facebook page.

They are:

- **Anwar Al-Beaiji** – Middle East Region.
- **Riyad Ali-Adeeb** – Gulf Coast Section.
- **Jonathan Allen** – Pacific Section.
- **Catherine Campbell** – Rocky Mountain Section.
- **Josh Hickman** – Eastern Section.
- **Ignacio Iregui** – South America Region.
- **Ryan Lemiski** – Canada Region.
- **Ruairi McDonald** – European Region.
- **Nikki Morris** – Southwest Section.
- **Olatunbosun Oke** – Africa Region.
- **Reetu Ragini** – Asia-Pacific Region.

* * *

As always, we look forward to hearing your thoughts and comments.

Best wishes for 2013 from the Young Professionals Committee!

INMEMORY

Awardee Abdulla Al Naim

Newly named AAPG Honorary Member Abdulla Al Naim, vice president of exploration for Saudi Aramco and a towering figure in Middle East exploration and AAPG leadership activities in the region, died unexpectedly Dec. 31. He was 57.

Tributes to him began almost immediately from all parts of the world as news of his death spread. AAPG Executive Director David Curtiss called Al Naim "a visionary leader and geoscientist – the energy profession has lost a tireless advocate for the advancement of science and technology to find and develop the oil and natural gas the world so desperately needs."


AL NAIM

Biographer Abdulkader M. Afifi wrote that Al Naim was born and raised in Dammam, "literally between oil facilities and within sight of Aramco's headquarters in Dhahran."

"Abdulla's true passion was exploration," Afifi noted.

Al Naim received his bachelor's degree in geology from King Saud University in Riyadh, then began his career with Aramco in 1978 as a wellsite geologist. This was followed by a number of administrative assignments within the company, leading to the positions of manager of the area exploration division (1996), manager of the exploration operations department (2002) and manager of the reservoir characterization department (2004).

He became Saudi Aramco's executive director of exploration in November 2004, and was appointed vice president in April 2006.

At one point he also held the position of acting vice president of petroleum engineering and development, being responsible for the management and development of all Saudi Aramco oil and gas fields.

An AAPG member since 1986, Al Naim's leadership for the Association in the Middle East Region has been constant, consistent and exemplary.

In 1989 he was instrumental in the founding of the AAPG affiliate Dhahran Geological Society, and then served as the group's first president. At that same time he served on AAPG's International Committee.

> An AAPG Honoray Member, Al Naim was called "a visionary leader and geoscientist."

He was president of the Middle East Region for 2004-06.

He served on the organizing committees of the regional Society of Petroleum Engineers (SPE) technical conferences, and was a member of the technical and executive committees of every GEO conference since its inception in 1994, serving as the chair in 2006.

At the time of his death Al Naim was a member the AAPG Corporate Advisory Board, and was instrumental in providing guidance and corporate support for AAPG conferences, workshops, field trips and publications on both the local and international levels.

Al Naim received several awards for his leadership, including the AAPG International Special Commendation Award in 1999 and an AAPG Distinguished Service Award in 2006.

Al Naim most recently was awarded AAPG honorary membership. He will be honored posthumously at this year's AAPG Annual Convention and Exhibition, set May 19-22 in Pittsburgh. EE

Geosciences Director Millspaugh

Robert C. Millspaugh Jr., former AAPG geoscience director, passed away Jan. 20 in Tulsa. He was 87.


MILLSPAUGH

Millspaugh received a bachelor's degree in geology from the University of Oklahoma in 1949. He joined Cities Service Oil Company in 1950, where he was employed for 35 years, serving as chief geologist, exploration staff manager, director of exploration-applied research and technology, and chief geologist for Colombia-Cities Service in Bogota, Colombia.

An AAPG member since 1951, Millspaugh began his career at AAPG as education manager in 1986. In 2000 he was named director of the newly named AAPG geoscience department, which he led until his retirement in 2004.

Pioneer Awardee Sonnenberg

Longtime, award-winning AAPG member Frank P. Sonnenberg died Jan. 12 in Centennial, Colo. He was 89.


SONNENBERG

Sonnenberg, who received his bachelor's and master's degrees in geology from the University of Cincinnati, spent over 40 years in international oil and gas exploration. He was the founder and first president of the Southeast Asia Petroleum Exploration Society in 1973, and in 2000 received AAPG's Pioneer Award.

He was an active DPA member, chairing the group's board of certification from 1990-94 and receiving its Distinguished Service Award in 1994. He served in the AAPG House of Delegates from 1988-91.

He also was the father of AAPG Honorary Member and past president Stephen Sonnenberg.

Foundation VIP Holland


HOLLAND

David "Scotty" Holland, former CEO of Pennzoil Exploration and Production and a longtime, award winning supporter of the AAPG Foundation, died Jan. 5 in Houston. He was 81.

Holland, an AAPG Foundation Trustee Associate, received the Chairman's Award in 2010, presented to honor those who have made "extraordinary contributions" (monetary or service) to the AAPG Foundation.

In 2008 he helped establish the Holland Award of Excellence through the AAPG Foundation and Hardin-Simmons University, presented annually to honor faculty members at the Holland School of Sciences and Mathematics at Hardin-Simmons University in Abilene, Texas.

Holland served in the U.S. Air Force, then received his bachelor's degree in geology from the University of Texas at Austin. He began his career as an exploration geologist for Marathon Oil in Midland, Texas.

Holland left Marathon and went on to serve a long career with Pennzoil before retiring as president and chief executive officer for Pennzoil E&P and group vice president of Pennzoil in 1990.

Holland loved exploration geology and was committed to support higher learning. He and his wife, Jacque, established the Endowed Holland Geology Scholarship Fund in 1997 and were instrumental in funding the Holland School of Sciences and Mathematics, Holland Medical High School and Holland School of Health Sciences at Hardin-Simmons University, Abilene, Texas in 1999.

He was president of Holland Holding, Holland Energy and Post Oak Petroleum, chairman of Trend Exploration and director of Gaither Petroleum Corp. He was a member of the UT Geology Foundation and in 2011 was instrumental in funding the Holland Family Student Center at the Jackson School of Geosciences, University of Texas at Austin.

---

* **Abdulla A. Al Naim**, 57
Dhahran, Saudi Arabia, Dec. 31, 2012
Donald Neal Collins, 81
Evergreen, Colo., Dec. 10, 2012
Earl Wallace Cooper, 87
Denton, Texas, Nov. 30, 2012
Roy Berry Dannenberg, 83
Effingham, Ill., Jan. 24, 2012
John Peter Griesbach, 85
Horseshoe Bay, Texas
June 29, 2012
James Maurice Harmon, 86
Corpus Christi, Texas
Oct. 31, 2011
David "Scotty" Holland, 81
Houston, Jan. 5, 2013
Bryan Lloyd Jones, 83
Bridport, England
Nov. 26, 2012
Donald Edward Lawson, 88
Casper, Wyo., Dec. 4, 2012
Thomas D. McEvoy, 79
Oklahoma City, July 31, 2012
Robert C. Millspaugh Jr., 87
Tulsa, Jan. 20, 2013
Robert Matheson Norris, 91
Santa Barbara, Calif.
Aug. 31, 2012
Edgar E. St. James, 65
Katy, Texas, Dec. 26, 2011
Frank P. Sonnenberg, 89
Centennial, Colo., Jan. 12, 2013
Phillip Edward Wyche, 85
Austin, Texas, March 17, 2012

(Editor's note: "In Memory" listings are based on information received from the AAPG membership department. Asterisk denotes AAPG Honorary Member.)

