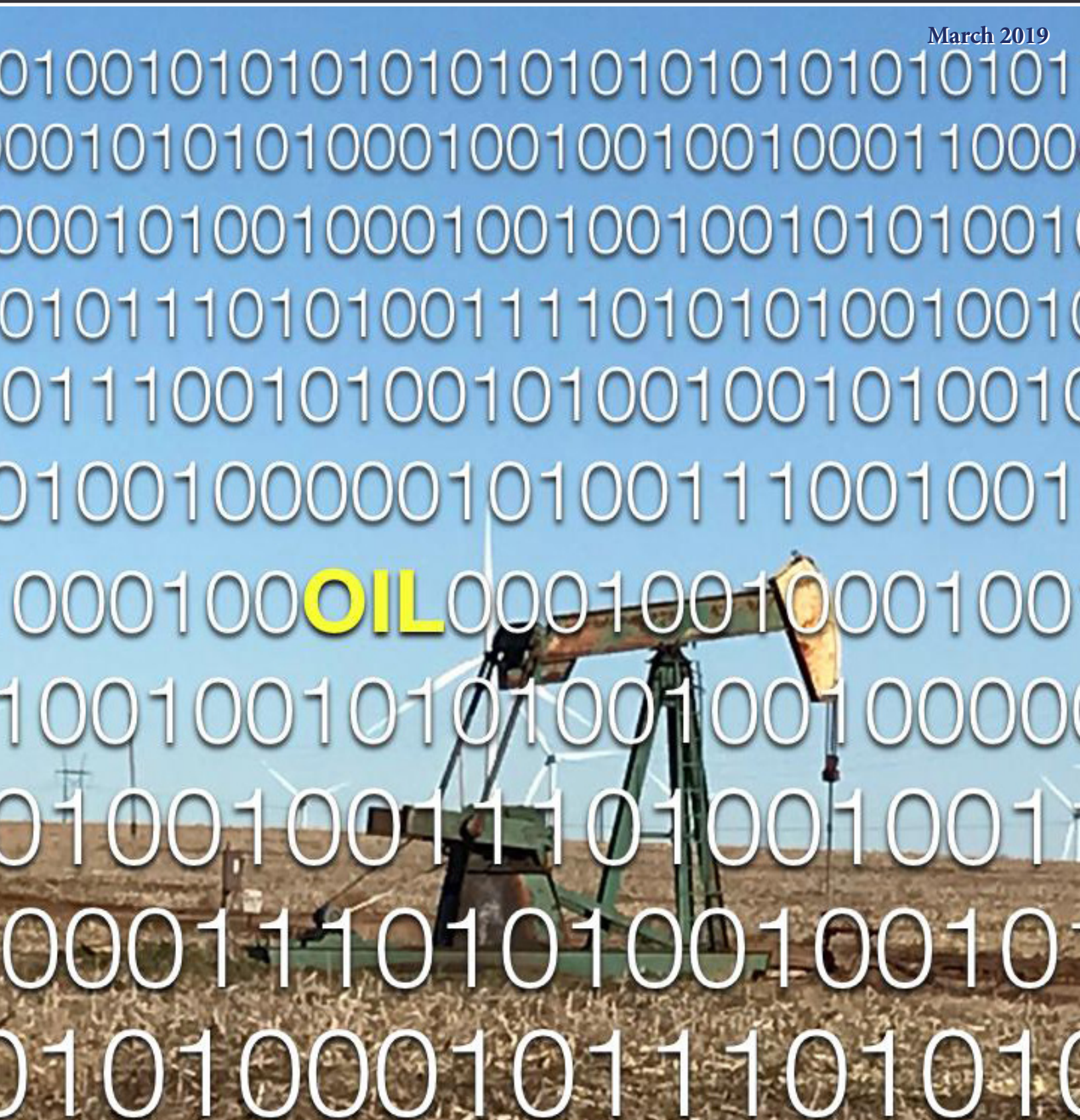
HGS Bulletin
Houston Geological Society
Volume 61, Number 7
March 2019



The Bulletin
Houston Geological Society

Volume 61, Number 7 — March 2019

In Every Issue

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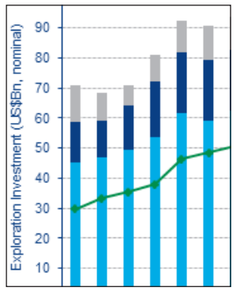

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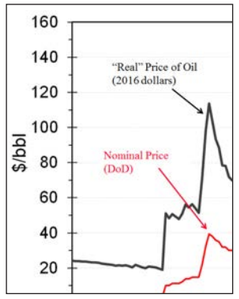

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About the Cover: Digital Oil. *Image courtesy of Wayne Camp*

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HGS Shrimp Peel & Crawfish Boil

Friday April 26, 2019
12:00 noon – 6:00pm

Bear Creek Pioneers Park, 3535 War Memorial Street, Houston, TX 77084
(Pavilion #6 is located off Bear Creek Drive)

- **Boiled Shrimp – Boiled Crawfish (Corn & Potatoes)**
- **Beer & Beverage – Live Music**

Ticket Cost

- **HGS Member pre-order $30**
- **Non-member pre-order $35**
- **Walk ups (if available) $45**

Register online at WWW.HGS.org
www.hgs.org/shrimp_peel_2019

- **Sponsorship Opportunities**

Shrimp Sponsor $2000.00 - 6 Complimentary event tickets
Crawfish Sponsor $2000.00 - 6 Complimentary event tickets
Beer & Beverage Sponsor $1000.00 - 4 Complimentary event tickets
Live Music Sponsor $1000.00 - 4 Complimentary event tickets
Platinum Corporate Sponsor $1000.00 – 4 Complimentary tickets
Gold Corporate Sponsor $750.00 - 2 Complementary ticket
Silver Corporate Sponsor $500.00 - 1 Complementary ticket
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To be a Sponsor please call Andrea Peoples at the HGS Office
713-463-9476 or email andrea@hgs.org

Cheryl Desforges
President@HGS.org

Alternative Universes

I attended the DUG Haynesville Conference in Shreveport last week on February 20. It was an upbeat conference highlighting the second act of the Haynesville play starting after the recent downturn. The play has come back with better production than before due to producers iteratively trying new innovations and changing one variable at a time to increase production. They have tried different lateral lengths, frac pounds, number of stages, proppant type, and choke management to get the best combination. I'm sure innovations in geological analysis are being done too, but the conference didn't really address those. Sometimes downturns have beneficial aspects, because they allow the time and motivation to do better evaluations and to just think. After all, 'necessity is the mother of invention'. The one very clear message for the future was that the major producers are looking to the gas-rich Haynesville as a major supplier of product for the LNG export facilities being built on the Gulf Coast. The capacity of the existing robust pipeline infrastructure is already being increased by adding larger diameter pipes, as well as new pipelines. The Haynesville will be one of the major U. S. areas supplying the world with energy.

The Oil and Gas Industry is doing its job by stepping up in a capitalist free-market system to provide the energy modern civilization needs to function and grow. "Total energy usage is predicted to rise between 25% and 35% by 2040 due to increasing population and higher global GDP." At the moment "80% of the energy we use globally is sourced from hydrocarbons (oil, natural gas and coal), and 20% comes from renewables and nuclear." Natural gas is the low carbon, environmentally sustainable energy bridge until economically competitive renewable technology can be developed for carbon free energy. But renewable energy is still not competitive with hydrocarbon. "A study by the University of Texas projected that U.S. energy subsidies per megawatt hour in 2019 would be $0.5 for coal, $1- $2 for oil and natural gas, $15- $57 for wind and $43- $320 for solar. Many of the renewable energy subsidies come in the form of a Production Tax Credit (PTC) of 2.3 cents per kilowatt hour. Wholesale prices for electricity in 2017 were between approximately 2.9 cents to 5.6 cents per kilowatt hour. Therefore, the wind production tax credit covers 30% to 60% of wholesale electricity prices." (quotes in this paragraph from Bill Maloney, March 23, 2018, Renewable Energy Subsidies –Yes Or No?: Forbes)

However, as I drove back to Houston after hearing the Haynesville message during the day, I began to wonder if I had gone through a worm hole to an alternative universe. The program on the radio was an in-depth discussion of the Rep. Alexandria Ocasio-Cortez's Green New Deal. It was surreal.

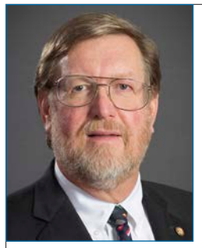
The Green New Deal is a manifesto calling for sweeping changes to American society as it implements eco-socialism. Key goals include cutting greenhouse-gas emissions to net zero over 10 years and guaranteeing jobs for all. The Petroleum Industry would be destroyed, much as President Obama destroyed the Coal Industry.

As Alex Hill said in The Hill (1/31/2019), "In short, the Green New Deal would be a deficit financed expansion of federal bureaucratic power to dictate investment decisions in one of the most dynamic sectors of the economy. Responding to the threat of climate change by growing the government and further centralizing energy market decisions puts at risk the free market economy that our nation has relied on for economic growth for more than two centuries."

From the President *continued on page 9*

Nomination for HGS Teacher of the Year Award is Open

The HGS Teacher of the Year has been established to honor individuals whose extraordinary efforts or unique contributions are in earth science education. The selected Teacher is given a $500 cash award along with a plaque presented at a HGS Event. The HGS Teacher of the Year will be encouraged to apply to the GCAGS and AAPG Teacher of the Year Programs which offer greater cash bonuses ($1500 and $5000 respectfully). Application materials can be acquired by e-mailing the Awards Chairperson and should be mailed/e-mailed to the HGS Office by April 1. Materials should sent to Attn: Awards Chairman, 14811 St. Mary's Lane, Suite 250, Houston, Texas 77079-2916. Questions can be sent to Mike Deming HGS Awards Chairperson at mike.deming.HGS@gmail.com.



Jim Tucker
editor.hgs@hgs.org

Find Your Passion, Find Your Niche

The above words were spoken by Bobby Ryan at the recent HGS Scholarship Night, during his presentation and discussion with Cindy Yeilding. I encourage you to listen to it if you were not there, on the HGS YouTube channel (https://www.youtube.com/channel/UC4E1jMy025zyFJ2ZxPEv0Ug). They discussed their careers and experiences, and provided quite a bit of advice to early-career geoscientists. I thought the talks and the questions and answers afterward were inspirational for early-career colleagues and stimulating for the rest of us. Look for a summary article in coming months.

March is another busy month, starting with the Applied Geoscience Conference at Anadarko's offices in the Woodlands on 5-6 March, recognized in our cover illustration. We hear a lot about data analytics these days, and the information during these two days should help sort out what it is all about and where it is useful in our jobs. And students will be presenting posters on this coming field.

March is a busy month at the local university geoscience departments. The University of Houston Department of Earth and Atmospheric Sciences will be holding their annual public day session on 20 March, with lots student posters for discussion in the afternoon, and the Dobrin Lecture in the evening (looks like a good one). This is always a stimulating event, and look for more information in this Bulletin issue. The following two days, the Rice University Earth, Environmental and Planetary Sciences Department will be hosting its annual Industry-Rice Earth Science Symposium (IRESS) over 21-22 March. In addition to the technical presentations on the theme Minerals and Energy: Science, Economics and Policy, there will be lots of student posters and a dinner presentation on what we learn from exploring other planets. Look for more information elsewhere in this Bulletin.

The awards for volunteers who have contributed to HGS success through the past years during their careers are awarded annually in June at the President's Dinner. With so many Members, it is important that we gather recommendations from everyone in the HGS. Awards Chair Mike Deming has an article reviewing the awards in this issue, so please give this important recognition opportunity some thought, and send nominations to Mike or to HGS.

My apologies for the delay in getting this issue to you this month. Our brilliant graphics consultant, Lisa Krueger, has been in the hospital recently, and should be out soon. You see her excellent eye in the layout and composition of the Bulletin every month, so our thoughts are with her.

Volunteer for something this month. ■

Lessons from a Career

My Most Memorable Mentor

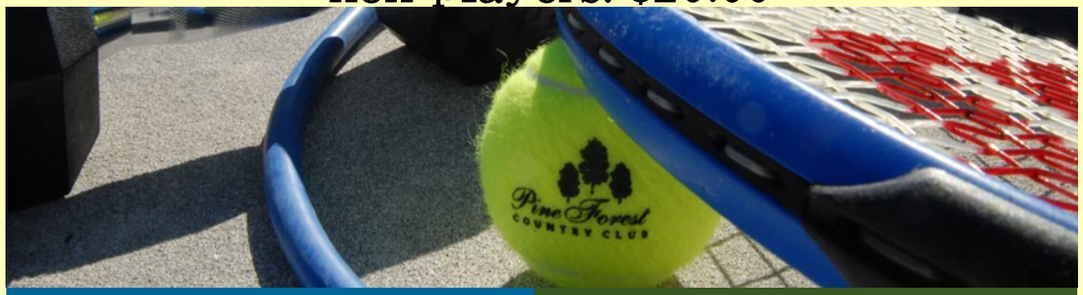
By Deane Foss

Paul Lamerson, Chevron geologist, was my first mentor when I showed up for work in Chevron's Thrust Belt District in Denver in 1978. This wasn't just any group I was joining. The then-current group, with no notable recent departees, were, along with Amoco and American Quasar, responsible for one of the most successful oil and gas plays in the USA in the mid- to late 1970s. Paul was always busy. Frank Royse, his boss, needed him for prospect presentations, well planning, well drilling, well results, land deal evaluation;you name it, Paul was the *go-to guy*.

He had files of all the significant wells in the Fossil Basin portion of the Thrust Belt, made and kept a set of balanced cross sections up to date, did field work in Idaho in the summertime, and worked on a PhD during lunch. And yet had time, seemed like, always had time, to answer my "neophyte" questions. Mentors are important in all stages of a career in any industry. To this day, I still like my vacations a little more when a thrust belt is underlying the glorious scenery. Thanks, Paul. ■

2019 HGS Tennis Tournament

players: $50.00
non-players: $20.00



Saturday, April 27, 2019
8:00 am - 12:00 pm
Pine Forest Country Club
18003 Clay Rd.
Houston, Texas, 77084

Sponsorship Opportunities:
The Big Four: $1,000.00
GOAT: $700.00
Grand Slam: $500.00
ATP World Tour Finals: $300.00

For more information visit www.hgs.org/events

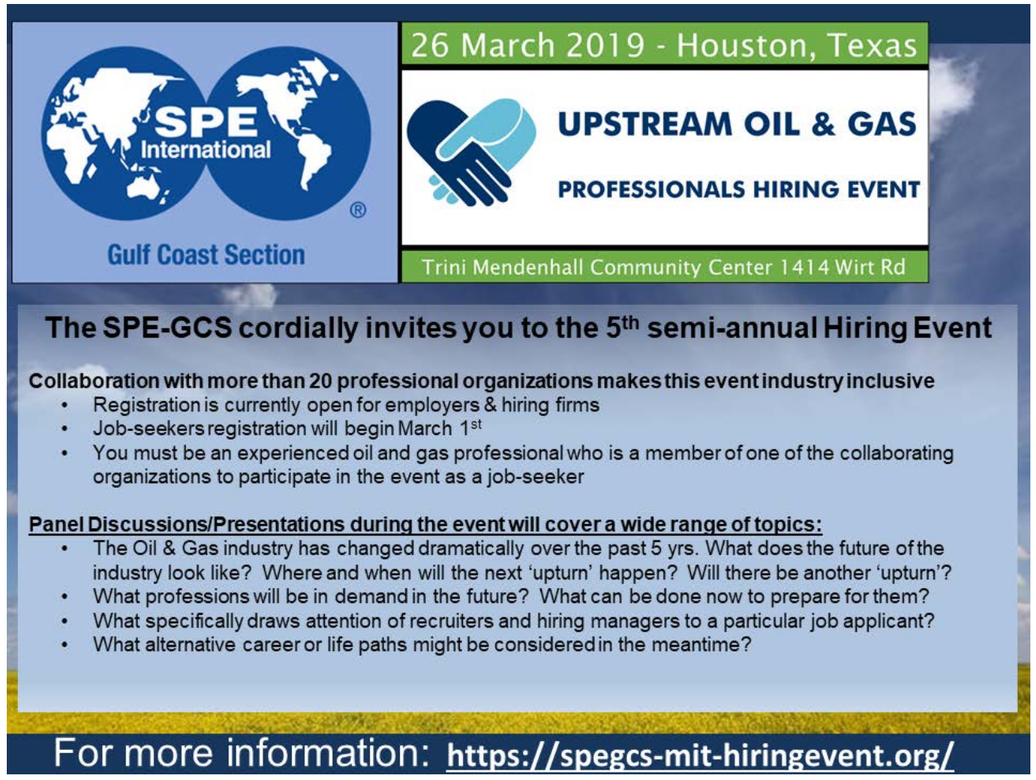
From the President *continued from page 5*

The cost of the proposed plan would be tremendous. Bloomberg (2/25/2019) reports that American Action Forum, which is run by Douglas Holtz-Eakin, who directed the non-partisan CBO from 2003 to 2005 estimates "The so-called Green New Deal may tally between **$51 trillion and $93 trillion over 10-years**". "That includes between $8.3 trillion and $12.3 trillion to meet the plan's call to eliminate carbon emissions from the power and transportation sectors and between $42.8 trillion and $80.6 trillion for its economic agenda including providing jobs and health care for all." The group said in its analysis. "It's further expansion of the federal government's role in some of the most basic decisions of daily life, however, would likely have a more lasting and damaging impact than its enormous price tag."

