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Volume 47 Number 3

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The Bulletin Houston Geological Society

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about the cover: Green sand beach at Mahana Bay, Hawai'i (Big Island), located near South Point, is an olivine sand that originated from olivine rich basalt. *Photo by Laura Reich*

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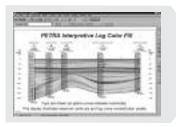
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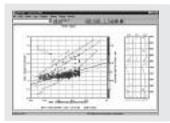


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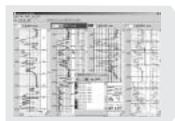
CONTOUR MAP



BUBBLE MAP



LOG CROSS PLOT



RASTER LOG

CROSS SECTIONS

Structure and Stratigraphic
Digital and Raster Logs
Deviated Wells
Interactive Formation Correlation
Log Curve Editing
Depth Shifting
Interpretive Overlays

MAPPING

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Contour Editing
Commercial Land Grids
Geo Referenced Images
Import Digitized Contours
Log Curve Maps
Grid Operations - Volumetrics

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Decline Curves
Cums (first, last, avg.)
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A Half-Empty Bottle of Wildcatter Whiskey

Spending \$1 million...

McCarthy invited

175 directors, journalists

and film stars to

the gala event.

or years I have been intrigued by a dust-covered bottle of $oldsymbol{\Gamma}$ Wildcatter whiskey remaining in my father's liquor cabinet. The half-empty bottle of whiskey has been in my father's possession since he received it as gift in 1967. That bottle is a relic of bygone oil wildcatter days and remains a "spirit" of the times. Oilman Glenn H. McCarthy was once dubbed the "King of the Wildcatters" and "Diamond Glenn" and was featured on the

cover of TIME magazine in 1950. He began distributing Wildcatter in 1963, "If it doesn't sell we will drink the inventory" he said.

McCarthy was born on Christmas day in 1907 in Beaumont, Texas, just a few miles from the newly discovered Spindletop field. McCarthy's father was a driller at Spindletop, a burly man of Irish descent. In his younger days he had

been a sparring partner for "Fighting" Bob Fitzsimmons, the World Heavyweight Boxing Champion in 1897. Son Glenn, equally tough and a fine athlete, became a highly recruited football player and briefly attended Texas A&M College on a scholarship before being kicked out for hazing. He transferred to the Rice Institute but eventually dropped out because of football injuries and a desire to go into business for himself.

He soon opened a dry-cleaner and two gas stations. He fell in love with a beautiful customer in a convertible Cadillac by the name of Faustine Lee, daughter of Thomas Lee of the Yount-Lee Oil Company. She and McCarthy eloped and afterward he vowed to make his own wealth without her father's assistance. Despite failing in his first well in Hardin County in 1931, his second well discovered an extension to the Conroe Field which he soon sold for \$50,000. He parlayed this money into leases dropped by Humble and drilled a risky extension to the Anahuac Field in Chambers County. The White #1 had an initial production rate of 588 barrels of oil a day and extended the field 3 miles to the north. Leasing drove prices as high as \$1,000 an acre, but the wells were cheap. The cost of drilling and completing a well to the Frio at 7,100 feet was \$23,000. Wells were drilled in 21 days on this deep-seated salt dome. By the end of 1935, annual production for the field was up to 342,239 barrels and McCarthy sold out to Humble Oil for \$700,000. McCarthy maintained an astonishing success rate of 38 oil strikes before 1942, including sizable discoveries of 11 fields including Chocolate Bayou, Coleto

> Creek, Blue Lake, Winnie-Stovall, Bailey's Prairie, Fannett, Anchor-Angleton, Stowell, and North Stowell. By 1949, he had amassed oil reserves of 150 million barrels. and compiled a net worth of \$212 million.

> With his oil riches, McCarthy purchased such as the 4000-acre Westmoreland Farm at present-day

Sharpstown, acreage on the site where

the Astrodome and Reliant stadium stand today, a 22-story downtown Shell building, KXYZ radio, and the Houston Post, and was chairman of Eastern Airlines. On 25 acres near the Medical Center, he built the magnificent 1100-room Shamrock Hotel, complete with the world's largest hotel swimming poollarge enough for an exhibition with a 14-foot ski boat pulling skiers. It cost \$21 million and took 3 years to build. He opened the Shamrock with a gigantic party on St. Patrick's Day, 1949. The opening coincided with the opening of McCarthy's newly produced film "The Green Promise" starring Walter Brennan and the then 10-year-old Natalie Wood. McCarthy rented 16 Pullman cars and brought a contingent of Hollywood film stars that Houston had never witnessed. Spending \$1 million, he invited 175 directors, journalists and film stars to the gala event. Attendees included Dorothy Lamour, Maureen O'Hara, Ginger Rogers, Andy Devine, Robert Stack, Gene Autry and Lana Turner. The Emerald Room nightclub within the hotel regularly hosted entertainers such as Frank Sinatra, Liberace, Dinah Shore, and the Marx Brothers throughout the early 1950s.

President's Letter continued on page 7

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The Shamrock Hotel was sold to the Hilton chain in 1955 after McCarthy defaulted on a loan. It remained a Houston landmark despite falling occupancy until it was destroyed by the wrecking ball in 1987, which he regrettably was alive to witness. Glenn McCarthy passed away in 1988 in a modest home in La Porte.

Popular only in Houston and unsold elsewhere, Wildcatter bourbon whiskey was discontinued in the early 1970s. Perhaps it's time that I sample a bit of that whiskey and raise my glass to a true Texas wildcatter.

HGS News

I could not be more amazed at what achievements many of our HGS volunteers are able to attain ... recent events such as the fine APPEX continuing education class, smooth-running HGS golf tournament, well-constructed HGS booth for the Houston Gem and Mineral Show, enjoyable HGA event at Magic Island, and another great Shrimp Peel at Sam Houston Race Track. Not to mention all of the exceptional technical talks along with a superb Bulletin and website. Thank you, volunteers for bringing such quality events to members and guests of the HGS.

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lob Seekers:

During the past year, the HGS Jobs Hotline website has averaged over 30 positions per month. New ads are being posted almost every day!

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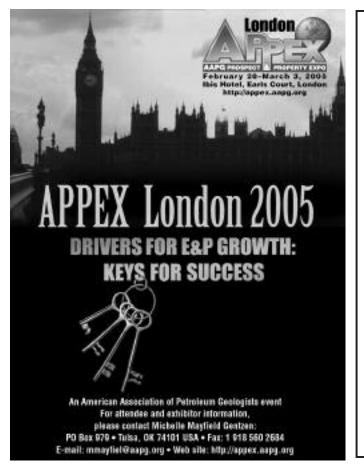
Get free listings, and a large response from qualified candidates, for your ads. Our website averages nearly 11,000 website "hits" per month.

Current Jobs page at:

http://www.hgs.org/en/jobs/search.asp

Contact info:

Mike Cline at T/X Resources - Chairman, HGS Personnel Placement Committee (713) 665-5449 • mikec@txresources.com



Reserves **Short Course**

Recent events in the petroleum business have made reserves a "hot topic." The HGS Continuing Education Committee is pleased to announce as its offering for Fall 2004, a one-day short course in "Petroleum Reserves—Avoiding Writedowns—An overview of reserve definitions and reporting requirements." The course is slated for early December. Instruction will be led by John Hodgin and Thomas Wagenhofer, of Ryder Scott Company. Watch the HGS www.hgs.org, the December Bulletin, and other advertisements for the date, venue, and other specifics.



HGS Bulletin Instructions to Authors

All materials are due by the 15th of the month, 6 weeks before issue publication. Abstracts should be 500 words or less; extended abstracts up to 1000 words; articles can be any length but brevity is preferred as we have a physical page limit within our current publishing contract. All submissions are subject to editorial review and revision.

Text should be submitted by email as an attached text or Word file or on a clearly labeled diskette in Word format with a hardcopy printout to the Editor.

<u>Figures, maps, diagrams</u>, etc., should be digital files using Adobe Illustrator, Freehand, Canvas or CorelDraw. Files should be saved and submitted in .eps (Adobe Illustrator) format. Send them as separate attachments via email or on a diskette or CD if they are larger than 1 MEG each, accompanied by figure captions that include the file name of the desired image. DO NOT EMBED them into your text document; they must be sent as separate files from the text. DO NOT USE POWERPOINT, CLIP ART or Internet images (72-DPI resolution) as these do not have adequate resolution for the printed page and cannot be accepted. All digital files must have 300-DPI resolution or greater at the approximate size the figure will be printed.

<u>Photographs</u> may be digital or hard copy. Hard copies must be printed on glossy paper with the author's name, photo or figure number and caption on the back. Digital files must be submitted in .jpg or .eps format with 300-DPI or greater resolution at the printing size and be accompanied by figure captions that are linked by the file name of the image. The images should be submitted as individual email attachments (if less than 1 MB) or on CD or zip disk.

Advertising

The *Bulletin* is printed digitally using QuarkXPress. We no longer use negatives or camera-ready advertising material. Call the HGS office for availability of ad space and for digital guidelines and necessary forms or email to ads@hgs.org. Advertising is accepted on a space-available basis. **Deadline for submitting material is 6 weeks prior to the first of the month in which the ad appears.**

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The Houston Geological Society Website is seen by many people each day. In recent months, we averaged about 15,000 visitors per week. You have four options for advertising your company or your services on the Website.

For those companies already advertising in the *Bulletin*, their company names are posted on the Supporter page for free but they have the option to link this to their home page for an additional \$10/month fee. If you have a product or service available at no charge, you can post it in the Business Directory at no charge. To arrange to put your ad on our Website or to get more information, send an email to Dave Crane (webmaster@hgs.org) or go to the HGS Website at www.hgs.org/ads.

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by Arthur E. Berman, editor@hgs.org

Election Issues in the Context of Petroleum and History Part 2. United States Energy Dependence

 $P^{residential}$ candidates Bush and Kerry say they have plans to reduce American dependence on foreign oil, and especially on oil from the Middle East. I doubt this is possible, certainly in the relatively short-term.

I learned along with my generation of petroleum geologists the

hard truth of the discovery and production cycle described by M. King Hubbert as major oil companies effectively abandoned domestic exploration beginning in the 1980s. Hubbert recognized that oil discoveries in the United States had peaked in the 1930s and that the correlative production peak occurred about 1970 (Laherrière, 2000). According to his prediction and what is now historical fact, the period following peak production is characterized by steady, inevitable decline. There are, of course, adjustments to the pattern that

result mostly from the combination of new technology and increases in crude oil price that permit, for example, deeper drilling or deepwater exploration. The pattern, however, is not reversible and the technology-driven spikes merely buy some more time in the decline but do not change its slope.

What, then, do Bush and Kerry mean when they talk about plans to greatly reduce dependence on imported oil? I went to their websites to find out.

That exercise was more challenging than I expected. In fact, I scanned once completely through GOP.com's 2004 Platform statement without finding a word about energy independence.

On my second time through I found what I think is Bush's plan: "President Bush has proposed a comprehensive national energy plan to upgrade the Nation's electrical grid, promote energy efficiency, increase domestic energy production, and provide enhanced conservation efforts, all while protecting the environment" (www.gop.com/GOPAgenda/AgendaPage.aspx?id=8).

The U.S. public is largely uninformed on issues of petroleum supply and generally believes that plenty of oil remains in the U.S. The Democratic and Republican party platforms play into that mis-apprehension and create an expectation that oil self-sufficiency is a tangible, short-term possibility.

Kerry's plan was somewhat easier to find but, like Bush's, I couldn't believe this is all he has to say:

"Democratic presidential nominee John Kerry outlined a \$30-billion, 10-year plan to veer the U. S. towards energy independence. The plan includes tax breaks and incentives for carmakers and buyers, coal producers and alternative fuels research" (www.johnkerry.com/pdf/pr_2004_0624b.pdf).

"Veering toward energy independ-

ence" hardly inspires me with confidence, and increasing domestic production is a nice idea; but Hubbert proved 30 years ago that it does not make a difference in the overall scheme of U.S. consumption.

In fairness, there are a few bullet points or part of another paragraph that go along with each statement beyond what I have cited. See for yourself whether I have distorted the substance of either of their plans or not. I believe you will agree that I have not.

After considerably more research I summarize Bush's and Kerry's positions on energy independence as follows:

Editor's Letter continued on page 10

Editor's Letter continued from page 9

Kerry on Energy:

- Clean energy: Make America energy independent from Middle East oil through investment in research and development for clean energy and energy-efficient technologies.
- Industrial biotechnology: Promote use of "synthetic biology" to create biodegradable plastics, energy, fuels, and chemicals based on agricultural waste as opposed to Middle East oil.
- · Develop more fuel efficient cars.
- Use nanotechnology and photo-voltaics to supplement fossil fuels

Bush on Energy:

- Open the Arctic National Wilderness Preserve (ANWR) to oil exploration.
- Ease licensing of nuclear power plants.
- Increase participation by U.S. companies in Caspian Sea exploration and production projects.
- Encourage Latin American and Asian countries to increase their oil production.

Both plans lack originality. Neither plan could make the United States independent of foreign oil for at least for a decade or two, in the most wildly optimistic scenario.

Let me put it in perspective. U.S. oil consumption is approximately 19 million barrels of oil per day (MMBOPD). Less that half that amount is produced domestically and the remainder is imported. Annual U.S. oil consumption is now between 15% and 25% of total domestic reserves so, at the present rate, we will use up our reserves in 4 to 7 years. Clearly, American dependence on imported oil can only increase (National Environmental Trust, 2001).

The United States has 2.8% of total proven, in-place world oil reserves; it has 10.4% of the world's undiscovered resources, most of which are in areas currently not open to exploration, such as the Arctic. In contrast, the OPEC countries control 78% of the world's oil reserves (Environmental Media Service).

The United States is the most intensely explored and historically oil-productive nation on Earth. Cumulative production to-date is about 150 billion barrels of oil (BBO). Proven reserves are 50 BBO along with an approximately equal amount of undiscovered "resources" (Masters and others, 1991). It is important to distinguish between "resources" and "reserves" because resources means in-place, possible reserves. Undiscovered reserves in the lower-48, continental United States will consist of small- to medium-sized fields, mostly in very small accumulations of less than 1 to 5 MMBO estimated ultimate recovery (EUR).

The predictions of M. King Hubbert are painfully true and, while domestic exploration and production of petroleum should and will continue profitably for many companies, it will not have a substantial effect on America's dependence on foreign oil.

There is some merit in the Bush and Kerry plans but make no mistake: neither is a formula for energy independence at least in the next decade or so in the best of all possible outcomes.

ANWR has been the subject of considerable discussion at least since the oil shocks of the early 1970s because it is a huge unexplored area (19.5 million acres, about the size of South Carolina) close to Prudhoe Bay, North America's largest oil field (10 BBO EUR). The United States Geological Survey (USGS) estimates an economically recoverable resource for ANWR of 2.6 BBO and a resource range of 3.2 to 16 BBO (Environmental Media Service).

I cannot imagine how 2.6 BBO was determined because a simple technical risk analysis yields the following:

- Without any wells or seismic data, the source, migration pathways and timing, reservoir presence, trap definition, and seal presence are unknown and therefore high risk.
- Assuming that seismic data will reduce trap definition risk to an optimistic 50% probability of success, and, holding all other risks to an unrealistically hopeful 30% apiece, gives a 0.4% chance of success.
- Applying 0.4% risk to the highest estimate of 16 BBO yields a risked volume of 70 MMBO assuming it is all recoverable; this is a wildly uneconomic project in the Arctic where about 1 billion barrels at certainty are necessary for a 15% discounted return (economics become worse if the 16 BBO are not in one accumulation).

Add to that the estimated 7 to 12 years required from discovery to first oil in the U.S. markets. If ANWR did result in a 2.6-BBO field and all that was recoverable, this would satisfy the current U.S. rate of consumption for about four-and-a-half months. Any way it is analyzed, ANWR, while certainly worth discussing and possibly drilling, is not going to significantly contribute to U.S. energy independence.

The best part of Kerry's plan is emphasis on improved automobile efficiency. In 2002, the transportation sector accounted for about 68% of total petroleum use with gasoline accounting for two-thirds of the petroleum consumed in the transportation sector. The internal combustion engine in cars accounts for 40% of all petroleum use in the United States (New Energy Bill: Reducing our dependence on foreign oil, 2004). This is clearly an area where we can make an important impact on our total petroleum use and therefore dependency on foreign imports.

Another debate is now under way to determine when the peak in world oil discovery occurred and to predict when the production peak will take place. This inevitably is an important factor in America's future supply of petroleum and therefore must be considered in a discussion of energy independence. There is a range of well-supported scenarios for the timing of peak oil production. Some experts believe the peak has already occurred or is occurring now. This implies serious shortages of petroleum by 2020 or sooner (Bakhtiari, 2004). Others, notably the USGS, think the shortfall will not be acutely felt until 2036–40 (Ahlbrandt, 2002). Most predictions call for a production maximum between 2006 and 2012.

Nearly all of the great international oil provinces are near or in decline. The North Sea is in full decline, about six percent per year (Bakhtiari, 2004). Russia will reach a plateau between 2004

and 2006 (Wood MacKenzie, 2003). Iran and Kuwait are near their limits and will peak in the next decade, and Saudi Arabia is not far behind; Ghawar is about to begin the same decline that we now see at Prudhoe Bay and Brent (Bakhtiari, 2004).

What this means is that the presidential candidates' plans for energy independence will become increasingly inadequate with each passing year regardless of who is elected in November.

As I have contemplated, researched and written this and last month's Editor's Letter (Berman, 2004), a shattering observation has emerged: there are more undiscovered, conventional petroleum reserves in Iraq by anyone's estimation than anywhere else on Earth.

