HGS Bulletin

Volume 66, Number 8

Houston Geological Society

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In Every Issue

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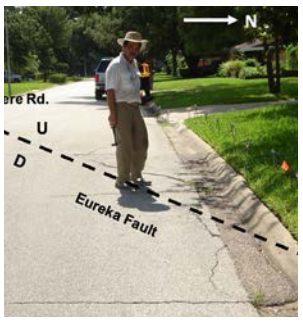

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About the Cover: HGS Art Contest Winner:Red Rocks of Antelope Canyon by Sharma Dronamraju.
Beautiful sunlit Antelope Canyon, reaching about 120ft below the ground. A private land in the Navajo Nation is both a geologist's and photographer's delight. These are Jurassic dunes, carved beautifully by rain and desert streams. Copyright Sharma Dronamraju

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Path of Totality

ECLIPSING EARTH SCIENCE

A few days ago, at a dinner with some friends and family, a discussion of the April 8th total solar eclipse and the swath of Texas that will be in the "path of totality" came up. The eclipse has been the subject of local and national news for nearly a year now, and it is exciting to see so much public interest in an earth science event. The solar eclipse path will transect Texas from southwest to northeast, entering Texas in the Maverick Basin, moving directly through the Llano Uplift and exiting the state through East Texas. Hotel rooms and Short-Term Rentals began booking up nearly a year ago as people wanted to be in the path to view the nearly four-minute-long totality (100% eclipse) as the moon's shadow races across the Earth's surface at about 2,000 miles per hour. A superb photo of this phenomenon as viewed from space can be seen at Nasa's Astronomy Picture of the Day (apod.nasa.gov) for March 24, 2024.

and it is exciting to see so much public interest in an earth science event

A record number of visitors are expected in all these areas where the total eclipse can be viewed, along with the accompanying traffic and congestion, all things that people are willing to endure to see a major earth event. If you elect to not join the crowd in Central or East Texas, the eclipse will reach 94 percent of totality in the Houston area.

A likely boost in earth science interest will result among students in the next year, and the HGS Educational Outreach Committee should see a bump in interest in our Rocks and Minerals and our Bones in School programs. Volunteers for this committee are always needed as we get requests from schools all over the Houston area. The HGS may be coming to a school near you!

PATH FORWARD FOR THINGS IN TOTAL

The HGS endeavors to include the totality of geoscientists in Houston. Petroleum exploration geology dominated the early years of the Society with the oil boom in and around Houston. Over time, the scope of the Society expanded. Engineering and environmental geology became disciplines that were included. Academia, educators and students have been fully involved in the Society and activities. Occasionally, I have met mining (salt mainly) geologists and aggregate geologists during HGS activities. In addition, marine hazard specialists, and many petrophysicists, mineralogists, paleontologists are found among the Society's membership. Geothermal geologists and those engaged in carbon capture and sequestration are also among the roster. The HGS supports the Texas Bureau of Professional Geology (TBPG) and its Professional Geologists (PG). Many of the mentioned disciplines are not exempted from the PG Act, unlike petroleum, and the broad spectrum of the HGS includes many PG members.

In a continuation of the theme, path of totality can apply to the operational changes the Society is experiencing. The way members interact has changed in the post-pandemic and increasingly virtual era. It incorporates changes in technology, in business climes, in networking behavior. Also included are financial changes, as cited in one of my earlier columns, with the loss of important income streams. The Society adapts to remain viable in all of these dynamics in order to serve the Houston Geological Community as well as the greater Houston Community in general.

MAKE PLANS TO ATTEND THESE APRIL EVENTS

April will see the regular monthly events such as the General Dinner, the Environmental & Engineering Dinner, the up-and-coming CCS Luncheon and the NeoGeos Happy Hour. GeoGulf is in San Antonio this year, and the HGS will be represented with a booth by the Exhibits Committee there. The Continuing Education Committee is featuring a Luncheon Talk with Scott Tinker, and of course, don't miss the annual Shrimp Peel. Take a look at the calendar. I will be at many of these, and as always, look forward to seeing you there, too.

VOTE IN THE HGS OFFICER ELECTION FOR 2024-2025

The Officer Candidates have been announced and can be found elsewhere in this *Bulletin*, as well as on the website. Electronic Ballots will be arriving by email early this month. The Candidates have graciously offered their time and commitment, so please review their biographies and be sure to e-vote. Contact the office if you haven't received a ballot by April 10.

SPECIAL THANKS FOR HELPING MOVE THE OFFICE

The office has completed its move three doors down from the previous location, saving nearly **From the President** *continued on page 7*

Caroline Wachtman
editor@hgs.org

What is Your Definition of Success?

This month I talked with Michael Campbell about his contributions to mining and hydrogeology, and I talked with Cathy Farmer about her contributions to the Potential Gas Study. The definition of professional success and establishing a legacy was an undercurrent of both interviews.

Reflecting on what I've heard from HGS members over the past eight months, I am surprised by what is on the "success" list and what is missing. Mature-career HGS members tend to define their professional success by their contributions to the following: the profession of geology, the science of geology, the energy supply, or education and mentorship. Interestingly, job titles and promotions rarely make it to the list of success-defining characteristics. Meetings, presentations, reports and other day-to-day business that seems so important in the moment does not make or break a successful career.

SUCCESS IS CONTRIBUTING TO THE PROFESSION

When I first spoke with long-time HGS member Richard Howe in July 2023, he highlighted one way that he and other HGS members contributed to the profession of geology. Howe described the HGS' role in advocating for Professional Geologists to sign and seal reports where geology impacts the public's health and safety.

HGS members define their professional success by their contributions

Howe also explained the importance of contributing to the profession by contributing to professional societies. Many others echo this view. For example, in this month's conversation with Michael Campbell, he highlighted being elected President of the Energy Minerals Division of AAPG and Chairman of the Energy and REE Committee, among many examples of service.

SUCCESS IS CONTRIBUTING TO THE SCIENCE

For many HGS members, contributing to the science of geology is a strong metric of success. For example, the HGS Buffalo Bayou study group was established in December 2023 to contribute to the geologic understanding of the stratigraphic and structural history of Houston's Buffalo Bayou. We have 25 group members, including former *Bulletin* Editor Ken Thies, who has extensively studied the Pleistocene stratigraphy and paleontology of Houston. Thies and others are interested in contributing to science by sharing their decades-long experience and expertise.

Similarly, Howard Kiatta, who I interviewed for the October *Bulletin* describes that one of his key accomplishments was to produce the book *Typical Oil and Gas Fields of Southeast Texas, Volume II*, and to facilitate creation of 3-D Seismic Case Histories from the Gulf Coast Basin. In both of these books, Kiatta was able to leverage his decades of experience in South Texas and Gulf Coast geology.

SUCCESS IS CONTRIBUTING TO THE WORLD'S ENERGY SUPPLY

Many HGS members describe their success in terms of barrels of oil or cubic feet of gas discovered. Bill Maloney, described the success of increasing Equinor's North America production from 75 KOEBD to 300 KOEBD (March *Bulletin*). Similarly, Cathy Farmer (this *Bulletin*) highlighted that her major career achievements have been the oil and gas discoveries she made, such as finding 1 BBOE in Senegal in 2014. John Seitz (February *Bulletin*) explained success in terms of the number of successful exploration and appraisal programs he led, including the 30 MBO Rochelle field.

SUCCESS IS CONTRIBUTING MENTORSHIP AND EDUCATION

As I looked across the room at the HGS Scholarship night dinner held in February, I saw dozens of mature-career HGS members beaming with pride at the accomplishments of the students receiving awards. Jeff Lund, Bill Demis, Walter Light, Linda and Charles Sternbach and many others have supported these students with career mentoring because it is fulfilling to see students succeed.

Cindy Yeilding described in the March *Bulletin* that she is working with her son, who is a Rice University student, to develop and promote simple, easy to understand information about energy systems. For Yeilding, success is using her platform as a retired BP executive, well-published scientist, and oil-finder to educate others about energy. Similarly, Robbie Gries (January *Bulletin*) had a long and technically-successful career as an independent wildcatter, and has chosen to devote much of her time over the past decade to writing the stories of other women geologists as a way to amplify their voices and educate others about their stories.

REFLECTIONS ON SUCCESS IN THIS EDITION OF THE BULLETIN:

- Learn about Michael Campbell's career and legacy in an interview about his recently published memoirs in *Michael D. Campbell: Anecdotes of a Lifetime*

From the Editor *continued on page 7*

From the President continued from page 6

$15,000 per year in rent and yet maintaining storage space and access for the many needed items for committee support, including lots of rocks, of course! There is also a conference room that is available for committee meetings and members' use, and a reception area that displays the many historic HGS memorabilia and (of course) rock, fossil and mineral specimens. The entire move was done with volunteer help, a benefit of just moving down the hall. Special thanks is given to everyone who helped: Andrea Peoples, Troy Meinen, Angel Callejon, Chuck Caughey, and the special efforts of several committees including Educational Outreach and Earth Science Week, who came in and organized their materials prior to the move. ■

WORD BRECCIA – A GEOLOGY WORD JUMBLE

Unscramble the words below and rearrange the circled letters to find the answer to the clue.

LOLOWAFT __ O_ _ _ _ _

SHURTT _ _ _ O O _

CRISTIL _ _ _ O_ _ _

THROS O O _ _ _

BRAGNE _ _ _ _ _ O

Don't fault this city for its geology _ _ _ _ _ _ _

From the Editor continued from page 6

- Read about Cathy Farmer's contributions to the United States Potential Gas Assessment in A conversation with *Cathy Farmer: From Roustabout to Senior Advisor for the Potential Gas Agency*
- See career reflections from Petros Papazis in *We are the HGS*
- Learn from Mike Erpenbeck about HGS members who will receive awards at the upcoming GeoGulf Convention in *HGS Members Featured in GeoGulf24 Awards Ceremony*
- Take a self-guided field trip to see a compilation of Mustafa Saribudak's geophysical contributions on faults in Houston in *The Active Faults of Harris County: A Self-paced Field Guide*

We Are The HGS

Petros Papazis, HGS member since 2002

"Petros means 'rock' in Greek. My dad is a Greek geologist and he had a sense of humor when he named me," laughs Petros Papazis, a geologist and the Western Gulf of Mexico (GOM) Exploration Manager at Chevron. Papazis started his college coursework in engineering, but switched his major after taking an introductory geology course and attending an AAPG annual convention with his geologist father. Papazis continued in geology and examined the petrography of the Barnett shale for his Master's degree at University of Texas at Austin. "I studied shale when no one cared about it; so, when shale boom came, I was ready to go," he says. This early foundation in shale provided an in-demand skill set that Papazis has utilized throughout his career.

Papazis joined Chevron in 2005 and started working international asset development projects based in Houston. He then transferred to the Calgary office to model Steam Assisted Gravity Drainage (SAGD) assets in Canada. When the shale boom happened, Papazis was well-positioned to explore for unconventionals in Canada, before transferring back to Houston to support shale exploration across multiple regions. Papazis took a short break from shale to explore in the GOM and throughout Eurasia before returning to lead reservoir completion optimization, exploration, and appraisal in the Permian.

"I studied shale when no one cared about it"

In 2022, Papazis was ready to move on from shale. "My heart is in doing the thing that no one else cares about at the time," says Papazis. "I'm a bit of a contrarian," he laughs. Papazis was eager to take on a new challenge in exploration while the unconventionals were still in the limelight. He transitioned to be the Exploration Manager for the Western GOM and also took responsibility for career development of geoscientists in the GOM region.

Papazis says one key lesson he has learned over the past 19 years at Chevron is the importance of a learning mindset. "I recognize how little I know and how much I have to learn," says Papazis. He continues, "The only way to be successful is to surround yourself with people who know more than you and get them in an environment where they can effectively share what they know." Papazis says that creating an environment where people can contribute is critically important, and it is a differentiator from previous generations who were focused on following established processes. "The challenges are getting harder; no one has all the right answers, so we need to think differently," he says.

We Are The HGS *continued on page 9*

Alexandra Staub, HGS member since 2023

"I came to the HGS Student Expo in 2021 and got an internship that led to a full-time job with Hess," says Alexandra Staub. Staub helped with the Expo in 2022 and recently joined the HGS with an interest in getting more involved in the organization that helped to launch her career. Staub says that she wanted to join the HGS because it is an active organization with abundant, interesting lectures and short courses. Staub is also interested in building her professional network with Houston geologists.

Staub's journey to becoming a geologist started with an influential high school teacher, whose class on Earth systems led Staub to apply for a summer geology field school. The course exposed students to petroleum systems play elements. "I couldn't believe that this is what geologists got to do for a living," says Staub. From that first experience, she says she was hooked on geology.

From that first experience, she was hooked on geology

Staub studied modern sedimentology for her undergraduate thesis at Clemson University. Then, she earned a Master's degree from University of Kansas where she studied the stratigraphy of the Book Cliffs. Now at Hess, Staub is learning to build reservoir models and utilize geophysical data to evaluate appraisal opportunities in Guyana. Staub is excited to be working as petroleum geologist. "It's fun work and it's great to get back to it," she says. ■

We Are The HGS is a series that highlights the careers and contributions of HGS members with the intention of building community. Would you like to be featured in We Are The HGS? Send a note to editor@hgs.org.

We Are The HGS continued from page 8

A second key lesson is that forming an effective team is more of an art than a science. Papazis says that assembling an effective team is not only about gathering the best and the brightest talent, but finding the right mix of complementary skills, personalities, and behaviors. "It's scouting for the right puzzle pieces," he says. In Papazis' current role, he is tasked with assembling teams and enjoys testing out hypotheses about how teams will perform.

Papazis' father, a long-time HGS member, encouraged the younger Papazis to get involved in the HGS. Papazis says that his father's generation engaged with professional societies differently than geologists do today. "Dad's community was very active and engaged. I don't see that kind of enthusiasm anymore," he notes. Papazis explains that today's generation is expected to be fully connected to work and there is no separation between work and non-work life. Papazis reasons that when workers feel like they are always connected there is less drive to seek out new connections.

