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EXPLORER

MAY 2007

ROCKY MOUNTAIN ROUNDUP

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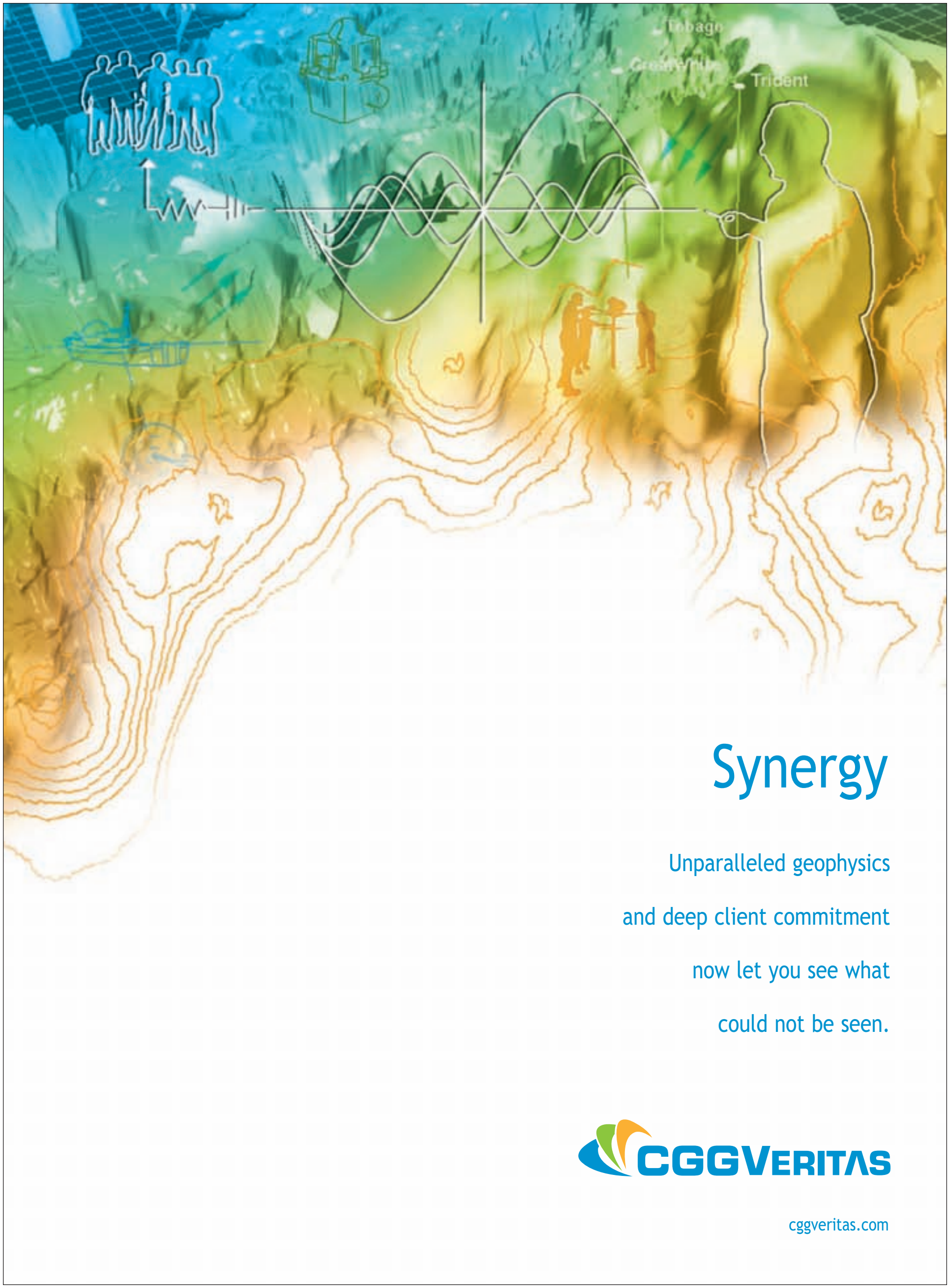
AAPG EXPLORER



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On the cover: Experts predicted it would be a hot region, and they were correct – the American Rockies continue to deliver the exploration and production success stories, as this month's EXPLORER examines with several stories that begin on page 8. Our cover shot, capturing a perfect blend of activity in a beautiful setting, is the Koskie rig in the Paradox Basin. Photo courtesy of Bill Barrett Corp.

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REGULAR DEPARTMENTS

STAFF

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

Communications Director
Larry Nation
e-mail: lnation@aapg.org

Managing Editor
Vern Stefanic
e-mail: vstefan@aapg.org

Editorial Assistant
Susie Moore
e-mail: smoore@aapg.org

Correspondents
David Brown
Louise S. Durham
Barry Friedman

Graphics/Production
Rusty Johnson
e-mail: rjohnson@aapg.org

Advertising Coordinator
Brenda Merideth
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
e-mail: bmer@aapg.org

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AAPG photo

Long Beach convention chair Dalton Lockman, left, gives a cheer as President Billingsley waves a race flag at the start of the meeting.

PRESIDENT'S COLUMN

Long Beach Had Many Highlights

By LEE T. BILLINGSLEY

The convention in Long Beach was a huge success by any measure.

Although the West Coast is two time zones away from a large percentage of our U.S. members, it is an important venue for our annual meetings – and having a West Coast convention gives the AAPG Pacific Section a chance to "show their stuff."

This issue of the EXPLORER contains other news from the convention, but my personal highlights include:

✓ **Graduated dues bylaw amendment** – It passed overwhelmingly in the HoD with about 90 percent approval by my estimate.

The HoD approved the graduated dues bylaw amendment on April 1, but the new dues structure will take a few months to implement. Consequently, current members will not see a change in this year's (2007) renewal statements, but nearly all of current members will not be affected by the new structure anyway.

✓ **Student programs** – Student participation in the meeting increased due to efforts of the convention committee. Students appeared very excited to get a glimpse of petroleum geology as a profession, as demonstrated by a convention. And we were excited to have them.

✓ **Imperial Barrel Award competition** – This is a new program for AAPG and adopted from Imperial College in London. Students from participating schools form groups to analyze a data set that includes 3-D seismic and subsurface data. The group presents a complete exploration analysis of the area to a panel of judges (see story, page 34).

The competition creates extra work for the students, but it provides them a fantastic experience. I will appoint a permanent committee to help with the expansion and further implementation of this exciting new program.

Billingsley

Thanks go to Steve Veal, past AAPG vice-president and current part-time manger in the London office, for bringing us the idea and helping to make it happen.

✓ **Corporate Advisory Board** – Representatives from petroleum companies have a new charge and system for advising. AAPG leadership and staff will provide them with background information on selected topics.

The initial topics are: a) university geoscience research projects funded by corporations and administered through AAPG; b) a pool of visiting professors from industry available to universities; and c) endowed faculty support through the AAPG Foundation.

✓ **Ad hoc Global Climate Change Committee** – The group held a private meeting and drafted a statement for EC review.

I will transmit the statement to DPA and DEG leadership for comment. **We will post the draft statement on the AAPG Web site by May 1 for member comments.** After approximately 3 0 days for comments, the

See **President**, page 6

Candidate Balloting Deadline Is May 15

An important deadline looms this month for AAPG members:

Online voting for the 2007 slate of AAPG officer candidates ends at midnight (CDT), May 15.

Biographies, pictures and statements from all candidates for AAPG office remain available for viewing on the AAPG Web site, www.aapg.org.

The candidates were given the opportunity to respond briefly to the subject: "Why I Accepted the Invitation to be a Candidate for an AAPG Office."

Responses and biographical information were provided by each candidate and edited only for grammar, spelling and format.

This information, which will remain online through the election period, also appeared as a hardcopy insert in the January EXPLORER.

Ballots will be counted on May 16.

House Vote Overwhelming

Graduated Dues Structure Passed

By LARRY NATION
AAPG Communications Director

The much-debated AAPG graduated dues structure was overwhelmingly approved by a standing vote of the House of Delegates meeting at the 2007 AAPG Annual Convention in Long Beach, Calif.

The new dues structure, which allows for a tiered dues cost ranging from $20 to $80 depending on the declared income of the member, has been discussed over the past six months in EXPLORER columns, on the AAPG Web site and the HoD Newsletter, as well as in local society and delegate meetings.

Chairman Larry Jones presided over the House debate that lasted 88 minutes. Five delegates spoke against the proposal and 25 spoke in favor, including President Lee Billingsley and four past AAPG presidents.

Delegates also debated and decidedly defeated a proposal for an automatic sunset provision on the dues proposal.

The dues measure stemmed from desires to make membership financially available to geologists who cannot afford the annual $80 membership fee. That group is mainly those in the international arena where pay scales are prohibitive. After membership growth committees struggled with the problem for years, an ad hoc Graduated Dues Committee was formed in early 2006.

Their study of AAPG expenses, the "structured dues" experiences of the Society of Petroleum Engineers and the Society of Exploration Geophysicists and other items led to the proposal that the Long Beach delegates approved.

Tabbed as the "Ability to Pay" model, the tiered structure allows for both hard and electronic copies of the EXPLORER and BULLETIN for the full-dues paying member, with the option to pay for hard copies in the lower tiers (see Table 1).

The new dues structure will be effective in stages to allow for reprogramming and accounting changes. New members will be eligible to join under the new dues structure effective July 1. Present

See **HoD**, page 6

Table 1. Ability-to-Pay Graduated Dues Structure (proposed fee schedule)

Gross Personal Income (US$)	Dues* (US$)	Products	Options* (US$)
Level 1 >$50,000	$80	EXPLORER hardcopy/optional	BULLETIN
Level 2 $50-25,000	$40	EXPLORER hardcopy/digital BULLETIN	$30 BULLETIN hardcopy fee
Level 3 <$25,000	$20	Digital only	$20 EXPLORER hardcopy fee and $30 BULLETIN hardcopy fee

* Does not include postal surcharge for non-U.S. mailing.

AAPG Executive Committee Comments

The 2006-07 Executive Committee commends the House of Delegates for overwhelmingly approving the proposed bylaw changes to provide for a graduated dues structure.

It is important to understand the potential for future growth of our great organization is both within and outside of North America.

The AAPG leadership and majority of HoD members recognize that salaries of geoscientists vary greatly around the globe. This initiative is designed to stimulate growth outside the United States, but we applaud the wisdom of a fair system enabling retirees, young professors and other U.S.-based lower-income geologists to join and contribute to AAPG.

During the debate on graduated dues some members and delegates may have been offended by the remarks of the immediate past AAPG treasurer, which appeared in the March 2007 EXPLORER and in the *Delegates' Voice*.

Make no mistake. Both current and future members who choose the lower dues option due to a lower annual income are welcome in AAPG. Both the overwhelming majority of delegates and the current Executive Committee confirm that your membership is valuable to the organization.

We disagree with the past treasurer's assertion that the world and (by inference in his stating that the absence of an income verification system is a mistake) AAPG members and potential members throughout the world do not "share common values and definitions of honesty and integrity."

Likewise, members paying lower dues will not "cheapen" AAPG membership. And we do not find it "offensive" to allow voting rights for qualified members, no matter what level of dues they pay. Rather, we are excited about the new ideas and energy that new members will add to our Association.

We welcome the opportunity to implement the new graduated dues structure and welcome participating members. And if the vision is accurate, AAPG will have a growing, active community of petroleum geoscientists around the globe in the years to come.

The 2006-07 Executive Committee
Lee Billingsley, President.
Will Green, President-elect.
John Dolson, Vice president.
Mike Party, Secretary.
Randi Martinsen, Treasurer.
Ernie Mancini, AAPG Elected Editor.
Larry Jones, Chairman-HoD. ❑

Midland Valley

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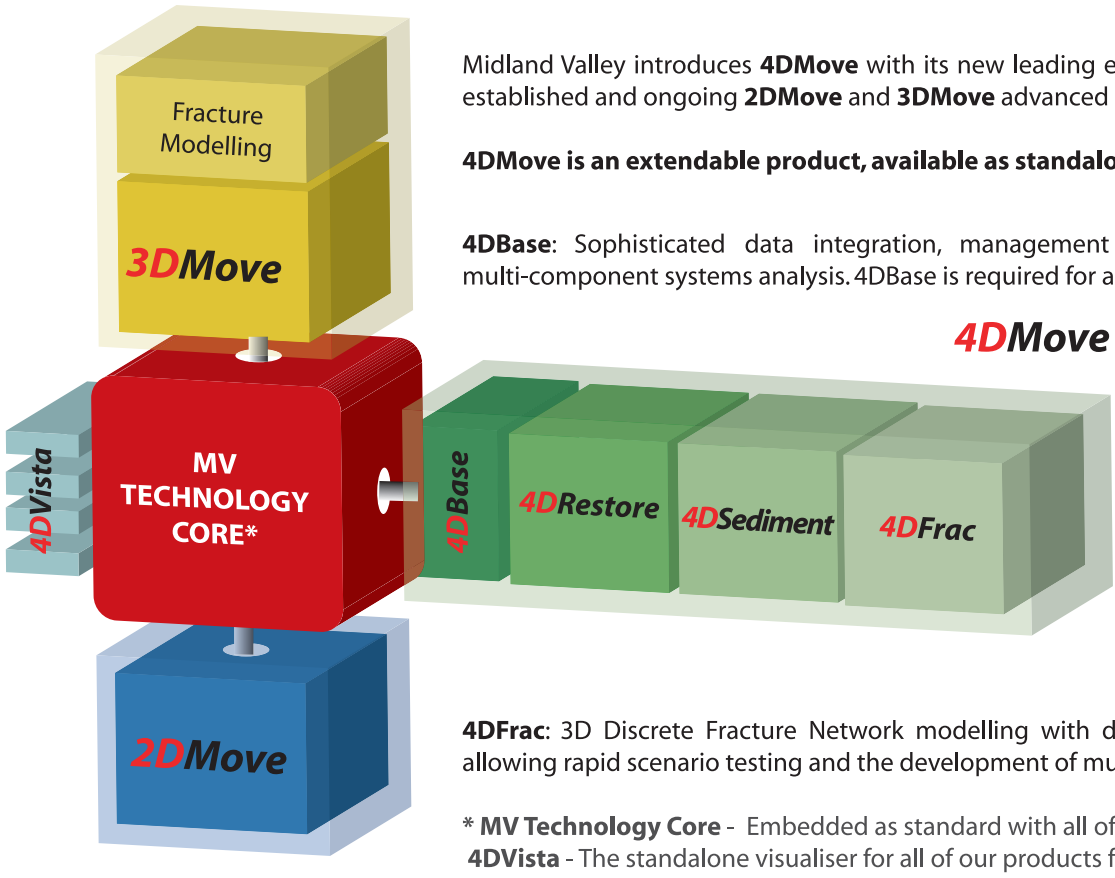

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REGIONS AND SECTIONS

The technical program and registration both will be available in early June for the AAPG European Region Energy Conference and Exhibition, which will be held Nov. 18-21 in Athens, Greece.

The meeting, the first joint venture meeting between AAPG and the AAPG European Region, is built on the theme "Challenge Our Myths."

It will offer more than 350 technical presentations – 230-plus oral papers in five concurrent sessions, and 120 posters.

The sessions and exhibition all will be held in the Megaron International Conference Centre in the heart of Athens.

Technical program highlights include:

✓ A session on "Untraditional Theories and Ideas in Global and Large Scale Geology," which will examine the basis for the concept of subduction zones.

✓ Updates on recent exploration and production in the Mediterranean, North Africa, Middle East, Caspian, Black Sea, Russia, North Sea, Norwegian Sea and Barents Sea.

✓ Updates on carbonate and clastic reservoirs, structural geology, heavy oil, unconventional resources and resource estimation.

✓ A look at the energy supply and demand picture.

Greece's multi-dimensional history and culture also will provide the setting for a number of social activities, including visits to classical and historical locations in and around Athens.

More information will be available in the June EXPLORER, and online via the AAPG Web site at www.aapg.org/athens. ❑

President

from page 3

EC will review and approve a new statement on global climate change by June 30.

The topic of global climate change will not be "solved" by the considerable work of our ad hoc committee and our revised statement. AAPG needs a permanent committee on the subject.

✓ **The Sundowner** – This event, taught to us by the Perth organizing committee, is like dessert after a fine meal. It occurred on the evening of the convention's last day. This year we enjoyed Executive Director Rick Fritz wearing a Hawaiian party shirt. Tommy Bahama would have been proud.

* * *

The annual convention and exhibition is an extremely busy time for EC members, because we try to attend all the various committee meetings scheduled during the convention. This year seemed especially fruitful with several new ideas coming from the committees.

I want to personally thank the Long Beach organizing committee, AAPG volunteers and AAPG staff for making the convention an uplifting, memorable experience for me and other attendees.

The new structure should be in place for new applicants beginning in July of this year.

* * *

As my year as president is nearing a close, I am even more convinced of and committed to the missions of AAPG.

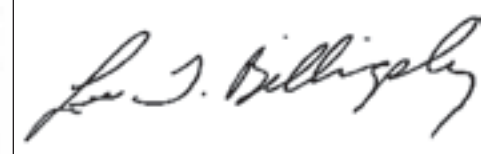
As I have stated in numerous addresses, AAPG has opportunities to play important roles in the areas of support for geoscience education, delivery of technical content and public outreach. As a professional association we are uniquely qualified for some of these roles.

If we do not assume these roles, no other institution will. Not government, not corporations, not the public and not academia.

As my high school and college-aged children used to complain about "burnout" near the end of their semesters, my exhortation to them was, "Sprint to the finish!" I intend to take my own advice.

Remember to vote in the AAPG elections. The deadline is May 15, and you can vote online.

'Til next month,



HoD

from page 4

members will be eligible to participate in the new structure following the present renewing of membership, which will be at the start of the new dues cycle in 2008.

* * *

In other House activity, delegates approved some housekeeping measures that included wording changes to previous House votes that dealt with:

✓ Limitations on candidacy.

✓ Adding International Regions to Advisory Council review relationships.

✓ Other miscellaneous wording updates.

Of the total 227 AAPG delegates, 174 – or 77 percent – were present in Long Beach.

* * *

Delegates also voted Affiliated Society status for the Geological Society of South Africa (Johannesburg) and the Qatar Geological Society (Doha). Associated Society status was approved for the American Association of Stratigraphic Palynologists (Arlington, Texas).

* * *

In new officer balloting, Houston consultant **George R. Bole** was voted chair-elect and **Robert E. Webster**, of Hunt Oil in Dallas, was elected House secretary/editor.

Both will take office on July 1, when present chair-elect **Marty Hewitt**, of Nexen Petroleum in Calgary, will take the gavel as House chairman for the coming year. As chair he also will sit on the AAPG Executive Committee. ❑

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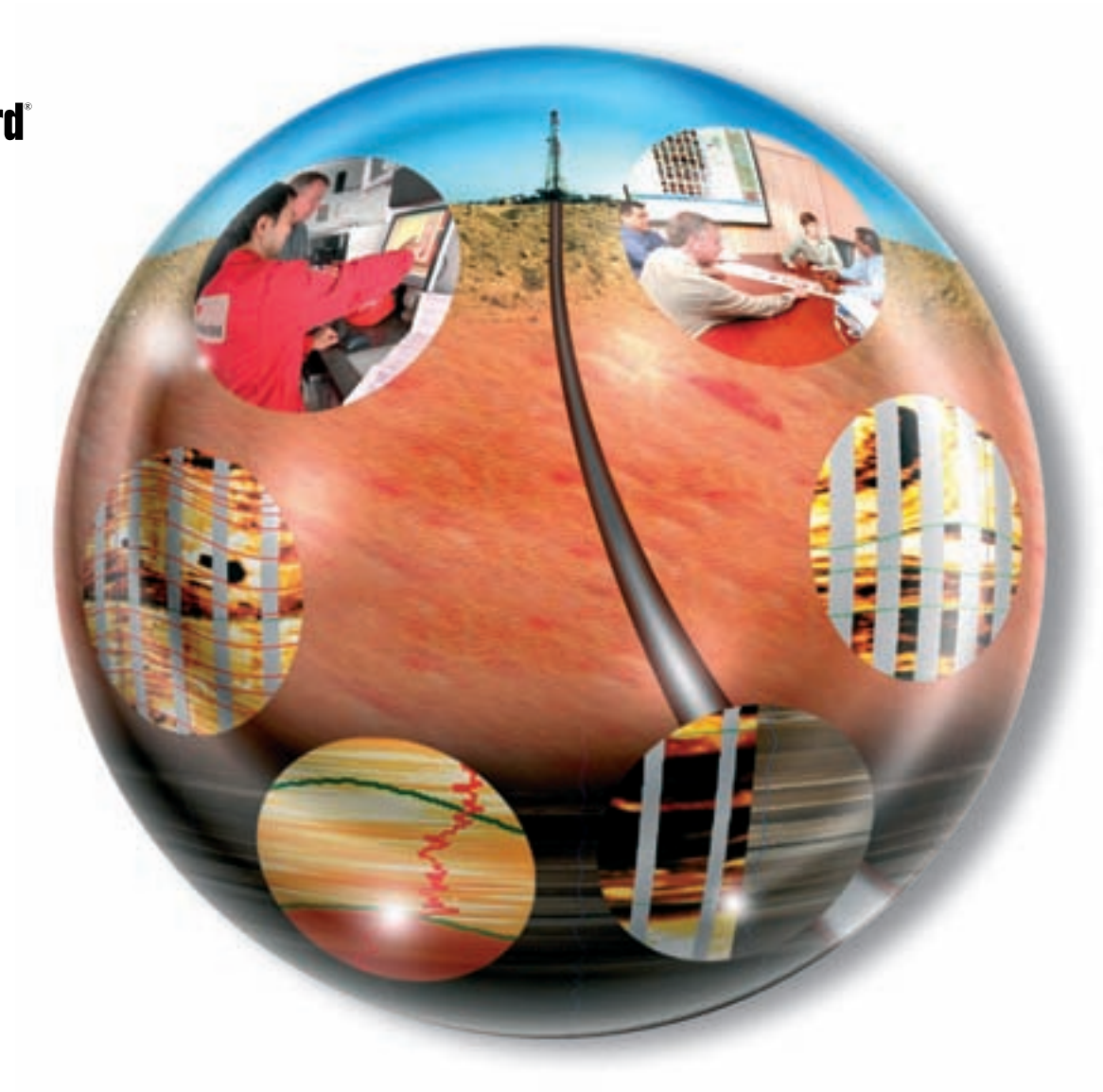

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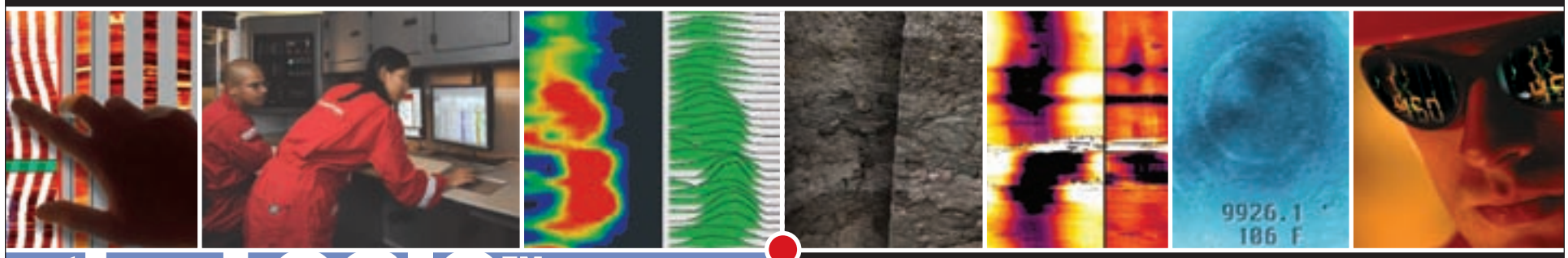

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Caveat: Economics Are No Slam Dunk

Rockies Living Up to Promise

By LOUISE S. DURHAM
EXPLORER Correspondent

During a luncheon talk at the 2006 AAPG Annual Convention in Houston, speaker Peter Dea predicted the Rocky Mountains would become the kingpin of domestic natural gas production owing principally to unconventional reservoir development.

The region appears to be well on the way to achieving this status.

The record-breaking crowd of 750 attendees that assembled at this year's annual 3-D seismic symposium sponsored by the Rocky Mountain Association of Geologists was indicative of the industry's near-frenzied activity level in the Rockies.

The attendance numbers represented an increase of 150 over the previous year – the largest one-year increase ever, according to Randy Ray, president of Julander Energy.

"We see a steady level of activity in the Rockies," said Dea, president and CEO at start-up company Cirque Resources.

"There's a tremendous amount of development drilling in the Powder River Basin, Pinedale anticline, Jonah, Piceance, parts of the Uinta, the Williston Basin, parts of the Wind River Basin – basically all the basins are seeing a steady level of development activity," Dea noted.

"There's still another decade's worth of development drilling in select fields in a lot of those basins."

Photo courtesy of Chris Schenk, U.S. Geological Survey

Everything is still pointing up in the American West: Above, a sandstone of the Frontier Formation, Muddy Gap section, Wyoming.

The drilling and development action is concentrated on resource plays, according to Ray. Many of these are supported with the latest technology, such as 3-D seismic and micro-seismic measurements trying to map the fractures while the wells are being fraced.

There's seemingly something here for everyone: Tight gas sands, shale, coalbed methane, thrust belt exploration.

A caveat: The economics are no slam-dunk.

The Piceance Basin is a good example.

Pumping in the Piceance

About 100 wells are drilling for gas in the tight Mesaverde sands in the Piceance Basin, according to Steve Cumella, senior geologist at Bill Barrett Corp., which is active here and several other locales in the Rockies. Production and activity in the Piceance have escalated this year, and production from the basin tallies about one Bcf/day from wells that average 8,000 feet in depth.

"The average reserves per well may be 1-1.5 Bcf, and well costs are about $1.5 to $2.5 million," Cumella said, "so the economics are not real good.

"The appeal of places like the Piceance is predictability – there's basically no dry hole risk in a lot of these areas," he noted. "You can plan a big program, and as long as your wells are economic you can predictably add reserves.

"In some of the Rockies plays where you're dealing with resource plays, there can be very large areas that can be developed with relatively little dry hole risk," Cumella said. "The challenge becomes making the wells economic either by keeping well costs as low as possible or by using technology to increase the well's productivity, or both."

Much of the tight gas in the Rockies is found in reservoirs comprised of fluvial sandstones that are discontinuous and have very low permeability. This results in limited drainage area for a given well, so well spacing of 20 acres or less is pretty much the norm.

"In much of the Piceance the well density is 10 acres," Cumella said. "If

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Photo courtesy of Bill Barrett Corp.

The farmer and cowboy – and the natural gas well – are friends in the Piceance Basin.