So how did we get to the point where the use of hydrocarbons for energy is the driver for pushing us into socialism and autocratic control over all aspects of our lives?

Coincidentally, in the February 27 General Lunch meeting Dr. Rusty Riese answers this question in a succinct presentation, ***"Geologists, the Public, and Public Policy: What Are Our Ethical Responsibilities?"***. I recommend everyone look at and share Rusty's presentation, which is annotated with the text of his talk. The PowerPoint is available from the HGS Home page and the recording will also be on the HGS YouTube Channel. As Rusty pointed out, this dilemma we find ourselves in has been decades in the making, analogous to slowly boiling a frog. It started with the progressive destruction of our education system since 1965, accelerated by unethical scientists falsifying data and a growing ignorant population. It seems overwhelming and irreversible. However, as Rusty pointed out, the only hope of reversing the situation is to have many voices speaking out to point out the truth. What better people than geologists to be the evangelists of the climate change truth. We know it better than any other discipline.

Most reasonable people say The Green New Deal will never happen. But I say we should not underestimate the destructive power of a government populated by ignorant people with power. Look at Venezuela for a recent example.



Monday, March 4, 2019
Live Oak Room • Norris Conference Center • 816 Town and Country Blvd #210
Social Hour 5:30–6:30 p.m.
Dinner 6:30–7:30 p.m.

Cost: $40 Preregistered members; $45 non-members/walk-ups

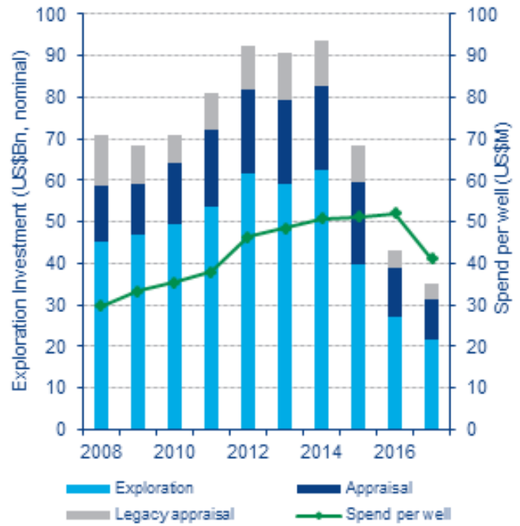
To guarantee a seat, pre-register on the HGS website & pre-pay by credit card.
Pre-registration without payment will not be accepted.
Walk-ups may pay at the door if extra seats are available.

If you are an Active or Associate Member who is unemployed and would like to attend this meeting, please call the HGS office for a discounted registration cost. We are also seeking members to volunteer at the registration desk for this and other events.

Julie Wilson
Wood Mackenzie

Conventional Exploration: Is It Good Business?

Exploration spending ballooned during the boom years of 2008-2014, reaching a peak of $95 billion globally. Discovered petroleum volumes reached an impressive 38 billion BOE in 2010, further fuelling the desire of oil and gas companies to explore. Flush with cash as oil prices climbed ever higher, the industry drilled close to 2,000 exploration and appraisal wells every year during 2008-2014. Then came the crash. Budgets and staff were slashed; discovered volumes plummeted. Exploration spending has remained at around one-third of the peak, but the sector is healthier and creating more value than at any time during the last decade. Even before the crash, full-cycle returns were in the single digits, but better decisions are bringing value back to the sector. And it's not timid, near-field exploration that has driven the recovery, but bold wildcatting.



Source: Wood Mackenzie

In this talk, Julie will outline the problems that beset conventional exploration during the boom, leading some to exit. She will highlight why exploration continues to be important, where explorers have been successful, and what companies are doing to make it good business. ■

Biographical Sketch

Julie Wilson is a Director of Exploration Research and has covered global conventional exploration since 2011, analysing the business of exploration. Julie has worked at Wood Mackenzie for 19 years in various roles in both the upstream consulting and research divisions. She moved to Houston from the U.K. in November 2000, and helped to build the local upstream consulting practice. She later built and managed the Houston-based team focusing on the deepwater U.S. Gulf of Mexico before switching focus to global exploration.

Prior to joining Wood Mackenzie, Julie worked in BP's upstream business for eight years in London and Aberdeen in a variety of political, commercial, and financial analysis roles.

Julie graduated from Heriot-Watt University in Edinburgh and from the University of Strathclyde in Glasgow, Scotland.

Wednesday, March 13, 2019

Black Lab Pub, Churchill Room • 4100 Montrose Blvd.
Social Hour 5:30–6:30 p.m.
Dinner 6:30–7:30 p.m.

Cost: $30 Preregistered members; $35 non-members/walk-ups

To guarantee a seat, pre-register on the HGS website & pre-pay by credit card.
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Alison Steele
Consultant

Professional Ethics in Client Interactions: Special Interpersonal Challenges for Environmental Consultants

Environmental consultants routinely engage in professional collaborations that have the potential to violate ethical, interpersonal, and legal boundaries if not properly managed. Consultants don't just manage projects – we manage people, often while environmental regulators and other stakeholders are simultaneously doing the same. Client employees can become acutely stressed by punitive regulatory enforcement, business financial losses, and job performance perceptions. Such personnel may act in ways that can both sabotage the consulting service, and jeopardize the consultant's integrity. By recognizing common warning signs and behavioral patterns, consultants can act preemptively to protect themselves, their work product, and their clients' interests. It is especially important that the boundary between technical services and legal services be recognized and respected, and this presentation will explore that distinction in detail.

Biographical Sketch

Alison Steele received a Bachelor of Science degree in Geology from Acadia University in Nova Scotia Canada, and a Master's in Geochemistry from Washington University in St. Louis. She has 26 years of experience in environmental regulatory affairs, and has owned and operated her own consulting firm for 12 years.

Volunteer Day at YMCA Camp Cullen

By John Adamick, photos by Mile Allison

On Saturday 16 February, HGS volunteers convened at the YMCA Camp Cullen to continue the projects for the youth camp development. Past efforts have focused on the geological quarry exhibit, and this time the group focused on construction of the "mining camp" youth activity area. Work focused on "Prospectors' Hill" where kids pan for pyrite "gold", finished work on the "General Store", and began to erect the "Bank" structure. The planned activity is having the kids go to the store to get their supplies (gold pans and such), pan in gravel, and then pan for gold and take it to the bank for prizes.

The volunteers got a lot of satisfaction for helping out, and the YMCA staff fed them and took them to tour of the quarry geology exhibit site constructed earlier with HGS help, and the onsite geology lab. There are a number of geology-themed projects for the future, and interested HGS Members and others can contact jadamick@stauroliteconsulting.com to be notified of future HGS Volunteer Days. ■

Tuesday, March 19, 2019

Southwestern Energy Conference Center, 10000 Energy Drive, Spring, TX 77389
Social 11:15 a.m., Luncheon 11:30 a.m.

Cost: $35 Preregistered members; $40 non-members/walk-ups

To guarantee a seat, pre-register on the HGS website & pre-pay by credit card.
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Applying New Technologies to Old Areas: Relative Geologic Time, Wheeler Diagrams and Near Field Exploration in Faulted Plays

Steve Tobias
NearFX LLC

Large 3D seismic volumes cost tens of millions of dollars to acquire, millions to process and hundreds of thousands or more to interpret. And yet more often than not, only a small percentage of seismic reflections are mapped out, typically top/ base of key reservoirs and seals, flooding surfaces and sequence boundaries. It seems intuitively obvious that a lot of useful information is being left behind, and yet what to do? Picking every horizon would be as de-focusing as it would be time consuming. And anyway, what would it give you?

This presentation explores this intriguing topic by examining an integrated data set offshore Louisiana. Using new technologies, every peak and trough in a 3D volume can now be rapidly converted into thousands of small "mini-maps" which are then weaved into a highly detailed volume by an interpreter. Because these many thousands of surfaces are chronostratigraphic, it becomes possible for the first time to assign a Relative Geologic Time (RGT) to each one of them using quite clever software (several excellent vendors offer RGT capability – here we use Paleoscan by Eliis). This allows the ready transformation of these richly detailed seismic volumes from a form familiar to workstation users (the vertical axis being depth or two-way-time) into something totally unique: a vertical RGT axis. This transformation yields the 21st century version of the venerable Wheeler diagram, but with exquisite 3D detail instead of a cartoon-like representation. This transform should be every bit as important to a seismic interpreter as a Fourier or Wavelet Transform is to a geophysicist. Yet because of its newness, the application of Wheeler Transforms to interpretation methodology is in its infancy.

With the help of:1) the Wheeler Transform, 2) viewing in different azimuths, 3) integrating and propagating well logs and paleo tops, 4) studying the "instantaneous" accommodation space of each sequence, and 5) the construction of key seismic attributes and animation techniques, the weaved RGT volume can be sectioned into properly defined stratigraphic sequences. Only then can stratigraphic exploration proceed in a systematic way while fully integrating all the 3D seismic data.

What is perhaps just as interesting for teams working the Gulf of Mexico is that this approach provides an important new seismic stratigraphy tool for those exploring in faulted environments. Many must have noticed that the eustatic signatures so helpful to international seismic stratigraphers (such as onlap, downlap, etc.) are mostly missing in and around expansion faults. The reason for this is that the various onlaps terminate against fault planes instead of underlying strata. The eustatic signatures are there, but manifest in a different dimension. Only through the study of expansion profiles can these signatures be recovered and various systems tracts better described. As will be discussed, the study of expansion profiles dovetails quite well with RGT analyses. Another important part of this workflow that will be discussed is the need to initially decouple structural from stratigraphic analysis, and then recouple them again within the geomodel, followed by the propagation of various calibrated properties throughout the model.

Taken together, these new technologies hold the promise to rejuvenate "Near-Field" stratigraphic exploration in old areas. ■

Biographical Sketch

Steve Tobias holds degrees in geology and geophysics and has had a long career in both New Ventures and Near Field Exploration. He started with Mobil, and later worked with Tenneco in Colombia and BHP Petroleum in Australia. He was Pogo Producing's first international exploration manager during the time that they drilled up the highly prolific Gulf of Thailand. Steve led an international consulting group for seven years, and then co-founded South Bay Resources in 2003. It was extremely successful in using neural networks in the exploration of onshore Texas and Alberta, until it wasn't. Steve then joined Hess where he served in various roles, including Manager of Exploration Excellence and Denmark Exploration manager for three years. For the past year, Steve has provided exploration services for a variety of clients in the GOM and the North Sea. His current area of focus is offshore Gulf of Mexico on the outer shelf and deep water, with emphasis on subsalt plays. Steve also consults in the use of Paleoscan workflows.

Monday, March 25, 2019

Live Oak Room • Norris Conference Center • 816 Town and Country Blvd #210
Social Hour 5:30–6:30 p.m.
Dinner 6:30–7:30 p.m.

Cost: $40 Preregistered members; $45 non-members/walk-ups

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

If you are an Active or Associate Member who is unemployed and would like to attend this meeting, please call the HGS office for a discounted registration cost. We are also seeking members to volunteer at the registration desk for this and other events.

HGS North American Dinner Meeting

Beth Everage
Consumer Energy Alliance

The Politics of U.S. Energy Production

The development and production of oil and gas in the U.S. is regulated under a complex set of federal, state, and local laws that address every aspect of exploration and operation. The U.S. Environmental Protection Agency administers most of the federal laws focusing on standards for drinking water and quality. Resource development on federally-owned lands and waters is managed primarily by the U.S. Department of the Interior via the Bureau of Land Management and the Bureau of Ocean Energy Management. State regulations have been at the forefront of oil and gas exploration since the 1930s. These regulatory programs, which are as varied as the geography, geology, ecosystems, and social fabric of the U.S., are intended to be flexible, yet effective, in providing environmental protection and regulation. Local control over oil and gas is limited to zoning issues such as project locations, noise and traffic.

Although regulation of oil and gas operations has existed for more than 100 years, the debate surrounding access America's fossil fuel resources has become increasingly polarized over the past decade. Federal and state decision makers are facing greater pressure from vocal anti-energy organizations to create regulations that will curtail future oil and gas exploration.

This presentation will address the landscape for energy policy in the U.S., including state and federal elections, regulatory reform and roadblocks to domestic energy production. ■

Biographical Sketch

Beth Everage is a Senior Policy Director at Consumer Energy Alliance where she consults with clients from the energy and transportation sectors on regulatory affairs, stakeholder relations, and communications. Beth has eight years of experience as Manager, Energy & Environmental Policy at the Greater Houston Partnership where she led advocacy and education efforts aimed at communicating complex energy and environmental issues to a broad range of stakeholders in order to build industry partnerships and coalitions with regional entities. Beth's prior professional experience includes conducting environmental impact studies and air quality analyses for highway projects and management of a successful grant program aimed at regional mobile source emission reductions. Beth has a BS in Bioenvironmental Sciences and an MAg in Natural Resources Development from Texas A&M University

Wednesday, March 27, 2019

Petroleum Club of Houston • 1201 Louisiana (Total Building)
Social Hour 11:15 a.m.
Luncheon 11:45 a.m.

Cost: $35 Preregistered members; $40 non-members/walk-ups

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

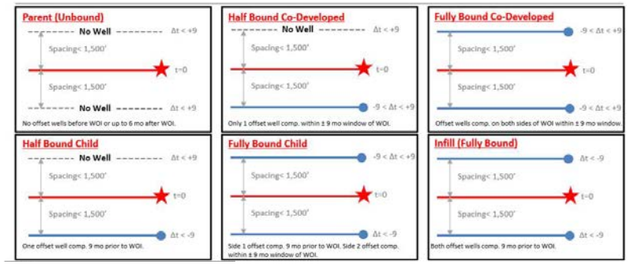
If you are an Active or Associate Member who is unemployed and would like to attend this meeting, please call the HGS office for a discounted registration cost. We are also seeking members to volunteer at the registration desk for this and other events.

HGS General Luncheon Meeting

Stan S. Valdez, P.E.
VSO Petroleum Consultants, Inc.

Engineering Perspective of the Oil Industry – What is the Correct Inter-well Spacing?

A recent (January 2, 2019) Wall Street Journal article entitled *"Fracking's Secret Problem—Oil Wells Aren't Producing as Much as Forecast"* has made statements and conclusions that have stoked the concerns of oil and gas investors related to potentially systemic over-optimistic reporting of oil and gas reserves and economic returns associated with horizontal drilling inventories in unconventional resource plays.



The article provides fodder for the debate of numerous topics that will not be addressed herein, however, with regard to the impacts of well spacing on a well's ultimate recovery, the article states the following:

> *"EUR estimates from many companies were grounded on two assumptions: that they could pack wells closer together, squeezing more value from the land they leased, and that they could replicate their best early wells. The results to date suggest those assumptions were often wrong."*

As resource plays mature, the remaining wells will necessarily have closer inter-well spacings and will contend with depleted regions around existing older wells. The purpose of this talk is to discuss the following topics related to well spacing:

1. **Discussion of induced fracture geometry and stimulated rock volume ("SRV")** Numerous technical papers have been submitted that discuss the geometry of induced fractures, the rock mechanics that drive certain geometries, and how the SRV will ultimately drive drainage patterns within the reservoir. The key findings of these papers will be summarized and reviewed in light of what geologic factors provide the largest impact to SRV for a given stimulation.
2. **Provide well spacing framework for type well analysis in unconventional plays that could help reserves estimators achieve more consistent forecasts with higher certainty** The following illustration summarizes a framework for classifying existing and future wells in terms of relative distance and timing from other wells. This proposed framework can be used to more rigorously choose analogous wells for the purpose of building "Type Curves" that better represent future performance:
3. **Review the impacts of inter-well spacing on individual well performance using a Williston Basin case study**; The above framework was applied to certain wells located within the Williston Basin to provide an example of how the framework should be applied as well as to observe the well performance of each of the six classifications shown above.
4. **Discuss the economic optimization of well spacing** – Optimum spacing is really an economic question, and largely is derived by the objectives and outlook of individuals or companies. The optimum spacing may differ if one's objective is to maximize single-well rate-of-return rather than total present value. Additionally, one's outlook on commodity price may also drive spacing optimization decisions. We will review various illustrative economics based upon the Williston Basin case study to observe the impacts of various drivers on optimum well spacing. ■

Biographical Sketch

Mr. Valdez is a Petroleum Engineer with 22 years of diversified industry experience. Mr. Valdez is currently the President of VSO Petroleum Consultants, Inc. and provides property evaluations, drilling prospect evaluation and field and play studies for numerous oil and gas investors. Mr. Valdez is a 1996 graduate of Texas A&M University with a BS degree in Petroleum Engineering and is a Registered Professional Engineer.

Searching for Past HGS Publications

We are trying to compile a complete listing of HGS publications over the years, and include those we have not yet captured into the Datapages online database. For those not familiar with Datapages, it is an online database of images of worldwide geoscience publications, operated by the AAPG. Currently all the legacy HGS Bulletins are included, as well as the special publications listed below. The HGS benefits significantly from sales of these online publications.

