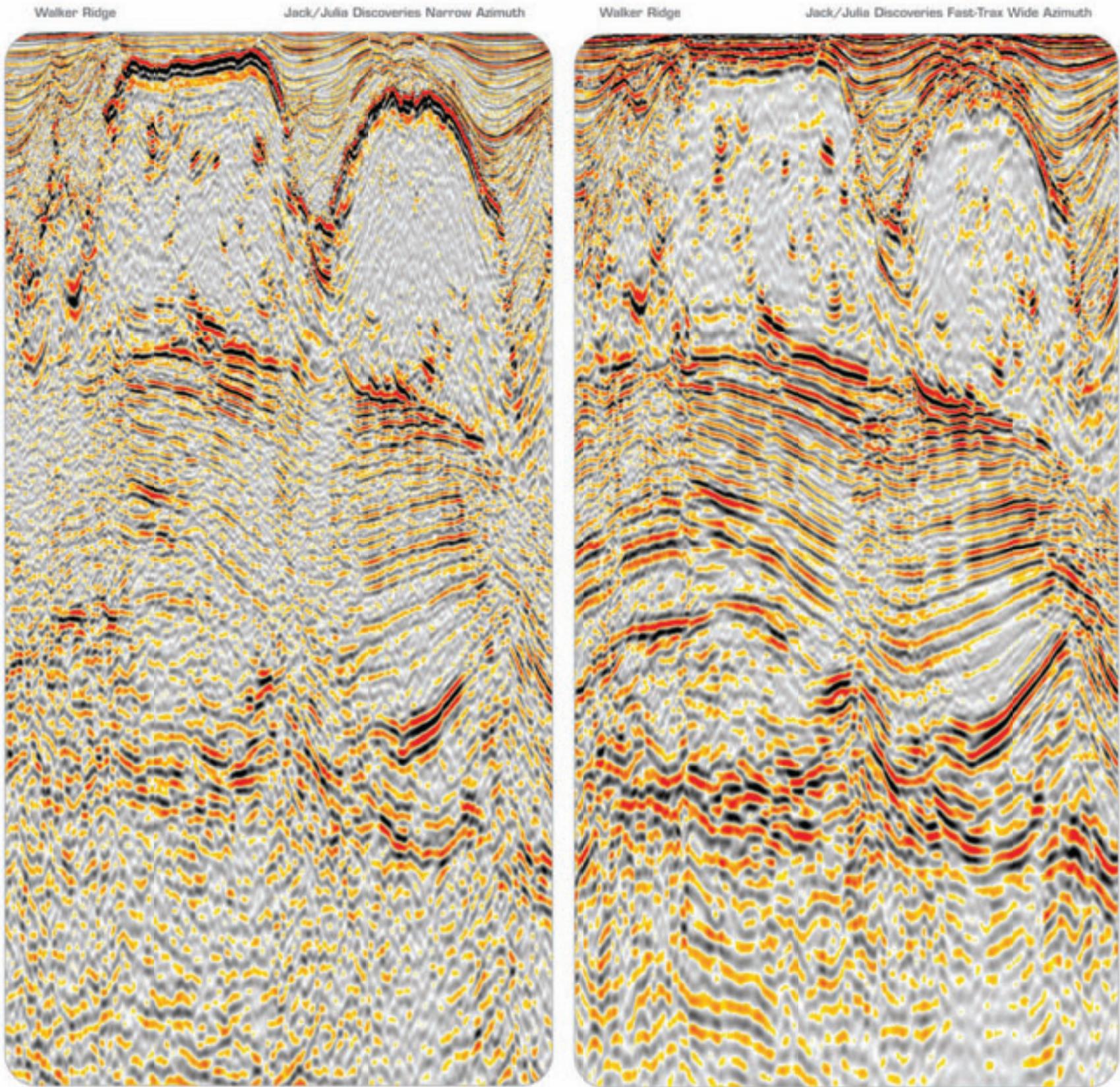




Rolling on the River
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See page 3



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On the cover: One of AAPG's most popular field trips is the Lewis & Clark Geotour: "Marias River to Gates of the Mountains, Montana," an adventure that takes place July 12-17 and offers participants whitewater float trips, canoe trips and other excursions on and around the Missouri River in a geology-oriented journey that is scientific, historical and fun. Feeling adventuresome? There's still time to get your feet wet – contact the AAPG education department, or go online to www.aapg.org, for more details. Photo by AAPG member Denise Stone.

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It's a mystery – but maybe not for much longer. The **Blackbeard** West well, a tight hole that's been on hold since 2006, has a new operator who is excited about its future. **12**

Let the exploration begin: **Libya**, a country for years off-limits to U.S. investment and operations, is finally on the menu. **16**

Happy birthday to them! **Saudi Aramco** celebrates its 75th anniversary this month, and we take a look back at its creation – an event that took place even though no one knew if Saudi Arabia had any oil potential at all. **19**

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Photo by Sam Samford

Honored recently by the Roswell Geological Society were (from left) AAPG President Willard "Will" Green, Carl A. Shelling, Edward K. "Eddie" David, George M. Yates, Patrick J. F. "Pat" Gratton, A. T. "Toby" Carlton, Phelps Anderson and H. Lee Harvard.

PRESIDENT'S column

Have You Considered Submitting a Paper?

By WILLARD 'Will' GREEN

AAPG relies on the significant contributions of members to make our publications the best. We actively seek manuscripts for the AAPG BULLETIN and proposals for Special Publications.

Consider these observations:

✓ E&P Notes are very popular with BULLETIN readers. If you are working on an interesting exploration play or have a useful field description, consider submitting a manuscript.

✓ Geohorizons BULLETIN papers focus on current technical methods. If you have a unique way to solve a geotechnical problem, a brief Geohorizons manuscript will spread the word.

✓ Discussions and Replies in the BULLETIN allow you to expand on a published paper. While many readers think "Discussions" primarily serves to correct a published paper, Discussions also can be used to extend good work.

If you have more to share than a single paper, consider submitting a proposal for a Special Publication. The AAPG BULLETIN and Special Publications are among the most highly valued member services.

Like just about everything else in life, advances in the electronic world are changing the way AAPG publishes. For example:

✓ The electronic BULLETIN allows us to do more with color, oversize images and data archiving.

✓ Special Publications now come in a variety of formats – from all print to all electronic – to best deliver timely technical information.

✓ The "Getting Started ..." series, championed by the AAPG Publications Committee and Vice Chair Terri Olson, recently delivered its tenth CD, "Getting Started in 3-D Seismic Technology," by Bruce Hart. In fact, we also will have the eleventh volume out by May, "Getting Started in Sequence Stratigraphy," by Shuji Yoshida.

High-quality science publications like these help AAPG members find and produce oil and gas.

Consider sharing your work with others. For more information, contact AAPG Editor Gretchen Gillis at ggillis@sugar-land.oilfield.slb.com.

APPEX and Aberdeen

In early March I traveled to London for APPEX (AAPG Prospect and Property Expo), which was the best-attended Expo to date with over 450 registrants.

South Africa, host country for this year's AAPG International Conference and Exhibition in Cape Town, had a large booth in the exhibit hall, and Iceland had a booth to give notice of the country's first-ever licensing round in early 2009. General Chair Mike Lakin and committee did a fine job of organizing the Expo.

From London I flew to Aberdeen to visit the University of Aberdeen and the Aberdeen Explorer's Club. My

schedule included meetings with the university principal and vice principal, and sessions with a third year geology class and the integrated petroleum geology MSc class. Many of these graduate students already have accepted jobs in the petroleum industry.

Many thanks to Colin North, David Macdonald, Andrew Hurst and Ali MacLeod for arranging my visit. It has become traditional for AAPG presidents to visit the University of Aberdeen – and I'm glad I did!

Middle East Region

The Middle East Region is taking giant steps forward. GEO 2008 in Bahrain (held the same week as APPEX), attended by Rick Fritz and President-Elect Scott Tinker, was a great success with over 4,400 participants.

Our new director of the AAPG Middle East office planned in Bahrain, Abeer Al Zubaidi, is on board and attended the AAPG Convention in San Antonio.

And more recently, the process of organizing a Student Chapter at the University of Kuwait has begun.

Roswell Geological Society

March 18 was a memorable day: I attended and presented a program at the Roswell (N.M.) Geological Society's "Local National Leaders Recognition

See **President**, next page

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Balloting deadline is May 15**The Time to Cast Your Vote is Now**

There's still time to vote in this year's AAPG officer election, but time is running out.

Members can vote online by accessing the AAPG Officer Election icon on www.aapg.org through May 15 noon CDT.

Members should cast their ballot online if possible; AAPG has switched to the electronic voting method to reduce election costs, especially postage.

This year, AAPG mailed paper ballots to those members who do NOT have a valid e-mail address or to those whose e-mail addresses bounced back as non-deliverable.

To cast your vote, you will need both your AAPG member number and an

assigned code, referred to as an "E-Signature." Both numbers have been provided in your e-mail notification or on the paper ballot, and can be used only one time.

Those who receive a paper ballot can instead to choose to vote online; however, do not also return the paper ballot.

User support is available online.

In the president-elect election members will choose from three candidates – two nominated by the Advisory Council and a candidate who filed a petition to be on the ballot. Voters are instructed to cast the vote in order of preference.

In a Bylaws change effective in 2006,

ballots for offices with more than two candidates provide voting in order of preference; the candidate receiving a majority of the "first choice" votes is elected.

Previously, the candidate with the most votes was declared the winner without regard to a majority tally.

The new process allows for determination of a majority without a costly and time-consuming run-off.

If no candidate receives a majority of the "first choice" votes cast, then the candidate who received the least number of "first choice" votes shall be dropped from consideration, and the second choices of those voters whose first choice was the dropped candidate

will be deemed those voters' first choice. The process is repeated until a candidate receives a majority vote.

Also on the ballot are candidates for vice president-Sections and treasurer. Races for secretary and vice president-Regions will be on next year's ballot.

Voting results will be announced online and in the June EXPLORER.

The candidate slate is:

President-Elect

John C. Lorenz, Geoflight LLC, Edgewood, N.M.

Dwight M. "Clint Moore", vice-president-corporate development, ION Geophysical, Houston (petition candidate).

Ronald A. Nelson, Broken N Consulting, Cat Spring, Texas.

Vice President-Sections

David H. Hawk, Energy Analysis and Answers/Consultant, Boise, Idaho.

W.C. "Rusty" Riese, BP Americas, Katy, Texas.

Treasurer

Edith C. Allison, U.S. Department of Energy, Washington, D.C.

Kay L. Pitts, Aera Energy LLC, Bakersfield, Calif.

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President

from previous page

Night," when the RGS recognized and honored 12 residents and former residents for giving their time and expertise to serve their business and social communities.

Considering Roswell's relatively small size (50,000 population now), it's unique that so many have served as presidents, chairmen or CEOs of national or international organizations.

The first 10 years of my career were in Roswell as an exploration geologist for Shell Oil Co.

Past AAPG presidents Pat Gratton, Eddie David and Toby Carleton were present and also received recognition.

Pat grew up in Roswell and returned after college to work for Shell in 1957 before moving to Dallas as an independent; he also served as president of SIPES. Eddie moved to Roswell as a geologist for Texaco in 1962 and continues to live and work there with his own E&P company. Toby, also a past president of SIPES, now resides in Midland, Texas, working as a geologist and rancher.

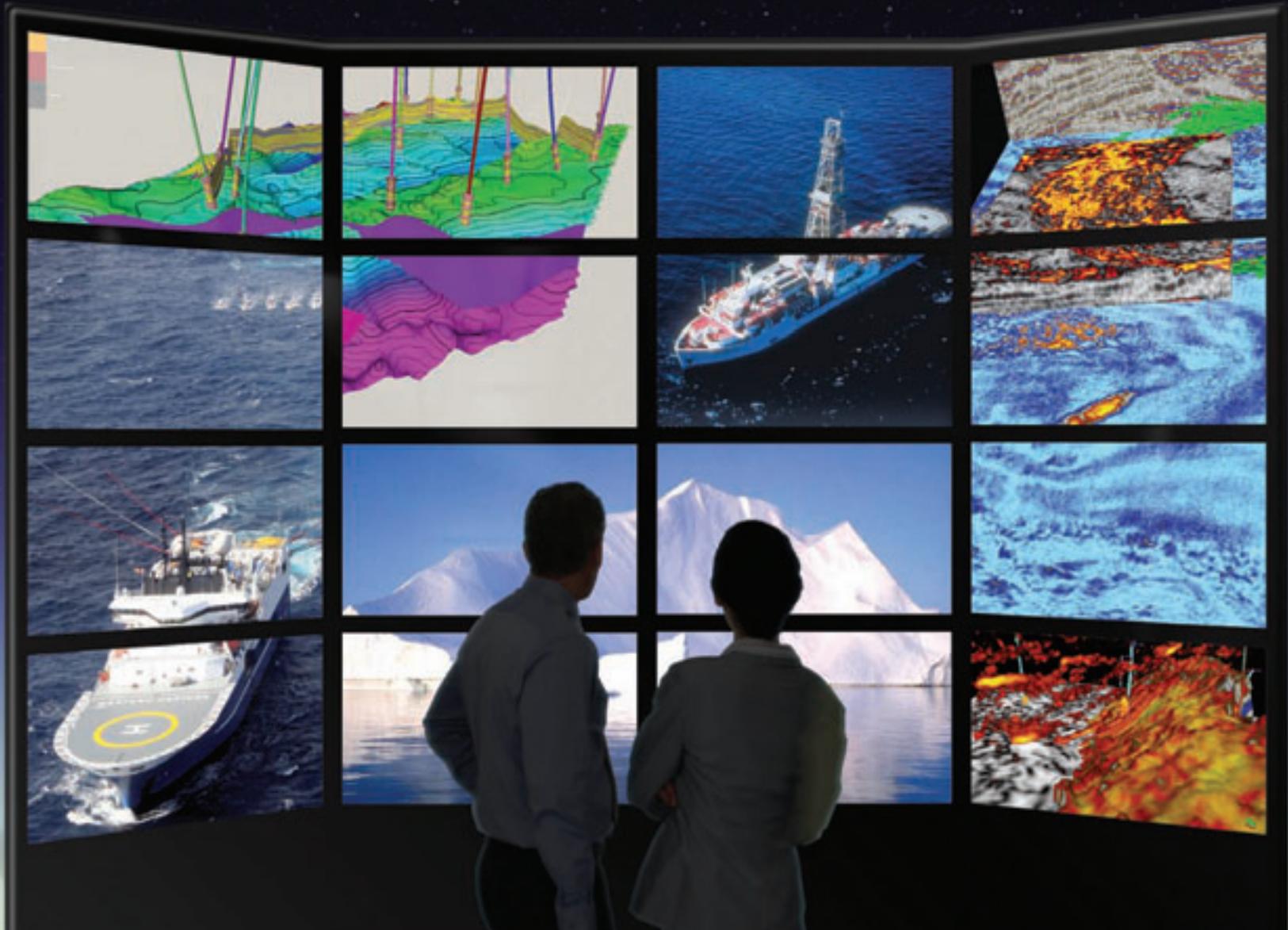
Also present were current Roswell citizens who have been president of AAPL (Carl Schellinger) and IPAA (George Yates). Former Roswell resident Robert O. Anderson, past chairman and CEO of Atlantic Refining Co., was honored posthumously.

RGS president Lee Harvard, owner of Harvard Petroleum, organized an outstanding, fun event.

Bueno.

Will Green

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*Lots of room to explore – but access limited***New Ideas Keep GoM a Prime Target**

By LOUISE S. DURHAM
EXPLORER Correspondent

In the early 1990s Gulf of Mexico production had dropped below 20-year record low levels, and much of the industry was off looking for finds anywhere but the Gulf.

Then, in 1993, Anadarko announced its Mahogany subsalt discovery, igniting a whole new play in the Gulf's extensive subsalt environs.

Add the deep gas play and the ever-increasing action in the deep water, and the Gulf became and remains a top producer for the energy-gorging United States, where most offshore regions have been declared off-limits for drilling.

One of the more recent high points in the Gulf's long history was the successful production test of Chevron's Jack #2 well in 2006 at Walker Ridge in the deepwater Lower Tertiary Wilcox trend. The well was drilled to 25,000 feet subsea in 7,000 feet of water and tested 6,000 bopd.

The test triggered a near-frenzy in the mainstream media once potential recovery for the entire play was publicized to be in the billions of barrels.

The highly touted Jack well actually followed a string of significant deepwater discoveries in the Lower Wilcox, dating back to 2001.

Only a few years prior to these discoveries, few geoscientists envisioned the presence of any significant Paleogene sands in the deepwater Gulf, let alone hundreds of feet of net sand spread across a vast area of the present-day lower continental slope and abyssal plain.

"It came as a surprise to many



Photo courtesy of Chevron

The Chevron Jack #2 well at Walker Ridge represents one of the recent high points in the Gulf of Mexico's storied history. The well, in the deepwater Lower Tertiary Wilcox trend, was drilled to 25,000 feet subsea in 7,000 feet of water, and tested 6,000 bopd.



Blickwede

how the Gulf province continues to surprise us in terms of discovering new resources in parts of the stratigraphic section that industry had not previously

geologists that any significant sands would be encountered this far out in the basin," said AAPG member Jon Blickwede, senior staff geologist with Statoil's Global Exploration-Americas division in Houston. "The deepwater Wilcox play is a good example of

perceived as having any potential.

"It's a myth that the Gulf is in its elder years and played out," Blickwede added. "In the geographic sense, most of the Gulf of Mexico basin is under-explored, and some of the best global exploration opportunities are sitting under our noses."

Challenges and Obstacles

But there are challenges – of various kinds.

Both federal and state political posturing has kept the geologically promising eastern one-third of the GoM off

the Florida coast off limits to drilling for more than two decades, Blickwede noted.

To date, only about 70 wells have been drilled in this entire eastern Gulf area, even though a number of promising plays have been identified (see related story, page 14).

A prospect in one of these plays – Destin Dome, offshore the Florida panhandle – was the site of a 2-3 tcf discovery about 30 years ago. Political intervention on both the federal and (Florida) state level put the skids on developing this significant resource.

The Yucatan platform of Mexico also looms as a promising locale for GoM exploration. It encompasses an area about three-fourths the size of the North Sea, yet only about 50 wells have been drilled here – most without the benefit of modern seismic.

The eastern margin of the intra-platform basin on the Mexican side is probably the best place to pursue this play, Blickwede said, as the westward tilt of the Yucatan platform would favor secondary migration toward the east.

This play has a pedigree of sorts.

"The intra-platform basin as it's conceived has one of the best analogs imaginable," Blickwede noted. "It has elements analogous to the super giant accumulations of the Arabian platform."

Yucatan's petroleum potential has been documented by one major discovery in northern Guatemala – the Xan Field – and two smaller discoveries in Belize.

See **Future Plays**, page 10



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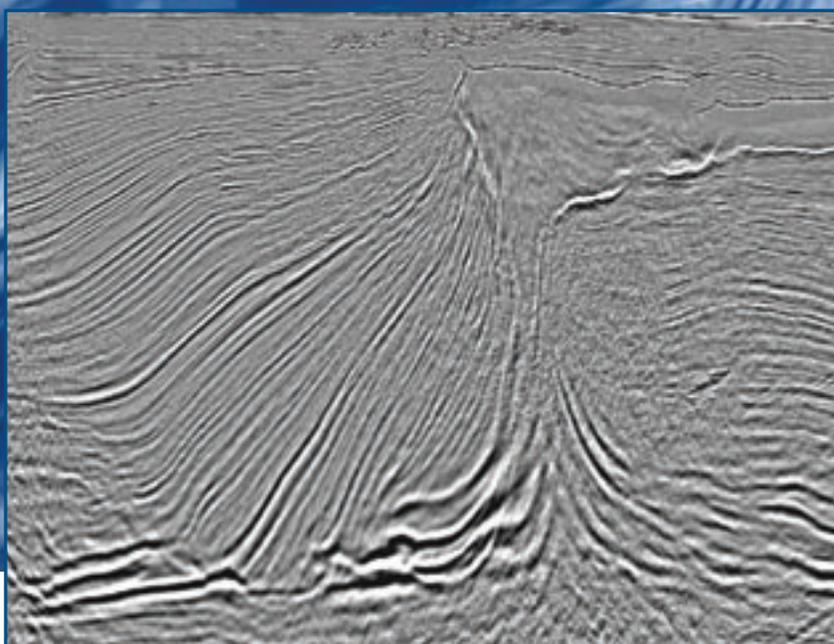
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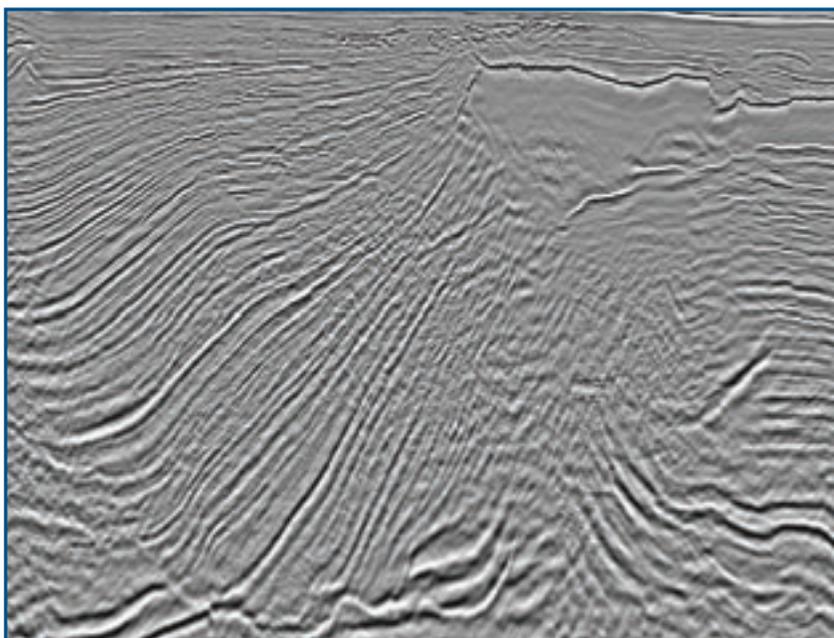


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Future Plays

from page 8

There's been considerable attention focused on drilling off the coast of Cuba, which has the smallest and least explored offshore area of the three countries having sovereignty over the GoM.

A well drilled in the offshore Cuban sector three years ago was rumored to have been a discovery, according to Blickwede.

A number of countries are cozying up to the Cuban government to get on board to drill in waters reportedly as close to Florida as 50 miles – an ironic twist given the moratorium covering most of the eastern Gulf.

“It's a great time in the industry for explorationists to be creative and bring new ideas forward.”

Mexican Gulf Targets

Across the Gulf to the west from Cuba, the Mexican sector of the deepwater is perhaps the most promising under-explored Gulf area. Fewer than 10 wells have been drilled in water depths greater than 500 meters, Blickwede noted.

In contrast, about 1,800 wells have gone down in these same depths offshore Texas and Louisiana.

The more highly explored areas of the GoM also hold plenty of potential for new plays – and one of these entails the

Gulf-wide Cretaceous-Tertiary boundary mass transport breccias.

This complex clastic, or “cocktail,” unit at the K-T boundary has been demonstrated to be the main reservoir in giant fields in Mexico's Bay of Campeche. Outside of this locale and also western Cuba where it's a productive reservoir as well, it would be a new play.

“Most people perceive the K-T boundary breccia to be restricted perhaps to just the immediate area around Chicxulub crater in Mexican waters,” Blickwede said.

Going Deeper

Given the once-inconceivable find of great volumes of Lower Tertiary Wilcox sands in the deep basin, there's some head-scratching as to just how deep in the stratigraphic section the operators might go.

Outside the eastern Gulf, the Mesozoic has not been actively pursued in the U.S. offshore GoM. An exception was Shell's Baja #2 well drilled in 2000 in Alaminos Canyon Block 557, which penetrated a section at least as old as the Lower Cretaceous, according to Blickwede.

Effective porosity and permeability can be limiting factors as one goes deeper in the section, but there are examples of high porosity and permeability being preserved at great depths.

“In the northeastern Gulf in the Jurassic Norphlet play in those aeolian sands offshore from Mobile Bay, there are some significant gas accumulations below 25,000 feet subsea with porosities above 20 percent and associated good permeabilities,” Blickwede said.

“In that case, it's been documented that it's apparently due to very continuous clay coatings on quartz grains, which protect the sands from cementing up with quartz overgrowth cement – which at those depths and temperatures is what you'd most worry about in a highly quartzose sand like the Norphlet.

“There are parts of the Cretaceous in the Tuscaloosa where a similar phenomenon occurs.

“The porosity basement in terms of depth of burial is difficult to put a firm number on,” Blickwede noted. “It sort of depends on the composition and diagenetic conditions of the sand.”

Carbonates are a different breed of cat.

“Carbonates don't necessarily have to be exposed to fresh water to develop good porosity and permeability post deposition,” Blickwede said.

“Hydrothermal fluids from below can come into contact with carbonates, and the organic acids in those fluids can post-depositionally develop good porosity and permeability.

“So there are scenarios where probing deeper doesn't necessarily mean you'll run out of effective porosity.”

First, Some Questions

If you're determined to head out to the deepwater Gulf with the goal of identifying new plays in under-explored parts of the stratigraphic column, Blickwede has a to-do list:

- ✓ Question paradigms – the deepwater Wilcox is a good example.
- ✓ Look for anomalies, exceptions to the rule.
- ✓ Use your understanding of the regional geology for clues, and evaluate whether the play concepts make sense in the regional context.
- ✓ Push the data, especially the seismic, to its limits.

But he, like so many others, believes the time is right to make good things happen.

“It's a great time in the industry for explorationists to be creative and bring new ideas forward,” Blickwede said. “The state of the industry is very aggressive now, and there's a heightened receptiveness to new ideas or exploration concepts.” □



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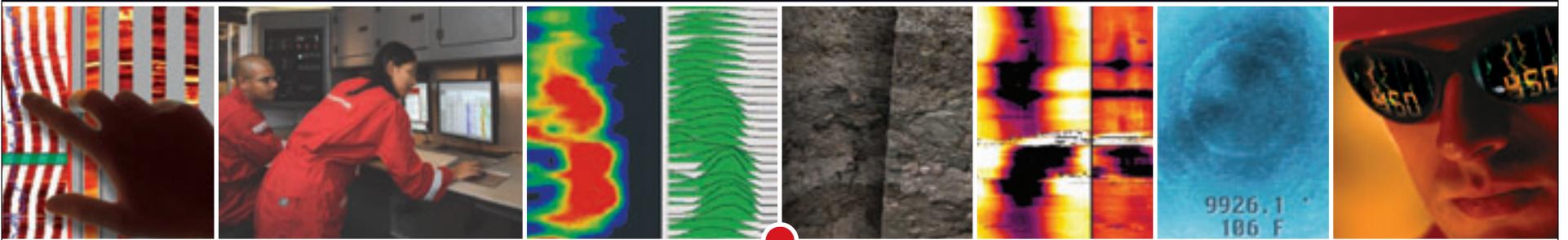
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GoM test intrigues

Shallow Water, Deep Miocene Play

By LOUISE S. DURHAM
EXPLORER Correspondent

There was mystery and a lot of unanswered questions surrounding the mega-deep Blackbeard West well that spudded early in 2005 at South Timbalier Block 168 on the shallow water Gulf of Mexico shelf.

As tight holes go, this may have been as tight as any has been in industry history, spawning rampant rumors and speculation as it headed for a near-world-record target depth of 38,000 feet in the quest for ultra-deep gas (>25,000 feet).

The well spudded during the time when the shallow water deep gas play (15,000 to 25,000 feet) was essentially the domestic exploration event of the moment.

Some of the savvier deep gas players met with success and continue playing this trend today, while others faded from the picture after a few costly unproductive deep holes.

As for that eagerly anticipated ultra-deep test at Blackbeard, the project has been on hold since August 2006, when the Blackbeard West well was temporarily abandoned by operator ExxonMobil. The well reached a measured depth of 30,067 feet, reportedly running up a tab somewhere above \$200 million.

Enter seasoned shallow water deep gas player McMoRan Exploration.

The company acquired the rights to the Blackbeard project when it purchased the Newfield Gulf of Mexico shelf properties in 2007.



Photos, graphics courtesy of McMoRan

A production test announced in early April for McMoRan's Flatrock #2 well at South Marsh Island indicated a gross flow rate of approximately 103 mmcf/d, 1,890 b/d of condensate and no water. The well was drilled in 10 feet of water and bottomed out slightly deeper than 18,000 feet.

This past March McMoRan re-entered the Blackbeard West well, which sits in 70 feet of water. The plan is to drill to a proposed total depth of 31,267 feet to evaluate the deeper targets – and possibly deepen the hole to as much as 33,000 feet.

At press time, the drill bit had reached 27,000 feet.

The Rowan Gorilla IV rig is drilling the well for operator McMoRan and partners



Moffett

Plains Exploration and Production Co. and Energy XXI (Bermuda).

It's all about the deep Miocene rocks, something near and dear to the heart of veteran geologist James Moffett, co-chairman of the board at McMoRan – he's

quick to say, "I cut my eye teeth doing work onshore in the deep Miocene."

32 Prospects, 17 Discoveries

It was a natural progression to ultimately move onto the shelf to apply the deep Miocene exploration techniques honed in the onshore environment.

In fact, McMoRan assembled exploration rights to 1.5 million gross acres to pursue hydrocarbons in the deep Miocene geological trend beneath historical or existing production in shallow waters. So far, they have racked up 17 discoveries on 32 prospects drilled since 2004.

