HGS Bulletin
Houston Geological Society
Volume 55 Number 5
January 2013

Legends of Sedimentology




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January 14, 2013

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The Bulletin
Houston Geological Society

Volume 55, Number 5 January 2013

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The Houston Geological Society Bulletin (ISSN-018-6686) is published monthly except for July and August by the Houston Geological Society, 14811 St. Mary's Lane, Suite 250, Houston, Texas 77079-2916. Phone: 713-463-9476; fax: 281-679-5504

Editorial correspondence and material submitted for publication should be addressed to the Editor, Houston Geological Society *Bulletin*, 14811 St. Mary's Lane, Suite 250, Houston, Texas 77079-2916 or to psanto@statoil.com

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POSTMASTER: Send address changes to Houston Geological Society Bulletin, 14811 St. Mary's Lane, Suite 250, Houston, Texas 77079-2916

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Applied Geoscience Conference

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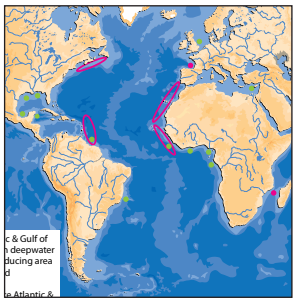

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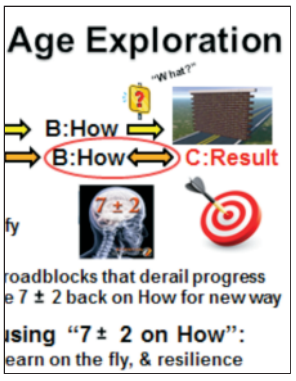

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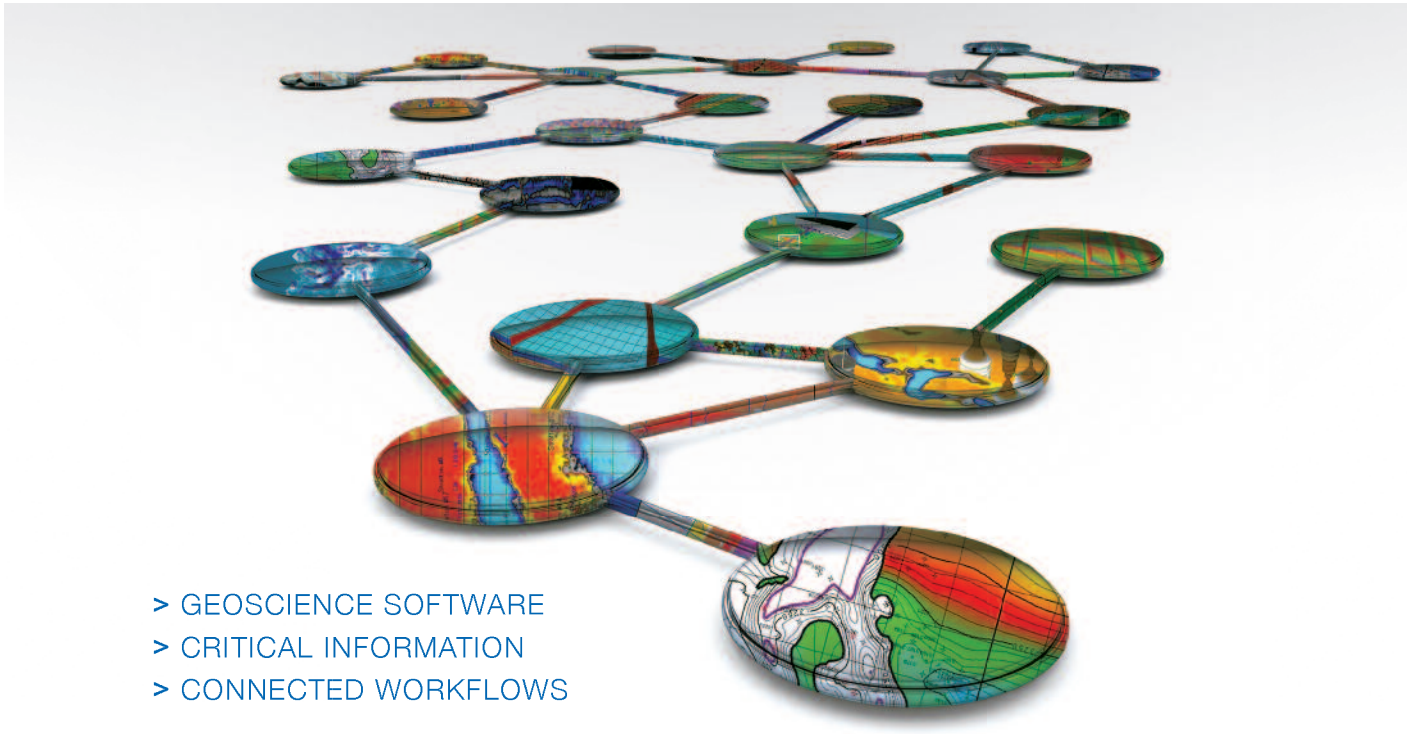

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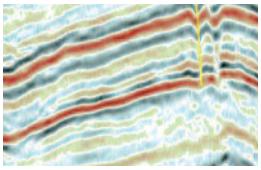

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HGS Legends Night 2013

Legends in Sedimentology

Monday, January 14, 2013

Special HGS Dinner Meeting Program

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Legends Night *(2009)*
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Martin Cassidy
mcassidy.hgs@gmail.com

Happy New Year
The Old is New Again

The New Year is upon us and, yes, it is a new beginning. However, we are in the middle of our HGS year with our monthly HGS General evening and noon meetings, our International, North American, Environmental and Engineering, and Northsiders meetings. A special treat in January is Legends Night 2013: *Legends of Sedimentology* on January 14, 2013. It is a night with our great teachers, **George Devries Klein**, James Coleman, Miles Hayes and Robert Folk.

HGS' meetings are important opportunities to stay current with new technology and information. These are going to be much needed as change in our business occurs at an increasing rate.

Not only do we have new understanding of "shale" oil and gas, in many reservoirs not strictly shales, horizontal drilling, and hydraulic fracturing technologies improve by the month. Water protection and handling, a concern as old as civilization, is now a hot topic. At the recent Gulf Coast Association of Geological societies (GCAGS) meeting in Austin, a full day of talks dealt with water issues of the Gulf Region – its use, availability, and the level of need in unconventional plays. The amount of time given to water use talks was equal to that allocated to shales in the Gulf Coast Region.

We in the industry need to be very careful that in the quest for speed in drilling to objective that we do not slight the planning and execution of drilling the shallow portions of wells. Water is precious, especially in the semi-desert of Southwest Texas.

We in the industry need to be very careful that in the quest for speed in drilling to objective we do not slight the planning and execution of drilling the shallow portions of wells. Water is precious, especially in the semi-desert of Southwest Texas.

A cautionary tale comes from distant North African land of Tunisia where an American firm had a water blowout in the desert while drilling a simple deep hole for a seismic survey. Suddenly, the well spit the drill string out of the uncased hole with a heavy flow of fresh water. The mobile rig managed to drive free, but the well continued to flow, a crater expanded, and a lake began to form. Attempts to control the flow were futile as the well swallowed casing and lowered the rig. Workers were able to scramble to safety.

Management went to the Tunisian President to ask permission to leave the lake and was relieved to learn that the new oasis was welcome. Now, nearly 30 years later, birds nest in the reeds and local herders water their flocks around "Lake Rankin," named after the engineer whose casing disappeared down the hole. Such a lake would not be acceptable in South Texas!

This year economics of oil and gas plays are likely to change because the industry is viewed as a milk cow by the Federal Government and as a devouring dragon by environmentalists and most media. We need to explain ourselves to those outside the industry! Our livelihood depends upon it.

We must also be adaptable. The great crew change is coming, and we are it! What are the retirees to do? There are wives that say: "I married you for better or for worse, but NOT for lunch." You can volunteer to join a committee of the HGS and you can generate prospects and sell them. To help you in that venture HGS member **Charles Sternbach**, current President of the AAPG division of DPA, will organize a Playmaker Forum for this January 24, 2013. For details please see a description later in this *Bulletin.*

So the year begins with the industry in more transformation than ever. Old questions are new again. Stay alert, keep educated, and become or remain involved in the HGS. ■

HGS LEGENDS NIGHT 2013

JANUARY 14, 2013

HGS LEGENDS Night

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Patricia Santogrossi
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Semantics and Seismic Stratigraphy

A colleague recently demonstrated a propensity to use the word "productive" when he referred to hydrocarbon-bearing sands, none of which have been produced. The concern was that our management audience might attach more importance to the observations than was warranted. Neither is all that is resistive on logs necessarily pay; it may be tight marl, an ash bed, or even pressured shales. Words are very powerful, can be subliminal, and may send a listener off on a mental tangent. A bit of care and precision is often advisable. When complex concepts are under discussion, often simple and descriptive terms are easiest to grasp. With regard to seismic stratigraphy, some practitioners are industry trained rather than book learned. My first industry job was a summer internship at Shell's Bellaire Research Center wherein my project, in 1975, was to explain what Vail et al.'s long abstract, a predecessor to the famous book on Sequence Stratigraphy (1977), was about. Participation in Shell's first Seismic Stratigraphy Workshop (1978) and then in its second in 1984, laid the groundwork for my career. I recall that I was only repeat attendee/contributor; the first was attended mainly by exploration stratigraphers, and the second mainly by research geophysicists.

The ability to perceive subtle differences to decode the spatial and temporal distribution of deposition and deformation events varies with the individual. It cannot be presumed to be present or even acquirable skill for every geoscientist.

This ultimately led to involvement in training at Shell, Marathon, and Vastar in Structure and Basin Evaluation, and to an interest in how people learn. This exposure led to opportunities to influence a succession of managers regarding accommodation space, lateral prediction accuracy, and reservoir detection on seismic. Eventually, I also realized that if there were say ten sequential observations in a particular area of study, some people may be able to recognize and describe seven of them and others only three. The ability to perceive subtle differences to decode the spatial and temporal distribution of deposition and deformation events varies with the individual. It cannot be presumed to be a present or even acquirable skill for every geoscientist. Some may have innate skill, practice can hone the skill; however, some do not have the knack and may only be able to appreciate it.

One training set was designed to help a hand–picked team to learn to calibrate proximal to distal facies and faunal changes in a basin. One of my managers thought that there was nothing to this seismic stratigraphy / lateral prediction stuff so he borrowed this well calibration training set developed from the classic West Cameron shelf to slope setting and gave it to his "favorite" geologist. The manager inadvertently, and rather neatly, proved my point when the fellow returned the sections and, instead of showing progradation from landward to seaward, he had backfilled the section seaward to landward. Would not have believed it if I had not seen it with my own eyes.

Another gem captured for training purposes is the one shown in Figure 1 of a minibasin from Garden Banks. Minibasins are by definition those small basins that form entirely within canopied salt. They largely contain Pliocene and younger in situ sedimentation, the oldest of which sets the upper boundary for the age of the arrival of the canopy — lower Pliocene in northeast GC and upper Pliocene in KC for example. Any and all Miocene and older material and fauna are reworked. Incidentally, the base of these basins should not "sag" beneath the base of the salt canopy. Check your velocities if they do.

The example minibasin is filled with upper Pliocene and Pleistocene sediments. This example shows the use of some simple, descriptive nomenclature. I have never been fond of codes for either faunal markers or for sequence stratigraphic elements, as I think they have formed a culture of "haves" and "have nots" as to the understanding of basin architecture and the ability to appreciate the systematic way in which basins are developed and preserved.

From The Editor *continued on page 9*

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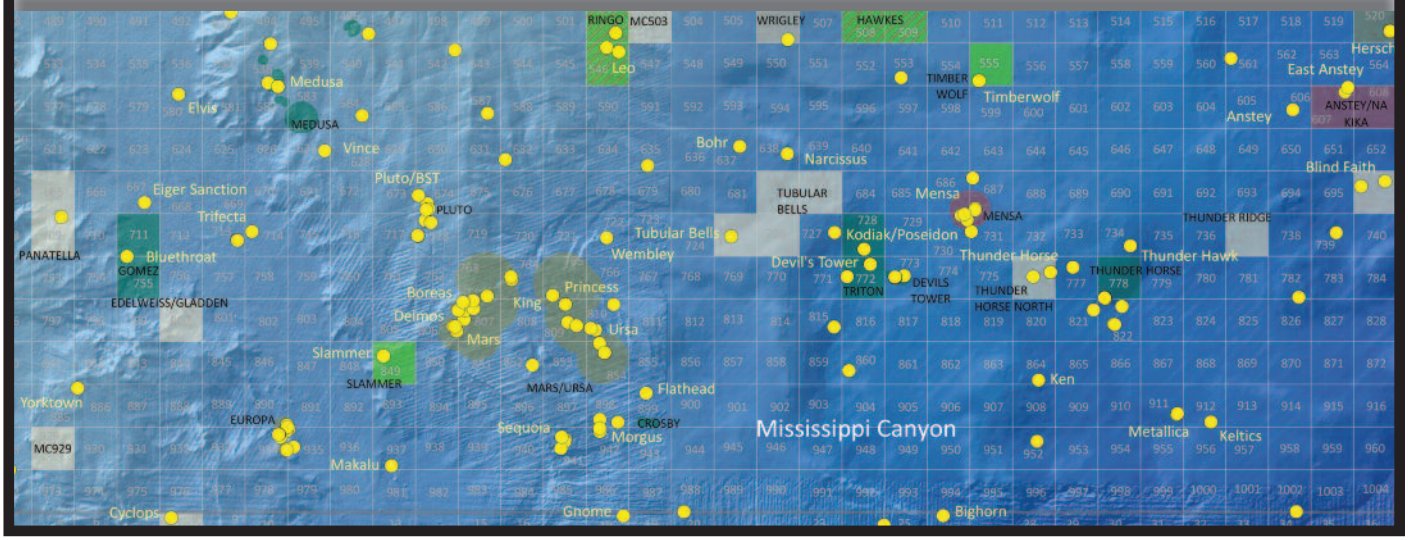


From the Editor continued from page 7

Here is a simple way to unlock the clues to a basin's development. First of all, gross packages of the basin's fill can be identified that are genetic and representative of the ***basin phases*** of development (**Figure 1a**). This is an indicator of every time the basin changed shape due to salt evacuation. The boundaries are identified by ***discordance*** of both geometry / alignment and of facies.

I am still waiting to get my hands on software that would allow this work to be done / shown easily in three dimensions. In the meantime, I have graduated from colored pencils on paper to PowerPoint. I still hand color sometimes when I am in a hurry to capture a first impression or when I want to go portable or be "hands on".

From The Editor *continued on page 11*

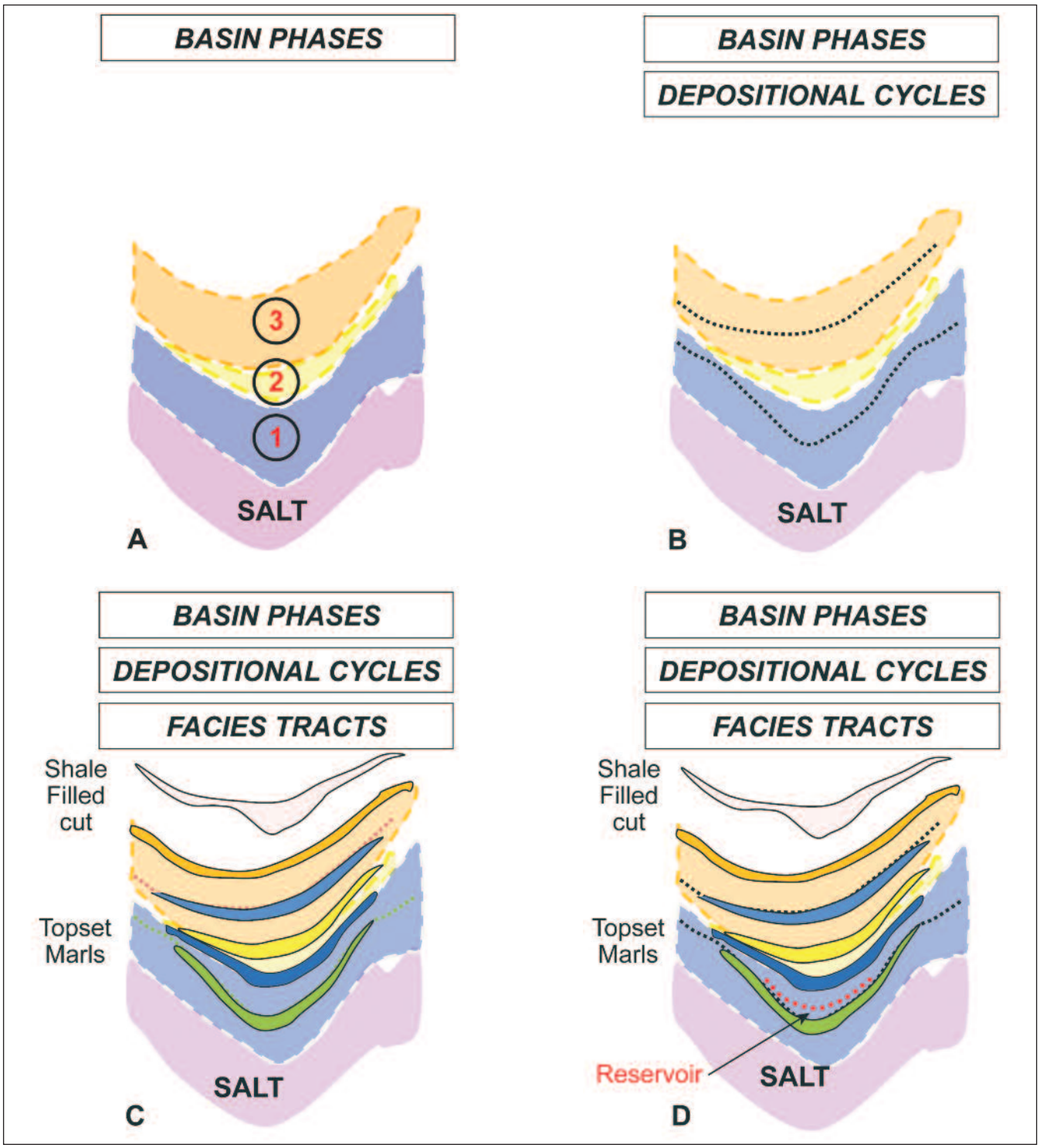
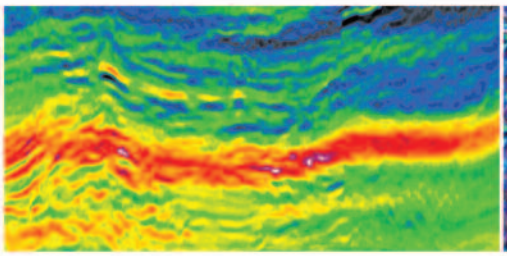
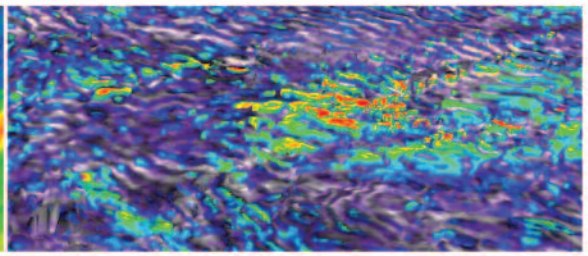


Figure 1. *Pliocene fill of a minibasin in Garden Banks*

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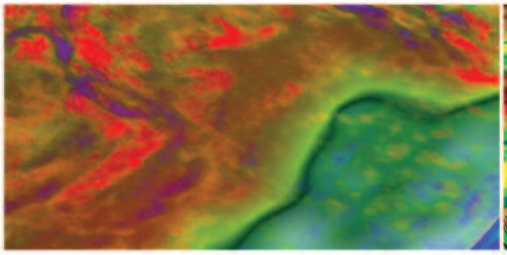
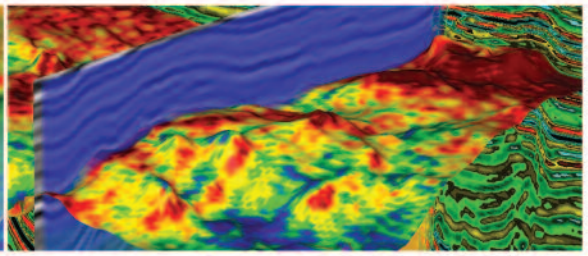

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From the Editor continued from page 9

Basin phases 1 and 3 in this example (**Figure 1b**) have more than one ***depositional cycle*** in the fill as indicated by the dotted black lines. Each of the five depositional cycles is capped with a marl ***facies tract*** which indicates that the clastic "machine" shut off episodically (**Figure 1c**). Only the second depositional cycle of the first basin phase shows evidence of coarser clastics in a basin floor fan setting (**Figure 1d**). A younger shale cut and fill cycle is shown in the Pleistocene.

