

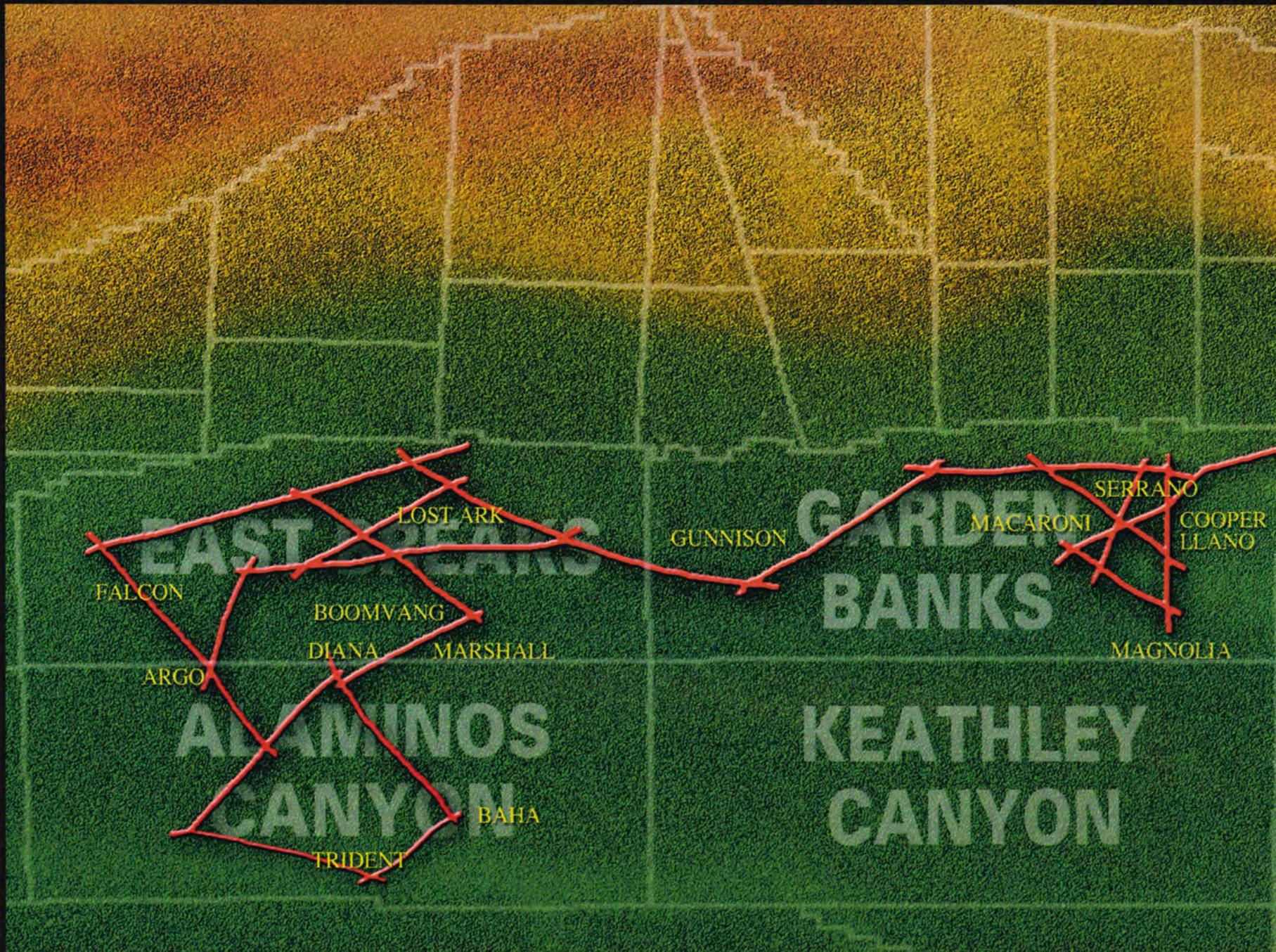
North to Alaska

No, We Don't Mean ANWR

See page 6

EXPLORER

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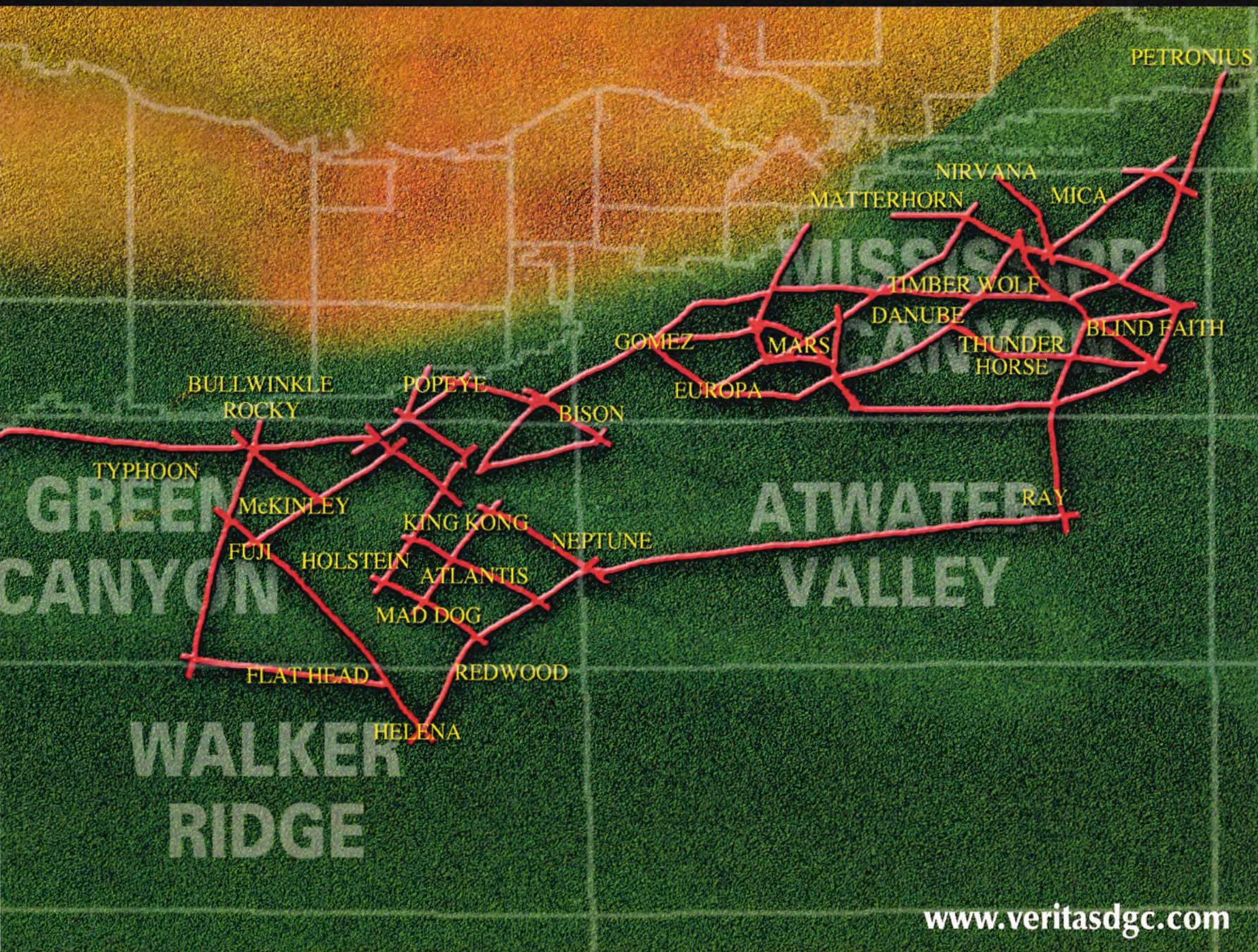


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Veritas Marine Surveys adds to its extensive deepwater Gulf of Mexico library with a long-offset 2D well tie survey. This program will initially consist of over 5350 full-fold 2D kilometers in four distinct geographic areas. The Long-Offset Deepwater Well Tie program will deliver 10,000-meter offsets for the first time in the deepwater Gulf of Mexico. Lines will be extended 10 kilometers past the wells to provide full fold data a minimum of five kilometers on each side of the wells. Over 100 wells will be tied in this survey.

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On the cover: A view looking west along Alaska's Atigun River in Atigun Gorge, about 130 miles south of Prudhoe Bay and 100 miles southeast of Umiat (nearest corner of the National Petroleum Reserve-Alaska). The dark-colored slope behind the helicopter exposes the contact between shales of the Torok Formation (low on the slope) and overlying sandstones of the Fortress Mountain Formation, both Lower Cretaceous in age. The sandstones here are shallow marine to deltaic facies, and are lightly oil stained. Dark-colored rocks along river are intensely deformed Permian to Lower Cretaceous rocks of the Siksikpuk and Okpikruak formations. Mountains in background are mostly carbonates of Carboniferous-aged Lisburne Group. These exposures provide important constraints on stratigraphic and structural relations that are important to assessment of oil and gas potential in the NPR-A. Photo by Dave Houseknecht.

CONTENTS

- Coming soon: A new USGS resource assessment of the **National Petroleum Reserve-Alaska**, an area that may hold the key to Alaska's exploration future. **6**
- A potentially controversial paper proposes a new category for **oil and gas evaluation**: "Viable resource." **10**
- Geoscience projects and targets that are unconventional today can become commonplace tomorrow – but only with a commitment by industry and government to **research**. **12**
- What's the **state of the geophysical industry** today? Still breathing, but still hurting. **18**
- The geophysical industry is facing a host of **environmental and safety issues** that threaten all seismic operations. **20**
- Deeper targets? Deeper water? Maturing fields? Whatever the challenge, the **geophysical technology** needed for the most complex and demanding scenarios seems at hand. **22**
- And now, for something completely different: Seismic is being used in Belize to help archaeologists reconstruct the events that led to the **disappearance of the Maya**. **24**

REGULAR DEPARTMENTS

Geophysical Corner	28	Membership and Certification	47
International Bulletin Board	30	Readers' Forum	48
Business Side of Geology	32	Professional News Briefs	48
www.aapg.org Update	41	In Memory	49
Foundation Update	42	Classified Ads	50
DEG Reporter	44	Director's Corner	51
Education Calendar	46	EMD Column	51

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PRESIDENT'S COLUMN

Cairo Charmed, Cairo Bound

By ROBBIE GRIES

My daughter spent a high school year as an exchange student in Cairo with an Egyptian family she came to know as "Mom and Dad" – and enjoyed, for the first time ever, a sister and a brother! She traveled all over the city (at all hours day and night) and was at much less risk than she had been doing the same in Denver.

Her letters and pictures sent home of this fascinating city, incredible culture and warmly embracing people made me look forward to the time when I could enjoy it for myself.

Now Cairo is my number one destination objective next fall!

On September 11, AAPG President-Elect Daniel L. Smith, Executive Director Rick Fritz, AAPG convention staff member Dana Free and I were in San Antonio at the SEG annual meeting with Walt Lynn, SEG president, and our counterparts from Cairo. Our planning and discussions came to a halt with the horrifying news of that day.

Each one of us was in an emotional state, and not willing to make any decisions in that condition.

Weeks later, after careful thought, all four societies involved in Cairo meeting discussions decided to forge ahead with the plans we had started for a joint conference in Cairo.

AAPG enjoys a partnership with SEG, the Egyptian Petroleum Exploration Society and the Egyptian Geophysical Society. The EAGE is joining the meeting as a technical program contributor.

We all carefully re-planned the Cairo meeting to minimize our financial risk, including budgeting for fewer attendees and more security. AAPG and partners found ways to mitigate and share financial risk and to strengthen ever-present security plans.

Why would we stay committed to a meeting in North Africa?

□ AAPG has a great number of members and corporate friends in Europe that live and work in North Africa. They are committed to and involved in Africa and the Middle East. They are dedicated to developing membership and geoscience programs.

□ We have members and corporate friends in Houston that explore and develop in Africa.

□ AAPG has members all over Africa – and especially in Cairo – who have worked tirelessly and selflessly toward this meeting for two years.

Companies and members alike that are involved continue to offer their full support and enthusiasm for AAPG's next international meeting. They are assisting with our sponsorship and with the outstanding technical sessions.

The field trip committee never missed a beat – they are providing us with choices that will knock your socks off! And the cultural program is the envy of any region.

Samir Abdelmoaty (BP), who has



Robbie Gries in Cairo, Egypt, as she and others made final plans for this fall's AAPG International Conference and Exhibition.

chaired the arrangement committee for two previous meetings in Cairo, brings a treasure of experience and advice to our organizing committee, which includes David Blanchard (Ocean Energy) and Mike Cochran (Anadarko).

Our AAPG African regional president, Bayo Akinpelu, promises a wealth of West African papers and participants, and AAPG's Middle East regional president, Mahmoud Abdul-Baqi, has developed amazing support and technical program ideas.

The European Region has participated from the beginning, too, especially through the efforts of Wolfgang Schollinberger and our European regional president, David Roberts.

Companies like BP, TotalFinaElf, ChevronTexaco, Shell, Agip, Anadarko, OceanEnergy, Apache, British Gas, Halliburton ... and so many others (Hey! even Priority Oil & Gas!) have stayed committed to this meeting.

Conference Chairman Moustafa El Ayouty, one of the pioneers of Egypt's petroleum industry, has an excellent team assembled, and also enjoys the support of the Petroleum Ministry of Egypt.

Working with this team in Cairo has been a pleasure for everyone.

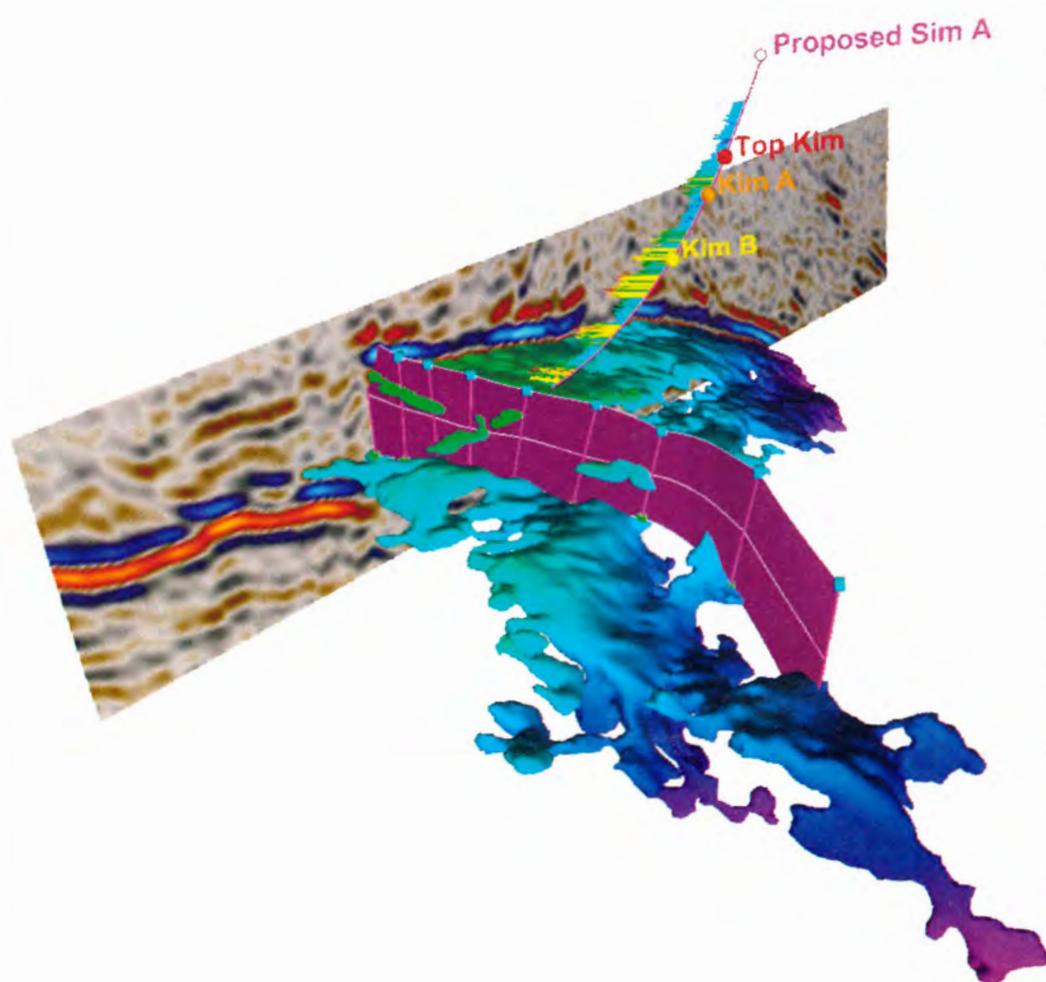
The next best thing will be spending October 27-30 there – and I'll add on some days for two of these amazing field trips.

Hope you will join me!

Robbie Gries



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"Shell U.K. Exploration and Production successfully used Petrel to make a structural model of the company's highly complex North Cormorant reservoir"

*New Assessment Could Change Alaska Focus***NPR-A Looking Good After Study**

By DAVID BROWN
EXPLORER Correspondent

The National Petroleum Reserve-Alaska (NPR-A) could offer enormous potential for frontier exploration, plus one important advantage:

It isn't ANWR.

In May, the U.S. Geological Survey will release a new NPR-A resource assessment, with estimates of undiscovered oil and gas and descriptions of known plays – a study that is sure to raise the industry's awareness of the area.

It might raise a few eyebrows, as well.

With several promising oil plays, a likely conventional gas resource and significant potential for coalbed methane production, NPR-A may become the focus for future Alaska drilling.

After the USGS releases its resource assessment in Washington, D.C., it will provide a detailed review May 19-22 at the AAPG/SPE Pacific Regional Conference in Anchorage.

The Survey plans more than 30 presentations at the meeting, including papers, posters and core workshops. Ken Bird, USGS project chief in Menlo Park, Calif., will summarize the study.

NPR-A is "a dream province to work in for a geologist like me," said David Houseknecht, USGS research geologist in Reston, Va., "because it is one of the few onshore provinces in North America that still has the potential for 100-500 million barrel accumulations to be discovered, and where you can still



Geologists examine shallow marine strata of Lower Cretaceous Nanushuk Formation about 40 miles west of NPR-A.

make significant contributions by putting together regional studies."

A Huge, Diverse Region

In June, the U.S. Bureau of Land Management will hold a lease sale on about four million acres in NPR-A's northeast corner.

BLM currently is preparing an EIS for another area, on acreage just to the west, where a lease sale may be held as early as 2004. Houseknecht described an earlier NPR-A lease sale in May 1999 as "highly successful," generating over \$100 million in winning bids for about 870,000 lease acres.

Covering more than 36,000 square miles, NPR-A extends along and inland from the northern coast of Alaska. Point Barrow is roughly a centerpoint at its north, and the Brooks Range of mountains a limit to its south.

"NPR-A is such a huge area that it encompasses everything from the northern front of the Brooks Range to a broad foothills belt that represents the surficial expression of the thrust belt, to a marshy coastal plain," Houseknecht said.

Geologically it is very diverse, he added, with rocks from Mississippian in age ranging up to late Cretaceous in age.

"In vast areas of NPR-A there is

continued on next page

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essentially no well control," Houseknecht said. "It is truly a frontier province where regional studies matter, where outcrop work still has significance."

He said the USGS has been working on the current NPR-A project for almost four years. The most recent previous resource assessment of the Reserve was released in 1980.

Included in the new NPR-A assessment will be:

- Probabilistic estimates of in-place and technically recoverable resources for each play and the entire NPR-A.

- Estimates of economically recoverable oil and gas resources.

- Digital maps of each play.

- Distribution of accumulation sizes for each play.

Houseknecht said a six-page color fact sheet will be distributed on the mid-May release date, with a more detailed "e-bulletin" subsequently accessible through the USGS Web site at www.usgs.gov.

Local Support

NPR-A has a similar climate to ANWR, but not the intense political heat. Opening most of its area for exploration may be viewed favorably by policy makers.

It's already supported by the people who live there.

Richard Glenn, vice president-land for the Arctic Slope Regional Corp., lives in Barrow, Alaska. He holds a master's degree in geology from the University of Alaska at Fairbanks.

Glenn also serves as co-captain of a Barrow whaling crew, the Savik Ahmaogak Crew.

"The North Slope people have advocated for safe, responsible onshore exploration," Glenn said. "Our municipality tax base depends on the tax revenue generated from oil and gas infrastructure.

"The revenue has built schools, health clinics, fire halls and other community necessities in our villages," he continued. "The industry represents one of the few places where our people can work in our region, which lacks agriculture, commercial logging or fishing, or other economic bases."

Growing interest in exploring NPR-A "tests our mettle," said Glenn, whose mother was born in Barrow and is an Inupiaq Eskimo. He was born in California and returned to Barrow as a youngster.

"Our culture has been changing for centuries," he said. "Exploration success in NPR-A is bound to change things. Some for the better, and others for the worse. We believe that on balance, the advantages outweigh the disadvantages."

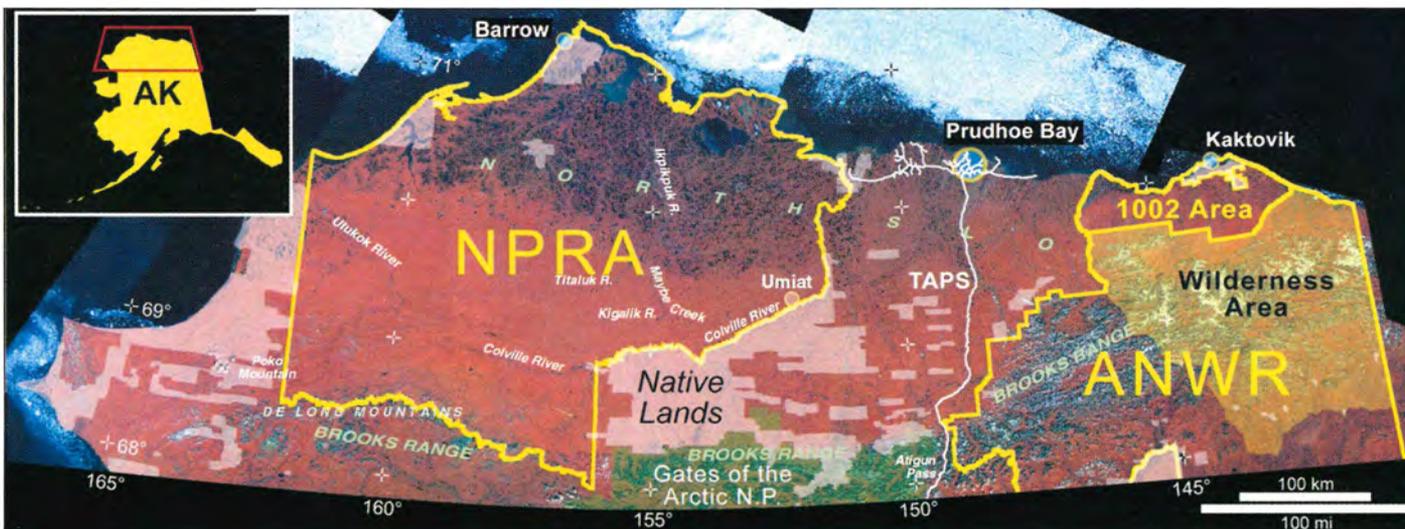
One advantage favoring NPR-A development stems from its designation as a petroleum reserve, not a "wildlife refuge."

Glenn observed that both NPR-A and ANWR host wildlife resources and also offer millions of acres of geologic potential.

"NPR-A is a petroleum reserve and so carries much less of the mythic trappings that the 1002 Area of the ANWR coastal plain has," he said.

"In truth, on the surface there is little difference between the coastal plain of NPR-A and the coastal plain of ANWR," he added. "Both areas lie within the traditional homeland of our Inupiat people, with camps and settlements up nearly every river drainage along the coastline."

See **NPR-A**, next page



A geographical setting of the National Petroleum Reserve-Alaska (NPR-A): At 23 million acres, or 36,000 square miles, it's about the size of the state of Indiana. The Arctic National Wildlife Refuge (ANWR) comprises 19 million acres, or 30,000 square miles, and is about the size of South Carolina. The 1002 Area holds 1.5 million acres, or 2,300 square miles, about the size of Delaware.

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NPR-A

from previous page

Seeps Started the Saga

Glenn observed that northern Alaska first attracted exploration interest more than 100 years ago. The USGS began studying the area in 1901, drawn there in part by the discovery of oil seeps.

In 1923, the Federal government set aside a sizeable expanse as Naval Petroleum Reserve Number 4. The Navy sponsored two multiyear exploration programs in the Reserve, the first spurred by World War II and the second by the Prudhoe Bay discovery and the Arab oil boycott.

After almost 50 test wells, the Umiat Field, discovered in 1946, remained the largest known oil accumulation in the Reserve at 70 million barrels. The area became a National Petroleum Reserve in 1976, with the USGS responsible for further research and evaluation.

Additional exploration took place in the 1980s following BLM lease sales. No commercial discoveries resulted from the effort, though Houseknecht noted that one well, the Chevron Livehorse, is still a tight hole after 20 years.

After some offshore disappointments, industry interest in northern Alaska and NPR-A waned. Arco Alaska attempted exploration just to the east of NPR-A in 1994-95, targeting a turbidite prospect near the Colville River Delta.

That try also failed, Houseknecht said, but Arco decided to drill deeper for a look at sands in the Kingak shale. It found the Alpine reservoir.

Alpine Success

Estimates of Alpine oil reserves range up to 430 million barrels, and Houseknecht said the reserve estimates are expected to increase, based on current production rates. It's high quality oil, at 40 degrees API gravity.

Phillips Petroleum became operator of the Alpine field when it acquired Arco's Alaska holdings. Alpine production began in late 2000 and, through a series of improvements, subsequently reached 100,000 barrels per day.

"The size of the reservoir and the nature of the oil discovered there came as a surprise even to the industry, because a reservoir of this quality was previously not known in that formation," Houseknecht said.

Phillips later announced two Alpine satellite discoveries.

In Fiord, five miles to the north, one of two initial wells tested at 2,500 barrels of oil per day. A test well drilled at Nanuq, six miles to the south of Alpine, produced 1,750 barrels of oil and 1.2 million cubic feet of gas per day.

Phillips said it plans to begin production from both areas when processing capacity becomes available at Alpine. Anadarko Petroleum holds a 22 percent interest in Alpine and the satellites, and is an active driller in the area.

A Brookian turbidite play, also just to the east of NPR-A, already has led to discovery of the Tarn oil field, with an estimated 70 million barrels of reserves, and the Meltwater field, with 50 million barrels.

"After two recent drilling seasons, Phillips Alaska announced last May that all of their NPR-A exploration wells but one tested oil and gas and could be commercial," Houseknecht said.

"Collectively, all of this success has resulted in tremendous industry interest, because it is known based on our work and the work of others that these plays

"These reservoirs are fine-grained in subtle stratigraphic traps. Sequence stratigraphy is important."

extend westward into NPR-A," he added.

Houseknecht identified three promising plays that extend into and across the Reserve:

- ✓ A Beaufortian Upper Jurassic Topset play (Alpine).
- ✓ A Brookian Clinoform play (Tarn).
- ✓ A Torok structural play to the south.

"During field work in support of our assessment, we discovered and described an oil-stained, amalgamated sandstone succession – probably a channelized turbidite system – that we were able to trace for about 12 miles

along strike," he said. "The main body of the oil-stained sandstone is about 300 feet thick."

Exploration success in the NPR-A area has resulted from the 3-D seismic identification of subtle stratigraphic traps as well as "integrated, interdisciplinary geoscience analysis," he observed.

"These reservoirs are fine-grained in subtle stratigraphic traps," Houseknecht noted. "Sequence stratigraphy is important."

"It's also very important to understand the geochemistry of the source rocks

and the migration history of the hydrocarbons," he added, "because it can increase your probability of commercial discovery."

Target: Coalbed Methane

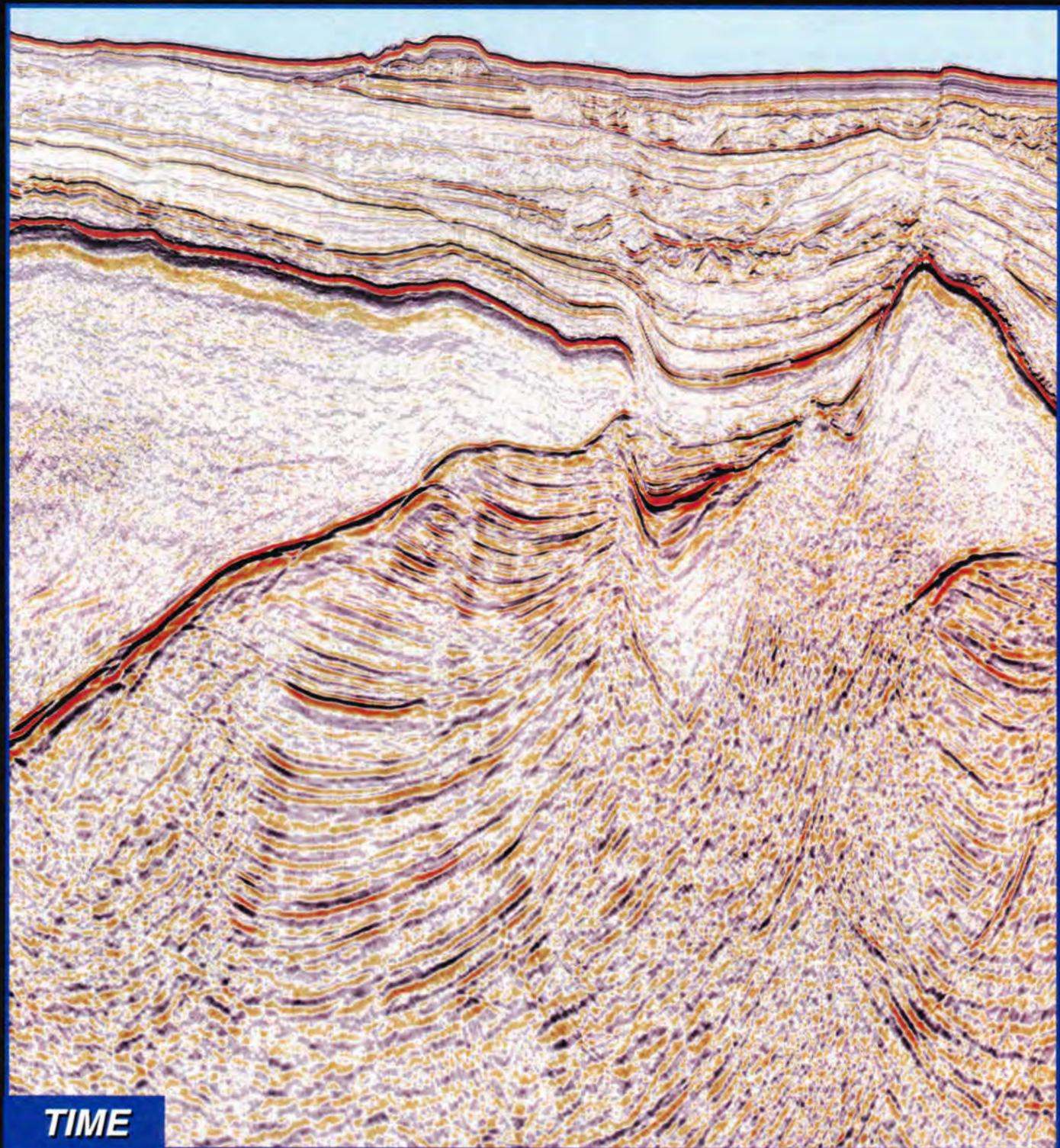
In addition to its potential for conventional oil and gas accumulations, NPR-A offers the promise of substantial coalbed methane production.

