The Bulletin
Houston Geological Society

Volume 46, Number 8 April 2004

contents

In Every Issue

about the cover: Orange and vermillion skies are the backdrop for the Failing-2500 drilling rig at the U.S. Bureau of Reclamation's Tularosa Basin National Desalination Research Facility in Alamogordo, NM. Particulate matter from California wildfires painted colorful desert sunsets during the October and November 2003 groundwater exploration program. Test boreholes were completed at depths up to 2,090 feet. The facility will use high total dissolved solids (TDS) groundwater for research programs. The site is east of the White Sands National Monument. *Photograph by Michael F. Forlenza*

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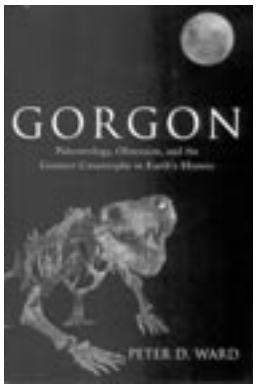
Technical Meetings

Other Features



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by Craig M. Dingler

President's Letter

Springtime Events and Celebrations

April brings warmer weather and plenty of activities. In addition to the normal schedule of dinner meetings and talks, there are many other interesting events vying for your attention.

Earth Day: On April 24, the Houston Geological Society will have a booth at this year's Earth Day event in Hermann Park. The event is meant to encourage understanding of and participation in local and global environmental issues. It is presented by the Citizen's Environmental Coalition, of which the HGS is a member organization, and sponsored by Marathon and others. This is a good public outreach project for the HGS and Dan Beaber with the Environmental and Engineering Geologists Group will be coordinating our efforts. The event is free to the public, and by moving to Hermann Park from Rice University, where it was held last year, it should be more accessible to everyone (with free parking, too). This year should be exceptionally good because numerous groups and businesses will be presenting environmental information and activities. Our HGS volunteers will be putting the Earth back in Earth Day, and attentively explaining the science to the lay population.

You should receive your HGS ballot sometime about April 10. Please mark your selections and mail it back! Denise Stone and the Nominations Committee have done an outstanding job this year putting together a great slate of candidates.

Elections: You should receive your HGS ballot sometime about April 10. Please mark your selections and mail it back! Denise Stone and the Nominations Committee have done an outstanding job this year putting together a great slate of candidates. Information on each nominee is located elsewhere in this Bulletin. (Beginning on page 29) Your vote really does count, and with an HGS ballot there are no hanging chads! No matter who wins, please thank the candidates for their willingness to run for office—the HGS thrives on this great spirit of volunteerism!

Meetings: The AAPG Annual Meeting is April 18–21, and the Dallas Geological Society is expecting a large contingent of geologists from Houston to attend. The deadline for advanced registration has passed, but walk-ups are always welcome. One of the more interesting events should be the Division of Environmental Geosciences luncheon on Tuesday, April 20, where T. Boone Pickens will be the guest speaker presenting "Texas Water: Oil of the 21st Century." Pickens' company, Mesa Water, was formed to develop and market groundwater from the Ogallala aquifer beneath his ranch before it is drained by municipalities and water management authorities under the right of capture, an oddity of Texas water law.

From May 3 to 6, the Offshore Technology Conference (OTC) celebrates its 35th Anniversary. As usual, there are numerous engineering talks, but this year there are also some seismic and exploration-related sessions that sound worthwhile. A couple of industry breakfasts have discussions of current trends in key developing regions, such as offshore Angola and Qatar. For those of you who were piqued or pleased by my discussion of future opportunities in the petroleum exploration sector, on Thursday, May 6, the OTC has a full afternoon panel presentation for "Hubbert's Peak: Impending Oil Crisis – Exaggeration of Fact?" You can check it out at www.otcnet.org/2004 and register on-line. At $85 for a full registration, it's a pretty good deal—even better for spouses and students who get complementary admission. Or, if you can obtain a pass from a vendor, it's always fun to just spend a few hours walking around all that amazing technology in the exhibit hall!

From May 3–5, the Texas Commission on Environmental Quality holds its annual Environmental Trade Fair and Conference at the Austin Convention Center. **President's Letter** *continued on page 7*

President's Letter continued from page 5

This is always a good venue for meeting agency personnel and learning more about the latest regulations.

Upcoming HGS Events: Guest Night is June 19th at the Houston Museum of Natural Science. The timely topic is Mars, and the guest speaker will be a key person from NASA. It's not called Guest Night for lack of a better name! Please bring your friends, family, boss and associates and dine among the dinosaurs, hear the latest information on Mars, and see some spectacular imagery from the Red Planet!

Earlier that day, the HGS will have its annual skeet shoot. The joint HGS/GSH fishing tournament will be the following Saturday, June 26. For more information, check for advertisements in this month's Bulletin. ■

Retraction: In my February letter, I made a "flippant, parenthetical remark" that was misconstrued by some as implying that a university's geoscience department was closing. I apologize for any misunderstanding that it may have caused. The new department chairman states that the department will change its name to reflect increased program offerings, it will expand in terms of both its number of faculty and the size of its remodeled facility, and that it has the full support of the university's administration. Indeed, that is good and exciting news!

Nominations Sought for Teacher of the Year Award

In the spring of each year the Houston Geological Society selects a K-12 teacher from the greater Houston area for the HGS Teacher of the Year Award. This is an important award that recognizes and honors a teacher for their outstanding abilities and inspirational efforts in Earth Science education.

Anyone can nominate a teacher for the award. Nominations come from members, other teachers and student's parents. If you know of a deserving teacher please forward their name and contact information to either Sharie Sartain (smsartain@houston.rr.com) of the HGS Awards Committee or to Art Berman (aberman@houston.rr.com) of the Academic Liaison Committee.

Editor's Letter

by Diane Yeager,
editor@hgs.org

Texas Energy Center

Innovative Research Center to Find Solutions to Energy and Pollution

The United States continues to demand more 'power' with less environmental impact. How we meet this seemingly impossible obstacle and prevent future energy crises may finally be addressed through advanced solutions from the Texas Energy Center (TxEC). It is getting a lot of press these days. When I first starting reading about the TxEC it seemed obvious to me that Texas would be the ideal choice for energy research and development but I have since learned that "Texas is now facing well-organized, well-funded competition from other states, such as Michigan, Ohio, New Mexico and others, to supply next generation technologies. TxEC represents Texas' aggressive bid to attract new energy-related businesses; assist in the expansion of existing businesses; and attract various large federally-funded energy projects." *(TxEC Fact Sheet)*.

T x
E C
The future of Texas energy technology.

TxEC is organized as a 501(c)(6) non-profit corporation under the laws of Texas for the purpose of promoting the technical and commercial interest of its members. TxEC is working hand-in-hand with corporations such as Air Liquide America, Schlumberger Technology, and the Gas Technology Institute, among others. The founding supporters of TxEC include the Greater Fort Bend Economic Development Center, the City of Sugar Land, and Fort Bend County. In addition to corporate and local government entities, TxEC counts state and national leaders among its staunchest supporters. The location for TxEC is the University of Houston Fort Bend research park at its new location near Highway 59 at the Brazos River in Sugar Land. The facility layout will allow the University of Houston faculty and industry scientists to share laboratories and knowledge.

TxEC is a public-private sector effort conceptually modeled after the Texas Medical Center, and it plans to focus on four main issues: clean energy, hydrogen and zero emission power plants, natural gas, and ultra-deepwater.

TxEC is a public-private sector effort conceptually modeled after the Texas Medical Center, and it plans to focus on four main issues: clean energy, hydrogen and zero emission power plants, natural gas, and ultra-deepwater.

Of these initiatives, cleaner energy (fuel cell development) is getting a lot of attention as the future solution to automobile pollution. We are learning that the hydrogen fuel cell may be the clean alternative to the gasoline and diesel burning automobiles on the road today. Some environmental groups are beginning to disagree, proposing that fuel cells will accelerate ozone depletion. Agree, or disagree, I believe we need to move forward with the research and development to understand and improve on the technology.

TxEC will also focus on ultra-deep water research. What better place than the Houston area for ultra-deepwater research? Houston is un-doubtedly the hub for deep-water exploration experts and industry support. TxEC envisions that $300 million a year in federal dollars will become available on a dollar-for-dollar matching basis with industry representing a total new research and development activity of $4.3 billion over a seven year period of time *(TxEC webpage)*. That sounds like a lot of money. Is all of this worth it? You bet it is! As geologists we know that the global oil supply is finite so we must find new energy supply. We as a nation cannot continue to bury our heads in the sand expecting energy to show up at our door steps with no "environmental" problems. Texas and the Houston area have the greatest pool of talent to meet the challenge.

To learn more about TxEC log onto their webpage at www.txec.org. ■

Have some information related to this topic you would like to share? Have a different point of view? Why not start a Forum Topic on the HGS Website? Go to http://www.hgs.org and follow the links!

Monday, April 12, 2004

HGS General
Dinner Meeting

Westchase Hilton • 9999 Westheimer
Social 5:30 p.m., Dinner 6:30 p.m.

Cost: $25 Preregistered members; $30 Nonmembers & Walk-ups

Make your reservations now on-line through the HGS website at www.hgs.org or by calling 713-463-9476,or by e-mail to Joan@hgs.org (include your name, e-mail address, meeting you are attending, phone number and membership ID#).

*by **Alan Stubblefield, Alan Clemens,** and **Matt Williams***
Southwestern Energy Production Company

Creating Value in East Texas

Overton Field is located in Smith County, Texas, approximately 20 miles southeast of Tyler on the western flank of the Sabine uplift in the east Texas basin. The field produces from the Taylor interval (Cotton Valley), the lowest member of the Jurassic Cotton Valley. As is typical of most production from the Cotton Valley sands, the interval has low permeability, with distribution of rock quality controlled by a complex depositional and diagenetic history. Southwestern Energy Production Company (Southwestern) acquired the field in 2000 with 16 existing wells. The field was purchased based on evaluation of the geologic, engineering and completion data that suggested that significant extension and infill opportunities existed. Since then Southwestern has successfully drilled and completed 105 wells and expanded the acreage from 8,800 to 24,000 acres. Production has been increased from 1.5 MMCFD to 63 MMCFD in early 2004. The success of this development has been the result of coordinated iterative interpretation of geological and engineering data, improved completion practices, and innovative operational and drilling processes that have minimized costs. Development is expected to continue at least through 2005.

Production has increased from 1.5 MMCFD to 63 MMCFD.

Bibliographical Sketch

Alan Stubblefield is Vice President of Production for Southwestern Energy Production Company in Houston, Texas. Alan manages the East Texas Team responsible for development of Overton Field. He has held various positions since joining the company in May 1998. Prior to joining Southwestern, he worked 14 years with Anadarko in a variety of engineering and management positions. Alan earned a BS degree in Petroleum Engineering from Texas Tech University. He is a member of the Society of Petroleum Engineers (SPE) and is a Registered Engineer in the State of Texas.

