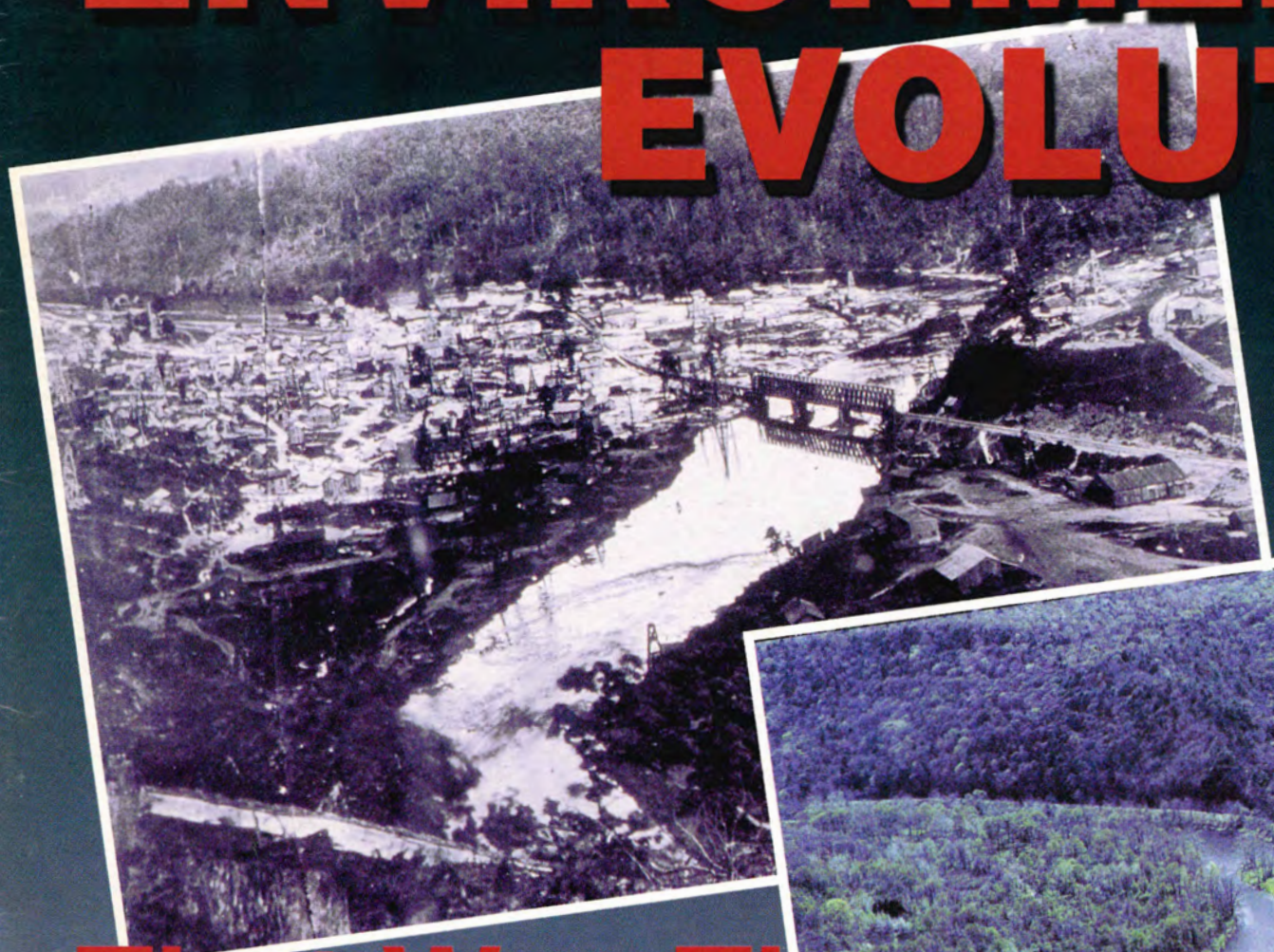
AAPG AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS, AN INTERNATIONAL ORGANIZATION

EXPLORER

FEBRUARY 2001

ENVIRONMENTAL EVOLUTION



That Was Then ... This Is Now

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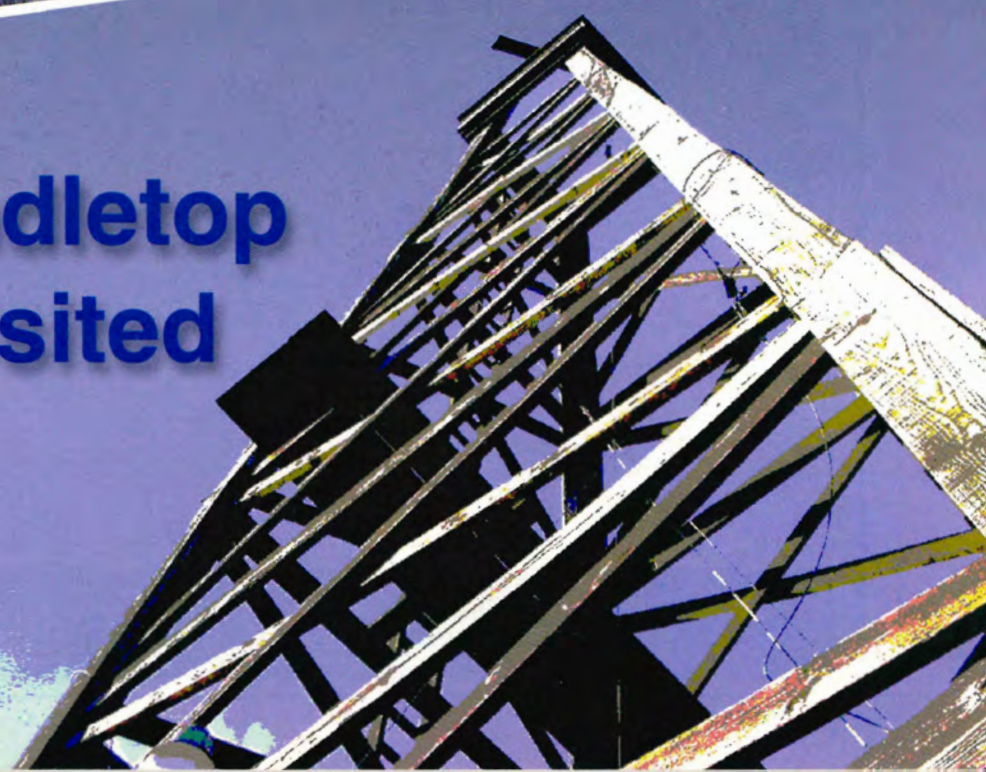
Also:

Spindletop Revisited



Vol. 22, No. 2
February 2001

AAPG EXPLORER

On the cover: The historic oil field photo on top is how Pioneer and Funkville, Pa., looked in 1867 – and next to it, how it looks today. Explorationists have learned that society's norms dictate how the industry should approach environmental responsibility and reclamation, as examined in our story on page 8. Top photo courtesy of Paul Giddens, reprinted by permission of Princeton University Press. "Today" view courtesy of Samuel T. Pees.

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Celebrating a piece of history: from left, Charles Sternbach, Michel T. Halbouty and AAPG executive director Rick Fritz, all standing in front of a seismic section of the Spindletop salt structure.

Photo courtesy of Charles Sternbach

PRESIDENT'S COLUMN

Another Salute Due For All His Efforts

Continuing our conversation . . .

Mike Halbouty recently organized a field trip for 350 geologists to Beaumont, Texas, to see the birthplace of petroleum geology at Spindletop, on the centennial celebration of the historic event. (See story, page 6.) Mike also wrote four wonderful articles on the history of Spindletop and its importance to our industry.

Perhaps we've become too accustomed to Mike's contributions. Perhaps we've come to expect Mike's generous donation of his precious time.

Mike is too large a talent, and at the vigorous age of 91, too much an icon to need our clumsy compliments, but . . . perhaps, we should recognize our industry's debt to Mike a little more often, and a lot more loudly.

THANKS, MIKE!

Marlan W. Downey

Dues Hike Effective Next Year

A dues increase of $10 a year for Active and Associate members of AAPG has been unanimously approved by the Executive Committee.

In approving the dues increase, the Executive Committee also provided the option to all members to receive either the printed BULLETIN or an Internet/CD BULLETIN option.

Reasons cited for the increase included postal rate increases and rising costs in publishing and meeting expenses.

The increase raises the annual dues to $72 and will be effective July 1. The previous dues increase was in 1994, with prior increases in 1991, 1990 and 1987.

Make Plans Now For Denver

The official announcement for the 2001 AAPG annual meeting in Denver has been completed and is being mailed to the membership.

This year's meeting, with the theme of "2001: An Energy Odyssey," will be held June 3-6 at the Colorado Convention Center in downtown Denver.

The 82-page announcement features a greeting from general chairman Steve Sonnenberg and provides all of the information members need in planning their trip, including the technical program, forums, education courses, field trips, speakers, housing and leisure activities, as well as some general information about visiting the Denver area.

It also gives information on special attractions that will be found at the meeting, including details on the huge exhibition hall; the Prospect and Property Marketplace; an Interactive E-Poster session; AAPG Center activities; receptions; and the Career Transition Workshop.

The announcement groups topics in the technical program into general themes, designed to help readers "navigate" through the listings of oral sessions, posters, short courses and field trips.

Themes for the 2001 meeting are:

- ❒ Business, Opportunity and Vision.
- ❒ Environment.
- ❒ Technology.
- ❒ Gas.
- ❒ Petroleum Systems.
- ❒ Depositional Systems and Sequence Stratigraphy.
- ❒ Reservoir Geology and Characterization.
- ❒ Structure and Tectonics.

Registration and housing reservation forms are included, as is a reminder: April 26 is the preregistration deadline.

Meeting information also can be found online at www.aapg.org.

Bush, Halbouty Note Gusher's Impact

Spindletop: Pivotal for Humankind

A century of oil-driven energy was celebrated in early January at Spindletop Hill near Beaumont, Texas, the site that essentially marked the dawn of the age of petroleum.

Spindletop's centennial anniversary was marked on Jan. 10 with thousands of participants who gathered at the site for speeches, activities and a re-enactment of the gusher that represents the oil industry's beginnings.

Speakers included former President George H.W. Bush and AAPG member and legendary wildcatter Michel T. Halbouty, who told the crowd that "the significance of Spindletop cannot be overlooked – it started the modern petroleum industry."

Bush, also a veteran of the Texas oil industry, said that today's public should "let future generations know that the oil from this Texas soil helped transform the American land of liberty into a beacon of freedom, hope and, yes, opportunity to the world."

Centennial activities included a recreation of the Spindletop gusher as it occurred 100 years earlier – to the minute.

A towering column of water spouted about 150 feet high from a replica 1901 derrick, misting those in attendance. The scene included actors who were portraying the original drillers.

"No production in the world had ever been like that," Halbouty said of the original geyser. "Not Baku (Russia), Pennsylvania or Corsicana (Texas). They were producing 50, 75, maybe 100 barrels a day. Spindletop came in at 100,000 a day.

"In one year the potential was for more oil than had been produced up to that time."

The Jan. 10 anniversary was preceded by another event marking the historic occasion – a Houston Geological Society field trip to the site, which also featured Halbouty, who authored a book on Spindletop that was reprinted last year.

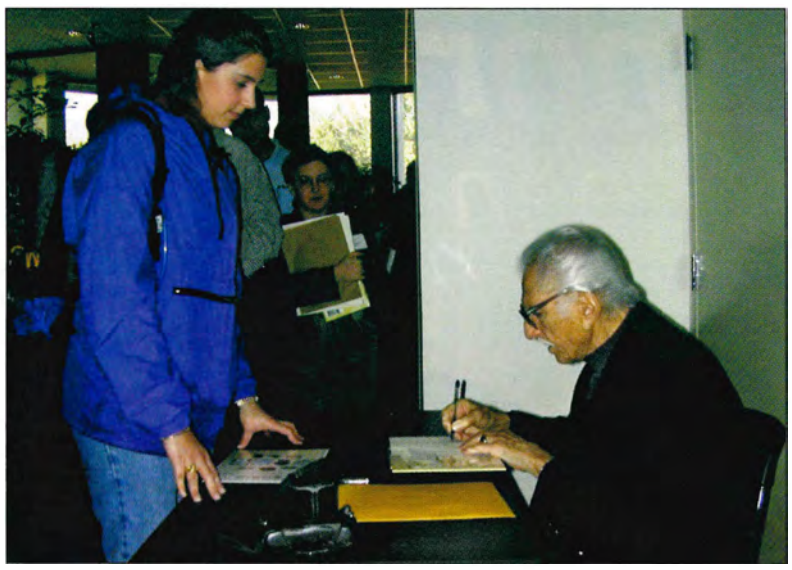
The HGS trip to Spindletop, held the weekend before the centennial observation, attracted more than 350 participants as Halbouty retold, with enthusiasm and in his own words, the story of the Spindletop discovery and its importance in world history. Halbouty's appearance and words were embraced and cheered by those in attendance.

"I believe there is a great need for explorers to learn the legend and lore of exploration," said past HGS president Charles Sternbach. "It was particularly satisfying to see a strong showing of younger professionals alongside some 'old hands' hanging on Halbouty's words."

Halbouty talked of the difficulties, ridicule and hardships faced by the Spindletop discoverers, and suggested that the best advice he could give today's explorationists is not to give up in the face of adversity.

"If they could do it," Halbouty said of the Spindletop discoverers, "why can't we?"

(Editor's note: Charles Sternbach contributed to this article.)



Keeping the story alive: Famed wildcatter Michel T. Halbouty autographs copies of his book on the Spindletop discovery during the centennial celebration activities at the site near Beaumont, Texas. Halbouty and former U.S. President George H.W. Bush both spoke during festivities that included a recreation of the Spindletop gusher, timed to erupt to the minute it occurred 100 years earlier.

Photo by Art Berman

After Spindletop, Everything Changed

One Day That Shook the World

By MARY FRITZ
EXPLORER Correspondent

About 100 years ago a self-taught Texas geologist named Pattillo Higgins had a vision of the future.

Standing on a low, grassy hill a few miles south of his hometown, he foresaw a great inland port city in southeast Texas, bustling with the commerce of shipping, cattle, agriculture, timber, bricks and factories of all kinds.

The catalyst for Higgins' dream was the same one that has fueled many a dream since, a gut-clenching inner certainty that he knew where oil in quantities previously unknown and unimagined could be discovered.

Admittedly, it wasn't a mainstream idea.

Industry and modern transportation ran almost completely on coal. Oil was used only for lighting and lubrication.

Higgins, however, could see the vast advantages of oil over other energy sources and believed it would revolutionize American industry – so he tried for years to interest others in the prospect, and he even organized a company and purchased acreage.

But when it came to drilling a well…

His business partners were only half committed to the idea.

Formally trained geologists, steeped in the prejudices of their time, dismissed his ideas as impossible and ridiculous.

Both the feasibility of the venture he proposed and his personal honesty were questioned in his hometown newspaper.

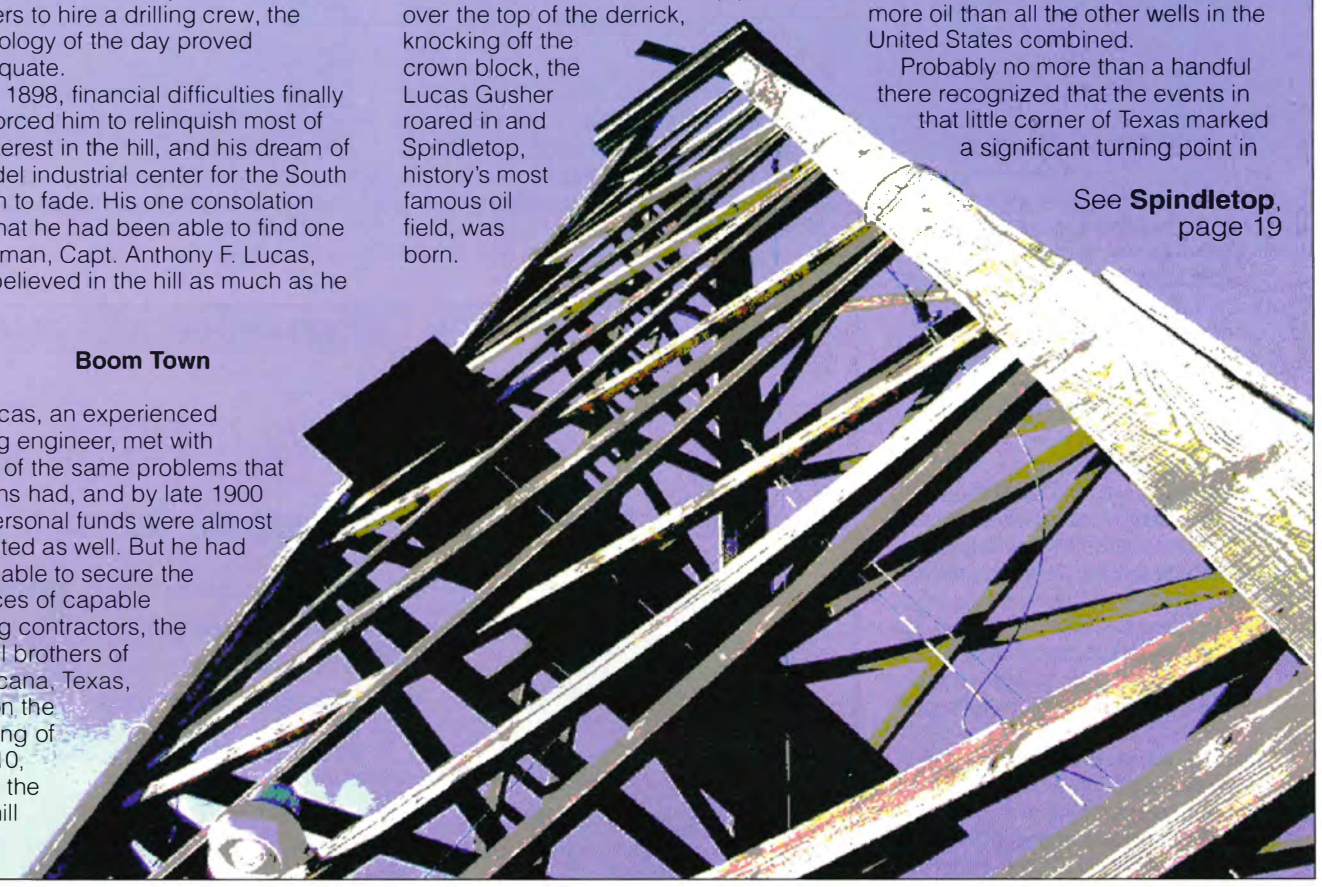
And when he finally convinced his backers to hire a drilling crew, the technology of the day proved inadequate.