I particularly eschewed the practice of what I called "seismo-facies" description using amplitude and continuity etc. characteristics instead of calibration and lateral prediction from well control.

Over the years, some reservoir characterization framework methodologies were developed for projects and for training, and the search for effective ways to communicate the steps in the process began. A simple pyramidal image seemed logical to me at one time to describe the process (**Figure 2**). The inspiration for this was the "funneling" process we used in recruitment, to start out with broad simple questions and then to home in on key questions that would display desired traits.

Too often I observed analyses that skipped key steps or observations that were absolutely necessary to anchor an interpretation. Some groups failed to do the necessary regional and sub-regional work to become familiar with a trend. Some groups did not routinely calibrate well data to seismic at the genetic level to learn where the potential reservoirs "lived" or how they were distributed laterally and/or downdip. Most disturbingly, some groups presumed that almost any amplitude or AVO phenomenon was a direct hydrocarbon indicator. We used to call this "loop-level" seismic stratigraphy. With these lapses, a faniform amplitude became a fan, when it was actually the amplitude supported portion of a regional marl event. In another case a colleague was determined that any high amplitude on an unconformity was indicative of sand. Hmm… A regional marl again with varying porosity was the actual culprit. My work with instantaneous amplitude in the early 80's and sub-regionally varying trends gave me the tools to avoid many such pitfalls.

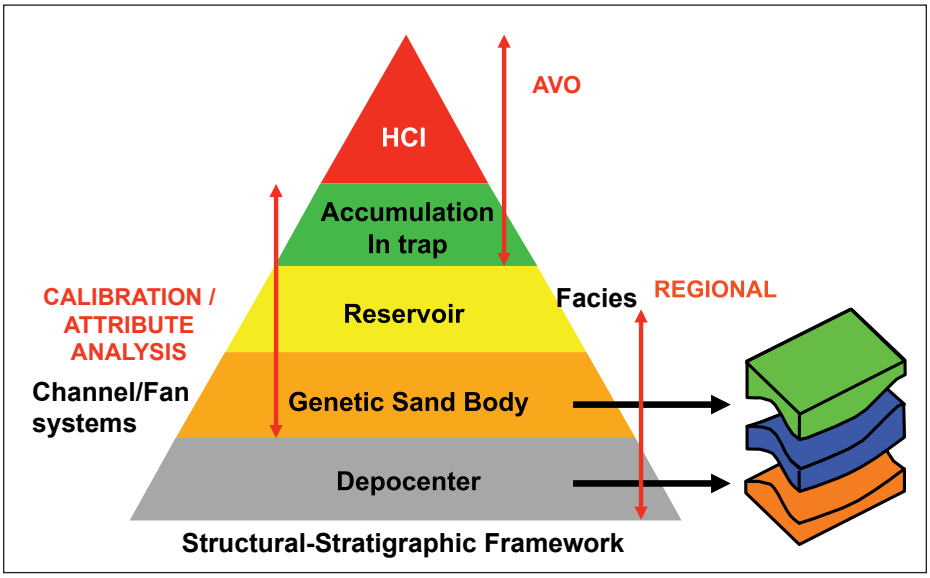

Figure 2. *Reservoir Characterization Workflow*

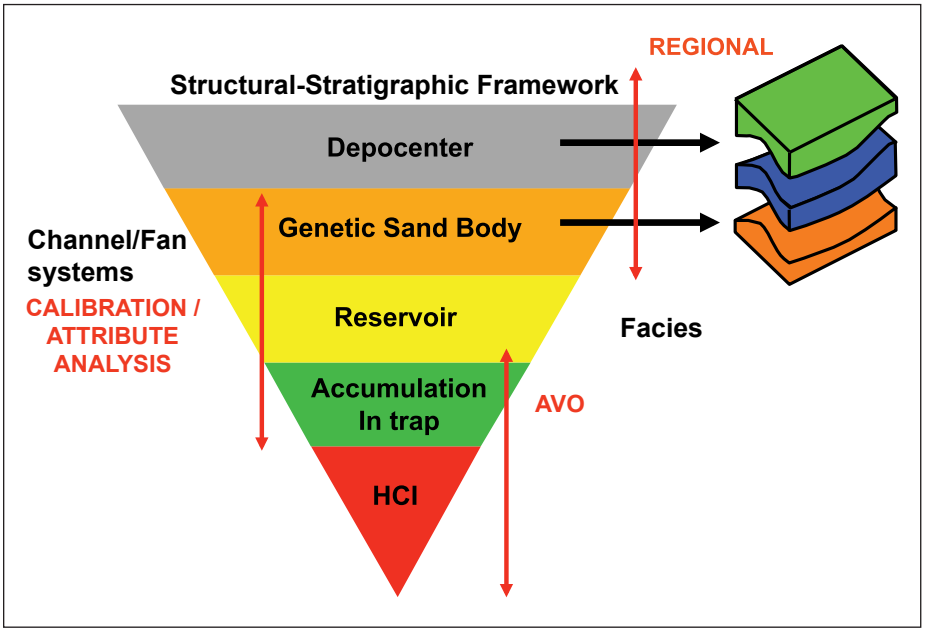

Figure 3. *Reservoir Characterization Workflow*

The latter tendency to start an analysis with an amplitude expression became so prevalent that I was moved to display **Figure 2** as shown in **Figure 3** when I was called forth with two other "contrarians" to speak to Arco Geoscience management in Plano on the integration of geology and geophysics. Perhaps now people would get the point that you cannot 'base' your interpretation on the head of a pyramid!

Another envisioned method of describing the whole process came to me after I

From The Editor *continued on page 11*

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SYSTEMS ACQUISITION LICENSING PROCESSING IMAGING

From the Editor continued from page 9

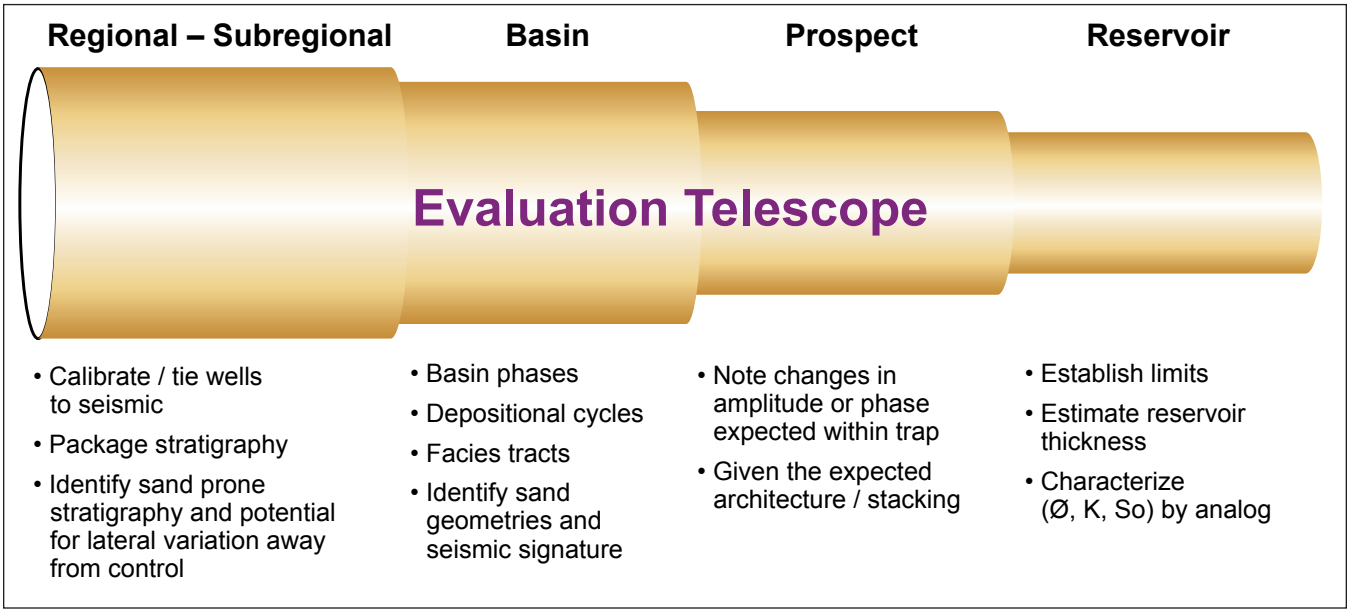


Figure 4. *Lateral Prediction Continuum*

showed a co-worker geologist, who had become enamored of AVO, that I could deduce the same answers he had reached after study of five examples by simple and real-time observation of their seismic sections.

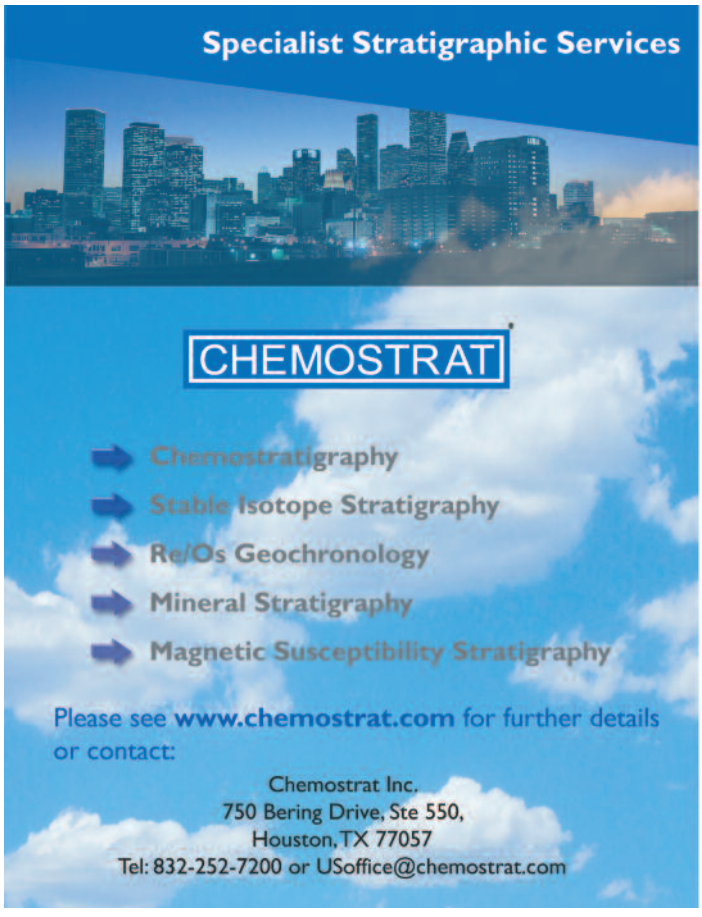
Figure 4 shows a drawing made at home of a telescope using my husband's CAD drafting program. This was not the first time he had aided me with such a thing. Previously he had helped me make a base map from some intersections and scales from old seismic sections for a South American basin. The resulting map on these data thereafter turned out to be a perfect tie to a published map for the other half of the basin. Cool.

Here the intent is to show that the process needs to be a continuum of the stages of analysis (**Figure 4**). Different work is done at each of the stages and all of it fits comfortably within the work done in previous stages. The work stages need not be done in this particular order. Well calibrations may be done at the field / prospect scale, for example, in order to predict reservoir characteristics and distribution within the trap for reserve estimation.

Just as I was beginning to wonder how I might bring this column to a close, there was an occurrence yesterday in a prospect review meeting to assess what needed to be done. An individual made the stunning statement that he saw no difference between a sedimentologist and a seismic sequence stratigrapher. He said it was just semantics…… ■

I would like to thank David Miller, a Statoil colleague, for standing in as our post-editor for December's extended article by Potter and Szatmari and for this issue.

HGS Legends Night
Monday, January 14, 2013 (page 14)



HGS Legends Night 2013
Legends of Sedimentology

Online registration now open!

Monday, January 14, 2013, 5:00pm – 9:00pm

Westchase Hilton, 9999 Westheimer Road

Event organized by HGS past-president John Tubb

HGS offered the first Legends in Wildcatting program in 2000. Since then, HGS has hosted 6 special *Legends* meetings with varying emphases. The enduring format shows versatility and vitality. This year, we chose to feature Legends of Sedimentology.

HGS invites you to join us for the next of these memorable dinner events honoring

George Klein

James Coleman

Miles Hayes

Robert Folk

These speakers are recognized by the industry as outstanding leaders in sedimentology.

Dr. George Devries Klein

George Devries Klein is a sedimentologist, sedimentary geologist, sequence stratigrapher, basin analyst, regional geologist, and petroleum geologist. He authored a total of 383 refereed papers, books, reports, abstracts, and reviews, including 11 reference books. His expertise includes tidal sedimentology, deep-water sedimentology, cratonic, foreland and rift basins, sandstone petrology, cycle stratigraphy and basin analysis. He proposed the term "Tidalites" as a process facies formed in response to global astronomical forcing factors and also recognized the combined tectonic/glacial eustatic origin of Pennsylvanian cyclothems, amongst other contributions.

Klein earned his M.A. from the University of Kansas, and a Ph.D. from Yale, both in geology. He worked as a sedimentologist for Sinclair Research, Inc, and then taught at the University of Pittsburgh, University of Pennsylvania, and the University of Illinois at Urbana-Champaign. After three years' service as Executive Director of the New Jersey Marine Science Consortium and as New Jersey Sea Grant Director, he opened his consulting firm, SED-STRAT Geoscience Consultants, Inc in Houston. Dr. Klein has also taught sandstone deposition models and basins analysis short courses for AAPG, SEG and other organizations.

Dr. Klein is the recipient of 13 awards including a Visiting Fellowship to Wolfson College at Oxford University, the SEPM Outstanding Paper Award for 1970, the Erasmus Haworth Distinguished Alumnus Award from the University of Kansas Department of Geology, the Japan Society for the Promotion of Science Fellowship, a Fulbright Fellowship to the Netherlands, and the Lawrence L. Sloss Award of the Sedimentology Geology Division of Geological Society of America.

Klein is a member of HGS, AAPG, SIPES, GSA, and GCSSEPM. He is married to Suyon Cheong originally from Seoul, South Korea.

Dr. James Coleman

Dr. James Coleman is a sedimentologist and expert in coastal wetlands. He has authored several hundred articles on world-wide wetland loss, is a leading expert on river deltas, and has conducted field work in some thirty major deltas. He served as co-chief scientist on the 1988 Deep Sea Drilling Project, Leg 90 in the Gulf of Mexico. From 1989 to 1997 he served as Executive Vice-Chancellor of Louisiana State University (LSU). He currently serves as a Boyd Professor* at Louisiana State University, the highest academic rank in the University.

Dr. Coleman is a former chairman of the Marine Board and a former member of the Ocean Studies Board of the National Academy of Sciences. He is a member of the National Academy of Engineering and Russian Academy of Natural Sciences. His major research interest is deltaic sedimentation processes. He has received the Kapitsa Medal of Honor for his contributions to the field of petroleum sciences and served on President Bush's Ocean Policy Commission.

*[*There have been only sixty-eight Boyd Professors at LSU since 1953. – Ed]*

Dr. Miles O. Hayes

Dr. Miles O. Hayes is a coastal geomorphologist and sedimentologist with over 50 years of research experience. He has authored over 250 articles and reports and four books on numerous topics relating to tidal hydraulics, river morphology and processes, beach erosion, barrier island morphology, oil pollution, and petroleum exploration. Based on extensive field experience throughout the world, he has developed innovative techniques with regard to environmental protection, interpretation of ancient depositional systems, oil-spill response, and shoreline processes. Three of the original concepts proposed and developed by Dr. Hayes are: the importance of hurricanes to barrier island and near shore shelf sedimentation; the effect of tides on shoreline morphology and sedimentation patterns; and the environmental sensitivity index (ESI) for mapping shorelines, which has been applied worldwide.

Dr. Hayes' teaching experience includes a range of both undergraduate and graduate courses while a Professor at the Universities of Massachusetts and South Carolina. Seventy-two graduate students received their degrees under his supervision, most of whom are now leaders in their respective academic, government, and industry positions. He is at present Chairman of the Board of Research Planning, Inc. (RPI), a science technology company located in Columbia, South Carolina.

Dr. Robert L. Folk

Robert L. Folk was born Sept. 30, 1925 in Cleveland, Ohio. By age five, he had a collection of some pretty, formerly Canadian, Pre-Cambrian shield stones from local glacial deposits.

Dr. Folk received all three of his geology degrees from Penn State University, where he worked under the incomparable Paul D. Krynine. All of his research was on carbonate rocks, a predestined interest, as he had no car and carbonates were the only rocks that cropped out within walking distance of campus.

Dr. Folk taught at the University of Texas from 1952 to 1988, with a primary emphasis on sedimentary petrology, but he also delved into the Tertiary field geology of the Gulf Coastal Plain, and freshman physical geology. He produced extensive work on the classification of both terrigenous clastics and carbonate rocks. His classifications are in general use by geologists to this day.

After a stint at the University of Milano in 1973, he became completely "italianizzato" and enjoyed over the next 15 years the enlightening of young students to bella Italia, their orientation to "la dolce vita," and to some of the world's most exciting geology.

In l980, Dr. Folk joined Prof. Hank Chafetz, currently at the University of Houston, in Italy to study Roman travertines and saw for the first time rocks made by bacteria. In 1988, at the hot springs of Viterbo, Italy, he discovered rocks made by "dwarf creatures" — nannobacteria. This find rapidly became an obsession and a compulsion to find them in many rocks and minerals as well as in a Martian meteorite.

Dr. Folk states that many of his discoveries were made "by dumb luck, through random reading, and idle curiosity, without financial motivation."

HGS Legends Night 2013 Sponsorships Available

Please contact the HGS office, 713-463-9476, or email nina@hgs.org for information on sponsorship opportunities. See page 8 for the HGS Legends Night Sponsorship Form.

All profits from this event will go to HGS' two scholarship programs: the Calvert Foundation Fund for Graduate Students and the HGS Foundation Fund for Undergraduate Students. Each fund gives out seven scholarships per year to the top students from area Universities. ■

More Outreach Activities

*by **Janet Combes***

HGS volunteers came forward multiple times during the fall of 2012. In addition to the Earth Science Week and Energy Day activities in mid-October, volunteers also participated in the Sally Ride Science Festival on October 27; it is held annually at Rice University for middle-school girls interested in science. Up to 1000 students attend every year. This year Huw James, Jim Tucker and Kevo Richard staffed the booth, answering questions and distributing various handout s and Texas rock kits.

Huw James with the HGS K12 display at the Sally Ride Festival.

The Sally Ride Festival at Rice University.

Several weeks later, on November 9-11, the HGS K12 booth and multiple volunteers came to the Houston Gem and Mineral Show where over 1000 school kids came on field trips on Friday; the weekend had hundreds of Scouts working on geology badges. The kids, the parents, and the volunteers all have fun and learn from the experience – see the grins in the photos. Volunteers included Gerrit Wind, Janie Schuelke, Elizabeth Fisher, Laura Lee Stanley, Martin Cassidy, Bev DeJarnett, Dave Reiser and his wife, Mike Erpenbeck, and Janet Combes.

Gerrit Wind on Friday morning at the HGMS show.

Janie Schuelke showing some school kids "how to drill a well" poster on Friday morning at the HGMS show.

Elizabeth Fisher looks on during Friday afternoon's activity.

Martin Cassidy shows a geophone to some Scouts on Saturday morning

Laura Lee Stanley explains the poster to the Scouts on Saturday morning while holding a drill bit.

Bev deJarnett talks with the Scouts and their parents.

Bernie Kuhn on weekend duty.

Janet Combes signs off for a Scout requirement on Sunday afternoon.

Marcellus Fairway Program

Exploring Boldly

To date over 1,000 square miles, of the proposed 1,500, have been acquired of the multi-client data consisting of four high quality 3D surveys in the heart of the Marcellus. The CGGVeritas programs will be completed next year with imaging objectives ideal for the Marcellus Shale. Explore boldly with high-quality data in the right location.