Rockies

from page 8

you have a section of land of 640 acres, that would be 64 wells. At a Bcf or greater, you'd be looking at 60-100 Bcf per section, so that's the sort of appeal you have here with high well density.

"If you look at where the big rig counts are and high levels of activity – Jonah, Pinedale, Piceance, parts of the Green River Basin, Natural Buttes – there's a pretty common theme of large stratigraphic intervals of gas saturated sandstone with high well densities."

'A Lot of Frac Work'

In fact, Ultra Petroleum has even drilled pilot wells on five-acre spacing at Pinedale field in the Greater Green River Basin in southwestern Wyoming. Half of the field has already been approved for 10-acre density, according to Steve Kneller, vice president of domestic exploration.

(See related story, page 14.)

Ultra currently operates 12 of the 30 rigs running at Pinedale, where the wells average 14,000 feet in depth, and drill and completion costs register a cool $6-$7 million. The company also controls a sizeable position in the active Jonah natural gas field on the south edge of Pinedale.

The productive discontinuous alluvial sand bodies in the Lance Pool section at Pinedale are probably no more than one-two acres in size, yet per well average reserves last year tallied seven Bcf, Kneller noted. This can be credited to reservoir height, given that the average section in the overpressured, super-tight rock (permeability = two-three micro-darcies) measures about 5,500 feet thick. The sands typically are stacked as distinct packages in the reservoir.

"We're completing the wells with a large number of frac jobs," Kneller said. "Each is fairly small, but 25 frac jobs per wellbore turns into a lot of frac work. We do them sequentially and open up the whole 5,500-foot section."

Ultra is the largest operator and owner on the Pinedale anticline, where more than 600 producing wells were kicking out 700 MMcfd from the field at the end of 2006.

A year-end reserves assessment by Nederland Sewell tagged gas in place at Pinedale at 48 Tcf, according to Kneller.

"The estimate for recoverable resources as of year-end was 27 Tcf," he said. "That's down to 10-acre well density, and if we go to five it should be more than that. At year end, Pinedale was rated the number two field in the U.S."

Pinedale was first mapped in the 1920s, and the first well was drilled in 1939. Twenty-something wells were drilled – all having gas shows – between 1939 and 1997 when Ultra drilled the first commercial well.

"It was a resource where people knew the structure was there, knew the gas was there, and just couldn't figure how to get it out," Kneller said. "It took a better understanding of the geology and geophysics and the completion techniques," he added, "and getting the thoughts together in the same room at the same time to get that 'Aha!' moment that made the difference between what was an uneconomic field and what is now a huge field."

Buzz in the Baxter

In the late 1980s and early 1990s, the Bakken shale was the focus of considerable activity in the Rockies. The action concentrated on the upper Bakken, which was marginally economic.

In 1995, independent Dick Findley drilled a well in eastern Montana that experienced a big drilling break and telling mud logs in the fractured dolomite middle section of the Bakken – and a mental light bulb went off. This became the defining moment that eventually led to development of the multi-million barrel Elm Coulee oil field.

(Findley received AAPG's 2006 Explorer of the Year award in recognition of his work there.)

Today, horizontal wells kick out sizeable volumes of oil from this segment of the Bakken, and Findley noted the play started an incredible amount of activity in North Dakota.

"There are some mixed results in North Dakota, and we're just starting to see some very nice wells come on,"

See **Overview**, page 12

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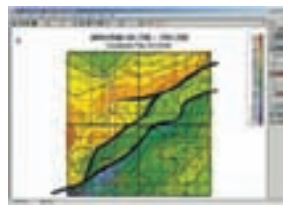

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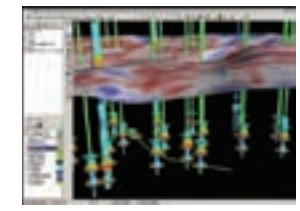

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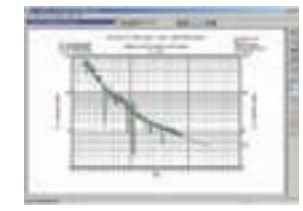

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Roadblocks Aplenty

Permitting Still a Rocky Adventure

By LOUISE S. DURHAM
EXPLORER Correspondent

The Rocky Mountains are the locus of a virtual beehive of industry activity these days.

In fact, this is the fastest growing producing region in the United States, according to Randy Ray, president of Julander Energy. It accounts for about a third of domestic natural gas production.

"This is significant, because natural gas is a clean energy fuel and the country is now concerned about burning clean fuel," Ray said. "The Rockies can provide a huge amount of that."

A comment from Peter Dea, president and CEO at Cirque Resources, underscored the importance of this supply.

"In January 2002 we had 700 U.S. rigs drilling for natural gas," Dea said. "Now that's doubled to 1,400, yet we've seen a 5 percent decline in U.S. gas production.

"This says we need to keep drilling a lot of wells to even try to stay flat," Dea added.

Instead of encouraging industry's all-out effort to produce this invaluable commodity in the Rockies, however, various groups and agencies are seemingly throwing up roadblocks aplenty.

For instance, drilling is prohibited for much of the year in numerous areas.

"There are so many federal lands (under the aegis of the BLM) in the Rockies," said Ray, who noted the largest accumulation of these lands is in Wyoming, Colorado and Utah. "Basically you can only operate July to November.

"There are restrictions for raptors, sage grouse, prairie dogs, and in winter it's migratory paths for large game," Ray said. "Every area varies, but on average we're restricted to about a third of the year for drilling – we don't have these restrictions on fee lands.

"We're very conscious of protecting the environment," Ray said, "but some people don't want any activity at all, so it's always a challenge there."

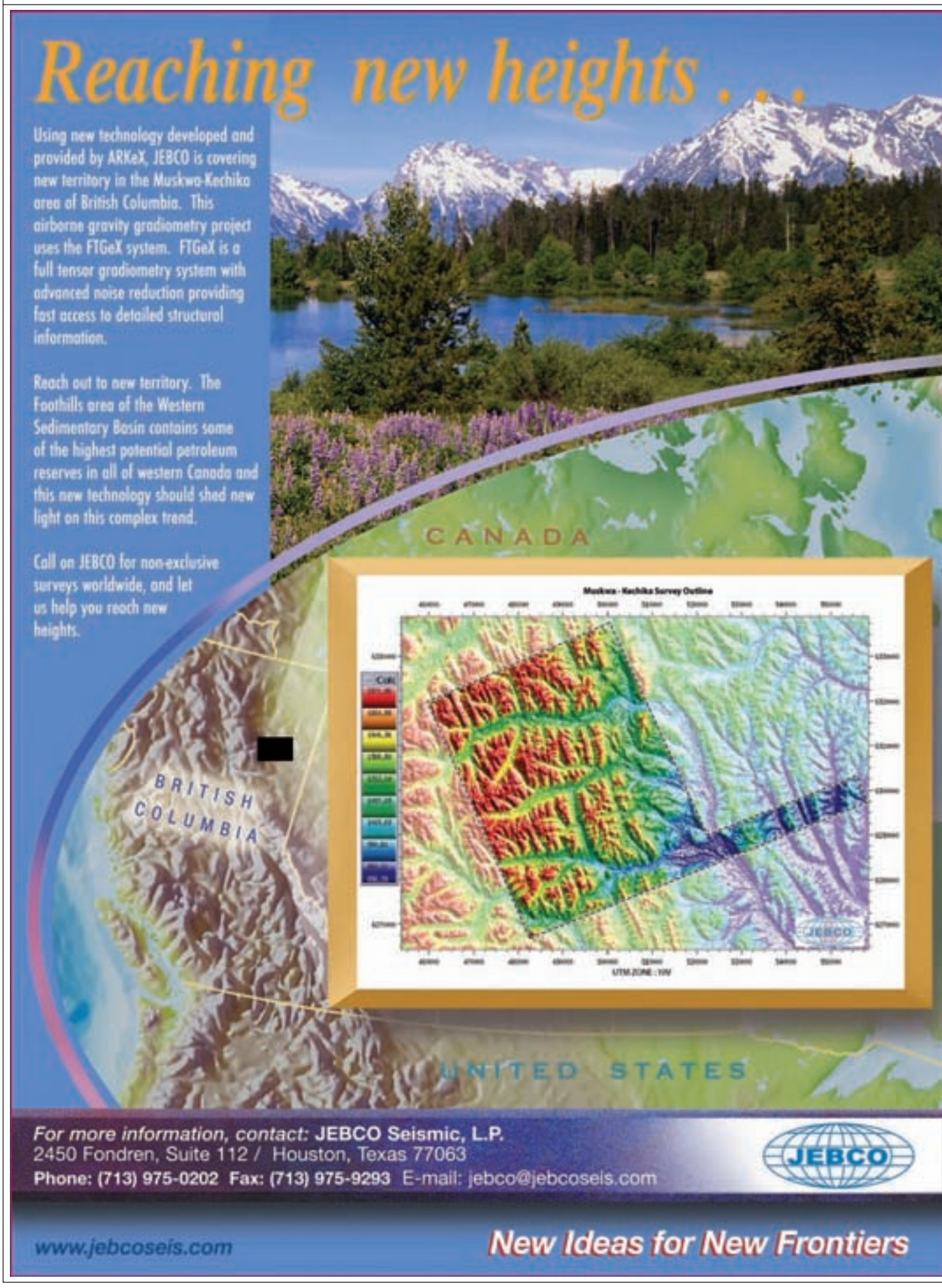
Dea voiced his take on the issue.

"The Rockies still suffer from over-regulation from federal agencies," Dea said, "especially the BLM, which is a pretty dysfunctional organization. There's poor communication from Washington, where the BLM people seem to appreciate the need for our industry, versus the field personnel who have too much autonomous power and are very inefficient in many regards.

"Some field officers are doing a good job and others a lousy job in issuing permits in a timely manner," Dea noted. "It's a major problem in some field offices, which are not doing their fiduciary duty to allow clean burning natural gas to be provided to the consumers of America in a timely fashion.

"It's an ongoing problem that never seems to get much better," Dea said. "We fight a lot of rhetoric." ❑

ROCKY MOUNTAIN ROUNDUP



Overview

from page 10

Findley said. "The operators that are starting to be rewarded by going up the learning curve and sticking with it will be rewarded and remain active."

Fred Julander at Julander Energy predicts shales may surprise everyone, with the extent and magnitude of recoverable resources just now starting to be tapped.

In fact, there's considerable buzz about the first horizontal well now being drilled in the Baxter shale. It's a Questar effort in the Vermillion Basin in southwest Wyoming.

Just don't expect many details – yet.

"It's a tight hole," said Vinnie Rigatti, general manager legacy division at Questar. "The well is targeting a specific zone within the overpressured Baxter."

The Baxter interval is 3,500 feet thick, and the company has completed at various points within that interval throughout its 18 producing wells.

Prior to drilling the horizontal well, Questar completed the Trail 13C-15J vertical well, which reached TD of 13,700 feet and came on exceptionally strong compared to the previous 17 wells the company drilled in the play. It's thought the well either intersected a vertical fracture system or fraced into such a system, Rigatti said. The well produced more than 65 MMcf of gas during its first 11 days on production.

Horizontal wells are noted for increased reservoir contact. The thinking at Questar is that the vertical fractures in the Baxter interval are a big part of the producing mechanism, so the anticipation is that the horizontal wellbore will intersect more vertical fractures than a vertical well. ❑

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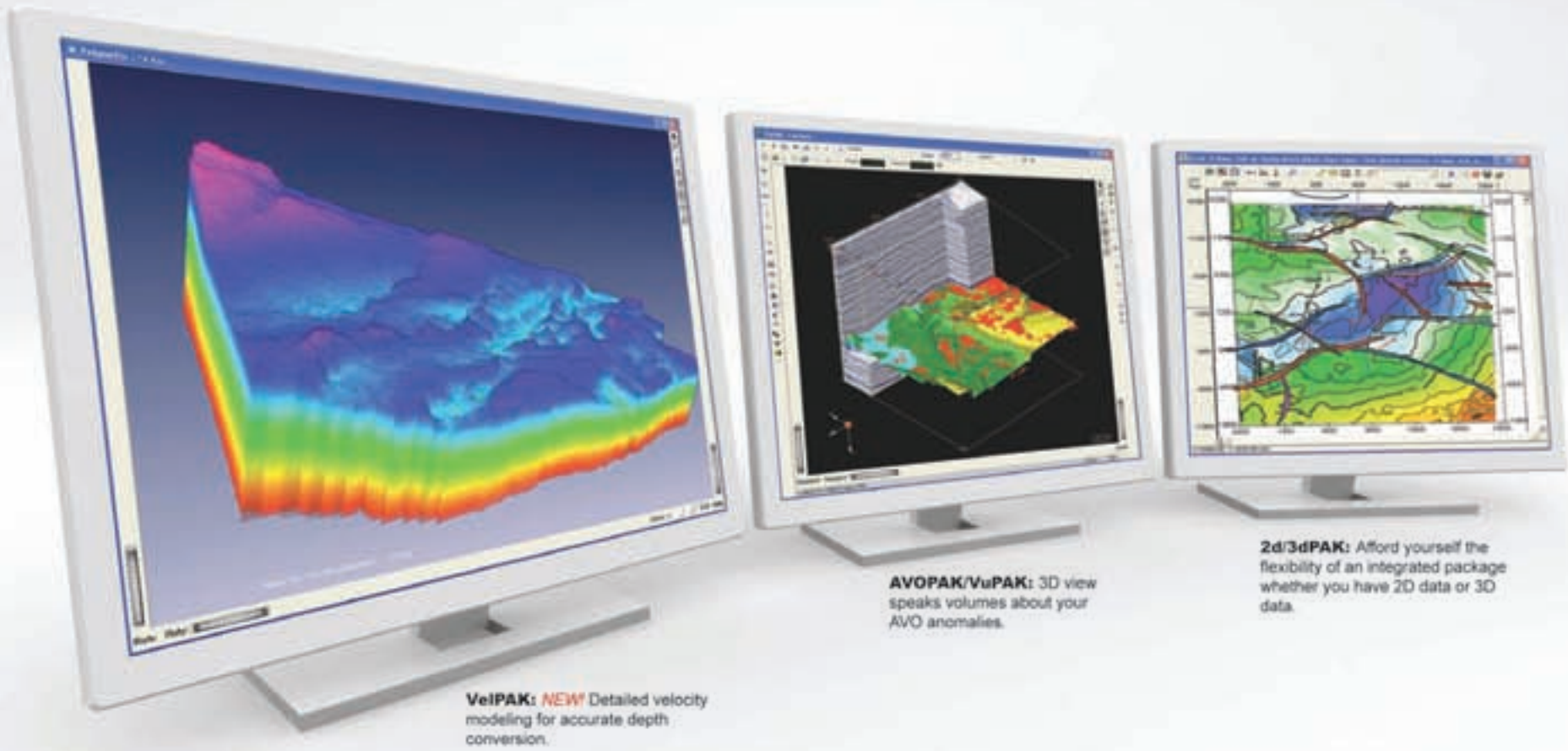

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Subtle Sweet Spots

Shales Add to Wyoming Portfolio

By DAVID BROWN
EXPLORER Correspondent

The southwest Wyoming region has almost everything you could want in a Rocky Mountain hydrocarbon province:

✓ Abundant exploration opportunities.

✓ Multiple petroleum systems and producing horizons, with good (if sometimes ambiguous) sourcing.

✓ Excellent existing gas production, including the Pinedale field, one of the top three gas fields in the United States.

✓ An emerging unconventional resource play in the Baxter shale.

✓ And a history of geological study and drilling going back 80 years.

Production from the Cretaceous typifies this area of the state, according to Randi Martinsen, a senior lecturer in petroleum geology at the University of Wyoming who also serves as AAPG treasurer.

"The productive horizons were deposited during the time of the major Cretaceous seaway," she said. "It was a foreland basin at that time."

The area contains a thick interval of Cretaceous age marine shale and associated marine to transitional-marine sandstones that historically have been the major exploration targets.

Oil production in the region includes the Patrick Draw field, which dates back almost 50 years and is now on tertiary, CO_2 recovery.

"Patrick Draw is a major oil field that produces out of the Upper Cretaceous Almond Formation. It's a structurally influenced strat trap," she said.

Photo courtesy of Questar

The QGM Canyon Creek gas plant in the Vermillion Basin in southwest Wyoming.

More recently exploration has focused on thick successions (thousands of feet) of variable net-to-gross, sand-rich fluvial systems, she noted. Production is from numerous vertically stacked, relatively thin and highly discontinuous tight sandstone reservoirs.

"That's why the spacing can be down to 10 acres" in the large gas fields, Martinsen said.

The Pinedale field is "a big, whopping anticline – it's a really big structure," and the nearby Jonah gas field also is a more subtle fault-bounded structural trap, she said. Both produce from the Lance formation.

Interestingly, Jonah, in addition to being the state's biggest gas producer in 2006, also was the state's biggest oil producer. Pindale, when more fully developed, is expected to overtake Jonah in both gas and condensate production.

Continuous or basin-centered gas plays not obviously tied to structure or stratigraphic facies changes can be found in the Wyoming Cretaceous, but Martinsen said those plays still require study and analysis.

"In reality they are very subtle traps," she explained. "There's a lot of gas in the basin but it's not a case of, 'There's gas everywhere.' People still have to do the work. They have to do the geology."

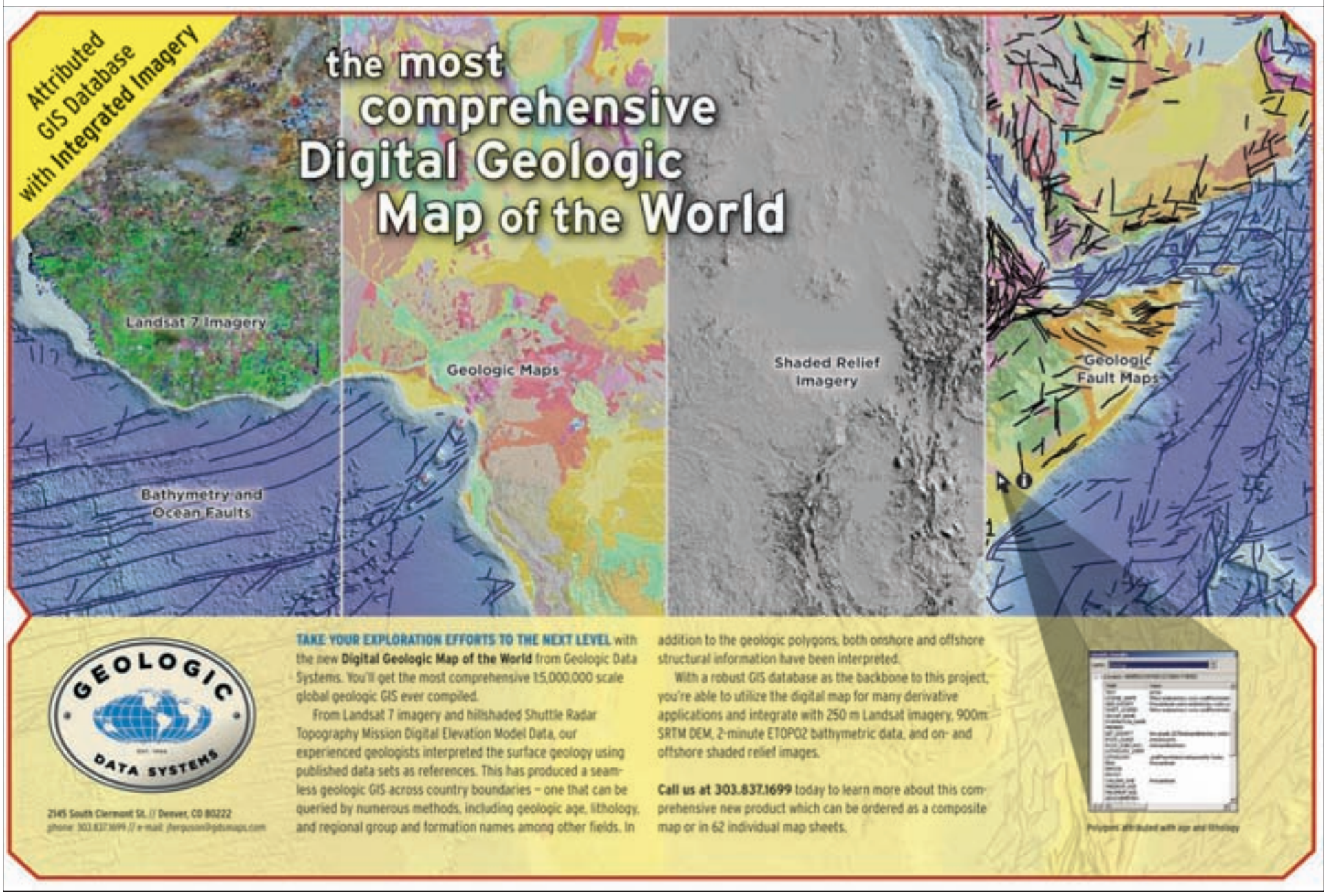
ROCKY MOUNTAIN ROUNDUP

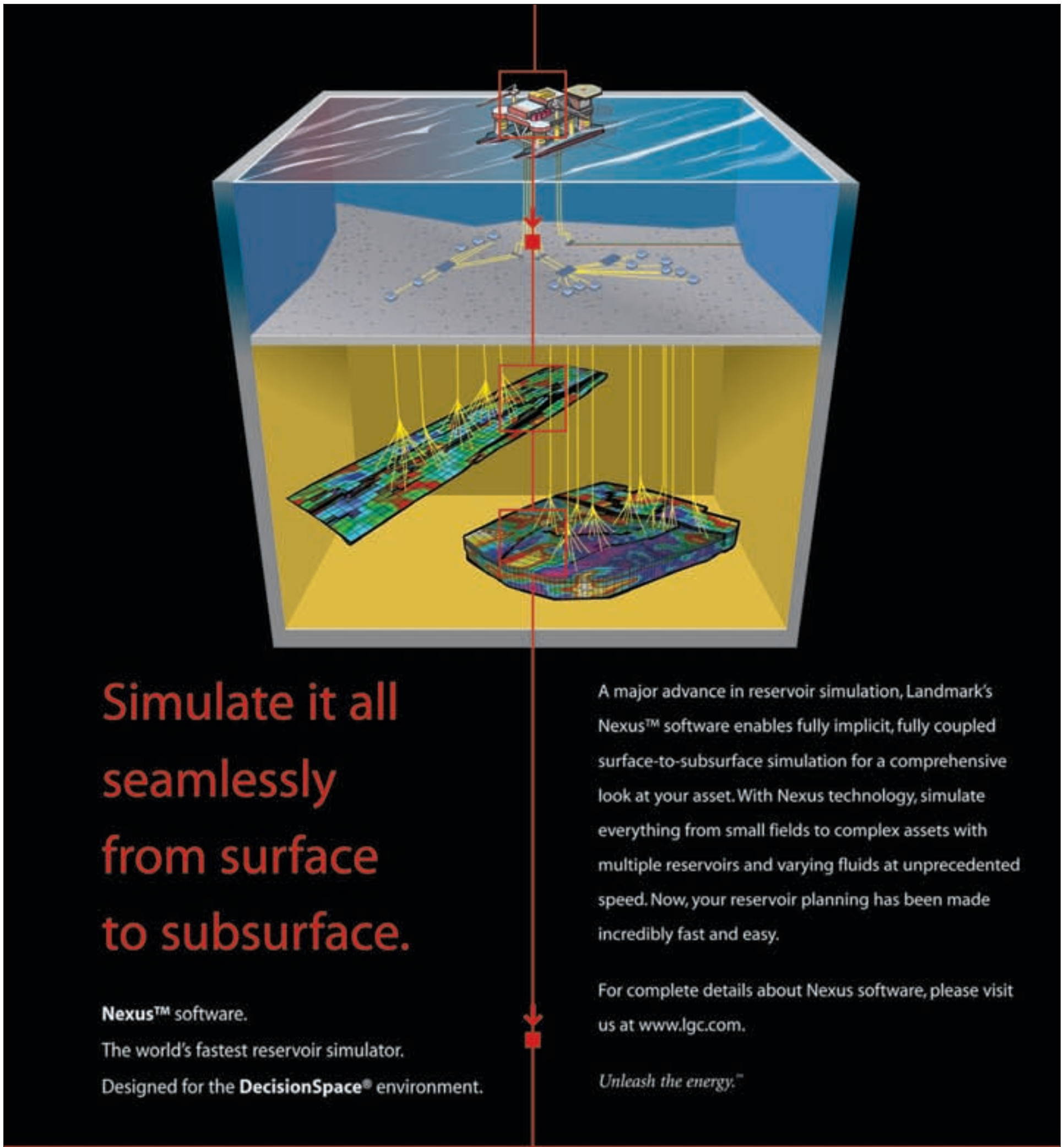
Good Results

One new unconventional play generating good results in southwest Wyoming targets the Cretaceous marine Baxter shale.

Questar Exploration and Production Co. of Denver, a wholly owned affiliate of Salt Lake City-based Questar Corp., recently announced a nine million cubic feet-a-day well producing from the Baxter and Frontier formations.

See **Wyoming**, page 16





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Wyoming

from page 14

That's far and away the best results from any of the company's 18 wells in the play, and Questar Exploration president Charles Stanley said the unusually high production rate probably was related to naturally occurring fractures.

The Baxter shale play is located in the Vermillion sub-basin of the greater Green River Basin, about 75 miles south of Rock Springs, Wyo., said Vincent Rigatti, general manager of Questar Exploration's legacy division.

"We've been active in the Vermillion since the 1920s," he said, "and it's been a pretty steady pac of activity through the decades."

Questar and other operators had drilled into and tested deeper potential pay zones in the region, including the Frontier, Dakota and Nugget, Rigatti said.

"Through that drilling they had to drill through the Baxter, and that was difficult because it was so over-pressured," he noted.

When operators completed those wells and tried to produce from the Baxter, they got a "real nice flow rate, for one or two days," he added.

As the Barnett shale play unfolded, Questar decided to take another look at the Baxter shale, Rigatti said. The company started with re-entries in two existing wells.

"What we found out is that not all shale plays are the same," he said, "so we tried to compare and get information from the other shales to help with our evaluation of the Baxter."

A drilling program to define the play has proceeded methodically and somewhat slowly, "in part because we've been evaluating such a big area.

Questar has about 140,000 net acres in the Vermillion," Rigatti said.

"We're working on a new EIS for that whole area that covers 157,000 acres," he added. "That's been going on for about a year."

The Baxter Learning Curve

Like any shale play, the Baxter involves a learning curve – and Questar Exploration has just started moving up the curve, Rigatti said. The company recently spudded a horizontal well in the shale.

"This is our first horizontal well (in the Baxter play) so we're keeping things fairly simple from a well plan and completion standpoint," he noted.