By 1898, financial difficulties finally had forced him to relinquish most of his interest in the hill, and his dream of a model industrial center for the South began to fade. His one consolation was that he had been able to find one other man, Capt. Anthony F. Lucas, who believed in the hill as much as he did.

Boom Town

Lucas, an experienced mining engineer, met with many of the same problems that Higgins had, and by late 1900 his personal funds were almost depleted as well. But he had been able to secure the services of capable drilling contractors, the Hamill brothers of Corsicana, Texas, and on the morning of Jan. 10, 1901, the little hill south of Beaumont began to tremble, and mud bubbled up over the rotary table.

A low rumbling sound came from underground, and then, with a force that shot six tons of four-inch pipe out over the top of the derrick, knocking off the crown block, the Lucas Gusher roared in and Spindletop, history's most famous oil field, was born.



A six-inch stream of green-black oil spouted more than 100 feet over the top of the derrick, spilling by later estimates over 100,000 barrels of oil per day. That one well was producing more oil than all the other wells in the United States combined.

Probably no more than a handful there recognized that the events in that little corner of Texas marked a significant turning point in

See **Spindletop**, page 19

Environmental Evolution

Industry Moves to Society's Norms

By DAVID BROWN
EXPLORER Correspondent

To what extent is the environment a concern in the petroleum industry?

To exactly the same extent as in society as a whole, according to Lee C. Gerhard, principal geologist for the Kansas Geological Survey.

"Companies do not lead. They are not out in front of society," he said, "but they are not behind society."

Gerhard, former president and one of the architects of AAPG's Division of Environmental Geosciences, has examined current and past environmental practices in the industry for a paper he's writing with co-author William F. Lawson, director of the U.S. Department of Energy's National Petroleum Technology Center in Tulsa.

Their paper, "Environmental Evolution of the Petroleum Industry," is a subject that holds a personal fascination for Gerhard.

"I keep a working file of all these things, and I have for many years," he said. "It may sound strange, but I've been interested in this subject since the early 1960s."

In the paper, Gerhard primarily considers the development and effects of technology in exploration and geophysics, exploration drilling, production and post-production.

"Much of the environmental progress of the petroleum E&P industry is tied directly to the invention and deployment of new technologies for locating, drilling and producing the world's oil and gas," he wrote.

Gerhard sets out to examine environmentalism in E&P during the past 40 years, with a look at "its direction and probable future progress." But he goes back to the earliest days of U.S. oil production to make a point about past practices.

"For instance, the way we treated (handled) saltwater in the old days in the Titusville area was that we let it flow down the creeks. In more modern practices it's reinjected into other aquifers," he noted.

After examining the history of the petroleum industry's relation to environmental concerns, he's convinced that the industry evolves with – and responds to – changing social views.

Gerhard sees the E&P sector of today's industry as "benign" in environmental impact. Earlier practices may have been less benign, he said, but they were in step with practices in other industries at the time.

"The oil industry in those days met the norms of society," he commented. "It meets the norms of society today, and it will meet the norms of society in the future."

Horse of a Different Color

This evolution isn't always conscious or purposeful.

Gerhard said advances in technology have tended to make the industry more efficient and less intrusive.

As an example, he cited the reduction in a wellsite footprint from 60 acres to just six acres at Prudhoe Bay, Alaska. And he's developed a comparison of horse power with modern horsepower, in efficiency and environmental effect.

"Before you can gain access, you have to gain credibility that you can do a good job ... with the environment as a whole."

"Modern automobiles pollute an order of magnitude less than horses," Gerhard said. "Horses add 772 grams of pollution per kilometer traveled, modern cars only 72.4 grams per kilometer."

Gerhard recalled attending a meeting of scientists and explaining the minimized effects of today's E&P.

"The shocked reaction of the audience – who were not geologists and were not members of the petroleum industry – to the pictures I showed and the arguments I made, made me realize I needed to write this paper," he said.

Start Spreading the News

Lawson agrees that "industry has been driven to become more efficient, and one of the outcomes is that it has given industry a better environmental posture."

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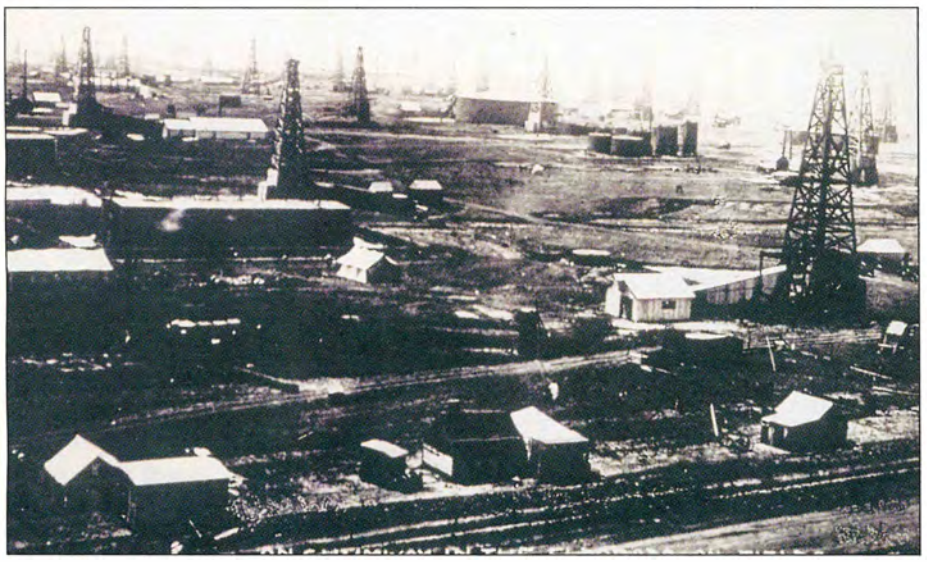

In the industry's infancy, scenes like this one showing Kansas' El Dorado Field in 1915 were common – derricks and oil splashed the countryside – but today such scenes are gone, replaced with an approach found on the Montana-North Dakota border (right), where facilities painted in camoflage colors blend in with the countryside.

El Dorado photo courtesy of the Kansas Oil Field Museum; Montana-North Dakota photo by Lee Gerhard

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Companies like Enron and BP have become aggressors in environmental practices, he noted.

"These companies have really taken the lead and the moral high ground," Lawson said. "They have set their own standards for reducing emissions.

"I think we'll likely see other companies doing some similar things, large companies," he continued. "And we're going to see more and more people wanting to know about energy, because energy will be so important to the U.S. economy over the next decade."

What worries Lawson is the lack of capital investment in the energy industry, which has crippled areas from E&P resources to pipeline infrastructure to refineries.

That's unfortunate but hardly surprising, he said.

"If you look at the energy sector as a whole, the return on investment has been very, very low compared to other segments of our economy, so there hasn't been much of an incentive to invest during recent years," he explained. "But if energy prices remain high, there will be a return on investment. It's a world commodity issue now."

Lawson said he would like to see investment in technologies that could restore E&P areas to pristine condition within five years, allow exploration in rain forests without disruption, reduce volumes of drilling fluids, eliminate the need to build roads in wilderness areas and achieve other environmental aims.

He sees a new effort to "communicate environmentally" in the petroleum industry.

"Before you can gain access, you have to gain credibility that you can do a good job of husbandry with the environment as a whole," he said.

"There are many areas where the industry does have a good story to tell. The independents are not very united in telling their story – at least they haven't been – but the independents have a good story to tell."

Teaching the Educated

Gerhard realizes that he brings up controversial points in discussing the industry and the environment. He called protesters against E&P "highly schooled but poorly educated.

"There are a couple of problems," he said. "First, the public doesn't realize that the industry is pretty benign, as far as E&P goes. And the American industry is E&P.

See **Enviroment**, page 18

Fracs Observed in Real Time

Deep Mix A Stimulating Thought

By LOUISE S. DURHAM
EXPLORER Correspondent

"It only takes about 30 minutes for a bad completion to ruin a good well."

Gee, it just reeks of *Old Economy*, and yet folks these days are clamoring for it at whatever price the market dictates.

We're talking natural gas, the fuel-of-choice for domestic electricity generation and staying warm during this frigid winter. Storage supplies are dwindling, production levels are nothing to write home about and prices have skyrocketed for this hot commodity.

So what could be more timely than the debut of a new technique that could lead to an improved, safer and much lower-cost way to pull additional natural gas out of marginally-producing fields?

A U.S. Department of Energy (DOE)-sponsored project with RealTimeZone Inc. (RTZ) in New Mexico has successfully demonstrated such a technique, which uses a new method of mixing the fluids used to fracture, or frac, gas-bearing formations.

The natural gas industry spends more than $1 billion per year to fracture these reservoir rocks to release more gas, according to Gary Covatch at the DOE's National Energy Technology Laboratory (NETL). The frac treatments allow increased reservoir contact, with the fracture-creating fluids moving from the well to as much as 1,000 feet or so into the formation to create channels that let more gas move into the wellbore.

Traditionally, the fracture stimulation fluids are mixed at the surface. RTZ, however, has developed a downhole-mixing technique designed to give the operator more control over the fracturing process.

The company has applied the stimulation technique in the Permian Basin, where it used the treatment to restore nearly 300,000 cubic feet/day (cfd) of natural gas production from a 12,300-foot natural gas well scheduled for plugging.

The tab was half the price of a traditional frac job.

The precursor to the DOE-RTZ project dates back several years when RTZ developed a real time stimulation diagnostic system in conjunction with Halliburton, with some assistance from Schlumberger, according to George Scott, one of the principals at RTZ.

Reservoir stimulation treatment monitoring has long been practiced by completion engineers using radioactive tracers. It was kind of an after-the-fact approach; however, where the gamma ray tool was used after the treatment was pumped to detect tracers behind pipe to discern where the treatment ended up, or the vertical height of the treatment.

"The DOE was familiar with the patent we co-authored with Halliburton for real time stimulation monitoring and contacted us a little over two years ago," Scott said, "and they basically wanted to fund continued development of the system."

All Mixed Up

DOE's National Energy Technology Laboratory (NETL) is working with RTZ on the project, which is valued at $1.3 million with the federal government contributing $922,000.

Scheduled for completion in June 2002, the effort is in its last two phases:

❒ Field testing the downhole mixing technique.

❒ Real-time monitoring of the fracture as it is created.

"Once you observe a frac treatment in real time and see what it's doing, you realize it would be nice to tweak a few things here and there to modify and control the stimulation treatment to maximize and optimize it," Scott explained.

For example, it's common to want to avoid excessive fracture height while acquiring as much fracture length as possible. Engineers also want to observe proppant placement occurring in the reservoir.

"If you don't have a stimulation system to go hand-in-hand with real-time monitoring," Scott said, "then what do you do with it?

"For instance, in the past when you're fracing a well and the sand is concentrated too high, it'll pack off in the fracture," he said, "and in a matter of seconds you'll have a screenout and pressure that gets way high, way fast, and you must shut down instantly or blow something up.

"If you tried to lower the concentration of sand in the fluid at the surface it would be too late, because it would take a half-hour to get it pumped and reach the perfs two miles down."

Enter downhole-mixing, where different components are pumped – some down tubing and some down casing – that mix down the wellbore.

When a pressure increase is detected, the completion engineer can dilute the concentration of sand going into the formation in real time by instantly increasing the tubing volume, likely avoiding a premature screenout or early abort of the frac job.

Changes in stimulation pressures observed at the surface allow the operator to know if the fracture is being created as planned. Altering the fluid mixture can ensure the fracture goes in its intended direction, and fracture length can be optimized with minimized fracture height.

In other words, this real time system lets the operator make adjustments "on

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the fly" to enhance the stimulation process for greatly improved production results.

Fertile Ground

The Permian Basin, where RTZ plies its trade, is fertile territory for implementation of the downhole-mixing system technique.

Many producing zones occur with water zones in close proximity, according to Scott, and a big frac job can easily treat right into the water, causing irreversible damage.

In deep wells such as the Morrow, which is part of the focus of the DOE-RTZ test project, the engineer is quite restricted on what can be pumped as a function of pressure. So any method whereby the operator can decrease the treating pressure is significant.

While real time stimulation diagnostic data typically are most appreciated by the completion engineer, there's a lesson here for reservoir geologists, according to Scott, who cautions they need to be more cognizant of the entire completion process.

"The geologist might take the brunt of putting together a bad prospect when, in fact, it was just stimulated out-of-zone," he said.

"It only takes about 30 minutes for a bad completion to ruin a good well."

Scott noted the experimental Morrow frac job at 12,300 feet was accomplished at half the pressure of a typical frac treatment – 5,000 lbs/square inch versus about 10,000 – and sported a price tag of $40,000 versus $80,000 for a traditional fracture stimulation procedure.

"The zones we went into wouldn't have warranted a substantial amount of money spent on a frac job," he said, "but since we were able to do an experimental poor boy approach, we make a commercial well with the technique.

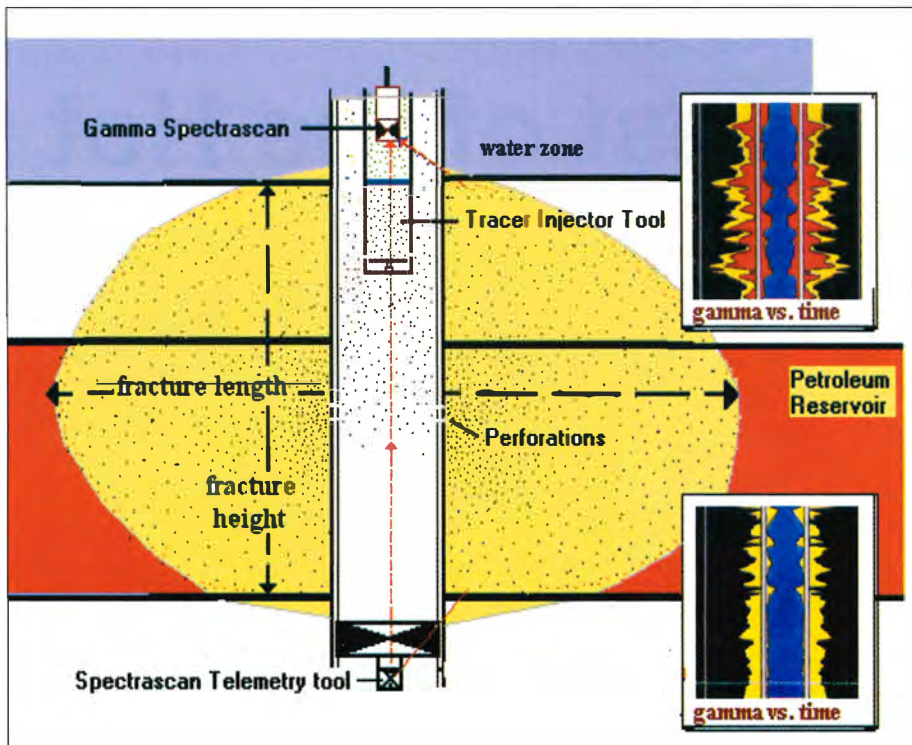
"If we can go into wells about to be plugged or actual dry holes – which we plan to do – and make any kind of production, especially commercial production, it speaks volumes for how this technology can be applied under even more significant circumstances."

The fluid used in the test was comprised of bauxite mixed with a methanol gel at the surface that was blended with liquid carbon dioxide (CO_2) down the wellbore. The bauxite serves as a proppant to keep the fracture open, and the gel and CO_2 create the fracture, penetrating deep into the reservoir rock.

After the fracture is formed, the miscible CO_2 becomes gaseous and moves out of the formation, allowing the fracture fluid to be removed from the rock at a faster rate and enabling the well to produce gas sooner.

If RTZ's technology can be used on even 20 percent of the fracture stimulation treatments implemented by domestic gas producers, it could save the industry more than $100 million per year, according to Covatch at DOE-NETL.

He noted this could perhaps reduce natural gas prices and allow companies to apply additional resources to locate and produce more gas. ❑



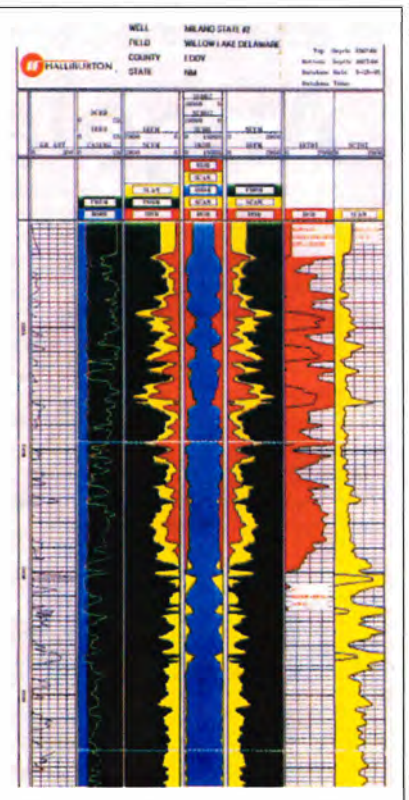


Figure 1:Example of actual real-time tracer log.

Shown: Gamma vs. Time

Graphics, data courtesy of Realtime Zone & Halliburton Energy Services

West Africa Elephants Abound

Angola Hottest of the Hot Offshore

Editor's note: A report in the January EXPLORER offered a big-picture view of the enormous hydrocarbon potential of offshore West Africa, and how many experts believe "privately, but with a passion, that West Africa will likely emerge as the world leader in offshore exploration and production activities in the coming years."