Contact: Dennis Langlois
+1 832 351 1052
dennis.langlois@cggveritas.com

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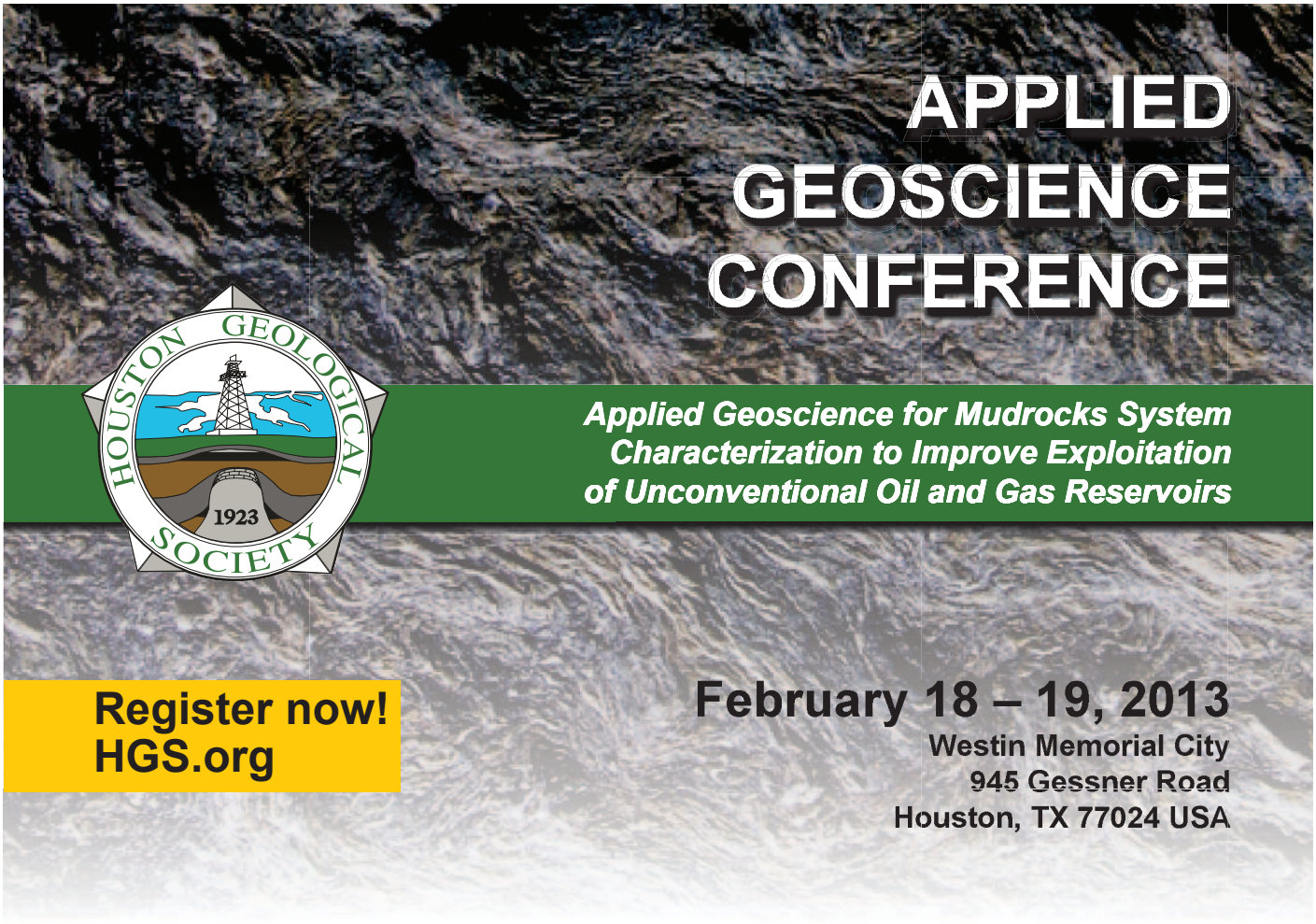

Integrated Approaches to Unconventional Reservoir Assessment & Optimization

Presentations will include discussions of unconventional oil and gas reservoirs across North America with major themes in:

Day 1: Outcrop to Subsurface Characterization
Emerging Plays
Day 2: Mudrocks System Characterization
Reservoir Characterization Towards Optimized Stimulation and Production

Features invited technical subject matter experts of industry, government & university.

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TECHNICAL PROGRAM

2013 Applied Geoscience Conference
Westin Memorial City, Houston, Texas

MONDAY, FEBRUARY 18, 2013

7:00 am Registration Opens ..... Fourth Floor, Willow Room
8:00 am - 8:00 pm **Core Display**..... Fourth Floor, Pecan Room
Selected Core from Emerging and Established Unconventional Reservoirs
8:00 am - 5:00 pm Technical Sessions..... Fourth Floor, Azalea Room
11:35 am - 1:00 pm **Poster Sessions**..... Fourth Floor, Cedar Room
Invited Presentations from Industry Consortiums

OUTCROP TO SUBSURFACE CHARACTERIZATION	SESSION 1
8:00 am	Opening Remarks
8:10 am	Outcrop to Asset: Integrated Field, Core and Log Study; Eagle Ford *Calum Macaulay, Shell, Houston, TX USA*
8:45 am	Niobrara Exploration & Production: Integrated Reservoir Insights and Repeatable Results *Benjamin C. Burke, Noble Energy Inc., Denver, CO USA*
9:20 am	The Monterey Formation: A Natural Laboratory for Lithology, Diaganesis, Mechanical Stratigraphy and Facies Architecture *Richard Behl, California State University, Long Beach, CA USA*
9:55 am	Break
10:25 am	Fayetteville Shale Exploration in Arkansas: Stratigraphy, Petrology, and Geochemistry *M. Ed Ratchford, Arkansas Geological Survey, Little Rock, AR USA*
11:00 am	Pennsylvanian Gothic & Hovenweep Shale Formation Exploration in the Paradox Basin: Stratigraphy and Petrology *Pete Moreland, Bill Barrett Corporation, Denver, CO USA*

EMERGING PLAYS	SESSION 2
1:00 pm	Opening Remarks
1:10 pm	The Cline Shale—Characterizing a New Resource Play in the Midland Basin *Jeff Tanner, Laredo Petroleum, Midland, TX USA*
1:45 pm	Role of Basin Modeling in Point Pleasant Appraisal, Eastern Ohio *Steven Crews, Hess Corporation, Houston, TX USA*
2:20 pm	Local Expression of Regional and Global Factors in Mudstone-Reservoir Occurrence, Character, and Distribution in Platform/Ramp Source-Rock Settings: Examples from Toarcian Posidoniaschiefer, Schistes Cartons, and Jet Rock, Northwest Europe *Kevin Bohacs, ExxonMobil Upstream Research Company, Houston, TX USA*
2:55 pm	Break
3:15 pm	Exploration to Field Development of the WolfBone Play, Southern Delaware Basin, an Oil-Rich Unconventional Resource *Bill Fairhurst, Eagle Oil & Gas, Dallas, TX USA*
3:50 pm	Mississippian Exploration: Stratigraphy, Petrology, and Reservoir Properties *Dr. Lyn Watney, Kansas Geological Survey, Wichita, KS USA*
4:25 pm	Sweetspots in Foreland Basins: Insights from the Neuquen Basin, Argentina, and from Physical Models *Dr. Peter Cobbold, University of Rennes, France*

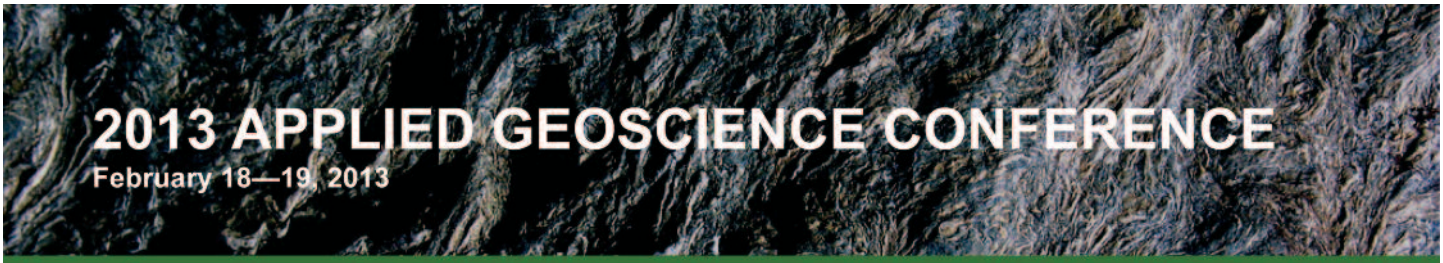
6:00 pm - 8:00 pm Conference Social Hour ..... Fourth Floor
6:00 pm - 8:00 pm **Poster Sessions** ..... Fourth Floor, Cedar Room
Invited Presentations from Industry Consortiums

TUESDAY, FEBRUARY 19, 2013

7:00 am Registration Opens…..……..……..……Fourth Floor, Willow Room
8:00 am - 4:00 pm **Core Display**…...……..……..Fourth Floor, Pecan Room
Selected Core from Emerging and Established Unconventional Reservoirs
8:00 am - 5:00 pm Technical Sessions……...……..……Fourth Floor, Azalea Room
11:35am - 1:00 pm **Poster Sessions**……..……..Fourth Floor, Cedar Room
Invited Presentations from Industry Consortiums

MUDROCK SYSTEMS CHARACTERIZATION	SESSION 3
8:00 am	Opening Remarks
8:10 am	Integrated Geophysical Analysis of Unconventional Resources *Yaping Zhu, Exxon/Mobil Exploration Company, Houston, TX USA*
8:45 am	Processes and Scales of Mineral Diagenesis in Mudstones: Impacts Upon Rock Properties and Porosity *Kevin Taylor, University of Manchester, Manchester, UK*
9:20 am	Is it the Rock or the Frac? Shale Reservoir Quality and Production Performance *Randy Miller, Core Laboratories, Houston, TX USA*
9:55 am	Break
10:25 am	Dual Mineral Matrix and Organic Pore Textures in Thermally Mature Niobrara Formation, Rocky Mountain Region, USA—Implication for Tight-Oil Carbonate Reservoir Modeling *Chris Laughrey, Weatherford Laboratories, Houston, TX USA*
11:00 am	Understanding Fundamentals of Multi-phase Flow in Liquid Rich Mudstones *M. M. Honapour, Hess Corporation, Houston, TX USA*

RESERVOIR CHARACTERIZATION TOWARDS OPTIMIZED STIMULATION & PRODUCTION	SESSION 4
1:00 pm	Opening Remarks
1:10 pm	 *Ross Peebles, Global Geophysical, Houston, TX USA*
1:45 pm	Natural Fracture Occurrence in Domestic Unconventional Shale Plays-Frequency and Prediction *Julia Gale, Bureau of Economic Geology, Austin, TX USA*
2:20 pm	Integrating Outcrop Analogs and Geomechanical Modeling - Insights into Induced Hydraulic Fractures *Alan P. Morris , Department of Earth ,Material, and Planetary Sciences, SW Research Institute, San Antonio, TX USA*
2:55 pm	Break
3:15 pm	Use and Abuse of Geomechanics in the Development of Unconventional Gas Plays *Amie Hows, Shell Exploration and Production Houston, TX USA*
3:50 pm	A Mechanical Stratigraphic Method for Integrating Geological Heterogeneity with Engineering Design *David Amendt, ConocoPhillips, Houston, TX USA*
4:25 pm	Evaluating the Impact of Mineralogy, Natural Fractures, In Situ Stresses on Hydraulically Induced Fracture System Geometry in Horizontal Shale Wells *Cameron Miller, Schlumberger, Oklahoma City, OK USA*
5:00 pm	Conference Summary and Closing *Technical Chairs*



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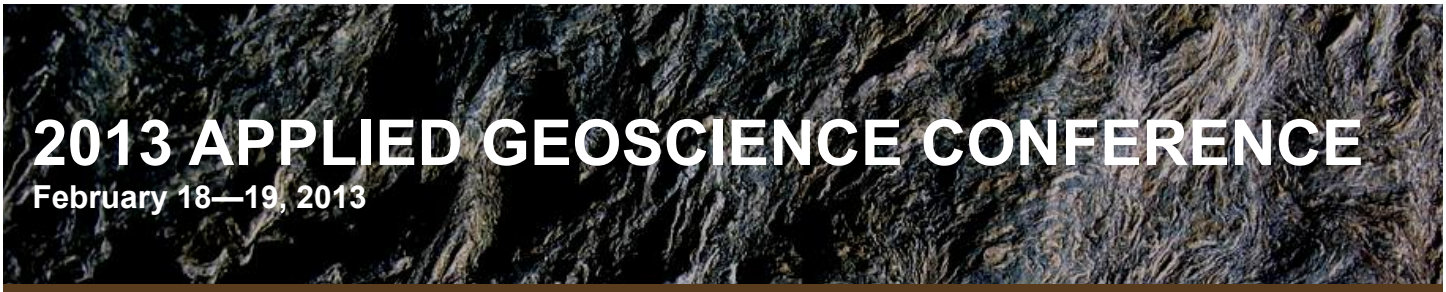

2013 APPLIED GEOSCIENCE CONFERENCE

February 18—19, 2013

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Reception - $5,000
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Speaker Reception - $3,500
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Coffee - $1,000
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February 18—19, 2013

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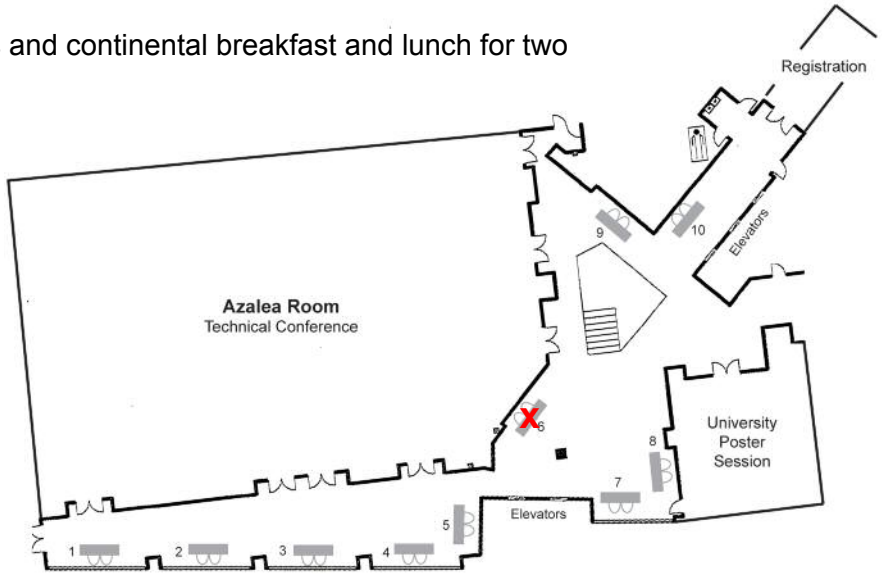
- Breakdown:
  Tuesday, February 19
  4:00pm—6:00pm



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Wednesday, January 9, 2013

Black Lab Pub, Churchill Room • 4100 Montrose Blvd.

Social 5:30 p.m., Dinner 6:30 p.m.

Cost: $25 Preregistered members; $30 non-members & walk-ups

To guarantee a seat, you must pre-register on the HGS website and pre-pay with a credit card.
Pre-registration without payment will not be accepted.
You may still walk up and pay at the door, if extra seats are available.

Matthew R. Cowan
Terrain Solutions Inc
Henry M. Wise
SWS Environmental Services

A Preview and Discussion of the Upcoming 83rd Texas Legislative Session

The 83rd Texas Legislative Session begins January, 2013; profiles of bills that will be submitted began November 12, 2012. We will discuss how the legislative process works and preview the legislation that has been filed to-date that may affect the various geoscience communities. Discussion of the issues and their possible implications will follow. We will also look at how Texas has historically viewed regulations from various Texas agencies and the licensure of Professions. ■

Biographical Sketch

Matthew R. Cowan, P.G. has more than 16 years of professional experience in geology, environmental remediation and hydrogeology. Mr. Cowan is currently the Chief Field Geologist for Terrain Solutions Inc. who oversees site investigations and remediations of soil and groundwater. Mr. Cowan is a graduate of Texas A&I University with a Bachelor's Degree in Geology with a Minor in Mathematics. He obtained his Master's Degree in Geology from Texas A&M University-Kingsville. He is a Licensed Professional Geoscientist in Texas and is a Licensed Public School Teacher in Texas. Mr. Cowan has served as the Environmental and Engineering Group Chairman since 2007. He has is a past Secretary for the Houston Geological Society. Mr. Cowan is also past Treasurer/Secretary and current President of the Texas Association of Professional Geoscientists.

Henry M. Wise, P.G., has more than 30 years of professional experience in geology, uranium exploration and development and environmental remediation. His experience includes the exploration and in-situ recovery of roll-front uranium deposits in South Texas where he was responsible for the delineation and production at the Pawilk Mine for U.S. Steel. He also has substantial experience in environmental site assessments and soil and ground-water remediation projects in Texas using dual-phase extraction techniques. Mr. Wise is currently the Remedial Services Senior Specialist for SWS Environmental Services in La Porte, Texas, where he oversees several TCEQ State Lead and Emergency Response contracts. Mr. Wise is a graduate of Boston University with a Bachelor's Degree in Geology. He obtained a Master's Degree in Geology from the University of Texas at El Paso. A Licensed Professional Geologist in Texas, he was a Founding Member in 1977 of the Energy Minerals Division of AAPG, a member of the Uranium Committee and a Certified Professional Geologist of AIPG. He is also co-chairman of the HGS Governmental Affairs Committee and writes both "Governmental Update" for the HGS *Bulletin* and "The Wise Report" which is published both privately and on the HGS and AIPG-Texas websites.

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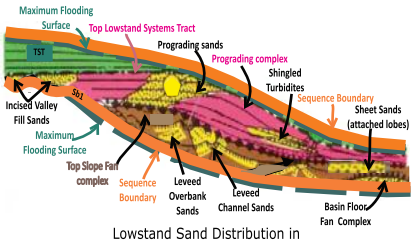

Lowstand Sand Distribution in Deepwater Basin with Shelf Slope Break

Get More from your Core

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Tuesday, January 15, 2013

Hyatt North Houston (former Crowne Plaza Hotel - Greenspoint)
425 North Sam Houston Pkwy E

Social 11:15 AM, Luncheon 11:30 AM

Cost: $31 pre-registered members; $35 for non-members

To guarantee a seat, you must pre-register on the HGS website and pre-pay with a credit card.
Pre-registration without payment will not be accepted.
You may still walk up and pay at the door, if extra seats are available.

Fred Baldassare,
ECHELON Applied Geoscience Consulting, Murrysville, PA
Mark A. McCaffrey, PhD,
Weatherford Laboratories, Dallas, TX
John A. Harper, PhD,
Pennsylvania Geological Survey, Pittsburgh, PA

A Geochemical Context for Stray Gas Investigations in the Northern Appalachian Basin: Implications of Analyses of Natural Gases from Quaternary-through-Devonian-Age Strata in North-Central Pennsylvania

As the pace of drilling activity in the Marcellus Formation in the northern Appalachian 21 Basin has increased, so has the number of alleged incidents of stray natural gas migration to two shallow aquifer systems. For this study, more than 1,900 gas and water samples were analyzed for molecular composition and stable isotope compositions of methane and ethane. The samples are from Quaternary to Middle Devonian-age strata in a five-county study area in northeastern Pennsylvania. Samples were collected from 181 gas wells during mudgas logging programs and from 67 private water supply wells during baseline groundwater-quality testing programs.

Evaluation of this database reveals that microbial, mixed microbial/thermogenic, and thermogenic gases occur in some shallow aquifer systems, and that the gas occurrences pre-date Marcellus Formation drilling activity. Isotope data reveal that thermogenic gases in the regional Quaternary/Upper Devonian shallow subsurface (average δ13C1 = -42.13 ‰; average δDC1 = - 228.26 ‰) typically are distinct from gases in Middle Devonian strata (average δ13C1 = -32.87 ‰; average δDC1 = -163.45 ‰). Additionally, gas geochemistry at the site-specific level reveals a complex thermal and migration history with gas mixtures and partial isotope reversals (δ13C1>δ13C2) in units above the Marcellus Formation.

Identification of a source for stray natural gas requires the synthesis of multiple data types at the site-specific level.