"The North Slope is probably the largest coal basin in North America," said Charles Barker, research geologist for the USGS in Denver.

"I've been working in Alaska since 1997," he said. "The problem is there's no data about the gas content of the coal."

continued on next page

MISSISSIPPI CANYON . . .



TGS-NOPEC Geophysical Company is pleased to announce the availability of 627 OCS blocks of 3D Pre-Stack Time Migration seismic data in the Mississippi Canyon Area of Offshore Louisiana. Currently 402 OCS blocks of 3D Pre-Stack Depth Migration data are available now with the final 225 OCS blocks coming available early Q3 of 2002. For additional information contact your TGS-NOPEC marketing representative and check us out on the web: www.tgsnopec.com



Left, the Lisburne well, drilled within the NPR-A in 1979; right, a sandstone bluff of Lower Cretaceous Nanushuk Formation on Poko Mountain, about 15 miles west of NPR-A.

... IN DEPTH COVERAGE



TGS NOPEC
G E O P H Y S I C A L C O M P A N Y

continued from previous page

"It's known that when the coal is penetrated, you get a gas kick," he continued. "They're extremely low-ash coals, in the order of 5 percent. Consequently they develop common cleat at low rank, and cleat permeability is essential to coalbed methane production."

Using worldwide averages for coal of the same rank as NPR-A, Barker estimated the area might have 200 trillion cubic feet of gas in place. He said the Reserve's coalbeds are within the normal development range for coalbed methane, up to 4,000 feet in depth.

Barker hopes to begin a two-year project to drill 4,000 to 5,000 feet deep slimhole test wells for coal gas in NPR-A.

"With helicopter support it's very rapid, about two weeks per well," he said. All he needs is funding.

Drilling with helicopter support costs about \$100 per foot, Barker estimated. He added that "helicopters are expensive."

"We're going up this summer to put stakes in the ground where we want to drill, and then start the permitting process. We have money to do that," he said.

If the test wells are funded and completed over a two-year period, an initial assessment of NPR-A coalbed methane resources could be completed within a few months of acquiring the final data, Barker said. Effective pipeline planning depends on a good understanding of all the gas resources in place, he noted.

"Because it's so isolated up there, it's a stranded market."

"Interest is rising because if they put in the gas pipeline, coalbed methane would be eligible to be produced to that," he explained. "Underdesign of the pipeline could strand gas up there for decades."

Development extent "depends on how much land you want to disturb," Barker said, citing the controversy over ANWR. "But this is an actual petroleum reserve."

Delicious Potential

Jim Clough is head of the Energy Resource Section of Alaska's Geological and Geophysical Survey. He thinks there's an excellent chance of producing NPR-A's coalbed methane resource.

"Personally, I'm very optimistic that it can and will be developed, probably much more readily than the coal will be developed," he said. "It's a lot easier to extract the gas."

Clough estimated North Slope coal resources at 3.7 trillion short tons.

"That's hypothetical," he commented.

See **Alaska**, page 11

'Think Tank' Charges Answered

Mankin Takes Case to Congress

By DAVID BROWN
EXPLORER Correspondent

As the U.S. Geological Survey prepares to issue a new resource assessment for the National Petroleum Reserve-Alaska, a RAND issue paper questions the common methodology for such assessments.

This paper, "A New Approach to Assessing Gas and Oil Resources in the Intermountain West," proposes a new category for oil and gas evaluation: viable resource.

The viable resource "is a fraction of the technically recoverable resource that is also economically feasible for production, sufficiently supported by infrastructure, and environmentally acceptable," the paper says.

Industry proponents quickly rejected the paper's conclusions, based on everything from the inappropriateness of economic limits on recoverable resources to the vagueness of the phrase "environmentally acceptable."

AAPG Secretary Charlie Mankin presented the Association's response to a congressional committee on April 18.

"The oil and gas that is there is there. We purposely do not put an economic limit on the price of oil and gas, because that becomes very time-dependent," said Lee Gerhard, principal geologist for the Kansas Geological Survey and chair of AAPG's Governmental Affairs Committee.

AAPG considers the USGS assessment methodology "sound, if

"There is so much misrepresentation and misinformation ... It is very difficult for the average citizen to know what's going on."



conservative," said Naresh Kumar, president of Growth Oil and Gas in Dallas and chair of AAPG's Committee on Resource Assessment.

"We do not endorse specific numbers, because this is an industry activity," he said.

RAND calls itself "a non-profit institution that helps improve policy and decision making through research and analysis."

It states that "views and conclusions expressed in issue papers are those of the authors and do not necessarily represent those of RAND or its research partners."

The February 2002 issue paper addresses the debate over access to potential natural gas resources in the Rocky Mountains area, citing conclusions in a 1999 National

Petroleum Council study and a later U.S. Department of Energy study of the Green River Basin (see related story on the AAPG Web site).

"In summary, the results of these access restriction studies overlook some important considerations and, in doing so, appear to be biased toward maximizing the amount of resources that are perceived to be precluded from development as a result of federal access restrictions," it says.

Kumar questioned that an artificial viability measure would be meaningful in assessing potential resources.

"What was not viable 10 years ago is perfectly viable today," he said.

He also noted that the paper makes no attempt to balance environmental impact against other effects of restriction, such as limitations on

national supply.

"AAPG has gone to Congress the past several years, making the statement that energy security is very, very important," Kumar said. "A lot of the resource is locked up under various restrictions and legislation.

"Oil is a worldwide commodity, but gas is a completely different matter," he continued. "It's a domestic issue. The Rocky Mountain Basin has a very significant gas resource, and two-thirds of the gas in the Rocky Mountains is under some sort of restriction."

Gerhard said AAPG and other industry groups have to publicly counter the position taken in the RAND paper, because "it will become a mantra" if left unchallenged.

"Note that the issue paper was funded by the William and Flora Hewlett Foundation for the Wilderness Society," he said. "It's an agenda-driven issue."

"There is so much misrepresentation and misinformation in the discussions on these politically charged issues that it is very difficult for the average citizen to know what's going on," he added.

In general, according to Kumar, initial resource estimates prove to be too low, and increase over time.

"There is no substitute for drilling. Based on today's information, the USGS comes up with estimates. But new plays, new concepts, new technologies keep coming," he said.

"Those resource numbers keep going up and up and up." □

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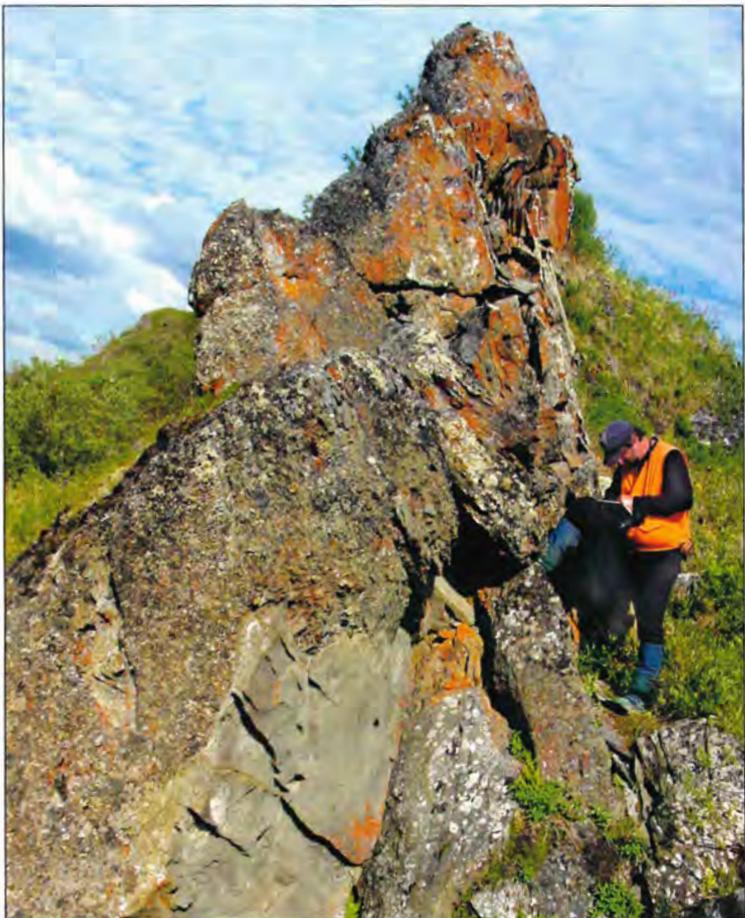
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A geologist at work in Alaska examines conglomerates in Cobblestone Sandstone member of the Fortress Mountain Formation. The large tan block is a clast of sandstone in conglomerate. This site is in the Brooks Range foothills, about 80 miles southeast of Umiat.

Alaska

from page 9

"but every time they've drilled into the west in the Deadfall syncline, the numbers hold."

With that kind of coal resource, the potential for coal gas can't be ignored, he said. It's a major attraction for energy development.

"They ought to consider the fact that down the road they may be able to produce at least 10 percent of this 800 Tcf of gas estimated on the North Slope. So there's another 80 Tcf of gas that could go down that pipeline," he said.

No one doubts that oil will drive the industry's expansion into NPR-A. Gas resources, both conventional and non-conventional, could bolster that interest, however.

"The farther west they go, the higher the gas potential is for the coalbed methane, because the coals are thicker and they're higher rank," Clough explained.

Even without the methane, NPR-A provides numerous exploration targets, with possibilities for production in almost every part of the Reserve.

"I think there's a tremendous potential for conventional oil and gas. Frankly, I think it's as good an oil play as it is a gas play. It will be dominantly stratigraphic traps," said Gil Mull, petroleum geologist for Alaska's Division of Oil and Gas.

"When you get down to the southern area the plays are going to be gassier, down in the foothills of the Brooks Range," he said. "When you go into the extreme southern part, you're in the thrust belt."

Recent work indicates that hydrocarbon potential across NPR-A might be more promising than believed earlier, according to Mull.

"We've found a belt with lower thermal maturity than we'd previously thought — really rich, good Upper Triassic to Middle Jurassic source rock," he said. "Clearly some of those oily source rocks were in the basin and in the cooker."

Mull also expects exploration to spread westward into NPR-A, though he said it may be slowed for at least three reasons:

- Companies will move further from existing infrastructure as they move

west.

- Gravel and other construction materials may be a problem to the west.

- Lack of pipeline transportation will be a limiting factor.

Ultimately, development will depend on economics. Mull noted that the industry already has started committing more resources to exploration groundwork.

"There's a lot of 3-D seismic being shot out there," he said. "The resolution with that 3-D seismic is absolutely awesome to me."

Challenges – and Endorsement

While NPR-A appears promising geologically, its remoteness, frontier nature and subtlety make economic exploration a question mark.

It's the type of region where dry holes are sure to be drilled, and sure to be expensive.

Over-regulation or expensive requirements may tip the balance away from resource development.

Glenn said NPR-A exploration presents logistical problems "that haven't been experienced in the Prudhoe Bay area for some time." Well locations are scattered along a 150-mile swath covering the area's northern and eastern edge, he noted.

"At the farthest-flung locations, the companies would have timing and supply issues, not to mention the lack of additional support infrastructure," Glenn said.

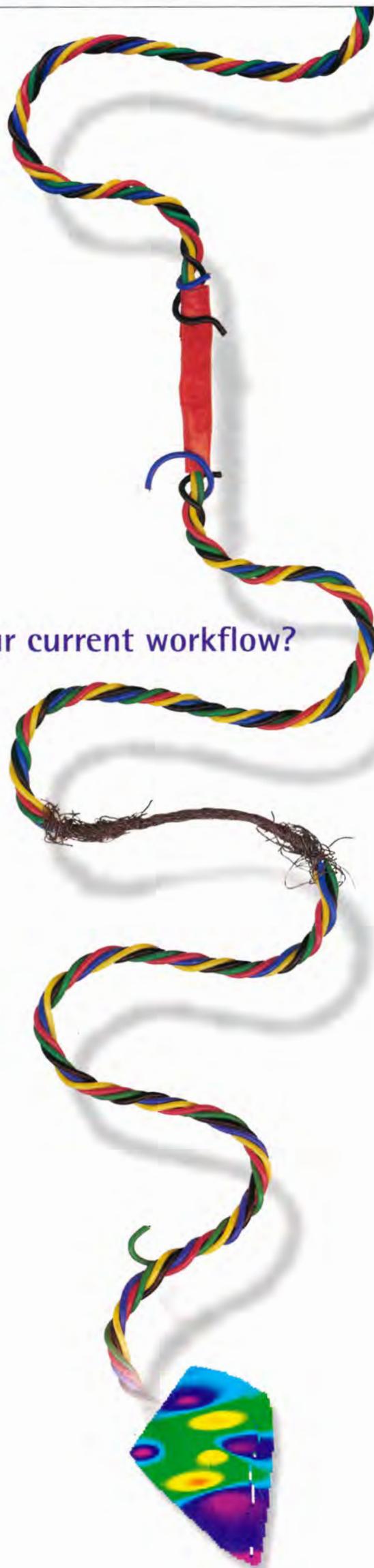
"The companies must make every wellsite as self-contained as possible. A rig will be stacked over the summer west of Teshekpuk Lake on an insulated ice pad, for instance, because it takes too long to wait for winter travel conditions to allow rig transport from the Prudhoe Bay area."

AAPG has published a policy statement on NPR-A:

"It is in the best interest of the United States to allow exploration and development activities in NPR-Alaska, one of the most prospective areas of the country," it says.

"AAPG not only supports the full leasing of the NPR-A area, including the coastal plain, but supports regulations and stipulations which allow for timely, economic and environmentally sound exploration and development activities in the area." □

Your current workflow?



Research, Incentives Needed

Gas Faces Unconventional Future

By KATHY SHIRLEY
EXPLORER Correspondent

What was once unconventional can become commonplace. Remember when fixing a lunch in a microwave oven was rare?

In the case of natural gas, the unconventional can become as common as the ubiquitous microwave.

What it will take, according to Scott Tinker, director of the Bureau of Economic Geology at the University of Texas at Austin and the Texas state geologist, is a commitment by industry and government to research.

"It will take a different research model ... to bring new unconventional resources on production, because the industry has undergone some fundamental changes."

"What is considered unconventional gas today will be the conventional gas of tomorrow – we already have seen that in the production curve," Tinker said.

"Coalbed methane, shale gas and tight gas were not sources of natural gas just 15 to 20 years ago," he said, "but investment in research (by the federal government and private

entities) along with incentives to explore for and produce these unconventional resources made these reserves attractive – and consequently new natural gas sources were brought into the mainstream.

"So, with the future rise in natural gas demand and a greater portion of the natural gas production coming from unconventional sources, it is imperative that we create new gas resources through research, technology and incentives."

Tinker stressed the importance of research in meeting America's future needs for natural gas in a paper at the recent annual meeting in Houston, "Fractures, Salt, Seismic and Ice: Vital Research Components of America's Natural Gas Energy Future."

"There are huge sources of natural gas available in North America, but increasingly those reserves will be from unconventional sources like coalbed methane, tight gas, shale gas, deep gas below 15,000 feet, deepwater Gulf of Mexico gas and methane hydrates," Tinker said in a post-convention EXPLORER interview.

"Tight gas, shale gas and coalbed methane now account for approximately 20 percent of U.S. consumption. Combine these existing unconventional sources with deepwater, subsalt, deep gas, brine gas and gas hydrates, and by 2020 more than 50 percent of U.S. gas consumption will come from unconventional natural gas sources."

Growth Patterns

Tinker pointed out that throughout the past century natural gas was found in association with oil but commonly not explored for as an independent source of energy.

"But during the 21st century the United States will lead the world in transitioning away from coal and oil into methane and hydrogen," he added. "The environmental and efficiency benefits of natural gas and renewable energy sources like nuclear make them attractive, and the number of new natural gas powered electrical generation plants is evidence of the growth cycle we will see in the coming years."

Natural gas provides economic stability compared with oil or coal, he continued.

"Currently, we only import about 15 percent of our natural gas needs versus 57 percent of our oil in the United States, and most of those natural gas imports come from Canada – a stable, friendly ally close to home," he said.

"Along with economic stability comes a national security component to the energy supply that makes natural gas and other renewable energy sources very attractive."

In addition to this growth in demand, resource availability points to a future fueled by natural gas, according to Tinker. Potential future oil reserves are on the decline in the United States, but undiscovered natural gas reserves are still enormous.

However, these new natural gas

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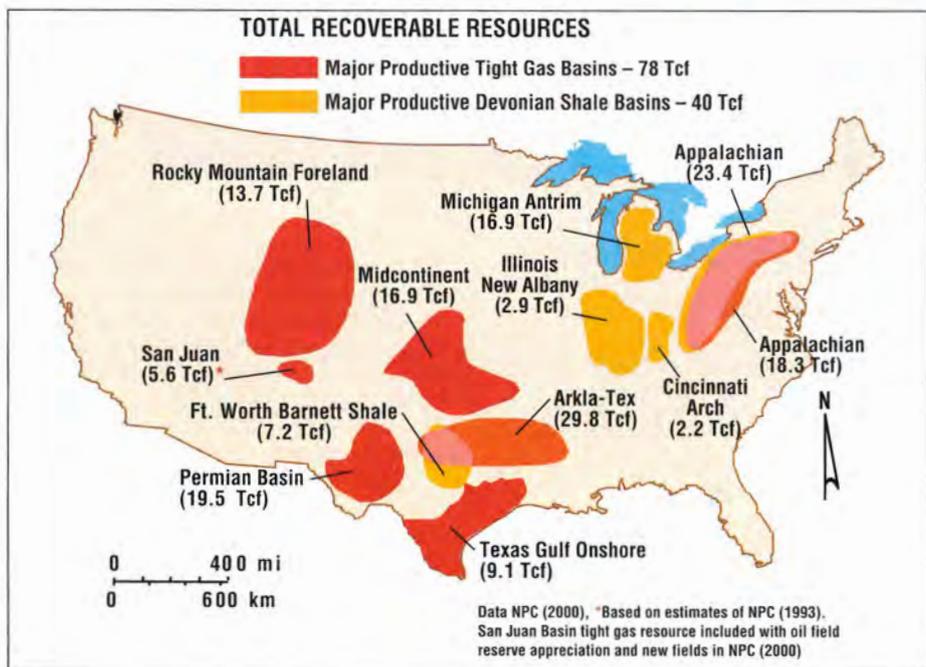


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Data courtesy of the Bureau of Economic Geology

Figure 1 – Technically recoverable resources for major productive tight gas and Devonian shale basins in the lower 48.

continued from previous page

sources won't come without a price, he said – namely, "a tremendous amount of research to understand how to characterize, quantify and safely drill for and produce those resources.

"And it will take a very different research model than has been historically used to bring new unconventional resources on production," he added, "because the industry has undergone some fundamental changes."

Tangible Benefits

For the most part large, private research laboratories maintained by major oil companies are a distant memory, and those research facilities that do exist within companies are focused more on international targets or research that can pay out in the short-term, he said.

Consequently, the federal government will have to take the lead in future research efforts.

"This new research model will have to have a greater federal component focused on developing research and technology for resources that the private sector is not currently exploring for, such as

unconventional natural gas," Tinker said.

That may seem like a simple concept, but there is resistance from both camps that must be overcome.

"Traditionally the petroleum industry has preferred minimal government involvement in its business, and that sentiment remains in some sectors today," he said.

"Conversely, federal officials need to recognize the game has changed for the private sector and get away from the attitude of 'corporate welfare.'

"Research undertaken by the federal government would fill a void that is not being addressed by private companies," he said. "Also, the nation will reap a return on this investment through additional capital and royalties paid on those resources."

Plus, there's an energy and environmental benefit for the country.

"We will add resources that would not otherwise be attainable and burn cleaner fuel," he said. "Those are true tangible payoffs that impact the average American citizen."

Needed: More Infrastructure

Tinker said the infrastructure is in place for the federal government to

See **Research**, page 15

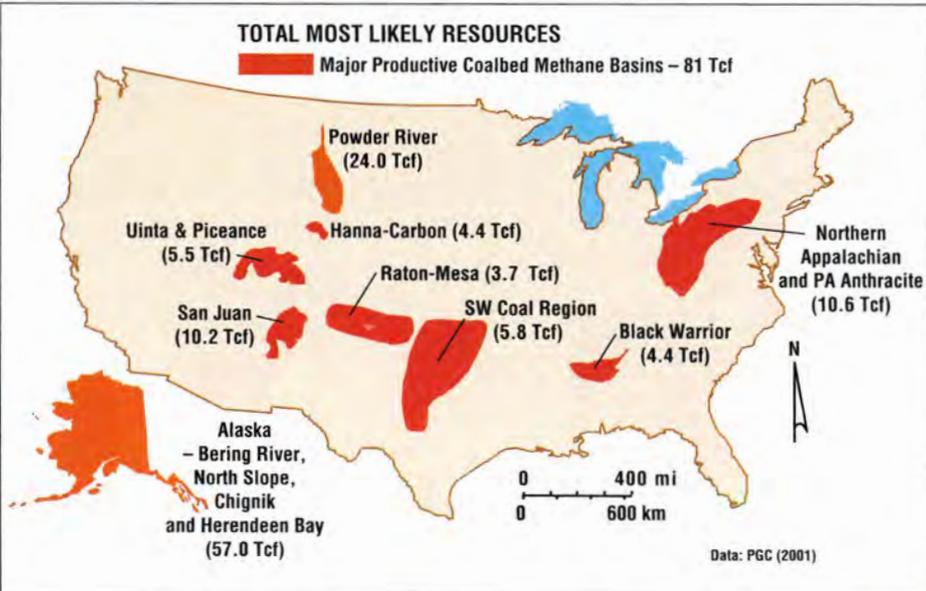


Figure 2 – Total most likely resources for coalbed methane basins in the lower 48.



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Some Things to Study, Something to Prove

So, What Do We Need to Know?

So what are the geologic and technological issues that the industry and government should address to prepare for the future?

□ Research on the geology of unconventional natural gas resources is crucial.

Clearly, these are not typical reservoirs – they are fractured shales, coals, deep tight sandstones and carbonates, aquifers and subsalt reservoirs – but the one element they all share is that there is a fracture component in the production of natural gas. Therefore, research into fracture understanding is vital.

Today, this work is in its infancy.

"Researchers understand how to describe fractures and we are starting to understand how to quantify them," Scott Tinker said, "but still have yet to understand fully how multi-phase flow happens in fractures, and how to predict fracture distribution away from well control."

While "a tremendous amount of research is being done on this issue," Tinker said that "more is needed in the areas of modeling, predicting and simulating behavior in fractures.

"This research is vital to the future of natural gas exploration."

□ Understanding salt dynamics and flow, and its relationship to sedimentation and structure.

"Often natural gas is associated with

"If the federal government and industry can partner to invest in research and technology, we can show students this is a tremendous business with a bright future. Right now students don't see that."

subsalt environments around the globe," Tinker said, "and more in-depth knowledge is needed on issues such as the generation and migration of hydrocarbons during salt movement and the ways traps are set up and then broken by salt."

□ Three-D seismic has proven its value and changed the way the industry explores for hydrocarbons, but four-component marine seismic and nine-component land seismic have the potential to open up worlds of data that have never been available.

"This technology will allow us to begin to characterize vertical planes like fractures through two independent measurements," Tinker said. "Multi-component data have the potential to identify fracture trends – both their orientation and perhaps even their spacing.

"Much in the same way the

combination density neutron log opened up the wellbore environment several decades ago, multi-component seismic will most likely benefit all facets of the energy business," he said, "and has to be a huge part of future research."

□ New direct observation tools also will be important to future exploration.

Tinker cited the example of cathodoluminescent scanning electron microscopy, which is being developed at the Bureau of Economic Geology and will allow geoscientists to identify micro fractures at a very fine scale.

"Natural gas is often able to flow through narrow pathways created by micro fractures," he said. "This new technique will provide important input in describing and predicting fracture aperture, orientation, spacing, clustering, geometry, relation to lithology and cementation."

□ Methane hydrates present several unique research challenges such as determining what their physical properties are and how they form, evolve and break down – and what controls gas concentration.

Tinker added that analyzing the effect of hydrates on sediment strength and seafloor stability – as well as characterizing and exploring for hydrates through remote sensing, improved simulation and modeling, and new production technology – is important.

□ An immediate need, according to Tinker, is for government and industry to prove to students that there is a commitment to the energy industry.

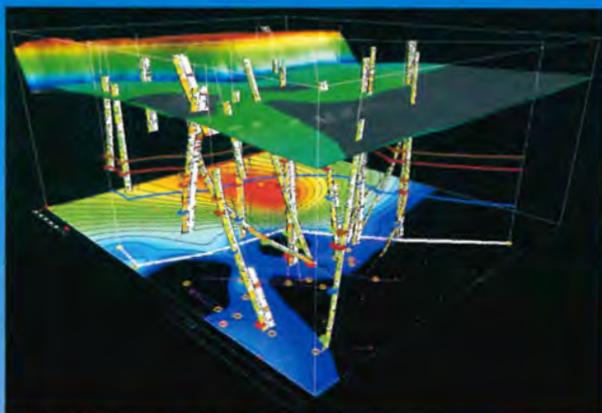
"If the federal government and industry can partner to invest in research and technology, we can show students this is a tremendous business with a bright future," he said.

"Right now students don't see that," he continued. "It is fundamental to the industry that we have the future expertise to meet new challenges, and today that message is not being heard at American universities.

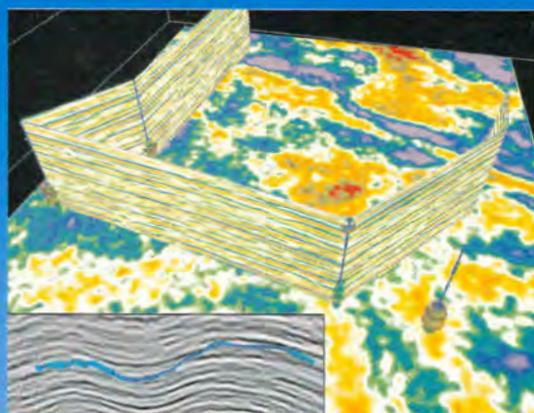
"Enrollment in geoscience programs around the country is declining, and we have to make the commitment necessary to bring students back to this business."

– KATHY SHIRLEY

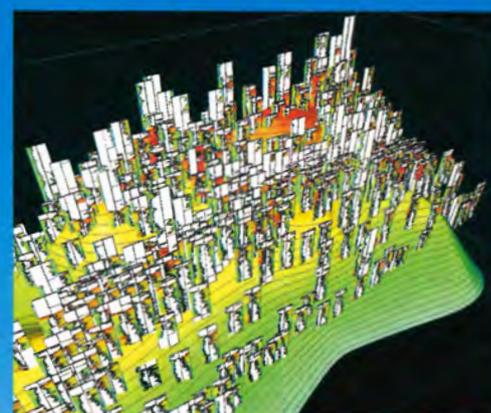
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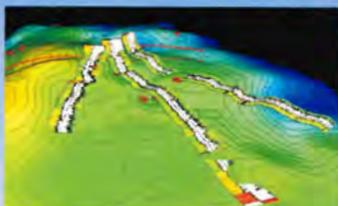
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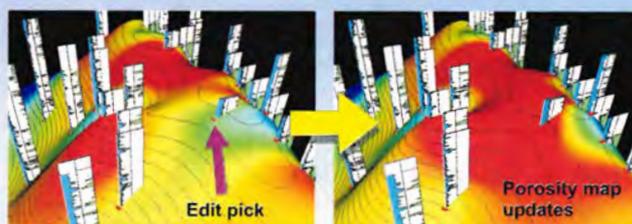


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Research

from page 13

invest in research and support technology development – but the infrastructure necessary for the country to move toward a natural gas future is not.

There are pipeline and deliverability issues that must be addressed, he said. For example, the deliverability problems experienced in California last year could impact the country on a broader scale and natural gas imports must be explored. It will take government involvement to solve these issues.

“We are importing on the order of billions of cubic feet of gas a year, as LNG, and trillions of cubic feet through pipelines – that’s a whole order of magnitude of difference,” he said. “The technology is available to expand imports through liquefied natural gas, but it will take a significant ramp up for the private sector to risk investing in LNG.

Tinker said that, based on various reports, gas prices have to be at about \$3.50 to \$4 per thousand cubic feet – and more importantly, stable – before the LNG investment will be made.

“So, some combination of federal incentives and an investment in research and technology in partnership with the private sector must be part of making LNG a vital element in our energy future,” he said.

The same is true for unconventional natural gas sources. Tinker said technology will have to be developed in partnership between the private and public sector to tap resources like gas below 15,000 feet, where reservoirs get hot and overpressured, or frozen gas in the Gulf of Mexico or the Arctic.

This is not just an issue for the United States, either. Japan, for example, is banking on methane hydrates, which is a tremendous potential resource for that country.

“In recent years Japan has said it hopes to be an energy exporter in the next three decades because of the nation’s gas hydrates potential,” Tinker said, “and they are investing in that potential.”

These investments in natural gas don’t mean the role of oil or coal will diminish as part of the American energy landscape. Tinker said there is a three- to five-decade transition in which current levels of oil and coal consumption will remain steady. However, the substantial growth in energy demand will have to be filled – and that’s where natural gas and renewable resources come in.