In terms of reserves, West Africa's 17 deep water field discoveries have a combined total of over nine billion barrels of oil equivalent, and an average field size of 535 million barrels of oil equivalent.

As also reported, the world's deep water fields identified for development over the 2000-2005 period will have average production rates of over 34,000 barrels a day of liquids, but West Africa's fields will far exceed that average with approximately 93,000 barrels daily – over five times the average expected productivity of deep water fields in the Gulf of Mexico identified for development during the same period.

The 17 offshore African fields could boost regional liquids production by almost 1.6 billion barrels a day, or about 40 percent of the deep water additions to global liquids production.

This month: A brief country-by-country look at West Africa's offshore potential.

By KATHY SHIRLEY
EXPLORER Correspondent

Since the mid-1990s offshore West Africa has been a hot exploration province – and recent regional deep water discoveries have been among the world's largest finds.

Several countries have logged discoveries, and every success fuels even greater interest in virgin territory – indeed, despite the number of dramatic exploration successes to date, most of the deep water acreage offshore West Africa is still virgin hunting grounds, leaving plenty of room to search for that elusive elephant.

A recent report by Roger Knight, with London-based Infield Systems, and Dominic Harbinson, with Douglas-Westwood in Canterbury, England, outlines exploration and development activity in the most prospective West African countries.

Other global hot spots may emerge, of course, and other countries may attract the industry's interest, but past successes and a growing geologic knowledge of this core group of West Africa countries should keep companies busy in the near future.

Angola

Angola is currently leading the charge of West African countries exploiting deep water oil and gas resources. To date blocks 14 through 18 in the Lower Congo Basin have yielded 25 deep water finds, and several of these fields have estimated reserves of one billion barrels.

The only real failure offshore Angola has been on block 16 where, despite recording the nation's first deep water discovery at Bengo in 1996, Shell drilled a total of nine wells without making a commercial discovery. The acreage, which was believed to hold

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about 155 million barrels of oil, was relinquished in June 1999.

Also, block 14 has not been as prolific as operator Chevron had hoped. The firm has made several shallow water discoveries on the block, but the 60 million barrel Tomboco Field in 526 meters of water was the only deep water find until Cabinda Gulf Oil's recent Lobito 1X discovery (estimated recoverable reserves, over 274 million barrels of oil equivalent). Two additional deep water wells on the block were dry.

In other Angolan activity:

✓ ExxonMobil is studying a massive integrated development known as Kizombo on block 15 in 1,000 to 1,300 meters of water, with estimated reserves of around two billion barrels of oil equivalent. The block's first deep water discovery was Kissanje in 1997, which was followed quickly by Marimba, Hungo and Dikanza. In 1999 the firm added the Chocalho and Xicomba fields, and last year the firm found the Mondo and Saxi fields.

ExxonMobil estimates recoverable reserves in excess of three billion barrels of oil equivalent on block 15. Initial development, which is valued at $3.1 billion, will center on the Hungo discovery.

✓ TotalFinaElf's success on block 17 is by far the most spectacular in Angola's deep water province. The firm made its first discovery at Girassol in 1996, where development is under way.

Subsequent discoveries include Dália in 1997; Rosa and Lirio in 1998; Tulipa, Cravo, Orquídea and Camélia in 1999; and Jasmin and Perpetua in 2000.

The four 1999 finds were in water depths of about 1,400 meters. Jasmin is in 1,292 meters of water and tested 10,800 barrels of oil a day. Perpetua, in 795 meters of water on the block's eastern section, tested 8,700 barrels a day.

Total reserves for the block are now estimated at 3.5 billion barrels of oil equivalent. Average exploration costs for block 17 are estimated at 20 cents a barrel – among the lowest recorded anywhere in the world.

✓ BP-Amoco has made three discoveries on block 18, including Platina, Plutonio, and Galio, and a fourth discovery called Paladio was made in 2000 midway between Galio and Plutonio. The new field has estimated reserves of 325 million barrels of oil equivalent.

Blocks 31-33, which lie to the west of blocks 15-18, are thought by some industry experts to contain even greater potential. The three blocks were licensed in 1999 by BP-Amoco, TotalFinaElf and ExxonMobil, respectively, with $200 million signature bonuses part of the deal.

Angola's national oil company, Sonangol, announced it will operate block 34 – hailed as one of the world's most sought after deep water blocks – in conjunction with Norsk Hydro as technical advisor. Norsk Hydro will have a 30 percent stake and Sonangol 20 percent. Bids have been solicited from other oil companies for the remaining 50 percent equity.

✓ Sonangol also is planning license awards for acreage lying to the west of blocks 31-34. These new offerings may not generate the intense interest as previous blocks because they are in ultra-deep water of 2,000 meters or more, and many of the major players already have a full portfolio of deepwater acreage. Few independents could afford the signature bonuses that may be demanded.

Nigeria

The first deep water acreage off Nigeria was granted in 1993, and since that time 21,000 square kilometers of 2-D seismic and 23,500 square kilometers of 3-D seismic has been acquired and 33 exploration and appraisal wells have been drilled, representing an investment of $1.5 billion.

Six deep water fields due on stream through 2005:

❒ Shell's Bonga, scheduled to start production in 2003.

❒ Texaco's Agbami, also scheduled to start production in 2003.

❒ TotalFinaElf's Ukot discovery, planned to go online in 2004.

❒ Statoil's Nnwa (set to begin producing in 2005).

❒ ExxonMobil's Erha (set to begin producing in 2005).

❒ Texaco's Ikija (set to begin producing in 2005).

Together these fields hold reserves of almost four billion barrels of oil equivalent, which includes 2.5 trillion cubic feet of gas. Bonga, Erha, and Agbami hold over two trillion cubic feet of gas combined.

The problem of how to deal with associated gas is a significant issue for these projects. The lack of infrastructure and government pressure to restrict flaring narrows development options for fields producing from these gas-rich reservoirs.

To date, Shell's Bonga Field is the only deep water development offshore Nigeria that includes plans to commercially develop gas reserves. Gas from the field will be piped to a gas-gathering hub near Shell's shallow water EA Field, then routed to the Bonny Island LNG facility.

In addition to operational issues, the period of low oil prices in the late 1990s and the consequent mergers and skills shortages in the industry are impacting future development offshore Nigeria.

For example, ExxonMobil will likely delay full development of Erha until its Kizomba project in Angola's block 15 is complete. There is not enough room in the system to concurrently develop two such projects without a fair degree of synergy between them.

Likewise, Texaco is faced with the choice of developing Agbami, the company's largest find in 40 years, or the Frade Field offshore Brazil to the north of the giant Albacora Field.

Also, the recently announced merger with Chevron could impact

See **West Africa**, page 17

New Memoir Examines Hot Margin Play

A new publication that studies an area that is among the world's hottest exploration targets has been released by AAPG.

Petroleum Systems of South Atlantic Margins, AAPG Memoir 73, is a 451-page volume that represents a collection of papers presented at the 1997 Hedberg Conference, which was held in Rio de Janeiro, Brazil, co-sponsored by AAPG and the Brazilian Association of Petroleum Geologists (ABGP.

The book, edited by Marcio Mello and Barry J. Katz, is being published jointly by AAPG and Petrobras.

The South Atlantic continental margins basins have undergone a surge of exploration activity, fueled by recent giant discoveries on both the South American and African margins.

The book contains:

❒ Descriptions of the petroleum geology of more than 12 basins along the margins.

❒ Detailed discussion of the petroleum systems within the basins.

❒ Methodologies used in the assessment of petroleum system components.

❒ Overviews of the different components found in the region's many systems.

The book's price is $49 for AAPG members, and $83 for non-members.

To order, call 1-800-364-2274 (USA and Canada) or 1-918-584-2555; or visit the AAPG online bookstore at http://bookstore.aapg.org.

International Tours Set in February

Speakers Heading to Australia, New Zealand, Middle East

AAPG's Distinguished Lecture program will be going global in February as two speakers begin international speaking tours.

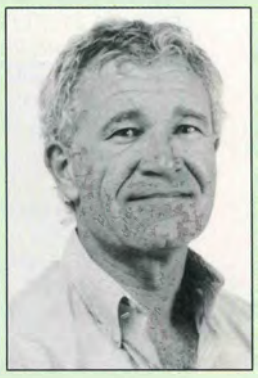
Paul Crevello, this year's Roy M. Huffington Distinguished Lecturer, will be making a speaking tour of Australia and New Zealand, and Paul "Mitch" Harris will tour the Middle East.

Crevello, of Crevello & Associates, Luala Belair, Brunei, will be offering two lectures:

❒ "Carbonate Reservoir Models: Coupling Depositional Sequence and Pore Network Models in Static 3-D Realizations."

❒ "Turbidite and Deepwater Depositional Systems of Borneo: Evolving Foredeep Slope and Basin-Floor Fan Systems."

Crevello



Harris

Crevello, who begins his tour Feb. 5, will be speaking in Perth, Adelaide, Melbourne, Sydney and Brisbane, Australia; and Wellington, New Zealand.

Harris, with Chevron Petroleum Technology, Houston, also will be offering two lectures:

❒ "Geologic Framework for the Tengiz and Korolev Fields, Kazakhstan – Carboniferous Isolated Carbonate Platforms."

❒ "Stratigraphic Framework and New Exploration Concepts for the Lower Shelf Margin Cretaceous Carbonates of Texas."

His 10-day tour, which begins Feb. 14, will go to Ankara, Turkey; Cairo, Egypt; Dhahran, Saudi Arabia; the United Arab Emirates; and Oman, Muscat.

Additional information on these tours and the Distinguished Lecture program can be found on the AAPG Web site at www.aapg.org. ❒

GEOPHYSICAL CORNER

Three-D seismic case histories will be in the spotlight for the seventh annual 3-D Seismic Symposium, set March 2 at the Denver Marriott Hotel City Center.

The symposium, sponsored by the Rocky Mountain Association of Geologists and the Denver Geophysical Society, will feature 12 talks plus a keynote luncheon address, all built around the theme "3-D Seismic Reflects Value."

The talks, all featuring 3-D case histories, will illustrate new techniques and geologic ideasthat affect a company's bottom line.

The case history format, according to co-chair Randy Ray (who compiles and edits the EXPLORER's Geophysical Corner), is "rich in application information, where you learn by example.

"This year's program will highlight '3-D seismic as a tool for companies' asset growth and increased business value," he added.

The luncheon address, presented by Thomas A. Mazza, senior vice president of DDD Energy, will be on "Onshore 3-D Seismic as a Business Driver: Lessons From the Front Line and the Effect on the Bottom Line."

More information on speakers, registration and exhibitors is available online at www.rmag.org.

The pre-registration deadline is Feb. 15.

West Africa

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development decisions for projects operated by the two companies.

The Congo

North of the Cabinda enclave, in the narrow Haute Mer zone of the Republic of the Congo, TotalFinaElf has discovered a series of what seems to be three smaller fields compared to those in Angola, but their proximity to the border indicates there is a chance that they will extend into Angolan waters.

The three fields are Moho, Bilondo and Libonolo, and they are in water depths ranging from 546 meters to 800 meters. Combined reserves for the fields are estimated at 925 million barrels.

The firm must still determine whether to develop the fields as subsea tiebacks to N'Kossa or from a stand-alone floating production system.

Drilling began in 2000 in the deeper waters off the northern mouth of the Congo River, where four large blocks have been permitted:

❒ ExxonMobil operates the Mer Profonde Nord.

❒ TotalFinaElf was granted the Mer Profonde Sud and the Mer Trés Profonde Sud.

❒ Agip operates the Mer Trés Profonde Nord.

TotalFinaElf has drilled two wells on its acreage – one that was a discovery (Andromède Marine-1 well on Mer Trés Profonde Sud), and one that was unsuccessful (the Muhanga Marine-1 in the Mer Profonde Sud).

The discovery well was drilled in 1,893 feet of water and tested 7,000 barrels of oil.

However, given the tremendous success the company has enjoyed in West Africa, this new discovery may have to wait in line pending development of other large fields off Nigeria and Angola.

Gabon and Equatorial Guinea

Immediately north of the Congo acreage, in southeast Gabon ultra deep water, TotalFinaElf, Unocal, Kerr-McGee and RB Falcon have bought into Vanco Energy's Anton and Astrid Marin permits. These cover 6,600 and 6,000 kilometers, respectively, in water depths ranging from 1,000 to 3,000 meters.

To date over 40 prospects have been identified, and some believe that the acreage has potential as great as the Angolan blocks to the south. An additional nine deep water blocks were offered in Gabon's ninth licensing late last year 2000.

Another area garnering attention is on the border between Nigeria and Equatorial Guinea, where ExxonMobil's Zafiro Field and its associated satellites show good promise for a developing exploration program.

ExxonMobil has been awarded exclusive rights to explore and technically evaluate 22 blocks in the neighboring deep waters of Sao Tome and Principe.

Triton Energy's La Ceiba Field on block G offshore Equatorial Guinea was a major new discovery in 1999 and the field is being fast-tracked as a four-well subsea early production system tied into the Sendje Berge floating production system, which will be moored in 100 meters of water. First production was expected by late last year.

A much larger 20-well scheme could be in the making in the next couple of years.

About 15 miles southwest of La Ceiba, Vanco has signed an agreement for the Corisco Deep block K covering 1.1 million acres and extending into water depths of 2,500 meters on what is hoped to be an extension of La Ceiba's geologic trend. Vanco planned to acquire 2,000 square kilometers of 3-D seismic in 2000 and its first wildcat is expected within two years.

Also, Chevron has taken over as operator of block L, which is northwest of Triton's acreage and is believed to be on trend with La Ceiba. Chevron's work program includes seismic acquisition and exploration drilling with expenditures of $15 to $20 million.

Ghana and the Ivory Coast

Deep water blocks have been licensed off both Ghana and the Ivory Coast, covering prospects in Cretaceous-Tertiary reservoirs.

In 1999 Ocean Energy and Shell drilled a dry hole at East Grand Lahou offshore the Ivory Coast, and Hunt's WCTP-2X wildcat on Ghana's Cape Three Points acreage found only oil shows.

These two failures have dampened enthusiasm for the deep waters in the western Gulf of Guinea.

However, more recently Dana's West Tano WT-1X was drilled right on the edge of the continental shelf and found oil in two levels of Cretaceous sands. Different geological modeling will be necessary to understand this offshore region. ❒

Environment

from page 9

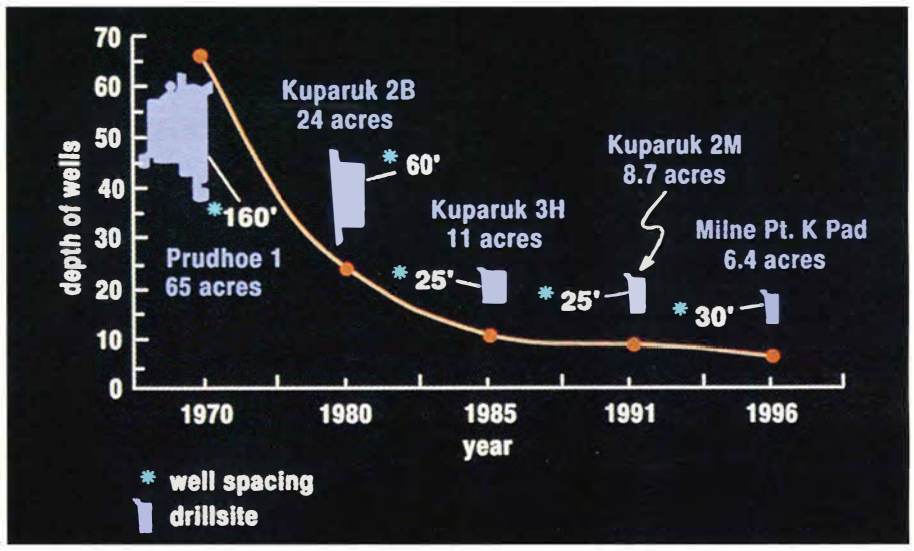
"The second thing is that they have no historical perspective."

And Gerhard risks irritating other sectors of the industry by separating out the effects of E&P for comparison. Almost all serious environmental concerns have to do with transportation and storage or refining and fuels instead of upstream operations, he said.

Gerhard doesn't see even the Exxon Valdez spill as an industry problem.

"That was a shipping accident," he stated flatly. "It had nothing to do with the oil industry, other than that the cargo happened to be oil."

Gerhard



Working smarter and better: Data from Prudhoe Bay shows the order of magnitude decrease in wellpad footprints there since the 1970s.

Data courtesy of the Division of Oil and Gas, State of Alaska

Industry's Responsibility

Environmentalism itself has gone through an evolution, as well as a recycling of some ideas, Gerhard said. He remembered growing up as a dedicated recycler of discards during World War II.

"As a little kid, I went out and gathered tin cans," he recalled. "Whatever we put out, we gathered up and turned into ammunition or armaments."

In tracing the evolution of environmental activism, he also pointed out a shift from health and safety concerns – "No one that I know argues about health and safety," he said – to interest in the visual, aesthetic and recreational environment.

He wondered if the public could adequately assess the cost-benefit trade-off among petroleum, human health and safety, and purely aesthetic concerns.

"The American consumer for the first time right now with the price of natural gas is seeing up front the effects of the interest in recreation and aesthetics," he said.

Gerhard related his experience in explaining to a roomful of people the social benefits of petroleum, "including the pharmaceuticals that were keeping half the people in that room alive." At the same time, he acknowledged that the social benefits of environmental protection have attained broad support.

"We have gone through this fundamental social change that's going to last quite a while, which is that clean is good," he said. "And I agree with that."

With arguments on both sides, Gerhard emphasized the importance of allowing exploration and production to continue in accordance with society's environmental standards, in hopes of providing the energy to meet society's needs.

"There isn't any back-up," he said. "None of the proposed renewable-energy resource bases can power a city."

He has no doubt that E&P can and will take place without any long-term environmental damage.

"Impacts (from E&P) are transitory," he noted. "And almost any impact you can think of is already constrained by government regulation.

"In the case of producing oil fields, the environmental presence might last for 70 or 80 years," he continued, "but once they're gone, you'll have a hard time knowing they were there."