Alan Clemens joined Southwestern as a Staff Geophysicist in 1998 and was promoted to Exploration Manager in 2000. Alan began his career as a Geophysicist with Mobil Oil in 1980. He has also worked for TXO, Enron Oil and Gas, and Zilkha Energy. Alan has worked multiple basins with a focus on East Texas, Gulf Coast (both onshore and offshore) and the Permian basin. Alan has a BS degree in geophysical engineering from the Colorado School of Mines and a MBA from the Houston Baptist University.

Matt Williams joined Southwestern in 1998 and is currently Staff Geologist, responsible for the Overton Field development. In addition he has developed projects in Louisiana, south Texas and the Permian basin for Southwestern. Matt previously had worked for Occidental Oil and Gas in International and Domestic Exploration and Production for which he was Chief Geologist of Occidental of Oman. In addition, he worked for ARCO Alaska and Tenneco Oil Company since beginning his career in 1983. Matt has a BS degree from Texas Tech University and a MS degree from Texas A&M University. He is a Texas Professional Geoscientist and a member of the AAPG, Houston Geological Society and East Texas Geological Society.

Tuesday, April 13, 2003

Hotel Sofitel • 425 North Beltway 8 • Houston 77060
Social 11:30 a.m., Lunch 11:45 a.m.

Cost: $28 Preregistered members; $33 Nonmembers & Walk-ups

Make your reservations now on-line through the HGS website at www.hgs.org; or, by calling 713-463-9476 or by e-mail to Joan@hgs.org (include your name, email address, meeting you are attending, phone number and membership ID#).

HGS NorthSiders Lunch Meeting

by ***Andrew R. Scott***
Altuda Energy Corporation
San Antonio, Texas

Coalbed Methane Exploration Concepts—Where is the Next Big Play?

Natural gas prices are expected to remain relatively high over the next two to five years and these higher gas prices have turned coalbed into one of the most active gas plays in the United States. Coalbed methane (CBM) is an important part of the natural gas supply for the United States and now represents more than 7 percent of total gas production and 7 percent of dry gas proved reserves—and these values are expected to increase. Everyone asks where the next big San Juan Basin-scale CBM play will be in the United States. The simple answer is that the San Juan Basin (SJB) is unique and there will not be another "perfect CBM play." But all basins share characteristics with the SJB and following proven exploration concepts can minimize risk in any coal-bearing basin.

Everyone asks where the next big San Juan Basin-scale CBM play will be.

Over the past decade, hydrogeologic evaluation and comparison of coal basins in the United States and internationally indicates that depositional systems and coal distribution, coal rank, gas content, permeability, hydrodynamics and tectonic/structural setting are critical controls on coalbed methane producibility. A dynamic interplay among these controls determines high coalbed methane productivity and the absence of one or more of these factors will result in lower coalbed methane production. Where is the next coalbed methane play? The most prospective drilling locations will be in areas of upward flow potential in the presence of thermally mature coals that have reached the threshold of thermogenic gas generation, and/or where secondary biogenic gas generation has occurred. A regional understanding of hydrogeology to delineate sweet-spots and an accurate economic evaluation of the prospect are critical to project success.

Of equal importance are the economic aspects of any hydrogeologic-based play. Accurate determination of land acquisition and drilling costs water disposal methodology, pipeline gathering system costs, and future gas prices on a local and regional scale must also considered. Enhanced recovery techniques such a nitrogen and carbon dioxide injection will ultimately recover more CBM resources and some deeper coal beds may prove exploitable. An emerging technology that utilizes microbes to stimulate or enhance CBM production through the in situ bioconversion of coal or sequestered carbon dioxide potentially may result in CBM production in areas that are currently uneconomical. If this technology is successful maybe the correct answer to "Where is the next big CBM play?" should be both "nowhere" and "everywhere". ■

Bibliographical Sketch

Andrew R. Scott has more than 14 years of coalbed methane experience and has published more than 70 senior author papers and abstracts. He is fortunate to have received 12 best paper awards for his research efforts from a variety of geological organizations including the American Association of Petroleum Geologists, Geological Society of America, International Coalbed Methane Symposium and Rocky Mountain Association of Geologists, *Mountain Geologist Journal.* Prior to starting Altuda Energy Corporation, Mr. Scott held a position of Research Associate at the Bureau of Economic Geology, the University of Texas at Austin, where he worked on a wide variety of research projects and served as Program Director of Domestic Energy Research. Andrew also served as Director for the Texas Region Petroleum Technology Transfer Council and, recently, President of the Energy Minerals Division of the American Association of Petroleum Geologists.

Environmental and Engineering Group
Dinner Meeting

Tuesday, April 13, 2004

Rudy Lechners Grill • Woodlake Square, Gessner at Westheimer
Social 5:30 p.m., Dinner 6:30 p.m.

Cost: $25 Preregistered members; $30 Nonmembers & Walk-ups

Make your reservations now on-line through the HGS website at www.hgs.org; or, by calling 713-463-9476 or by e-mail to Joan@hgs.org (include your name, meeting you are attending, phone number and membership ID#).

by ***Ben Thomas, Ph.D.***
RAM Group
Houston, Texas

What's New in Risk Assessment in the Environmental Geosciences?

Risk assessment has become the dominant paradigm for managing environmental issues since its introduction by the United States Environmental Protection Agency in the mid 1970's. Today, more than 25 state and tribal agencies have developed and implemented risk-based decision-making programs in an effort to standardize and streamline the regulatory process.

It is an opportune time to consider what we have learned over the past 30 years, and how the risk assessment process has evolved during this period.

It is an opportune time to consider what we have learned over the past 30 years and how the risk assessment process has evolved during this period. This presentation will discuss such issues as the health risks posed by complex mixtures, how we extrapolate from Mickey to Walt and how our increasing understanding of the human genome and of disease processes like cancer will affect the strategies we use to characterize and assess a contaminated site.

Bibliographical Sketch

Dr. Thomas has over 25 years of experience in toxicology, risk assessment, regulatory negotiation, litigation support, strategic planning, program development, and program management. He received his bachelor's degree in biology from Tulane University, his MS and PhD in pathology (study of disease processes) from the University of Texas Health Science Center at Houston. He subsequently worked for 12 years as a corporate toxicologist with the Shell Oil Company, where he provided primary toxicological support for a wide range of product/process areas including petroleum exploration and production, refinery operations, gasoline, kerosene, diesel fuels, lubricants, asphalts, aromatics, olefins, solvents, metals, catalysts, radiation, solar technology, mining and synfuels. During that time, he was active in various trade associations and committees and served as Chairman of the American Petroleum Institute's (API) Toxicology Committee, Chairman of the API Benzene Toxicology Task Force, Chairman of the API Solvent Neurotoxicity Task Force, Chairman of the Chemical Manufacturers Association (CMA) Butadiene Toxicology Research Task Group, Chairman of the Asphalt Institute's Toxicology Work Group. Dr. Thomas serves as the Principal Toxicologist for Environmental Litigation Associates and Lecturer, Institute of Environmental Technology (http://www.ela-iet.com). Dr. Thomas joined the consulting industry in 1990 and presently serves as a Principal and Vice President of the RAM Group in Houston, Texas (http://www.ramgp.com). ■

Websites You Might Need:

Texas Board of Professional Geoscientist • www.tbpg.state.tx.us
The Railroad Commission • www.rr.state.tx.us
Texas Department of Licensing and Regulation • www.license.state.tx.us
Bureau of Economic Geology • www.beg.utexas.edu
Texas Commission on Environmental Quality • www.tceq.state.tx.us
Louisiana Natural Resource Department • www.lnrd.state.la.us

Thursday, April 15, 2004

Petroleum Club • 800 Bell (downtown)
Social 11:30 a.m., Lunch 11:30 a.m.

Cost: $30 Pre-registered (see deadline below) members, affiliates, and guests; $33 Non-members and walk-ups.

Make your reservations by telephone, Fax, or e-mail to Mrs. B. K. Starbuck-Buongiorno by 12:00 Noon, Tuesday March 23, 2004.
Telephone: (713)651-1639, Fax: (713)951-9659, e-mail: bkspee@aol.com

SIPES
Luncheon Meeting

by ***Richard C. Bain***
ChevronTexaco
North America Upstream

Exploitation of Thin Basin-floor Fan Sandstones, Navarro Formation (Upper Cretaceous), South Texas

During thirty years of industry drilling in the Paleocene Lobo Trend of South Texas, thin sandstones of the Upper Cretaceous Navarro Formation have been regarded as a high-risk secondary objective that occasionally pays the cost of drilling an additional 1,000 feet to test it. Several recent completions have yielded impressive sustained flow rates in excess of 1 million cubic feet of gas per day (MMCFGPD) per vertical foot of reservoir, therefore justifying an effort to better understand its occurrence.

The sand averages 10 feet in thickness and cannot be resolved seismically as a discrete event.

The Navarro reservoir in southern Webb and northern Zapata Counties is a thin sporadically-occurring sand encased in deep-water shales that occurs basinward of the Cretaceous shelf margin. It is interpreted as a basin-floor fan based on log character and paleontologic bathymetric analysis. The sand averages 10 feet in thickness and cannot be resolved seismically as a discrete event, however, areas favorable for sand accumulation can be predicted using seismic attributes derived from 3-D volumes.

Where the sand thickness exceeds 15 feet a good correlation exists with the amplitude value of the seismic peak associated with the sand top. However, in most areas the sand is thinner and accommodation space in subtle intrabasinal depressions can be inferred by 3-D isochron mapping. Most areas that have Navarro sand correlate with isochron thicks; however, not all isochron thicks have sand, most likely because sediment supply was less than the available accommodation space. These attributes should be applicable in other areas in which seismic resolution of a sand body is difficult. ■

Bibliographical Sketch

Richard C. Bain (BS geology, Waynesburg College; MS geology, Ohio State University)

Dick Bain is a Staff Development Geologist with ChevronTexaco's MidContinent Business Unit in Houston. During 25 years with Chevron, and now ChevronTexaco, he has worked a variety of assignments in South Louisiana, the Gulf of Mexico, Permian Basin and South Texas. For the past eight years he has been a development geologist for ChevronTexaco's Lobo Trend properties in Webb and Zapata Counties, Texas. His talk, "Exploitation of Thin Basin-floor Fan Sandstones, Navarro Formation (Upper Cretaceous), South Texas," was originally presented at the 2003 GCAGS Convention in Baton Rouge, LA.

Monday, April 26, 2004

Westchase Hilton • 9999 Westheimer
Social 5:30 p.m., Dinner 6:30 p.m.