So, we are looking for both references to, and copies of, any HGS publications we have not yet located. The floods of recent years have destroyed many of our stored publications we would have otherwise available.

If you are sorting out your library, or have digital copies of any recent HGS publications, please send this information to: editor.hgs@hgs.org. Many thanks. ■

HGS Special Publications Available on Datapages Archive Online Database

Disappointing Seismic Anomalies: Dry Hole Symposium #2, 2003

Deepwater Gulf of Mexico Dry Hole Seminar, 2000

Countdown to the 21st Century Houston Geological Society Technical Symposium, March 31, 1998

Environmental Geology and Genetic Sequence Analysis of the Trinity River Valley-Delta Region, Chambers and Liberty Counties, Texas, 1990

The Downdip Yegua: State of the Trend, 1989

Typical Oil and Gas Fields of Southeast Texas - Vol. 2, 1987

Field Seminar of the Big Bend, Trans-Pecos Region, Texas, 1986

Finding Deep Sands in the Gulf Coast Tertiary, 1984

Houston Area Environmental Geology: Surface Faulting, Ground Subsidence, Hazard Liability, 1981

Claiborne Sediments of the Brazos Valley, Southeast Texas, 1979

Lignite Resources in East-Central Texas, 1979

Oil Fields and Their Relation to Subsidence and Active Surface Faulting in the Houston Area, 1979

Stratigraphic Cross Sections of Southeast Texas, 1979

Damon Mound: Field Trip Guidebook, 1978

The Chenier Plain and Modern Coastal Environments, Southwestern Louisiana and Geomorphology of the Pleistocene Beaumont Trinity River Delta Plain, 1978

Geology of Alternate Energy Resources in the South-Central United States, 1977

Deltas: Models for Exploration, 1975

Structure, Stratigraphy and Petroleum Potential of the Northern Gulf of Mexico, 1974

Abnormal Subsurface Pressure: A Study Group Report, 1969-1971, 1971

Deltas of the World, Modern and Ancient: Bibliography, 1971

Holocene Geology of the Galveston Bay Area, 1969

Environments of Deposition, Wilcox Group: Field Trip Guidebook, Texas Gulf Coast, 1968

Deltas in Their Geologic Framework, 1966

Guidebook to the Geology of El Rancho Cima, Hays and Comal Counties, Texas: A Guidebook for Boy Scouts, 1963

Geology of the Gulf Coast and Central Texas, and Guidebook of Excursions, 1962

Typical Oil and Gas Fields of Southeast Texas, 1962

Geology of Houston and Vicinity, Texas, 1961

Jackson Group, Catahoula and Oakville Formations and Associated Structures of Northern Grimes County, Texas, 1960

Lower Tertiary and Upper Cretaceous of Brazos River Valley, Texas, 1959

The Frio Formation of the Upper Gulf Coast of Texas: Study Group Report, 1959

Upper and Middle Tertiary of Brazos River Valley, Texas, 1958

Stratigraphy of the Upper Gulf Coast of Texas, and Strike and Dip Cross Sections, Upper Gulf Coast of Texas, 1954

Boling Field, Fort Bend and Wharton Counties, Texas, 1953

Guidebook, Field Trip Routes, Oil Fields, Geology, 1953

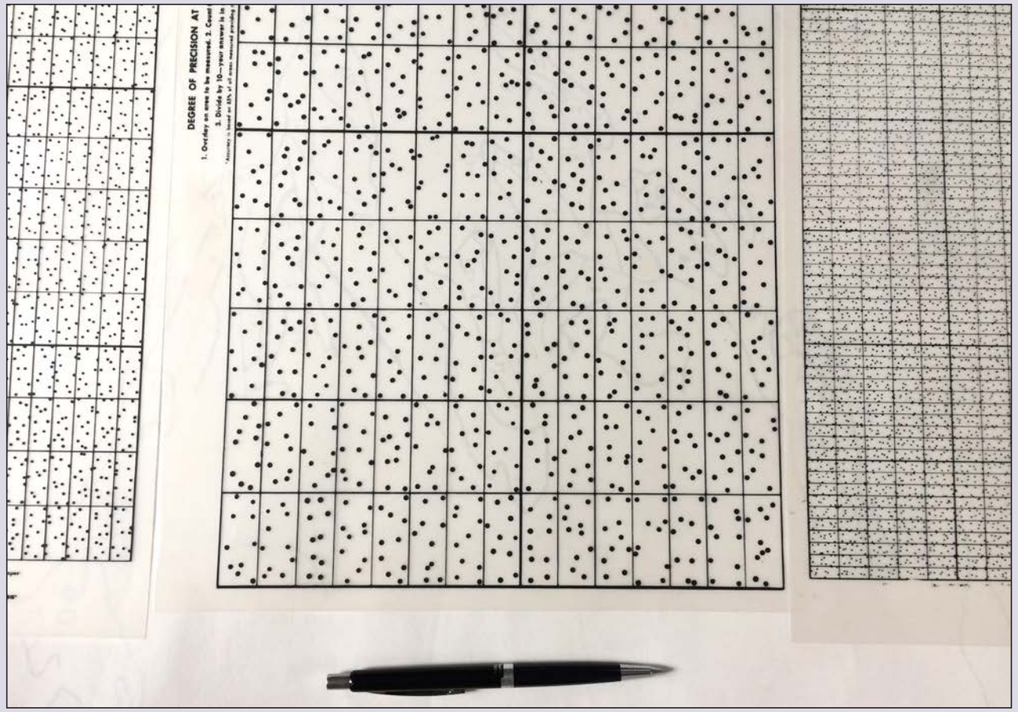
Composite Study Group Papers, Texas Gulf Coast, 1946 [Report of] Well Logging, 1947

An Introduction to Gulf Coast Oil Fields, 1941

Guide for Field Trips: AAPG 26th Annual Meeting, 1941

Study of the Wilcox Group, Texas, Louisiana, Mississippi, Alabama, 1940

Early Career Quiz



This is a recollection of useful tools no longer in common use. It is encouraged to ask a colleague to talk about this.

The winner of a HGS meeting registration is the first respondent to editor.hgs@hgs.org that:

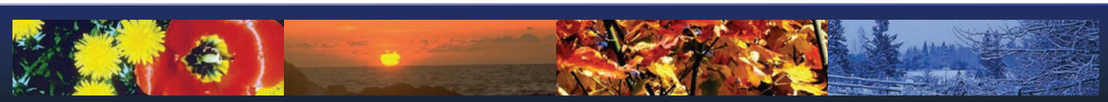
1. Correctly names the items in the picture,

2. Explains their use, and

3. Has worked the fewest number of years and months as a professional geoscientist.

Send your answers to: editor.hgs@hgs.org. (It's not the pencil!) Have fun.

March 2019



GeoEvents

Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday

Members Pre-registered Prices:

Dinner Meetings members	$40
Emeritus/Honorary members	$40
Student members	$10
Nonmembers & walk-ups	$45
Except - Env. & Eng.	$30
Nonmembers & walk-ups	$35
Emeritus/Honorary members	$15

Reservations:
The HGS prefers that you make your reservations on-line through the HGS website at www.hgs.org. If you have no Internet access, you can e-mail 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, check with the Webmaster@hgs.org. Once the meals are ordered and name tags and lists are prepared, no more reservations can be added even if they are sent. **No-shows will be billed.**

1 Don't wait, make your reservations online at hgs.org

2

3

4
HGS General Dinner Meeting
"Conventional Exploration: Is It Good Business?" Julie Wilson Page 11

5
2019 Applied Geoscience Conference Subsurface Intelligence and Analytics
Anadarko Petroleum Allison Tower, The Woodlands

6

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12

13
HGS Environmental & Engineering Dinner Meeting
"Professional Ethics in Client Interactions: Special Interpersonal Challenges for Environmental Consultants," Alison Steele, Page 13

14

15

16

17

18

19 *Note: 3 Events for the 19th*
HGS Board Meeting
6 p.m.

19
HGS Northsiders Luncheon Meeting
"Applying New Technologies to Old Areas: Relative Geologic Time, Wheeler Diagrams and Near Field Exploration in Faulted Plays, Delaware Basin, Texas," Steve Tobias, Page 15

19
Norwegian Energy Day
"Energy and Digitalization- Reshaping the Industry," Page 52

20
Department of Earth and Atmospheric Sciences *Dobrin Lecture*
"Super Resolution Imaging: From Subsurface Fracture Detection to Cancer Identification" Lianjie Huang, Ph.D., Page 37

21
Industry-Rice Earth Science Symposia
Minerals and Energy: Science, Economics and Policy page 36

22

23

24

25
HGS North American Dinner Meeting
"The Politics of U.S. Energy Production," Beth Everage, Page 16

27
HGS General Luncheon Meeting
"Engineering Perspective of the Oil Industry – What is the Correct Inter-well Spacing??" Stan S. Valdez, Page 17

28

29

30

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March 5 – 6, 2019
HGS Applied Geoscience Conference
Subsurface Intelligence and Analytics,

March 23 – 29, 2019
Explore the Solitario Flatirons with HGS Fieldtrip
Big Bend Ranch State Park

April 12 – 14, 2019
Take a Kid to the Outcrop Family Campout
YMCA Camp Cullen, Trinity, TX, page 6

April 26, 2019
HGS Shrimp and Crawfish Boil
Bear Creek Pioneers Park, Page 4

April 27, 2019
HGS Tennis Tournament
Pine Forest Country Club, Page 8

May 19 – 22, 2019
AAPG 2019 Annual Convention & Exhibition
San Antonio, Texas, USA

June 8, 2019
HGS Skeet Shoot
Greater Houston Gun Club Page 32

July 22 – 24, 2019
Unconventional Resources Technology Conference (URTeC 2019)
Denver, Colorado

October 23 – 25, 2019
GCAGS Annual Convention
Houston, TX

Candidates for the 2019–2020 Executive Board

Houston Geological Society Officer Election

The candidates put forth by the Nominations Committee are:

President - Elect: Sarah Gephart Stanley, James W. Tucker

Vice President: Bryan Guzman, Scott Sechrist

Secretary: J.Schulenberg, Tami Shannon

Treasurer-elect: Angela Hammond, Thomas Reed

Editor-elect: Ceri Davies

Directors (2 positions):
Wayne K. Camp, Bob Fryklund, Constantin Platon, Ryan E. Yarrington

HGS Election Voting Instructions

Members will be able to vote in one of two ways:

1. Return the paper ballot that will be delivered in the mail, *OR*
2. Vote online following instructions that will be delivered by e-mail.

PLEASE VOTE – Upon receiving the paper ballot or the e-mailed instructions!

The voting period opens April 10, 2019 and continues to May 10, 2019.

President-elect (two candidates)

Sarah Gephart Stanley

Education
Master of Science (MS), Geology
Ball State University, Muncie, IN
Master of Arts in Education (MA), Secondary Education, Biology, and General Science, Ball State University, Muncie, IN
Bachelor of Science (BS), Education, Biology and General Science major, Earth Science minor, Ball State University, Muncie, IN

Professional Experience
Geophysical Insights, Houston, TX
Senior Geoscientist and Lead Trainer, Since October, 2017 is has been my pleasure to contribute to the efforts of Geophysical Insights in the areas of curriculum development, attribute analysis, interpretation, and client support. In these capacities I have introduced fellow geoscientists to new methodologies in geophysical attribute analyses.

IHS Markit, Houston, TX
Senior Principal, Governance and Common Codes (2016 – 2017)
Selected by upper management to create team dedicated to standardizing IHS Energy input codes, sanitizing data inputs, quality control, data governance, and merging Canadian and US data into single database.
Director, US Operations Training and Certification for IHS Energy Technical Division (2011 – 2017)
Created and managed internal training and certification program that covered 150+ IHS applications for IHS Energy technical staff.
Director of Training, Seismic Micro Technology, Inc. (acquired by IHS MARKIT) (2002 – 2011)

Sarah Gephart Stanley *continued on page 28*

James W. Tucker

Education
Rice University, BA (Geology)
Texas A&M University, MS (Geology)

Professional Experience
Occam Resources (2012-present)
Consultant – Reservoir architecture, structural geology

ARAMCO (2002-2012)
Geologist-Eastern Province exploration, upstream geological research, weekly seminar coordinator, shallow drilling research project

Computational Geology (2000-2002)
Chief Geologist-Dipmeter and structural analysis, software support and special client projects

CGG Americas (1997-1999)
Integrated Studies Manager, General Manager Reservoir Services
Supervise reservoir study projects in Venezuela and Mexico, global interpretation client projects, software and services sales

Consultant (1996)
North African interpretation projects

AtlanticRichfieldCompany (1978-1995)
Geologist – Various exploration and development projects and interpretation in the US midcontinent and Gulf of Mexico, Celtic

James W. Tucker *continued on page 29*

Candidates for the 2019–2020 Executive Board *(continued)*

Vice President (two candidates)

Bryan Guzman

Education
2008 – BS Geology University of Texas at San Antonio
2018 – MS Analytics Texas A&M University

Professional Experience

2007 – 2008	Geo-Tech Balcones Energy Library
2008 – 2011	Geologist – Ingrain Inc.
2011 – 2013	Geoscientist – Ingrain Inc.
2014 – 2015	Product Champion – Drill Cutting Technologies – Ingrain Inc.
2015 – 2017	Senior Technical Sales Advisor – Ingrain a Halliburton Service.
2017 – 2018	Senior Technical Sales Advisor – Halliburton
2018 – Present	Senior Account Manager – TGS

Professional Affiliations
HGS, AAPG, SPE, SPWLA

Professional Activities

2011 – 2017	HGS Chairman Exhibits Committee 2013 – 2014
	HGS Secretary
2015 – 2016	HGS Treasurer Elect
2016 – 2017	HGS Treasurer
2017 – Present	HGS Advertising Committee Chairman
2018 – 2019	GCAGS Treasurer (Houston 2019 Conference)

Statement
Bryan began his career as a geologist for Ingrain Inc in 2008 where he was an integral part of the company's validation period that lead to the commercial launch of their product line and subsequent acquisition to Halliburton. Currently, he works at TGS in the capacity of sales & business development. Over his career he has held positions in operations, research & development, and sales & marketing.

Outside of work, Bryan enjoys personal studies in theology, outdoors activities like hiking or camping, and playing video games. Most of all he enjoys spending time with his wife and two young children.

Ever since I joined the HGS, I have enjoyed the benefits of education, networking, and friendship. Currently, I have been working on ways to grow the advertising for the bulletin, *continued*

Bryan Guzman *continued on page 30*

Scott Sechrist

Education
Houston Community College, Houston, TX
Post Baccalaureate Courses 1985-86, for University of Houston/MS Geology program.
S. F. Austin State University, Nacogdoches, TX. Bachelor of Arts Degree 1975- 1977 Electronic Communication R-T-F/Marketing
Southwest TX State University, San Marcos, TX. Bachelor of Arts Degree 1972-1974 Geography/Remote Sensing
Trinity University, San Antonio, TX. Baccalaureate Courses, 1970-1972 Geology/Geography

Professional Experience

2015-present	Acoustic Geoscience Consulting – Multiple Clients in the Gulf Coast and Permian Basin
2014-2015	Grand Gulf Energy Geophysical Consultant
2012-2014	Subsurface Consultants / Noble Energy Deepwater Geophysical Consultant
2006-2011	Subsurface Consultants / Knowledge Reservoir Multiple Clients – Domestic and International
2002-2005	Calpine Natural Gas – Senior Geophysicist
2002-2002	JM Huber Geophysical Consultant
1997-2001	Panaco, Inc. Chief Geophysicist
1985-1996	Acoustic Exploration, Inc
1980-1984	Seiscom Delta United, Petty-Ray Geophysical
1978-1979	Bendix Field Engineering/DOE NURE Program

Professional Affiliations
American Association of Petroleum Geologists – DPA C.P. Geologist #6065; C.P. Geophysicist #90
Society of Exploration Geophysicists – SEG/OTC Oral & Poster Session Judge
Society of Independent Professional Earth Scientists – Continuing Education Committee, Houston
Houston Geological Society –Board of Directors, Shrimp Peel Committees
Geophysical Society of Houston – Electronic Publications, Publicity Committees

Statement
During my 40 years of experience, the HGS has always been there to support me in my career. For Geoscientists of all ages and skill levels, I have observed the HGS to always be the Number One source for Networking; with the highest quality Technical

Scott Sechrist *continued on page 30*

Candidates for the 2019–2020 Executive Board *(continued)*

Secretary (two candidates)

J.Schulenberg

I am honored to stand for secretary of the Houston Geological Society. I've been involved with AAPG and HGS since graduating from the University of Houston with a degree in Geology/Geophysics Option. I am AAPG certified in both geology and geophysics and am a long-standing member of SEG and GSH. I am a founding member of the University of Houston College of Natural Sciences and Mathematics Alumni Association.

Currently serving HGS

- HGS President's Rising Star Award 2018
- Delegate AAPG House of Delegates
- Secretary on the Calvert Memorial Scholarship Board
- Video committee recording presentations at luncheons/special events.