Editor's note: Hans Krause, editor of the EXPLORER's Historical Highlights column, is a consultant in Caracas, Venezuela, who has held senior executive positions in both PDVSA and Shell Venezuela. Krause is an AAPG Honorary Member, Distinguished Service Award winner and chair of the AAPG History of Petroleum Geology Committee. Miguel Ramirez, current President of AAPG Latin America Region, recently retired from ExxonMobil Exploration in Bogota, Colombia.

Cartagena – History, Culture and Geology

By MIGUEL RAMIREZ and HANS KRAUSE


RAMIREZ


KRAUSE

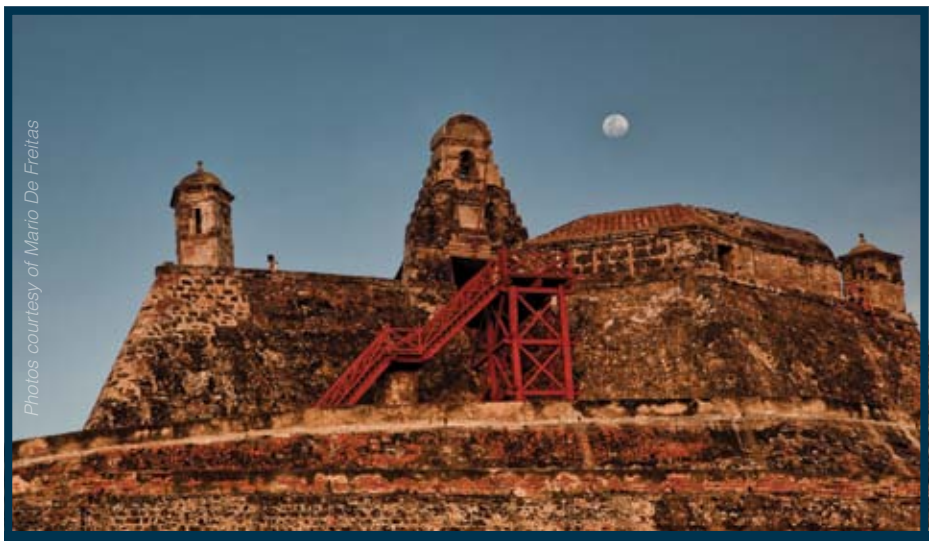
Beautiful Cartagena, the site of this year's AAPG International Conference and Exhibition, is the city where Colombia's *bogotanos* flock to enjoy themselves, to see and be seen.

With its massive and well-preserved Spanish-built walls and fortifications – the only walled city in South America – it also is one of the most historically significant cities in the Western Hemisphere.

The city stands on a sand bar at the northeast end of the Bay of Cartagena. So large is this bay that in colonial days it was said that all the fleets in the world could find anchorage there at one time.

Its full name is Cartagena de Indias – to distinguish it from Spain's ancient city of Cartagena – and it was founded on June 1, 1533, by Spanish conquistador Pedro de Heredia. He landed on a sandy beach of what is now the walled suburb of Getsemani – where the modern Convention Center is located – and established the colony there. It was later moved to the adjacent Island of Calamari, site of an Indian village.

Heredia's statue can be seen in the Los Coches Square, just across from the main gate of the walled city.


Photos courtesy of Mario De Freitas

The Castillo San Felipe de Barajas, a famous castle on Cartagena's Hill of San Lázaro, is a 16th century fortress that dominates and reflects the city's history, culture and strategic importance.

Cartagena began with only 200 Spanish inhabitants, who initially lived in "bohios," a type of Indian house built of straw and mud. The city grew quickly, fueled by the plundering of gold from the tombs of the Sinu Indians.

The increasing wealth of its inhabitants made it an attractive target for pirates and corsairs, and 10 years after its founding the city was first pillaged by the French.

Other assaults soon followed – including one in 1586 by Sir Francis Drake – and Cartagena began to surround itself with walled compounds and forts, a process that continued for about 200 years.

Coralline limestone, from the Plio-Pleistocene La Popa Formation, was mainly used for these walls. This formation outcrops in the La Popa Hill, crowned by a convent, and in numerous localities around the city.

By the time the defenses were finished in 1756, the city was considered impregnable. Today these fortresses – on which Spain spent the equivalent of trillions of dollars in today's money – are colonial Cartagena's most significant feature.

(Legend has it that Spain's King Phillip II, while in Madrid reviewing the defense expenditures for Havana and Cartagena, remarked, "This is outrageous! For this price those castles should be seen from here!")

A Prized Possession

Cartagena was Spain's most important trading port on the coast of South America, especially for gold and silver from the mines of New Granada and Peru. It was so important, in fact, that in 1717 it became the capital of the Viceroyalty of the New Granada.

Continued on next page

This month's Historical Highlights article marks the second anniversary of the EXPLORER series that tells the stories of how specific discovery wells came about, how key concepts evolved, and how technological and historical events shaped the science and profession. The series celebrates human ingenuity, cleverness and perseverance – or simply luck! – and emphasizes anecdotes and the human-interest side of the E&P profession. All articles published in the series can be viewed at: aapg.org/explorer/archives/historical_highllights.cfm. And if you have such a story – and who doesn't? – and you'd like to share it with your fellow AAPG members, contact Hans Krause at historical.highlights@yahoo.com.

Continued from previous page

Precious metals were loaded in Cartagena on the galleons that after the end of the yearly hurricane season first went to Havana, where they were joined by similarly loaded galleons sailing from Mexico, and then continued to Spain. On the return trip the galleons arrived in Cartagena loaded with Spanish merchandise, turning the city into the major South American trading post.

A major attempt to take the city and invade New Granada was made in March and April of 1741 by English Vice Admiral Edward Vernon, who arrived at Cartagena with a massive fleet of 186 ships and 23,600 British and American colonial troops. The assault – at the beginning of the rainy season, when mosquitoes return in force after the dry season lull – proved a disaster, as over half of the invading force fell and died from tropical diseases, chiefly yellow fever.

It proved particularly deadly for the American soldiers, 90 percent of which did not return home.

After weeks of intense fighting, the undermanned Spaniards had defeated the British forces and forced them to withdraw. This significant victory allowed Spain to control the Caribbean for the next 70 years, until its hold was weakened by the wars of independence that began in South America in the early 19th century.

One of the American soldiers in Admiral Vernon's fleet was George Washington's older half-brother, Lawrence, who was so impressed with the admiral that he named his Mount Vernon estate in Virginia after him.

Cutting the Connection

Napoleon Bonaparte's invasion of Spain in 1807 triggered major political changes in the American colonies, and after 278 years of Spanish rule Cartagena declared its independence Nov. 11, 1811.

Upon the defeat of the French armies in the Peninsular War in 1814, Spain decided to recover the rebellious territories, and by mid-1815 a large Spanish expeditionary fleet under the command of General Pablo Morillo arrived in New Granada and besieged Cartagena. After a five-month siege the fortified city fell in December of that year.

Cartagena was devastated and in ruins, with a large segment of its population perishing from hunger and tropical illnesses.

Morillo executed the nine leaders of the rebellion: They are commemorated today with statues that can be seen in front of the Convention Center.

It was Simon Bolivar who declared Cartagena the "Heroic City," in reference to Morillo's siege. By 1816, the combined efforts of Spanish and colonial forces, marching south from Cartagena and north from royalist strongholds in Quito, Pasto and Popayan, completed the reconquest of New Granada, taking Bogota on May 6, 1816. Total independence was not gained until 1821.