Papazis says that he has attended many HGS dinner meetings over the past 20 years and is and is looking forward to engaging with HGS in the future. "I want to be present and active in this community of geoscientists," he says. ■


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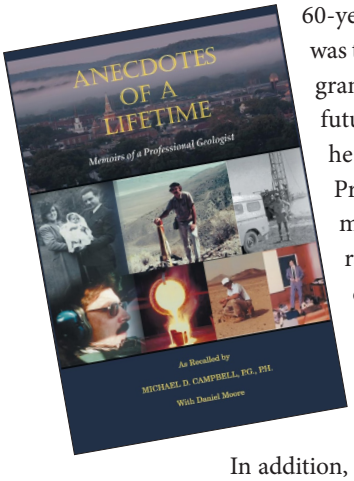
Michael D. Campbell: Anecdotes of a Lifetime

By Caroline Wachtman

"Grandpas have stories," says Michael Campbell, who recently published his memoirs in a book called Anecdotes of a lifetime, Memoirs of a Professional Geologist. Campbell recalls stories covering nearly eight decades, beginning with his childhood in Ohio and continuing through his nearly 60-year career. "The principal objective was to create a record for my children, my grandchildren and those families in the future about their geologist Grandpa," he says. He and his wife, Mary (a Professional Genealogist), have been married for almost 50 years and raised 5 children (two sons and three daughters, all of whom have one or more college degrees in geology, medicine, psychology, archaeology, or education.



In addition, Campbell hopes that readers will see "how persistence and dedication can be the key to a successful professional and personal life." Campbell's account speaks to a new generation of geologists as he offers insights into building a resilient and rewarding career. Careful reading of Campbell's nearly 456 pages of anecdotes yields the following advice: making mistakes can lead to better decision-making; build maturity and confidence through work experience; and, a resilient and flexible career is based on having diverse geoscience skills.

LEARNING THROUGH MISTAKES

Campbell describes himself as being risk averse, a trait that served him well during international mining environmental projects in 1960s to 1980s and as the Regional Technical Manager and Chief Hydrogeologist in charge of evaluating and remediating soil and groundwater contamination cases at Dupont from 1990-1994. Conservatively managing risk has also advantaged Campbell's career as an independent consultant on environmental and mining issues. By 2023, Campbell had served as an expert witness, assisting both plaintiffs and defendants, on more than 40 cases.

The path to these roles was marked by learning experiences. Campbell recalls that during his high school years he enjoyed building and testing small rocket engines . He built a makeshift lab space in his parents' basement to investigate solid-fueled rocket propulsion and set up a launch stand in the backyard. Campbell hated waiting the requisite time to confirm the test firing, and on one occasion in 1957, he stood up behind the low blast barrier too quickly and received shrapnel shattering his upper arm bone in return. Patience and following protocols became the unintentional lesson that day. As he spent the next month recovering in the hospital, Campbell says he recognized his limits and realized that being a rocket engineer was not in his future.

In another story, Campbell recalls taking on a part-time job during college at Ohio State. He got a job waiting tables and cooking at a local "greasy spoon." Campbell occasionally noticed a large, black Lincoln sedan would pull up to the back door and a bag would be exchanged with the restaurant's owner. Soon, Campbell was asked by the restaurant's manager to transport briefcases of cash to the bank. Campbell said alarm bells were raised when the briefcase — to which he was handcuffed — came undone and he found stacks of crisp hundred-dollar bills. This was obviously more money than the restaurant could reasonably make serving pancakes and burgers to students. Campbell soon realized that he had unwittingly been lured into a money laundering operation, and he found an excuse to quietly leave the job. While it may not have been apparent at the time, Campbell was learning to be cautious in business interactions and trust his instincts when something seemed too good to be true.

BUILD CONFIDENCE AND MATURITY THROUGH WORK EXPERIENCE

In 1959, Campbell started college at San Bernadino Valley College in California, near where his grandfather lived. Campbell says that he discovered a love of geology during field trips in the San Bernardino Mountains. After a year, he transferred to the Ohio State University (OSU) to continue studying geology, but struggled to maintain his grade-point average. Friends, girlfriends and fraternity activities, combined with part-time work competed for his time. Campbell realized he needed money to continue school and geology would wait.

After this first year at OSU, Campbell worked at Anchor Hocking, one of the world's leading glass manufacturers, located in Lancaster, Ohio. His job involved using a jackhammer to break apart hot, melted glass coatings on the inside of the cooling blast furnace. Then, Campbell periodically took semesters off to work at Diamond Power. After his second year of college, and particularly poor grades, he took a year off to work for Diamond Electronics. Campbell says that these work experiences gave him self-confidence and helped him develop professional skills, including being reminded by his boss that work started at 9 a.m. instead of 10 a.m., Campbell recounts. **Michael D. Campbell** *continued on page 14*

Michael D. Campbell continued from page 13

When Campbell returned to Ohio State, he enrolled in a hydrogeology course with Dr. Jay Lehr. Campbell explains that Lehr was different from many of the other professors because he genuinely enjoyed teaching and engaging students. Lehr hired Campbell as a research assistant to build groundwater models and became a mentor to Campbell. "The more encouragement I got, the better grades I got," says Campbell. The work experience buoyed Campbell throughout the rest of his time at Ohio State and to graduation in 1966.

A RESILIENT AND FLEXIBLE CAREER

"Before the student graduates, he/she should diversify the curriculum undertaken," says Campbell, who focused his studies on hydrogeology and mining, but also studied geophysics among other disciplines. Campbell explains that geoscience is an integrated discipline, so it is important to have an integrated course of study.

Campbell says that his strong base in both mining and hydrogeology allowed him to be more resilient to job market trends. For example, Campbell's first job after college graduation was as a mining geologist for Conoco in Sydney, Australia. Six years later, the uranium mining industry had declined, so Campbell pivoted back to hydrogeology and was appointed Director of the National Water Well Association (NWWA) Research Facility. After earning a master's degree in Geology and Geophysics from Rice University, Campbell pivoted back to focus on mining issues Manager of the Alternate Energy Group for Keplinger and Associates, Inc. in 1976 and later founding a mining consulting firm in 1982. In 1986, Campbell again pivoted back to hydrogeology as a consultant for engineering companies and then as a Regional Technical Manager and Chief Hydrogeologist for Dupont. As a consultant, Campbell says that he was also routinely called to serve as an expert witness. "Litigation is an integral part of business and of the science of hydrogeological and mining projects," he explains.

Geoscience is an integrated discipline, so it is important to have an integrated course of study

For current students considering a career in geology, Campbell advises to study a diverse curriculum. "They should take all the geology courses they can to explore what part of geology they find most interesting," he says. Campbell predicts that the next generation of geologists will be mining the moon or asteroids for rare elements and critical minerals, so having planetary geology experience will be valuable. In addition, Campbell believes that environmental work on industrial clean-ups, the oil and gas industry, and critical mineral exploration and mining will remain strong sources of employment.

Campbell also encourages early-career professionals to be active in their local geological societies, including the HGS. He says that making and maintaining friendships with other geologists has been integral to his success. In addition, he has made many dinner meeting presentations at the HGS Engineering & Environmental committee since the mid-1970s.

GOING FORWARD WHILE LOOKING BACK

As Campbell reflects on his career, he says he is pleased with his work history and accomplishments. Campbell was appointed Chairman of the Uranium and REE Committee of the Energy Minerals Division of AAPG from 2004 to 2021 and was elected President of the Energy Minerals Division of AAPG in 2010. Campbell has also won numerous awards and honors, including being elected as a Fellow of the Geological Society of America, the Australian Institute of Geoscientists and the London Geological Society. Campbell served as Vice President of the Eastern Section of the American Institute of Professional Geologists (AIPG) and was awarded a leadership citation from the organization in 2015. In 2004, Campbell was inducted to the 1959 Lancaster High School Hall of Fame for "outstanding contributions to the fields of geology and hydrogeology." He is currently serving as Principal and Chief Geologist and Hydrogeologist for I2M Consulting, LLC in Katy, Texas. ■

For more on Campbell's Memoirs, see: https://www.i2massociates.com/downloads/AnecdotesRelease2023.pdf

Or, purchase the book on Amazon here: *Anecdotes of a Lifetime: Memoirs of a Professional Geologist:* Campbell, Michael D, Moore, Daniel: 9798888871959: Amazon.com: Books

A Conversation with Cathy Farmer: From Roustabout to Senior Advisor for the Potential Gas Agency

By Caroline Wachtman

"I've been very happy to go through my career and remain technical," says Cathy Farmer, who retired from BP in 2009 and from ConocoPhillips in 2015. Farmer is now a Senior Advisor to the Potential Gas Agency and a technical lead for the Potential Gas Committee. "I'm using what I learned in my career of over 40 years to do something good for the country," says Farmer.

Farmer started her career in 1978 as a roustabout working for Amoco in Wyoming. "It was an interesting way to start," she says. Farmer continues, "Not many geologists or engineers can say they started in the oil business as a roustabout – but I did, and I am proud of that fact." Farmer then spent nearly the next decade based in Amoco's Denver office working exploration opportunities throughout Montana, Wyoming, California, and Alaska.

In 1987, Farmer transferred to Houston and started working on international exploration projects throughout the Middle East and later West Africa. It was during this period that Farmer worked her first expatriate role. Although Amoco had a rule against women working expatriate assignments, Farmer was one of the first women expatriates and the only woman at Amoco to work a Temporary Foreign Assignment in Jordan. Farmer says that the men she encountered treated her as they would a school colleague. "They dealt with it just fine," she says.

Farmer went on to work as an expatriate in Norway before returning to Houston in 1997 to support Amoco's Trinidad exploration team that made multi-Tcf gas discoveries, including Red Mango and Cannonball. Farmer's work on gas assets continued, following the BP-Amoco merger, when she worked the GOM ultra-deep gas play, including key wells such as Blackbeard and Will K.

Farmer retired from BP in 2009 but wasn't finished with her geology career. She became a Geoscience Fellow at ConocoPhillips, where she worked New Ventures for the next six years. During her tenure, she led exploration campaigns in offshore Senegal resulting in the 2014 discovery of Sangomar, the largest oil discovery made in the world that year.

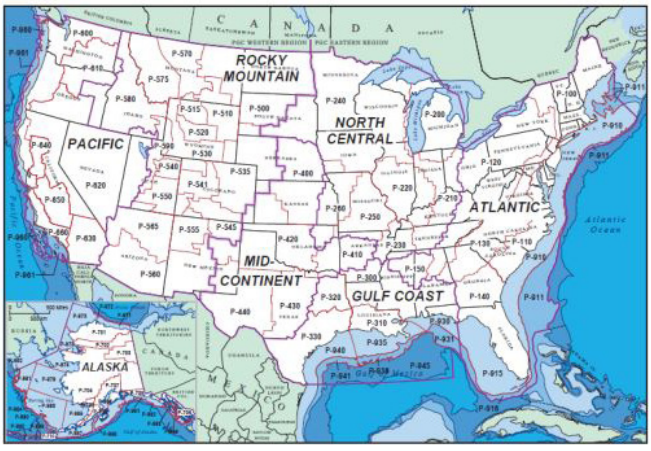
After retiring for a second time in 2015, Farmer laughs, "I spend a lot of time mowing." Farmer splits her time between her horse ranch in Fort Bend County and a satellite ranch near Schulenberg. Farmer says that Fort Bend County is the perfect location to retire, because it is far enough from the city but "close enough to get DoorDash," she smiles.

The future gas supply of the US is nearly 4,000 Tcf

POTENTIAL GAS ASSESSMENT FOR THE US

The Potential Gas Committee was formed in 1964 by the Potential Gas Agency at Colorado School of Mines to develop an assessment of gas resources in the United States. Farmer, who graduated from Colorado School of Mines with a bachelors in Geological Engineering and a master's degree in Geology, recalls being a student at Mines and observing Harry Kent, the lead author of the 1979 Potential Gas Committee report, adding up resource volumes with a manual adding machine. Farmer was interested to leverage her expertise and volunteer with the Potential Gas Committee following her career at Amoco, BP and ConocoPhillips. She assumed the role of Senior Advisor to the Potential Gas Agency in 2022 after the former director unexpectedly passed away. The Potential Gas Committee report is updated every two years, and Farmer is now preparing to lead her second assessment.

The Potential Gas Committee report divides the US into seven regions encompassing 90 geologic provinces. The report relies on a unique dataset compiled by a team of 40-60+ volunteers with deep basin-specific geologic expertise. Because the Oil and Gas Industry typically has more data, and more recent data than do governmental agencies, many of the volunteers come from Industry. However, Farmer points out that the data are not proprietary and cannot be tied back to specific prospects or leases. Furthermore, Farmer notes that the report is not run by Industry. "It's bigger than any one company," she says.



The Potential Gas Assessment consists of seven work areas and 90 geologic provinces.

Cathy Farmer *continued on page 16*

Cathy Farmer continued from page 15

Unlike reserves data compiled by the Energy Information Administration, the Potential Gas Committee report focuses on technically recoverable gas resources that are yet to be discovered. Farmer says that the technically recoverable gas estimate was 3,352 Tcf in 2022. When combined with reserves, the future gas supply of the US is nearly 4,000 Tcf. The resource assessment has dramatically increased in the past decades due to the expansion of technically recoverable gas resources unlocked by fracking and horizontal drilling.

The Potential Gas Committee's work is utilized by operators, investors and government to inform decisions. For example, Farmer explains that project developers need to understand the location and quantity of gas resources before investing in LNG. "You need to know where to build the pipeline, before you can develop the resource," she says.

Farmer asserts that natural gas is an important fuel for the US and for the world because it is highly thermally efficient, portable and reliable. She explains that the Potential Gas Agency was instrumental in influencing Congress to lift the US oil export ban in 2016. In 2023, the US was the largest exporter of LNG (Reuters).

As Farmer gears up for the 2024 report that will be delivered in fall 2025, she is optimistic about the future of the gas industry in the US. "We need everything—solar, wind, coal, natural gas, nuclear; and the demand for oil and natural gas is not going to go away," she says. Furthermore, Farmer says the US needs a new generation of geologists to find and develop those resources. "The resources are here [in the US] and we need people here to develop them," she says.

To volunteer for the Potential Gas Committee, contact clfarmer@mines.edu.