Gerhard said future economic realities probably will do more than any other factor to shape the nature of environmental concerns in society. The petroleum industry can have an influence if it's willing to communicate, he believes.

He isn't sure where his study of environmental evolution will eventually be published. But it's up to the industry, including geologists, to present the facts to the public, according to Gerhard.

"Somehow we have to communicate to ourselves and to the rest of the world what are the effects of what we do," he said.

"We have to tell our own story. Otherwise, other people are going to tell it for us, with their own spin. We have to tell it like it is." ❑

Spindletop

from page 7

world history.

Former AAPG President Michel T. Halbouty, a native of Beaumont, recorded the story of the great oil field in 1951, when he and boyhood friend James A. Clark, now deceased, co-authored the book *Spindletop* to commemorate the 50th anniversary of the landmark discovery. The book's foreword summarized the impact that Higgins, Lucas and the army of wildcatters that rose up out of Spindletop had on the oil industry, the nation and the world:

"There and then America was blessed with the supply of energy and the incentive to move up from a secondary position in world affairs to that of undisputed leadership.

"Before Spindletop oil was used for lamps and lubrication. The famous Lucas gusher changed that. It started the liquid fuel age, which brought forth the automobile, the airplane, the network of highways, improved railroad and marine transportation, the era of mass production and untold comforts and conveniences."

The Legacy Continues

For years, Halbouty has been proud to proclaim how the legacy of those days continues. Analogies can be drawn between then and now, but sharp disparities also exist.

"There was a tremendous amount of money made because of Spindletop," he said, "but more was lost. Eighty million dollars were invested in it, but only $50 million came out. That was because of all the wild speculation that went on, with absolutely no controls whatsoever. There was incredible waste.

"But there was an awful lot besides money that came out of Spindletop," Halbouty said. "It was the beginning of several companies that became the giants of the industry – The Texas Co., Gulf Oil, Cities Service, and really, Humble Oil Co., a forerunner of Exxon USA. Then there were some very important smaller companies, like Pan American and Amoco, that got their start, too."

Independents also came into their own with the vindication of the theory of salt domes forming traps for hydrocarbons.

Scientific method began to replace "creekology" and other antiquated misconceptions on how to find oil. Prior to the discovery, Higgins talked with one geologist who believed an underground vein of oil drained out of the Rocky Mountains and pooled in a great oil lake in Texas.

Another geologist condemned his efforts, saying oil could be found only in proximity to hard rock.

In every way, on both the personal as well as the global level, the world was never the same after Spindletop. ❑

SW Section Sets Annual Meeting In Dallas

"2001 – A Geologic Odyssey" is the theme for this year's Southwest Section's annual meeting, set March 10-13 at Brookhaven College in Dallas.

The meeting will be held in conjunction with the grand opening of the Ellison Miles Geotechnology Institute at the college, named in honor of the AAPG member who made a major donation toward its construction.

The meeting's program features more than 20 oral papers plus posters, a free short course on "Development Geology, Reservoir Characterization and Reservoir Management," a field trip to the Brazos River and social activities.

The All Convention Luncheon will feature Albert A. Bartlett, professor emeritus at the University of Colorado's department of physics, who will discuss "Arithmetic, Population and Energy."

The pre-registration deadline is Feb. 20. To register, or for more information, go online to www.southwestsection.org, or www.dgs.org; or contact the Dallas Geological Society at 972-756-1883.

WILDCAT RECOLLECTIONS

Santos Finds Took Some Time

By JACK EDWARDS

Shell Oil's Pecten explored on 23 risk contract blocks in nine onshore and offshore basins in Brazil from 1976 to 1990. A total of 27 wildcats and six development wells were drilled on 13 blocks.

Combining the cost of 43,000 kilometers of seismic surveys with wildcat drilling, Pecten spent $220 million net. Including partners costs, total exploration expenditures were $386 million.

Merluza Field in the Santos Basin (figure 1) was first indicated in 1979 by a wildcat that encountered gas shows while drilling. Two other discoveries were made in the offshore Brahia and Potiguar basins during 1979 and 1982, but were non-commercial.

Persistent belief that the Santos Basin held good exploration opportunities led to the drilling of two more wells that confirmed Merluza as an economic discovery. Geological and geophysical studies, these two more wells and lengthy negotiations with partners and Petrobras led to development of Merluza Field in the late 1980s.

* * *

On the basis of the 2-D seismic survey conducted by Petrobras, risk contract blocks were acquired in the Santos Basin in 1978 under the direction of Larry Gordon, Pecten's new ventures manager.

The seismic survey disclosed a number of north-south trending, salt cored Cretaceous anticlines, with amplitudes increasing down dip from west to east. One of the largest structures was 14 kilometers long and three kilometers wide, with 220 meters of vertical closure. This Lower Cretaceous prospect, named Merluza, covered 29 square kilometers.

In 1979 the Merluza prospect was tested by wildcat SPS-11 on block ACS 14, acquired by Pecten/Shell/Marathon. The location was on the fold axis three kilometers north of the crest of the Merluza structure. It drilled through Tertiary and Cretaceous clastics into Albian Guaruja limestone below 5,000 meters (Figure 2)

While drilling, a thin gas zone was recognized in an Upper Cretaceous shallow-marine sandstone. A gas show also was indicated in a Turonian sandstone. A strong water flow from the deep Lower Cretaceous limestone forced abandonment without logs or tests being run.

In 1982 after geologic and geophysical review and with partner's agreement, the SPS-21 was drilled four kilometers south of the SPS-11, very near the deep crest of the Merluza structure. It found the thin shallow-marine sandstone, but not the deeper Turonian sandstone – and partners lost interest and withdrew from the contract.

* * *

Pecten geologist Seymore Sharps interpreted from sample studies that the Turonian Lower Itajai sandstone interval with a gas show in the SPS-11 was of turbidite origin. Structural restorations indicated that during Turonian time the Merluza salt pillow grew by sediment loading on the flanks.

The crest was eroded and Lower Itajai turbidite sandstones onlapped the north half of the structure, causing the absence of the turbidite sand in SPS-21 on the crest (Figure 3).

Pecten geophysicists Bill Elbel and Tom Baird mapped a high amplitude reflection tentatively tied to the turbidite gas sand interval in the SPS-11. This strong reflection expanded down the north plunge of the anticline from the area between the SPS-21 and the SPS-11.

They interpreted the thickness of the porous sand, which gave rise to this reflection.

Next, a recommendation was prepared under the direction of Richard Gardell and Jack Edwards to drill a third well on the Merluza prospect.

During 1984 Pecten, acting alone, drilled the SPS-20 three kilometers north of the first well (SPS-11) on the fold axis, within closure, but well down the north plunge. SPS-20 was a gas condensate discovery in the Itajai turbidite with 26 meters (86 feet) of pay with 20 percent porosity.

During 1985-86, Pecten conducted additional geologic studies by Sharps and Patricia Santigrossi. Geophysical analysis of reprocessed seismic data

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Figure 1 – Persistent belief that the Santos Basin held good exploration opportunities led to the drilling of two more wells that confirmed Merluza as an economic discovery

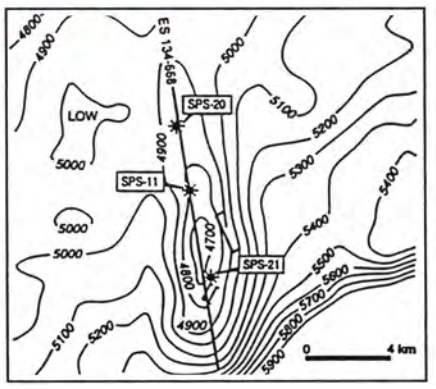

Figure 2

Merluza Santos block I-II depth to base of turbidite sand (Lower Turonian unconformity).

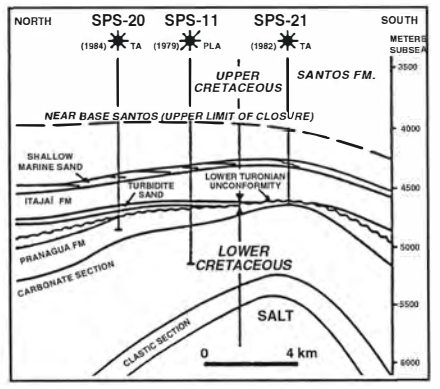

Figure 3

Merluza cross section through wells SPS-20, SPS-11 and SPS-21,

Map by Rusty Johnson; graphics courtesy of Jack Edwards

continued from previous page

(by Elbel, supervised by Baird) resulted in excellent ties with the well log synthetics. This seismic data was used to map the Turonian reservoir thickness and extent.

This work increased confidence in the porosity – thickness geometry of the reservoir beyond the economic threshold of gas volume needed to proceed with development.

* * *

While exploration studies and economic evaluation continued, discussions with Petrobras took place to formulate a gas contract.

The original risk contract did not contain a gas development clause. These discussions were led by Phil Jensen, Bruce Bernard and Fred MacDougal of Pecten, and Luis Reis of Petrobras.

Pecten and Petrobras eventually agreed to a development plan, and from 1986 to 1990 six development wells were drilled based on the seismically mapped reservoir geometry.

A production platform and a 100-mile pipeline to shore was constructed. Commercial production was established in May 1993 and gas began to flow to Sao Palo, Brazil. The Merluza field operation was turned over to Petrobras in accordance with the risk contract.

Merluza has produced an average of 60 million cubic feet of gas and 3,000 barrels of condensate per day. The original estimated ultimate recovery for Merluza Field was 300 billion cubic feet of gas plus 11 million barrels of oil.

Subsequently Petrobras has discovered four oil and gas fields in Lower Cretaceous limestones in the southern part of the Santos Basin. Pecten had drilled one of these blocks and decided not to test or complete the well because of the 2000-ppm H2S content of the gas in this offshore location.

(Editor's note: Edwards is with the department of geology at the University of Colorado, Boulder.

Antonio Tisi and Gonzalo Encisco, both now in Shell international ventures, published studies of Merluza Field, and parts of their work were used in preparing this description of its discovery.)

BUSINESS SIDE OF GEOLOGY

Whoever Took 'Estimating 101?'

By PETER R. ROSE

Last month we said that modern petroleum explorationists have two main professional responsibilities:

❒ Find opportunities (= prospects).

❒ Measure them objectively, in terms of chance of success; reserves expectations (estimated ultimate recovery); and profitability.

Finding opportunities is the fun part of the exploration business, the value-adding part. It involves new geography, new geology, new tools, secrecy – and the competitive excitement of the hunt!

However, if we are to stay in business, the measurement part is also important.

Yes, it's often mundane – even uncomfortable – especially if our prospects are judged to be uneconomic. And let's face it, a lot of geologists are just naturally less interested in dollars than dolomite or downwarping!

Even so, measuring the economic value of our prospects is a key part of our professional obligations to our clients and investors.

Of course, assessing prospect value necessarily involves estimating many geotechnical parameters (and some economic ones) that affect prospect profitability.

For the geotechnical parameters, estimating is required because:

✓ We cannot crawl down into the subsurface with a measuring tape or microscope.

✓ Mother Earth is a very coarse filter.

A lot of investment capital is riding on our ability to objectively estimate *variable factors* – such as productive area, average net pay thickness, hydrocarbon recovery factor (bbl/af or mcf/af), recoverable reserves, etc. – and *existence factors*, such as our confidence (= probability) that reservoir, closure, top seal or hydrocarbon charge requirements are satisfied at depth.

This month, we'll discuss the variable factors.

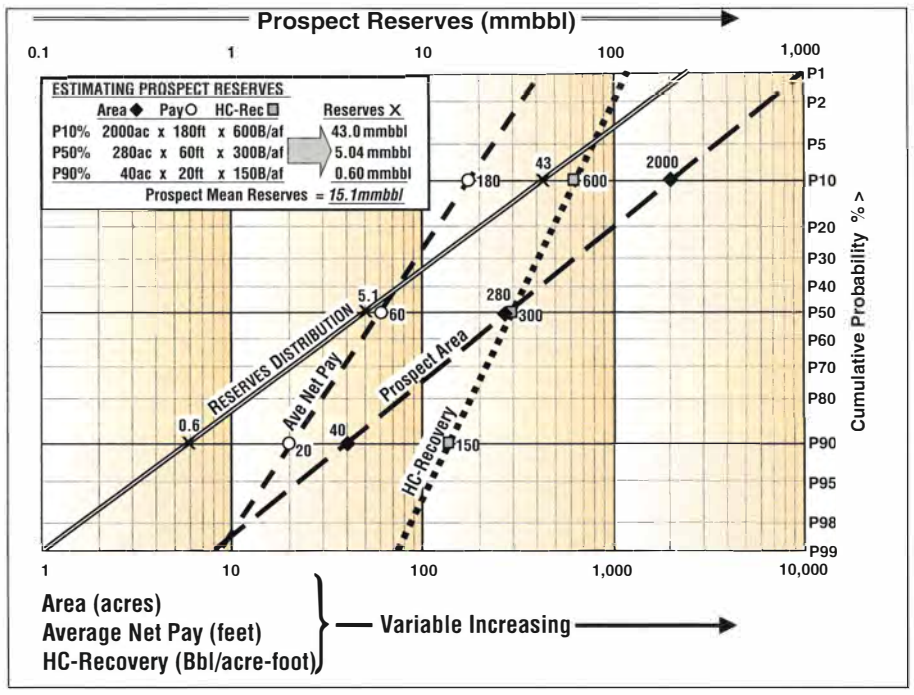

Figure 1

* * *

The general industry convention is to estimate the *variable factors* – those uncertainties involving recoverable reserves, or flow rates, or prices and costs – as probabilistic ranges, using cumulative probability distributions.

In figure 1, for example, the exploration team is 90 percent sure that, given a discovery, the productive area will be at least 40 acres; they think there's only a 10 percent chance it could be larger than 2,000 acres.

What really boggles the mind is that, despite the huge capital investments being laid out yearly by dozens of competing corporations on highly uncertain oil and gas ventures, very few petroleum geoscientists or engineers have ever received any formal training in effective estimating techniques! Lots of math, physics, chemistry, geoscience and computer science, to be sure – but no training in estimating.

Almost no geologist or engineer ever took a course called "Estimating 101."

* * *

We also should learn how to eliminate *systematic bias* as well – the tendency for us to consistently overestimate reserves or underestimate costs, to give two examples.

Two biases that commonly bedevil our geotechnical forecasts are **overconfidence** (setting predictive ranges too narrow, resulting in frequent surprising outcomes) and **overoptimism** (motivational bias, caused by excessive zeal in "selling" the prospect).

These techniques have proved to be useful in refining our estimates of exploration variables and eliminating bias:

1. Use of multiple working hypotheses

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E-Journal Adds New Articles

The following articles were recently posted to Search & Discovery (http:\\www.searchanddiscovery.net), a free Internet journal published by AAPG/Datapages.

❒ Creativity, Elephant Hunts, Globalization, Doodle Buggers and Useful Quotes, by E.R. Brumbaugh.

❒ Composition and Origins of Coalbed Gas, by Dudley Rice (adapted for Internet).

❒ Coalbed Methane: Louisiana's Underexploited Energy Resource, by John R. Echols (adapted for Internet).

❒ Combining Surface Geochemistry and Axial Surface Map Analysis for Petroleum Exploration, by Julio Perez-Infante, Enrique Novoa, Irene Romero, Marcias Gonzalez, Claudia Fintina, Carmen Zambrano, Marco Odenhal and Angel Gonzalez.

❒ Relationship of Porosity and Permeability to Various Paramaters Derived from Mercury Injection-Capillary Pressure Curves for Sandstone, by Edward D. Pittman (adapted for Internet).

❒ Cenozoic Structural Evolution and Tectono-Stratigraphic Framework of the Northern Gulf Coast Continental Margin, by F.A. Diegel, J.F. Karlo, D.C. Schuster, R.C. Shoup, and P.R. Tauvers (adapted for Internet).

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and maps.

Prepare several possible interpretations – optimistic and pessimistic – to test the envelope of possibilities surrounding all key parameters: MAKE MORE THAN ONE MAP!

(This is one drawback to conventional workstation mapping, which tends to focus on THE answer.)

2. Independent Multiple Estimates.

Get input from exploration team members, exploration committee reviews or other joint-venturers in partnership prospects. For example: Averaging independent estimates by four seasoned experts usually gives a better (and quicker) answer than having one geoscientist work four more weeks on the problem!

3. Honor Nature's Envelopes.

Make predictions employing a parameter's observed (and therefore expectable) distribution (exponential for percent decline-estimates, lognormal for prospect reserves estimates, etc.).

4. Reality Checks.

Is your prospect reserves distribution reasonable compared with a current field-size distribution?

Are your estimates of reservoir parameters credible considering analog fields?

Are the extreme outcomes (P99 percent, P1 percent) plausible?

Is it remotely possible (P1) that the productive area of the prospect in figure 1 could be as large as 10,000 acres? Could it be as small (P99) as eight acres, and still support flow into the borehole?

5. Use Proper Statistical Measures.

For exploration portfolios, the mean (= average) is the single best representation of the prospect reserves distribution. Use probabilistic ranges, rather than minimum/most likely/maximum.

Avoid the meaningless term "most likely," as well as single-number estimates.

6. Learn From Prior Predictions.

Start preserving all your predictions, and compare them against actual outcomes.

What can you learn about your predictive performance? Do you typically overestimate? Are your ranges too narrow?

How can you improve your estimating ability?