"Once we get the well landed and tested, it will take at least six months of production before we can have a good understanding of the ultimate results," he said.

Questar also is looking at results from fracturing its earlier Baxter wells.

"We started out with what you'd call a conventional frac. Now it's more of a slickwater frac – at least, that's where we are right now," he said. "In some of the wells we've done up to seven frac stages in the Baxter alone."

To date, Questar has kept one or two rigs working in the play. With a drilling boom going on in Wyoming, "it's always challenging to get qualified personnel, especially during these periods of high industry activity," Rigatti said.

Several Questar wells outside of closure are productive in the Baxter, he noted. And results vary as evaluation drilling has moved southward in the Vermillion.

"We have one well that showed lower pressures. We're starting to come out of the overpressured cell and we have seen some oil production," Rigatti said.

Questar officials have estimated per-well ultimate recovery at two-to-four billion cubic feet equivalent in the Vermillion unconventional play area.

Successful shale plays seem to reach a tipping point when enough knowledge is accumulated or uncertainties resolved, followed by hundreds or even thousands of wells.

Questar's impact statement for the area "evaluates the drilling of up to 4,000 wells.

"That doesn't mean you're going to drill 4,000 wells, Rigatti added. "I don't know what the ultimate number will be."

Mowry Shale Sweetspots

Wyoming could see another shale gas play extending more into the central part of the state, this one in the Mowry

See **Assessments**, page 18

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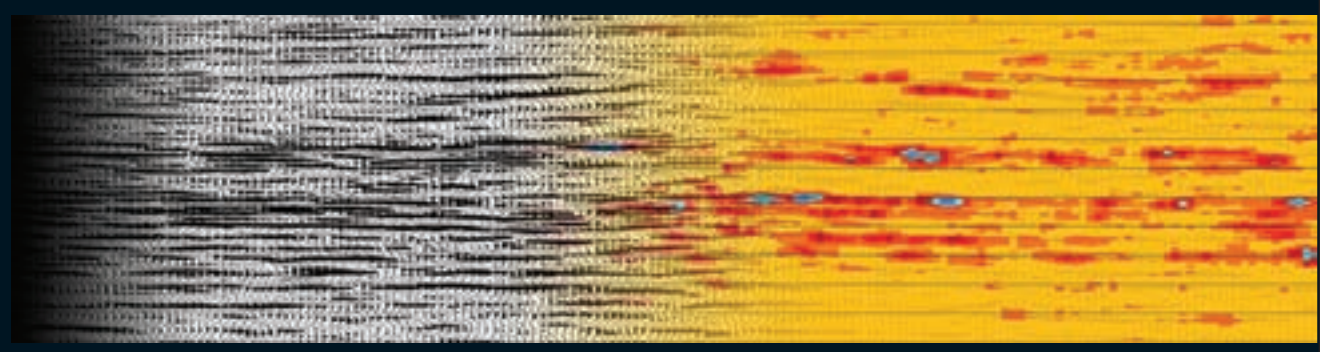

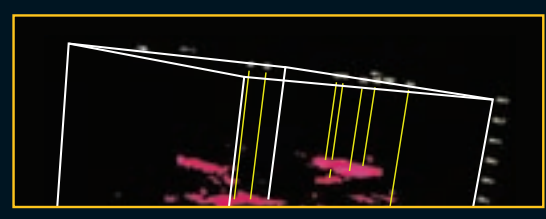

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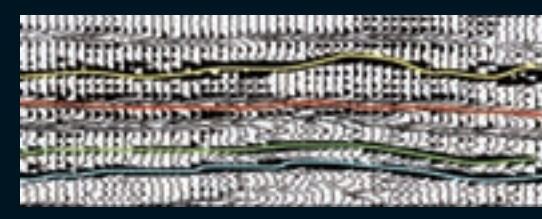

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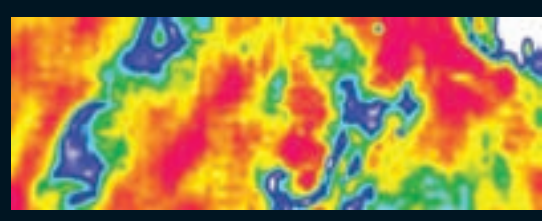

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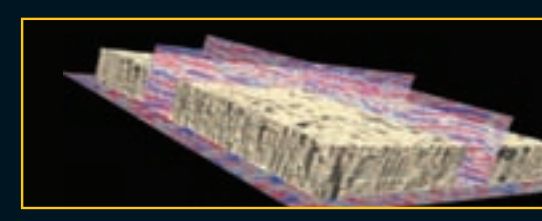

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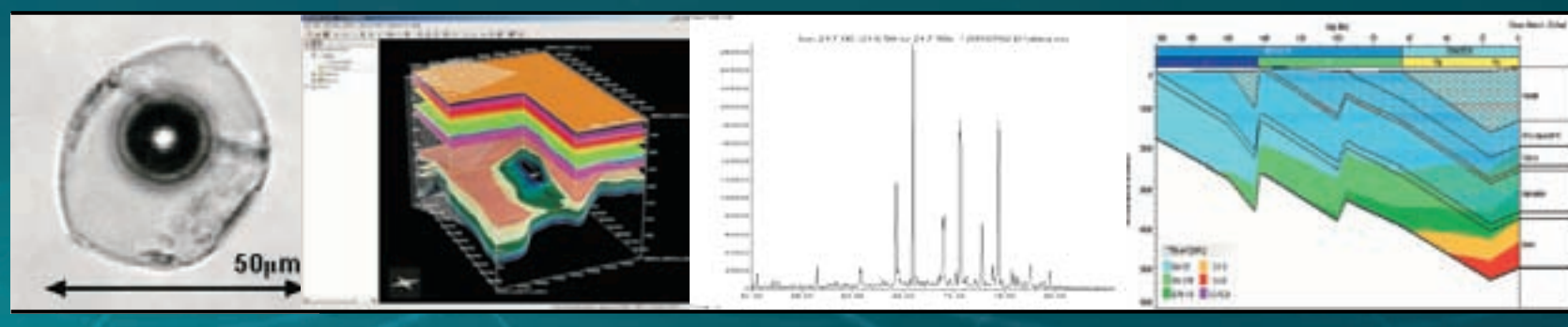

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Abstract Deadline Nears for GEO2008

The abstracts submission deadline is coming fast for GEO2008 – the eighth Middle East Geosciences Conference and Exhibition.

The meeting will be held March 3-5 at the Bahrain International Exhibition Centre, built on the theme "Integrated Geoscience – Technical, Business and People Solutions."

Abstracts, which should be submitted online, are due June 4.

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Assessments

from page 16

shale below the Frontier.

Ronald Surdam of the Wyoming State Geological Survey presented an analysis of Mowry shale potential at the recent AAPG Annual Convention in Long Beach.

Surdam said the Mowry is known as a significant source rock. Below 8,000 feet in Wyoming it has generated all its potential hydrocarbons but expelled only 20 percent of its gas, he noted.

He said the Mowry shows a regional seismic velocity inversion surface at 8,000-9,000 feet. Although the Mowry can reach a depth of 16,000 feet in the state, he focused on the 8,000-10,000-foot area for gas prospecting.

Regionally, seismic results can display a dramatic velocity slowdown in the Mowry. Total organic carbon in the shale would have to approach 25 percent to account for that slowing, according to Surdam.

Because analysis has found a maximum 2.5 percent organic content in the Mowry, the seismic indicates a rich gas content, probably associated with fracture porosity, he said.

Surdam concluded that seismic attributes can be used to detect gas-rich sweet spots in the Mowry shale.

A shallower Mowry oil play has developed at the far eastern edge of Wyoming. Brigham Exploration of Austin has drilled three vertical and two horizontal wells in that play with its partner, American Oil and Gas of Denver.

Boom Times?

The U.S. Geological Survey completed an undiscovered oil and gas assessment of the Southwestern Wyoming Province in 2002. At that time, the USGS estimated a mean undiscovered resource of 84.6 trillion cubic feet of gas, 2.6 billion barrels of NGL and 131 million barrels of oil in nine total petroleum systems.

Martinsen said the survey's assessment of gas potential helped touch off the southwestern Wyoming drilling boom.

A six-fold increase in natural gas prices probably didn't hurt, either.

Tom Finn, a USGS geologist in Denver, worked on the southwest Wyoming assessment and coauthored its section on the Hilliard-Baxter-Macos system, with a mean estimate of about 12 trillion cubic feet of undiscovered, unconventional gas.

That's a remarkable call, given the lack of existing production or even well control in the Hilliard-Baxter-Macos at the time.

"I can count on a map five or six wells that produced from that unit at the time we were doing the assessment, so we had no idea what was going on, really," Finn said.

In addition to Baxter shale, the USGS identified the Phosphoria, Mowry Composite, Niobrara, Mesaverde, Lewis, Mesaverde-Lance-Fort Union Composite, Lance-Fort Union Composite and Wasatch-Green River Composite petroleum systems in the southwest Wyoming province – defined by sometimes overlapping sourcing.

"We attribute most of the Paleo oil to Phosphoria source rock. Then we have the classic Mowry oil, early-late Cretaceous," Finn said.

"Then there's evidence for Type 3 Kerogen sourcing in other shales, and of course there's the coals," he added.

In its assessment, the USGS used the terms "unconventional gas," "continuous gas" and "basin-centered gas" interchangeably.

Almost.

"Some unconventional plays are not basin-centered – for instance, coalbed methane or some of the shallow gas plays," Finn noted.

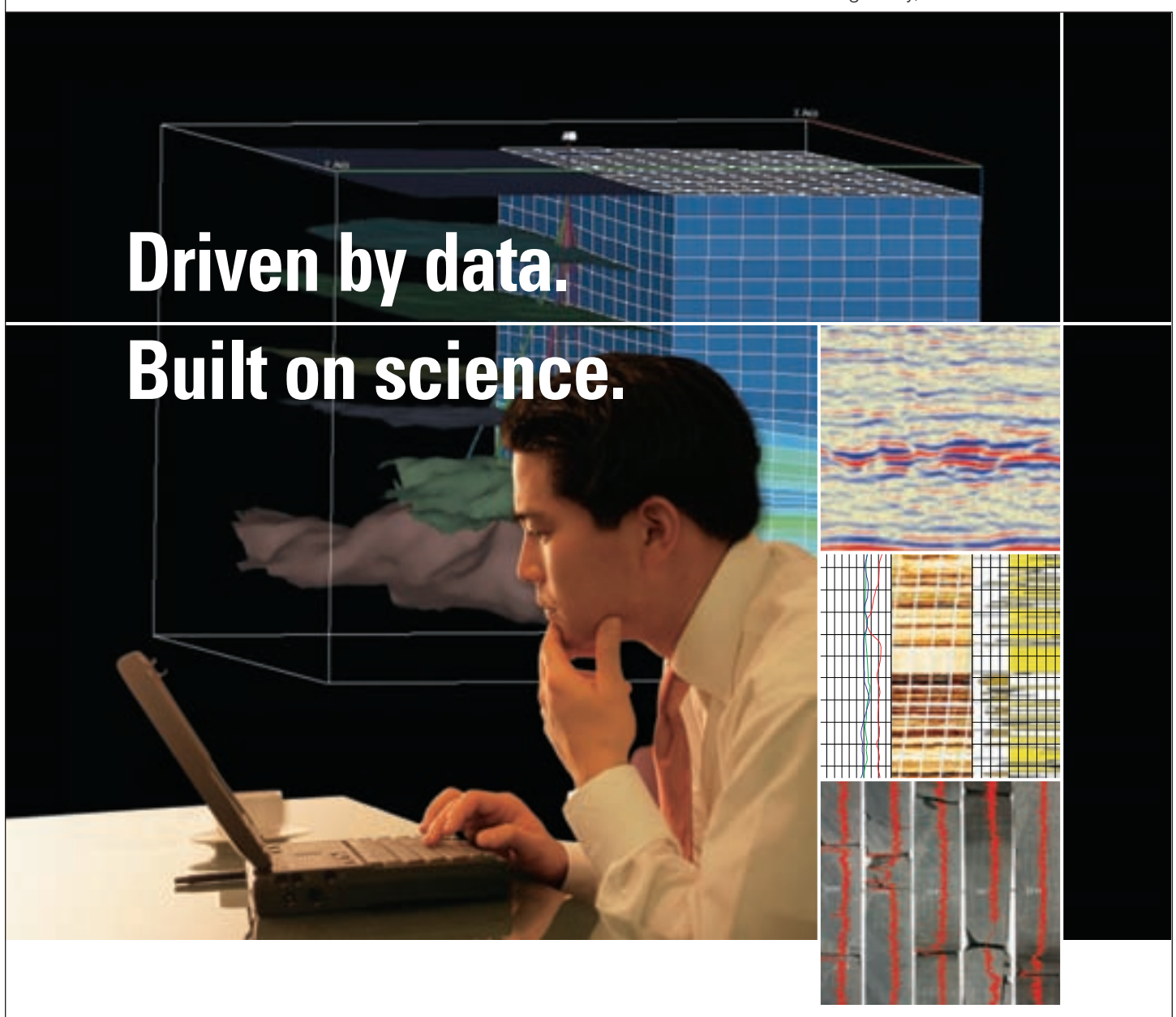
Most of the undiscovered gas resource in the area was classified as unconventional and continuous, and Finn said coalbed methane was not a major factor.

"As I recall, when we did that assessment we didn't give the coalbed methane as much as we should have," he said.

With multiple exploration chances, southwest Wyoming should be active for the foreseeable future – despite, or maybe because of, its long exploration history.

Said Rigatti:

"It's interesting. The old adage that the best place to find oil and gas is around oil and gas fields – that's true." ❑



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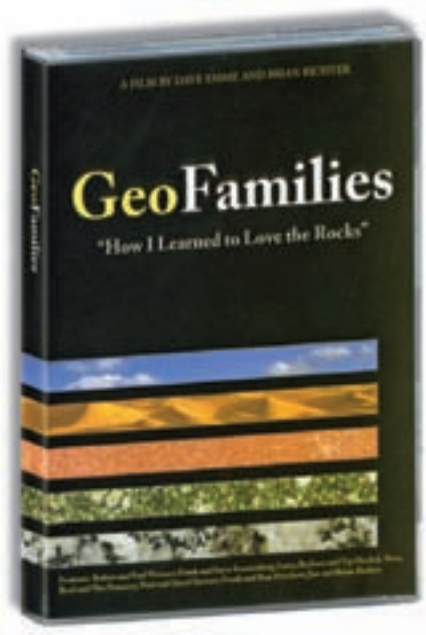
New Film Tells Geologists' Story

Rocks: It's a Family Affair



BY BARRY FRIEDMAN
EXPLORER Correspondent

They sit on sofas, around coffee tables and on outdoor rocks in the backyard – sometimes with grandparents and wives and brothers and sisters – talking the way those in documentaries usually talk.

You hear stories about growing up poor, high school triumphs, business successes and failures; you see the graduation and vacation photos and the grainy ones, too, when fathers had hair and sons had beards; and you watch the pride, bemusement and joy of people working in an often incomprehensible profession.

But in this case a common thread weaves through the stories and the pictures and memories, tying one generation to another: Geology.

That's the world that Dave Emme wanted to capture on film. That's the story he wanted the world to hear.

Welcome to "GeoFamilies – How I Learned to Love the Rocks," a new documentary made by the son of geologists who remembers lovingly listening to hear his parents' stories of their profession (petroleum) and their love (geology).

The movie features more than a dozen AAPG members – seven families – including two past AAPG presidents, who by reflecting on their careers and family bonds offer a universal portrait of those drawn to the wonders of the earth.

"GeoFamilies," as the first half of the name suggests, is a documentary about geology; more importantly, as the second half indicates, it's also about families.

"Mainly I wanted to make a film that the geologic community would find entertaining and also look at with a source of pride," says David Emme, a Palo Alto, Calif., based filmmaker who both directed and produced the hour-long film.

"I also think that it's important to preserve the personalities of each generation."

To that end, Emme has these families reliving what it's like and what it means to be in the earth sciences.

"I wanted to understand why people got into the field and stayed in it, so the film goes through the whole experience from childhood and school to careers and retirement."

Personal Perspectives

Geology, as he was reminded, is a collaborative effort – even if the collaboration is sometimes a bumpy road.

In the film, there's a memorable scene where Paul and AAPG member Daryl Stewart, father and son owners of Stewart Petroleum, are talking about their company's early days in the mid-1980s and how they used to work on a red felt table underneath a Pink Floyd poster in Daryl's room.

As the business starts to grow, Daryl thinks the new company should get a computer, something Paul vows he'd never use.

"Still," says Daryl, "we had a friend come over, fed him some scotch, let him bounce on the trampoline we have, and he got us set up on the computer."

Paul smiles as Daryl tells the story.

You can see it in his eyes: *The kid was right on this one*.

Also sharing memories and experiences with their son and father, respectively, are past AAPG presidents Robert "Bob" Weimer, who shares screen time with his son, Paul, and Steve Sonnenberg, who joins his father Frank for some reflective and perceptive views of their professional love and personal journey.

Why geology?

"Geologists become interested in geology for a number of reasons, but definitely it is the outdoors and the hiking and the trying to unravel this earth history piece," Steve Sonnenberg says, perhaps speaking for everyone in the film.

"(It's) the big puzzle," he said of the earth, "that sometimes we go to look at because it intrigues and captures the imagination of people – and makes them geologists."

Paul Weimer, a tenured professor at the University of Colorado, a past AAPG officer and Distinguished Lecturer who has spoken to groups on five continents, said that another bond felt by geologists is the feeling that "there are no borders.

"As geologists, you can meet people

continued on next page

BAKER HUGHES INTEQ

Photo courtesy of David Emme

Left, professor Bob Weimer and young student Steve Sonnenberg; right, the slightly older but still-young professional Sonnenberg with his geologist father, Frank.

continued from previous page

and just instantly be friends – just hit it off immediately," Weimer said.

And his father, who in addition to being a past president is also an AAPG Honorary Member, Distinguished Educator Award winner and Sidney Powers medalist, defines the geologic bond succinctly and perfectly:

"It all starts with the rocks."

Rock On

Emme, who says he wanted to document the character of geology and the characteristics of those who go into the profession, says becoming a filmmaker was not something he had in mind when he graduated from Stanford University in 2006.

Even today, he knows there's something in his DNA that makes him hard to categorize.

"When it took me two hours to answer the 'What is your permanent address?' question from my insurance agent, I realized that I'm harder to predict than most."

His initial foray into filmmaking was going to be a documentary on the local music scene in Boston, but was contacted by a family friend, Brian Richter, a geologist and AAPG member who appears in the film, who wanted to make a film about multi-generational geologic families.

It was Richter, incidentally, who provided most of the funding for the film, which was completed for less than $3,700.

Emme says it took him about 20 minutes to put the music documentary on hold and begin work on GeoFamilies.

He started DRE Films and, because both of his parents are geologists, says he had an intuitive feel for the characteristics that define geology and the geologist, though he says his appreciation for the profession has grown since doing the film.

As for GeoFamilies, he contacted his subjects, conducted and edited the interviews and was, generally, in charge of every step of the process.

To him, there is geology, literally, in the blood of those featured. Like children, he said, geologists have to keep their sense of wonder and excitement.

And when children are raised in such an environment, you can see the symmetry and connection in a very real way.

"When a geo-family goes camping," he said, "mom and dad spend all their time doing exactly what the children want to do; wandering around looking at things. Everyone is picking things up and breaking them with hammers to see what's inside, finding rocks, climbing rocks, even licking rocks and, in general, exploring. At any given point in a child's life, there is always an appropriate life-lesson that can be taught through geology.

"The bond created by those shared activities is enormous, especially when established over a lifetime."

A Good Start

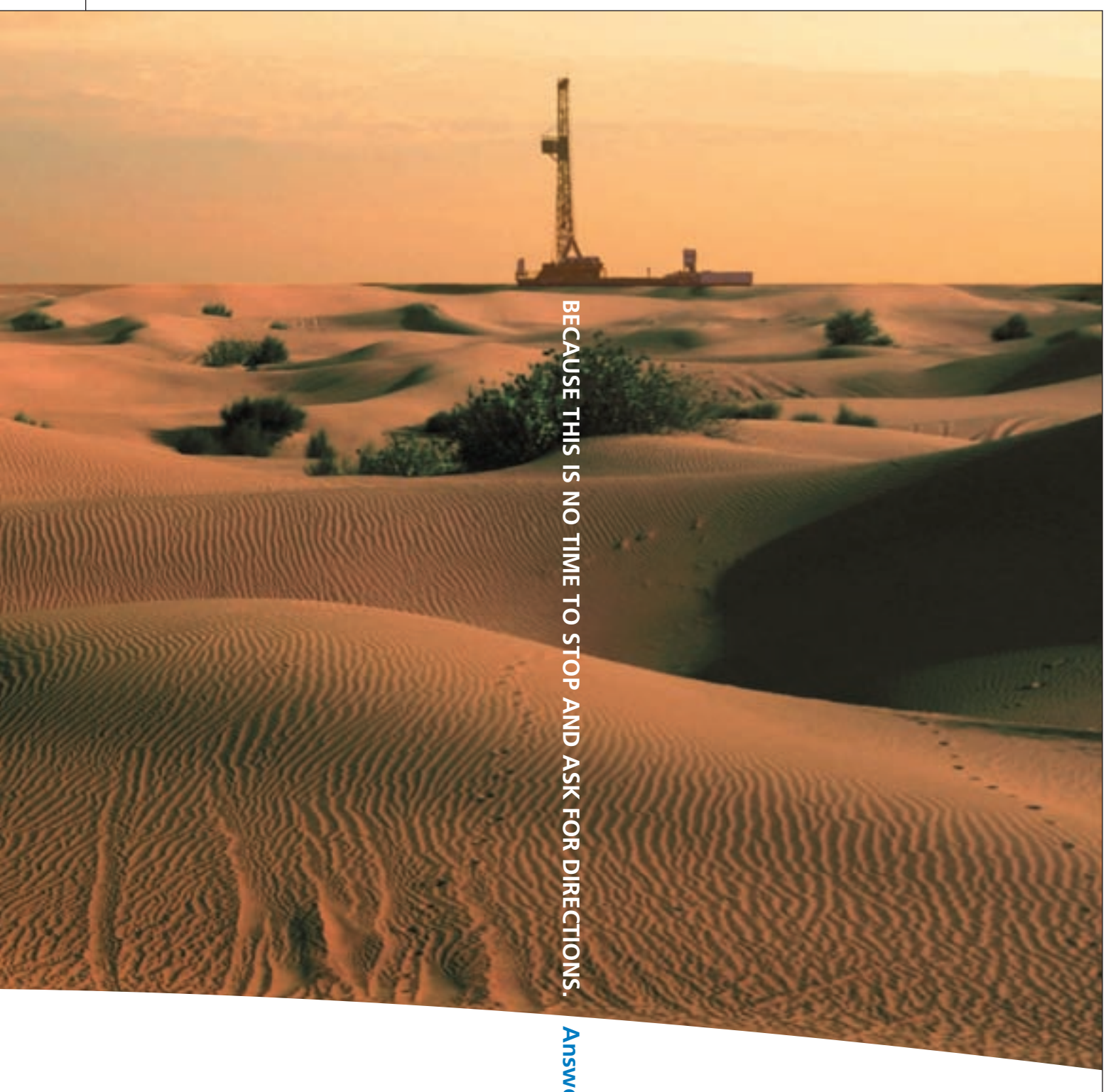
Emme is aware that the film, a portion of which was shown as part of the opening session at the recent AAPG Annual Convention in Long Beach, has a certain "inside baseball" feel to it – but that, he says, can act as not only a balm to geologists and their families, but even as a recruiting tool.

"I would like the film to get out."

The film, which is being distributed by the Rocky Mountain Association of Geologists and also available through the AAPG Bookstore, was recently first screened in Denver for those who were featured, and Emme was heartened by the "energy and excitement" in the room.

"When you get 17 geologists telling stories and talking about how much they love geology," he says, "it's hard not to make it sound like a really good field, which could serve as a nice synopsis for somebody thinking about pursuing it as a career."

And for those who don't, Emme says the film is for "anybody who wants to understand why their crazy friends and family love rocks so much." ❑



Production Plateau Possible In 13 Years

By LARRY NATION
AAPG Communications Director

World oil production will reach a peak plateau by 2020-40. This was one of several key implications of a Hedberg Research Conference released at the AAPG Annual Convention in Long Beach.

Production at the plateau level will be 90-100 million barrels per day, a level only 10-20 percent higher than world oil production in 2005, said Richard Nehring, chairman of the Hedberg Research Conference on Understanding World Oil Resources, held last November in Colorado Springs.

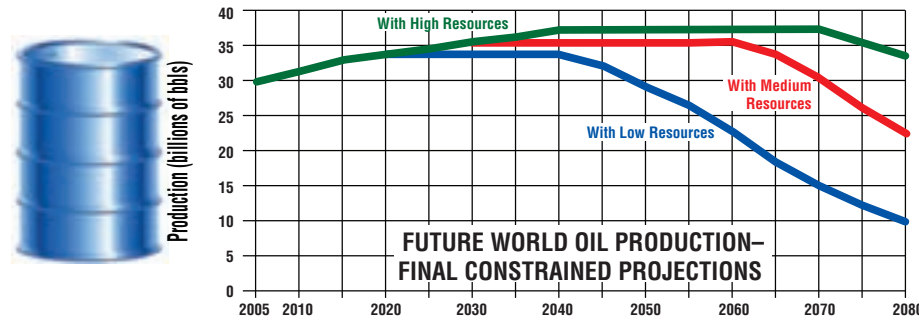
"Depending on the ultimate level of world oil resources – which is substantially uncertain – this plateau of maximum production is likely to last for 20-30 years before world production begins its ultimate decline," Nehring said.

"The primary reason why world oil production will reach a peak plateau within 15 to 25 years is not a lack of world oil resources," he said. "World oil production will reach a peak plateau within 15 to 25 years primarily because current world oil consumption is using up the world's oil resource endowment at a rapid rate.

"Consumption of the first trillion barrels of world oil production took more than 140 years from the beginning of oil production in 1859, he said. "Consumption of the second trillion barrels will occur within only 30 years."

Nehring presented estimates of ultimate world oil resources – conventional and unconventional – ranging from 3.4 to 5.0 trillion barrels. Although these estimates are substantial, resources at these levels will still constrain future production.

Current levels of production require a high level of gross reserve additions simply to replace declines. A substantial industry effort will be necessary to even increase production capacity slowly over the next 15-25 years and maintain it thereafter.



Production and reserve additions will be further constrained by:

✓ Access prohibitions.

✓ Resource nationalism and insufficient reinvestment.

✓ Wars and civil unrest.