Independence from Spain meant that its main reason for existence – the trans-shipment of gold and silver from South America to Cuba and Spain – had passed, and the city entered a long period of decline that lasted essentially until the 20th century.

A City of Culture and Geology

A fascinating chapter of Cartagena's history has to do with the cultural influence that African slaves brought to the city.

Early in its history, Cartagena was the main port of entry of African slaves; their arrival signaled the beginning of an intense process of cultural and racial integration that mixed Europeans, Africans and Indians – influencing the physiognomy, cuisine, music, art and even the accent of the Spanish spoken in the city.

Colombia prides itself on having abolished slavery in 1851 – 14 years before it was abolished in the United States.

The La Popa limestones are very malleable and porous and well-suited for facades and as construction stone.

(Malleable comes from the Latin word "malleo," which means hammer. Remember the motto of geology: Mente et Malleo, or Mind and Hammer – which nowadays seems to go more like Mente et iPAD!)

Beautiful fossils comprising coral heads, bryozoans and algae are visible in most buildings in the old city – something that will add a little lagniappe to your visit to Cartagena!

Cartageneros affectingly called the old city "El Corralito de Piedra" (the Little Stone Corral), because the city is completely enclosed by walls.

Generous Gifts Made 2012 a Memorable Year

BY NATALIE ADAMS, AAPG Foundation Manager

Last year proved to be a banner year for the AAPG Foundation, as nearly $3 million was received in financial gifts.

That makes 2012 the second highest year of support in Foundation history, behind only the giving total for 2005 – when the Foundation received a $10 million bequest from the late L. Austin Weeks.

Programs that saw the biggest jump in funding included the General Fund; the James Hartman Student Leadership Program; the OSU-GIS Consortium; Grants-In-Aid; the Imperial Barrel Award; and the Education Fund.

Clearly, your donations are helping us reach the next generation of geologists in so many exciting ways.

* * *

A current focus of the AAPG Foundation's fundraising efforts is the L. Austin Weeks Undergraduate Grant program, which supports educational expenses of undergraduate geoscience students and the departments of their school or university.

The Foundation annually can support approximately 67 grants through the program. Each $1,000 grant is split in half between a qualified student involved in an AAPG Student Chapter and the university he/she attends.

AAPG has more than 300 student chapters who could desperately use additional funding – and with an additional $6 million, the Foundation could provide annual grants to each active student chapter.

Contact the Foundation for information on how to contribute to this initiative.

* * *

Three new members have been announced for the AAPG Foundation Trustee Associates. They are:

❒ **Richard K. "Dick" Stoneburner**, president of the North America shale production division for BHP Billiton Petroleum, Houston, and a current AAPG Distinguished Lecturer (see related story, page 4). His contributions are directed to the General Fund and to the Roger W. Stoneburner Memorial Grant, which funds a graduate student Grant-In-Aid.

❒ **John Robinson**, of Littleton, Colo., an AAPG Distinguished Service Award and Wallace E. Pratt Memorial Award winner. His contributions have been directed to the General Fund.

❒ **Valary Schulz West**, with Cinco Resources in Dallas, a former chair of the AAPG House of Delegates and winner of several AAPG honors, including the Distinguished Service Award. Her contributions are supporting the General Fund and also will be used to start a Digital Products University Subscription for the University of Saskatchewan.

* * *

Finally, it's been announced that this year's Michel T. Halbouty Lecture, featured annually at the AAPG Annual Convention and Exhibition, will be presented by **Jeff Ventura**, president and CEO of Range Resources, who will talk on "Range's Path to Discovery and Commercialization of the Marcellus Shale – the Largest Producing Gas Field in the United States."

The Halbouty Lecture will be held May 20 during the AAPG ACE in Pittsburgh.

Funding for this lecture is provided by the AAPG Foundation.

Watch the EXPLORER for more details on Ventura and his talk.

Foundation (General)
Joel A. Alberts
Isaiah Allison
Arden A. Anderson
Thomas Westley Angerman
Jerry Vestal Atkinson
Lee B. Backsen
Richard Arthur Baile
Joan Roberts Barminski
In memory of Tom Dibblee
Caroline and E.C. Beaumont
In honor of Edward A. Beaumont
Edward C. Beaumont
Peter E. Blau
Louis Chapman Bortz
In memory of Willard Oswald Lowe
Louis Chapman Bortz
In memory of John R. Barwin
Janet Brister
G.W. Brock
Michael David Brondos
Spencer Lawrence Brown
Dhreoma R. Burford
In memory of Arthur E. Burford
Michael A. Cervantes
Chevron Humankind
Matching gifts/John Gilbert, Curtis Humphris, Donald Medwedeff and Richard Ball
Kenneth W. Ciriacks
John McRae Colvin Jr.
Clarence Frederick Conrad
ConocoPhillips Corporate Contributions
Matching gift/ Jennifer Crews
M.A. Custer
William James Davies
Henry C. Dean Jr.
John Conrad Dolson
Byron Fred Dyer
Thomas Edward Ewing
Glen Lee Faulkner
David R. Feineman
In memory of Parke Dickey, Mark McElroy and A.D. Poole
Robert Bruce Ferguson
William Robert Finley
Helen Laura Foster
In memory of George Gryc
James E. Geitgey
John Edward Gilcrease
William E. Gipson
In memory of Robert Gutru
David Barrett Givens
Landry "Lanny" J. Goodman
Bob Greider
Jeffrey and Paula Gural
Gilmor Semmes Hamill IV
In memory of Hollis Hedberg
Tom and Carolyn Hamilton
In memory of Tom Barrow
William Gilbert Hargett
In memory of Howard Laster
Dexter Lee Harmon
In memory of Bob Senning
Sherod Alexander Harris
John Cleveland Harrison
David Harold Hawk
William A. Heck
Robert Alexander Hefner IV
Anonymous gift
Bernard Louis Hill Jr.
Bob and Betty Hilty
Roger Emerson Hively
Sumner Hixon
Gary John Hoose
William Meredith House
Dan Allen Hughes
Kingdon R. Hughes
John D. Humphrey
John Scott Isby
Charles G. Johnson
Faris Thayer Johnson Jr.
Thomas Johnson Joiner
Crandall Davis Jones
Marcus Dudley Keene
In honor of James Dudley Keene
Thomas Eugene Kelly Jr.
Merlin Dean Kleinkopf
Irvin Kranzler
Christopher Mark Kravits
Radford Phillip Laney
David E. Lange
In memory of Marilyn Fritz
Gary William Lauman
Loren Michael Leiker
Walter Scott Light Jr.
Donald Ransom Lindsay
In memory of Bob and Ramona Sneider
Thomas M. Maher
William Stanley Marshall
Terry J. Mather
In memory of Rufus LeBlanc
James S. McGhay
In honor of AAPG Staff
John David McLeod
David John Mellings
Dwight McClintock Moore