(Next month, a look at *existence factors*.) ❒

EDUCATION CALENDAR

2001 SCHOOLS, SHORT COURSES

An Overview of Exploration Play Analysis
March 19-21, Houston

Introduction to Concepts and Techniques of Petroleum Geology
April 3-5, Houston

* Structural Styles and Hydrocarbon Traps in Compressive Basins
April 23-27, Houston

Reservoir Characterization: Principle Methods and Case Studies
May 7-8, Dallas

High-Resolution Well-Log Sequence Stratigraphy
May 14-18, Denver

How to Evaluate Carbonate Reservoirs from Well Logs
June 2-3, Denver
(with AAPG annual meeting)

* Deep Water Sands, Integrated Stratigraphic Analysis
June 2-3, Denver
(with AAPG annual meeting)

* Prospect Evaluation "Surgical Theater" and Workshop
June 2-3, Denver
(with AAPG annual meeting)

E&P Methods and Technologies
June 7-9, Denver
(with AAPG annual meeting)

Applied Subsurface Mapping
July 9-13, Dallas

* Overpressure in Petroleum Systems in Deep Water Plays
July 14-15, St. Petersburg, Russia
(with AAPG regional international meeting : Register through AAPG convention department)

Well Log Analysis and Formation Evaluation
Aug. 7-10, Austin, Texas

Probability and Statistics for Exploration and Exploitation
Aug. 20-22, Dallas

Introduction to the Petroleum Geology of Deep-Water Clastic Depositional Systems
Sept. 8-9, San Antonio
(with SEG annual meeting)

Terrigenous Clastic Depositional Systems and Sequences – Applications to Reservoir Prediction, Delineation and Characterization
Oct. 1-2, Dallas

Quantification of Risk – Petroleum Exploration and Production
Oct. 8-11, Houston

Practical Salt Tectonics
Oct. 29-31, Houston

* Advanced Risk Analysis for the Energy Industry
Nov. 12-13, Houston

2001 FIELD SEMINARS

Carbonates

Carbonate Sequence Stratigraphy, As Illustrated By Lower Cretaceous Platform Carbonates, Central Texas
April 16-20
Begins in San Antonio
Ends in Austin, Texas

Sequence Stratigraphy and Reservoir Distribution in a Modern Carbonate Platform, Bahamas
June 25-30
Begins, ends in Miami, Fla.

Arid Coastline Depositional Environments
Nov. 4-9
Begins, ends in Abu Dhabi, U.A.E

Clastics – Ancient

Clastic Reservoir Facies and Sequence Stratigraphic Analysis of Alluvial-Plain, Shoreface, Deltaic and Shelf Depositional Systems
April 22-28
Begins, ends in Salt Lake City

Wave-Dominated Shoreline Deposits, Book Cliffs, Utah: Depositional Models for Hydrocarbon Exploration
May 14-22; Aug. 20-28
Begins, ends in Grand Junction, Colo.

* Cretaceous Outcrops of the Western Interior, Ferron Sandstone, Fall River Formation and the Muddy Sandstone – Utah, Wyoming and South Dakota
June 7-14
Begins in Wyoming
Ends in South Dakota
(following AAPG annual meeting)

Clastics – Modern

Modern Clastic Depositional Environments
April 18-24; May 18-24; Sept. 12-18
Begins in Columbia, S.C.
Ends in Charleston, S.C.

Modern Deltas
Sept. 10-14
Begins in Baton Rouge, La.
Ends in New Orleans

Sequence Stratigraphy

Sequence Stratigraphic Influence on Sandstone Reservoir Characteristics of Cretaceous Foreland Basin Deposits
June 24-29
Begins in Rock Springs, Wyo.
Ends in Steamboat Springs, Colo.

Sequence Stratigraphy Field Seminar: Sequences and Facies on an Active Margin
Oct. 14-19
Begins, ends in La Jolla, Calif.

Tectonics and Sedimentation

Exploration Potential, Tectonic Framework and Depositional Systems of Strike-Slip and Extensional Basins
March 31-April 6
Begins in Palm Springs, Calif.
Ends in Las Vegas, Nev.

Grand Canyon Geology via the Colorado River, Arizona (An AAPG Geotour)
June 10-18
Begins in Marble Canyon, Ariz.
Ends in Marble Canyon; South Rim, Ariz.; or Las Vegas, Nev.

Utah-Nevada Overthrust Belt and

continued on next page

What's New on the Web

Education Just A Touch Away

By JANET BRISTER
Web Site Editor

Did you get your Education Calendar? Would you like one – at the snap of your fingers?

The annual calendar is online now at www.aapg.org with new features that will aid you in planning your professional education.

Each calendar page includes a link to a short description of every course, school or field seminar offered. If you want more detail, a link is there along with links to information about the instructors and leaders.

All educational opportunities are divided into two categories: Field Seminars, and Schools and Short Courses. Each category shows an index in alphabetical or chronological order.

New for your download is a PDF document of the entire calendar – and unlike the usual PDF that you would download and print, this one has some navigating tools for easy reference. This way you can print the specific information you need yet keep the calendar on your hard drive for future reference.

Included in this document and as a separate download is a registration form that can be filled out right on your computer screen.

In other words, filling out the form on the screen is like putting a piece of paper in a typewriter and typing your way through it "the old fashioned way" – simply tab through the fields provided and complete the information.

Once finished, you can then print it out and mail or fax it to AAPG.

* * *

Forms such as this are being implemented throughout the AAPG site. Look for the red instructions "Click here first" or "Click here to complete this form," or simply click where you believe a field should be. If any of these result in a blinking cursor, you know you can begin typing.

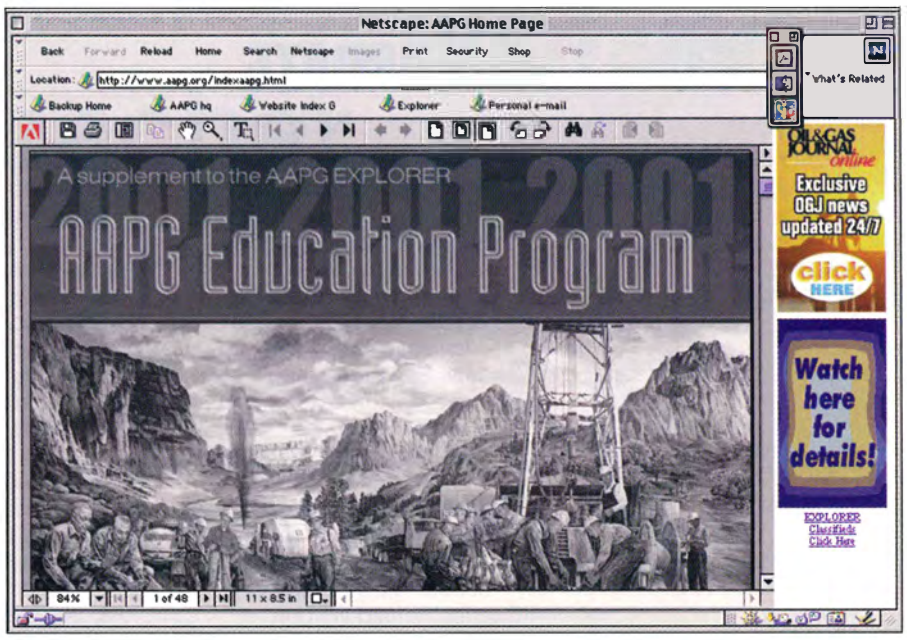
Also, there is a navigation panel that may be hidden on your PDF document. The navigation icon that toggles its availability on and off is just left of the printer icon in the icons strung across the top of your window (see figure above).

The navigation panel provides three options: Bookmarks, Thumbnails and Annotations.

The Bookmarks are a sort of table of contents, or index, that allow you to navigate through the calendar's major sections. Between this and the links within the document you should be able to discover the information you need regarding courses and field seminars of interest.

The PDF is about 1.5 Mb in size. For users with slow connections (28.8 kbps) this could mean about a 10- to 15-minute download, depending on your connection.

Good browsing! ❑



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Eastern Great Basin Tectonics
June 18-22
Begins in Salt Lake City
Ends in Las Vegas, Nev.

E&P in Thrusted Terrains, Practical Applications of Structure and Stratigraphy in the Montana/Alberta Thrust
Aug. 5-10
Begins in Great Falls, Mont.
Ends in Calgary, Canada

Submarine Fan and Canyon Reservoirs, California
Sept. 17-21
Begins, ends in San Francisco

** New AAPG course or field seminar.*

FOUNDATION UPDATE

Foundation General
Antony George Abouzakhm
Lee B. Backsen
Erik Curtis Bartsch
Kevin Hans Bjornen
Louis Chapman Bortz
In memory of Charles Masters
Jeremiah Johnson Burton
Greg J. Calvert
George Stewart Causey
W. Kevin Coleman
John Edward Cramer
Arnaud Etchecopar
Thomas A. Fitzgerald
James A. Gibbs
In memory of Al H. Silberberg and Don Boyd
Sherod Alexander Harris
Jerry Lynn Hickman
Wilson Humphrey
Yousif Khoshu Kharaka
Jason Eric Lewis
Tim R. Lindsey
Dustin Wayne Luensmann
David Gerard Lund
Charles John Mankin
Robert Anthony Martin
David William J. Middleton
Marcus Eugene Milling
Steven William Nance
Clifton R. Naylor Jr.
Kwok-Choi Samuel Ng
Jaime Alonso Pavas
Sammy Gene Pickering
Johann G. Rigor
James Warner Roach
Peter R. Rose
Edgar Rueda-Gualdron
Kweku-Mensah O. Sagoe
Alfredo Pastor Sanchez
John Wayne Shelton
In sponsorship of Internet subscriptions for Baylor University; In memory of Robert B. Brockhouse, James H. Clement and B.W. Wilson
Charles Earl Shultz
Richard Steinmetz
M. Ray Thomasson
Sheldon Lee Turrill
Ciro Edgar Vargas
Christian Walls
William P. Wilbert
In memory of James O. Jones
Charles Ronald Willden
Andrew J.B. Wright
Raul A. Ysaccis

Grants-in-Aid Fund
John F. Bookout Jr.
Carrie B. Donnell
Ryan Michael Dupuis
Nedra Keller Hansen
In memory of Kenneth Keller
Anthony John Lomando
John M. Parker
In memory of Karl W. Frielinghausen and John F. Harris
Sean P. Trimble
Slawomir M. Tulaczyk

For the Classen Family Named Grant
Paul H. Dudley Jr.
In memory of John Loftis

For the Kenneth H. Crandall Named Grant
John H. Silcox

For the Fred Dix Named Grant
Jack C. Threet

For the Peter W. Gester Named Grant
John H. Silcox
In memory of S.J. Kriz

For the Bernold M. "Bruno" Hanson Named Grant
Keil Arthur Albert
Richard R. Bloomer
William H. Curry Jr.
Nancy M. Doelger
Thomas Edward and Linda Ewing
Gerald M. Friedman
Lee C. Gerhard
Eric Kevin Hass
Dudley Joe Hughes
Kenneth G. Johnson
William Gerard Murray
William Charles Penttila
Edward B. Picou Jr.
David Cooper Salter
Jack C. Threet
Don F. Tobin
Donald L. Zieglar

For the R.E. McAdams Named Grant
Jack C. Threet

For the Alexander A. and Geraldine Wanek Named Grant
Estate of Alexander A. Wanek

For the Sherman A. Wengerd Named Grant
Patrick John F. Gratton
In memory of George "Bill" Wilson

For the Raymond Woods Named Grant
Hubert H. Hall

Continuing Education Fund
Miguel Alfredo Quintana

K-12 Fund
James A. Batchelor
Edward G. Dobrick
Dana Davenport Gagliano
Henrita H. Hanson
Kristofer Michael Lucskay
John H. Silcox
In memory of Greg Stanbro
Gerald Gordon Tiernan

Gus Archie Development Geology Fund
James A. Hartman ❑

MEETINGS OF NOTE

2001 U.S. Meetings

March 10-13, Southwest Section, AAPG, annual Section meeting, Dallas.

April 9-11, Pacific Section, AAPG, annual Section meeting, Universal City, Calif.

April 25-28, Society of Independent Professional Earth Scientists, annual meeting, Galveston, Texas.

April 30-May 3, Offshore Technology Conference, Houston.

June 2-3, SEPM, 75th anniversary mid-year meeting, Denver.

June 3-6, AAPG annual meeting, Denver.

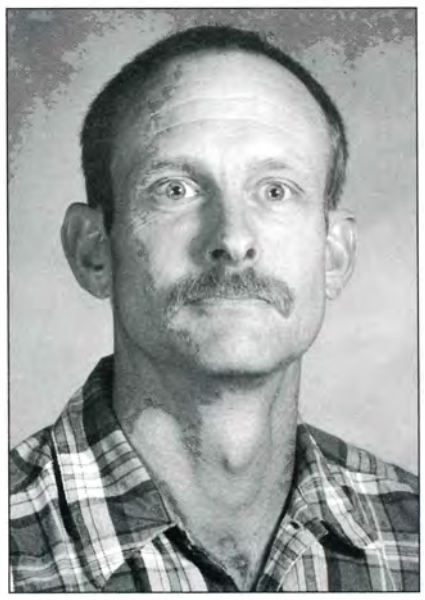
2001 International Meetings

June 18-22, Canadian Society of Petroleum Geologists, annual meeting, Calgary, Alberta, Canada.

June 11-15, European Association of Geoscientists and Engineers, annual meeting, Amsterdam, The Netherlands.

Honor Goes to Coloradan

A Challenging Teacher


McKinney

John McKinney, an eighth grade earth science teacher at Castle Rock Middle School in Castle Rock, Colo., has been selected as AAPG's National Earth Science Teacher of the Year.

McKinney will receive his award in June at the AAPG annual meeting in Denver.

AAPG's Teacher of the Year program began in 1996. It is designed to recognize teachers who go beyond the textbook to incorporate applied geology into their lesson plan to give students "an appreciation of how one field of science touches their everyday life."

McKinney, who resides in Sedalia, Colo., received a bachelor's degree in geography from the University of Oregon in 1979, and a master's degree in earth science from the University of Northern Colorado in 1993.

He has taught earth sciences at Castle Rock for nine years.

"In my class, students are challenged to think about what they learn," he said, "and engage in meaningful assessment activities that motivate them to learn.

"Many of my students will never have another earth science class in their life," McKinney continued, "so I feel compelled to teach them as much about our planet as possible in the nine months they spend with me."

McKinney, a native of Los Angeles, worked 10 years in the construction business before becoming a teacher. His primary focus at Castle Rock has been "developing interesting classroom activities that motivate students to learn," but he also has written a 180-page textbook to match his curriculum and has been active in a number of leadership roles at the district level.

McKinney is an avid mountaineer-camper – two years ago he achieved a "life goal" by reaching the summit of Cerro Aconcagua, the highest point in the Western Hemisphere – and he has been "fascinated by geology since my childhood.

"My career in education has been an extension of my interest in geology and the earth as a whole," he said.

McKinney described himself as "deeply committed to exposing my students to the wonders of this planet," and as a teacher not afraid to "challenge students to think about their role in the future of our planet.

"I focus on how our modern society is built with fossil fuels," he added, "and try to create an awareness in my students of the energy issues that face our planet."

McKinney's students start the school year by studying earth's history "as told in the sedimentary and fossil record."

Activities and projects include:

❒ A "jigsaw reading activity" format to help students learn about fossil fuels and their importance to modern society.

❒ A "Dinosaur Symposium," in which over 50 life-sized dinosaurs are drawn in chalk on the school parking lot, arranged in a geologic timeline.

❒ A local geology field trip, in which students learn about the geology of the Castle Rock area by studying the sedimentary rocks found around the school. The students then are "challenged to take their parents on a similar trip and explain how the rocks that we see in Douglas County tell a fascinating story of geologic change."

❒ Projects in astronomy and meteorology.

❒ A special class in constructing fossil reproductions, which are then used in a student-operated "Mobile Museum" that goes to elementary schools to teach younger children about the fossil record and geologic time.

The award includes $5,000, funded by the AAPG Foundation. Half of the award money is designated for use under McKinney's supervision for education purposes at Castle Rock Middle School; the other half is for his own personal use. ❒

Environment Seminar Set

The Division of Environmental Geosciences is co-sponsor of a session on Environmental Planning in the E&P Business, "Operations, Drilling & Production: Case Studies" to be held March 6 at the Aberdeen, Scotland, Exhibition and Conference Center.

DEG is co-sponsor with the Petroleum Exploration Society of Great Britain and the Institute of Petroleum, London.

Eight speakers are planned, and registration is $50 (U.S.). For further information contact Gail Williamson, PESGB at Gail@pesgb.demon.co.uk.

AAPG DIVISION OF ENVIRONMENTAL GEOSCIENCES
REPORTER
RATIONAL SCIENCE FOR RATIONAL POLICY

2001 Annual Meeting DEG Denver Program Preview

Environmental Solutions for Business

By William Sarni, DEG Technical Program Chair and Charles Senz, DEG Vice Chair

The Division of Environmental Geosciences (DEG) has developed a unique program focused on the successful integration of environmental solutions into business operations. The DEG program for the 2001 Annual Convention in Denver, Colorado includes technical sessions on: Sustainability (Metrics and Applications), Approaches to Reducing Greenhouse Gas Emissions, CO_2 Sequestration and Remediation Technologies. The program includes field trips to Glenwood Canyon, Rocky Mountain Arsenal and NREL, and a poster session and short course on the application of innovative remediation technologies. The DEG is also privileged to have Dr. Bernard Bulkin, Vice President of Environmental Affairs-BP, presenting Sustainability-Making it Real at the DEG Luncheon.

Approaches to Reducing Greenhouse Gas Emissions
DEG will focus on the successful application of market-based approaches to reducing Greenhouse Gas Emissions (GHG) in the energy industry. This oral session will include technical and business managers from several major energy companies who will present their experience in GHG trading programs, the competitive advantage of addressing GHG emission reductions, and the development of a national strategy for GHG management.

CO_2 Sequestration (DEG/EMD)
The DEG and EMD have developed a comprehensive program, which provides an assessment of the geologic, geophysical, reservoir, and economic considerations critical to evaluating the success of CO_2 sequestering programs in addressing GHG emission reductions. Applications of CO_2 sequestering programs along with quantitative assessments of program performance will be presented in two oral sessions. These sessions represent current findings and conclusions on the viability of CO_2 sequestration in geologic reservoirs, and together with the DEG session on the Applications of Reducing GHG Emissions, will provide attendees with an in-depth understanding of key environmental issues affecting the energy industry in the upcoming decades.

Sustainability Forum — The Integration of Metrics and Applications
As Sustainability programs within the energy industry are initiated, several companies have developed metrics for quantitatively assessing the success of Sustainability programs. Several approaches to quantifying Sustainability performance and the successful application of Sustainability models to business operations will be presented by industry representatives.