I had some appreciation for the undeveloped proven reserves that exist in that region as a result of wars, embargo, tyranny and mismanagement during the years of Hussein's rule in Iraq: the Department of Energy estimates 112 BBO (Luft, 2003). For the reasons I've cited Iraq is also the most underexplored oil-productive area in the world. Estimates of undiscovered reserves range from 45 to 300 BBO (Luft, 2003) with most estimates in the area of about 200 BBO.

I believe that both Bush and Kerry know this. This may explain many of the perplexing aspects of the conduct of this election campaign. The fact that Bush's and Kerry's energy plans are deeply sequestered in their platforms and, when found, are thoroughly unconvincing and inconsistent with the very idea of energy independence now makes sense. The reason Kerry has not seriously challenged Bush's takeover of Iraq, just its handling, is also very clear now: Kerry knows we need the oil and he would have done the same thing if he were president.

For Bush and Kerry, Iraq is the best short- to medium-term solution to the depletion of not only domestic sources of petroleum but also the imminent and irreversible decline of the world's great conventional petroleum provinces. The issue is both strategic and economic and directly relates to the need for constant petroleum supply as a cornerstone of U.S. Middle East policy since World War II (Berman, 2004b). Saddam Hussein provided a convenient foil for execution of long-standing United States policy in the Middle East. I leave it to the reader to evaluate the validity of Iraq's weapons of mass destruction or Al-Queda ties in

ANWR Statistics (assuming most optimistic reserves and recovery factors)

- Production of ANWR oil fields will account for only 10.6% of the average U.S. daily import of oil.
- ANWR production at 1.1 million barrels per day constitutes only 5.6% of the average U.S. daily consumption of oil.
- USGS between 5.7 and 16.0 billion barrels of reserves in ANWR (95% and 5% confidence levels), with a mean of 10.3 billion barrels

US Undiscovered Reserves

Undiscovered conventional resources, onshore and state waters 30.3 BBO 258.7 TCF 7.2 NGL

US oil consumption = 18.92 million barrels/day

Source: http://energy.cr.usgs.gov/energy/stats_ctry/Stat1.html#Undiscovered USGS United States Energy and World Energy Production and Consumption Statistics USGS Central Energy Team http://energy.cr.usgs.gov/

the face of having one-fourth of the planet's undiscovered reserves all in a place the size of California.

Perhaps this also explains why the U.S. military has chosen to give ground in places like Fallujah, Najaf and the many other areas of Iraq now outside our control: they simply do not directly affect the petroleum resource.

The history of civilization is filled with seemingly insurmountable crises and energy has been a recurrent theme in Western history over the last thousand years at least. In the 12th century, Europe was deforested and therefore out of energy supply. Coal was discovered as a remedy. In the 18th century all the coal measures of Europe had been mined to **Editor's Letter** continued on page 12

Editor's Letter continued from page 11

the water table and the West was out of energy again. This time steam provided the solution for pumping water out of the mines. Today we foresee the end of the conventional petroleum supply and we search for a solution.

Depletion of conventional petroleum sources is hardly the end of our supply. At least an equal amount of unconventional petroleum reserves is contained in two of the world's tar belts, in Canada and Venezuela. A credible estimate of Venezuela's Orinoco region yields 44 years of global supply at our current rate of consumption (Kovarik, 2003). Shell Canada estimates that its holdings alone in Canada's Athabasca region will yield 350 BBO recoverable, more oil than in Saudi Arabia (Kunkel, 2004). Not only are these areas being developed today, but the current price of oil makes them economic as well.

Gas hydraates in the U.S. alone are estimated at 320,222 trillion cubic feet and, for the world, nearly 50 million trillion cubic feet of gas (U.S. Dept. of Energy, 2004)!

I think that there may be enough petroleum to last our planet for centuries, especially if we actively pursue alternative sources while conserving the conventional and unconventional supplies we already have. This does not minimize the desperation of nations and their politicians to claim through power and aggression the most easily extractable resources that we know about. What is certain is that the United States will depend on imported petroleum for a long time. It is equally certain that much of the public does not understand this. There is great danger here.

Frank Herbert's *Dune* series is, I believe, an apt fictional metaphor for our unfolding situation as petroleum becomes scarce and the Islamic world rebels against the hegemony of the West. In Herbert's novels, the universe is addicted to a substance called spice found only on one planet, Arrakis (whose name phonetically resembles Iraq.) Arrakis is a desert world whose language and culture are decidedly similar to the Middle East of today. The leader of Arrakis unites his people in a holy war against the powerful and rigid Galactic Empire to regain control of the spice, the future and the Empire (there is even an antagonist who attempts to control the universe by creating synthetic spice).

A central idea in the *Dune* series is that the essence of human strength is the ability to exist on the perilous edge of crisis. The more a person confronts the dangers of the unknown, the more conscious he or she becomes. The human ability to consciously adapt is always underestimated.

Our generation finds itself at such a threshold. The experts in the petroleum industry are debating whether the world is presently at peak oil production or whether the peak is a few years away. Ppredictions emphasize scarcity and impending crisis. As I discussed in my previous Editor's Letter (Berman, 2004a), predictions are usually wrong. In the early 1970s the experts were predicting a serious oil supply shortage by the end of that decade. That did not happen for many reasons, but an unanticipated factor was the extraordinary capacity of people to adapt and change their consumption habits.

George W. Bush and John F. Kerry both present weak and inadequate plans for meeting the current and future energy needs of the United States. Both plans are deceptive because they promise or imply energy independence; this is simply impossible in the reasonably near-term. The level of U.S. petroleum use, the maturity of exploration and development in this country, and the time required to discover and implement alternative sources require oil imports for a long time under any scenario.

I believe that the main reason the United States is in Iraq today is because that country contains one-fourth of the remaining undiscovered oil reserves in the world in an area smaller than California. The American strategy of war and occupation is focused on securing and maintaining the oil fields and adjacent areas with identified undiscovered reserves. Unrest and insurgency in the cities has been contained but not overcome because it has no direct relationship to the oil reserves we need. Our strategy is consistent with U.S. policy since World War II: preserve the supply of petroleum from the Middle East to the United States. As Saudi Arabia ceases to be the world's major supplier of oil, the United States must look elsewhere for future supply. Iraq was identified as the best source of future petroleum.

The U.S. public is largely uninformed on matters of petroleum supply and generally believes that plenty of oil remains in the United States. The Democratic and Republican party platforms play into that misapprehension and falsely create an expectation that oil self-sufficiency is a tangible, short-term possibility. As earth scientists, we know better and have a responsibility to help direct future energy policy.

I think the geoscience and engineering community should issue "white papers" through AAPG and other professional organizations stating our opinions and assessments of measures, such as opening ANWR, to address future petroleum supply. The vast reserves of the Orinoco and Athabasca regions of North and South America will be critical to the world oil supply beyond the imminent decline in conventional oil production. Hydrogen power must be aggressively advanced and perhaps linked to domestic natural gas exploration as a means to cleanly provide the energy to crack hydrogen from water. Energy efficiency in the transportation sector, where more than half of all petroleum in the United States is consumed, should be relentlessly pursued.

Development of conventional oil reserves must likewise be objectively understood and directed whether in the U.S. or in Iraq.

Energy leadership must come from those with knowledge and experience. It is time for geoscientists to come forward and assert what we know to be appropriate and feasible measures to address petroleum supply. We must expose purely political ploys such as developing ANWR, nanotechnology, and photo-voltaics and nuclear power for what they are: hopelessly inadequate, not timely and not worth the environmental costs.

First and foremost, however, we must help create an awareness of energy reality: the United States is dependent on foreign oil. We have been for some time and will only become more dependent. This is not a reversible trend and no one is to blame.

Second, we should emphasize the future geoscience career opportunities for exploitation of remaining conventional petroleum reserves and for the identication and production of the very considerable unconventional oil and gas resources in the world.

The Bush and Kerry plans contain elements with merit but lack scope and perspective. One of these men will be our next president. We must ensure that he takes the country in the right direction because time favors growing scarcity and crisis. There are abundant possibilities in conventional and unconventional petroleum sources and in emerging technologies for alternative energy. In this endeavor it is important to remember that predictions are commonly wrong and that the human race is remarkably able to find unanticipated solutions and to adapt for survival.

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PRESS RELEASE:

Intersociety Exploration Committee on Certification of Petroleum Reserves Evaluators is Established Houston, Texas, September 29th, 2004

T oday, the American Association of Petroleum Geologists and The Society of Petroleum Evaluation Engineers, announced that the first meeting of an Intersociety Exploratory Committee on the potential establishment of a program for the Certification of Petroleum Reserves Evaluators was held in Houston, Texas.

Recognizing concerns since the Enron scandal, recent reserves writedowns, and the passing of the Sarbanes-Oxley Act by Congress in 2002, not to mention investor confidence in the oil and gas industry, these long-recognized professional petroleum industry societies have organized an exploratory committee to evaluate the merits, interest and importance of establishing a Voluntary Certification Program for Petroleum Reserves Evaluators.

"During the past year there has been a lot of publicity regarding reserves writedowns and concerns about the reliability of reserves disclosures," said Mr. Daniel J. Tearpock, AAPG representative on the management team for the Committee. Mr. Tearpock continued, "From the standpoint of oil and gas companies and their investors, to Wall Street and the SEC, reserves are an important part of every-day life in the energy industry."

Mr. Ron Harrell, At-Large representative on the management team stated, "We now have a business environment that demands higher standards throughout the energy industry and particularly the oil and gas sector. The investor deserves the assurance that a company's reserves estimates have been prepared by qualified individuals who are trained to meet international industry standards." Mr. Harrell identified several vital components of a potential certification program including recommended geoscience and engineering practices, reserves definitions, better standards, testing, continuing education, and ethics, and he emphasized that this initiative is oriented toward individual professionals, not companies or corporations.

"As an exploratory committee represented by these very distinguished industry societies, along with the encouragement of the Society of Petroleum Engineers, our mission is to evaluate the importance and feasibility of such an initiative, and to define the requirements for the certification of geoscience and engineering petroleum reserves evaluators," stated Mr. Richard Miller - member of the management team. "If the committee sees merit in moving forward with this initiative, the committee will recommend such action to our respective societies.

Worldwide oil and gas reserves are estimated to have a value over \$600 trillion. It is vital that private and public companies, as well as governments, have reliable reserves estimates. With the complexities involved and the integration of significant amounts of data, accurate reserves evaluations require the integration of both geoscience and engineering. The committee is composed of members from both disciplines.

In the coming weeks, the Exploratory Committee will more clearly define its mission, the overall goals and milestones, and establish a timetable for future action by the Committee and the sponsoring industry associations. The Committee believes that if this initiative is implemented the certification of petroleum reserves evaluators has the potential to provide the financial community with greater confidence in the estimates of oil and gas reserves. It can provide the opportunity to develop better standards in both reserves estimation and disclosure. It will offer training to those who recognize the need. It will provide recognition of expertise, by established professional industry associations, to those individuals who qualify and pass the certification process and become certified.

Finally, the committee believes that if the sponsoring societies move forward with this program that it will have the benefit of providing added assurance, to both government agencies and the investment community, that the oil and gas industry, has the experience, expertise, ethics and professionalism to provide accurate and reliable oil and gas reserves estimates.

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Sailing Up The Nile River—in The Company of Herodotus, World's First Geologist/ Geographer, 2500 Years Ago.

by Franz L. Kessler

erodotus was among the first traveler-writers in the history of mankind. He was born and raised in Hellenic Western Anatolia (now Turkey)—a land, where meandering rivers shape the coastlines, and where access to the sea was governed, and often destroyed by sediment deposited during the winter rains.

Herodotus finally settled down in Southern Italy, where he composed his works and died 424 B.C. In Herodotus' writing we observe a meshwork of archaic theology and syncretic speculations. He takes great care to separate his own observations from what he infers or what he has heard from others.

The latter form the background for amazing snapshots of truly poignant scientific observations, and precise reasoning. These are the focus of this article.

Herodotus travels to Egypt in the fifth century B.C. He portrays the Egypt of the declining Late Kingdom, but well before the Hellenistic Ptolemids.

Approaching the Nile delta by boat, Herodotus notes that the water far out in the sea is unusually shallow:

"First when you are still approaching in a ship and are distant a day's run from the land, if you let down a sounding-line you will bring up mud and you will find yourself in eleven fathoms. This then so far shows that there is a silting forward of the land.

As he enters the delta, he observes the flatness of the land, the softness and colors of its soil:

"From thence and as far as Heliopolis inland Egypt is broad, and the land is all flat and without springs of water and formed of mud...

"As their land advanced forward, many of them were left in their first abodes, and many came down gradually to the lower parts...

"It has soil which is black and easily breaks up, seeing that it is in truth mud and silt brought down from Ethiopia by the river...

"For they (the farmers) have no labor in breaking up furrows

with a plough nor in hoeing nor in any other of those labors which other men have about a crop. But when the river has come up of itself and watered their fields and after watering has receded again, then each man sows his own field...

"But the soil of Libya, we know, is reddish in color and rather sandy, while that of Arabia and Syria is somewhat clayey and rocky.

Herodotus then intelligently speculates about the magnitude of sediment transport, and mud deposition:

"For it was evident to me that the space between the mountain ranges, which lie above the City of Memphis, once was a gulf of the sea, like the regions about...Ephesos and the Plain of the Maiander, if it be permitted to compare small things with great. And small these are in comparison, for the rivers, which heaped up the soil in those regions none is worthy to be compared in volume with a single one of the mouth of the Nile, which has five mouth."

"If then the stream of the Nile should turn aside into the Arabian Gulf (=Red Sea) what would hinder that gulf from being filled up with silt as the river continued to flow, at all events within a period of twenty thousand years? Indeed, for my part, I am of the opinion that it would have been filled up even within ten thousand years...

Two problems clearly intrigued our early travel-writer: The origin of the Nile, and the problem of the mid-summer Nile-valley flooding. On the first one, he cites the available sources. None appealed to him, rightfully though. On the summer flooding, he tests several theories (melting snow, wind patterns) but admits, that none of the solutions offered are viable solutions:

"As regards the nature of the river, neither from the priests nor yet from any other man was I able to obtain any knowledge: and I was desirous especially to learn from them about these matters, namely why the Nile comes down increasing in volume from the summer solstice onwards for a hundred days, and then, when it has reached the number of these days, turns and goes back, failing in its stream, so that through the whole winter season it continues to be low, and until the summer solstice returns."

Salling up the Nile River continued on page 61

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by William R. Almon and William C. Dawson ChevronTexaco Exploration Technology Company Bellaire, TX

Seal Character and Variability Within Deep-Marine Depositional Systems: Seal Quantification and Prediction

Seals are a key element of petroleum systems, yet they have received limited systematic study. Textural and compositional variations permit the recognition of six shale lithofacies in Tertiary deep-marine depositional settings. Each shale type endmember has distinctive textures and fabrics, which record variations in depositional conditions. Textural and compositional variations in shales, considered within the context of sequence stratigraphy, provide a basis for seal risk assessment. As determined from mercury injection capillary pressure (MICP) analysis,

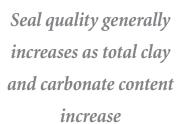
the pressure required to attain critical seal pressure (10% non-wetting phase saturation) varies over a considerable range (15 to 20,000 psia). Tertiary shales from offshore Brazil have consistently low critical seal pressures relative to age-equivalent shales from offshore West Africa. Tertiary shales from wells in the Gulf of Mexico have intermediate critical MICP values (mean: 4,700 psia). The organization of shale

facies within a sequence stratigraphic framework reveals systematic variations in seal character. Silt-poor shales from uppermost transgressive systems tracts, and some condensed shales, have good to excellent seal potential. In contrast, silt-rich shales from highstand and lowstand systems tracts have moderate to low sealing capacities. Seal quality generally increases as total clay and carbonate content increase; other compositional variables have limited predictive relationship with seal character. Likewise, log-derived parameters lack significant potential to accurately predict critical non-wetting saturation values. Additional seal variability factors include changes in the rate of deposition, early marine cementation, and depositional fabric. Available data provide a compelling argument for textural control of seal character induced by high-frequency stratigraphic cycles.

Biographical Sketch

WILLIAM R. ALMON is a research geologist for ChevronTexaco Exploration Technology Company, Bellaire, Texas. He earned his

PhD in geology and an MA in chemistry from the University of Missouri (Columbia). He received an MS in petroleum engineering from the University of Tulsa and an MA in geology and a BA in chemistry from Washington University (St. Louis). His 30-year career includes positions in research management, applied tech-



nology and exploration at Cities Service, Anadarko, Texaco and ChevronTexaco. His research interests include sequence stratigraphy and siliciclastic depositional systems, as well as sedimentary geochemistry and diagenesis. He has twice been a recipient of the Leverson award. He is a member of AAPG, SEPM, GCAGS and SPE.

WILLIAM C. DAWSON is a research geologist for ChevronTexaco Exploration Technology Company, Bellaire, Texas. He earned BS and PhD degrees in geology from the University of Illinois at Champaign-Urbana, and an MS degree in geology from the University of Texas at Arlington. His professional experience includes: the Illinois State



Geological Survey, Fossil Petroleum Corporation, Eason Oil Company and Texaco Research. His research interests include shale sedimentology, seal characterization, sequence stratigraphy and reservoir diagenesis. He is a former associate editor of the AAPG *Bulletin* and a recipient of the Leverson award. He is a member of AAPG, SEPM, GCAGS and the International Association of Sedimentologists.