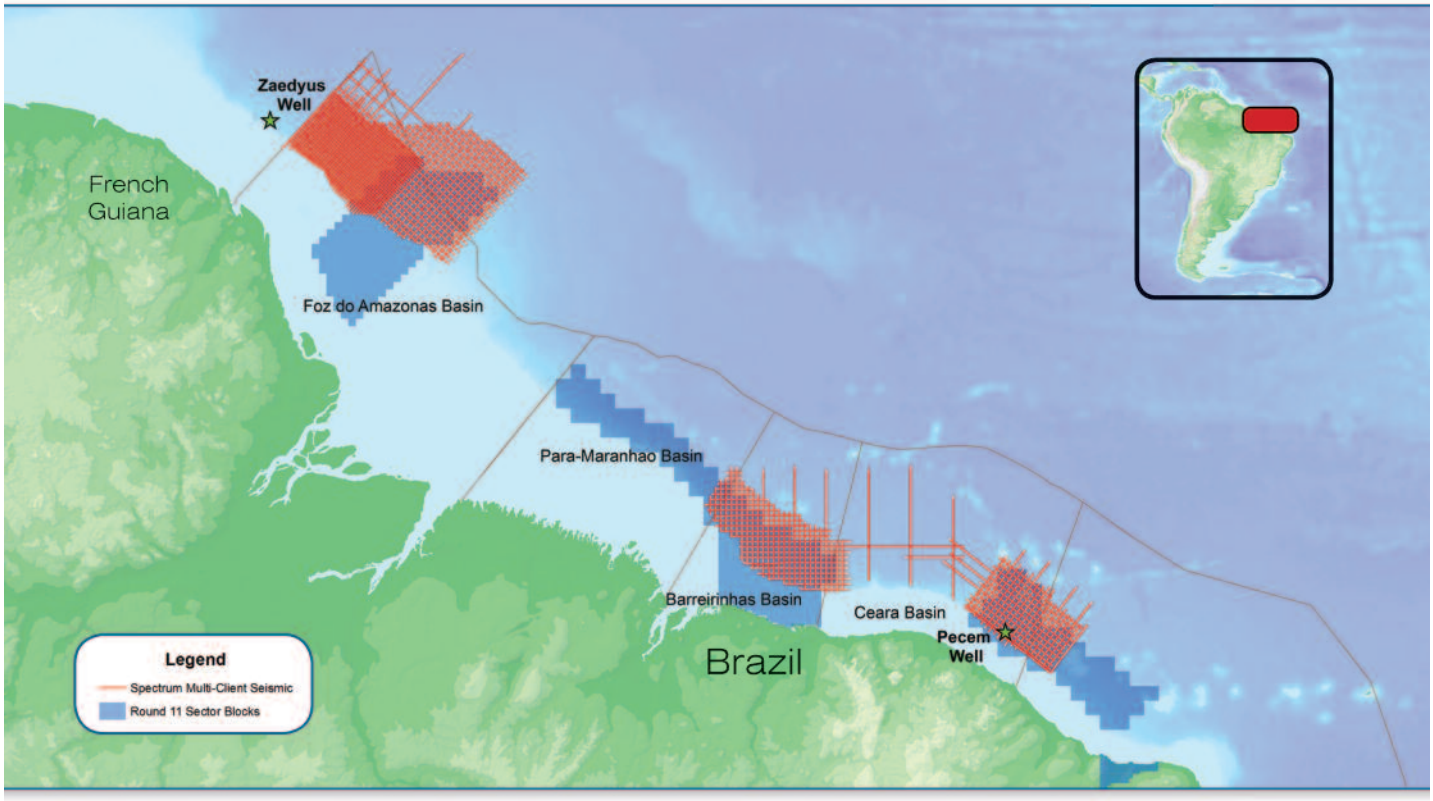
Identification of a source for stray natural gas requires the synthesis of multiple data types at the site-specific level. Molecular and isotope geochemistry provides evidence of gas origin and secondary processes that may have affected the gases during migration. Such data provide a focus for investigations where the potential source of the stray gas includes multiple formations. ■

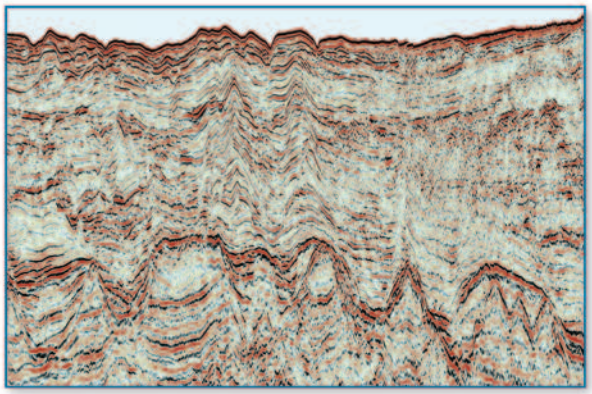
Biographical Sketch

Dr. McCaffrey received his B.A. (1985) from Harvard University, magna cum laude with highest honors, in geological sciences, and his Ph.D. (1990) in chemical oceanography (in the area of organic geochemistry) from the Massachusetts Institute of Technology / Woods Hole Oceanographic Institution Joint Program. Mark spent 10 years at Chevron and Arco as a petroleum geochemist, then founded OilTracers LLC, a firm that specializes in applications of petroleum geochemistry. After 10 years, OilTracers was acquired by Weatherford Laboratories. Mark is a California Registered Geologist, License #5903; a Texas Professional Geoscientist, Geology, License #350; and an AAPG Certified Petroleum Geologist Certificate #5339. He has authored more than 30 articles on the application of geochemistry to petroleum exploration, reservoir management, oil biodegradation, and paleoenvironmental reconstruction. As an Expert Witness in gas fingerprinting, he has testified in Mississippi State Court, in Ohio Federal Court, before the Oklahoma Corporation Commission, and before the Railroad Commission of Texas.

Equatorial Margins Brazil

Multi-Client Seismic - Amazonas, Ceara and Barreirinhas Basins





Canyon Features from Foz do Amazonas Survey (Phase I)

Spectrum is active in three basins along the Equatorial Margins of Brazil. Our PSTM data is now available for each of the Ceara, Barreirinhas and Foz do Amazonas phase 1 surveys.

Spectrum has also commenced the next phase of its Foz do Amazonas program, which will acquire an additional 6,000 km over this basin.

Following completion of this new survey Spectrum will have collected over 34,000 km of new, long offset data over these highly perspective areas.

All of these surveys have been acquired with 10,000m offsets and 13 second record lengths. Companies participating in Spectrum's new seismic programs will have a competitive advantage in the upcoming Round 11 in 2013.

Spectrum

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Monday, January 28, 2013

Westchase Hilton • 9999 Westheimer
Social Hour 5:30–6:30 p.m.
Dinner 6:30–7:30 p.m.

Cost: $28 Preregistered members; $35 non-members/walk-ups

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HGS North American and International Dinner Meeting

Steve Getz
Getz Exploration

Circum-Atlantic and Gulf of Mexico Deepwater Oil Plays in Coarse-Grained Clastic Reservoirs Deposited in Deepwater Environments

Hydrocarbon plays in coarse-grained clastic reservoirs deposited in deep water environments have been made for more than eighty years on the North American crustal plate (**Figure 1**). These hydrocarbon plays, which are mainly oil, encompass both siliciclastic quartzose and bioclastic carbonate reservoirs composed of rock grains larger than silt.

The first highly commercial world-class giant oilfield discovered in deep water clastics in North America was Poza Rica oilfield with an Estimated Ultimate Recovery (EUR) of greater than >1.5 BBO, which was found during 1930 in the Tampico area of the eastern Mexico coastal plain. Poza Rica is pooled in late Lower Cretaceous Tamambra formation basinal carbonate debris that was shed during major storms to the west from the adjacent Golden Lane El Abra shallow water carbonate atoll. Close to 2 BBO have also been produced from the Golden Lane atoll margin shallow water carbonates, which are partially time-stratigraphically equivalent to the downdip Tamambra carbonates. Several billion barrels of oil

HGS North American and International Dinner *continued on page 31*

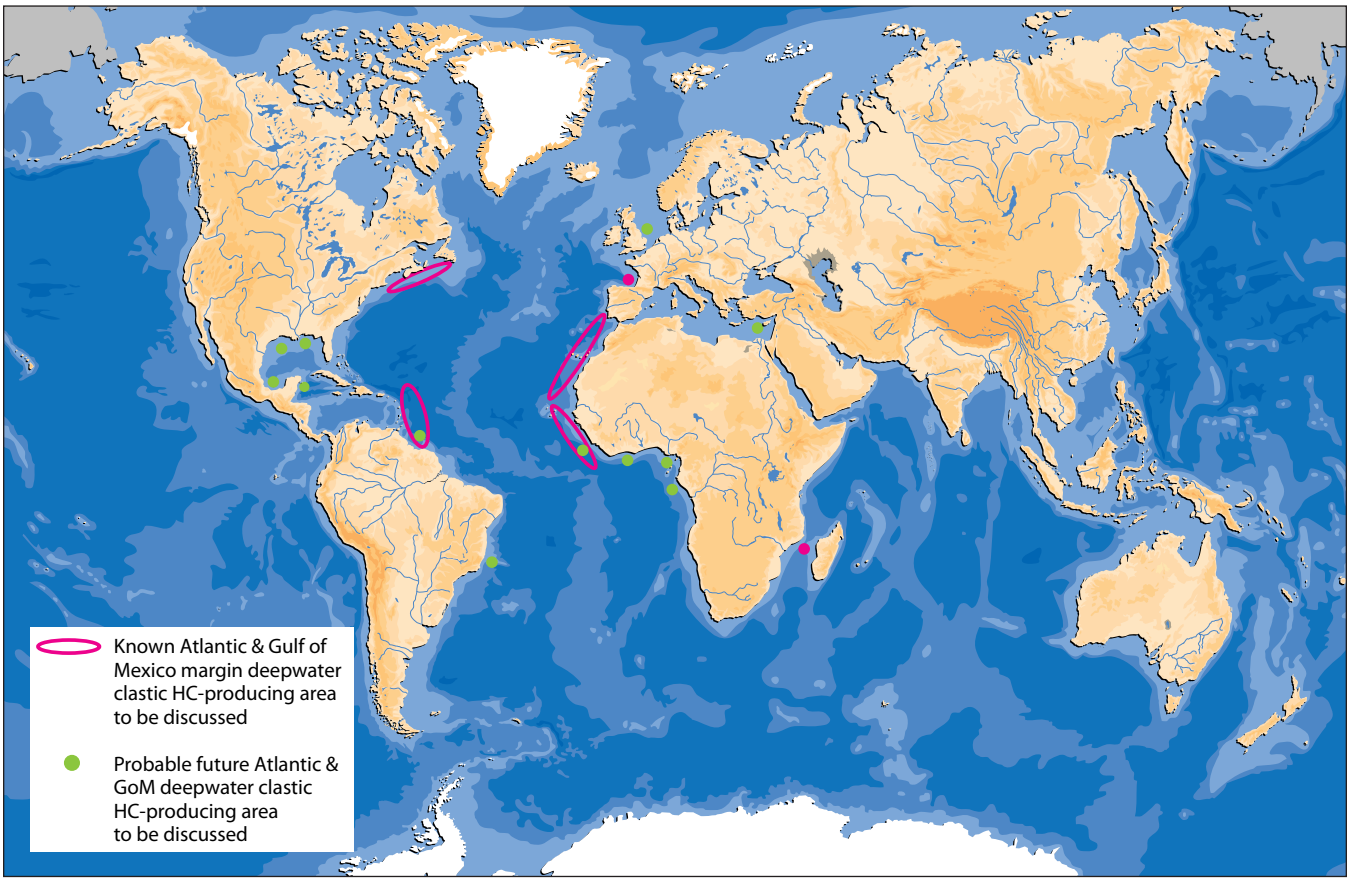
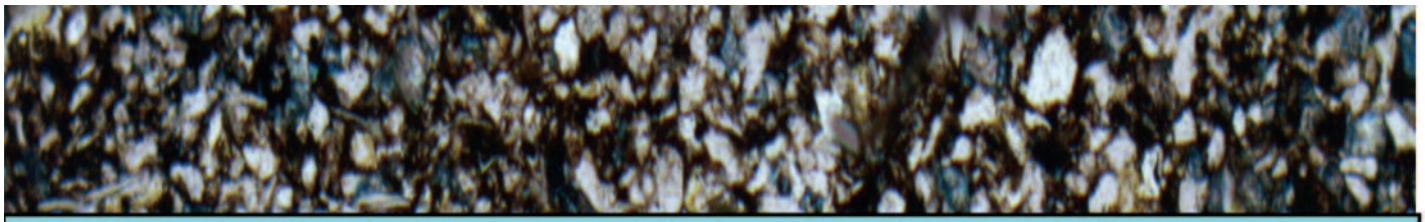


Figure 1



Applied Geoscience Conference

Interdisciplinary Micro to Macroscale Geomechanics

November 6-7, 2013

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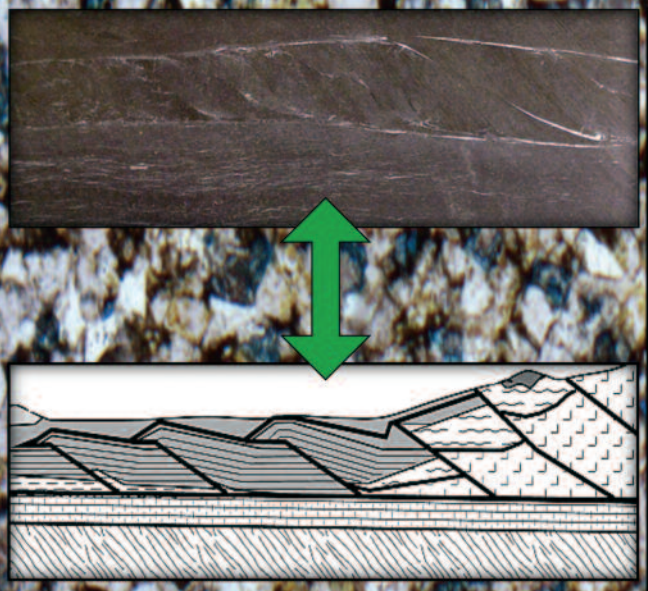

Geomechanical Approaches for Optimization of Unconventional Reservoirs

Geomechanical rock properties are dependent on factors from the nano-pore scale to the seismic scale. Examining case studies where an interdisciplinary approach was utilized to understand the value of geomechanics at all reservoir scales is fundamental to further characterization of unconventional reservoirs.

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- Engineering & Geomechanical Integration

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- Seismic, Structure, & Geomechanics

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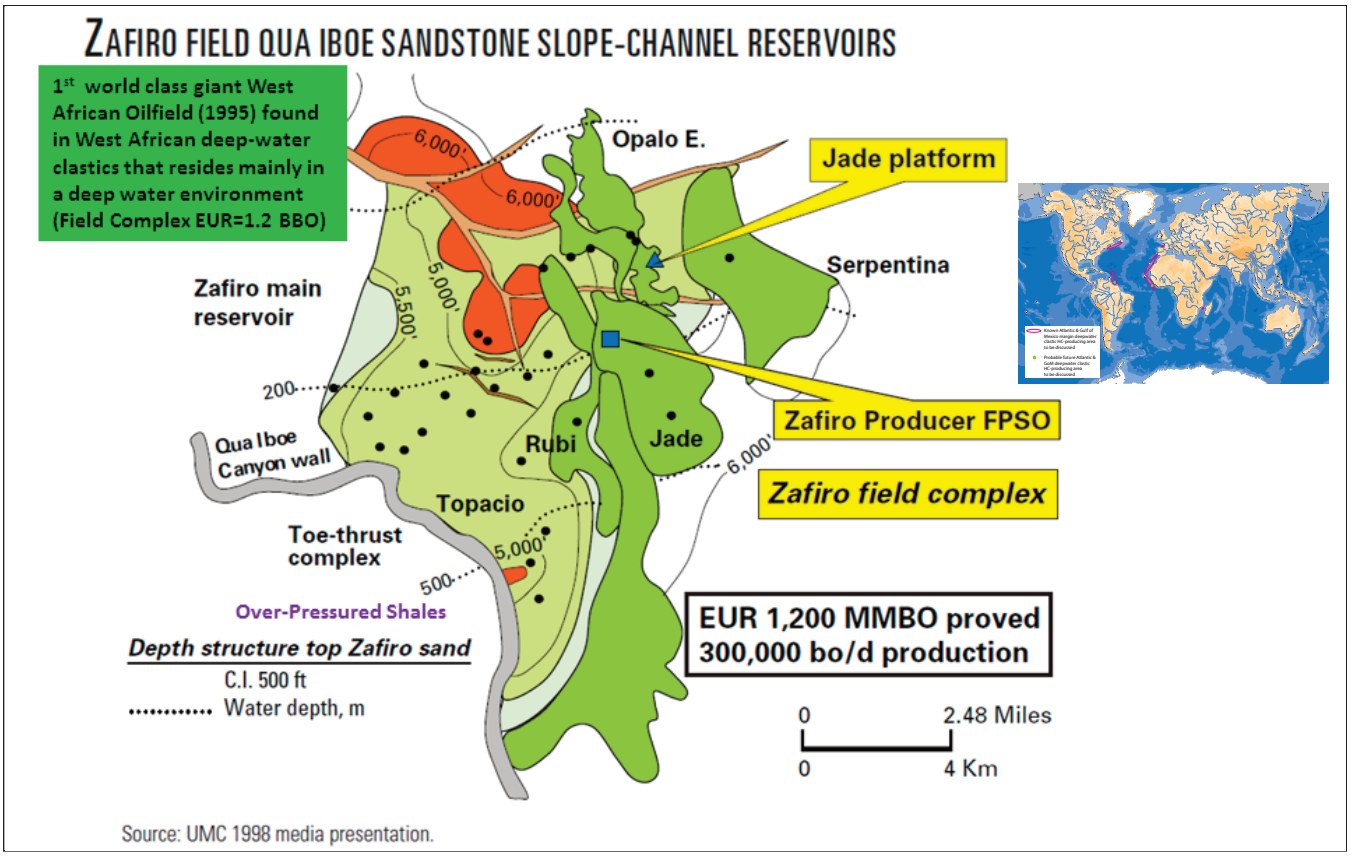

Figure 2: *Zafiro Oilfield was first olifield developed in a West African deepwater environment. Taken from: Bruso, J., Getz, S., and Wallace, R.* Oil and Gas Journal, *February 16, 2004*

are also pooled in a foreland basin trough that formed directly over Poza Rica oilfield during the Paleogene. This shallower oil is pooled in Laramide-aged upper Paleocene and lower Eocene Chicontepec sandstones that are time-stratigraphic equivalents to the oil-bearing deepwater Wilcox formation basin floor fan sandstones deposited to the northeast at the junction of the continental slope and rise in the Gulf of Mexico basin.

Forty-six years after Poza Rica oilfield was discovered, another giant oilfield, Cantarell, was found in deepwater bioclastic reservoirs in the Campeche embayment of eastern Mexico. Cantarell field has EUR of 13 to 15 BBO, making it the largest conventional oilfield ever found on the North American continent. The oil at Cantarell is pooled primarily in bolide impact breccia deposited on the Mexican continental margin during the impact of the Laramide-aged Chicxulub meteor with the Yucatan platform at, or very near, the Cretaceous/Tertiary boundary. During the past decade another billion barrels of oil was added to this supergiant field when Pemex drilled deeper into the sub-thrust fault block and found Sihil field pooled in the same semi-ubiquitous bolide breccia reservoir complex present in the Cantarell block hanging wall anticline.

Numerous other giant oil fields, and a few giant gas fields, have been discovered in deepwater quartzose sandstone reservoirs deposited on the ancestral Gulf of Mexico continental slope in both United States' and Mexican waters. These turbidity sandstone deposits range in age from Paleocene Wilcox through the Pleistocene. Oil deposits present in deep water Wilcox formation rocks in southwestern United States' offshore waters are pooled in unconfined submarine fan sandstones. They are reputed to contain EUR of 12 to 15 BBO and were discovered in the ultra-deep waters of the Gulf of Mexico basin during the last decade. Chevron now produces oil from deep water Wilcox sands on a production test basis from Jack field wells in order to confirm the economic viability of that field. On the modern-day shallow water continental shelf, McMoran is currently trying to prove the economic viability of its deep (>20,000') Davy Jones gas discovery in ponded Wilcox slope fans.