Innovative Remediation Technologies
This poster session will offer a look into the future of environmental remediation. Cutting-edge remedial techniques will be illustrated by some of the leading engineers and scientists involved in environmental restoration. Emphasis will be on techniques that rely on chemical and biological reactions, which work to break down contaminants in situ.

Short Course — Remedial Technologies for the New Millennium
This short course will provide an immediate benefit to those who want a detailed picture of the latest technologies in environmental remediation. State-of-the-art techniques for detection and mitigation will be presented. Monitored Natural Attenuation (MNA) will be detailed, providing attendees with proven and practical information needed to successfully evaluate and demonstrate the role of this important cleanup tool. The most promising in-situ treatment technologies will be explained and attendees will receive handout materials that will be immediately useful in their selection and implementation of cleanup programs for their sites.

Field Trips
The DEG will offer two exciting field trips addressing environmental issues in Colorado with universal relevance.

Resource Development and Infrastructure in Harmony with the Environment - Our first trip will take us across the Continental Divide to Colorado s beautiful Western Slope where we will see first-hand how resource development and infrastructure can coexist with sensitive environments. Barrett Resources Corporation operates over 400 natural gas wells along the Colorado River in Garfield County, with new wells being drilled at a density as high as one well per 20-acre spacing unit. The development of the gas field is coincident with a growing residential population and increasing environmental concern. The tour of Barrett s operations will highlight environmental protection efforts put in place to mitigate potential effects on wildlife, air and water quality, soil, neighborhoods, and scenic vistas.

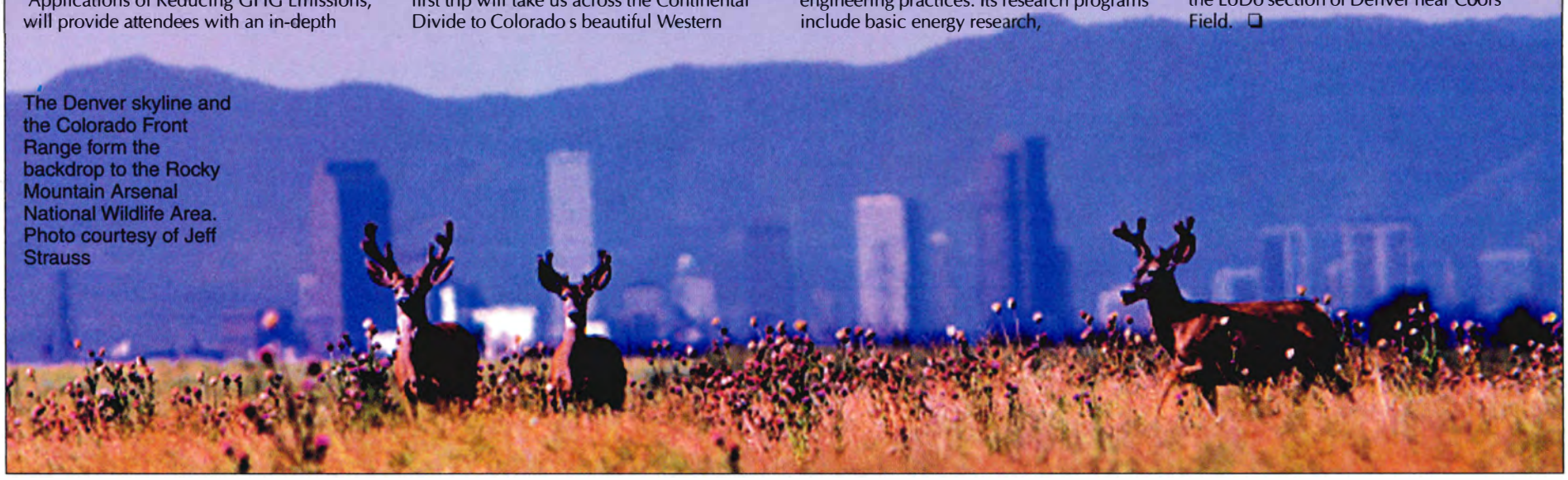
Glenwood Canyon is a spectacular gorge cut by the Colorado River into Paleozoic sediments and Precambrian crystalline rocks. In the 1980s, the Colorado Department of Transportation (CDOT) undertook the construction of one of the last legs of I-70 and the U.S. Interstate system through the canyon. Multiple environmental and geotechnical issues were encountered and had to be mitigated prior to and during 10 years of construction. The result is an award-winning, large-scale engineering project that preserved much of the scenic and biological resources of the canyon while providing for a much-needed safe and reliable transportation system. This leg of the trip will be lead by CDOT s chief engineer for this massive construction project.

Participants will have an evening in the beautiful Rocky Mountain town of Glenwood Springs, a vacation destination for over a century and famous for its hot springs.

Reuse, Renew, Recycle: Two Colorado Cases - Come with us on a one-day visit to two of the best examples of how we, as a nation, can allocate wisely our resources for future generations. The National Renewable Energy Laboratory (NREL) in Golden was established in 1974 to lead the United States in developing renewable energy technologies, improving energy efficiency, and advancing related science and engineering practices. Its research programs include basic energy research, photovoltaics, wind energy, advanced vehicle technologies, biofuels, biomass electric, fuels utilization building technologies, solar thermal electric, hydrogen, geothermal power and superconductivity. We will visit three of NREL s six research facilities. The Alternative Fuels User Facility houses alternative fuels research, such as ethanol (used as an oxygenate additive in gasoline) and biofuels (plant waste and residues). The testing and analysis of photovoltaic devices (solar cells) is conducted at the Outdoor Test Facility, one of the most heavily funded research areas. In addition, the Solar Energy Research Facility includes laboratories for research in photovoltaics, superconductivity, and related materials science.

The Rocky Mountain Arsenal National Wildlife Area, the site of chemical weapons, incendiary bomb and agricultural chemical production from World War II until 1982, will become one of the largest urban wildlife refuges in the U.S. With the discovery that the Arsenal was a wintering ground for bald eagles, the US Fish and Wildlife Service became involved in 1987 to manage the Arsenal s wildlife as cleanup progressed. Our site visit will include a tour of publicly accessible areas; and discussions of the state-of-the-art hazardous waste landfill, water treatment facilities, and contaminated soils remediation. Bring your camera and binoculars to take advantage of the spectacular views of the Rockies, the Denver cityscape, and the Arsenal wildlife.

Sustainability-Making it Real — DEG Luncheon with Dr. Bernard J. Bulkin, VP of Environmental Affairs-BP
The DEG Luncheon, will host a presentation by Dr. Bernard J. Bulkin, VP of Environmental Affairs of BP. Dr. Bulkin will present a discussion of the BP s successful application of Sustainability into their business operations. He will present the key aspects of BP s Sustainability initiative, as well as with actions taken by BP to meet environmental protection, social, and economic goals. The DEG Luncheon will be held at the historic Wynkoop Brew Pub in the LoDo section of Denver near Coors Field. ❑



The Denver skyline and the Colorado Front Range form the backdrop to the Rocky Mountain Arsenal National Wildlife Area. Photo courtesy of Jeff Strauss

DEG Executive Committee Recommends Bylaws Changes

The DEG Executive Committee is recommending several important changes to the DEG Bylaws affecting certain roles of the elected DEG leadership. Please log on to the DEG Web site at www.aapg.org/deg to review these changes. You will be asked to approve or reject these recommendations when you vote for your new DEG Officers. The election ballots will be mailed to the DEG membership on February 1, 2001. If you have any questions or comments, please contact Doc Weathers, DEG President, at dweathers@utsystem.edu or (915) 688-0456.

A listing of DEG officers is on the AAPG Web site (www.aapg.org). Use the link there to get to the DEG Web site.

Produced by the AAPG Division of Environmental Geosciences

INTERNATIONAL BULLETIN BOARD

Team Leaders 'Spread the Word'

By WALTER GRÜN

Allow me to introduce myself as one of these proud AAPG Service Team Leaders (STL).

It was more than two years ago when AAPG's Executive Committee decided to establish the Service Team Program as a response to the increasing international AAPG membership. The idea behind this program was to better serve the needs of members far away from AAPG headquarters – and, no doubt, there was also the intention to increase the membership in foreign countries.

My friend Bruce Lemmon (former head of AAPG's office of international development) gave a clear definition of an AAPG Service Team and you can read it in the "AAPG Service Team Operational Guidelines & Resource Book," the bible of every STL.

In short, it is the duty of an AAPG Service Team to be "the hands, feet, eyes and ears of the Association in specific countries or multi-country 'focus areas,' acting as an extension of headquarters' operations in delivering products and services to members and the broader geoscience community around the world, as well as collecting feedback for AAPG staff, committees and international Regions to act upon."

In 1999 I was appointed one of the first STLs by then-president Ray Thomasson. Since then Bruce and I visited several countries in my focus area in order to spread AAPG's gospel.

It was no waste of time and money. In most of these countries AAPG's membership didn't exceed five, although there was great interest in becoming a member and participating in AAPG activities.

The main problem in all these countries was the lack of money. A monthly salary of a university professor equals the annual dues of an Active AAPG member.

* * *

Consequently we developed the "AAPG Student Membership Program." Due to a fund, which was fed by companies like Schlumberger, Landmark and mainly by BP, I was able to pay the membership dues for needy students. As AAPG is not permitted to pay the dues of its members, the Austrian Geological Society as an affiliated society to AAPG took over the administration of this fund.

In the last two years 340 students in 13 countries took advantage of this AAPG program. Eight AAPG Student Chapters were established in five countries, and we expect the establishment of additional five chapters within this year. In this way we are able to support a young generation of outstanding geoscientists. Now we are supporting the future of our science and of our profession on an international basis.

Each Student Chapter is headed by a local faculty sponsor who must be an Active AAPG member – which creates severe financial problems.

This was discussed in the International Liaison Committee last year during the AAPG annual meeting in New Orleans. As a result, Merrill Shields, wife of Ray Thomasson, inaugurated a 'First Ladies Fund' designed to encourage wives of past presidents to sponsor the establishment of students chapters – especially in countries where AAPG is just beginning to make its presence known.

Support also came from Chris Heath, who annually donates a significant amount for paying membership dues of faculty sponsors. This "Chris Heath Fund" is open for everybody who wants to foster the internationalization of our Association.

But how to support all the others who are willing to become a member and can not afford it? I don't see a solution, unless, we can convince charitable AAPG members to take on a "godparenthood" for these colleagues.

* * *

During our cooperation with colleagues in Central and Eastern Europe we have been confronted with the request to help to close the gap regarding the lack of AAPG BULLETINs in the libraries of universities and institutions. I was proud to learn that our BULLETIN always was one of the most demanded scientific publications in the former communist countries. If an Internet–connected member wants to get rid of his BULLETIN paper copies – here is a place.

There are plenty of other AAPG programs available to serve the needs of these countries, including:

❒ The Distinguished Lecture Program – a majority of Central and Eastern European countries participated in the past and they are looking forward to this year's tour of Brad Prather.

❒ The Visiting Geologists Program just started to go international and I am convinced we will find enough Western European AAPG members who are willing to visit the exciting Eastern part of our continent and its universities crowded with skilled and enthusiastic geoscience students.

The foundation for all these activities are the Service Team Leaders of their countries.

At present there are 15 active in Central and Eastern Europe, all volunteers who agreed to spend their time for our Association. They are valuable multipliers in both directions and they should, sooner or later, become the backbone of the AAPG regions. ❒

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
Heidrick, Tom Lee, Chevron Overseas, San Ramon (M. Schoell, C.F. Kluth, J.C. Phelps); **Rowan, Elisabeth L.**, U.S. Geological Survey, Menlo Park (K.J. Bird, L.B. Magoon III, H.E. Cook III)

Illinois
Snyder, Richard Lee Jr., Farrar Oil, Mount Vernon (G.D. Hollensbe, J.R. Coffroth, D.L. Parker)

Oklahoma
Bichsel, Kenneth Joseph, Petroleum Well Logging, Oklahoma City (M.E. Rawls, L.C. Bridges, V.J. Veroda)

Texas
Charles, Mark Wesley, Computing Solutions, Dallas (Reinstate); **Leason, Jonathan Oren**, Anadarko Petroleum, Houston (Reinstate); **Popkess, Don R.**, Echo Production, Graham (R.H. Springer, W.R. Antle, K.B. Morgan); **Radjef, Eric M.**, BP Amoco, Dallas (C.L. Vavra, J.A. Lorsong, S.A. Gordon); **Reeves, Scott R.**, Advanced Resources International, Houston (J.R. Kelafant, J.F. Eppink, R.L. Billingsley); **Squyres, Gary**, The Woodlands (M.L. Srack, G.R. Evans, M.B. Clark); **Ye, Shin-Ju**, Halliburton Energy Services, Houston (D.V. Chitale, J.H. Howard, P.J.Y.M. Rabiller)

Australia
Ainsworth, Richard Bruce, Woodside Energy, Perth (S.K. Twartz, R.J. Seggie, M.W. Shuster)

Canada
Bergquist, Christopher Lee, Anderson Exploration, Cochrane, (Reinstate)

England
Tognini, Paolo, Amerada Hess International Exploration, London (A.M. Harding, G.A. Olson, R.F. Hardman)

Estonia
Ainsaar, Leho, University of Tartu, Tartu (K.O. Bjorlykke, M.T. Harris, R.C. Millspaugh)

France
Lanaud, Richard, Total Fina Elf, Paris (P. Orsolini, F.R. Walgenwitz, P.W. Homewood)

India
Iyer, R. Subramania, Oil & Natural Gas Corp., Chennai (D.S. Fu, N. Ganesh, K.D. Ganesh); **Shaikh, Mohammedhusen I.**, Oil & Natural Gas Corp., Mumbai (Reinstate)

Indonesia
Sukmono, Sigit, Institute of Tech Bandung, Bandung, Java (E.B. Setyobudi, H. Sumantri, R.P. Koesoemadinata)

Lithuania
Kilda, Linas, Geological Survey of Lithuania, Vilnius (C.P. North, T.M. Haselton, R.C. Millspaugh)

New Zealand
Darby, David, Institute of Geology & Nuclear Sciences, Lower Hutt (R.E. Swarbrick, B.D. Field, R.H. Funnell); **King, Peter Richard**, Institute of Geology & Nuclear Sciences, Lower Hutt (P.M. Lloyd, J.M. Beggs, B.D. Field); **Sutherland, Rupert**, Institute of Geology & Nuclear Sciences, Lower Hutt (B.D. Field, R.H. Funnell, R.H. Herzer)

Nigeria
Ali, Idris Zoaka, Department of Petroleum Resources, Lagos (S.P. Braide, A. Adesida, E. Enu)

People's Republic of China
Liu, Wenxiang, Chevron Beijing China, Beijing (K.H. Hsu, J.R. Gilbert Jr., H.S. Chen)

Qatar
Emang, Michael Ipui, Qatar General Petroleum, Doha (J.A. Kading, M.A. Beg, I.B. Ishak)

Scotland
Mollicone, Phillip Leslie, Reservoir Management, Aberdeen (Reinstate)

Slovak Republic
Milicka, Jan, Comenius University, Bratislava (W.P. Grün, F.J. Picha, J. Francu); **Pereszlenyi, Miroslav**, Oil & Gas Research VVNP, Bratislava (W.P. Grün, F.J. Picha, J. Francu)

Ukraine
Omelchenko, Valeriy G., Technical University Oil & Gas, Ivano-Frankivsk (B.P. Kabyshev, A.A. Kitchka, W.P. Grün)

Certification

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

Certification – Petroleum Geologist

California
Hoyt, David E., Santa Barbara Resources, Santa Barbara (Reinstatement)

Colorado
Fields, Robert A. Jr., Colorado Interstate Gas Co., Colorado Springs (R.A. Baugh, J.B. Curtis, P. Loeffler)

Pennsylvania
Gerome, Paul D., Equitable Production, Pittsburgh (M. Canich, G. Wrightstone, L. Wickstrom)

Texas
Henry, Gary Edward, petroleum geologist, Wichita Falls (W.C. Stephens Jr., J.L. Gilbert, J.W. Ritchie)

Certification – Coal Geologist

Oklahoma
Cardott, Brian Joseph, Oklahoma Geological Survey, Norman (S.A. Friedman, L.L. Brady, R.L. Grubbs)

Certification – Petroleum Geophysicist

Pennsylvania
Morris, James Robert, Belden & Blake, Pleasantville (S.W. Nance, T.J. Appleby, P. Imbrogno)

Texas
Towle, Philip Jonathan, Baker Hughes E&P Solutions, Houston (Reciprocity by The Geological Society)

Student Expo Set at OU

The University of Oklahoma will be the site of AAPG's first Spring Student Expo, set March 16-18 in Norman, Okla.

The Spring Expo, a follow-up to last fall's successful Expo at Rice University, provides a chance for students interested in petroleum careers to showcase their work and themselves to industry representatives, who are also invited to present exhibits that promote their companies.

The weekend event will start with an Icebreaker and buffet on the evening of March 16. Poster and exhibition sessions and interviews will be held the next day, and the final day will include field trips, workshops and tours.

For further information, contact Roger M. Slatt, of the OU School of Geology and Geophysics, at rslatt@ou.edu.

PROFESSIONAL NEWS BRIEFS

David M. Allard, to exploration manager, Apache Egypt, Cairo, Egypt. Previously exploration geologic manager, Apache Egypt, Cairo.

Laura Merrill Bazeley has been elected to the board of directors, WZI Inc., Bakersfield, Calif. She is a consultant in Bakersfield.

Troy B. Beserra, to senior exploration geologist, Anadarko Petroleum, Houston. Previously senior geologist, Burlington Resources Oil & Gas, Midland, Texas.

Charlie Bukowski, to exploration manager, Alta Resources, Houston. Previously geologist, Edge Petroleum, Houston.

Arnoud J. de Feyter, to senior explorationist, Agip Gabon, Port-Gentil, Gabon. Previously explorationist, ENI S.P.A.-Agip Division, Milano, Italy.

Michael David Duerr, to natural gas explorationist, Von Duerr Petroleum Consultants, New Braunfels, Texas. Previously petroleum explorationist, Corpus Christi, Texas.