Cost: $25 Preregistered members; $30 Nonmembers & Walk-ups

Make your reservations now on-line through the HGS website at www.hgs.org; or, by calling 713-463-9476 or by e-mail to Joan@hgs.org (include your name, email address, meeting you are attending, phone number and membership ID#).

North American
Dinner Meeting

*by **D.S. Muller** and **F.T Wirnkar***
BP America
Houston, Texas

Stratigraphic Entrapment of Hydrocarbons in the Upper Cretaceous Lewis Shale and Lower Fox Hills Sandstone, Eastern Green River Basin, Wyoming

The eastern Green River basin is an active hydrocarbon province in central Wyoming. BP America is involved in a multi-rig, multi-year program in the basin. BP currently has seven rigs operating in the basin. Production is primarily from tight Cretaceous sandstones requiring hydraulic fracture stimulation to produce at economic rates.

Early exploration and development in the eastern Green River Basin was primarily driven by high production rates associated with shoreline deposits at the top of the Almond Formation. These sands and underlying paralic and coastal plain deposits of the Almond were deposited during the final transgression of the Cretaceous cratonic seaway of the central United States. Much of the subsequent development in the basin has targeted less extensive sands deposited within the Main Almond in the environments behind the transgressive/ stillstand bar deposits.

Hydrocarbons within the regressive phase of this third order filling cycle have increasingly been recognized and targeted as drilling has progressed in the basin.

The Almond is overlain by the Lewis Shale. The Asquith Marker, a regionally recognizable Maximum Flooding Surface within the lower Lewis, marks the overall transition from the transgressive phase to the regressive episode associated with the infilling. Above the Asquith marker, the overlying sediments of the remainder of the Lewis and overlying Fox Hills and Lance Formations accomplished the final infilling of this last phase of the Cretaceous intracratonic seaway.

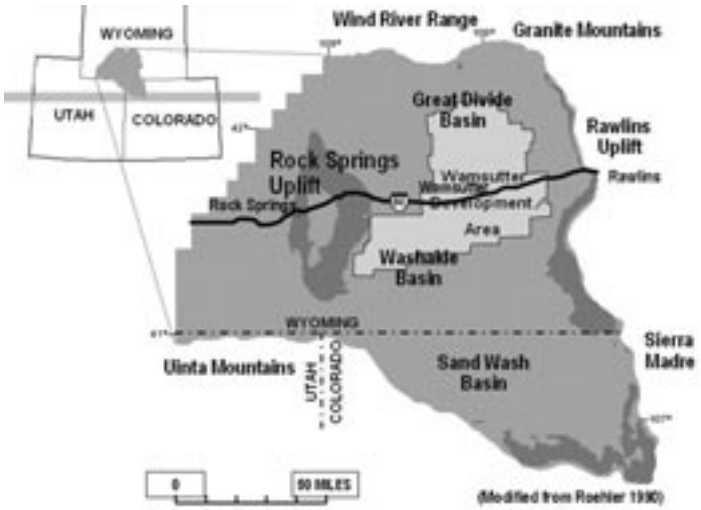

Figure 1 Location of the eastern Green River Basin, south-central Wyoming.

Hydrocarbons within the regressive phase of this third order filling cycle have increasingly been recognized and targeted as drilling has progressed in the basin. This presentation addresses the stratigraphy, trapping configuration, results, and recent developments associated with the younger strata of the Lewis Shale and Fox Hills Sandstone in the eastern Green River Basin. Stratigraphic traps within the Upper Cretaceous Lewis and Fox Hills of the Red Desert Basin occur in sands deposited within basin floor fans, slope fans, lowstand-wedge deposits, shelf margin deltas and nearshore marine environments associated with the final major regression of the Western Interior Cretaceous Seaway. Lewis gas and condensate are generally produced as part of a co-mingled production stream together with gas from the underlying Almond Formation of the Mesaverde Group. Production logs and standalone Lewis producers demonstrate that the Lewis is locally a very

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significant component of the hydrocarbon production stream within the Red Desert basin portion of the eastern Green River basin

Entrapment in Lewis Shale within the Red Desert basin occurs at present updip, distal edges of sand packages that were deposited from a northerly provenance ("Red Desert Delta" or "Sheridan Delta") within and near the margins of the Lewis seaway during the Maastrichtian. Geometries, log character, seismic data, and other characteristics of the sands within the Lewis Shale for a number of different traps at several stratigraphic levels indicate that deposition occurred in a variety of settings. ■

Bibliographical Sketch

Dave Muller received his Bachelor's degree in geology from Colgate University in 1977. He was a Fulbright Scholar at the University of Iceland in 1978 and received his MS from the University of Colorado in 1980. He joined Amoco in 1980 and is currently a Geological Associate with BP. Dave's career has run the gamut, from operations and development, equity negotiations, OCS sale evaluation, petroleum systems consulting, new basin entry and regional studies. Dave has a composite of 11 years of experience in the Rockies. He is currently working with an exploration team in the deepwater Gulf of Mexico.

Fabian Wirnkar received his MSc in geophysics from the University of Ohio in Athens in 1989. He joined Amoco in 1991 as an Exploration Geophysicist and is currently a Senior Geophysicist with BP. His interests include seismic stratigraphy, seismic sedimentology, special seismic processing and economic evaluation of exploration and development projects. Fabian is currently working in the Permian basin.

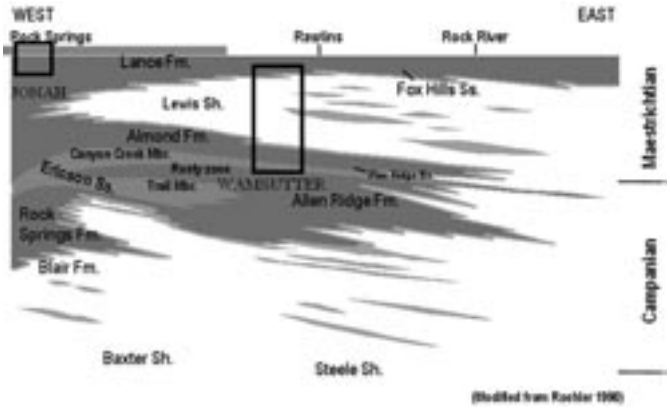

Figure 2. Simplified Wheeler diagram, stratigraphic setting of the Upper Cretaceous Lewis Shale.

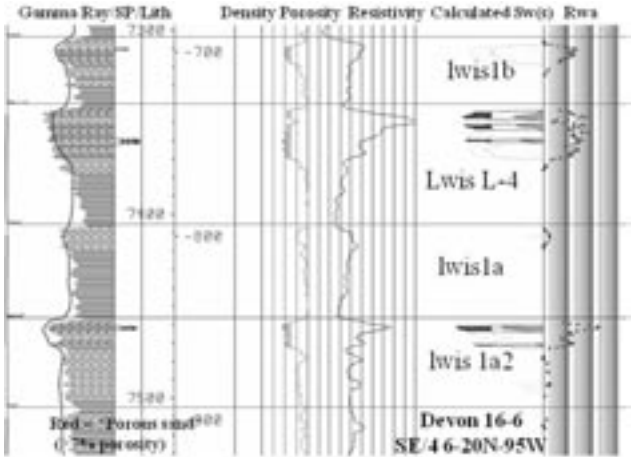

Figure 3. Devon 16-6-20-95 (SE/4 16-20N-95W), a high rate producer from multiple zones in the Upper Lewis/Fox Hills.

Wednesday, April 28, 2004

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HGS General
Luncheon Meeting

by ***Harry H. Roberts***
Coastal Studies Institute
Louisiana State University

Gas Hydrates in the Gulf of Mexico's Complex Geologic Setting: Future Energy Resource or Just Another Geohazard?

Complex geology of the northern Gulf of Mexico's continental slope makes identification of the gas hydrate stability zone difficult. Bottom simulating reflectors (BSRs) that mark the transition from solid gas hydrate above to free gas below are rarely identified on seismic profiles, but do occur in special cases. Both high-resolution acoustic data and 3D-seismic surface attribute images calibrated to ground-truth (manned submersible observations, sampling and piston coring) confirm that widespread fluid and gas expulsion at the seafloor is characteristic of the northern Gulf of Mexico continental slope. Gas hydrate at the seafloor and in the shallow subsurface is a product of the expulsion process.

A variety of seafloor features are associated with hydrocarbon venting from a leaky subsurface petroleum system. It is suggested that fluid flux rate determines the types of seafloor features, the occurrence of gas hydrate and chemosynthetic communities, and the degree of hydrocarbon biodegrdation. The rates of fluid venting are qualitatively defined as rapid, moderate and slow. Mud volcanoes and mud flows represent the rapid flux settings. These are mud-prone environments that host only limited and localized chemosynthetic communities and show little evidence of biodegradation. Heat flow is often associated with rapid fluid flux environments and retards the crystallization of gas hydrate. Residence time at these vent sites is so short that gas and oil may be relatively unaltered by bacterial oxidation. Moderate flux settings include gas hydrate mounds outcropping on the seafloor. Gas plumes representing the composite effect of many local seeps occur over areas where gas hydrates are exposed, suggesting that fault-supplied gas is consistently by-passing the seabed. This process provides a constant supply of gas for hydrate formation. These environments are characterized by the most diverse, dense, and widespread chemosynthetic communities. Finally, slow flux environments are mineral-prone and include areas where authigentic carbonates precipitate from hydrocarbons oxidized by bacteria. The carbonates occur as nodular masses in sediments, hardgrounds, slabs, and mound-like buildups. Very localized chemosynthetic communities and highly biodegraded hydrocarbons are associated with slow flux environments.

Over a sea level cycle (~100 kyr) gas hydrate stored in the continental margin decomposes as falling sea level approaches the glacial maximum. Many of the northern Gulf's slope failures at the shelf-to-slope transition probably are associated with hydrate decomposition. During rising to high sea level, the gas hydrate reservoir is quickly recharged because of the availability of abundant fluids as gases supplied by the northern Gulf's deep hydrocarbon-generating zones. ■

Biographical Sketch

Harry H. Roberts, Boyd Professor at LSU, has been a researcher at Coastal Studies Institute (CSI) and teacher in the Department of Oceanography and Coastal Sciences for over 34 years. He is a marine geologist-sedimentologist who has worked on both carbonate and siliciclastic depositional settings domestically and in foreign areas. For the last decade a large part of his research effort has been focused on developing a better understanding of the impacts of fluid and gas expulsion on the surficial geology and biology of the Gulf's continental slope. Gas hydrates are products of the expulsion process in some settings and therefore have been a focal point of the study. Manned submersibles, in situ experiments, 3D seismic surface attribute data, and high-resolution acoustic data have all played parts in these studies. Harry also continues work on the Mississippi River delta system and has recently developed a research program around the collection of high resolution geophysical data (side-scan sonar, chirp sonar, bathymetry) and various types of cores (vibracores, box cores, piston cores) to help better understand details of the sedimentary architecture that may be related to Louisiana's substantial land loss problem.