CALL FOR PAPERS

BUDDING NEW TECHNOLOGIES

Southwest Section AAPG 2005 Convention April 10-13, 2005

Fredericksburg, Texas

The Southwest Section is seeking paper and poster presentations for the 2005 Southwest Section Convention to be held April 10-13, 2005 in Fredericksburg, Texas. There will be Technical Sessions on Monday, April 11th in the morning and afternoon, and only morning sessions on Tuesday, April 12th and Wednesday, April 13th. We are soliciting papers covering topics from field studies to emerging technologies.

With historical Fredericksburg as the backdrop for the convention, we anticipate a rather sizeable turn out. This would be a great opportunity for you, as an author, to present your work before a large and appreciative audience.

The planned attractions for the convention include a German Festival with an Oompah Band, a Wine and Wildflower Tour, shopping for the spouses and, of course, the ice breaker which will be held at a local brewery. Mark your calendars and watch for coming announcements. If you have any questions about the convention, contact Mike Party (Convention Chairman) at (432) 686-5971 or by email at mparty@wbltd.com. We hope to see you in Fredericksburg!

Deadline for submittal of papers is December 15th 2004. If you would like to present a paper or poster, please contact:

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Luncheon Meeting

by Roy K. Dokka
Center for GeoInformatics and
Department of Civil &
Environmental Engineering
Louisiana State University
Baton Rouge, LA

The Anatomy of a Silent Disaster: Ongoing Subsidence and Inundation of the Northern Margin of the Gulf of Mexico Basin

Coastal areas of the south-central USA are the site of America's greatest wetland, the gateway to America's energy

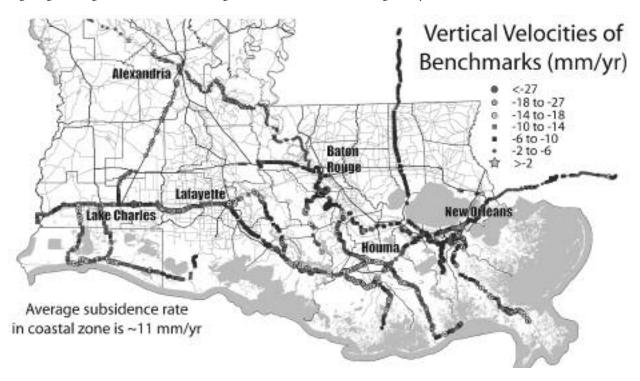
heartland, and home to over 10 million people. This area is being increasingly threatened by progressive inundation by the relative rise of the Gulf of Mexico. Inundation has been linked to several causes including subsidence of the land, eustatic sea level rise, erosion, and canal dredging. The lack of precise rates on processes has prevented the development of a theory that can explain inundation. Subsidence, however, is suspected by

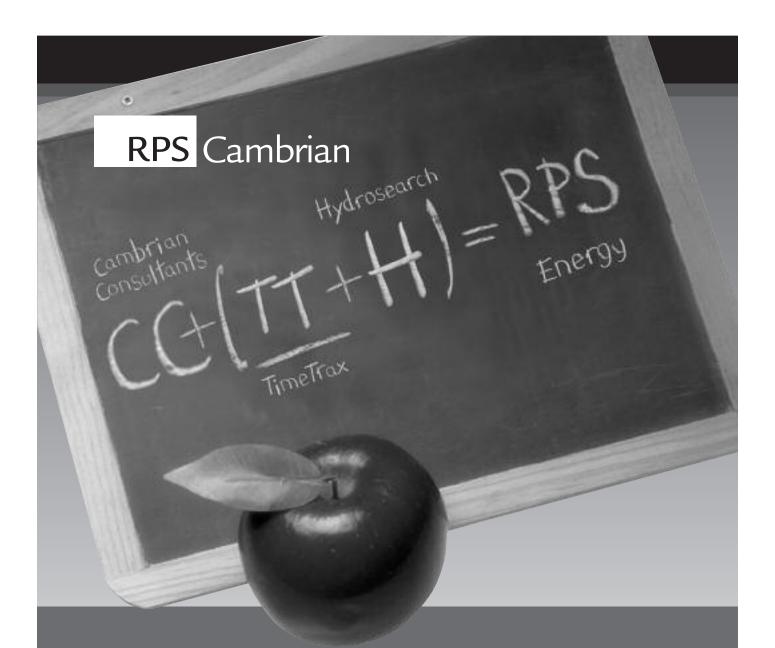
most workers to be the dominant factor based on: 1) the region's deltaic geologic setting; and 2) the observed magnitude of subsi-

dence implied by a few marine tide gauges along the coast (relative sea level rise minus the eustatic component).

...substantial portions of the Gulf Coast (primarily Louisiana) will lie below sea level and be inundated by end of this century. Recent analysis of NOAA/National Geodetic Survey (NGS) 1st order leveling data produced vertical velocities for over 2700 benchmarks in Louisiana, Mississippi, Alabama, Texas, Arkansas, Florida and Tennessee. Motions were related to the North American Vertical Datum of 1988 (NAVD88) and show that subsidence is not limited to coastal wetland areas, but rather includes the

entire coastal zone as well as areas several hundred kilometers inland. Regionally, vertical **HGS General Luncheon** continued on page 21





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Joint HGS/SPE/HEC/SIPES General Luncheon continued from page 19_



velocities range from less than -30 mm/yr along the coast to over +5 mm/yr in eastern Mississippi-Alabama. The mean rate is ~ 11 mm/yr in coastal Louisiana. In the Mississippi River deltaic plain, subsidence was significantly higher than previous estimates based on long-term geologic measurements. The data also indicate that adjacent alluvial ridges where the population is concentrated have been similarly affected. The Chenier Plain and Cajun Prairie of southwest Louisiana, areas previously thought to be only slowly sinking, are actually subsiding at rates similar to those of the deltaic plain.

Recognition that all areas of the coast as well as inland areas are sinking implies that subsidence recorded by benchmarks is not just due to local sedimentary processes and/or the activities of humans. Geodetic data when combined with subsurface geologic information suggest that subsidence includes a large tectonic component due to lithospheric flexure and normal faulting. Tectonic effects can be attributed to late Quaternary sediment loads such as the modern Mississippi River delta and Pleistocene deposits offshore. Previous models of simple flexure are inadequate, however, to explain the regional component of subsidence. Instead, it is proposed that active faulting in coastal areas influences regional subsidence by episodically weakening the lithosphere, which in turn changes the way that the lithosphere bears the load of sediments over time. Evidence also suggests that substantial subsidence in southwest Louisiana is due to salt intrusion/evacuation induced by sediment loading (active minibasin formation).

It is likely that the natural processes that have caused subsidence of benchmarks over the past 50 years will continue into the near future and at similar rates. Thus, if eustatic rise continues (or increases) and humans fail to build protection levees to appropriate heights, substantial portions of the Gulf Coast (primarily Louisiana) will lie below sea level and be inundated by end of this century. In Louisiana, this will result in a loss of ~\$140B of land and property, as well as the land, jobs, homes, and cultural heritage of over 2 million people.

Biographical Sketch

Dr. Roy K. Dokka is the Fruehan Endowed Professor of Engineering at Louisiana State University. He also serves as Executive Director, Center for GeoInformatics and is Director, Louisiana Spatial Center (LSRC). The LSRC is a partnership with the National Geodetic Survey-NOAA focused on creating a state-of-the-art positional infrastructure for the region. Dr. Dokka



is a Fellow of the Geological Society of America and was awarded a lifetime honorary membership in Alpha Lambda Delta, the National Freshman Honor Society. He is currently Past-President of the South-Central Section of the Geological Society of America.

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5:30 p.m. - Social Hour/UH Student Poster Session 6:30 p.m. - Dinner 7:30 p.m. - Lecture

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Robert E. Sheriff Lecture Series:

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Mr. Dave Meaux, president of the University of Houston Geological Alumni Association (UHGAA), will serve as Master of Ceremonies. Dr. John F. Casey, Department of Geosciences Chairman, will present an overview of current activities at UH. There will be posters and presentations on current thesis and dissertation research activities of UH graduate students.

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The Robert E. Sheriff Lecture Series was initiated in 1999 by the UHGAA. For the past several years it has been co-sponsored by the International Explorationists Group of the Houston Geological Society. The series honors Dr. Sheriff as an educator, scholar and proponent for the geosciences.

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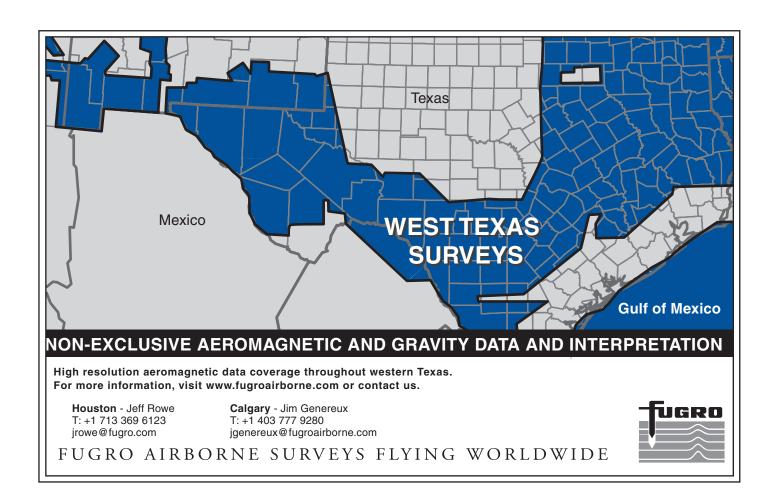
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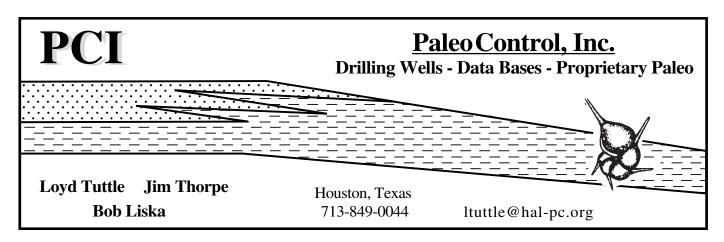
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Preliminary List of Presenters:

Preliminary List of Presenters:				
Lew Ashwal	Tanya Atwater	Kevin Biddle		
John Bird	Suzanne Baldwin '	William Bosworth		
Sam Bowring	Dwight Bradley	Clark Burchfiel		
John Casey	Lawrence M. Cathle	s John Dewey		
Bruce Fegley	Richard Gordon	John Gibson		
Mark Harrison	Jim Hays	Paul Hoffman		
Robert Kay	Raymond Jeanloz	Sue Kay		
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Ali Pollat	James Pindell	Walter Pitman III		
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Buck Sharpton	Sean Solomon	Robert Stern		
Trond Trosvik	Paul Tapponier	Don Turcotte		
Brian Wernicke	Justin Wilkinson	Hua-wei Zhou		
	Mary Lou Zoback			

Sh	eriff Lecture - Poster Competition - November 15 - UH	Hilton
Student Name	Poster Title	Advisors
Banga, Tat	Source, flow pattern and compartmentalization of oil and brine around South Liberty Salt Dome, Texas Gulf Coast	R.M. Capuano, D.S. Van Nieuwenhuise
Bell, Mary Sue	Cratering evidence for the age and thickness of an extensive ice-rich mantle in western Utopia Planitia, Mars	Arch Reid
Blumentrit, Chuck	Boundary between Muenster Arch and Ouachita Thrust Stress Regimes from Seismic Curvature Attributes	Kurt Marfurt
Bose, Sushanta	Microbial Mat Induced Sedimentary Structures	Henry Chafetz
Bundalo, Neda	3-D Gravity Modeling of Southern California	Stuart Hall
Cassidy, Martin	Relation of World-wide Distribution of CO2 Gas Deposits to Plate Tectonics	James Lawrence
Cheng, Fang-Yi	Fine Scale Meteorological Simulations of the Houston-Galveston Metropolitan Area with Landsat-derived High-resolution Land Use and Land Cover Datasets	Daewon Byun
Coarfa, Violeta	The Aromatic Hydrocarbon Representation in the SAPRC99 Chemical Mechanism of the Community Multiscale Air Quality (CMAQ) Model	Daewon Byun
Djordjevic, Marija	Influence of Anisotropy on salt flank imaging	Kurt J. Marfurt
Dragoi-Stavar, Diana	Geophysical study of the ocean-continent transition (West Africa)	Stuart Hall
Famini, Joel	Analysis and classification of seismic attributes in Vacuum Field, Lea County New Mexico	Kurt J. Marfurt
Fernandez, Jaime	Multiple low frequency radar sounding techniques for identification of subsurface water on Mars	Shuhab Khan
Fu, Dongjun	Rock properties and seismic attributes of chert reservoirs in the Devonian Thirty-one Formation, West Texas	Kurt Marfurt, Charlotte Sullivan
Gheraism, Mariana	3-D VSP elastic Kirchoff prestack depth migration - Vinton Dome, Louisiana	Kurt Marfurt
Gray, Jana	Establishing the temporal and compositional relationships among lava flows of the Craters of the Moon (COM) National Monument, Idaho through implications from image spectroscopy and hyperspectral imaging	Shuhab Khan
Henshaw, Ekeng	Integrated Core-Log-Seismic Attribute Study of Barnett Shale, Fort Worth Basin, Texas	Kurt Marfurt, Charlotte Sullivan, Don Van Nieuwenhuise
Hinkle, Doug	Delineating areas of critical concern for erosion along Trinity River, Liberty Co. Texas	Bill Dupre
Hoelting, Cory	Constrained least-squares migration	Kurt Marfurt
Jovanovic, Katarina	Vector VSP's P and S waves separation by Antialias Discrete Radon Transform	Kurt Marfurt
Kumar, Mritunjay	Interface effects on reflection coefficients	De-hua Han, Fred Hilterman
Li, Li	S-wave velocity modeling of the Southern California crust using deformable layer tomography	Hua-wei Zhou
Liu, Jianlei	3-D Radon transform, Fourier transform and their applications	Kurt J. Marfurt
Ma, Long	Origin of dolomite in organic-rich lacustrine Green River Formation: A geomicrobiological perspective	Henry Chafetz
Martinez, Yardenia	Developing new topographic correction techniques for satellite imageries for steep slope areas: case of study for mapping Iron Lake Fault, Salmon National Forest, Central Idaho	Shuhab Khan
Ngan, Fong	The development of objective analysis tools in UH Real-time Trajectory Analysis System	Daewon Byun
Oyedele, Oluwayomi	3D high resolution seismic imaging of late Quaternary turbidite systems	William Dupre, Kurt Marfurt, John Sharp -BP
Perez, Gabriel	Relationship of seismic attributes to velocity and anisotropy estimation: application to fracture detection	Kurt Marfurt
Petrovic, Ana	Mapping karst topography from space	Shuhab Khan
Pralica, Nebojsa	A revisit of near-surface static corrections with deformable layer tomography	Hua-wei Zhou
Simonovic, Simona	Strain localization and the role of oxide minerals in the oceanic crust: Evidence from ODP Hole 1105A, Leg 179	John Casey
Sissenwein, Rachel	Nature of the spinel phase in ordinary chondrites	Arch Reid
Yu, Lili	Mapping Bay of Islands Ophiolite Complex using combined analysis of Landsat ETM and SIR-C data for spectral characterization of lithology in Newfoundland, Canada	John Casey
Zhao, Bo	Optimized seismic attributes and logging attributes to predict reservoir fluid saturation with constrained support vector machine	Hua-wei Zhou, De-hua Han
Zhou, Jie	The genesis of caliches and their controlling factors	Henry Chafetz
Zhou,Yong	Structural development of the Peregrina-Huizachal Antinclinorium, Mexico	M.A. Murphy









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Luncheon Meeting

by Tarek Ghazi, Pete Emmet (presenter), Bob Hickman, Glenn Granata, Angel Callejon and Maurice Slot

New Genetic Framework and New Plays in Offshore Peru

The Peruvian offshore is an

anomalous convergent margin.

It is underlain by continental

crust.

In the spring of 2004, Gaffney, Cline & Associates, Inc. undertook a comprehensive reinterpretation of the hydrocarbon

prospectivity of the offshore basins in Peru. From north to south, the study included the Tumbes-Progresso, Talara, Trujillo, Salaverry and Pisco basins. The main focus was to delineate basin geometry and evolution, while tracing a robust tectono-stratigraphic correlation scheme across a region greater than 1000 km in strike length. Kinematic reconstructions

of key dip lines, thermal maturation models and a regional velocity model and depth conversion were essential in building this new framework. These new interpretations were built on the back of an intensive multi-discipline integration of key seismic lines, wells, remote sensing, and surface geological data.

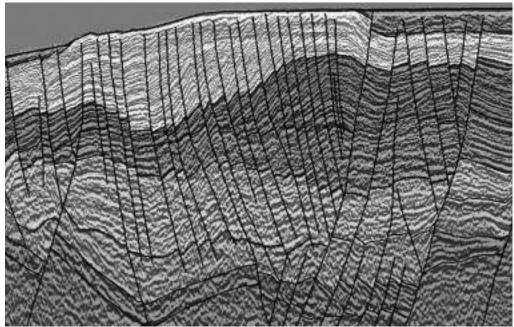
Overall, the Peruvian offshore is an anomalous convergent margin. It is underlain by continental crust, including Cretaceous

and Paleozoic strata and Precambrian crystalline rocks, whereas many other convergent margins are underlain by oceanic accre-

tionary prisms. Several extensional basins have formed and have been inverted during the Cenozoic, largely controlled by the reactivation of basement faults. This new genetic framework has exposed several new play concepts and has produced a better understanding of previous concepts. The new prospectivity, especially in shallow water, will likely

attract another round of exploration licensing in the area.