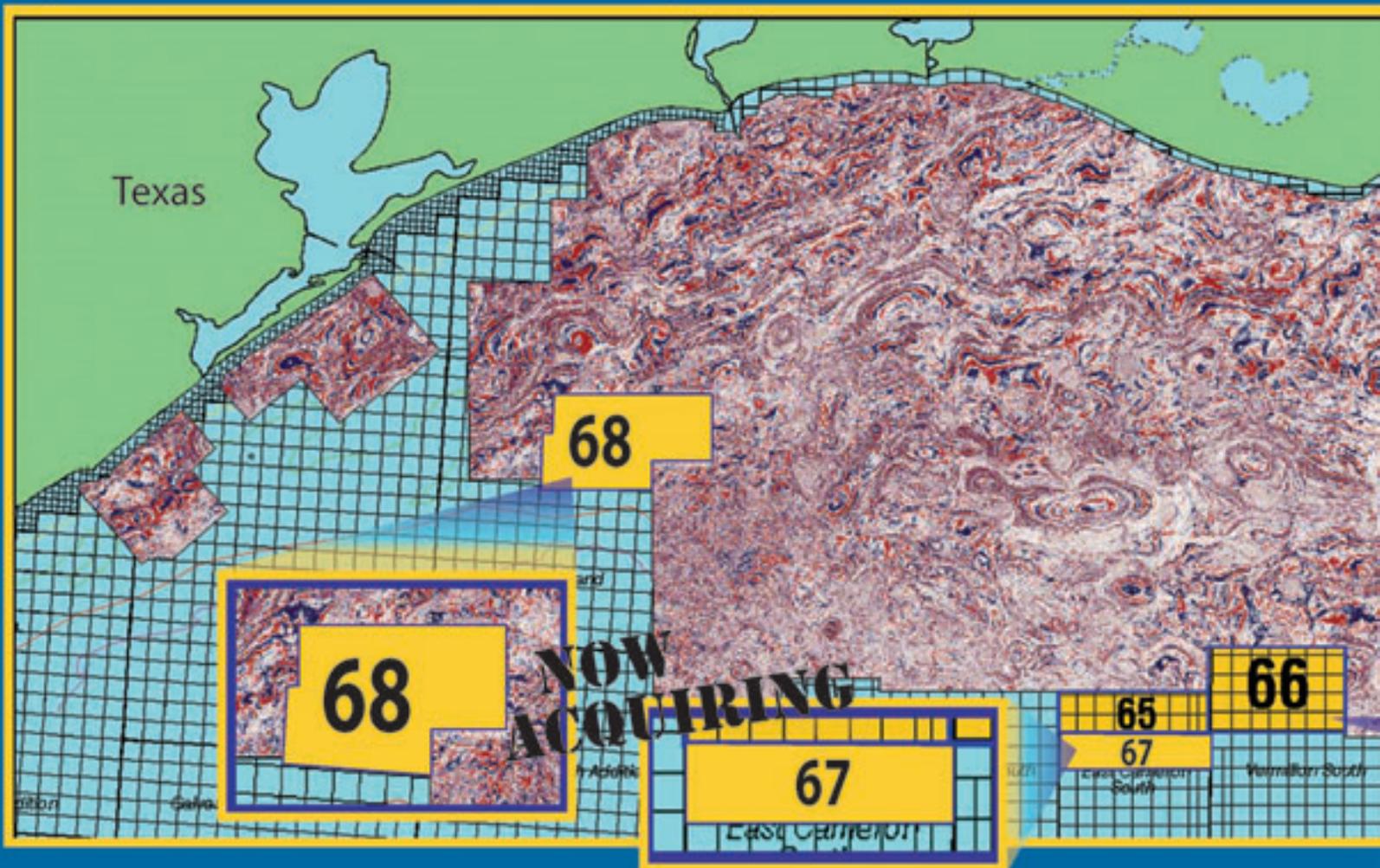
"The importance is not only have we found production, but we're able to see these wells flow at rates substantially higher than the Plio-Pleistocene," Moffett said. "There, an average well would be 10 million (cubic feet) a day, and a big one would be 20 to 25, but we're getting completions that flow at 30 to 60."

A production test announced in early April for the company's Flatrock #2 well at South Marsh Island indicated a gross flow rate of approximately 103 mmcf/d, 1,890 b/d of condensate and no water. The well was drilled in 10 feet of water and bottomed out slightly deeper than 18,000 feet.

When the shallow water deep gas play first kicked off, many prospectors were concerned about the quality of the sands in the deeper pressured

continued on next page

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continued from previous page

reservoirs.

"We knew from onshore they had a lot of gas," Moffett said. "Below the geopressure there was high quality sand that had good flow rates in the Planulina, Hollywood, Hackberry – to name a few of so-called deeper gas (reservoirs) onshore – and we've been able to confirm those kinds of quality sands do exist on these deep structures."

"If you've got the structure and the high quality sands with the high flow rates, that's what will make these deep wells feasible," he said. "Blackbeard is just a continuation of the same concept."

"The ultra-deep play at Blackbeard is to test to see if the same sands exist even deeper than our original deeper gas sands concept as you go out into the deeper part of the shelf," he said.

The intrepid explorer emphasized that even though the current modern day shelf is what everyone sees, it had no impact on Miocene deposition.

"The controlling feature for Miocene deposition in the Gulf Coast was the shelf at Miocene time, which was north of the current coastline," Moffett said.

"If you draw a line along the shelf edge today and move it back to the north and put it onshore you can see all of a sudden that all of this deepwater deep gas and shelf deep gas (sands) were being deposited in the same Miocene basin just off the mouth of the Mississippi River, which is the source of all the sand."

A Stratigraphic Test?

Moffett noted the shelf play they have been drilling is in what they call the traditional trapdoor normal fault tectonics, which occurred in an extension type pressure regime, whereas

the deep gas fold belt that's been delineated in the deep water is more of a compressional feature.

"The geological style changes at about 25,000 feet, and you go below the traditional tectonics of the deep gas play I've been playing," Moffett said, "and you go into the fold belt of the Miocene that's been basically calibrated out in the deepwater."

Moffett noted that the structures seen in the traditional deep gas play can be quite large – as much as 3,000 to 5,000 acres, which they think may apply to Flatrock. But the structures in the deep water and what appear to be the same structures and same age rocks in the ultra-deep (play) are substantially larger – 10,000 to 15,000 acres.

The discoveries reported at fields such as Thunder Horse, Mad Dog and others are in deep water, but the sands are the same age as what appears to be in the ultra-deep section on the shelf, according to Moffett.

In a sense, Blackbeard might be considered to be a stratigraphic test. The structures can be seen via 3-D data, so the challenge is to confirm that the prolific deep sands from the deepwater gas play do, in fact, exist underneath the shelf.

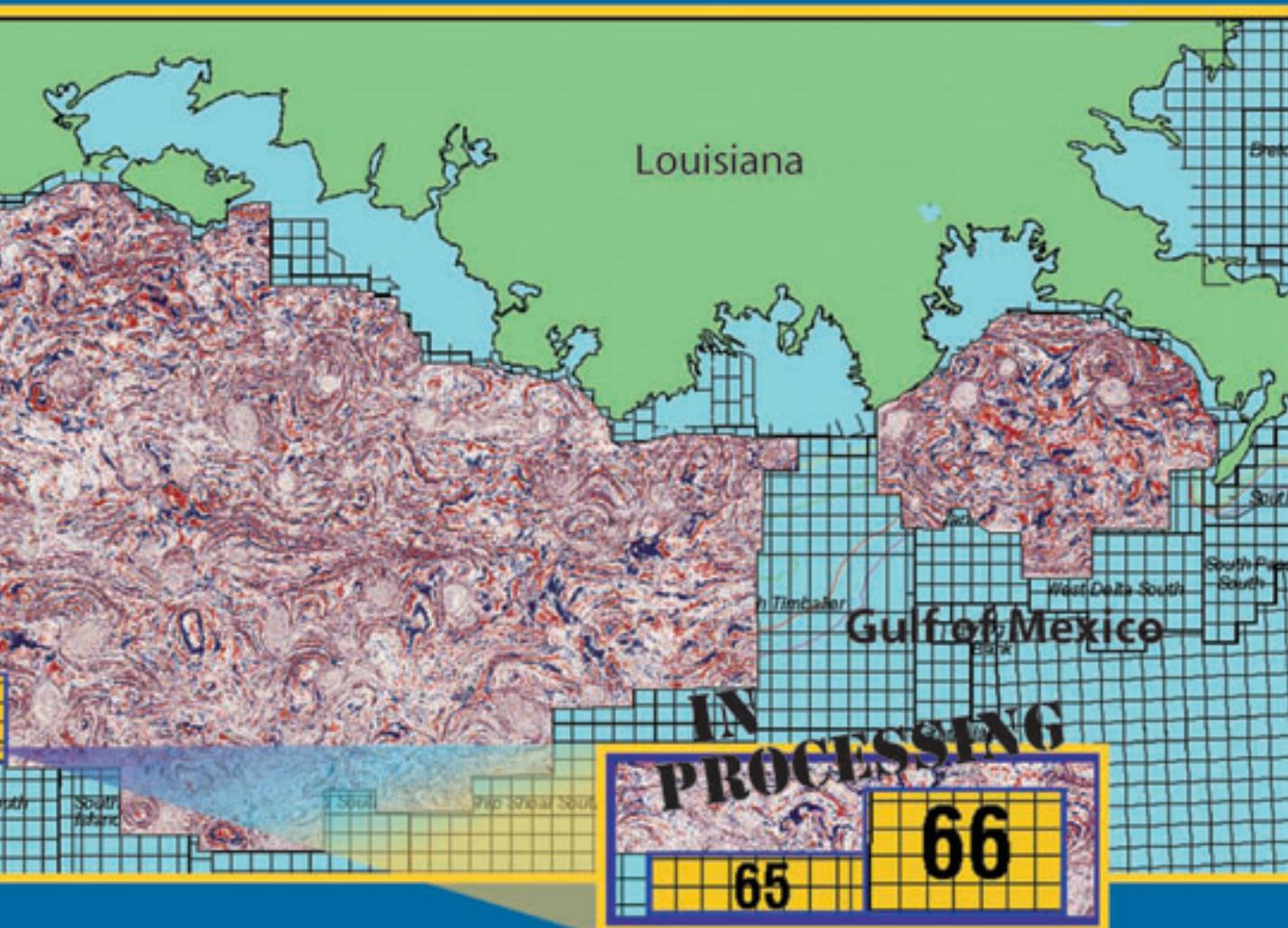
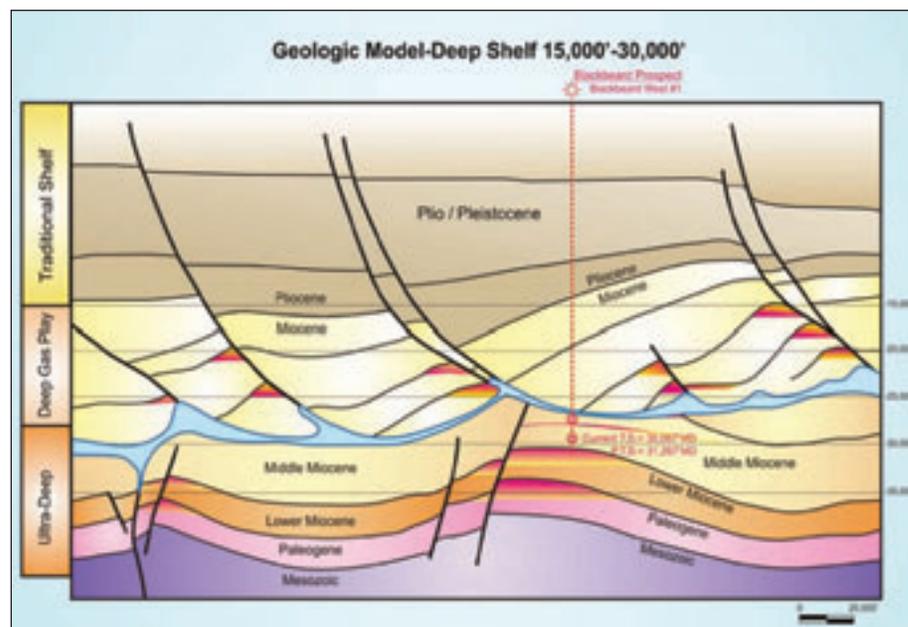
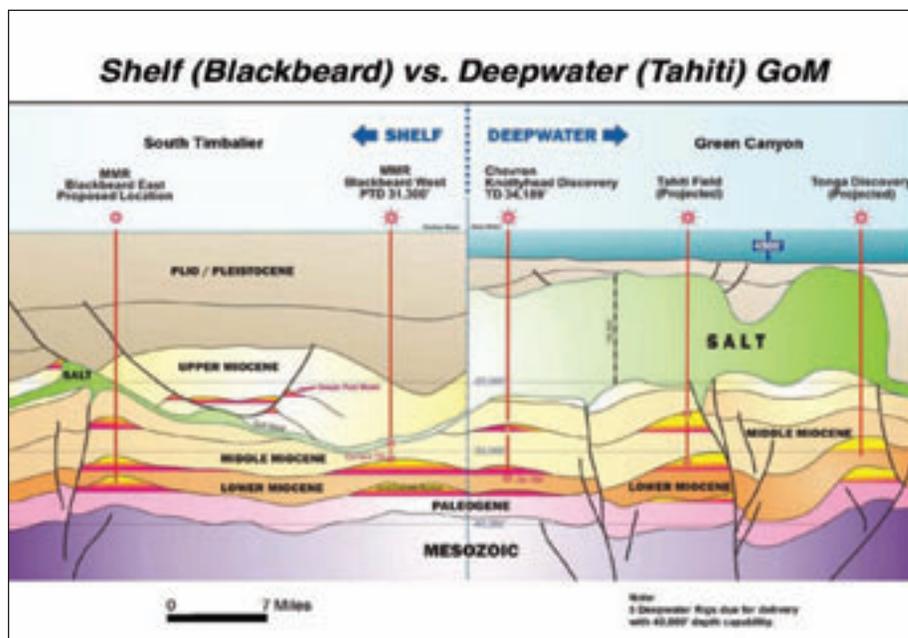
"Logic says they should, because all the sands, we believe, came from the Mississippi River to the north," Moffett said.

"If they're in deepwater, some of them had to come across the shelf – that's our play in a nutshell."

For now, intrigue is the name of the game.

"Until we get in the new hole and test our concepts and prove these sands exist or if there was some barrier to deposition, everybody has to hold their breath," Moffett said.

"We should know something in the next several months." □



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Eastern sale notable

Gulf Tracts Attract Premium Bids

By LOUISE S. DURHAM
EXPLORER Correspondent

Two federal sales of offshore hydrocarbon leases in the eastern and central Gulf of Mexico garnered more than \$3.7 billion in high bids in March, according to the U.S. Minerals Management Service (MMS), which conducted the sales.

In fact, Sale 206 in the central Gulf attracted \$3.67 billion, which set a record for high bids since area-wide leasing initially began in 1983. The sale received 1,057 bids from 85 companies on 615 tracts.

Eastern Gulf Sale 224 garnered 58 bids from six companies on 36 tracts, yielding \$64.7 million in high bids.

It is noteworthy that these sales inaugurated enhanced revenue sharing with oil and gas producing Gulf states, along with higher royalty rates, indicative of the region's vital role in the nation's energy supply.

The more-than-7,000 leases in the Gulf account for 25 percent of the United States' domestic oil supply and 15 percent of domestically produced natural gas, the MMS noted. More than 30,000 jobs are directly related to Gulf energy exploration and production.

Central Gulf Sale 206 offered 5,569 tracts comprising approximately 29.8 million acres in federal areas offshore Louisiana, Mississippi and Alabama. The lease area occurs between three and 230 miles offshore in water depths ranging from close to 10 feet to more than 11,200 feet.

About 34 percent of the tracts that

The top five companies submitting the highest dollar amount of high bids for Sale 206:

Hess Corporation – 25 (\$437,541,152)
Cobalt International Energy, L.P. – 36 (\$389,056,079)
BP Exploration & Production Inc. – 63 (\$336,575,445)
ConocoPhillips Company – 20 (\$323,891,298)
Chevron U.S.A. Inc. – 49 (\$240,987,863)

The top five bids for Sale 206:

Anadarko E&P/Murphy E&P/Samson Offshore – Green Canyon/432 (\$105,600,789)
Marathon Oil/Hess Corporation – Walker Ridge/226 (\$93,024,910)
Cobalt International Energy, L.P. – Green Canyon/858 (\$85,418,889)
Chevron U.S.A. – Green Canyon/945 (\$81,063,073)
Cobalt International Energy, L.P. – Keathley Canyon/163 (\$74,418,889)

The top five companies submitting the highest dollar amount of high bids for Sale 224:

BHP Billiton Petroleum (Deepwater) Inc. – 27 (\$47,858,420)
Anadarko E&P Company LP – 7 (\$12,754,728)
Murphy Exploration & Production Company – 7 (\$3,188,682)
Eni Petroleum US LLC – 1 (\$527,006)
Shell Offshore Inc – 1 (\$384,377)

The top five bids for Sale 224:

Anadarko E&P Company LP/Murphy Exploration & Production Co. - Lloyd Ridge/289 (\$8,049,750)
BHP Billiton Petroleum (Deepwater) Inc – De Soto Canyon/680 (\$5,285,555)
BPH Billiton Petroleum (Deepwater) Inc – De Soto Canyon/681 (\$5,285,555)
BPH Billiton Petroleum (Deepwater) Inc – De Soto Canyon/725 (\$5,285,555)
BHP Billiton Petroleum (Deepwater) Inc – De Soto Canyon/726 (\$5,285,555)

attracted bids in Sale 206 are in ultra-deep water greater than 5,249 feet, MMS reported. Lloyd Ridge Block 286 in slightly more than 10,000 feet of water was the deepest tract to receive a bid.

The top bid received for a block was \$105,600,789, proffered for Green Canyon Block 432 (see accompanying

figures). The bid was submitted by Anadarko, Murphy E&P (USA) and Samson Offshore.

The MMS asserted the high level of industry interest in the deepwater and ultra-deepwater areas of the central Gulf is being sustained by the information gained through new discoveries and the

advancements in deepwater technology.

Eastern Gulf Sale 224 comprises 118 whole or partial unleased blocks spread over 546,971 acres in the Eastern Planning Area. The acreage occurs south of the Florida Panhandle and west of the Military Mission Line in water depths that range between 2,657 feet and 10,213 feet.

Sale 224 is historic in a sense in that it's the first sale where the revenue sharing provisions of the Gulf of Mexico Energy Security Act of 2006 begin immediately, according to the MMS.

Producing Gulf states Alabama, Mississippi, Louisiana and Texas will share in 37.5 percent of the high bids on whole and partial blocks in the Eastern Planning area. These four states also will share in 37.5 percent of all future revenues generated from the acreage leased in March in the Eastern Planning Area. No royalty relief will be issued with the leases.

For the central Gulf Sale 206, the royalty rate for blocks in all GoM water depths is increased to 18.75 percent from 16.66 percent.

The new revenue sharing provision will provide funds to help the four Gulf producing states meet the educational, environmental and infrastructure needs of their communities, according to Randall Luthi, director of the MMS.

Lease Sale 224 is the only sale scheduled for the eastern GoM under the current Five Year Outer Continental Shelf Oil and Gas Leasing Program. The acreage included in Sale 224 was last available for lease in 1988. □

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Work progressing**Libya Poised for Production Success**

By LOUISE S. DURHAM
EXPLORER Correspondent

Even before passage of the recent U.S. energy policy legislation – which omits any effort to increase domestic oil and gas production – many U.S.-based companies already had set their sights on conducting a significant part of their operations in other, more E&P-friendly countries.

A notable case is Libya, where the action is heating up following the lifting of economic sanctions imposed by the United States in 1986 that placed it off limits to investments by U.S. companies.

Given Libya's vast, largely unexplored areas, it's viewed as one of the most appealing exploration regions on the international scene.

In fact, it harbors an estimated 36 billion barrels of high quality oil reserves, according to the Energy Information Administration. Relatively low production costs and geographic proximity to Western markets add to the appeal of doing business there.

ExxonMobil is among the big companies with big plans for Libya.

In a way, this is a kind of homecoming. Prior to the merger of Exxon and Mobil, the two separate entities had been among the earliest companies, along with Oxy, to enter Libya back in the 1960s. When they both chose to exit the country prior to the sanctions, the joint production between the two was more than one million barrels of oil per day, according to Russ Bellis,

exploration director at ExxonMobil International.

"With our re-entry in 2005, our objectives have not changed from what they were originally, which is to build a material presence and work with the Libyan National Oil Corporation (NOC) to fully exploit, find and further develop hydrocarbon resources in Libya," Bellis said. "It's a simple broad-based strategy."

A Five-Year Commitment

The company's most recent effort entailed negotiating a Heads of Agreement to execute an Exploration and Production Sharing Agreement with the Libyan NOC for Contract Area 21 about

110 miles offshore in the Sirte Basin, which reportedly is a world class petroleum province.

Contract Area 21 sits in water depths ranging from 5,400 feet to 8,700 feet, and the untested block is thought to be a particular prize in that it's considered to be among the most prospective unlicensed areas in the Libyan offshore.

As part of the agreement, Bellis confirmed they committed to a five-year work program, which will entail:

- ✓ At least 4,000 kilometers of 2-D seismic acquisition.
- ✓ 2,000 square-kilometers of 3-D seismic.
- ✓ One deepwater exploration well.
- ✓ Implementation by the company of a training program aimed at upgrading the skills of the nationals.
- ✓ Provide other support for education in Libya.

The actual EPSA is in the process of being worked out.

Meanwhile, the company is busy in other areas.

"We have two EPSAs in place today," Bellis said, "which we won in exploration rounds.

"In Round 2 in 2005, we were awarded Contract Area 44 off the northeast coast," he noted. "We've already completed recording more than 5,000 kilometers of 2-D seismic data there that's now being interpreted.

"In 2007, we participated in Round 3 and were awarded Contract Area 20 (immediately west and adjoining 21) in the offshore Sirte Basin, effectively northeast of Tripoli," he said. "In that contract area, we're currently recording 2-D seismic, and will likely acquire 3-D there next year."

Additionally, the company presently is implementing CSEM (controlled source electro-magnetic) mapping in area 44 and plans to apply this same technology in area 20.

Oxy's Big Presence

Oxy, another prominent player in Libya, reportedly has a position tallying about 30 million acres, making it the country's largest holder of oil and gas acreage.

The company first began operations in Libya in 1965.

Unlike ExxonMobil, which had no standstill agreements to allow it to re-enter assets previously held, Oxy re-entered its historical producing areas in 2005 where it's applying new technology and EOR methodology to enhance recovery.

In fact, Oxy has signed agreements with the Libyan NOC to upgrade several of its existing petroleum contracts to be more in line with the contractual framework now in place relative to the country's petroleum industry.

Following a \$5 billion capital investment over a five-year period, the fields included in the agreements are anticipated to kick out more than 300,000 barrels a day compared to current levels of 100,000 barrels.

Following an almost-20-year lockout, you may be curious as to whether all parties must tread lightly.

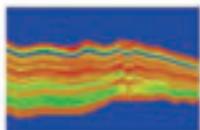
In fact, there appears to be a notable lack of intimidation.

"By our participation in the country, we've acknowledged there is an acceptable working relationship with the Libyan government," Bellis said. "The government has strived for a very transparent process in terms of how acreage is awarded.

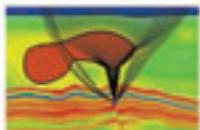
"They work hard to make it as transparent as they can." □

**Solving the 3D puzzle**

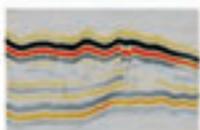
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Saudi Aramco

Aramco Born of Foresight, Deal Seemed like a lot to pay – at the time

By DAVID BROWN

EXPLORER Correspondent

On May 29, 1933, a subdued meeting took place at Kazam Palace in Jiddah, Saudi Arabia.

The country's finance minister, Abd Allah al-Sulayman, read a proposed business agreement out loud.

King Abdul Aziz Al Saud nodded his approval, papers were signed and fountain pens were handed out to officials involved in the negotiations.

Saudi Aramco was born.

And so remarkable that was, because the fist of a global economic depression squeezed against all ventures.

Less than three months earlier every bank in the United States had been shut down, closed for a full week, for fear of a panic that threatened financial doom.

No worse time for a foreign investment in a remote corner of the Middle East.

This year, Saudi Aramco observes its 75th anniversary as the world's single most important company in crude oil production.

In 1933, no one knew if Saudi Arabia would ever produce a drop of oil.

Birth of a Nation

The story of Saudi Aramco begins in many places – in the desert and on the coasts of the Arabian Peninsula, in the government offices of Westminster, in the headquarters of Standard Oil Co. of California.

And, in the abundant marine life and sediments of the Paleozoic seas, certainly.

It starts before Saudi Arabia even existed, in the remarkable exploits and conquests of the country's future king, known to the world as Ibn Saud.

Before his 30th birthday, Ibn Saud invaded and wrested control of Riyadh from a rival family. Within two years, he had built a force that defeated his nearby enemies and their Ottoman supporters.

After World War I, Ibn Saud took control of Al-Hasa and the Hejaz region of the western Arabian Peninsula, then expanded his control to dominate most of the Najd plateau.

In the Treaty of Jeddah, signed in 1927, Great Britain recognized the Kingdom of Najd and Hejaz as a fully independent and sovereign state under the rule of Ibn Saud.

Success had come as much from his political and diplomatic skill as military strategy. The king played off British interests against Ottoman force, rewarded supporters and, when necessary, compromised grudgingly.

His most conservative and religiously devout followers distrusted the king's familiarity with Western powers and Christianity, a recurrent theme for the country.

In March 1932, Ibn Saud consolidated and unified Al-Hasa, Qatif, Najd and Hejaz into the Kingdom of Saudi Arabia.

He ruled an awkwardly poor estate. Much of the country's income came from pilgrims on their way to Mecca, but hard economic years slashed that revenue by as much as 80 percent.

And so it was that Karl Twitchell came to Jiddah.

Land of Wealth?

Years later, rumor and speculation – and envy – would say that Twitchell acted as an agent of American oil. But in truth, he didn't begin with an eye for petroleum.

A Vermont-born mining engineer and geologist, Twitchell spent years conducting surveys in the Middle East. He traveled to

Geologists Made Their Marks

(Editor's note: This is an excerpt of the story "Arabesque Adventurers," published in the AAPG EXPLORER Special Issue: A Century.)

By KATHY SHIRLEY

EXPLORER Correspondent

Many petroleum geologists fancy themselves adventurers of a sort because they are often exploring remote regions of the world in search of new petroleum provinces.

But only a handful of geologists can claim to have changed the course of a nation by their mere presence. Only a handful has directly influenced the pages of history.

This is a story of such people.

The first American geologists to come ashore in the Al Hasa Province of eastern Saudi Arabia in 1933 arrived with courage, dedication and determination to succeed. And in doing so, they initiated a way of life that transformed the essentially nomadic desert country that is older than Abraham into a powerful westernized nation.

Most of these adventurer-geologists are now dead, and most were AAPG members. They broke new ground and crossed new territories, sometimes defining their roles as they developed – and their legacy continues to make an impact to this day.

It started with Standard Oil Co. of California (now Chevron Corp.), the first American firm to explore for oil in the Middle East. The company began its Middle East operations in Bahrain, where its subsidiary Bahrain Petroleum Co., brought in the first producing well on the island nation in May of 1932.

While working on Bahrain, Socal geologists Fred A. Davies and William F. Taylor became convinced that the low hills along the coast of Saudi Arabia – only 12 miles away across the Persian Gulf – were similar to the classic domal structure that paid off in Bahrain.

Their hunch helped encourage Socal to negotiate an oil concession for 371,263 square miles of the desert nation.

Saudi Arabia, hit hard by the worldwide depression of the 1930s, desperately needed the revenue an oil concession might bring. But the government was not willing to let the concession go for a less than fair price.

After months of tough negotiations, Saudi King Ibn Sa'ud instructed his finance minister on May 29, 1933, to "Put your trust in God, and sign."

First To Arrive

Robert P. "Bert" Miller and Schuyler B. "Krug" Henry, the first geologists to enter Saudi Arabia, came ashore in Al Hasa on Sept. 23, 1933 – just two years after the United States officially recognized Ibn Sa'ud's nation.

One month later former AAPG member J.W. "Soak" Hoover joined Miller and Henry. Three more geologists, Tom Koch, Art Brown and Hugh Burchfiel, arrived soon after Hoover, and those six became the nucleus of the first season's 10-man American team that mapped the desert.

(According to AAPG records, all but Henry were members of the Association at one time.)

A steady stream of Americans poured into Saudi Arabia in those first years, reaching a total of 425 in 1940. Soon after the concession was signed, Socal formed a subsidiary, California Arabian Standard Oil Co., to handle operations there.

Miller and Henry wasted no time in examining the hills that initially attracted Socal. The two covered 75 miles of the coast during their first week and discovered a structure – later named the "Dammam Dome" – that they instinctively knew would be oil bearing.

"We ... could see the beds dipping away from a common center," Miller said in a 1983 interview (a year before his death) for "Aramco World" magazine. "We got on one of the beds and drove around it, and we knew, in just a few minutes – it was like a copy of Bahrain Island. To get two structures like that was rather a marvelous thing."

Getting Acquainted

Many who were involved in Saudi Arabia in 1933 must have expected clashes between two vastly different cultures. But, surprisingly, there were no major incidents. The Saudi government and Socal desperately wanted the concession to evolve into a lasting relationship and both sides went out of their way to avoid any conflicts.

In fact, the Saudis sometimes were too accommodating.

When Miller and Henry waded ashore there was a crowd waiting to greet them. The local emir and other dignitaries from towns along the coast as well as the Bedouins planned a celebration of



Taking a break from hot exploration: from left, Dick Bramkamp, Dick Kerr, Max Steineke and Fred Davies, in Jubail in the early 1940s.

welcome, delaying their work.

The government was so solicitous, in fact, that it sometimes impeded the geologists' work. Each field party was required to have 16 soldiers along to demonstrate to the Bedouins that the geologists traveled under the protection of King Ibn Sa'ud. Plus, the Arab culture prohibited the combining of jobs. So whenever two geologists headed for the desert they were accompanied by a guide, an interpreter, a cook, a cook's helper, a houseboy, a mechanic, a mechanic's helper, a driver, four camel drivers, a contingent of soldiers and two to three dozen camels.

But the Americans and Arabs soon learned to live together and began adopting many of each other's customs.

The geologists grew beards, adopted the Arabs' ghutra head dress and practiced their Arabic on anybody that would listen.

The Saudis were entranced with the things the geologists brought to the desert. Cars, generators, radios and other wonders of western civilization were welcomed by the townspeople and the desert Bedouins alike ...