Geophysics PhD Student's Research is a Game Changer for Oil and Gas Exploration

By Chris Guillory, *College of Natural Sciences and Mathematics at the University of Houston*

LARKIN SPIRES TARGETS MYSTERIES IN ORGANIC-RICH SHALES

Organic-rich shales, hidden layers beneath the Earth's surface, hold secrets vital to our energy needs. Understanding their behavior is key for safe and efficient resource extraction.

Larkin Spires, a geophysics PhD student in the Department of Earth and Atmospheric Sciences at the University of Houston, is delving into the intricate world of shale mechanics.

Larkin Spires conducted a study of organic-rich shales beneath the surface and how they behave with different fluids as part of the hydraulic fraction process.

"The research we're doing will help the oil and gas industry save money because it can help them de-risk a prospective drilling area while promoting greater efficiency," said Spires.

Think of Spires as a detective piecing together clues to solve a mystery. By improving our understanding of shale's durability when it contains organic matter, she's promoting better predictions about how shale will behave deep underground.

Spires' research findings were published in the journal *Nature Scientific Reports*. The work focuses on refining mathematical models to better capture the behavior of organic-rich shales that lie underground.

"There's a theory to explain the effect of different fluids in rock, but it has not been verified as applicable for organic shales" said John Castagna, Margaret S. and Robert E. Sheriff Endowed Faculty Chair in Applied Seismology at the UH College of Natural Sciences and Mathematics. "We want to try to predict the different fluids in the rock remotely from the surface. This can be important for oil and gas operations as well as carbon storage."

Castagna is Spires' faculty advisor and collaborated with her on the study.

USING ARTIFICIAL MATERIAL

Spires, who was named to the inaugural cohort of UH-Chevron Energy Graduate Fellows, is taking a different research approach. While other scientists take small samples of shale and squish them under different pressures, Spires is using artificial material for the same purpose.

"I use 3-D print material that is basically a lab rat for geology so I can control the porosity and flow of fluid through it," said Spires.

Spires created a rock physics model that allows for testing of the artificial rocks she created. The tests uncovered details about each object's solid modulus, the measure of a material's resistance to being squished or stretched. It's like the firmness of a mattress. Some are soft and bouncy, while others are firm and unyielding.

"Solid modulus tells us how stiff a material is, which is vital when dealing with underground layers like shale," said Spires.

According to Spires, knowing the solid modulus of organic-rich shales is essential for oil and gas extraction. It helps engineers design more streamlined techniques for drilling and fracking.

MATHEMATICAL MODELS EXAMINED

Spires' study examined models using Gassmann's equation and the Brown-Korringa equation for fluid substitution.

Gassmann's equation is used to predict how rocks with different fluid content behave when you change things like pressure, temperature and volume. It can be compared with a rulebook that helps researchers understand how the rocks will act under different conditions. Think of it as predicting how a balloon will change size if you squish it or heat it up.

"Gassmann's equation, which has been used for 60 years, works well in conventional oil and gas situations with similar mineral components, but it does not work well in fracking," said Spires. "That's because fracking often involves shale with organic constituents much softer than other minerals and Gassman theory breaks down."

Fracking, the common term for hydraulic fracturing, is a process of injecting water, sand and possibly chemicals into a well to release oil and gas reserves located underground.

Spires' model is based on observations, rather than only theories, to help determine the density and stiffness of rocks underneath the surface by considering their mineral composition.

"The model using the Brown-Korringa equation produced a lower level of error at higher organic content while being a better fit for the data," said Spires. "With that in mind, my goal is for this model to become one that can provide a more reliable way to explore shale with highly compressible organic matter." ■

The Active Faults of Harris County: A Self-paced Field Guide

By Mustafa Saribudak and Caroline Wachtman

INTRODUCTION

Over 70% of HGS members live in Harris County, and many of those members are interested to learn more about the geology of the area. It is easy to see how geologic processes shape the landscape of Harris County after episodic events such as hurricanes or flooding, but other geologic processes such as faulting and subsidence are subtly at work over geologic timescales. This guide focuses on the surface and subsurface expression of selected well-documented faults in the Houston area to provide geologic context for the processes that shape our community. This reference focuses on four faults in the greater Houston area: 1) Long Point, 2) Eureka-Heights, 3) Hockley, and 4) Willow Creek.

The geophysical data presented in this guide were gathered in the early 2000s by first author, Mustafa Saribudak, and have been published by Saribudak and Nieuwenhuise (2006), Saribudak (2011 and 2012), and Saribudak et al. (2018). Recently, major highway construction projects have obscured or remediated (e.g., asphalt patches) surface expression at some fault locations. But, upon close inspection, subtle fault deformation is visibly expressed as cracks or scarps.

This guide is intended to be a self-paced study, and the locations listed below are intended to be easily accessible, making this an activity to share with small groups. Driving directions and GPS coordinates of each fault are provided. Note that participants should always wear a high-visibility safety vest and only park in designated parking lots. Parking along highways is not a safe choice.

STRUCTURAL SETTING OF HARRIS COUNTY

Sheets (1971) documented faults in Harris County associated with salt tectonic movement and regional-scale growth faults associated with formation of the Gulf of Mexico. Growth faults are characterized by increasing displacement with depth. Because displacement on growth faults occurs contemporaneously with sedimentary deposition, the downthrown side of the fault typically contains a thicker sedimentary package. Growth fault geometries can form hydrocarbon traps (Shelton, 1984, Ewing, 1983).

In the late 1970s, the United States Geological Survey (USGS) launched an extensive study of faults in Houston (Verbeek and Clanton, 1978; Verbeek et al., 1979; O'Neill and Van Siclen, 1984; Clanton and Verbeek, 1981). Based on detailed analysis of well logs and seismic data, Verbeek et al. (1979) documented an extensive fault network along the upper Texas Gulf Coast, including numerous faults in the Houston area at depths of 3,200-13,000 ft.

Some of the deep-seated faults in Harris County penetrate depths shallower than 3000 ft (McClelland Engineers (1966), and dozens of faults have surface expressions. Verbeek and Clanton (1978) used aerial photographs to identify and map the surface expressions of faults. More recently, researchers from University of Houston, such as Engelkemeir and Khan (2008) and Khan et al. (2013) have used light detection and ranging (LiDar) to map the surface expression of faults in the greater Houston area. Active faults in this region are typically not discrete ruptures. Rather, they are expressed as zones of intensely sheared ground that is tens of feet wide.

Some of the faults have been recently reactivated by petroleum production (Sheets, 1979) or groundwater withdrawal (Holzer and Gabyrsch, 1984). Fault movement is reported to be 0.2 -0.8 inches per year (Shaw and Lanning-Rush, 2005). Norman (2005) identified some locations where displacement is more than one inch (3 cm) per year. Today, active faults are the source of damage to pavements, utilities, homes, businesses, and other manmade structures (**Figure 1**).

Engelkemeir and Khan (2008) report over 300 active faults in the Houston area, but the most recent USGS mapping project compiled by Shaw and Lanning-Rush (2005) identifies 150 active faults, including approximately 30 named faults (**Figure 2**).

SURFICIAL STRATIGRAPHY IN HARRIS COUNTY

The coastal plain of the Gulf of Mexico is underlain by a thick sequence of largely **The Active Faults of Harris County** *continued on page 19*

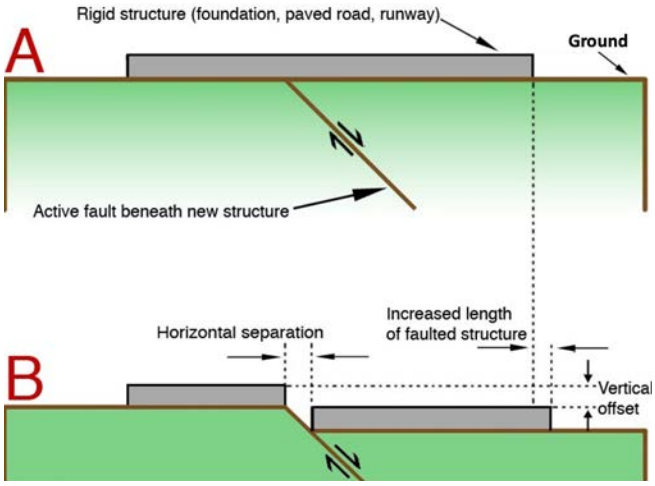


Figure 1. *A) An active growth fault beneath a foundation and B) The fault movement results in horizontal and vertical separations, and is the source of damage to homes, businesses, utilities, and pavements.*

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unconsolidated, lenticular deposits of clays, silts and sands formed in shallow water and marsh-dominated depositional environments. Three Pleistocene-age formations crop out at the surface in Harris County. In ascending order, these are the Willis, Lissie, and Beaumont formations. The Willis is primarily composed of clays with lesser amounts of silts and sands; the Lissie formation contains sands with fewer silts and clays, and the Beaumont contains finer clays with silt (Moore and Wermund, 1993).

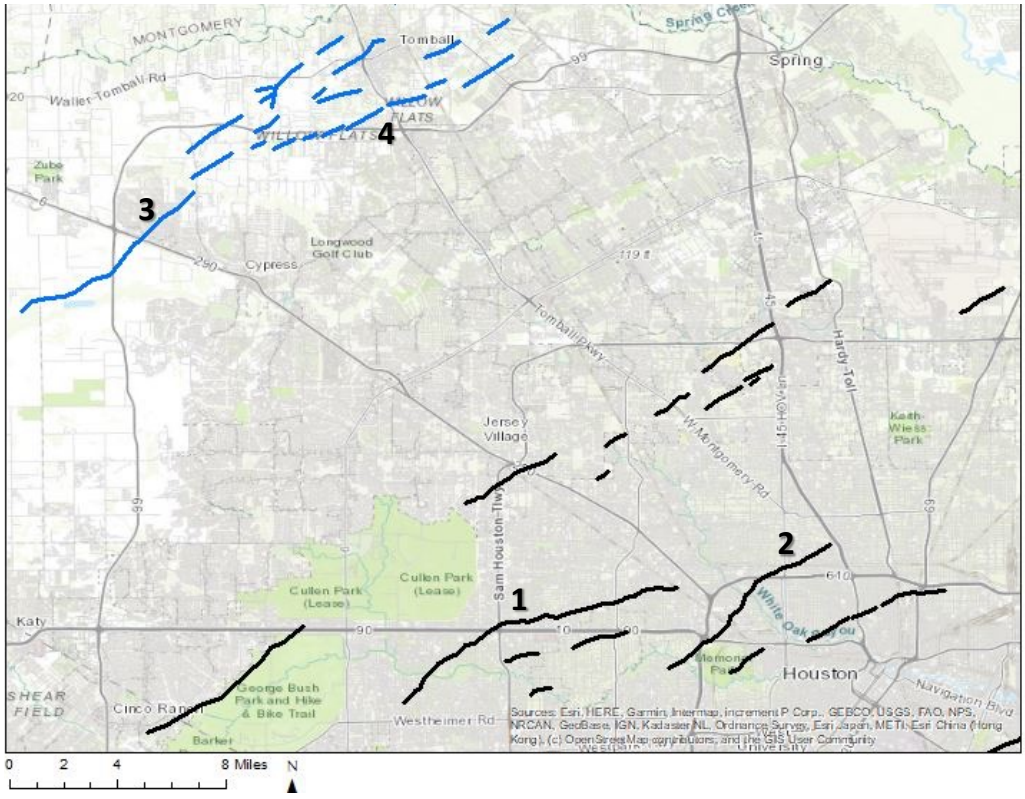

Figure 2. *Map of well-documented faults in Harris County, based on Shaw and Lanning-Rush (2005) and Engelkemeir and Khan (2008). The guidebook focuses on four faults: 1) Long Point, 2) Eureka Heights, 3) Hockley, and 4) Willow Creek.*

HISTORY OF NEAR-SURFACE GEOPHYSICAL WORK ACROSS GROWTH FAULTS

Common methods to identify faults include aerial photographs and field mapping; and subsurface borehole data on both the down and upthrown sides of the faults (Elsbury et al., 1980). In addition, geophysical methods may be used to define faults. A pioneering resistivity study was performed over some of the Houston faults by Kreitler and McKalips in 1978. They used a resistivity meter with four electrodes, and manually crossed several fault locations using a Wenner array. Their results mostly identified anomalous resistivity values that correlated with the locations of the faults.

Building on the work of Krietler and McKalips (1978), Saribudak and Nieuwenhuise (2006) used a multi-electrode resistivity meter and other geophysical methods (conductivity, magnetic, gravity and GPR) to map the Willow Creek fault. Engelkemeir and Khan (2008) published seismic and GPR work over the Long Point fault, which is one of the most active faults of the Houston area. Additional resistivity surveys were conducted over the Long Point, Katy-Hockley, Tomball, and Pearland faults, and results were published in Saribudak (2011). During the following year, integrated geophysical results (resistivity and GPR) were published in Saribudak (2012) for the Hockley fault. Khan et al., (2013) published geophysical results (seismic, gravity and GPR) over the Hockley fault along with airborne LiDar data. More recently. Saribudak et al., (2018) published new geophysical data and discussed the deformation mechanism of the Hockley fault.

STOP 1: LONG POINT FAULT

Location: Coordinates of the fault location are 29° 47.515', 95° 32.064', which falls in the vicinity of the intersection of Moorehead Drive and Westview Drive in the West part of Houston. The fault is located in the northeast part of the intersection of Sam Houston Tollway Road (Beltway 8) and Interstate Highway 10 (I-10). (**Figure 2**)

Driving directions: The easiest way to reach the Long Point fault is to take Westview Road from I-10 and drive to the East until reaching the intersection of Moorehead Drive and Westview Drive. Then, proceed North along Moorehead Drive at the intersection. The fault is located about 140 feet from this intersection. There is a three-foot fault scarp that is highly visible and hard to miss.