J.P. Fagan, to president, Centennial Geosciences, Amherst, N.Y. Previously senior geophysical engineer, PRJ, Lakewood, Colo.

Terry L. Ganey, to Rockies exploration geologist, Continental Resources, Enid, Okla. Previously president, Ganey Oil, Denver.

Jonathan S. Gross, to vice president-exploration, Cheniere Energy, Houston. Previously technology manager, Cheniere Energy, Houston.

James Andrew Halgas, to senior geologist, Triton Energy, Dallas. Previously area geologist, Coho Resources, Dallas.

Jeff Lelek, to infrastructure exploration delivery manager-North Sea, BP, Aberdeen, Scotland. Previously exploration and production manager-Australia, BP Australia, Melbourne, Australia.

Tim Nicholson, to manager-deepwater geology, Unocal Indonesia, Balikpapan, Indonesia. Previously advising geologist, Unocal, Sugar Land, Texas.

Chester A. Peyton Jr., to vice president-oil and gas development, Indusmin Energy, Point Roberts, Wash. Previously explorationist/owner, Interactive Exploration Services, Cypress, Texas.

Spencer Quam, to subsurface team leader-Ohanet (Algeria) development, BHP Petroleum, London. Previously development geophysics advisor, BHP Petroleum, Melbourne, Australia.

Kent R. Roberts, to president, Roberts Resources, Wichita, Kan. Previously geologist/lease operations manager, Hummon Corp., Wichita.

James D. Robertson has been awarded a Distinguished Alumni Award by the Department of Geology and Geophysics, University of Wisconsin-Madison, Wis. Robertson, a retired vice president of Arco International, is now with BP Amoco, Fort Worth.

Steven J. Seni, to assistant director, environmental services, Railroad Commission of Texas, Austin, Texas. Previously deputy assistant director, hydrocarbon storage and brine mining, Railroad Commission of Texas, Austin.

Mark Sonnenfeld, to technical advisor-geoscience, iReservoir.com, Greenwood Village, Colo. Previously senior geologist, Marathon Oil, Petroleum Technology Center, Littleton, Colo.

Barry M. Stevens, to geologist, Anadarko Petroleum, Houston. Previously geologist-project manager, The Carel Corporation, Keller, Texas.

Rex D. Stout, to senior geologist, exploitation division, EOG Resources, Oklahoma City. Previously senior geologist, Marathon Oil, Oklahoma City.

John Troschinetz, to project geologist, EOG Resources, Midland, Texas. Previously senior staff geologist, Arco Permian, Midland.

Steve Uchytil, to geological specialist, offshore-deepwater, EOG Resources, Houston. Previously senior principal geologist, Vastar Resources, Houston.

Paul B. Welch, to senior geologist, J-W Operating, Dallas. Previously exploration manager, CXY Energy, Dallas.

Doug Wilson, to senior staff geologist, deepwater Gulf of Mexico, Anadarko Petroleum, Houston. Previously senior principal geologist, Vastar Resources, Houston.

Andrew Zolnai, to petroleum industry manager, ESRI, Redlands, Calif. Previously senior consultant, Landmark EAM, Weybridge, UK.

(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, rockwell@aapg.org; or submit directly from the AAPG Web site, www.aapg.org/explorer/pnb_forms.html)

Commentary: The Global Climate Change Debate

What Is It That We Can Control?

(Author's note: The writer has no vested economic interest in the eventual outcome of the global climate debate, but requires that all data and theory be carefully considered before the debate is considered resolved.

The debate can be likened to a complex forest ecosystem. Identifying a few trees cannot characterize the forest.)

(Published here is a portion of an article titled "Moderating the Climate Debate," prepared by Lee C. Gerhard of the Kansas Geological Survey. The complete text, including references, can be found on the AAPG Web site at www.aapg.org.)

By LEE C. GERHARD

One of the more enduring joint scientific and political debates in recent times has been between those who believe that human influences on climate are warming the earth – with consequences that may be detrimental to humankind – and those who believe that earth dynamic systems are too large to be significantly influenced by human activities.

Unfortunately, the debate was initiated by political action before scientific research had formulated, constrained and data-backed the concept.

The present U.S. debate was initiated in 1988 from testimony of one scientist before the U.S. Congress, who argued that human activity was changing climate. International political action resulted in the Kyoto protocol, signed by the executive branch over the objections of the U.S. Senate, which holds absolute authority to ratify international treaties.

Many sincere scientists and non-governmental environmental groups have participated in the debate. All have good intentions.

The problem remains the lack of science to substantiate either side of the debate.

Science must progress unhampered by politics if it is to be effective in helping shape public policy.

Basis of the Scientific Debate

The coincidence of two events is the basis for the argument that human greenhouse emissions are driving the climate.

❒ Carbon dioxide levels in the atmosphere have been rising since the end of the Little Ice Age (circa 1850). Best estimates of initial concentration are about 280 PPM (parts per million). Current Mauna Loa measurements are about 356 PPM.

❒ Since the late 1800s the global temperature is estimated to have risen, perhaps 0.6 degree Celsius.

Several computer models project that earth temperatures will rise anywhere from 2 to 6 degrees Celsius over the next 100 years as a consequence of these emissions.

Laws of physics require that increases of greenhouse gas in the atmosphere increase temperature. The same laws require that if greenhouse gases are driving climate, the effect must be seen first in the upper atmosphere.

Satellite data, now vetted, do not show that effect. Therefore, on that basis, any current climate change cannot be attributed dominantly to greenhouse gas increases.

Recent research has demonstrated that historically there is up to a 400-year lag between temperature changes and consequent carbon dioxide concentration changes. That hypothesis requires climate drivers other than carbon dioxide.

* * *

The single most important basis for imputing human impact on climate is computer modeling.

Current general circulation models remain primitive compared to the complexities of real climate control. They are as yet unable to simultaneously back model 1,500 years, encompass modern measurements and project the same

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temperature predictions. Computer models result in hypotheses, not information.

Placed in a petroleum context, if computer models were real information we would never again drill a dry development well.

* * *

The general consensus of those who do not subscribe to human control of Earth's climate is that the changes are natural variations in climate, well within range of recorded geological history.

Although artificial increases in greenhouse gas concentrations will have some effect on climate, they argue that:

✓ Such increases will be overwhelmed by natural variations.

✓ Human effects, therefore, are masked and not measurable.

✓ Solar and orbital controls on climate are the most likely large-scale natural climate controls.

* * *

Climate change tends toward regional change – not global.

There are disconnects between north and south and between regions. Many of these are oceanographic disconnects. At any time in history, some regions warm, others cool and others may see little change. We do not yet understand why.

Geological, archeological and human historical records demonstrate that climate is naturally unstable and constantly changing. Climate science has not progressed far enough to predict those natural changes, either in direction or magnitude ... Natural climate change demonstrated in geological and archeological records has been much greater than any reasonable forecast of human-induced change.

Whatever the human component of climate change may be, it is likely dwarfed by the amplitude of natural change.

Whatever the human component of climate change may be, it is likely dwarfed by the amplitude of natural change.

Much study and research is needed before this debate is settled.

The Political Science Debate

Against this backdrop of incomplete science are several major issues that dominate the public debate about climate change.

Since the public debate was initiated in a political setting, we must deal with public perception. In politics, perceptions are reality.

Public perception of the importance of humanity in earth processes has changed in recent decades, moving from a Ptolomeic geocentric universe (the sun orbits around the earth), to the science-based heliocentric universe (the earth orbits around the sun) to today's "humanocentric universe," in which the universe revolves around humankind.

Belief systems drive opinion on science issues, and because this current climate paradigm is based on a belief system, it has ignored data that conflicts with belief and promulgates information sets and models that sustain the belief.

For example, recent reports illustrate anthropogenic warming of the global climate with a graph showing that global temperature is rapidly rising – but the same report that provided that graph (Goddard Institute for Space Studies, 1999) also provided a climate chart showing that the United States today is cooler than it was in the 1930s.

The first is cited as evidence of global warming. When both are viewed together, however, several other probable interpretations emerge:

❒ Because the data clearly show that the United States is cooler today than it was during the 1930s, one conclusion is that a "heat island effect" is shown in the global data – knowing that the United States, unlike much of the rest of the world, has placed its thermometers to minimize the heat island effect of cities.

❒ Another interpretation might be that there is no global climate – each continent and ocean has its own climate, and some are warming while others are cooling.

* * *

Selective use of data is also an issue.

The draft IPCC (Intergovernmental Panel on Climate Change) report uses Mann et al's (1999) tree ring temperature analysis for the last 1,000 years. The draft report, normally not quotable prior to an official release, was released near the end of the last U.S. national election.

The Mann et al result is the well-known "hockey stick" diagram that shows slight cooling for most of the last thousand years with an abrupt and large warming only since about 1930.

The IPCC report uses the Mann et al paper to explain that the Medieval Climate Optimum (a multi-century rapid warming event) never existed, despite overwhelming, well-documented evidence that it did.

To take the IPCC position is to ignore the Viking agricultural settlements on Greenland, restriction of alpine glaciers, advent of wineries in England and distribution of Native American cultures, among many other well-documented events.

* * *

On the other side of the debate, some still insist that the earth temperature is stable and has not been rising. The crux of their debate lies in an assumption that temperature data is biased by proximity to heat islands and inaccurate measurements.

Other arguments raised by contrarians are mostly about relative benefits of climate warming and the inability of proposed policies (Kyoto) to mitigate any human induced change.

In reviewing scientific arguments, an explanation that best fits *all* the evidence is the most likely. An explanation that accounts for only part of the evidence is likely to be fallacious.

Economic Policy

The reason for the climate issue may be simply economic; the nations most favoring a carbon tax to reduce use of fossil fuels are the oil importing countries, and the climate issue may be useful for reducing imports that are economically damaging, and for raising revenue.

In 1980 the United States had a $400 billion net positive foreign investment

See **Global Warming**, next page

Global Warming

from previous page

position. By 1997 the United States was in a negative $1.3 trillion position. That change results in foreign ownership of U.S. assets and means of production.

Recent buyouts of U.S. corporations by foreign investors illustrate the issue:

✓ Daimler Benz bought Chrysler.

✓ British Petroleum bought Amoco and Arco.

✓ The concrete industry is dominated by foreign enterprises.

✓ The pharmaceutical industry is heavily internationalized.

✓ Non-U.S. investors now own much U.S. farmland.

The list continues to grow. The United States is being bought with its own money, the result of profligate spending for imports – a significant portion of which is imported oil and the cars to burn it.

According to U.S. Energy Information Administration figures, a carbon tax of about $348 (US) per ton of carbon would be necessary to increase the price of oil and other fossil energy sufficiently to reduce demand and thus carbon emissions. This translates to an annual tax of about $325 million (US) on oil alone – about $42 new tax per barrel – on oil that now sells at the relatively high price of $33 per barrel. Oil would then cost the consumer $75 per barrel.

Coupled with taxes on natural gas and coal, the new federal tax revenues would be about $750 million per year. Nearly all countries favoring the Kyoto Protocol plan increased energy taxes to enforce the agreement.

The climate debate, then, becomes an economic debate of governmental revenues versus consumer expense.

Some of the intended consequences of forced climate change mitigation – raising revenues and decreasing the nation's reliance on imported energy – may have little to do with any environmental issue or climate change. European governments push the United States to reduce energy consumption not for environmental reasons, but for competitive economic advantage.

Unintended Consequences

Many public policies and laws have unintended consequences, and despite the best efforts of legislators, unintended consequences frequently make problem solutions into new problems.

The unintended consequence of the human-induced climate change theory is to make people believe that humans can control climate. By raising false hope, the result is that people will believe that changing energy use habits can ameliorate the rising sea level and a future cold period.

* * *

There is a bright side to the debate: It has brought increased research in climate science, computer modeling and geologic analysis of past climates.

Today's published science:

✓ Contains better data.

✓ Avoids, for the most part, taking sides in the debate.

✓ Sheds much light on climate stability and drivers.

The laws of physics must drive the debate, linked to observations, measurements and better analysis of apparently conflicting data.

What is the Petroleum Industry To Do?

The petroleum industry should view this issue in terms of each company's national interest, linked to new scientific knowledge.

Since the European community is leading efforts to control carbon dioxide emissions, companies headquartered in Europe should acknowledge their political realities: Indeed, both BP (Great Britain) and Shell (Netherlands) have elected to support their countries' positions on the issue through corporate policy.

U.S. companies have been less enthusiastic about accepting anthropogenic climate change. The U.S. position, clearly spelled out in the Senate's 95-0 vote in favor of a resolution against supporting the Kyoto Treaty, is that efforts to control carbon dioxide emissions by taxation of fossil fuels are not acceptable.

There is little incentive, therefore, to embrace expenditures that do not reflect the direction of federal policy – political realities will drive corporate actions.

On the other hand, the U.S. government is clearly encouraging the substitution of natural gas for liquid petroleum where possible. While natural gas is emission-benign compared to other fuels, remember that the United States has a larger potential natural gas supply than much of the rest of the world, and exploitation of that resource for transportation fuel could significantly reduce our dependence on imported oil.

The domestic industry should recognize U.S. political realities … The petroleum industry must address real energy needs and concerns, and work to develop a national energy supply policy.

Summary

❒ Belief systems are appropriate to politics; they are less so to science in the public interest. The agenda of science should be to seek the truth.

❒ The common belief system argues that the world is unchanging – but climate changes all the time, in both directions and at many scales. There is no flat line in climate.

❒ One of our biggest jobs is to separate natural change from human change. To believe that humans control climate is to make people believe that humans can prevent sea level from rising, and climate from changing.

❒ If economics and revenues drive the climate debate, it should be acknowledged. If not, then a much better scientific case must be made for significant anthropogenic climate modification.

Collapse of the recent climate treaty

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READER'S FORUM

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

Big Oversight

In reporting the "notable" discoveries of last year ("The Headline Discoveries of 2000," January EXPLORER), I find it most inexplicable that you missed the most significant of all: the Kashagan oil discovery off the Kazakh coast in Northern Caspian Sea.

Although reserves estimates are rather speculative (a second well is currently drilling, but seismic is pretty indicative), the Kashagan Field, with its oil-in-place pegged at eight-50 billion barrels, is certainly a major find. It may prove to be one of the supergiants of all times, dwarfing even the nearby Tengiz Field.

The discovery, announced by Offshore Kazakhstan International Operating Co. (OKIOC) last July, is changing the Caspian oil scene, politics and all, in a dramatic way.

Ferruh Demirmen
Katy, Texas

A Little Reminder

As an independent consultant, I have seen an increase in drilling activity by the small independent operators. Many of these folks don't have the workstations and data bases that the majors have, but they do have a feel for the areas that they work in and who to call on for help.

One of the problems that I see is that the larger companies have forgotten that basic geological principles and exploration/production methods apply no matter where in the world you are exploring or producing. The Gulf of Mexico deep water, South China Sea, North Sea or West Texas all have things in common, and an experienced explorer can move from one area to another quickly and productively.

Perhaps the HR folks need to be informed of this by the exploration managers before they write the job descriptions that we see on the Web and in the papers.

John Watkins
Seguin, Texas

Looking Ahead

Regarding "Predictions for 2010" (January EXPLORER): Very, very interesting. If the predictions come even partially true, many "business as usual" operations will change within a decade.

I look forward to some of the changes, especially the less polluting and more affordable energy regime. Fuel cells can be part of the solution.

Shubhankar Dutta
Ahmadi, Kuwait

Pros ...

(Regarding the Geophysical Corner, January EXPLORER): I found this article of great value, since it is a perfect example of the importance of having a good structural model to complement the seismic (or vice versa) to honor all available data. Any interpreter involved in tectonically complex areas should take notice that seismic alone can mislead his/her work.

Very recently I've worked in a Venezuelan block where I found the exact same situation that was described in Mr. Wellborn's article. Three-D seismic reflectors clearly continued updip from the wells that drilled through highly dipping and overturned beds, and we were very close to interpreting updip locations for new development wells without great care of the structural data provided by those wells.

Some of the article's figures could be perfectly used to illustrate my report on that block – I would only need to flip them around!

Marcelo F. Santiago
Buenos Aires, Argentina

... And Cons

Regarding the Geophysical Corner (January EXPLORER): I am not happy at all with this article, which gives the impression 3-D seismic can fail in describing complex structure.

Of course, if you don't apply a proper acquisition design (shot outside the structure to illuminate the steep dips – the cube into consideration is quite small) and the proper processing flow (prestack migration with an accurate model driven by the integration of well data, and multiple attenuation) you get a wrong image. But this is not due to the limitation of 3-D seismic by itself.

This is why again I find this article – and the title, particularly – misleading. It should be "finding the limit of low cost 3-D surveys."

Denis Mougenot
Massy, France

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implementation talks in Europe creates an opportunity for enhancing climate science and rigorous testing of hypotheses about climate change before embarking on additional efforts to manipulate earth dynamic systems.

Victor J. Yannacone once argued that scientists have a non-delegable duty to use their special skills and special knowledge for the good of humanity. The scientific method demands no less.

Are we meeting the ethical standards society has a right to expect of us? ❑

CLASSIFIEDADS

POSITION AVAILABLE

Post-Doctoral Researcher
Petroleum Systems Modeling
University of Colorado-Boulder

The Energy and Minerals Applied Research Center at the University of Colorado-Boulder is seeking candidates to fill a post-doc research position in petroleum systems modeling. The position will be for two years, beginning in early 2001. The job will be working on the deep Gulf of Mexico, specifically on the modeling of petroleum systems associated with deforming allochthonous salt and related fault systems, and a deep-water foldbelt in the Mississippi Canyon and Atwater Valley protraction areas. Researcher will be working in a large team-oriented research program that is funded by a large industrial research consortium. Petroleum systems modeling research will be integrated with sequence stratigraphic, biostratigraphic, and structural studies. Data sets include 2-D and 3-D seismic, and state-of-the-art modeling software. Candidate must have a strong background in modern concepts in petroleum systems modeling, source rock maturation, 2-D and 3-D multiphase fluid flow, and the development of overpressure. Specific experience in the Gulf of Mexico is not a pre-requisite. Salary will be commensurate with experience. Interested candidates should send vitae, plus three names of references to Paul Weimer at: Department of Geological Sciences, University of Colorado, Boulder, CO 80309-0399 or paul@emarc.colorado.edu.