The Bedouins quickly learned the advantages of medicine, and many were convinced the geologists, who carried medical supplies, were doctors.

The geologists were not doctors, of course, but they were certainly more than

just geologists. Through necessity they also became electricians, mechanics, inventors and much more.

Their inventions and developments included a still to distill water, a photo lab and huge, low pressure tires more suited for traveling on sand.

By the end of the first field season, the geologists had marked the spot on the Dammam Dome that they hoped would be the site of the first oil well in Saudi Arabia.

When they returned from a much-needed vacation in the mountains of Lebanon to start the 1934-35 season, there were reinforcements waiting to greet them. The most significant among the new geologists was AAPG member Max Steineke.

Steineke of Arabia

Almost all who worked with Steineke agree that he was the one man who unraveled the stratigraphy and structure of Saudi Arabia's desert. Steineke was soon named chief geologist and remained in Saudi Arabia until his death in 1952.

Many claim that Max Steineke, who in 1951 received AAPG's Sidney Powers Award, discovered more oil in his lifetime than any other geologist in history. He is credited with discovering much of the 10 billion barrels of proven reserves in Saudi Arabia at the time of his death.

Barger said of Steineke, "He always talked to every young geologist that came in. This is a ploy used by some managers to make people feel at home, like part of the team. But Max talked to them because he thought he might learn something he didn't know."

... By 1939 the first wave of geologists had all gone home and Steineke was the senior scientist. But the changing of the guard did not change the job. There were still miles of uncharted desert to explore.

One of the most significant tasks undertaken by the second wave of geologists was the mapping of the Rub' al-Khali, also known as the Empty Quarter, which is one of the harshest deserts in the world. Only two Europeans had crossed the Empty Quarter before Barger and Harriss were sent to map the region.

Two more major oil fields were discovered in those first 10 years of exploration – both credited to Steineke's geologic expertise.

The Abu Hadriya Field, over 100 miles northwest of the Dammam Field, was discovered in March 1940 when the No. 1 well struck oil at 10,115 feet. That same year the No. 1 Abqaiq was spudded 35 miles southwest of Dhahran. The Abqaiq well was shut in early in 1941 when World War II interrupted operations in Saudi Arabia, but even then drillers knew that the Abqaiq field was the largest discovery so far.

The field turned out to be one of the world's largest oil reservoirs.

The Abqaiq Field was probably Steineke's greatest achievement. Seemingly unrelated clues like salt flats, tertiary outcrops and the alignment the sand dunes led him to believe the region had potential. Structure drilling proved his theory, that there was a well-defined dome at Abqaiq whose surface features had been obliterated.

Barger wrote in one of his letters, "Max has been all his life looking for a place like this." □

Aramco

from previous page

Saudi Arabia in 1931 at the invitation of Ibn Saud, with the backing of Chicago philanthropist and Arabia-supporter Charles Richard Crane.

His first interest was water. The young country – nestled between the Red Sea and the Persian Gulf – needed water for agriculture, for mining, for any kind of development.

Twitchell eventually recounted those efforts in his book *Saudi Arabia*, published in 1947. He listed the water resources of the various regions of the kingdom and provided supporting details, including the depth that drinking water had to be raised from wells.

Next, he examined the wealth and potential of the country's agriculture and livestock.

"Besides the forest products of charcoal in northern Hejaz, and the poles and timber of Najd in the Buraida district ... there are in Saudi Arabia a number of important agricultural crops, including dates, sorghums, wheat and rice," Twitchell noted.

Finally, he turned to the most promising of the kingdom's mineral resources:

Gold.

About 5,000 years earlier, primitive mining work had begun to exploit gold deposits near the Arabian coast of the Red Sea. Twitchell thought it might be the area of King Solomon's mines.

"I was asked if I could suggest any other practical sources of income, it being understood that my reports did not encourage anticipation of any large agricultural increase in the Hejaz," Twitchell recalled.

"I had prepared for such a question ... I had seen the ancient workings, mine ruins and tailings at Umm Garayat – near Wejh – so I replied that there might be minerals of

commercial value in this country," he wrote.

Despite the discovery of placer gold nuggets, attempts at mining gold would prove little more than marginally economic, and no great aid to the Saudi treasury.

Arabian culture dictated that the king personally assist his people and bestow financial gifts when appropriate. Ibn Saud also had to pay for a government. Lacking a reliable revenue source, he borrowed from merchants and traders.

At one point, al-Sulayman was forced to announce a moratorium on debt payments and to commandeer local supplies.

Put bluntly, Ibn Saud needed money, badly.

And so the interest of the oil industry was welcome, indeed.

Practicing Patience

Standard Oil Co. of California already had created the Bahrain Petroleum Company, known as Bapco. It began exploratory drilling in that island kingdom and British protectorate in October 1931.

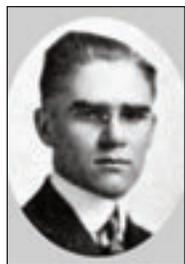
Ibn Saud smelled cash. He knew American oil companies would pay bonus money for a drilling concession in Saudi Arabia, even before a discovery in Bahrain.

Twitchell advised patience.

He met with the king in January 1932, and "Ibn Saud asked me to arrange for oil geologists and oil-drillers. I recommended strongly that the results of the Number 1 Well at Bahrain be awaited before doing anything regarding oil," he recalled.

"Since no evidence of faulting or difference geologically between Bahrain and the mainland of Hasa could be seen, and in view of the fact that oil well exploration and drilling is extremely expensive, and that if the Bahrain well did not strike commercial oil it would be unlikely that it would be found in Hasa, a definite wait-and-see policy was advocated," Twitchell wrote.

But if Bapco found oil in Bahrain, Saudi Arabia would be in a much more favorable



Davies

position to negotiate, he reasoned.

After some thought, Ibn Saud agreed.

Standard of California geologist Fred Davies, an AAPG member since 1920, went to Bahrain to help direct drilling at Jebel Dukhan. The word "jebel" means mountain or hill, a high place.

He later noticed its similarity with Jebel Dhahran, just across the Gulf's waters. The company used geologic reports from Davies and Twitchell when evaluating plans for an exploration concession in Saudi Arabia.

That possibility became more urgent after Bapco found oil in commercial quantity at Jebel Dukhan in June 1932.

Let's Talk Money

Twitchell returned to the United States to gauge interest in a Saudi minerals or oil concession offering. He found less enthusiasm than he'd hoped.

Not only was the world floundering in economic depression, it was swimming in oil. Foreign discoveries and new production from Texas and Oklahoma had flooded the market, sending crude prices below 25 cents a barrel.

Meetings with the Texas Company (Texaco) the Near East Development Co. (a consortium that included Shell, Mobil, Standard of New Jersey, Atlantic Richfield and others) and Gulf Oil Co. brought no offers, but Twitchell found a more supportive audience in Standard of California executives.

After only four business conferences to discuss the matter, a Standard board member in New York told Twitchell the company would be willing to negotiate a concession agreement.

The Iraq Petroleum Co. (IPC), at that

time the world's leading oil consortium, also joined in the negotiations.

Hoping for the best, al-Sulayman asked for the equivalent of 100,000 British pounds in gold. Standard of California responded by offering 20,000 in gold. IPC agreed to much less, the equivalent of 10,000 British pounds in rupees.

In the next round of talks, al-Sulayman reduced the Saudi's position to 50,000 worth of gold plus an annual rent of 5,000.

IPC dropped out of the bidding. The potential for Saudi oil production, especially in the country's Eastern Province, seemed unlikely to justify an investment amounting to US \$250,000.

Standard of California offered an immediate 30,000 pounds in gold, a loan of another 20,000 pounds in gold 18 months later, and agreed to the 5,000 pound yearly rent payment.

So it was that the company and Saudi Arabia reached their agreement.

Aftermath

Exploration would be carried out by the California Arabian Standard Oil Co., known as Casco, as soon as possible.

Twitchell received a generous payment for serving as a consultant to Standard of California, and a bonus when negotiations were successfully completed.

Casco turned into the Arabian American Oil Co., and then Aramco, and today Saudi Aramco.

Davies, a native of Aberdeen – South Dakota – became the president of Casco, then of Aramco, and finally chairman of the board.

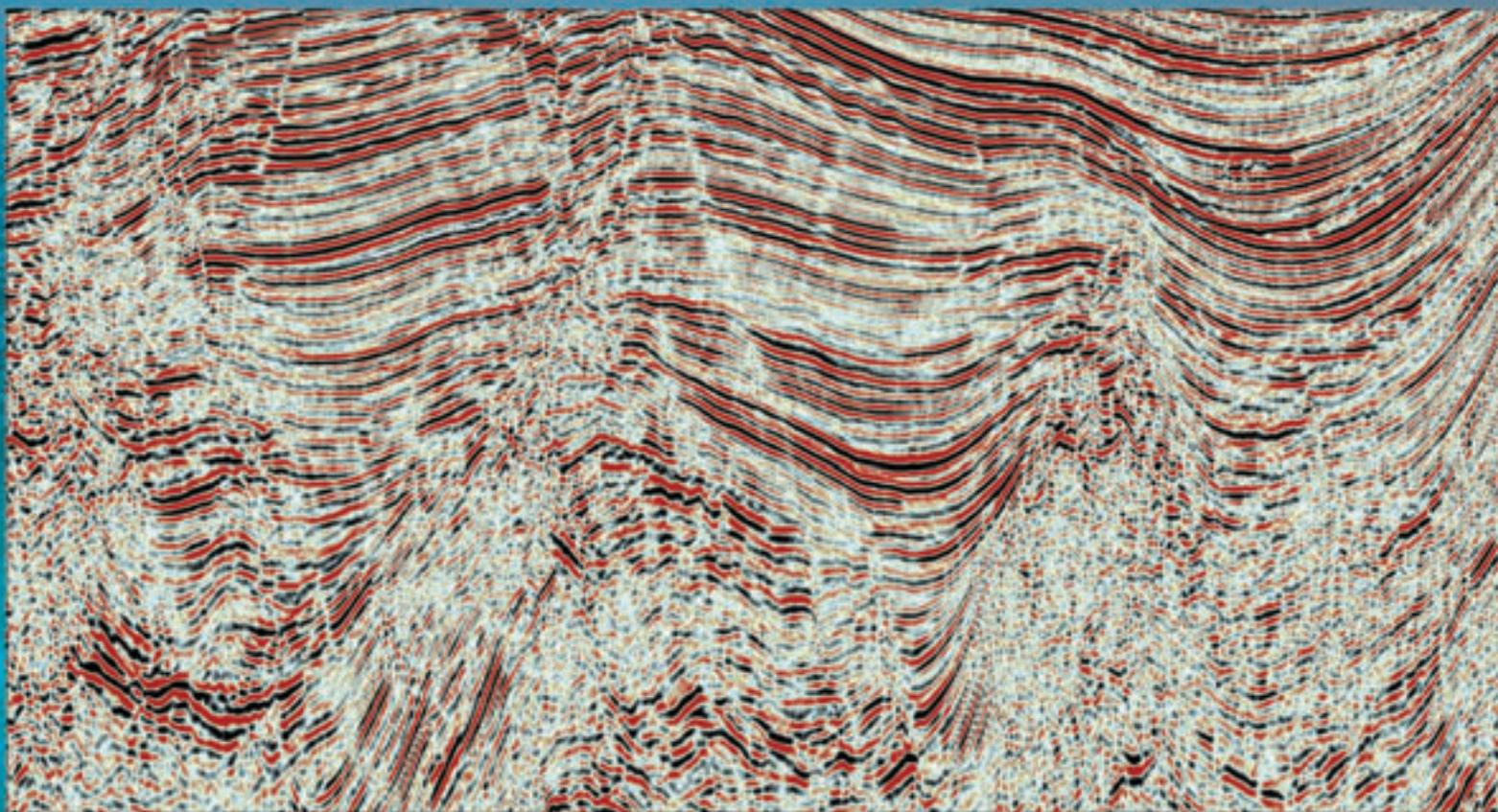
King Abdul Aziz bin Abdul Rahman Al Saud lived out his life as a major figure in the Arab world, to his death in 1953.

Casco drilled at Dhahran for four years without success.

In the fifth year, in March 1938, a drill bit encountered the vast oil reservoirs of Saudi Arabia for the first time. □



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Creative approaches required

Industry Needs to Attract Females

By **VERN STEFANIC**
EXPLORER Managing Editor

AAPG President-Elect Scott Tinker said in Bahrain that the goal of attracting women to the geoscience work force requires awareness of and creative approaches to challenges and changes.

Tinker made his remarks as one of three keynote speakers at the third Women's Leadership Forum (WLF), held in conjunction with the March GEO 2008 conference in Manama, Bahrain.



Tinker

WLF is an international gathering of professionals to discuss issues of recruiting, leadership, retention and career development of women in the petroleum industry. One of the forum's co-chairs was AAPG member Pinar Yilmaz.

Several industry executives and professionals – representing a variety of corporate disciplines and levels – participated in the forum, including Abdulkarim Al-Sayed, chief executive of Bahrain Petroleum Co., who said “women are essential to meet the pressing challenges in our industry.”

He said women comprise 32 percent of the Bahrain labor market, according to 2004 statistics.

“Despite hardships, women – especially Bahraini women – have contributed to progress and prosperity in significant and indispensable ways,” Al-Sayed added.

Tinker, who plans to make awareness of the recruitment and retention of women in the geosciences one area of focus of his AAPG presidency (2008-09), praised the panel of women science and engineer speakers as true “pioneers,” and told forum attendees that:

✓ Attracting more women to the geoscience work force means that the industry needs to “lose gender stereotypes and facilitate mentoring – including a cross-gender mentoring program.”

✓ Retaining women will require “flexible programs and work/life balance solutions.”

✓ Promoting women demands that the industry must “break the corporate mold” regarding the “glass ceiling,” and must “track the metrics of female promotions compared to those of men – (it) needs to be a win-win situation.”

As an example of the “difficult challenges to overcome,” Tinker said adjustments need to be made to accommodate the industry’s changing demographics.

“Google’s company policy requires a minimum of 20 percent female engineers,” Tinker said. “They’ve found that (team) ratios of less than one woman to five men result in unhealthy communications patterns – at least one woman is on every engineering search committee.”

“To accommodate special needs of women in the workplace, Google introduced flexibility programs – the four-day workweek, telecommuting, shorter hours during vacations, and others,” he said.

Of course, flexibility is not without challenges, he added. Issues that could arise include:

✓ Reverse discrimination concerns.
✓ The willingness of female scientists to maintain their scientific edge during “part-time” years.
✓ How to handle “precedent setting” cases of flexibility.

✓ “Flexibility dysfunction,” which is when there is so much flexibility that “not much gets done.”

“Fifty percent of the population is female,” he concluded. “We need to continue to adapt and improve, particularly in high tech industries. Everyone will benefit.”

Other Voices

Another AAPG member and forum speaker, Fowzia H. Abdullah of the Kuwait University Faculty of Science, said “forums like this one can be solutions for the networking problems working women face.

“Women don’t have as many opportunities for social learning as men do,” Abdullah added.

“At our university, we’ve learned we have to keep parents very aware of the need for their daughters to have the same preparation as male students in the same discipline,” Abdullah said. “We must influence those who have an influence on children and decision-makers.”

Other participants included:

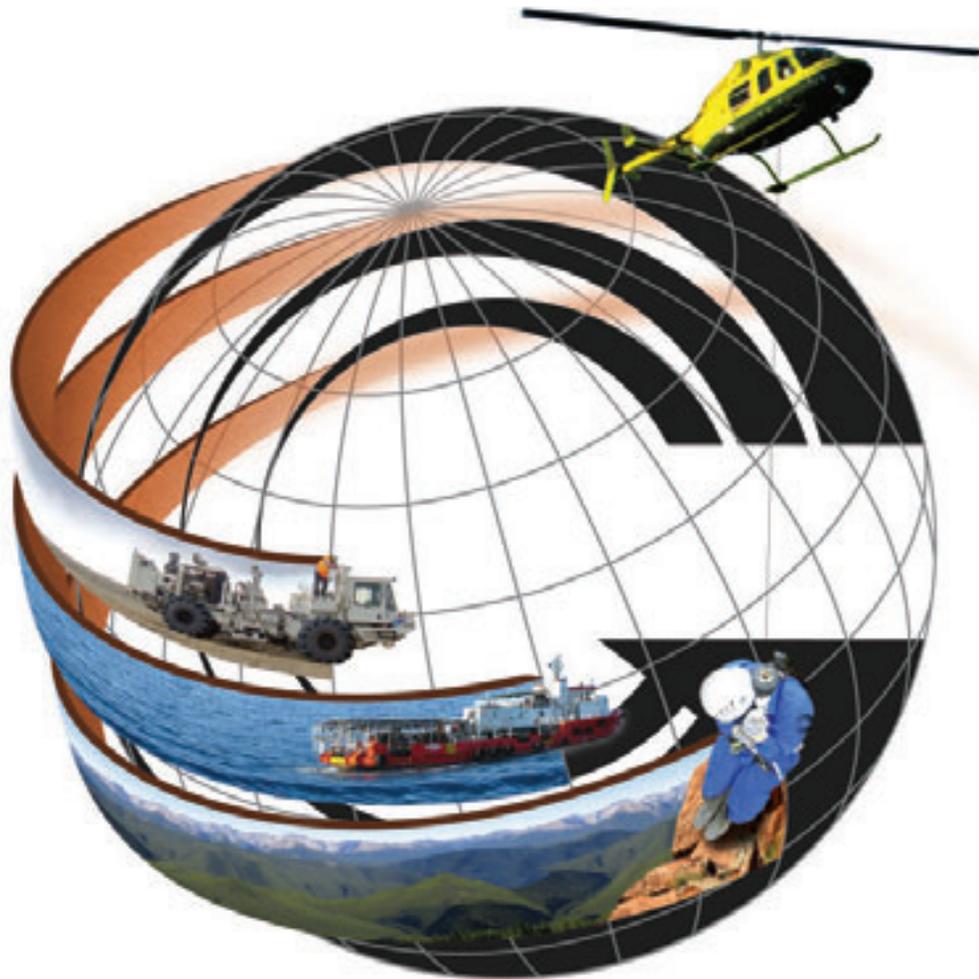
✓ Sara Al-Akbar, the founder and CEO of the independent oil company Kuwait Energy, who succeeded despite the reality that “what men take for granted, women have to work hard to get.”

✓ Amal Al-Awami, a consultant for

Saudi Aramco, who spoke of new scholarship programs in Saudi Arabia to help prepare young women to join the work force.

✓ Aba N.A. Al-Riyami, gas director of Petroleum Development Oman, who said that the industry should “nurture children toward their interests and don’t set up obstacles to their learning,” and about women in the work force, “I encourage you to take on new initiatives, and strive to understand people.”

✓ Melanie Dreiman, with Saudi Aramco, noted that “international oil companies are now taking the lead in serious endeavors to attract, retain and promote women in the workplace.” □



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Large areas still to be explored

Iraq's Potential Remains Untapped

By LOUISE S. DURHAM
EXPLORER Correspondent

So who has the most proven oil reserves? Few would argue that Saudi Arabia tops the list, reportedly harboring 260 billion barrels of proven reserves. The consensus appears to be that Iraq occupies the number two spot with 115 billion barrels followed by Iran with 90 billion barrels.



Since the war began in Iraq five years ago, oil production and exports have been subjected to numerous disruptions. The good news is they are now at the highest levels of any time during that five-year span.

This accomplishment is all the more notable given the many bouts of oilfield-related sabotage along with the lack of modern equipment and technical know-how Christian in the country's oil fields following two wars and decades of decades of U.N. sanctions.

Iraq's average production for February was 2.4 million bopd, according to the Oil Ministry, which noted exports averaged 1.93 million bopd.

The February output grossed US\$5.037 billion for the month.

That's a lot of money, and where it all goes continues to be under discussion. But the fact is that's also a lot of oil and there's more oil to be found.

The bulk of the oil production and exports in Iraq originate in the southern province of Basra, where a new wave of violence recently erupted. A lesser yet still sizeable amount of oil comes from fields in the north, in the vicinity of the city of Kirkuk.

Given that the country's petroleum wealth is concentrated principally in the northern and southern regions, it is noteworthy that the Oil Ministry recently invited both local and international companies to submit bids to develop the Akkas natural gas field in the western province of Anbar. The field reportedly holds estimated reserves of 2.15 tcf of gas and



See **Potential**, page 24

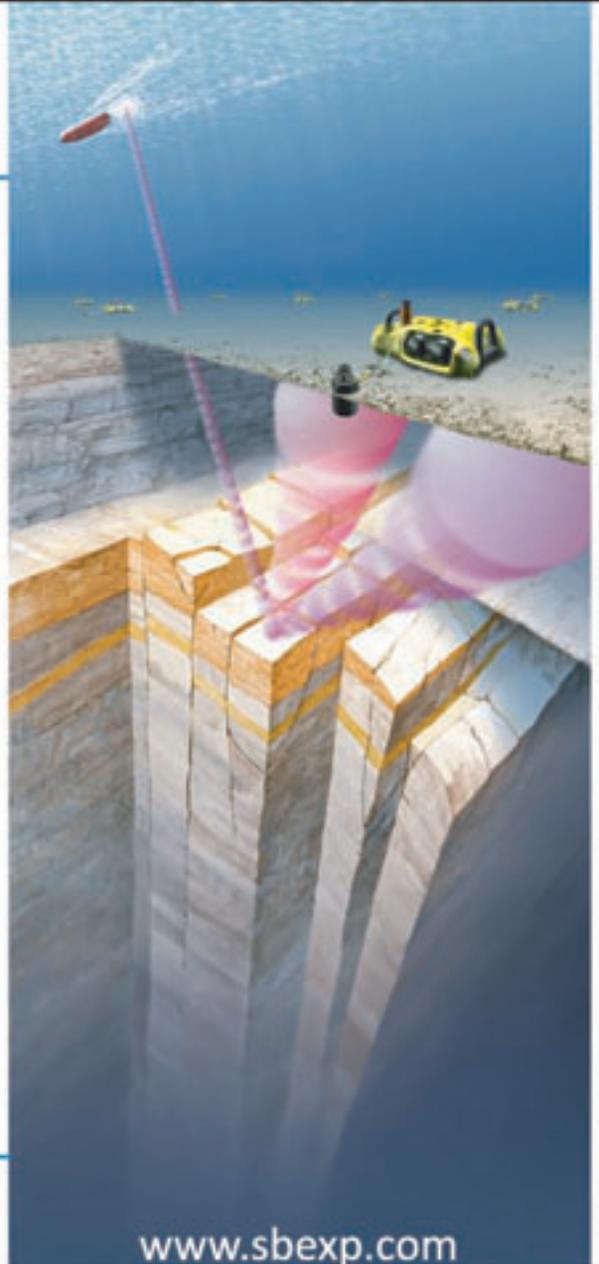


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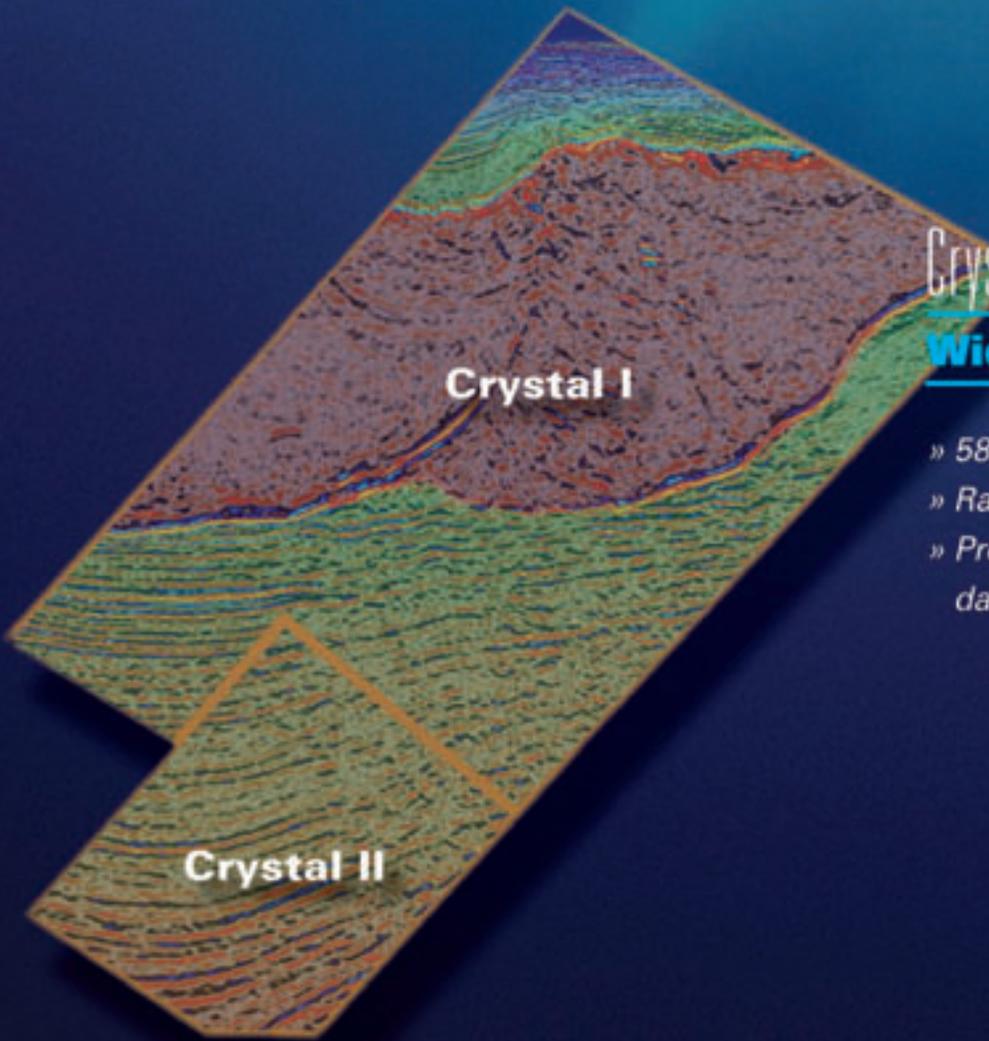
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Potential

from page 22

perhaps as much as 100 million barrels of liquid hydrocarbons.

The Oil Ministry also is soliciting proposals for construction of two oil pipelines to link the Basra oil fields to Iran's Abadan refinery.

Iraq: Room to Grow?

From a geological point of view, Iraq is far less intensely explored than Saudi Arabia and, perhaps, Iran, according to AAPG member Louis Christian, a Dallas-based Middle East exploration consultant.

Christian's findings complete in a report he calls, "Good News and Bad News from the Middle East: Reserves, Producibility, Future Potential and Possible Economic Consequences" offers "a backward glance" at the region's oil and gas reserves as well as a look at future production potential.

"Tens of kilometers or even one hundred kilometers between wells and seismic lines in parts of Iraq west of the Euphrates River leave open, inadequately explored regions where Iraqi gravity and magnetic modeling suggests undrilled structural trends and horst blocks with the potential for Mesozoic and Paleozoic closures, carbonate shelf edges and reef trends analogous in age and dimensions to the Paleozoic basins of West Texas," Christian said.

"A (published) regional composite seismic profile across the 600-kilometer width of Iraq shows structural interpretation between the East Baghdad and Tel Ghazal oil fields," Christian said. "But west of Baghdad the Abu Jir fault zone and indicated Mesozoic and Paleozoic rollovers remain essentially undrilled."

At Hith – about 175 kilometers northwest of Baghdad – a huge asphalt lake at the surface has been mined for 5,000 years or more. Christian noted it's estimated to contain about five billion barrels of heavy oil or asphalt open to outcrop.

"The bricks at ancient Nineveh are held together with asphalt mastic," he said, "and I have personally seen the triumphal highway entering the main gates of ancient Babylon paved with this asphalt and gravel."

There are a number of inadequately explored yet inviting gravity highs along the Hith-Abu Jir fault trend, according to Christian.

Super-Giant Middle East Oil Fields

(From GeoArabia, v.2, no. 3)

Top 33 Ranked Oil Fields	Country	Primary Reservoir	Billions of Recoverable Barrels
Ghawar	Saudi Arabia	Upper Jurassic carbonates	90
Burgan	Kuwait	Lower Cretaceous sandstone	86
Safaniya	Saudi Arabia	Lower Cretaceous sandstone	32
Majoon	Iraq	Lower Cretaceous sandstone	30
Rumalia	Iraq	Cretaceous carbonates, sandstones	22
Zakum	Abu Dhabi	Lower Cretaceous carbonates	17
Kirkuk	Iraq	Tertiary, Cretaceous carbonates	17
Manfia	Saudi Arabia	Lower Cretaceous, Upper Jurassic	15
Umm Shaif	Abu Dhabi	Lower Cretaceous	14
Zuluf	Saudi Arabia	Upper Jurassic carbonates	14
Ahwaz	Iran	Lower Cretaceous carbonates	14
Ahqaq	Iran	Tertiary, Cretaceous carbonates	13
Abqaiq	Saudi Arabia	Upper Jurassic carbonates	13
Khurais	Saudi Arabia	Upper Jurassic-Paleozoic carbonates/sandstones	12
Marun	Iran	Tertiary-Upper Jurassic carbonates	12
Berri	Saudi Arabia	Upper Jurassic-Paleozoic carbonates	11
Gachsaran	Iran	Tertiary, Upper Cretaceous	11
East Baghdad	Iraq	Lower Cretaceous	11
North Field	Qatar	Lower Cretaceous sandstone	10
		Permian carbonates-Devonian sandstone	10?
Bu Hasa	Abu Dhabi	Lower Cretaceous carbonates	+ gas
Kuh-e Mand	Iran	Tertiary-Cretaceous carbonates	9
Agha Jari	Iran	Tertiary-Cretaceous carbonates	9
Raudhatain	Kuwait	Upper Cretaceous-Lower Cretaceous	8
Khafji	Kuwait	Lower Cretaceous sandstone, carbonates	7
Qatif	Saudi Arabia	Upper Jurassic, Middle Jurassic carbonates	6
Marjan	Saudi Arabia	Upper Cretaceous, Lower Cretaceous Jurassic carbonates	6
Bab	Abu Dhabi	Lower Cretaceous carbonates	6
Fateh	Dubai	Upper Cretaceous carbonates	6?
Sabriya	Kuwait	Upper Cretaceous carbonates	6
Asab	Abu Dhabi	Lower Cretaceous sandstone	5
Zubair	Iraq	Lower Cretaceous carbonates	5
Shaybah	Saudi Arabia	Lower Cretaceous carbonates	5
Dukhan	Qatar	Upper Jurassic, Middle Jurassic carbonates	5
Abu Sa'fah	Saudi Arabia	Upper Jurassic carbonates	4

He noted that Paleozoic prospectivity in Iraq depends largely on lower Silurian source rocks, where thermal maturity runs the gamut from cool and immature to mature and on to sometimes over-mature, depending on current temperatures as well as past burial and re-uplift histories.