Geologic overview: The Long Point Fault extends approximately 11 miles to the West-southwest from US 290, through the Beltway/I-10 Interchange, and close to Eldridge Parkway in West Houston (**Figure 2**). It is a typical Gulf Coast growth fault that slips slowly about 0.25 - 1 inch per year. The fault strikes through many neighborhoods and is responsible for deformation of residential and commercial buildings. The location of the resistivity profile that was collected across the Long Point fault is shown in **Figure 3** and **4**. **The Active Faults of Harris County** *continued on page 20*

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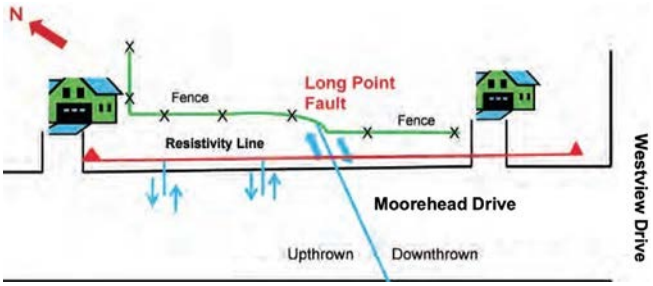

Figure 3. *Schematic map of Long Point fault at Moorehead Drive. The fault location is about 140 feet from the intersection of Moorehead and Westview Drives. Note the deformation on the fence line and the presence of two small faults in the upthrown part of the Long Point fault. The position of a resistivity profile is shown with a red line. There are houses in this neighborhood that have had continuous foundation repairs since 1970s up to now due to the creeping fault movement.*

Figure 4.*Picture showing coordinates of the Long Pont fault, the fault scarp on the road and the location of resistivity profile. The view is to the north.*

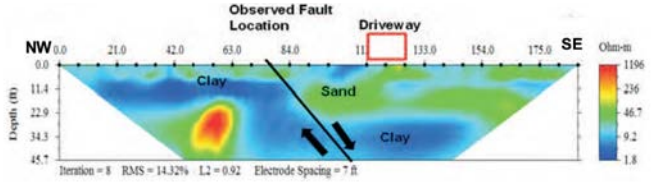

Figure 5. *Resistivity imaging data taken along Moorehead Drive across the Long Point fault. Note the fault offset in the southeast direction which juxtaposes the sand and clay layers.*

The resistivity data collected along Moorehead Drive is shown in **Figure 5**. A fence-line break and the driveway of a nearby house are reference markers. The fault juxtaposes low resistivity soil layers (clay as displayed by the blue) against moderately resistive units (sand as displayed by green color) thus creating an anomaly. The Long Point fault location observed at the site is superimposed on the resistivity imaging data, which shows south-dipping clay layers on the South part of the fault trace. The northwest part of this anomaly is limited by a high resistivity layer shown by the red color.

Figure 6. *Resistivity imaging data taken along Moorehead Drive across the Long Point fault. Note the fault offset in the southeast direction which juxtaposes the sand and clay layers.*

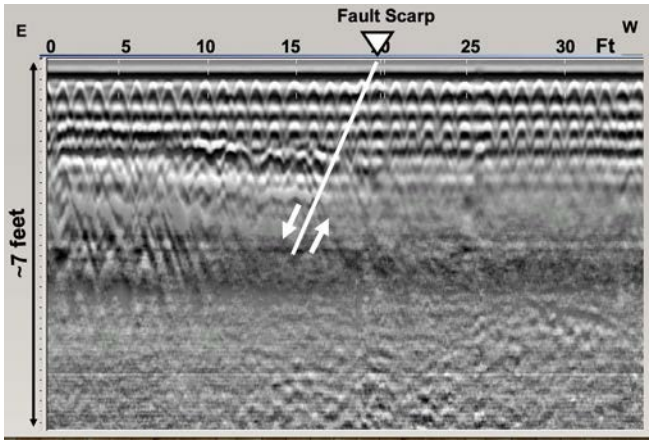

Figure 7. *The GPR data across the Long Point fault. The deformation caused by the fault is visible between 7 and 25 feet. Hyperbolic anomalies are due to rebar reflections.*

The resistivity anomaly can be caused by any change in the soil properties, such as change in moisture, clay content, and porosity ratio across the fault. In general, in the absence of tectonic activity, the soil layers should present horizontal layers. In the case of a growth fault, the different soil layers are juxtaposed across the fault, which creates a visible resistivity anomaly.

Ground Penetrating Radar (GPR) surveys were performed across the fault (**Figure 6**). The 400-MHz antenna was used with a cart system to collect GPR data. The ability of a GPR system to work successfully depends upon two electrical properties of the subsurface, electrical conductivity and relative dielectric constant. The value of dielectric constant ranges between 1 (for air) and 81 (for water). The dielectric constant for sandy soils, depending on its moisture content, varies 6 to 20. However, the dielectric constant of clay is much higher than sandy soil and ranges between 10 and 40. For this reason, the presence of clay absorbs the electromagnetic signals of GPR and limits its exploration depth.

The GPR data is shown in **Figure 7**. The GPR data is displayed in a black-white amplitude format. The high amplitude values are shown by the white color, which are mostly caused by the presence of rebar in the subsurface and the underlying clay. Rebar was likely placed within the pavement to minimize the effect of faulting across the road. Despite the heavy presence of rebar and high conductivity soil **The Active Faults of Harris County** *continued on page 21*

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layer (high dielectric constant) the GPR profile clearly indicates the downthrown section of the fault.

The surface expression of the Long Point fault has generally remained consistent since the photos were taken. The prominent fault scarp is visible despite repairs. Some of the houses in the downthrown side of the fault have been repaired intermittently. Trip takers are encouraged to observe the extension of the fault along Westview Drive, to the East of the intersection of Westview and Moorehead Drives. The fault scarp is also visible at this location.

STOP 2: EUREKA-HEIGHTS FAULT

Location: Coordinates of the fault location are 29° 48.914', 95° 25.036', which is near the intersection of West 31st Street and Dunsmere Road. The fault strikes northeast to southwest and crosses the NW section of N Loop W Freeway, I-10, and Highway 290. The fault tips out before Interstate 45 (**Figure 2**).

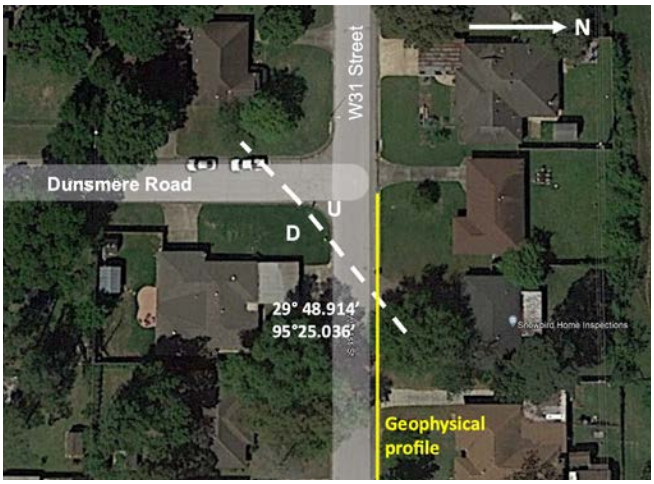

Figure 8. *Site map showing the approximate location of the Eureka fault crossing West 31st Street and Dunsmere Road. Fault deformation is highly visible on the asphaltic pavement of West 31 Street. The yellow line indicates the location of geophysical profiles.*

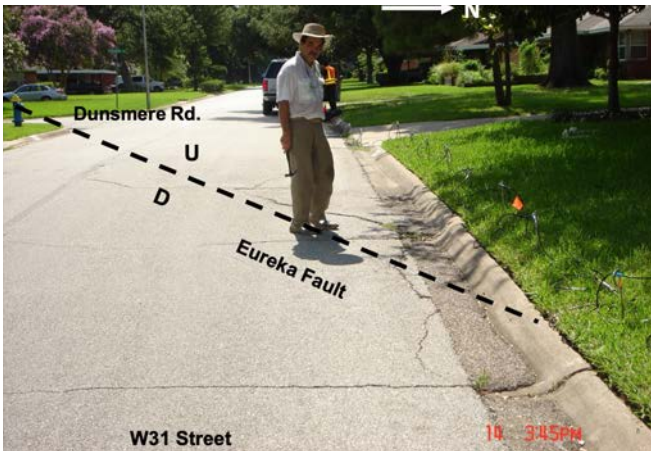

Figure 9. *Picture showing the approximate fault location during the collection of the resistivity data in 2008.*

Driving Direction: The easiest way to reach the fault location is to take the N. Durham exit from N. Loop W Freeway, and drive until reaching West 34th Street. Turn to the West (to your left) on West 34th Street and drive about 400 feet to the West. Then, turn South (left) on Randal Street. After driving about 800 feet, turn West (right) onto West 31st Street. Drive approximately 900 feet on West 31st Street until arriving at the intersection of Dunsmere Road.

Geologic overview: The fault crosses West 31st Street and Dunsmere Road (**Figure 8**). Fault deformation is expressed as cracks on West 31st street that extend 75 feet across the intersection. The fault is about seven miles long. It crossesmany residential places and commercial buildings.

Resistivity and GPR were conducted along the North edge of West 31st Street (**Figures 8** and **9**). Collecting these data were challenging due to the location of utilities, and insufficient contact between electrodes and fill material in driveways (see **Figure 8**). However, the resistivity data indicates a significant fault anomaly (**Figure 10**). In **Figure 10**, the blue color is interpreted to represent clay lithology and the shape of the blue anomaly is interpreted to represent fault offset.

A GPR survey was also conducted across the fault to map the subsurface deformation. The GPR data shown in **Figure 11** is interpreted to represent a fault zone between stations 10 and 37 feet. The fault location marked on the data coincides with the location of fault scarp observed on ground.

The Active Faults of Harris County *continued on page 22*

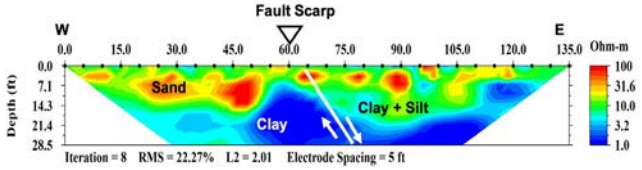

Figure 10. *Resistivity data collected along West 31st Street across the Eureka fault. Note the fault offset in the East direction which juxtaposes the interpreted sand and clay layers.*

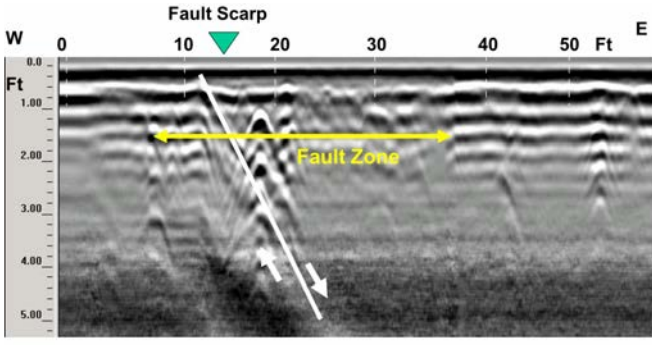

Figure 11. *GPR data across the Eureka fault. The deformation caused by the fault is visible between stations at 10 and 37 feet. Hyperbolic anomalies are due to utility lines.*

The Active Faults of Harris County continued from page 21

STOP 3: HOCKLEY FAULT SYSTEM

Location: There are two fault locations (A and B) to visit at this site. Coordinates of Location A are 29° 56.617', 95°45.241'. Coordinates for Location B are 29° 57.581, 95° 45.283'. The Hockley fault system crosses Highway 290 near the location of the Premium Outlet Shopping Center.

Driving directions: The easiest way to locate the Hockley fault is to drive West on Highway 290 from the Houston area and exit at Fairfield Falls Way. Proceed on the westbound feeder road until you reach Fairfield Falls Way.

Geologic overview: The fault A is evidenced by zones of intensely sheared and cracked ground at this location. The Hockley Fault system continues as a discrete rupture across Highway 290. The uneven highway surface, most obvious in East-bound lanes, is caused by the movement of the fault (**Figures 12** and **13**).

The second fault location (B) is located across from the highway on the East-bound feeder road (**Figure 13**). The Location of B does not align with the strike of Location A; it is shifted approximately 130 feet to the West. There is a discrete rupture of the feeder road. There are smaller cracks in the vicinity of this fault indicating that the deformation is diffusive.

Visits during April and August 2010 to the Hockley fault site provide additional evidence in the rate of fault deformation (**Figure 14**). Small cracks in the pavement over the main fault trace photographed in April 2010 and had extended and widened significantly by August 2010. Note that the cracks in **Figure 14** have been filled with asphalt. A site visit to the Hockley fault in 2022 showed that cracks were covered with an asphaltic patch.

Fieldwork for geophysical surveys was conducted in 2004 and 2005, before the shopping mall was constructed and before the expansion of Highway 290. There was a grass-covered median between the East- and West-bound lanes of the Highway (**Figure 15**) where more geophysical data was collected. For simplicity, only two geophysical profiles (L1 and L2) are discussed in this work.

The resistivity data collected along L1 is provided in **Figure 16.** A major fault anomaly is located at a station of 440 feet. The fault dips to the southeast but there is no rupture visible in sandy and clayey layers at the surface.