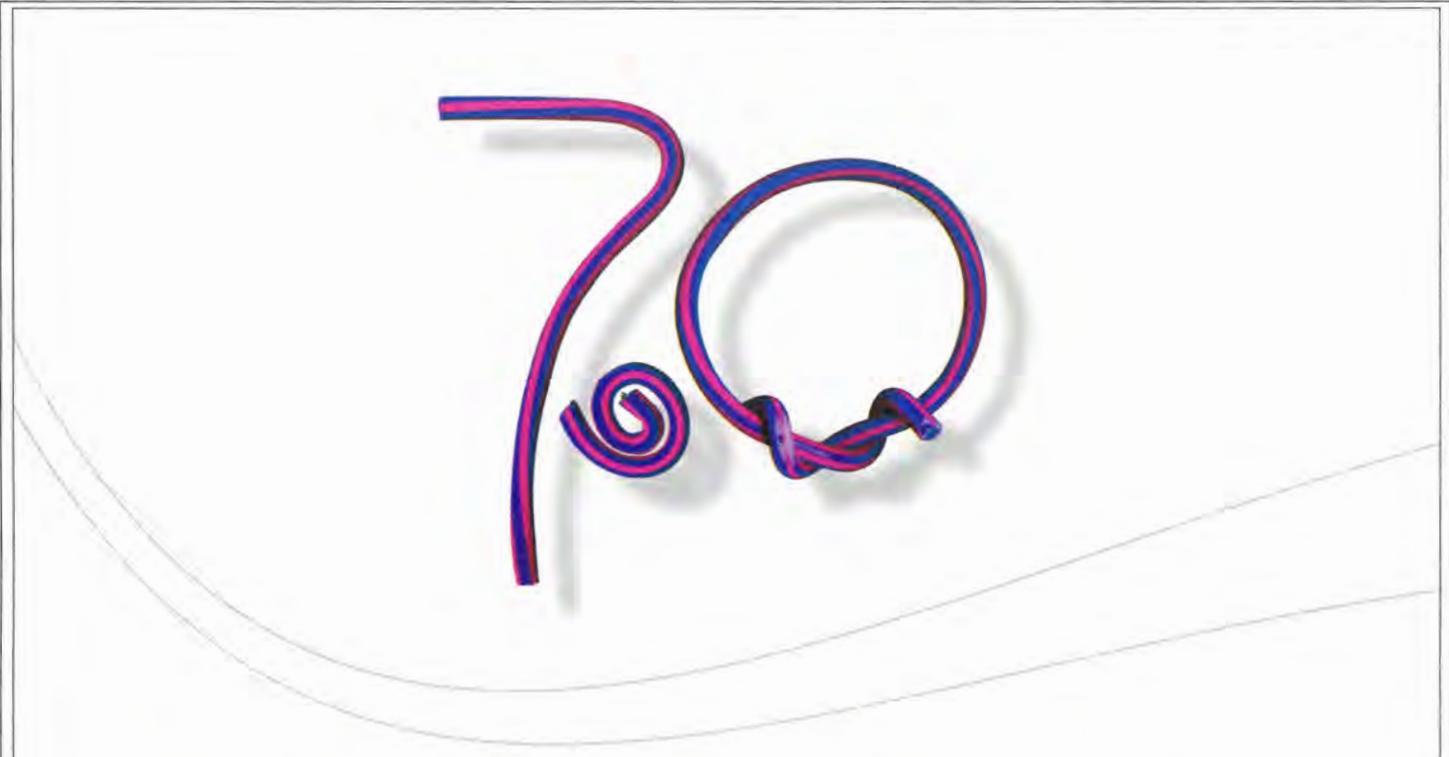
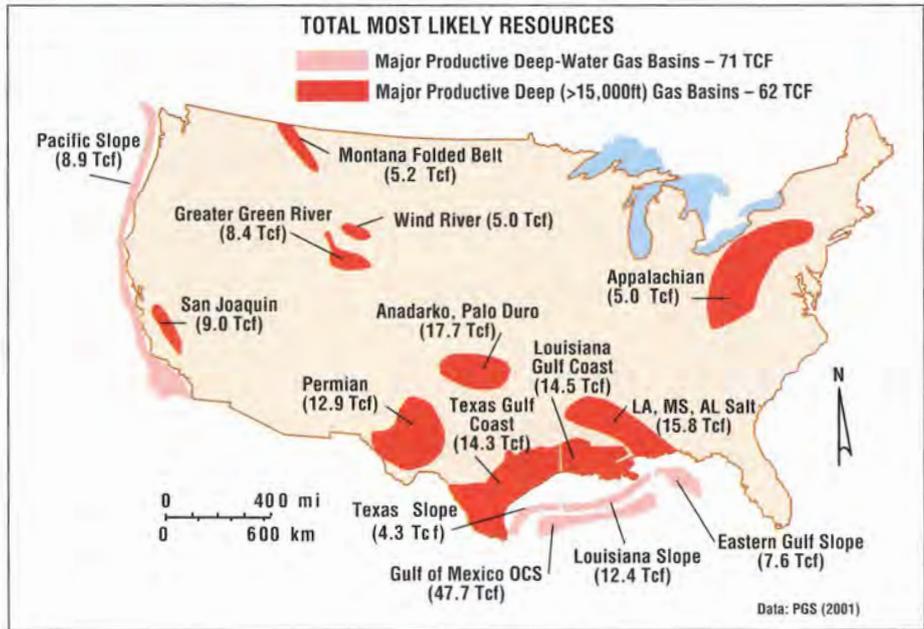
“We have to invest in that growth reality,” he said. “I am a huge believer in conservation, as well, and I think we can do a much better job of conserving our energy resources.

“However, even when you factor in successful conservation issues there is still a large growth demand that has to be met,” he said.

“When you look at the production curves for shale gas, coalbed methane and tight sands gas and how those resources were created, we could be having this conversation 20 years from now and be discussing the same type of production curve growth for methane hydrates, deep gas and sub salt reserves – resources that don’t exist today,” Tinker said.

“Proper investment from – a federal-private sector partnership – can make that future a reality.” □

Figure 3 – Major productive deep and deepwater gas basins in the lower 48. Scott Tinker’s message is that unconventional gas targets today can be the conventional gas targets of tomorrow, but only if research demands are met.



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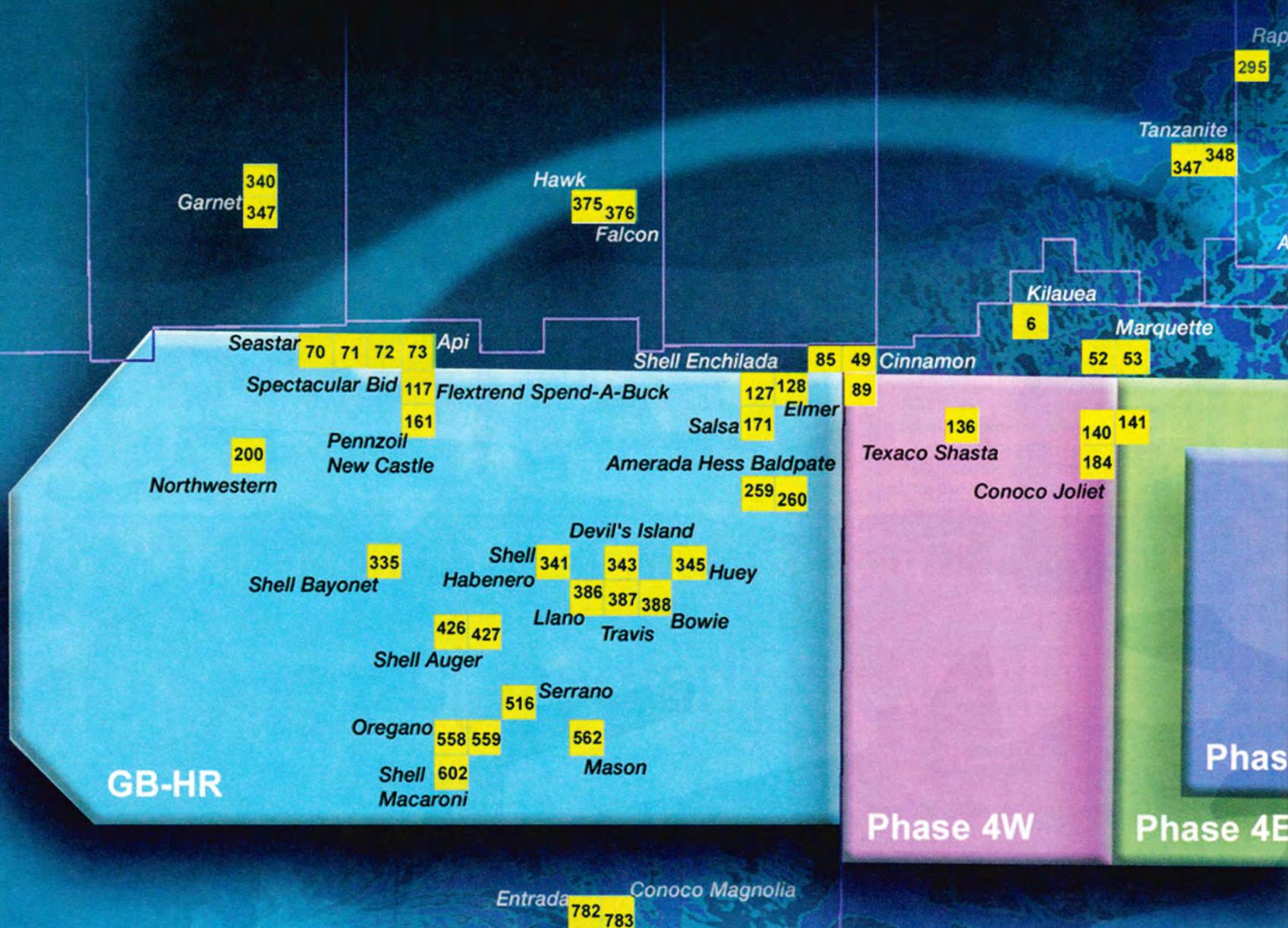


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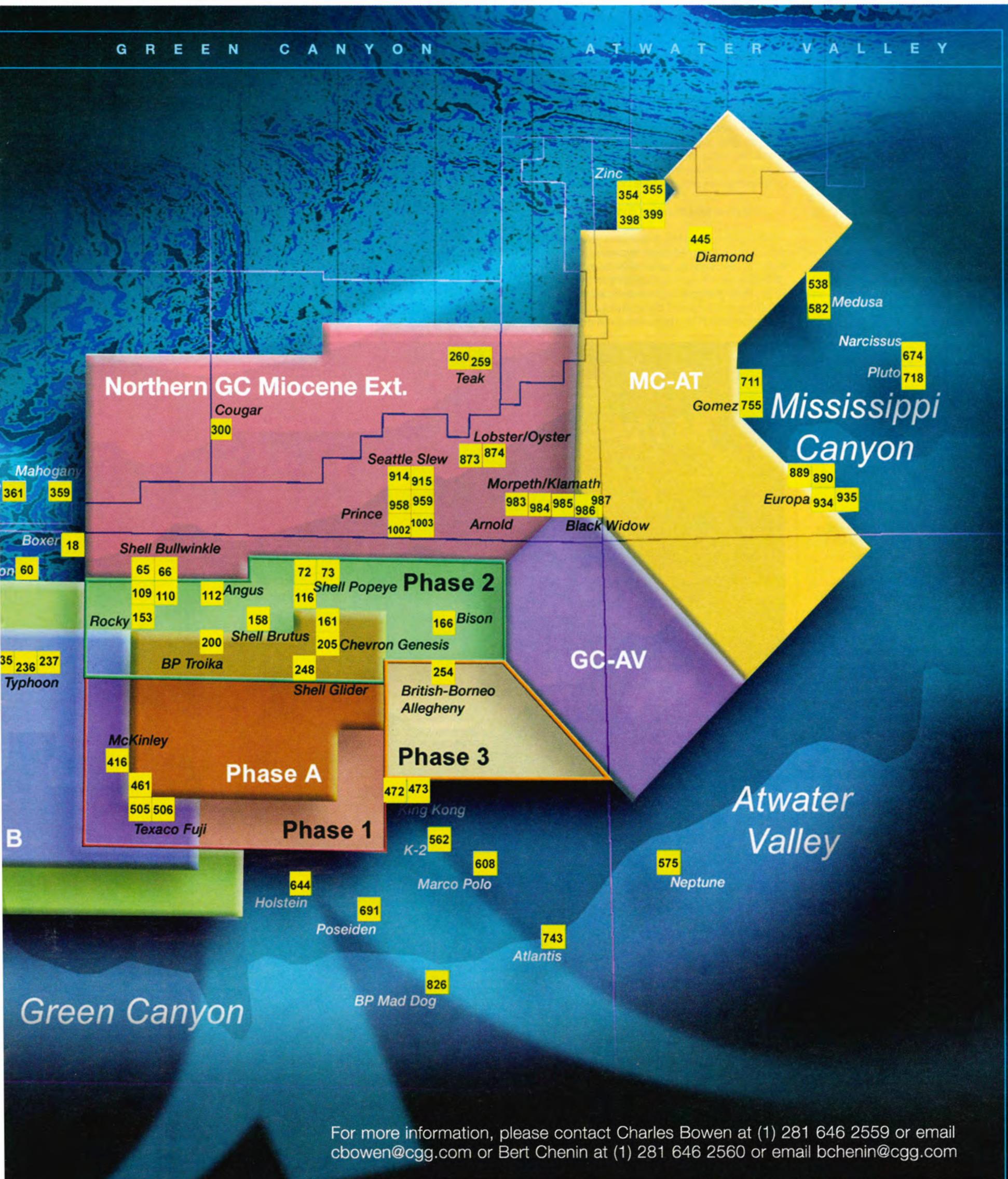
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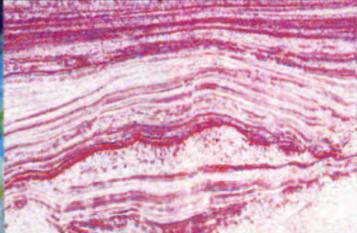
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Mergers, Inventory A Drag

Seismic Lagging Industry Upturn

By LOUISE S. DURHAM
EXPLORER Correspondent

If you could listen to a heartbeat of the geophysical industry today, you might be tempted to call 911. While not yet to the life support stage, the health of this sector might best be described as poor and still declining.

The suffering is especially acute among the seismic data contractors.

"We as an industry missed the last up-cycle of 18 months or so almost entirely," said Jim White, vice president multi-client data worldwide at WesternGeco, "and activity has trailed off dramatically in the last three to four months."

It's a real conundrum.

For the last 10 years there was a close correlation between drilling activity and seismic data acquisition that was pretty robust until 1998. When the rig count dwindled basically to historical lows during the downturn of late 1998 and into 1999, the contractors continued on for a year or so via deepwater activity and library data shoots, according to Tim Probert, president and CEO of Input/Output Inc.

A profound disconnect between drilling and seismic became apparent once commodity prices did an about-face and headed into the stratosphere.

Drilling activity revved up like gangbusters, reaching a high for the cycle last July. The seismic contractors, however, were left in the lurch during the near-frenzied drilling pace, and idle crews and vessels were the order-of-the-day.

Today, drill bit action in the United States has declined about 40 percent from its peak in 2001. Domestic seismic activity is down another 10 percent from its already depressed level at the height of the drilling action, and international seismic has dropped by 26 percent, Probert noted.

The finger pointing is in myriad directions.

When commodity prices skyrocketed, the E&P companies allocated budgets to drilling rather than seismic to reap the benefit of the high prices. Another area of blame: There's long been talk that the E&P companies were caught holding vast quantities of unworked seismic data when prices tanked in 1998-99, and they needed to work through their inventory.

"I'm not sure there's a whole lot to that," White said. "But I know one thing that has hurt in the last three to five years is the consolidation of the oil companies, causing a shrinking client base."

"When an Exxon and a Mobil merge, it's like one plus one equals 0.8," he said. "They jettison smaller properties and focus on bigger areas where they find huge reserves, and it takes a year for the deal to go through. So for a year they're sitting around not doing a lot as separate entities."

On the other hand, certain mergers can be a big positive, particularly among the seismic contractors themselves.

The relatively new undisputed industry giant, WesternGeco, came about as a joint venture between Schlumberger and Baker Hughes. The link-up of PGS and Veritas is under way, and more such activity undoubtedly will follow.

This industry consolidation is lauded by the contractors for the most part.

"On the contractor side, consolidation is good because it brings discipline to the market," said Bert Chenin, vice president offshore North America at CGG Americas. "There is still over-capacity today."

White concurs.

"If we could get the capacity to more manageable numbers, we could make some headway where we'd have more opportunities," he said. "That's one of the best things we can do as an industry."

Chicken-and-the-Egg Syndrome

If you're wondering if this ultimately will result in a handful of super-sized companies running the smaller ones out of business, the consensus for the moment is that this is an unlikely scenario.

White emphasized there always will be niche players in the business to fill certain

needs. He noted, however, that companies without data libraries and a niche area where they perform a service well and can generate cash flow and make money are in for a tough ride.

He predicted, too, that some of the marginal companies will be weeded out over the next year.

These thoughts are shared by Steve Mitchell, vice president and division manager at Fairfield Industries.

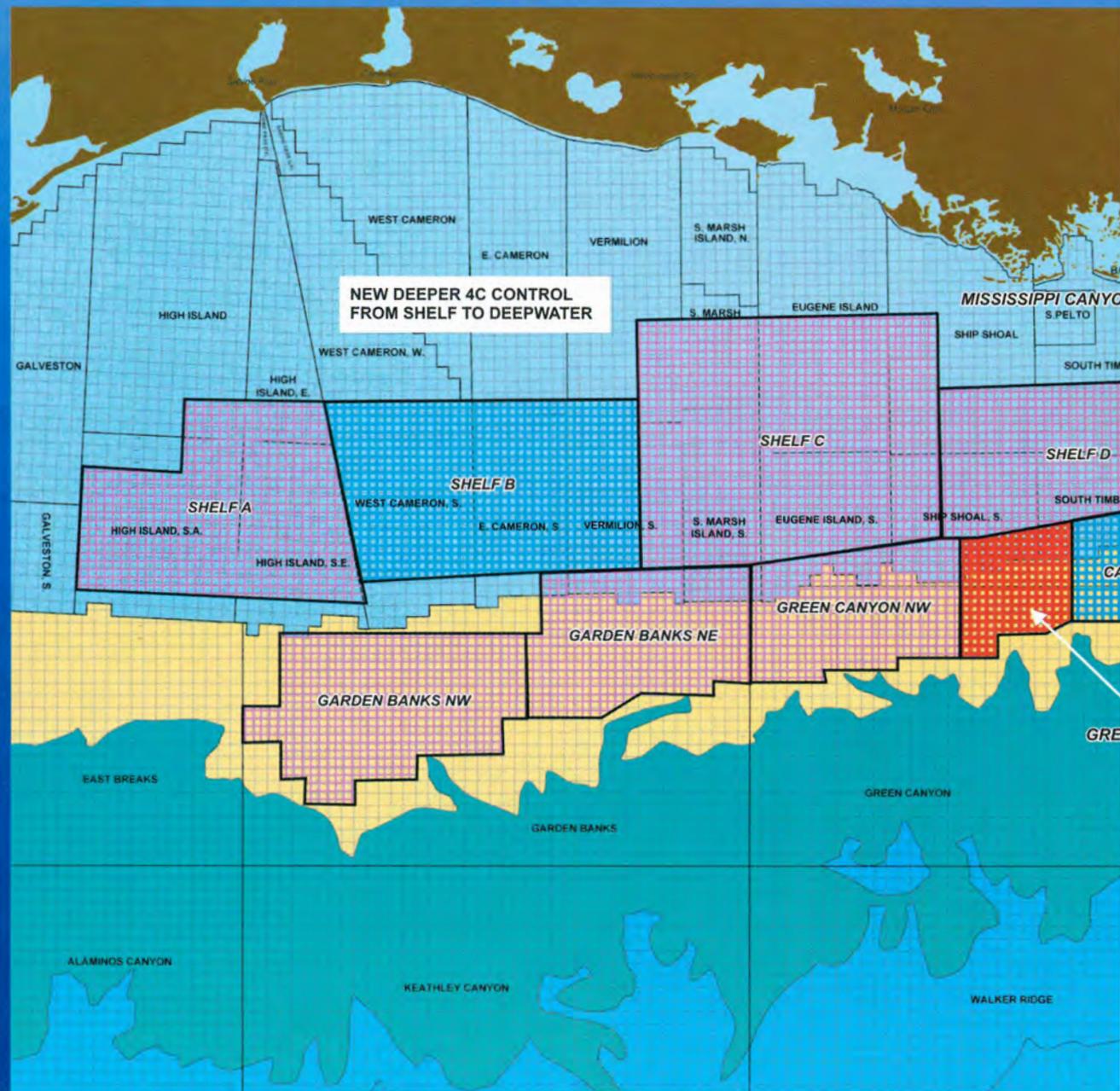
"I think there will be several large

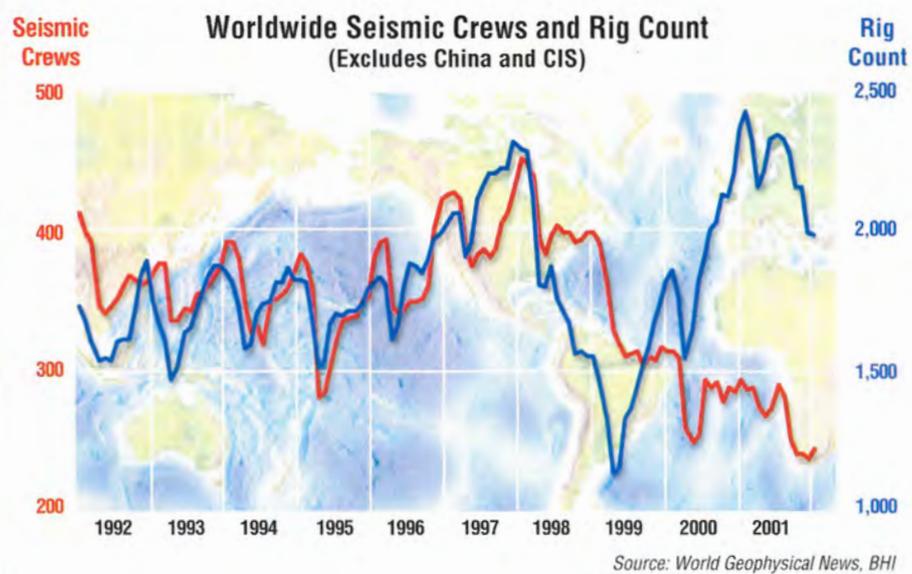
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companies," he said, "and the small companies will become more specialized to a locale. I will say the healthier seismic companies are and will be those that have a spec data base to carry them over the hump in lean times."

To accommodate changes in the marketplace, Fairfield has adjusted its strategy somewhat: They increased their capability and are acquiring long offset data on spec surveys to accommodate the demand for deeper targets on the Gulf of Mexico shelf.

Also, they outfitted all equipment with the capability to acquire multi-component, or 4-C, data once the anticipated demand becomes a reality.

But this is a reality that seems to stay just out of reach.

Acquisition is pricey – Chenin said it

costs 10 times more to acquire 4-C as normal streamer data – and there's the thorny problem of how best to deal with the data.

"We're waiting on the industry to catch up on the interpretation side," Mitchell said. "We do a little, and the interpretation side learns more, and then we get a little more efficient at shooting it."

"It's the chicken and egg syndrome. There's chickens and there's eggs now," he said, "but we had to start somewhere."

Stop the Hemorrhaging

While it may behoove contractors to regroup strategy-wise, the overall impact might be likened to using a bandage to stop the hemorrhaging. So other, more all-encompassing changes to get the industry back on track to better times are being pondered and discussed.

Who on the contracting side of the business would argue with Probert's assessment that the current business model is broken, especially in North America?

Twenty years ago, seismic contractors performed jobs on a term contract basis, realizing steady margins of 8-10 percent on their money, according to White. Today, there are turn-key contracts that may be 60 or so pages long, filled with onerous terms and conditions placed on the contractors.

One outgrowth of the E&P companies' aggressive wielding of concentrated purchasing power is the global procurement contract. The larger companies who represent a significant percentage of global exploration dollars in a given year will offer contracts for the next five years, yet with no promise of any projects.

"Even though they don't guarantee any work, they make it clear that all of their business will be conducted only with seismic acquisition contractors under the global procurement contract," said Chip Gill, president of the International Association of Geophysical Contractors. "They don't promise anything but say you must sign if you want our business."

Unlike other oilfield services groups, the seismic contractors typically are burdened with all the risk once they sign a contract.

This can include such variables as inclement weather and community-related problems where the work occurs. Ranking high among the most worrisome risks is the issue of marine exclusion zones, where an area of one-half kilometer around an offshore production facility ordinarily is off limits to seismic vessels.

The trend toward collecting multi-component and time lapse (4-D) seismic data increases the need for proximity to these facilities so that the seismic grid is closer to the reservoir. Yet, even if a vessel is invited to work in this zone, it bears all liability – an untenable situation, Gill said.

Given such scenarios, it's clear the upside for contractors today is minimal and the downside enormous – a self-inflicted ailment in the minds of some members of the community.

"We as an industry have accepted that, so we can blame only ourselves," White said. "We allow ourselves to get caught up in a bidding process where we assume all the risk."

"We need to better understand what it is we're trying to accomplish," he continued, "and create a new business model so the oil companies will know we're not going to go about business the way we used to."

The irony of the current situation is striking when one considers what seismic data brings to the table.

"The geophysical industry facilitates

See **Seismic Industry**, page 39

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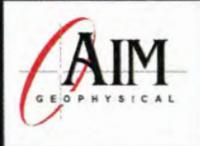
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*At Risk: The Bottom Line***Industry Must Face Tough Issues**

By KATHY SHIRLEY
EXPLORER Correspondent

The geophysical industry is facing a host of environmental and safety issues that could significantly impact the bottom line of seismic operations – and in some cases hamper access to certain regions of the world.

Marine mammals, public lands and explosives handling are among the most important and potentially contentious issues geophysical contractors face – and the industry is taking a more proactive role in working to find balanced solutions to these problems.

And because seismic activity is often the first wave of exploration efforts, these issues are potential threats to the entire upstream oil and gas industry, according to Chip Gill, president of the International Association of Geophysical Contractors.

The impact of geophysical noise on marine mammals, for example, is increasingly having a big input on operations.

"We've had a marine mammals protection act in the United States for sometime," Gill said, "and while that has not yet resulted in regulations in the Gulf of Mexico, it has impacted how we conduct seismic operations in other areas of the country like offshore California and Alaska."

While more countries are becoming "proactive" in the area of marine mammal protection, the United Kingdom has been an active jurisdiction for some time. Several years ago regulations were instituted governing the North Sea – the first set of rules that aggressively regulated the geophysical industry in that area.

(The UK currently is reviewing and considering changes to those regulations.)

"Since then, Australia has undertaken a review of this whole issue and completed a regulatory process last year that instituted rules governing our operations," Gill said. "Brazil is currently looking at some regulatory action and it appears that country will be very aggressive in restricting our operations. Plus, for the first time the United States is taking a look at marine mammal safety in the Gulf of Mexico."

Brazil, now with its offshore basins open to international oil companies, has had a huge increase in seismic activity – is struggling with its regulatory regime, he said. Brazilian officials spoke at a recent environmental conference in Houston and signaled the country's intent to conduct a rule-making process that could make Brazil one of the most aggressive regulatory regimes in the world at affecting seismic operations, according to Gill.

In fact, for the first time since 1984



Photos courtesy of WesternGeco

You thought rough terrain would be the hard part of the job? The geophysical industry is facing a host of environmental and safety issues that make hostile environments seem tame – and could significantly impact their operations.

the Minerals Management Service is rewriting its rules governing the geophysical industry.

"We don't know what the final outcome will look like, but we need to be prepared to follow that process and interact with the MMS any way we can," Gill said. "That's true for other countries like Brazil as well."

Seeking Sound Science

Such regulatory efforts prompted the IAGC to approach the issue proactively as a potential threat to the geophysical business.

"Regulation in the worse case can cause outright restrictions or exclusions, which is a threat to our business," Gill said.

Also, he added, regulations can affect the cost side of operations.

"If we are required to do certain things that cost more money, who pays that additional cost?" he asked. "Do those extra costs make it prohibitive to conduct acquire data? Or, if it's a cost we can't bear, can we pass it on to the client?"

Last year the IAGC created a top-level task force made up of senior

management personnel from larger marine data acquisition companies to address the impact of air-gun arrays on marine mammals. Also, Veritas DGC loaned an expert in offshore marine seismic data acquisition to the IAGC to work on the issue.

The task force's mission is to develop and implement a proactive global strategy to ensure that any government action on this issue is based on sound science, and that it fairly balances certain and necessary benefits to marine mammal populations against the cost of the regulations themselves.

Most regulatory structures call for either visual or passive acoustic monitoring for the presence of animals and then some mitigation measures. These can run the gamut from soft start-ups to drive the animals away from the area to outright shutdowns.

"The key issue here is sound science – we need to make sure regulations are actually necessary," Gill said.

"At the same time, we are cognizant of the concerns that our acoustic emissions have an impact on marine mammals," he added. "We are concerned as well. If our activities are harming marine mammals, we want to know what those affects are so we can take reasonable



measures to minimize or eliminate them."

The task force also has been working to develop geophysical industry protection standards for seismic acquisition activities in relation to marine mammals.

"Currently there is a good deal of misinformation about our effects on marine mammals," he said. "One of the things we want to do is put together a fact sheet that anyone can use to guide them on this issue."

Some environmental groups have attempted with various levels of vigor to shut down seismic operations, he observed. Greenpeace, for example, attempted to shut down an acquisition crew off Sakhalin Island last summer, and the Natural Resource Defense Council issued a paper ("Sounding the Depths") calling for dramatic measures that would severely threaten the seismic industry.

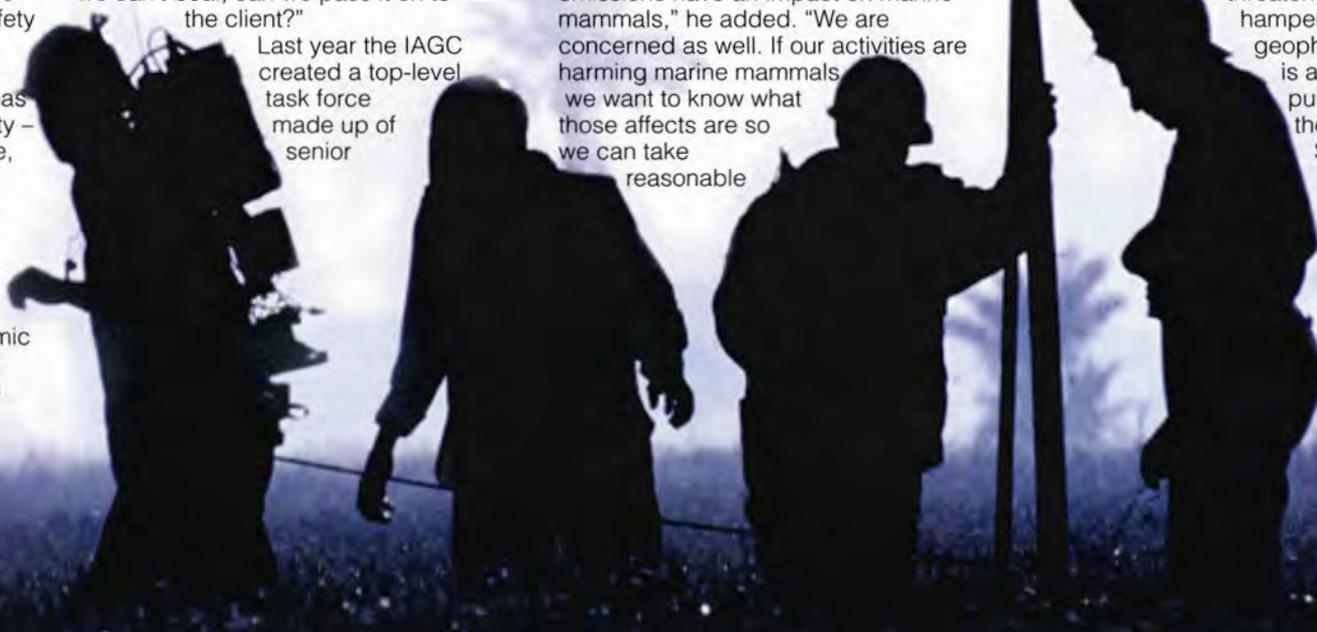
To address marine mammal regulations, IAGC is networking with the rest of the E&P community, such as the OGP (International Association of Oil and Gas Producers).

"We share the same concerns in terms of access and the freedom to conduct our business," he said, "so organizing with these other groups is an important step."

Legal Delays

Another issue that threatens to severely hamper the geophysical industry is access to public lands in the United States, particularly in the Rocky Mountain states. The

continued
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Bureau of Land Management has become increasingly more restrictive in recent years as a result of added pressure from environmental groups, according to Marty Hall, U.S. marketing and sales manager for PGS Onshore and chairman of the IAGC Western U.S./Alaska Regional Committee.

"There have been regulations and guidelines in place for seismic operations along with the rest of oil and gas activities and we've been following those regulations for years," Hall said. "However, recently the interpretation of the regulations has gotten tougher and tougher – today it's to the point that seismic operations on public lands in the Rockies are restricted to just several months a year, generally between July and November 15.