The AAPG Hedberg Research Conference on Understanding World Oil Resources was designed to bring together many different perspectives on the complex problem of world oil resources and their implications for world oil production. The 75 conference participants came from 18 different countries spread across all six populated continents.

A broad variety of organizations were represented at the conference, including 15 international, national and independent oil companies and 10 national, state and provincial geological surveys and resource agencies.

All of the broad professional specialties of oil exploration and development were represented – geology, geophysics and petroleum engineering, together with many key subspecialties as well. All three components of future additions – recovery growth from existing fields, future discoveries and unconventional resources – were discussed at length at the conference.

The conference format included one session of oral presentations, which emphasized assessment methodologies and provided essential background for evaluating the subsequent posters.

Three poster sessions provided empirical grounding, covering both conventional and unconventional oil resources. The two conventional poster sessions assessed both recovery growth and future discovery potential.

Because world oil resources are concentrated in a small number of major provinces and, within those provinces, in a small number of giant and supergiant fields, Nehring said the posters focused on those provinces with an additional potential beyond current known recovery of at least five billion barrels each.

The poster sessions on unconventional resources included major deposits of oil from mature source rocks, which is just beginning to come into prominence with the development of the Middle Bakken in the Williston Basin in Montana and North Dakota.

The lengthy discussion sessions at the Hedberg Conference focused on thrashing out the issues surrounding oil recovery growth, future discovery potential and unconventional sources of oil.

Nehring said the conference deliberations did not include conversions (such as gas-to-liquids or coal-to-liquids) or direct oil substitutes such as biofuels.

Results were detailed at a morning oral session, followed by a poster session the following morning.

An AAPG publication on the results is planned. ❑

Hedberg Resource Conclusions

Hedberg research conference conclusions included:

✓ Peak oil production is not imminent.

✓ Nevertheless, peak oil is foreseeable (2020-40).

✓ A continuous decline in world oil production is inescapable in the latter half of the 21st century.

✓ The "peak" most likely will be a high plateau for a few decades.

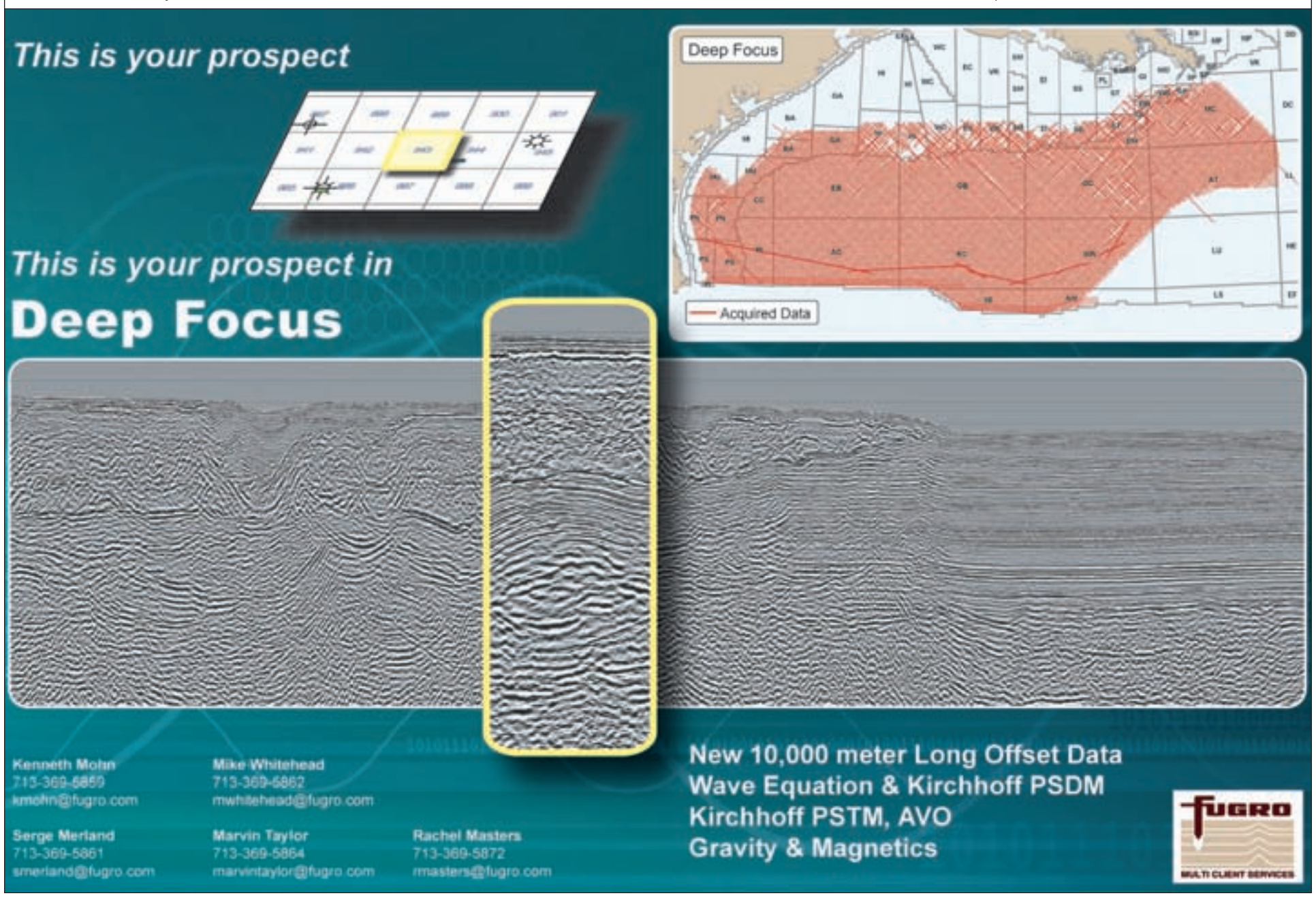
✓ Production will grow slowly to the peak plateau.

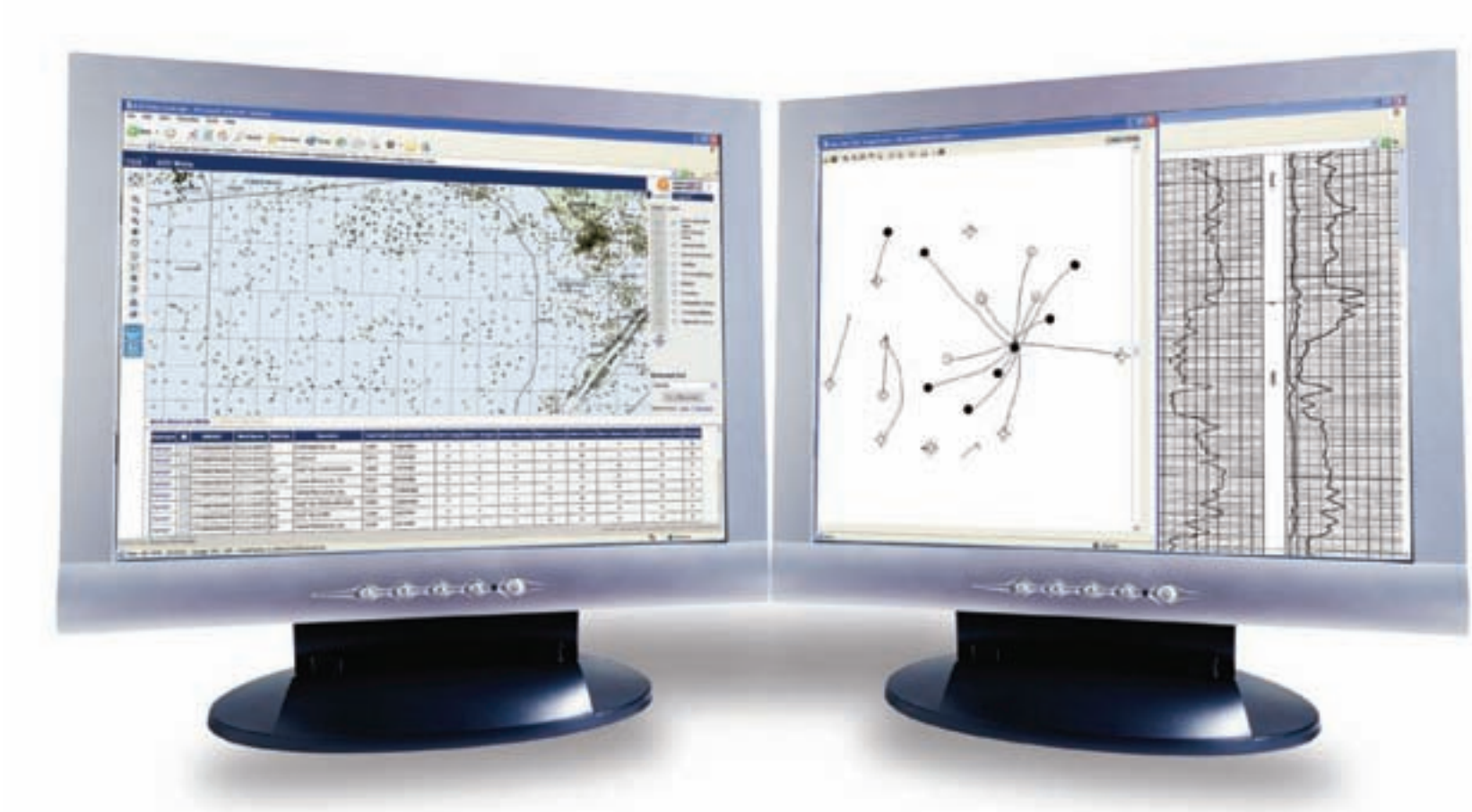
✓ Peak plateau production is likely to be between 90-100 million bod, which is 0.75-1 percent of ultimate world oil resources.

✓ Peak plateau spans mid-point in cumulative world oil production.

✓ Achieving this production will require a massive, sustained industry effort for the next 40-50 years.

✓ Achieving this production will require an accommodating political environment. ❑





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Deep Drilling Unlocking Planet's Secrets

Finding Facts Before Conclusions

By BARRY FRIEDMAN
EXPLORER Correspondent

The Integrated Ocean Drilling Program (IODP) is all about science.

An international marine research drilling project, it is dedicated to advancing scientific understanding of the earth – including but certainly not limited to a further understanding of global warming – and to do so in a non-partisan, non-political way.

Specifically, its objectives are to explore four principle themes:

❒ The deep biosphere and the subsea floor ocean.

❒ Environmental change.

❒ Earth processes and effects.

❒ Solid earth cycles and geodynamics.

Nancy Light, director of communications for IODP, puts the work into perspective.

"We are not a political organization and have no agenda other than scientific research," she says. "Politics do not play into our agenda whatsoever.

"Our scientists look at the data and are currently looking at the creation of climate models that would reflect the historic patterns – in geologic time – that may exist."

The IODP was established in October 2003, and followed the work of Deep Sea Drilling Project (DSDP) and the Ocean Drilling Program (ODP). Funded by the U.S. National Science Foundation and 22 international partners (JOIDES), it conducts basic research into the history of the ocean basins and the overall nature of the crust beneath the ocean floor using the scientific drill ship JOIDES Resolution.

Photos courtesy of Integrated Ocean Drilling Program

Looking for data, but not a poltical agenda: The scientific drill ship *JOIDES Resolution*, operated by the Integrated Ocean Drilling Program, has provided "more than enough science" to help policy makers make the right decisions.

Joint Oceanographic Institutions Inc. (JOI), a group of 18 U.S. institutions, is the program manager; Texas A&M University's, College of Geosciences is the science operator; and Columbia University, Lamont-Doherty Earth Observatory provides logging services and administers the site survey data bank.

Information obtained by IDOP and its predecessors is disseminated via industry journals – not conservative or liberal think tanks – which further underscores the project's neutrality.

Data, Not Politics

According to Steven R. Bohlen of JOI, over 25,000 research papers have been written that use ODP or IODP data, and approximately 35,000-40,000 samples are sent to researchers throughout the world so they can conduct studies and test hypotheses.

"Sadly," he says, "the National Science Foundation has not put much money into bringing the program to the public. We like to call this (IODP) the best program no one has ever heard about.

"Through scientific drilling, we really have learned how the planet functions," he continued. "More than any other program in the geosciences, this one has revolutionized how we think about the earth. But the budgets for public outreach have been anemic, and next to nothing when compared with NASA budgets for education and outreach."

According to Bohlen, the work over the years (from DSDP and ODP, as well as IODP) led to many advances, including the discoveries:

✓ That the role of methane hydrates is driving rapid warming of Earth.

✓ That global climate change is even more rapid than at first believed.

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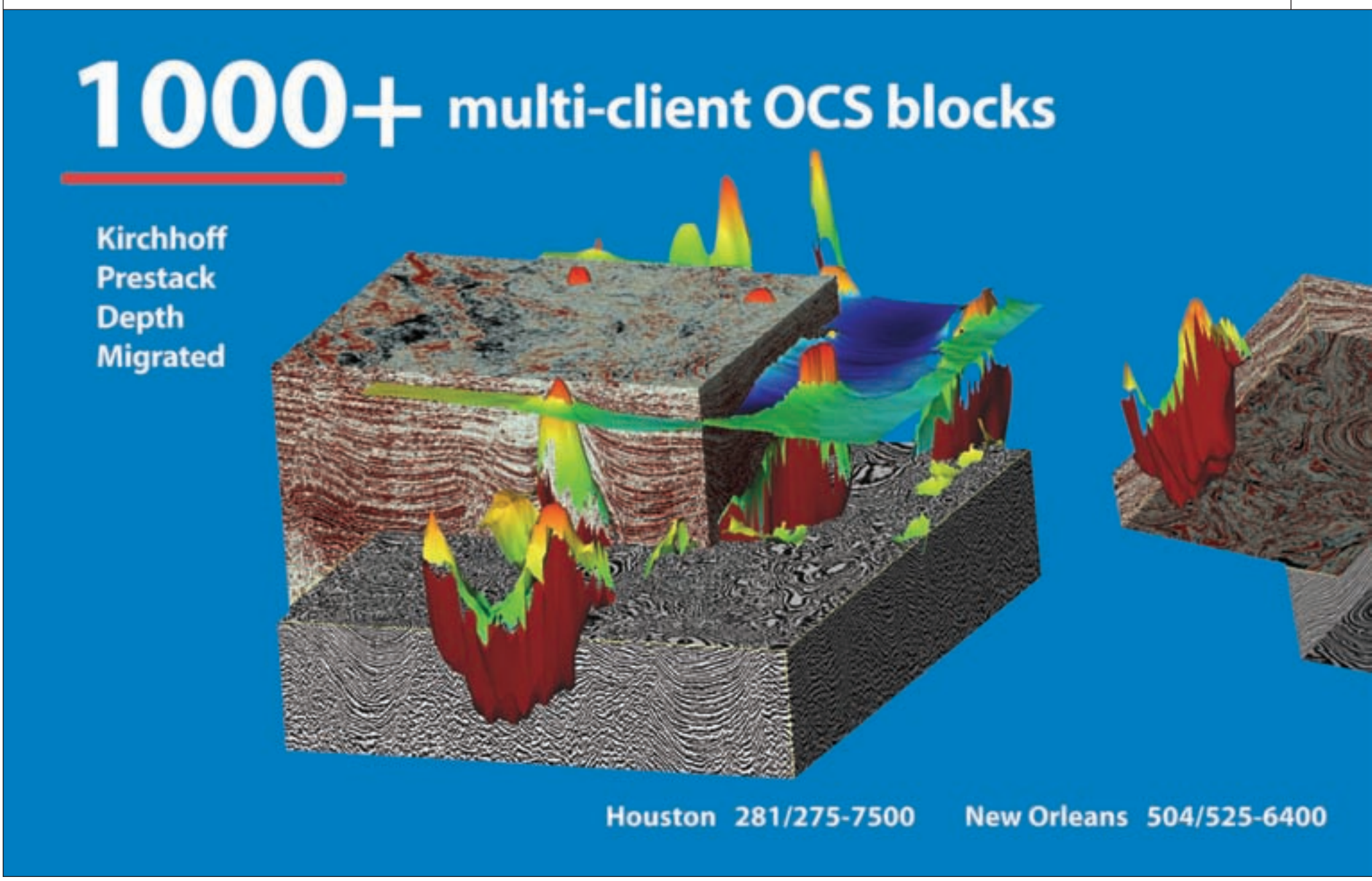

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✓ That the Mediterranean Sea was almost completely dry in the last Miocene period.

✓ That wind blown dust found in ocean cores in central East Africa probably caused early humans to migrate northward.

✓ That copper and zinc sulfides were deposited on the seafloor near spreading ridges, causing mining companies to change how they explore for the so-called massive sulfide deposits. (The chief scientist for the Canadian Geological Survey estimated the economic impact at about $500 million/year.)

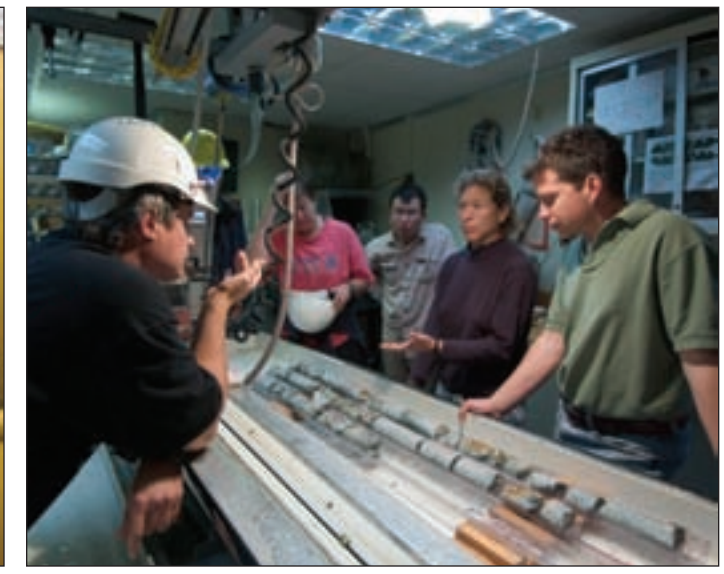
✓ That no ocean crust exists that is older than 180 million years.

✓ That the earth has been generally cooling since the Paleocene-Eocene Thermal Maximum.

"IODP has provided the basic material – cores that contain the history of Earth – so hundreds of scientists around the planet have been able to conduct basic research and reach important conclusions about climate and environmental change," Bohlen said.

"The results of the program have been used in the global warming debate," he said, and then echoed the sentiments of Nancy Light:

"But overall the program has been free of the political overtones of the debate about anthropogenic climate change."



Collecting the data, analyzing the results: Scientists aboard the *JOIDES Resolution* conduct basic research into the history of the ocean basins and the overall nature of the crust beneath the ocean floor. Specifically, its objectives are to explore four principle themes: The deep biosphere and the subsea floor ocean; environmental change; Earth processes and effects; and solid earth cycles and geodynamics.

Science and the Elephant

Clearly, IODP isn't just about global warming. As Bohlen points out, the work being done on tsunamis and earthquakes is substantial, as well.

"Ocean Drilling has drilled various sediments that have shed light on large tsunamis, though most of the evidence lies on land," he said. "Discovery of methane hydrates as a significant component of continental shelf sediments has caused us to realize that not just earthquakes and explosive volcanic eruptions (and meteor impacts in the ocean) can cause tsunamis, but also decomposition of methane hydrate in sediments.

"The program has also drilled a number of holes and established sea-floor observatories that help us understand the formation of great earthquakes (> 8.0 magnitude) in subduction zones. How subduction zones work – how much ocean sediment is scraped off the down-going ocean crustal plate, how fluids flow (and potentially lubricate fault surfaces), faults are created and move, etc. – is a significant achievement of the program."

Still, the elephant in the room (or the ocean, as it were) is global warming.

"I find the observational evidence so compelling," he said. "Earth is warming, most likely at an unprecedented rate … And we still do not have a good understanding of how fast the ice will melt. Five years ago we thought the melting would be gradual. We are now seeing nonlinear effects and processes that greatly enhance melting."

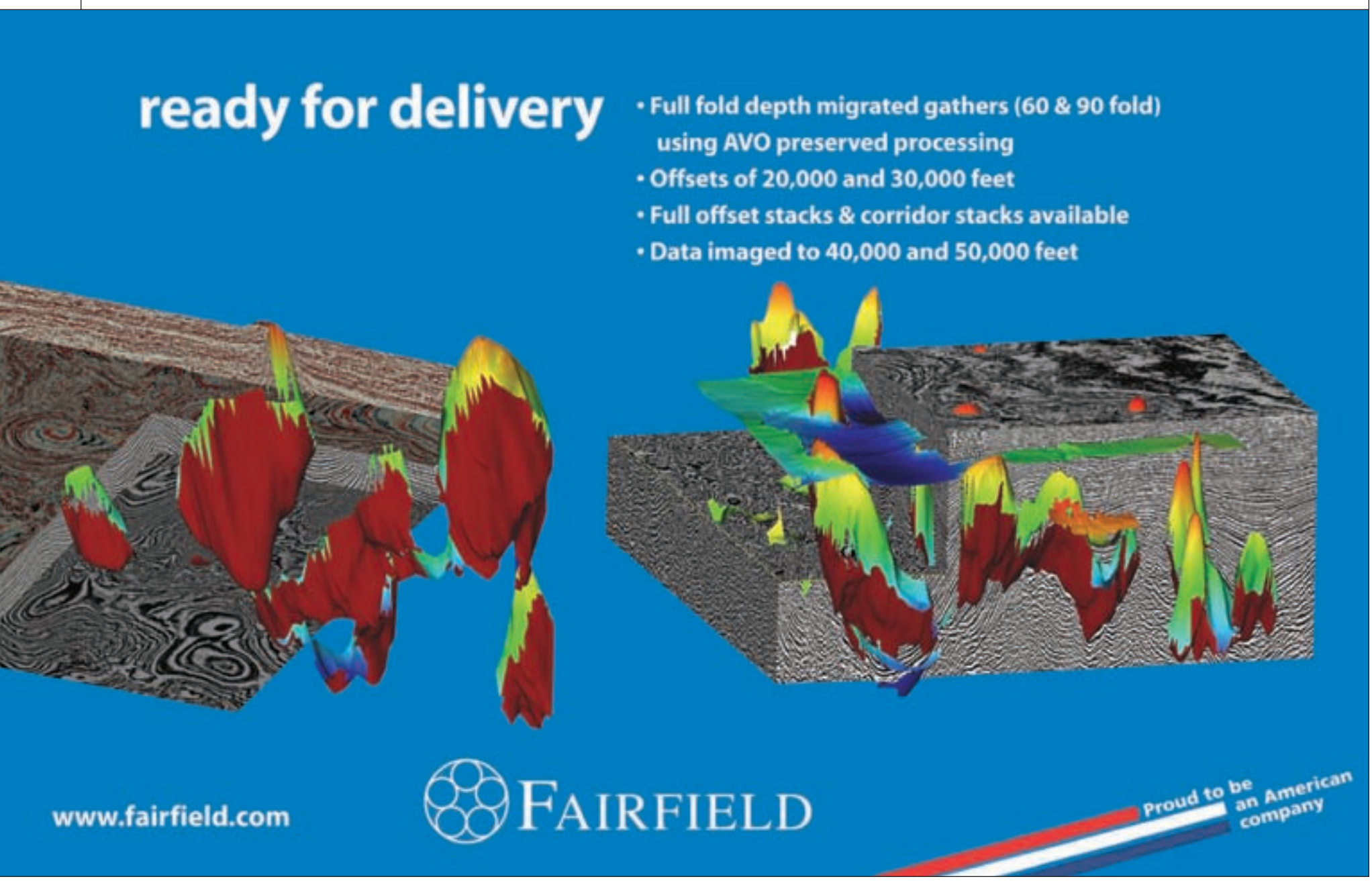
What bothers Bohlen is not that there's a spirited debate as to the rapidity of climate change or even the extent to which man is responsible, but that there are those who would mock the science altogether.

"Calling the warming a hoax does a disservice to humanity, not to mention the hard work of scientists the world over who have toiled to bring objective observation into the debate.

"Even if we were to stop burning all fossil fuels tomorrow, the Earth would continue to warm for another 50-100 years," he said. "So we are going to have to learn how to adapt, but this does not mean that we should do nothing.

"We need to continue to refine how Earth warms and how the climate has changed in the past, especially with an eye toward understanding the dynamics of rapid change.