The resistivity data collected along Line 2 (L2) is given in **Figure 17**, which is interpreted to shows a fault anomaly across the discrete rupture **The Active Faults of Harris County** continued on page 23

Figure 12. *Photo showing the location of Hockley fault (Location A) at the intersection of westbound feeder road and Fairfield Falls, where the Premium Outlets shopping mall is located. The fault is evidenced by the cracks across the feeder road. These cracks are regularly fixed and are sometimes covered with asphalt patches. Look for deformation to the foundation of the store visible in the background. The fault crosses the West and the East-bound lanes of Highway 290. The yellow line indicates the location of the resistivity profile.*

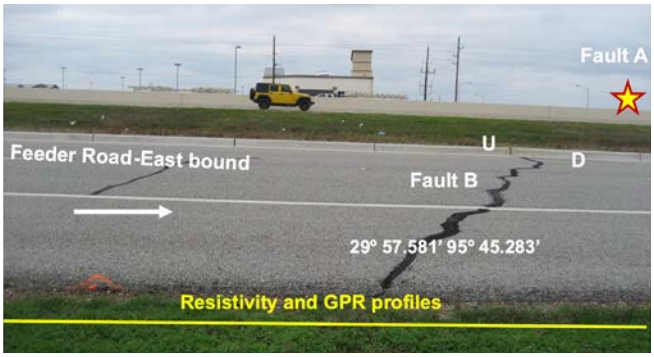

Figure 13. *Photo showing the location of Fault B on the East-bound feeder road. Note that the fault is expressed as a discrete, linear rupture, which has been filled with asphalt. Resistivity and GPR data are collected along the yellow line.*

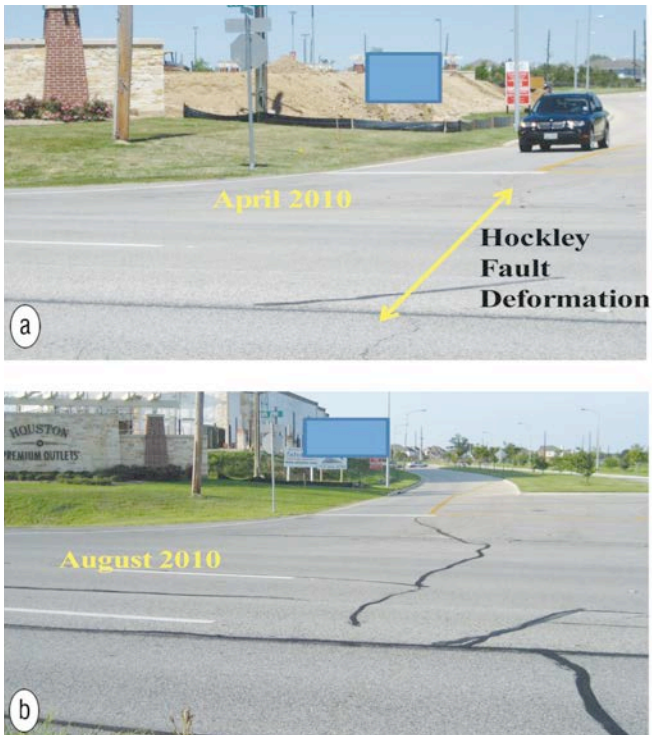

Figure 14. *Recent pictures of Hockley fault at Highway 290 Frontage and Fairfield Falls Way roads: (a) taken in April 2010 and (b) taken in August 2010. Note the development of the tiny cracks in (a) into significant cracks in (b).*

 continued from page 22

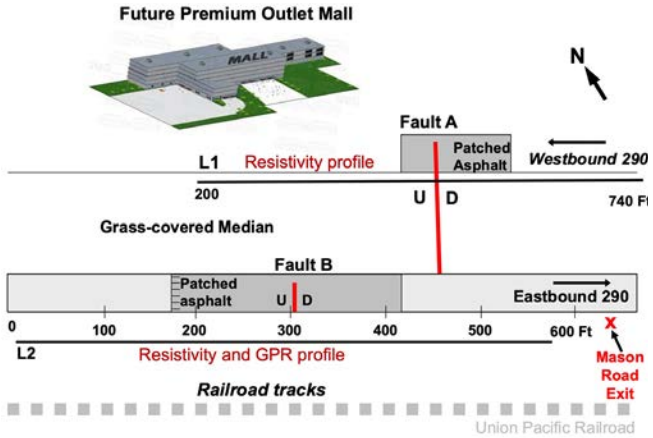

Figure 15. *Schematic map of the Hockley fault at Highway 290 and Fairfield Village during 2004 and 2005. The shopping mall was not yet built, and Highway 290 had a grass-covered median between the East and West bounds. Locations of resistivity profiles (L1 and L2) are shown with a red color. GPR data were also collected along Line 2 (L2) on the feeder road of eastbound. Not to scale.*

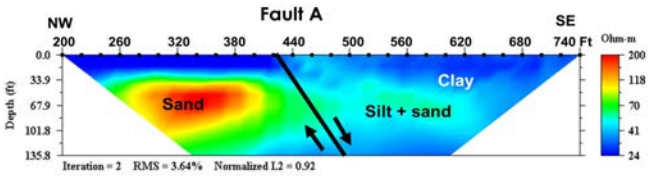

Figure 16. *Resistivity data collected along profile L1 located in the northern section of the grass-covered median in the year 2005.The fault occurs where the scarp is observed on the ground. *

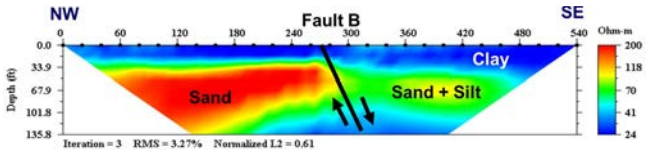

Figure 17. *Resistivity data collected along profile L2 on the southern section of the East-bound feeder road. The fault anomaly is located where the scarp is located and is well-correlated with the resistivity data.*

observed in **Figure 13**. The fault juxtaposes high-resistivity sand and low-resistivity sand and clay layers.

A GPR survey was also conducted along Line 1 (L1) at the southern edge of the East-bound feeder road. The 400-MHz GPR data is displayed in a color-amplitude format, and a color assigned to a specific positive or negative value of the recorded signal. The GPR data shows a significant anomaly at station 302 feet. The data are interpreted to show juxtaposition and offset of sedimentary layers down to the southeast.

STOP 4: WILLOW CREEK FAULT

Location: Coordinates of the Willow Creek fault are 30° 3.857', 95° 37.282'. It is located on Highway 249 (Tomball Parkway) between Willow Creek and Holderrieth Road (**Figure 19**). The fault location is about 4,800 ft to the North of Grand Parkway (Highway 99). In 2003, a discrete rupture was visible on both bounds of the highway (**Figure 20**).

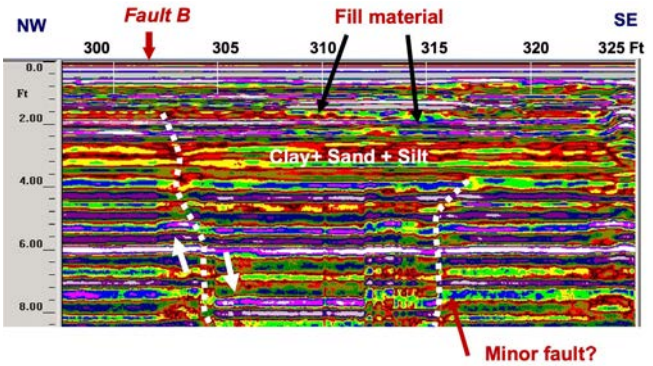

Figure 18. *GPR data along profile L2. A significant GPR anomaly was observed across the fault scarp between stations 300 and 305 feet. Down-to-the-southeast drag is interpreted at depths of 6 and 8 feet below ground level. There is also a minor fault anomaly at station 315 feet. The interpreted offset of sedimentary layers at this location is in the northwest direction.*

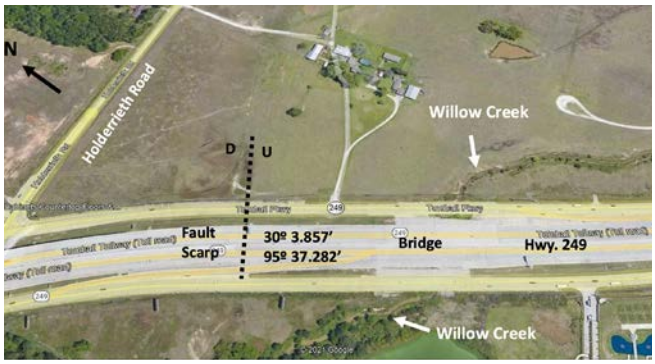

Figure 19. *Site map showing the location of Willow Creek fault, which is located between Willow Creek and Holderrieth Road. Note that willow Creek makes a sharp turn across the interpreted fault location. There were also asphalt patches to the South of the Creek and on the bridge. It is interesting to note that the farmland to the northeast (where the farmhouse islocated) is undeveloped.*

Driving Directions: The easiest way to drive from downtown Houston to the fault location is to take I-10 West until reaching Loop 610. At this intersection, take Loop 610 North to drive about 1.5 miles to get to Highway 290 exit. Take Highway 290 North and drive about 8 miles to reach Sam Houston Parkway (Belt 8). Then take Sam Houston Parkway (SHP) north. SHP bends to the west to meet Highway 249. At this intersection, take Highway 249 North, pass under Grand Parkway (99). Slow down to drive over the Willow Creek bridge. The fault location is about 300 feet to the North of the bridge. Immediately, there is a driveway to a farmhouse to the East, which may be a good parking location.

Geologic Overview: The Willow Creek fault is located about 300 feet north of the Willow Creek Bridge, strikes in a NE-SW direction, and dips to the north (**Figures 3**). This fault is antithetical to the South-dipping regional Tomball fault that is located about 3 km north. A discrete pavement break crossing both South- and North-bounds of Highway 249 clearly marks the presence of the fault (**Figure 20**).

The Active Faults of Harris County *continued on page 24*

The Active Faults of Harris County continued from page 23

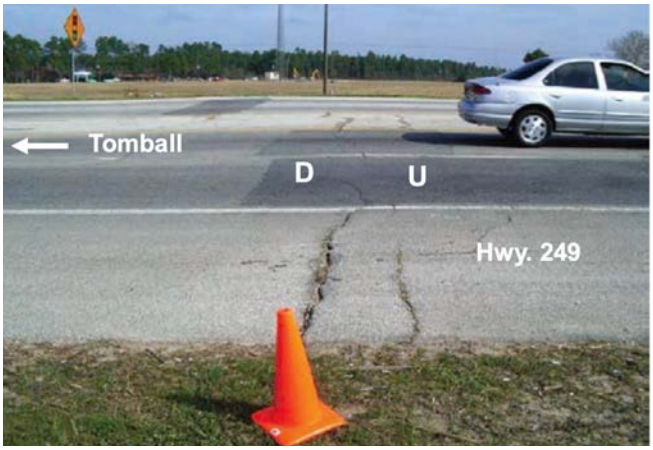

Figure 20. *Picture of Willow Creek fault taken in 2003.*

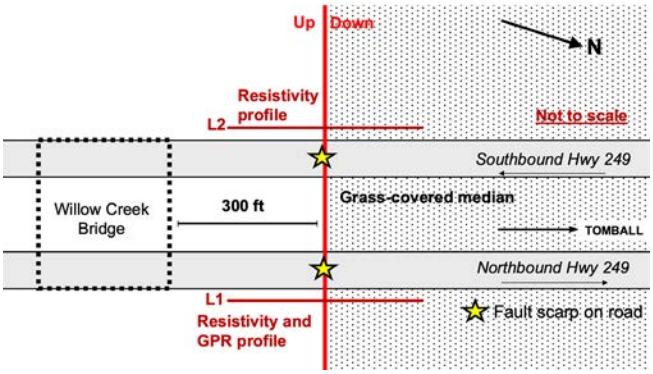

Figure 21. *Schematic map of Willow Creek fault at Highway 249 during the year 2003. Highway 290 had a grass-covered median between the East- and West-bound lanes. Locations of resistivity profiles (L1 and L2) are shown with a red color. GPR data were also collected along Line 1 (L1) on the edge of northbound. Not to scale.*

When the photo in Figure 20 was taken, Highway 249 had a grass-covered median between the East- and West- bound lanes. Multiple geophysical surveys were conducted across the fault (**Figure 21**). Two geophysical profiles will be discussed in this study.

Two resistivity profiles across the fault are provided in **Figure 22**. They both indicate a sharp resistivity contrast over the fault scarp. The resistivity contrast is interpreted to be caused by the juxtaposition of high resistivity sandy and low resistivity clayey sediments.

A GPR survey profile collected across the fault scarp along profile L2 and is provided in **Figure 23**. The GPR data indicates discontinuous layers beneath the scarp at a depth of 2 feet that are interpreted to result from deformation. In addition, the published GPR data (Saribudak and Nieuwenhuise, 2006) detected differential subsidence and a deformation zone between the bridge and the footing of the bridge. The Willow Creek fault movement is a possible cause for this deformation.

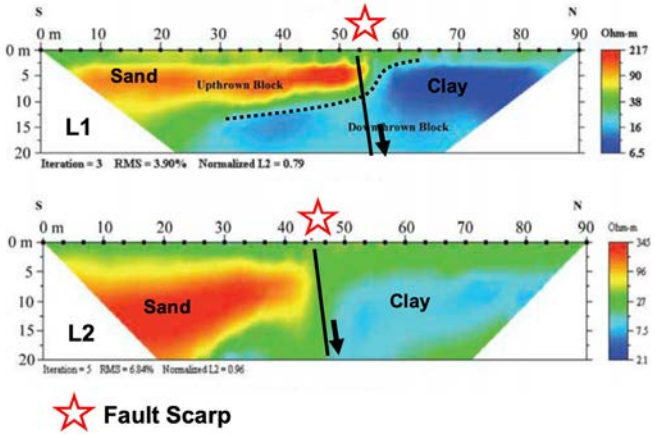

Figure 22. *Resistivity data collected across the fault along profiles L1 and L2. Note that the downthrown side is to the North and juxtaposition of low-resistivity layers along the fault plane is obvious.*

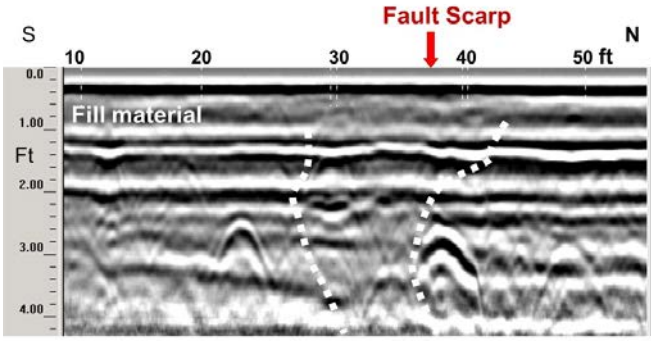

Figure 23. *The GPR data across the scarp of the Willow Creek fault. The data are interpreted to show minor deformation that is less significant than observed at the Long Point, Eureka Heights or Hockley faults. However, the disruption of sedimentary layers is interpreted to be visible. Hyperbolic anomalies could be due to buried pipes.*

CONCLUDING REMARKS

Active faults in Harris County are usually not discrete rupture planes, but zones of sheared ground tens of feet, which are described as fault zones as shown in this study. Geophysical methods discussed here do not provide a fault offset, except with seismic reflection. Common methods used to identify these faults, in addition to geophysical techniques, include analysis of aerial photographs and field mapping and drilling borehole data on both the down- and upthrown sides of the faults. Gamma rays electrical logging used in boreholes give the precise fault offset between the borehole locations.