Continued on next page

Continued from previous page

In memory of Alfred Cleon Moore
David Watts Morrow
Brett Stephen Mudford
James Howard Murphy
Richard Louis Nagy
Jerome Nicholas Namy
Stephen R. Narr
Jack Lewis Nelson
William Howard Nichols
Leslie Owen Niemi
Josh Winters Oden
Richard Evan Paige
Arthur L. Paquett
In memory of Richard A. Paull
H.W. Peace II
In memory of S.T. Ayers
Emily Rose Poorvin
Julius Mosal Ridgway
In honor of Larry Baria
Michael A. Rogers
William Dake Rose Jr.
J. Paul Roston
Edward Michael Rothman
William Ray Scheidecker
William B. Schroeter
Valary Schulz West
Stephen Harrison Secrest
Shell Oil Company Foundation
Matching gifts/L. Taras Bryndzia, D. Lindsay and J. Hjerpe
Kirk W. Sherwood
Martin L. Shields
Bruce R. Sidner
Rudolf B. Siegert
Robert Gerard Slyker Jr.
Daniel Lester Smith
Darrell Eugene Smith
William Mark Smith
Dennis M. Sparks
Marion Eugene Spitler
Gordon Griffith Start
William C. Stephens Jr.
H. Leighton Steward
Richard Kelty Stoneburner
John Lee Stout
In memory of John W. Rold
Stephen Malcolm Strachan
Michael William Strickler
Paul Milton Strunk
Donald Frederick Todd
Patrick Marion Tolson
TransCanada Corp.
Matching gift given by David De Gruyter
Edwin Leslie Trice III
In memory of E.L. Trice Jr.
Gene Van Dyke
La Verne Leonard Vigoren
Marta S. Weeks-Wulf
Rolf Westgard
John A. Williams
William Otis Williams
In memory of Paul Walker Fairchild
Ann O. Willis
Daisy M. Wood
In memory of P.W.J. Wood
David Fricke Work
Joe Brian Young
Donald Lowell Zieglar

Amoruso Special Publications Fund
John J. Amoruso
Dan J. Breaux
M. Dane Picard
Richard Steinmetz

Awards Fund
Teacher of the Year Award
Peter David Carragher

Bridge Fund
Shell Oil Company Foundation
Matching gift/C. Scott Cameron

Daniel A. Busch Library Fund
Lee Travis Billingsley
In honor of Pete Rose
Arthur Henry Forbes Jr.

Digital Products Fund
David Ray Grogan

Baylor University
John Wayne Shelton

University of Colorado
Frederic August Tietz

University of Saskatchewan
Valary Schulz West

Distinguished Lecture Fund
Walter Scott Light Jr.
Forrest Elwood Nelson
David William Stangl
In memory of F.H. "Mick" Merelli

Education Fund
Bruce S. Appelbaum
William Charles Burkett
ConocoPhillips Corporate Contributions
Matching gift/Susan Young
William Robert Finley
Richard M. Foshee
Edwin Robert Goter
In memory of Gerald M. Friedman
Paul Michael Guerino
Samuel Cole Guy
In memory of James Woodrow Mathews
Gerald Edmund Harrington
Paul F. Hoffman
William Franklin Howell
In memory of Clyde Harrison and Henry Cullins
Wilson Humphrey
Elizabeth Johnson
Steven Rick Lockwood
Sandy Meyer
Joseph Paul Mueller
In memory of Glen Stewart
Prasanta K. Mukhopadhyay
Sally M. Murray
In memory of Grover E. Murray
Susan Smith Nash
Mark Preston Nibbelink
In memory of Arion and Mary Nibblelink
Lewis Stan Pittman
In memory of Ed Roy
Gary Neil Polasek
Chase Savage Reid
Peggy Joyce Rice
Carole K. Richards
In memory of Roger Stoneburner
Gene E. Richards
In memory of E.T. Hill
Charles Curtis Rubins
In memory of William Perkins
David Cooper Salter
In memory of Lowell C. Ellis
Shell Oil Co. Foundation
Matching gift/Rita Monahan
Christy H.L. Smith
Marlis Earl Smith
In memory of Bruno Hanson
David William Stangl
In memory of F.H. "Mick" Merelli
Chad Eric Taylor
David Lowell Tett
David Paul Thetford

Enhancing the Quality Of Earth Science Fund
Dennis Edwin Thomas

Grants-in-Aid Fund
Charles B. and Marilyn C. Fritz Memorial Grant
Richard Dale Fritz
In honor of Charles and Marilyn Fritz

Classen Family Named Grant
Jim and Jacquie Classen

Don R. Boyd Memorial Grant
Patricia K. Boyd
In memory of Don R. Boyd

Eddie David Named Grant
Edward K. David
In honor of Robert E. Long

Edward B. Picou Jr. Named Grant
Edward Beauregard Picou Jr.

Edward C. and Caroline Beaumont Named Grant
Edward C. Beaumont

Frank E. Kottlowski Memorial Grant
Ronald F. Broadhead
In honor of Ben Donegan

Fred A. and Jean C. Dix Named Grant
James E. Briggs
Chevron Humankind
Matching gift/Mike Unger
John Myers Armentrout
In memory of Clem Bruce
Philip Rodney Brown
Willis Reider Brown
Walter Scott Light Jr.
Jeff May and Karen Crossen
Teresa M. O'Neill
In memory of Brian J. O'Neill
R.J. Bottjer and Sara L. Peyton
Clyde Ray Seewald
Martin L. Shields

Harry and Joy Jamison Named Grant
Leslie A. Jamison
In honor of Harry Jamison
Sara Jamison and David Phillips
In honor of Harry Jamison
Charles G. Mull

Ike Crumbly Minorities in Energy Named Grant
Michael A. Cervantes

J. Ben Carsey Sr. Memorial Grant
Michael A. Cervantes

John and Erika Lockridge Named Grant
John P. and Erika H. Lockridge

John D. "Jack" Edwards Memorial Grant
ConocoPhillips Corporate Contributions
Matching gift/Jennifer Crews

John H. and Colleen Silcox Named Grant
John and Colleen Silcox
In honor of John Sweet

Jon R. Withrow Named Grant
Jon Richard Withrow

Lawrence W. Funkhouser Named Grant
Jean K. Funkhouser
In honor of Lawrence W. Funkhouser

Mruk Family Named Grant
Denise M. Cox
In memory of Frances Mruk
April Louise Parsons

Pittsburgh Association of Petroleum Geologists Named Grant
Pittsburgh Association of Petroleum Geologists

Richard W. Beardsley Named Grant
G. Warfield Hobbs

Robert K. Goldhammer Memorial Grant
Michael A. Cervantes
ConocoPhillips Corporate Contributions
Matching gift/Jennifer Crews
Encana Cares (USA) Foundation
Matching gift/Mark Gallagher

Roger W. Stoneburner Memorial Grant
Jean K. Funkhouser
In memory of Roger W. Stoneburner
Richard Kelty Stoneburner

William E. and Jean Crain Named Grant
William E. Crain

James A. Hartman Student Chapter Leadership Summit
Chevron Humankind
Matching gift/Richard Ball
Steven T. Keirstead
William Otis Williams
In memory of Graham R. Curtis

Imperial Barrel Award Fund
Willard R. Green
In memory of Sid Bonner and Michael Shearn
Kenneth Eugene Nemeth
In memory of Jack Parker

Named Public Service Fund

Hugh Looney Excellence Fund
Paul H. Dudley Jr.
In memory of Robert Gutru

Jack C. and Catherine I. Threet Endowed Fund For the Advancement Of Petroleum Geology
Jack C. Threet
In memory of John T. Smith

Publication Pipeline Fund
Martin Macdermott Cassidy
Gerrit Wind

E.F. Reid Scouting Fund
Terri Duncan
Ronald L. Hart
Bryan Haws
William Myrl Hoag
Walter Scott Light Jr.
Gary Robinson
In memory of Maury Mendenhall
Chad Eric Taylor
Elaine Maley Travers
In memory of Robert W. Richter

Visiting Geoscientist Fund
Michael A. Cervantes

L. Austin Weeks Undergraduate Fund
Jack P. Martin

The monthly list of AAPG Foundation contributions is based on information provided by the AAPG Foundation office.