"Policy makers have more than enough science to begin to create policy to address the problem." ❑



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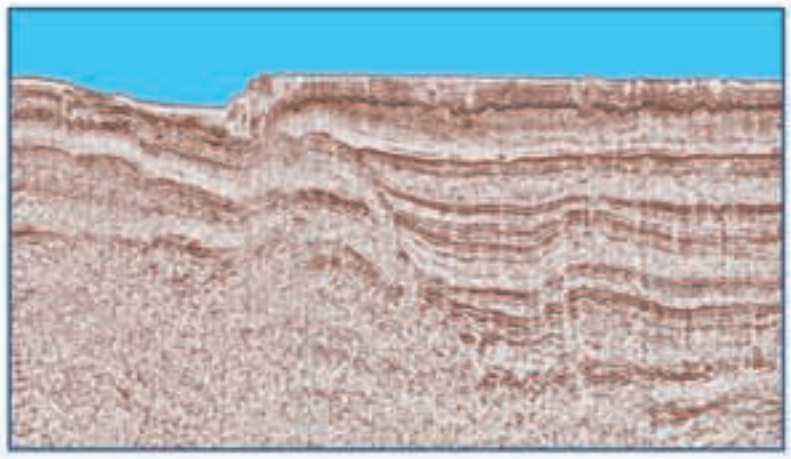
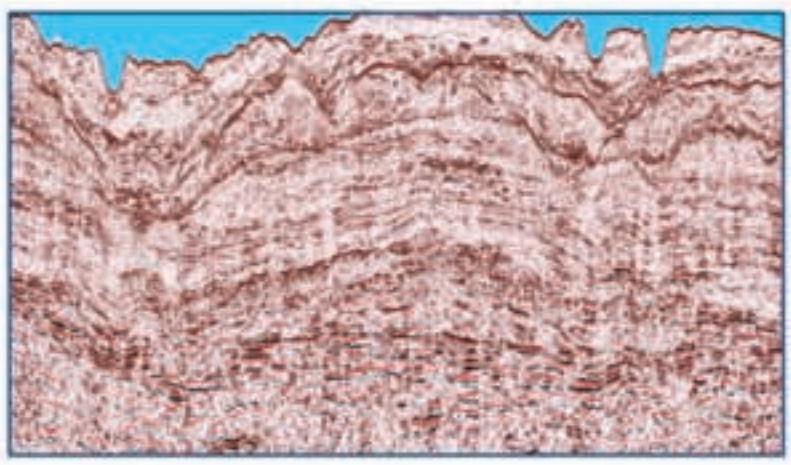


Liberia

- 2D seismic Data
- Gravity Data
- Magnetic Data
- Well Logs
- Interpretations and Reports

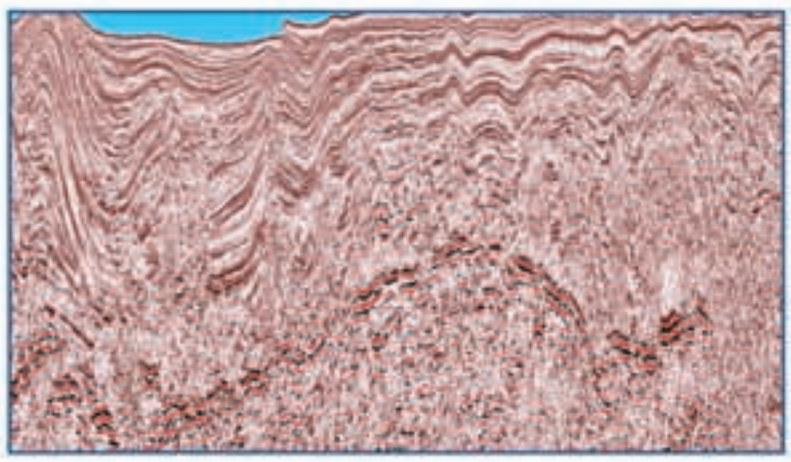


Nigeria

- 2D seismic Data
- 60,713 well logs available

Red Sea

- 2D seismic Data
- Pre-Stack Depth Migration
- Gravity Data
- Magnetic Data
- Interpretations and Reports



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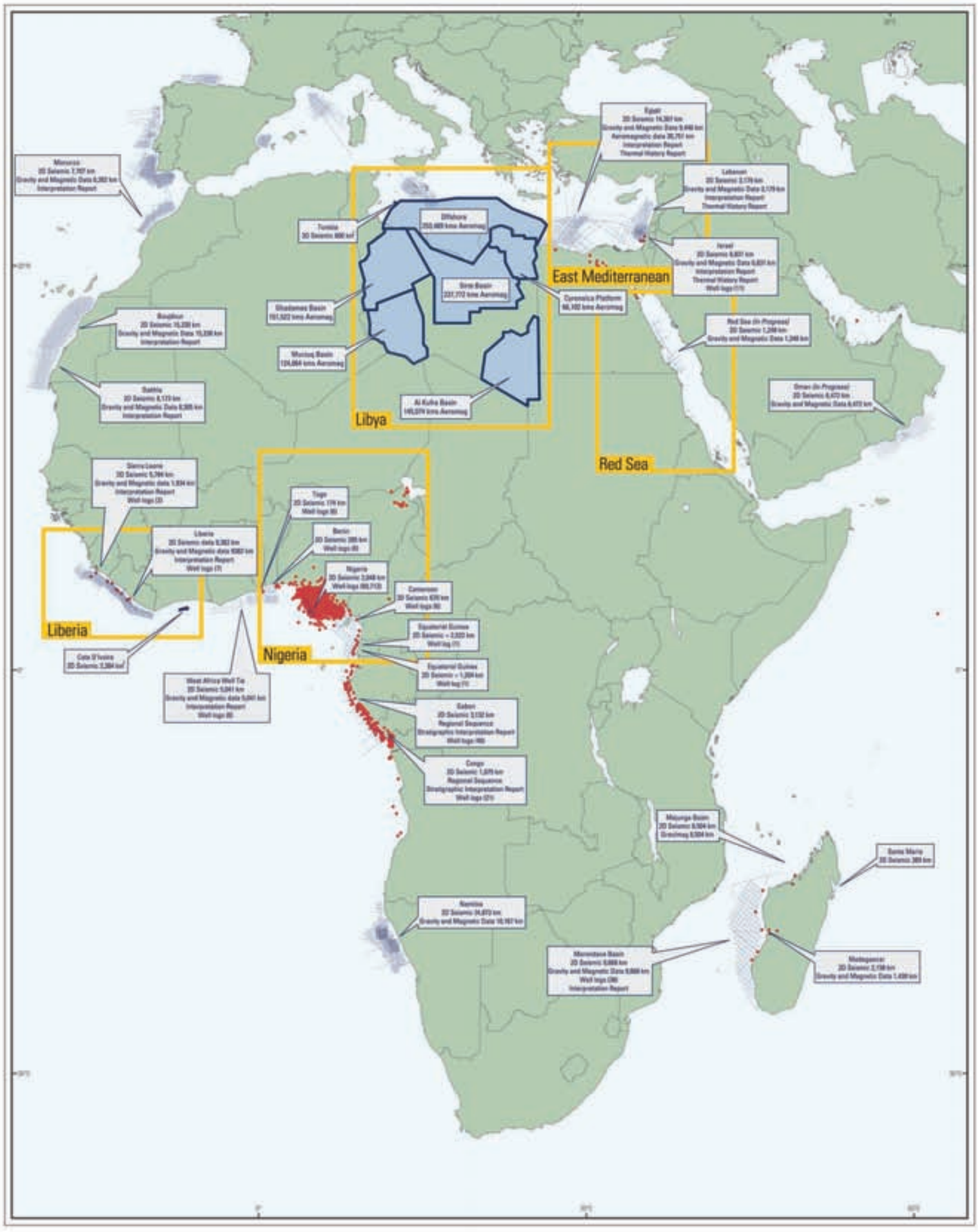

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A 'Prosperous, Exciting' Meeting

Program Makes Long Beach a Hit

By VERN STEFANIC
EXPLORER Managing Editor

AAPG's return to the West Coast for an annual convention proved to be a winning move, as nearly 5,200 people journeyed to Long Beach, Calif., for a meeting that seemed to offer something for everyone.

AAPG's 92nd annual convention – and it's first in California since 1996 – "exceeded all expectations," according to general chairman Dalton Lockman.

"I would characterize the meeting as prosperous, thriving and exciting," Lockman said. "From my vantage point, it was clear that Long Beach had an unparalleled level of excitement right from the start of the opening session to the last chip eaten at the Sundowner."

Leading the way, he added, was the technical program.

"I saw technical sessions that were powerful, with high quality discussions that carried outside of the sessions itself," Lockman said.

That was no accident; organizers had set four priorities for the meeting, with the technical program leading the way. And anchoring that was a core that included nine forums and special sessions, including Richard Nehring's presentation of results from last year's Hedberg Research Conference on Understanding World Oil Resources (see related story, page 22).

Other priorities were the field trips, student events and guest activities. The emphasis on students proved especially fruitful, with a large number of "new, young faces" being seen throughout the meeting.

"Students were engaged like never before with the added emphasis on their participation," Lockman said. "We increased student activities and participation with several new functions."

Other highlights included:

✓ Arnold Bouma's acceptance of the Sidney Powers Medal at the opening session.

✓ Ken Rudolph's Halbouty Lecture, in which he offered an optimistic look at how technology is improving exploration efforts ("The new generation is going to be way better than I am at finding information and meeting needs," he said).

✓ Michael Economides entertaining talk at the All Convention Luncheon, in which he regaled the audience with a sometimes funny, sometimes scary assessment of the world's current and future energy situation: "I don't care how you say it. Yes, Virginia, there is an energy crisis."

Economides also predicted that the price of oil will "stay over $60 for quite a while," and that natural gas will "go over $20 again.

"Geologists' opinion notwithstanding, we are not going to meet demand," he said.

Billingsley's Address

AAPG President Lee Billingsley, in his presidential address at the opening session, challenged members to help achieve the goal of making AAPG "indispensable to geologists worldwide."

Billingsley reminded geologists of the challenges that the industry and profession face, including media misperceptions, limited education opportunities, a shortage of qualified geoscience graduates and restrictions that impact exploration efforts.

But, he added, he had a vision – a dream – that one day the world would be a place where:

✓ Students in K-12 are taught earth science as part of their curriculum. Their teachers have taken college courses in geosciences, and they have attended workshops on the application of earth science to solve human needs.

✓ Undergraduate enrollment in geoscience meets industry demands.

✓ There are adequate numbers of qualified faculty in geosciences departments to teach a core curriculum beneficial to industry, government and research.

✓ New graduates have a well-balanced background that includes field experience and all the basic courses in mineralogy, structure, sedimentation and geophysics.

✓ Energy companies can fill their employment needs with qualified graduates as "baby boomers" retire.

✓ Young professionals are active in AAPG and help create new forms of digital content and delivery.

✓ Baby boomer geologists do not just retire to golf courses, they "pay it forward" by helping others.

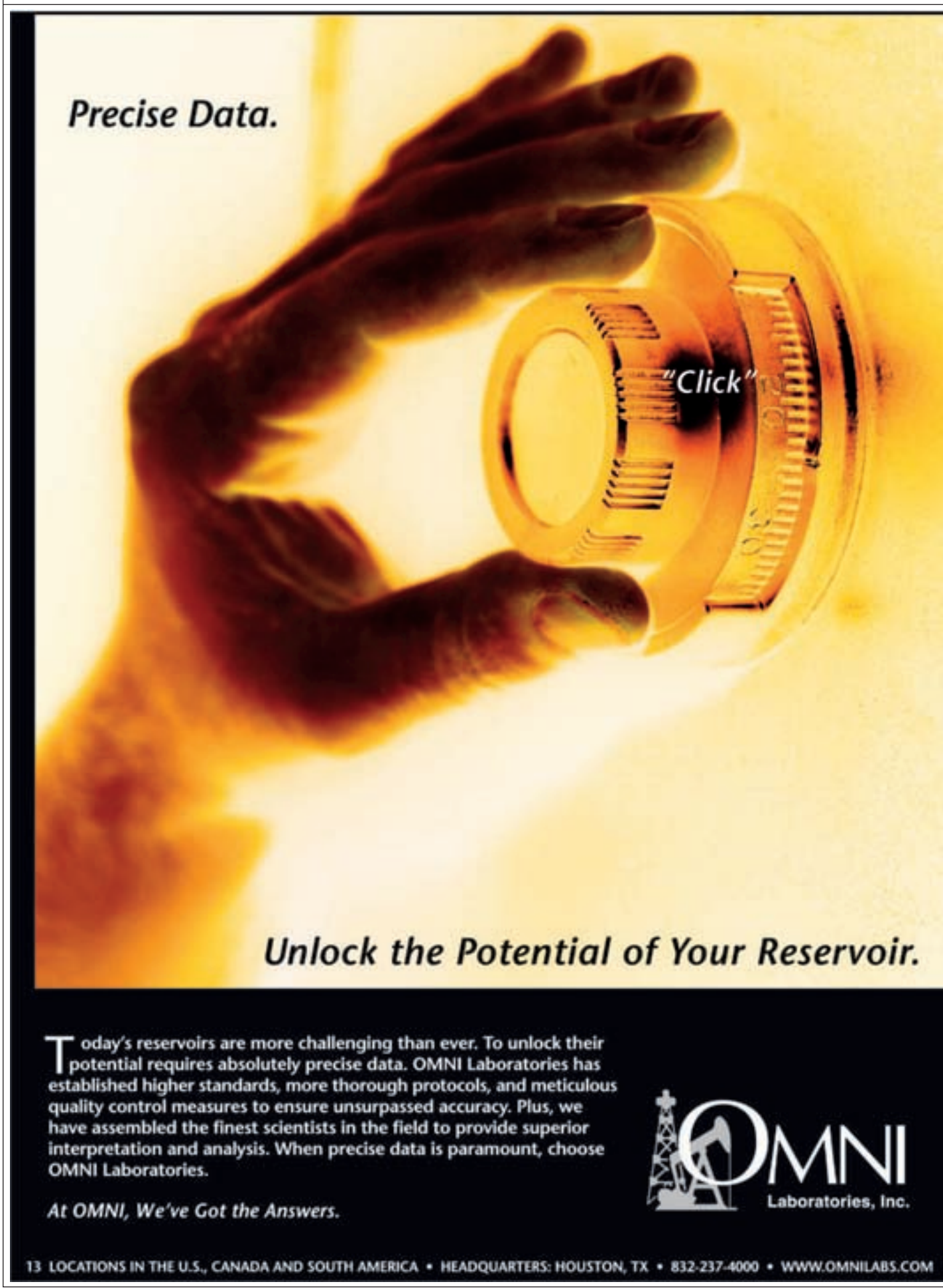
✓ Professional geologists have a continuously expanding global technical database.

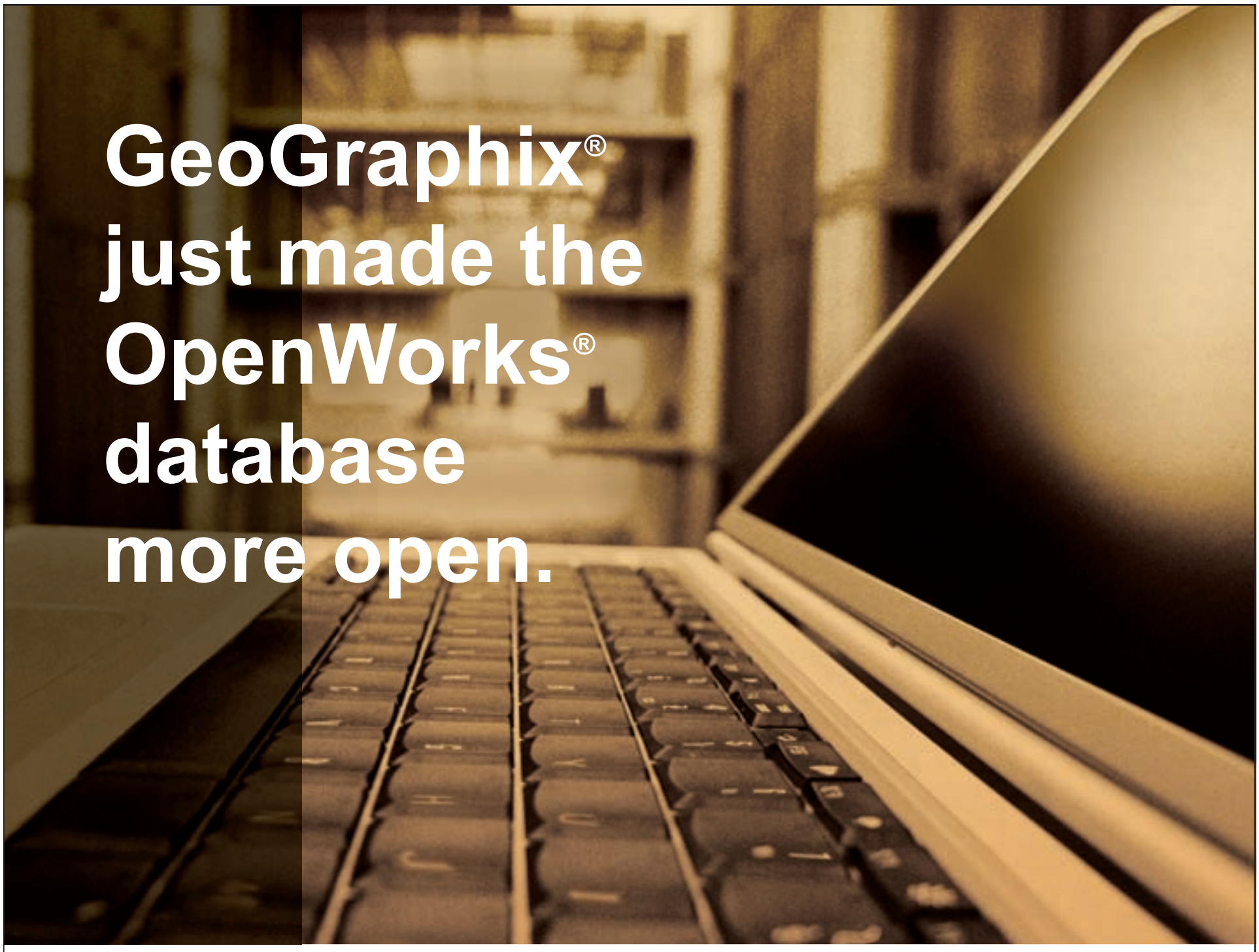
✓ Government officials recognize that, for now, fossil fuels are the most cost-efficient energy source; that market-driven energy choices provide the best opportunity for a healthy economy; and that a healthy economy allows development of technologies to reduce emissions and research alternative energy sources.

✓ All areas with potential are open for environmentally responsible oil and gas development.

✓ Geologists are called upon to provide both perspective and solutions to global climate change.

"AAPG can play a significant role in all these 'dreams,' Billingsley said. "We provide the bridge between academia and industry, between government and the public, between government and industry, between the public and industry." ❑





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Cost, Access, Environment

Alternatives Plentiful But Have Issues

By LOUISE S. DURHAM
EXPLORER Correspondent

Alternative energy is where it's at these days in the minds of plenty of folks who are looking at the potential market for some mighty esoteric sources in some cases.

Take chicken fat, for instance.

Today, a minuscule amount of biodiesel in the United States is made from this gloppy substance – yet it appears to be gaining in popularity.

The interested parties who have visions of striking the big one in chicken fat rather than crude oil includes an entrepreneurial twosome – recently spotlighted in a metropolitan newspaper – who arranged to come up with $5 million to build a new biodiesel facility in a small Missouri town near a poultry plant, where the fat supply is plentiful.

Given the flurry of activity and escalating interest in the alternative energy arena in general, it's timely indeed that a session at the AAPG Annual Convention in Long Beach, Calif., focused on this topic.

Any meaningful discussion of alternative fuels – many of which are decades away from being a reality – needs to include a look at the fuels available to serve as a bridge between the future and today's principally hydrocarbon-based energy sources.

Session co-chair and EMD president Bill Ambrose provided this view in his opening presentation in Long Beach.

"The session included a variety of different energy sources, such as biofuels and fuel cells," Ambrose said. "The point I want to make is there is a variety of what we call non-alternative energy sources that are hydrocarbon-based that are something between conventional hydrocarbons and alternative energy that can help bridge the gap until the alternative sources discussed in the rest of the session come into their own.

"Some of these alternatives may not be fully developed until mid-century."

Plenty of Mineral Potential

Given that the domestic oil and gas companies are increasingly being shut out of various hydrocarbon-rich locales on the international scene, it's noteworthy that Ambrose's talk focused for the most part on the energy minerals available in Canada and the United States.

These minerals include coal, coalbed methane, uranium, gas hydrates, gas shales, oil shale, tar sands and geothermal energy.

In fact, Ambrose noted the North American energy mineral resource is enormous. It contains:

✓ More than a trillion tons of identified coal, of which 275 billion tons is technically recoverable.

✓ More than 200 billion tons of oil shale.

✓ More than 250 million pounds of U308, producible at $30/lb.

✓ Approximately 690 Tcf of coalbed methane.

✓ Between 467 and 607 Tcf of shale gas.

✓ More than three billion barrels equivalent of tar sands.

✓ 2.4 x 1019 joules of identified and undiscovered convection hydrothermal resources (energy equivalent of 430 billion barrels of oil).

Ambrose added that the potential North American gas hydrate resource may be many thousands of Tcf. Although gas hydrates aren't yet economically feasible, he noted they have been produced successfully in permafrost regions of Russia and northern Canada, and could become a sustainable source of natural gas within the next 10 to 20 years.

A Question of Costs

Despite the considerable available resources, recovering them is no slam dunk as technical, economical and environmental challenges must always be dealt with in varying degrees.

"A lot of unconventionals are very sensitive to price," Ambrose noted. "Take oil shale, for example, where one ton of rock typically equals one barrel of oil. This is a tremendous resource, but production of that realistically can only be supported by good prices.

"The offsetting factor to take into account would be improved technology for getting that oil shale resource," Ambrose said. "Technology is changing and improving, so oil shale could be produced even though prices are not as high as we'd like.

"The question is how high the price has to be for the improved technology to make the difference."

There are major disposal issues associated with by-products of some energy minerals production.

For instance, a big problem with producing coalbed methane is economic and safe disposal of the produced water, which can amount to substantial volumes in some basins.

Disposal of radioactive material associated with uranium has long been a huge challenge. ❑

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Five 'Discoveries' That Matter

The world's energy outlook may not be as bad as some people predict – but a team effort may be needed to keep it that way.

Robert Ryan, vice president of global exploration for Chevron, offered that assessment during a speech at the Division of Professional Affairs luncheon in Long Beach.


Ryan

"I tend to blow off peak oil," Ryan said, but he added that there are five areas of "discovery" potential that could make or break the world's energy future:

✓ **Exploration**: "The world is full of undiscovered resources," he said. Citing the Wilcox trend as a success story, he asked, "What other huge basins of the world have been under-explored?"

✓ **Recovery**: "Imagine if you increase recovery by just a few percent – a few percent," he said. "The increase can be huge. There's a lot to recover." And turning to coalbed methane and tight gas, he added, "there are lots of resources."

✓ **Renewables**: Geothermal energy, bio-fuels, hydrogen and other renewables all are needed for our energy future. "If they don't contribute in a big or even a small way, we won't make it."

✓ **Efficiency**: "If we reduce our domestic use by 1 percent a year, we'll save 180 million barrels a year."

✓ **Talent**: New geoscientists must be added to the mix – and quickly – to ensure future supplies. "The wave is cresting" on the industry's current group of explorers, he said.

"These are the areas that we need," he said. "We need all discoveries to meet the challenge."

– VERN STEFANIC

Where Is Our Energy Going?

China and India, in their efforts to secure U.S. supplies of energy and minerals for their people, are cornering those markets in a way that could jeopardize domestic supplies.

That was the warning given by Vince Matthews, director of the Colorado Geological Survey, during his luncheon talk to the Energy Minerals Division at the AAPG Annual Convention.


Matthews

Matthews presented multiple charts, graphs and tables that showed how China and India's demand for energy and import-export trends threaten to take valuable resources out of the United States – and, in speaking specifically to the area he knows most about, Colorado.

"Chinese companies and their rivals are scouring the globe," he said, quoting Bloomberg News, "for access to the raw materials needed to sustain the Asian nation's growth as commodity prices surge."

This is happening because those countries realize their own production is unable to match their peoples' need.

The long list of U.S. items that are being sought and secured included energy items such as oil, natural gas, coal, uranium and molybdenum, plus other commodities and items like lead, nickel, copper, steel and even cement.

The impact on his state is:

✓ Colorado will suffer from the effects of inflation.

✓ Residents will see increasing shortages of raw materials.

✓ Pressures will mount to develop more state natural resources.

✓ Conflicts may arise with multi-national corporations operating in the state.

Worse, no easy answers seem to exist to halt what he sees as a looming crisis.

"I don't like throwing out problems without solutions, but that's what I've done," he said.

The answer, he believes, lies in education.

"Nothing can be done about it until the people know about it," he said. "I'd love to have your ideas on it."

– VERN STEFANIC

Challenges, Choices Await Geologists

Lee C. Gerhard listed major challenges facing geologists – and society – at the Division of Environmental Geosciences luncheon. They included:


Gerhard

✓ Providing minerals for 10 billion people by 2100.

✓ Providing healthy drinking water for today's population, much less 10 billion people by 2100.

✓ Feeding 10 billion people by 2100.

✓ Providing sufficient energy to 10 billion people by 2100.

✓ Avoiding invasive species and homogenization of the global biota, loss of biodiversity.

✓ Maintaining integrity of science in the face of human hubris.

To meet these challenges, there also are realities that:

✓ For every action, someone wins, someone else pays.

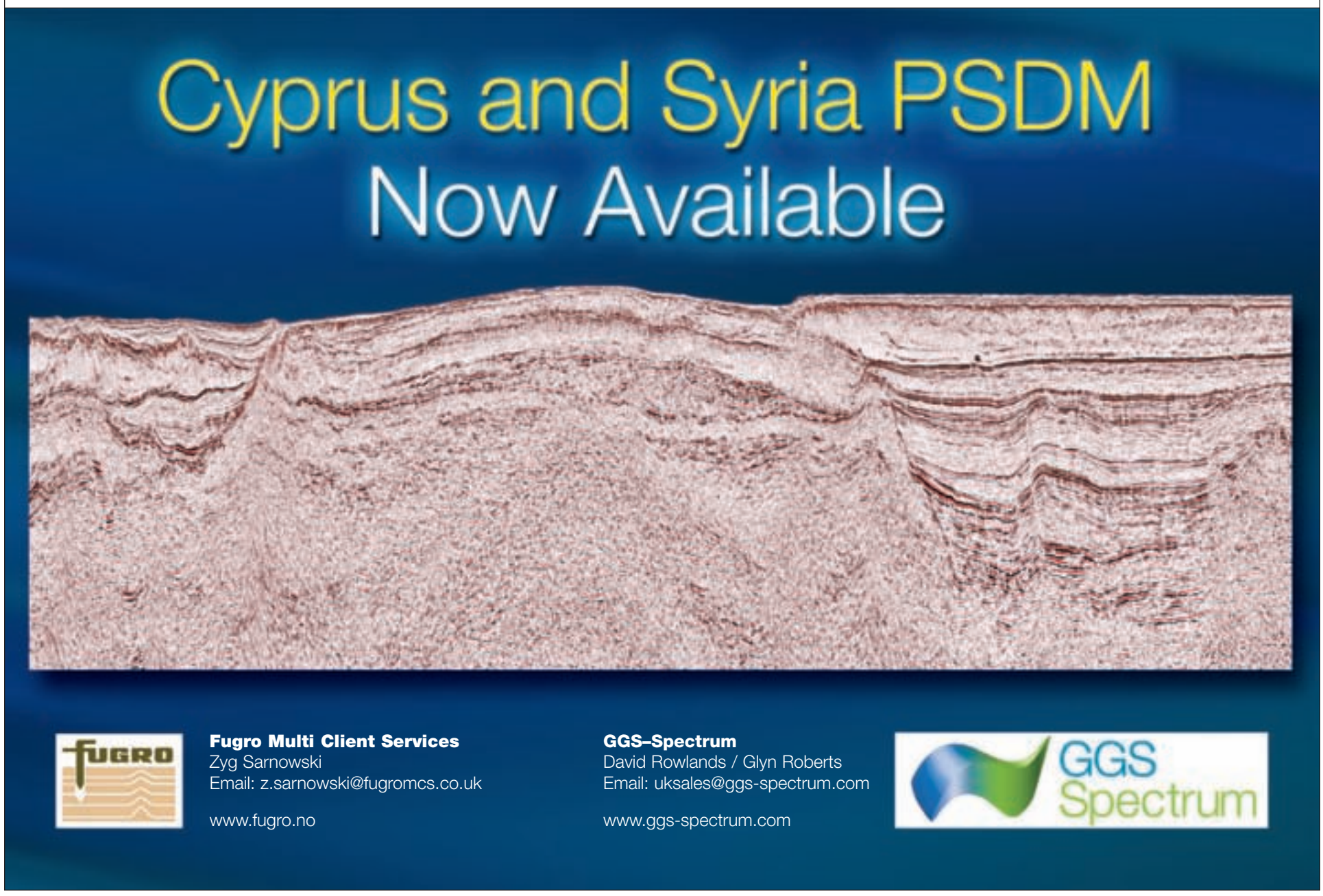
✓ Accounts must balance. Gains must exceed costs.