It is important to know that pavement cracks and offset can be caused by subsidence of ground due to the excess withdrawal of ground water. In addition, the Beaumont Formation, which underlies a significant part of Harris County, contains swelling clays. These clays are also known as "shrink-swell soils." When wet or dry, these clays swell or shrink, respectively, which cause significant fault-like deformation to roads, houses, and utility lines. ■

The Active Faults of Harris County *continued on page 25*

 continued from page 24

QUESTIONS FOR FIELD TRIP PARTICIPANTS:

- Is the surface expression of the fault easy to identify? What do you see?
- Why is the surface expression of the Long Point fault easier to identify than other faults in the area?
- What are indications that this fault is connected to a deeper fault system v. restricted to the shallow surface?
- What do you think is the impact of this fault on surficial processes, e.g. runoff/drainage?
- What are other geologic processes that could have caused the apparent resistivity anomalies?
- Which fault(s) is antithetical? Why do you think this structural orientation is present? Why is it present at this location?

SAFETY TIPS TO KEEP IN MIND WHILE IN THE FIELD

Note that participants should always wear a high-visibility safety vest, and only park in designated parking lots. Parking along highways is not a safe choice. They should be alert by being aware of their surroundings. A sun-protective hat and drinking water would be helpful. It is recommended that participants should be cordial and socialize with the people when they are, especially in neighborhoods.

ACKNOWLEDGMENT

The first author thanks geologist Richard Howe for helping correctly identify some of the fault locations.

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NeoGeos February Happy Hour

Monday, Monday, April 15, 2024

Social Hour 5:30–6:30 pm

Dinner 6:30–7:30 pm, Presentation 7:30- 9:00 pm

HGS Members/Emeritus/Honorary Life $65
Students $65 • Non-Members & Walkups $75
Norris Conference Center, Citycentre
816 Town and Country Blvd #210 • Houston, TX 77024
https://www.hgs.org/civicrm/event/info?id=2539
Event Contact: Linda Sternbach • linda.sternbach@gmail.com

HGS General Dinner Meeting

Mark Shann
Westlawn Americas Offshore

A Deliberate Search for Disruptive Oil & Gas Discoveries in the Gulf of Mexico and Beyond

This presentation will talk about the search for disruptive discoveries in the US and southern GOM. What are the main differences across the Gulf in terms of petroleum systems and hydrocarbon potential? Is there new play potential from recent global analogs?

Disruptive discoveries are the material exploration finds that can reset basin creaming curves and reinvigorate exploration (think Starbroek in Guyana). They require some thinking beyond the norm, based on careful data observation in combination with the application of new technology, especially seismic imaging. This talk examines some of the key similarities and differences in the petroleum systems and hydrocarbon potential across the Gulf of Mexico and draws on recent global discoveries to suggest that some new play types may also be present across the wider GOM. ■

BIOGRAPHICAL SKETCH

Mark Shann is a data-led geoscientist with 35+ years in the E&P upstream business and has had the fortune to have worked across the world in his endeavors. He says he is thankful to BP International for the first 32 years, which gave him an excellent on-the-job/formal set of training opportunities, and global geological exposure.

Shann jumped to working private equity in 2014 and saw in a very immediate way how technical rigor combined with a certain amount of luck can create business value in the upstream sector, first with Sierra Oil and Gas in Mexico, and now with Westlawn Americas Offshore. Mark now works as Chief Technology Officer for Westlawn Americas Offshore. WTO holds exploration and production assets in the US GOM.

Wednesday, April 17, 2024

HGS Continuing Education Committee
Zoom Virtual Luncheon Meeting

11:45 a.m. – 12:50 p.m.
HGS Members $20 • Students $20 • Non-Members $25
Register using the HGS website calendar.
Zoom link will be emailed to registrants.
https://www.hgs.org/civicrm/event/info?id=2557
Event Contact: Bill DeMis • billdemis@aol.com

Dr Scott Tinker,
former Director of the Texas Bureau of Economic Geology, Austin

Seeking Energy Truth

No one has a patent on truth. We can only seek the truth, and in the quest, we strive to be not only completely factual, but factually complete. Factual completeness shows us that all forms of energy impact the environment, and all forms of energy have societal benefits. Contrary to some political narratives, there are no binary, clean and dirty solutions, there are only trade-offs. The challenge facing a world of over 8 billion people, living from extreme poverty to extreme wealth, is how to increase human flourishing while also protecting the environment. ■

BIOGRAPHICAL SKETCH

Scott Tinker works to bring industry, government, academia, and nongovernmental organizations together to address major societal challenges in energy, the environment, and the economy. Dr. Tinker is the former Director of the Texas Bureau of Economic Geology, the State Geologist of Texas, and a professor at UT. With Director Harry Lynch, Dr. Tinker coproduced and is featured in the award-winning energy documentary film Switch, which has been screened in over 50 countries to more than 15 million viewers.

Dr. Tinker formed the nonprofit Switch Energy Alliance in 2016 and has completed two new films: Switch On, a feature length documentary addressing global energy poverty, and Energy Makes our World, a five-minute, Hollywood-quality film made for global museums and giant screens. Tinker is the voice of EarthDate, a two-minute weekly program that focuses on remarkable stories of Earth. EarthDate is featured on 400 NPR and public radio stations in all 50 United States.

Dr. Tinker has served as president of the American Geosciences Institute (AGI), the Association of American State Geologists (AASG), the American Association of Petroleum Geologists (AAPG), and the Gulf Coast Association of Geological Societies (GCAGS).

Dr. Tinker is an AGI Campbell Medalist, AAPG Halbouty Medalist, GCAGS Boyd Medalist, and a Geological Society of America Fellow. He has given over 850 keynote and invited lectures in over 60 countries.

WELCOME TO NEW MEMBERS, EFFECTIVE FEBRUARY – MARCH 2024

Azeez Alrifaie
Leslie Bernal
Theodore Curiel II
Emiliano de Lillard
Sarath Devarajan
Rob Dudley
Juliet Irvin
Jonthan Membreno
Fabian Pena
Keith Reeves
Joseph Stone
Larry Welch
Burch Wylie
Kathryn Young
Ethan Young
Wenping Zhou
Charlie Zhu

Tuesday, April 23, 2024

Social 11:15 AM, Luncheon 11:30 AM- 1:00 PM
Cost: $40 pre-registered members
$45 for non-members/ALL walk-ups
$40 for Emeritus/Life/Honorary
Students: $30 if pre-registered
Greenway 5 Conference Center, Houston, TX 77046
https://www.hgs.org/civicrm/event/info?id=2550
Event Contact: Bryan Guzman | bryan.guzman@premiercorex.com

HGS CCS Luncheon Meeting

Isabelle Pelletier
Lapis Energy

Oil and Gas Field Development vs. Geological Carbon Sequestration

Part of the assessment and development of a sink for Geological Carbon Sequestration is to comply with Class VI Permit requirements and build a 4D model of the sink and the CO2 plume displacement. Many assume that the workflow from the O&G Field development can be simply followed. Lapis Energy has indeed used the experience from O&G industry, and adapted as it is not a simple inverse or cut & past challenge. This presentation will browse through some of the learnings. ■

BIOGRAPHICAL SKETCH

Isabelle Pelletier began her PhD program in France at Institut Francais du Petrole (now IFPEN), in the 90s when interests in CCUS started. Most major O&G companies had a Research Department at the time and they initiated efforts in CCUS. Operational CCUS projects started with Sleipner Field in Norway, Weyburn Project in Canada, and CO2CRC Otway Project in Australia where injection started respectively in 1996, 2000, 1998. Her majors were Geochemistry and Hydrogeology, which brought her into joining conversations related to dissolutions and precipitations incurred through injection and sequestration. Her career has spanned over 32 years in software development to O&G and currently to CCS with Lapis Energy. Her study led her to learn more about computer sciences applied to geosciences (algorithm and numerical equations), (geo)statistics and reservoir development.

To learn more details about her career, visit her LinkedIn Profile: https://www.linkedin.com/in/isabelle-pelletier-28334215/

Call for Papers

HGS-GESGB Africa Conference

Africa 2024: The Future in Energy, Skills and Diversity

24 - 25 September 2024
Houston, TX.

Submit you Abstract to
Africa2024@hgs.org

AFRICA
CONFERENCE

April 2024

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
	1 Make your reservations online at hgs.org	2	3	4	5	6
7	8	9	10 **HGS E&E Dinner Meeting** *TBD* *https://www.hgs.org/civicrm/event/info?id=2516*	11 **GeoGulf 2024** *https://www.hgs.org/civicrm/event/info?id=2540*	12	13
14	15 **HGS General Dinner Meeting** *A Deliberate Search for Disruptive Oil & Gas* *Page 27* *https://www.hgs.org/civicrm/event/info?id=2539*	16	17 **HGS Continuing Education Zoom Luncheon Meeting** *Seeking Energy Truth* *Page 28* *https://www.hgs.org/civicrm/event/info?id=2557*	18 **HGS NeoGeos Happy Hour** *https://www.hgs.org/civicrm/event/info?id=2534*	19 **HGS Annual Shrimp Peel & Crawfish Boil** *https://www.hgs.org/civicrm/event/info?id=2553*	20
21	22	23 **HGS CCUS Luncheon Meeting** *Oil and Gas Field Development vs. Geological Carbon Sequestration* *Page 29* *https://www.hgs.org/civicrm/event/info?id=2550*	24	25	26	27 **AAPG Southwest Section Meeting** *https://www.hgs.org/civicrm/event/info?id=2521*
28 **AAPG Southwest Section Meeting** *https://www.hgs.org/civicrm/event/info?id=2521*	29	30	**RESERVATIONS** The HGS prefers that you make your reservations online through the HGS website at WWW.HGS.ORG. If you have no internet access, you can e-mail OFFICE@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, contact the HGS office at OFFICE@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.**			

INSTRUCTIONS TO AUTHORS

Materials are due by the first of the month for consideration to appear in the next month's publication. Submissions should be emailed to editor@hgs.org. The Editor reserves the right to reject submissions or defer submissions for future editions.

Text should be submitted as a Word file. Figures or photos may be embedded in the document or submitted separately. The following image formats are accepted: tif, .jpg, .png, .psd, .pdf.

Feature submissions, e.g., Rock Record, should be approximately 600 words. Technical papers should be approximately 2000 words or less (excluding references).

HGS Members Featured in GeoGulf24 Awards Ceremony

By Mike Erpenbeck (Chair, GeoGulf24 Nominations and Awards Committee)

In the upcoming Gulf Coast Association of Geological Societies (GCAGS) GeoGulf24 Convention (April 10-12) in San Antonio, the Awards ceremony will honor many HGS members. Houston Geological Society was the host local society to the GeoGulf23 convention last year, and HGS members stepped up to volunteer for the many tasks that are needed to host a well-run Convention.

The 2023 GeoGulf held in Houston was considered a highly successful convention, and its six-figure profit reversed a multi-year trend of little to no convention profit. This was largely accomplished by dramatic cost reduction by the work of volunteers who stepped up to learn and execute many of the functions formerly handled by paid, experienced convention professionals.

It started with **Charles Sternbach** who served as Convention General Chair and whose ideas, creativity, and engagement with volunteers were the driving force for the success of GeoGulf23. In addition, Charles has more than 10 years of recognized service to GCAGS. He is being honored with the **Don Boyd Medal**, the top award given by GCAGS.

Distinguished Service Awardees from HGS include **Bryan Guzman**, who has been GCAGS Treasurer since 2019, and has revamped the financial structure of GCAGS over that period. **David Risch** and **Sandy Rushworth** will also be honored. They teamed up to plan and organize judging of the conference poster sessions and the oral presentations over the last three Houston conventions.

THE COMPLETE LIST OF ALL GEOGULF24 SERVICE AWARDEES

Charles Sternbach	HGS	Don Boyd Medal
James Pindell		Outstanding Educator
Mark Rowan		Outstanding Educator
Dr. Richardo Sanchez y Padilla		Outstanding Educator
Bryan Guzman	HGS	Distinguished Service Award
Sandy Rushworth	HGS	Distinguished Service Award
David Risch	HGS	Distinguished Service Award
Mark Shuster		Distinguished Service Award
Cheryl Desforges	HGS	Distinguished Service Award
Dorene West	HGS	Distinguished Service Award
Dallas Dunlap		Honorary Membership
James Hawkins	HGS	Special Commendation Award
David Tett	HGS	Special Commendation Award
Andy Pepper		Special Commendation Award

Longtime contributors to GCAGS convention work include **Dorene West** who was on the Transactions editorial team since 2016, Vice-Chair of the Convention in 2015 and 2019, and set up GCSSEPM luncheon speakers for 2015, 2016, 2019, and 2024. **Cheryl Desforges** was GCAGS Treasurer in 2008 and served on the Technical Committee and as Technical Committee Chair, chaired numerous sessions, facilitated field trips, and volunteered for short courses in 2015, 2019, and 2023 conventions.

Finally, HGS members contributing largely to the success of GeoGulf23 and receiving the Special Commendation Award are **James Hawkins** and **David** Tett. Hawkins made everything look easy, but behind the scenes he put in many hours (an incredible amount, according to nominator Linda Sternbach) ensuring the success of Pheedloop processes for sign-up, on-site check-in (400 persons) and registration, badges, Convention website interaction, and the Exhibitor module. Tett supervised the volunteer process, coordinated check-in volunteers, proofed program books, designed signage, aided the Technical Program and General Chair, and helped ensure everything went smoothly for Convention attendees. There are indeed innumerable details in hosting a Convention.