Wildcat wells in the Tumbes-Progresso basin have penetrated a thick Neogene section and have tested substantial flows of oil and gas. However, a thicker lower Eocene section that hosts large complex structural and possible stratigraphic traps remains essentially untested. Remigration of hydrocarbons from early-forming traps may be an important controlling factor here.

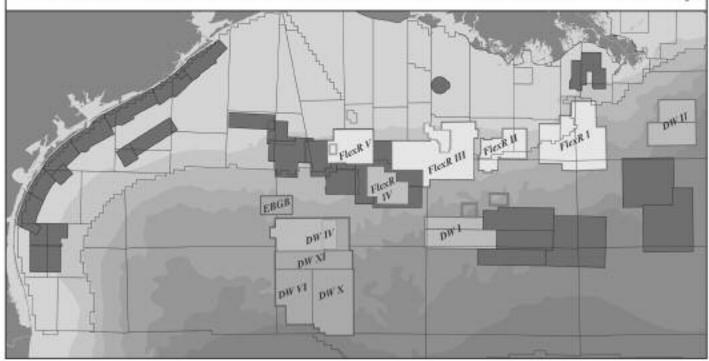


Offshore Peru seismic Line at the shelf-slope break.

In the Trujillo basin, postmortem analysis of wildcat failures suggests that two of the four wildcat wells were drilled off-structure with respect to deep targets, while the other two tested the Trujillo-Salaverry basement arch. This arch likely formed in the late Miocene, which is significantly later than previously believed. Although the arch itself is not prospective, this earlier time of formation leaves the way clear to charge the Salaverry basin with hydrocarbons migrating out of the Trujillo basin in the late

GSH continued on page 27

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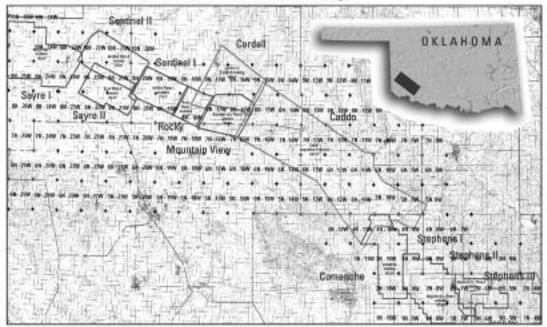
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GSH Luncheon continued from page 25

Eocene to early Miocene. The Salaverry basin was previously thought to be unprospective.

Traditional exploration targets in the Trujillo basin have been turbidite sands of Eocene to Miocene age that are draped over basement structures. The study has resulted in a better understanding of the paleogeography and paleobathymetry that controlled the distribution of these sands. Cretaceous sandstones in the Trujillo and Salaverry basins and Eocene carbonates in the Salaverry and Pisco basins may also be prospective. Carbonate targets have not been tested in the Peruvian offshore to date.

Biographical Sketch

Pete Emmet is a consulting geophysicist with Brazos Valley G&G Services of Cypress, Texas (pete@bvgg.com). Pete's geophysical practice involves data management and interpretation services utilizing The Kingdom SuiteTM applications of Seismic Micro-Technology. Pete earned a PhD in geology and geophysics from Rice University in 1996, for which he studied the structural and stratigraphic evolution of Cenozoic inversion structures of the western Flores Sea, Indonesia.

This project was conducted by a management and interpretation team assembled by Gaffney, Cline and Associates, Inc. (GCA) specifically for the project. The project management, data integration and final documentation responsibilities were handled by Tarek Ghazi of GCA, Houston (tghazi@gaffney-cline.com). Seismic data loading and interpretation were



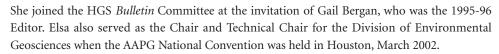
performed by Pete Emmet. Structural analysis was performed by Bob Hickman of Structural Solutions, Sugar Land (rghickman@earthlink.net). Well log analysis and composite log creation were performed by Glenn Granata of Granata Geological Consulting, Houston (gwgranata@sbcglobal.net). Thermal maturation modeling was performed by Angel Callejon of Platte River Associates, Inc., Houston (a.callejon@platte.com). Velocity modeling and depth conversion were performed by Maurice Slot of In-Depth Solutions, Oklahoma City (maurice@in-depthsolutions.com).

Vounteer of the Month: Elsa Kapitan-White

Elsa Kapitan-White is the November recipient of Volunteer of the Month Award. Elsa has been a leading member of the Bulletin Editorial Board since 1995 and is currently an Associate Editor of the HGS *Bulletin*.

Elsa reviews seemingly every word that goes into the *Bulletin* and always finds things that need to be corrected or at least questioned. As she goes through the articles she often makes suggestions to the Editor for key parts of the article that can be highlighted in the "pull quote" that appears in every article to attract the reader's interest. She does all this typically in less than one day.

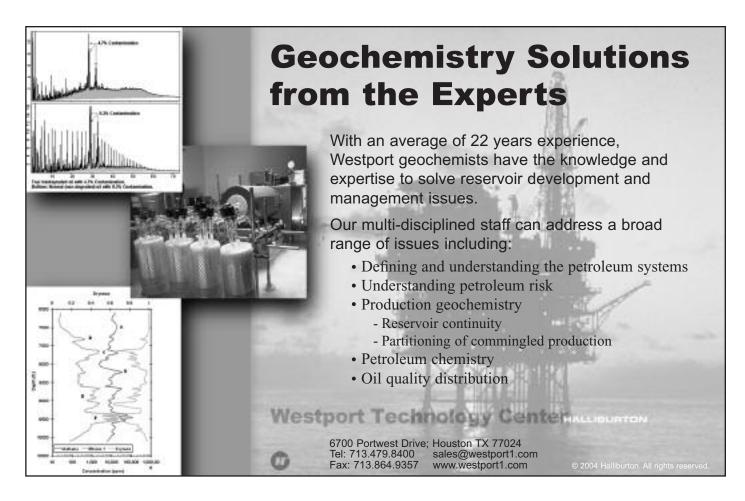
Elsa received a BS in geology from Centenary College in Shreveport, LA, and an MS in geology at Texas A&M University. She became an editor while working at the Ocean Drilling Program in College Station, Texas. She has since been a technical editor for numerous publications including journals and books.

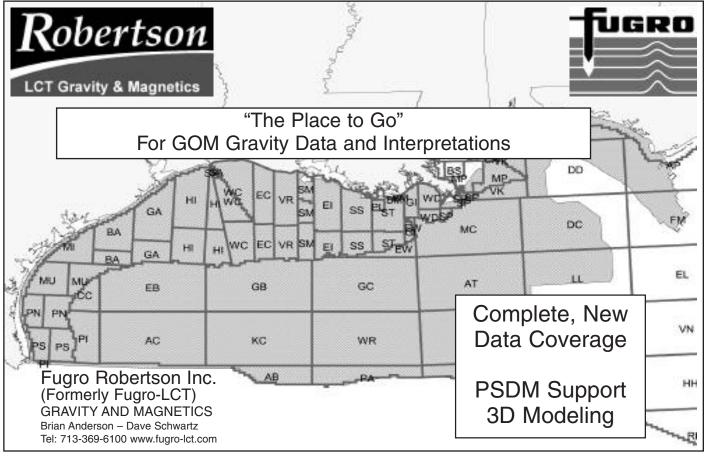




The HGS is fortunate to have had Elsa Kapitan-White as a devoted volunteer for the past nine years. Her professional attention to detail has made a profound impact on the quality of the *Bulletin*. She has provided an enormous assistance to the many HGS *Bulletin* editors and the Society is most grateful for her contribution.

Elsa is a Technical Editor for Schlumberger Oilfield Communications - Marketing.





PESGB & HGS Africa Symposium—Another Success.

by Al Danforth, co-chair HGS International Group



From left to right: Mike Larkin, Duncan MacGregor, Steve Henry, Ian Poyntz, Ray Bate, Al Dansforth and Valerie Clure.

The 3rd PESGB/HGS International Conference on African E&P "Africa: The Continent of Challenge and Opportunity" held at the QE2 Conference Centre, London, September 7–8, was a great success. Well attended, there were nearly 400 people at the two-day program of talks, posters and vendor exhibits. The QE2 conference center is an excellent venue, conveniently located in central London near Westminster Abbey and not far from Victoria Station.

The PESGB Committee consisting of Ray Bate, Duncan MacGregor, Mike Lakin and Valerie Clure, organized an excellent program covering the currently hot and emerging plays of Africa. HGS supported the event with efforts by Ian Poyntz, Steve Henry and Al Danforth. Many HGS members attended, either to present talks or posters, as vendors or to take advantage of seeing the latest on emerging plays.

The highlight for me was hearing Dr. Kevin Burke discuss "New Perspectives on African Tectonics and Petroleum Systems of the past 200 MY." Kevin's 75th birthday will be celebrated this month at UH with a long weekend of presentations by his former students, capped by the Sheriff Lecture on Monday November 15, showcasing posters on current students' research, programs of the UH Geosciences Department, and a lecture by Dr. Celal

Sengor on the Geology of the Middle East," (see pages 20–21).

Of particular interest at the London meeting were two talks by ChevronTexaco on the company's core areas. Mike Roberts gave an excellent review of "Petroleum System of the Eastern Deepwater Niger Delta" and Mark Smithard presented "Deepwater Exploration Block 14, Offshore Cabinda, Angola," which provided a review of the history of exploration and discovery of the several new fields and the evolution of the technology that enabled recognition of the key parameters for mapping reservoir and oil and gas accumulations. These talks were presented at this conference for the first time, another indication that this annual event has become a key venue for exchanging ideas on exploration in Africa.

The conference has become an annual event that alternates between London and Houston, organized jointly by the Africa Special Interest Group of the Petroleum Exploration Society of Great Britain (PESGB) and the International Explorationists Group of HGS. The event was originally held every two years in London until 2002 when HGS helped to organize the first joint event. In 2003 the conference drew a large crowd in Houston and the momentum continued this year in London. HGS will again host the event in Houston in 2005.



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PUBLICATIONS

- · Conference program with abstracts
- Post-conference SEPM Special Publication
- Visit the official Conference Website beginning March 1, 2004 at www.sepm.org/microfossils2005.htm
- Call for abstracts: April 1 October 14, 2004 via the Website
- Registration begins September 6, 2004 via the website.

Direct all inquiries by e-mail to Thomas Demchuk (Thomas.D.Demchuk@conocophillips.com)

Microfossil images courtesy of The Natural History Museum (London), Mitch Covington, and Gulf Coast Section SEPM

Controlled Source Electro-Magnetics for Hydrocarbon Exploration

by Dave Peace and Dave Meaux, AOA Geophysics,
Mike Johnson, Spectrum EIT
Alan Taylor, AT Energy

CSEM - Whats All the Excitement About??

The controlled source electromagnetic (CSEM) method may be the most significant new technology for oil and gas exploration

since the development of 3-D seismic 20 years ago. The promise for the technology lies in its ability to differentiate resistive, potentially oil-bearing intervals from surrounding, more conductive water-bearing units. The principal is the same as that used in well logging devices to identify hydrocarbon zones in well bores. The technique is not new but the capability to resolve relatively thin resistive intervals in the depth domain offers new promise to lower risk through direct hydrocarbon indicators in conjunction with modern seismic methods.

With marine controlled source electromagnetcs (CSEM) now available and proved in principle, oil companies can use rock property data from well logging in appraisal, production and exploration to better understand and delineate the hydrocarbon-saturated reservoir section to which CSEM is most sensitive.

EM Techniques in General—A Brief Introduction

Electromagnetic techniques for oil and gas exploration have been used for many years. These methods include magneto-tellurics (MT), marine magneto-tellurics (MMT) and, during the last few years, CSEM.

Conventional electromagnetic methods have provided practical

solutions over past decades to difficult geological problems for which seismic methods proved ineffective. Examples of these situations include sub-volcanic and sub-salt plays. MT-MMT

identifies contrasting rock layers by measuring their electrical properties. Naturally occurring electric fields are measured as they pass through areas of interest. Measurements are related to the rock property response to the resisitivity and, by extension, to the porosity of the reservoir intervals. The value of MT-MMT methods is that they provide an independent measure of rock resisitivity without having to drill a well.

MT methods determine average formation resisitivity to depths up to 10 kilometers in a range of approximately 5% to 10% of depth

down to a minimum resolution of about 250 to 500 meters of depth or thickness. These techniques are generally considered to be broad, regional reconnaissance tools rather than accurate tools for prospect definition. Figure 1 shows a typical MMT profile across an area in the West of Shetlands-Faeroe Islands region in northwestern Europe.

Controlled Source Electro-Magnetics continued on page 32

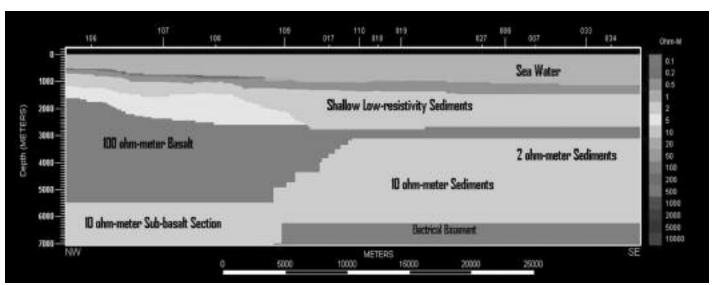


Figure 1 - Example MMT section

Controlled Source Electro-Magnetics continued from page 31

The new CSEM method, although superficially similar to MT, is different and uses an artificial electrical dipole energy source instead of recording passive earth energy. This improves the resolution of the method by about an order of magnitude and permits the identification of thin, high-value resistors in a background matrix of low-resistivity conductor rock down to tens of meters rather than the hundreds of meters typical of passive MT-MMT resolution. With offset information from, for example, a nearby discovery well, the CSEM method can identify a target hydrocarbon-bearing reservoir rock in a structure before it is drilled.

When properly applied, the CSEM method is proving valuable in reducing risk for exploration, appraisal and development projects. It is applicable to a variety of geological targets in water depths of 500 to 3,000 meters or more. Its use is now being extended into exploration evaluation drilling to help make decisions for new offshore license bidding and wildcat exploration well drilling. In the future it is anticipated that CSEM will also be suitable for reservoir monitoring purposes.

Since the method was first used some 3 years ago, at least 150 prospects have been evaluated with CSEM on five continents and several companies are currently conducting long-term project work using the technique.

A Brief History of CSEM

At the start of the 21st century, the use of CSEM expanded from

onshore mining exploration into new applications for hydrocarbon exploration, initially in deep water (500 m or more) and, more recently, in shallower water (less than 500 m).

The basic idea behind the use of CSEM for hydrocarbons is to identify resistive layers in an otherwise conductive environment. The fundamental equipment required to run a CSEM survey consists of seafloor EM receivers and an electric dipole transmitter. The current hydrocarbon exploration equipment has been adapted from equipment developed for other academic purposes.

Charlie Cox, Professor of Geophysics at Scripps Institution of Oceanography, initiated and conducted the original academic research and developed early marine EM equipment some 25 years ago. The main focus of his work was in the field of crustal and deep ocean trench studies. Cox's work was continued by Steve Constable, currently Professor of Geophysics at Scripps Institution of Oceanography. Constable was partly assisted by Lucy McGregor of Southampton University. Due to funding considerations, the two institutions joined forces with Scripps concentrating on receiver design and Southampton on the source.

In 1994 a marine electromagnetic consortium was created at Scripps and funded through industry participation by a dozen or more major oil companies. This consortium adapted and extended passive land MT methods into a deepwater marine MT tool. Marine MT became a fully commercial technology in the mid 1990s and many MMT surveys have subsequently been carried out around the world in difficult seismic areas.

By 2000, Statoil and a major U.S. oil company (MUOC for short) were evaluating the CSEM method and its application in oil and gas exploration. Statoil had the first new CSEM survey performed offshore Angola, West Africa. The survey used existing Scripps receivers and Southampton's EM source and, although the data recorded were of relatively low resolution compared with the quality of data now being recorded 3.5 years later (10-13 against 10-15 today), the survey was a technical success. This effort proved that the CSEM method could be used for commercial oil exploration. Shortly after this first survey, several other CSEM surveys and cruises using

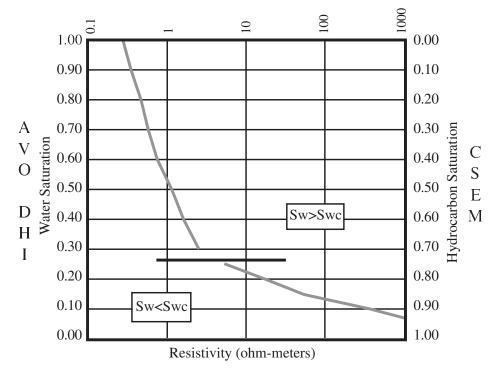


Figure 2 – Graph of resistivity v water saturation

the same equipment were conducted by Statoil offshore Norway and by the MUOC off West Africa. CSEM was effectively proved and adapted to deep water oil exploration purposes by late 2001.

Since then several major oil companies have invested significantly in appraisal and exploration application in this new technology and three service companies are now actively using and developing the technique in a variety of basins around the world. It is estimated that at least 150 prospects have been evaluated using the CSEM method to date. Unfortunately most of the results are currently confidential because of obvious commercial reasons, but industry newsletters have reported an interesting variety of success rates claimed.

How Does It Work, What Does It Measure? Hydrocarbon as a Resistor

With marine CSEM now available and proved in principle, oil companies can use rock property data from well logging in appraisal, production and exploration to better understand and delineate the hydrocarbon-saturated reservoir section to which CSEM is most sensitive. High-saturation hydrocarbon reservoirs are typically significantly more resistive than the surrounding sedimentary sections.