Houston in the 21st Century Seminar Program

by Richard Howe

The Engineering, Science, and Technology Council of Houston (ECH) is developing a series of seminars that will address the various technical issues that are impacting and will impact the Houston Metropolitan Area in the 21st century. This program of seminars is titled "Houston in the 21st century." ECH hopes to hold one to two seminars each year. The first seminar of the series is tentatively scheduled for April 2004 and will address flooding. Other proposed topics include transportation, water resources and distribution, air quality, expansive clays and their impact on construction, emerging health and medical challenges and their impact on the quality of life, and regional energy requirements and power distribution.

The purpose of these seminars is to educate the public on technical issues that affect them and to provide a forum for technical exchange between scientists and engineers in the private sector, academicians, and technocrats.

The purpose of these seminars is to educate the public on technical issues that affect them and to provide a forum for technical exchange between scientists and engineers in the private sector, academicians and technocrats. Public with interests specific to the seminar topic, elected officials, the news media, the science and engineering community and science educators will be invited to attend. The format of the meeting is nonpolitical and no particular views or ideologies will be advanced.

ECH is an umbrella organization for 25 engineering, science, and technological societies located in Houston. Many of these organizations are local chapters of national societies. ECH's function is to advance engineering, science and technology through education and interdisciplinary communication. ECH was originally founded in 1948 as the Engineering Council of Houston, hence the "ECH" acronym. Initially an engineering society, ECH expanded its enrollment over the following decades to include scientific and technological societies. In 1995, ECH formally changed its name to the Engineering, Science and Technology Council of Houston.

ECH's educational efforts include co-sponsoring the Science and Engineering Fair of Houston and summer internships at the Houston Museum of Natural Science. ECH annually presents excellence in education awards for area secondary school science and math programs. ECH is currently developing a mentor program that will foster interest among young people in science and engineering. ECH helped establish the memorial to the crew of Space Shuttle *Challenger* at Tranquility Park and is currently developing a similar memorial for the crew of *Columbia*.

Claudia Ludwig and Richard Howe are HGS's representatives to ECH. Claudia is a past-president of ECH and is this year's president of the Science and Engineering Fair of Houston. Richard is president-elect of ECH and will assume duties as president this June. ■

Environmental and Engineering Group Goes to TBPG Board Meeting

by ***Matthew R. Cowan, P.G.***

We as geologist have entered a brave new world. We now are exploring the realm being a Licensed Geoscientist. As a result we have many questions and issues to be resolved. Fortunately we have not been left to our own devices to struggle with the many issues we will surely face. The Texas Board of Professional Geoscientists (TBPG) is at the vanguard in helping to define our role as professionals. The members of the board are W. Kevin Coleman (Chairman), Edward G. Miller (Vice Chairman), Rene D. Pena (Secretary/Treasurer), Gordon Ware, Kelly K. Doe, Kimberly R. Phillips, Shiela B. Hall, Murray H. Milford, and Danny Perkins.

On February 13, 2004, six members (Richard Howe, Arlin Howles, Henry Wise, Claudia Ludwig, Glenn Lowenstein and Matthew R. Cowan) of the Houston Geological Society braved the ice and cold to travel to Austin to see the Texas Board of Professional Geoscientist at work. We saw the board hard at work organizing itself into an organization to protect the health and safety of the public who are served by the geoscience community. Even as it is addressing issues of organization of the board and operations, the members of the board were working on fleshing out the rules that we as professional geoscientists will have to work by. The board showed interest about the issues that we face. The board admits that it has not only a lot of work to go but a long road to travel in fashioning the rules and regulations that we geoscientist will be practicing under but also rules and regulations that protect the integrity of our profession.

I would be remiss if I did not recognize the following people: Executive Director Michael D. Hess, Executive Assistant Marty Denman, Director of Licensing Annita M. Herrera, Chief Financial Officer Vincent Houston, and General Counsel Lisa M. Mims. These people are the support personnel that allow the board to function on a day-to-day basis.

Comment: I urge the membership of the Houston Geological Society to support the Texas Board of Professional Geoscientists. You can achieve this by attending TBPG board meetings and providing comments and suggestions. ■

The Texas Board of Professional Geoscientists is at the vanguard in helping to define our role as professionals.

Members on the Move

Members who have recently changed jobs, received awards related to their careers, been elected to professional positions, or moved their homes are invited to update their member profile and notify the HGS Webmaster of the effective date. We will make a note here and refer them to your member profile.

This service is only available to current HGS members. Note that both members and non-members must be logged in to read the HGS Membership Directory on line.

SIPES Election: The Houston Chapter of the Society of Independent Professional Earth Scientists (SIPES) announces the newly elected members of its 2004 Executive Committee and its 2004 National Directors. The Executive Committee members are as follows: J. Phil Martin, Jr., Chairman; Wulf F. Massell, Chairman-Elect, Jeannie Mallick, Secretary; Larry Rairden, Treasurer; and James L. Allen, Past Chairman. The National Directors are Raymond Blackhall and Paul W. Britt. (Posted 2/11/2004)

Manny N. Fernandez has transferred to the ConocoPhillips IGA (Integrated Geological Analysis) group, effective February 2, 2004. In his new role, Manny will continue to lead the Global Geological Operations Network, and work on the Qatar Gas project as well as other IGA group projects pertaining to Geoscience Operations. Manny was formerly the Geoscience Operations Team Lead , Deepwater Gulf of Mexico for ConocoPhillips. (Posted 2/9/2004)

Mike Munsil was appointed Houston Region Director for the Texas Association of Professional Geoscientists, effective January 2004.

Before Long, Russia Won't Be Able to Satisfy the World's Oil Thirst

*by **Wayne Andrews***
Senior Vice President Equity Research
Raymond James & Associates
*(submitted by **Arthur E. Berman**)*

Art Berman's Comment: *This article was sent to me by my friend and colleague Josh Rosenfeld out of a shared interest in Russian petroleum potential, a recent consulting assignment I had working for Yukos and a mutual friend in an executive position with that company. The* Bulletin *is reprinting the article because it presents a provocative and ominous message about the inability of Russia to maintain its oil production and possibly its promise of future world petroleum supply.*

Quite simply anticipated foreign investment in the Russian petroleum sector following the fall of communism has not materialized largely due to political and structural problems in the Russian Federation. The Putin regime has created serious investor concern with its handling of the Russian "oligarchs" especially those in leading positions with the oil company Yukos. This, combined with ongoing infrastructure weakness and unsound oil field management, makes Russia an unattractive candidate for significant foreign investment. with little possibility for improvement in that situation.

Thanks to Wayne Andrews and Raymond James for their permission to reprint this article.

Since the mid-1990s, when Western economic powers crafted their long-term petroleum strategy, they have turned their gaze eastward. The vast hydrocarbon reserves beneath Russia represented an almost entirely untapped source of oil. Both domestic and foreign observers predicted that the nation's rapidly growing oil industry would help satisfy the world's insatiable demand far into the future. For several years, it seemed as if the conventional wisdom could be correct. Between 1998 and 2003, for instance, Russian oil output soared 43%, more than any major petroleum exporting country. Output has reached 8.5 MMbpd, or 11% of the world total. Last year alone, output grew a whopping 10%, almost triple the world average, and most analysts are predicting another 7-8% this year. Does this sound too good to be true? Maybe that's because it is.

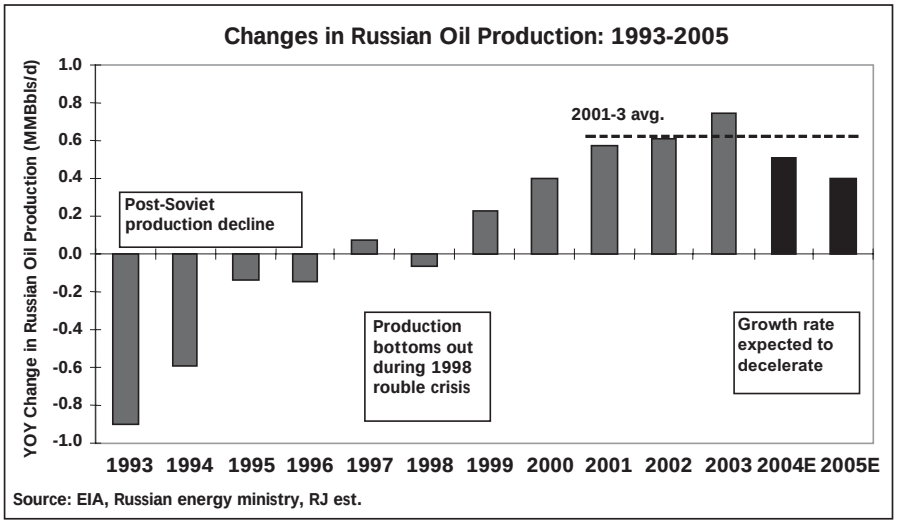
As the adjacent chart shows, we believe that last year's 740,000 bpd increase in Russian oil production will not be repeated again—probably ever. This represented a growth rate of 10%, nearly three times higher than the estimated 3.5% for the world as a whole. Between 2001 and 2003, growth averaged over 9% a year. For the next two years, however, we are forecasting a substantial deceleration in the growth rate: 510,000 bpd (6.1%) in 2004 and 400,000 bpd (4.5%) in 2005. Our outlook is more conservative than that of most other oil analysts, but even it may turn out to be too optimistic.

Challenging the conventional wisdom: Why Russia's oil production growth rate IS slowing

The conventional wisdom is not always off base, but in this case we believe it is flat out wrong. In fact, a potent combination of political and economic factors—many of which are only now coming to the fore—is beginning to severely constrain the growth rate of oil production in the entire former Soviet Union, and especially Russia. For the following three reasons, we expect the growth rate to slow dramatically over the next two to four years. In fact, the prospect of reaching a plateau is probably only a matter of time.

1. *Low investment is leading to reserve depletion.* Infrastructure was neglected for decades in Russia, and all of the recent investment barely restored oil production to pre-1991 levels. Because most of this investment aimed at quick profits rather than reserve growth, almost all of the "low-hanging fruit" has already been picked, and reserves at many Soviet-era fields are being rapidly depleted.