Come a little early on April 10 to the GeoGulf24 Convention at 3:00 PM (just prior to the Icebreaker) and offer congratulations to your HGS colleagues! ■

Candidates for the 2024–2025 Executive Board

Houston Geological Society Officer Election

THE CANDIDATES PUT FORTH BY THE NOMINATIONS COMMITTEE ARE:

President-Elect: Patricia (Patty) Walker, Bob Wiener

Vice President: Catherine (Catie) Donohue, Jonathan Rotzien

Secretary: Sophie Broun,Geraldine Tijerina

Treasurer-Elect: Angela Hammond, Barry Rava

Editor-Elect: Lucia Torrado

Directors (2 positions):
Bryan Bottoms, Matthew R. Cowan, Lauren Seidman Robinson, Catherine Cox Strong

HGS ELECTION VOTING INSTRUCTIONS

HGS Members will be able to vote online via the HGS website. You must be logged into your account to cast your vote. Ballots will be online only - no mailed ballots! Please check the HGS website in the coming weeks for updates and announcements.
PLEASE VOTE

THE VOTING PERIOD OPENS APRIL 10, 2024 AND CONTINUES TO MAY 10, 2024.

President-Elect (two candidates)

Patricia (Patty) Walker

As a geoscience student I was introduced to the professional societies by an alumnus of my alma mater, Oklahoma State University. Herb Davis was very active in the Oklahoma City Geological Society and frequently sponsored students to attend the luncheons and technical talks. He emphasized the importance of building networks within your geoscience community outside of your current employer, alumni, and circle of friends. He also led by example the concept of paying it forward to the next generation. This was a valuable lesson.

In this rapidly changing work environment for geoscientists, the need to maintain these networks has never been greater. From work-from-home/flexible schedules, constant mergers and acquisitions, and new business lines that will require geoscience skills, the need to have a viable society that can provide networking opportunities, mentoring and technical training has never been greater.

Many of the geoscience societies have been under immense financial pressure over the last 10 years as corporate sponsorships have waned and memberships have declined. HGS has been working very hard over the past few years to balance financial health with continuing to offer programs, training and networking opportunities that benefit the members and encourage new membership. I am running for president-elect because I want to continue to be part of that positive direction and see HGS thrive as a professional society.

Patricia (Patty) Walker *continued on page 39*

Bob Wiener

It is an honor and privilege to be nominated to run for the very important office of President-elect of the Houston Geological Society. I enjoyed my 2016-2017 year as HGS Vice President, and I believe I can make a further contribution as HGS President-elect and then President. I grew up and went to school in Rhode Island. My family traveled extensively across the USA and Europe. These trips gave me the desire to study geology. The 1973 Arab oil embargo got me a job in the science, technology, and business of oil and gas exploration and production. As mentioned above I am not a corporate person and when you work outside the corporate world professional societies become much more important. They are a source of continuing education, professional contacts, and friends who can help guide you through the technical, business, and human relationships that go into oil, gas, and other energy deals. With regards to working with groups, in the town where I live, I have been a member of the Planning and Zoning Commission and City Council. So, I am familiar with budgets, strategic planning, and consensus building, which are important aspects of the President-elect and President positions.

Education

BS Geology from University of Rhode Island (1973)
Senior year spent at Middle East Technical University, Ankara, Turkey

Bob Wiener *continued on page 40*

Candidates for the 2024–2025 Executive Board *(continued)*

Vice President (two candidates)

Catherine (Catie) Donohue

I am honored to be nominated for the position of HGS Vice President for the 2024-2025 term. An important responsibility of the position is to organize the monthly dinner and luncheon speakers; I view this as a vital contribution to our membership. Our science and community benefits from active dialogue and the exchange of ideas, and these meetings serve as the most accessible way to engage our extensive local geoscience community. If elected, I will seek out speakers with compelling technical content that will challenge and connect our audience and ensure that HGS remains a successful place to grow. I will actively solicit feedback from our membership to ensure that our topics reflect the needs and interests of our organization. Through this effort, involvement in HGS will continue the healthy upward growth trend of recent years. HGS has been a meaningful part of my own career, since starting as an explorationist in the Gulf of Mexico and attending meetings with mentors and colleagues. My current positions at GeoMark Research and as a Rice University instructor, as well as my previous experience working for oil and gas operators and environmental consulting firms, allows me to see many facets of a geoscience career. I am well suited and committed to creating a compelling speaker program for HGS meetings next year and appreciate your support for HGS Vice President.

Education

MS Rice University
BS University of Michigan

Professional Experience

2018 – present	Vice President of Geoscience Applications, GeoMark Research, Houston, Texas
2020 – present	Course Instructor, Rice University
2013 – 2018	Senior Geologist, Marathon Oil Corp.
2011 – 2013	Senior Geologist/Geochemist, Apache Corp.
2004 – 2011	Senior Geoscientist, BHP Billiton
2000 – 2002	Environmental Consultant

HGS Service

Currently serving on the HGS/GESGB Africa Conference Committee
Served as a session chair for 2021 HGS/EAGE Latin America Conference

Catherine (Catie) Donohue *continued on page 40*

Jonathan Rotzien

Thank you to Walter S. Light, Jr. for this nomination. It is an honor to be recognized by my mentor I hold in the highest esteem. He is an incredible explorer, leader and one heck of an oil finder. It is humbling and a privilege to be associated with this sharp group of candidates for the upcoming election, including Catie Donohue, who would perform superbly in this role. I appreciate the opportunity to run for VP, and I'd be delighted to deliver an excellent speaker program for HGS. As a VP, I'd enjoy sharing the success we've had with Houston Explorers Club, GCSSEPM, British Sedimentological Research Group, IMAGE, GeoGulf (formerly GCAGS) and many other JIPs and societies with HGS. Thank you for your consideration. HGS has a bright future, and I look forward to contributing to the growth and prosperity of HGS and its members.

Education

2013: PhD, Geological and Environmental Sciences, Stanford University; NSF Graduate Research Fellow; Siemon W. Muller Graduate Fellow; Stanford Project on Deepwater Depositional Systems (SPODDS) Research Group
2007: BA, Geology, The Colorado College, cum laude

Professional Experience

2015 – Present President, Basin Dynamics, LLC
2013 – 2015 Geologist, BP
For additional employment info, please see company website, LinkedIn, ResearchGate, AAPG, HOT Energy Group, Subsurface Consultants & Associates, LLC profiles. For a CV, please see University of Houston website.

Other Professional Affiliations

West Texas Geological Society
Abilene Geological Society
Oklahoma City Geological Society
Shreveport Geological Society

Rotzien has served on several evaluation, advisory, investment, editorial and technical conference boards for institutions including the Houston Explorers Club, Stanford University, Colorado College, Bulletin of Canadian Petroleum Geology, Gulf Coast Association of Geological Societies, GeoGulf, Gulf Coast Section of SEPM and the American Association of Petroleum Geologists.

Candidates for the 2024–2025 Executive Board *(continued)*

Secretary (two candidates)

Sophie Broun

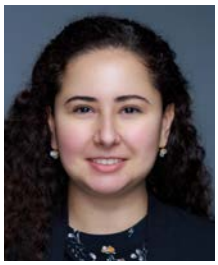
I joined HGS late last year to connect with Houston-based Geologists and to learn more about the local industry. Houston is one of the best places in the world to be a Geoscientist with an abundance of opportunities and world class geology. Since joining HGS, I've been so impressed by the quality of technical presentations, social events and mostly by how welcoming the members of the HGS have been.

If elected to Secretary, I hope to bring fresh ideas for ways to make the Society even better and help out wherever I can with event planning, membership recruitment, board co-ordination and strong governance. I'm particularly passionate about promoting Geology as a career path and helping early career Geoscientists.

I look forward to meeting as many HGS members as I can and being an active part of the community.

Education
MBA The Wharton School University of Pennsylvania
MS Petroleum Geoscience Royal Holloway University of London
BEng (Mechanical) / BS (Applied Mathematics, Physics)
University of Western Australia

Professional Experience
Joint Venture Advisor, Chevron
Operations Geoscientist, Chevron, Gulf of Mexico
Exploration Geophysicist, Chevron, Exmouth Exploration
Operations Geoscientist, Chevron, Greater Gorgon & Exmouth
Drill Site Manager, Chevron, Offshore Australia
Field Drilling Engineer, Chevron, Offshore Australia



Geraldine Tijerina

Throughout her journey, Geraldine has been privileged to connect with inspiring mentors and members within the Houston Geological Society, deeply valuing the strong community established by our predecessors. The HGS's dedication to ongoing success and advocacy of its members is critical in Houston, the energy capital of the world. If elected as Secretary, Geraldine is committed to actively aiding in the needs of our community and ensuring the voice of Houston is heard and represented.

Education
Geraldine Tijerina earned her BS in Geoscience, specializing in Petroleum Geology, the University of Houston – Downtown (2019) and her MS in Geology (2021) the University of Houston.

Professional Experience
Tijerina is a development and exploration geoscientist with five years in the upstream oil & gas industry specializing in reservoir field development and planning studies, prospect development, and subsurface evaluations. Her career began at Whitney Oil & Gas, starting as a Geotechnical Intern, advancing to Geoscience Technician, and eventually Geologist, primarily focusing on South Louisiana assets and Gulf Coast subsurface geology.

HGS Service and Other Professional Affiliations
Tijerina is an active NeoGeo, SPE, AAPG and HGS member. Geraldine's passion for geosciences drives her to volunteer for events hosted by the HGS and AAPG, focusing her efforts to inspire future generations of geologists through educational outreach events, engineering science fairs, and student expos; this will be her second-year volunteering at OTC.

During her college career, Geraldine served as the UHD-AAPG student chapter president and treasurer (2018 – 2019), advocating for the enrichment of the students by facilitating interactions with industry professionals, sponsoring HGS short courses, and organizing professional educational talks.

Candidates for the 2024–2025 Executive Board *(continued)*

Treasurer-Elect (two candidates)

Angela Hammond

I am honored to have been asked to run for the HGS Treasurer-Elect as I would love to continue giving back to the HGS and as the current treasurer of the HGS Undergraduate Fund feel that this is the right office for me to accomplish this. I have been a member of the HGS for 22 years, the same amount of time I have resided in Houston and worked for Shell. Through this organization I have met many amazing individuals, many who have become friends and have seen the good that the HGS has done and can continue to do for not only students, but all who are students of the Earth. I am an enthusiastic, high-energy individual that has excellent organizational skills that have served me well as the both the treasurer of the HGS Undergraduate Student Fund, my daughter's Girl Scout Troop and the social committee in my neighborhood. I look forward to being a future HGS officer and helping to grow this great organization's finances so that we can continue to support continuing education, networking, and outreach to students; to cultivate our next generation of HGS leaders. ■

Education and Licensure
MS Geological Engineering, Michigan Technological University
BS Geological Engineering, Michigan Technological University
APM Chartered Project Professional

Professional Experience
Hammond is a Front End Development Manager – Perdido Corridor (U.S. and Mexico) for Shell, USA. Hammond has worked for Shell since 2002, mostly in Production Geology.

HGS Service
Angela Hammond has been a committee chair of the HGS Undergraduate Fund for the past 11 years and the acting Treasurer for the past 3 years.

Other Professional Affiliations
Hammond is also a current member of AAPG, SEG, and a past co-editor of the GCAGS.

Barry Rava

I am humbled to be up for Treasurer. Volunteering in the geological community is a great way to give back to the community from which I have learned so much and which has provided my bread and butter for a life time. I will endeavor to uphold the standards and ethics of the HGS and monitor society funds to keep the HGS financially viable as it moves into the future. ■

Education
MS in Geology and Planetary Science, University of Pittsburgh
BS in Geology, Hofstra University

Professional Experience

1996	President, Icarus Oil and Gas Inc
1981 – 1991	Conoco
1991 – 1993	Pennzoil
1993 – 1996	EOG Resources

Other Professional Affiliations
Barry Rava is a long-time member of HGS and SIPES in Houston. He is Past President and Chairman of SIPES Houston and the National and SIPES Foundation. Rava is Past Continuing Education Chair of SIPES Houston and GCAGS. He is a Board Member and Past President of the Gulf Coast Geological Library, and Past Treasurer of GSH and Corpus Christi Geological Library.

Candidates for the 2024–2025 Executive Board *(continued)*

Director – Two-year term *Vote for two candidates*

Bryan Bottoms

I am honored to accept the nomination for the HGS Board of Directors. I have spent the past few years becoming increasingly involved in the HGS by serving as the NeoGeos Committee Chair. As the NeoGeos Committee Chair, I host monthly Happy Hour and Trivia events targeted at increasing member involvement among early career geologists. While serving as Chair, the NeoGeos committee has been revitalized, and once again hosts regular monthly events after languishing during Covid. This year we have increased our sponsorship outreach, and in turn have boosted event turnout and revenue for the Society.

In addition to serving as NeoGeos Chair, I have volunteered at numerous events including educational outreach to teach local elementary school students about rocks and fossils. I served as a poster judge for the annual Sheriff Lecture event and served as a judge at the 2023 Science and Engineering Fair of Houston on behalf of HGS. I am also a regular attendee of the monthly dinner meetings. I'm excited for the opportunity to continue serving this organization in an increased capacity. By serving on the Board of Directors, I hope to set an example among other early career geologists, encouraging them to become more involved with their local geological society. I hope that my potential presence on the Board can bring some fresh perspectives and ideas to the organization that will benefit the Society as we continue to adapt to an ever-changing world.

Education and Licensure

P.G. State of Texas, License # 15091
MS University of Arkansas; 2017
BS University of Arkansas; 2012

Professional Experience

08/2019 – Present	Vice President – Geology, Detring Energy Advisors, Houston, TX
10/2017 – 08/2019	Associate Geologist – Tapstone Energy, Oklahoma City, OK
08/2015 -10/2017	Graduate Student, Teaching Assistant, and Research Assistant, University of Arkansas, Fayetteville, AR
02/2013 - 05/2017	Field Geologist/MWD Engineer – Chesapeake Energy/77 Energy, Oklahoma City, OK

HGS Service

04/2022 - Present	NeoGeos Committee Chair

Matthew R. Cowan

I have been a member of the Houston Geological Society since the Late 1990's as I was finishing up college. In 2005, I got involved volunteering with several committees. Through that time, I got to meet a lot of people who expanded my knowledge of not only my specific field of geology but the greater world of geology. I understood the value of being involved in a Professional Society. I have served on statewide organizations relating to professional licensure, continuing education and involved with hosting conferences for the geological profession. That experience will help me be a Director on the HGS Board. It was a privilege to see the HGS turn 100 this past year. My desire is to serve as Director and to be a steward of this profession to help secure the next 100 years for the HGS. It would be an Honor to have your vote.