As the graph in Figure 2 demonstrates, the resistivity of a reservoir increases as salt water in the pores is replaced by hydrocarbons (the bulk resistivity of seawater is approximately

Model Response, Freq: 0.2512 Hz

10⁻¹⁰
10⁻¹²
10⁻¹⁴
10⁻¹⁸
10⁻¹⁸
10⁻¹⁸
10⁻¹⁸
10⁻¹⁸
10⁻¹⁸
10⁻¹⁸
10⁻¹⁹
0 5000 10000 15000
Transmitter Receiver Range

Figure 3 - CSEM Response from 200 meters for 50 Ohm-m target

November 2004

0.3 ohm-m). The result is not linear and has different formulas applying on either side of a saturation point of 75% hydrocarbons (Keller and Frischknecht, 1966). Up to the 75% saturation point there is little or no resistivity contrast with surrounding materials.

However, once the hydrocarbon saturation passes the critical 75% point, the overall resistivity rises dramatically, quickly reaching values of 50 to 100 ohm-m. Sub-sea background matrix conductor resistivities are usually in a range between of 0.5 to 5 ohm-m with 1 ohm-m a common value. Thus there is a large difference in resistivity between the low-resistivity conductor matrix and the high-resistivity hydrocarbon-saturated reservoir section.

This resistivity difference is what CSEM measures. Thus CSEM is an excellent discriminator between high-hydrocarbon-saturation economic reservoirs and low-hydrocarbon-saturation non-tp low-economic reservoirs.

Figure 3 shows a plot of receiver-source offset versus electrical signal response. This assumes a target 200 meters thick with a resistivity value of 50 ohm-m at a depth of 2400 meters below seabed in a water depth of 1500 meters. The red curve shows the electrical response to the background matrix conductor and the blue curve shows the significant alteration to the response caused by the resistive target. When normalized this model response corresponds to a signal change of over 70% and would

represent an excellent CSEM target. The maximum response is at an offset of about 89 kilometers and with a system response level capable of measuring signals at 10 to 15 ohm-m, which is today's cutting edge.

Low-resistivity, non-economic reservoirs are generally not resistive enough to provide sufficient contrast with the host matrix rock material and are thus more difficult to see than the high-resistivity reservoir that forms a viable economic drilling target.

Finally, and somewhat ironically for a tool apparently favored by many companies, the AVO/DHI response appears at the much lower resistivity, sub-economic reservoir levels as well as the high-saturation, economic levels seen by CSEM.

Controlled Source Electro-Magnetics

continued on page 34

Controlled Source Electro-Magnetics continued from page 33_

One of the motives to develop CSEM was the failure of AVO/DHI to predict low-hydrocarbon-saturation reservoirs. A plot of seismic reflectivity versus hydrocarbon saturation shows a reversed relationship with the most rapid change occurring at much lower hydrocarbon saturations. Thus CSEM is an ideal counterpart to seismic attribute analysis.

Target Edge Sensitivity

The CSEM method is particularly useful for detecting the first few percentage increases in hydrocarbon saturation at the edges of a reservoir. Figure 4 shows a simple 3D model with a highresistivity reservoir in a low-resistivity matrix. Figure 5 shows the CSEM responses for

- · uniformly low resistivity sediments in red
- high-resistivity reservoir in blue (assuming 1D)
- red curve showing the 3D change from one to the other as the edge of the reservoir is crossed.

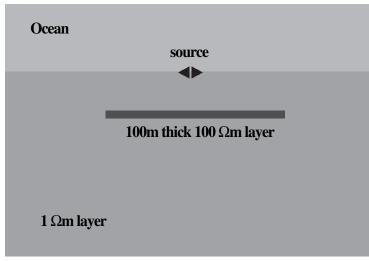


Figure 4 - 3D Model

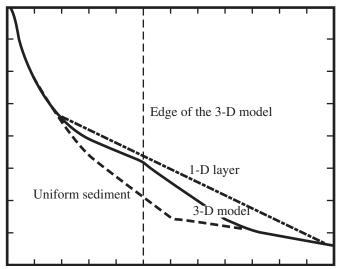


Figure 5 CSEM response showing edge sensitivity

Part of the process of survey design is to take this effect into consideration and design lines to accommodate the best CSEM response for a particular objective.

CSEM Survey Method

The CSEM survey method is relatively straightforward. A series of stand-alone marine EM receivers are dropped to the seafloor in a predetermined fashion. Then an electric dipole transmitter is towed slowly and very close (30 to 50 meters) above the receiver array to provide the input signal. The receivers continually record the source signal as it passes through the earth to and through the target. Depending on the nature of the target (for example, simple bump, complex channels or sub salt) and the survey requirements (size and detail), the survey ship may tow different types of source lines: long, individual lines, a star pattern, or loose or tight grids. Often initial lines are planned in a star pattern, with three or four lines converging at one point

roughly in the center of the target. Receivers are laid out along the line, separated typically by 1 to 3 kilometers, depending on the necessary data density for the particular exploration problem.

Once the appropriate source sail lines have been completed, the receivers are recovered and the CSEM data recorded, checked, processed and evaluated on board, which enables making real-time updates and changes to the acquisition program.

CSEM Survey Design

Survey design is very important to the successful outcome of a project with data density often playing a secondary role to the number and location of lines/stars/grids and receiver positioning. Factors that come into play during the survey design include water depth, target reservoir depth, aerial extent and thickness of target, background resistivity and target reservoir resistivity.

The CSEM method has some limitations in both geometry and instrumentation.

Water depth

All early surveys were done in water depths of at least 500 meters because of the airwave effect (at long offsets the EM wave will travel preferentially up through the water column through the air and back through the water column and will arrive at the receiver before the portion of the wave that travels through the target). Recent experiments carried out in shallower water down to 100 to 300 meters have results quieter than expected but still needing more work to be fully understood.

Target depth

Generally speaking, targets deeper than 150% to 200% of water depth are less detectable because the EM wave at long offsets arrives at the receivers via a route that does not adequately sample geology and because of the previously mentioned airwave effect. At very close offsets the EM wave travels directly from the transmitting dipole to the receiver through only water, again bypassing the geology (see Figure 9).

Target size

The current rule-of-thumb is as follows:

- Targets smaller in size than their depth of burial are hard to see
- Targets the same size as their depth of burial are usually detectable but may be marginal in hard[EKW: What is hard: rocks? complex?] geological situations
- Targets larger than their depth of burial usually make good CSEM targets.

Thus fine tuning of offset vs. burial depth taking into account water depth is a complicated task and requires modeling of the problem, usually in three dimensions.

CSEM Survey Modeling

One of the benefits of CSEM (and MMT surveys) is that the likely CSEM response can be modeled to specific target reservoirs by conducting initial simple 1D models and then more complex 3D models (other methods are also possible: 2D/2.5D/imaging, etc).

Modeling in 1D and 3D generally consists of calculating theoretical voltages of the geological structure both with and without hydrocarbons and showing the ratio of the different calculations. A clean sandstone unit may have a resistivity of 5 ohm-m, whereas an oil-filled sandstone may be as resistive as 50 to 100 ohm-m. Shale units are generally modeled as 1 to- 5 ohm-m depending on their depth. Of course, real data values should be used wherever available.

Basic 1D modeling will show whether a project is technically feasible and may also reveal general survey parameters such as necessary transmitter frequency, important transmitter-receiver offsets, survey equipment capability, system noise requirements and total anticipated anomaly strength. Many reservoirs are large enough to be modeled as infinitely large bodies.

Controlled Source Electro-Magnetics continued on page 36

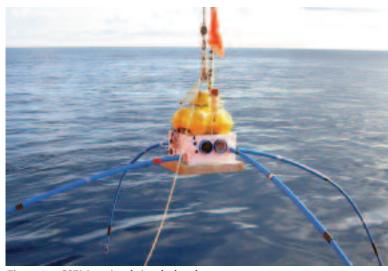


Figure 6 – CSEM receiver being deployed



Figure 7 – CSEM dipole electrical source



Figure 8 - The RV PolarBjorn, a superb CSEM survey vessel used by AOA-AGO



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Figure 10 shows a summary of 1D forward calculations for a suite of frequencies and transmitter-receiver offsets. The data is cut-off at a signal level of 1 _ 10-16, which is generally regarded as the noise floor of a very good CSEM receiver.

In this case, the model is a flat-lying, infinitely large, 100-meterthick body with a resistance of 50 ohm-m buried 1000 meters below the seafloor in 2000 meters of water. Figure 9 indicates that at a transmitter frequency of 1 Hz, the resistive body is easily detectable between 4000 and 6000 meters from the transmitter.

The scale bar at left shows the anomaly strength, with anomalous voltage values of 0 to 0.5 (0% to 50% above background levels). Generally an anomaly of 20% to 25% is considered good

Energy Propagation Modes

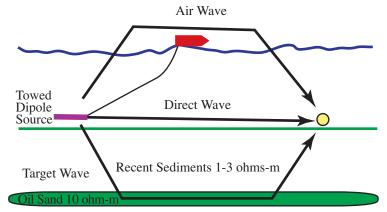


Figure 9 - CSEM Energy Propagation Modes

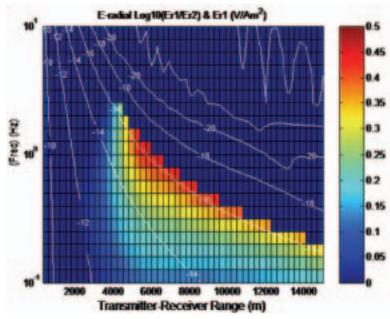


Figure 10 - Summary plot for 1D CSEM modeling

and anything above 30% to 40% is considered excellent. The white lines running across the grid represent the signal strength of the data. At 1 _ 10-22 and 1 _ 10-24 the solution becomes numerically unstable, accounting for the very crooked response.

The transmitted waveform is normally a square wave. If the fundamental frequency chosen was 0.4 Hz, the third and fifth harmonic frequencies, falling at 1.2 Hz and 2.0 Hz, respectively, will also give anomalous results over the resistive body. Choosing the appropriate transmitter frequency is crucial to the success of the project.

With the type of information we can get from the 1D summary plot in Figure 10, a quick analysis of the CSEM target can be made, and we can answer the question, Is the CSEM prospect

> model reasonable in this case? If the answer is yes, then the first simple hurdle has been passed and we can proceed to the more detailed 3D modeling of the prospect.

Example 3D Model

Figures 11 and 12 demonstrate a 3D modeling exercise. The target geology shows 2000 meters of water, 1000 meters of shale at 1 ohm-m and a potential reservoir horizon. Under the reservoir is another 500 meters of mud and an electrical basement of 5 ohmm. In reality many reservoir areas represent a 1D world well enough that this type of modeling acts as a very good approximation.

Figure 11 shows the 3D cross-section equivalent of the 1D structure modeled in Figure 10. The infinite plane in the 1D model has been replaced with a 4-kilometer by 3-kilometer resistive slab with a thickness of 100 meters.

Figure 12 shows the result of the 3D forward model of the case described in Figure 11. The plot is a ratio between the voltages of (a) the 3D model with a hydrocarbon-charged reservoir and (b) the model with a water-filled reservoir. In this case the model indicates a good CSEM target. The 3D modeling program emulates a large number of receiver locations for each transmitter location. Of course, this setup seems intuitively backward. What we have in real life is a limited number of receivers and a large number of transmitter locations. Through the principal of reciprocity, the receiver-transmitter pairs are interchangeable; thus, the voltage measured between one pair is independent of which node is the transmitter

Controlled Source Electro-Magnetics continued on page 38

Controlled Source Electro-Magnetics continued from page 37_

and which node is the receiver. This setup is the equivalent of a receiver located where the TX is indicated and transmitters located at every node on the grid.

Some Example Applications

Bearing in mind that the CSEM method identifies only thin resistors, an appraisal drilling location provides an ideal initial CSEM target and offers the best chance of success.

Typically an initial CSEM target may resemble Figure 13 where we can see a large, simple four-way closed structure outlined

with a smaller offset structure to the right. This target has been interpreted from good 3D seismic and the outline represents the extent of significant AVO/DHI anomalies. A successful discovery well was drilled, followed by another discovery in the offset area. The decision to appraise the structure is in order and the six black dots represent the planned appraisal wells on the structure guided by the seismic and AVO interpretation. Unfortunately the appraisal wells did not result as planned and Figure 14 shows that while the first two wells in the main structure came in according to the prognosis, the others resulted in one low-saturation gas well and two wells with adequate reservoir but no hydrocarbons. Similarly, the offset structure was smaller than expected. Thus, in what is today a reasonable appraisal program, more than one well comes in off-prediction owing to the limits of seismic-AVO interpretation.

The US\$500,000 to \$1 million cost to run a CSEM survey is appropriate considering the cost of two or more appraisal well failures in the absence of the CSEM survey. CSEM in the preceding example situation offers a totally independent reading of reservoir resistivity and areal anomaly extent. The discovery wells provide a direct resistivity calibration between a high-resistivity feature that actually corresponds to a good hydrocarbon reservoir as opposed to some other high-resistivity geological feature such as a sill, salt or tight sands. Well control is critical to achieving early CSEM success in a region. Once the critical correlabetween resistors and hydrocarbon accumulations are made in an appraisal well scenario, the method can be used for exploratory evaluation away from well control.

Figures 15 and 16 show logical extensions away from the CSEM-proven area. Figure 15 demonstrates a situation with adjacent acreage to a proven CSEM target with a CSEM anomaly in Block 2. In similar fashion,

Figure 16 shows two targeted four-way dip closures identified from 2D seisimic where a proven CSEM structure is nearby targeted prospects and with a CSEM anomaly over one or both of them.

Figures 17 below shows a hypothetical example of more challenging conditions for the CSEM method. The figure shows a typical set of thin meandering channels on Block 1, similar to situations in deepwater Nigeria or the Nile delta. Here the CSEM targets are much thinner and more sinuous and thus

Controlled Source Electro-Magnetics continued on page 43

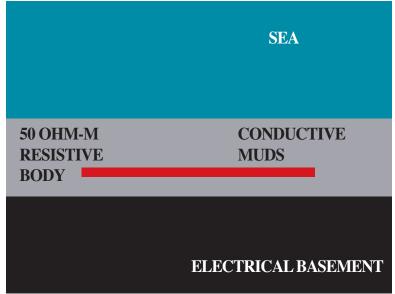


Fig 11 − 3D model cross section

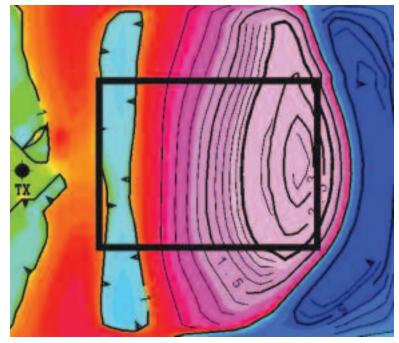


Fig 12 - Map ratio of 3D target response

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14	15 International Explorationists Dinner Meeting R.E. Sheriff Lecture by Celal Cengör (Istanbul Technical University) "The Geology of the Middle East" See page 22	16 GSH Luncheon Meeting See page 25 Northsiders Luncheon Meeting See page 47 Environmental and Engineering Group Dinner Meeting See page 51	17
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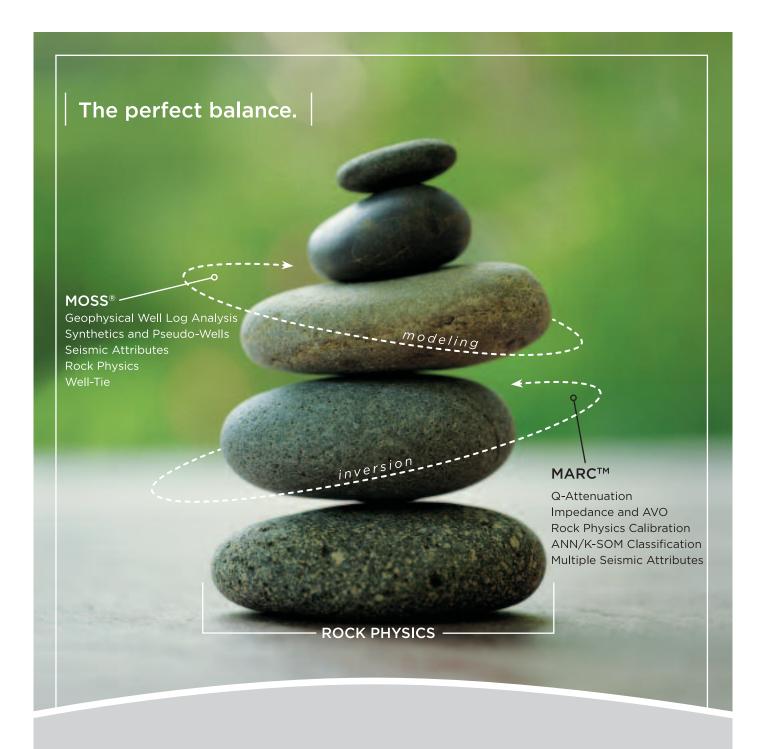
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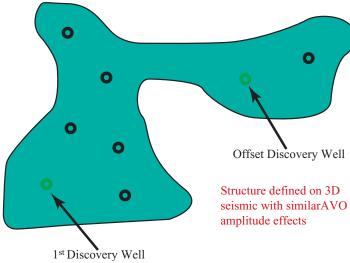


Figure 13 – Pre appraisal drilling

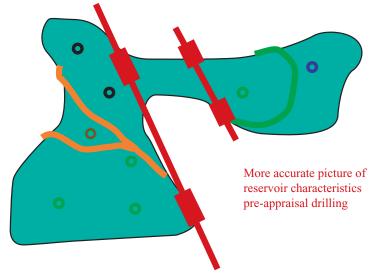
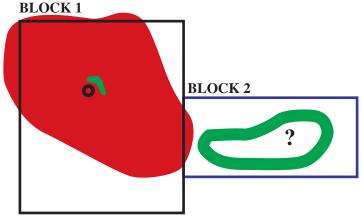


Fig 14 - Post appraisal drilling



Adjacent Acreage...