2. *Political fears and higher taxes make investment less attractive now than ever before.* Even before the Kremlin's campaign against Yukos, most supermajors were leery of committing large amounts of capital to Russia. Now, the sudden increase in political uncertainty hangs **Before Long, Russia Won't Be** *continued on page 55*



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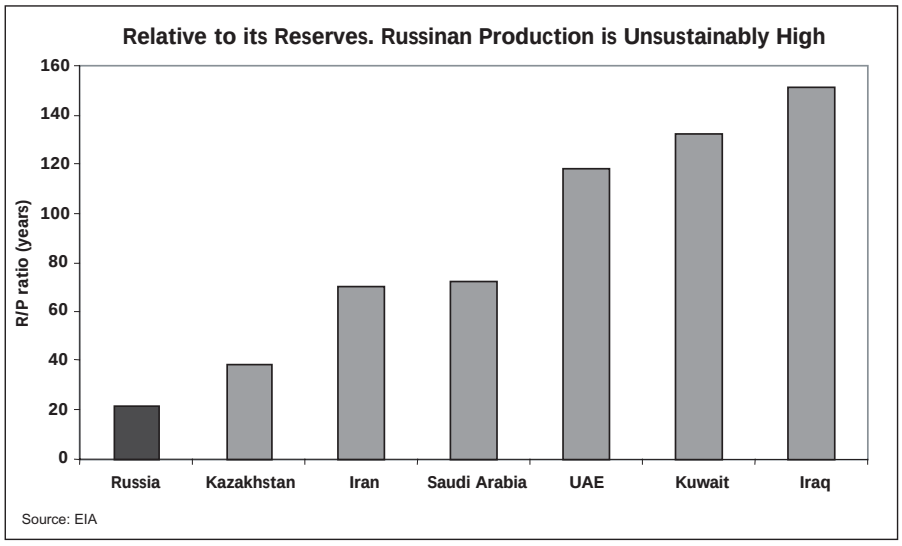
over the market, scaring away potential investors. The likelihood of higher oil taxes is also reducing expected future IRRs.

3. *Pipeline bottlenecks are limiting exports.* The Russian pipeline system is an inefficient, statedominated monopoly. To maintain central control over oil exports, the Kremlin opposes deregulation of the pipelines. As exports approach capacity, bottlenecks are already emerging.



Foreign investment in Russian oil was never all that high…

Contrary to popular belief, the massive levels of foreign direct investment (FDI) predicted for Russia after the fall of Communism never quite materialized. In the early 1990s, the fault lay with the country's poor credit rating and lingering fears that Communists might come back to power. In the aftermath of the 1998 default on the public debt, the level of uncertainty rose even further. It was only under the law-and-order presidency of Vladimir Putin beginning in early 2000 that meaningful FDI began to trickle in. But still, investors hungry for emerging market profits largely preferred Russia's neighbor to the south: China.

It appears that even the modest capital targeting Russia's petroleum industry in the 1990s was dominated by short-term investors, who preferred rapidly rising production over sustainable growth in reserves. This can be easily shown by the massive level of capital flight out of the country, which "cancels out" much of the FDI inflows. According to an estimate from the University of New South Wales, capital flight during 1992-95 alone totaled a whopping $7 billion. Much more recently, there was the decision by Sibneft's leading shareholders to sell out to rival Yukos. Though the merger fell through under Kremlin's pressure, it still showed that domestic entrepreneurs are trying to cash out their oil investments and move their savings abroad. Why would this be happening if growth opportunities in the Russian oil industry were as good as some analysts claim they are?

Certainly, there were some exceptions. Rapid consolidation during the 1990s meant that the industry coalesced into a few major players, led by Yukos, Lukoil, Sibneft, and TNK. These companies achieved high levels of operational efficiency, adopted Western standards of corporate governance, and generally were reliable partners for joint ventures. Majors like BP (BP/$48.75) and Marathon (MRO/$34.23) went as far as acquiring substantial stakes in their partner companies, with BP's $8 billion spent on the TNK deal representing the largest-ever foreign investment in Russian history.

Still, the publicity generated by a few high-profile deals was not commensurate with the actual level of longterm development of the oil sector. *In the case of Russia, the recent production gains represent "low-hanging fruit" that has just about all been picked.* With a few exceptions, the harder-to-develop reserves remain just as they had been a decade ago—undiscovered and untapped. As the chart below shows, *Russia's reserve life is lower than in many other large oil exporters, which bodes poorly for future growth prospects.*

… and after the recent political changes, expect it to go even lower

Even before late 2003, therefore, foreign investment in Russian oil was more of a trickle than a flood. But the developments of the past four months represent yet another snag. First came the Russian government's attack against Yukos, the largest corporation in the country. What began as the arrest of the company's chairman escalated into the threat of oil license withdrawal and a $3 billion tax penalty. The actual motivation behind this is irrelevant. Maybe it was a legitimate law enforcement action, or maybe a politically motivated scare tactic. Either way, this heavy-handed maneuver by the Kremlin is almost universally regarded as a grave political error. After believing for years that the rule of law was finally becoming entrenched, foreign investors found themselves sorely disappointed. In short, the political risk premium has clearly increased as a result of the Yukos situation. Renationalization of the oil industry is still extremely unlikely, but in the minds of potential investors, it is not as impossible as they once thought.

Besides Yukos, the worsening tax climate for oil companies in Russia is yet another **Before Long, Russia Won't Be** *continued on page 57*

Before Long, Russia Won't Be Able to Satisfy continued from page 55

cause for concern. In fact, it may have an even greater impact on the industry, since tax hikes can hit every company, not just those that get entangled in political battles. In a December speech, Putin signaled his willingness to close loopholes that allow many producers to pay less than the statutory 24% tax rate. The prospect of higher royalties and a "windfall tax" in case of unusually high commodity prices is also very real. Moscow relies on oil taxes for some 40% of its entire revenue, so it is easy to see why the idea is attractive to populist-minded policymakers. In fact, in last fall's elections, the nationalist Rodina party campaigned on aggressively raising taxes on the entire natural resource sector. Rodina won 10% of the seats in parliament, and seeing the popularity of its agenda, Putin is likely to co-opt its ideas as he campaigns for reelection. *Consequently, the outlook for investment in the industry is looking even bleaker than before.*

Pipeline bottlenecks: Blame Transneft!

Unlike the upstream and downstream segments, the midstream of Russia's oil industry is almost totally controlled by the state. Over 90% of the oil pipelines are owned and operated by Transneft, a state enterprise. The Kremlin insists on maintaining this pipeline monopoly, and so Transneft is secure in the knowledge that it will not be broken up or privatized in the name of greater efficiency. Furthermore, it has a strong financial incentive to oppose private-sector investment in new pipelines. Since it is backed by the regulatory power of the Kremlin, it can essentially veto any competing pipelines that materially threaten its monopoly. *All this translates into a chronic lack of capacity in Russia's pipeline system. In particular, capacity on the export side is constrained at about 3.5 MMbpd.*

Export bottlenecks are a new phenomenon in Russia, since until very recently pipeline capacity exceeded production capacity by a wide margin. Over the next several years, however, it is highly likely that the bottlenecks observed last year will get progressively worse. In January 2003, for example, Transneft declined to ship 3.7 million barrels from the company Surgutneftegaz. Around the same time, the monopoly's management decided to stop all exports to the Latvian port of Ventspils. These decisions clearly show Transneft's power over the market. While there are plans on the table for a multi-billion dollar pipeline in Russia's Far East, its construction will take years, by some estimates until 2008. Until then, export sales will remain constrained by the Transneft network, irrespective of what happens to production capacity.

Conclusion

While Russian oil output will continue to grow for the foreseeable future, the 8–10% growth rates observed for the past three years are rapidly becoming a thing of the past. Even the Russian government itself admits that depletion of existing reservoirs is a major long-term challenge for the industry. In fact, the energy ministry's own production growth forecast for 2004 is a mere 2.5%, an even more conservative projection than our 6.1% estimate!

For all the Kremlin's business-friendly rhetoric, the reality is that the climate for foreign investment is becoming less and less attractive. Existing momentum can only take the industry so far, and without massive infusions of new capital, production growth rates must inevitably slow down. Smaller countries of the former Soviet Union—most notably Kazakhstan and Georgia—should be less susceptible to the slowdown, as the supermajors reallocate their capital from Russia to the untapped potential of Central Asia and the Caspian region. But all indications are that Russian oil output will remain at least 80% of the FSU's total.

The bottom line is this: We believe analysts predicting many more years of near-10% Russian output growth are living in fantasy land. We are not expecting Russia to continue to provide the panacea for the world's oil thirst, and we don't think prudent investors should, either. ■

An Aging Question: The Discovery of Radioactive Decay was Pivotal to Scientifically Determining the Age of the Earth

by ***David Filmore,*** *(Today's Chemist at Work)*

Reprinted with permission from Today's Chemist at Work, *January 2004 13(1), 39-40 Copyright 2004 American Chemical Society.*

On a spring day in 1904, Ernest Rutherford was giving a lecture at the Royal Institution in London on his disintegration theory of radioactivity. His research with Fredrick Soddy at McGill University in Montreal had shown that as radioactive elements released their high amounts of energy, they were actually decaying spontaneously into different elements. This experimentally supported demonstration of alchemy was a seminal piece of work, to say the least. It ushered in a century of nuclear physics and described the source of most of the inherent warmth of the Earth.

On that day about 100 years ago, however, the young scientist had concerns that were diplomatic in nature. Upon observing the precise exponential character of radioactive decay, he had rather quickly come to the conclusion that it could be used for calculating the ages of geological materials. In initial measurements, he aged a piece of pitchblende, the main component of uranium ore, to be several hundred million years old. On the other hand, the eminent and self-confident physicist William Thompson (Lord Kelvin), who, incidentally, was nodding off in the front row of the lecture hall that day, had recently published his calculation that the Earth itself could be no older than about 20 million years.

To avoid an awkward situation, Rutherford put on the charm during the portion of his talk that dealt with the implications of radiometric dating. Iit worked as far as pacifying Kelvin ("the old boy beamed upon me," recounted Rutherford), although he was never fully convinced of Rutherford's claim. The fact was, however, that 20 million years was a grand underestimate. Radioactive decay would provide the physical means to give the Earth its due. Spiritual considerations are, of course, commonly involved in thoughts on the origin of the planet, and it is not surprising that religion was the initial source for determining the Earth's age. Eastern religions, such as Hinduism and Jainism, traditionally suggest that the Earth is eternal or goes through eternal creation–destruction cycles. Traditional Judeo-Christian faith, on the other hand, looks to the Bible with such questions and has much shorter, and pretty specific, answers. Most famously, in 1650, Archbishop James Ussher of the Church of Ireland published a "starting" date of October 23, 4004 B.C., based on a careful study of Genesis. This date was printed in some versions of the King James Bible for the next 200 years. Despite the authority associated with this date, the Earth being younger than 6000 years was highly questionable to many. Scientists began to approach the problem more empirically. Thermodynamics was a blossoming science in the 18th and 19th centuries, and it became the method of choice for the first scientifically based estimates of the age of the Earth. The assumption of these attempts was that the planet originated as a molten sphere and that it was continuously dissipating heat. Thus, determining the rate of dissipation would provide a means of calculating the Earth's age. In 1774, Georges-Louis Leclerc, comte de Buffon, of France, monitored the cooling process of small spheres and estimated an age of between 75,000 and 168,000 years. Lord Kelvin, one of the most prodigious scientists and inventors of his time, made very precise calculations for the cooling process of the Earth and, in 1862, arrived at a value of 98 million years, which he later revised to about 20 million years.