Previously served HGS

- Academic Liaison Co-chair recruiting speakers for the 2018 HGS Flood Conference
- Video team recording the two-day HGS Flood Conference event
- HGS Continuing Education committee
- Special awards judge for HGS at the Annual High School Science and Engineering Fair.

Additional HGS Outreach

I work with numerous colleges to target and encourage the best applicants for the HGS Calvert Memorial Scholarship applications. This effort presents an opportunity to build bridges between university geoscience departments and HGS while encouraging students to become active members in the society.

I truly enjoy giving back to the Society and hope to continue those contributions serving as HGS Secretary in the coming year. ■

Tami B. Shannon

Education

Texas A&M University - Corpus Christi - Master of Science Degree, Environmental Science, 2007
Winona State University - Bachelor of Science Degree, Hydrogeology, 1997

Experience

1997-2000	Systems Engineer, CompuCom Systems
2001-2003	Transportation Engineer, Wilbur Smith Associates
2003-2006	GIS Technician, City of Corpus Christi
2006-2007	GIS Analyst, UT Marine Science Institute
2007-2010	Senior GIS Analyst, Deloitte - Petroleum Services Group
2010-2012	GIS Coordinator, Fugro GeoConsulting, Inc.
2012-2014	Senior GIS Programmer/Analyst, Resource Data Inc
2013-2014	GIS Application Developer, Gulf Interstate Engineering
2014-2015	GIS Project Lead, RPS Knowledge Reservoir
2015-2017	GIS Application Systems Expert, Oxy, Inc
2017-Current	International Appraisal Data Lead, Oxy, Inc.

Professional Affiliations

Houston Geological Society
Geophysical Society of Houston
Texas Board of Professional Geoscientists GIT #46

Professional Activities & Awards

2018-2019	Candidate for HGS Secretary
2016-2017	HGS President's Award
2016-2017	Editor, HGS *Bulletin*
2015-2016	Editor-Elect, HGS *Bulletin*

Statement

Thank you for considering me for your 2019-20209 HGS Secretary. I have been a member of HGS since 2007, when I first moved to Houston and learned of this esteemed organization. As a "silent" member for many years I participated in numerous meetings and events, but in 2015, it was an honor to have the HGS membership elect me HGS *Bulletin* Editor for 2016-2017. I worked closely with the HGS Board and its talented volunteers for over two years to gain great knowledge of the Society and to understand the Board's objectives and inner workings. As a nominee for HGS Secretary for 2019-2020, I am confident my previous experience as HGS Editor and Board member would make me an excellent candidate for this honored position. ■

Candidates for the 2019–2020 Executive Board

Candidates for the 2019–2020 Executive Board *(continued)*

Treasurer-elect (two candidates)

Angela Hammond

As a front end development manager for Shell, Angela does more than manage. With more than sixteen years of experience as a production geologist and development planner, she strives to inspire and develop others. She has worked closely with partners and co-owners, development managers and vice presidents on balancing risk and value tradeoffs, competitively scoping developments, integration, and strategy initiatives. She has enjoyed and had fun working on numerous Deepwater projects (and one unconventional EOR project) over the years from exploration through to first oil. She sees herself as a student of leadership, always working to better herself and others. Angela has been a member of HGS for 16 years, a Trustee on the Undergraduate Student Scholarship Committee for 5 years, is a current member of AAPG, SEG, and a past co-editor of the GCAGS. She has also been the treasurer for her daughter's Girl Scout troop for the past 3 years. ■

Thomas Reed

Thomas worked 29 years in exploration and production as an individual contributor and in management. His career includes onshore and offshore USA, as well as Nigerian Shelf. He is an active member of HGS, GSH, SEG, AAPG, NABG, participates in the annual HGS Applied Geoscience Conference on the Geophysics and Sponsorship committees, and is a Distinguished Toastmaster. During his career he enjoyed sharing his love for earth sciences through career days at public and private schools in Denver, Houston, and Ft Worth. After retiring from Oil and Gas, he joined Edward Jones Investments as a financial advisor in Montgomery, TX. He brings a unique perspective to the HGS treasurer-elect role and is eager to continue giving back to earth sciences in this role. He is 27 years married, has two grown children, both in college. He has an AA degree from Glendale Community College, double BS degrees in Applied Mathematics and Geology from the University of California, Davis, and a MS degree in Exploration Geophysics from Stanford University. ■

Candidates for the 2019–2020 Executive Board *(continued)*

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

Wayne K. Camp

Wayne K. Camp is a Distinguished Geological Advisor with Anadarko Petroleum Corporation, The Woodlands, Texas, where he has been employed since 1980 working various domestic and international projects, including supervising exploration and development teams from 1986-2006. Prior to working at Anadarko, Phillips Petroleum Company employed Camp in Houston for two years. Camp received his B.A. degree in geology (with honors) from the State University of New York at Oneonta (1976), and his M.S. degree in geology from Colorado State University, Fort Collins, Colorado (1979). Camp lives in Montgomery, Texas with his wife Joanne, and has two daughters and three granddaughters.

Leadership and Advisory Roles

2003-2004	Chairman, AAPG Unconventional Gas Research Group
2005	Co-chair, AAPG Vail, Colorado Hedberg Conference: "Understanding, Exploring and Developing Tight Gas Sands"
2006	Contributing Editor, AAPG Hedberg Series 3: "Understanding, Exploring and Developing Tight Gas Sands"
2009	Session Chairman and Proceedings Reviewer, Indonesian Petroleum Association
2010	Advisor, America's Natural Gas Alliance (ANGA), Houston, Texas2010-2013 Member, U.S. DOE Unconventional Resources Technology Advisory Committee
2011-2013	Lead Editor and Contributor, AAPG Memoir 102: "Electron Microscopy of Shale Hydrocarbon Reservoirs"
2012-present	Planning Committee Member, Houston Geological Society Applied Geoscience Conference
2013	Associate Editor, "Interpretation for Unconventional Resources", SEG/AAPG Interpretation Journal
2013-2014	Unconventional Theme Chair, AAPG Annual Convention and Exhibition, Houston, Texas, April 6-9, 2014

Wayne K. Camp *continued on page 30*

Bob Fryklund

Bob Fryklund, Chief Upstream Strategist, Energy, IHS Markit, has over 38 years of industry experience focusing on global upstream strategic leadership and has advised on many of industries most revolutionary projects over the last two decades. He has held various executive leadership positions at both majors and leading independents. A recognized Thought Leader on upstream oil and gas, he frequently speaks at key industry meetings, such as the World Economic Forum, CERAWeek by IHS Markit, the Offshore Technology Conference, APLA, and the American Association of Petroleum Geologists Conference. He is also an established media consultant and source for both print and television. Mr. Fryklund serves or has served on several boards and executive committees, including the Association of Petroleum Geologists Advisory Board; the Independent Producers Association of America; the Brazilian Petroleum Institute; the International Energy Agency; the Libya-US Council, a bilateral trade association; and American School of Tripoli. Mr. Fryklund is a member of the Houston Geological Society and the American Association of Petroleum Geologists and has published numerous articles in three languages. Mr. Fryklund holds an AB from Hamilton College, has completed advanced studies at the University of Houston and the University of Tulsa, and holds an advanced certificate in management. ■

Candidates for the 2019–2020 Executive Board

Candidates for the 2019–2020 Executive Board *(continued)*

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

Constantin Platon

Education
2011 Master of Science: Geological Sciences @ The University of Alabama, Tuscaloosa, AL
2005 Bachelor of Science: Engineering Geology @ Univ. Al. I. Cuza, Iasi, Romania

Experience

2016-Now	Lone Star College, Houston, TX: Geology Professor (Adjunct)
2015-Now	OAK GeoSciences, Houston, TX: E&P G&G Consultant, Outdoor Educator
2011-2015	Shell E&P, Houston, TX: Exploration Geologist (Brazil, Guyana, Colombia, GoM)
2008-2011	The University of Alabama, Tuscaloosa, AL: Teaching Assistant (Geology)

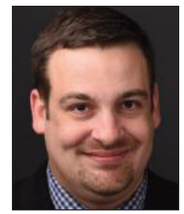
Professional Affiliations
HGS, AAPG, SEPM, GSA, GSH

Professional Accomplishments

2015	responsible for largest commercial hydrocarbon discovery @ Liza-1 well, first deepwater well in Guyana
2011	students changed majors to geology after attending my classes, to become my professional peers

Statement

- Passionate Geologist: expertise in sedimentary geology, salt tectonics, deep-water exploration
- Play Based Exploration, 2D & 3D seismic interpretation, Lower 48 Unconventionals
- Business Skills: data rooms, technical committee meetings with partners & JV
- Romanian Citizen, lived continuously in USA since 2005 (US Permanent Resident/GC)
- Passionate Geologist – Explorer at heart – loves rocks: to study, to climb on, to ride over
- Outdoor Adventurer: mountaineering & bicycle-touring expeditions; happy camper 20+ y
- Outdoor Educator, Tennis Coach, Kayak Instructor, 38 years old, married, 2 young children ■



Ryan E. Yarrington

Education
Houston Baptist University, Bachelor of Business Administration with double majors in Marketing and Business Administration 2005

Experience

2018-2019	Oildex/Drilling Info – Enterprise Account Executive specializing in OSS (Oilfield Services Suite) Oildex Software
2014-2018	MultiClient Geophysical – Seismic Data Marketing Representative focusing on Global Offshore 2D and 3D Seismic Acquisition
2011-2014	Sigma/ESG/Global Geophysical Services- Business Development/Marketing for Onshore Microseismic Acquisition and Engineering services Data Processing, and Reservoir Characterization
2011	HSEQ- Safety Advisor specializing in Environmental laws and procedures

Professional Affiliations
Houston Geological Society
Geophysical Society of Houston

Professional Activities and Awards

2011 - present	HGS International Explorationists Committee Treasurer
2016-2017	HGS Rising Star Award

Statement
I am very honored to once again be nominated for a position on the HGS Executive Board of Directors for the 2019-2020 year. The Houston Geological Society, with its vast history in the Houston area has been integral in providing continuing education opportunities within the Geoscience Industry as well as cultivating a strong sense of community both locally and across the globe. After 8 years of membership and 6 years of volunteering for the HGS in the International Explorationists Group, I would love to expand my involvement in a Society that has made such a significant impact on my life professionally and personally. There are many things that I can bring to the table with a larger role in the HGS. Some of those attributes include flexibility, adaptability

Ryan E. Yarrington *continued on page 31*

Candidates for the 2019–2020 Executive Board *(continued)*

Editor-elect (one candidate)

Ceri Davies

Education
University of Liverpool
Masters of Earth Science, Geophysics with Geology, 2005
PhD in Paleomagnetism, 2009

Experience
CGG Robertson
2010 – 2014 Marketing Geologist
2015 – 2017 Regional Technical Manager
2018 – today Business Development Manager

Professional Affiliations
Houston Geological Society
Geophysical Society of Houston
Rocky Mountain Association of Geologists
American Association of Petroleum Geologists

Statement
With a warm welcome I appreciate the nomination for the Editor-elect role with the Houston Geological Society. Growing up surrounded by the natural world at its best along the coastlines of Wales, I became endeared to the curiosity geology could bring to everyday life.

I have continued that curiosity through my education in Liverpool and followed my career to the largest collection of geologists globally. I enjoy the diversity the Houston Geological Society brings, from the insights of West Texas to the next wildcat adventure offshore. Houston harbors and supports a geologists dream like no other city can.

I look forward to working with the Society and its members to continue in providing the material, presentations and opportunities to keep the curiosity alive. ■

continued from page 22

Sarah Gephart Stanley—*Candidate for President-elect*

Developed Seismic Micro Technology's first full-time training center to support SMT geoscience software. Hired and managed team of trainers Worked with other regions on global projects for clients, such as ONGC, Lukoil, Rosneft, and Hydro, and to meet revenue projections.

Schlumberger, Houston, TX
Curriculum Supervisor, Schlumberger Geoquest
Managed creation and/or upgrades of 29 technical training manuals for GeoQuest. Supervised 3-member staff and numerous subject matter experts. Led certification of new teaching methodology and course content.

Supervisor, GeoQuest Geolab
Oversaw lab and cross-product data integration specialist. Directed release planning, quality control, and efficient testing of data transfers via Geoshare, Geonet, and related products. Managed global internal and external Geoshare support. Promoted Data Flow Integration resources within Schlumberger.

Lone Star College, Houston, TX
Director, Geoscience Technology Training Center at North Harris College
Led and greatly expanded first-of-its-kind beginning and mid-career computer training program for geoscientists. Managed center finances, hired and supervised contract instructors, and prepared business plans and budgets.
Taught and supported Landmark Graphics SeisWorks, GeoQuest IESX, and other geoscience courses, and performed UNIX systems administration for GTTC program and business model that became template used by AAPG in assisting other start-up training centers domestically and internationally.

Consulting Geologist and Adjunct Geology Faculty Member
Instructed Physical Geology courses, labs, and assisted with Geoscience Technology Training Center.

Metfuel, Incorporated, Houston, TX
Area Geologist
Mapped all company properties in Black Warrior Basin coalbed methane project.
Drilled and mapped 500+ wells in less than 365 days.

CSX Oil and Gas Corporation, (TOTAL Minatome CORPORATION), Houston, TX
Senior Geologist, Onshore Exploration and Exploitation

Wainoco Oil and Gas Company, Houston, TX
Geologist, Appalachian Basin and South Texas

Candidates for the 2019–2020 Executive Board *(continued)*

Sarah Gephart Stanley—*Candidate for President-elect*

City Service Company, International Group, Houston, TX
Exploration Geologist, South and Central America

Statement
Throughout my geoscience career, it has been my honor to be associated with the HGS. My affiliation has allowed me to come to know many fine individuals in the petroleum industry. I have also tried to advance the Houston Geological Society through my volunteerism with the AAPG, making sure that the Houston Geological Society is represented nationally. Some of my society highlights include:

- HGS and AAPG Continuing Education Commiittees
- AAPG Sub-Committee Chair for Technical Training Centers
- HGS Employment Committee
- AAPG House of Delegates and HoD Foreman, Long Service Award
- HoD Nominations and Awards committee
- DPA Editor

Awards and Short Courses

- Harrison Schmitt Award (formerly AAPG Special Award)
- HGS President's Award
- Midland College Petroleum Geotechnical Training Program Pioneer Award
- AAPG Mid Continent Short-course on Computer Software
- HGS Shortcourses include:
  - What To Do When the Bottom Drops Out Symposium
  - Unix Basics For Interpreters
  - SeisWorks for Interpreters
  - 3D Visualization Overview Symposium (assisted)

Even though the HGS is the largest local geological society, I feel that we need to continue to expand our outreach through innovation and interaction with our society members and with members of other local societies. I consider it an honor to be nominated for President-elect of the Houston Geological society, and if elected, will do my best to uphold the trust the membership has placed in me. ■

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James W. Tucker—*Candidate for President-elect*

Sea, SE Turkey, Ghana and other West Africa, onshore China, and various other areas;
Exploration Planning Director (international)

Milchem Drilling Controls (1972)
Fabrication and field service of desilters, mud centrifuges, and shale shakers

Publications
Various abstracts and short articles

Houston Geological Society Activities

1982-1984	Ballot Committee, member and chair
1998-2002	International Explorationists Committee, member and chair
2014-	Africa Conference Committee
2017-2019	Editor-Elect and Editor

Other Professional Activities

1984-1988	LA Basin Geological Society; Treasurer, Secretary, Vice-president, President
1992, 1997	Dallas Geological Society; cofounder of the International interest group, *Newsletter* Editor
2011-	Dhahran Geoscience Society; AAPG councilor
1990-1995	AAPG; *Bulletin* Associate Editor
2014-2016	AAPG; Treasurer
	AAPG Delegate or Alternate from Los Angeles, Dallas, Dhahran, and Houston

Memberships
HGS, AAPG, GSA, AGU, AIPG YBRA, SPE

Certifications and Licenses
AAPG Certified Petroleum Geologist #3472
AIPG Certified Professional Geologist CPG-7224
California Registered Geologist License No. 4386
Texas Licensed Geologist License No. 2182

Statement
I joined the Houston Geological Society when I was transferred to Houston in the summer of 1980 and have maintained my membership since then, including when located elsewhere, since I knew I would be back. I have always looked at local societies as the first circle of my professional involvement, and have participated in them wherever I have been located. I have been in societies near insolvency with declining memberships, and societies with robust membership and funds, and learned from all of them.

It is important that the HGS continue to serve Members. Our size, as the world's largest local geological society, allows us to have many and varied programs, publications, training courses, public and youth programs, and social activities, as well as providing scholarships for our future colleagues. This will continue as we add

James W. Tucker *continued on page 30*

Candidates for the 2019–2020 Executive Board *(continued)*

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James W. Tucker—*Candidate for President-elect*

innovative activities to our current ones while maintaining prudent economies. We prepare for the future by constant diligence and continuing involvement of our Members. We are a volunteer organization, and that is our strength, and carries the obligation to participate where interested.