"Between endangered species, nesting, grazing issues and other concerns like these increasingly restrictive regulations, we are very limited as to when we can operate."

Gill believes there's a constituency that doesn't want any activity on public lands at all and they are using the existing legal framework – like the Endangered Species, Antiquities and National Environmental Policy acts "to throw up roadblocks in front of us every step of the way."

The seismic industry is targeted because it typically is the first wave of exploration activity, Hall said.

"Today, almost every time the BLM approves a seismic project, environmental groups appeal the decision and attempt to get a stay," he said. "Consequently the BLM is much more sensitive and is attempting to dot every I and cross every T before they approve any project."

The seismic industry is intervening in these appeals cases to ensure both perspectives are presented. Also, industry officials are attending BLM meetings and visiting district and state BLM directors and Department of the Interior officials to explain how seismic crews operate – and the minimal environmental impact of these crews.

"Plus, we have to make sure people understand the impact if we are not able to conduct our business," Hall said. "Finding and producing additional domestic energy supplies is important not just to the petroleum industry, but also to our national security."

Hall's committee has established a subcommittee dealing with public lands access issues. Members of the subcommittee are taking the lead in meeting with government officials, going to meetings and looking for other ways to get involved.

Committee members are intervening in specific cases as well. For example, in a recent case in Wyoming where environmental groups were using erroneous information in an appeal of a BLM decision, IAGC members intervened and the appeal was denied. The project went forward.

"It is definitely impacting the seismic business in the Rockies," Hall said about the legal challenges. "As an industry we have to do all that we can to educate the public, government officials and policy makers about the long-term impact of these restrictions."

An Explosive Subject

Another issue impacting the geophysical industry today deals with safety. In the last two years the industry had four fatalities in four separate incidents as a result of unplanned premature detonation of explosives.

See **Seismic Issues**, page 40

IAGC Involved in Effort to Protect the Whales

The geophysical industry is actively participating in research programs to better identify the impact of air-gun arrays on marine mammals – IAGC members, for example, have committed to fund a seismic vessel for an MMS led research project this summer in the Gulf of Mexico.

IAGC president Chip Gill said this will be the third year of the study examining the impacts of industry activity on sperm whales in the Gulf.

There was no general awareness of sperm whales in the Gulf of Mexico until the 1980s as the petroleum industry moved out into deeper waters where the giant mammals feed.

The research program will satellite tag whales to monitor their movements on the surface as well as affix a temporary tag that can provide data on the whales' position, acoustic information – both vocalizations and what the animal is hearing – and physiological data like heart rate.

IAGC will be providing the seismic source vessel and will help design an experiment that looks at the animals' behavior:

- ✓ Before any seismic source is introduced into the water.
- ✓ Any alterations in behavior when a seismic source is introduced.
- ✓ How they respond when the

seismic source is removed from the water.

"There appears to be less concern about the immediate physical impact on the animals," Gill said. "It is generally accepted by the research and regulatory community that these animals are not physically harmed – the question is how seismic acoustic noise affects behavior.

"Does it interrupt their ability to feed, mate or raise their young? Research like the program planned for this summer should help answer some of those questions."

– KATHY SHIRLEY

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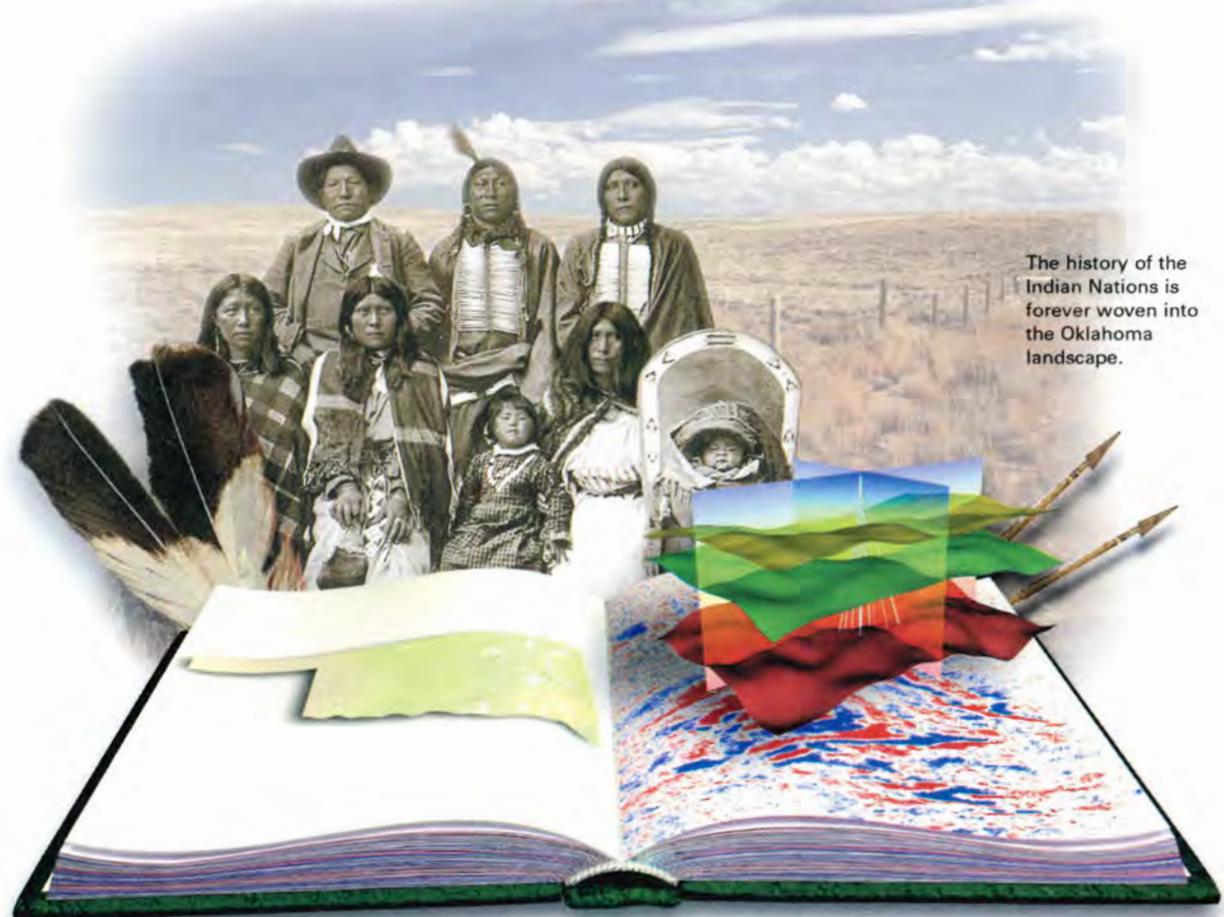
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'Seeing Through Clouds,' 'Squeezing Data'

New Technologies Hit the Market

By LOUISE S. DURHAM
EXPLORER CorrespondentDeeper targets? Deeper water?
Maturing fields?

Whatever the challenge, the oil and gas folks keep coming up with the technology needed to meet the most complex and demanding scenarios head-on.

Much of the tech know-how originates within the seismic industry, which currently is laboring to regain at least some semblance of its former robust health.

Yet, ongoing R&D efforts belie this struggle – at least for now.

WesternGeco alone spends \$50 to \$60 million a year on R&D, according to Jim White, vice president multi-client data worldwide.

They have plenty to show for it.

The company's new Multi-Vision™ regional program in the Gulf of Mexico (GOM) incorporates both the old stand-by technology, 2-D, and the new 4-C, or multicomponent technology – a survey concept developed by project partner AIM Geophysical, according to Robert Hubbard, manager North and South America new ventures for multi-client at WesternGeco.

"From a regional understanding, the



2-D with 10,000 meter offsets we have is important to tie key fields throughout the shelf into the deepwater," Hubbard said.

"Doing this with OBC technology, we know exactly where the cable is versus a 2-D streamer boat," he said, "and we feel this is a great advantage for looking at the deeper potential targets on the shelf that people are starting to chase.

"We're pleased with the data we're getting, both pressure and shear," Hubbard added, "and we think the images we'll get will be excellent with the cable on the bottom."

He noted the shear wave data will enable them to see through some of the shallow gas clouds that have plagued the industry on the GOM shelf for years.

The plan is to come up with a contiguous grid shot in phases with an average of two crews working over the life of the project

Besides this long-term undertaking, the company is busy with projects using its new "Q-Marine" technology. This fully calibrated single-sensor marine seismic acquisition and processing system provides high-resolution, and low noise data for enhanced reservoir management.

It's part of the Q-technology package for both land and water, designed to afford improved reservoir images as well as reliable pictures of subsurface areas that previously could not be imaged.

The repeatability levels of Q-Marine technology mean the data are 4-D ready, i.e., every survey can be a baseline time lapse survey – a plus for the oil finders who increasingly are wanting 4-D surveys to get a better handle on what's happening in the reservoir over time.

When used on land, Q-technology has a 30,000-channel capacity. Q-Marine, however, boasts 4,000 channels per streamer, up to a maximum 20 streamers. The system uses point-receiver recording with a 3.125m interval between individual hydrophones, and the output from each hydrophone is digitized and recorded separately on tape.

'Q' Case Study

Q-Marine was the topic of a case study paper presented by Jeff G.S. Pan, senior advisor at Kerr-McGee Oil & Gas, in the Convention Theater at the recent AAPG Annual Meeting in Houston. Nick Moldoveanu, geophysical support manager at WesternGeco, co-authored the paper.

Kerr-McGee acquired and processed a data set provided via five 2-D single sensor (Q) lines from a multi-client Q-2D program conducted over a recent field discovery in the deepwater GOM. The initial discovery occurred via conventional 3-D multi-client seismic data.

The objective, according to Pan, was to determine the benefit of single sensor data for reservoir characterization and field development.

He noted the project results showed the Q data enabled:

- Effective coherent noise attenuation.
- Preservation of broader frequency bandwidth.
- Proper spatial sampling of the seismic wavefield.
- Preservation of accurate amplitude.
- Applicability to AVO analysis.

Kerr-McGee is conducting a 3-D Q

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survey in the North Sea as part of its ongoing evaluation of the single sensor technology.

Spectral Decomposition

The GOM is a prime example of the challenges facing operators in the quest to create value. The shelf area is dotted with highly mature fields that demand evermore sophisticated technology to detect remaining reserves.

Then there's the "frontier" deepwater region with its tantalizing potential for big finds, at the same time calling for the newest technology available to key in on reservoir detail and avoid a super-pricey dry hole in this complex arena.

One of the techniques being used to depict the intricacies of the reservoir is spectral decomposition, which affords unique high resolution seismic images of both stratigraphic and structural reservoir traps (see Geophysical Corner, page 28). Resolution of reservoir boundaries, heterogeneities and thickness is much greater than what is possible with traditional broadband seismic displays.

"It's analogous to what you do with remote sensing or satellite data on the surface," said Greg Partyka, staff geophysicist at BP. "There you use frequency bands of infrared and visible wavelengths to get subtle details.

"With seismic data, you have a seismic bandwidth with much lower frequencies than used in remote sensing," he said, "but you can leverage this by looking at the information provided by discrete frequencies just like you do with satellite imaging data."

Using spectral decomposition, a suite of amplitude maps is acquired from a range of frequency slices in the reservoir zone. Images from certain frequencies are combined selectively to depict the unique geologic relationships within the zone. The amplitude maps can be animated to aid in the interpretation process.

When tied in with all other information, spectral decomposition is an effective risk reduction tool, according to Craig Cooper, manager of imaging technology at BP.

It's a novel – but relatively inexpensive – way to use seismic data to try to extract details about a particular zone in a seismic volume, according to Partyka.

"All you need is a seismic data set plus some kind of guide horizon to help you identify the zone of interest," he said. "Once you have that, for a fairly large 3-D survey it's a matter of running over a few hours and looking at the results.

"You have nothing to lose and everything to gain," Partyka noted. "It lets you squeeze out that added bit of information from the seismic."

He offered one note of caution: If there's no contrast in the rock properties or fluid properties in the zone of interest, spectral decomposition won't be a magic bullet. It only reveals what's in the seismic, so if there's a bunch of noise, it will display noise.

Although spectral decomposition deservedly carries the "cutting edge" label, it is not a new application.

Partyka has been working on it since 1991 at Amoco, and BP, which has established a track record for successful use of the technique, acquired the patent in 1996. Apache also has had a version of the technology for some time.

Now, however it appears to be on the cusp of widespread useage.

Deepwater Driving

Besides the role it plays in the demand for more advanced reservoir interpretation processes, the ever-increasing activity in

the deepwater GOM is helping to hasten the development/commercialization of a number of exciting tools to operate in this often-hostile environment.

Perhaps one of the most intriguing gizmos is the autonomous underwater vehicle (AUV), which already has proven its merits in the research milieu.

The AUV is a far more sophisticated tool for acquiring remote data than its predecessor, the remotely operated vehicle (ROV). The ROV requires a skilled surface pilot for operation, and it has a tendency to veer off course and depth configuration during a deep tow survey because of the extreme length of the tether. Turning is difficult, sometimes requiring a second towing vessel.

In contrast, because it is autonomous, the AUV is agile. It can be programmed to avoid obstacles and to maintain a

See **Technology**, page 38



Photo courtesy of WesternGeco

The deepwater OBC 4-C *Bluefin*, a floating example of technological advances designed to meet exploration demands.

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New Ideas for New Frontiers



'Non-Invasive, Non-Destructive'

Archaeologists Want Seismic View

By SUSAN EATON
EXPLORER Correspondent

At the height of the Maya civilization, the population in Central America had swelled to between 12 to 20 million people, many of whom lived in expansive cities with formal plazas, ceremonial altars, ball courts and towering pyramids.

Around 900 A.D., in the Late Classic era, the Maya civilization – with its unique hieroglyphic text and advanced knowledge of cosmology – vanished mysteriously.

This spring, in the dense tropical forests of Belize, geophysicists will conduct reflection and tomographic seismic surveys in an attempt to help archaeologists reconstruct the events that led to the mysterious disappearance of the Maya.

While archaeologists traditionally excavate on the scale of centimeters and meters, geophysicists look at things on the scale of hundreds of meters and kilometers. Using the seismic method, geophysicists can sample significantly larger areas, condensing timelines for archaeologists by highgrading tracts of potential acreage for further investigation.

Transferring technical expertise developed in the imaging of subsurface structures that contain oil and gas, the geophysicists will seismically map the interiors of Maya pyramids that may contain burial tombs of the ruling class or the "elite."

"The use of seismic is driven by a



Photos courtesy of Robert Stewart

One person's hill is another person's buried treasure. This tropical rainforest at Upper Plaza, Chan Chich in Belize covers remnants of Maya civilization.

new ethic in archaeology," said Robert Stewart, professor of geophysics at the University of Calgary and head of CREWES, the Consortium for Research in Elastic Wave Exploration Seismology.

"Seismic is non-invasive, non-destructive," Stewart added. "Once you excavate, you've altered the provenance and the associations, and you may have even lost some microscopic evidence."

Encouraging Results

In 2000 and 2001, using the hammer seismic technique with three-component geophones, Stewart acquired high-resolution 2-D seismic data over two Maya pyramids and an adjacent plaza at the Ma'ax Na and the Chan Chich archaeological sites located in the Rio Bravo Conservation and Management Area (RBCMA).



Situated just east of the Guatemalan border, the privately owned RBCMA contains 260,000 acres, and represents about four percent of Belize's landmass.

"We can transmit seismic energy through these rubble-filled archaeological ruins," Stewart said. "Using this energy, we have been able to make both 2-D tomographic slices and reflection images of these structures."

"The seismic survey geometry is similar to a VSP or a crosswell tomographic survey turned on its side."

High signal-to-noise first arrivals were recorded on all of the data. Processing of the first-breaking energy – via traveltimes inversion or tomography – created interior images of the structures.

Constructed of local carbonate block and mortar, the pyramids were found to

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Good data is in the details

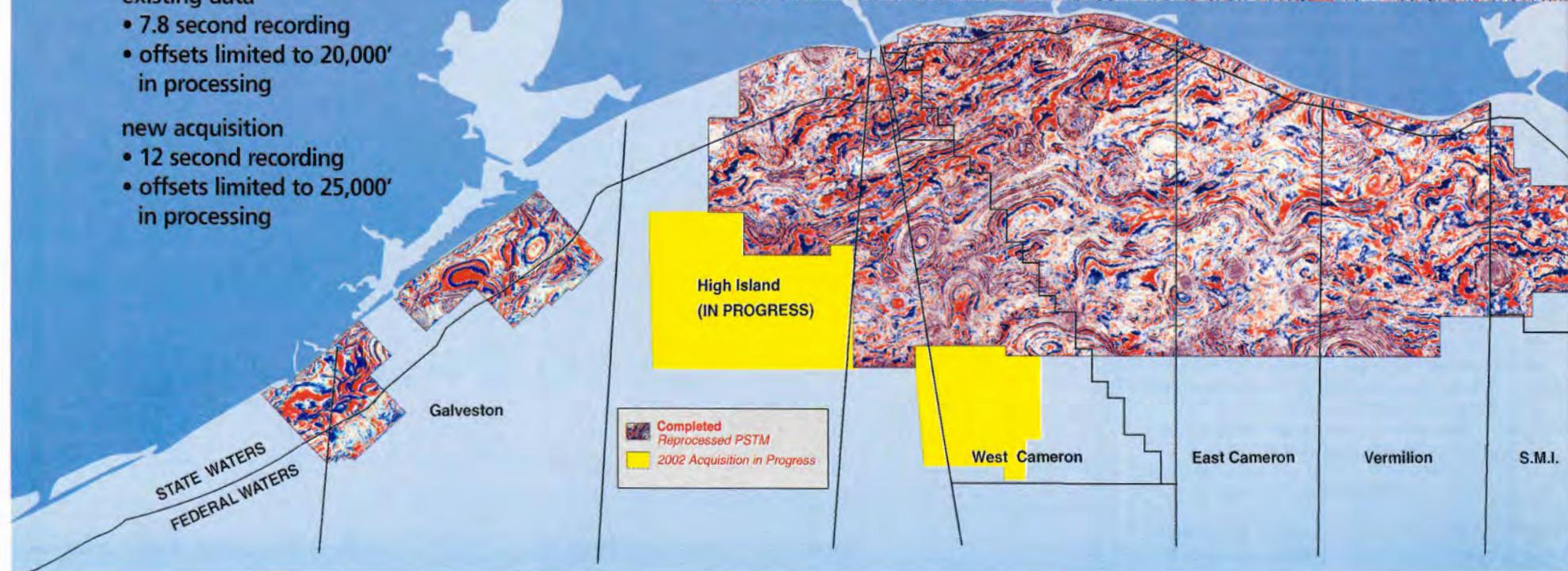
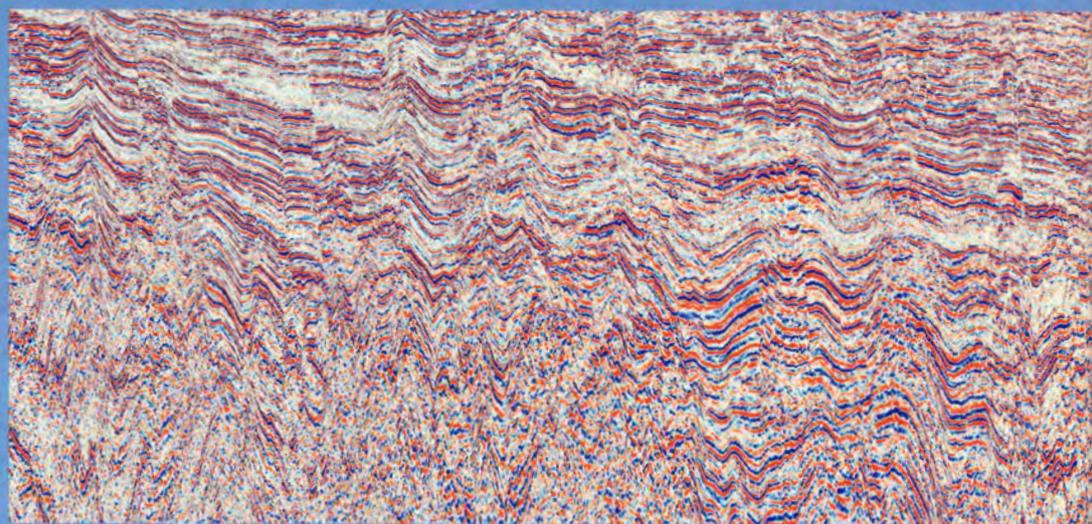
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- offsets limited to 25,000' in processing



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have surface velocities of 200-300meters/second and interior seismic velocities of about 500-700 meters/second. There is seismic evidence of anomalous, low velocity regions surrounded by the higher velocity areas within the cores of the pyramids.

One possible interpretation of such anomalies is the existence of open areas that could be burial chambers or tombs.

Encouraged by these results, Stewart is returning to northwestern Belize in May to conduct a third field season.

Non-Invasive Visits

Chan Chich and Ma'ax Na were built on the Eocene age limestone platform that comprises the Yucatan Peninsula. The karsted limestone platform – altered by erosion, slumping, and faulting – forms a series of escarpments, uplands and *bajos* (wetlands) in the Three Rivers Region, which straddles the Guatemalan-Belizian border.

Fourteen known major archaeological sites exist in the Three Rivers Region; only seven have been investigated. With the exception of Ma'ax Na, most sites have been plundered and bear the scars of looters' trenches.

Leslie Shaw of Bowdoin College in Brunswick, Maine, is the director of the Ma'ax Na Archaeological Project. Discovered in 1995 by researchers from the University of Texas at Austin, Ma'ax Na ("Monkey House" in Mayan) is large, approaching the size of Tikal in neighboring Guatemala.

Excavation of the site began in 1997. Non-invasive seismic data acquisition is being used to high-grade excavation

sites at Ma'ax Na – the site contains 20 to 25 large, intact structures that have not been looted.

"We would rather limit the number of large structures that we excavate," Shaw said, "because excavation can destabilize a structure, and because it takes a lot of time and money to do it well."

"We could not identify the early construction phases of a structure without major excavation."

According to Shaw, Stewart is the first to use 2-D seismic imaging of Maya tombs – and his work has enabled Shaw and her peers to identify three possible construction phases inside a pyramid at Ma'ax Na.

The Maya were opportunistic builders who took advantage of pre-existing or earlier structures – pyramids increased in height with additional construction phases.

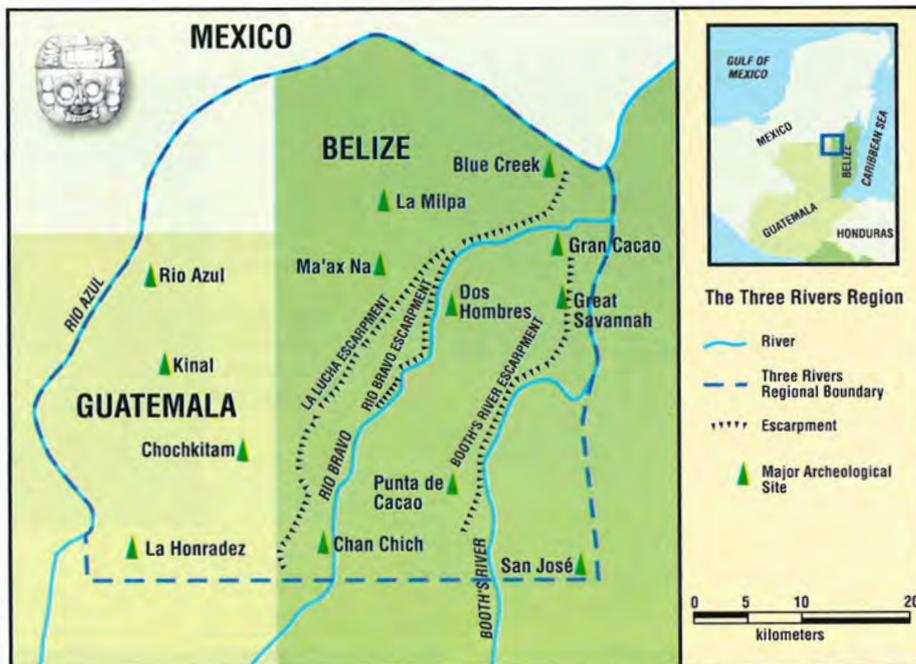
Shaw's enthusiasm for the seismic technique is echoed by Brett Houk, the director of the Chan Chich Archaeological Project. Chan Chich ("Little Bird" in Mayan) was discovered in 1938 by J.E. Thompson. The city was occupied by the Maya from about 770 B.C. to 900 A.D.

In 1997, the University of Texas at Austin began excavation at Chan Chich.

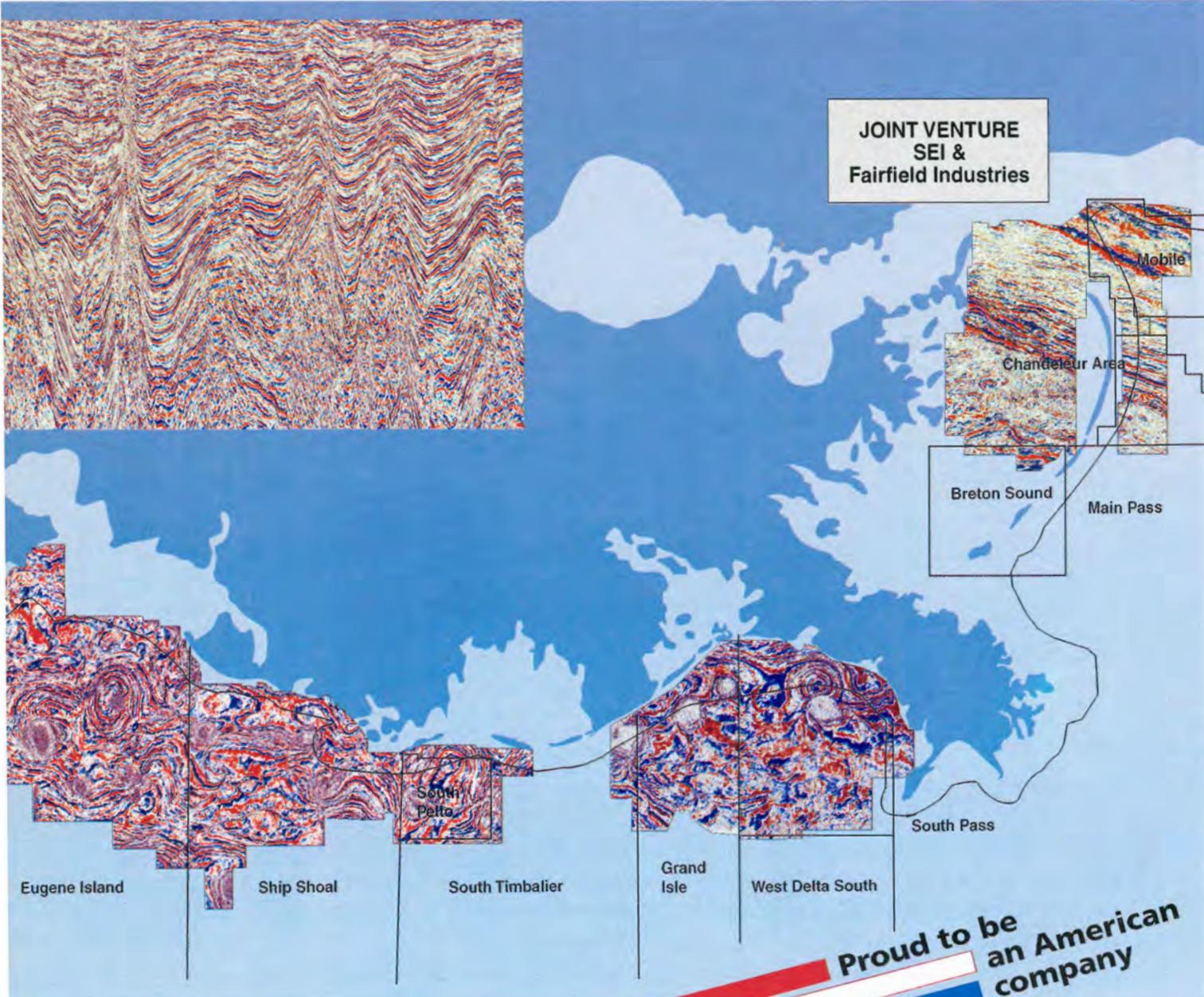
"There's a big movement in Belize not to destroy anything that's intact," Houk said. All archaeological work, including seismic data acquisition, is done under permit with the Belize Department of Archaeology. Archaeologists need compelling arguments to obtain excavation permits from the Belizian government.

Houk suggests that seismic imaging might just provide the subsurface picture needed to advance such compelling

See **Maya Project**, next page



Listening for clues: Workers acquire seismic data over two Maya pyramids and an adjacent place at the Ma'ax Na and the Chan Chich archaeological sites located in the Rio Bravo Conservation and Management Area (RBCMA).

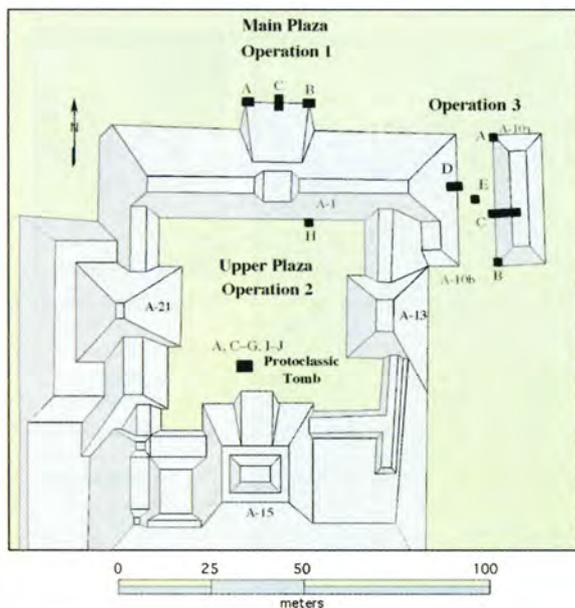


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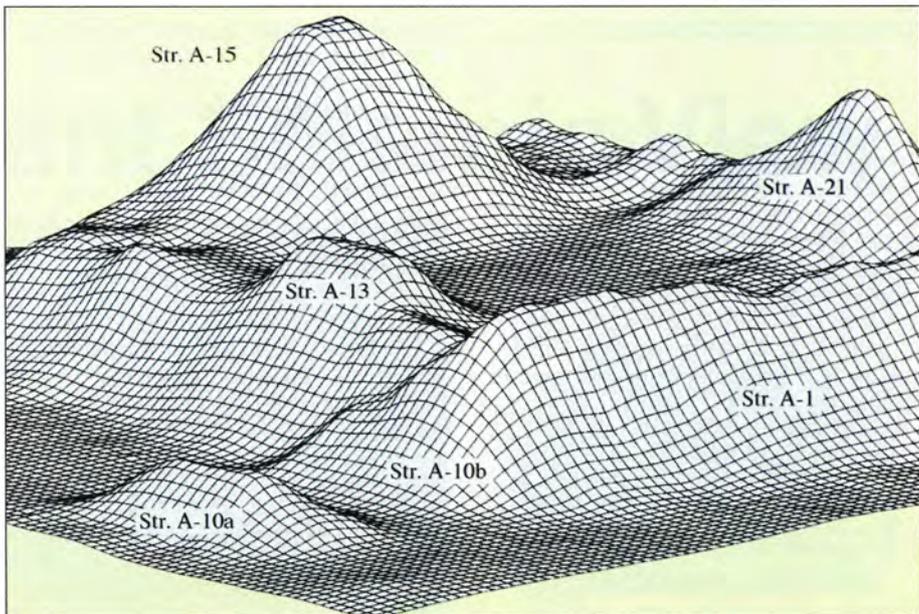
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Left, a schematic of the Upper Plaza, including the A-15 Pyramid.