Hutton famously wrote in his **Theory of the Earth,** *"We find no vestige of a beginning." Furthermore, Charles Darwin needed well over 100 million years to account for his theory of evolution. But the physics of the day just wouldn't budge.*

The problem with these values, however, is they didn't agree with blossoming scientific theories of the day. According to the work of James Hutton in the late 18th century and Charles Lyell in the mid-19th century, the two founders of modern geology, the contemporary physical state of the planet is the result of very gradual changes that occur over immense spans of time. Hutton famously wrote in his *Theory of the Earth*, "We find no vestige of a beginning." Furthermore, Charles Darwin needed well over 100 million years to account for his theory of evolution. But the physics of the day just wouldn't budge.

Time Decayed

Radioactivity, discovered by Henri Becquerel and the Curies in Paris in the last years of the 19th century, resolved this conflict. The large amounts of energy bound up in some nuclei, such as uranium and thorium, act as a **An Aging Question** *continued on page 61*

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natural heating source for the Earth, thus debunking the idea of the continual planetary cooling process that was the basis of Kelvin's calculations. And the constant half-life in radioactive materials that was observed by Rutherford offered the possibility of precise geological timekeeping. Thus, scientists set out to gain more data on, among other things, products of the decay processes, as well as the decay rates for different materials.

Rutherford's initial age measurements of pitchblende used uranium/helium ratios, but helium gas, he determined, readily escapes into the atmosphere upon analysis, making the results likely underestimates. In 1907, Bertram Boltwood at Yale University observed that the abundance of lead in uranium-bearing minerals was strongly correlated with their estimated age, leading him to assert that lead was the final product of uranium decay. On the basis of this finding, Boltwood attempted some of the first radioactive dating measurements of rocks using ratios between uranium and lead.

Several years later, Arthur Holmes, a geologist at Durham University, refined Boltwood's uranium decay rate and calculated ages for several rocks based on the uranium–lead method, including one he dated at over a billion years old. And by the 1920s, the first estimates for the age of the Earth based on the uranium–lead method were surfacing in the public view. Henry Russell, an astronomer at Princeton University, reasoned in 1921 that the Earth was about 4 billion years old based on the assumption that the total amount of lead in the Earth's crust was produced by uranium decay. Holmes revised these calculations, and in 1927, he published a book that estimated the age to be about 3.2 billion years old. Several other uranium–lead calculations arrived at values in the 3–4-billion-year range as well. These determinations were a lot closer to reality than what was available at the beginning of the century, but a very important factor was lacking in the calculations, which inevitably made them inaccurate. This was the presence of isotopes.

Mass Spec Effect

The measurements by Holmes and others were based simply on the respective total amounts of uranium and lead in a mineral sample. But in 1913, J. J. Thompson at the University of Cambridge used his recently developed parabola spectrograph—the first mass spectrometer—to confirm the existence of isotopes by detecting neon atoms with two different atomic weights. His student, Francis Aston, went on to improve the resolving power of the instrument and measure a host of isotopes including, in 1927, three isotopes of lead. The presence of isotopes, of course, had big implications for radiometric age measurements. The decay of ^{238}U to ^{206}Pb is an entirely distinct process, with a much different halflife, from ^{235}U decay to ^{207}Pb, or, for that matter, from ^{232}Th to ^{208}Pb. Mass spectrometry (MS) offered a means of measuring isotope ratios, thus providing more accurate results for calculating geological ages.

At Harvard in the 1930s and 1940s, Alfred Nier was taking just this approach. He was able to detect a fourth isotope of lead, ^{204}Pb, which was not the result of radioactive decay. A focus of Nier was to try to determine the original, or "primeval," isotopic ratios of lead that existed at the formation of the planet. He, as well as Holmes, concluded that these values were a mathematically significant factor in modern isotopic ratios and, therefore, were required for accurate age measurements. In 1941, he came up with what he thought were good estimates of primeval lead ratios, from which Holmes calculated a 3.3-billion year time scale, but it turned out they were not. Perhaps Nier's biggest contribution to age measurements was the significant resolution improvements he made to the mass spectrometer (developing the instrument that separated ^{235}U from ^{238}U in the original development of the atomic bomb), while greatly simplifying its construction. Because the instruments could be more easily replicated, the powerful tool quickly became broadly available.

4.6 Billion Years

By the time Clair Patterson, a young University of Chicago graduate student, got into the "dating game," as it has been called, the problem was a reasonably well defined one. Plotting exponential growth curves based on lead isotope ratios—$^{206}Pb/^{204}Pb$ and $^{207}Pb/^{204}Pb$—provided the means to date an object basis of the uranium decay processes. The confounding issue remained the unknown primeval ratios.

In the late 1940s, Harrison Brown at the University of Chicago came up with a plan for measuring these ancient values. Based on his substantial knowledge of geochemistry, Brown concluded that the lead in iron meteorites would be preserved from the formation of the solar system without change from uranium decay. He assigned the task of analyzing meteorite samples to Patterson, one of his chemistry graduate students who had gained expertise in MS on the Manhattan Project. It would take Patterson seven years to make the necessary measurements. A large portion of that time was taken up putting together clean laboratories—first at Chicago and then at the California Institute of Technology, where he became a postdoctoral student in 1952—to exclude contamination from hindering his analysis of lead samples that were 1000 times smaller than any observed before. (Incidentally, his realization during this period of the high prevalence of lead in common objects was a seed for what would soon become a lifelong crusade to remove lead from consumer products such as gasoline.) Patterson's efforts eventually panned out, and he was able to produce highly clean meteorite samples in the early 1950s. By that time, the development of MS had accelerated, and in 1953, **An Aging Question** continued on page 62

An Aging Question continued from page 61

he took a trip to Argonne National Laboratory in Illinois to use its then top-of-the line spectrometer. His analysis at Argonne of the meteorite samples along with modern-day rock samples would be the basis for the age he publicly presented later that year: 4.55 ±0.07 billion years. In 1956, Patterson demonstrated that the data from five different meteorite samples and several deepsea Earth sediments all fell on the same isotopic growth curve, strongly supporting the use of meteorites as a "starting point" for Earth's geological clock. Even today, with significant increases in instrument precision, Patterson's number has held up as the most accurate determination of the age of the Earth. ■

Further Reading

Borman, S.; Russell, H.; Siuzdak, G. *Today's Chemist at Work* Sept 2003, 47–49.

Bryson, B. *A Short History of Nearly Everything*; Broadway Books: New York, 2003.

Dalrymple, G. B. *The Age of the Earth*; Stanford University Press: Palo Alto, CA, 1994.

Lewis, C. *The Dating Game: One Man's Search for the Age of the Earth*; Cambridge University Press: Cambridge, U.K., 2000.

McGrayne, S. B. *Prometheans in the Lab: Chemistry and the Making of the Modern World*; McGraw-Hill: New York, 2001.

HGS Undergraduate Scholarship Foundation Presents Six Scholarships

The HGS Undergraduate Scholarship Foundation has been providing scholarships to deserving students since 1984. To date, over $94,000 in scholarships have been awarded. This year the Foundation awarded six scholarships. John Adamick presented scholarship winners at the January HGS dinner meeting. Universities included in the undergraduate scholarship program include Lamar University, Sam Houston State University, Stephen F. Austin State University, Texas A&M University, the University of Houston and the University of Texas.

The following were presented in the March 2004 Bulletin *as having received the Outstanding Student Award. The Outstanding Student Awards will be profiled in the May 2004* Bulletin.

Listed below are the HGS Undergraduate Scholarship Foundation receipients that were presented as the Outstanding Student Awards.

Donnie Buckalew
Lamar University

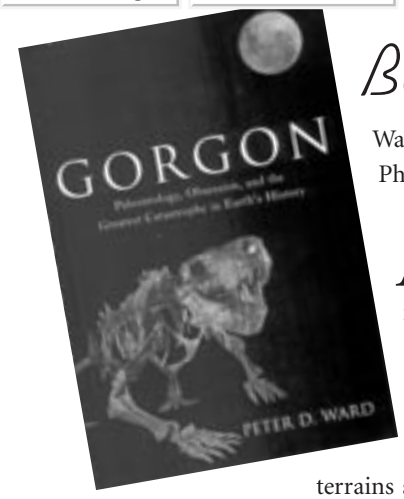
Paul Burgess
University of Houston

Courtney Harmon
Texas A&M University

Lynn Holik
Sam Houston State University

Jennifer Rohrer
Stephen F. Austin State University

Alka Tripathy
University of Texas



Book Review

by **George O. Chandlee,** *Source Environmental Sciences, Inc.*

Ward P. D., 2004, *Gorgon: Paleontology, Obsession, and the Greatest Catastrophe in Earth's History*, with Photographs (Black and White), 257 pp. Viking Penguin. $27.95.

As geoscientists, the promise of adventure, even if only in our imagination, is a shared professional attribute. The anticipation of working in alien, seldom visited, and not commonly known, foreign terrains sparks a hope that the goal of adventure will be realized. If this pursuit for adventure is coupled with a passion to discover new and unforeseen geologic events, then a recipe for bold efforts is forged.

In *Gorgon: Paleontology, Obsession, and the Greatest Catastrophe in Earth's History*, Peter Ward describes his own adventures and experiences as to "why scientists would so doggedly, and at the cost of such hardship, devote their lives" to the pursuit of knowledge about the mysteries of Earth history. Ward describes his visits to and experiences in the Karoo Basin in South Africa over a period of 10 years. In a first-hand narrative, he relates the perils, the primitive living conditions, physical hardship, unpredictable weather, and laboratory disasters that often accompany geologic exploits.

The most well-known and popularized event in the biological and geological history of the Earth has long been dominated by one major event the Cretaceous mass extinction. This marked the end of the dinosaurs and created the window of opportunity of the expansion of mammals. The notion is that this is the "watershed" event in the history of the Earth. There is, however, overwhelming evidence that another, more catastrophic event took place at the end of the Paleozoic. The magnitude of this extinction event eclipses the Cretaceous extinction. In fact, it was so cataclysmic that an estimated 90% of all species then in existence became extinct.