It is an honor to be nominated for President-Elect/President, and I will work hard to engage Members and the larger community. I look forward to HGS participation for many years to come. ■

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Bryan Guzman—*Candidate for Vice President*

website and HGS organized conferences. Until recently, I have spent much of my time working on the exhibits committee organizing the set-up and transportation of the HGS booth for various conventions throughout the year. When I served as HGS Secretary, it afforded me the opportunity to learn more about the many functions of the HGS when compiling the monthly board meeting minutes. I was also exposed to the financial side of the organization as the HGS Treasurer-elect and Treasurer where I witnessed the society's dedication to the various efforts through the annual budget. It has been a pleasure meeting many people along the way and I am thankful to the opportunities the HGS has provided me while serving as a chairman, secretary and treasurer. It would be my great pleasure to serve in the capacity of HGS Vice President. ■

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Scott Sechrist—*Candidate for Vice President*

Meetings and Continuing Education presentations in the industry.

As an HGS member, I have volunteered through the years in a wide range of events: working at the registration table for Technical meetings, stuffed convention bags, participated in Science Fair judging, volunteered at Shrimp Peels and Golf Tournaments, learned how to shoot Skeet and helped to promote the HGS Fishing Tournament, provided liaison with other local geoscience societies and was honored to serve on the HGS Board of Directors.

Now as an Emeritus member of HGS, I feel it is my duty to contribute further to the ongoing success of the Houston Geological Society. In humble recognition of all the benefits HGS membership has provided to me, I would be honored to serve my fellow Houston Geological Society members as Vice President. My first priority will always be to continue the HGS tradition of providing outstanding speakers and topics at HGS Luncheon and Dinner meetings, to benefit the entire HGS membership. I thank you for your consideration and would appreciate your vote. ■

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Wayne K. Camp—*Candidate for Director*

2014-2016	Lead Chairman, SEPM-AAPG Joint Research Conference "Mudstone Diagenesis", Santa Fe, New Mexico, October 16-19, 2016
2016-2017	Vice President, AAPG Energy Minerals Division
2016-2017	Vice Chair, AAPG Energy Minerals Division Annual Meeting Committee
2017-2018	President-Elect, AAPG Energy Minerals Division
2017-present	Lead Editor and Contributor, AAPG Memoir 121 (tentative): "Mudstone Diagenesis: Research Perspectives for Shale Hydrocarbon Reservoirs, Seals, and Source Rocks" (in press).
2018-present	President, AAPG Energy Minerals Division
2018-present	Session Chair, Canadian Society of Petroleum Geologists 2019 Gussow Conference "New Directions in Geoscience for Unconventional Resources: Living at the Interface between Geochemistry, Geomechanics, and Engineering"

Publications (excluding abstracts and posters)

Camp, W.K., 2008, Basin-center gas or subtle conventional traps? in, S.P. Cumella, K.W. Shanley and W.K. Camp, eds., Understanding, Exploring and Developing Tight Gas Sands: American Association of Petroleum Geologists, AAPG Hedberg Series, no. 3, p. 49-61.

Camp, W.K., 2011, Pore-throat sizes in sandstones, tight sandstones, and shales: Discussion: American Association of Petroleum Geologists Bulletin, v. 95, p. 1443-1447.

Camp, W.K., and B. Wawak 2013, Enhancing SEM grayscale images through pseudocolor conversion: Examples from Eagle Ford, Haynesville and Marcellus shales, in W.K. Camp, E. Diaz, and B. Wawak, eds., Electron Microscopy of Shale Hydrocarbon Reservoirs: American Association of Petroleum Geologists, Memoir 102, p. 15-26.

Camp, W.K., S. Egenhoff, J. Schieber, and R.M. Slatt, 2016, A compositional classification for grain assemblages in fine-grained sediments and sedimentary rocks-Discussion: Journal of Sedimentary Research, v. 85, p. 1-5.

Camp, W.K., (in press), Diagenetic evolution of organic matter cements: Implications for unconventional shale reservoir quality prediction, in W.K. Camp, N.S. Fishman, P.C. Hackley, J.H.S. Macquaker, K.L. Milliken, and K.G. Taylor, eds., Mudstone Diagenesis: Research Perspectives for Shale Hydrocarbon Reservoirs, Seals, and Source Rocks, American Association of Petroleum Geologists Memoir 121.

Candidates for the 2019–2020 Executive Board

Candidates for the 2019–2020 Executive Board *(continued)*

continued from previous page

Wayne K. Camp—*Candidate for Director*

Honors and Awards

Best Student Paper Presentation, 1979 Geological Society of America
Best Technical Presentation, 1987 Houston Geological Society
Best Technical Presentation, 2003 Rocky Mountain Association of Geologists
Top 10 Hedberg Paper, 2009 American Association of Petroleum Geologists
R.H. Dott, Sr. Memorial Award, Best Special Publication, 2010 American Association of Petroleum Geologists
Certificate of Merit, 2018, American Association of Petroleum Geologists, Energy Minerals Division

Professional Membership

American Association of Petroleum Geologists (AAPG); Energy Mineral Division (EMD)
Society for Sedimentary Geology (SEPM)
Geological Society of America (GSA)
Houston Geological Society (HGS)
Indonesia Petroleum Association, former member
Rocky Mountain Association of Petroleum Geologists (RMAG), former member
Sigma Xi (Honorary Scientific Research Society), former member ■

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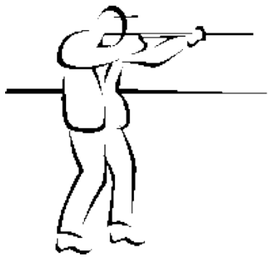
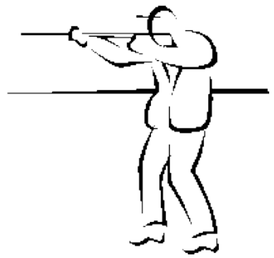
Ryan E. Yarrington—*Candidate for Director*

to new situations, integrity, networking skills, an ability to analyze situations objectively, follow through on commitments, quality communication, a willingness to work with others, a positive disposition, and of course, my fantastic sense of humor! Between those characteristics and the guidance that I receive from other seasoned members of the Board I feel that I could be a strong member of the team. If I am elected Director, I would aim to channel my skills into supporting the various committees that I would oversee and to encourage them with their continued growth in the Society. As a part of the HGS Board as a whole, I look forward to the possibility of being involved in the ongoing success and expansion of the largest local Geoscience society in the country. I hope that I can count on your vote! ■



HGS SKEET SHOOT



Saturday, June 8, 2019
Greater Houston Gun Club
6702 McHard Road, Missouri City

This tournament is a 50 target event. Shells are provided, however **you must bring eye and ear protection.** Greater Houston Gun Club and National Skeet Shooting Association safety rules will be in effect. Trophy winning shooters will be determined by the Lewis class system. Door prizes will be awarded by blind drawing after the conclusion of shooting. All competitors are automatically entered into the door prize drawing, but you must be present at the time of the drawing to win. BBQ lunch will be provided from 11:30 until 1:30. Refreshments will be available throughout the day. **Non-shooting guests are welcome to enjoy lunch and refreshments at a cost of $20 per guest.**

HGS recognizes that 2019 is a lean year in the oil patch, and sponsorship for events like this is hard to find. **For $150, you'll receive paid entry for one shooter and one guest (total value of $120) and be listed as a platinum sponsor on the webpage and at the event.**

We are limited to 160 shooters in four rotations. Entry fee is $90 per shooter for registrations received by FRIDAY, JUNE 1st. After June 1, registration will be strictly on a "space available" basis and the entry fee will be $120 per shooter. ***Register early!!***

For more information, contact: Andrea Peoples at (713) 463-9476 or office@hgs.org

For directions to the club, visit www.greaterhoustongunclub.com

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ONLINE REGISTRATION INFORMATION AT: https://www.hgs.org/civicrm/event/info?id=2078

To pay by check, mail this form with a check made out to HGS to:
Houston Geological Society, 14811 St. Mary's Lane, Ste. 250, Houston, TX 77079

To pay by credit card, please call the HGS office: (713) 463-9476.

Name: _____ Company: _____

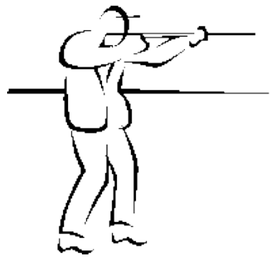
Email: _____ Phone: _____

Preferred time: (circle one) 9:00 10:00 11:00 12:00 Ammo: (circle one) 12 gauge 20 gauge

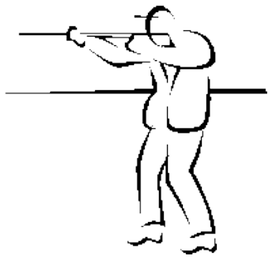
Entry Fees: $ _____ + Guest Fees: $_____ + Sponsor Contribution: $ _____ = Total: $_____

If you wish to register as a squad, please return forms for all squad members together.

ALL SHOOTERS WILL BE REQUIRED TO SIGN A DISCLAIMER OF RESPONSIBILTY BEFORE THEY WILL BE ALLOWED TO SHOOT!



HGS SKEET SHOOT



Saturday, June 8, 2019
Greater Houston Gun Club
6702 McHard Road, Missouri City

Sponsorship Form

AMMO BAG SPONSOR $1,500.00
Registration for a Team of 5
Company recognition on the HGS website, Bulletin and event
LUNCH SPONSOR $1,000.00
Registration for a Team of 5
Company recognition on the HGS website, Bulletin and event
BEVERAGE SPONSOR $750.00
Registration for a Team of 5
Company recognition on the HGS website, Bulletin and event
AMMO SPONSOR $750.00
Registration for a Team of 5
Company recognition on the HGS website, Bulletin and event
FIELD SPONSOR $750.00
Registration for a Team of 5
Company recognition on the HGS website, Bulletin and event
FLURRY SPONSOR $750.00
Registration for 2 team members
Company recognition on the HGS website, Bulletin and event
PLATIMUN WEBSITE SPONSOR $150.00
Registration for 1 shooter and 1 non-shooting guest
Company recognition on the HGS website, Bulletin and event

To pay by credit card, please complete the form and return to office@hgs.org or call 713-463-9476
To pay by check, mail this form with a check made out to HGS to:
Houston Geological Society, 14811 St. Mary's Lane, Ste. 250, Houston, TX 77079

Name: _____ Company: _____

Email: _____ Phone: _____

Sponsorship Level: _____ Amount: _____

Credit card # _____ Exp. Date: _____

For more information, contact: Andrea Peoples office@hgs.org
For directions to the club, visit www.greaterhoustongunclub.com

HGS Welcomes New Members

New Members Effective February 2019

ACTIVE MEMBERS

Neal Auchter
John Ollman
Christopher Angel
Kera Gautreau
William Cain III
Chloe Merrell
Felicity Adams Kahn

STUDENT MEMBERS

Yury Golchenko
Alvaro Iglesias
Mary Fearn
Melanie Adelman
Devin McQuaig
Matthew Nix
Alex Blizzard
Trang Pham

ASSOCIATE MEMBER

Eric Martin

Welcome New Members

Annual Houston Geological Society Awards

It's Awards Season again. The Oscars, Grammys, Golden Globe and more. Well it's also HGS Award Season as well. The HGS President's Night held in June, is where the Houston Geological Society honors those individuals and companies who are recognized for outstanding volunteering or other major contributions to the Society. These Awards range from giving awards to children who spent many hours cleaning gunk off Mastodon bones that were covered with Hurricane Harvey floodwaters to the HGS Gerald Cooley Award, its highest.

Many awards are presented at President's Night. The most prestigious Award is the **Gerald Cooley Award** given to honor those who have continued to serve the society well above and beyond the call of duty over many years. **Honorary Life Membership** honors members who have distinguished themselves in the science of geology or have contributed outstanding service to the success and welfare of this organization. The **Distinguished Service Award** *honors members who have given long-term valuable service to the society*. The **President's Award** honors members whose extraordinary efforts or unique contributions in a fiscal year or over a short period of time deserve special recognition. **Chairman's Award** honors members whose extraordinary efforts or unique contributions to their committee deserve special recognition. The **Rising Star Award** honors individuals who are relatively new to the HGS or its activities, and have made significant and promising contributions to the enhancement and success of the society. The HGS also recognizes companies with the **Corporate Star Award**, honoring those companies who have made significant contributions to the Houston Geological Society. The **HGS Teacher of the Year Award** has been established to honor individuals whose extraordinary efforts and unique contributions are in earth science education.

Awards at President's Night vary from plaques, salt lamps, *Orthoceras* bowls, dinosaur heads, dinosaur 3D dioramas, rocks, minerals, and fossils. Some of the most notable Rock Awards given out include the Stibnite mineral given to Gerald Cooley Award honoree Deborah Sacrey. This mineral is an antimony sulfide mineral (Sb_2S_3). Our ancestors would crush this mineral and mix it with oil to make the earliest known make-up. Cleopatra is said to have used this to make the highlighted lines around her eyes. Charles Sternbach received his Gerald Cooley Award which was a Proterozoic Stromatolite fossil from the Bitter Springs Formation, Alice Springs, Australia. This is one of the oldest fossils found. The largest/heaviest Rock Award went to President Ken Nemeth who received a slice of a petrified wood tree trunk from Indonesia. It almost crushed the podium.

This year's HGS Awardees will be recognized in the June HGS Bulletin. The HGS Awards Committee looks forward receiving instructions from the HGS Board to make an Award for you.

Rock on my friends.

HGS Grand Canyon Field Trip
Dates: June 7 - 15, 2020
Cost: $3700/person

Geology, Fault: This impressive drag fold on the Butte Fault was worth the hike to see. Photo courtesy of Phil Salvador.

You are invited to join the HGS on its 2020 Grand Canyon field trip. This "Journey Through Time" will weave the geologic story of the Canyon with other natural sciences on display here, the human history in the Canyon, and of course the thrills (and chills) of running many exciting rapids of the Colorado River.

We will float the River on motorized rafts, providing us the opportunity to see and discuss the classic geology so beautifully portrayed here, from some of the earliest Precambrian sediments found in the States up to modern processes which continue to shape the canyon. Geological concepts are introduced and magnificently illustrated in the Canyon such that the geology comes alive for everyone. In addition to running rapids, we will offer a number of short hikes in some of the many side creeks, eat like royalty and sleep under the stars. Your river guides and gear are supplied by Hatch River Expeditions, one of the most experienced outfitters serving the Grand Canyon. Past participants have stated this was the best geologic trip they ever took and many have brought one or more of their family along to share this incredible experience with them.

While this is not an overly strenuous trip, participants must be in good enough physical condition to climb in and out of the rafts. You will have the opportunity to enjoy some hiking each day, the longest being six miles and several require some scrambling. The hikes are always optional; however, I encourage you to participate in as many as you are comfortable doing to fully experience this extraordinary trip.

The trip joins in Las Vegas on June 7. We will provide transportation by motor coach from there to Marble Canyon by way of Zion National Park for an opportunity to view the geology there, the first night in Cliff Dwellers Lodge, food and drink for our 8 days/7 nights on the river, a helicopter ride to Bar 10 Ranch the last day, and the flight from there back to Las Vegas. Costs not covered include your round-trip airfare to Las Vegas, first night's dinner and breakfast in Marble Canyon, tips for our river guides, souvenirs purchased at Phantom Ranch or Bar 10 Ranch, and anything you might spend in Vegas should you decide to extend on either end. Optionally, you may join us in Marble Canyon and Hatch will arrange a return flight to there at the end.

Reserve your spot now with a $500 deposit by calling the HGS office at 713-463-9476; the balance due is by December 15, 2019. Please read the HGS's refund policy before booking your trip.

Trip Leader: **Steven Earle** is a Past-President of HGS and also served as Editor and as chair of North American Explorationists. He received his BS in Geoscience from the University of Arizona. While there, he spent as much of his free time as possible hiking the trails of the Grand Canyon. Steve is passionate about the Canyon and loves sharing his knowledge with everyone. After a 40-year career as an oil and gas explorationist, he is now retired in Pagosa Springs, Colorado. This will be Steve's sixth and final time to lead the HGS field trip.

UNIVERSITY of HOUSTON

Department of Earth and Atmospheric Sciences

Dobrin Lecture

Student Poster Session Guidelines

25th Annual Dobrin Lecture

March 20, 2019, 2–8 p.m.

Lianjie Huang, Ph.D.

Senior Scientist 5, Los Alamos National Laboratory

presents

Super-resolution Imaging:
From Subsurface Fracture Detection to Cancer Identification

Wednesday, March 20

2:00–5:30 p.m. – Poster Session

5:30–6:30 p.m. – Happy Hour

6:30–7:30 p.m. – Presentation

Historical Analysis of the Real Global Price of Oil

By William D. DeMis, *President, Rochelle Court, LLC, Houston Texas*

Abstract

The Real Global Price (RGP) of oil is the price of oil corrected for inflation and for changes in the value of the US dollar on global currency markets. The RGP of oil is a superior measure of oil's value because it measures oil's purchasing power with respect to OPEC.

The US dollar's value has fluctuated as much as 45% on global currency markets after the U.S. abandoned the Bretton Woods system in 1971. Key OPEC countries obtain 60-90% of their revenue from oil sales that are almost exclusively traded in US dollars. Changes in the RGP of oil can have a profound effect on OPEC's purchasing power.

An historical analysis of the RGP of oil over the OPEC era shows that in 1973, 1979, and 1995, OPEC reacted to a low US dollar with nominal price increases, supply cuts, and/or openly suggesting abandoning the dollar. When the RGP was low enough, non-OPEC countries collaborate with OPEC to push up the nominal price (e.g., Mexico and Norway in 1998; Russia and others in 2016).