About 175 kilometers southwest of Baghdad, one particular well in the Kifl field flowed at a 5,600 barrel per day rate from lower Cretaceous deltaic Zubair formation sandstones. The well hasn't been connected to a pipeline.

"If commercial developments were possible in areas such as Kifl, west of the Euphrates River, oil production in predominately Sunni areas could begin to approach the production already established in areas that are predominately Shia in southern Iraq and Kurdish in northern Iraq," Christian said, "possibly facilitating political settlements between the main cultural/ethnic groups."

Given that the Anbar province reportedly is a former Sunni insurgent stronghold, the proposed development of the Akkas field is considered to have the potential to boost the economy of the Sunni region. □

Good News – Bad News

AAPG member Louis Christian, a Dallas-based Middle East exploration consultant, offers other observations about "the good news and the bad news" found in the region:

✓ As of 10 years ago or more, median field size for the Middle East was about 150 million barrels.

✓ A 50 percentile (median) field size for about 100 Iraqi oil fields plots out to be 130 million barrels.

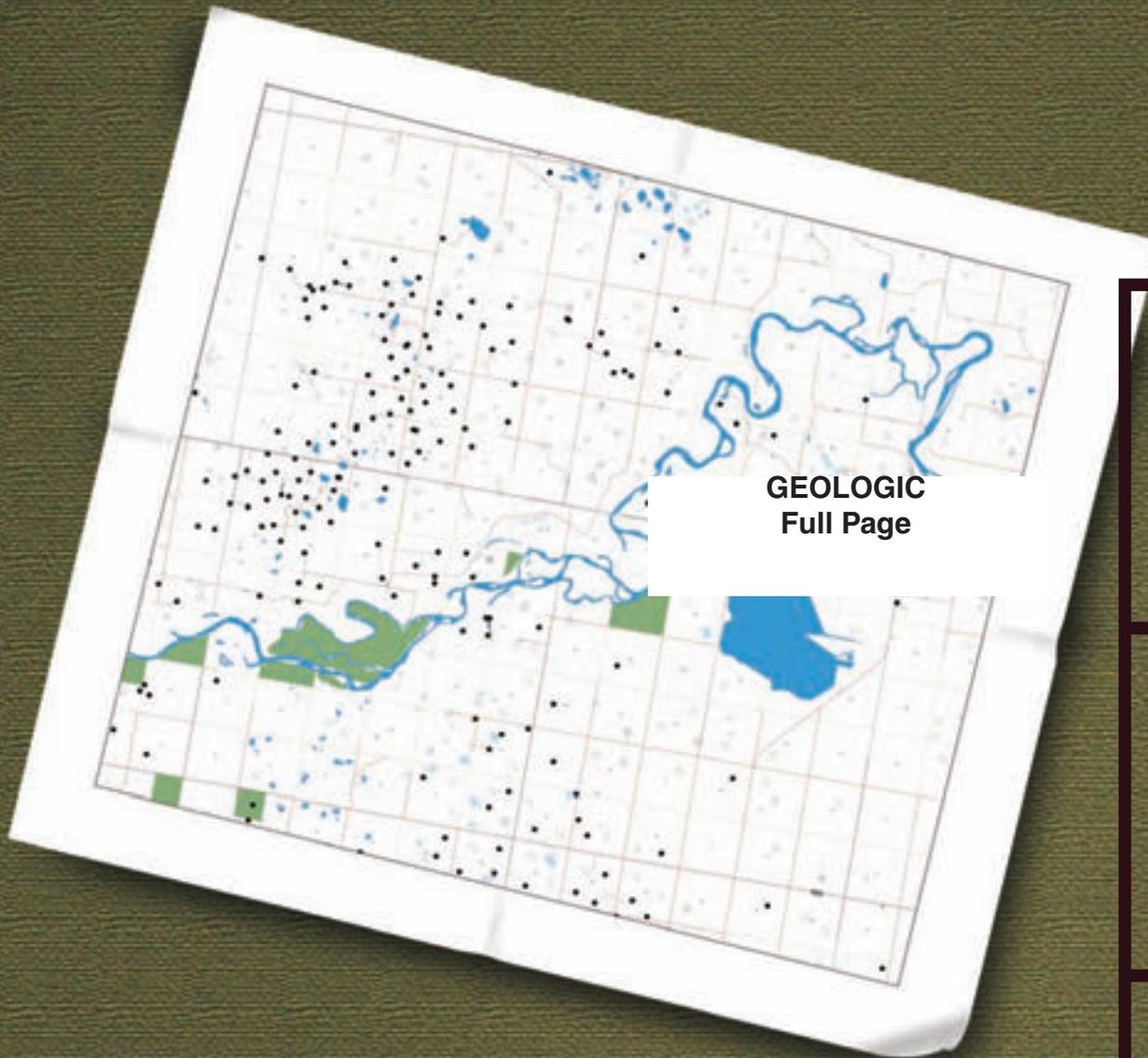
✓ Dozens of conventional oil discoveries once considered non-commercial (at 2,000-3,000 barrels per day) in Saudi Arabia, Iraq and Iran will surely be developed and marketed in the coming years – "delaying or prolonging the much-feared terminal decline of King Hubbert." (See "King Hubbert: An Irascible Iconoclast," December 2007 EXPLORER.)

✓ From a purely geological perspective, Iraq remains much less intensely explored than Saudi Arabia and, perhaps, Iran.

✓ Iraq's new constitution stipulates that already producing oil fields "shall remain in Iraqi, not foreign hands. Unexplored areas may possibly be made available for joint Iraqi and foreign exploration and development. Will this some day include American oil companies?"

✓ Iran is "structurally so much more complex than Saudi Arabia that in no way can it be said that conventional surface structural mapping, seismic mapping and drilling have come anywhere close to exhausting prospective areas in the Zagros Fold Belt, nor in (its) various interior basins." □

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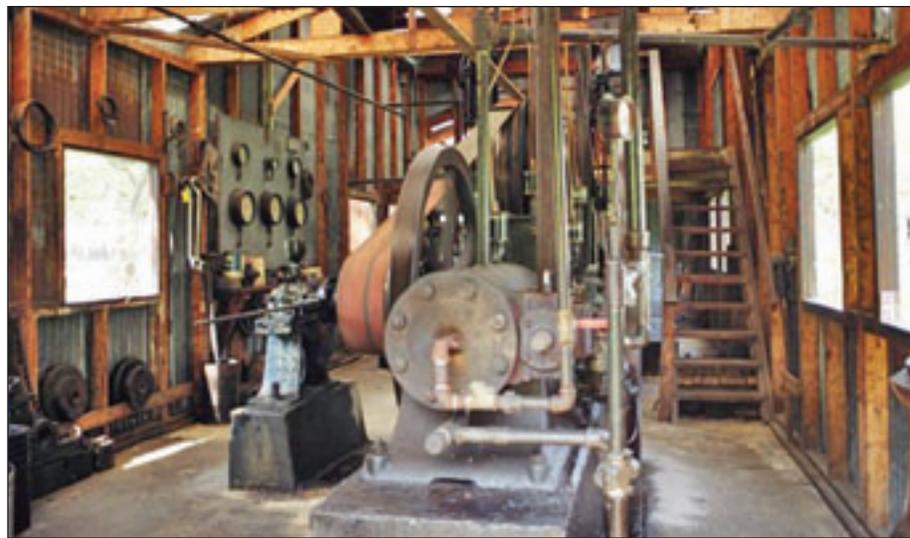
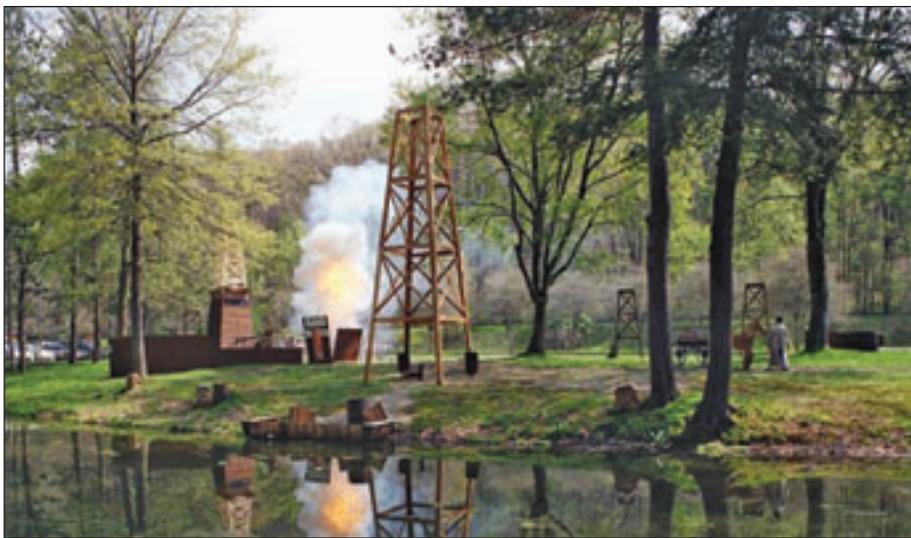
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Visitors to the Drake Museum can experience a genuine "nitro show" (left) and tour the power room to get an idea of what life was like when Drake made his famous discovery.

Museum spruced up for 150th celebration

Drake Story Being Retold – Well

By BARRY FRIEDMAN
EXPLORER Correspondent

"I wish I had a nickel for every time I've tried to explain ... to the bus-exiting kids that oil has been around almost forever and that our claim to fame is drilling to get it."

Not that she minds repeating the tale, for Barbara Zolli, director of the Drake Well Museum in Pennsylvania, says, "It's our story and we take pride in sharing it."

As old as the oil industry itself, it's a story that's 150 years in the making, which is why it deserved a birthday present of sorts.

The Commonwealth of Pennsylvania recently granted more than \$6 million for much-needed renovations and expansions

at the museum for the rapidly approaching "Oil 150 Celebration" in 2009.

But it's more than the money; it's the history.

Almost a century and a half after the fact, it may no longer matter to most where the modern oil industry actually began – with the exception of people in Spindletop, Texas, and Signal Hill, Calif., of course – but to the people of Titusville, Pa., a small town of approximately 6,000, where the Drake Well Museum is located, the "where" is a very big deal.

This is where in 1859 Edwin L. Drake struck oil at a depth of 69-1/2 feet in this northwestern Pennsylvania town. The well produced 10 to 20 barrels a day when oil was selling for unheard price of \$20 a

barrel – it was more oil than had ever been collected at one time before.

How big was this?

Life magazine's "Millennium Edition" ranked Drake's achievement as number 47 of the most significant 100 events of the past 1,000 years, claiming that his well had "doubled the world's oil supply in one day."

Bigger and Bigger

Titusville, naturally, seemed like a good place for the museum – especially since local residents marked the famous well so it wouldn't be lost.

Then, at the turn of the 20th century, a collection of early oil industry memorabilia was collected and housed; then

photographs, providing detailed documentation of the region and the industry from 1860 to 1915, were added (today, there are more than 11,000 images).

In the 1930s, in anticipation of the 75th anniversary of the strike, local oil producers raised funds and built the first museum building and research library located on the site of Drake's successful well.

And Pennsylvanians took to the place. By 1945, total attendance for all state parks was 10,270 – and 3,676 of those came to the Drake Well Museum. Also that year, the Pennsylvania general assembly

See [Museum](#), page 28

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Drake

from page 26

appropriated \$185,000 toward adding a wing and constructing a board-for-board replica of Drake's engine house and derrick.

In 1959, the museum building was enlarged to include a research library for the Centennial of Oil.

In 1963, the limestone museum and library were finished.

In 1966, with the addition of 80 professional exhibits, Drake's original well and an acre of land around it were listed in the National Register of Historic Places as a National Historic Landmark.

By 1979, the American Society of Mechanical Engineers designated Drake's well as a National Historic Engineering Landmark, citing the revolutionary technological changes that occurred on the site and creating a bronze plaque stating, "Few events in history have so transformed the face of civilization."

Perfect Timing

For the past 20 years, the focus at Drake was on improving collections management by computerizing records, hiring professional staff and upgrading collections storage and environmental monitoring.

That's why museum officials smiled especially wide when Pennsylvania, with the Drake discovery sesquicentennial approaching, released a \$6.64 million capital project to upgrade the facility's 41-year-old building infrastructure and systems, to completely re-design the permanent exhibits, and to create a comprehensive research and collections storage area.

Zolli says the project will enhance the



Photos courtesy of the Drake Museum

Drake's original well (top), and a rendering of the museum after the planned renovations.

Drake Well Museum's ability to preserve and interpret oil industry history.

"It will accomplish three things," she said:

- ✓ The upgrade of building systems and infrastructure (including fire suppression).
- ✓ The design and installation of a new, larger permanent exhibit.

✓ The creation of a comprehensive state-of-the-art collections storage system and Research Library.

An additional \$1 million in funds was raised to provide interior and exterior orientation to the region, including the construction of a new 50-seat Orientation Theater.

Yes, It Matters

The question, for those outside the industry, is why does a place like Drake still matter?

Zolli thinks the answer is obvious.

"As the birthplace of the modern oil industry, the Drake Well Museum continues to attract local, national and international attention," she said. "Recently we hosted Japanese, German and Australian documentary film crews; the *Wall Street Journal*, *CBS Evening News*, *PBS Lehrer News Hour* and *Bloomberg News*; and provided historic images and contemporary oil producers for stories and videos about independent oil, pipeline history and petroleum geology."

Moreover, Zolli says the growth of public interest in hydrocarbon-based energy positions the museum as a unique place to help visitors understand current issues within the historical context of regulation, production and technological growth.

"Drake Well Museum can demonstrate environmental impact, explain economic cycles and help visitors compare the merits of alternative resources," she said.

Drake does that by using what Zolli refers to as "the real stuff" of powerful objects, images, tours, documents and the experiences and expertise of workers throughout the industry who helped shape the profession – and does it by connecting audiences to their pasts, entertaining them and encouraging their exploration and curiosity in a social setting.

"Drake tries to help people understand the past and its impact on the present as a way to make informed decisions for the future."

For Zolli, though, there's something else – something more obvious to all those students getting off all those buses, something she tells each of them.

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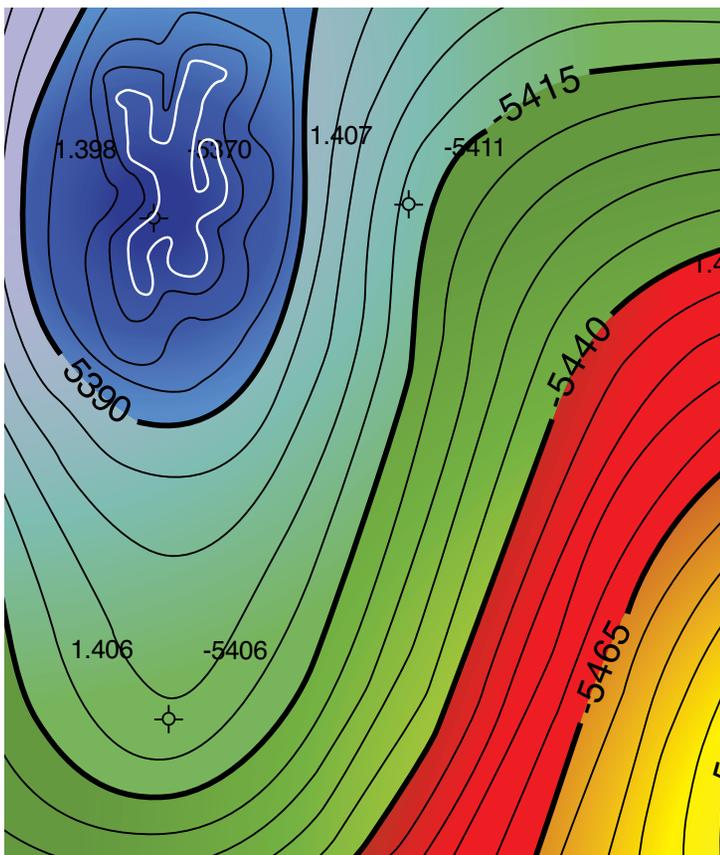
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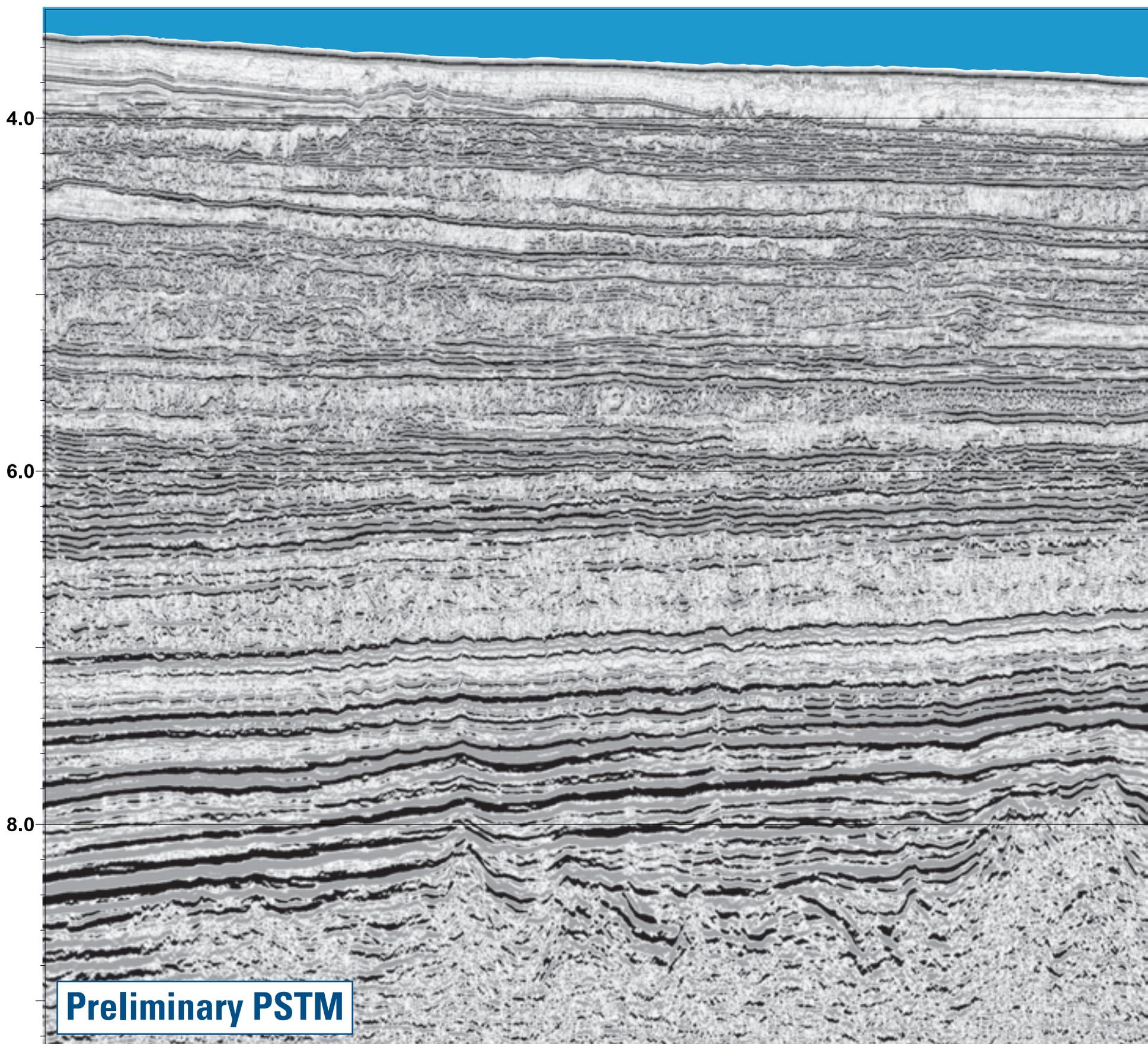


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TGS-NOPEC Geophysical Company (TGS) has completed the acquisition of a multi-client 3D survey in the Gulf of Mexico. The survey, known as **"Orion"**, is predominantly located within the "181 South" area, an area that has been off-limits to exploration until the most recent 5-year leasing plan announced by the MMS. **Orion** covers approximately 175 OCS blocks (4100 square kilometers) in the Lloyd Ridge OCS area.



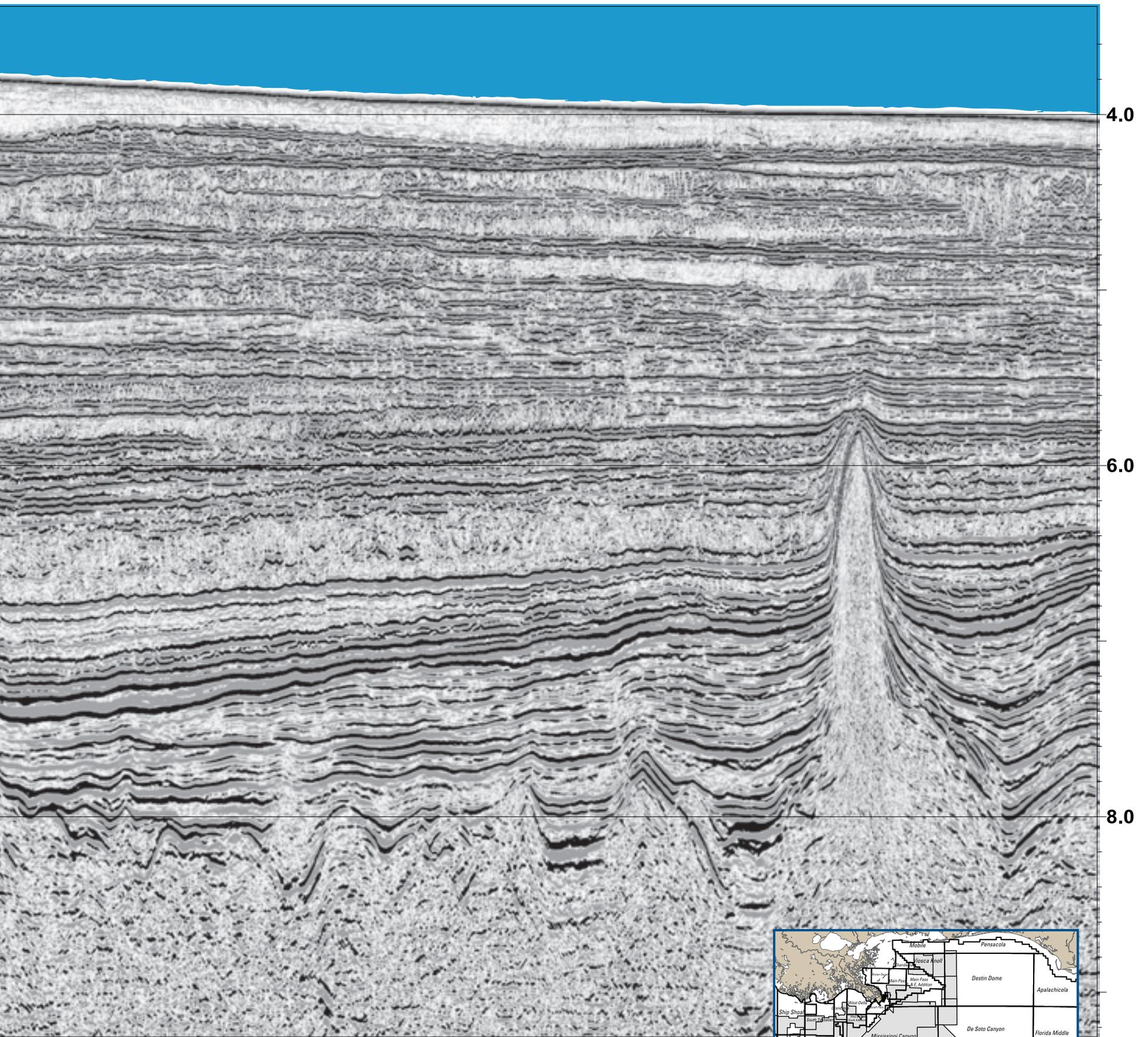
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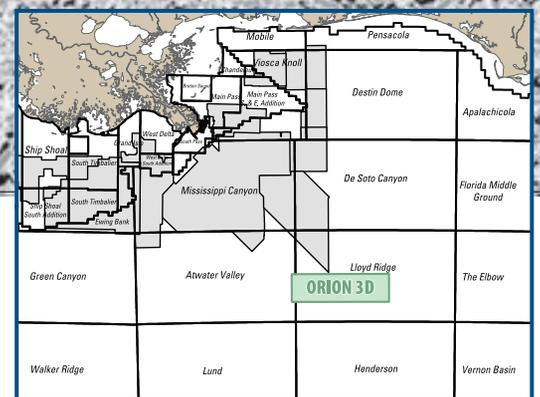
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The data was recorded with 9000 meter streamer offsets and is being processed with both pre-stack time and pre-stack depth migration. In addition to the full offset migrations, partial offsets stacks will be generated for evaluating Amplitude Variation with Offset (AVO). For additional information please contact your TGS marketing representative at 713.860.2100.



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GEOPHYSICALcorner

When Thin is In, Enhancement Helps

(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. This month's column deals with "thin-bed reflectivity inversion.")

By SATINDER CHOPRA
JOHN P. CASTAGNA
and YONG XU

Expanding the frequency bandwidth of surface seismic data is an unending quest for geophysicists, because increased seismic resolution is essential for extracting stratigraphic detail from seismic images.

While both vertical resolution and horizontal resolution are important for interpreting small geologic features on seismic data, we focus our attention here on vertical resolution – recognizing that migration procedures usually enhance horizontal resolution.

If the frequency spectrum of a seismic wavelet is centered around 30 Hz, which is usually achievable, and the seismic interval velocity is greater than 3000 m/s, reservoirs having a thickness less than 25 meters may not be resolved. "Not resolved" means there is no distinct reflection peak or trough centered on the top and bottom interfaces of the reservoir unit.

This interval thickness, where seismic data can no longer position a distinct reflection peak or trough at the top and base of the interval, is called "tuning thickness."

Because numerous stratigraphic targets have thicknesses of 10 meters or less – which is thinner than tuning thickness for most seismic profiles – frequency enhancement procedures need to be applied to seismic data to study reservoir targets in this "thinner than tuning thickness" domain.

* * *

One post-stack spectral inversion method that resolves thin layers having a thickness less than tuning thickness was published in 2005 (contact the authors for the reference). This method is driven by geological principles rather than by mathematical assumptions and uses spectral decomposition to enhance the frequency spectrum local to a thin-bed unit.

This spectral, or thin-bed, reflectivity inversion outputs a reflectivity series, and the apparent resolution of the inversion product is superior to the resolution of the input seismic data used to generate the reflectivity response.

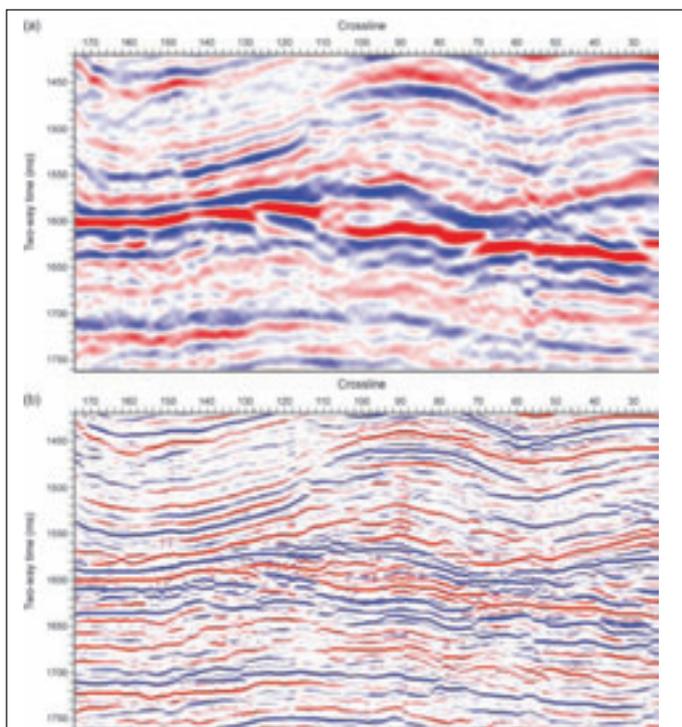
Applications of this method in deconvolving complex seismic interference patterns are changing the mindset of many seismic interpreters, because the technique shows stratigraphic patterns with such remarkable detail.

The method consists of the following steps:

1. A set of time-varying and space-varying wavelets is estimated from the seismic data.

For this purpose, it is good to have well control data to aid in selecting optimal space and time dependencies that should be expressed by these wavelets. In the absence of well control, a statistical method of wavelet estimation can be adopted.

2. The wavelets estimated in step 1 are removed from the seismic data using



Data courtesy Arcis Corporation, Calgary

Figure 1 – Comparison of (a) a conventional seismic section and (b) its derived thin-bed reflectivity. More geologic detail can be seen with the reflectivity data than with the input data.