✓ Unintended consequences are a usual result.

Thus, Gerhard said, hard choices are to be made and priorities must be set rationally with priorities on the health and safety of humankind at the top of the value scale, with natural system perturbations, social interest and aesthetics and recreation following.

He also noted that the priorities sometimes have gotten scrambled as self interests trumps rationality.

– LARRY NATION



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The winners: Members of the University of Aberdeen's student chapter team with some of the rewards that come from winning the Imperial Barrel Award in Long Beach.

Barrel Award Has Big Payoff for All Involved

Aberdeen Takes First Place

In the first Imperial Barrel Award (IBA) student competition that was held at the AAPG Convention in Long Beach, the University of Aberdeen (Scotland) won first place, which netted the team $20,000 in scholarship funds, a trophy and individual medals.

Imperial College in London has been offering the prestigious Barrel Award for the past 30 years. This year AAPG offered the competition and awards at the annual convention as the Imperial Barrel Award.

Nine universities from around the world offering master's-level degrees in petroleum geosciences were invited to participate in the competition.

The second place team was Imperial College, winning the Selley Cup, which provides $10,000 in scholarship funds, a trophy and team medals.

The University of Oklahoma was the third place team and won the Stoneley Medal, which provides $5,000, a trophy and team medals.

The group competition is a global exploration geosciences project focused on the assessment of the petroleum potential of a basin. Teams were provided a complete data set and had a few weeks to complete a technical assessment of the basin's petroleum plays and prospects.

On the Friday prior to the convention, teams gave a 25-minute presentation of their work, made recommendations for future activity and faced 10 minutes of questioning by judges. A panel of industry experts judged the technical work and presentations and provided written evaluations for the students.

"IBA provides a unique opportunity for students to gain valuable experience by participating in an exploration evaluation, presenting to a panel of senior industry experts and competing to win scholarship funding," said Steve Veal, director of the AAPG European Region office in London.

Mike Mlynek, AAPG student coordinator, said seven universities participated in the inaugural year of the AAPG competition. Other competitors were the University of Houston, Gubkin Russian State University, University of Wyoming and California State University-Long Beach.

The event's sponsors were Aera Energy, Schlumberger, Occidental, Wagner & Brown Ltd., ConocoPhillips and AAPG.

Companies and schools interested in participating in next year's competition should contact Mlynek at students@aapg.org. ❑

Student Chapters Receive Honors

Student chapters from the University of Oklahoma and the University of Indonesia in Jakarta were honored with Outstanding Student Chapter Awards during the annual convention in Long Beach.

For the tenth year, program sponsor Schlumberger presented two $1,000 scholarships to the schools in recognition of their honor – OU being the outstanding U.S.-based student chapter, and the University of Indonesia as the outstanding international chapter.

Awards are presented yearly at the AAPG Annual Convention. Student chapter requirements for selection of awards are maintenance of student AAPG memberships, active AAPG faculty sponsor and participation in Earth Science Week, field trips, meetings and special community events.

"Schlumberger is committed to working with universities who continue to excel with their geological programs," said Rod Nelson, vice president of innovation and collaboration for Schlumberger, as he made the award presentation. "We are pleased to support AAPG with its student development programs, for these students will one day be a valuable part of our oil and gas industry." ❑

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GEOPHYSICAL CORNER

Gas Hydrate and LNG Tankers

(The Geophysical Corner is a regular column in the EXPLORER, edited by Bob A. Hardage, senior research scientist at the Bureau of Economic Geology, the University of Texas at Austin.)

By BOB HARDAGE

Theoretical models have been developed at the Bureau of Economic Geology that relate formation velocity and resistivity to hydrate concentration (C_{gh}) in deepwater, near-seafloor sediments. Our studies indicate that in numerous targeted intervals across the Gulf of Mexico, C_{gh} is 0.5 to 0.6 of the available pore space in unconsolidated deepwater sediments.

The reaction of most explorationists to this finding is "Too bad. That gas concentration is too low to be of interest." This conclusion is logical for anyone whose experience has been only with conventional gas reservoirs, where gas concentrations of 50 to 60 percent are not appealing.

It may not be a correct conclusion for gas hydrate reservoirs.

* * *

Let's consider how the formation of hydrate causes a high concentration of natural gases by comparing the physical sizes of a sediment grain and a unit-volume of hydrate.

A unit-volume of Structure I hydrate is shown as figure 1. Limited page space does not permit the unit-volume geometries of Structure II and Structure H hydrates to be illustrated. This crystalline structure is called a "unit-volume" because Structure I hydrate grows in increments of this fundamental building block. This unit-volume consists of eight cages of structured water that can each trap one gas molecule.

Dendy Sloan at the Colorado School of Mines defines the diameter of each cage of this unit-volume as a length that varies from 8 to 10 angstroms. Because any arbitrary diameter across this unit-volume will span no more than six cages (probably no more than four cages, actually), the diameter of a unit-volume of hydrate is less than 60 angstroms (6×10^{-9} m).

For a size comparison, sedimentologists define the low end of the very-fine grain scale to be fragments of sediment that have diameters of about 60 microns (6×10^{-5} m). The diameter of a very-fine sediment grain is thus larger than the diameter of a unit-volume of hydrate by a factor of 10^4.

Because the volume of an object is proportional to (diameter)^3, if we ratio the volume of a very-fine grain and the volume of a unit-volume of hydrate we find that this 10^4 difference in diameters means that 10^{12} unit-volumes of hydrate can fit into the space occupied by one very-fine sediment grain.

Assuming that on average only 80 percent of the eight cages in a unit-volume manage to trap a gas molecule, hydrate formation causes approximately 6×10^{12} gas molecules to be compressed into a volume equal to that of a single very-fine grain.

This simple arithmetic supports the statement by Pellenbarg and Max that hydrate has the highest energy density (184,000 BTU/ft^3) of any form of biogenic or thermogenic gas found naturally. By comparison, liquid natural gas (LNG) represents the highest energy density (430,000 BTU/ft^3) of natural gas that humans can create using cryogenic technology.

Hydrate thus has an energy density E_{gh} that is 0.42 that of the energy density E_{LNG} of LNG.

For any deepwater, near-seafloor sediments where clusters of hydrate unit-volumes can be assumed to be distributed throughout the sediment pore space, the energy density of the gas trapped in the structured-water prison cells of this dispersed hydrate can be expressed as

$$E_{gh} = (0.42\phi C_{gh})E_{LNG}$$

where ϕ is the porosity of the host sediment containing the hydrate.

* * *

Table 1 shows how E_{gh} is related to E_{LNG} for:

✓ Common porosity ranges found in deepwater, near-seafloor sediment.

✓ That range of C_{gh} that causes the reaction "Too bad the concentration is so low."

Now let us consider a specific example: If a hydrate system has a porosity of 0.5 and a hydrate concentration of 0.5, how large does a hydrate accumulation have to be in order to have an amount of stored energy that equals the energy stored in one LNG tanker?

Simply solve the energy-balance equation

E_{gh}(hydrate reservoir volume) = E_{LNG}(tanker volume).

Using the ratio $E_{gh}/E_{LNG} = 0.1$ from table 1 for $\phi = 0.5$ and $C_{gh} = 0.5$, the result is

Hydrate reservoir volume = 10 LNG tanker volumes.

If we assign length, width and depth dimensions of 600, 100 and 50 feet to our hypothetical LNG tanker volume, the size of the hydrate reservoir that has the same equivalent stored energy is 826 acre-ft (~10^6 m^3).

Thus, when the hydrate concentration in deepwater sediments is only 0.5 of the available pore space, we see that there is a tremendous amount of gas in a small volume of sediment.

When Mother Nature causes hydrate to form, the result is an impressive concentration of energy that is independent of burial depth. Because structured-water hydrate has a large bulk modulus and is difficult to compress, hydrate will have the same crystalline structure, and thus the same energy density of entrapped gas, when it is a seafloor outcrop that it has at a deep depth below the seafloor.

This concept about the relationship between gas concentration and confining pressure differs from the logic that has to be used in dealing with compressible gases found in conventional reservoirs.

Punchline – There may be a large number of LNG tanker equivalents awaiting the bold who initiate deepwater hydrate production.

* * *

The only intent of this discussion is to illustrate that a tremendous amount of energy is stored in deepwater hydrate. What has been avoided is any discussion of the challenges of trying to produce that hydrate.

As a geophysicist, I have two observations about strategies for producing deep-water hydrate:

✓ Hydrate production is the engineer's problem.

✓ I am glad I am not the engineer assigned to the problem.

For geophysicists, it is exciting to try to unravel the mysteries of deep-water hydrate systems using 4C OBC seismic data and rock physics theory. Refer to Geophysical Corner articles published in the July 2006 and August 2006 EXPLORERs and available on the AAPG Web site, if you wish to know how some of this multi-component seismic research is being done. ❑

(Editor's note: Hardage is senior research scientist at the Bureau of Economic Geology, Austin, Texas.)

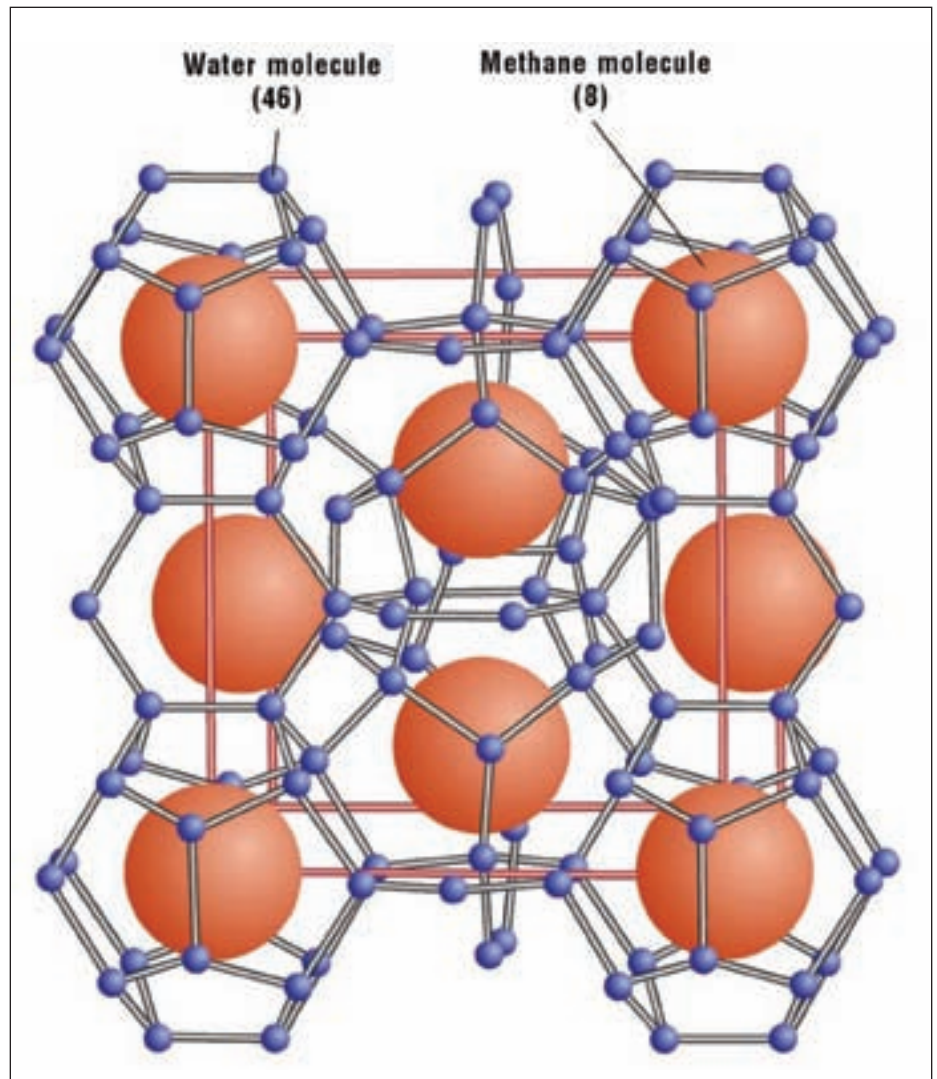
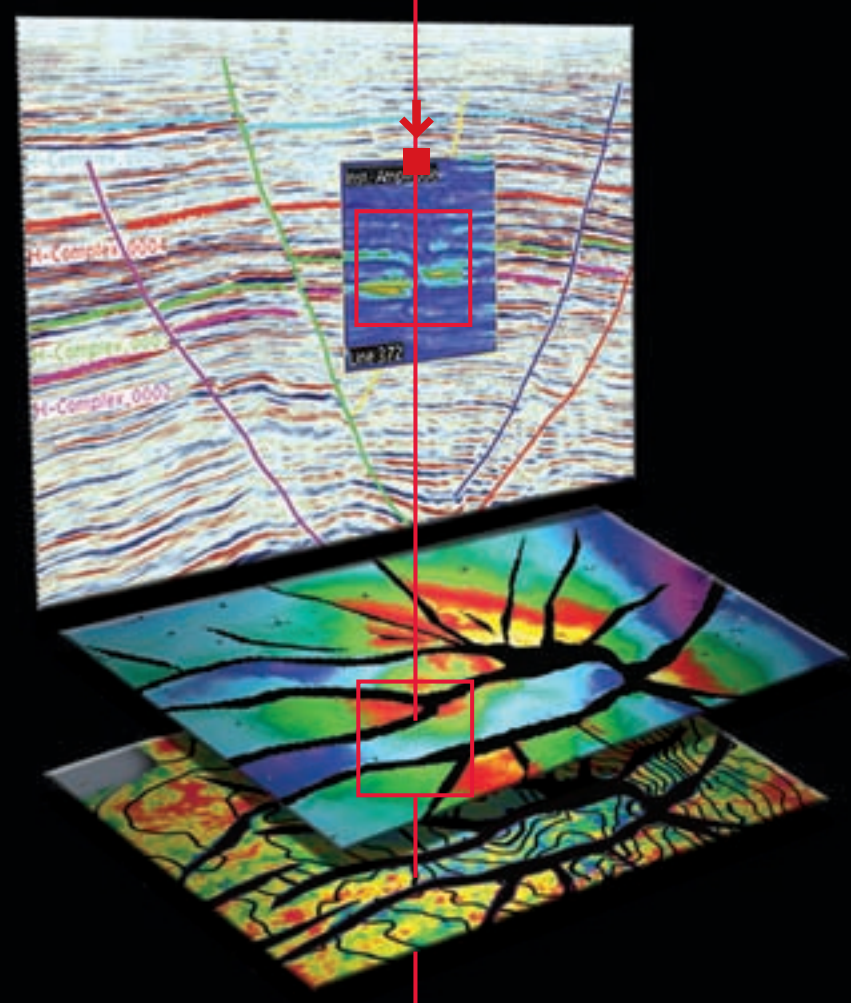


Figure 1 – One unit-volume of Structure I hydrate showing eight methane molecules trapped in the eight cages of 46 structured water molecules that compose this particular hydrate crystalline structure. (Adapted from a drawing by Bjorn Kvamme, University of Bergen, Norway.)

C_{gh}	ϕ			
	0.4	0.5	0.6	0.7
0.4	7%	9%	10%	12%
0.5	8%	10%	13%	14%
0.6	10%	13%	15%	18%
0.7	12%	14%	18%	21%

Table 1 – Hydrate energy density E_{gh} relative to LNG energy density E_{LNG} for ranges of porosity ϕ and hydrate concentration C_{gh} that are common to deep water, near-seafloor sediments across the Gulf of Mexico. The relationship between E_{gh} and E_{LNG} is defined by the first equation below.



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WashingtonWATCH

Image Has Impact on U.S. Budget

By DON JUCKETT

After checking in to my hotel in Long Beach at the beginning of the recent annual meeting – weary from a cross country flight – and as I was schlepping my luggage across the lobby to the elevators, a familiar voice of a AAPG member and longstanding acquaintance from across the lobby greeted me with:

"What the (expletive) is going on in Washington and who is doing something about it?"

The reference was with regard to the fact that in the resolution of the 2007 federal budget process approximately $60 million was restored to the Department of Energy budget that could have been used – but from all indications will *not* be used – to provide for oil and gas research and development and technology transfer projects, including the Petroleum Technology Transfer Council.

Adding to the general concern is the fact that once again the administration (i.e. the Department of Energy) has requested no funding for the 2008 fiscal year.

By the time this column is published, the answer to the question "where will those funds be allocated?" likely will be answered.

The prospects that the administration will reverse its efforts to phase out what has been consistently characterized as "corporate welfare for the petroleum industry," or that Congress will intervene to provide additional direction that will ensure the use of those monies in oil and gas research seem to be very small.

Don't for a moment believe that both the administration and the Congress are not aware of the consternation and outrage of the impacted community. Many from the academic and industry communities, plus GEO-DC, IPAA and other industry groups, have visited agency officials, congressmen and senators from both sides of the aisle to plead the case.

However, considered in the context of efforts to curtail tax provisions of the 2005 Energy Policy Act, the perception that petroleum industry profitability is grossly out of line with the whole industry in the rest of the country/world, and the general low esteem with which the oil and natural gas industry is held in Washington, it should be no great surprise that *all* facets of industry activities are seen through jaundiced eyes by the nation's policy makers.

Increasingly, it seems that there is a need for a new approach and redesigned strategy in how we make our case in the policy arena.

How then, should we as geoscience professionals, begin to work to change the image?

* * *

We are an organization of about 31,000 members, and while that may represent the largest single organization of petroleum geology expertise on the planet, it is not a number that impresses policy makers in Washington.

I conclude from this observation that as an organization we need to proactively seek out and enlist others of like mind and interest to both support the concept of science-based policy development and amplify the strength of the message.

AAPG member participation in the final comment period of the MMS 2007-2012, Five-Year Plan is an example of how this can work effectively. Joining with groups like IPAA, the Industrial Energy Consumers of America and the Consumers Energy Alliance you contributed about 1,500 of the 90,000 comments to MMS on opening additional Outer Continental Shelf acreage in the Gulf of Mexico and Alaska.

Not only was the response the largest ever in the history of the MMS process, it was the greatest positive response supporting access to additional OCS acreage in more than two decades.

Note that two of the organizations involved in the effort have the word "consumer" in their title. As the association of professional petroleum geologists, we are best qualified to speak to the science of our profession.

Many of you have heard me say on occasion that "science does not speak for itself – it needs a spokesperson, it needs a translator and it needs context." Who better to serve as the spokespeople, the translators and the context providers than AAPG members?

As the knowledge experts for the science, members are uniquely positioned and have the ability to add the context to work with local interest groups as spokespersons for the profession and what it has contributed to modern society on a global basis.

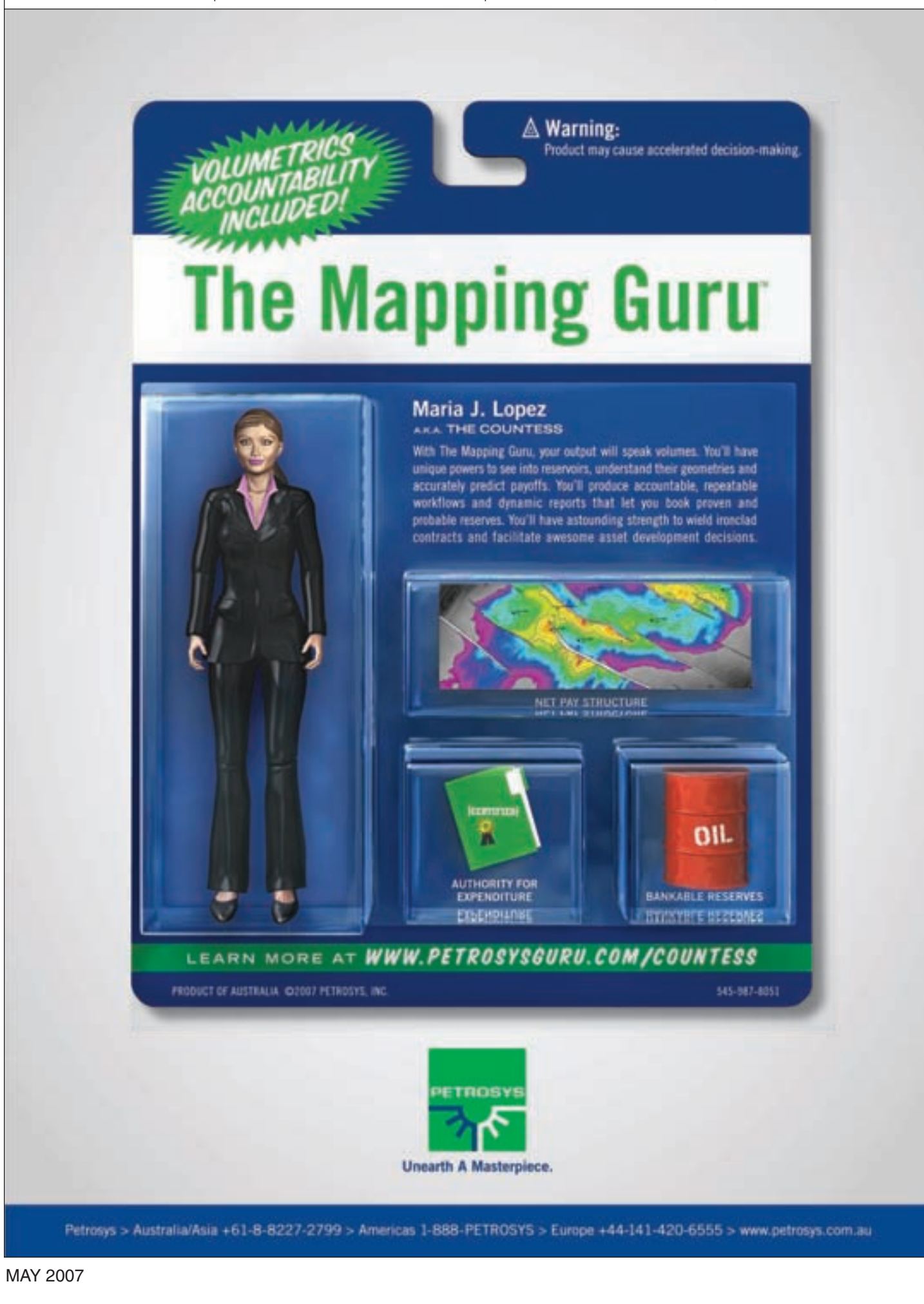
On an individual basis, get involved!

It will not only aid in establishing an informed public, it will pay dividends in the support that an educated public can bring to the policy process.

* * *

My thanks to the large number of members who sought me out at Long Beach to offer your views on GEO-DC. Together we have come a long way since the Houston convention one year ago. ❑

(Editor's note: Don Juckett, head of AAPG's Geoscience and Energy Office in Washington, D.C., can be contacted at djuckett@aapg.org, (703) 575-8293.)



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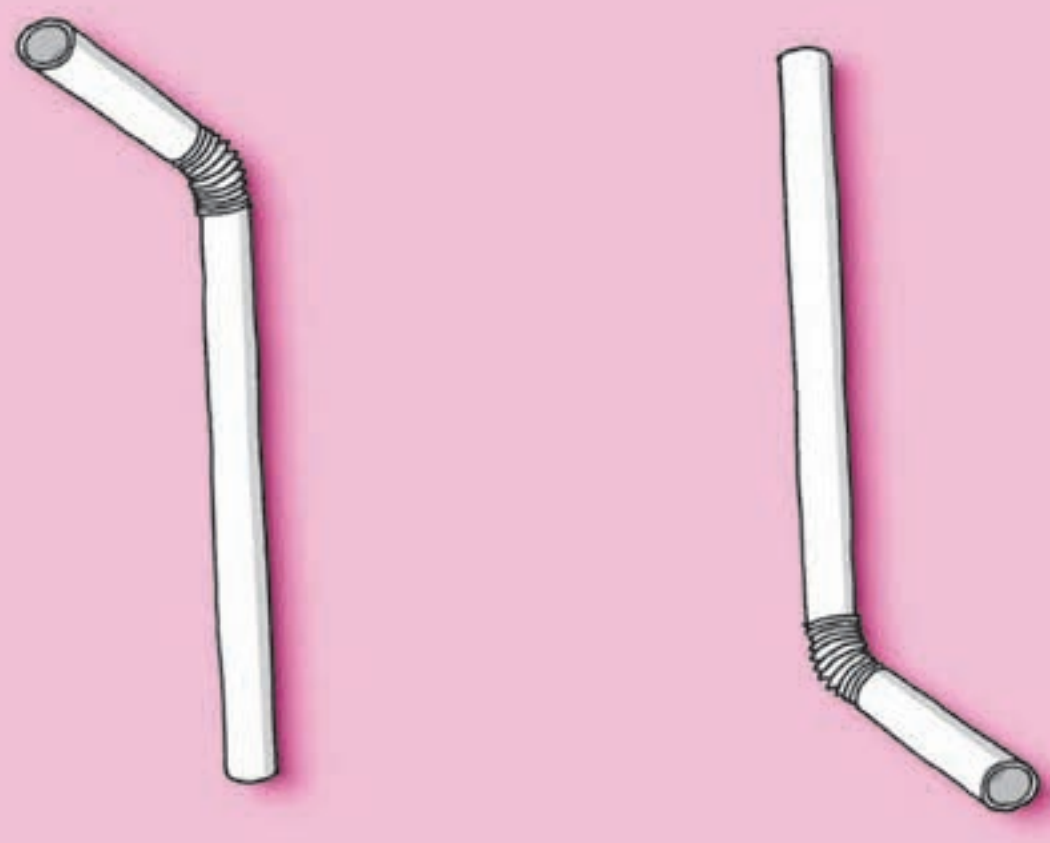

A SIMPLE STRAW AN INSPIRATION

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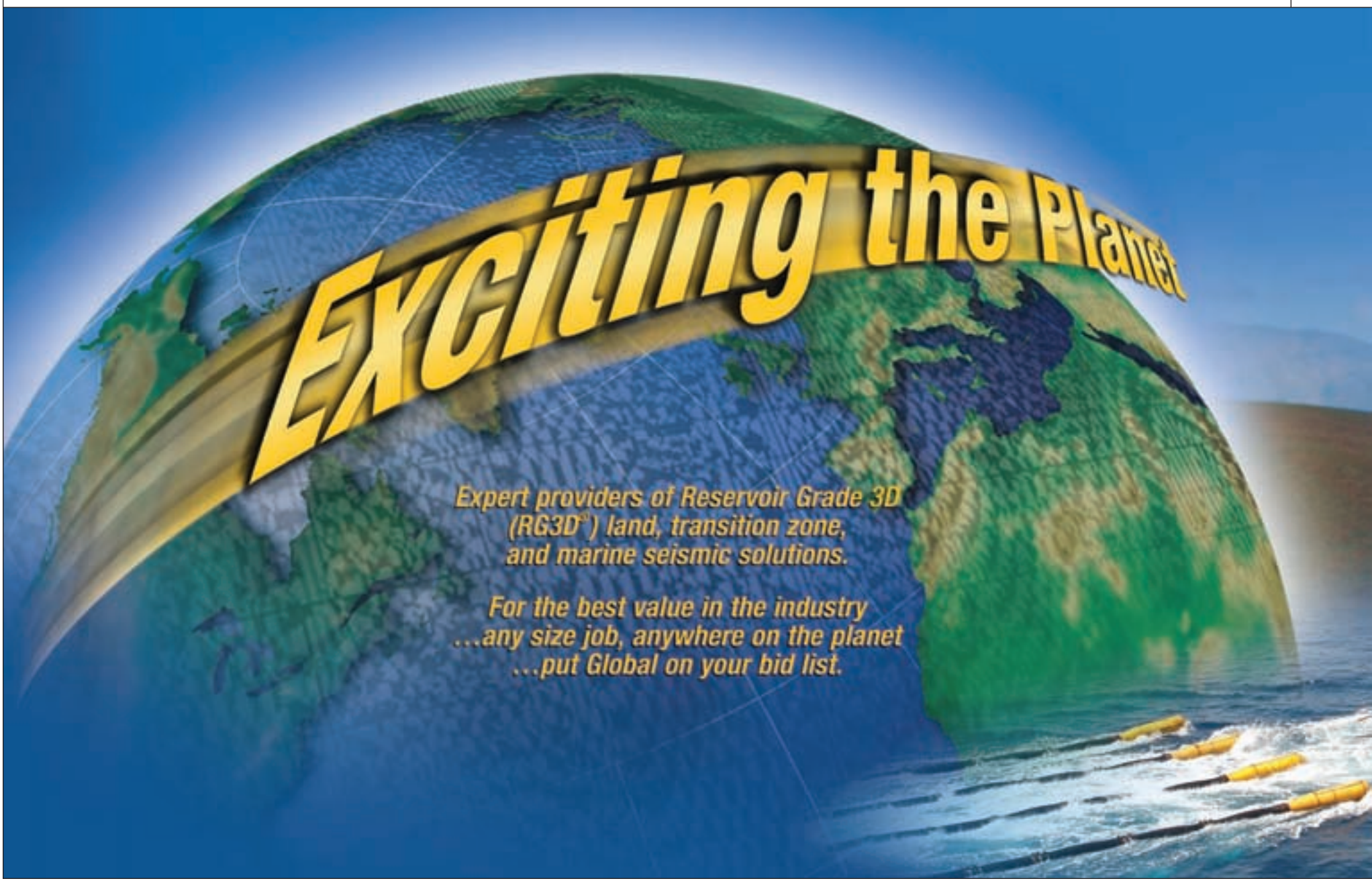
What a swell meeting it was: Scenes from the AAPG Annual Convention in Long Beach.