BP is now producing oil from its Thunder Horse oilfield with an EUR of an estimated 1 BBO. Thunder Horse is pooled in Miocene basin floor sands deposited in another slope setting that became a salt withdrawal anticline or turtle. In the United States' portions of the huge Gulf of Mexico basin complex, giant deepwater oilfields have been found in facies tracts involving basin floor fans, slope fans, slope channel sandstones, and even in slope channel levee sandstone and shingled turbidity sandstones. These Gulf of Mexico

HGS North American and International Dinner continued on page 33

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For questions: info@internationalpavilion.com

HGS North American and International Dinner continued from page 31

oilfields that I have described were probably sourced principally by late Jurassic source rock units.

The first world-class giant oilfields discovered in quartzose sandstones deposited in deep water environments in South America were found in Brazilian waters by Petrobras. Barracuda field, discovered in 1989, contains EUR of 659 MMBO in Oligocene turbidite sands and 580 MMBO in Eocene turbidite sands. Roncador oilfield was discovered in 1996. It has EUR of 2.6 BBOE in Cretaceous Maastrichtian turbidite sandstones. Petrobras was a significant innovator of deepwater and ultra-deep water oil production in the western hemisphere.

Edop oilfield of Nigeria, whose EUR is 500 MMBO, may have been the first world-class giant oilfield found in the deepwater Pliocene Biafra formation, Qua Iboe member, slope sandstones along the West African margin. Equatorial Guinea's Zafiro oilfield with an EUR of 1.2 BBO, discovered during 1995 in downdip Qua Iboe' slope channel sandstones in the same submarine canyon, was the first world-class giant oilfield found on the modern-day continental slope of West Africa (**Figure 2**). It was fast-tracked into production by the Mobil-UMIC group. Within a year of the Zafiro discovery, Shell's Bonga field, with an estimated EUR around 1.5 BBO, was discovered in quartzose turbidite fans on the continental slope in Nigerian deep waters; and Girassol field, whose EUR is estimated to be greater than 600 MMBO, was found by the Total group in slope channel sandstones deposited in Angolan deep waters.

More recently, the Anadarko Petroleum/Tullow Oil group found Jubilee field, with an EUR greater than 1.2 BBO, which is pooled in Turonian quartzose turbidite fans offshore Ghana near their boundary with the Ivory Coast (aka Cote d-Ivoire). Since then several operators, including Anadarko, have explored the West African offshore waters from Liberia northwards. Morocco, with its Jurassic and Cretaceous deep water sandstone targets and associated hydrocarbon source rocks, could represent the next significant deep water oil frontier on the continental margin of northwest Africa.

During the past year, Tullow extrapolated their Jubilee trend onto the opposing, or conjugate, plate margin in French Guyana and made their Zaedyus discovery. That discovery reputedly logged 72 meters or 236 feet of net oil pay in two Upper Cretaceous quartz sandstone turbidite deposits. The offshore deep waters of British Guyana, as well as the Eastern Venezuelan offshore sedimentary basins, which incorporate Venezuela and Trinidad and Tobago, should prove to be the logical continuation of the oil-bearing northeastern South American deep water quartzose sandstone trends. Further north, the offshore Eastern Canada Scotia basin, which mirrors basins offshore Morocco, could represent the next prolific deepwater oil frontier on the continental margin of eastern North America. ■

Biographical Sketch

Steven L. Getz is a professional geologist and geophysicist who worked more than nine years with Cities Service Oil Company and then became an oil and gas geoscience consultant for twenty-six years. He has generated prospects that led to large oil and gas discoveries in Equatorial Guinea, Guatemala, and in Trinidad, where he held the title of Chief Geophysicist for Trinmar Limited for two staggered six-month contracts. He has also generated prospects that became commercial oil and gas discoveries in Indonesia, China, the Permian basin, and onshore Gulf of Mexico. From 2005 through 2010, he held the title of Chief Geologist with Allen Hoffman Exploration. Since 2011, he has consulted with Fortesa International on their onshore Senegal acreage, where he has served as their Chief Geophysicist and Exploration Manager of Senegal.

Mr. Getz is currently the Chairman of the AAPG Geophysical Integration Group and the HGS North American Interests Group. He is also an active member of the SEG and is active in the IQEarth field studies group.

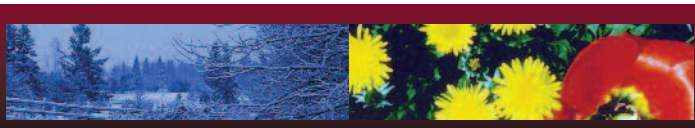
One Hundred Word Wonder

I generated the Zafiro prospect, during 1Q 1993 while a consultant for United Meridian Company. At the time, the international division of United Meridian had only two geoscience managers on staff. Mobil farmed into the Equatorial Guinea Block B acreage based on my Zafiro and Delta prospect summaries. UMIC's Zafiro discovery well was drilled by Mobil in late 1995.

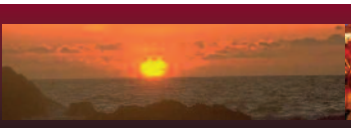
I still have the original write-up and play concept diagram for the prospect wherein I estimated a 250 MMBO reserve; it eventually became a 1200 MMBO field. I used the Hackberry play as the analog for the downdip Qua Iboe play in Equatorial Guinea. The updip analog was Edop field in Nigeria.

Steve Getz

January 2013



Sunday	Monday	Tuesday	Wednesday
	HGS office closed December 24 – January 1	1 New Year's Day	2
6	7	8 **HGS Board Meeting** *6 p.m.*	9 **HGS Environmental & Engineering Dinner Meeting** *"A Preview and Discussion of the Upcoming 83rd Texas Legislative Session", Matthew R. Cowan and Henry M. Wise, Black Lab Pub, Houston, TX, Page 25*
13	14 **HGS Legends Night 2013** *"Legends of Sedimentology", George Klein, James Coleman, Miles Hayes, Robert Folk, Westchase Hilton, Houston, TX, Page 14*	15 **HGS Northsiders Luncheon Meeting** *"A Geochemical Context for Stray Gas Investigations in the Northern Appalachian Basin: Implications of Analyses of Natural Gases from Quaternary-through-Devonian-Age Strata in North-Central Pennsylvania", Mark A. McCaffrey, Hyatt North Houston, Houston, TX, Page 27*	16 **SIPES Luncheon Meeting** *"The Role of Private Equity in Upstream E&P", Michael Heinz, Houston Petroleum Club, Houston, TX, Page 47*
20	21	22 **Forum on Microseismic Technology (SEG)** *Napa, CA*	23
27	28 **HGS North American and International Dinner Meeting** *"Circum-Atlantic and Gulf of Mexico Deepwater Oil Plays in Coarse-Grained Clastic Reservoirs Deposited in Deepwater Environments", Steve Getz, Westchase Hilton, Houston, TX, Page 29*	29	30 **HGS General Luncheon Meeting** *"The Golden Age of "Shale" Exploration", Paul M. Basinski, Petroleum Club, Houston, TX, Page 37*



GeoEvents

Thursday Friday Saturday

3 **You can make your reservations NOW online at ww.hgs.org**	**4** **Members Pre-registered Prices:** General Dinner Meeting..... $28 Nonmembers & walk-ups ..... $35 Env. & Eng. ..... $25 Luncheon Meeting ..... $30 Nonmembers & walk-ups ..... $35 International Explorationists ..... $28 North American Explorationists $28	**5**
10	**11**	**12**
17	**18**	**19**
24 **AAPG Playmaker Forum** *Dig Deeper with the Experts* *Norris Conference Centre, Houston, TX,* *Page 51*	**25**	**26**
31 **AAPG Forum** *Mississippian Lime Forum* *Oklahoma City, Page 13*	**Reservations:** The HGS prefers that you make your reservations on-line through the HGS website at www.hgs.org. If you have no Internet access, you can e-mail reservations@hgs.org, or call the office at 713-463-9476. **Reservations for HGS meetings must be made or cancelled by the date shown on the HGS Website calendar, normally that is 24 hours before hand or on the last business day before the event.** If you make your reservation on the Website or by email, an email confirmation will be sent to you. If you do not receive a confirmation, check with the Webmaster@hgs.org. Once the meals are ordered and name tags and lists are prepared, no more reservations can be added even if they are sent. **No-shows will be billed.**	

Upcoming GeoEvents

February 5-8, 2013
NAPE Expo
Houston, TX

February 18-19, 2013
Applied Mudrocks Conference (AGC)
Houston, TX

May 6-10, 2013
The 13th Multidisciplinary Conference on Sinkholes and the Engineering and Environmental Impacts of Karst
Carlsbad, NM

May 19-22, 2013
AAPG Annual Convention & Exhibition
David L. Lawrence Convention Center, Pittsburgh, PA

August 12-14, 2013
Unconventional Resources Technology Conference
Colorado Convention Center
Denver, CO

September 11-12, 2013
12th PESGB / HGS Conference on African E & P
London, UK

November 6-7, 2013
Applied Geoscience Conference
Interdisciplinary Micro to Macroscale Geomechanics
LoneStar College Convention Center
Houston, TX

April 6-9, 2014
AAPG Annual Convention & Exhibition
Houston, TX

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FIRST ANNOUNCEMENT AND CALL FOR PAPERS

The 12th PESGB/HGS Conference on African E & P

Africa: Success in Rift, Sag and Passive Margin Settings

Wembley Stadium, London, September 11th-12th, 2013

This annual conference, alternating between London and Houston has established itself as the primary technical E & P conference on Africa, with an attendance regularly exceeding 300, including operators, consultants, governments and academia. There will be a large poster programme in addition to the oral programme of about 25 high quality talks covering E & P in all regions of Africa. Suggested themes include:

- **Interior Rift Plays**
- **Palaeozoic Sag Settings and Interior Basins**
- **Continental Margins and Deepwater Plays**
- **Technology Advances in Exploration and Production**

Abstracts (circa 200 words) should be sent as soon as possible and no later than 13 March 2013 to Duncan Macgregor at duncan.macgregor2@ntlworld.com or to a designated Session Chair to be announced in the next circular. Extended abstracts are normally written once your paper is accepted and are issued on a conference CD. Details of sponsorship opportunities and display booths are available from the PESGB office 'Africa Conference 13' at 5th Floor, 9 Berkeley St, London and from rebecca@pesgb.org.uk

The conference committee for the 2013 London event will include Ray Bate (Chairman), Duncan Macgregor, Richard Dixon (Technical Co-ordinators), and Al Danforth and Ian Poyntz (HGS, Houston). Currently, volunteers are being sought to be proactive Session Chairs and should contact Duncan asap.

PESGB

Background basins image courtesy of the Exploration Fabric of Africa project compiled in memory of Ed Purdy, a former contributor to many African conferences.

Wednesday, January 30, 2013

Petroleum Club • 800 Bell (downtown)
Social 11:15 AM, Luncheon 11:30 AM

Cost: $30 pre-registered members; $35 for non-members/walk-ups; Emeritus/Life/Honorary: $15; Students: FREE

To guarantee a seat, pre-register on the HGS website & pre-pay by credit card.
Pre-registration without payment will not be accepted.
Walk ups may pay at the door if extra seats are available.

HGS General Luncheon Meeting

Paul M. Basinski
Ardent Exploration LLC,
Houston, TX

The Golden Age of "Shale" Exploration

Unconventional "shale" resource plays are experiencing a Golden Age of discovery across North America, and this explosive growth is beginning to go global. As in previous times, such as the Dutch Spice Trade or Industrial Revolution, ground-breaking and seemingly radical concepts in the oil-patch have found alignment with new technologies and have realized unprecedented outcomes. Economically recoverable hydrocarbon volumes recently unimaginable will change the energy balance of North America and beyond. Perhaps analogous to the 1920's rush of discoveries after the "anticline theory" emerged, the duration of this Golden Age may be all-too-brief given the speed at which our Industry evolves and adapts.

Geoscientists and organizations have a truly unique opportunity to discover vast new resources and create compelling value during this historic period. Behaviors and methods that can spark the fuse of discovery include learning on the fly, focus on the "right" questions, informed risk taking, collaborative and pragmatic work in interdisciplinary spaces, and reliance on results over process.

The veracity and bottom-line impact of visualization of a geologic discovery, athletic achievement, or scientific innovation, and then relentless pursuit of it, is well established in research and in case studies (**Figure 1**). Wallace Pratt's landmark insight that oil is found in the mind has never been more relevant that in today's flurry of activity around unconventional resources, and, more specifically, in this Golden Age of Shale. Geoscientists are well-advised to further acknowledge the guidance of Albert Szent-Gyorgyi. The Hungarian winner of the 1937 Nobel Peace Prize in Medicine for the discovery of vitamin C stated that discovery is about seeing what "everybody has seen" and then "thinking what nobody has thought."

How do we bridge this gap and "think what nobody has thought"? It starts with how we perceive and respond to our world. The reticular activating system (RAS), more commonly known as "finding what you're looking for", plays a key role. Our RAS influences what we see and, because it is triggered by one's priorities, environment, and emotions, research has shown that it can be trained and focused with new information (Miller, G.A., 1968).

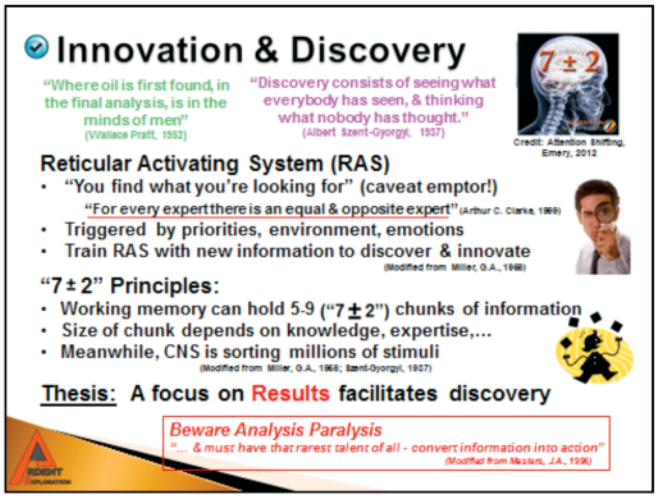


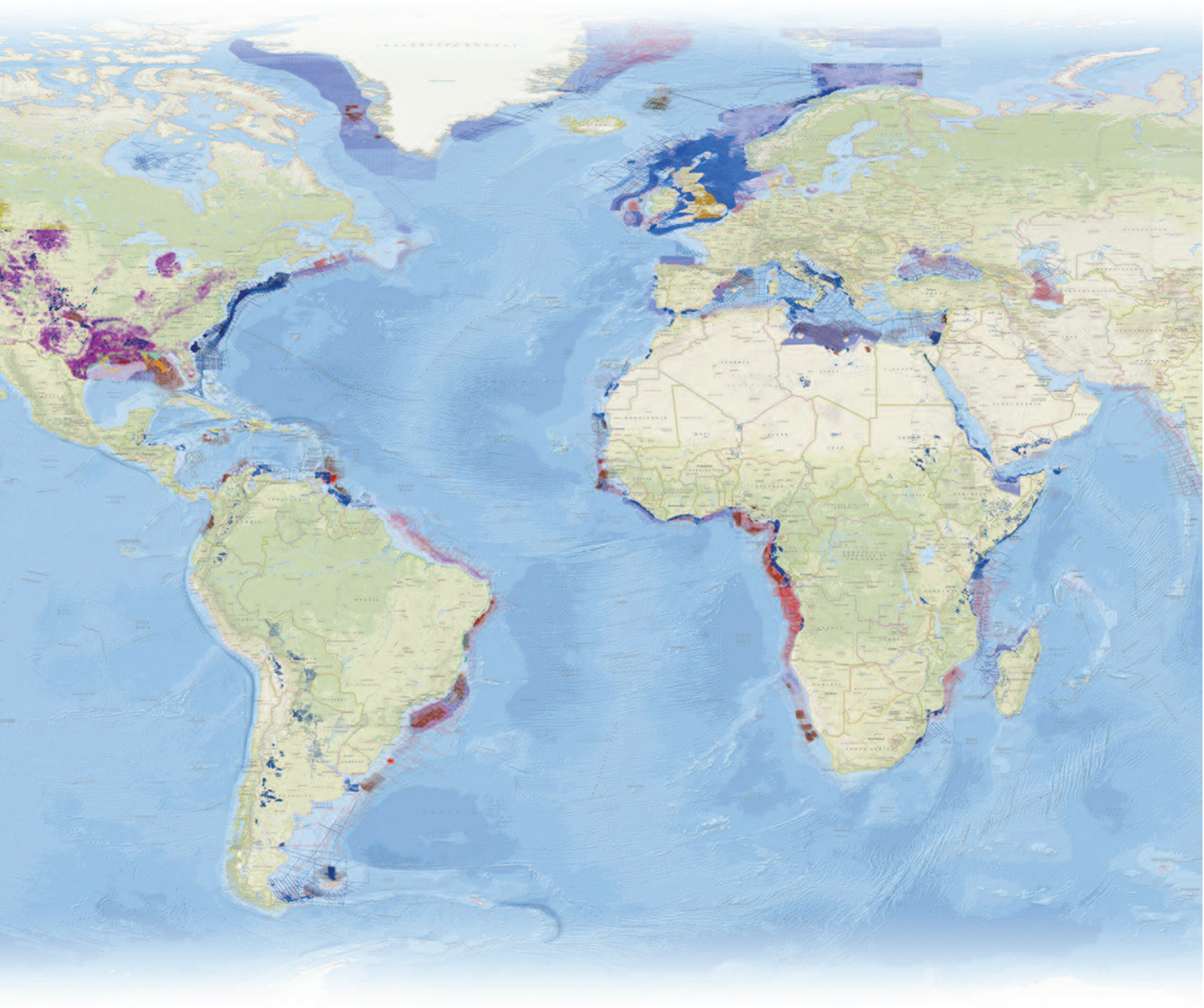
Figure 1

Related research led to the discovery of "7+/-2", a concept that the human brain can consciously process between 5 to 9 "chunks" of information simultaneously; and, more significantly, the size of a "chunk" depends on knowledge, expertise, etc. Think of a "chunk" as the size of a file (perhaps in megs) and the brain is a dual-quad core processor. The larger the 5 to 9 "chunks" of information, the more network connections, computations, and ultimate computing power we can yield. Meanwhile, our central nervous system is subconsciously sorting, 24/7, millions of additional stimuli. Perhaps the human brain is a million, or even a billion, core processer! It may be well documented that we can increasingly tap our potential through the power of positive thinking, continuous learning, passionately pursuing our dreams, effective communication and collaboration, etc. Fine, it is likely that we have already heard this, and perhaps read a few books about it, maybe even attended a seminar or two. However, it's not about what we "know," but rather *if*, and *how*, it is practiced. So, is there a simple process that we can follow to help lead us toward innovation? The thesis herein is "YES" and is termed **ACB** in which a focus on results facilitates discovery.

Two basic approaches that have led to discovery are presented (**Figure 2**). There can be little doubt that the Scientific Mode,

HGS General Luncheon *continued on page 39*

Looking for the next big opportunity?