OPEC has overcorrected with nominal price spikes when oil supplies were tight. From 1974-1985, and 2005-2014, oil was overvalued in a RGP analysis. These two RGP spikes ultimately led to reduced demand, new competing oil supplies and nominal price declines in 1986 and 2014.

A commodity analysis corroborates this exchange rate analysis. Gold and oil prices have historically tracked closely over the OPEC era. But from 1986 to 2000, and after 2014, this relationship became decoupled. During these decoupled periods, oil was undervalued relative to gold.

In the absence of significant changes in the US dollar's value, or profound changes in oil supply, the price of oil will most likely trade in a RGP range of $30-46/bbl, or $45 to $70 in nominal prices. The probability that the nominal price of oil will drop below $40/bbl or rise above $80/bbl is low. If the US dollar's value were to drop by 25%, the nominal price of $80/bbl would be at the low end of the current RGP trading range. If oil prices cross the low side of the RGP trading range, history has shown that OPEC (and sometimes non-OPEC) countries collaborate to force up nominal prices to regain purchasing power.

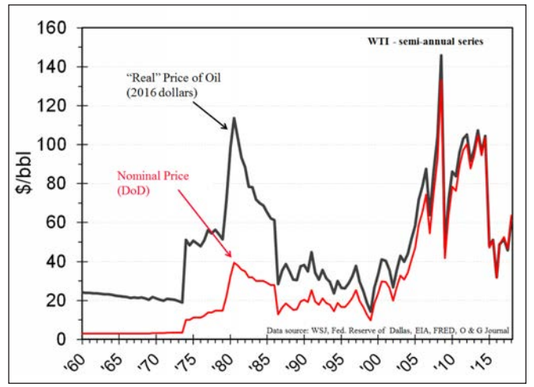


Figure 1. *Oil prices throughout OPEC era. Horizontal axis is time; 1960 to February, 2018 for this and other figures. Nominal price is in dollars of the day (DOD); it is not corrected for anything. The "real" price is the price of oil corrected for inflation to a 2016 base, using the US CPI. The "real" price is extensively used in oil industry literature for this global commodity (e.g., BP, 2017)*

Introduction

Commodities, with rare exceptions, are contracted for and traded around the world in US dollars. The dollar-denomination of crude has long been transparent to Americans because they live in a "dollar bubble." Exchange rate variations of the greenback are not felt by Americans until the price of gasoline goes up; and then the price change is blamed on OPEC, or "greedy" oil companies. However, changes in the US dollar's value have had a profound effect on OPEC (e.g., DeMis, 1996, 2000; Salman, 2004). OPEC has reacted to changes in the value of the US dollar since 1971 with nominal price increases, production cuts, and calls to abandon the US dollar as a basis for pricing oil (Platt's Oilgram News, 1995; DeMis, 1996, 2000). After supply-and-demand balance, the single biggest driver of OPEC's actions has been the changing value of the US dollar.

Many geoscientists today are familiar with the inverse relationship between the US dollar's value and oil prices. This inverse relationship (and most geoscientists' awareness of it) has only come about in the last dozen years. Nevertheless, before 2005, OPEC's reactions to losses in purchasing power from declines in the value of the US dollar have been anything but subtle (e.g., DeMis, 2000).

Economists typically show two data series when discussing value: nominal prices and "real" prices (**Figure 1**). The nominal price is the price in dollars of the day (DOD) – it is not corrected for anything. The "real" price is the price corrected for inflation, usually using the US consumer price index. Even today, key industry publications like BP's *Statistical Review of World Energy* (BP, 2017; their unnumbered figure on page 20) still show a spurious data series for the historical oil price graph. It shows oil prices in "real terms", meaning the price of oil corrected for inflation using the American consumer price index! *This* in a British publication. The publication does not account for profound changes in the value of the US dollar after the Bretton Woods system ended in 1971.

Historical Analysis of the Real Global Price of Oil *continued on page 52*

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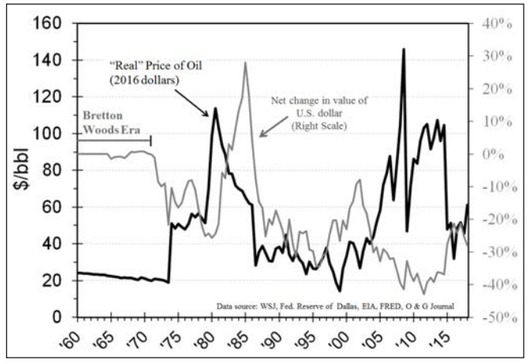

Figure 2. *"Real" price of oil and value of the US dollar. Percent changes in the value of the US dollar are relative to the 1970 base. After the Bretton Woods system ended, the value of the US dollar has floated, and vexed OPEC. Drops in the value of the US dollar have eroded OPEC buying power; a fact not shown on a common "real" price analysis.*

The fallacious assumptions of using the uncorrected "real" price of oil for analyzing price behavior include: 1) the US dollar's value has been constant on global currency markets; 2) the US consumer sets the price of oil, and; 3) the oil market is entirely internal to the US. Upon inspection, any reader knows points 2 and 3 are wrong. The point of this paper is fallacy number 1. The US dollar's value has fluctuated wildly since the end of the Bretton Woods system (**Figure 2**).

The Real Global Price of oil corrects for inflation *and* for variations in the value of the US dollar on global currency markets. The RGP of oil is a superior measure of oil's value because it measures oil's purchasing power with respect to OPEC. This paper traces the history of the Real Global Price over the OPEC era. A RGP analysis allows for a better understanding of OPEC past actions, and allows for better prediction of long-term oil value trends. Although supply-demand factors cannot be excluded.

Literature Review

A computer search of "exchange rates and oil prices" produces a torrent of papers that fall into two types: classical economic papers and non-economic papers.[1] A review of classic economic literature would fill 3 volumes of any scientific bulletin. A limited review of classic economic papers is provided.

Trehan (1986) early but obscure work uses vector analysis to show that drops in the US dollar's value might lead to oil price increases. He concludes with the bizarre statement that his analysis "…is not meant to deny a role to OPEC. … it is difficult to believe *that OPEC does not take the value of the dollar into account when setting the dollar price of oil*" (emphasis added). Even a casual reader has to question why the author would need to *speculate* about OPEC's regard for the greenback's value ("Can't you just ask them?").

At the very time of Trehan's (1986) analysis, there was a plethora of published comments by frustrated OPEC oil ministers on the eroding value of the US dollar. For example, Iraq's oil minister is quoted in the New York Times in 1977: "Although we sell a barrel of crude oil for $13, its effective purchasing power is no more than $5." OPEC's focus on the dollar's value was broadcasted in New York Times articles[2], non-economic papers (e.g., Eaker, 1979), and fee-based information services[3]. Economists' selective avoidance of reading actual OPEC statements to understand OPEC's motivations is common in "classic" economic papers. This myopia will be addressed later in this paper.

Amano and van Norden's (1995, 1998) influential works on the US dollar and exchange rates concludes that the "…two variables appear to be 'cointegrated' (sic.) and that *causality runs from oil prices to the exchange rate and not vice versa*" (emphasis added). The authors do not cite Trehan (1986). The authors do not include any OPEC press releases that quote "gripes" from OPEC oil ministers that the low US dollar is under-cutting their purchasing power. This myopia is particularly noteworthy because in the mid-1990s, during the very time of Amano and van Norden's work, OPEC was vociferous about the declining value of the US dollar and its effect on their budgets (e.g., Tachibana, 1995; Hammadi, 1995; Platt's Oilgram News, 1995; DeMis, 1996). OPEC enacted production quotas to force the nominal price up in response to a declining US dollar (DeMis, 1996, 2000).

Nevertheless, Amano and van Norden's work dominated economists' writings. For example, Marten (2008) states in *Current Economics*, "The causality between the USD and oil is usually assumed to work *from the oil price to the USD*" (emphasis added). Even today, popular news outlets stridently echo economists' consensus about this direction of causality with news articles titled, "Why Oil Prices Affect Exchange Rate, not Vice-Versa" (Norman, 2015).

More recently, Beckmann et al (2017) provide a comprehensive review of classic economic literature on exchange rates and oil prices. Their conclusion on causality derives from an arcane distillation of 47 classic economic papers. They conclude, "… causality from US dollar depreciations to increases in the price of oil often materializes at a *daily frequency or over a few months*" (emphasis added). Their analysis is entirely weighted by the previous 12 years when prices responded quickly to dollar changes when oil supplies were tight. US dollar depreciations in 1990s caused OPEC to increase nominal prices (e.g., DeMis, 2000; Salman, 2004), however these price changes did not happen "daily" or even "over a few months", but over years (ibid.)

Classic economic papers have two systemic problems. They are mathematically dense treatises that render voluminous data into complex mathematical formulae that all get jammed into computer models. The resulting numbers are then groomed for statistically significant relations (e.g., Uddin et al, 2013). Classic economic papers have no mechanism for capturing quotes from OPEC about drops in the value of the US dollar because "statements" cannot be digitized and jammed into a formula.

Indeed, the word "OPEC" is included only once, and only in a citation, in Beckmann et al's (2017) comprehensive review of 47 classic papers! Economists' myopia regarding OPEC oil ministers' disgust for a fallinga US dollar in their "classic economic papers" – a disgust that was commonly as quoted in contemporary newspapers and non-economic journals – is noteworthy, but not unusual.[4]

The second problem is that economists rarely write retrospectives. An economist who reviewed DeMis (2000) said, "What you have done is an historical retrospective. Historical retrospectives in economics are very out-of-favor today. Nobody gets tenure for publishing them." (Dr. J. Farley, 2000, personal communication). Books like, This Time is Different, are brilliant exceptions to this generalization.

Papers that are not classical economic analyses, and OPEC press releases, show OPEC has long offset the declining US dollar by enacting production quotas to increase nominal prices (e.g., DeMis, 1996, 2000). Non-classic economic papers written by members of OPEC – *and remember these are the guys who set the price* – contain no ambiguity that causation runs from drops in the US dollar to lost OPEC revenue to OPEC-orchestrated price increases by cutting production (e.g., Hammadi, 1995; Salman, 2004).

The analysis provided in this paper uses a simple exchange rate model to calculate oil's value to OPEC. When oil prices are viewed in a RGP analysis, in concert with OPEC statements, OPEC's motives and long-term price moves can be easily understood.

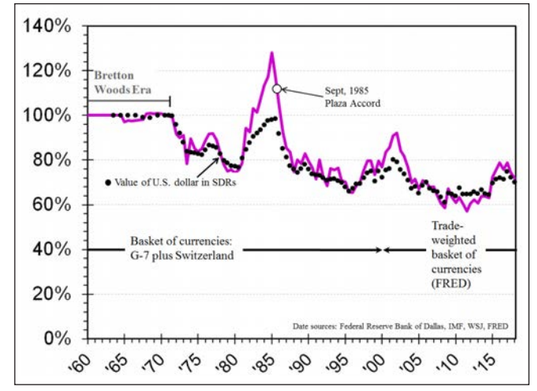

Figure 3. *Value of the US dollar on global currency markets. Reference basket of currencies is weighted with respect to each country's GDP. Parity (100%) is the value of the basket in 1970. After 2000, the Federal Reserves of St. Louis' trade-weighted value of the dollar is used (from FRED website). The FRED data series is corrected to a 1970 base. Calibration points (black dots) are the IMF's calculation of the US dollar's value as expressed in SDRs, also normalized to a 1970 base. Semi-annual data series.*

Value of the US Dollar

The value of the US dollar must first be calculated to define the RGP of oil. The value of the US dollar is calculated using a reference basket of currencies: the G-7 countries plus the Swiss franc. The basket is weighted with respect to each country's gross domestic product (GDP). **Figure 3** shows the value of the greenback over the OPEC era. Parity (100%) is set to the US dollar's value in 1970. After 2000, the value of the US dollar shown is the trade-weighted average provided by the Federal Reserve Economic Data (FRED data) of St. Louis website. The FRED data series post 2000 is corrected 20% to fit the 1970 base and so the two data series overlap.

The US dollar's value is also calculated by the International Monetary Fund (IMF) and is expressed in Special Drawing Rights (SDRs). SDRs are the pseudo currency the IMF uses to determine member countries reserves. SDRs are expressed as a percent of their 1970 base and used as calibration points on **Figure 3** (much like vitrinite reflectance is used to calibrate a maturation model). The currencies data series fit the SDR calibration points. It's a good enough match.

This RGP analysis also includes a correction for inflation. The GDP deflator for the reference basket of currencies is used. Interestingly, the US GDP deflator produces virtually the same results (DeMis, 1996).

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[1] Caution to readers. Many papers address oil price effects on currencies besides the US dollar. These non-US dollar papers are irrelevant to this discussion because OPEC transacts in US dollars almost exclusively.

[2] For example: *New York Times*, August 4, 1977 headline: "OPEC might switch to SRDs if Dollar Plummets, Officials Says". For example, *New York Times*, March 17, 1978 headline: "For Oil Pricing, a Basket of Currencies in Offing?" – to list a very few of the widely read articles being printed at the time.

[3] *Petroleum Intelligence Weekly*, May 12, 1980, cited in Samii and Clemenz (1988)

[4] Please see Daniella D. Booth's book, *Fed Up*, for insights into academic and detached concerns of economists at the Federal Reserve. Per Ms. Booth, what was eye-opening at the Federal Reserve of Dallas was not that dozens of PhD economists missed the mortgage and banking melt-down of 2008, but that they were still running computer models that showed everything was all right during the crisis. "You could have looked out the window and seen things were not okay!" Ms. Booth correctly predicted the '08 crash, as did the men celebrated in the book and popular movie "The Big Short." None of them, including Ms. Booth, have PhDs in economics.

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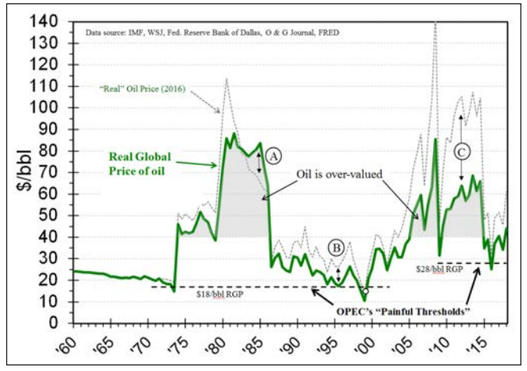

Figure 4. *Real Global Price (RGP) of oil throughout the OPEC era. "Real" price of oil shown by dashed line. OPEC had more purchasing power in 1973-'85, than in 2005-'14. Above about $40/bbl (RGP) oil is over-valued. Point A shows when rising greenback gave OPEC strong purchasing power, even as "real" prices fell. Point B shows when OPEC's purchasing power in RGP terms was the same as 1973. Point C shows that the recent "real" price high had less value in a RGP analysis. OPEC's lower limit to purchasing power, it "painful threshold" was $18/bbl (RGP). In 2016, this threshold seems to have risen to about $28/bbl (RGP).*

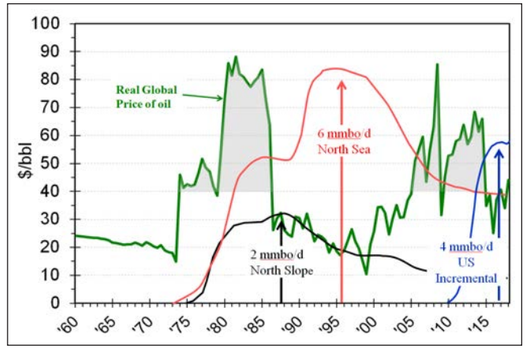

Figure 5. *Real Global Price and new oil supplies. Production profiles depicted schematically, not to scale. Above about $40-45/bbl (RGP), the high value of oil brings on major new oil supplies.*

Real Global Price

Figure 4 shows the Real Global Price of oil. OPEC had strong purchasing power in two periods, 1974 to 1986, and 2005 to 2014. Oil was manifestly *over-valued* during these times, when it was over about $40/bbl (RGP). OPEC's painful threshold is defined by times when OPEC called for abandoning the US dollar as the basis for pricing oil (e.g., 1995), or when non-OPEC countries collaborated with OPEC to cut production (e.g., 1998, 2016). OPEC and non-OPEC countries collaboration in 2016 to push up nominal prices suggests that their imbedded social cost, and military costs, have risen significantly since 1998. Thus, OPEC's lower threshold in 1973 to 1995 was $18/bbl (RGP). In contrast, by 2016, OPEC and non-OPEC's lower threshold appears to be $28/bbl (RGP), although this new "painful threshold" is too new to be clearly defined. History is always the best guide. Oil has long had a *value* floor that someone defended. Before OPEC, the Texas Railroad Commission defended oil prices in times of excess supply (Yergin, 1991).

Oil can be over-valued because its value is manipulated by a cartel and so thus oil's value does not find a natural equilibrium. The two episodes of high RGP of oil were un-natural and brought on large non-OPEC production from provinces like the North Sea, the North Slope, and the North American "shale revolution" (**Figure 5**).