Right, a mesh, 3-D digital elevation survey plot of the Upper Plaza, Chan Chich. (Houk, 1997)



Maya Project

from previous page

arguments, and is optimistic that the seismic method could provide an interior "floor plan," pinpointing the locations of the walls and floors, burial chambers, tombs and various phases of construction.

He is ready to go to the next step.

"I think it's really exciting," Houk said.

"We now have to excavate to prove the seismic concept, to see if it works."

Evolution of a Process

Stewart's archaeological application of high-resolution, multicomponent seismic technology has evolved through two field seasons.

"We're still trying to figure out the correct shooting geometries and the right instruments," he said. Ideally, he would like to use a real time processing unit in the field, facilitating daily discussions between geophysicists and archeologists.

In 2000 and 2001, hammer seismic surveys were conducted around the base of A-15 Pyramid at Chan Chich (see accompanying graphics). A-15 is the largest structure bordering the Upper Plaza – it stands some 18 meters high and is about 40 meters by 40 meters at its base.

The geophones were planted along a contour line two meters above the base of the A-15 Pyramid.

Stewart experimented by varying the location of the source points:

□ In the 2000 survey, the geophones were planted, with a two-meter spacing, on one side of A-15, with the five source points on the opposite side of the pyramid. This configuration produced a geometry similar to that of a VSP on its side.

□ In the 2001 survey, the geophones were laid along the same two-meter high contour line at A-15, and the 27 sources were located at the same elevation as the receiver (geophone) line.

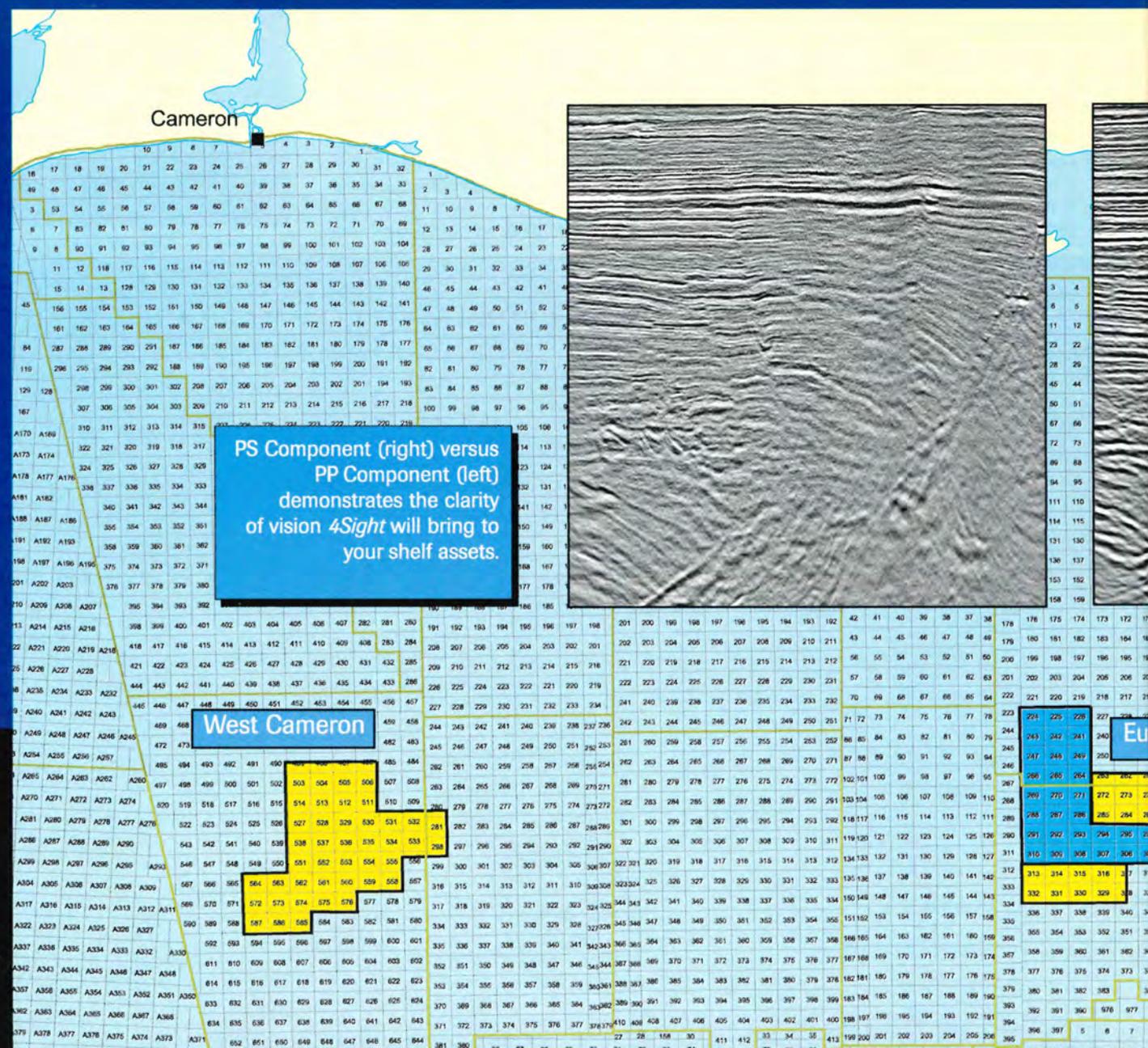
Also in 2001, a similar survey was conducted at a Ma'ax Na pyramid that was about 28 meters by 28 meters at the base and 15 meters high.

Both the 2000 and 2001 seismic surveys were acquired using three-component surface geophones, a 60-channel portable seismograph unit and – as a surface impact source – a hammer.

In 2000, Stewart, assisted by an 18-year-old student, expended a lot of muscle power hitting a sledgehammer 20 times at each source location.

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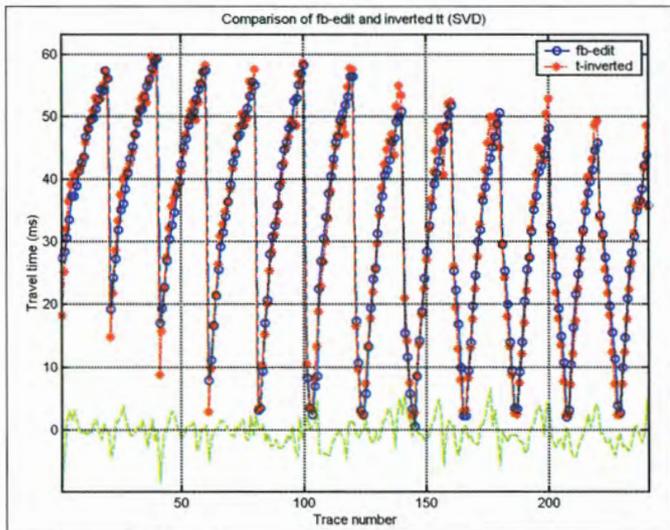


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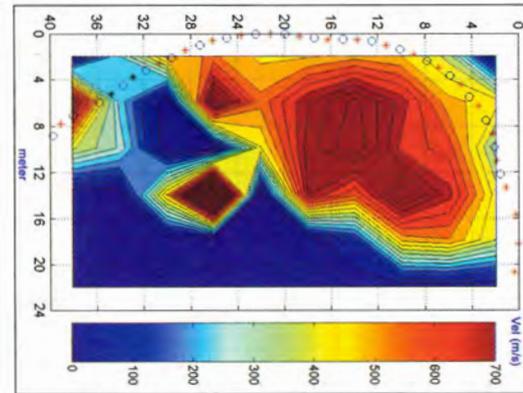
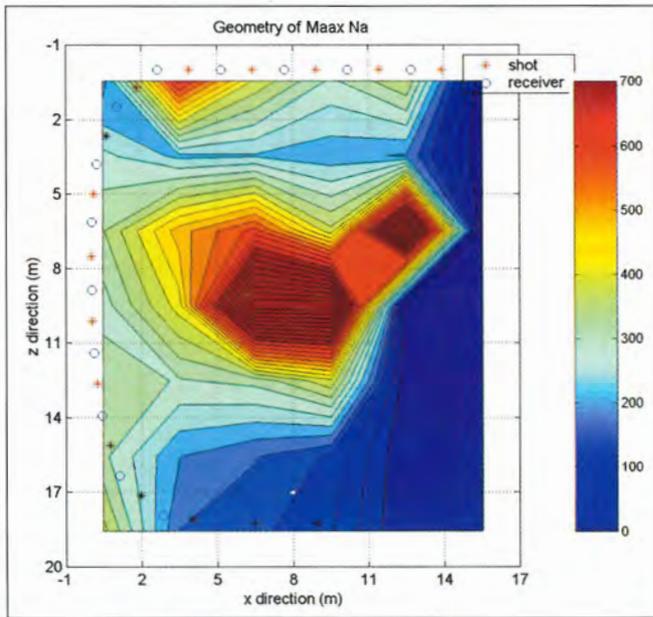
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Comparison of the observed first-break time and calculated time from inversion-estimated slowness model, year 2001 data.



Top: Velocity from the 2001 tests around the Chan Chich, Belize pyramid.

Left: Velocity map of Ma'ax Na, Belize pyramid.

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Processing of the 2000 survey suggested that Stewart didn't need so much muscle power. Sufficiently enlightened, he switched to three hits with a mallet at each source location, resulting in a higher frequency content in the 2001 data set.

"We need really high frequencies for the small pyramids," he said, "and low frequencies for the larger structures."

Stewart's research indicates that the seismic method can image deeper into archaeological sites than other shallow remote-sensing or geophysical methods developed in the mining industry – magnetometry, thermal imaging, ground penetrating radar, resistivity and conductivity. This is not surprising, given that seismic is designed to image kilometers into the earth's subsurface.

Ground penetrating radar (GPR), according to Stewart, doesn't always work in wetlands or in soils that are conductive.

Shaw concurs. "Wet soils in the tropics don't give great GPR readings," he said. "You need a level surface that's cleared to get good readings."

Into the Woods

At Ma'ax Na, the 15-meter-high pyramids are covered with dense tropical forest and vegetation – in fact, trees favor the limestone pyramids because they can establish deep root systems that aren't possible in the thin tropical soils.

Dragging GPR equipment through the dense jungle – up and over pyramids without getting it stuck – is a logistical challenge and an archaeologist's worst nightmare. The deployment of a string of geophones, in contrast, is simple and doesn't require clearing of vegetation.

Around 850 A.D., the social fabric of the Maya civilization began to unravel. The demise of the Maya may have occurred within a single generation or even over a period of a few years.

Archaeological evidence points to apparent upheaval, violence and warfare – perhaps brought on by an extended period of drought, famine or disease.

"What collapsed was not the Maya," Houk said, "but the ruling class of the Maya around 900 A.D."

Today, the descendants of the Maya live a subsistence lifestyle in the shadows of their ancestors' great cities. Archaeologists are hopeful that non-invasive seismic technology will play a key role in reconstructing the past and unlocking the mystery of the Maya. □

GEOPHYSICAL CORNER

Spectral Decomp Applied to 3-D

The Geophysical Corner is a regular column in the EXPLORER, edited by Denver consultant R. Randy Ray. This month's column is titled "Spectral Decomposition for Seismic Stratigraphic Patterns."

By KENNY LAUGHLIN
PAUL GAROSSINO
and GREG PARTYKA

While seismic processors have long used spectral decomposition, it is only in recent years that it has been applied directly to aspects of 3-D seismic data interpretation.

The method for doing this was first published in "The Leading Edge" in 1999, in a paper by Greg Partyka and others that illustrated the idea of using frequency to "tune-in" bed thickness.

Although spectral decomposition is a relatively new technique, some companies are experiencing great success in many basins around the world.

(Most of the best examples are in clastic environments where depositional stratigraphy is a key driver.)

Companies using spectral decomposition observe significant detail from these images at great depth – but have found that interpretation and integration with well data and models is critical to its success.

* * *

As shown in the channel system of

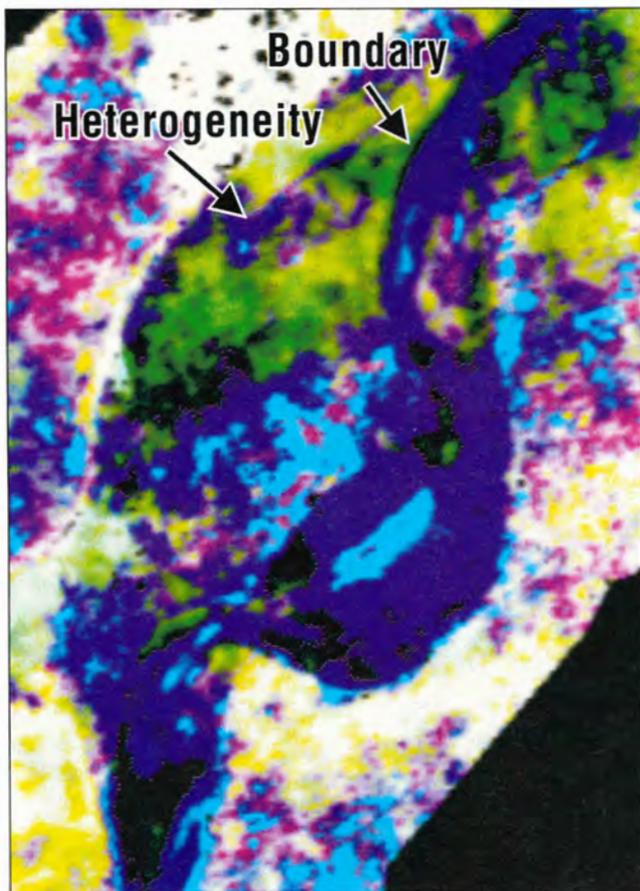


figure 1, spectral decomposition can extract detailed stratigraphic patterns that help refine the geologic interpretation of the seismic.

The concept behind spectral

decomposition is that a reflection from a thin bed has a characteristic expression in the frequency domain that is indicative of temporal bed thickness.

In other words, higher frequencies

image thinner beds, and lower frequencies image thicker beds.

This approach is similar to how remote sensing uses sub-bands of frequencies to map interference at the earth's surface. Just like remote sensing, it is very important to dynamically observe the response of the reservoir to different frequency bands.

The key is to create a set of data cubes or maps, each corresponding to a different spectral frequency, which can be viewed through animation to reveal spatial changes in stratigraphic thickness. Spectral decomposition reveals details that no single frequency attribute can match.

* * *

Based on well-understood principals, typical amplitude maps are dominated by the frequency content of seismic data and will best image stratigraphy with thickness related to the dominant frequencies processed with the seismic.

This is illustrated in figure 2a, where we have a stratigraphic feature that varies in thickness. If the frequency content is high, thinner stratigraphic features will be "tuned" in and highlighted by higher amplitude (figure 2b). If the frequency content is lower, thicker stratigraphic features will stand out (figure 2c).

What is needed is to see all the

continued on next page

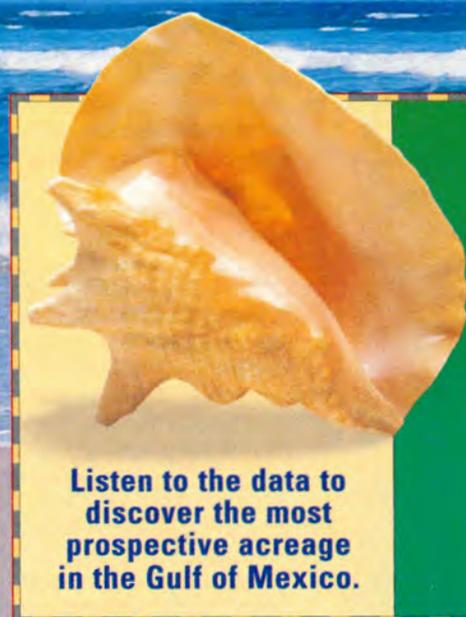
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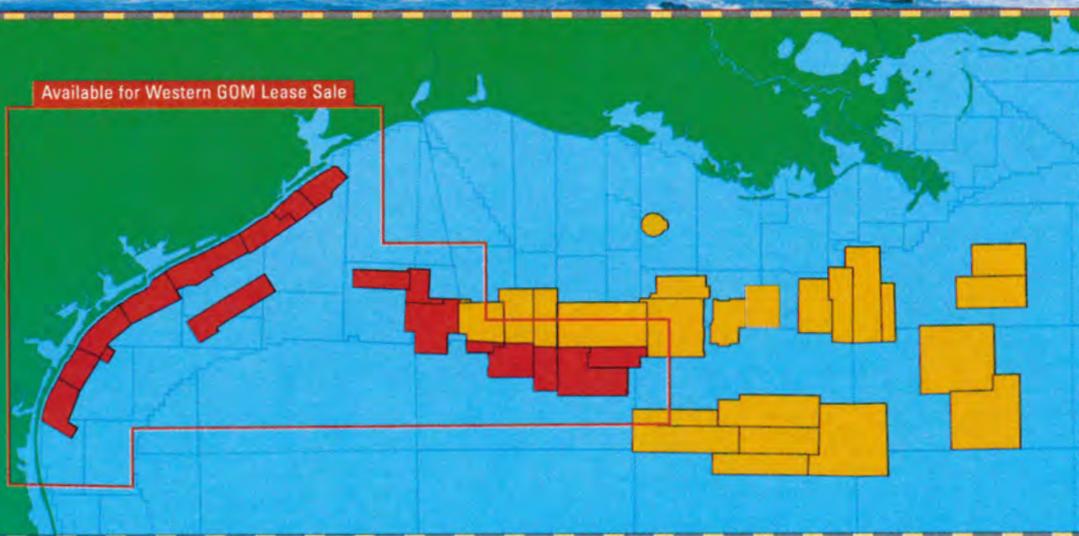
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Figure 2 – Thin bed interference. In thin reservoirs with varying thickness (left) seismic data with higher dominant frequency would highlight the thinner parts of the reservoir on amplitude maps (middle), while seismic with a lower dominant frequency would highlight the thicker parts on an amplitude map (right).

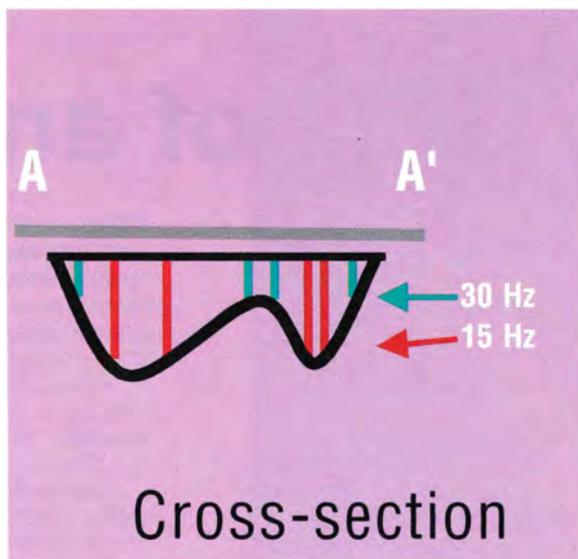


Figure 2a

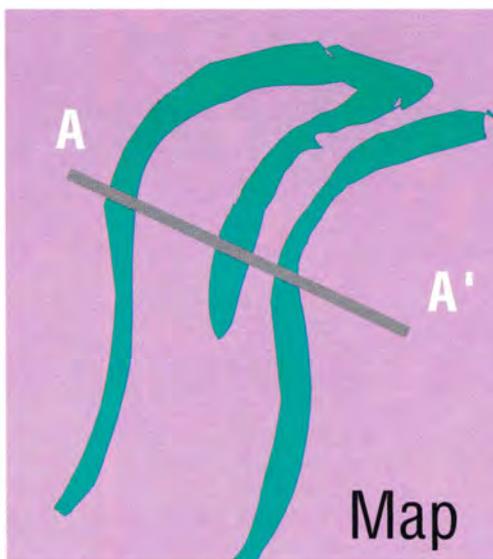


Figure 2b

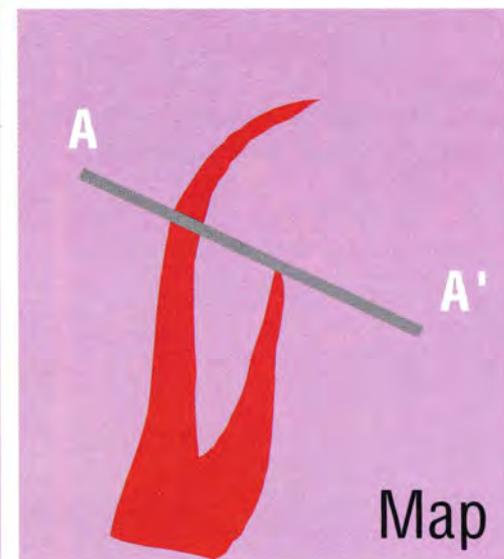


Figure 2c

continued from previous page

different stratigraphic thicknesses in a meaningful way.

Spectral decomposition provides this by generating a series of maps or cubes that observe the response of the reservoir to different frequencies. These are then animated allowing the interpreter's eye to catch subtle changes in the reservoir through motion.

There are other good methods that can analyze tuning, but none are as easy to create or as routinely used as the method of animation called the "Tuning Cube."

To use spectral decomposition, you would interpret a seismic horizon and create a seismic amplitude map. The amplitude map is critical as a base to determine if spectral decomposition is adding to your interpretation.

If you believe that amplitude is a meaningful indicator for reservoir presence, then spectral decomposition is a new step in the interpretation workflow.

The seismic horizon is then used to transform a window of the data around the event of interest into the frequency domain and generate a series of amplitude maps at different frequencies. Thin bed interference will cause notches in the frequency domain related to the bed's thickness. This is expressed on the amplitude maps as areas of high and low amplitude when animating through the different maps.

Subtle changes in reservoir thickness or internal heterogeneities can be observed when comparing these images. Very quickly you will get a feel for areas with active stratigraphic variation that need to be evaluated in more detail.

Tracking between these maps and the seismic cross-section is critical to determine if the features you are seeing are geologically meaningful. So is combining these images together.

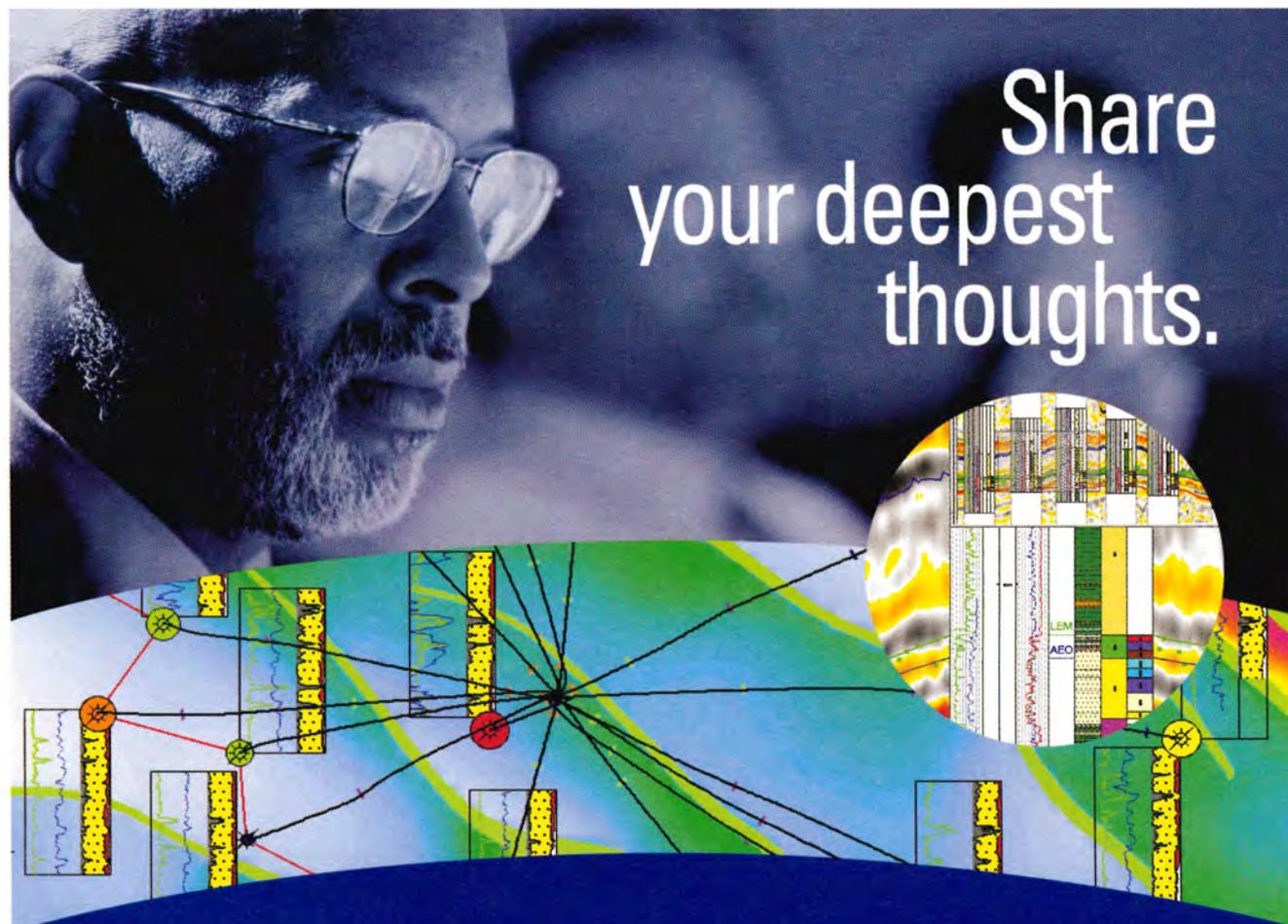
* * *

For example, consider figure 3 (page 31), which contains a stratigraphic feature that appears to have a fan geometry.

At lower frequencies from the "Tuning Cube," the feeder channel of the "fan" is highlighted (left image). At higher frequencies, different lobes of the fan geometry are highlighted (middle image). At the highest frequencies available in the seismic data, the thinnest areas are highlighted (right image).

In this example, there are actually 30 images that need to be animated to

See **Spectral Decomposition**, page 31



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INTERNATIONAL BULLETIN BOARD

Sponsor Program a GEM of an Idea

By **BRENDA K. CUNNINGHAM**
Robbie Gries does it. Mike Party is just now learning how to do it. Bob Cowdery's been doing it for years.

Before your imagination carries you away, "it" is financial sponsorship of AAPG members – and the initiative is called the Geoscientists Enabling Membership (GEM) Program.

For many years, several AAPG members have quietly provided funds for other AAPG members around the world that, for one reason

or another, simply couldn't pay the dues.

Sherm and Florence Wengerd, for example, began their financial sponsorship of a Madagascar geologist after a visit to that country in the mid-1980s. Their guide for that trip was a geologist's wife, and through their conversations they learned that currency was not allowed to leave the country, making it impossible for her husband to pay dues to any organization outside of Madagascar. They volunteered to

provide funds for his membership should he choose to apply.

Mrs. Wengerd has continued their sponsorship even after Sherm's death a few years ago.

* * *

GEM is a member-to-member initiative open to *all* AAPG members, regardless of whether you give or receive, or reside inside or outside of the United States.

As a financial sponsor you may, if

you wish, stipulate a country, region, discipline or other criteria for use in pairing your sponsorship with potential recipients. You may remain anonymous if you so choose.

Although a mentoring relationship may be an additional benefit of the program, no such obligation is required.

Sponsorships may continue on a yearly basis for whatever length of time you, the sponsor, desires. In most cases, a geoscientist may simply need financial sponsorship until their employment situation improves, or their country's economy is vitalized.

AAPG headquarters recently was informed by an international member that, because of the economic crisis within his country and the resultant uncertainty of his personal finances, he would be unable to pay his upcoming dues. Acting independently from AAPG headquarters, the GEM Program was able to locate a financial sponsor for him so that his membership remains intact until his country's financial situation improves.

Because of tax regulations, AAPG cannot be involved in the administration of the program.

I have volunteered to act as the GEM Clearinghouse, and as such will be responsible for:

- Cataloguing those who wish to sponsor a fellow geoscientist, and all relevant information.
- Receiving direct requests from those desiring sponsorship from within the United States.
- Receiving requests from those desiring sponsorship that reside outside the United States via the appropriate Regional President or AAPG Service Team Leader.
- Coordinating bookkeeping with AAPG headquarters.

* * *

As a clarification, this program in no way obligates an AAPG member to professionally sponsor an applicant, nor does it relieve an applicant from providing the appropriate professional sponsors on his or her membership application. The GEM Program involves **ONLY** financial sponsorship.

Since the beginning of my involvement with this program eight months ago I have been contacted by over 25 AAPG members wishing to become a GEM.

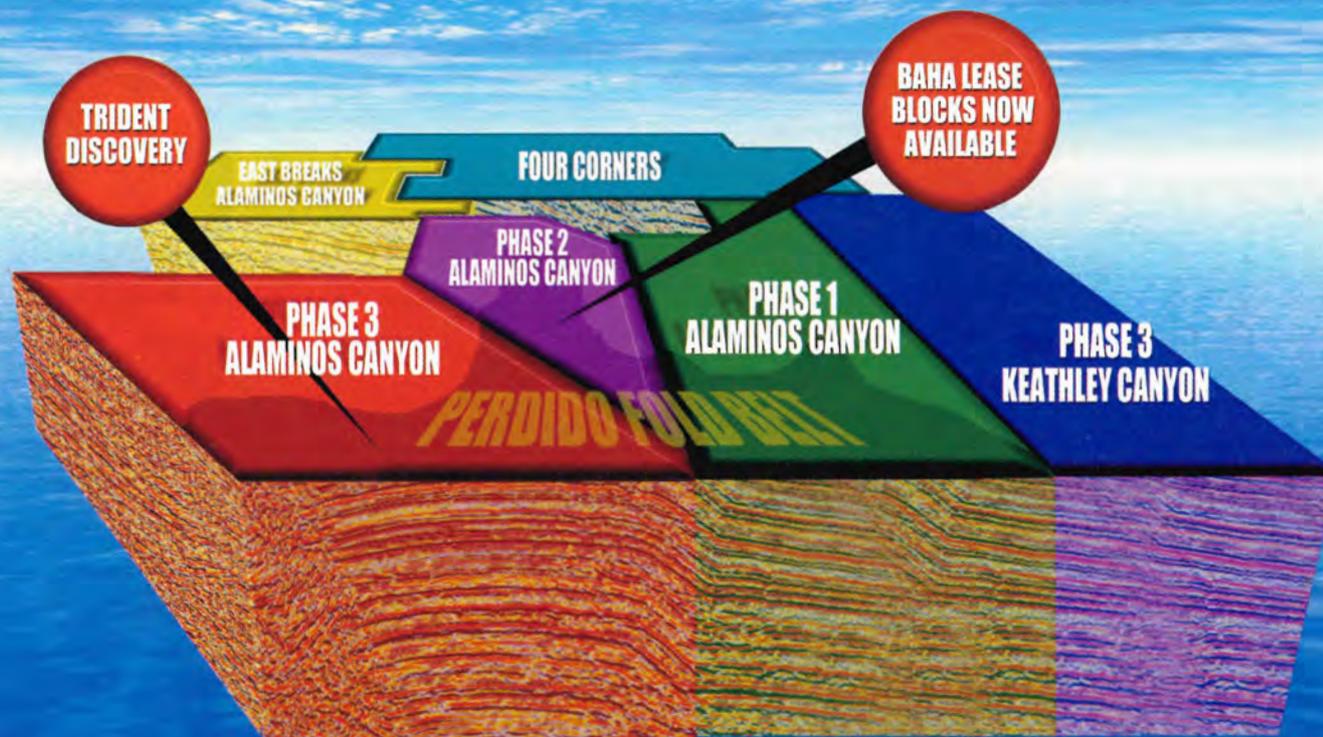
I encourage you, if your individual situation allows, to become a GEM. Please contact me directly if:

- ✓ You wish to financially sponsor a fellow geoscientist.
- ✓ You are in need of a sponsor and reside in the United States.
- ✓ You have questions or comments.