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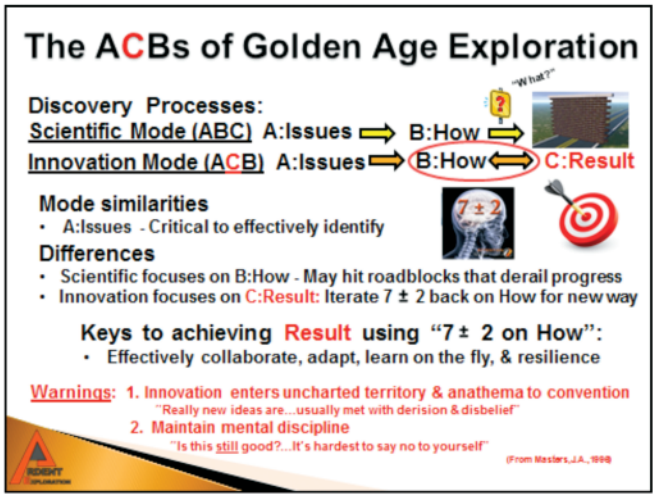


Figure 2

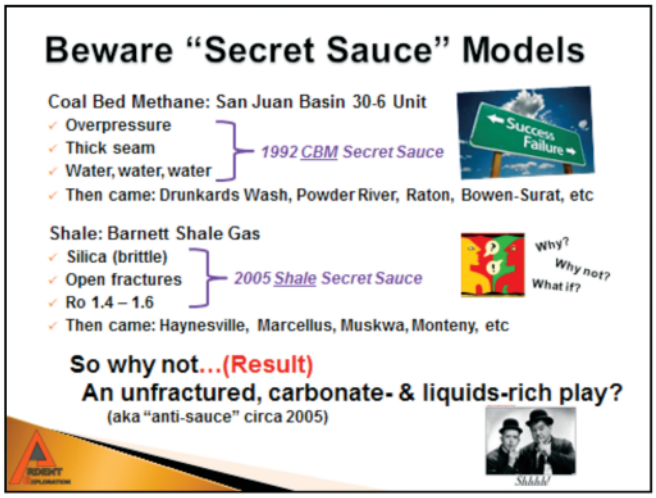


Figure 3

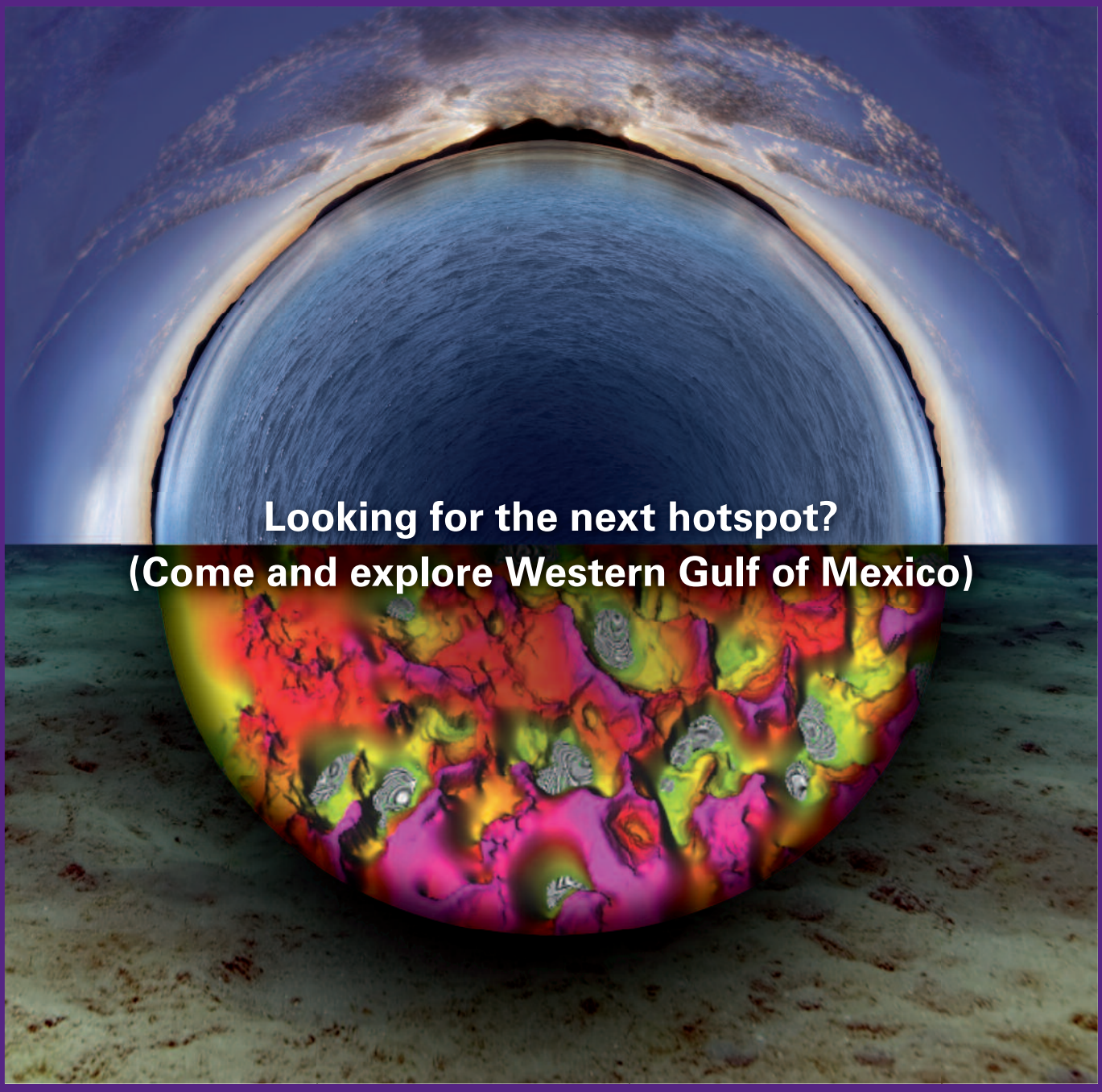
herein termed **ABC** — one with which we're intimately familiar — is pervasively used across our industry and culture. It is a tried and true method, and requires no additional elaboration. A second proposed method, **ACB**, may start with similar questions and issues as **ABC** and, in both methods, it's mission-critical to identify and characterize the relevant starting parameters. However, the path forward may significantly diverge between the two methods because **ACB** implicitly acknowledges that the initial issues are often poorly understood or perhaps even irrelevant and have a tendency to morph with further examination. This contrasts with **ABC**, where one works the problems and issues 'A' through 'B' (How) to achieve the 'C' (Result). **ACB** starts with the desired result and, through collaboration with varied subject matter experts, some perhaps far-afield of the traditional oil patch, plus learning on the fly, adaptation, dreaming, and plain old resilience, uses our "7+/-2" rule, and re-iterates back on "How" to find a solution. New and very different questions, issues, and associations may result. A hypothetical exploration example, from Southeast Asia, will demonstrate how the **ACB** mode may reframe 'How', leading to a very different set of exploration goggles, helping discover a play that eluded others.

Geoscientists and organizations have a truly unique opportunity to discover vast new resources and create compelling value during this historic period.

In our journey toward shale exploration success, it's advantageous to remain mindful that our RAS, especially when operating in **ABC** mode, can lead to very comfortable "secret sauce" recipes (**Figure 3**). In such analog-based "recipe space", the closer the prospect is to the analog, the higher our confidence may become and, as a result, the easier it might be to "sell" to our Company or investors. Competition inevitably escalates if the recipe has been successful, making it increasingly difficult to "get-on-base", let alone "hit-a-home-run", because of a play's discovery "creaming curve." If competition is chasing that 800-pound elephant with a hazel eye that's only visible on a Blue Moon, that leaves plenty of uncontested exploration opportunity in the rest of the resource triangle jungle. Furthermore, given that shale plays are unique in their own way, a model may literally evolve from an exploration asset to an expensive liability. Here are examples from two famous play "secret sauce" recipes. The first is CBM from the San Juan 30-6 Unit, San Juan Basin, NM and the second is Shale gas from the Barnett in Fort Worth Basin, TX. These were exploration model "poster children" for years, and are posited to have inhibited subsequent discovery, through their specificity and our RAS, because the new plays did not appropriately fit the criteria of THE model.

An early-days vignette of the ConocoPhillips (COP) Eagle Ford shale discovery, South Texas, will illustrate how a "clandestine", passionate and integrated technical Team, who employed **ACB** and focused on **results**, identified, characterized, and captured a new liquids-rich shale play concept in an unfractured, carbonate-rich reservoir; although much of Industry was focused on the Barnett gas "secret sauce" from fractured siliceous shale (**Figure 4**). Reality is that the COP initiative was also treaded on old ground, but with a new twist. The Eagle Ford, like most unconventional plays, has been "discovered" numerous times and, in 1978, was described as "…full of oil in most locations…". This was a perfectly apt contemporary description because by 2005 the knowledge, expertise, and technology began to exist to convert resource to reserves. Earlier it was a different story.

HGS General Luncheon *continued on page 41*



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HGS General Luncheon continued from page 39

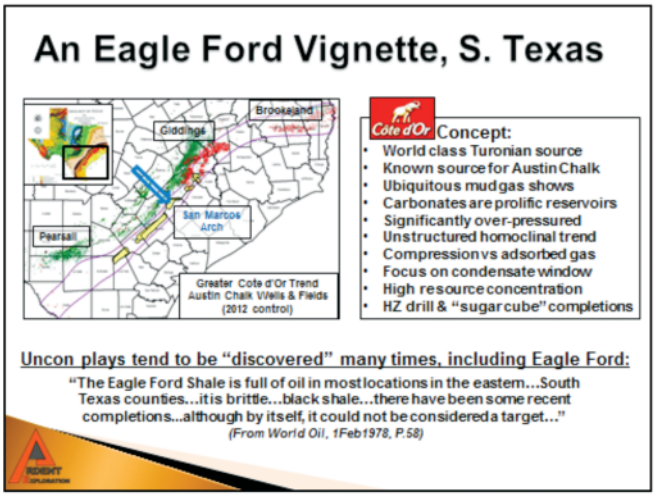

Figure 4

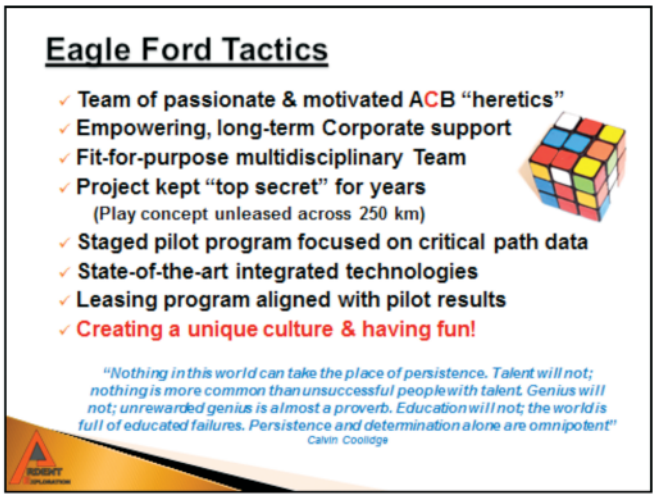

Figure 5

The Eagle Ford play concept was created through the combination of common knowledge and well-established geologic tenets, with deduction and inference fused with long-term Corporate alignment, support, spirited debate, "ah-ha" revelations, plenty of elbow grease, lots of Team lunches, and fun (**Figures 4 & 5**)!

Known facts about the Eagle Ford included:

- Proven Austin Chalk source with ubiquitous mud gas shows from the globally recognized Turonian-age stage,
- Carbonates can be the most prolific reservoirs.

Deductions were:

- Currently active petroleum system;
- Overpressure present-driven by oil cracking to gas at high bottomhole temperature (BHT);
- Natural fracturing limited except around faulting;
- Distal Austin Chalk facies highly prospective and, in many ways, analogous to the Eagle Ford (at one time termed "a difference with no distinction".

Inferences included:

- Compression storage play because BHT too high for adsorption (adsorption in Barnett was believed, at the time, to hold 50%+ of the gas),
- The sweet spot will be a supercritical reservoir fluid fairway from which flow, liquids & NPV can be optimized,
- Resource concentration will be exceptionally high, and
- Horizontal drilling and massive multistage hydraulic fracks will be required to create a "sugar cube" reservoir to recover hydrocarbons at an economic rate.

Concerns included:

- Are the reservoirs brittle enough to effectively frack and get an economic rate?

Figure 6

- Is the horizontal stress anisotropy too great?
- Will we have condensate drop out & liquid loading that kills production?

In retrospect, our Team had more than its share of miscues and outright surprises, both positive and negative, on the road from concept to reality. Some were simply beyond contemporary technology such as flow contribution from organic matter permeability and some inherent, for example, the Austin Chalk did not turn out as good as the Eagle Ford for many reasons. However, by adopting **ACB** and remaining focused on results, we weathered the storms, had a blast adding a page or two to the "Book of Shale", enriched our professional lives, and materially moved the needle for our Company. Through 2008, we secured >300,000 acres for <$100,000,000, and, by 2012, a prize that had grown to 1.8 BBOE of which 77% was liquids.

HGS General Luncheon *continued on page 43*

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HGS General Luncheon continued from page 41

Lastly, as the shale "how-to cookbook" is being "carved into stone" in North America, it is advisable to recognize that these never-better "secret sauce recipes" are biased toward marine-sourced Paleozoic plays (**Figure 6**). Given that the majority of global hydrocarbon production is from the post-Paleozoic, it is probable that numerous, altogether new, unconventional plays await discovery. Southeast Asia, for example, is amply endowed with productive Tertiary and lacustrine petroleum systems, and history suggests their giant unconventional counterparts will be differentially secured by those so prepared for the challenge. Another Golden Era anyone? ■

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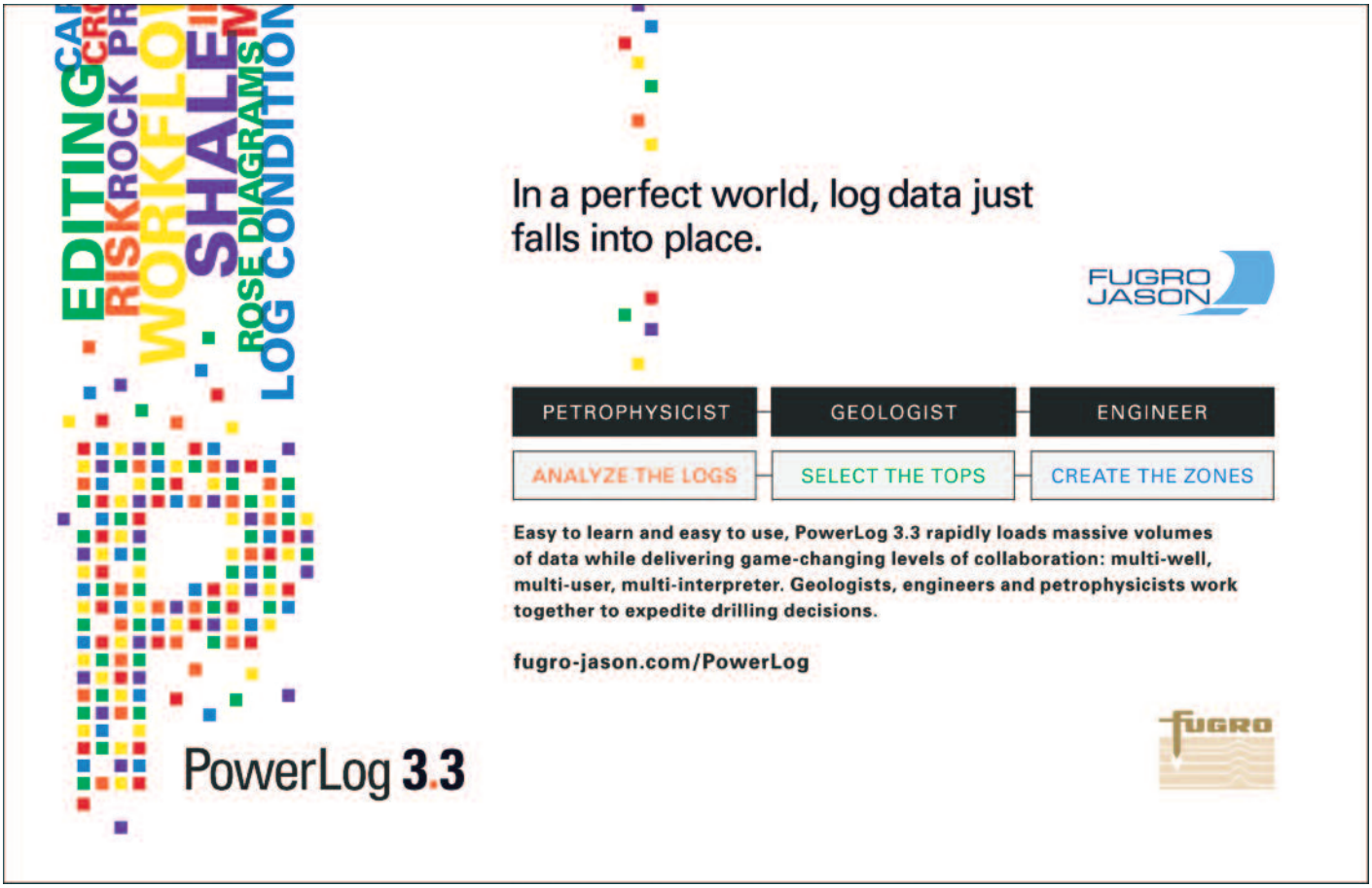
Biographical Sketch

Paul M. Basinski has over 30 years of E&P experience – 25+ of which trying to figure-out unconventional resources. He is a giant field-finder and recognized technical expert with diverse senior management experience. Paul has a varied, innovative track record generating unconventional plays and had the fortune to lead Teams of truly exceptional individuals, aligning technologies with pragmatism, having fun delivering Tier-One results. Paul holds a B.A. Geology, SUNY-Buffalo, NY, followed by a stint with Kerr-McGee on Project 79, a "top-secret" unconventional uranium exploration play in New England, where he developed a lifelong passion for everything unconventional. Paul proceeded to University NV-Reno (Mackay School of Mines) and completed a thesis characterizing a lacustrine unconventional uranium trap driven by diagnenetic zeolite absorption (huh?!), earning a M.S Geology. Upon graduation, Chevron made the miscalculation of hiring a mining guy who was both clueless about the oil business as well as what a dry hole symbol looked like, but, ever since his first well, Paul's recognition has continued to improve. Several companies later, Paul found himself at Burlington Resources / ConocoPhillips for 13 years of combined service, holding positions including Eastern US Exploration Manager, Geologic Fellow-Unconventional Resources New Ventures, and Senior Geologic Fellow-Global Unconventional Resources New Ventures. In 2005, Basinski generated a liquids-rich "shale" play concept in the Eagle Ford, S. TX, formed a multidisciplinary Team of "the right stuff", and spearheaded the code-named Cote d'Or Project through 2008, capturing >300,000 acres at <$100 MM, adding 1.8 BBOe (77% liquids) recoverable resource. Paul subsequently initiated COP's Global Unconventional Team, participated in 50+ unconventional play assessments, and characterized and championed the #1 ranked global shale play,

HGS General Luncheon *continued on page 45*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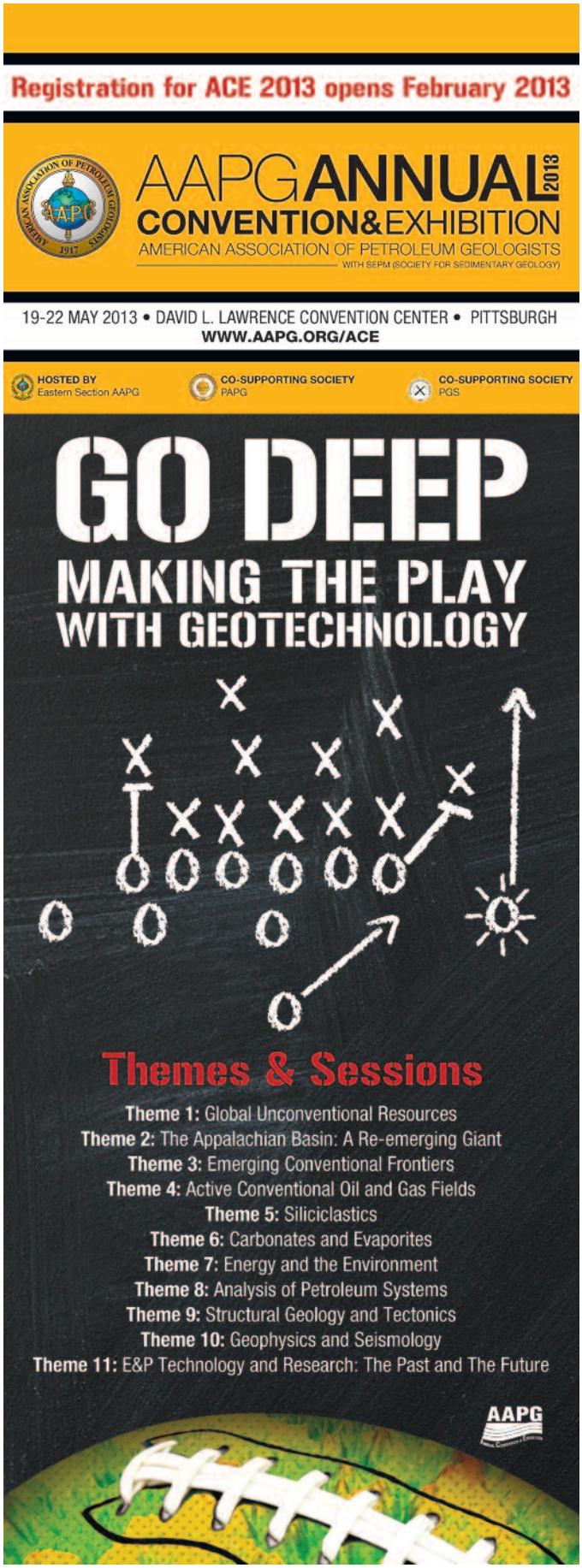
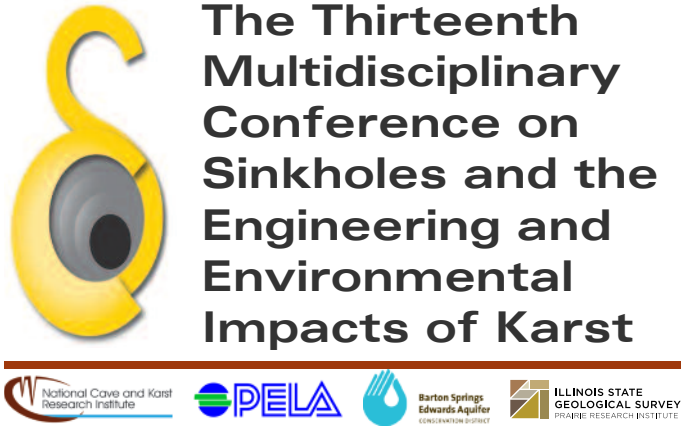


HGS General Luncheon *continued from page 43*

securing preliminary NOC agreement on a 60 BBOIP project. Paul, and several superior mates, developed "Shale Analysis Methods", received the COP Technology Award, and subsequently secured a US Patent but, much to his dismay, was unable to land an amphora of the legendary vintage 121 BC Falernian wine for what seemed like a good excuse. In May 2011, Paul "retired" and co-founded Ardent Exploration, at half the pay and twice the hours, to identify and capture liquids-rich, economically compelling, "ugly rocks" plays across NAM. Meanwhile, Paul is having a ball on the bleeding-edge of unconventional resource technology serving as Energy Minerals Division (EMD) co-Chair, 2013 AAPG International Convention (ICE), Cartegna, CO and AAPG Technical Program Representative and Theme Chair, 2013 URTeC, Denver, CO. Previously, he held various EMD Chair positions: 2011 AAPG Annual Convention, Houston, and AAPG ICE, Milan, IT, and, most recently, 2012 AAPG ICE, Singapore.