Does the discovery in your block 1 extend into the structure in adjacent block 2 now available for licensing?

Fig 15 - Adjacent features

more difficult for survey design for CSEM interpretation. Where individual channels will give one type of response, stacked or crossing channels will give a different and perhaps reinforced response that needs more careful interpretation. Similarly the examples in Block 2 show channels running close to each other or in parallel that will probably be harder to see as individual units. The presence of salt is important in many areas because salt is a good resistor and can cause complications in distinguishing salt from target reservoir bodies.

Conclusions

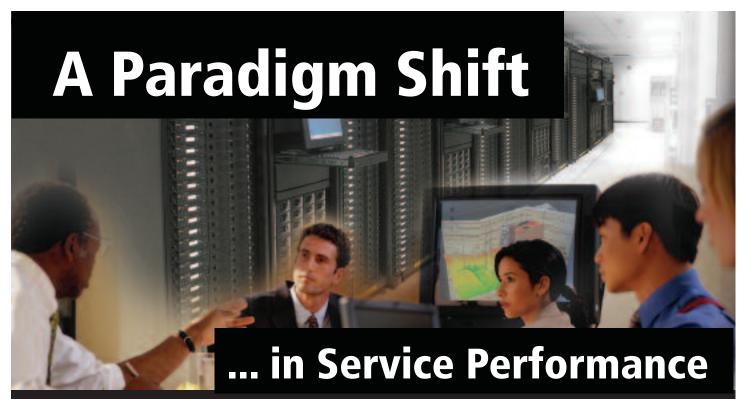
- 1. The SCEM method has proved successful though there are practical, physical limitations to the range of targets that can be resolved by CSEM at present
- 2. The method is proved in water depths of about 500 to 3000 meters and encouraging tests have taken place in shallower water.
- 3. Vertical resolution has been achieved down to tens of meters although at present closely stacked reservoirs tend to be imaged as one. Reservoirs separated by greater thicknesses and with different areal extents are more likely to be correctly imaged.
- 4. To date the method has been used on five continents with more than 150 targets evaluated. While most results are currently confidential, the method is gaining acceptance.
- 5. In spite of the successes thus far the technology is not yet mature and is not a direct hydrocarbon indicator by itself.

Future Developments

Possible future developments include

- Upgrades to system performance including the use of stronger sources, tuned sources, multiple sources and better receivers (although present-day ones are getting close to known theoretical limits).
- Improved navigation for source and receiver location and towing positions. Typical accuracy at present is about 10 to 15 meters.
- Improvements in 3D modeling techniques and data processing
- Integration of CSEM results into typical workstation environments to make it easier for the average seismic interpreters who do not know much about EM to be

Controlled Source Electro-Magnetics continued on page 44



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Controlled Source Electro-Magnetics continued from page 43_

able to use it effectively and integrate it into their everyday work-

- New acquisition techniques with data sent directly to the ship in similar fashion to seismic data, rather than the present standalone, individual recording unit methods
- Greater understanding and acceptance of EM techniques

Acknowledgements

While this paper has several authors from AOA-AGO, I would like to acknowledge the efforts of a number of very skilled, clever and persistent people including

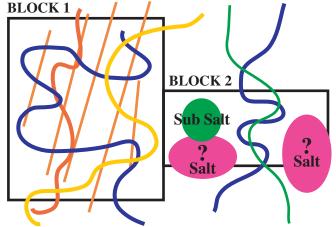
AOA-AGO: Arnold Orange, Ransom Reddig, James Schofield, Tracy Campbell and Lionel Fray

Scripps: Charlie Cox, Steve Constable, Jacques Lemire, Jim Behrens and Kerry Key

BLOCK 1 BLOCK 2

Rank Exploration Applications Limited 2d Seismic only – Simple geology

Figure 16 Using 2D not 3D



Rank Exploration Applications - More difficult Geology

Figure 17 More complicated CSEM targets

Southampton: Lucy McGregor, Martin Sinha and Jennie Rust

Statoil: Terje Eidesmo, Svein Ellingsrud and other Statoil colleagues

MUOC: In cognito at present

Biographical Sketch

Dave is an experienced geologist and geophysicist with more than 30 years experience mainly for new ventures evaluation. He has a degree in geology and earth sciences and is the European representative for AOA Geophysics based in the UK.

He started with Esso Exploration in the UK, working on new venture projects in NW Africa in Offshore Morrocco, Senegal and Portuguese Guinea. Later with Agip he carried out many evaluations in the Mediterranean for Agip and partners.

In the late 1980's he joined Texaco in their European New Venture group looking at new opportunities throughout Europe, and later started up new operations in Italy as their Exploration Manager based in Rome (a tough assignment!), where he first started looking at the Eastern Med region.

Since leaving Texaco 4 years ago, the East Mediterranean is an ongoing evaluation project that is getting a lot of companies excited about the potential of the region.

Co Authors

Dave Meaux from AOA Geophysics here in Houston who carried out a regional Gravity-Mag study of the Eastern Med for the evaluation project

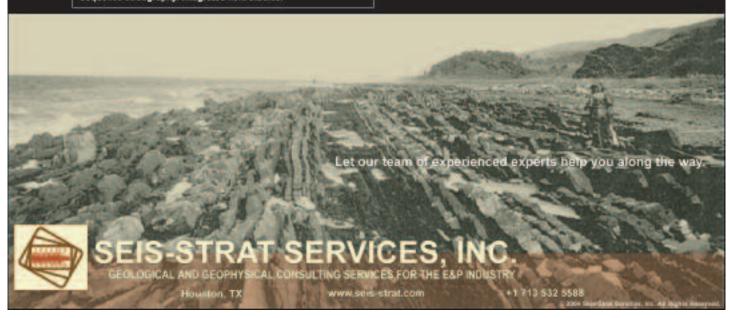
Mike Johnson Director of Spectrum EIT in the UK who have recorded a lot of new seismic data in the East Med region on which the project is based.

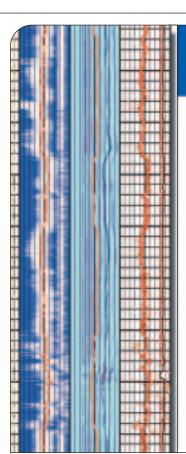
Alan Taylor of AT Energy who is closely involved with helping bring the first Lebanese Licence Round to fruition

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by Dave Peace and Dave Meaux AOA Geophysics Mike Johnson Spectrum EIT Alan Taylor AT Energy

Controlled Source Electro-Magnetics for Hydrocarbon Exploration

ahead of the drill bit.

Electro-Magnetic or EM techniques and surveys have been Earound for decades now and most explorationists probably have had some limited exposure to one or more of them. Such EM techniques include land magneto-tellurics (MT), audio MT, marine MT and now controlled source EM or CSEM for short. (see related article page 31)

EM methods help the explorationist by measuring the flow of electrical energy passing through the earth, which allows us to identify conductor and resistor rocks. MT and marine MT have been successful commercial exploration tools for some time now and are very good for answering regional broad brush geological questions. They work by measuring the passive, or

naturally occurring, energy in the Earth, and are very good in areas where seismic fails or is ambiguous, areas such as sub-salt, sub-volcanics and sub-carbonates i.e., poor seismic regions.

However, the new offshore EM technique of CSEM is rather different. Although it uses similar receiver technology similar to that of the passive MMT method, it combines them with an active electrical dipole EM source. This gives CSEM the ability to image much thinner resistors down to some tens of meters rather than the hundreds of meters of passive EM. Thus CSEM offers an entirely new set of applications for EM. With appropriate offset information the method is now being used to predict hydrocarbon fluid content ahead of the drill bit.

For many of us, 3D seismic and good amplitude/DHI/AVO control have been our watchwords over the last 5–10 years. However, whereas we can often see a DHI or AVO anomaly for a wide range of hydrocarbon saturations from maybe 5–10% upward, CSEM appears more sensitive to the higher hydrocarbon saturations, say from 65% to +90%. Hence CSEM can be a valuable tool where AVO and DHIs are not telling us all we need to know.

This makes it a very useful tool for appraisal and development projects. As CSEM confidence is gained in a given geological area, then it can be applied more comfortably to look at exploration projects in the same basin.

with appropriate offset
information the method is
now being used to predict
hydrocarbon fluid content

last 3 years a physical tool is changing appraisal, dev
This paper ar can help you

CSEM has been effectively proved over the last 3 years as an exceptional new geophysical tool that can change and already is changing the way we all work in appraisal, development and exploration.

This paper and talk describes how CSEM can help your exploration, appraisal and development work be more successful, it will show details of the method and equipment, practical applications of the

method and examples of the type geological areas where it can be used, and should help the everyday explorationist understand where and how CSEM can help everyday appraisal, development and exploration activities.

Biographical Sketch

DAVE is an experienced geologist and geophysicist with more than 30 years experience mainly for new ventures evaluation. He has a degree in geology and earth sciences and is the European representative for AOA Geophysics based in the UK.

He started with Esso Exploration in the UK, working on new ven-

ture projects in northwest Africa in offshore Morrocco, Senegal and Portuguese Guinea. Later with Agip he carried out many evaluations in the Mediterranean for Agip and partners.

Northsiders continued on page 49





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Northsiders continued from page 47

In the late 1980s he joined Texaco in its European New Venture group looking at new opportunities throughout Europe, and later started up new operations in Italy as the Exploration Manager based in Rome (a tough assignment!), where he first started looking at the Eastern Mediterrean region.

Since Dave left Texaco 4 years ago, the East Mediterranean is an ongoing evaluation project that is getting a lot of companies excited about the potential of the region.

DAVE MEAUX from AOA Geophysics here in Houston carried out a regional gravity-mag study of the Eastern Mediterranean for the evaluation project.

MIKE JOHNSON Director of Spectrum EIT in the UK, recorded a lot of new seismic data in the East Mediterranean region on which the project is based.

ALAN TAYLOR of AT Energy is closely involved with helping bring the first Lebanese License Round to fruition.

Poster Sessions for November 16 Northsiders Luncheon Meeting at Anadarko

Along Strike Variations in Thrust Fault Termination: Insights

from new seismic data across the Darby (Hogsback) Thrust, Uinta County, Wyoming

Kevin Martindale, Scott Young, Van Mount, John Byrd and Tom Bergstresser, Anadarko Petroleum Corporation, The Woodlands

Poster Discussion: Geometry and Kinematics of Basement-Involved Wedge Structures: Example from the Southern Margin of the Hanna Basin, WY

Van S. Mount, Garett Hodne, Thomas Griffith, John Byrd, Anadarko Petroleum Corporation, The Woodlands

Carbonate Deformation: Outcrop Analogs for Fractured Reservoirs (A Field Trip examining fractured Cretaceous carbonates in the Texas Hill Country)

Lans Taylor and Jim Grant, Anadarko Petroleum Corporation, The Woodlands

Modeling Dual Porosity Carbonate Reservoirs: Integration of Core, Well Log, 3D Seismic and Well Bore Image Data for Stochastic Modeling of Fault and Fracture Systems, Al Rayyan Field, Qatar"

Julie Kupecz & Rick Svor, Anadarko Petroleum Corporation, The Woodlands



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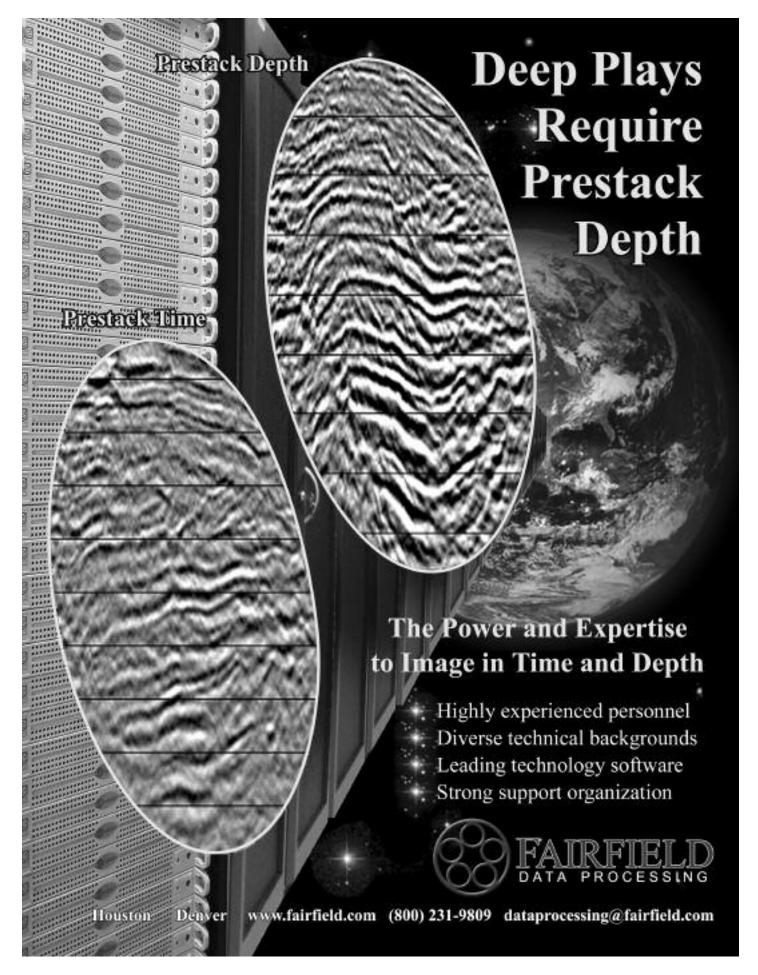
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Dinner Meeting

by **Steven P. Musick**, Leader Groundwater Planning and Assessment Team Technical Analysis Division Texas Commission on Environmental Quality Austin, TX

Overview of Groundwater Management in Texas

Since 1904, Texas courts have applied the English common law doctrine of the "rule of capture" to determine liability for damages relating to the withdrawal and use of groundwater. This

doctrine and its interpretation through case law essentially provides that groundwater, once it has been captured by a well and delivered to the surface, belongs to the landowner. Over the years, the courts have placed only a few limitations on the rule of capture. These limitations include drilling a well on someone else's property ("trespass"), wasting the water, pumping water for the sole purpose of injuring an adjoin-

ing landowner ("malicious or wanton conduct") and causing land subsidence on adjoining land from negligent over-pumping.

In 1917, Texans amended the Texas Constitution with the passage of the "Conservation Amendment." This action established that conservation, preservation and development of the state's natural resources are duties of the state and that the Legislature shall enact all laws appropriate for this purpose. In all subsequent groundwater decisions, the Texas Supreme Court has reiterated the Legislature's broad power to regulate groundwater use, even within the common-law framework established by the rule of capture.

In 1949, the Texas Legislature first authorized the creation of groundwater conservation districts (GCDs) and the designation of underground reservoirs for the purpose of groundwater management. State law pertaining to the creation of GCDs and the management of groundwater resources has been amended many times over the past 55 years, most recently in 1997 and 2001. With the passage of Senate Bill 1 in 1997, the Legislature expressly recognized that GCDs are the state's preferred method of groundwater management, clarified and strengthened district authorities, and streamlined the priority groundwater management area (PGMA) designation process. The passage of Senate

Bill 2 in 2001 continued the trend to further strengthen and clarify GCD groundwater management authority and define necessary state agency actions and roles.

Groundwater, once it has been captured by a well and delivered to the surface, [essentiallly] belongs to the landowner.

State law requires GCDs to: register permit, and maintain records of water wells; develop and adopt a comprehensive groundwater management plan; andadopt rules necessary to implement the management plan. The Texas Water Development Board (TWDB) provides technical and administrative support to GCDs in the development of their groundwater management plans and is

responsible for the administrative review and certification of GCD management plans. The State Auditor's Office (SAO) is required to review GCD activities to determine if a district is actively engaged in achieving the objectives of its management plan. The Texas Commission on Environmental Quality (TCEQ) is responsible for enforcing management plan requirements if a GCD fails to adopt and submit a plan for certification, fails to receive TWDB certification of its plan or is determined to be not operational by the SAO.

In addition, the TCEQ is responsible for delineating and designating PGMAs, creating GCDs in response to landowner petitions or through the PGMA process, and providing technical assistance to districts when requested. The TWDB performs PGMA water-availability and water-use studies at the request of the TCEQ, and is responsible for the delineation and designation of groundwater management areas. TWDB also provides financial assistance to GCDs for activities including groundwater data collection, development and implementation of long-term management plans, and participation in regional water-planning efforts. The Texas Parks and Wildlife Department also conducts natural resource evaluations when requested by the TCEQ in the PGMA process and provides follow-up assistance as needed. The Texas Department of Agriculture **Environmental** continued on page 53

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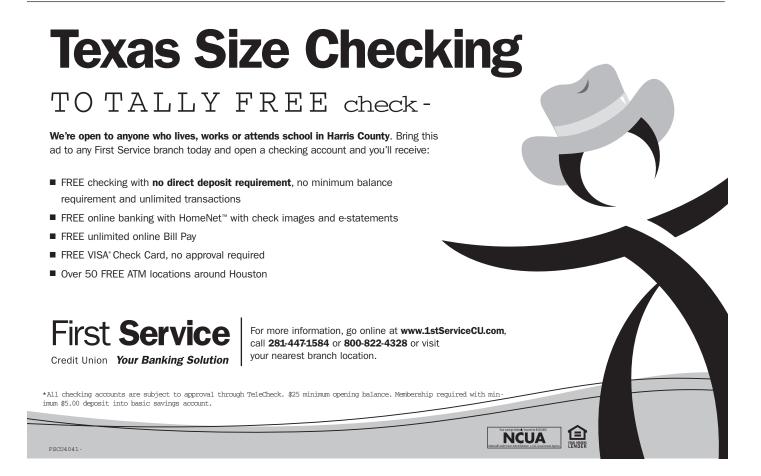
Environmental and Engineering continued from page 51

may also provide input to the TCEQ for the purposes of PGMA evaluation. The Texas Cooperative Extension is charged with conducting educational programs in designated PGMAs on the area's water resources and the management options available for these resources.