If you are in need of financial sponsorship and live outside of the United States, please contact your AAPG regional president, regional vicechair, or AAPG Service Team Leader. This information may be found on AAPG's Web site (www.aapg.org) under the

continued on next page

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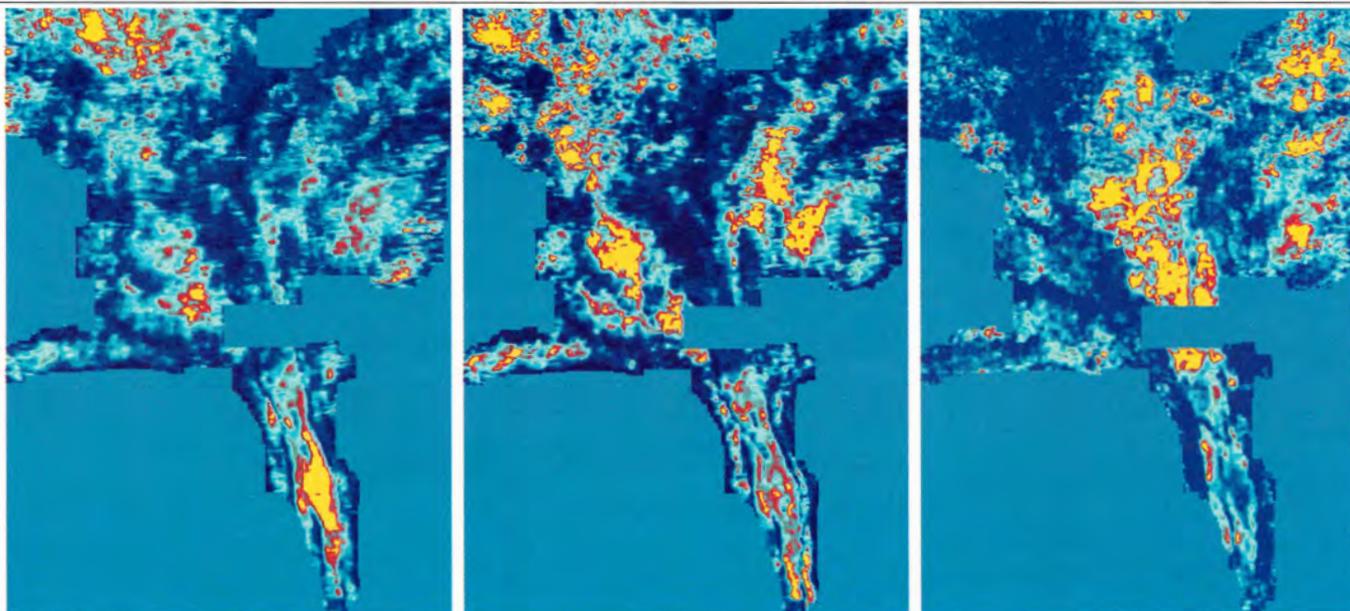
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Figure 3 – Three successive spectral decomposition images showing the different parts of the reservoir being highlighted by different frequency bands. Thicker stratigraphy on the left, thinner on the right.



Spectral Decomposition

from page 29

allow the eye to catch all of the detail available. Integration with well control is critical to determining the accuracy of the geologic interpretations.

As mentioned, spectral decomposition is a relatively new technique that already has helped bring great success in many basins around the world.

As such, it is poised to become an essential tool for the geologic interpretation of seismic data.

(Editor's note: Kenny Laughlin is a geophysicist with Landmark Graphics in Denver; Paul Garossino is a geophysicist with BP's Upstream Technology Group in Houston; and Greg Partyka is geoscientist with BP's Upstream Technology Group in Sunbury, U.K.)

continued from previous page

International button).

This year alone, the GEM Program has financially sponsored eight faculty advisors at universities in Eastern Europe and the former Soviet Union. The program, in addition to the First Ladies' Initiative developed by Merrill Thomasson and other AAPG past presidents' wives, allows these professors, as Active AAPG members, to act as faculty advisors for new AAPG Student Chapters in their respective countries.

In light of recent world events, initiatives such as these that have the potential to close the "six degrees of separation" between the people of the world are even more important than ever. We are ALL scientists of the Earth.

Please join us in our efforts to make the benefits of AAPG membership a reality for as many qualified geoscientists as possible!

(Editor's note: Brenda Cunningham, an AAPG honorary member, is with West Texas Digital Inc., Midland, Texas, and can be reached at (915) 682-3682; or by e-mail at wtdi@swbell.net.)

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BUSINESS SIDE OF GEOLOGY

Bad Manners Are Bad for Business

By PETER R. ROSE

Since starting this column in January 2001, the topics have focused on concepts and techniques to help you value your E&P ventures more objectively, or to manage your E&P business more efficiently. But Robbie Gries' stirring presidential address at the recent Houston annual meeting (see page 34) reminds us that ethics is a key part of our profession and business, one that we need to pay more (and more frequent) attention to.

So, without going back, chapter and verse, to our AAPG Code of Ethics, as Robbie did so effectively, I've decided to devote an occasional column to this essential but frequently neglected aspect of the Business Side of Geology – professional ethics.

Because the annual meeting is still fresh on my mind, I'd like to start with two ethical issues that seem to be arising more frequently in our presentations in open technical sessions. These issues concern:

- Blatant commercialism in supposedly objective scientific papers.
- The lack of appropriate acknowledgements of prior sources in our illustrations and prepared remarks.

All of us should recognize that, when we present a good paper or poster at a regional, national or international

Our long-term professional success in this business rests upon a foundation of intellectual and factual integrity, and small dishonesties imply larger underlying ethical shortcomings.

meeting, two things are happening:

✓ We are contributing to, and participating in, the ongoing growth of geoscientific knowledge, from which all geoscientists, our employers and clients, as well as society itself, benefit.

This open tradition has been operating for at least 250 years, and I hope it will continue forever.

✓ Inevitably, we are demonstrating technical expertise – putatively sanctioned by AAPG – that may well contribute to our career advancement, new partners or new clientele. And that's OK, so long as it is incidental to – and not the object of – our presentation.

In addition to the venues AAPG provides for our scientific proceedings, the active networking that goes on at such meetings is also a valuable service that AAPG provides.

The problem is, what is passive professional exposure, and what is just crass business advertising?

Although the boundaries may be fuzzy, my own impression is somewhat consistent with Justice Potter Stewart's analogous comment about pornography: "I can't define it, but I know it when I see it."

Unless we promptly and effectively correct this developing trend, our annual AAPG meetings may well degenerate into commercial fairs.

The second issue concerns failing to cite previous workers on whom our later work rests. Because I've been a professional geologist now for 43 years, I've witnessed a lot of presentations and posters, and read a lot of articles. Increasingly, I think I'm seeing a lot of concepts, ideas, findings, quotes and even figures thrown up on the screen that I know were first put forward by

someone other than the speakers who now blithely present them as their own. What I don't often see (or hear) is the obligatory "after Smith 1987," or "modified from Jones 1999."

It's not an acceptable excuse to blame such lapses on the ease and reach of the Internet, or the facility of PowerPoint, or one's ignorance of the prior literature. At worst, such omissions represent scientific dishonesty; at best, they reflect just bad professional manners. You also may be violating copyright laws.

But rest assured, your more experienced listeners do notice, and they do remember. This also applies to private presentations to clients and prospective partners.

So what do these two problems have to do with the business of petroleum geology?

Well, first, our long-term professional success in this business rests upon a foundation of intellectual and factual integrity, and small dishonesties imply larger underlying ethical shortcomings.

Second, the progress of our profession depends substantially upon learning from each other through open sharing of ideas and techniques.

When we do not fairly credit the work

continued on next page

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of others, we risk turning off otherwise worthy contributors, and also getting ourselves shut out of future free exchanges of information, by alienating colleagues who could be helpful to us.

Third, crass commercial self-promotion in scientific proceedings insults the intelligence of technical audiences, wastes their time, turns them off – and reveals the speaker's ignorance, lack of class and selfishness.

Again, influential listeners notice, and remember. *Bad manners are bad business.*

How to correct these problems?

□ On AAPG's part, the technical program chair for each meeting should include a prominent warning in both the Call for Papers and Notification of Acceptance to prospective presenters.

Judges should be required to evaluate speakers' observance of these two principles, along with other traditional criteria of performance.

□ Session chairs and AAPG members in the audience should speak out at the end of offending presentations, when they find such omissions and/or commercialism offensive and inappropriate.

□ Speakers who offend twice should not be allowed to present under the AAPG auspices for three years, instead being advised to pay for a booth at next year's exhibits hall!

For prospective speakers, here are some useful hints:

✓ Don't lift slides directly from your sales pitch for your AAPG paper.

✓ Ask yourself, "Does my talk clearly emphasize a new technical contribution, or is it just a vehicle to promote my business?" Don't use AAPG venues as advertising vehicles!

✓ Don't show data in your talk that you're not willing to release to interested colleagues.

✓ Show your logo only twice – on your opening and concluding slides.

✓ Go over each slide carefully and proactively, looking for material originated by someone else, and acknowledge them!

* * *

This month's recommended reading: "Stocks for the Long Run," by Jeremy Siegel (1994 McGraw-Hill). An excellent, thoughtful perspective on personal investing, based on thorough, documented historical data.

Read it, you'll like it!

(Editor's note: Peter R. Rose is managing partner of Rose & Associates, Austin, Texas.)

Four Lecture Tours Planned for May

Four AAPG Distinguished Lecturers – two domestic and two international – will make their speaking tours in May.

They are:

Domestic Tours

□ James A. Harrell, professor at the University of Toledo, Toledo, Ohio, and a long-time veteran of Egyptian field work, will be speaking from May 6-20 on the topic, "Archaeological Geology in Egypt: Ancient Oil Wells and Mummy Bitumen, Earliest Geological Map, First Paved Road, Pyramid Temple Pavements and the Sphinx Age Controversy."

Scheduled stops on his tour include the University of South Dakota, Vermillion, S.D.; Tulsa Geological Society; Southern Methodist University,

Dallas; Four Corners Geological Society, Billings, Mt.; Utah Geological Association, Salt Lake City; California State University, Fullerton; Northern California Geological Society, San Ramon; the University of California, Santa Barbara; and the Northwest Energy Association, Portland, Ore.

□ Kurt W. Rudolph, hydrocarbon systems resource manager for ExxonMobil Exploration, Houston, will speak May 16 at the Permian Basin Geophysical Society, Midland, Texas, on "DHI/AVO Analysis Best Practices: A Worldwide Analysis."

His lecture is co-sponsored by the Society of Exploration Geophysicists.

International Tours

□ James A. MacKay, exploration geologist for ChevronTexaco, Houston, will tour Latin and South America from May 6-17, speaking on "Exploration Risk Assessment: What Is It? Who Is Responsible?"

□ Gabor C. Tari, chief geophysicist-interpretation for Vanco Energy, Houston, will be touring Eastern Europe and Central Asia from May 6-24, offering three lectures.

His tentative schedule includes stops in Bulgaria, the Czech Republic, Hungary, Poland and Slovakia. For specific dates and speech titles check the AAPG Web site at www.aapg.org.

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AAPG 2002 Hits 'A Home Run'

Big Crowds Boost Annual Meeting

By VERN STEFANIC
EXPLORER Managing Editor

A convention that celebrated the profession's golden days even while eyeing future exploration possibilities ended up being the largest AAPG annual meeting in nearly two decades.

Final attendance figures for the AAPG annual meeting at the George R. Brown Convention Center in Houston totaled 7,665, making it the largest association gathering since the 1985 meeting in New Orleans.

"I felt AAPG 2002 was a home run," general chairman Jeff Lund said, even before the final figures were released.

Lund, in praising the hundreds of people who were involved in planning, organizing and managing the meeting, said that "all delivered beyond my expectations."

"Our opening session went well ... and we immediately saw registration headed to the hoped-for 7,000-plus target," he said, "and that our fears of disappointing attendance due to the recession, low oil prices in the fall and '9-11' or possible new terrorist threats were going to be overcome."

The Houston attendance figures marked only the fourth time since the 1985 meeting in New Orleans (9,276) that an AAPG annual meeting drew more than 7,000 people. During that same period, annual meetings in Houston attracted 7,645 (1988) and 6,811 attendees (1995).

The large numbers made for considerable optimism during the meeting, despite current global conditions that could have been described as unstable at best, and volatile in the extreme.

Several technical sessions dealt with exploration opportunities in remote global regions – in one case, an entire session on exploration in and from outer space – and the exhibition hall was packed with its usual array of eye-popping technology and displays.

The total number of commercial and educational booths sold in the exhibit hall hit 836, including 65 booths in the International Pavilion.

In fact, even though Texans attending the meeting represented 59 percent of the total attendance (3,955), the meeting had a sizable international flavor. Non-U.S. attendees totaled 17 percent of the final number. Non-U.S. locales with the largest numbers of attendees were:

1. Canada – 199.
2. England – 171.
3. France – 76.
4. Brazil – 64.
5. Norway – 54.
6. Saudi Arabia – 42.
7. Venezuela – 40.
8. Australia – 35.
9. Netherlands – 33.
10. (tie) Mexico, Nigeria – 30 each.

The meeting's theme was "Our Heritage – Key to Global Discovery," and Lund said a personal highlight for him was "getting to know Mike (Michel T.) Halbouty, who inspired our heritage theme."

Indeed, Halbouty, one of the profession's storied oilfinders, had a high profile in Houston, giving a technical talk, speaking at the DPA luncheon and receiving the American Geological Institute's Legendary Geoscientist Award at the All-Convention luncheon.



"Having Mike participate ... made me realize we succeeded in making our theme come alive," Lund said, "and we connected to the many students and young geologists who attended."

Are We Wimps?

Among the meeting's other highlights was the Presidential Address, presented by Robbie Gries during the opening session, which challenged the ethics and morality of geologists with a question:

"Are we ethical wimps," she asked, "or just prudent?"

Gries, in expanding on points made in her column in the April EXPLORER, said that "most AAPG members really are good people," but that she agreed with Dennis Moberg, professor at Santa Clara University (Calif.), that "a significant number of unethical acts in

business are likely the result of foibles and failings ... rather than selfishness and greed.

"Our moral lapses are usually not because of what one does, but for what we fail to bother to do," she said.

"Scripts (cognitive shortcuts that take the place of careful thinking), distractions and our natural tendency to exclude those unfamiliar to us cloud our best thinking and interfere with the expression of our best ethics."

Gries spoke of ethics from two perspectives: As professionals needing to do their best, and as victims of those who do not.

"We each must be guided by high standards of business ethics, personal honor and professional conduct," Gries said.

"If you have been in this business very long and have not been the victim of someone's dishonest behavior, then

you are likely the exception and not the rule," she said. "And it is much worse when the perpetrator is a member, bound by the same code of ethics that we all are."

Gries, in giving an example of how a business associate treated her in an unethical manner, questioned her own choice at that time in not demanding action against the perpetrator.

"Because I didn't, and others did not cause him to be accountable for his poor ethics, he was allowed to continue in this misbehavior," Gries said, "and who knows how many other good companies and geologists were burned?"

"He was also allowed to set poor standards for his employees, and many

continued on next page

Paper by Harris, Cooper Earns Matson Award

A paper presented in Houston by Richard G. Harris and Mark Cooper dealing with remote sensing has earned them the George C. Matson Award for the best oral presentation at an AAPG annual meeting.

The top paper was "Structural Analysis of Eastern Yemen Using Remote Sensing Data," presented in the AAPG session on "E&P Activities in North Africa and the Arabian Platform."

Harris and Cooper, both with PanCanadian Petroleum in Calgary, Canada, will receive their prize at the 2003 AAPG annual meeting in Salt Lake City.

The Jules Braunstein Award, given for the best poster presentation in Houston, will be announced at a later date.

Other winning technical presentations at the Houston meeting were:

EMD Sessions

□ Frank Kottowski Memorial Award (best paper) – Janok P. Bhattacharya, Carlos V. Aiken, Rucsandra M. Corbeanu, George A. McMechan, Xueming Xu and Xiaoxian Zeng, all with the University of Texas at Dallas; and Christopher D. White, with Louisiana State University, Baton Rouge, La., for "3-D Outcrop Reservoir Characterization."

□ Best poster award – Hal Gluskoter, Ron W. Stanton and Peter D. Warwick, all with the U.S. Geological Survey, Reston, Va.; and Romeo M. Flores, USGS, Denver, for "Adsorption of Carbon Dioxide and Methane in Low-Rank Coals and the Potential for Sequestration of Carbon Dioxide."

DPA Sessions

□ Best paper – John I. Howell III, Portfolio Decisions Inc., Houston, for "Implementing Portfolio Management;

continued from previous page

of them adopted these unethical standards," she added, "many that are AAPG members today."

Gries said AAPG members already have a standard in place: the Code of Ethics, which applies to a geologist's dealing with clients, the association and with each other – and gives a format for holding members up to the standard.

"Now, let's look at our history on this issue," she said. "AAPG has not brought any ethical charges against a member in the last 10 years. We have had about five or six charges filed in 10 years, which represents about .0002 percent of our membership."

"Either we are an exceptionally ethical group," she said, "or we are just not bothering with initiating a grievance."

Even in recognizing the huge cost of time and money in pursuing legal actions that enforcement of the Code brings, Gries said the situation begs a question: Will we enforce our thoughtful and deliberate Code of Ethics, or not?

"If not, then let's remove the Code from our bylaws," she said, "recognizing that we are not, as individuals or as an organization, going to spend the time, money and emotional energy policing ethics – recognizing that perhaps we are just being prudent in a very litigious world."

"Or, if we decide to keep it, then let's practice it, let's teach it, let's enforce it."

"Are we ethical wimps," she closed, "or are we prudent? Let's decide." □

Integrating Tools, Process and People." His co-authors were Lillian H. Warren and Anita L. Howell.

Student Sessions

□ Best paper – Victor A. Pusca, University of Wyoming, Laramie, Wyo., for "High-Relief Bypass Surfaces – A New Perspective on the Architecture of a Diatomite/Clastic Reservoir in the Monterey Formation of California."

□ Best poster – Vanessa R. Kertzus, Universidad Central de Venezuela, Caracas, Venezuela, for "Biostratigraphic Analysis and Environmental Implications of La Luna Formation, Rio Loro Section, Western Venezuela." □

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Congressman, Governor Agree

Lack of Energy Policy Decried

Global events, market instability and dependence on foreign oil are important reasons why America needs a meaningful energy policy – and leaders from the petroleum industry must help educate the public about the issues and the role of oil and gas supplies in the nation's future.

That was the message of two nationally prominent political leaders who spoke to luncheons during the AAPG annual meeting.

U.S. Representative Joe Barton, chairman of the House subcommittee on energy and air quality and an author of

the Energy Advancement Conservation Act that passed the House last summer, spoke to the All-Convention luncheon, and Arkansas Gov. Mike Huckabee, chairman of the Interstate Oil and Gas Compact Commission, spoke to the Division of Environmental Geosciences luncheon.

Both speeches were focused firmly on America's future, and on the country's need for a solid energy policy.

Expanded coverage of the talks can be found on the AAPG Web site at www.aapg.org.

All-Convention: Barton

U.S. Representative Joe Barton told AAPG members that a supply component must be part of any meaningful energy policy – and the U.S. House of Representatives is resolved to pass legislation that will provide the nation with a sound basis for future energy decisions.

"America needs an energy policy," Barton said. "Why? Because we are the world's greatest economy and we run on energy – so we have to have an energy policy and it has to have a

supply component.

"Conservation is important," he said, "but we're an economy that wants to continue to grow and sustain economic prosperity, which means a supply component must be part of our energy policy."

Opening the Arctic National Wildlife Refuge to exploration is a key part of the supply component in any energy legislation, and Barton said the House is closer to achieving this goal than ever before.

"We have to open ANWR because that's where the oil is," Barton said. "The petroleum industry has proven it can produce oil from the North Slope or anywhere in the United States in an environmentally safe manner – you only have to look at the experience at Prudhoe Bay."

DEG: Huckabee

Arkansas Governor Mike Huckabee also stressed that America needs a sound energy policy focused on the future.

"No one here needs to be reminded of how vulnerable our country is to a disruption of our oil and natural gas supplies," he said, "but what are the problems we face in the next few years?"

Huckabee suggested three areas of concern.

□ Terrorism – "A successful attack on our energy infrastructure would have devastating, catastrophic effects on our economy, not to mention the potential human toll," he said. "We cannot afford for something of a catastrophic nature to happen to our energy industry."

□ Instability in the Middle East and its impact on America's petroleum supply. The Energy Information Administration estimates the United States imports 56 percent of its oil supplies, he said, – and by 2020 that figure will swell to 62 percent.

□ Energy consumption, which is outpacing production. Since the 1970s, energy production has grown only 14 percent, but consumption is up over 30 percent. The EIA predicts that the nation's total energy consumption over the next 20 years will increase by 32 percent.

Huckabee also said the federal government should not be the sole solution for our energy policy. There is plenty the states and industry should work toward, including his "Four E" suggestions:

□ Educating the public.

"Americans must understand the true costs and consequences of our ever-increasing reliance on imported energy," he said.

□ Expansion of research efforts.

"Federal and state resources should be leveraged to encourage public and private research to recover and more efficiently find our own reserves," he said.

□ Exploration – and an important step in that direction is re-examining federal and state policies on providing incentives for domestic exploration and production, he said.

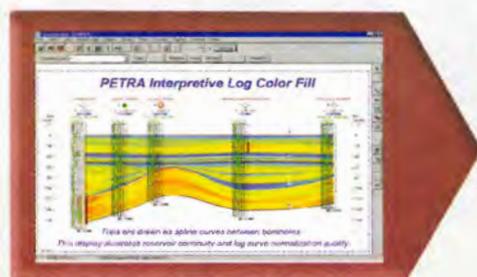
□ Efficiency.

"I'm convinced we can implement all of these solutions," Huckabee said. "I'm also convinced we must do so to plan for the future."

– KATHY SHIRLEY

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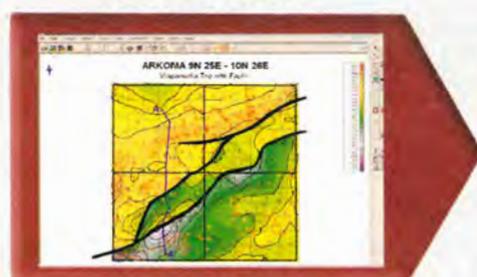
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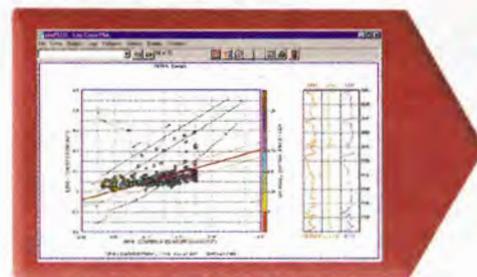
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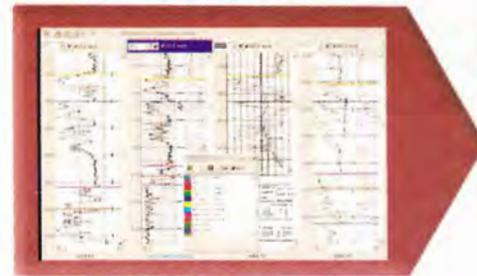
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House Officers Elected

HoD Makes 'Short' Work of Agenda

AAPG House of Delegates Chairman Ed Dolly came within 10 minutes of making good on his goal of completing the 2002 HoD meeting in Houston before noon.

Considering that the agenda contained about 50 items, the 12:10 p.m. adjournment was considered a monumental accomplishment by the delegates and observers.

Of 248 elected delegates, 207 attended the meeting held in Houston during the annual meeting.

As Dolly noted in the March EXPLORER, the nine-month period between House meetings (the previous meeting was last June in Denver) had shortened the business year. But the agenda still included reports from various House committees, AAPG, the AAPG Foundation and the divisions.

Business at hand included the accepting of the Association of Ukrainian Geologists and the Scientific Council for Petroleum of the Croatian Academy of Science and Arts as affiliated societies.

Delegates also accepted the Geological Society of America as an associated society of AAPG.

Additionally, delegates put the final touches on recommendations from the Ad Hoc Committee on Constitution and Bylaw Amendment Process (COCBAP), which was formed in 1998. The multi-year debate over the question of how changes to the governance of AAPG are to be handled has been sometimes rancorous over the years.

Delegates at last year's Denver meeting approved the COCBAP 2 Resolution to formalize a mechanism through which to obtain comments from each of the three governing bodies on amendments affecting any one of them.

At Houston, delegates put the finishing, legal touches on the resolution, providing closure on the issue.

Under new business, delegates approved retroactive awarding of the House Recognition of Service Award to past HoD secretaries and secretary/editors beginning with the 1996-1997 term of office.

Those receiving House awards in Houston included:

□ Honorary Membership Award – Will Green, Midland, Texas.

Delegates put the finishing, legal touches on the COCBAP resolution, providing closure on the issue.

□ Distinguished Member Award – Jean Lemmon, of Tulsa, and Tom Mairs, Dallas.

□ Long Service Award – Patrick Daugherty, Wichita Falls, Texas.

□ House Certificate of Merit – Ed Dolly, of Denver.

Delegates also voted George Eynon, of Calgary, Canada, as 2002-03 House chairman-elect, and Katharine Lee Avary, of Morgantown, W.Va., as secretary/editor.

The two will assume office on July 1, along with Terry Hollrah, of Oklahoma City, who begins his term as chairman of the House. □

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Instructors

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Technology

from page 23

constant distance from the seabed and only needs a crew and vessel for the launch and recovery process.

Needless to say, the AUV requires some ultra-sophisticated programming technology. Boeing has been developing this kind of software for a number of years, and the company recently formed a partnership with Oceaneering and Fugro to provide an AUV for commercial use.

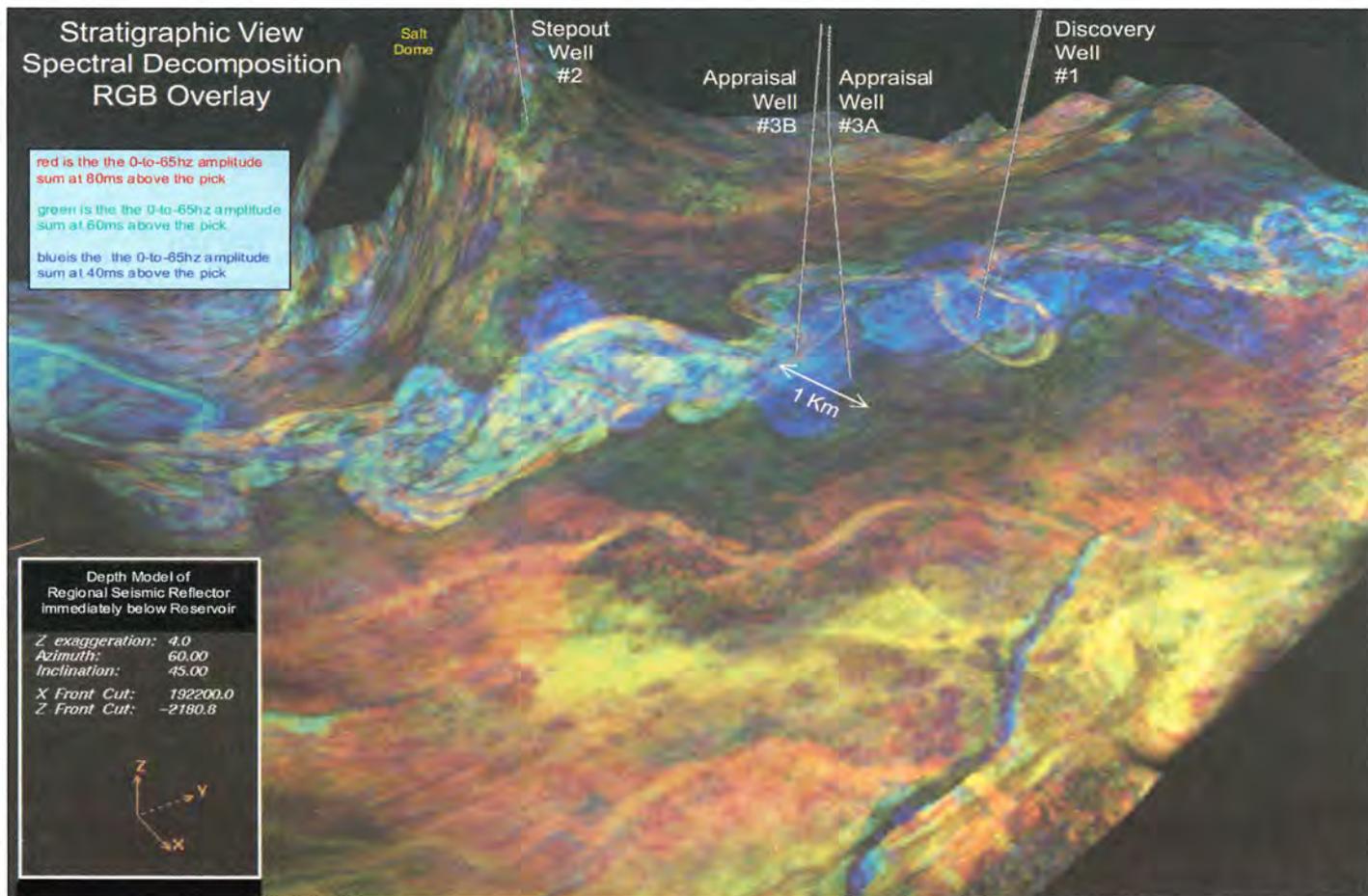
The machine, which is rated to 3,000 meters, currently is being tested off the California coast and will be available commercially the second quarter of this year, according to Carl Sonnier, AUV program manager, Fugro Geoservices.

"The purpose of the tool is mainly deepwater construction planning, like big offshore platforms, pipelines and such," Sonnier said, "so the initial payload is designed as a survey tool and targeted at that specific market."

Initially, the machine will collect side scan data – basically conducting acoustic mapping of the seafloor – and will be used for bathymetry to develop terrain contours. Sonnier said it's also equipped with a shallow seismic system called a sub-bottom profiler used to map the top 100 feet or so beneath the mudline.

"The vehicle is designed to handle multiple payloads," he said, "so we intend to do other types of things, like gravity for instance. There's a variety of other oceanographic sensors we can carry, and I view the vehicle as a sort of truck where we can slap on different payloads."

The analogy is apt, given that once the cage containing the AUV is lowered



Images, data courtesy of Greg Partyka, BP Upstream Technology Group

A 3-D perspective view of a subsurface structure map, undeveloped offshore West Africa reservoir, draped with a 2-D spectral decomposition image. The reservoir is a sandy turbidite filling an erosional valley at a depth of about 3,100 meters. The draped image also conveys a 3-D perspective by showing three different slices through the reservoir section with different color bars (red, green and blue). Understanding the vertical stacking patterns of flow units is important for determining optimum drainage.

into the water, the vehicle backs out much like a car out of a garage. It dives to the seafloor, goes through a calibration process and begins its work.