HGS Legends Night

Monday, January 14, 2013 (page 14)



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by ***Mr Michael Heinz, Jr.***

Biographical Sketch

Mr. Heinz is a partner in the Energy Private Equity Group of Kayne Anderson Capital Advisors and a member of that group's Investment Committee. In his role as partner, he is responsible for sourcing, assessing, structuring and managing investment opportunities as part of Kayne Anderson's emphasis on energy transactions. In addition, Mr. Heinz works closely with management teams in the development and execution of their business plans. Mr. Heinz has been actively involved with over 40 past and current portfolio companies.

Prior to joining Kayne Anderson in 2002, Mr. Heinz was a senior vice president of Netherland, Sewell & Associates, Inc., a Texas-based oil and gas consulting firm that provides a complete range of professional reservoir engineering, geophysical and geological services to the worldwide petroleum industry. Mr. Heinz began his career in the oil and gas industry in 1984 as a reservoir and operations engineer for Exxon Company U.S.A.

Mr. Heinz earned a B.S. in Petroleum Engineering from the University of Tulsa in 1984. Mr. Heinz is a registered professional engineer in the state of Texas, and is a member of the Society of Petroleum Engineers (SPE) and the Independent Petroleum Association of America (IPAA).

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Monday, January 14, 2013 (page 14)
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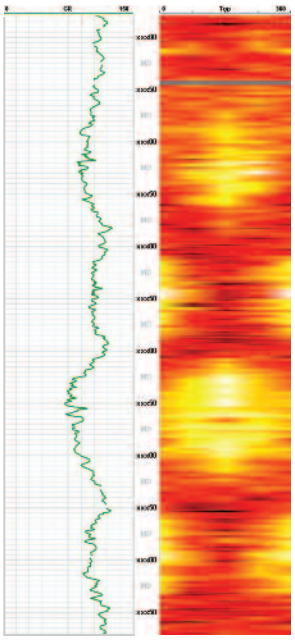

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Playmaker Forum — New DPA Program for the New Year!

by Charles A. Sternbach, *DPA President 2012-2013, Past President HGS 1999-2000*

My main goal for AAPG's Division of Professional Affairs (DPA) is to offer valuable content for petroleum geoscientists that will enhance their professional skills and improve their business bottom line. DPA will partner with the AAPG Education Department to present "The Playmaker Forum", planned for Thursday, January 24, 2013, at the Norris Conference Center in Houston, next to the Hotel Sorella, near Beltway 8 and I-10. You'll learn from world-class oil finders, bold marquee playmakers, and accessible networking opportunities. All HGS and AAPG members can benefit and should know that registration is filling fast. Sign up online at http://www.aapg.org/forum/playmaker/index.cfm

This program's topics can be applied right away and will make both experienced and young professionals more valuable to their current employers. Playmaker topics will get you thinking about adding value to upcoming prospect expos, such as NAPE, and to other meetings around the globe.

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Our keynote speaker, Harold Hamm, who is the CEO of Continental Resources, will describe the Bakken and Woodford plays, his success in growing Continental Resources, and his vision for transformation of our national energy resource mix. DPA will honor Mr. Hamm for his dedication to our industry with the presentation of its Heritage Award at the meeting.

Playmaker Forum Agenda

The Art of Exploration Speakers

- **Charles Sternbach**, DPA President, *Playmaker Program*
- **Dan Tearpock**, *10 Habits of Highly Successful Oil Finders*
- **Ted Beaumont**, AAPG President, *Exploration Creativity*
- **Bill Maloney**, Executive VP, Statoil DPNA, *From Ideas to Profits: Creative Entry into Successful Plays*

Perfecting Prospecting Workflows

- **Robert Pledger**, *Marketing Your Prospect at Expos*
- **Steve Bachman**, *Assembling and Presenting Conventional Prospects*
- **Richard Stoneburner**, AAPG Distinguished Lecturer, *Unconventional Play Fundamentals*

Playmaker Networking Luncheon 12:00-1:00 pm

Insights into Established Plays

- ***Keynote speech*** by **Mr. Harold Hamm**, CEO of Continental Resources, *Changing the Game in the Bakken /Woodford*, to be followed by the Presentation of AAPG/DPA Heritage Award, 2013
- **Bill Zagorski**, AAPG Outstanding Explorer awardee, *New Insights on Liquid-Rich Marcellus*
- **Charles Cusack, Jana Beeson, Dick Stoneburner**, and **Gregg Robertson**: *Eagle Ford Discoveries* 2010 GCAGS Best Paper Award

Emerging Plays

- **Shane Matson**, *Mississippian Lime: Kinematics of a Play*
- **Ken Mariani**, CEO of Enervest, *Utica Shale*
- **Tom Bowman**, *"Eaglebine" Activity*
- **Rick Fritz**, *Leveraging AAPG and DPA to Improve Professionalism*

Wildcatter Corner Reception and Social Event 5:30 – 7:00pm

Playmaker Forum *continued on page 51*

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- Seismic Amplitude Interpretation
- Interpretation of 3D Seismic Data
- Principles and Applications of Well Logging
- Formation Evaluation of Thinly-bedded Reservoirs
- "Old" (Pre-1958) Electric Logs: A Quick Review
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What's the real value of Membership in AAPG's Division of Professional Affairs?

Rick Fritz, DPA membership chair, **Valary Schulz**, DPA President Elect, **David Curtiss**, AAPG Executive Director, and I discussed the reasons AAPG members join DPA. It was easy for us to list DPA's "deliverables" such as peer-reviewed global certification, great education events, representation in Washington by GEO-DC, and its web resources. We believe though that a singular advantage to membership in the DPA is, well, the incredible people who are involved.

DPA networking, online and at AAPG meetings, offers opportunities to learn from the best oil finders in the business and to participate in world class programs. We hear stories about how DPA has kindled friendships that "sealed the deal," provided insights that led to new plays, or inspired personal missions. These stories, DPA's "lore," are DPA's best recruiting tools. Every DPA member could tell such stories and you are encouraged to share yours with **Chandler Wilhelm**, editor of our DPA "Correlator" newsletter at Chandler.Wilhelm@shell.com.

Impact of People and Programs

Here's one of my stories about how a DPA event changed my life as a geologist. I attended a "Legends in Wildcatting" DPA luncheon organized by Jim Gibbs, a past-president of both AAPG and DPA, at the 1997 Dallas Annual convention. There was also a series of talks that profoundly transformed my professional life. In them, Tom Jordan, Mike Halbouty, Bernard Duval, John Masters, and Roy Huffington shared their thoughts on oil finding. I sat in the front row and took 10 pages of notes which I still have! This panel told how great oil explorers combine science and business to consistently achieve spectacular results. Powerful stuff!

These experiences made me want to create more forums like that one! When I became President of the Houston Geological Society in 1999-2000, my top goal was to create a "Legends in Wildcatting" program. Over the last 13 years, HGS has continued to host Legends panels; the eighth will be 14 January 2012. Building on the success of Legends, in 2008 we launched a new program on the international stage, ***Discovery Thinking Forums***, as an AAPG/DPA event at Annual AAPG Conventions. Since then we have held seven such panels for typically standing room only crowds, with many more forums planned as we look toward 2017, AAPG's 100th Anniversary.

Each of these programs started as a 'wildcat' idea, and this Playmaker program is such an idea for DPA. For me, many thematic roads and friendships lead back to that pivotal DPA event in1997. That DPA Luncheon fifteen years ago was my personal tipping point. I hope our Playmaker Forum this January 24th will be as valuable an event for you and a tipping point for many experienced and young professionals. ■

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Networking Lunch will be followed by: Keynote speech by Mr Harold Hamm, CEO of Continental Resources, Changing the game in the Bakken /Woodford

Afternoon sessions: Examples of hot and emerging Plays (Bakken, Woodford, Marcellus, Eagle Ford, Mississippian Lime, Utica, Eagle Bine, more):

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SPEAKERS INCLUDE:

Harold Hamm, Domestic energy: Bakken and Woodford
Richard Stoneburner, Unconventional Play fundamentals, AAPG Distinguished Lecture
Bill Zagorski, New insights on liquid rich Marcellus, AAPG Outstanding Explorer of the Year
Bill Maloney, Ideas to profits: creative entry into successful plays

Charles Sternbach, Playmaker Program, **DPA President**
Dan Tearpock, 10 Habits Highly Successful Oil finders
Ted Beaumont, Exploration Creativity, AAPG President
Robert Pledger, Marketing your prospect at expos
Steve Bachman, Assembling and presenting conventional prospects
Charles Cusack, Eagle Ford Discoveries, GCAGS Award winning paper
Shane Matson, Mississippian Lime: Kinematics of a play
Tom Bowman, Eagle Bine Activity
Ken Mariani, Utica Shale
Rick Fritz, Leveraging AAPG and DPA to improve professionalism

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Government Update

by ***Henry M. Wise, P.G.*** *and* ***Arlin Howles, P.G.***

If you'd like the most up-to-date Texas rules, regulations, and governmental meeting information, we direct you to the HGS website to review The Wise Report. *This report, which comes out as needed but not more often than once a week, offers the most up-to-date information that may be of interest to Texas geologists.*

AGI Government Affairs Monthly Review (November 2012)

Hearing Held in Alaska on Offshore Drilling in the Arctic

A field hearing on "Preparing for Offshore Drilling in the Arctic: Lessons Learned from the First Season" was held at the University of Alaska Anchorage on October 11, 2012. The hearing was held by the Senate Committee on Commerce, Science & Transportation's Subcommittee on Oceans, Atmosphere, Fisheries and Coast Guard and was attended by Subcommittee Chairman Mark Begich (D-AK).

The hearing was held to examine the operational lessons to be learned following the first season of exploratory drilling activity in the Arctic. Shell has completed preliminary drilling in the Beaufort and Chukchi Seas for the 2012 season. The U.S. Geological Survey has estimated that the offshore Alaska region could contain 27 billion barrels of oil and over 120 trillion cubic feet of gas. Witnesses included David Hayes, Deputy Secretary of the U.S. Department of the Interior; Laura Furgione, Acting Director of the National Oceanic and Atmospheric Administration's National Weather Service; Thomas Ostebo, Commander of the Seventeenth District of the U.S. Coast Guard; Pete Slaiby, Vice President of Exploration and Production for Shell Alaska; Jacob Adams, Chief Administrative Officer for the North Slope Borough in Alaska; and Edith Vorderstrasse, Consulting Division Manager of the Ukpeagvik Iñupiat Corporation.

Pete Slaiby, head of Royal Dutch Shell PLC's Alaska operation, called for an overhaul of the current regulatory process saying, "To put it bluntly, the regulatory process for drilling in Alaska is broken; it is not efficient, it results in unnecessary and costly delays, and it needs to be fixed."

Slaiby told Begich that, "Shell paid the federal government $2.2 billion for leases in the Chukchi and Beaufort Seas." Slaiby called for clarity and consistency in the regulatory process, a single office to handle federal permitting for offshore Alaska energy projects, as well as coordinated and timely decisions from federal agencies. Slaiby asked Congress to limit the amount of time for activists to file lawsuits from six years to 60 days. He advocated for lease extentions beyond 10 years since fluctuations in Arctic sea ice only allow for drilling during three to four months out of the year.

Jacob Adams, Chief Administrative Officer for the North Slope Borough, recommended that the Interior Department modify their upcoming management plan for the National Petroleum Reserve-Alaska to make it easier for oil companies to transport oil from the Chukchi Sea to the Trans-Alaska Pipeline System through a pipeline that runs through the reserve.

Opening statements, witness testimonies and an archived webcast of the hearing can be found on the committee's web site (http://commerce.senate.gov/public/index.cfm?p=Hearings&ContentRecord_id=99add094-55db-4de3-b114-88e18c73e7e0).

NSF Opens Wyoming Supercomputer and Launches *Sikuliaq*

The National Science Foundation (NSF) dedicated the National Center for Atmospheric Research (NCAR) Wyoming Supercomputing Center (NWSC) in Cheyenne on October 15, 2012 and launched the *R/V Sikuliaq* on October 13, 2012.

The Supercomputer, known as "Yellowstone" is one of the world's most powerful supercomputers is able to calculate 1.5 quadrillion

Government Update *continued on page 55*

Loyd Tuttle ltuttle@hal-pc.org
Bob Liska liska.bob@gmail.com
Jim Thorpe jthorpe@hal-pc.org
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Fourth Annual AAPG Deepwater Reservoirs Geosciences Technology Workshop

15-16 January 2013 • Houston, TX

Determining reservoir connectivity, calculating pore pressure, understanding the structural subtleties, identifying hazards, and developing accurate images (including subsalt), are deeply affected by new multi-disciplinary discoveries in science and technology. The 4th Annual AAPG Deepwater Reservoirs Geosciences Technology Workshop will return to its roots, and bring together the latest developments.

Solving Water Problems in Oil and Gas Production: New Technologies for Cost Savings and New Revenue Flows

26-27 February 2013 • Fort Worth, TX

Water concerns are intensifying as issues around hydraulic fracturing, new regulations, drought, and surface water management continue to dominate the public. Join us for presentations, intensive discussions, and a review of new and emerging technologies that address current and anticipated problems.

Eagle Ford Shale

18-20 March 2013 • San Antonio, TX

The Eagle Ford Shale is one of the "Big Four" shale plays in the U.S., and the fact it contains both liquids and gas makes it economically viable when other plays are not. Join us as we look at the latest lessons learned and bring together presentations from geology, geophysics, geochemistry, and engineering perspectives to gain insight into productivity in the Eagle Ford.

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For information on this AAPG GTW's, please log on to our website at http://www.aapg.org/gtw.

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(i.e., a million billion) mathematical operations per second. This speed is comparable to the world's population of 7 billion people simultaneously conducting 200,000 calculations per second.

Yellowstone is dedicated to the geosciences and is funded by NSF with additional support from the state of Wyoming and a broad public-private consortium. Yellowstone's extraordinary computing power will enable geoscientists to capture Earth's systems in unprecedented detail. The results will improve forecasting of hurricanes, tornadoes and other severe storms; wildfire behaviors; mapping of critical water supplies; predictions of solar disruptions impact on Earth; and many other concerns.

The *Sikuliaq*, named after the Inupiat word meaning "young sea ice," is the first global-class, ice-capable ship owned by the NSF. The vessel is capable of working in any ocean in the world and has been called "one of the most advanced research vessels in the world," by NSF Director Subra Suresh.

First Assessment of Utica Shale Gas Resource Released

According to the U.S. Geological Survey (USGS), the Utica Shale contains a mean estimate of 38 trillion cubic feet of technically recoverable natural gas. This assessment is the first of the Utica Shale by the USGS.

The Utica Shale is found beneath the Marcellus Shale, which is the largest unconventional gas basin USGS has assessed. The Utica Shale contains mean estimated 940 and 208 million barrels of unconventional of oil and natural gas resources respectively.

Italian Seismologists Convicted of Manslaughter

On October 22, 2012, four scientists, two engineers, and a government official were found guilty of manslaughter for statements made six days before a magnitude 6.3 earthquake struck L'Aquila, Italy on April 6, 2009.

The prosecution emphasized that the charges were not for failing to predict the exact time, place, and magnitude of the earthquake, but for reassuring statements they made that the risk of a large earthquake was low. Six days after their statements, the L'Aquila earthquake occurred and was responsible for the deaths of 309 people.

At a meeting of Italy's National Commission for the Forecast and Prevention of Major Risks on March 31, 2009, the experts stated that the small to mid-sized tremors, which had shaken the town over the last three months, reduced the danger of a larger earthquake because they discharged energy.

The prosecution alleged that the reassuring statements provided by the experts caused the deaths of 30 people who stayed indoors instead of going outside, as is the custom after a tremor. The experts were charged with six years in prison, and owed the court fees as well as $10.2 million dollars in damages caused by the earthquake. They have been banned for life from public service.

The defense plans to appeal the decision.

After the Summer, More Americans Link Extreme Weather to Climate Change

Researchers from Yale and George Mason universities published a report, "Extreme Weather and Climate Change in the American Mind," (http://environment.yale.edu/climate/files/Extreme-Weather-Public-Opinion-September-2012.pdf) which found a large (74 percent) and growing majority of Americans say "global warming is affecting weather in the United States." This percentage is five points up from the last survey conducted in March.

The survey of 1,061 adults who answered agree/disagree questions has a three percent error margin. The report also included regional breakdowns as well as questions about what kinds of weather trends participants have experienced and whether they link those trends to climate change. Participants in areas hardest hit by recent extreme events, like the summer drought in the Midwest, were more likely to agree that droughts have increased in frequency.

Texas Gas-Fired Power Plants Use Less Water than Coal

According to a study conducted by the Texas Clean Energy Coalition (http://fuelfix.com/blog/2012/10/23/natural-gas-plants-save-water-over-coal/), switching coal-fired for gas-fired power plants would conserve 60 percent of fresh water used for energy generation in Texas.

This study was funded by the George and Cynthia Mitchell Foundation, U.S. Department of Energy, and the National Science Foundation as part of a nationwide effort to study water use. Even though hydraulic fracturing uses millions of gallons of water to extract gas from shale, this study found that Texas coal mining requires five times the amount of water. This is mainly due to the higher efficiency of natural gas-fired power plants compared to currently operating Texas coal plants.

Texas coal is rich in lignite which requires higher water volumes than other types of coal. Therefore, this study is not applicable across the U.S.

First U.S. Graduate Program in Subsea Engineering

The University of Houston has been granted approval to offer the first U.S. graduate program in subsea engineering. The program has been formed in partnership with world leading energy engineering companies including Cameron, FMC Technologies, and GE Oil & Gas.

Government Update *continued on page 57*

HGS Welcomes New Members

New Members Effective December 2012

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Government Update continued from page 55

The master's degree program, which will be offered next fall, is designed to equip students with the skills necessary to reach the world's most inaccessible gas deposits including those located in the Gulf of Mexico. Courses will be taught by experts in the industry. Each course will include a major design project, a written project report, a technical presentation, and the use of state-of-the-art subsea engineering software

Key Reports and Publications

Government Accountability Office (GAO)

"Water Pollution: EPA Has Improved Its Review of Effluent Guidelines but Could Benefit from More Information on Treatment Technologies" (http://www.gao.gov/products/GAO-12-845) — The United States Government Accountability Office (GAO) was asked to examine the processes the Environmental Protection Agency (EPA) follows to screen and review industrial categories for effluent guidelines. This entails examining the results of the screening and review process, as well as limitations to this process, and EPA actions to address any such limitations. GAO recommends that the EPA expand its screening phase to better assess hazards and advances in treatment technology and to improve the effectiveness of effluent guidelines.