Letters to the editor should include your name and address and should be mailed to Readers' Forum, c/o AAPG EXPLORER, P.O. Box 979, Tulsa, Okla. 74101, or fax (918) 560-2636; or e-mail to forum@aapg.org. Letters may be edited or held due to space restrictions.

READERS' FORUM

Measure for Measure

The growing internationalization of the AAPG commented on by President Ted Beaumont in his January EXPLORER column lends more reason for the use of S.I. units (International System of Units) in BULLETIN and EXPLORER articles.

(I have advocated the use of S.I. units in two previous letters. Third time a charm?)

The number of U.S. members probably includes many who originated outside the United States and were familiar with S.I. units before settling in the United States. So, why not use units of measurement that many, if not most, members are familiar with and what the rest of the world uses?

Why continue to use English measurement units that are only used by a majority of one, the United States, in the world community? Why wait to make the change only when the increasing international member curve crosses the declining U.S. curve?

President Beaumont also made some comments regarding changing the AAPG's name. My suggestion: Why not just drop the word "American" and call ourselves the Association of Petroleum Geologists, APG? The SEG and the SPE get along fine with three letters. We should be able to do likewise.

As an association all members, regardless of country of origin, would be encompassed.

Sidney Rieb
Vashon, Wash.

Water Issues

Regarding your two articles on water issues (January EXPLORER), first the one on the upcoming AAPG Geosciences Technology Workshop "Solving Water Problems in Oil and Gas Production:" This is a critical and essential topic – it is important that our AAPG members take a leading role in seeking to understand and answer the many questions about use of water, treatment and disposal of produced water and the risk and regulations associated with these questions. These are questions that are being asked around the world by all citizens.

The oil and gas industry must do outstanding and professional work of the very highest standard to understand the risk and consequences of all our operation. We must then present our findings on these many questions in an equally professional and objective manner to all those who have a need and right to know.

In my travels over the past year I have been asked about these questions in America, Australia, Germany and Ukraine. The questions are from very concerned people who have become aware of the potential consequences of water usage and disposal in our operations through the media and personal investigation.

As an industry, we cannot fail in our obligation to investigate and inform the world on this essential topic. As an AAPG member, I look forward to the results of the GTW and to answering the call for input and assistance that anyone can provide to get the answers to these critical questions on a sound, scientific basis and in a format for presentation around the world.

The article on hydro fracturing, but it appears to … imply that criticism of the technique is unjustified.

If the operators and the oil and gas industry had taken the lead in investigating the consequences of these operations and set their own very high standards and enforced them, would we have all the questions that have been raised?

As an industry, we must not wait to be forced by regulation to do what is right for our companies, our country and our citizens. As the United States is leading in the application of this technology, we should be setting standards that are good for the planet.

Conrad Maher
Newport Beach, Calif.

Where's Israel?

Regarding "A Look Back at a Big Year" (January EXPLORER), specifically this paragraph: "In the Levant Basin of the Eastern Mediterranean, Noble Energy chalked up a sixth consecutive field discovery with its Tanin find, bringing total discovered (gross) mean resources to approximately 35 Tcf."

In practically all of the other discoveries listed in the article, the country in which that discovery occurred is explicitly mentioned, with the exception of the item noting the Noble gas discovery. The Levant Basin in the eastern Mediterranean covers the area of a few countries. Even though many professionals are fully aware that these gas discoveries are in Israel, it is about time that Israel is given the recognition afforded every other country.

This is not the first instance where Israel has not been mentioned on maps or other professional presentations where adjoining countries are identified – however, it is discouraging to think that this practice continues to be a standard whenever such situations arise.

It is extremely disappointing that such a standard has apparently been adopted in a professional geologic journal from the AAPG. Israel can and should be treated like every other country and recognition be given to its existence, especially in the scientific realm.

Seymour R. Baker
Modi'in, Israel

(Editor's note: No such standard exists, by either the EXPLORER or AAPG. The oversight was just that – an oversight.)

Word Play

Regarding the wwwUpdate column on "What Words Help You Search?" (January EXPLORER): I agree that aapg.org (and most websites) need better search. However, in my experience with enterprise knowledge management, building and managing taxonomies is more trouble than it's worth. It's just too difficult. It's also rather subjective: Your taxonomy is not my taxonomy.

Another problem is that taxonomies always lag the zeitgeist – you can't keep up with usage.

What makes Amazon, Google, etc., so effective is that they *don't* use rigid taxonomies. They collect massive amounts of user data to deduce user intent. This goes far beyond what taxonomy can do – it's highly personalized (via user profile, user history, session cookies, etc.), non-linear and flexible. Amazon purchase suggestions are based on the behavior of millions of people.

One of the few places where I've seen taxonomies work is in a rigid corporate environment, where you can control users (because their jobs depend on it). Another place is Wikipedia, because there is no control at all – anyone can categorize a document. This works.

If AAPG wants to pursue categorization and improve search, my recommendations would be:

- Build in some machine learning to

Continued on next page

Editor's note: Berman, an AAPG member, is with Labyrinth Consulting Services in Sugar Land, Texas.

COMMENTARY

Say It LOUD: A Few Words About Peak Oil

By ARTHUR BERMAN

A story in the January EXPLORER ("Surprise! North America Grabbed the Spotlight"), included the observation "The Peak Oil guys are pretty quiet now, thanks to the creativity and innovation of the industry," regarding the tight oil additions to oil production in the United States and Canada.

I am on the board of directors of the Association for the Study of Peak Oil (ASPO USA), and I can assure you that we are not quiet nor do these additions change our concern about the growing cost of oil and its effect on our economy.

In the past month alone, we held a major conference in Austin co-sponsored by the University of Texas, a great advocate for the oil and gas business (Texas leads the United States in both oil and gas production). Right after the conference in Austin, a group of our members presented a panel discussion at the fall American Geophysical Union meeting in San Francisco.

In the same month, we were invited to spend two hours with Adam Sieminski, the new administrator of the U.S. Energy Information Agency (EIA), and all of his top line staff. On the same day, we met with the new chairman of the Senate Natural Resources Committee and with a former senior senator who is now among the leading energy lobbyists in Washington.

Some people take us very seriously because they understand that "peak oil" does not mean we are running out of oil. It means that we have run out of the cheap oil on which the global economy is predicated. That is serious business.

We also applaud the creativity and innovation of the industry that has increased U.S. production over the past few years. It is, however, very expensive oil. Tight oil requires at least $80 per barrel for operators to break even because of the cost of horizontal drilling and hydraulic fracturing, not to mention the unprecedented leasing costs that the shale revolution has brought to our industry.

The high price of oil is among the key underlying reasons the United States and most of the developed world cannot get out of this recession. Gross domestic product (GDP) and oil consumption correlate because the economy runs on energy, and oil and its refined products are the largest component of primary energy consumption.

Because of the high price of oil, consumption in the United States has fallen 1.5 percent per year since 2005, and GDP has followed suit. Pre-2005 normal growth for the U.S. economy was 1.8 percent per year. With an annual 1.5 percent decline built in, it is not hard to see the problem with resuming growth.*


BERMAN

The IHS tight oil study the EXPLORER story quotes is confusing because it combines Canada and the United States. Canada has been energy self-sufficient for decades and is the leading oil exporter to the United States – any production additions from Canada are still imported oil for the United States.