Once the mission is complete, the machine returns to the surface, is pulled

back into the cage and brought onto the boat – an offshore work-class vessel will suffice.

The cost of the equipment tallies several million dollars, but the overall throughput is much higher compared to

alternative deepwater techniques, according to Sonnier.

"The net effect," he said, "is you can reduce the cost of these type surveys by 25 percent over previous tools to collect deepwater data." □

Selected AAPG Education Offerings for May/June

SCHOOLS AND SHORT COURSES

High-Resolution Well-Log Sequence Stratigraphy — Application to Exploration and Production

Date: May 13-17, 2002
Location: Denver, Colorado
Tuition: \$1,100 AAPG members; \$1,200 non-members
Content: 3.5 CEU

Instructors: C. Robertson Handford, Consultant, Austin, Texas; Jeffrey A. May, EOG Resources, Denver, Colorado

Reservoir Engineering for Petroleum Geologists

Date: June 17-18, 2002
Location: Houston, Texas
Tuition: \$500, AAPG members; \$600, non-members
Content: 1.5 CEU

Instructor: Richard G. Green, LaRoche Petroleum Consultants, Dallas, Texas

Hedberg Research Conference July 21-26, 2002 Vail, Colorado

Late Paleozoic Tectonics and Hydrocarbon Systems of Western North America — The Greater Ancestral Rocky Mountains

Applied Subsurface Mapping

Date: July 8-12, 2002
Location: Dallas, Texas
Tuition: \$950, AAPG members; \$1050, non-members
Content: 3.5 CEU
Limit: 50

Instructor: Joseph L. Brewton, Subsurface Consultants, Houston, Texas

An Overview of Exploration Play Analysis

Date: July 22-24, 2002
Location: Houston, Texas
Tuition: \$800, AAPG Members, \$900, non-members
Content: 2.4 CEU
Limit: 40

Instructors: Peter R. Rose, Jeff Brown, both with Rose and Associates, Austin, Texas

FIELD SEMINARS

Salt and Extensional Tectonics in the Paradox Basin, Utah

Leader: Michael R. Hudec, Bureau of Economic Geology, The University of Texas at Austin
Date: May 19-24, 2002
Location: Begins and ends at Grand Junction, CO
Tuition: \$1,600, includes lodging, internal transportation, field guides, and lunches in the field
Limit: 23
Content: 4.0 CEU

Controls On Porosity Types and Distribution in Carbonate Reservoirs

Leaders: Evan K. Franseen, Kansas Geological Survey; Robert H. Goldstein, University of Kansas; Mateu Esteban, Carbonates International, Mallorca, Spain
Date: June 2-7, 2002

Location: Almeria Region, SE Spain, Spain. Fly from London/Barcelona/Madrid.

Tuition: \$2,000 includes field transportation, all meals and lodging during trip, guidebook (dependent on exchange rate)
Limit: 15
Content: 4.8 CEU

Wave-Dominated Shoreline Deposits and Sea Level Changes, Book Cliffs, Utah: Depositional Models for Hydrocarbon Exploration

Leader: John K. Balsley, Consulting Geologist, Moab, Utah
Dates: June 10-18; August 19-27, 2002

Location: Begins and ends in Moab, Utah

Tuition: \$1,750, includes 4-wheel-drive transportation, river run, lunches and guidebook
Limit: 15
Content: 6.0 CEU

E&P in Thrusted Terrains: Practical Applications of Structure and Stratigraphy in the Montana/Alberta Foothills

Leaders: Steven N. Boyer, Consultant, Tacoma, WA; William Hansen, Jireh Consulting Services, Great Falls, MT; Kirk Osadetz, Geological Survey of Canada-Calgary; James Sears, University of Montana, Missoula; Glen Stockmal, Geological Survey of Canada-Calgary
Date: July 15-20, 2002
Location: Begins and ends in Calgary, Alberta, Canada
Tuition: \$1,500, includes lunches, transportation, guidebooks, admission to Glacier and Waterton National Parks, and some additional meals.
Limit: 15
Content: 4.2 CEU

Details at

<http://www.aapg.org/education/index.shtml>

AAPG GEOTOUR Canoeing with Lewis & Clark: Geology of the Upper Missouri River Breaks National Monument, Montana

Leader: William Hansen, Jireh Consulting Services, Great Falls, MT
Date: May 20-27, 2002
Location: Begins and ends in Great Falls, Montana
Tuition: \$2,000, includes fully outfitted and guided four-day canoe trip through the famous White Cliffs of the Missouri (canoe lessons for beginners), admission to Lewis & Clark Interpretive Center, C. M. Russell Western Art Museum, Ulm Pishkun Buffalo Jump and Giant Springs State Parks; cruise boat trip through Lewis & Clark's "Gates of the Mountains" canyon in the Montana Thrust Belt, wild west dinner train through central Montana with prime rib dinner, lunches, transportation during Geotour, guidebook and all meals and lodging during canoe trip.
Limit: 11
Content: 4.5 CEU



"Gates of the Mountains" on the upper Missouri River, south of Great Falls, Montana

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Seismic Industry from page 19

the creation of wealth," Gill said. "In fact, the E&P companies readily cite 3-D seismic as making the significant difference in their increased success rates. Yet the industry is not compensated in a way commensurate with the extent of the wealth created.

"The actions of the oil companies, especially the largest ones, drive the valuing of what the seismic contractors do as a commodity service rather than a value added service," Gill noted.

Keep On Keeping On

Despite a weakened pulse, the industry perseveres.

For instance, contractors are buzzing about WesternGeco's ambitious non-exclusive 24,000-linear-mile 2-D 4-C shoot, which is well under way in the Gulf of Mexico. The Multi-Vision™ program is in partnership with AIM Geophysical, and data are being acquired in water depths as much as 1,000 meters.

The 2-D data with 10,000-foot offsets will tie key fields throughout the shelf to the deep water.

And the deepwater targets that continue to lure the big players with deep pockets offer promise for seismic action.

"The deep offshore activity that began two to three years ago is maturing," said Luc Schlumberger, executive vice-president processing and reservoir at CGG, "and we see a move to proprietary high resolution seismic data to really understand the geometry and physics of the reservoirs.

"There's a strong effort up front with seismic to develop these deep, expensive fields," he said, "and avoid a costly mistake."

Given the immense value of such activity and the potential to experience negative fallout down-the-line from the increasingly murky state of the contracting business, the E&P companies at some point may be convinced to reconsider their current hard-edge tactics.

As profits fall and risk increases, the contractor numbers likely will continue to diminish along with the invaluable R&D they provide. It's not inconceivable that capacity could shrink to a level where the lack of competition, particularly among the big contracting companies, might prove to be unpalatable to the oil finders.

"This has the potential to be an unintended consequence of their drive to wring out cost," Gill said, "regardless of the price of that drive." □

Groat Gives Growth Advice to EMD

Yes, there is life after 25 – but if the goal is to improve upon an already good thing, it will require more than just routine maintenance.

At least that's the message Chip Groat, director of the U.S. Geological Survey, delivered to the members of the 25-year-old Energy Minerals Division (EMD) of AAPG during their recent luncheon in Houston.

Groat praised the manner in which EMD has ventured into new areas.

"One of the more interesting aspects of EMD is it has gotten involved in things beyond the limiting scope of its name," he said. "This shows EMD has understood how other techniques and technologies are important to the geosciences and

resource sciences in general."

Still, Groat suggested some new directions that might ensure not only the continuing strength of EMD but creative growth as well.

Those included:

□ Creating value via matrix relationships – informal arrangements could give those interested in a topic added momentum and clout through pooled resources, resulting in increased ability to get things done.

□ Growth of an organization can be achieved by expanding the audience.

"Professional societies need the ability to convince and show people what they do has value," Groat said, "not only to the country and the greater good of energy resources, but also to the greater good of

the individuals who ... depend on these resources."

□ EMD could assume some of the educational responsibilities that could advance public awareness.

□ There is a need for integration to diminish organizational barriers for better communication.

For EMD to not only maintain its success but enhance what it brings to both its membership and the public, the core message is to look beyond boundaries to serve broader interests by taking a broader view – while continuing to stay relative to the members.

An expanded story on Groat's talk can be found online at www.aapg.org.

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AAPG member Dave Campbell (left) has some quality time at the AAPG Spring Student Expo.

126 Meet With Companies

Students Take Expo Break

More than 35 companies met 126 students at the AAPG Spring Student Expo, held in mid-March at the Sarkeys Energy Center at the University of Oklahoma.

Created to be a follow-up to the highly successful AAPG Student Expos held annually at Rice University in the fall, the students attending the Spring Expo were geoscience-related majors representing 37 colleges from 18 states, as well as Canada and Venezuela.

The Spring Expo featured two mini-courses, a field trip to the Arbuckle Mountains, a St. Patrick's Day dinner, a reception, music and other fun – as well

as formal employment interviews and 25 student poster sessions.

Winning cash prizes for the poster presentations were:

□ Biaolong Hua, of the University of Texas at Dallas, for "Parsiminius 2-D Post- and Pre-Stack Kirchhoff Depth Migration."

□ Keumsuk Lee, of the University of Texas at Dallas, for "GPR Survey of a Delta-Front Reservoir Analog in the Wall Creek Formation, Wyoming."

□ Travis Wilson, of Colorado School of Mines, Golden, Colo., for "Converted Wave Morrow Sandstone Reservoir Delineation, Eva South Field, Texas

County, Oklahoma."

The Expo was hosted by the OU School of Geology and Geophysics and Sarkeys Energy Center and the Oklahoma Geological Survey, and was funded by several companies and people.

Major sponsors were Chesapeake Energy Corp., Kerr-McGee and AAPG.

Platinum Level sponsors were Baker Atlas, Devon Energy, Shell, Vanco Energy, Viola Inc., Schlumberger Oilfield Services and PSEC Inc.

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Silver Level sponsors were Flamingo Seismic, Hiawatha Exploration, Reservoirs Inc., Carl E. Gungoll Exploration, Marlan Downey, Laurel Petroleum, the Oklahoma City Geological Foundation and Panhandle Royalty Co. □

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Seismic Issues

from page 21

Investigations revealed that mishandling the explosives was a primary area of concern, although one of the accidents was caused by static electricity.

In that case, the investigators found there was some concerns about the detonator meeting the manufacturer's specifications for static resistance, said Jeff Howell, quality health safety and environment manager for WesternGeco's Houston facilities and chairman of IAGC's work group on minimum threshold for safety against static, radio frequency and stray currents.

"We've been using detonators for years in this industry and we are now finding out that there are varying levels of parameters, specifications and testing of detonators against some of these hazards," Howell said.

The IAGC Health, Safety and Environment Committee already was planning to revise its safety manual this year, and a work group has been established to thoroughly examine the explosives section, according to Howell.

Another work group will look at developing training programs for explosives handling, while a third group will develop safety guidelines for static detonators.

"Our hope is that through these efforts we can standardize the quality of detonators, training methods and safe handling practices," he said. "We are taking a two-way approach, addressing best practices on the industry's part and ensuring we receive the safest product available from the manufacturers.

"We are trying to focus on lessons learned from these incidents to prevent these tragedies in the future," Howell continued. "If we don't learn anything from these accidents then as an industry we are remiss.

"Of course, a manual can't cover everything, but IAGC's efforts to provide minimum safety procedures will help ensure safety. In many places around the world there are not a lot of safety regulations, so it is incumbent on the industry to set well-defined safety guidelines and best practices." □

www.update

Member Directory Online for Members

By JANET BRISTER
Web Site Editor

The Membership Directory is back, and you can find it on the AAPG Web site at www.aapg.org.

All you'll need to do to use it is push a little button – the "Members Only" button, that is, which also has been added to the home page.

Behind this button is the access to the directory for both AAPG and DPA members.

See – membership has its privileges.

In fact, there are also plans to add other services that only members of AAPG are allowed to use, including:

A search engine for BULLETIN articles, abstracts and publications.

The capability of making your membership dues payment.

The means to review your member records.

The key to all of this, of course, is a password. (The dreaded "p" word!)

But here's the good news: It is easy to attain your password. Should you forget it, a simple click will result in an e-mail message to you bearing the necessary information for you to log in.

However, if AAPG's records do not contain your correct e-mail then, obviously, you won't receive your log in information.

On your membership dues statement has been printed your e-mail address of record. If this is incorrect or if this e-mail is one you rarely check, you may want to contact the membership department and arrange for a more current e-mail.

* * *

PDF: Portable Document Format documents are abundantly provided throughout the Internet.

Most are print-only type documents that you download or view, print what you want and then move on.

However, more and more sites have utilized the form feature of PDF documents. This feature allows the browser to tab through form fields and complete the document using their computer.

Upon completion the user prints the form and then physically returns that to the business as requested.

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Now obviously you were able to type this information into the form using your computer, so the assumption is you should be able to **save** this document and return it to the business via an e-mail attachment.

That would make sense. You did everything else electronically, so why not this?

Well, simply because of this: Most browsers use software that is a PDF reader, and a reader is *not* going to do anything more than read the document provided.

In other words, there is no writing. There is no revising. Just reading.

If you have software that creates PDF documents, you may use it to open the form, complete it, save it

and return it via e-mail to the place of business. However, should you choose to do that, please take time to give the file a new name. You wouldn't want your data to replace the master file.

Good browsing!

New Search & Discovery Articles

The following articles have been posted recently on Search and Discovery (www.searchanddiscovery.net), AAPG's online journal:

Interactive Sandstone Petrology: A Digital Tutorial for Future Reservoir Geologists, by Suk-Joo Choh, Kitty L. Milliken and Earle F. McBride, adapted for demonstration of the SEPM award-winning poster at the 2001 AAPG annual meeting in Denver.

Applying Fluid Inclusions to Petroleum Exploration and Production,

by D.L. Hall, S.M. Sterner, W. Shentwu and M.A. Bigge, adapted from the presentation to the Tulsa Geological Society, March 27, 2002.

3-D Geometry and Evolution of Shale Diapirs in the Eastern Venezuelan Basin, by Leonardo Duerto and Ken McClay, adapted from a poster presentation at the 2002 AAPG annual meeting in Houston.

Borehole Gravity, by David A. Chapin and Mark E. Ander, after an article in "Geophysical Corner," AAPG EXPLORER, February 1999.

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Environmental Management Systems and the ISO 14000 Standards

According to the American National Standards Institute (ANSI), the International Organization for Standardization (ISO) 14000 series of standards includes "environmental management systems, environmental auditing, environmental labeling, environmental performance evaluation, and life cycle assessment." They are voluntary standards to encourage use of management systems protective of the environment for companies involved in trade and commerce. Corporations can develop environmental programs using a standard way to measure their success. Standards can provide consistency and simplicity, especially in international operations that involve environmental management. The ISO 14000 standards are designed to be practical and usable for all types of businesses, as they set their own performance goals.

As a result of the June 1992 U.N. Conference on Environmental Development held in Brazil, ISO made a commitment to develop international standards for environmental management systems and tools. The purpose was to improve environmental performance in the business community and to support sustainable business development.

In 1996, the ISO developed ISO 14000 to provide a basic, non-specific framework by which nearly all companies could establish an environmental policy. The ISO 14000 certification includes planning environmental objectives, developing an environmental policy, assessing impacts of business activities to the environment, and corrective action planning. Also included in the standard are guidelines for developing and implementing an environmental management system, defined by ISO as a "management tool enabling an organization of any size or type to control the impact of its activities, products, or services on the environment."

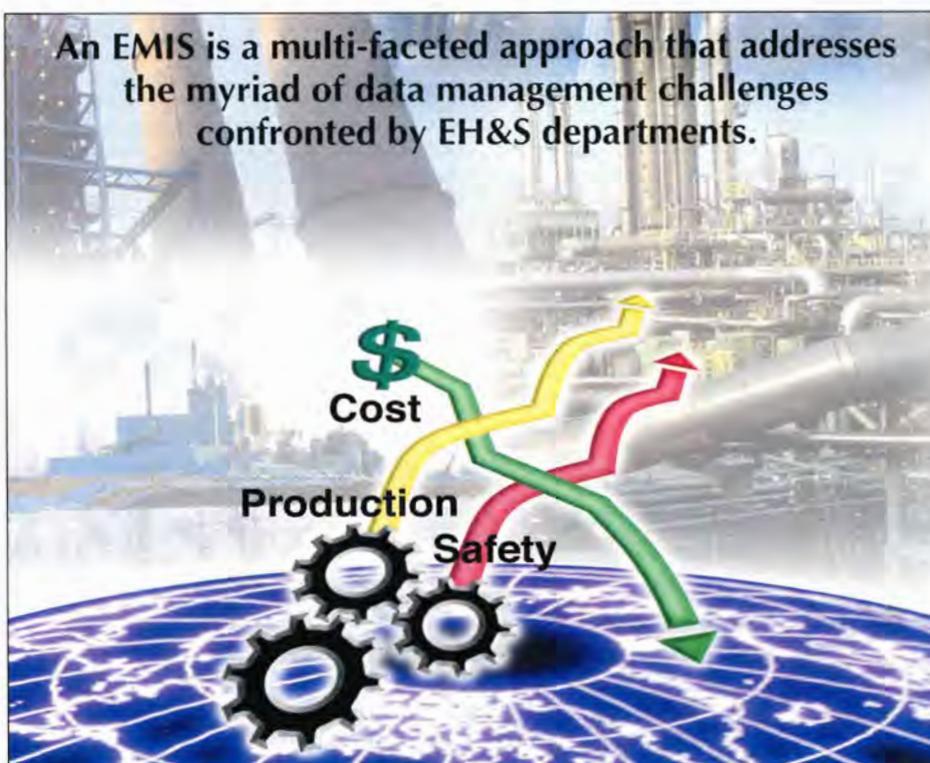
The generality of the ISO 14000 guidelines has allowed companies from all sectors, including petrochemical, energy, and manufacturing, to establish environmental management systems. Companies across the United States and worldwide, including Shell Exploration & Production Company, Praxair, and Daimler Chrysler Corporation have already received ISO 14000 certification or are in the process establishing their programs. As part of their ISO 14000 program, many companies are implementing Environmental Management Information Systems (EMIS) to enhance compliance, reduce risk and meet ISO requirements.

Defining an EMIS

There are a wide range of data elements required to ensure compliance

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with the monitoring, record keeping and reporting requirements associated with local, federal and global regulations, permit provisions, and internal (e.g., corporate) standards. Environmental, Health and Safety (EH&S) professionals are confronted with the complex issue of efficiently managing EH&S related data elements. EMIS applications have been designed specifically to address these complex issues. Most EMIS packages are modular in nature and address the following functional areas:

- ✓ Air (Emission Calculations and Reporting)
- ✓ Water (Water Discharge Monitoring, Tracking Analytical Data)
- ✓ Waste (Manifesting and Waste Summaries, RCRA Compliance)
- ✓ Inventory (SARA 311/312, TSCA IUR)
- ✓ Compliance Management (Title V Compliance, ISO 14000 Compliance Metrics, Permit Compliance Tracking)

It is important to note that some EMIS applications are broader in functionality, and include Health and Safety functionality.

Many organizations invest significant dollars in commercially available or customized software applications to streamline the EH&S data management process. In nearly every case, however, organizations have realized that software alone is not the key to enhanced EH&S data management. A comprehensive Information Technology (IT) solution is needed as just one element amongst many others that impact the successful transformation of data management practices from existing, time-consuming, low value-added tasks to streamlined, high value-added tasks. As part of a total IT solution, many companies integrate the EMIS with data sources that offer environmentally related data elements, such as:

- ✓ Process Historians
- ✓ Laboratory Information Management Systems (LIMS)
- ✓ Maintenance Management Systems (MMS)
- ✓ Human Resources Systems (HR)
- ✓ Enterprise Resource Planning (ERP) Systems
- ✓ Production/Yield Accounting Systems

Construction and implementation of an EMIS is a multi-faceted approach that addresses the myriad of data management challenges confronted by EH&S departments. Some of the elements required for a successful EMIS implementation include:

- ✓ Identification of the business process needs and requirements for an EMIS
- ✓ Development of a justification document to demonstrate financial benefits of an EMIS to management
- ✓ Software selection
- ✓ Development of an implementation plan
- ✓ System integration to various business process data sources
- ✓ Gap analysis and custom development
- ✓ Cultural change management (transforming from manual processes to automated processes)
- ✓ Training

EMIS Benefits

Benefits realized from the implementation of an EMIS are specific to each company based on applicable environmental requirements and associated environmental liabilities. Generally, organizations investing in the strategic initiative of a total EMIS solution can expect to realize benefits such as:

- ✓ Enhanced staff efficiency yielding improved data access, accuracy and handling

DEG Announces New Officers

The ballots from the recent DEG election have been tabulated and the three newly elected national officers are Rima Petrossian, Steven Tischer and Gerald Baum. Petrossian will serve as President for 2003-2004, Tischer will start a one-year term as vice-president on July 1 of this year. Baum will serve a 2-year term as editor of Environmental Geosciences also beginning July 1 of this year. The group represents almost 60 years of AAPG membership.

Petrossian is Assistant Division Director of the Water Resources Planning Division of the Texas Water Development Board (TWDB) in Austin, Texas and is a charter member of DEG. Steve Tischer is the Remediation Business Practice Manager for ARCADIS G&M in Midland, Texas and has managed a wide range of remediation projects. Jerry Baum is with the Maryland Geological Survey in Baltimore, Maryland and is responsible for resource assessments, geological mapping, and geohazard assessment at that organization.

- ✓ Increased time for value-focused activities
- ✓ Standardization of business process and environmental data resulting in improved data quality through systems integration and increased information sharing
- ✓ Reduced compliance risk and associated business disruption
- ✓ Elimination of disparate islands of information (e.g., stand-alone spreadsheets and databases)
- ✓ Centralization of data collection, analysis and reporting
- ✓ Enhanced ability to benchmark and transfer knowledge throughout the organization

Additionally, companies have determined that implementing an EMIS has a direct impact on their ability to manage compliance and minimize violations. Furthermore, there are more opportunities for waste reduction and pollution prevention projects. The extent to which a company capitalizes on these environmental performance-related opportunities is being considered when rating the company's Sustainability Index and making investment decisions. Socially responsible investors are becoming increasingly interested in a company's social and environmental initiatives as well as the company's financial bottom line (often referred to as Triple Bottom Line).

Several financial organizations like Innovest Strategic Value Advisors, Inc. use proprietary standards to grade the environmental and social performance of companies. These organizations link environmental and financial performance in their rating systems, and their reports are used to influence the investment recommendation and/or decisions of analysts, investment firms, and mutual funds.

If you would like to learn more about EMIS, the organization for standardization, and ISO 14000, and environmental management standards, try www.iso.ch or www.ansi.org.

(Editor's note: Information for this article was prepared by Scott Lockhart and Susan Easley, Data Systems and Solutions (ehs@ds-s.com, 713-346-4200).)

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DEG information is available online through the AAPG Web site: www.aapg.org

Produced by the AAPG Division of Environmental Geosciences

Focus on Science, Avoiding Delays

BULLETIN to Beef Up With Papers

The AAPG BULLETIN, in taking steps into the future, aims to remove its backlog of manuscripts and provide additional scientific information for the members.

One of the steps into the future is making all abstracts from AAPG meetings available on the AAPG Web site. By the move, more space will be available in the BULLETIN to publish reviewed articles.

The number of pages in the BULLETIN is limited due to increasingly difficult economic concerns, including postage and printing.

In a letter to the members in the April BULLETIN, AAPG Editor John Lorenz explained that there is currently an average of two years from the time a manuscript is submitted for review until it is published.

"Such delay is unacceptable for a journal of the stature the BULLETIN enjoys," Lorenz said, "and we are working to improve significantly that situation."

In taking the steps to streamline the editing/production process and fast track articles in the pipeline and remain economically responsible to the membership, abstracts for section and international meetings and the Annual Report will be available online on the AAPG Web site, www.aapg.org.

The extra BULLETIN pages, which were otherwise occupied by the abstracts, will now be available for at least one additional paper – a move that was approved by a unanimous vote of the AAPG Executive Committee.

Another step into the future involves online searches with AAPG's already extensive digital library.

Members now may go to the Petris Web site (www.petris.com) and as a fee-for-service obtain reprints of additional articles originally published by SEPM, NOGS, SEG and CSPG. Expansion of digital access will continue for individual

members and corporate customers, according to AAPG Geoscience Director Jack Thomas.

Following the trend of the publishing industry, it is widely acknowledged that at some point all AAPG publications, including the EXPLORER, will be online only. This will improve greatly the access to our materials regardless of the location of the member.

Coupled with education modules currently offered or being developed, the AAPG member will have greater access to AAPG information by computer access, Thomas said.

Lorenz noted in the BULLETIN letter that shortening the period between the time a manuscript is submitted and its publication includes adopting an online manuscript submittal and review system and streamlining the headquarters handling process.

"Taking these steps into the future requires that we not forget why the AAPG continues to be strong – member service," Thomas said. "That means that needs for hard copy maps, publications, short courses and training will continue to be offered, to meet requests made by the membership." □

Foundation

from page 43

Amy Bayer
Thompson

Digital Products Fund

Bruce Burton Dice
*In memory of
William O.
Ham Jr.*
Richard Dale Fritz

Grants-In-Aid Fund

Mark Endacott
Gregg
Nedra Keller
Hansen
*In memory of
Kenneth Keller*

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AND SHORT COURSES**

High-Resolution Well-Log Sequence
Stratigraphy
May 13-17, Denver

Reservoir Engineering for Petroleum
Geologists
June 17-18, Houston

Applied Subsurface Mapping
July 8-12, Dallas

An Overview of Exploration Play Analysis
July 22-24, Dallas

Well Log Analysis & Formation Evaluation
Aug. 6-9, Austin

Probability and Statistics for Exploration
and Exploitation
Aug. 19-21, Houston

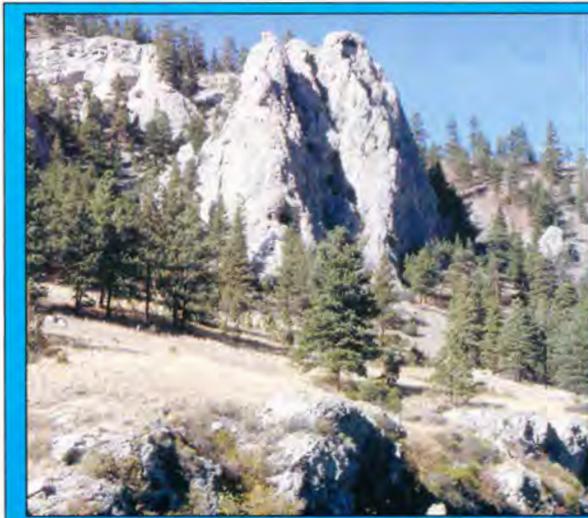
Quantification of Risk
Nov. 11-14, Dallas

Characterization of Compartmentalized
Reservoirs
Sept. 23-27, Houston

Structural Styles and Traps
Oct. 5-6, Salt Lake City
(With the SEG annual meeting)

Terrigenous Clastic Depositional Systems
and Sequences – Applications to
Reservoir Prediction, Delineation and
Characterization
Oct. 21-22, Dallas

Practical Salt Tectonics



Dramatic Mississippian limestones exposed in the hanging wall of the Eldorado thrust along the Missouri River, part of the "Gates of the Mountains" area south of Great Falls, Mont., provide the setting for AAPG's Geotour, "Canoeing With Lewis & Clark: Geology of the Upper Missouri River Breaks National Monument, Montana," which will be held this month. For more information go to the AAPG Web site, www.aapg.org.

Oct. 29-30, Austin, Texas
(with GCAGS Section meeting)

Sept. 22-28
Begins in Rabat
Ends in Fez, Morocco

2002 FIELD SEMINARS**Carbonates**

Controls on Porosity Types and
Distribution in Carbonate Reservoirs
June 2-7
Begins, ends in Almeria, Spain

Sequence Stratigraphy and Reservoir
Distribution in a Modern Carbonate
Platform, Bahamas
June 24-29
Begins, ends in Miami, Fla.

** Syntectonic Carbonate Sedimentation
in Extensional Regimes: Seismic Profile
Analyses and Outcrop Analogues from
the Atlas Mountains

Arid Coastline Depositional Environments
Nov. 3-9
Begins, ends in Abu Dhabi, U.A.E.

Clastics – Ancient

Wave-Dominated Shoreline Deposits, and
Sea-Level Change, Book Cliffs, Utah;
Depositional Models for Hydrocarbon
Exploration
June 10-18; Aug. 19-27
Begins, ends in Moab, Utah

Clastics – Modern

Modern Clastic Depositional
Environments
May 23-29, Sept. 3-9

Begins in Columbia, S.C.
Ends in Charleston, S.C.

Modern Deltas
Sept. 9-13
Begins in Baton Rouge, La.
Ends in New Orleans, La.

Tectonics and Sedimentation

* Outcropping Oil Fields – From Seeps to
the Subsurface
May 13-21
Begins, ends in San Francisco

* Salt and Extensional Tectonics –
Paradox Basin
May 19-24
Begins, ends in Grand Junction, Colo.

E&P in Thrusted Terrains, Practical
Applications of Structure and Stratigraphy
in the Montana/Alberta Foothills
July 15-20
Begins, ends in Calgary, Canada

Submarine Fan and Canyon Reservoirs,
California
Sept. 16-21
Begins, ends in Bakersfield, Calif.

Geotour

Canoeing with Lewis & Clark: Geology of
the Upper Missouri River Breaks National
Monument, Montana
May 20-27
Begins, ends in Great Falls, Mont.