"Unconventional Oil and Gas Development: Key Environmental and Public Health Requirements" (http://www.gao.gov/products/GAO-12-874) — In this report, the Government Accountability Office (GAO) identifies and discusses eight federal environmental and public health laws, including the Clean Water Act (CWA) and the Resource Conservation and Recovery Act (RCRA), which apply to unconventional oil and gas development. GAO found key exemptions or limitations in regulatory coverage which affect the applicability for six of the eight laws. Officials from the Environmental Protection Agency (EPA) have limited legal authority in conducting inspection and enforcement activities, the report says. For example, the oil and gas waste exemption from RCRA waste requirements represent a significant limitation to EPA's role in regulating these wastes. In addition, the GAO discusses additional requirements that apply on federal lands. GAO did not make any recommendations in this report.

Oil and Gas: Information on Shale Resources, Development, and Environmental and Public Health Risks (http://www.gao.gov/products/GAO-12-732) — In this report the U.S. Government Accountability Office (GAO) discusses the size and production of shale oil and gas resources as well as the environmental and public health risks. Based on estimates from Energy Information Administration (EIA), U.S. Geological Survey (USGS), and the Potential Gas Committee, the size of shale oil and gas resources in the United States has increased over the last five years, the report states. GAO expects estimates to evolve as new information becomes available. The report concludes that shale oil and gas development poses risks to air and water quality as wells as a number of health risks which are unknown. GAO did not make any recommendations in this report. ■

HGS Legends Night
Monday, January 14, 2013 (page 14)

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2012 Robert E. Sheriff Lecture Student Abstracts

[These are ten of the 27 entries for the Sheriff poster series, presented as is. The remainder will be published next month along with identification of the winners. - Ed.]

Lithologic Correlations Across the Eastern North Pamir Suggest a Regionally Extensive Thrust Nappe

Daniel Imrecke, *Ph.D. Candidate*

Older, widely used, geologic maps of the eastern North Pamir show a collage of Paleozoic lithologies. Recent work has documented that many of these lithologies are Triassic in age and regional similarities in lithologies and structural relationships suggest a broad continuity in the tectonic architecture across the region. We compare two regional areas: 1) the Baoziya Thrust and Tanymas Thrust are exposed north and northwest of the Muztaghata massif, in the hanging wall of the Kongar Shan normal fault. The Baoziya/Tanymas thrust hanging-wall consists of upper greenschist to amphibolite facies schists and quartzites with abundant Triassic igneous intrusions. Detrital zircon analyses of the hanging wall yield Permo-Triassic maximum depositional ages and Late Triassic metamorphic age signatures (Robinson et al., 2004; 2012). The footwall of the Baoziya Thrust consists of greenschist facies marbles, phyllites, and quartzites with Triassic maximum depositional ages, whereas the Tanymas thrust footwall consists of Paleozoic sandstones, limestones, and marls. 2) The Torbashi Thrust is exposed south of the Muztaghata massif as a large folded klippe in the hanging wall of the Shen-ti fault. Its hanging wall consists of amphibolite facies schists and gneisses with abundant igneous intrusions. Like the Baoziya/Tanymas hanging-wall, the Torbashi Thrust hanging-wall yields Permo-Triassic maximum depositional ages and a Late Triassic metamorphic signature. The northern exposure of the footwall consists of greenschist facies marbles, quartzites, phyllites, and metavolcanics with Triassic metamorphic age signatures, whereas the southern exposure consists of Permian limestones and slates. Based on structural juxtaposition and lithologic similarities we correlate the north exposure of the Torbashi Thrust with the Boaziya Thrust, and correlate the southwest exposure of the Torbashi thrust with the Tanymas thrust. We propose the Torbashi and Baoziya/Tanymas faults were a continuous structure which formed a regionally extensive thrust nappe in the Northern Pamir. The thrust sheet was subsequently cut by the Muztaghata gneiss dome in the Miocene. ■

The Impact of Mantle Heterogeneity on Oceanic Core Complex Formation, 12 – 16°N, Mid-Atlantic Ridge

Alex Barnard, *Ph.D. Candidate*

The 12-16°N segment of the Mid-Atlantic Ridge has two fundamentally different modes of seafloor spreading: symmetric and asymmetric. The central part of this segment (~14°N) is characterized by continuous axial rift valleys flanked by normal faults with high length/displacement ratios. In contrast, crust that has spread asymmetrically within this segment features shorter fault scarp lengths, outward tilted surfaces, nodal basins, discontinuous neovolcanic zones and has a more irregular bathymetric character. Asymmetric spreading is a result of amagmatic tectonic extension and is accommodated by very-large-offset low-angle normal faults. These faults expose a complete section through the mafic crust to serpentinized mantle on the seafloor. Collectively, tectonic, magmatic and hydrothermal processes lead to the formation and character of oceanic core complexes. Dredged peridotites from this region are predominantly harzburgites. Electron microprobe analyses of accessory chromian spinel suggest at least 16 to 20% melt extraction preceded their exposure. However, it is difficult to reconcile the high melt volumes implied by the peridotite with thin, absent, and asymmetrically spreading crust. This evidence supports our prior suggestions that magma supply, and oceanic core complex formation, within these ridge segments is controlled by mantle heterogeneities. Heterogeneities may include, but are not limited to, garnet-pyroxenite sources that produce high volume melts and ultra-depleted mantle that produce little melt. Large segments of the mantle are likely receiving a free ride to the surface without significant melting. ■

Radial anisotropy in the northeastern Tibetan Plateau from Surface Wave Tomography

Lun Li, *Ph.D. Candidate, Geology*

Three-dimensional anisotropic shear wave velocity structure and radial anisotropic model of lower crust and upper mantle beneath NE Tibetan plateau are constructed from measurements of Love wave dispersions and previously obtained Rayleigh wave dispersion in order to answer two important questions regarding the plateau dynamics: (1) whether the deformation in the crust and upper

mantle is coupled; (2) whether asthenosphere upwelling exists beneath the NE Tibetan Plateau. We have analyzed Love waves recorded at the Northeast Tibet Seismic (NETS) array and applied the two-plane-wave tomography method to compute average and 2-D phase velocities. Transverse component seismograms from 66 events at 36 stations were filtered at 14 center frequencies with a narrow bandwidth of 10 mHz. Average phase velocity varies from 3.55 km/s at 20 s to 4.55 km/s at 100 s, which are higher than previously obtained Rayleigh wave phase velocities at corresponding periods. 2-D variation of Love phase velocity was calculated at the periods from 20 s to 100 s using 2-D, Born sensitivity kernels. Low-velocity anomalies are imaged along and to the south of the Kunlun fault at each period, similar as from Rayleigh wave tomography. However, the magnitude and size of the low phase velocity are much stronger and larger in Love wave images than in the Rayleigh wave maps. We invert the 2-D phase velocities of Rayleigh and Love waves in the period range from 20 to 100 s simultaneously, to construct a radially anisotropic shear wave velocity model. Such anisotropic properties, which cannot readily be obtained from body wave studies only, can provide new insights into geodynamic process in this tectonically actively region. ■

Facies Architecture, Branching Pattern, and Paleodischarge of Lower Delta-Plain Distributary Channel System in the Cretaceous Ferron Notom Delta, Southern Utah, U.S.A.

Yangyang Li, *Ph.D. Candidate*

Distributary channel systems are an important component of deltaic systems, but details of their branching pattern, internal variability, complexity, and relationship with adjacent levee, bay, and crevasse splays, are rather poorly documented in ancient examples. A gooseneck-shaped canyon in southern Utah, U.S.A. provides 3-D outcrop exposures of a lower delta-plain distributary channel system of the Late Turonian Ferron Notom delta. Thirty two measured sections and 9 cross sections allow direct mapping and documentation of the branching pattern of a distributary system. A main channel belt of about 250 m wide narrows to about 200 m downstream of the branching point. The subordinate channel belt is about 80 m wide. Water discharge from the main channel belt, upstream of the branching point, is estimated to be 85-170 m3/s. Compared to paleohydraulic estimates of trunk rivers mapped in previous studies, the branching documented in this study is probably a 4th order split. The distributary channels are characterised by a U-shaped geometry in oblique and strike-oriented cross sections. They are filled with medium-grained, cross-bedded sandstone, metre-scale inclined beds, ripple-cross-laminated sandstone, and muddy abandoned channel deposits with local tide- and wave-influenced deposits. Detailed bedding diagrams indicate a meandering channel pattern with local braided threads within the main channel belt. Distributary channels erode into adjacent levee and underlying heterolithic bayfill deposits. The subordinate channel belt fed a crevasse splay, which is characterised by a coarsening upward facies succession consisting of interbedded wave-rippled, current-rippled and planar-bedded very fine-grained sandstone and thin mudstones. ■

Seismic Modeling of Kerogen Maturity for Source Rocks: Bakken Shale, Williston Basin, USA

Malleswar Yenugu, *Ph.D. Candidate, Geophysics*

Thermal maturity of source rock measures the degree to which a formation has been exposed to high heat needed to break down the organic matter to generate hydrocarbons. The conversion of kerogen to oil/gas will build up overpressure. Overpressure is caused by conversion of solid kerogen to fluid hydrocarbons in a relatively fixed pore space. The excess pressure caused by kerogen maturity does have impact on the seismic elastic properties.

Source rock maturity yields oil/gas which develops overpressure (e.g., Meisner, 1978; Luo and Vasseur, 1996). It is important to understand how the maturity of kerogen will affect the seismic properties that are of interest to geophysicists. Immature source rocks are in the normal pressured regime and the pressure increases with maturity and over-matured source rocks will be in over-pressured regime. . The wave propagation, velocities, anisotropy and AVO effects by kerogen maturation have been obtained as a function of initial kerogen content (immature), excess pore pressure (mature) for Bakken shale from Williston basin, USA. ■

Sheriff Lecture Poster Competition Abstracts *continued on page 60*

2012 Robert E. Sheriff Lecture Student Abstracts continued from page 59

Facies architecture, paleo-reconstruction and controls of a fluvial system: Cretaceous Ferron-Notom Delta, Utah, U.S.A.

Danfix D'Souza, *M.S. Geology Candidate*

There are 4 models that have been hypothesized to explain channel-belt organization in ancient fluvial systems 1) avulsion processes create clustered channel-belts with random geometry, 2) channel-belt organization is related to net to gross, wherein the cross sectional geometry of fluvial systems can be attributed to changing accommodation and sediment supply, 3) channel-belt organization is controlled by sequence stratigraphy in which a fall in base level creates lateral confinement and amalgamated clusters within valleys, and 4) fluvial systems can be self-organized by autocyclic processes, producing non-random stratigraphy, dominated by avulsion clusters.

The aim of this research is to test these models by examination of fluvial deposits of the Late Cretaceous (Turonian) Ferron Sandstone Member, within the Mancos Shale Formation in Central Utah, along Sweetwater Wash, where the alluvial stratigraphy of the upper part of the Ferron is particularly well-exposed. Detailed cross sections, based on measured sections, walking out beds, and photopans, will show the proportion of channel belt, floodplain, and overbank splays and crevasse channels, which will address the degree of amalgamation of the channel-belts. Previous sequence stratigraphic analysis will help determine the larger-scale allogenic controls on alluvial architecture and stratigraphy. Detailed analysis of the internal facies architecture will enable determination of the plan-view style of the rivers that build each channel belt. This will also allow a test of the classic idea that meandering systems form muddy alluvial successions while braided systems form predominantly sandy successions. ■

Constrasting MORB-Boninite Reaction Trends in IBM forearc mantle

Matthew Loocke, *M.S. Geology Candidate*

Petrographic and geochemical analysis of spinel from 35 lower crustal dunites, peridotites, troctolites and gabbros recovered from the inner trench slope of the Bonin Ridge (BR) reveals 2 groups of samples which reacted with distinct melt compositions. Group A consists of peridotites (cpx-harzburgite), troctolites, and gabbroic rocks with medium Cr# (100 x Cr / Cr + Al) spinels ranging from 45 to 60 and high TiO2 and Al2O3 spanning ~0.1-2.25 and ~12-30 wt. % respectively. Group B consists of only dunites and cpx-free peridotites with high Cr# spinels ranging from 65 to 94 and low TiO2 and Al2O3 spanning ~0-0.12 and ~3-21 wt. % respectively. The group A and group B samples are the result of melt-rock reaction with a mid-ocean ridge basalt (MORB)-like melt and a more depleted boninitic melt respectively. MORB-like forearc basalts (~50-52 Ma) and boninites (~44-48 Ma) recovered from the BR have been interpreted to represent a change from decompression melting at subduction initiation to flux melting and boninitic volcanism. The group A and group B samples are a lower crustal record of the change from MORB-like melts created by decompression melting at or soon after subduction initiation to arc-type flux melting and boninite volcanism. Further, the presence of melt-hybridized peridotites and gabbroic rocks with spinels belonging to group A and not group B suggests that the lower crust of the BR may be dominated by gabbroic rocks and material related to the FABs. This would imply that a large portion of the lower crust in the fore-arc was formed during or shortly after subduction initiation and is similar in composition to MOR lower crust. ■

Land Surface Subsidence and Aquifer Compaction: A Comparison of Surficial and Deep-Monument GPS Data, Northwest Harris County, Texas

Jesse Ortega, *M.S. Geology Candidate*

Land surface subsidence occurs in urban areas worldwide, often in locations where inhabitants or businesses extract fluids from subsurface aquifers. Subsidence may also result from sediment compaction and/or surface faulting. In this study, groundwater withdrawal has been identified as the primary mechanism for the recent and rapid subsidence observed near the Addicks Reservoir, northwest of the Houston metropolitan area. Not only does Texas have one of the highest rates of groundwater withdrawal in the United States, but the other mechanisms listed above are slow: occurring over geologic time.

This study is centered on the use of a deep-monument, permanent GPS station in northwest Harris County, which began collecting data in 1996. A co-located extensometer has monitored compaction at the site since 1975. Furthermore, a surface-based, portable GPS station is located 50 meters from the deep-monument site. The proximity of these devices allows for the crucial comparison of regional vertical displacement with local compaction taking place within the aquifers. The deep-monument GPS station records vertical positions at a depth of 600 m, which is below the aquifers in this area. Thus, the positions are largely unaffected by groundwater withdrawal, and have observed only two centimeters of subsidence since measurements began. Conversely, vertical displacement at the surface records both the regional displacement as well as the local aquifer-driven displacement. This surface-based station observed subsidence of 25 centimeters during its first decade of operation (1996-2006) which reveals that nearly all the subsidence at this site is a result of aquifer compaction rather than regional processes.

This study incorporates data collected from a borehole extensometer and several GPS stations in order to constrain both past and current subsidence rates. The findings are compared with geologic, groundwater, and precipitation data to further the understanding of subsurface fluid behavior as well as the effects of groundwater withdrawal on aquifer compaction and rebound across Harris County, Texas, USA. ■

Tracking the Trace and Kinematics of the Houston Long Point Fault with LiDAR and GPS Data

Gabriel Saenz, *M.S. Geology Candidate*

The Houston metropolitan area, and more broadly the Gulf Coast in general, have numerous normal faults that result in damage to engineering structures on, near or just above the surface of the Earth. Many faults in the Houston Metropolitan area are moving at rates of 0.5 to 3 cm per year. These faults involve soft sediments, and as a result very little seismic energy is accumulated to produce destructive earthquakes. However, creeping along these faults causes moderate to severe damage to hundreds of residential, commercial, and industrial structures and infrastructure in the Houston area, requiring constant repairs that burden private citizens, businesses, and government agencies. The Long Point Fault, a creeping surface fault that spans much of the northwest and west part of the Houston metropolitan area will be mapped in fine detail using LiDAR data from the 2001 Tropical Storm Allison Recovery Project. The kinematics of the creeping fault will be derived from continuous GPS data of four stations located in the middle segment of this fault. ■

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Malleswar Yenugu, *Ph.D. Candidate, Geophysics*

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

Figures, maps, diagrams, etc., should be digital files using Adobe Illustrator, Canvas or CorelDraw. Files should be saved and submitted in .ai (Adobe Illustrator) format. Send them as separate attachments via email 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.

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revised 8/6/10

Houston Petroleum Auxiliary Council News

Edie Bishop, *HGS Liaison* 713-467-8706 or ewbishop@bishorb.com

At a recent AAPG Foundation Meeting in Scottsdale, Arizona, HPAC/HGS members **Norma Jean** and **Larry Jones, Edie** and **Dick Bishop** along with **Bev** and **David Worthington** were able to check one off their bucket list when they took a hot air balloon ride over the area. Entertained by Bev, they searched for wildlife and did not spot even a cow! Now Texans believe that even great land is made better by running some cattle or at least drilling an oil/gas well or two!

This just in from **Martha Lou Broussard** and **Linnie Edwards** on their HPAC plans for *Exploring Houston*. On January 29, 2013 we will explore Glenwood Cemetery on Washington Avenue. Founded in 1871, Glenwood Cemetery is one of Houston's most beautiful and historic cemeteries. Some of the most notable Houstonians are buried there, including billionaire Howard Hughes, actress Gene Tierney, and Anson Jones, the last president of the Republic of Texas. We will take a walking tour of the cemetery's historic core, learn Glenwood's history and design, and look at its wonderful art and architecture.

After lunch we will change from the sublime to the ridiculous by visiting the Beer Can House. John Milkovisch, a retired upholsterer for the Southern Pacific Railroad, started his project now known as the Beer Can House in 1968 when he began inlaying thousands of marbles, rocks, and metal pieces in concrete and redwood to form unique landscaping features. When the entire front and back yard were completely covered because he "got sick of mowing the grass," he turned to the house itself and began adding aluminum beer-can siding. Over the next 18 years, the house disappeared under a cover of flattened beer cans used for both practical and decorative reasons. Garlands made of cut beer cans hang from the eaves, make the house sing in the wind and have lowered the family's energy bills. *Ripley's Believe It or Not* estimated that over 50,000 cans adorn this monument to recycling.

We will leave from Memorial Drive Presbyterian Church at 9:15 and return about 3:30. Reserve your spot on the bus. Send a check for $29 to cover the tour costs and lunch made out to HPAC to **Martha Lou Broussard**, 3361 Bellefontaine, Houston, TX 77025. Guests are always welcome.

Kudos to **Barbara Fleming**, **Ann Sneed** and their committee members **Dottie Bates, Sally Blackhall, Sally Bolam, Mary Ann Cole, Jean Grogran, Elinor Macmillan, Noma Macurda**, and **Donna Parrish** for a highly successful Holiday Luncheon last month. Members enjoyed the wonderful meal in the lovely setting of the Pine Forest Country Club while they listened to the beautiful voices of the high school students from Cy-Falls. A grand time was had by all! Also, hats off to our President **Mickey Murrell** and First Vice President **Barbara Peck** for putting together exceptional programs for the year. Thank you for sharing your time and talents.

Remember that in addition to our regular luncheon programs and this special interest group, we have other interest groups: **Bridge**: **Audrey Tompkins**, 713-868-0005 or **Daisy Wood**, 713-977-7319, and **HPAC Exploring Houston**: **Martha Lou Broussard**, 713-665-4428. *Spouses and guests are also welcome to attend these events.*

Geologists, please encourage your spouses to join HPAC, where they will have the opportunity to meet other spouses of Geologists, Geophysicists, Engineers, and Landmen. They will participate in informative and entertaining programs, delicious lunches and welcoming fellowship. The HPAC membership form is included in the HGS *Bulletin*. Please contact **Edie Bishop** at 713-467-8707 or at ewbishop@bishorb.com.

You are invited to become a member of

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2012–2013 dues are $20.00 Mail dues payment along with the completed yearbook information to **Winona LaBrant,** 10123 Valley Forge Drive, Houston, Texas 77042

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SeaBird Exploration

Matthew J. Padon
Business Development Manager

SeaBird Exploration Americas
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Houston, TX 77079 USA
www.sbexp.com

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11767 Katy Freeway
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Heather Wilson
Account Manager

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Sara Davis
Business Development Manager
s_davis@seismicventures.com

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