The EIA estimates that U.S. crude oil production will increase to nearly eight million barrels per day by 2020 and then decline. Present consumption is almost 15.5 million barrels per day. If EIA is correct, the United States will still have to import about seven million barrels per day allowing for demand decline, and that does not look like energy independence to me.

Most of the exuberant reports about energy self-sufficiency from domestic production lump crude oil, natural gas liquids, refinery processing gain and biofuels as "liquids." That is fine, but we must bear in mind that what we import is crude oil and today, we cannot use other liquids for transport – the main use of crude oil – without massive equipment and infrastructure changes that will cost trillions of dollars and take decades.

These same optimistic reports almost never consider cost, price or profit margins.

The new production we are finding from tight oil is both important and exciting, and it will help make the United States less dependent on foreign crude oil. It will not, however, make us energy independent.

Peak Oil guys like me are hoping that at least people in the oil and gas business will realize that we have a problem that is not going away.

(*All data in this section from Douglas-Westwood.)

Continued from previous page

adapt to user behavior over time. You need technologies like fuzzy term matching, relevance scoring, part-of-speech analysis, content clustering. It's all basic graph theory and is well-understood by some web app developers.

- Allow people to add categories – or at least tags – of their own, so that your users can decide how they want to find things over time. You can weight them differently, but at least they are there. This has to be super-easy and fast.

Good luck with whatever you decide to do ...

Matt Hall
Mahone Bay, Canada

Denver's 3-D Seismic Symposium Set March 5

The 19th annual 3-D Seismic Symposium will be held March 5, at Denver's Sheraton Downtown Hotel.

The symposium will feature 12 presentations, concentrating on case histories in resource plays using large-scale 3-D seismic surveys. Case studies include Rocky Mountain projects in the Niobrara, Bakken and Piceance, plus analog plays from the Fayetteville, Marcellus, Eagle Ford and Western Canadian basins.

Attendees will hear "the most up-to-date concepts and workflows in our industry," according to co-chairs David Scolman and Jim Thorson, both AAPG members.

The keynote speaker will be AAPG member Thomas Jorden, chairman, CEO and president of Cimarex Energy.

Other talks by AAPG members include:

- "Reservoir Geomechanics Applied to Stimulation of Shale Gas/Tight Gas/Tight Oil Reservoirs," by Mark Zoback, the Benjamin M. Page Professor of Geophysics at Stanford University.
- "Utilizing Geophysical Concepts in Unconventional Resource Evaluation," by Eric Von Lunen, a senior geophysical adviser for Nexen Inc.
- "Obstacles and Pitfalls for the Everyday Interpreter," by Glenn Winters, chief geophysicist for Fasken Oil and Ranch.
- Using 3-D Seismic Data to Make Sound Decisions Drilling Horizontal Wells in the Niobrara Formation," by Jack Wiener, senior technical adviser for Halliburton.
- "Rock Physics and Seismic Data Used in Characterization of Source Rock Reservoirs," by Marita Gading, with Statoil ASA in Trondheim, Norway.
- "PSDM for Unconventional Reservoirs? A Niobrara Shale Case Study," by Morgan Brown, with Wave Imaging Technology.
- "Seismic Data – Key to Solving the Eagle Ford 'Puzzle,'" by Murray Roth, president of Transform Software Services.
- "Application of Seismically Derived Fracture Mapping for Unconventional Reservoir Exploitation," by Paul Miller, with Schlumberger in Houston.

Registration and additional information is available through RMAG (rmag.org), DGS (denvergeo.org) or the 3-D Symposium websites (3dseismicsymposium.com).

EMD
from page 50

Shale Gas and Liquids: International production of shale gas largely has been in Canada, benefitting from the U.S. boom, but testing also is under way in Europe (U.K., Poland) and Asia (China, Australia, India, New Zealand and Japan).

Recent U.S. highlights include:

✓ Bakken oil production in North Dakota exceeded 700,000 BOPD by year-end 2012.

✓ Eagle Ford oil production averaged >300,000 BOPD in April, and since varies from 325,000-350,000 BOPD.

✓ Barnett Shale production peaked in May 2011 at 5.87 BCF/D.

✓ Haynesville Shale production has declined after a 2012 peak.

Rig counts have decreased steadily in most plays due to commodity price, even as drilling in liquids-rich plays has increased.

Coal: The latest released data shows total coal distribution in 2011 was 1,080.8 million short tons (mmst), an increase of 0.02 percent from the previous year (EIA, 2012). Distribution to domestic destinations accounted for 973.6 mmst, a 2.5 percent decrease compared to 2010, whereas distribution to foreign destinations, which was 107.3 mmst, increased by 31.3 percent over 2010.

In April 2012, net electric generation from natural gas was 95.9 million megawatt hours, almost equal to that from coal (96.0 million megawatt hours).

Geothermal: The U.S. Geological Survey's public domain geothermal database is going forward, and TGS-Nopek is compiling a bottom-hole temperature database with a focus on the west Texas Delaware Basin.

March 12-14, Southern Methodist University in Dallas will hold its geothermal conference titled "Geothermal Energy and Waste Heat to Power: Utilizing Oil and Gas Plays," focusing on geothermal in oil and gas producing areas.

* * *

Upcoming EMD events:

EMD is co-sponsor of two upcoming events with the Division of Environmental Geoscience (DEG):

✓ "Solving Water Problems in Oil and Gas Production: New Technologies for Cost Savings and New Revenue Streams" is a Geoscience Technical Workshop (GTW) planned for Feb. 26-27 in Fort Worth. (See story, January EXPLORER.)

✓ "Protecting Assets with Environmental Baseline and Ground-Water Monitoring" is a short course to be held during the AAPG Pacific Section Meeting in Monterey, Calif., in April.

EMD also is gearing up for the AAPG ACE in Pittsburgh May 19-23. We have an exciting program planned – seven oral and five poster sessions, two short courses/workshops, three field trips, and a luncheon featuring Seamus McGraw, author of "End of Country."

Watch our article in the May EXPLORER for more details.

Editor's note: Reynolds and Boak are president and president-elect, respectively, of the Energy Minerals Division.