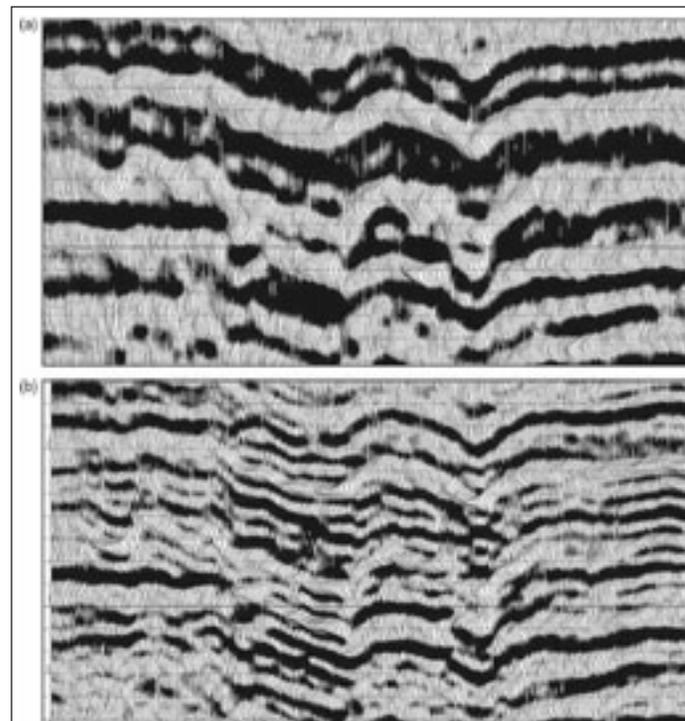


Figure 2 – Comparison of (a) a segment of a band-limited seismic section and (b) the equivalent section derived when thin-bed reflectivity is convolved with a 5- to 120-Hz bandpass wavelet. The section in panel b has enhanced resolution.

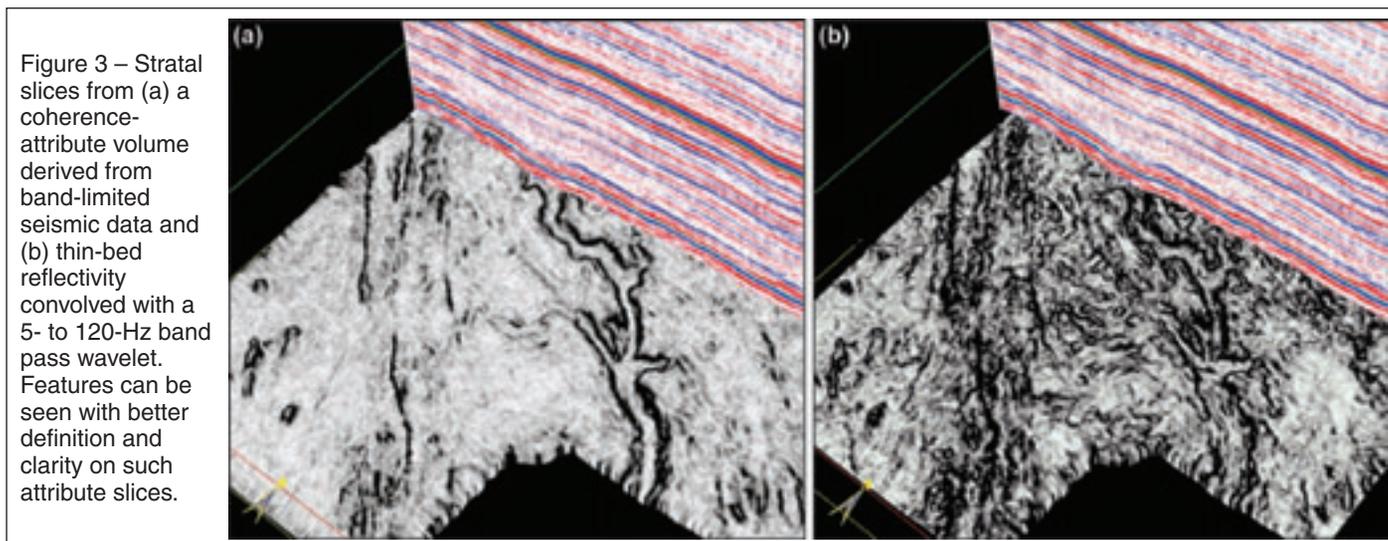


Figure 3 – Stratral slices from (a) a coherence-attribute volume derived from band-limited seismic data and (b) thin-bed reflectivity convolved with a 5- to 120-Hz bandpass wavelet. Features can be seen with better definition and clarity on such attribute slices.

an inversion procedure in which spectral constraints are derived on the basis of spectral decomposition procedures.

It is important to note that no Earth model or any assumption about stratigraphic layering is used in this inversion procedure – the trace-by-trace inversion procedure requires no starting geologic model and has no lateral continuity constraints.

Figure 1 shows a comparison of a segment of a seismic section from Alberta, Canada, before and after reflectivity inversion. After reflectivity inversion, more reflection detail can be seen, and faults are shown with improved clarity.

Once thin-bed reflectivity is derived from an input seismic volume – using, for example, a wavelet derived from an existing well – an interpreter can determine the amount of uncertainty involved in the inversion process by using a blind-well test.

Our experience with such exercises suggests that thin-bed spectral inversion creates data that tie favorably with other wells positioned in the same 3-D seismic volume.

Figure 2 shows a comparison between a segment of an input seismic section (figure 2a) and an equivalent segment of thin-bed reflectivity that has been convolved with a bandpass

wavelet that extends the high end of the frequency spectrum to 120 Hz (figure 2b). Enhanced resolution of the reflectivity section is indicated by the extra reflection cycles.

More individual reflection cycles can now be tracked, leading to more detailed interpretation of the data.

* * *

Seismic attributes are a great help in extracting geologic information and are widely used to map geologic features at many scales. Geologic information not revealed by conventional displays of seismic data can often be seen on displays of one or more attributes derived from the data.

As a result, there has been an explosive growth in the development and application of seismic attributes.

Attribute computation done on data with enhanced resolution proves to be particularly useful for mapping onlap and offlap patterns or other stratigraphic features, which facilitates the mapping of parasequences and the direction of sediment transport.

Figure 3 shows a comparison of a stratal slice through a coherence-attribute volume generated for both input seismic data and for enhanced-resolution data.

Notice the significant impact that

enhanced resolution has on the coherence attribute, as evidenced by the increased lateral resolution of the channel system and by the improved faulting picture seen in figure 3b.

Conclusions

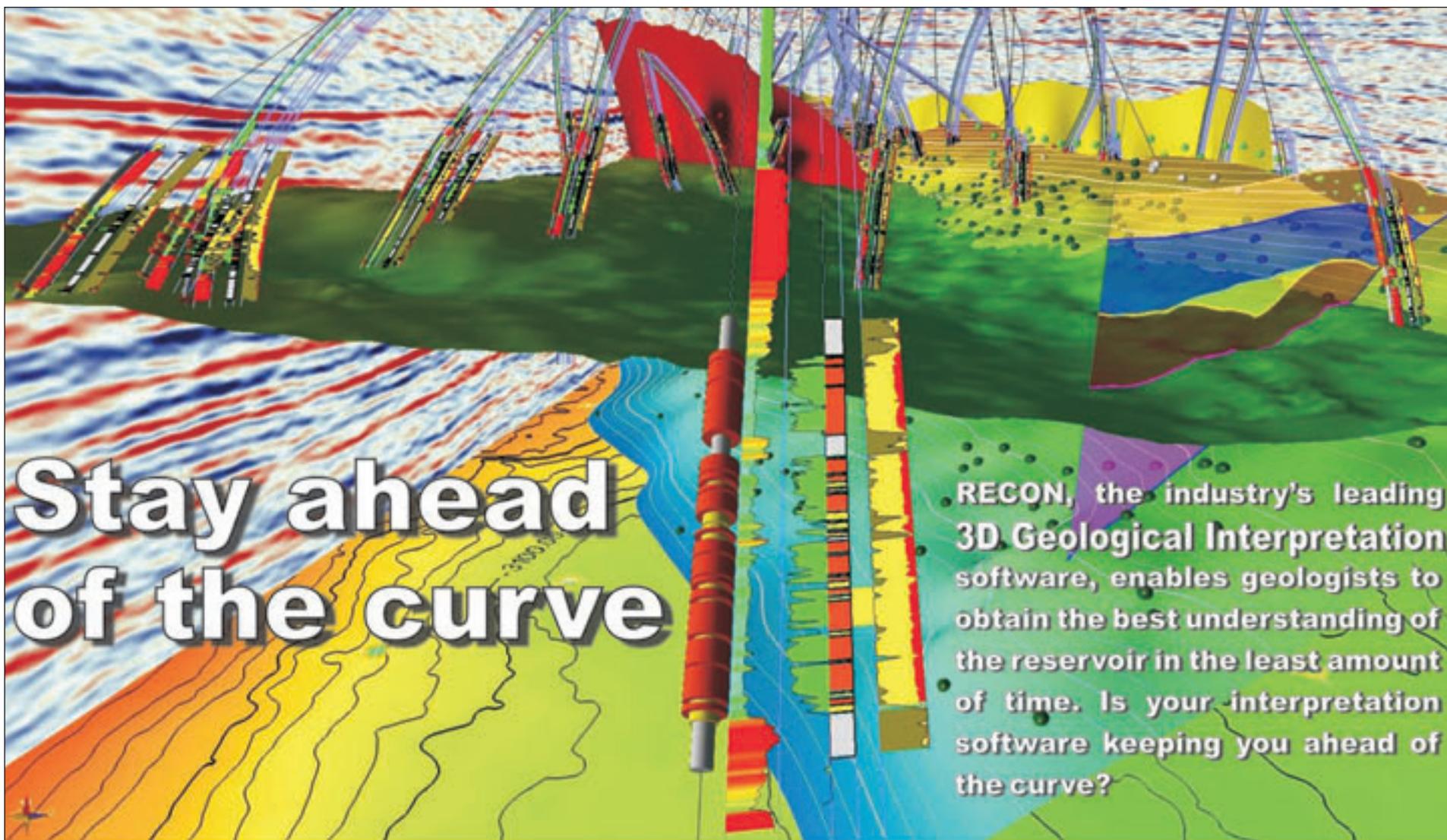
The thin-bed spectral inversion method discussed here is a novel way of removing wavelet effects from seismic data to create a pure reflectivity sequence. For data with a high signal-to-noise ratio, units with thicknesses less than the tuning thickness of the input data can be resolved.

The improved-resolution seismic data retrieved in the form of reflectivity data are not only important for more accurate geologic interpretations but prove to be advantageous for:

✓ Convolving the extracted reflectivity with a wider bandpass wavelet (say 5-120 Hz) to provide a high-frequency section.

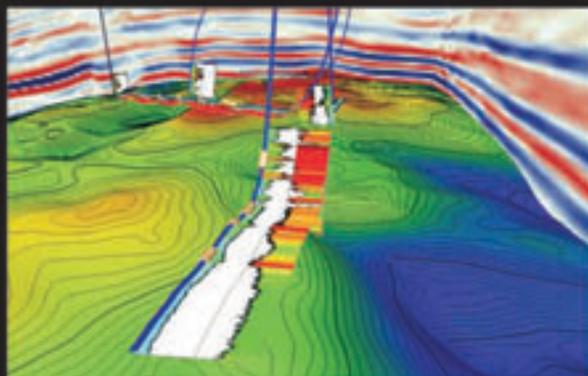
✓ Providing high-frequency attributes that enhance lateral resolution of geologic features. □

(Editor's note: Chopra, an AAPG member, and Xu are with Arcis Corp., Calgary, Canada. Castagna is with the University of Houston/Fusion Petroleum Technologies Inc.)



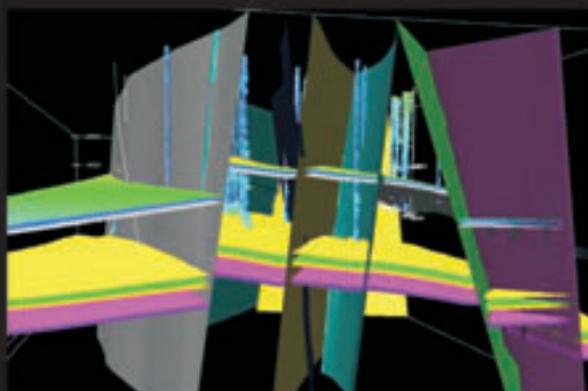
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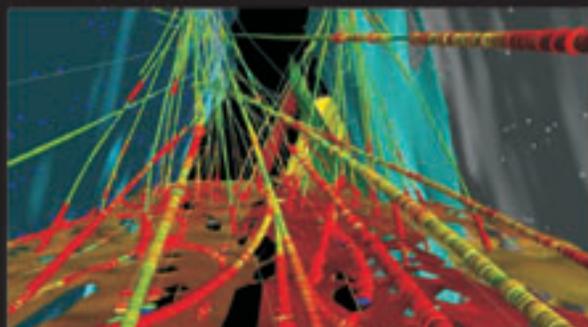
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WASHINGTONwatch

It Was 'Raining Science' in Capitol

By DAVID CURTISS
GEO-DC Director

Early in the morning of March 5, a group of professionals gathered in the lobby of the historic Army and Navy Club on Farragut Square in Washington, D.C., two blocks from the White House. Exiting the building on this gray day left damp after overnight rain, they hailed cabs to take them to their first appointment of the day – breakfast in the U.S. Senate.

Hopping out at the Russell Senate Office Building they passed through security and into the Caucus Room. This richly ornamented room served as backdrop for many significant events in U.S. history – including the Watergate inquiry and the confirmation hearing of Supreme Court Justice Clarence Thomas.

Today, it will be the site of breakfast for these professionals.

Who are these people, eating breakfast in such grand surroundings? Perhaps they are those power-brokers you hear about, walking the halls of authority, rubbing shoulders with lawmakers.

In fact, that is precisely who they are: They are U.S. citizens engaged in participatory democracy.

They also happen to be AAPG members.

They are in Washington, D.C., together with 250 other scientists and engineers from a host of disciplines and professions, to tell their elected leaders about the importance of

In all, we held 16 meetings across Capitol Hill, and at each we indicated our willingness to help tackle these problems.

science, engineering and technology to the nation. They are here for 2008 Congressional Visits Day (CVD).

* * *

Events began two days earlier, on Monday evening, over crab cakes and salad at the Army and Navy Club's Eagle Grill, allowing participants to get acquainted.

Tuesday morning involved a briefing on federal geoscience programs and budgets at the American Geophysical Union, followed by an afternoon briefing on the federal budget and science activities at the American Association for the Advancement of Science.

That evening we gathered for a reception in the Rayburn House Office Building. In attendance were several members of the U.S. House of Representatives, including Reps. Rush Holt (D-N.J.) and Vernon Ehlers (R-Mich.), both Ph.D. scientists, and Rep. Bart Gordon (D-Tenn.), chair of the House Science and Technology Committee, who at the reception received the George E. Brown Jr.

Award for Science-Engineering-Technology Leadership.

We then hustled back to the Army and Navy Club for dinner in the club's wood paneled main dining room. It was a delicious meal enjoyed with good company.

* * *

On Wednesday morning, after our breakfast at the Russell building, we fanned out across Capitol Hill to meet with elected officials:

✓ Jim Hill represented California with visits with staffers of U.S. Senators Dianne Feinstein and Barbara Boxer, and Rep. Elton Gallegly.

✓ G. Warfield "Skip" Hobbs met with members of the Connecticut delegation, including the staff of Senators Chris Dodd and Joseph Lieberman, and a personal meeting with Rep. Chris Shays.

✓ Peter MacKenzie and Jeff Daniels of Ohio visited with staffers for Senators George Voinovich and Sherrod Brown, and Rep. Deborah Pryce.

✓ We had a large Texas contingent at CVD, and those participants met with staff for Senators Kay Bailey Hutchison and Jon Cornyn. Several participants were able to chat and take a photo with Hutchison in the Russell building (see next page).

In addition, Texans Pat Gratton and Valary Schulz met with staff for Rep. Pete Sessions; Dan Smith met with staff for Rep. Al Green; and Larry Jones and Allen Balla met with staff for Rep. Mike Culberson, then stopped the congressman in the hallway for a brief chat.

✓ Finally, AAPG participants met with staff members of the Senate Energy and Natural Resources Committee and the House Energy and Minerals Subcommittee.

In all, we held 16 meetings across Capitol Hill, and at each we communicated the importance of dealing with the work force crisis facing the energy and minerals industries, the need to support the preservation of geoscience data and samples, and the proper federal role in oil and gas research and development.

We also indicated our willingness to help them tackle these problems.

* * *

What did we accomplish? Well, the sun shone on Washington, D.C., during CVD, but it was raining

continued on next page



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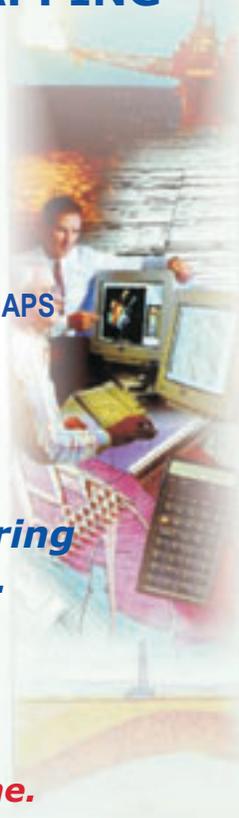
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WEEK 2	Holiday	1 day	Sept. 1
WEEK 2	Open Hole Log Analysis / Petrophysics	3 days	Sept. 2 - 4
WEEK 2	Multiple Bischke Plot Analysis	1 day	Sept. 5
WEEK 3	Seismic Survey Design, Acquisition, and Processing	5 days	Sept. 8 - 12
WEEK 4	Principles of 3-D Seismic Interpretation, AVO and Attribute Analysis	5 days	Sept. 15 - 19
WEEK 5	Applied Subsurface Geological Mapping	5 days	Sept. 22 - 26
WEEK 6	Basic Reservoir Engineering for Non-Engineers	2 days	Sept. 29 - 30
WEEK 6	Fundamentals of Sequence / Seismic Stratigraphy	3 days	Oct. 1 - 13
Project Schedule			
WEEK 7	Phase I: Initial Exploration – Delineate Prospects – Drill Exploration Well	5 days	Oct. 6 - 10
WEEK 8	Phase II: Assess Discovery – Refine Interpretation	5 days	Oct. 13 - 17
WEEK 9	Phase III-A: Field Development – Drill Development Wells	5 days	Oct. 20 - 24
WEEK 10	Phase III-A: Field Development Continued	5 days	Oct. 27 - 31
WEEK 11	Phase III-B: Explore for Additional Prospects	5 days	Nov. 3 - 8
WEEK 12	Phase IV: Field Performance Analysis – Results of Other Exploration Prospects	3 days	Nov. 10 - 14
WEEK 12	Phase V: Present Report and Project Results	1.5 days	
WEEK 12	Graduation Celebration	0.5 day	November 14

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science on Capitol Hill. And that's important.

As geoscientists we understand that an individual drop of water has little effect on a landscape. But multiple drops form rivulets that form streams that collectively can be transformative.

Sometimes change occurs quickly; sometimes it occurs drop by drop, moving grain by grain, with patience and persistence. Either way, it starts with that individual drop followed by another, and another – it's up to you and me. We must engage policy makers at CVD and back at home.

Here is another opportunity: Mark your calendars for Sept. 9-10. The American Geological Institute and its member societies are planning a first-ever GeoCVD. We'll provide more details as they become available.

Washington, D.C., could use more

rain. At GEO-DC we're scanning the clouds, umbrellas at the ready.

* * *

In early February the AAPG Executive Committee approved the addition of three new members to serve three-year terms on the GEO-DC Governance Board, which provides oversight and guidance to GEO-DC. They are AAPG members **Alfredo Guzman** and **Peter MacKenzie**, and past AAPG president **Dan Smith**, who was also named the board's vice chair.

Patrick J.F. Gratton, another AAPG past president, chairs the Governance Board. □

(Editor's note: David Curtiss, head of AAPG's Geoscience and Energy Office in Washington, D.C., can be contacted at dcurtiss@aapg.org; or by telephone at 1-202-684-8225.)



U.S. Sen. Kay Bailey Hutchison, R-Texas (center) met with AAPG members (from left) Allen Balla, Larry Jones, Dan Smith and Valary Schulz.

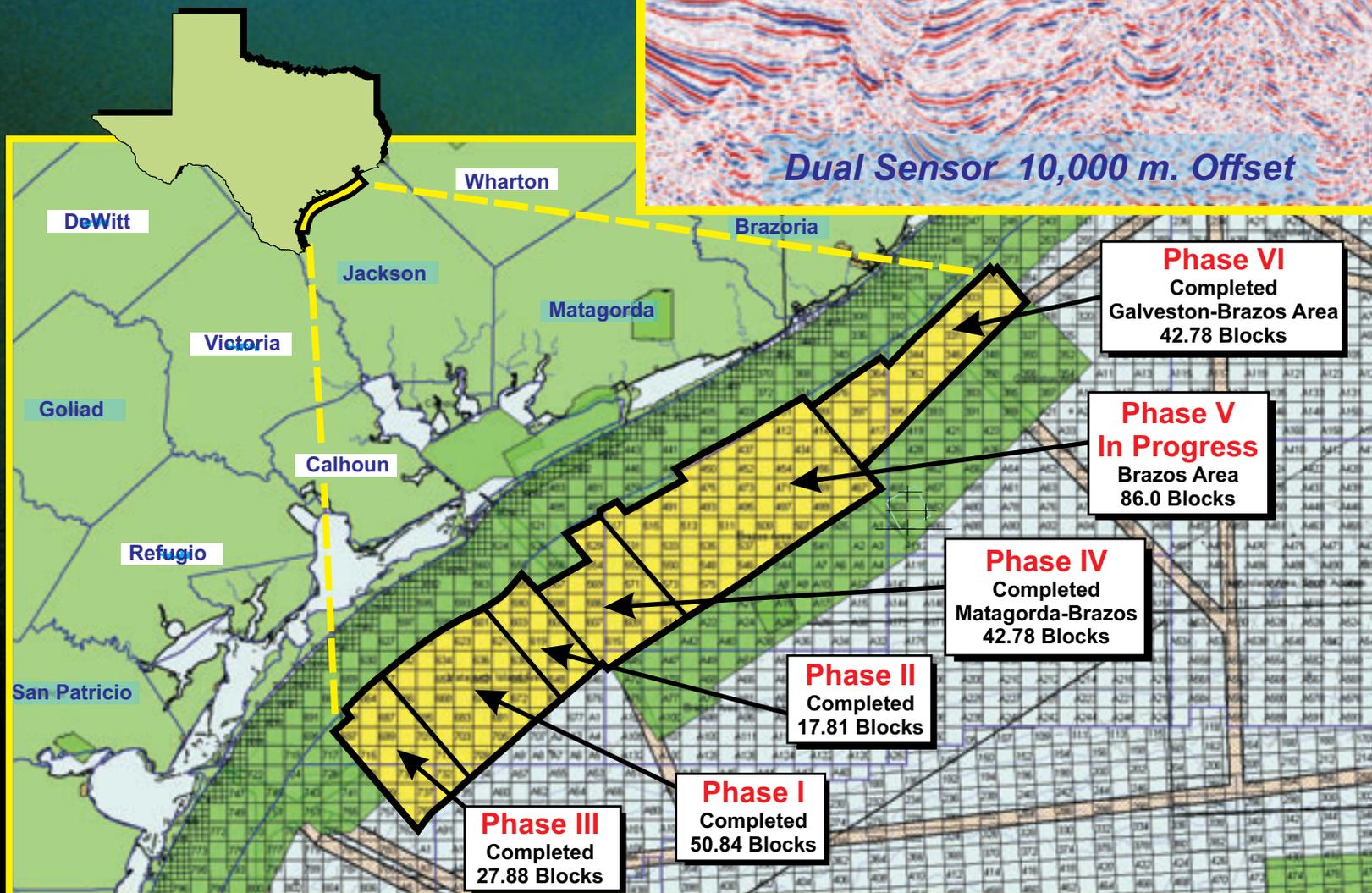
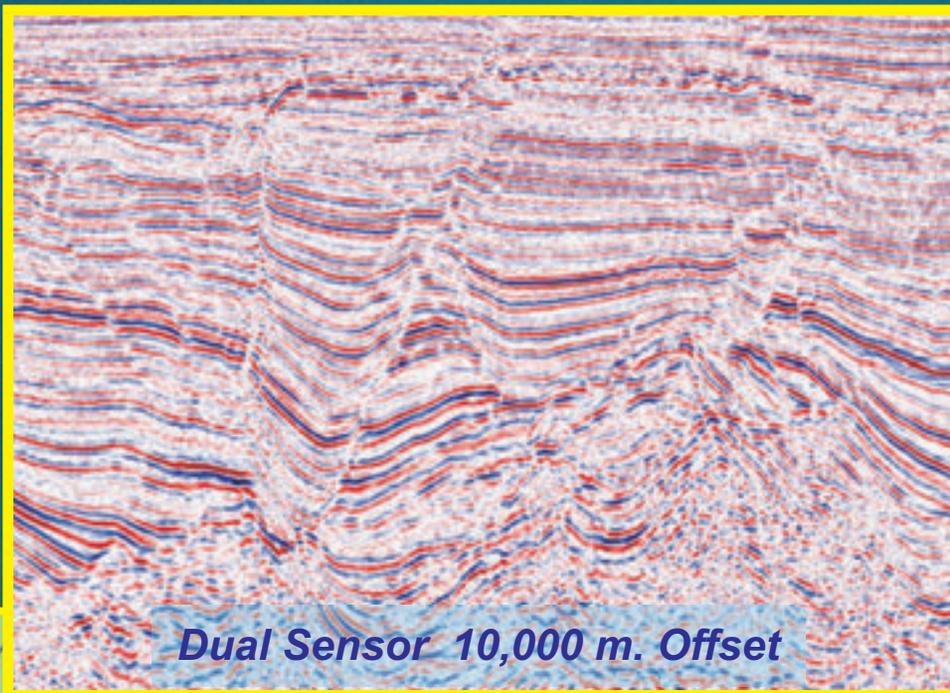
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SPOTLIGHT on...

Schmitt Still Reaching for the Stars

By SUSIE MOORE

EXPLORER Correspondent

AAPG member Harrison H. "Jack" Schmitt, geologist, author, politician, scientist-astronaut extraordinaire and the last man to walk on the moon, has added another award to his lengthy résumé.

Schmitt was presented the 2008 Pick and Gavel Award by the Association of American State Geologists (AASG) at the group's centennial celebration in March, an honor presented to those who make significant contributions to advance the role of geoscience in public policy and who have supported AASG's mission in government affairs.

His latest efforts include leading an initiative to make the use of private enterprise to fund space exploration and mining the moon's surface for helium-3 as an energy resource for use on Earth a reality.

In an April 2006 EXPLORER interview with Schmitt, he said for an enterprise of this magnitude to get started there must be permanent settlements on the moon.

"Once you have permanently settled the moon or you're in the process of establishing settlements, you have begun to move our species into other modes of existence," Schmitt said.

Schmitt, nicknamed Jack by his mother because his father's name was Harrison, was born in 1935 to a geologist and a schoolteacher.

A native of Silver City, N.M., he earned a bachelor's degree at the California Institute of Technology (Caltech), studied as a Fulbright Scholar at Oslo and earned a doctorate in geology from Harvard



Schmitt

University.

In 1965 he was selected for the scientist-astronaut program by NASA where he was the only scientist on board and served as lunar module pilot for 1969's Apollo 17 mission – the last Apollo mission to the moon. He was the last

of 12 men to walk on the moon. That would be enough of an accomplishment to last most people for a lifetime, but Schmitt was just getting started.

After retiring from NASA he was elected U.S. senator for New Mexico in 1976,

and Refining at the session Return to the Moon: Research, Resources and Rewards. He has served as chairman of the Senate's Science, Technology and Space Subcommittee.

He has served as chairman of the NASA Advisory Council since 2005 as well as serving on several other boards, including the Orbital Sciences Corp., Edenspace Systems Corp. and PhDx Systems. Joining AAPG in 1971, he was named AAPG Honorary member in 2006.

Schmitt is author of *Return to the Moon: Exploration, Enterprise and Energy in the Human Settlement of Space* (2006 Springer-Praxis).

And as a technical session co-chair at the recent AAPG Annual Convention and Exhibition in San Antonio he presented the paper *Lunar Resource Mining, Processing*

and Refining at the session Return to the Moon: Research, Resources and Rewards.

Schmitt currently resides in Albuquerque, N.M., and is chair emeritus of the Annapolis Center in Maryland as well as adjunct professor of Engineering at the University of Wisconsin-Madison where he occasionally teaches Resources from Space.

As for his efforts in making commercial ventures into space become a reality, Schmitt noted, "No major investors in lunar helium-3 fusion power have stepped up." However, he said, "small amounts of private funding is pushing the technology forward at the University of Wisconsin-Madison.

"We are still following up leads," he concluded. □

Announcement Readied for Cape Town

It's been discussed for months, but now the planning can get serious for the next AAPG International Conference and Exhibition (ICE).

The official announcement for this year's ICE, set Oct. 26-29 in Cape Town, South Africa, is expected to be available in late May.

In it you'll find the information on the location, speakers, special events and the entire technical program, built on the theme "African Energy – Global Impact."

The technical program itself will have more than 70 sessions that are built around "the big five" symbols of Africa's animal kingdom – specific themes that reflect the geology, history, culture and

potential of Africa. They are:

✓ The Elephant – A Steady Advance: "Deepwater: Ancient Analogues, Current Technologies, Future Opportunities."

✓ The Leopard – Unraveling Secrets: "Advances in Geoscience and Allied Disciplines."

✓ The Black Rhino – Turned Around From Near Extinction: "Next Generation Tools and Technologies."

✓ The Lion King – Roar of the Future: "The New Business of Energy."

✓ Cape Buffalo – Beauty and the Beast: "Gondwana and Pangean Petroleum Systems: Exploration, Development and Production – Emerging Plays, Lessons and Analogues."

In addition, the program offers 16 short courses, eight field trips and several special forums, including:

✓ The potential impact of the oil industry's looming demographic crisis.

✓ The role of the independent in west African exploration and production.

✓ Keynote talks on subjects ranging from mega-tectonics of Africa to exploration case studies circum Africa.

✓ Global climate change.

Pre-registration is expected to open in mid-May, as well.