Historical Analysis

Bretton Woods System

The Bretton Woods system fixed the US dollar's value on global currency markets from World War II until 1971. The collapse of this system, and floating the US dollar, allowed the greenback to swing wildly on global currency markets; gaining and losing as much as 45% in value. This monetary event has been the single biggest driver of the vicissitudes of US oil industry since 1973 (DeMis, 2000; see AAPG SnD #70037). Changes in the US dollar's value are sparingly mentioned in The Prize (Yergin, 1991). Indeed, Yergin (1991) makes no mention of "Bretton Woods" or the date, "August 15, 1971" in his book. But overlooked accord collapse profoundly affected OPECs purchasing power and resulted in the 1970s "price shocks".

So what was Bretton Woods? In 1944, major Allied Powers held a meeting at Bretton Woods, New Hampshire to establish a post-war basis for currency exchanges. The Bretton Woods agreement created a modified gold exchange among signature countries. The US treasury agreed to make gold and the US dollar convertible for foreign banks at $35/oz at the "gold window." Each nation agreed to fix its currency to a 1% trading range with respect to the dollar. The US dollar became as "good as gold," and the world's reserve currency. The US became the world's banker.

Bretton Woods worked very well immediately after WW II when Europe had no gold and needed to re-build using US dollars (from the Marshall Plan). But things never stay the same.

Europe re-built and their economies grew. By the 1960s, European countries had recapitalized their central banks (backed by gold and US dollars), and gained stable currencies in their own right. In the middle 1960s, it was generally agreed by central banks that there were too many dollars in circulation; the greenback was overvalued. Attempts to "defend the dollar" by the London Gold Pool in the 1960s failed (Ghizoni, 2013). Then things got worse. By the late 1960s, inflation from the war in Vietnam and deficit spending on President Johnson's Great Society program (Spencer,

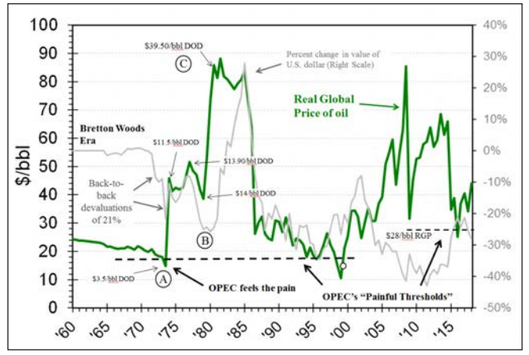

Figure 6. *History of the RGP of oil and US dollar- Part 1. After Bretton Woods system ended, the US dollar fell 21%. Point A: in 1973, OPEC's purchasing power reached an all-time low. OPEC reacts to dollar drops by increasing oil to almost 11/bbl. Point B: by the late 1970s, the dollar had fallen by over 15%, nominal prices were dragged down. OPEC openly discussed pricing alternative to the US dollar. Point C: revolution in Iran pushed nominal prices up to $39.5/bbl.*

1974; IMF Bulletin, 2008) caused profound downward pressure on the US dollar.

Many countries, notably France and Switzerland, converted their US dollars to gold at $35/oz at the "gold window" while the free market price rose to $40/oz on the streets of Zurich where they sold gold for US dollars, then run back to the gold window to convert those greenbacks into more bullion at $35/oz. There was a run on gold at Fort Knox. By July, 1971, the US had only 10 billion of gold bullion left (Spencer, 1974). On August 15, 1971, President Nixon announced that the "gold window" is closed; Bretton Woods ended.

Real Global Price Events

The Real Global Price of oil is controlled by inflation, by drops in the nominal price of oil (because of excess supply), and by of drops in the value of the US dollar. Of the three factors, drops in the value of the US Dollar have most vexed OPEC (until the shale revolution of today). The following historical analysis will focus on changes in the US dollar's value, and OPEC's response.

1973-'74

After the Bretton Woods collapse, the greenback was floated. It floated like a rock. An attempt to peg the dollar's value using the Smithsonian Accord failed. In December, 1971, the US dollar was devalued by 9 percent. In February, 1973, the dollar was devalued by another 10 percent. Up to this time in history, two back-to-back currency devaluations in 14 months were the province of banana republics - not the once-mighty greenback.

By March, 1973, OPEC was demanding an amendment of the January 1972 Geneva Agreement in response to the falling value of the greenback. OPEC wanted "full compensation as a result of the devaluation of the US dollar" (MEES, 1973). By the fall of 1973, OPEC's purchasing power was at a low (**Figure 6**). Nominal oil prices were about $3.5/bbl. By October of 1973, the price of gold had tripled and the price of corn and wheat had doubled (Rogers, 1994). In other words, commodities were rising in response to a falling dollar. Therefore OPEC announced the oil embargo and a new OPEC posted nominal price of $5.11/bbl soon followed. The embargo ended in March, 1974, followed by nominal oil prices rising to $11/bbl.

The greenback regained value after the 1974 "oil price shock". Economists felt that the US could better weather future "oil price shocks" by virtue of robust US production (Tucker, 1992). Countries that had no oil production saw their trade deficit soar, and the value of their currency fall.

Much has been made of the "geopolitical theater" and OPEC's use of "the oil weapon" to explain the price spike of the early 1970s (e.g., Yergin, 1991). The Prize is a brilliant book, but it only refers to the US dollars collapse in a few sentences, and even these are as ancillary comments. Certainly, the West's support of Israel during the Yom Kippur War in 1973 did pique Arab nations. But OPEC's real frustration was with the declining US dollars, which clearly predated this war. Before the December 12, 1970 OPEC meeting in Caracas, OPEC resolved that the reference prices for OPEC oil should be adjusted for drops in the dollar to maintain "purchasing power of members countries oil revenues" (Salman, 2004).

The "oil price shocks" of the early 1970s were simply OPEC's reaction to lost purchasing power from the erosive effects of a decade of inflation in the 1960s and early '70s, and a precipitous 21% drop in US dollar's value on global currency markets (DeMis, 1996, 2000). OPEC members were just regaining their lost purchasing power when oil demand tightened in 1974. This price increase would have happened irrespective of the Yom Kippur War.

1979

By 1979, experts had anticipated that US domestic oil production would reduce its reliance on OPEC oil. This did not happen. The US was consuming more OPEC oil in 1979 than it had 5 years prior, at the time of the embargo. The value of the US dollar fell because of growing US reliance on OPEC oil. Also, the US balance of trade continued to be negative (Tucker, 1992). From 1977 to 1979, nominal oil prices rose from $13/bbl to about $14.85/bbl. But the dollar fell 17%. The US dollar's fall cut OPEC's purchasing power as shown by the RGP of oil (**Figure 6**).

In 1979, OPEC openly explored alternatives to the US dollar (Samij and Clemenz, 1988). Some members suggested that oil be priced

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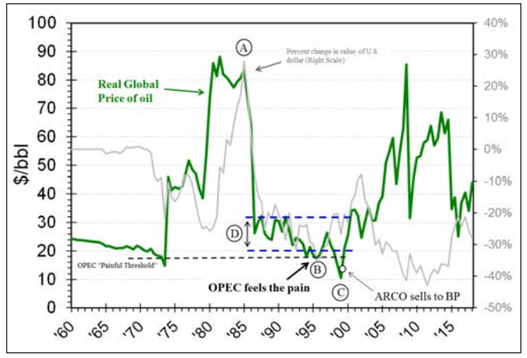

Figure 7. *History of the RGP of oil and US dollar – Part 2. Point A: the value of the US dollar peaked in 1985 thereby maintaining OPEC purchasing power. Point B: by 1995, OPEC's purchasing power was as low it was in 1973. Point C: RGP of oil drops to new low. OPEC and non-OPEC countries collaborate to push prices up to the middle of the post-1986 trading range, Point D. AROC was sold at a 40 year low.*

in a basket of currencies. But the "basket of currencies" schemes were deemed too impractical for both buyers and sellers. However, the revolution in Iran removed 4 million barrels of crude oil and condensate off the market. Nominal oil prices soared to $39/bbl, the RGP of oil doubled - so everyone forgot about the 17% drop in the value of the greenback.

Mid 1980s

In the mid-1980s, the value of the US dollar soared because of large differences in real interest rates between the US and Europe. Between 1980 and 1985, the US dollar gained 50% against the Japanese yen, Deutsche Mark, French Franc, and British pound. In summer of 1985, one US dollar could buy one British pound.

OPEC's purchasing power was at its zenith because of the high dollar, but global demand was softening, and other supplies of oil were coming on line (e.g., North Sea). The US dollar's high value allowed Saudi Arabia to maintain purchasing power while cutting its production to maintain nominal prices. Saudi Arabia became the "swing producer" during this period of high US dollar value. Saudi Arabia's production fell to less than 4 million barrels per day by 1985.

In September, 1985, the Plaza Accord was implemented to depreciate the US dollar (Henning and Destler, 1988) (**Figure 3**). Perhaps not coincidentally, three months later, in December, 1985, Saudi Arabia's Oil Minister, Sheik Yamani, declared Saudi Arabia would no longer be the swing producer: it would pursue a market share policy (MEES, 1985). Nominal oil prices fell from $30/bbl in November, 1985 to $10/bbl by March 1986. (Everybody in lost their job, including me.)

Mid 1990s

After the Plaza Accord, the US dollar began a long value slide down to a new nadir in 1995. From 1990 to 1995, the US dollar had fallen 15%. By 1995, one dollar could only buy 85 Japanese yen. The nominal price of oil sank from $25/bbl (DOD) in 1990 to $17/bbl (D0D) in 1995. OPEC was frustrated by the declining value of the US dollar, members wanted higher prices and more purchasing power. But the "inverse relationship" between the price of oil and the US dollar's value commonly seen in the 21st century could not materialize in a market flooded with oil. OPEC had a tough time.

By 1995, the RGP of oil dropped to the "painful threshold" set in 1973 (**Figure 7**). In 1995, the loss in purchasing power was worse than 1973 because OPEC economics had fundamentally changed. Important OPEC countries obtained 60-90% of their revenue from oil sales. In 1973, OPEC countries consumed about 1 million barrels a day. By 1995, OPEC countries were consuming 5 million barrels day, or one-fifth, of their own quota (Gately, 2013).

The 1995 oil consumption numbers show that key OPEC countries had changed from mostly rural populations to fully modernized economies with a burgeoning middle class. Key countries also had subsidized health care and education cost which had to be paid for with oil revenue (DeMis, 2000). OPEC's need for purchasing power from oil in was more desperate in 1995 than it was in 1973.

Once again, as happened in 1979, OPEC's response to this drop in the greenback was to openly call for abandoning the US dollar as was widely reported in various news media (e.g., Platt's Oilgram News, 1995) - but ignored by most-all economists. Various pricing schemes were publically offered: the Iranian Oil Minister suggested that oil be priced in yen; the Algerian oil minster suggested that OPEC adopt an SDR-based pricing system; the United Arab Emirates (UAE) oil minster suggested oil be priced using a basket of currencies (Tachibana, 1995).

OPEC oil ministers' threats to drop the US dollar as a basis of pricing oil are the under-reported news of the decade!

OPEC's frustration with low purchasing power was manifest and the later nominal price increases were obvious. OPEC's 1995 comments confirmed their long disgust with the falling dollar, and their dire need for more purchasing power. In the mid-1990s, many people suggested OPEC was dead; that OPEC would never hold a production quota again (e.g., Bahree and Tanner, 1995). This point of view was rubbish to anyone who actually read OPEC's statements. So, irrespective of any differences within OPEC, it was clear OPEC would make a production agreement at their 1996 meeting. Prices rose to their post-1986 RGP trading range (DeMis, 2000).

1998-'99

In 1998, nominal oil prices collapsed to $10/bbl. The US dollar had strengthened 15% above its 1995 low. The '98-'99 price collapse was not driven by a change in the value of the dollar; oversupply was the driving factor. OPEC had raised its production quota just before a recession hit Asia. This caused a profound slump in oil demand (Clayton, 2015). Up to 1997, most of the growth in world oil consumption was in Asia, so the Asian economic slow-down led directly to a decreased oil consumption.

Another factor was that Saudi Arabia had grown weary of Venezuela's chronic cheating on quotas. Saudi Arabia wanted to give Venezuela and other quota cheaters "a good sweating" (*sensu* J. D. Rockefeller; see Yergin, 1991) and would not blink on cutting production to stabilize prices.

This event does not fit the dollar exchange rate-oil value story being told here. But the 1999 event is important because it showed that even countries outside of OPEC could feel the "painful threshold." In 1999, the RGP of oil was far below OPEC's "painful threshold" set in 1995. Non-OPEC countries sent representative to attend or "observe" OPEC meetings. Key non-OPEC countries Norway and Mexico worked with OPEC to get an agreement to cut production by 2 million barrels a day (Ibrahim, 1999). With non-OPEC countries and chronic OPEC cheaters now toeing the line, Saudi Arabia agreed to take the largest cut of 500K bbl/day (ibid). Prices quickly rebounded to their post-1986 trading range.

This collaboration presaged OPEC and non-OPEC cooperation of 2016. This intervention, to maintain a floor to oil's value, is part of the long history of oil. Before OPEC, the Texas Railroad Commission defended prices in times of excess supply (Yergin, 1991).

2005-2014

After 2005, the greenback began a long slide caused by exploding US deficits from fighting two post-9/11 wars (Paul and Quenemoen, 2003; DeMis, 2016). The greenback dropped 36% from 2002 to 2008 (**Figure 8**). By 2005, OPEC surplus capacity fell to less than 1 mmbo/day (Fattouh, 2006). Now that supply and demand were tight, OPEC (and day-traders in commodity "pits") could make almost daily adjustments to nominal prices to offset changes in US dollar's value – *as OPEC had wanted to do since 1970.*

Figure 8 also shows that after 2005, the oil-dollar inverse relationship was manifestly established and continues today. This relationship might have originated from former Deputy Secretary-general of OPEC, Ramzi Salman, who suggested in the influential journal, *Middle East Economic Survey*, that OPEC "…change the present price range to a floating (range) that moves up and down, linked to an index based on a basket of currencies" (Salman, 2004). Although Salman warned this pricing scheme could bring

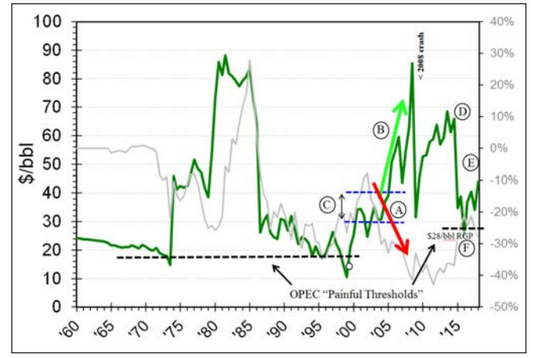

Figure 8. *History of RGP of oil and the US dollar – Part 3. Point A: the US dollar drops over 30% by 2008. Point B: after 2004, with oil supplies tight, OPEC could quickly offset the declining greenback with higher nominal prices. Point C: trading range for 2000-2005. Point D: OPEC was challenged by "American oil supply shocks" and allowed prices to fall. Point E: in 2016, OPEC and non-OPEC countries collaborate to push up nominal prices. Point F: a new painful threshold of about $28/bbl (RGP) appears have been set.*

new instability to "an oil market already crammed with many unpredictable factors" (ibid), it was exactly what OPEC had been doing in very slow motion throughout the 1990s (DeMis, 1996), and what they had wanted to implement back in 1970 when the dollar's value first started to soften.

From 2005-2014, demand was driven by tight oil supply and growing oil exports to China (Fattouh, 2006). OPEC firmly controlled oil prices. And just like in the early 1980s, OPEC over-corrected the price. Oil became *over-valued*. Again, the high value of oil discouraged consumption and encouraged new supplies of oil outside OPEC.

The high RGP of oil was coincident with, and nurtured, American ingenuity and entrepreneurialism in horizontal drilling and multi-stage fracking in resource plays. By 2006, America had entered the "shale revolution." The high value of oil encouraged – and forgave – the requisite experimentation needed to perfect new innovations. Just as important, peaking oil prices brought an abundance of money to the "oil patch" through private equity partnerships. America's fracking revolution was on!