CLASSIFIEDADS

POSITION AVAILABLE

HEAD OF SCHOOL POSITION OSU BOONE PICKENS SCHOOL OF GEOLOGY

The Boone Pickens School of Geology at Oklahoma State University invites applications for the School Head position. This is a tenured position at the rank of Associate Professor or Full Professor to be filled by July 1, 2013. Salary is competitive and commensurate with the experience and qualifications of the successful candidate. Applicants should have a PhD in geosciences or a related field, have an outstanding research and teaching record and be highly regarded and recognized by the national and international geoscientific community. A record of an established collaboration with the energy industry is desirable. Prior administrative experience is preferred and potential for academic leadership and mentoring is expected. The Boone Pickens School of Geology Head position is designated 50% administration and 50% academic. The successful candidate will be allowed to have reduced teaching load, but will maintain a research program through externally-funded projects, peer-reviewed publications and mentoring of graduate students. The specific research field is open but the successful candidate is expected to strengthen the School's research foci in conventional and unconventional hydrocarbons, continental tectonics and neotectonics, and surficial processes and environmental studies. Currently the School has 14 tenured and tenure-track faculty, 3 research scientists/post-doctoral fellows, 15 PhD students, 50 MS students, and 140 undergraduate students. The School has recently expanded and will continue growing in terms of student enrollment, additional faculty, and external resources. The School houses modern research and teaching facilities, including well-equipped geochemistry, geophysics, remote sensing, sedimentology, and tectonics laboratories, as well as technology-enabled classrooms and the Devon Visualization Laboratory. The School also maintains a Field Camp in Canon City, Colorado. The School's mission and activities are strongly supported by an extended network of alumni and an active advisory board. The School maintains a strong faculty-student-alumni relationship and active student chapters for professional organizations. Applicants should submit statements detailing: (1) Leadership vision, (2) Research interests, and (3) Teaching philosophy, along with a Curriculum Vitae, and the names, addresses, e-mail addresses, and phone numbers of three references to:

Boone Pickens School of
Geology Head Search
c/o Dr. Loren M. Smith
Department of Zoology
501 Life Science West
Oklahoma State University
Stillwater, Oklahoma 74078
Phone: (405)-744-5555,
Fax: (405) 744-7824

Screening of candidates will begin March 15, 2013 and continue until the position is filled. The filling of this position is contingent upon available funding. More information on Oklahoma State University and the Boone Pickens School of Geology can be found on the web at http://go.okstate.edu and http://geology.okstate.edu, respectively. OSU is an AA/EEO/E-Verify employer committed to diversity. OSU-Stillwater campus is a tobacco-free campus.

* *

Geologist (Englewood, CO)
Amadeus Petroleum.
Req. BSc. or foreign equiv. in Geology + 1 yr. exp in petroleum geology. Periodic travel to well sites. Resume only: C. Corey, VP of Admin., ref 121470, 9250 Costilla Ave., #510, Englewood, CO 80112.

* *

The University of Alabama Department of Geological Sciences-Geophysics

The Department of Geological Sciences at The University of Alabama invites applications for a three-year, non-tenure track visiting faculty position in geophysics beginning August 16, 2013. The position will be filled at the Assistant Professor level. Though open to all geophysical sub-disciplines, preference will be given to candidates who will enhance our existing geophysics research programs in earthquake seismology and exploration geophysics. This position will also complement existing programs in tectonics, petrology, petroleum systems and hydrogeology. Candidates must have a strong record of research and a Ph.D. in geophysics, geology, or a related field by the time of appointment. The successful candidate will be expected to teach introductory geology courses and undergraduate and graduate courses in geophysics, advise graduate students and enhance the department's externally funded research program in geophysics. The department has a broad range of resources and existing facilities that the candidate can utilize including modern terrestrial reflection and refraction seismology hardware, high-resolution marine seismic equipment, broadband seismometers, a gravimeter, magnetic gradiometer, terrestrial lidar imaging system and ground penetrating radar. Modern computer equipment and software includes a Cray High Performance Cluster and industry standard seismic processing and interpretation software. Details regarding existing research programs, related department equipment and facilities are found at http://www.geo.ua.edu. Questions should be directed to Andrew Goodliffe, amg@ua.edu. A complete application includes a CV, research statement, teaching statement and names and contact information for at least three referees. Applications must be submitted electronically at facultyjobs.ua.edu. Applications will be reviewed beginning February 4, 2013 and will continue until the position is filled. The University of Alabama is an Equal Opportunity Affirmative Action Employer and actively seeks diversity in its employees.

* * * * * * * * * * * *

Houston, Texas USA

Ellington & Associates, Inc. seeks experienced biostratigraphers with backgrounds in geology, stratigraphy, and paleontology to support oil and gas projects in the Gulf of Mexico and worldwide. These full-time positions require sample analysis and interpretation for offshore-wellsite and office-based projects. Requirements: MS degree or higher in Geology or Paleontology, 3+ years experience, willingness to work offshore at least 100 days/year (with bonus for wellsite work). Reply to Ellington & Associates, 1414 Lumpkin Road, Houston, TX 77043 or email info@ellingtongeologic.com.

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.

DIRECTOR'S CORNER

Moving From Sound Bites Toward Substance

By DAVID K. CURTISS, AAPG Executive Director

Hydraulic fracturing has captured the public's attention, to the point where millions of people who have never been to a rig site now confidently offer opinions.

At one level this attention focuses on persistent concerns about the technology. Will hydraulic fracturing contaminate my drinking water? Will it set off earthquakes? These are questions that can be answered with fact-based science and engineering information.

These public concerns, however, delivered a perfect platform for politicians and celebrities to engage in an entirely different sort of battle that wasn't at all about hydraulic fracturing. This was an opportunity to hit the oil and gas industry – and in the process to gain name recognition and raise money.

So we have two very different things happening at the same time: One is a profound need to provide the public with accurate information. The second is to recognize that the political and public relations firestorm around this issue isn't really about the issue – but that it can have significant consequences for public acceptance.

How are we doing?

How do we know when our actions – and the industry has been diligently responding to both issues – are having an impact?

I'd say the most fundamental measure is when we hear the public conversation change. When the popular media and culture shifts from sound bites into a real discussion it suggests that the public is ready for greater understanding.

The resulting discussion isn't necessarily a sober, fact-driven analysis – there can still be a lot of yelling at this stage – but we see the conversation both deepening and broadening.


CURTISS

> **The resulting discussion isn't necessarily a sober, fact-driven analysis – but we see the conversation both deepening and broadening.**

And we may be reaching this point on the issue of hydraulic fracturing.

* * *

Esquire magazine, not your typical source of science reporting, featured an extensive article on hydraulic fracturing in its January issue.

The article begins, "Crude oil looks like poison. Messy poison."

Now, be honest: Would you keep reading? Or would you dismiss the article as just another hatchet job on the oil and gas industry and move on?

Well, the author uses these loaded words, phrases and imagery throughout the piece. They pervade his descriptions as he visits oilfield operations in Pennsylvania and New York, talking to industry spokespeople and rig hands. His visit with a prominent opponent of hydraulic fracturing claiming to have iron-clad proof of his own claims is similarly vivid.

He gets caught in the sound bite cross fire between supporters and opponents and observes, "This is how it goes. Facts are twisted, and belief replaces discourse." That is depressing.

You get the feeling that the author doesn't like what the industry is doing to develop these resources, and that he doesn't want to. That it isn't cool. In fact, he interviews one landowner in the Delaware Basin who claims he lost his job with a major music star because he was advocating for natural gas development on his land where hydraulic fracturing is currently restricted.

It may not be cool. But the author's reporting gets the broad strokes (and many of the finer strokes) mostly right. Significantly, he presents both sides of the issue, searching for answers and sifting for facts and genuine understanding about hydraulic fracturing.

This article is no glowing endorsement of resource development. But the author understands that these resources are the foundation of our society and always have been. And that he is a user and beneficiary.

Pragmatic resignation is how I'd describe his final assessment. And hope that the industry will continue to improve its processes.

* * *

It's no coincidence, I'm sure, that this article came out the same month as the film "Promised Land," starring Matt Damon.

The film is about landmen working to secure acreage positions in a rural county in the eastern United States while dealing with an environmental advocate stirring up opposition. It received lukewarm reviews by the critics.

I went to see the film on opening weekend. There were about 20 of us in the theater to see run-of-the-mill Hollywood fare. It wasn't horrible. But there was no cliché and sound bite left unused. And the plot twist, while bracingly cynical, was a letdown. The whole thing was simple minded, as if the screenplay was written in crayon.