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2002 Southwest Section Convention

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(over 50 talks & poster sessions) with sessions on:
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Horizontal Drilling Case Studies 3D Seismic Case Studies
Innovations in the Industry Geology of the SW Section

All Convention Luncheon Speaker: **Peter Scholle**,
New Mexico State Geologist & President, New Mexico Bureau of Geology,
"The Persian Gulf as an Analog to the Permian of New Mexico"
Division of Professional Affairs Luncheon Speaker: **Bob Gallagher**,
President, New Mexico Oil and Gas Association,
"Current Regulatory Issues Facing New Mexico"

Other Special Events:

Exhibitor Booths, Convention Center June 7, 8
Free - Horizontal Drilling for Geologists Short Course, Vithal Pai instructor
June 6th, 8am-1pm
Golf Tournament, June 6th, 1-6 pm, 4 man scramble, Ruidoso Links course
All Convention Ice Breaker, June 6th, patio of the Hawthorn Suites Golf &
Convention Center
All Convention Dinner, June 7th, Flying J Ranch, Dinner & Western
Entertainment
Spouse Events: Luncheon @ the Turf Club, Billy the Kid Racetrack & Casino
Luncheon: Cree Meadows Country Club, Shuttle Transportation
Cost of \$110 includes registration, two luncheons, transactions publication

For registration information:
Contact Jan Wilson @ 505-622-2700, email jan@zianet.com

MEMBERSHIP AND CERTIFICATION

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

For Active Membership

California
Garcia, Pilar Elena, ChevronTexaco, San Ramon (C.F. Kluth, M.J. Roberts, G. Schoenborn); Gerdes, Martha Lynn, ChevronTexaco, San Ramon (C.F. Kluth, D.A. Medwedeff, S. Bombarde)

Texas
Bosworth, William Paul, Marathon Oil, Houston (D.A. Smith, J.H. Cockings, R. Shamlan); Bottomley, Larry Anthony,

Hunt Oil, Dallas (M. Sturgess, R.D. Shepherd, R.H. Garrett); **Brown, Bruce Ward**, El Paso Production, The Woodlands (Reinstated); **Buchan, Robert Stewart**, independent, Corpus Christi (J.L. Collins, F.G. Cornish, E.J. Bomer); **Carroll, Michael**, Principle Energy Development, Houston (Reinstated); **Eguche, Josiah O.**, Conoco, Houston (S.D. Levine, F.M. Wall, K.C. Abdulah); **Foster, Adrian Neill**, ExxonMobil Exploration, Houston (W.M. Spindler, C.J. Warrner, J. Bacheller III); **Inegbenebor, Edward C.**, Star Deep/Napims, Bellaire (N. Omorodion, A. Adesida, A.S. Odusina)

Wyoming
Crabaugh, Jeff Patrick, University of

Wyoming, Laramie (R.J. Steel, R.S. Martinsen, J.R. Steidtmann); **Van Holland, Calvin Earl**, independent, Casper (J.E. Goolsby, A.K. Finley, B.L. Larson)

England
Evans, Anthony Michael, Imperial College, Reading (R.A. Levey, H.D. Johnson, D.G. Roberts)

Egypt
Laura, Sergio, IEOC, Cairo (T.R. Marchant, J.C. Dolson, P.O. Yilmaz)

India
Chakrabarti, Pradip Kumar, Oil & Natural

Gas Corp., West Bengal (S.K. Das, T.K. Some, D. Chaudhuri); **Khan, Badruzzaman**, Oil & Natural Gas Corp., Dehra Dun (K. Datta, R. Husain, D. Das); **Malhotra, Swati**, Oil & Natural Gas Corp., Ahmedabad (A. Garg, M. Nema, A.K. Dey); **Panwar, Piyush**, Oil & Natural Gas Corp., Ahmedabad (A. Garg, M. Nema, A.K. Dey)

Morocco
Ait Salem, Abdallah, ONAREP, Rabat (C.G.S.C. Kendall, S.K. Bhattacharjee, M. El Mostaine)

Venezuela
Vargas Caycedo, Jaime, Favel International, Venezuela (O. Forero-Esguerra, C. Arango, J.O. Ponder) □

Certification

The following are candidates for certification by the Division of Professional Affairs.

Certification – Petroleum Geologist

California
Countryman, Robert L., Occidental of Elk Hills, Bakersfield (Society of Independent Earth Scientists)

Texas
Han, Zhiwen, Ground Technology Inc., Houston (P. Yin, R. Lin, M. M. Cassidy); **McRae, John Robert**, David H. Arrington Oil & Gas Inc., Midland (J.M. Party, B.K. Cunningham, J.E. Geitgey); **Yates, Roy Leland**, Schlumberger, College Station (A. Frizzell, D. Farmer, D. Duncan)

Certification – Petroleum Geophysicist

Texas
Andrews, Charles Hubert, Seismic Ventures Inc., Stafford (Society of Independent Earth Scientists)

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Society of Exploration Geophysicists

Technical Papers

▶ DeadlineApril 10, 2002

Advance Registration

▶ DueSeptember 6, 2002

Housing Reservation

▶ DeadlineSeptember 6, 2002

READERS' FORUM**The Salary Survey**

Regarding your annual salary survey (March EXPLORER): Why do one of these anyway? Most of our society's members don't care to read that a beginning geologist is worth \$64,000 a year in salary, while some of them have difficulty finding work at any salary (too old, too ugly or something else that just doesn't fit the current corporate profile for new hires).

If you included consultants and they were honest about their day rates and days worked, maybe some more young people would think there was a work

place outside of working for a large company, for a reasonable wage.

Bob Hulse
Tyler, Texas

Your salary survey really encourages me, because I am a student in geology right now and I was deciding whether it was worth it to take geology, or if it will help me be successful in life.

It really gave me a boost in my determination to do well in school

Seye Faleye
Missouri City, Texas

PROFESSIONAL NEWS BRIEFS

David K. Basin, to senior project geochemist, OilTracers, El Dorado Hills, Calif. Previously staff geochemist, ChevronTexaco, New Orleans.

Kevin T. Biddle, to vice president-South America, ExxonMobil Exploration, Houston. Previously upstream advisor, ExxonMobil Corp., Irving, Texas.

Fabrizio A. Bolondi, to senior geophysicist, Agip Iran B.V., Tehran, Iran. Previously geophysicist, ENI-Agip Division, Milan, Italy.

Kent A. Bowker, to exploration manager, Star of Texas Energy Services, The Woodlands, Texas. Previously exploration advisor, Mitchell Energy, The Woodlands.

David B. Ephraim, to director, international business development, El Paso Production, Houston. Previously senior coordinator, business development, Texaco, Houston.

Daniel Franken, to senior geophysicist, RWE-DEA AG fur Mineraloel und Chemie, Hamburg, Germany. Previously senior support geoscientist, Schlumberger GeoQuest, Hannover, Germany.

James Edward Frazier, to geophysical manager, Fidelity E&P, Denver. Previously senior geophysicist, Tom Brown Inc., Denver.

Joseph E. Laing, to senior geologist, Shell Sarawak Berhad, Lutong, Malaysia. Previously senior geologist,

Saudi Arabia Texaco (ChevronTexaco), Mina Al Zour, PNZ, Kuwait.

Kevin McVey, to geologist, Samedan Oil, Houston. Previously geologist, Texaco, Houston.

Ron McWhorter, to geophysical advisor, south Texas exploitation, Devon Energy, Houston. Previously senior staff geophysicist, Mitchell Energy, The Woodlands, Texas.

Brian Rovelli, to head of northern Europe department-VDG, TotalFinaElf, Paris, France. Previously reserve manager, fourth round fields, TotalFinaElf-UK, Aberdeen, Scotland.

Frank Sheppard, to geophysicist, Newfield Exploration, Houston. Previously senior explorationist, Stone Energy, Houston.

Eric A. Weiss, to geological specialist, Phillips Venezuela (Ameriven), Puerta La Cruz, Venezuela. Previously geological specialist, Phillips China, Shekou, China.

(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.html)

**Geotrace Technologies Acquires
Ensign Geophysics Limited**

Chief Operating Officer Tim Terry stated that "the acquisition will add to the technologies of Geotrace while providing it with the geographic locations to expedite its expansion into the markets of Europe, Africa and the Middle East. In addition, Ensign's marine capability and LFP Reservoir Services Group will complement and enhance the reservoir services currently offered by Geotrace."

Geotrace Technologies is a leading provider of proprietary technologies aimed at reservoir imaging and description used to enhance the optimization of petroleum reservoirs. Ensign is an industry leader in marine seismic data processing and analysis services. Both companies serve the worldwide petroleum industry.

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RESERVOIR SERVICES

INMEMORY

Patty E. Holyfield, creator and teacher of the popular and successful "Rocks in Your Head" teacher training workshop that has been presented at various AAPG meetings, died March 11 after a long illness. She was 49.

Holyfield, a consultant in Southlake, Texas, received the AAPG Public Service Award in 2001 for her efforts in developing and leading the "Rocks in Your Head" program, which provides resources and helps prepare teachers for teaching geosciences at the K-12 level.

At the time of the award she had presented the course to more than 1,300 teachers, which impacted about 60,000 students per year.

- Beall, Edward Woodson, 71
Covington, La., Oct. 30, 2001
- Briggs, Kerry Stone, 76
Jackson, Miss., Sept. 30, 2001
- Conner, Carl Cameron, 79
Norman, Okla., Feb. 22, 2002
- Duggan, Michael Daniel, 64
Santa Fe, N.M., Oct. 19, 2001
- DuPriest, Grady Earnal (AC '51)
Magnolia, Ark.
- Garrett, Howard Lee, 77
Houston, Jan. 17, 2002
- Hickey, Dennis Patrick, 67
Surprise, Ariz., Feb. 8, 2002
- Holyfield, Patty, 49
Southlake, Texas
March 11, 2002
- Hughes, Hiram C., 65
West Frankfort, Ill., Oct. 1, 2001
- Lane, Billy Bert, 75
Billings, Mont., June 5, 2001
- Lewis, Ray C., 90
Schulenburg, Texas
March 15, 2002
- Lyle, William Meril, 72
Anchorage, Alaska, Feb. 2, 2002
- Malarin, Lawrence F., 81
Larkspur, Calif., July 3, 2001
- Marshall, Samuel H. Jr. (AC '54)
Topeka, Kan.
- Menish, Jack Angus, 84
Corpus Christi, Texas
March 13, 2002
- Nixon, Richard Paul, 79
Hays, Kan., Feb. 9, 2002
- Rowling, Reese M. (AC '52)
Corpus Christi, Texas

- Sigler, Gene C., 68
Shreveport, La., Oct. 30, 2001
- Strothmann, Frederick H., 86
Edmond, Okla., Feb. 19, 2002
- Turner, Francis Earl, 96
Buna, Texas, Jan. 25, 2002
- Webb, Keith Thompson, 78
Houston, Feb. 20, 2002
- Woods, Dalton James, 80
Shreveport, La., Oct. 12, 2001

(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.)



A Traveler's Guide to the Geology of the Colorado Plateau
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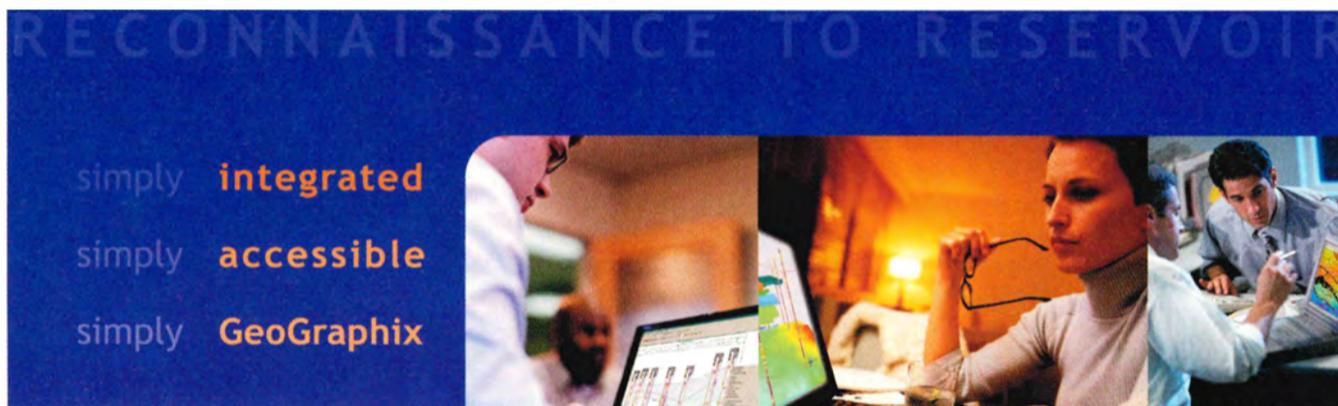
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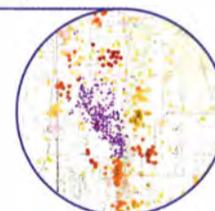


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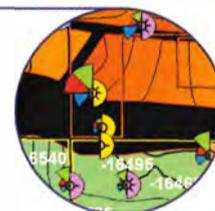
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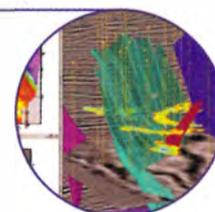
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EMD

from page 51

CBM exploration, test wells or pilot projects are ongoing in several countries including the United Kingdom, China and India. Additional information about CBM activity is available upon request.

Ayers also reported that an outline has been submitted by J. Pashin et al for an EMD CBM publication. This is currently under review.

EMD is requesting e-mail addresses for all EMD members.

Many of these addresses have changed, and others have never been recorded.

Why the request? We would like to send our newsletter to you by e-mail in order to reduce our expenses (but if you prefer to receive it by mail, please let us know).

E-mail also allows us to quickly update you on news and events concerning EMD commodities and technologies.

Please send your e-mail address to Norma Newby at AAPG (nnewby@aapg.org). □

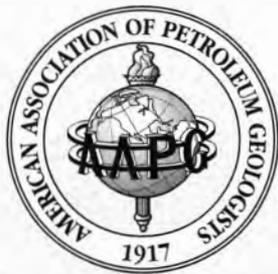
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Business Director

American Association of Petroleum Geologists

The American Association of Petroleum Geologists invites applications for the position of Business Director. Applicants must have an MBA degree and at least ten years of experience with a familiarity of the organization and operational structure of non-profit associations.

The position will report to the Executive Director of the Association and be directly responsible for the development and modification of the short and long term budgets, management reports, capital budgets, forecasting, investment strategies, direction and responsibility for the Accounting, Human Resources, Information Systems and Office Services departments, compliance with the annual audit, budget committee liaison and other responsibilities as directed by the Executive Director.

Applicants should send a letter of application, resume or curriculum vitae with complete employment and salary history. The applicant must include three business or professional references, including phone, fax, addresses and e-mail, who are familiar with the applicants professional qualifications.

Send application to:
Richard D. Fritz, Executive Director
American Association of Petroleum Geologists
P.O. Box 979
Tulsa, OK 74101-0979

AAPG is an Equal Opportunity / Affirmative Action Employer.

Director of Outreach American Association of Petroleum Geologists

Responsible for oversight of Convention Department and International Development. Duties include the following:

- Management of 12-14 employees with an annual budget of \$4-5M. Three managers will be responsible for the day-to-day operations of the directorate and they will report directly to the Outreach Director.
- Overall management of conventions, conferences training and lecture programs, including overseeing and preparing the annual budget. Work as liaison with and on several committees to ensure communication.
- Provide AAPG members a variety of educational and networking opportunities to keep current with industry changes through annual conventions, international meetings and exhibitions, research conferences, courses and field seminars.
- Maintain salary considerations, performance evaluations, and development of career planning for staff.
- Solicit and secure proposals from prospective cities for conventions.
- Development of international programs for AAPG to support foreign members and expand membership overseas.
- Negotiate joint meeting agreements.
- Identify duties and programs, and communication links throughout the Outreach Directorate that can be better combined to streamline communication with the members.
- Direct and supervise a comprehensive marketing plan to assure a return of a surplus or break even.
- Assist in developing a program for Certification of geoscientist expanding the awarding of CEU to the technical sessions at conventions.
- Expand the AAPG outreach through alliances with Government, Universities, and companies worldwide.

The Outreach Director will report directly to the Executive Director. Travel includes 3-5 international trips per year plus 5-6 one or two day domestic trips.

Send application to:
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POSITION AVAILABLE

WesternGeco

WesternGeco is the world's leading geophysical service company. The Seismic Reservoir Services (SRS) division has been established to help move advanced seismic technologies into the reservoir, a key WesternGeco objective of serving not only explorationists, but also development and production teams.

SRS North and South America based in Houston, Texas is expanding and is seeking:

Rock Physicists Job Code 6288

Competence in one or more of the following areas:
Rock physics and fluid substitution modeling - Shale properties - Carbonate properties including fracture modeling - Wave propagation in porous media - Analysis of petrophysical and laboratory data

Petrophysicists Job Code 6289

Competence in one or more of the following areas:
Log analysis - Formation evaluation - Database applications

Geophysicists/Geoscientists Job Code 62909

Competence in one or more of the following areas:
Seismic modeling and inversion - Seismic attribute analysis - Reservoir property prediction from seismic data - Multicomponent (4C) data analysis - Time-lapse seismic (4D) data analysis

Geologists Job Code 6291

Competence in one or more of the following areas:
Reservoir geology - Reservoir characterization - Sequence stratigraphy and seismic interpretation - Fluid migration analysis

We are seeking both experienced dynamic professionals and entry-level candidates with a Masters Degree or higher. Strong interpersonal skills and well-developed writing and oral communications skills will be necessary. Proficiency with computer workstations is required, and familiarity with Geoframe is desirable for the Petrophysicists, Geophysicists, and Geologists.

WesternGeco offers stimulating challenges in a dynamic, multidisciplinary, and multinational work environment, and a competitive compensation package. Qualified applicants should only apply online in our website www.careers.slb.com for the position they are interested in.

WesternGeco is a joint venture between Schlumberger (70%) and Baker Hughes (30%) combining the former seismic companies Western Geophysical and Geco-Prakla. For more information visit our corporate WesternGeco website www.westerngeco.com

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Thank you to all that visited us at the AAPG Convention Career Booth - The winner of the Hyatt Spindletop dinner for two certificate was presented by HGS International Chairman - Jim Tucker on March 18th at the HGS International dinner in Houston, TX to Dr. Allen Mattis of Phillips Petroleum Company.

BUSINESS OPPORTUNITY

Louis J. Mazzullo, Petroleum Geological Consultant. Western U.S. basins. Visit www.lmazzullo.com or call (505) 890-0080.

WANTED

Used metal square tube cabinets - 15"X15" X 48" to 60" deep, 36 slot

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You can reach about 30,000 petroleum geologists at the lowest per-reader cost in the world with a classified ad in the EXPLORER.

Ads are at the rate of \$2.10 per word, minimum charge of \$42. And, for an additional \$50, your ad can appear on the **classified section on the AAPG web site**. Your ad can reach more people than ever before.

Just write out your ad and send it to us. We will call you with the word count and cost. You can then arrange prepayment. Ads received by the first of the month will appear in the subsequent edition.

For further information or assistance, call Brenda Merideth at (918) 560-2647 or (800) 288-7636 (Canada and USA).

June 19, 2002 Third RMAG Coalbed Methane Symposium

2002 RMAG
Coalbed Methane
Symposium

The Denver Marriott City Center
Lunch Included, Social Hour Afterward

Visit: www.rmag.org or call 303.573.8621

The Symposium will provide an opportunity to meet your colleagues, learn about new and potential plays; developed and emerging drilling, completion and production practices. There will also be reviews of what contributed to the success of productive basins such as the Powder River, San Juan, Uinta and Raton basins.

DIRECTOR'S CORNER

Efforts Generate Great Results

By RICK FRITZ

One of my most vivid childhood memories was when one of my great aunts was baptized. My family attended a local Southern Baptist church in a small Oklahoma town. My aunt was a stout woman and she was quite afraid of water.

The preacher also was stout – and very determined to fully immerse my aunt.

As he began to lay her back in the water, I suddenly saw my aunt's arm spring out and take a death-grip on the side of the baptistery. Now ensued a rather interesting and intense wrestling match between my great aunt and the preacher. Each time the preacher would push down, my aunt would pull up. The result was what looked like the wash cycle on an old Maytag washing machine.

Putting together an annual convention in nine months is kind of like trying to baptize my great aunt. It is done with great difficulty.

Nevertheless, by most measurements, the results were very good.

Total attendance for the Houston annual meeting was 7,665, which is the largest since the New Orleans convention in 1985 (see related story, page 34).

Two of the things that make a good convention are a strong technical program and good exhibition. Although I attended mostly committee meetings in Houston, all reports indicated that the attendees enjoyed the many oral and poster presentations. Attendees also said that they thought it was a great exhibition and they appreciated the new technologies that were presented.

I congratulate the organizing committee lead by Jeff Lund from Kerr-McGee Oil & Gas Corp., and his co-chairs Charles Sternbach and Deborah Sacrey.



Personally, I have had many compliments on the meeting, although I had very little to do with the details of the conference. As the saying goes, I am primarily the boss and TV star – AAPG's staff makes me look good by their hard work, and the volunteers are the strength of any conference.

There were several key items that were discussed at the meeting, including:

□ One of the most important was the announcement by President Robbie Gries that the Executive Committee had voted that individual AAPG members will be able to access the BULLETIN portion of the AAPG archives with payment of their 2002-03 dues as a member service.

□ John Lorenz, AAPG editor, announced the plan to reduce the lead time for publishing articles in the BULLETIN from more than 24 months to less than 12 months (see related story, page 45).

□ We announced that John B. "Jack" Thomas is AAPG's new geoscience director, succeeding interim director John W. Shelton.

Like my great aunt's arm rising out of the water, there are always unexpected hiccups that occur during any meeting. For example, although some could say this is a good problem to have, we had more on-site registrants than expected, causing some long lines at the registration area. More than 50 percent of the attendees at the Houston meeting registered on-site, rather than pre-registering.

When we return to Houston in 2009, we will have a solution to speed up on-site registration – and we apologize for any inconvenience. Indeed, we appreciate the patience shown by the attendees at registration. However, it's important to realize that more than half of the 7,600+ attendees were not pre-registered. I know it's not a geologist's mindset, but it truly DOES pay to plan

ahead!

For next year's meeting in Salt Lake City, we plan to have online registration, which will make both pre- and on-site registration faster and more convenient for attendees.

Unfortunately, not all members can attend the annual meeting, so we are working on ways to provide all of the membership at least some of the technical information from the meeting. Volunteers and staff will be looking for talks that would make good papers for the BULLETIN, or a particular technical session that could be made into a special publication.

Also, we will be soliciting the authors for select oral and poster presentations to provide their work for digital presentation on *Search & Discovery*, AAPG's e-journal.

If you attended a talk or poster session that you would like to recommend for hardcopy or digital publication, please contact Jack Thomas at jthomas@aapg.org or call toll free at 888-945-2274 ext. 649.

Great efforts often generate great results. Although my great aunt's arm was never baptized, I think the results were good.

We appreciate the results of the Houston annual meeting and all the great efforts that made it happen.

Heating Up as Top Topic

Coal Gas Big on EMD Agenda

By REBECCA DODGE
EMD President-Elect

According to our EMD president's report to the Advisory Council and the House of Delegates at the Houston AAPG meeting, coalbed methane (CBM) resources – exploration and production – represent one of "our most active areas."

This was very evident during the recent Houston meeting. Two poster sessions covered CBM topics, along with one CBM/coal field trip.

(Despite its "hot topic" status, the CBM short course was unfortunately cancelled due to low early registration numbers. If you missed this one, register early next time!)

Here are other examples of how coalbed methane is heating up as an important topic:

□ In February, EMD participated in publicizing the Strategic Research Institute's "Coalbed Methane Produced Water Strategies" conference held in Durango, Colo. EMD members received conference brochures and will receive electronic copies of the conference findings as well.

□ Laura Wray, EMD's Rocky Mountain councilor, presented a talk to the Rocky

Mountain Association of Geologists on the CBM potential of the Denver Basin.

Wray also reports that the Colorado Geological Survey has received a two-year grant from the U.S. Bureau of Land Management to conduct an assessment of the CBM potential of the Sand Wash, North and Middle Park basins of Colorado.

The CGS has convened an Industry Advisory Group to oversee this new project.

□ Eastern Section councilor Douglas Patchen reports that the West Virginia Geological Survey is promoting CBM activity by providing updates on the emerging CBM play in southern West Virginia.

The WVGS also is cooperating with the Petroleum Technology Transfer Council to add a "CBM wells layer" to the basin GIS for West Virginia, Pennsylvania and Virginia, including data tables for individual wells.

As AAPG general chairman for the 2003 Eastern Section meeting to be held concurrently with the SPE Eastern Region meeting in Pittsburgh, Patchen also promises a strong EMD session including CBM talks.

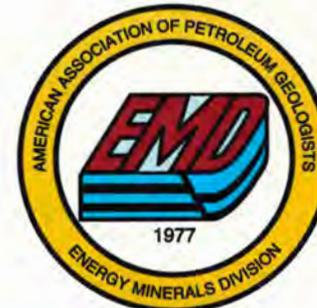
□ Mid-Century councilor Samuel Friedman reports that CBM was featured prominently in the Mid-Century meeting in Amarillo last fall, and that planning is under way for more papers and a field trip for the 2003 meeting in Tulsa.

□ Douglas Peters reports that CBM resources and projects will be included in the topics to be covered by the proposed "full-cycle" symposium on "Energy Solids, Liquids and Gases: Exploration Through Project Completion," planned for July 2003. Expect a "call for papers" to be issued soon.

□ CBM Committee chairman Walter Ayers' report to the board included a summary of CBM activity nationally and internationally. Highlights from Ayers' report include:

✓ The United States continues to lead the world in CBM exploration, reserves and production.

✓ Fifteen basins in the United States sustain commercial production, which totaled 1.38 Tcf for the year 2000 – this constituted 7.2 percent of the dry natural gas production in the lower 48 states and represented a fifteen-fold increase



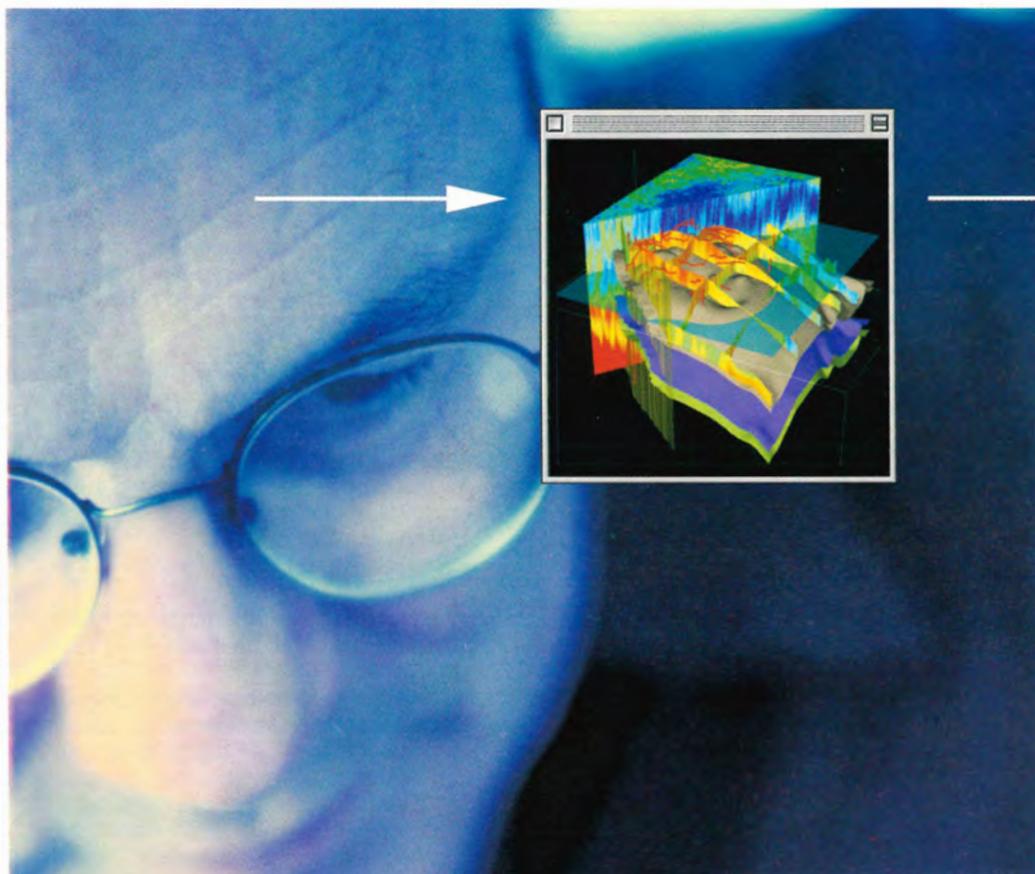
over the 1989 production of 91 Bcf.

✓ The San Juan, Raton and Piceance basins of Colorado and New Mexico accounted for 73 percent of domestic production.

✓ CBM reserves for 2000 were about 15.7 Tcf, which constituted 8.8 percent of the U.S. dry natural gas reserves. This represented a more than four-fold increase over the CBM reserves reported for 1989 of 3.7 Tcf.

Ayers also reported that CBM is being produced commercially in the Bowen Basin of Queensland, Australia.

See EMD, page 49



“Did we miss anything?”

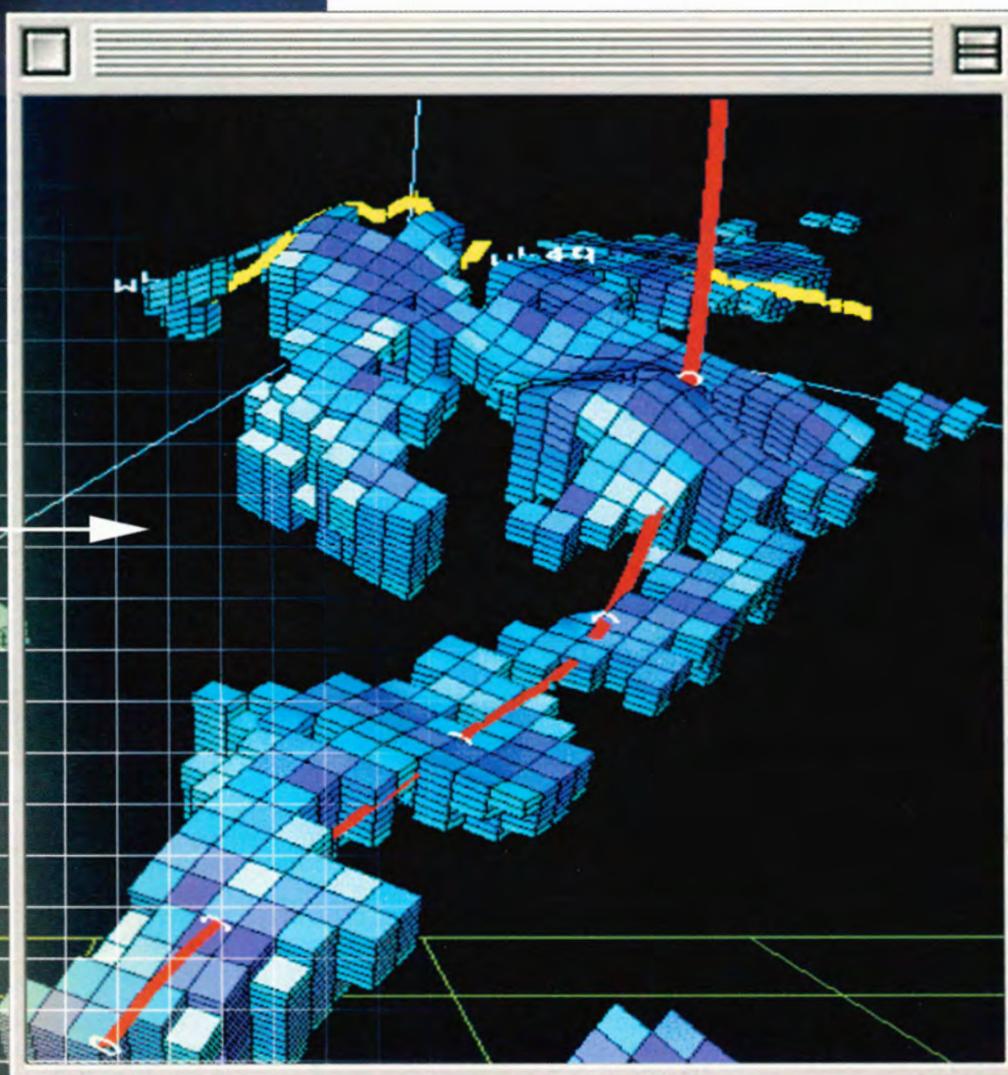
I need to identify more reserves and increase production. I've already got a number of wells including multilaterals in this field, and the porosity and permeability distributions in these carbonates are still very tricky.

Are there any productive sweet spots left to drill?”

After building a reservoir model based on inverted seismic impedance and well data, WesternGeco identified a series of potential sweet spots in weathered carbonates. This additional pay was reached through geo-steering horizontal wells, resulting in increased production.

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