For more information watch the June EXPLORER or go online to www.aapg.org/capetown/. □

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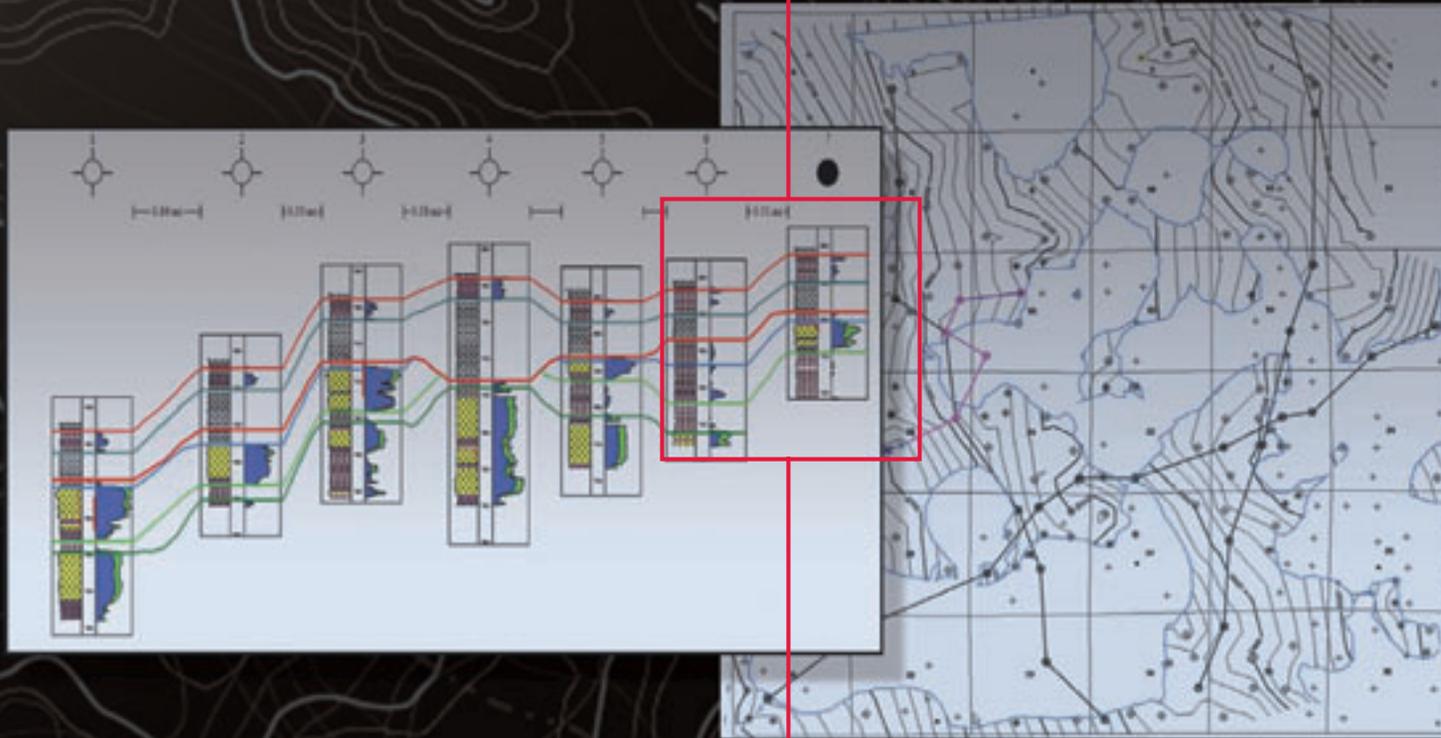
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Sep 29 – Oct 3	Calgary, Alberta	
Oct 13 – 17	Houston, Texas	
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Joe Alcamo, to senior staff geophysicist, Encore Acquisition, Fort Worth. Previously senior geophysical adviser, Vintage Production California (Oxy), Bakersfield, Calif.

John Arenson, to technical sales adviser-structural and stratigraphic interpretation, Paradigm, Houston. Previously manager-Military Installation Transformation Solutions, BearingPoint, San Antonio.

Henricus A. Bockmeulen, to director-new ventures, Continentoil, London, England. Previously director-business development, Williams International, Caracas, Venezuela.

Steve Ehrenberg, to PanTerra Geoconsultants, Leiderdorp, Netherlands. Previously StatoilHydro,

Stavanger, Norway.

Arnout J.W. Everts, to technical director, Horizon Energy Partners Asia Sdn Bhd, Kuala Lumpur, Malaysia. Previously senior geologist, Murphy Sarawak Oil, Kuala Lumpur, Malaysia.

John L. Ezerskis, to project environmental scientist-northeast Ohio, Floyd Browne Group, Akron, Ohio. Previously geologist/project manager, Ohio Drilling Co., Massillon, Ohio.

Stuart D. Harker, to vice president-geology, Circle Oil, Finchampstead, England. Previously adviser-geology, PGS Reservoir, Aberdeen, Scotland.

George A. Hillis, to exploration manager, BEPCO, Fort Worth. Previously division geologist, BEPCO, Fort Worth.

Robert Hobbs, chief operating officer, TGS-NOPEC, Houston. Previously manager-worldwide geoscience, Marathon Oil, Houston.

Scott Humphrey, to manager-Latin America marketing, Geotrace, Houston. Previously director-Latin America and Caribbean region, ION Geophysical (GX Technology), Houston.

Dan Jarvie, to president, Worldwide Geochemistry, Humble, Texas. Previously president, Humble Geochemical Services, Humble, Texas.

Stacy Jenkins, to senior geologist, Seneca Resources, Houston. Previously lead geologist, Sterling Energy, Houston.

Walter J. Korenkiewicz, to senior geophysicist, Berry Petroleum, Denver. Previously senior geophysicist, Rosetta Resources, Denver.

Jay S. Leaver, to executive vice president, Thomasson Partner Associates, Denver. Previously vice president-geosciences, Thomasson Partner Associates, Denver.

Steve Leeds, to vice president-business development, Core Laboratories, Denver. Previously manager, business development-Rocky Mountain region, Core Laboratories, Denver.

Jim Lowe, to consultant geologist, Noble Energy, Houston. Previously staff geologist, Southwestern Energy, Houston.

Peter MacKenzie, to president, MacKenzie Land & Exploration, Worthington, Ohio. Previously vice president-geosciences, Triana Energy, Worthington, Ohio.

James R. Maytum has been elected partner and named principal geologist, Geocal, Centennial, Colo. Previously manager-geotechnical operations, Geocal, Centennial, Colo.

Terri Olson, to petrophysical adviser, EOG Resources, Denver. Previously geoscience development adviser, EnCana Oil & Gas, Denver.

Mike Rogers, to manager-professional development, Nexen, Calgary, Canada. Previously vice president-exploration, Dolomite Energy, Calgary, Canada.

Benjamin Sloan, to subsurface team lead-Gorgon and Io-Jansz fields, Chevron Australia, Perth, Australia.

See **PNBs**, page 40

Central Utah Thrust Belt
BlueQube Survey

Data now available

Multidisciplinary approach to map complex structures at Navajo depth and help drive future exploration.



150 sq mi - BlueQube data and Interpretation report over Covenant Field - Now Available



300 sq mi - In processing



900 sq mi - Permitted, to be flown 2008

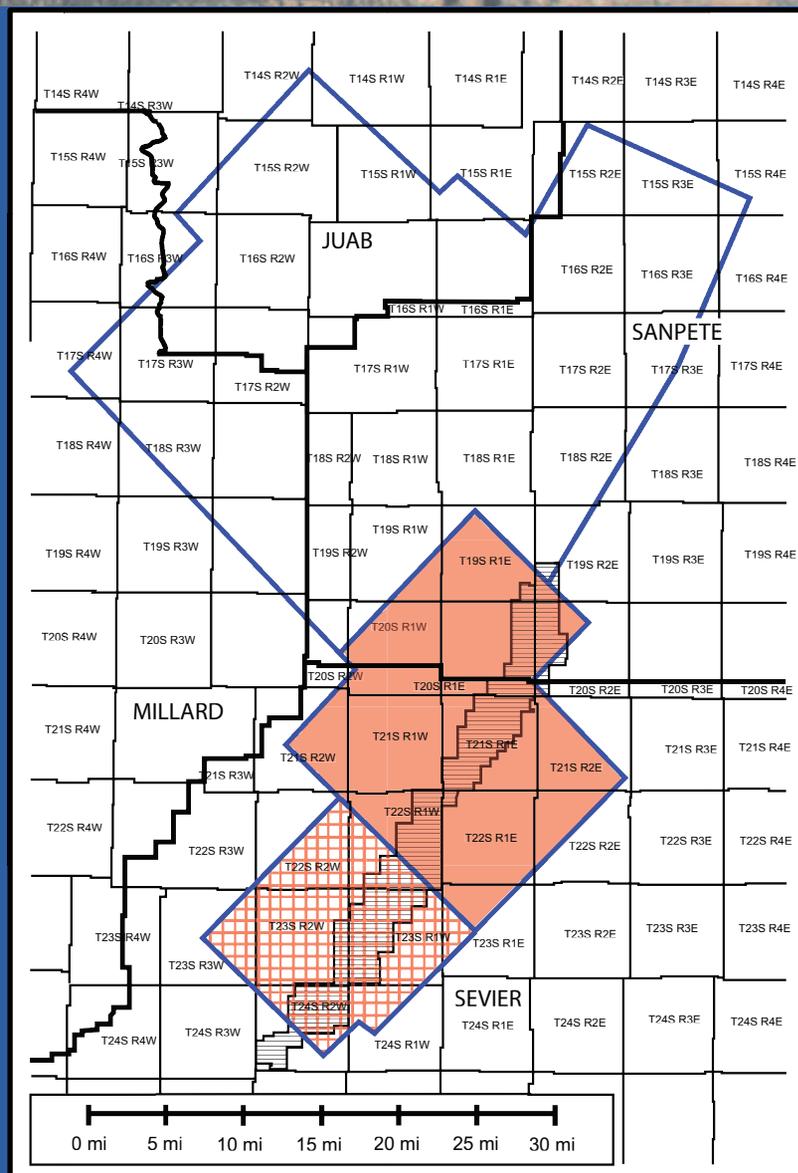
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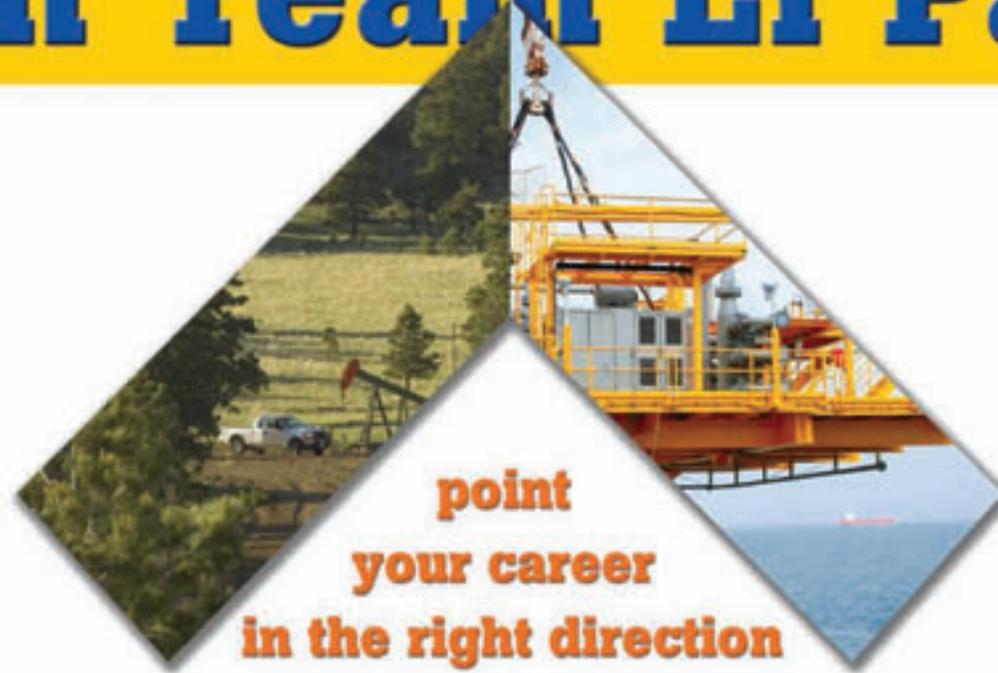
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'Bookout Initiative' Supports Teachers

By MARLAN DOWNEY
AAPG Foundation Trustee

A recent review of AAPG Foundation donors revealed that support for K-12 teachers and students ranked very high in donor interest.

This coincides with the intent of Jack Threet and Larry Funkhouser, co-chairs of the Foundation's fundraising efforts, to find ways that the AAPG Foundation can, in its growth, continue to make the Foundation's objectives parallel the interests of the donors.

Foundation Executive Director Rick Fritz has pointed out to the Foundation Trustees that K-12 support has been only a relatively modest part of past Foundation outlays, with the exception of the Foundation's highly regarded "Teacher of the Year" program.



Bookout



Downey



Funkhouser



Threet

The Foundation is interested in enlarging its support of new K-12 activities, while continuing its strong support of current programs.

In a discussion between John Bookout, former chairman of Shell Oil, Bill Fisher, Jack Threet and myself, we

were encouraged to "do something" rather than wait for an interesting new K-12 proposal to arrive before the Foundation board.

As AAPG had assisted in the initial funding of the Ellison Miles Geotechnology Institute (EMGI) at

Brookhaven College in Dallas, we began discussions with Diane Brownlee, EMGI director, and Stan Pittman, EMGI board member. The Institute was founded by long-time Dallas independent oilman Ellison Miles, and is very modern and well equipped.

It has become a center for K-12 teacher science training and is heavily used for professional workshops and meetings.

Our discussions with EMGI allowed definition of a series of low-cost earth science education courses for K-12 teachers, with EMGI providing facilities, teaching materials and staff for nominal costs.

This "teach-the-teachers" concept has several unique elements:

- ✓ The short courses are scheduled at the teacher's convenience (weekends and school holidays).
- ✓ The courses taught by EMGI provide credit hours needed for the teacher's annual certification requirements.
- ✓ The teaching materials are selected from the best currently available.
- ✓ Organization and supervision are provided by the EMGI staff.

John Bookout has agreed to fund the starting phase of this new AAPG Foundation program, which we have named the "Bookout Initiative." The program got off to a jump-start in October 2007, and has provided funding for training 223 teachers at an amazingly low cost of about \$35/teacher. The program has been heavily advertised in the teaching profession, and requests already have been received for 14 more short courses for the first quarter of 2008! Teachers are excited about using new knowledge and teaching materials in their classes.

The Bookout Initiative also funded a special field trip, "Geology on the Bus," in January 2008 that received rave reviews from all 35 teachers. This is no surprise, of course – once you show someone the lessons of the rocks, then understanding, enthusiasm and a sympathetic view of earth science emerges.

The AAPG Foundation has many wonderful programs that deserve your support; we hope that a larger Foundation will allow us to play a strong role in channeling your contributions to the sort of activities you find most worthwhile.

(Downey is a past president of AAPG.)

PNBs

from page 38

Previously planning analyst, Chevron International Exploration and Production, San Ramon, Calif.

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

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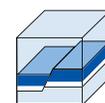




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FOUNDATION Update

By REBECCA GRIFFIN
AAPG Foundation Manager

It's been a busy month for the AAPG Foundation as initiatives have moved forward, members were honored and a significant gift was received to start a new program.

The gift was a \$250,000 donation from David "Scotty" Holland, a Trustee Associate and Member of the Foundation Corporation, which will endow the first AAPG Foundation Named Professorship.

The AAPG Foundation/Holland Professorship will be designated to Hardin-Simmons University in Abilene, Texas.

Holland, now retired, began his career with Marathon Oil (1957-66), then spent three decades with Pennzoil in a variety of countries and positions, including president and chairman of 17 different Pennzoil international subsidiaries.

In other Foundation news:

✓ This year the Grants-in-Aid Committee will award the first Ike Crumbly Minorities in Energy Grant in the amount of \$500.

The Ike Crumbly Minorities in Energy Grant, was established in 2003 by the AAPG Membership/Diversity Subcommittee to honor educator Isaac J. "Ike" Crumbly at Fort Valley State University.

The selected recipient must be a graduate geoscience student who is female and/or a visibly ethnic minority (black, Hispanic, Asian or Native American, which includes American Indian, Eskimo, Hawaiian or Samoan.)

For more details contact the Foundation office or go to the Foundation Web site at foundation.aapg.org.



Holland

extraordinary contributions (service or

✓ The 2008 Chairman's Award was presented to Trustee Emeritus and AAPG Honorary member Jack C. Threet at the Foundation Chairmen's Reception in San Antonio.

The Chairman's Award recognizes those who have made

monetary) to the AAPG Foundation.

Threet recently co-chaired the Foundation's Financial Campaign, "Meeting Challenges ... Assuring Success."

The award was first presented in 1999, to the late Michel T. Halbouty. Other past recipients include L. Austin Weeks, James E. Wilson, Merrill W. Haas, Hugh Looney, Lawrence W. Funkhouser, Fred A. Dix, Robert W. Esser and Eugene F. "Bud" Reid.

✓ In an effort to promote alliances between societies, Foundation Chairmen William Fisher and Paul Strunk recently invited the SEG Foundation Trustee Associates to attend the next AAPG Foundation Trustee Associates meeting, set Sept. 3-7 in Jackson Hole, Wyo.

✓ Finally, the Foundation Trustee Associates have another new member. Fred Barrett, of Bill Barrett Corp. in Denver, recently joined, bringing the group's total to 260. □

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Robert James Ardell
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Louis Chapman Bortz
*In memory of John D. Edwards,
James A. Peterson and Robey H.
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Kirby Lee Cockerham Jr.
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Minorities in Energy Grant
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SEAPEX Named Grant

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Marta S. Weeks Named Grant

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In memory of Melvin J. Hill

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For the "Bookout Initiative"

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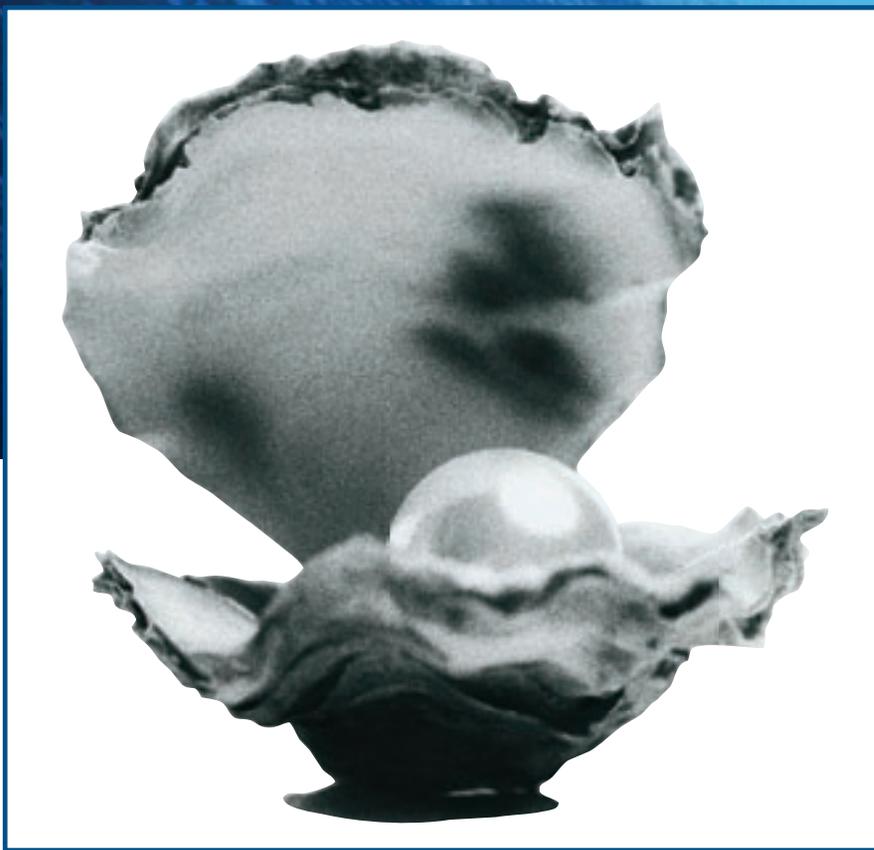
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May 2008

Midland Valley

Structure World

Welcome to May's Structure World column from Midland Valley. This month we announce the Keynote Speakers presenting at our Technology Meeting in Glasgow, Scotland in September while our interpreters tip looks at displacement data analysis.

upstream
technology
alliance

Thank you to all who visited us at the recent AAPG exhibition in San Antonio where we were exhibiting with our

Upstream Technology Alliance partners Badleys Geoscience and IES - Integrated Exploration Systems. It was great to catch up with friends old and new. We hope you enjoyed it as much as we did!

Silver Anniversary Technology Meeting



To celebrate our 25th Anniversary, we are holding a Technology Meeting with session topics of structural geology; reducing uncertainty; reservoir analysis and petroleum systems. Presentations will be delivered by keynote speakers from industry and academia. Our Upstream Technology Alliance partners Badleys and IES will also be represented.

Keynote Speakers include:

Tim Buddin, BP
Prof John Dewey, UCD
Dr Jan Kees Blom, Delft University
Prof Rob Butler, University of Aberdeen
Prof George Davis, University of Arizona

The meeting takes place from 30th September - 1st October 2008 in the Glasgow Science Centre, Scotland.



Come to one of our Public Trainings in Houston:

- **May 29th**
Public Training: **2D Move & 4D Base**
- **May 30th**
Structural Uncertainty Workshop

Silver Anniversary Events

- **Sept 29th**
Structural Uncertainty Workshop
- **Sept 30th - Oct 2nd**
Midland Valley Silver Anniversary Technology Meeting, Glasgow, UK.
- **Oct 2nd**
Field Trip: The Architecture of the Highland Boundary Fault.

Exhibitions

- **October 26th - 29th**
AAPG International, Cape Town.

More info? E-mail Sarah events@mve.com



You can contact Midland Valley on
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The structural geology experts
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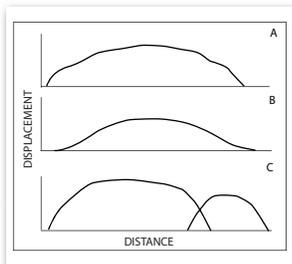
Additional activities that we will be holding with the Technology Meeting include a workshop on 'Reducing Structural Uncertainty' and a Field Trip looking at the Architecture of the Highland Boundary Fault.

To receive the full Technical Programme and Registration details for all of the Silver Anniversary events contact **Sarah** through events@mve.com or visit our website, www.mve.com.

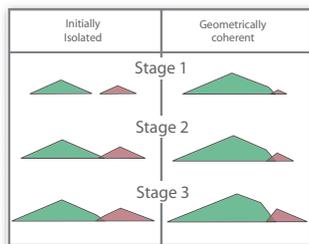
Interpreters Tips: how displacement data analysis can be an aid for structural interpretation?

Displacement measurements along faults can provide insights on both the evolution of a fault system and its segmentation pattern. Generally, the displacement on a fault decreases from the centre to the outer sectors of a fault. The displacement dies out at a tip line (the trace in space of the terminations of a fault) and can be transferred to some other fault or to a fold. Displacement-distance graphs (or displacement profiles) illustrate the change in displacement along the strike of a fault. The displacement-distance curve can show different shapes ranging from a circular arc to sinusoidal to D-shaped. Variations of displacement gradient can be related to different fault interactions (i.e. tips of linked faults generally show higher displacement gradients) and can indicate changes in structural trends.

Where you see an apparent change from a smooth displacement profile or rapid change in displacement gradient you should look for relay ramps or hard linked transfer faults that may have been omitted in the interpretation.



Displacement vs. distance profiles for two isolated normal faults and for a linked fault system (not in scale). (a) Arc-shaped profile; (b) approximately sinusoidal distribution; (c) overlapping faults with D-shaped distribution (redrawn after Schlische et al., 1996).



Evolution of displacement vs. distance profiles on pairs of sub-parallel, non-colinear faults (redrawn after Nicol et al., 2002).

As a rule of thumb, faults with small maximum displacements are unlikely to be continuous over large distances in either map or section view and thinking of them as elliptical segments forming parts of discontinuous arrays may be useful.

To receive the interpreter tip monthly, contact **Steven**: help@mve.com.



The winning team from the University of Leoben, Austria, which took first place in the European Region's Imperial Barrel Award competition – and represented the Region in the IBA finals in San Antonio.

REGIONS§ions Winning Teams Moved On to San Antonio

Twelve university teams from around the world competed in the finals of AAPG's Imperial Barrel Award program at the AAPG Annual Convention and Exhibition in San Antonio.

Results of the competition are on www.aapg.org and will be published in the June EXPLORER.

The 12 teams were the finalists of 34 university teams from around the globe that entered the annual prospect/exploration evaluation/presentation competition between university student teams competing to win scholarship funds.

The teams analyzed a complete dataset in six to eight weeks prior to the competition and (geology, geophysics, land, economics, production infrastructure and other relevant materials). Each team delivered their results in a 30-minute presentation to a panel of industry experts who acted as judges.

The first place team was awarded \$20,000, with \$10,000 for second and \$5,000 for third. The remaining finalists received \$1,000 each.

The program is rigorous and contributes to AAPG's mission of promoting petroleum geoscience training

and advancing the careers of geoscience students.

Listed here are the first place and "wild card" teams that participated in this year's IBA.

✓ Africa Region – Federal University of Technology, Nigeria.

✓ Asia Pacific Region – University of Indonesia.

✓ Canada Region – University of Alberta.

✓ European Region – University of Leoben, Austria.

✓ Eastern Section – West Virginia University.

✓ Gulf Coast Section – University of Louisiana, Lafayette.

✓ Mid-Continent Section – University of Oklahoma.

✓ Pacific Section – San Diego State University.

✓ Rocky Mountain Section – Colorado School of Mines.

✓ Southwest Section – Texas Christian University.

✓ Wild card (2008 only) – University of Aberdeen (2007 IBA winner).

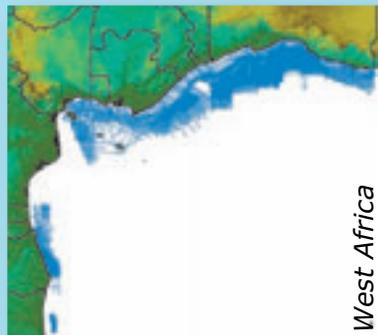
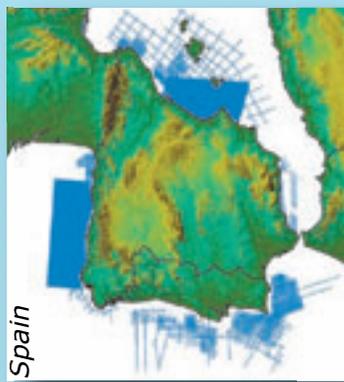
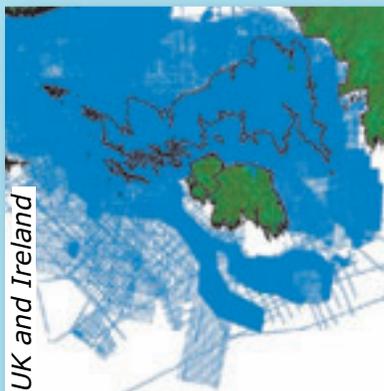
✓ Wild card (2008 only) – Imperial College London (program concept founder). □



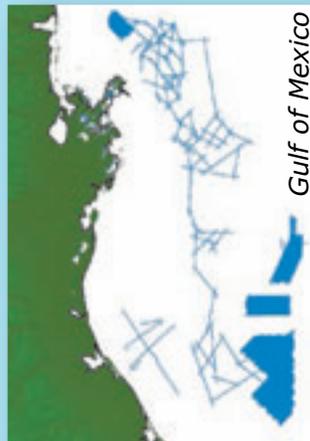
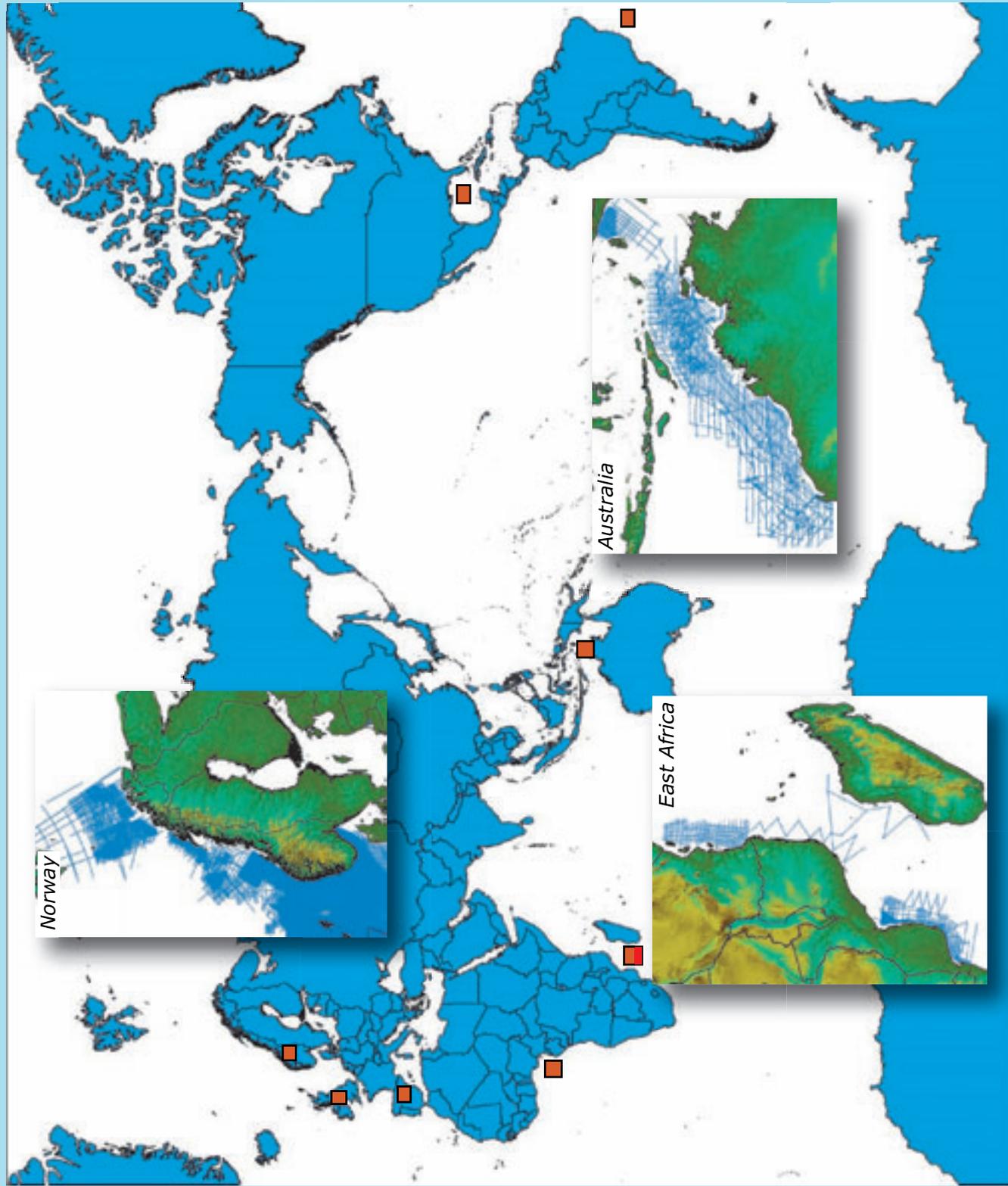
Other IBA finalists included teams from the University of Alberta (left), Federal University of Technology, Nigeria (lower left), and the University of Oklahoma (lower right).