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Indiana University
Geological Sciences

Assistant or Associate Professor in Sedimentology/Stratigraphy. The Department of Geological Sciences at Indiana University, Bloomington invites applications for a tenure-track position at the assistant- or associate-professor level, or a tenured position at the associate-professor level in the general area of sedimentology/stratigraphy. Candidates applying at the assistant-professor level should have post-doctoral experience.

Applications should include a personal statement of teaching and research interests, a detailed curriculum vitae, and names and addresses (including e-mail) of five referees. Appointment could begin as early as August, 2001. Applications should be submitted by March 1, 2001 to Chair, Sed/Strat Search Committee, Department of Geological Sciences, Indiana University, 1001 E. 10th Street, Bloomington, IN 47405. Information about the Indiana University Department of Geological Sciences can be found at: http://www.indiana.edu/~geosci.

Indiana University, as an Equal Opportunity/Affirmative Action Employer, encourages the candidacies of women and minorities.

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Tulane University, Department of Geology
W.K. McWilliams Jr. Graduate Fellowships

The Department of Geology at Tulane University invites applications for three Ph.D. Fellowships ($18K/yr) to be awarded in honor of W.K. McWilliams Jr., a founding partner of McMoRan Oil Co. Successful applicants will receive tuition waivers and be expected to teach one laboratory course a year. Tulane faculty members are working on sedimentary and environmental problems of the Gulf Coast, faulting processes, Mexican volcanoes, and Precambrian and Paleozoic paleontology. Applicants should consult the department's Web site (http://tulane.edu/~geology) and the Institute for Earth and Ecosystem Sciences Web site (http://tulane.edu/~iees) for more information. Requests for application materials to Dr. George C. Flowers (flowers@tulane.edu), Chair, Department of Geology, Tulane University, New Orleans, Louisiana 70118.

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PRESIDENT OF GSA FOUNDATION

The Foundation of the Geological Society of America seeks a geoscientist, preferably with national recognition for achievements in the geosciences and administration, to be its President. The individual should have a strong interest and experience in, or working knowledge of, fund raising and development. Primary responsibilities will include oversight and direct participation in fundraising for GSA programs and activities; identifying, cultivating and soliciting major donor prospects including individuals, corporations, and foundations; stewardship of funds; and staff

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administration. This person will be expected to have a major role in designing and implementing a strategic fundraising and development plan for the Foundation, and to closely and regularly interact with the Chief Executive Officer of the Geological Society of America and members of its staff, the GSA Foundation Board of Trustees, and the GSA Council. The President will report to the GSA Foundation Board of Trustees and be assisted in the Foundation by a full-time Director of Operations and a Data Manager.

The position could range from three-quarter to full-time, with the bulk of the activities to be conducted from the Society's headquarters in Boulder, Colorado, although full-time relocation to the Boulder area may not be required. A range of compensation options exists, depending on experience and qualifications of the candidate, and the length of the appointment. Interested persons should send a letter of application, resume/vita, and the names, addresses and telephone numbers of three references to GSA Foundation Board of Trustees Search Committee, c/o Donna Russell, GSA Foundation, P.O. Box 9140, Boulder, CO 80301-9140. Nominations of potential candidates by members of the geoscience community also are encouraged. Effective closing date for the applications is March 15, 2001, with a target starting date of July 1, 2001. The GSA Foundation is a non-profit corporation and an Equal Opportunity, Affirmative Action Employer.

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VP - Exploration

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AAPG Education Offerings May 2001

Reservoir Characterization: Principle Methods & Case Studies

Instructors: Jeffrey M. Yarus, Dennis R. Prezbindowski

Emphasis is placed on quantifying the geologic heterogeneity of rock units using seismic stratigraphic principles and developing predictive models based on mathematical and stochastic theory such as geostatistics. These data can be collected at widely varying scales utilizing a variety of subsurface and outcrop methods.

May 7-8

See Education Calendar page 1 for details.

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

Instructors: C. Robertson Handford, Jeffrey A. May

The key objectives of this course are to develop the techniques and skills to subdivide, correlate, and map stratigraphic units (reservoirs, seals, and source rocks) with well logs through the use of sequence stratigraphic concepts in a variety of nonmarine, shallow marine, and deep marine environments in siliciclastic and carbonate settings.

May 14-18

See Education Calendar page 2 for details.

Wave-Dominated Shoreline Deposits, Book Cliffs, Utah: Depositional Models for Hydrocarbon Exploration

Field Seminar Leader: John K. Balsley

Locale is in the Classic Book Cliffs. Outcrop-core-log comparisons are used to make the transition from outcrop to subsurface. Depositional systems directly related with the wave-dominated shoreline deposits are examined

May 14-22; August 20-28

See Education Calendar page 8 for details.

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Program Director, Energy Research

Bureau of Economic Geology
The University of Texas at Austin

The Bureau of Economic Geology, a major research unit of The University of Texas at Austin, is seeking a Program Director to oversee and coordinate research projects in energy, including reservoir characterization, basin analysis, and related disciplines. Energy research at the Bureau ranges from basic to applied, spans the globe, and is funded by a mix of Federal, State, and private sector sponsors.

The successful applicant will provide direction and oversight of the energy research program and be responsible for coordinating the successful design, planning, budgeting, and completion of research projects. Encouraging the application of new technologies, formation of collaborative research teams, and publication of research results are high priorities. He or she will be actively involved in program development, will collaborate closely with the other Associate Directors, and will report to the Director of the Bureau. Applicants should have a degree in geology or a related discipline, a minimum of 10 years of relevant industry, research, or academic experience in energy studies, and a record of successful leadership. An advanced degree and a record of scientific publication are highly desirable.

Interested parties should apply electronically (http://www.utexas.edu/employment/ UT Job Vacancies; posting No. 01-01-03-04-0381). Letters of interest with a Curriculum Vitae should be sent to Ms. Jenny Turner, Bureau of Economic Geology, The University of Texas at Austin, University Station, Box X, Austin, TX 78713-8924.

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Energy

It is at the heart of our work, not only the energy we provide to the entire world, but also the energy which drives our people. The following represents our needs in Saudi Arabia:

Basin Modeler (F05-108953)

You will work within multi-disciplinary teams to provide basin modeling support for active short and long term exploration programs. You will be expected to take a leadership role in defining approaches to solving applied problems and to lead longer-term technology programs in basin modeling. Additionally, you will use your basin modeling tools and expertise to model hydrocarbon generation and entrapment in single and multi-dimensional domains and to integrate tectonics, sedimentology, sequence stratigraphy and seismic data into the regional basin model. Will also be required to interpret organic petrography, source rock; biomarkers and fission track data; evaluate the regional prospectivity and risk potential of a basin; and have good geologic mapping skills.

Requires broad experience in 1D, 2D and 3D basin modeling on Sun workstations with Zmap or CPS-3 geologic mapping skills. Must have experience in integrating structural geology, sedimentology, palynology and sequence stratigraphy. MSc/PhD degree is preferred with 15+ years of industry experience, most of which must have been spent on basin modeling related problems.

For a detailed description for the above position, please refer to our website www.jobsataramco.com. For consideration, please send a resume to **Aramco Services Company, reference code 06E-AAPG, in one of the following ways: E-mail: resumes@aramco.com (please cut and paste rather than send an attachment); Fax: (713) 432-4600; Mail P.O. Box 4530, Houston, TX 77210-4530.**

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EMD

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When corrected by differential GPS techniques, the technique is accurate to better than one meter.

Since even one meter accuracy is better than that for U.S. Geological Survey 7-1/2' quadrangles, data points are measured with more accuracy than they can be plotted on many base maps. As a result, it has become routine to locate field data in a way that makes computer display easy.

Data Sources

Historical well data, land grid, seismic data and potential field data have been available in computer usable formats for many years. But frequently our data is out of date or incomplete, and we often wish to supplement existing data with novel new kinds.

Remote sensing can provide much of the data that we need in a georeferenced, computer readable format.

When we want to go to the field, remotely sensed data helps us to use our time efficiently and provides information on the places that we didn't personally visit.

LANDSAT images have often been used in regional studies since the data first became available in the 1970s. But, a lot of new things are happening in remote sensing, including:

❒ NASA's new LANDSAT-7 satellite provides somewhat higher resolution (15m) panchromatic ("black and white") images as well as an improved Enhanced Thematic Mapper Plus (ETM+) spectral sensor.

Good news for users is that the price of ETM+ data to the general public is $600 per scene.

A number of new mapping sensors are currently operating on NASA's Terra and EO-1 research satellites, and others are scheduled for launch in 2001.

❒ Although more suitable for economic intelligence (do you want to count the stands of pipe on your competitor's drill rig?) than for regional mapping, very high-resolution panchromatic data (best case resolution better than one meter) will be available from at least four domestic and international commercial suppliers in the near future.

❒ Radar satellites provide us with a new way to see the Earth.

The Canadian RadarSat system was the first commercial system able to pierce the clouds and image the surface beneath. NASA and the National Imagery and Mapping Agency (NIMA) carried out a radically different radar mission last February. The Shuttle Radar Topography Mission (SRTM) used interferometric radar to generate topographic coverage for about 80 percent of the world's land surface.

When processing of this digital elevation model (DEM) is complete in about two years, it will be first-ever global coverage on a single datum. The U.S. government has promised to release to the general public a worldwide set of the DEM, at 90-meter posting, priced at the cost of reproduction.

❒ Hyperspectral imagers, now on aircraft and soon on satellites, collect detailed visible and infrared reflection spectra of the surface. This data can be used to map features such as lithology, oil seeps and spills, spatial variation in clay mineral types, plant types or environmental stress in vegetation, and in a host of other applications. Another novel sensor type, airborne LIDAR is being used to collect topographic maps on the forest floor as well as on top of forest canopies.

A number of novel new satellite systems will be available in the next few years. Beyond new mapping instruments from NASA, they include:

✓ Commercial decision support satellites, able to monitor the whole world every few minutes at a resolution of 0.5 km.

✓ LANDSAT-like systems able to image the world once a week (clouds permitting).

✓ Higher resolution radar satellites.

NASA hopes that its next generation radar satellite will measure strain accumulations on active faults and volcanoes or subsidence due to fluid withdrawal.

In addition, both commercial satellite operators and existing mapping companies are developing value-added information products that will be more directly usable than satellite images.

All this means that revolutionary new ways of making maps are available to us. The defense community has recognized this revolution, and termed the new way *Geospatial Information.*

The good news is that these capabilities are available. The bad news is that the profession must learn to use them – remote sensing specialists are mostly gone, even from the major oil companies, in the name of outsourcing.

This, of course, shifts the need to understand and apply geospatial innovation to the non-specialist professionals. Vendors look to customers to identify product requirements. If we don't understand the technologies, we can neither be wise buyers nor able to direct technological evolutions.

The Energy Minerals Division has long had a committee on remote sensing. At last November's EMD leadership meeting in Dallas, a decision was reached to rename and redirect this committee. The new Geospatial Information committee has been warmly received within EMD, and we look forward to creating an active program of real value to all AAPG members.

Whether you want to join the revolution or just to learn more, please contact us.

(Editor's note: Kolvoord is chairperson of EMD's Geospatial Information Committee.)

DIRECTOR'S CORNER

Digital BULLETIN Now An Option

On this year's dues statement you can choose the option to receive the current BULLETIN in digital form only.

By RICK FRITZ

As I travel around the country meeting members, there are several questions I am often asked:

How is membership?

Are we doing OK financially?

What can AAPG do for me?

Where did you get that tie?

Seriously, one of the most often asked questions is "I have all of this paper in my library, when is AAPG going to offer a 'digital option,' i.e. when can I get a CD instead of hardcopy?

This is often followed by "When can I get the archives?"

I now have a complete answer to that question, but first let me tell you a story.

* * *

Demand for AAPG products and services have significantly increased over the last decade, and staff and volunteers have been working hard to meet these demands. Because the cost of basic services continues to increase, the Executive Committee – at the recommendation of the Budget Committee and headquarters – has decided to increase dues from $62 to $72 per year, effective next year. This puts AAPG dues in line with its sister societies such as SEG and SPE.

The good news is that on this year's dues statement you can choose the option to receive the current BULLETIN in digital form only.

If you choose this option you will be able to access the current year's BULLETIN via a special enhanced Web site on the Internet, and we will send you two CD-ROMs, each with six months of the BULLETIN for your permanent library.

Please note that if you choose this option, you will no longer receive a hardcopy of the BULLETIN.

The BULLETIN archives will still be available for $99 next year; however, the Executive Committee has decided that in 2002 we will start providing portions of the digital archives of the BULLETIN to members with their dues.

Other data and subscription options will be offered over the next few years as we are able to measure and satisfy demands.

It is important to note that archives will be for personal use only, and not for corporate use. AAPG will continue providing corporate subscriptions adding new libraries and especially new derived products. Many of these derived products will be in GIS format and will be particularly useful for accessing various types of data.

So that's my story, and I'm sticking to it. We look forward to providing quality products and services to all of our members.

Rick

Technology Affects Core Competencies

It's A New World for Mapping

By ROGER W. KOLVOORD

Map making is a core competency of earth scientists. We make maps to display our data, to analyze it and draw conclusions, and to communicate.

It is a fundamental skill that we learn as students and refine as we follow our professions.

Today, mapping is a dynamic and rapidly changing arena due to a confluence of changes in computer mapping, Global Positioning Systems (GPS) and remote sensing technologies.

It's not news that computers are useful in making maps. Our industry was, for 30 years or more, a leader in developing this technology.

But the effect of the synergies between these three areas may not be obvious.

Computer Mapping

As students, we all learn to select the material displayed on our maps based on the work we want to do or the ideas we want to communicate. Computer cartography is to map making just as word processing software is to writing: The computer allows easy, rapid creation of the map and facilitates selection of themes for display.

Thus, we can work with more data – and more types of data – more easily and efficiently.

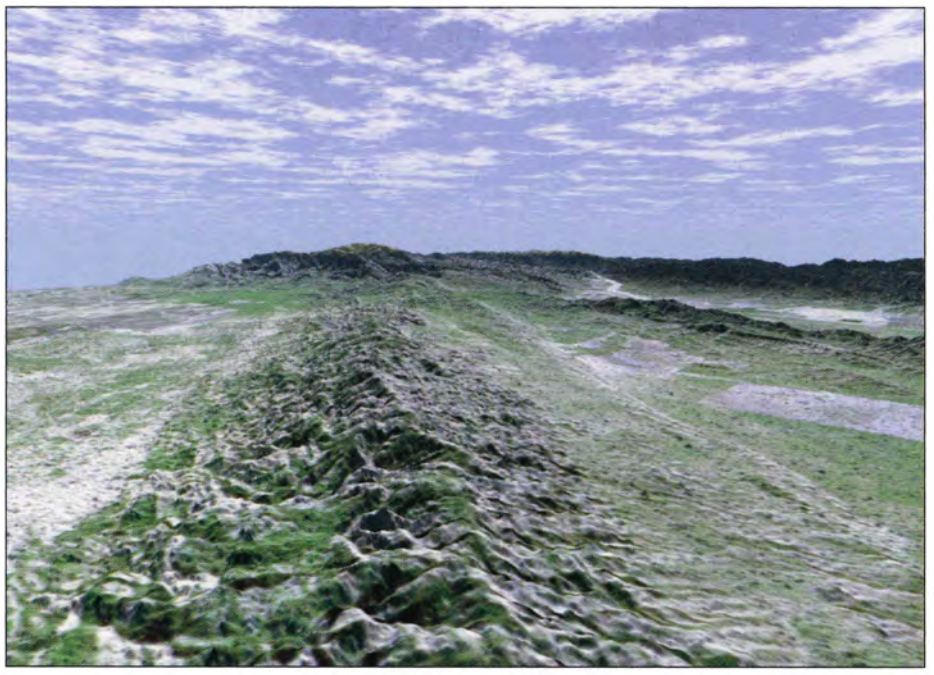
Twenty years ago we complained bitterly about maps at different scales or in different map projections; today, a selection on a menu fixes the problem.

Once, incompatible data formats made major problems; today, solutions to these problems are expected from our software. And standards organizations, such as the Open GIS Consortium, promise to further ease the problem in the future.

Moreover, our mapping software is more than just a fast and clever draftsperson. By simplifying operations like selecting, validating, manipulating and analyzing data, it allows us to *create* information.

Most of all, the computer allows us to visualize 3-D and 4-D information in ways that have never before been possible.

Geographic Information Systems (GIS) provide map-oriented access to database management systems. This combination gives powerful ways to access information about geographic features and provides tools to answer complex questions about spatial relationships.



Views from above, as shown in these two examples, are helping to improve the quality and accuracy of map making. Top photo, a perspective view of a portion of the San Andreas fault near Bakersfield, Calif., using data from last year's Shuttle Radar Topography Mission and an enhanced, true-color Landsat satellite image. Below, a Landsat-7 image of Denver; check out the upper right quadrant of the image (with old Stapleton airport runways and the new Denver International Airport in the corners) to see an oil and gas field, complete with well pads.

Graphics courtesy of NASA and U.S. Geological Survey

Very often the GIS package is customized to create a specialized E&P working environment that often integrates specialized capabilities, such as seismic interpretation, subsurface mapping, log analysis, reservoir modeling, structural interpretation, basin analysis or others into a mapping environment. This integration makes it possible to map many new spatial relationships.

Ultimately, all these capabilities hang from a single peg: that different datasets correctly overlay one another. This requires that all data be accurately georeferenced to a common coordinate system. When your potential area of interest includes the whole Earth, the most robust coordinate system is latitude and longitude.

Which brings us to …

Global Positioning Systems

Prior to the introduction of GPS units, going to a point on the ground and measuring the latitude and longitude was a pretty uncommon event for most geologists.

Today, field portable, battery-operated GPS units can rapidly determine the location of a point anywhere in the world by latitude, longitude and elevation to an accuracy of 100 meters or better. The method is based on determination of the precise arrival time of radio signals from four or more U.S. Department of Defense satellites.

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