Biographical sketch

STEVE MUSICK received his Bachelor's degree in geological sciences from the University of Texas at Austin in 1976. He began his professional career as an assistant geologist with the U.S. Geological Survey in 1977. He has been with the Texas Commission on Environmental Quality and its predecessor agencies since 1981. Steve worked initially in the Underground Injection Control program with responsibilities for permitting, enforcement and special projects. Since 1986 he has worked in the areas of groundwater management, groundwater protection, and program development. His work included priority groundwater management area (PGMA) studies and water quality protection and water supply issues for the Edwards aquifer. Steve is the Leader of the Groundwater Planning and Assessment Team in the Technical Analysis Division. His current responsibilities include program development and implementation for the state's groundwater protection program, support for the Texas Groundwater Protection Committee, development of the state's management plan for agricultural chemicals in groundwater and implementation of the Priority Groundwater Management Area Program under Senate Bill 1 (75th Legislature) and Senate Bill 2 (77th Legislature). smusick@tceq.state.tx.us





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Luncheon Meeting

by Allen Howard

Humble, Texas

Nu-Tech Energy Alliance

Social 11:15 a.m. · Luncheon 11:45 a.m. Cost: \$30 Pre-registered (see deadline below) members and affiliates \$35 Non-members, guests and walk-ups. Make your reservations by telephone, fax, or e-mail to

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HGS does not take reservations for SIPES Luncheon meetings

Determining a True Textural Permeability by Modeling Key NMR Outputs Using Only Conventional Log Data

Tn the ongoing research and development process to enhance $oldsymbol{1}$ formation evaluation, establishing a relationship to permeability has always been a key goal. In the early 1990's the commercialization of nuclear magnetic resonance (NMR) logging in the oil and gas industry provided the first such link through the direct measurement of the fluid volume and the distribution of that fluid in the rock.

This link to permeability set the stage for several refinements in NMR over the last decade, the results of which have dramatically shaped how the industry views bypassed pay. By utilizing conventional log data, textural or pore size changes within the reservoir can be detected and modeled. These models allow companies to take a new look at fields that have not had the benefit of such NMR measurements.

Biographical Sketch

Allen Howard is co-founder and partner of Houston-based NuTech Energy Alliance, which provides proprietary petrophysically-driven technology to the oil and gas industry. With extensive senior management, sales and operations management experience, Howard introduced MRIL technology to global markets. He holds a B.S. in



electrical engineering from Texas Tech University.

Dino Day. November 6. Volunteers Needed!

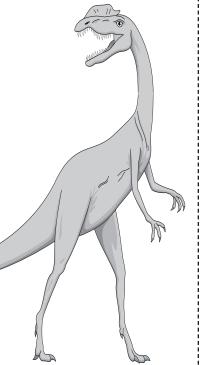
Houston Museum of Natural Science

Help all of Houston celebrate Dipsy's birthday and learn a little geology in the process. Many of our activities will be fossil-oriented and, of course, we'll do our bit on fossil fuels, too.

The HGS staffs the "technical" show-and-tell tables at this very popular family festival. This is an enormous

event and we need all available volunteers. We will also need a few volunteers to help with the logistics of Bob Bakker's talk(s), some mini-classes, etc.

Contact Coordinator Inda Immega (713) 661-3494 immega@swbell.net



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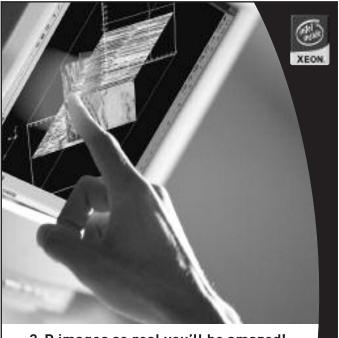
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Call for Candidates to the AAPG House of Delegates

Houston candidates are now needed to run for the office of AAPG Delegate in the election to be held in early 2004.

If you are interested in having a leadership role in the business and future course of AAPG by contributing your ideas and your voice toward AAPG's business agenda, consider running for Delegate. This service role offers opportunities for networking and making a meaningful impact on the continuing efforts of AAPG. If you would enjoy representing your colleagues to AAPG - and representing AAPG to your colleagues - this role is for you.

The House of Delegates is the legislative body of AAPG. Delegates participate in the legislative process during the annual

meeting of the entire House of Delegates at the AAPG Annual Convention. During their three-year term, Houston Delegates meet at monthly luncheons to network, process new member applications, and manage the business issues at hand. The group is fun and energetic and many companies, geoscience roles and practices are represented.

New candidates with fresh ideas and viewpoints are welcome. If you are interested in running, please contact Craig Dingler (cdingler@sprintmail.com 281-930-2394) or Martha Lou Broussard (mlbrou@rice.edu 713-665-4428).

Members on the Move

Jerry Ferguson has joined Yuma Exploration and Production Co. as an exploration geologist. He was previously with Alpine Resources, Inc. He can be reached at 713.968.7068.

Mark H. Leander has joined Fugro Multi Client Services, Inc. as Senior Staff Geophysicist. He was previously a Consulting Geophysicist and had been a geophysicist for Unocal and BP.



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2004 Fall Social Houston Chapter of SIPES

Date: Thursday, November 11, 2004 Time: 6:30 PM. Cocktails (Cash Bar), Complimentary Wine; 7:30 Dinner

Location: The Petroleum Club, Discovery Room

Exploring Mars — Robots and Humans; Geology and Biology (?)

Speaker: Dr. Carlton C. Allen NASA Johnson Space Center

How would you conduct a program of geological field work on the planet Mars? While our generation of scientists pursue this goal with robots, our sub-teen neighbor, son, daughter, or grandchild may walk on the red planet within our lifetime. How do we go about exploring Mars?

Our featured speaker, Dr. Carlton C. Allen, will give us his insights on the subject, drawing on his experience in and contributions to methods of extraterrestrial exploration. Dr. Allen will present us with an overview and update of Mars geology, the observations we're making from the spacecraft currently operating on the planet's surface, and from others in Mars orbit. He'll also discuss missions planned for the next decade, and the continuing controversy over possible evidence of life.

Mail this 2004 SIPES Social Registration form and a check (payable to SIPES Houston Chapter) to SIPES c/o BK Buongiorno, 1001 McKinney, Suite 801, Houston, TX 77002. Payment must be received no later than November 5, 2004. Entrée choices: (A) Tournedos Benjamin – Two (4 oz) Stuffed & Topped with Mushrooms-Madeira Sauce; (B) Snapper Ponchartrain-Crabmeat, Shrimp and Oysters with Wine Sauce; (C) Vegetarian Plate

Name	Entree Choice	SIPES Member	Telephone/email
	_ (A, B, C)	(Y or N)	
	_ (A, B, C)	(Y or N)	
	_ (A, B, C)	(Y or N)	
Number of persons attendingx \$50) per person =		Total payment due.

HESS Building • 5430 Westheimer, Houston Social 5:30 p.m.

Cost: \$25

Call or email Dale Bird, by noon Tuesday, November 16 281-463-3816 or dale@birdgeo.com

Dinner Meeting

by **Bob Lo**, BHL Earth Sciences **Petr Kuzmin**, Geotech Ltd.

AFMAG: Geotech's New Airborne Audio Frequency Electromagnetic (EM) System



Figure 1. AFMAG unit interior showing the three orthogonal coils, damping mechanism and suspension.

An airborne AFMAG (Audio Frequency electroMAGnetic) system has been developed and successfully tested by Geotech Ltd. The system uses proprietary and patent-pending technology to damp vibrations and de-rotate the electromagnetic (EM) fields respectively. Three orthogonal coils are used to measure the horizontal and vertical components of these fields (Figure 1).

The EM source energy is the Earth's natural time-varying magnetic field, in the audio frequency range of 30 to 6,000 Hz. This method is quite similar to MT or magnetotelluric methods; however, electric fields are not measured by AFMAG. Natural EM sources are nearly homogeneous, which allows deep penetration. Typical penetration depths, observed from the system tests, range from zero to hundreds of meters for small test bodies that were hundreds of meters in size. Theoretically, the AFMAG system is capable of detecting large conductive features such as salt water

trapped in anticlines as deep as 10 km. Like all airborne systems, this data can be rapidly acquired over large areas, over rugged terrain and over areas where access is difficult.

The development of AFMAG was partially funded by the Ontario Minerals Exploration Technologies (OMET) program and two mining companies. Therefore initial tests, completed in August of 2004, have focused on minerals exploration applications. Airborne field tests are very encouraging and in addition to mineral targets, some large conductive features due to conductive sedimentary units have been mapped (Figure 2).

Geotech is now completing its OMET project report and is seeking suitable petroleum plays for airborne tests to define airborne

GSH Potential Fields continued on page 61



Figure 2 - Geotech's airborne AFMAG system in field trials in Sudbury, Ontario with the principal designer, Dr. Petr Kuzmin.



HGS Welcomes New Members

Effective August 2004

ACTIVE MEMBERS Susan Lockhart ASSOCIATE MEMBERS

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Ron Casso Peter McCarty Kelly Shea

Irfan Cibaj Bruce McPherson John Vance

Jerry Drake Thomas Miles

Fred DuPont Alan Morgan STUDENT MEMBER

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GSH Potential Fields continued from page 59

AFMAG's performance in petroleum exploration. In addition, current development is now focusing on using the field data collected by the base station to monitor the natural EM fields and perhaps to provide a remote reference for signal processing of the EM fields. The base station data will also be assessed to determine if the number of airborne coils can be reduced to just the vertical dipole receiver coil, providing the possibility of installation onto a fixed-wing platform.

An introduction to the AFMAG method, the system, and its deployment will be presented. Results from the Sudbury test area, characterized by deep conductive targets including conductive sedimentary rocks, as well as several numerical models of typical petroleum target geometries, will also be presented.

Biographical Sketch

Bob Lo graduated from the University of Toronto with a Bachelors of Applied Science (geophysics) in 1981 and with a Masters of Science degree in physics in 1986. Bob also obtained an MBA from Laurentian University in 1994. Bob has held positions of Senior Geophysicist for Inco Ltd., Chief Geophysicist for Aerodat Ltd. and Vice President of Scintrex Ltd. Bob



currently works as an industry consultant, specializing in advanced geophysical interpretations of electromagnetic data for clients around the world. Bob is active in the geophysical community, having served as KEGS President, reviewing expanded abstracts and chairing sessions at various SEG Annual Meetings. Bob is a Professional Engineer and holder of a Certificate of Authorization from the Professional Engineers, Ontario.

Sailing Up the NIIe River continued from page 15_

As he travels further up the river, Herodotus describes the effects of the Nile rapids on his travel itinerary:

"From the City of Elephantine as one goes up the rive there is a country which slopes steeply; so that here one must attach ropes to the vessel on both sides, as one fastens an ox, and so make one's way onward; and if the rope breaks, the vessel is gone at once, carried away by the violence of the stream. Through this country it is a voyage of about four days in length, and in this part the Nile is winding like the River Maiander.. Then you will come to a level plain, in which the Nile flows round an island named Tachompso.. Adjoining this island there is a great lake, round which dwell Ethiopian nomad tribes; and when you have sailed through this you will come to the Nile Stream again, which flows into the lake. After this you will disembark and make a journey by land for forty days; for in the Nile sharp rocks stand forth out of the water, and there are many reefs..

Among the many wild animals Herodotus cites, he gives a particularly lovely description of the Nile Crocodile:

"Of the crocodile the nature is as follows: During the four most wintry month this creature eats nothing: she has four feet and is an animal belonging to the land and the water both; for she produces and hatches eggs on the land, and the most part of the day she remains upon dry land, but the whole of the night in the river, for the water in truth is warmer than the unclouded open air and the dew. Of all the mortal creatures of which we have knowledge this grows to the greatest bulk from the smallest beginning; for the eggs which she produces are not much larger than those of geese and the newly-hatched young one is in proportion to the egg, but as he grows he becomes as much as seventeen cubits long and sometimes yet larger. He has eyes like those of a pig and teeth large and tusky, in proportion to the size of his body; but unlike all other beasts he grows no tongue, neither does he move his lower jaw, but brings the upper toward the lower, being in this too unlikely of all other beasts..."

Here ends my summary of Herodotus' observations on the Nile River. His book is full of other interesting notes and stories. He writes, among other topics, about the measuring of time, astrology, sacred animals and the way the Egyptians lived.

Source: "An Account of Egypt" by Herodotus. Translated by G.C Macaulay. Published as E-book by Roberts Publishing, 197 Woodlands Pkwy. # 104-529, San Marcos, Ca. 92069

© 2004 by Franz L Kessler

Franz L Kessler has a PhD in sedimentology, and has worked 20 years in the oil industry as exploration geologist.

APPEX 2004

Article and photos by Arthur E. Berman

The AAPG Prospect and Property Expo—APPEX—was held at the George R. Brown Convention Center, Houston September 14–16, 2004. APPEX is the geological/geophysical community's premier prospect exposition and has been held in Houston since its beginning. This year's event was chaired by HGS members Paul Britt and Jeff Lund. Jeff served as Chair for the Advisory Committee and chaired the Organizing Committee. Also on the management team were Rick Fritz, AAPG Executive Director, Brenda Cunningham, AAPG Global Development Director, and Michelle Mayfield Gentzen, APPEX Staff Manager.

The concept behind APPEX is to provide a place for deals to be made. The deals are of all types including exploration prospects, development opportunities, lease plays, and acquisitions and divestments, to name a few. The Convention Center was filled with hundreds of booths hosted by major corporations, high technology companies, service companies and small independents. Displays ranged from computer graphics to hand-drawn paper maps. All the booths shared an intensity and enthusiasm of people talking about their prospects and asking questions about the prospects of others.

Several thousand were in attendance the day I visited APPEX. As in past years, I ran into people I hadn't seen for some time along with people I work with and around regularly. Of course the HGS membership was out in force, as was the staff of the AAPG.





Gulf of

In addition to the booths and deal-making, APPEX featured a special, one-day business forum and a short course. The forum was called "The Exploration Dilemma: What is the Role for

Exploration in the Energy Future?" Topics were presented such as global exploration opportunities, discovery trends and directions, the North American exploration outlook, and investment opportunites. Speakers included Philip Behrman, Sr. VP Worldwide Exploration, Marathon Oil; Bill Schneider, Sr., VP Newfield International Holdings; Larry Sheppard, VP New Ventures, Vintage Petroleum; Brian Maxsted, Founding Partner & EVP, Kosmos Energy, LLC; Leta Smith, PhD, Senior

> Consultant IHS Energy; Rod Erskine, President, Erskine Exploration; Carl Garrison, Managing Consultant, IHS Energy; and F.X. O'Keefe, Exploration Manager for Western Gas Resources, Denver. Pete Stark, PhD, VP, IHS Energy, served as speaker and moderator. Pat Gratton, AAPG

President, introduced the Forum. The keynote speaker for the Forum Lunch was John Seitz, Co-CEO and founder, Endeavor International Corp.

The one-day short-course was presented on the art of presenting prospects to managers and investors and was called "Packaging and Selling Your Prospect: Geoscience, Land and Financial Return." This course was organized by Matt Boyd as chair of the Young Professionals Committee, with special assistance by Kara Bennett.

In March 2005 APPEX will broaden its scope by holding a companion meeting in London showcasing international deals with emphasis on the U.K. and Europe but

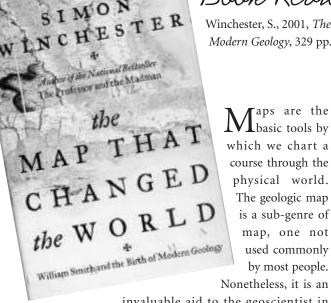
including prospects and properties from the Middle East, Africa, South America, Russia/FSU, Australia and southeast Asia. For more information on this exciting compliment to the Houston APPEX, contact AAPG or go to the London APPEX website:

http://appex.aapg.org/london/index.html.



Winchester, S., 2001, The Map That Changed the World: William Smith and the Birth of

Modern Geology, 329 pp. HarperCollins. \$13.95.



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invaluable aid to the geoscientist in

charting a physical location in the spatial sense, as well as in the temporal sense. This is because a geologic map depicts the location and relative age of the rocks. It is the fundamental tool by which geoscientists understand the position, the mode of formation, the structure and the history of the Earth's crust. Maps allow us to construct, interpret, analyze, and formulate scenarios and hypotheses about the physical reality the maps depict. For these reasons, the geologic map has an "importance, symbolic and real, for the development of one of the great fields of study geology—which, arguably like physics and mathematics, is a field of learning and endeavor that underpins all knowledge" (from the book).

Simon Winchester's book The Map That Changed the World: William Smith and the Birth of Modern Geology describes and explores the world of William Smith and the historical development and the events leading to his creation of the first geological map. In addition, the book describes the scientific and social context in which Smith lived and worked.