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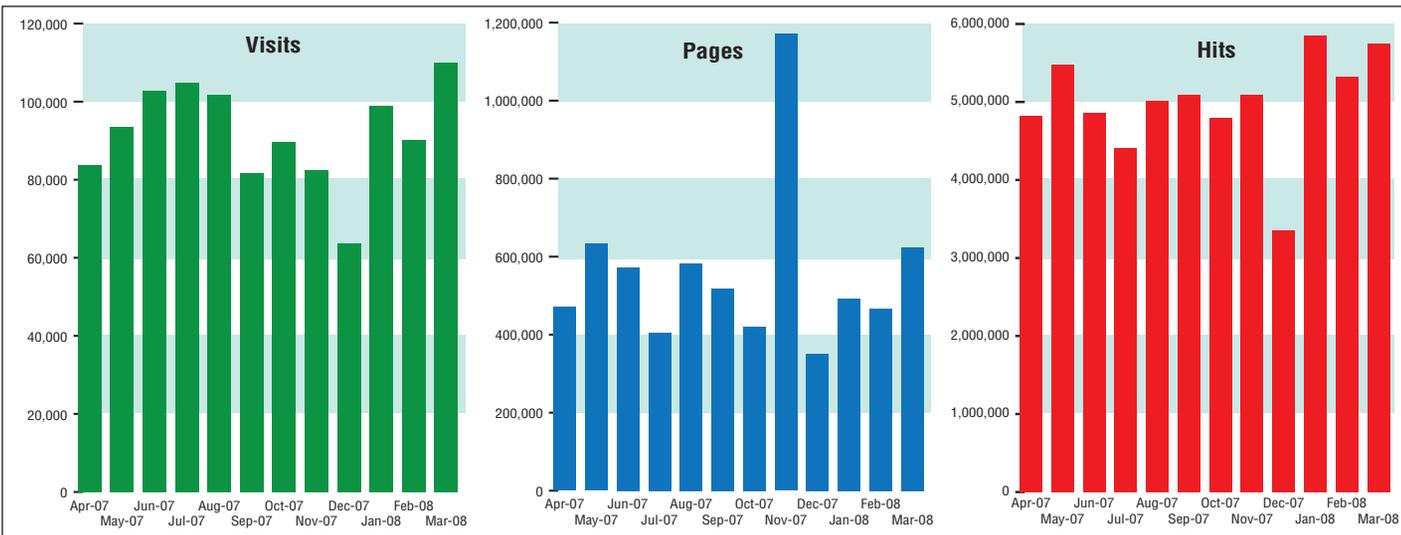


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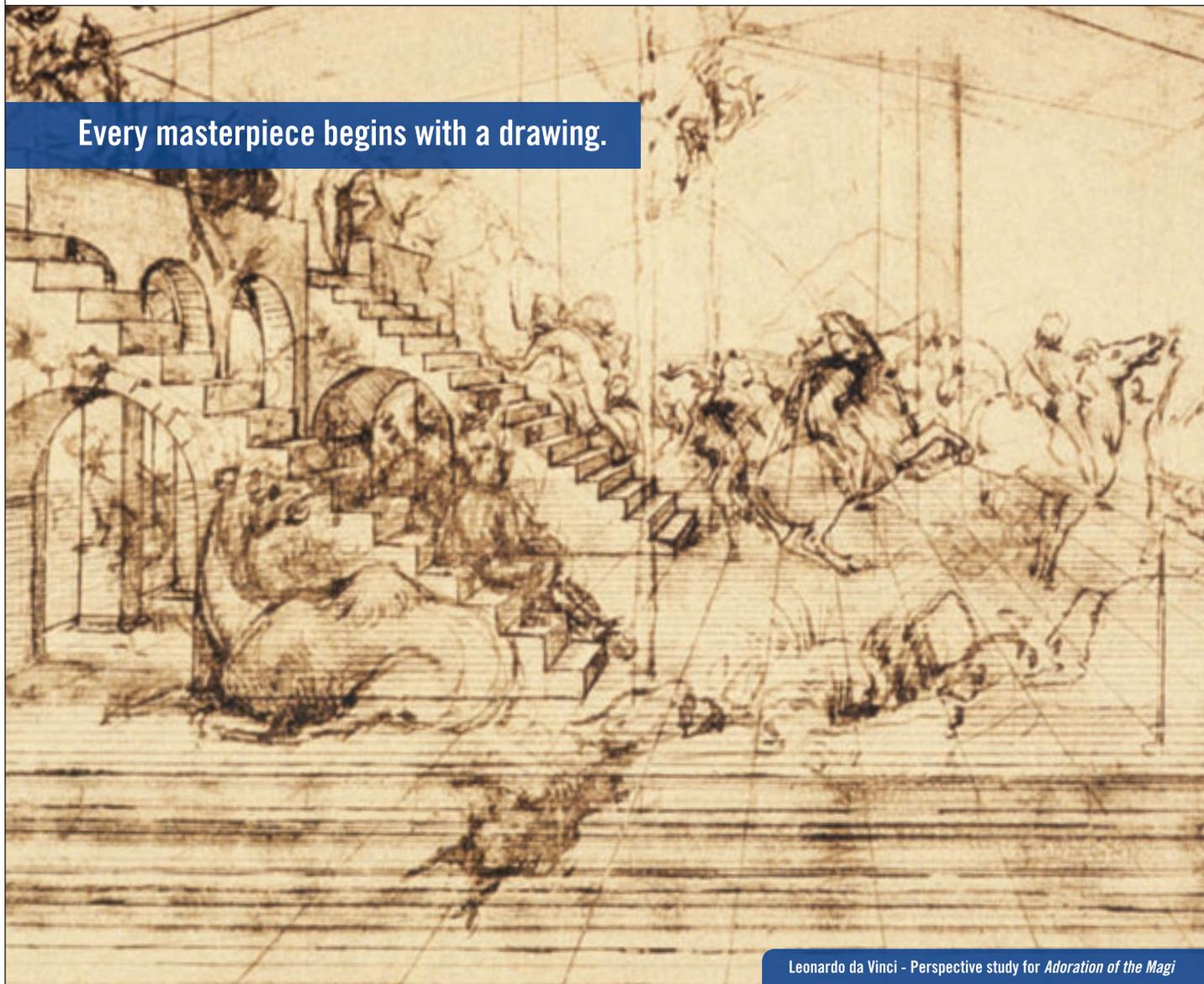
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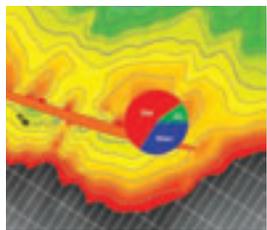


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AAPG Site Is BIG – And Still Growing

By JANET BRISTER
AAPG Web Site Editor

There are over 10,000 pages of news and informational content in the aapg.org Web site, and more than 3,000 pages served up from its sub-domains (DEG, EMD, DPA, Foundation, Students, etc.). And, of course, these pages are added to daily.

However, AAPG wants to expand its Web site services to attract even more traffic to our sites and to the organization. Some of the services planned include additional collaborative tools – such as Podcasts, blogs and wikis – and audio and video files from lectures, meetings, and other events.

Between 15,000 and 30,000 pages are accessed daily just on www.aapg.org alone, by between 2,500 and 3,500 visitors.

In 2004 those numbers were 10,000 to 18,000 pages accessed by 2,000 to 2,800 visitors.

It's exciting to see that not only the content has grown but the access and use has grown, too.

Students' Site

The latest addition of students.aapg.org serves primarily our college students and the resulting student chapters. It focuses on content of interest and help to the college audience.

From these pages students can:

- ✓ Learn about the job expos.
- ✓ Locate other student chapters to learn what they are doing and compare notes.
- ✓ Gather details about contests such as the Imperial Barrel Award.
- ✓ Learn about grants offered through the AAPG Foundation.

More to Come

The Bookstore and events registration system is nearing completion and you should begin to see a difference in what lies behind Members Only.

Then there are those collaborative tools that are popping up all over the Internet – which we plan to incorporate into AAPG's site as well.

Our Divisions are working on enhancing their content for their respective members:

- ✓ DPA is improving the certification registration process.
- ✓ DEG continues to grow its *Environmental Geosciences* journal and information.
- ✓ EMD's proprietary information maintained by its commodities committees grow regularly.

* * *

Because of the desire to expand Web services and information and the need to update and maintain the already extensive site, the AAPG Web site staff had doubled.

Jamie M. Edford is on board as web site editorial assistant. She was previously with University of Tulsa Petroleum Abstracts. □

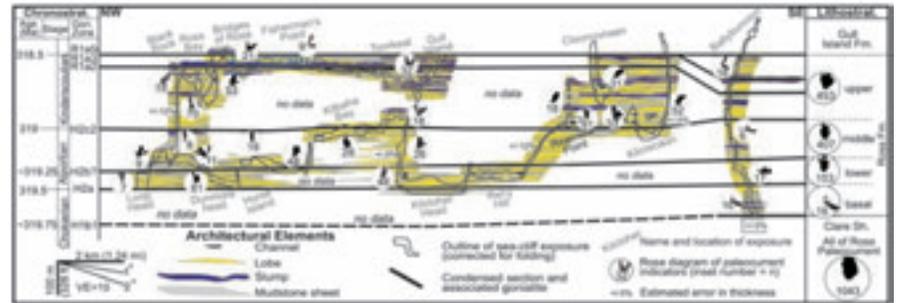
Coming to You In the May AAPG BULLETIN

Articles

Multiscale stratigraphic analysis of a structurally confined submarine fan: Carboniferous Ross Sandstone, Ireland
David R. Pyles

Ross Sandstone

Results of a detailed, multiscale stratigraphic analysis indicate that the Carboniferous Ross Sandstone, Ireland, is indeed an outcrop analog for the productive submarine fans that fill structurally confined minibasins in the northern Gulf of Mexico. A better understanding of the former will aid exploration and production of

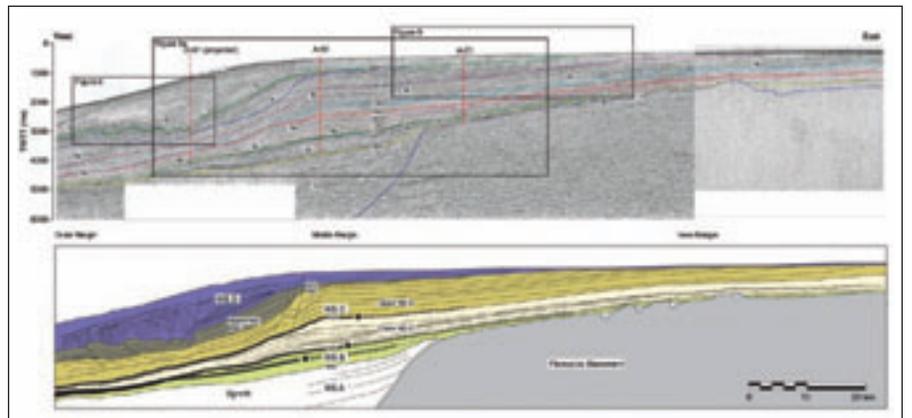


the latter.

Tectonically induced adjustment of passive-margin accommodation space; influence on the hydrocarbon potential of the Orange Basin, South Africa
Douglas A. Paton, David van der Spuy, Rolando di Primio, and Brian Horsfield

Increased Passive Margin Potential

Most passive margins have experienced some degree of postrift deformation. A single tectonic event significantly altered the location and style of sediment accumulation on the southern Orange Basin passive margin in South Africa, resulting in increased hydrocarbon

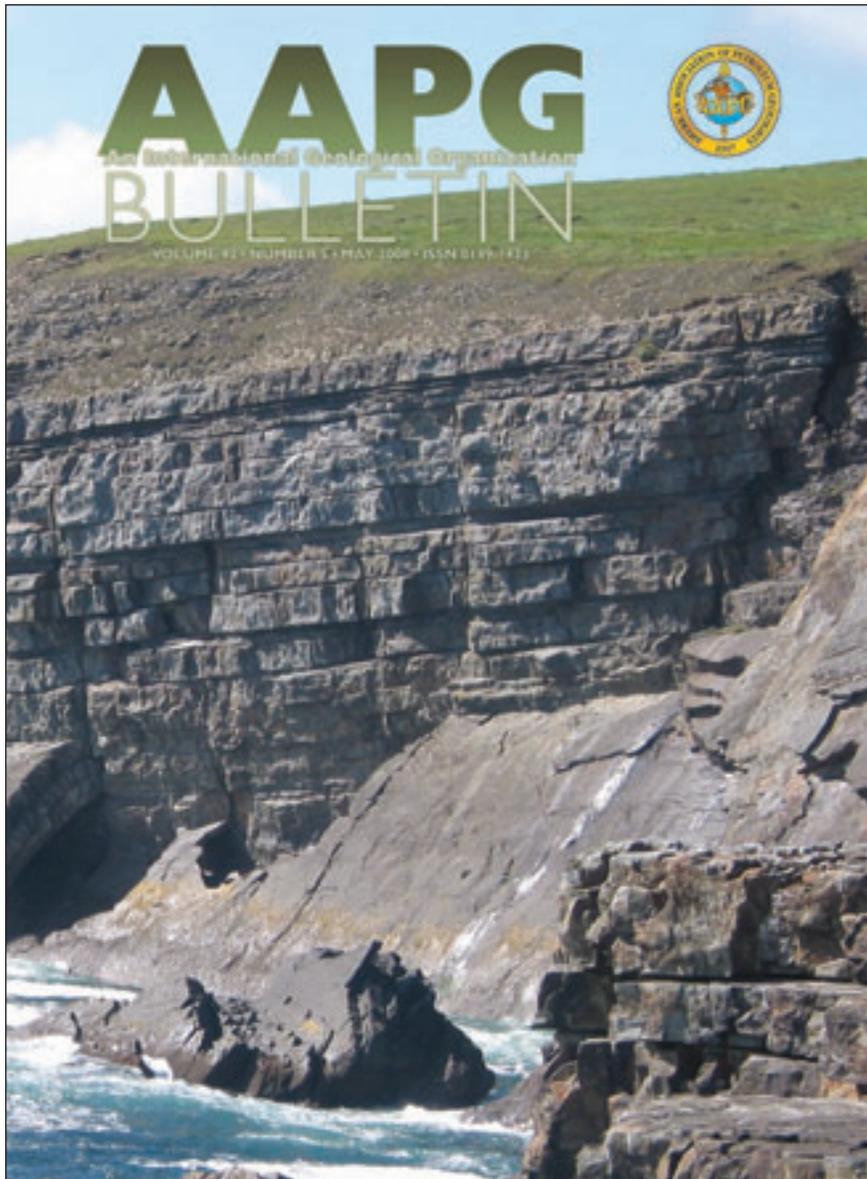
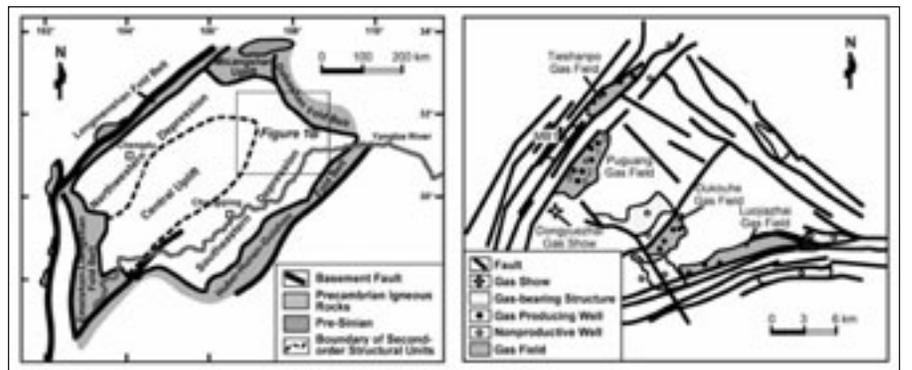


potential.

Evidence for multiple stages of oil cracking and thermochemical sulfate reduction in the Puguang Gas Field, Sichuan Basin, China
Fang Hao, Tonglou Guo, Yangming Zhu, Xunyu Cai, Huayao Zou, and Pingping Li

Puguang Gas Field TSRs

The Puguang Gas Field of the Sichuan Basin is the largest carbonate gas field in China but contains a high concentration of H₂S. This



Geologic Notes

A Review and Technical Summary of the AAPG Hedberg Research Conference on "Origin of Petroleum – Biogenic and/or Abiogenic and Its Significance in Hydrocarbon Exploration and Production"

Barry Jay Katz, Ernest A. Mancini, and Alexander A. Kitchka

Petroleum: Biotic or Abiotic Origin?

The question of whether petroleum is of a biotic or an abiotic origin, as well as the implications of such an origin, was tackled at the Hedberg Research Conference. While little common ground exists between the two camps, all participants agree that the meeting was an informative and useful exercise.

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MEMBERSHIP & certification

The following candidates have submitted applications for membership in the Association and, on the next page, certification by the Division of Professional Affairs. This does not constitute election nor certification, 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.

Information included here comes from the AAPG membership department.

(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.

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Frost, Gwendolynne Rose, ConocoPhillips, Farmington (S.E. Nez, C.F. Head, E.A. Pippin)

Oklahoma

Goodfellow, Karen B., Continental Resources, Enid (J.H. Stark, D.E. Pethoud, R. Jones); Jarrett, Andrew Whitney, Chesapeake Energy, Oklahoma City (J. Sharp, J. Kapchinske, M. Lester); Kenney, Kathleen Marie, Questar E&P, Oklahoma City (R.C. Thornburg, S.K. Broberg, R.E. Conrad II)

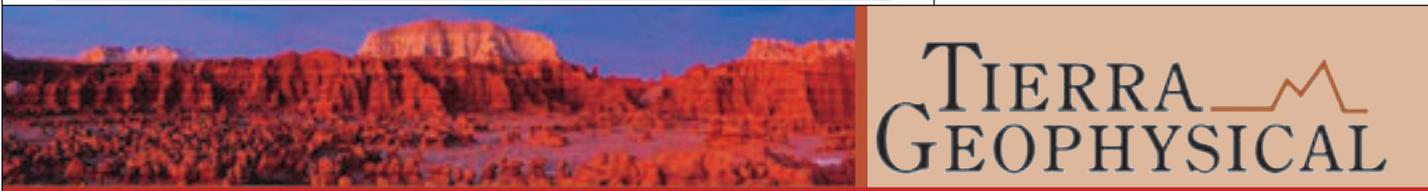
Pennsylvania

Adams, David Paul, ABARTA Oil & Gas, Pittsburgh (J. Interval, J. Wigal, J. Jenkins)

Texas

Allwardt, Jeffrey R., ConocoPhillips, Houston (S.R. Schwegal, D.N. Tolman, M.O. Maler); Close, David Ian, Schlumberger, San Antonio (D. Fairhurst, H.A. Balling, P. Winefield); Erigha, Eric Akporherie, independent, Houston (G.J. Nash, J.L. Honganen, D.R. Phu); Hardesty, Elizabeth C., Shell Oil, Houston (C.M. Griffith, J. Rehnmark, G. Yoder); Jones, Rebecca Harrington, Bureau of Economic Geology, Austin (S.C. Ruppel, F.J. Lucia, U. Hammes); Kim, Kyou Ho, Providence Energy Group, Houston (G. Bunge, S. Hamm, M.M. Cassidy);

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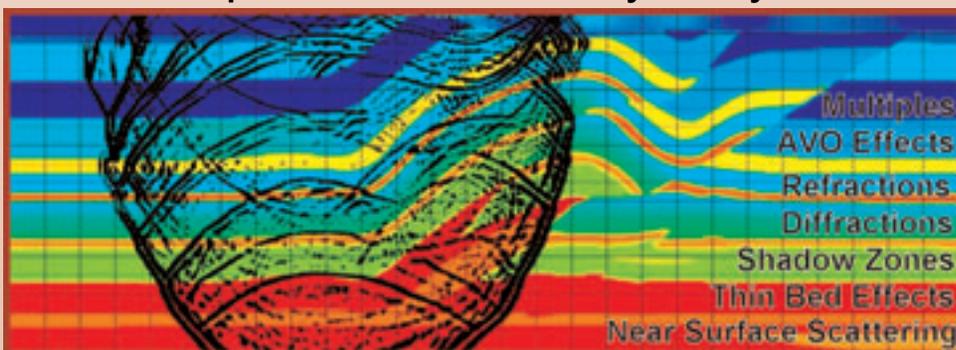
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continued from previous page

Latson, Rebecca Lynn, Hess Corp., Houston (J. Halgas, M.L. Price, S.B. Pluim); **McCormack, Niall James**, Hess Corp., Houston (A.S. Pepper, T.M. Cordingley, D.E. Ballentine); **McDavid, Andrew Dax**, Stalker Energy, Austin (P.A. Strunk, W.A. Walker Jr., W.L. Fisher); **Mobley, Casey R.**, Chevron, Houston (G. Pritchard, G. Rhoads, E. Van Reet); **Murray, Mychal**, Chevron, Houston (D.S. Beaty, D.E. Rowan, R.C. Bain); **Phillips, Mark Ingrum**, M.I. Phillips, Wichita Falls (J.L. Gilbert, J.W. Ritchie, D. Vader); **Rabson, William**, Dynamic Global Advisors, Houston (J.R.J. Studlick, B.J. Radovich, T. Matava); **Serrano, Isabel Cristina**, Edge Petroleum Corp., Houston (B.L. Faulkner, J.M. DeGraff, H.A. Creasey); **Shetler, J. David**, Black River Limited, San Antonio (reinstate); **Stolte, Christian**, Schlumberger, Houston (K.S. Glaser, D.R. Paddock, T.C. Hay); **Stull, Kenneth E.**, Schlumberger, San Antonio (D.L. Fairhurst, M.A. Norville, M.M. Guethle); **Throckmorton, Tracey Tolson**, Texas General Land Office, Austin (P.A. Boone, D.L. Collier, D. Hyatt); **Tompkins, Clifford Franklin**, DeGolyer and MacNaughton, Dallas (H.W. Peace, P.L. Neat, J.D. Hooks); **West, James Charles**, Pioneer Exploration, Houston (reinstate)

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People's Republic of China
Xue, Guanghua, ConocoPhillips China, Beijing (C.M. Curtis, R.J. Hofer, S. Li)

Poland
Porebski, Szczepan Jan, Polish Academy of Sciences, Krakow (reinstate) □

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Certification

The following is a candidate for certification by the Division of Professional Affairs.

Petroleum Geologist

Texas
Brennen, James D., consultant, Garland (L. Billingsley, H.W. Kiatta, B. Layton)

Commentary

Some Will Learn, Others 'Believe'

By GENE SHINN

The Marcellus shale cover story in the March EXPLORER was outstanding – not only is it a unique application of science and technology to tease out more gas, but because of another striking implication.

Just show that cover to most anyone and ask, "What do you see?" They will likely say, "I see a man standing on an old concrete sidewalk near a stream." I tried it on several people and that was their response.

My point – nothing to do with oil and gas – is that it is a wonderful example of how nature can mimic man-made objects.

Off the island of Bimini in the Bahamas there are several rows of stones that a growing group of New Age thinkers swear was made by ancient humans. In fact, a large number will say it is the remains of Atlantis!

I made the mistake of pointing out its natural origin some years ago and now there is a Web site

(<http://www.mysterious-america.net/bimini-caysal200.html>) that claims I am part of a government conspiracy to keep the public from knowing the truth!

This came about because I once cored the stones and determined they were beachrock formed a few thousand years ago when sea level was lower. Their straight alignment and shape is not unusual, because beachrock forms on stable beaches in warm tropical seas. If the beach is straight, the rock is straight.

Once exposed to the sun the slabs of



Photos courtesy of Gene Shinn



Shinn

The belief in Atlantian-made structures points the finger squarely at our education system and our poor job of imbuing critical thinking in our youth.

rock break up like an old sidewalk.

Unfortunately, there are the followers of Edgar Cayce and his Foundation who think otherwise. You see Cayce, who according to the faithful, communicated with reincarnated souls of Atlantians, and

they revealed to him that Atlantis is located off the island of Bimini.

The rush of New Agers beginning in the 1960s was on and, regrettably, many were putting real money into the search. Unfortunately, history is repeating itself.



Nature at work: The cover photo of the March EXPLORER reminded Gene Shinn about the "wonderful" way nature mimics man-made objects on the sea floor at Bimini (left and right shots).

The true believers' basic argument is that nature does not produce straight lines; it must therefore be the work of man, even though no man-made artifacts have been found.

The Marcellus shale photos clearly disprove that assumption, as do recently discovered identical submarine sites elsewhere.

My first publication on the subject, "Bimini's Atlantis Hoax," was serious and intended to warn potential investors of the scam. Meanwhile numerous TV programs, most recently the History Channel, show underwater photos of the aligned Bimini stones with statements like, "Nobody knows the origin of these stones."

My second publication, although a

continued on next page

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5/6 **Midcontinent:** CO₂ Applications for Enhanced Oil Recovery and Sequestration - Wichita, KS.

5/8 **Texas/SE NM:** How to Start/Fix/Manage a Small Waterflood - Midland, TX.

5/Var. **West Coast:** Well Logging - Long Beach (5/14) and Bakersfield (5/15)

5/15 **Texas/SE NM:** Fractured Reservoirs (Midland College) - Midland, TX.

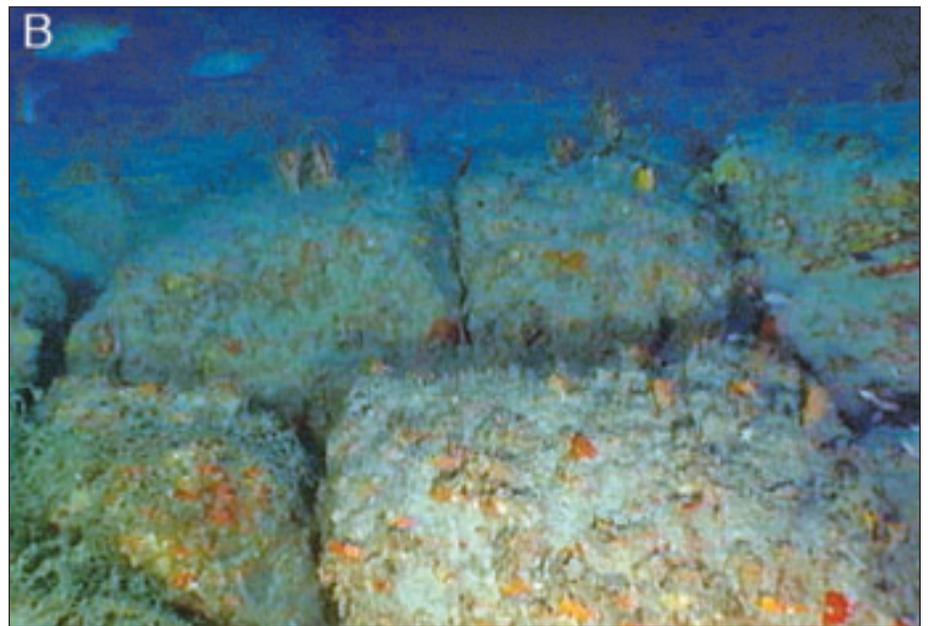
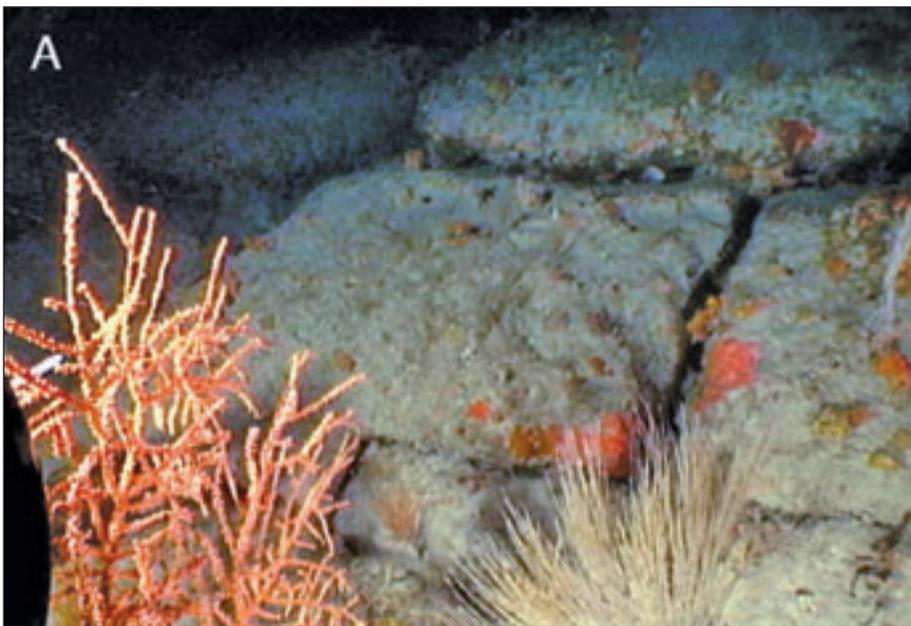
5/29 **Eastern:** Drilling & Completion in the Shales of Appalachia - Columbus, OH.