FOUNDATION UPDATE

AAPG Pioneer Award winner for 2007 W. Herbert Hunt, of Petro-Hunt in Dallas, has joined the AAPG Foundation Trustee Associates.

Hunt brings total Trustee Associate membership to 263. The group's next meeting will be Oct. 10-14, Maui, Hawaii.

In other Foundation news:

✓ William "Bill" Fisher was re-elected as a Foundation Trustee for a three-year term ending June 30, 2010.


Barrett

✓ Bill Barrett, of Bill Barrett Corp. in Denver, has been nominated to replace Bill Crain as a Member of the Corporation for the AAPG Foundation.

Crain, who did not seek re-election, will end his term on June 30, 2007. He will join the Trustee Emeritus members, which include Herbert Davis, Paul Dudley, Lawrence Funkhouser, Jack Threet and James E. Wilson.


Gunn

✓ Bob Gunn was nominated as a Regular Member of the Members of the Corporation to replace Bill Barrett. Gunn's term will be July 1 through June 30, 2011.

✓ ExxonMobil Corporation has provided funding to endow an AAPG Digital Products University Subscription for Kazakhstan University.

The gift of $12,500 to the AAPG Foundation will provide students and faculty at Kazakhstan University access to the entire collection, which includes over 600,000 pages of maps and geological information of AAPG's Digital Library.

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IN MEMORY

Hershel Spurgeon Carver Jr., 85
Sun City, Ariz., March 13, 2007

Duane Simon Goodnick, 85
Green Valley, Ariz., March 1, 2007

John Pipes Goodson (AC '65)
Shreveport, La., November 2006

Henri Alphonse Guillaume, 79
Smith's Gully, Australia
Jan. 22. 2007

Jerome Joseph O'Brien, 99
San Antonio, Sept. 18, 2006

John S. Schoelen, 78
Lafayette, La., Jan. 9, 2007

(Editor's note: "In Memory" listings are based on information received from the AAPG membership department. Age at time of death, when known, is listed. When the member's date of death is unavailable, the person's membership classification and anniversary date are listed.)

PROFESSIONAL NEWS BRIEFS

Thomas Bard, to exploration and new ventures manager-Eurasia, Chevron International E&P, San Ramon, Calif. Previously exploration and new ventures manager-DW Nigeria, Chevron, Houston.

Michael J. Fitzgerald, to executive vice president-exploration and production, Toreador Resources, Dallas. Previously senior vice president-exploration and production, Toreador Resources, Dallas.

Dominic Simon Fu, general manager-exploration, Sterling Global Oil Resources, Lagos, Nigeria. Previously principal consultant and chief geologist, Wipro Technologies and ONGC (respectively), Bangalore, India.

Win Goter, to regional exploration consultancy manager, Shell E&P, EPX-W Americas, Houston. Previously frontier west leader, Nigeria deepwater, Shell International E&P, Houston.

Dave Harris, to head, energy and minerals section, Kentucky Geological Survey, Lexington, Ky. Previously geologist, Kentucky Geological Survey, Lexington, Ky.

Mohit Khanna, to consultant geological adviser, BG Group, Mumbai, India. Previously geological adviser, Mumbai, BG Group, India.

(Editor's note: To be included in this column e-mail the information in the above format to smoore@aapg.org; or submit directly from the AAPG Web site, www.aapg.org.)

MEMBERSHIP AND CERTIFICATION

The following **candidates** have submitted applications for membership in the Association and, below, certification by the Division of Professional Affairs. This does not constitute election, but places the names before the membership at large. Any information bearing on the qualifications of these candidates should be sent promptly to the Executive Committee, P.O. Box 979, Tulsa, Okla. 74101. (Names of sponsors are placed in parentheses. Reinstatements indicated do not require sponsors.)

Membership applications are available at www.aapg.org, or by contacting headquarters in Tulsa.

For Active Membership

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Gilliam, Christopher Steven, CDX Gas, Birmingham (F.G. Ethridge, J.D. Phinisey, P.D. Gerome); **Li, Peng**, University of Alabama, Tuscaloosa (E.A. Mancini, B.L. Bearden, D.A. Goddard)

California
Feille, William Bryan Jr., Occidental Petroleum, Tupman (J.A. Anderson, T.L. Fleming-Reese, R.M. Scott); **Ponti, Daniel John**, U.S. Geological Survey, Menlo Park (D.D. Clarke, R.G. Stanley, K. Ehman); **Yue, Yongjun**, Chevron Corp., Bakersfield (D.K. Larue, J. Eacmen, D. Beeson)

Colorado
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Texas
Eguche, Josiah O., ConocoPhillips, Houston (S. Levine, T.D. Demchuk, D.T. McGee)

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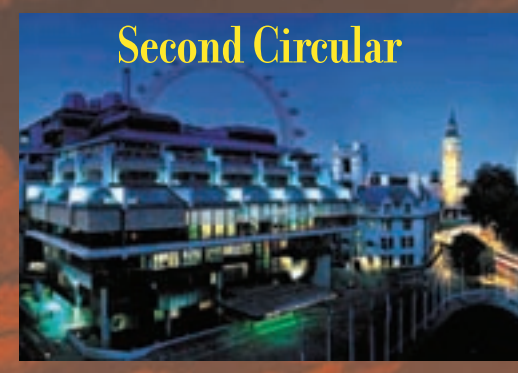
• Environment – engineering geology of London, groundwater, waste and contamination, geophysics
Tony Apello (Hydrochem. Consultant), Eddie Bromhead (Kingston U.), Neil Chapman (ITC), Niels Christensen (Aarhus, Denmark), Mike Edmunds (Oxford U.), Mark Everett (Texas AM), Stephen Foster (Adviser to World Bank), Alan Green (ETHZ), Bernard Kueper (Queen's U. Canada), Rosemary Knight (Stanford U.), Ursula Lawrence (Crossrail), David Lerner (Sheffield U.), Doug Mackay (UC Davis, Ca), Ghislain de Marsily (Université de Paris VI), Rick Miller (Kansas Geological Survey), Tim Newman (Thames Water), Duncan Nicholson (Arup), Peter Styles (Keele U.), Richard Teeuw (Portsmouth U.), Sarah Terry (Crossrail), Paul Younger (Newcastle U.)



• Earth and Planetary Interiors – geochemistry, geophysics, active tectonics, volcanology
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• The Earth System – evolution of Earth environments, Quaternary change
Liane Benning (Leeds U.), Mike Benton (Bristol U.), Harry Bryden (Southampton U.), Nick Butterfield (Camb. U.), Russell Coope (Royal Holloway, London U.), Julian Dowdeswell (Camb. U.), Lynne Frostick (Hull U.), Bernard Hallet (Wash U.), Paul Hoffman (Harvard U.), Niels Hovius (Camb. U.), Tim Lenton (East Anglia U.), Lynn Margulis (Massachusetts U.), Paul Pearson (Cardiff U.), Andrew Scott (Royal Holloway, London U.), Jim Secord (Camb. U.), Mark Sephton (Imperial College), Chris Stringer (Natural History Museum), Greg Tucker (Colorado U.), Paul Valdes (Bristol U.), Andy Watson (East Anglia U.), Eric Wolff (British Antarctic Survey)

These will be accompanied by open poster sessions and opportunities for specialist discussion.

Day three will be devoted to a plenary session on **Earth's Future**. Distinguished speakers will present new results and ideas relevant to our understanding of the planet and how these affect key environmental issues, present and future, including: natural hazards, climate change, energy and water resources.

Speakers: Richard Fortey FRS, Lord Rees of Ludlow PRS, Barry Parsons, Alan Boss, James Jackson FRS, Brian Tucker, Rick Battarbee FRS, Brian Hoskins FRS, Tony Hayward, Murray Hitzman, John Ludden, Gabriella Schneider.

Parallel with the plenary session on Day 3, sixth form science students will be able to attend their own special session – an exhibition and a series of presentations, including one from TV presenter Dr Iain Stewart (University of Plymouth), designed to show how studying Earth science at university can open the way to a rewarding life full of travel and excitement.

Field trips

The program of Bicentenary field excursions aims to celebrate Britain's Geology. The program includes many important sites of Classic British Geology and locations of Special Interest! Register now.

Call for posters

You may submit an abstract for a poster at the conference. See the Conference website for details of poster sessions. Submission deadline: **15 June 2007**

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Abstract submission deadline:**15 June**

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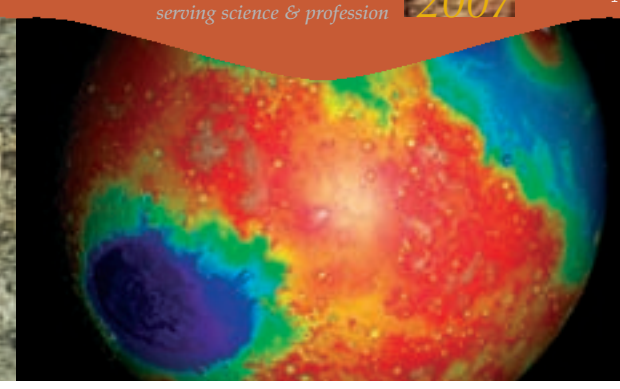

For information about the conference or any other bicentenary events, please contact Alys Johnson at alys.johnson@geolsoc.org.uk or call +44 (0)20 7434 9944
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A breathtaking and geologically captivating South to North transect of Alaska across three mountain ranges to the Arctic ocean and the Prudhoe Bay oil field—the largest oil field in North America.
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Begins and ends in Anchorage and ends in Fairbanks.
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A unique experience created for those looking to increase their knowledge base in this fascinating area.
June 9-16, 2007
Begins and ends in Salt Lake City, Utah.
$2,000 per person ($100 more after 5/11/07)

Folding, Thrusting And Syntectonic Sedimentation: Perspectives From Classic Localities Of The Central Pyrenees
An exciting excursion specifically designed for those interested in thrust-fold structures and tectonics-sedimentation interactions in compressional belts.
June 11-15, 2007
Begins and ends in Barcelona, Spain.
$1,750 per person ($100 more after 4/30/07)

Seismic Interpretation of Compressive Structures
The ultimate way to learn interpretation of seismic reflection data for trap delineation and reservoir characterization in both orogenic and passive margin fold-and-thrust belts.
June 21-27, 2007
Begins and ends in Calgary, Alberta, Canada.
$2,750 per person ($100 more after 6/22/07)

IN THE CLASSROOM

Interpretation Of Old DST's To Find Additional Oil And Gas Potential
The perfect way to better understand and utilize DST results and reports.
June 4-8, 2007
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Basic Well Log Analysis
A unique experience created for those needing to increase their understanding of the responses of common logging measurements to subsurface conditions, and to become familiar with basic openhole well log interpretation techniques.
July 24-27, 2007
$1,095 for AAPG members. $1,195 for non-members ($100 more after 6/26/07)
(Austin, Texas)

Application of Structural Geology in Prospecting in Thrusted and Extensional Terrain
Perfect for those engaged in exploration and production projects in thrusted and extended terrain.
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READERS' FORUM

Salaries

As a geoscience recruiter for my federal agency I knew government salaries were really low, but I'm appalled that we're not even on the same pay scale as other geologists were decades ago (April EXPLORER).

As well as being a Ph.D. with 30+ years experience, I am also a team leader in my agency and in joint industry projects, a subject matter technical expert in several areas and the most widely published scientist in my organization.

For that the government pays me what any geologist with five or six year's experience would make!

Mike Smith
New Orleans

Editor's note: 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.

Global Warming (continued)

The personal attack on Lee Gerhard (April Readers' Forum) does a great disservice to geoscience and the many geoscientists who value reproducible data more than unsubstantiated opinion. As an *ad hominem* attack it does not have any place in an AAPG publication, but the members of this learned society should consider whether there are any demonstrable and verifiable human contributions to global climate change, particularly any effects that might be attributable to using petroleum for energy and transportation.

Any consideration of this important issue calls for rational discourse that respects the scientific method and eschews the rhetorical excesses of Hollywood and political stump speeches.

To support the claim of any significant human influence on global climate, first you must show that global climate is not behaving as it always has over geologic time scales. An extensive body of peer-reviewed literature (Lamb, 1995) and the data sets they present clearly indicate that global climate is behaving quite normally, much as it always has throughout past geologic time.

The media-touted mathematical "models" relied upon to support the assertion that emissions of "greenhouse" gases – particularly carbon dioxide from the activities of Western industrial civilization – are the *cause* of global warming have been unable to effectively simulate, much less replicate, the documented climate history of the Earth even over the last 1,500 years, and certainly not over longer millennial geologic time scales.

There is no published, peer-reviewed scientific literature showing any statistically significant independent correlation between the levels of carbon dioxide attributable to human industrial activity and global climate on geologic time scales. The attempt by Mann, *et al.* has been shown to be unreliable and perhaps even a conscious and deliberate misrepresentation replete with "adjustments" necessary to make the results of the modeling effort conform to the social and political agendas of the modelers and those funding their efforts.

If working petroleum geologists used the methods of IPCC "science" for exploration, we would have already run out of oil. Real science requires reproducible data, not untestable opinions; facts, not rhetoric; discourse and disputation, not diatribes.

It is critical to understand that the stated purpose of the IPCC is to document human influence on climate, *not* to investigate the causes of climate change. This limited political mission statement forces the scientists of IPCC to work with shadow surrogates, much like Plato's men in the cave. This built-in bias reflects the political agenda driving IPCC and underlying the Kyoto Protocol – transferring wealth from the industrial nations of the world, particularly the United States.

Releasing the political overview of the IPCC report before the science was made available for rigorous checking is fundamentally dishonest. IPCC AR4 is a political document and should be treated with the same kind of skepticism that we give to any other political statement.

Some of the hyperbole of the IPCC's Third Annual Report (TAR) has been a bit tempered, however. Estimates of sea level rise have been reduced by 50 percent and temperature projections have been lowered significantly. Gone is the centerpiece of the TAR – the infamous "hockey stick" – upon which IPCC constructed the statement that human industrial activity was responsible for global warming.

Nevertheless, the anti-industrial development mantra continues and the hysteria builds toward a level of Luddite frenzy that has not been seen since the Marxist revolutions of the early twentieth century.

Victor John Yannacone Jr.
Patchogue, N.Y.

It would seem based upon the amount of mail that has been printed on the subject in the EXPLORER that our organization is in danger of being hijacked by a group of people that have abandoned science, and have little knowledge of geologic processes. Of course I am referring to the global warming alarmists.

The past two issues have been filled with letters demanding that the AAPG

continued on next page

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continued from previous page

consent and recognize man-induced or otherwise rise in earth temperature and all the dire consequences that come with it.

Having lived in many parts of the earth, I have not seen or researched any bona-fide example that this is taking place. Satellite earth temperatures show no rise. In fact, during the 1970s there was a decrease in temperature, and the reported fraction of a degree rise in temperature in the 1990s put us right back where we started.

Most of the computer models fail to predict any temperature rises. And contrary to what we have been told, most scientists and meteorologists dispute these claims of dramatic rise in earth's temperature and global warming.

Geologists have the knowledge of looking in the past for answers. By studying the earth's history we have seen that ice and cold temperature (as we have been in the last two million years) is the exception. Most of the earth's history has been warm and ice free.

Also, studying the atmosphere of the past you would discover that CO_2 is the minor greenhouse gas. The results would indicate that there is very little (if any) correlation between CO_2 and temperature. You would have to have CO_2 levels in percentage levels not PPM to make any difference.

In space insufficient here to explain, the whole product of global warming is flawed with incomplete data, obstructions and outright lies.

I would hate to see the reputation of the AAPG gain acceptance to these groups but lose respectability as a science organization because of these vocal individuals. As for the rise in CO_2 it is easy to see that billions of tons are produced each day by numerous geological processes, and man's contribution is insignificant when compared to this amount.

Perhaps the real reason that this has become such a hot subject, (no pun intended) is that billions of dollars of research money is granted to these individuals and groups to supposedly study the problem – money that could be better spent elsewhere.

Randy M. Pochel
Cedar Rapids, Iowa

The two letters on global warming (April EXPLORER) are perfect examples of the two poles of the discussion: On one side, that of the deniers, is the letter quoting scientific facts; on the other, the letter is moralistic, and written in what Al Gore so succinctly calls Post Normal Science.

John Woodward
Niceville, Fla.

Challenge With Facts

As a 50-year active member of AAPG I was encouraged by the article by Lunde et al, (March EXPLORER) regarding the theme for the forthcoming European Region Energy Conference in Athens (Challenge Our Myths).

I hope that some of our imaginative members will come forward with serious challenges to the myths (dogma) that govern petroleum exploration interpretations today.

Geologists should be aware, however, that any challenges to popular myths, such as the subduction concept in plate tectonics, will be strongly opposed by academia and the majority who have accepted and promoted such paradigms as gospel for many years.

Challenges therefore must be very well supported by geological facts, such as the comprehensive critique of plate tectonics by the late professor W.S. Carey, whose advocacy of global expansion has long been buried under the weight of popular dogma.

In my interpretation of the geology of the Oman Mountains (AAPG BULLETIN 1969 v. 53/3) I stressed the evidence for crustal extension and gravity tectonics, but this has long since been dissed by obduction enthusiasts.

More relevant to exploration decision-making, however, are the myths (dogma) that bolster today's assumptions on oil generation, migration and accumulation.

In the past I have followed L.G. Weeks in stressing the geological criteria that support the concept of early biogenic oil generation and accumulation (AAPG BULLETIN 1975 v. 59, pp. 69-84, and Journal of Petroleum Geology 1990 v. 13 [2], pp. 127-156). However, because these analyses have questioned some basic geochemical assumptions, the conclusions reached are rejected by the majority who have accepted geochemical

See **Forum**, page 49

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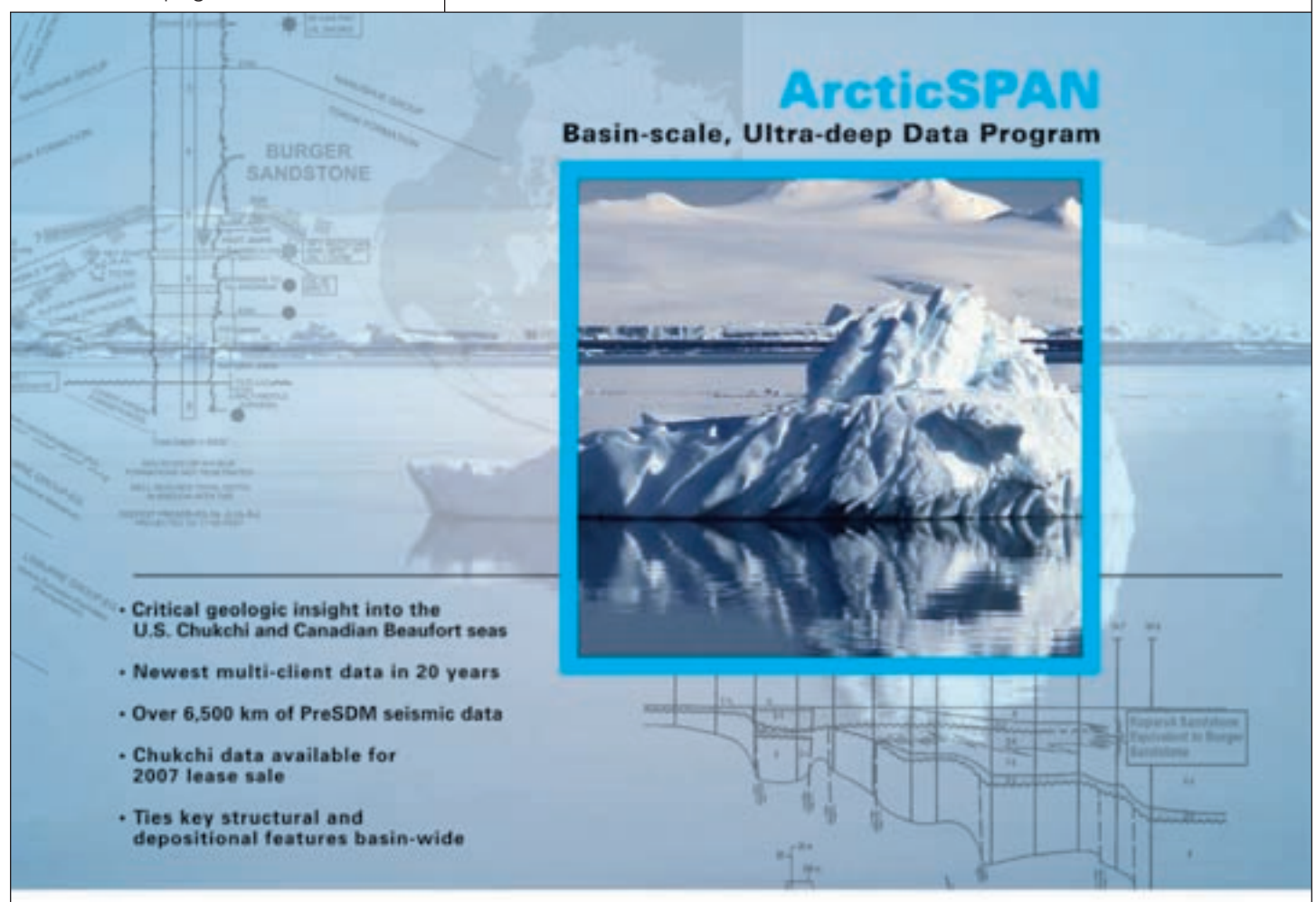

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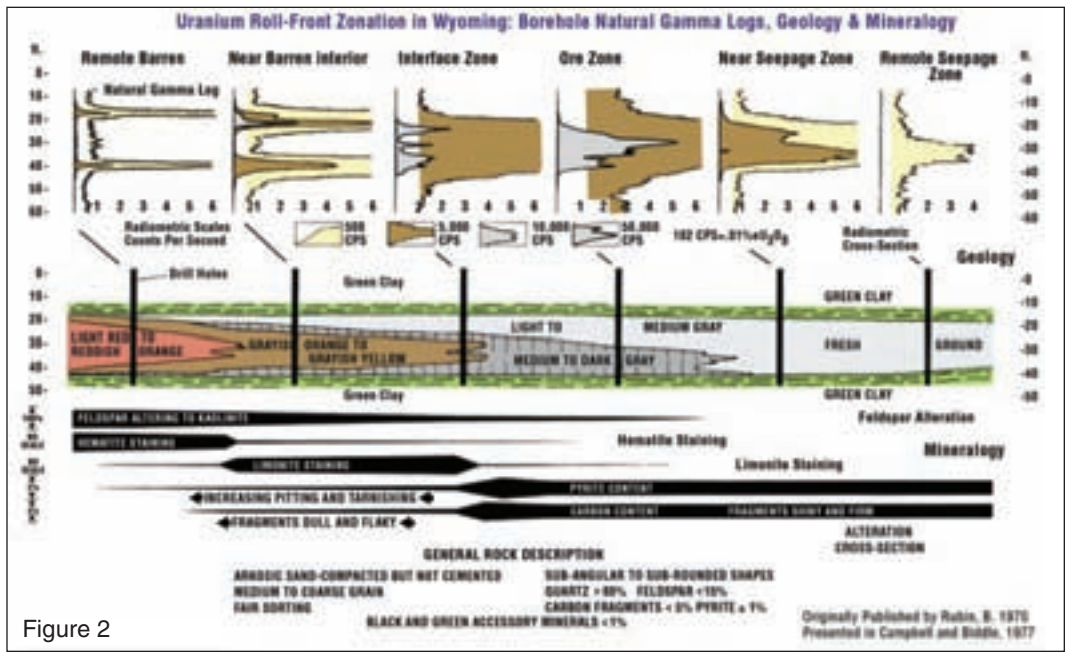

Figure 2

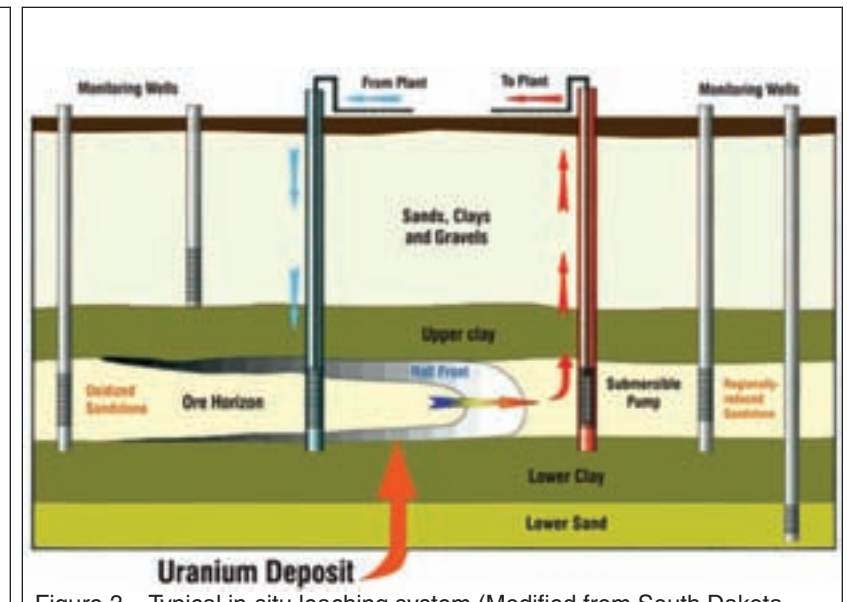

Figure 3 – Typical in-situ leaching system (Modified from South Dakota Department of Environment and Natural Resources, 2006)

EMD

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the pressure on production and price will be tremendous beyond 2020.