The Karoo Basin is in South Africa, a good eight hours drive into the interior from Capetown. It is "vast expanse of dry land and semiarid desert," a landscape shaped first by sedimentary rock deposition during the late Paleozoic and then by volcanic activity in the Jurassic as the continents rifted apart. The Permian-Triassic faunal succession in the Karoo, described in great detail by Robert Broom (a Scottish physician) in the early 20th century, records the rapid evolution of protomammals into true mammals. Broom painstakingly established a succession of Permian and Triassic time units based on his detailed studies of the Karoo fossils. These time units still serve as the basis of the modern stratigraphy in the region.

Gorgonopsians (or "Gorgon" for short, as in the book's title) were mammal-like reptiles and top-tier predators of the Late Paleozoic world. The fossils of these animals are found in the uppermost strata of the Karoo Series of South Africa. Here a continuous stratigraphic sequence records the biological and geological events that transpired in the transition from Paleozoic and Mesozoic. It is fertile hunting ground for deciphering the causes and effects of a catastrophic event that altered the history of the Earth.

As an example of the physical aspects of geological fieldwork, Ward provides a very detailed narrative concerning the effort and painstaking attention to detail required to obtain continuous sedimentary cores at a location in the Karoo Basin. The purpose was to obtain core samples for laboratory work. The process of manually drilling, recording the data and core orientation and packing the cores for later analysis is described at some length. Despite a full days effort sometimes fewer than 20 cores was all that resulted.

Another interesting section in the book describes the discovery of a particularly well-preserved and complete vertebrate fossil by Roger Smith, a colleague of Ward's, and an authority on Karoo vertebrate faunas and biostratigraphy. The book describes the details of its excavation. At first the members of the field crew thought this was a complete skeleton of a gorgonopsian, a rare discovery and a prize fossil. Rain and crew injuries threatened the excavation. Only after exhausting efforts was the skeleton extracted from the rock and wrapped in plaster. Further analysis showed, however, that this was not the passionately hoped for gorgon, but something resembling a Lystrosaurus, a very common vertebrate fossil found in early Triassic strata.

By assembling evidence from diverse (but ultimately related) disciplines such as geomagnetics, biostratigraphy and geochemistry Ward develops an explanation for the Late Permian extinction. As it turns out, uppermost Permian, Triassic, and lower Jurassic sedimentary rocks around the world are red in color. This is an indicator of oxidation. During the Late Permian the continents were separating apart and global sea level was falling. Organic rich marine sediments, ultimately destined to become sedimentary rock, were exposed to the atmosphere as sea level fell. Oxidation of these organic rich deposits depleted atmospheric oxygen. Ward postulates that during the period of time from the uppermost Permian to the lower Jurassic the oxygen atmospheric levels of oxygen fell to perhaps 15 percent or less, well below today's level of 21 percent.

Ward concludes: Late Permian terrestrial and marine fauna were in essence asphyxiated by a decrease of atmospheric oxygen, caused by a series of events that

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Warren L. and Florence W. Calvert Memorial Scholarship Graduate Students

The HGS Warren L. and Florence W. Calvert Memorial Scholarship Fund (CMSF) provided financial assistance to graduate students at Gulf Coast area universities. Since 1978 the fund has awarded $196,000 in scholarships to 52 students (16 female, 36 male; 40 M.S., 12 Ph.D) at 16 different colleges and universities.

The fund continues to receive applications from well-qualified students with financial needs who have the desire, interest and academic qualifications to pursue the education that will provide the expertise needed to fill the many technical and managerial positions in the petroleum exploration industry. The CMSF awarded five scholarships to deserving students in graduate studies for the 2003–2004 academic year.

Graduate students in the earth sciences (geology and geophysics) may apply for scholarships March 1 through June 15 each year. Scholarship forms are available from the secretary of the fund.

Wesley James Bauke is currently working on a Masters at Oklahoma State University, where he is doing a field-oriented structural thesis in Death Valley. He got his undergraduate degree from Sam Houston State University where he was an undergraduate teaching assistant.

Douglas S. Hinkle is currently working on a Masters at the University of Houston where he is studying patterns of erosion and deposition along the lower reach of the Trinity River. He got his undergraduate degree at the University of Houston. Prior to that, he spent 6 years in the U.S. Navy as an electronics technician and nuclear reactor operator.

James Cory Orofino is currently working on a Masters at Texas A&M University where he is studying inversion tectonics in the Grand Canyon region of the Colorado Plateau. He got his undergraduate degree in physics for Colorado College where, among his other achievements, he was captain of the rugby team.

John J. Perri is currently working on a Masters at the University of Texas at Austin, where he is studying the structural geology of the Eastern Franciscan subduction complex in California. He got his undergraduate degree in geological engineering from Cornell University, where part of his time was spent as a math tutor.

Suzanne A. Pierce is currently working on a PhD at the University of Texas at Austin where she is working to develop a method for integrating hydrogeologic techniques with economic and environmental data to improve groundwater allocation and management. She got her undergraduate degree from the University of Arkansas, Fayatteville after which she worked in the environmental field, including 4 years as Environmental Manager for the world's 7th largest copper mine in Chile.

MARS EXPLORATION DAY AT THE HOUSTON MUSEUM OF NATURAL SCIENCE WITH TROOP 5209

by Cecilia Cisar

On Saturday, January 17, 2004, Girl Scout Troop 5209 participated in Mars Exploration Day at the Houston Museum of Natural Science. Our troop members are Cecilia Cisar, Sydney Weyand, Noel Hilliker, and Shelby Gill. We are all 4th graders and first year Juniors from Cypress, Texas. Mrs. Denise Gill is our leader. During Mars Exploration Day we went on a scavenger hunt, did an egg drop, raced rovers, and met Bill Nye the Science Guy.

At a special Scout event we designed a landing apparatus to protect an egg from breaking when dropped from the museum roof. We put it in a lander and got to choose two of the following materials to cushion its fall: a parachute, bubble wrap, and four balloons. We used four balloons and a parachute (even though I wanted to exchange it for bubble wrap). This simulated the airbag and parachute landing of the Mars rover, *Spirit*. It was exciting to see one of our eggs land safely when it was launched from the museum roof.

Then we did the scavenger hunt. Volunteers from the Houston Geological Society were staffing some of the stops on the scavenger hunt to help us learn more about the Red Planet. Dr. Janet Combes taught us about solar panels and why they are used on the rovers. We also got to make a sundial that was like the one carried by the Mars rovers. Some of the other stops on the scavenger hunt were name the first spacecraft to land on Mars, where did Earth's oldest fossils live, and which Texas place is most like Mars. We learned that hematite, a mineral on Earth, might also be found on Mars. We even got to touch a piece of Mars that came to Earth as a meteorite.

After that we got to meet Bill Nye the Science Guy. Bill Nye was at the museum to film a live TV show that is called "First Look, Passport to Knowledge." The show was about the Mars rover, Spirit and covered the Mars activities at the museum. Bill Nye posed for picture with our troop and signed his books. All in all, it was a fun trip and it was fun learning about Mars. Maybe one of us will even get to go there! ■

Members of Troop 5209 attentively listen to HGS volunteer Janet Combes explain the use of solar energy on the Mars rovers.

Scouts proudly show their "egg lander"and their egg that survived the drop from the HMNS roof.

Members of Junior Girl Scout Troop 5209 (left to right) Sydney Weyand, Shelby Gill, Cecilia Cisar, and Noelle Hilliker with Bill Nye, The Science Guy.

On-line Event Registration: A Business Priority for the HGS

For many years there was a feeling in the geological community that sequence stratigraphy was an option, an esoteric if trendy alternative to "plain, old stratigraphy." The truth is that sequence stratigraphy is what stratigraphy has become due to the insights that modern seismic data has given to us, not merely a choice.

As with sequence stratigraphy a decade ago, some feel that doing HGS business on-line may be fine for others but they are going to continue registering for events the good, old-fashioned, tried-and-true way by calling Joan or Lilly by phone at the HGS office.

I won't push the parallel between sequence stratigraphy and on-line event registration too far but let me say what has not been said publicly, much less in print, before:

Registering for HGS events on-line may be a choice but it is also a hard business priority for the Houston Geological Society that everyone who can should start registering on-line.

The Houston Geological Society is a dynamic, active organization and, because of this, has a full schedule of technical talks, short courses, symposia and other events that are heavily attended by both Society members and by those in the earth science community at-large. The reservation scheduling and book keeping of HGS events is a strenuous and sometimes overwhelming task for our dedicated office staff, officers and volunteers.

If all or most of the event scheduling and registration were handled by phone, e-mail or fax our office staff would have no time for the other critical job functions that they perform. On-line registration vastly streamlines both the scheduling and book keeping of HGS events and it makes the process easier and more secure for you.

Why register and pay on-line on the HGS Website?

- it's easier and simpler for *you*!
- *you* are charged the right price
- *you* know exactly what you are signing up for, when and where is it being held and you can read or print a summary of the event
- *you* have a physical record of your reservation as well as all HGS events for which you are registered and that you have attended
- *you* can change, cancel, pre-pay your reservation and register a guest
- *you* walk directly into your event without having to sign-in

Why registering and paying for events on-line is good for the HGS

- it's easier and simpler for the HGS too!
- it saves money and saves time for our office staff
- it lets us know how many attendees to plan for and how many have already paid
- it makes our record-keeping simpler, faster and less expensive

I know that not everyone has access to a computer or the internet and, for those who do not, you can still register for events "the old-fashioned way" but with a twist: the order of preference is:

Webnotes *continued on page 71*

Webnotes continued from page 69

1. e-mail first
2. fax second
3. telephone *only if absolutely no other option is available to you*

Please understand that if you don't or can't make your reservation on-line and choose to do it by e-mail, fax or telephone, your reservation will still be made on-line. You are simply transferring the job to the HGS office staff.

On-line is the way all HGS event registration is handled (it's like sequence stratigraphy after all!).

E-mails or faxes are preferred because telephone call volume is often overwhelming. Someone will make your reservation on the Website for you: you must have the following information ready when you e-mail, fax or call:

1. Event name and date
2. Attendee's name and, if a current or past HGS or GSH member, their member number
3. Attendee's e-mail address (or a contact phone number if you don't know the e-mail address)
4. Credit card number and expiration date if you want to pre-pay or you may choose to pay at the door

e-mail reservations: Reservations@hgs.org
fax reservations: 713-463-9160
voice reservations: 713-463-9476

Regardless of how you make your event registration the HGS refund policy applies. If you make a reservation, pay for it and later decide to cancel before the reservation deadline, you can apply for a refund through the HGS office using the e-mail, fax or voice contact information.

Refunds cannot be made for reservations that were paid for but not cancelled before the reservation deadline.

Beginning in March an on-line event registration brochure will be distributed at all HGS events with clear and simple instructions and pictures to make on-line registration even easier for you.