Education and Licensure

MS Geology, Texas A&M – Kingsville - 2000
BS Geology with a minor in Mathematics, Texas A&M University – 1993
Texas Professional Geologist – 2003 to Present
Louisiana Professional Geologist - 2013 to Present

Professional Experience

2010 - Present	Chief Geologist Terrain Solutions Inc
1997 - 2010	Chief Geologist Lone Star Environmental
1996 - 1997	Staff Geologist LSI Environmental

HGS Service

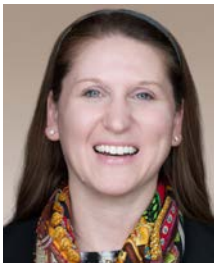
2011 - 2012	HGS Secretary
2006 - 2007	HGS Environmental and Engineering Committee – Treasurer
2007 - Present	HGS Environmental and Engineering Committee – Chair

Other Professional Affiliations

2016 - Present	American Institute of Professional Geologists (AIPG) – Board of Director
2021 - 2023	Association of Environmental and Engineering Geologists (AEG) – Secretary
2006 - 2018	Texas Association of Professional Geologists – President

Candidates for the 2024–2025 Executive Board *(continued)*

Director – Two-year term *Vote for two candidates*



Lauren Seidman Robinson

It was not until 2015 while working downtown for EP Energy, that I began being a truly active member of HGS by attending luncheon meetings and continuing education courses. Between HGS and the Society of Independent Professional Earth Scientists (SIPES) meetings (I mention SIPES because there is a substantial overlap between HGS and SIPES members), I have never met an assemblage of more friendly and supportive fellow geologists. The people are what keep me coming back.

I jumped at the opportunity to be a co-chair of the Social Media committee in the fall of 2017. At the time, it was my intention to help the committee for a few months while in their time of need. It is now 2024, and I am still going strong with Social Media. Additionally, I also volunteer on the Continuing Education committee. All in all, I never knew how rewarding it was to volunteer. I find giving back to HGS incredibly rewarding because of the caliber of its members. I have met some really interesting people, and made strong friendships since I joined HGS. That is what I enjoy the most…the people. At a job and in life, the people make it or break it for me.

Education
MS Geology, Baylor University, Waco, TX
BA Geology, Smith College, Northampton, MA
AAPG CPG #6492

Professional Experience
My professional experience spans over sixteen years of full-time employment in the upstream E&P sector.
Current role: Vice President at Miller and Lents in Houston, TX.

HGS service
Social Media Committee: Co-Chair (2017 – present)
Continuing Education Committee: Volunteer (2021 - present)

Other Professional Affiliations
SIPES, Limited Member
AAPG
SPE
GSA

Catherine Cox Strong

I am interested in serving as a Director for Houston Geological Society, because I have such high regard for this group and its members. In my view, the Society is the best of all the groups affiliated with the American Association of Petroleum Geologists. Houston Geological Society has provided opportunities for knowledge sharing and networking for decades. It seems the best part of being a geoscientist is getting to collaborate with fellow colleagues and having fun when we get together to share ideas. I would like to do my part in making sure this society remains financially strong and stays focused on its core objectives: "1) To stimulate interest and promote advancement in geology for the Houston area. 2) To disseminate and facilitate discussion of geological information, build relationships among geologists in the area, and to aid and encourage academic training in the science of geology."

Education
MS Geology, Texas A&M University
BS Geology, Texas A&M University
Licensed Professional Geoscientist in the State of Texas

Professional Experience
Born in Hondo, Texas, Catherine Strong is a graduate of Texas A&M, where she earned two degrees, Bachelor of Science in geology and Master of Science in geology, before joining the oil and gas industry as a Petroleum Geologist in 1982. Strong began her oil and gas career with the Hunt Family in Dallas, Texas, where she handled geological and team-lead duties for fourteen years at Petro-Hunt and Placid Oil, honing her skills in Gulf of Mexico, Gulf Coast, offshore California, and international assignments.

Strong's years in upstream oil and gas have resulted in technically diverse and geographically broad expertise in domestic, as well as, foreign areas. Most successful endeavors have been in Gulf of Mexico exploration, Gulf Coast exploration; production, and in technology development for Unconventional Resources. Strong also has significant experience in obtaining partner companies and in screening prospect and production opportunities.

In 2015, Strong accepted early retirement from ConocoPhillips after sixteen years with the company. During her tenure at

Catherine Cox Strong *continued on page 40*

Candidates for the 2024–2025 Executive Board *(continued)*

Editor-Elect (one candidate)

Lucia Torrado

I am honored to stand for the position of Editor-Elect. I started volunteering with the HGS while I was a graduate student at the University of Houston, specifically with the Exhibits Committee. I helped out with many tasks like setting up and transporting the booth, tending the HGS booth in several exhibits, but most importantly, I shared with my colleagues and peers the HGS mission and the benefits of joining the Society. I've continued to volunteer since those early days, serving as Secretary in the 2021-2022 term, which allowed me the opportunity to learn more about the many functions of the HGS.

Education

PhD, Geology, University of Houston
MS, Geology, University of Houston
BS, Geology, National University of Colombia

Professional Experience

During her graduate studies, she worked with the Conjugate Basins, Tectonics and Hydrocarbons consortium in conjunction with Spectrum Geo Inc. now TGS (2010-2018). She interned with Shell and Talisman Energy (now Repsol) where she worked in Colombia and Texas, respectively. Her graduate work consisted of an integrated regional-to-detailed basin evaluation in the search of new oil and gas opportunities in the Llanos basin (onshore Colombia), the Caribbean region (Nicaraguan Rise), and the deep-water Foz do Amazonas in the equatorial Atlantic (Brazil).

Torrado's research has been recognized as best poster presentation during the AAPG meetings including: "1st place poster presentation" (2017), "3rd place poster presentation" (2013), "Award of Excellence for Top 10 poster" (2014), and "Top 15 poster presentation" (2016, 2012). Additionally, she was the secretary for the AAPG's graduate chapter at the University of Houston which was awarded "Best Domestic Student Chapter" (2018).

Torrado has worked for PGS in the Cayos Basin (western Caribbean Sea), and the Pacific margin of Colombia, for Hocol in Upper and Middle Magdalena Basin in Colombia and more recently, in the Mexican GOM and North Sea as a geoscience consultant for TGS. Torrado works part-time running her small family business while looking for opportunities in the industry.

HGS Service

2021-2022	HGS Secretary

Other Professional Affiliations

2017-current	SEG Translation Committee Team Leader
2016-current	Journal reviewer
2020-2023	SEG Translation Committee Chair
2019-2023	AAPG Imperial Barrel Award Industry Advisor
2017	AAPG Graduate Student Chapter Secretary
2019, 2021	EAGE Technical Committee Member

continued from page 33

Patricia (Patty) Walker—*Candidate for President-elect*

Education

Patricia (Patty) Walker is originally from Tulsa, Oklahoma but has now lived in the Houston area for the last 38 years. She is an Oklahoma State University alumnus with BS and MS degrees in Geoscience from the Boone Pickens School of Geology. She is a past chair of the Executive Advisory Board for the school, a recipient of The Boone Pickens Entrepreneur Bootstrap Award and in 2022 named a Distinguished Alumni OSU College of Arts and Sciences.

Professional Experience

Walker's career with ExxonMobil began in 1986 and has taken her to six of the seven continents working on diverse energy projects in technical and management roles. In 2013, she was named as a Senior Principal Geoscientist in the Upstream and in 2015, promoted to Chief Geoscientist. In this role, she served as a technical expert and advisor to senior leadership on global ExxonMobil activities. In addition to her work with ExxonMobil, Walker has previously served as a geologic consultant focused on asset evaluations.

HGS Service

Vice President 2022-2023
Finance Committee 2022 - present

Other Professional Affiliations

AAPG, House of Delegates
Walker is very active in her community and is an Alderwoman for the Village of Tiki Island. Walker's husband Lawrence is a career geoscientist (now retired) and they have two adult children, Amanda and Nathan. ■

Candidates for the 2024–2025 Executive Board *(continued)*

continued from page 33

Bob Wiener—*Candidate for President-elect*

Professional Experience

1974	Short stint at Core Labs, Denver, CO
1974	Hired by Cities Service Company, Tulsa, OK as a trainee and worked on US East Coast exploration.
1978	Transferred to Cities International in Houston, TX; worked in Europe, Africa, Middle East Region; joined HGS; subsequently transferred to Region Geophysicist for Texas Offshore area.
1980	Joined Petro Ventures International Inc., a consulting firm.
1983	Joined Conoco and worked in Cairo, Egypt and Stavanger, Norway
1988	Returned to Houston to begin work as an independent geologist/geophysicist (Goh Seismic Interpretation Services and Goh Exploration, Inc.) Turns out I am not a corporate person.
2019	Began to shift focus from oil and gas exploration and development to geothermal development (Geothermal Resources LLC)
2024	Although overrides ran out a while ago, I am still busy consulting, working on projects, and staying active in professional societies. It's too much fun.

HGS Service

Vice President 2016 to 2017

Other Professional Affiliations

American Association of Petroleum Geologists
Geophysical Society of Houston
Society of Exploration Geophysicists
Society of Independent Professional Earth Scientists

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continued continued from page 34

Catherine (Catie) Donohue—*Candidate for Vice President*

Other Professional Affiliations

1999 – present	Member of AAPG since 1999
2020	Chair of Petroleum System Analysis, AAPG ACE
2018 – 2019	URTEC session chair
2023 – present	Association of Earth Science Editors Awards Committee Chair

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Catherine Cox Strong—*Candidate for Director*

ConocoPhillips in Houston, Texas, she served in director, technical advisor, and team-lead capacities for deep-water Gulf of Mexico exploration and in technology development for tight-gas-sand and shale unconventional resource plays. Prior to ConocoPhillips, Strong was a principal geologist with Vastar Resources (an affiliate of ARCO) for three years, where she worked exploration in the deep-water and deep-shelf areas of the Gulf of Mexico.

Strong joined Red Willow Production Co., an affiliate of the Southern Ute Indian Tribe, in 2015 as the lead geologist in the Houston, Texas, office responsible for prospect, lease sale, and project development decisions in the deep-water Gulf of Mexico.

Other professional affiliations

Strong has been active with Texas A&M's Department of Geology & Geophysics Advisory Committee since its inception in 2006, and she is currently serving as the Chair of the Advisory Council. She is a member of the American Association of Petroleum Geologists, where she is a House of Delegates representative.

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TX 77079
Phone: (713) 463-9476
Email: office@hgs.org

Active Membership

In order to qualify for Active Membership you must have a degree in geology or an allied geoscience from an accredited college or university or, have a degree in science or engineering from an accredited college or university and have been engaged in the professional study or practice of earth science for at least 5 years. Active Members shall be entitled to vote, stand for election, and serve as an officer in the Society. Active Members pay $36.00 in dues.

Associate Membership

Associate Members do not have a degree in geology or allied geoscience, but are engaged in the application of the earth sciences. Associate Members are not entitled to vote, stand for elections or serve as an officer in the Society. Associate Members pay $36.00 in dues.

Student Membership

Student membership is for full-time students enrolled in geology or an allied geoscience. Student Members are not entitled to vote, stand for elections or serve as an officer in the Society. Student Member dues are currently waived (free) but applications must be filled out to its entirety. Student applicants must provide University Dean or Advisor Name to be approved for membership.

Membership Benefits

Digital HGS Bulletin

The HGS Bulletin is a high-quality journal digitally published monthly by the HGS (with the exception of July and August). The journal provides feature articles, meeting abstracts, and information about upcoming and past events. As a member of the HGS, you'll receive a digital copy of the journal on the HGS website. Membership also comes with access to the online archives,with records dating back to 1958.

Discount prices for meetings and short courses

Throughout the year, the various committees of the HGS organize lunch/dinner meetings centered around technical topics of interest to the diverse membership of the organization. An average of 6 meetings a month is common for the HGS (with the exception of July and August). Short courses on a variety of topics are also planned throughout the year by the Continuing Education Committee. These meetings and courses are fantastic opportunities to keep up with technology, network, and expand your education beyond your own specialty. Prices for these events fluctuate depending on the venue and type of event; however, with membership in the HGS you ensure you will always have the opportunity to get the lowest registration fee available.

Networking

The HGS is a dynamic organization, with a membership diverse in experience, education, and career specialties. As the largest local geological society, the HGS offers unprecedented opportunities to network and grow within the Gulf Coast geological community.

Please fill out this application in its entirety to expedite the approval process to become an Active/Associate member of Houston Geological Society.

Full Name _____ Type *(Choose one)*: Active Associate Student

Current Email *(for digital Bulletin & email newsletter)*_____

Phone _____

Preferred Address for HGS mail_____

This is my home address _____ business address _____

Employer *(required)*_____ Job Title *(required)*_____ Will you volunteer? ____ (Y/N) Committee choice: _____

Annual dues Active & Assoc. for the one year *(July 1st-June 30th)* **$36.00**_____

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To the Executive Board: I hereby apply for membership in the Houston Geological Society and pledge to abide by its Constitution & Bylaws.

Company*(required, mark 'in transition' if unemployed)*_____

Company Address _____

City *(Work)* _____ **State** *(Work)* _____ **Postal Code** *(Work)* _____

School *(required)*_____

Major *(required)*_____ **Degree** *(required)*_____

Year Graduated _____

School *(optional)*_____

Major *(optional)*_____ **Degree** *(optional)*_____

Year Graduated _____

Years Work Experience *(required)*_____

Please submit a brief statement regarding your work experience in the practice or application of earth science or an allied science.

AAPG Member Number _____ OR

HGS Sponsor's Name _____

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