However, recent efforts by the international community in recycling and enrichment of nuclear wastes may play significant roles in stabilizing production and fuel prices in the future.

It is interesting to note that the major oil and gas companies, who in the 1970s held major stakes in uranium exploration and production, are so far sitting out this cycle.

There is a growing sentiment that if the major oil and gas companies wish to remain leaders of the global energy field they will have to re-enter the nuclear-power industry – both at the plant level to play a strong role in hydrogen production and distribution, and at the exploration level.

Needed: Well-Trained Professionals

In the 1970s and 1980s about 2,000 professional geoscientists were working on uranium projects in the United States.

Today only 400 geologists and only a few qualified hydrogeologists are working in the field.

It will take some time to train new geologists and hydrogeologists, and this will inhibit yellowcake production schedules as well. State licensing of geoscientists has reinforced an upward trend in professional competency and public responsibility in the analysis of uranium reserves and environmental compliance. ❑

(Editor's note: Campbell, P.G., P.H., of M.D. Campbell and Associates, Houston, is a founding member of EMD and chairman of its Uranium Committee.)

Forum

from page 47

arguments for catagenic generation of petroleum provide the answer to these fundamental problems of petroleum geology.

The fact that the process of primary and secondary migration both from and through consolidated impermeable rocks remains an "enigma" does not seem to have engendered the slightest doubts about the geochemical assurances of late, thermal generation and migration of petroleum. As one consequence, the probability of diagonetically entrapped oil and gas that I have advocated as a valid expectation for new reserves (AAPG BULLETIN 1977 61/4) is considered null and void.

The established verity of the influence of early trap timing on the presence or absence of hydrocarbon accumulation seems no longer to be a factor in prospectivity assessments.

The search for oil and gas has been going on for over a hundred years, and the geological literature is full of hard data that can be brought to bear on the basic problems of petroleum geology – yet in today's workstation world, the analyses of geologists that predated computer modelology are considered "passé."

More recently, I have questioned the paradigm of submarine allochthonous salt emplacement, which is now so prominent in the interpretations of salt diapirism in the Gulf of Mexico. Such divergence from popular dogma is not popular, and the suggestion that a salinity crises in the Gulf of Mexico may be analogous to that established for the Messinian in the Mediterranean goes undiscussed by the advocates of submarine salt glaciers.

In my view the questioning of geological myths is the way to advance our science, which today seems to be held in rigid compliance with popular dogma.

Galileo learned long ago that to question popular myths can engender unpleasant consequences. Today, to challenge popular geological myths often means confronting not only the dominant views of academia but also the management policy of major exploration companies – and this is not guaranteed to lead to a quick ticket to promotion.

Nonetheless, I hope that some geologist in Athens will have enough courage in their convictions to break out of the straight jacket of popular myths.

H. Hugh Wilson
Lothian, Md.

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27th Oil Shale Symposium

Announcement and Call for Abstracts

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The Colorado Energy Research Institute (CERI) at the Colorado School of Mines is pleased to announce the **27th Oil Shale Symposium** to be held at the School of Mines campus **October 15-17, 2007**, and to invite submission of abstracts for presentations and posters. The meeting will be followed by field trips on **Oct. 18-19, 2007**.

The Symposium will address oil shale development worldwide, including research & development, impact analysis, regulatory framework, and project & program status. Abstracts must include title, authors names (presenter denoted by *), affiliations and contact information. Abstract must be written in clear English, must not exceed 250 words, and will be reviewed for sessions on national programs, surface and in-situ processing, physical and chemical properties, stratigraphy, modeling, environmental management, policy and socioeconomic impact, data management, and decision support. **The deadline for submission is June 29, 2007.** Electronic submission is strongly preferred. Submissions may be made at the Website:

http://www.mines.edu/research/ceri/form1.html

Notification of acceptance will be made by **July 27, 2007**. Additional information will be posted at:

http://www.mines.edu/outreach/cont_ed/oilshale/

For further information, please contact:
Dr. Jeremy Boak, Symposium Co-Chair
Colorado School of Mines,
1500 Illinois Street, Golden CO 80401
1-303-384-2235 jboak@mines.edu

DIRECTOR'S CORNER

New Dues Regime Coming in Stages

By RICK FRITZ

One more annual meeting is "in the books," and before we can get into a too contemplative mood we are starting to work on the charges, recommendations and ideas from the meeting.

First, I want to say that Long Beach was a great meeting and thank all of those who put their hearts and hands into making sure it was successful. Each meeting has its own "mood," and from the comments of attendees this meeting had a very, very positive mood.

* * *

One of the first charges to emerge from the meeting is the implementation of the new graduated dues structure that was approved overwhelmingly by the House of Delegates (see page 4).

The plan for implementing the graduated dues is in three steps.

The **first step** is education of the membership on the plan and process. The goals of the leadership and staff in developing this new structure were:

❒ To respond to member needs.

❒ To build a fair dues structure for all members.

❒ To avoid any significant financial loss in making this change.

❒ To grow and increase the quality of our great association.

There are three key items that every member should know about the new system:

✓ Graduated dues are based on a member's **ability-to-pay**, i.e., their personal gross income (GPI), rather than where they live.

This is a key point and difference from other societies.

In other words, a member who is unemployed can pay graduated dues; a member who is retired can pay graduated dues; and a member who is working at a job or region where their income is low can pay graduated dues.

The reverse is also true in that a member who has good personal income in a country with low per-capita income would be expected to pay full dues.

Also the graduated dues program is for individuals only and does not apply to memberships paid by corporations.

✓ This new model is **not automatic or mandatory**; a member must elect to pay their dues based on the criteria set for graduated dues, e.g. greater than US$50k PGI – full dues; US$25-50k PGI – one-half dues (and no hardcopy BULLETIN option); and less than US$25k – one-quarter dues (digital only).

There is no proof required of any member's PGI. This new system is an honor-based program and is defined by our standards of professional conduct. It has been used without problem by other societies.

✓ The new dues program is designed so a member ***gets essentially what they pay for***. If a member qualifies and elects to pay the lowest level of the graduated dues, $20 (US), then they only receive digital services – no hardcopy; however, at any time the member can order hardcopy of the BULLETIN and/or EXPLORER for an additional fee for printing and postage.

As a result of this last item this model does not result in a significant loss for the association because AAPG will not incur printing and postage costs for that member unless they elect to pay for it.

The **second step** is the actual process of applying or implementing the new dues system.

The new dues structure will be implemented in two stages – we will start accepting new members under the new structure on July 1, and existing qualified members may apply at the start of the new dues cycle in 2008.

The primary reason for staging the implementation is the timing of our current dues cycle and the new dues structure requires significant modifications of our accounting procedures and electronic in-house and on-line systems.

The third and final step will be the continued yearly monitoring of the program to ensure it is achieving the goals.

The **third and final step** will be the continued yearly monitoring of the program to ensure it is achieving the goals set by the AAPG leadership. An annual review will be conducted by the staff, with interim updates to the Executive Committee, House of Delegates and Advisory Council.

* * *

If you have additional questions about the graduated dues structure, please note we prepared and updated a Q&A sheet for your convenience. You can find it on our Web page at www.aapg.org.

We appreciate the vision of the AAPG leadership in developing and approving this program, and look forward to providing this new service.

Price Boosts Uranium E&P

Nuclear Is Part of Energy Equation

(Editor's note: This article is based on the 2007 Report of EMD's Uranium Committee. See the AAPG EMD Uranium Committee Web site for the full report).

By MICHAEL D. CAMPBELL

There is general agreement on the necessity of transition to alternative energy sources, including nuclear power.

The resurgence of the nuclear-power industry has stimulated a significant rise in the spot market price of yellowcake (U_3O_8). By the end of 2006, yellowcake prices rose above $72/pound – more than doubling over the previous 12 months – and are presently about $91.

Although the average price involved in long-term contracts for deliveries in 2005 was less than $15/pound, as the contracts with the nuclear utilities mature, major price re-adjustments upward will certainly occur.

Because of the price, there is a resurgence of uranium exploration and production activity.

Discovery of new uranium deposits is resulting from following extensions of previously known, shallow deposits that were mined by open-cut methods (see figure 2, page 48). The oxidized tongue of sandstone shown in figure 2 as orange and grayish orange is represented in figure 1 as a leached, light gray color. The ore zone is medium gray surrounding the oxidized zone.

Using the geologic methods developed in the 1970s (illustrated in figure 2), the success rates are going up.

Figure 1 – Roll-front exposed in wall of open cut mine of the 1970s in south Texas (from Dickinson and Duval, 1977).

Out: Old Mining Technology
In: ISL

In the production of uranium, mining no longer requires open-cut surface mines as in the past. New environmentally friendly methods have developed substantially since the late 1970s.

Mining uranium in Tertiary sandstone deposits in South Texas, Wyoming, Kazakhstan and elsewhere now incorporates in-situ leaching (ISL) methods that involve water-well drilling technology and common industrial ion-exchange technology similar to household water-softening methods in use today.

Since the uranium ore has formed naturally in aquifers often used elsewhere along the trend for drinking-water supplies, the part of the aquifer being mined by ISL methods are prohibited by the state to be used as a source of drinking water. In addition, the area of influence of nearby large-capacity water wells needs to be carefully monitored to avoid drawing the naturally contaminated ground water away from the uranium production area.

The leaching agents used in ISL are typically special forms of O_2, CO_2 and, in some cases, ammonia-based fluids, all of which are non-toxic and are easily recovered by pumping.

It is the responsibility of the mining company (and required by state regulatory agencies) to install strategically located ground-water monitoring wells to periodically sample for fluids that may have escaped the hydraulic cycle of injection and recovery of uranium-saturated fluids for making yellowcake from ion exchange resins in the plant on the surface.

The typical cycle is illustrated in figure 3, page 48.

To a large extent, in-situ mining of uranium is both a natural resource development project and a natural, contaminant-remediation project. Although uranium ore is a natural energy resource, it is also a bacterial waste product that was formed within the bio-geochemical cell developed within the aquifer. Both rely heavily on, and are driven by, hydrogeological processes.

Protecting upper and lower aquifers from incursions of the production fluids is also a function of understanding the hydrogeological conditions in and around the production site.

The mine's hydrogeological staff monitors the behavior of the fluids and associated hydrochemistry during the in-situ leaching of the uranium ore zones and monitor the data generated from sampling the surrounding monitoring wells.

Energy-Source Competition

It is widely suspected that the price of uranium will continue to rise for the next few years until a uranium shortfall is realized as new production meets demand – which should occur within the next five to 10 years.

But if the world greatly expands the use of nuclear power by building many more plants than have been announced to date,

See **EMD**, page 48

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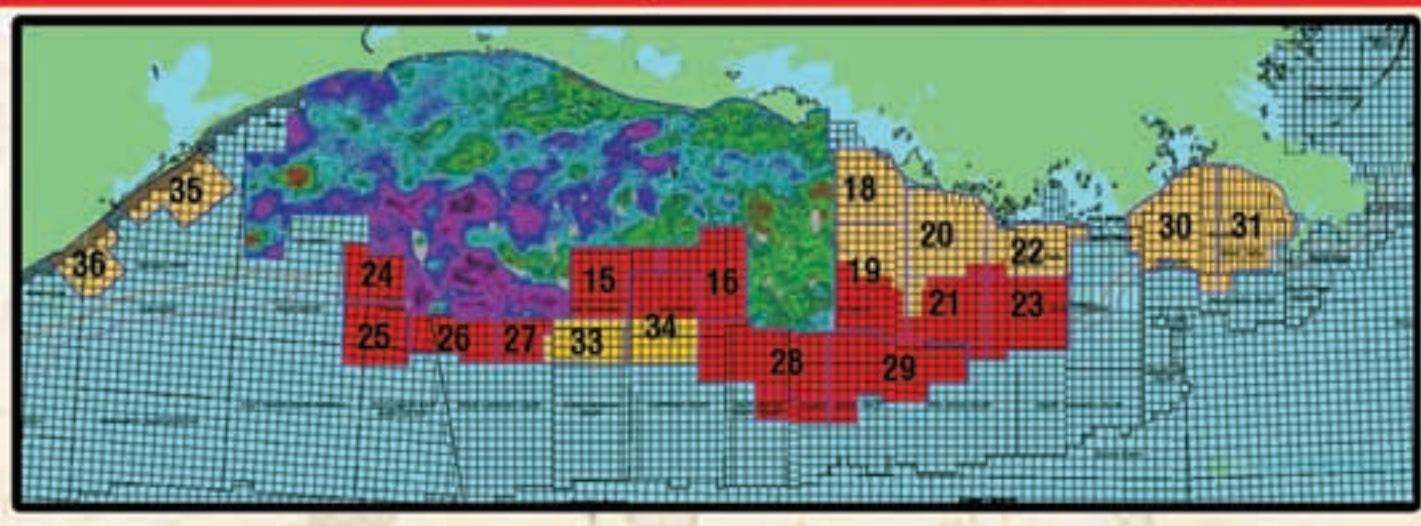

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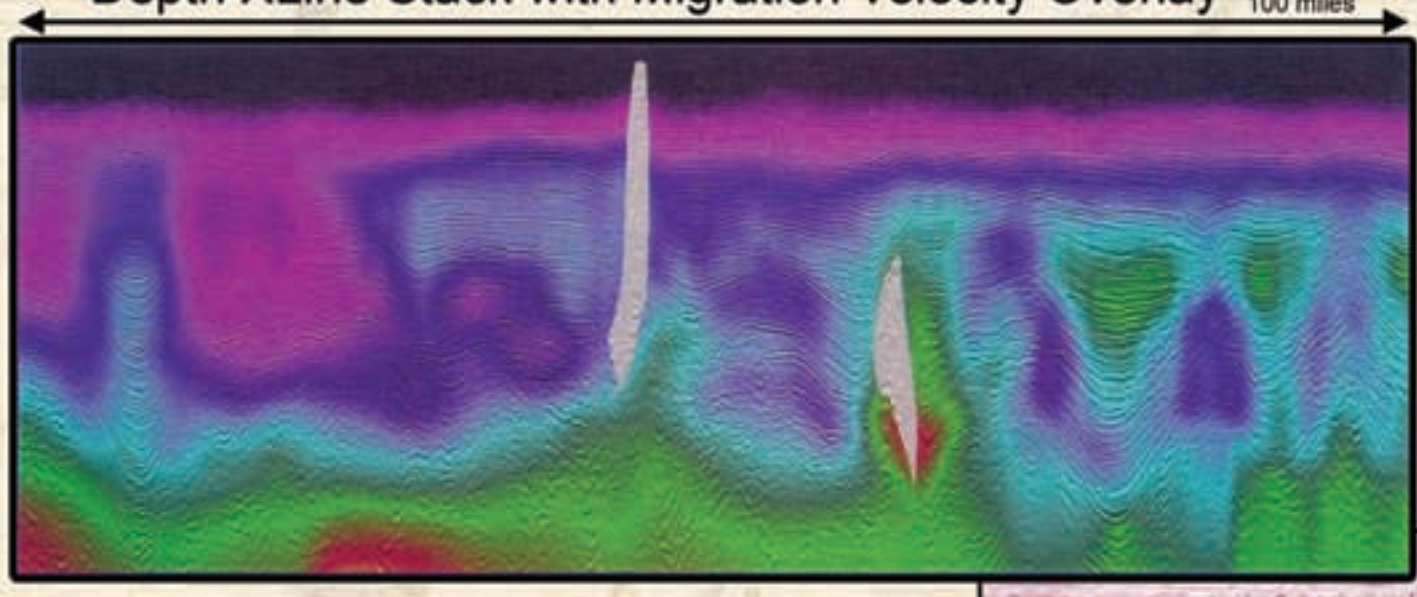

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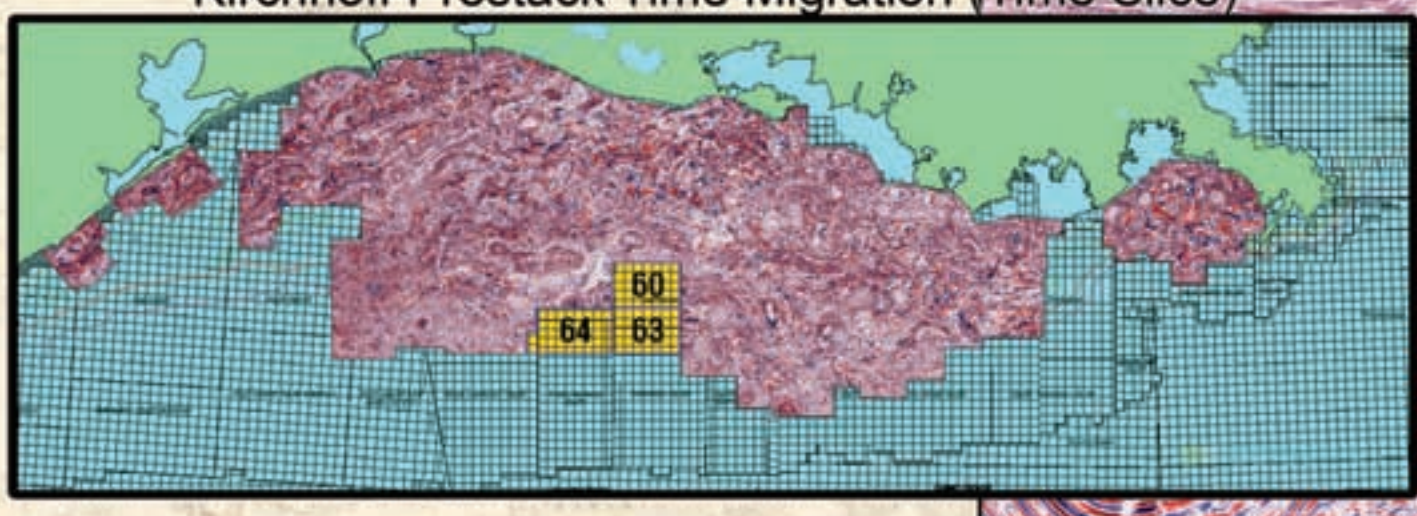

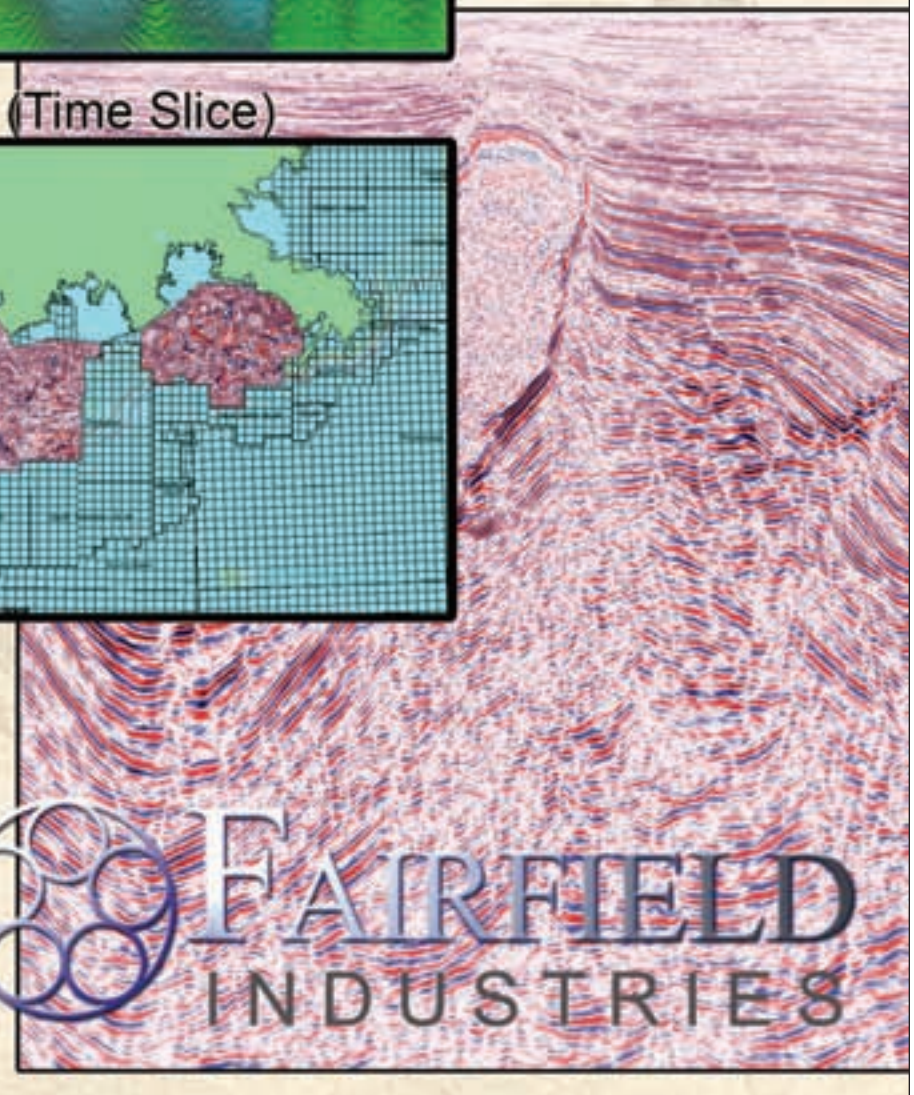

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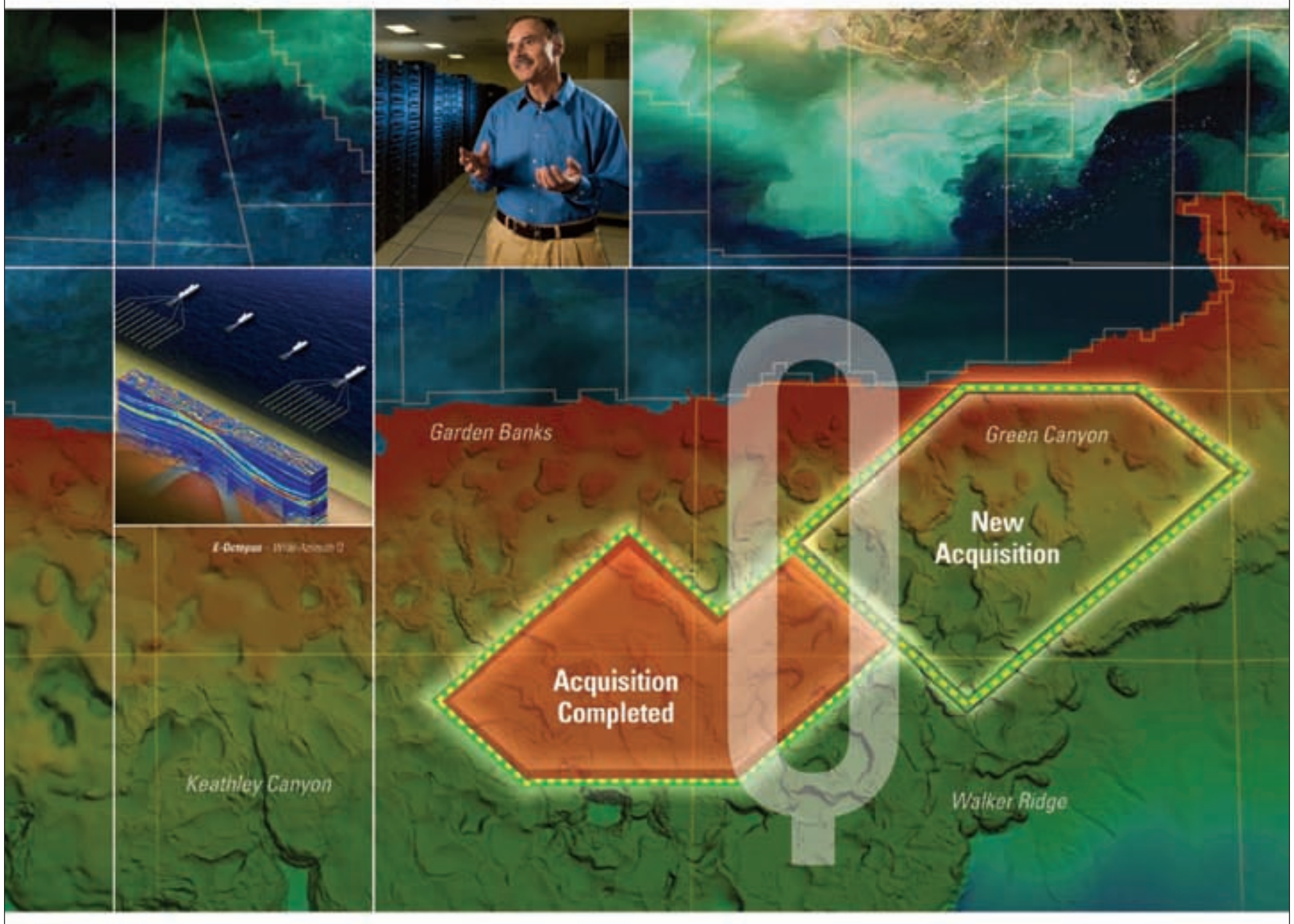

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