The HGS Executive Board is unanimously committed to as close to 100% on-line event registration as is possible. If you have internet access, please help us meet this very important business objective: **be kind, register on-line!** ■

Book Review Continued from page 67

began with the dropping of sea levels. A new type of extinction seemed to have occurred, fast and in pulses, "a series of episodes of extinction one after the other for perhaps a hundred thousand years." The Gorgon, the "lion-like" predator of the Permian, became extinct, along with nearly all its contemporaries due to oxygen depletion.

Thus, as one theme of *Gorgon*, adventure and the tireless pursuit of a goal can lead to discoveries that form the framework for a new architecture of the history of the Earth. As geoscientists, this book will be appealing because of the first-hand accounts of fieldwork in an exotic location. It will also unlock the imagination of nearly everyone if only because of the highly detailed narrative about the excitement of fieldwork and discovery. The book offers new thoughts about mass extinctions in Earth's history and opens us to a first hand account of the demanding, but exhilarating, aspects of geological field work. It will ask the reader to ponder a second mass-extinction in the history of the Earth and, in so doing, to forge a new perspective on the history of the Earth. ■

2004 North American Prospect

Article and photos by Arthur E. Berman

The North American Prospect Expo (NAPE) was held in Houston February 5 and 6, 2004, and the event had a decidedly upbeat atmosphere. I say this comparing NAPE to other petroleum industry gatherings I have attended over the past year.

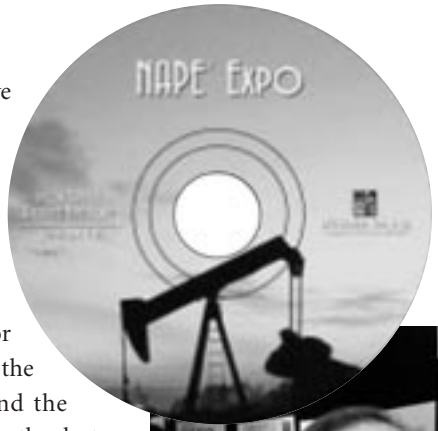
The HGS co-sponsored APPEX (AAPG Prospect & Property Expo—HGS *Bulletin*, November 2003) meeting in September 2003 was generally positive but somehow the expo felt dwarfed by the sheer size of the George R. Brown Convention Center.

The AAPG Annual Meeting in Salt Lake City in June 2003 was downright depressing. At AAPG attendance was light and the atmosphere was subdued at best. This was not just my opinion but was widely expressed at the meeting and by exhibitors I spoke with afterwards—several exhibitors told me they would never again have a booth at AAPG after the Salt Lake meeting.

The Africa Symposium (Africa: New Plays—New Perspectives; also in the November HGS *Bulletin*) held in the same month as AAPEX (September, 2003) was viewed enthusiastically by everyone I interviewed. Interestingly, however, several of those I interviewed on the Africa Symposium volunteered that that the George R. Brown Convention Center seemed like too big a venue for the recently-held AAPEX.

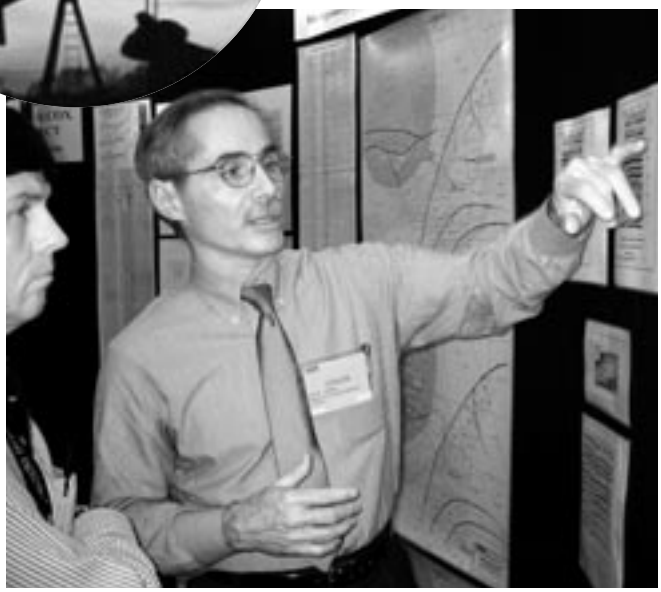
In any event, this year's NAPE was a well-attended and energetic event both days in early February. Five hundred eighty-nine companies exhibited at NAPE with a total of 878 booths and overall attendance of 9562. The George R. Brown Convention Center felt just right for the crowd that attended NAPE. I heard several people say that the

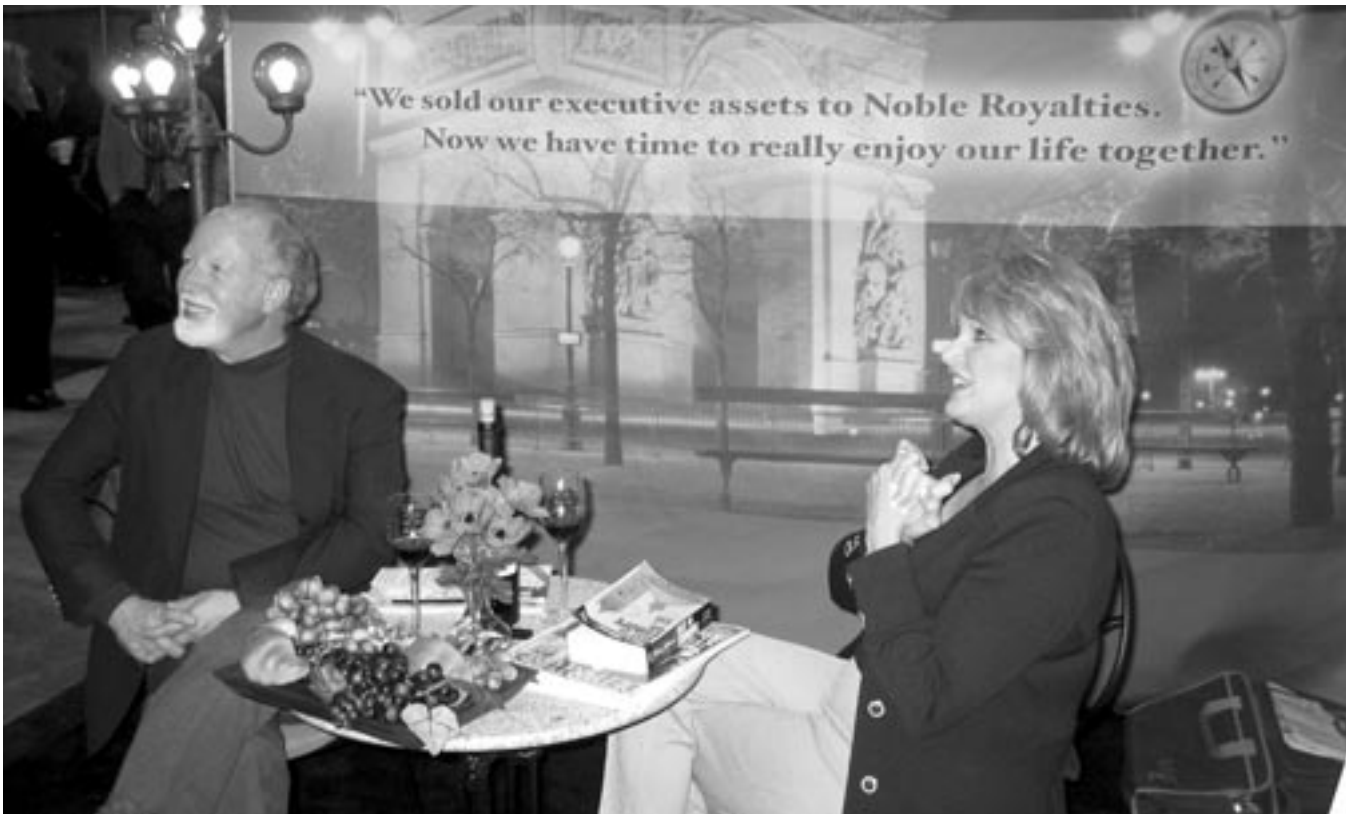
Expo (NAPE) Upbeat



event could only have been improved if everyone gave up on talking about deals and just admitted they were there for the social aspects of the meeting.

NAPE began in 1993 to provide a forum for oil and gas companies to present and market oil and gas prospects. NAPE brings together prospects, technology and venture capital to produce a market place for business, purchases and trade. NAPE is hosted by the American Association of Petroleum Landmen and the Independent Petroleum Association of America. Many thanks to Deborah Dupree, AAPL event coordinator, for providing attendance numbers and other statistics to the HGS *Bulletin*. ■





HGA *and* GeoWives **News**

HGA

By Norma Jean Jones, First Vice President

Spring is in the air and the 2003–2004 HGA Calendar year is drawing to an end. We are looking forward to our final meeting to be held on May 10 at the Junior League of Houston. Judy Lusky with the Sugar Land Steinmart will prepare us to update our wardrobes by presenting a style show of lovely spring fashions. With Shirley Gordon and Dixie Bartell co-hosting, we are confident of another outstanding event. We'll see you there. Encourage other members to attend, bring a prospective member or a friend or two, and you will be glad you did. Be watching for your invitations.

Thanks to Gwinn Lewis and Kathryn Bennett for co-hosting the March luncheon on St. Patrick's Day at Vargo's Restaurant. We had a lovely lunch and the Tip Top Dance Team awed us with the dance routines. I think we were all impressed and encouraged by this talented group of lovely mature ladies. If you missed this show, you really missed a treat.

I wish you all a Blessed and Happy Easter.

GeoWives

Share your talents with us on the evening of 25 April at the home of Pat Burkman, 802 Briar Hill, 77042. We have many gifted members and are looking forward to seeing that special piece of artwork or hearing amusing and interesting stories, perhaps about your travels. Advice on gardening in Houston would be most welcome as would any informational videos you may have produced or been involved in. Our musicians and singers are especially welcome. Even those who do not feel they want to share their talents on this occasion will be very welcome to join us in this great evening of fun. Call Pat at 713-783-6469 for more details.

Many thanks to Martha Lou Broussard and Linnie Edwards for a wonderful day out in the country in March.

Please see our membership application on page 70.

You are invited to become a member of

Houston Geological Auxiliary

2003–2004 dues are $20.00

make check payable to *Houston Geological Auxiliary* and mail to:

Audrey Tomkins • 3007 Stalley • Houston, Texas 77092

HGA YEARBOOK INFORMATION

Last Name	First Name	Name Tag

Spouse Name	Name Tag	HGS Members Company

Home Phone	Business Phone	Business Fax
( )	( )	( )

Street Address	City	Zip

Birthday, Month, Day ONLY	Email Address	Home Fax
		( )