The historical context of the life of Smith is important to understand why the first geological map was made. Canals were the quickest way to transport food and other products to and from the outlying villages and farms and the nearby major cities, such as London and Bath. For example, a local brewer, who might expect to sell his product within a radius of no more than 10 miles or so, could now load his wares to be transported on a horse-drawn canal boat and have them delivered to London in just a few days. Thus, the expansion of the rural-urban English canal system was driven by economics, and, collaterally, expanded the available information and the need for a way to predict the local geology.

Smith was hired by the Somerset Coal Canal Company in 1791 to survey coal deposits in southern England. Coal was of enormous economic importance to the area of Somerset in central England known today as Oxfordshire. Thus, the exploration and extraction of coal would lure coal miners to search for coal and to find new technologies to locate and map coal deposits. A guide or tool was needed so that men could predict with some accuracy whether or not coal was beneath the surface.

Smith had access to the mines and was able to look at rocks above and below the surface. As he descended into the mines, he noticed that the different types of rocks and coal would always be found in the same order from top to bottom.

It was in the Means Pit in Somerset Coal Measures where Smith first noticed the succession of rock types and observed that certain fossils were limited to occurring in very specific rock types. Smith termed this repeated succession of rock types "stratification." The first use of this word, apparently coined by Smith, was in 1817.

Smith needed a way to depict the geology of the area around Bath. He used as his model a map showing the various soils and types of vegetation found in the countryside near Bath, published in the Somerset County Agricultural Report. Various agricultural features were differentiated by colors. Smith recognized that color could be used to distinguish various types of rocks. In 1799, Smith made a circular map titled "A Map of Five Miles round the City of Bath." This map was hand-colored and showed the area and outcrop of three types of rock. It was the first modern geological map and set the stage for future geological maps. (In 1831 Smith presented a copy of this map to the Geological Society of London in Piccadilly, where it resides today.) The success of his map prompted Smith to produce a geologic map of England, Wales and Scotland. (Winchester provides a full-color copy of the map in the book and a reader can compare it with a modern geological map, also in the book. The two are very similar.)

Because of his chronic failure to pay debts incurred as the result of a mortgage for a home, Smith was put in "debtors' prison" for just over 11 weeks. Debtors' prison was the last resort to resolve non-payment of debts in 19th century London. It was a means by which the English legal system could execute a basic principle of common law, that "by arresting a debtor, his body had been seized in lieu of his estates" and this person would be held as guarantee of payment of the debt. (A well known debtors' prison is King's Bench Prison, made famous by Charles Dickens in David Copperfield.)

A not-too-evident metaphor emerges from the life, discoveries, and fortunes of William Smith. The financial debt incurred by him and the short time he spent in debtors' prison pales in comparison with the long-term debt owed to him by countless geoscientists, engineers and explorers. These professions have all implemented, to a lesser or greater degree, his principles and techniques to discover and understand the history of the Earth and to explore for its natural resources.

Through his commentary, Winchester describes the political and social environment in which William Smith worked. For example, Winchester notes that Smith was not a member of any upper or noble class, and in fact was sometimes embarrassed by the "ordinariness" of his ancestry. Class and status were extremely important in 19th century England. On the religious front, there were vague and tremulous stirrings of questioning Divine Creation but it was still considered a new notion. The thought that the earth was older than the 6000 years calculated by Bishop Usher was still considered heretical. As another example, geoscientists forget that words like "geology" and "stratigraphy," so common today, were not in the scientific lexicon when Smith first began working.

Geoscientists who read this book will find the themes interesting on two levels. On one level, the book can be read as a biography of William Smith. He was a field oriented and "hands-on" geologist who, based on personal observation and an intimate understanding of the geology of England, created the first geologic map of England. On a second level, the book describes how Smith was able to integrate and then synthesize his basic observations into a testable hypothesis with predictive power. As is well known, these tools, geologic maps and testable hypotheses, form the foundation of modern geology. For this, Smith is owed a debt.

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On-line registration is available!







Texas Professional Geologist Board News

The Texas Board of Professional Geoscientists (TBPG) has just posted its draft rule on continuing education to maintain our professional geologist licenses. The continuing education rules will probably be adopted sometime in spring 2005, but the actual requirement for taking continuing education will probably not take effect until 2006 because a number of our fellow PGs have already renewed into 2005. You can review it at http://www.tbpg.state.tx.us/DRAFT/draft1.htm

Texas Commission on Environmental Quality Update

The TCEQ has developed a new web page that lists all guidance, forms and other documents available from the TCEQs Remediation Division. Documents are listed by program area and by topic. Access this new web page at http://www.tnrcc.state.tx.us/permitting/remed/techsupp/remguidance.html

U.S. EPA Request For Comments

The U.S. Environmental Protection Agency (EPA) has extended the comment period on the following two documents through September 24, 2004:

"Clean-up Goals Appropriate for DNAPL Source Zones"

"Ground Water Use, Value and Vulnerability as Factors in Setting Clean-up Goals."

The Agency has indicated that it will be using comments on these two options papers to plan future activities and develop recommendations for EPA senior managers on a course of action to address the issues raised in the papers.

Please note, the U.S. EPA is specifically seeking your comments regarding the options and recommendations made in the paper rather than the style of the paper. The U.S. EPA wants "to hear your views on the options and to suggest solutions you believe the Agency should consider in addressing the problems stated in the papers."

Papers can be found at http://gwtf.cluin.org/

The agency is actively seeking stakeholder input early in the decision-making process. Now is the time to share your knowledge and practical experience to improve upon the nation's ground water remediation policies.

MTBE Vapors Threaten Environment

U.S. EPA officials announced recently that vapor from the gasoline additive MTBE also poses a threat to groundwater supplies. Recent efforts have focused on monitoring and preventing liquid leaks in underground tanks but have largely neglected the threat of vapor leaks, possibly underscoring recent efforts to improve liquid leak detection and prevention.

The warning came during a conference on groundwater contamination in Maryland, which has experienced significant MTBE contamination in the last month. Maryland Gov. Bob Ehrlich (R) has proposed new rules to prevent leaks in roughly 13,000 underground fuel storage tanks across the state, where more than 200 wells have been found containing MTBE. Eight of these wells had MTBE concentrations 1,300 times higher than acceptable levels, causing widespread concern of water contamination throughout the state.

For more information about MTBE and its role in the controversy over passing a national energy policy, visit http://www.agiweb.org/gap/legis108/energy.html

Earth Observation System Will Monitor Climate Change

In August, Bush administration officials Mike Leavitt of the Environmental Protection Agency and Vice Admiral Conrad Lautenbacher of Department of Commerce met with members of the media to discuss the Global Earth Observation System, a network of satellites and land- and ocean-based sensors that will be developed in coordination with 40 other countries. Leavitt and Lautenbacher pointed out the many benefits of the system, including monitoring climatic changes in polar regions, reducing damage from hazards such as hurricanes and forest fires, and monitoring private-sector environmental problems such as

Government Update Continued on page 59**



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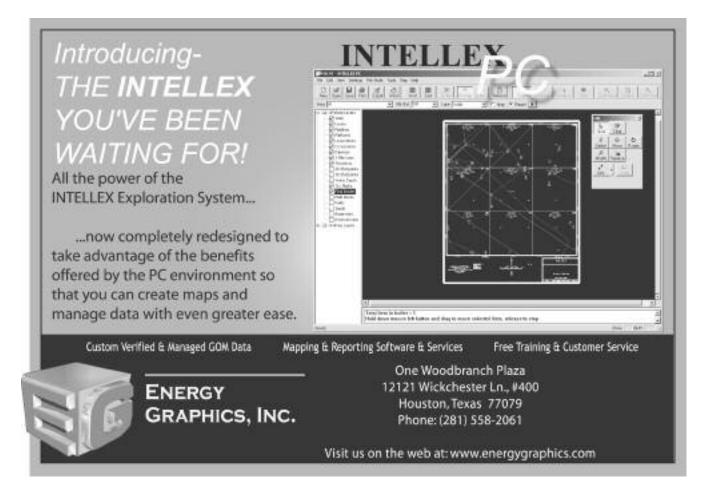
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Government Update continued from page 57.

agricultural runoff. The officials said that the greatest challenges to the development of the system and coordination of the data of different agencies will be bureaucratic, not technological. The National Ocean and Atmospheric Administration currently spends about \$800 million a year to manage its satellite data, and the officials could not give an estimate of how much cost the additional equipment and data processing required for the project will incur. A plan for network construction will be released in February 2005. For more information about the Global Earth Observation System, visit http://www.epa.gov/geoss/

Kansas School Board Election Produces Anti-Evolution Majority

Evolution opponents are set to gain a majority on the Kansas State Board of Education, after a closely watched Republican primary August 3, 2004. Republican Kathy Martin defeated moderate incumbent Republican Bruce Wyatt in the 6th District, and Republican Steve Abrams won the primary in the 10th District. According to the National Center for Science Education, this tips the board to at least a 6–4 anti-evolution majority. Martin and several other Republicans are running unopposed in the November election.



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			1		
Island Course	_	Lake Course		Marsh Cours	
1st Flight Chris Bechtel	Score	1st Flight Russ Neuschefer	Score	1st Flight Scott Layne	Score
Bruce Lowry	60	Behtaz Compani	57	Louis Terlikoski	58
Mark Johnson	00	Johnny Rau	37	Mark Carrigan	30
Terry Robertson		Bill Thomas		David Ephraim	
Terry Robertson		Dili Tilolilas		David Epitratiti	
Tom Fletcher		Rick Reischman		Terry Stanislav	
Lane Hammons	61	Jon Christian	58	Richard Burnett	59
Jeff Oslund		Ken Dice		Rick Hodge	
Mike Taylor		Davis Willis		David Nentwig	
,				O	
Pat Donais		Dave Williams		Wes Johnson	
Terry Johnson	62	Curt Bateman	59	Tony Barnes	59
ed Roop		Don Whitmer		Hank Pfalzer	
Commy Thompson	n	Chris Herbert		Todd Hveem	
2nd Flight	Score	2nd Flight	Score	2nd Flight	Score
hawn Hanson	300.0	Kevin Ferrin		Tim Davis	
ason Taylor	66	Wade Ryan	61	Andy Gambill	66
ielder Hill		Michael Till		Russell Wilson	
ionel Sigurtson				Cliff Naylor	
C					
onny Landrum		Dennis Clark		Stephen Chelette	
cott McDonough	67	Randy Hodges	61	Charles Oliver	66
am Metemeir		Kurt Sellers		Bill Thomas	
ill Lee		Jeff O'Kelly		Ken Weisenberger	
0.17		D		Cl. I. D	
B Morace	45	Bart Hughes	60	Charles Bowen	
Rene Thibideaux	67	Ricky Cook	62	Derick Deaton	66
ee Gladney		Doug Hargrove		Russ Propes	
odd Nicholson		Dixon Millican		Randy Zelle	
rd Flight	Score	3rd Flight	Score	3rd Flight	Score
ohn McTernan		Michael Whitehea		Margaret Johnson	
lex Marshall	72	Clive Hurst	65	Kim McCullough	69
Cenny Goh		Mark Leander		Zane Reynolds	
cott Silver		Eric Kubera		Bob Gregory	
teve Levine		Paul Hoffman		Rob Bammer	
Tike Barnes	73	Bop Parker	66	Wayne Turner	69
Chuck Secrest	75	Rick Hart	00	Tabia Bicklien	09
oe Edson		David Swenson		Richard Kimberlii	,
JC Ed3011		David Swellson		Richard Rimberm	1
lobert Unger		Kim Guyer		Richard Baren	
erry Greer	74	Denise Woods	67	Andre Broussard	69
Dave Grogan		George Pality		Steve Ward	
erry Melance		Jerry Hoffman		Jose Nevarez	
losest to the F	Pin	Closest to the	Pin	Closest to the I	Pin
rd hole	Jason Taylor	4th hole	Doug Hargrove	5th Hole	Rick Ysa
th hole	Charles Bukowski	8th hole	Robert Ray	8th Hole	Peter Gamwell
3th hole	Terry Robertson		One Roland Martinez*	14th Hole	Tom Schmidt
7th hole	Jeff Springmeyer	15th hole	Chip Oudin	17th Hole	Erik Davidson
ongest Drive		Longest Drive		Longest Drive	
adies	Susan Hudson	Ladies	Denise Woods	208000 21.10	
th Hole	Mark Dennis	7th Hole	Jeff Weersing	7th Hole	Mark Carrigar
1th Hole	Michael Gray	11th Hole	Jon Christian	11th Hole	Brad Taff
			,		

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HGS Golf Tournament continued from page 71 _____







Application to Become a Member of the Houston Geological Society

Qualifications for Active Membership

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Geologic Humor

The Shelving Index and How it Grew

From Pandora's Bauxite by Robert Lee Bates (1986), p. 10, reprinted by permission of AGI

1969: As a "non-attending member" of the International Congress at Prague, Laing Ferguson paid \$28* and has already got 7 inches of publications, with more presumably to come. When all are in, he expects to end up with an SI (shelving index)of only about \$3.50. This is by no means a record, and besides the Congress meets only once every four years. But consider the long-term prestige! "The presence of numerous sets on one's shelves certainly lends more charisma than merely North American journals, as they suggest that the occupant of the office might have actually been to Algiers, London, Copenhagen, New Delhi, and/or Prague. True indeed.

Eugene Swick says a friend calculated that to fill the four empty shelves in his bookcase with AAPG *Bulletins* would take 24 years and cost \$600* (assuming no increase in dues). After thinking it over, he a) resigned from AAPG, b) removed the shelves, and c) invested \$300* in assorted old guns and rifles, and d) mounted these in the bookcase. "He has now enveloped himself in an aura of manliness, and furthermore has saved \$300*, which he plans to spend on booze. How's that for scientific ingenuity?"

*Ed. note: keep in mind, these and the following costs are based on the year(s) cited in this 1986 publication

From a store in New Jersey you can order panels of "simulated books". You get 25 inches of "authoritative works by renowned authors" for \$7.95—which figures out to around 32 cents an inch. J. W. White is thinking about going into the simulated-book business, specializing in geological titles. He might find a ready market. Think of lining your office or study with beautifully bound volumes by the likes of Grabau, Chamberlin, and Wegener—all at a shelving index of only 0.32. Instant charisma!

If you want to know what the Russians are saying and have to rely on one of the technical-translation services, the cost averages around \$2 a page, but can run to over \$9. To fill a single 40-inch shelf with Russian translations would cost about \$45,000 or \$1,125 an inch That's even more expensive than books from Elsevier or Pergamon.

_ _ _ _ _ _ _ _ _ _ _ _ _ _

Here now is D. J. Kinzelman, who acquired 20 volumes of the AAPG *Bulletin*—100 inches of shelf space—and was paid a dollar to take them off the other fellow's hands. Thus he has obtained an instant library and made money at it. No nonsense about the shelving index under circumstances like that.

Neptunism Updated

From Pandora's Bauxite by Robert Lee Bates (1986), pp 13-14, reprinted by permission of AGI)

1970: In June, Schreiber & Anderson of Lamont-Doherty revealed in *Science* that the velocity of sound in lunar rocks is quite different from that in Earth rocks but much like that in provolone from Italy, cheddar from Vermont, and muenster from Wisconsin. The authors cite early speculation on the nature of the Moon, and their evidence leads them to suspect that "perhaps old hypotheses are best, after all, and should not be lightly discarded.."

The curious expression "Trans-Pecos, Texas" occurs in the title and content of a paper in the November *GSA Bulletin*. Trans-Pecos, Texas. It's OK on capital letters, and the hyphen's in the right place, but whence cometh that comma? If this heralds a new trend in punctuation, we may soon be faced with Trans-World, Airlines; Trans-Antarctic, Mountains; and Trans-Siberian, Railrway—not to mention such common terms as trans-Canada, pipeline; and trans-Atlantic, cable. In my view, advocates of such usage should be banished for life—to the deserts of Baja, California.

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Or the jungles of Papua, New Guinea.

According to the preliminary program of GSA's Rocky Mountain Section, members of either sex are invited to take the underground tour of the Homestake mine, "but nonprofessional wives must content themselves with a surface tour." A correspondent raises the delicate question, which I have no intention of getting involved with in this space, namely, just what is a nonprofessional wife?

. _ _ _ _ _ _ _ _ _ _ _ _ _ _

Instead of producing the customary yawn, muddy writing may on occasion provide a much-needed bit of comic relief—as in the title of a recent BuMines report, SEISMIC EFFECTS ASSOCIATED WITH AN UNDERWATER EXPLOSIVE RESEARCH FACILITY. Would you want your child doing research in a facility that might blow up at any moment, and underwater at that?



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ABSTRACT DEADLINE: JANUARY 17, 2005! Questions should be directed to Mike Ledet at abstracts@gcags2005.com.

www.gcags2005.com

HGA and GeoWives News

HGA

by Margaret Eisenhardt Jones

HGA members are enjoying a festival fall season with social activities. Members of HGA mark you calendar for Thursday, December 16, 2004 for the Holiday Luncheon and Musical Show featuring the "Ivory Touch." We will meet at Lakeside Country Club. Invitations will be in the mail so watch for them and send in your reservations as early as possible.

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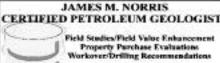
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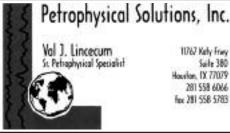
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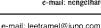
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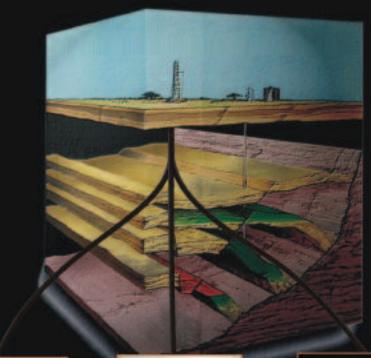
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