5/TBD **Central/Eastern Gulf:** Little Cedar Creek Field Case Study - Jackson, MS.

6/4 **Central/Eastern Gulf:** Enhanced Oil Recovery and CO₂ EOR - Shreveport, LA.

6/10 **Eastern:** Structural Principles and Trap Geometries in the Northern Appalachians - Morgantown, WV.

For further information, view PTTC's online calendar at www.pttc.org/national_calendar.htm



continued from previous page

spoof, was a true accounting of adventures with the true believers spanning a 30-year period. It was published in the *Skeptical Inquirer*, and this one really brought down the wrath of the Cacyites. They claim my work is a hoax.

I must admit, however, it has been a fun ride and a great lesson in human foibles.

When the special session, "A Tribute to (AAPG member) Bob Ginsburg" was organized for the 2005 Geological Society of America meeting in Denver I knew just what to present. You see, Bob's first publication in 1953 was on the formation of beachrock at Dry Tortugas. It was a fun, lighthearted presentation but with some serious implications.

Because of the Bimini stones (also called the Bimini Road) layout, they could be considered an example of "intelligent design." The belief in Atlantean-made structures points the finger squarely at our education system and our poor job of imbuing critical thinking in our youth.

I admit giving the talk was fun, but writing the paper for the upcoming "A Tribute to Ginsburg" volume for the journal *Sedimentology* was difficult. I had learned from earlier attempts that if you misspell a word the true believers will zero-in and throw the baby out with the bathwater.

I also had to be serious, because peer-review does not take kindly to scientists who stray into strange areas beyond our profession.

I hope all readers will pick up the baton and educate when and where you can.

Once again, I wish to thank all those involved in the Marcellus shale article, and especially Gary Lash, who took the cover photograph. It is a great example of what nature can do.

Now we can only hope the New Age thinkers don't see the images. They will surely say, "ancient beings from outer space created the formation during the Devonian and filled it with gas for our future use." □

(Editor's note: AAPG member Eugene "Gene" Shinn retired in 2006 as a geologist for the U.S. Geological Survey, where he was recognized as a pioneer in scientific research in carbonate sedimentology and coral-reef ecosystems. He is now with the University of South Florida in St. Petersburg, Fla.)



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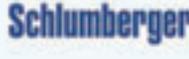

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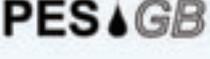

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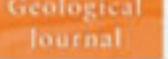

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All qualified candidates are encouraged to apply; however, Canadians and permanent residents will be given priority. The University of Calgary respects, appreciates and encourages diversity.

To see all University of Calgary academic positions, please visit: www.ucalgary.ca/hr/careers.

**READER'Sforum**

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.

Salaries

Regarding the findings of your recent AAPG Salary Survey (April EXPLORER):

I have been working for nearly four years in the industry, and have my M.S. in geology. When I first started I worked for an independent in Wichita, Kan., and started at \$37,000 – very, very low, even for just four years ago. That is why I got

fed up two years ago and left for a major – and by both tables, I make about \$20,000 less than the figures for the “3-5 year” experience category in 2007, and about \$10,000 less than the average M.S. with three-five years experience.

Just some food for thought.

Kent Swartz
Houston

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Aberdeen, Scotland

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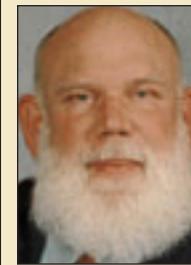
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Correction

An error in the April EXPLORER resulted in Patrick J. Gooding not being included in the list of this year's AAPG award winners.

Gooding, manager of the Kentucky Geological Survey's Well Sample and Core Library, was honored at the recent AAPG Annual



Gooding

Convention and Exhibition in San Antonio with a House of Delegates' Distinguished Member Award. Gooding, who has been an HoD delegate for the past five years, is presently

completing his fourth term as chair of the House's Credentials Committee. He's also chair of the AAPG Preservation of Geoscience Data Committee and a member of the GeoTour Committee.

Also receiving HoD Distinguished Member awards in San Antonio were John R.V. Brooks, of Brookwood, England; and Alan L. DeGood, Goddard, Kan. Jeannie Fisher Mallick, with Milagro Exploration in Houston, received the House's Long Service Award.

The EXPLORER regrets the error.

INmemory

Morton Bigger Jr. (AC '47)

Dallas

Charles A. Hinton (AC '48)

Mount Pleasant, Texas

Robert Lill (EM '51)

Calgary, Canada

Robert H. Paschall, 90

Bishop, Calif., Dec. 8, 2007

David N. Schell, 80

Covington, La., Feb. 20, 2008

Glenn L. Shepherd, 86

Wailuku, Hawaii, March 10, 2008

Roger D. Steward, 82

Corpus Christi, Texas
March 8, 2008

Jacques W. Vincent, 78

Tulsa, March 18, 2008

R.J. Yedlosky, 76

Fairmont, W.Va., March 8, 2008

(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.)

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William B. Hansen, Jireh Consulting Services, Great Falls, MT

<http://www.aapg.org/education/fieldseminars/details.cfm?ID=19>



Sedimentology And Sequence Stratigraphic Response Of Paralic Deposits To Changes In Accommodation: Predicting Reservoir Architecture, Book Cliffs, Utah

September 18-25, 2008

Begins and ends in Grand Junction, Colorado

Keith W. Shanley, Consultant, Denver, CO; J. Michael Boyles, Shell International E&P, Houston, TX

<http://www.aapg.org/education/fieldseminars/details.cfm?ID=16>



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June 14-21; September 25-October 2, 2008

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Walter J. Sexton, Athena Technologies, Inc., Columbia, SC

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Lee F. Krystinik, Fossil Creek Resources, Fort Worth, TX and Beverly Blakeney DeJarnett, Bureau of Economic Geology, The University of Texas, Houston, TX

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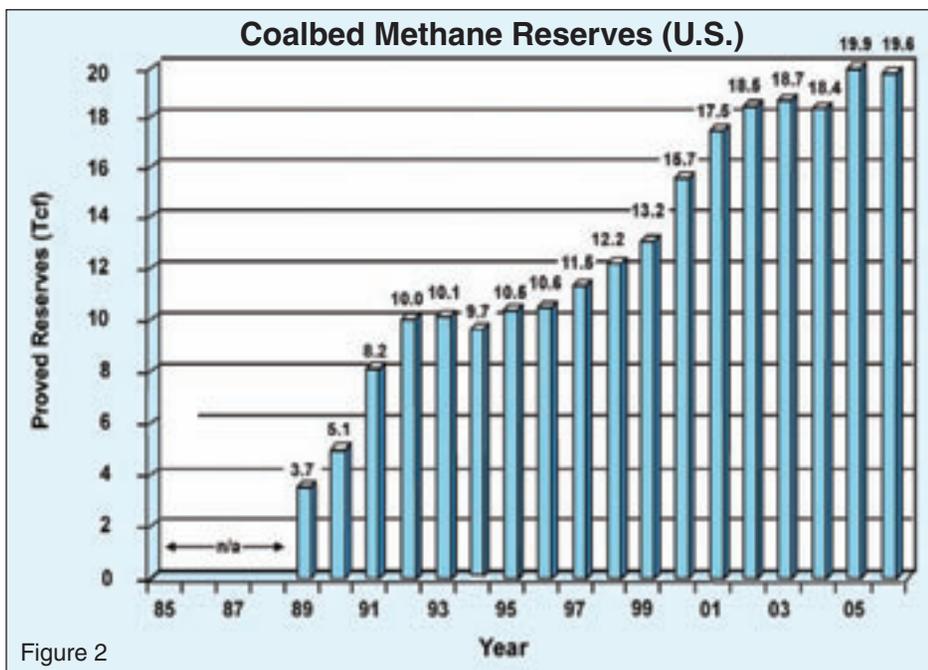


Figure 2

Coalbed Methane

from page 58

unconventional resources such as coalbed methane and gas shales worldwide is critical for economic stability and continued growth.

Enhanced coalbed methane recovery using sequestered greenhouse gases (carbon dioxide) and microbial conversion of the coal and sorbed gases into methane may represent a solution to solving energy and environmental objectives simultaneously and development of these technologies is accelerating to meet global demand. □

(Editor's note: Scott is with Altuda Energy Corporation in San Antonio and was general technical program co-chair for the recent AAPG Annual Convention and Exhibition.)

From Hazard To Resource

Coal mine explosions have been known for centuries, and the gas associated with coal mining operations always has been of major concern.

However, despite the early failures to recognize coal gas as beneficial rather than simply a mining hazard, Scotsman William Murdoch was the first to recognize the usefulness of coal gas as an illuminant in the late 1700s. Coal gas remained an important illuminating source for the world until it was replaced by electricity.

The first true coalbed methane production in North America is harder to pinpoint, but it probably occurred in West Virginia, Ohio, Oklahoma and other locations in the early 1920s and the 1930s. The early discoveries were serendipitous and tapped into water-free coal beds on structural highs.

These early wells were clearly targeted at coal seams, and it appears that at least one operator may have applied the same exploration strategy in Ohio and West Virginia.

The Big Run Field in West Virginia was developed in 1932 and produced over 2 bcf (56MMm³) of coalbed methane from 25 or 30 wells, and apparently there are several other fields that also produced coalbed methane. The Excello Shale gas play in Oklahoma also tapped into a thin coal seam surrounded by carbonaceous shale, so it too can be considered an early coalbed methane play.

The first coalbed methane wells in the San Juan Basin were drilled by Stanolind (Amoco) in the 1950s along the Ignacio Anticline and did not produce significant amounts of water because the coals were structurally high. Phillips Petroleum also drilled and completed wells in Fruitland coal seams during this time period, and the San Juan 32-7 #6-17 well, completed in 1953, has been producing gas for more than 50 years with minimal decline in reservoir pressure.

The first attempt at dewatering coal seams to produce methane was performed by Amoco in 1977 at the Cahn Gas Com #1 well in the Cedar Hill Field. The IP for the test wells was only 100 Mcfd (2,832 m³d) with 100 Bbl (15.9 m³) of water, but this production soon increased to more than 1 Mmcf (28.2 Mmm³d) by 1979, and the modern era of coalbed methane exploration and development was started.

— ANDREW R. SCOTT

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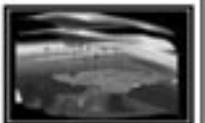
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The VP Finance will determine and provide for capital requirements and work closely with debt and equity sources to assure funds to support growth. He/She will direct preparation of monthly consolidations, capital return and allocation reports, budget comparisons against plan, tax, and other meaningful internal and external reports to measure performance against the business plan and return on capital expectations.

The successful candidate will advise the CEO and the management team in the capital allocation process providing the financial return analysis to determine use of equity and/or debt capital in

acquisitions and funding of exploitation, production, development, and (if appropriate) exploration. The successful candidate will participate in acquisitions and support closing negotiations.

The VP will selectively cultivate relationships with debt and equity sources, investment and commercial banks, other financial institutions, and value appraisal firms. The final candidate will be a "hands-on" financial strategist and tactician, providing for future funding and evaluating use and allocation of capital to enhance shareholder value while maintaining options for new opportunities.

The VP will assure commercial bank credits as needed and with the CEO co-lead external capital-raising efforts. The VP will support timely and meaningful communication of company performance to investors, lenders, and investment bankers as appropriate. The VP will have had fairly recent access to debt and/or equity capital markets, including existing relationships with investment and commercial bankers.

The Vice President of Finance will manage the build-out of a competent accounting and finance team.

Position Requirements

- This position requires a current certification in the state of California and a familiarity / general understanding of Canadian finance

and accounting procedure.

- Willingness to travel to Canada and South America as needs of job dictate.
- 5-10 years of finance, accounting, and/or audit experience. Experience in accounting in the exploration and production industry is desired.
- Experience in financial reporting, budgets, forecasting, and management reporting as it pertains to the oil & gas industry.
- Bachelor's degree in Accounting or Finance. CPA a must and a Masters in Accountancy a plus.
- Superior GAAP and SOX compliance knowledge.
- Excellent computer skills, especially with Microsoft Excel and PowerPoint required.
- Strong organizational skills and ability to multi-task required.
- Strong work ethic, positive attitude, strong communication skills, and results oriented.
- Ability to work overtime as required to meet internal and reporting deadlines.
- Based on prior experience, have access to domestic and selected international capital sources and markets.

For more information please contact Marek Helstrom at (661) 319-1700 or email at MHelstrom@pvecorp.com.

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Position Requirements:

- Willingness to travel to Canada and South America as needs dictate.
- Bachelor's or Graduate degree in Engineering with strong functional understanding of Oil & Gas exploration and development.
- General petroleum engineering experience – specifically:
 - Well Intervention & workover;
 - Well completions;
 - Production operations;
 - Ability to suggest and manage improvements to drilling, operations and service activities;
- Small-scale construction project capability;
- Supervision of service personnel;
- Broad understanding of subsurface issues (Prospect generation & target definition; Drilling; In-place volume estimation; Reservoir management);
- Ability to work with and influence operators to represent Company views as non-operator.
- Significant successful experience in Oil & Gas field operations in foreign locations.
- Experience in Oil & Gas operational budgeting, forecasting, and management.
- Exceptionally strong communication skills with the ability to work in a fast paced and sometimes stressful environment.
- Self-starter with the ability to anticipate and proactively manage problems and situations.
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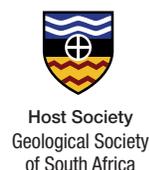
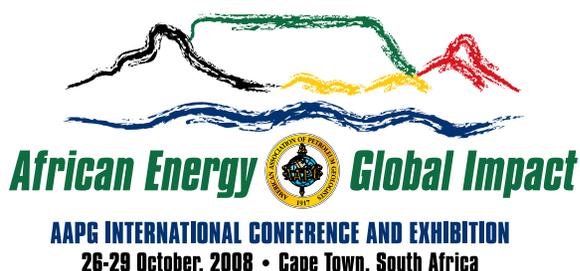
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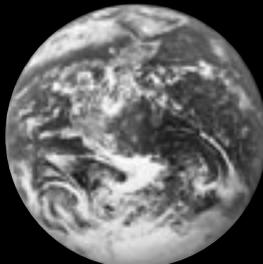
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We are seeking an enthusiastic earth scientist/petroleum geoscientist with proven experience in research, preferably with an established publications record. The position could include any branch of the petroleum geosciences, including structural geology, petroleum systems/basin analysis, reservoir sedimentology, sequence stratigraphy, 3D seismic interpretation and/or reservoir characterization/modeling. An established record in developing and managing petroleum industry-funded research projects would be advantageous.

The successful candidate will be the Director of the EGI/IC research alliance and based primarily at Imperial College in London. However, the position will involve establishing collaborative research links between EGI and IC, which will include time spent at EGI in Salt Lake City.

The level of the appointment will be subject to qualifications and experience, but will be at the Imperial College professorial level (minimum salary £59,430 pa).

A full curriculum vitae, application form and a recruitment monitoring form should be sent to:

Mrs. Maria A C Monteiro, Appointments Officer (Professors and Readers), Human Resources Division, Level 3 Faculty Building, Imperial College London, London SW7 2AZ, UK *email: m.monteiro@imperial.ac.uk*

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Further details and an application form are available from the Personnel Department, Royal Holloway, University of London, Egham, Surrey TW20 0EX; tel: 01784 414241; fax: 01784 473527; www.rhul.ac.uk/Personnel/JobVacancies.htm Please quote the reference **KB/514**

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Foundation Initiative Launched

By RICK FRITZ

Meeting Challenges – Assuring Success!

This is the theme for the fundraising campaign of the AAPG Foundation, whose mission is "to provide a source of funding to support educational, charitable and scientific objectives that directly and indirectly benefits the geologic professional and general public."

This financial campaign is designed to assure the mission is successful well into the future.

We first considered the program three years ago under the guidance of then-Foundation Chairman Jack Threet.

As a result, the AAPG Foundation started planning a financial program to increase funding for its key programs and emerging new opportunities.

The goal was to double the Foundation portfolio, which at that time was valued at a little over US\$16 million.

We initiated the program by hiring a consultant to conduct an audit and survey of selected AAPG Trustee Associates. We were not surprised that the survey indicated the Foundation had a good reputation, but we were very surprised to find that most members were not familiar with Foundation activities or support.

As a result we started a major ad



Fritz

campaign in the AAPG EXPLORER to define the Foundation's programs and objectives.

The survey also queried members about their interest in certain programs and topics. Based on the survey, the areas of greatest interest are K-12 education, public outreach and support of students and teachers. Of course, there also was great interest in science and dissemination of technical data.

After Bill Fisher became chairman of the Trustees, a Financial Campaign Committee was established with Jack Threet and Larry Funkhouser as co-chairs. Marta Weeks was asked to join the campaign, along with Bob Ardell, Bill Crain, Mike Party and Ed Picou. The remaining Foundation Trustees – John Amarusio, Bill Barrett, Marlan Downey, Jim Gibbs and Bill Gipson – are key members of the committee.

The "quiet phase" of the campaign began in July 2005. Shortly after, Austin Weeks bequeathed \$10 million to the AAPG Foundation. Marta Weeks agreed for its use as the lead gift in the campaign.

The financial campaign is designed to assure the Foundation's mission is successful well into the future.

* * *

I am writing this column a few weeks before we formally announce the campaign at the AAPG Annual Convention and Exhibition in San Antonio. Already the committee has raised another \$3.5 million mostly from only 70 Trustee Associate members.

Most important, the Financial Committee members have planted seeds for future giving. Many AAPG members have responded with great interest, and we expect to announce other major gifts in the near future.

We sincerely appreciate all of the work accomplished by the committee members and their tremendous service to both the Foundation and Association as well as the general public.

* * *

The "public phase" of the campaign is officially open. Our goal is to build the portfolio mostly with endowments for future generations.

The following are our key areas of focus and programs:

- ✓ Support opportunities for students and teachers to study geology.
- ✓ Provide financial assistance to students of all over the globe.
- ✓ Fund geoscience research and publications.
- ✓ Fund professional education opportunities.
- ✓ Facilitate the preservation and dissemination of geoscientific knowledge – especially in digital format.

The next step in the public phase is to provide all members with the opportunity to be part of the fundraising program. Look for announcements in the EXPLORER, BULLETIN, special mailings, town meetings, and on the AAPG Web site home page for information on how you can participate.

AAPG also will talk to industry and other institutions to provide immediate funding to jump start key projects.

* * *

Giving is contagious. I am always amazed how one gift leads to another.

We invite all AAPG members and the general public to give to the future of our profession, industry and society.

Resource beginning to be tapped globally

Coalbed Methane's Role Growing

By ANDREW R. SCOTT
EMD Coalbed Methane Committee
Co-Chair

Unconventional resources such as coalbed methane will become progressively more important worldwide as population continues to grow at an unprecedented – and possibly unsustainable – rate.

As a result, coalbed methane and other unconventional resources undoubtedly will play an important role in supplying energy needs to both economically developed and emerging nations worldwide in the foreseeable future.



Scott

* * *

Preliminary worldwide coalbed methane resources are estimated to range between 5,800 and 24,215 Tcf (164 to 686 Tm³).

The largest potential resources, which also have the largest degree of uncertainty, are in the Former Soviet Union with 4,000 to 16,116 Tcf (113 to 456 Tm³). North America ranges between 951 to 4,383 Tcf (27 to 124 Tm³), whereas South America and Europe range from 15 to 32 Tcf (42 to 91 Bm³) and 161 to 269 Tcf (4.6 to 7.6 Tm³), respectively. Africa ranges between 27 to 55 Tcf (760 to 1,557 Bm³), and the Middle East has no coalbed methane resources. The Asia Pacific

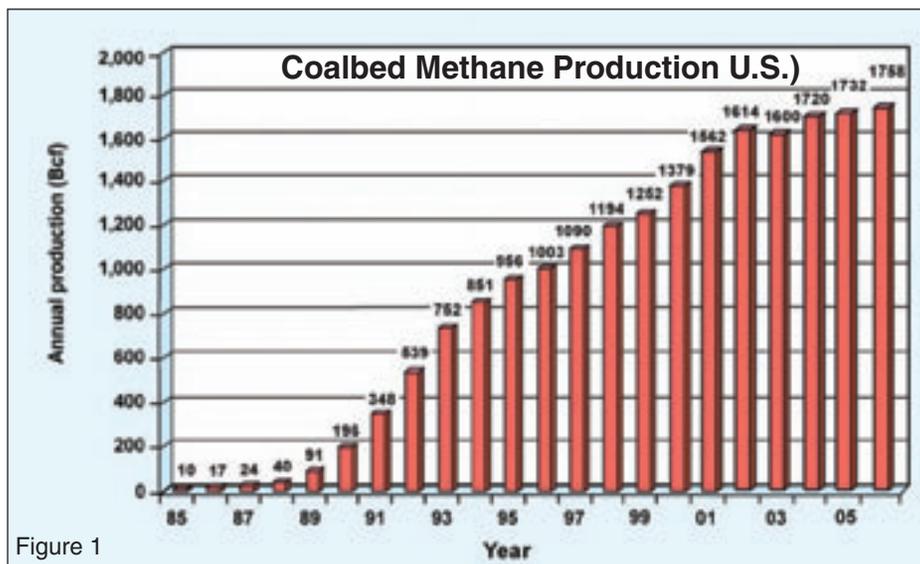


Figure 1

region, which includes China, ranges from 646 to 3,360 Tcf (18 to 95 Tm³).

The rate of coalbed methane resource development within individual countries will be highly variable due to local economic factors and government energy priorities and policies.

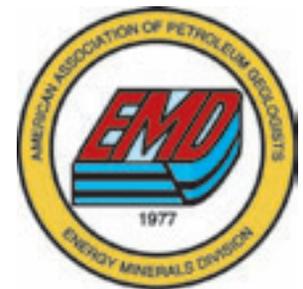
The United States remains the world leader in coalbed gas exploration, booked reserves and production, although coalbed methane production is expanding internationally – particularly in Canada and Australia, and commercial production from India will undoubtedly accelerate in the near future.

In North America, there is commercial coalbed gas production or exploration in approximately 12 U.S. and several

Canadian basins. Coalbed methane now represents 9 percent of 2006 dry-gas production and 9 percent of proved dry-gas reserves in the United States, with the major producing areas located in the San Juan, Powder River, Black Warrior, Raton, Central Appalachian and Uinta (Ferron and Book Cliffs) basins.

Other U.S. areas with significant exploration or production are the Cherokee, Arkoma, Illinois, Hanna, Gulf Coast and Greater Green River basins.

Annual coalbed methane production in the United States continues to increase, but not as rapidly as in previous years. The annual 2006 coalbed methane production was up slightly (1,758 Bcf; 49.8 Bm³) from 2005 coalbed methane



production, which was 1,732 Bcf (49.0 Bm³) from an estimated 54,000 wells (figure 1).

Coalbed methane reserves decreased slightly from 19.892 Tcf (563.3 Bm³) in 2004 to 19.620 Tcf (555.6 Bm³) in 2006, representing a decrease of only 72 Bcf (7.7 Bm³) (figure 2).

* * *

There are two important facts to remember:

✓ Demand for natural gas in the United States is expected to increase 50 percent over the next 20 years as additional co-generation power plants and natural gas electric power generation facilities are constructed.

✓ The global demand for energy will continue to increase regardless of the current economic downturn as the middle classes of emerging economies such as China and India continue to expand.

Therefore, development of

See **Coalbed Methane**, page 54

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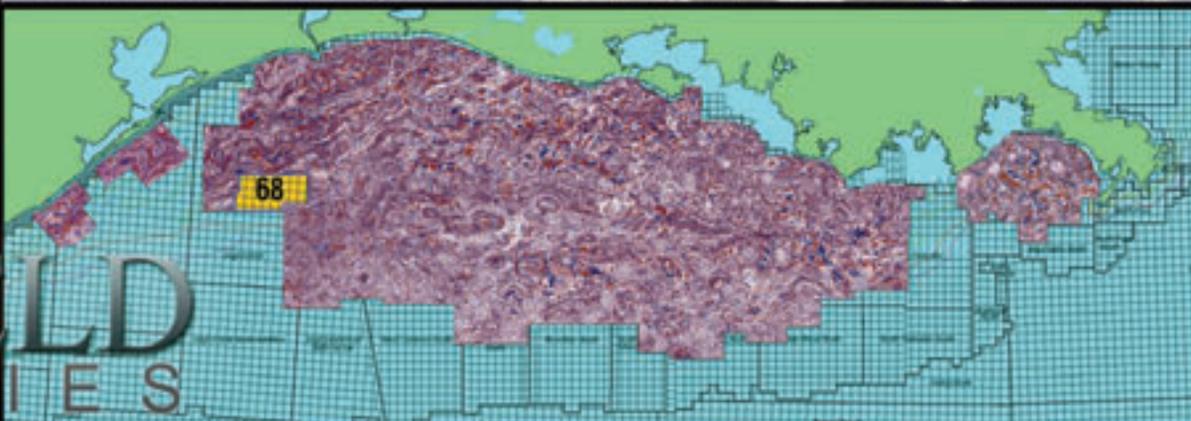
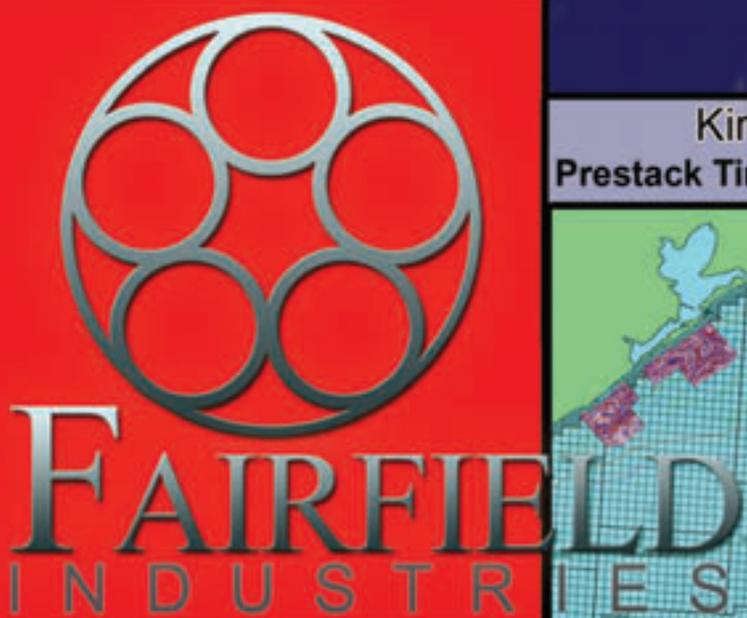
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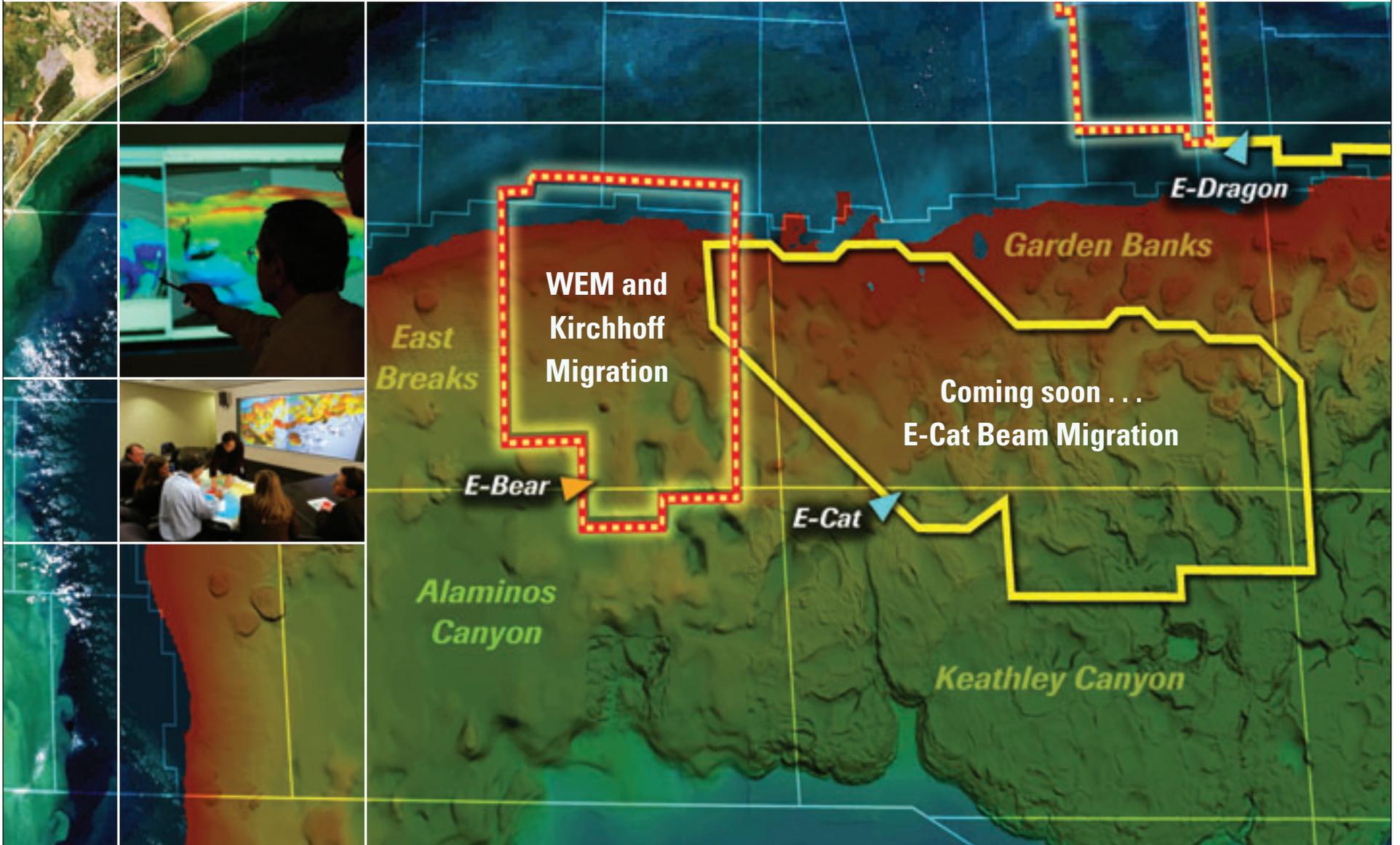
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