"Promised Land" bombed at the box office. And as Vern Stefanic, managing editor of the AAPG EXPLORER, and I discussed why that might be, he observed that it's taken several years to write, produce and distribute the film – and during the interim between the film's first steps of production and its final completion and distribution the public has become a lot more sophisticated about hydraulic fracturing.

I think he's right. Let's help them understand even better.

DIVISIONS REPORT

Report Offers Commodity Updates

By ANDREA REYNOLDS and JEREMY BOAK


REYNOLDS


BOAK

EMD members can have access to the complete Mid-Year Commodity Reports by going to emd.aapg.org/members_only/midyear12_11_29/index.cfm.

The AAPG Energy Minerals Division covers many scientific disciplines and interests – and because previous EXPLORER articles featured shale gas and oil shale, this quarter will focus on highlights from this year's EMD November Mid-Year Meeting Commodity Reports.

Detailed reports can be found on the EMD Members website.

(Are you interested in the details, but not yet an EMD member? Upgrade your membership today – at no additional cost to AAPG members – for online access to our research and reports.)

EMD also is updating its website, with many improvements to come in the months ahead. So please, excuse our dust during this transition.

▸ **Uranium and Nuclear Minerals**: Nuclear power production is forecast to remain steady at about 18-20 percent of electricity generation (EIA). Yellowcake price futures are favorable for increase as plant construction plans to develop in Southeast Asia and China and exploration targets emerge in India, Africa, Australia and South America.

U.S. uranium production in Q3 2012 was 1,048,018 pounds U_3O_8, down 1 percent from Q2 but up 24 percent from Q3 2011.

As uranium prices rise and geopolitical developments evolve, these factors will serve to enhance the economic potential for recovering both rare-earth elements and uranium.

▸ **Gas Hydrates**: The Ignik Sikumi test, which was a 60-day or so gas hydrate exchange trial carried out in Alaska's Prudhoe Bay Field in early 2012, was the first-ever field trial of methane hydrate production. CO_2 was exchanged in situ with methane molecules resulting in methane gas and CO_2 hydrate.

Other updates include an LWD drilling program offshore India (late 2012) targeting reservoir delineation and resource assessment of hydrate-bearing sands, and a gas hydrate production test in the Nankai area offshore Japan planned for early 2013.

▸ **Oil (Tar) Sands**: The EMD-sponsored AAPG Studies in Geology 64, titled "Heavy Oil and Oil Sand Petroleum Systems in Alberta and Beyond," will be published this month. Also, the upcoming AAPG Annual Convention and Exhibition in Pittsburgh will feature a poster session dedicated to tight oil sands.

Alberta production of upgraded bitumen passed 1.6 million barrels per day; and the ratio of surface-mined to in situ production changed from 60/40 in 2007 to 55/45 in 2009 to nearly 50/50 in 2012.

Current technology development focuses on alternative methods of recovery, including combinations of existing and developing technology, alternative sources of energy for steam production and reducing environmental impacts of surface extraction.

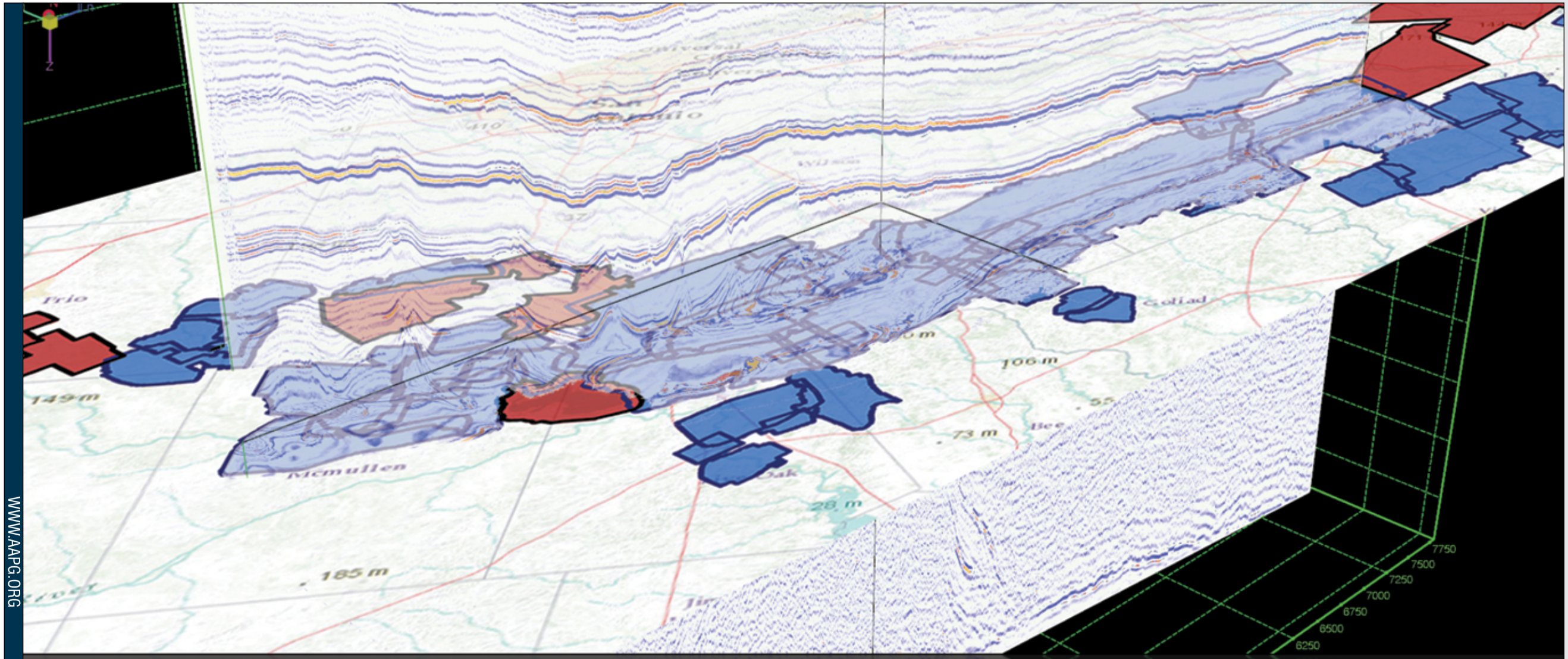
▸ **Tight Gas Sands**: The boundary between tight gas sand and gas shale, reflected in silty shale, siltstone and intimately interbedded sandstone/siltstone/ shale formations, makes it difficult to define some plays as tight gas sand or shale gas plays. Our EMD committee is expanding its focus beyond the Americas and is looking at global advances, with current interest in China.

▸ **Shale Oil and Oil Shale**: Total global production of shale oil is currently about 30,000 barrels per day (BOPD). American Shale Oil has restarted a pilot of its *in situ* process, and Shell is developing a test program on a multi-mineral Research, Development and Demonstration (RD&D) lease in western Colorado.

The U.S. Bureau of Land Management announced the award of two RD&D leases in Colorado to ExxonMobil and Natural Soda Holdings Inc.

In international news, a May 2012 Jordanian oil shale symposium highlighted recent developments and focused attention on large deposits in the Middle East, and Eesti Energia has begun production from its Enefit 280 retort system in Estonia, which adds about 5,000 BOPD in production.

See **EMD**, page 48



The seismic image shown is over 2,150 square miles of merged data in the Eagle Ford play.