2014-present

The value of the US dollar rose because of changes in economic fundamentals beginning in 2014. The *World Economic Outlook* predicted the US GDP would grow at 0.5%, whereas the Eurozone countries were forecast to grow at -0.3%. Especially important was the weak forecasted growth for Germany at -0.5%, and Japan at -0.7% (Rosenberg, 2014). Also, the *perception* that the Federal

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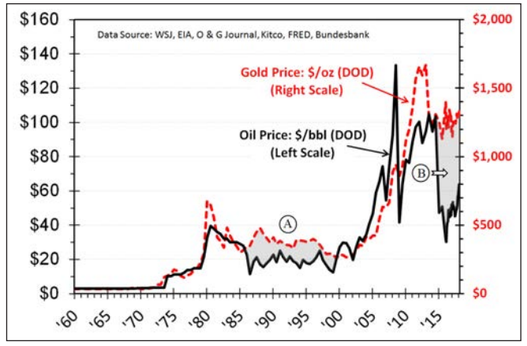

Figure 9. *Nominal oil and gold prices. The two commodities track each other closely except during two episodes, marked by A and B. From 1986 to 2000, and 2014 to present, oil and gold's long-term relationship became decoupled because of oversupply. Oil was undervalued in these times.*

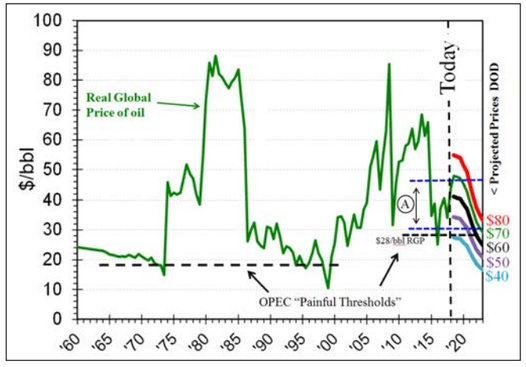

Figure 10. *Projected nominal oil prices in a RGP analysis with falling US dollar. This 5-year projection assumes the value of the US dollar drops by 25% and inflation is 2%. Point A: 2014 to present inferred trading range of $30 to $46/bbl (RGP). Note that $80/bbl shifts to the low end of the new trading range. In such a scenario, OPEC (and possible non-OPEC) countries would cut supplies to regain purchasing power.*

Reserve would begin raising interest rate buoyed the US dollar. European Central Banks were at effective negative interest rates (Irwin, 2014). Yield on the 10-year Treasury bond was 1.9% versus 0.2% for comparable German and 0.4% for Japanese notes (Smith, 2015). Money looking for real yields flowed into the US and lifted the greenback.

In 2014, oversupply put downward pressure on OPEC's prices. In February, 2014, Iraq oil production increased by 520 thousand b/d. America's production climbed to 8.5 million b/d, up incrementally 3.3 million b/d over the baseline. In the 1970s, the world had to deal with OPEC "oil price shocks." By 2014, OPEC had to deal with "American oil supply shocks." The sophistry of "Peak Oil" was forever dead. OPEC held production flat while rising American production displaced OPEC imports. The 2014 oil price crash occurred because of excessive US-driven supply, not a rising dollar.

A rising greenback helped OPEC retain purchasing power even as oil prices dropped. For almost two years, Saudi Arabia kept output steady in the hope it would slow the US shale revolution (Blas, 2018), destroy the expensive tar sands (Berman, 2016), and chase investors out of the "oil patch." This strategy slowed "shale players," and many companies had to file for bankruptcy protection, but American production continued to grow.

By 2016, OPEC and other non-OPEC oil producers realized they needed to cut production to restore purchasing power. They had reached a new "painful threshold." On October 10, 2016, Russian President Vladimir Putin announced Russia will support OPEC goals of cutting global crude output. On November 30, 2017, OPEC and Russia[5] agreed to extend their 1.8 million b/d production cut to the end of 2018. This announcement and declining production in Venezuela lifted nominal oil prices.

Today's Trading Range

Oil prices today trade in a range of about $45 to $70/bbl (DOD). This nominal price range converts to $30-46/bbl (RGP). This range is a bit higher and broader than the RGP trading range established for 2000-05 by DeMis, 2016. Today's range is shown on **Figure 9**. The lower end of this trading range is questionable because the new 'painful threshold' of $28/bbl (RGP) is poorly defined: there is not enough history on the super alliance of OPEC+, or how they will cooperate when prices drop. The width of the trading band, $16, is wider than the 2000-2005 trading band proposed by DeMis (2017) for the same reasons.

Commodity Analysis

A commodity analysis corroborates this RGP retrospective (**Figure 10**). Gold has always provided a standard measure for any currency's strength. Only recently has paper currency been unpegged to any metal. This analysis is also relevant because OPEC had once tried to peg oil prices to gold to combat declines in the greenback (Salman, 2004).

From 1960 to 1986, one ounce of gold could buy 11.5 barrels. When the RGP was low, from 1986 to 2000, one ounce of gold could buy 21 barrels of oil. Oil was undervalued with respect to gold. From 2005 thru 2014, when the RGP was high, the historic oil-gold relation was restored: one ounce of gold could buy 12.8 barrels of oil. Since 2015, the oil-gold relation has become decoupled again. One ounce of gold can buy 27 barrels of oil on average for that period. In the last 3 months, one ounce of gold buys 21 barrels of oil; oil prices are rising with respect to gold. The same rise can be seen in the RPG analysis.

Price Predictions

Prediction of the Past

The robustness of a model can be judged by the validity of its predictions. Using a RGP analysis, DeMis (1996) concluded:

"Towards the end of this decade, as global oil demand catches up with supply, there will be extreme pressure on oil producing countries to steeply raise prices to correct for the dollar's drop, or possibly even abandon the US dollar as the basis for pricing oil."

In 2004, global demand caught up with supply, and nominal oil prices rose steeply to correct for the dollar's drop; rising from $35 to $120/bbl. The "inverse dollar-oil" relation of today was born.

In November, 2000, Iraq abandoned the US dollar as a basis of pricing oil. In April, 2008, Iran dropped the US dollar as the basis for pricing oil.

DeMis (1996) presented a "what-if scenario" to show what would happen if oil prices fell to $10/bbl (DOD) in the then-near future, circa 1998; to demonstrate how a RGP analysis is a better tool to predict price behavior; and to show the price pessimists that they were wrong. A RGP model showed that at $10/bbl (DOD), oil's value would be below OPEC's "painful threshold" established in 1995. DeMis (1996) proposed that at $10/bbl, OPEC would have to make production agreements to quickly push oil prices to $25 or $30/bbl (DOD) - which is what OPEC did (Please see AAPG's Search and Discovery article #70037).

Case Study: ARCO sells to BP

Readers might think that effects of the changing value of the US dollar on OPEC's price policy have long been known to economists, major oil companies, and investment bankers. This is manifestly not true. In 1999, ARCO did not have a single economist, or investment bankers who advised them, who was using a RPG analysis to understand oil price behavior. During the 1998-'99 oil price collapse, oil fell to $10/bbl (DOD). ARCO's CEO, Michael Bowlin, was convinced that oil prices would stay low for years. Former President of ARCO International Marlan Downey recounts, "There was no way we could convince our CEO that oil prices would ever recover" (Downey, Personal Communication, 2008).

Mr. Bowlin unilaterally called a meeting with Sir John Brown, Chief executive of BP, and proposed that BP buy ARCO. Sir Brown was reportedly "shocked" by the offer (Salpukas, 1999). Mr. Bowlin told reporters that with "the uncertain future of oil prices, (this sale) is a good deal for the ARCO shareholders" (ibid). Mr. Bowlin had bankers on his side: "Analysts advised that unless crude oil prices recovered the company would see its earnings decline and have trouble paying it annual dividend" (ibid). No one ever mentioned that oil's RGP value was at an all-time low.

ARCO was sold at the lowest value of oil in the last 50 years, as shown in a RGP analysis (**Figure 7**). Shareholders lost massive value because ARCO, and the bankers advising its management team, lacked an analysis that showed oil's value relative to OPEC – they lacked a RGP analysis. Economists and investment bankers did not understand the relationship between oil's price, oil's value, and the US dollar. ARCO was sold at a deep discount and, not incidentally, thousands of ARCO employees lost their jobs in what is, in my opinion, the worst-timed and most ill-advised merger of the OPEC era.

Future Predictions

Many factors can affect the price of oil. For example, the socialist paradise of Venezuela is running out of other people's money, the economy is collapsing and its oil production is falling fast. This supply short-fall could force oil prices up. Conversely, if "American oil supply shocks" feed more oil into the global market, prices will go down - unless OPEC and non-OPEC countries want to cut production to make room for American oil.

Oil might be priced in other currencies. China has set up a futures market for trading oil priced in yuan. News reports claim that China is pressuring Saudi Arabia to price oil in yuan. News reports claim that a cabal led by China and Russia want to abolish the US dollar as the basis for pricing oil. And so on.

No price prediction can incorporate all the important factors with any semblance of accuracy. But a simple way to consider future oil price behavior is to just look at the purchasing power of oil with respect to the people who (try to) control the price.

Figure 9 shows $40 to $80/bbl (DOD) projected out 5 years using a RGP analysis. This model assumes the US dollar falls 25% gradually over 5 years with 2% annual inflation. A 25% drop in the greenback is not unreasonable. The dollar fell over 30% from 2002 to 2008. With a 25% decline in the US dollar's value, $80/bbl (DOD) oil would move to the low side of the RGP trading range, and be close to the new "painful threshold" of $28/bbl (RGP).

The US dollar will drop sometime in the near future. The greenback is still the major reserve currency of the world. However, the world, not just long-suffering OPEC, will not tolerate this major reserve currency being continuously devalued by exploding federal deficits.

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[5] There are 11 non-OPEC partners, as reported in Platt's Oilgram, January 22, 2018. Russia is the most significant. They also include: Azerbaijan, Bahrain, Brunei, Kazakhstan, Equatorial Guinea, Kazakhstan, Malaysia, Mexico, Oman, and Sudan

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Figure 11. *Price of oil in dollars of the day (WTI, Cushing) since March 1, 2018. The predicted price range of $45 to $70 as published in the May issue of The Outcrop is shown by red lines. Eighty percent of the time, the price was within the projected window. Oil price data is from the Federal Reserve Economic Data web site (FRED), accessed January 7, 2019.*

Conclusions

Over the long term, oil prices are driven by the value of the US dollar in the post-Bretton Woods era, and by the supply-demand balance. In times of tight supply, OPEC can offset the dollar's drops in value by increasing the price of oil. Oil can become over-valued because a cartel prevents oil prices from finding a natural equilibrium. In times of excess supply, OPEC cannot immediately offset drops in the US dollar. In times of very low value, OPEC and non-OPEC countries have put aside their differences and make production accords to regain purchasing power.

A Real Global Price analysis is a superior method for assessing past OPEC actions and historical trends because it measures OPEC's purchasing power, and because it is simple. Long-term oil price behavior can be better predicted using a RGP analysis. The trading range for oil prices today seems to be $45-70/bbl (DOD), but this price range can change dramatically when the US dollar changes value.

Post May, 2018 Predictions

The data for the above paper was assembled by late February, 2018 for *The Outcrop*. Since then, the price of oil (WTI, Cushing) has varied between $75 and $42/bbl (DOD), very close to the predicted range. Only 20% of the time was the price above $70/bbl. On December 7, 2018, OPEC+ intervened with a 1.2 million barrel production cut as the price was sliding past $50/bbl (DOD) to its nadir of $42/bbl. The predicted range from the May, 2018 paper of $45-70/bbl (DOD) has been fairly accurate (**Figure 11**). The robustness of a RGP analysis is affirmed, although the RGP analysis was not intended for predicting day-to-day, or even quarterly, fluctuations.

On January 7, 2019, Saudi Arabia announced their intention to cut oil exports by another 800 thousand barrels in an attempt to get $80/bbl. This export cut is in addition to the recent December, 2018 agreement (Faucon and Said, WSJ, Jan. 8, 2019). Oil prices have risen to over $50/bbl. Clearly Saudi Arabia needs more cash for their government budget that is run on this one commodity.

Going forward, absent large moves in the dollar (>10%), or a global recession, oil prices will continue to range in the $45 to $70/bbl (DOD), with a median price at about $60/bbl (DOD). I do not believe $45/bbl (DOD) is the new "painful threshold", but this value is pretty close to a common pain-point. The recent low price of oil caused Alberta Premier Rachel Notley to announce a temporary oil production cut of 8.7% in December, 2018 to shore up prices for ailing oil producers in the province (Oil & Gas360, December 3, 2018). The painful threshold is where panic sets in. It is probably below $40/bbl (DOD). It has not been tested yet.

The fundamental tenant of this historical analysis of the RGP of oil is that OPEC sets the price. Certainty OPEC's role has been pivotal for over 40 years. However, this basic tenant might be changing. Exploding US oil production is disrupting geopolitics and the long-held world order of OPEC's control over oil. Exploding US production is changing this world order.

Noteworthy are predictions by some that Permian Basin oil production could increase by as much as another 2 to 3 million barrels per day (the accuracy of this prediction is fodder for another paper). Brazil might be exporting 1 million barrels per day by 2022 (Querubin, 2019). It challenges the imagination that Saudi Arabia or OPEC+ will be able to keep oil overvalued, i.e., above $70/bbl (DOD) or $45/bbl (RGP), in the face a glut of another 3 to 4 million barrel per day in supply. Getting more non-OPEC members to cut production seems improbable because the big non-OPEC producers have already signed up to the OPEC+ cartel.

If such a glut were to happen, it would push oil prices below the "painful threshold" – wherever that might be. Oil prices might dip as low as $30/bbl. OPEC+ does not have enough budgetary "wiggle room" or cash reserves, or political cohesiveness, to cut production so as to push nominal prices above the "painful threshold." Several speculative scenarios follow.

The Texas Railroad commission might resume its historic role of preventing waste and re-impose "prorations" to dampen Texas oil production if prices fall too low and OPEC+ is floundering. As noted above, the Alberta government has already ordered a production cut to support prices. The Texas Railroad Commission's actions, if they were to occur, might push prices up to the $40s or $50s (DOD). This value still does not help OPEC.

China stepped into the economically-imploding socialist paradise of Venezuela back in 2001 to form a Comprehensive Development Partnership. China has lent $60 billion, primarily repaid in oil, to fund more than 600 investment projects. In return, Chinese companies have received preferential access to Venezuela's domestic market, and lucrative infrastructure concessions (Lansberg-Rodríguez, 2017). In addition, economically imploding Venezuela has become a client state of Russia. It is planning to allow Russia to base its Tu-160 nuclear-capable strategic bombers on the Venezuelan island of La Orchila in the Caribbean (Martel, 2018; Martin, 2018), a plan confirmed by the Russia news agency TASS.

Reasoning by analogy, friendly Middle East OPEC countries might be pushed to cash-rich China if oil's value drops below the "painful threshold" for too long a time. China's Belt and Road Initiative is intended, in part, to secure resources, especially out of East Africa. From leasing a military base in Djibouti just miles from America's only African military base, to alleged predatory lending which lead to Sri Lanka handing over it strategically located Hambantota deep-water port as debt collateral (Chellancy, 2017), to bailing out flagging the sovereign wealth fund in Malaysia in exchange for stakes in railroads and pipelines (e.g., Wright and Hope, 2019), to building a blue-water navy, China's goal is to secure resources and project power.

Once-friendly Middle Eastern OPEC countries, punished by painfully low nominal oil prices, might become easy prey for the trillions of US dollars China has in its central bank. A financially desperate Middle East would be a plume too ripe for China not to pick. This is not a good thing for America. This scenario would insure low nominal prices for a long time because China is a big consumer of oil. It would also mean a loss of friendly-to-the-US Middle Eastern oil resources. Russia might be facilitating this scenario today (i.e., putting a financial squeeze on Middle East oil producers to help China) with its recent announcement that it is "fine" with $60/bbl (DOD). This scenario is not unreasonable because there is evidence of a Russia-China strategic alliance (e.g., Goldstein, 2017).

The shale boom cannot last forever; Permian Basin oil production will decline again. Over the long run, the US will need access to Middle East oil supplies. But when that day comes, those Middle Eastern producers might have new alliances with China and Russia. On the other hand, by the time Permian Basin production declines, the US might be a natural gas economy; there will be little need for incrementally more oil to fill the energy short-fall created by declining Permian Basin production.

The future will be interesting. ■

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Biographical Sketch

William DeMis is President of Rochelle Court, LLC, a geoscience consultancy. He has over 30 years of experience in the petroleum industry. Mr. DeMis has held positions of Exploration Manager for Marathon Oil Company, Exploration Vice President for Roxanna Oil Company, and Chief Geologist for Goldman Sachs. Mr. DeMis is an AAPG Charles Taylor Fellow, former AAPG Books Editor and Associate Editor of the *AAPG Bulletin*. He is a Trustee Associate of the AAPG Foundation and a member of the AAPG, HGS, and RMAG. Mr. DeMis is a member of The University of Texas at Austin Littlefield Society.

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Norwegian Consulate General

Houston

Norwegian Energy Day, March 19, 2019

"Energy and Digitalization – Reshaping the Industry"

The Royal Norwegian Consulate General in Houston, in collaboration with partners NORWEP, DNB, Export Credit Norway, Innovation Norway and GIEK has the pleasure of extending a personal invitation for you to join us for the Norwegian Energy Day, this year focusing on digitalization.

Digitalization has brought great changes to countries, businesses, and people, and will continue to do so in the future. We will look at the implications of new and existing technologies for the energy industry: What opportunities are created? Which challenges arise?

We hope you will join us for an informative, dynamic conference featuring high caliber analysts, energy executives, project developers, academics, and more. They will present their views on key developments regarding digitalization in the energy industry. There will also be a panel discussion and pitches given by innovative Norwegian companies. The conference will include general market updates and perspectives on the future of the energy industry, and concludes with a mingling session.

The conference will feature speakers from ConocoPhillips, Rystad Energy, Kongsberg Gruppen, TGS Nopec, Arundo, ABB, Rice University and others.

The conference will be moderated by Jan E. Ødegård, Executive Director of the Ken Kennedy Institute for Information Technology and Associate Vice President of Research Computing & Cyberinfrastructure at Rice University.

Keynote speaker: Darryl Willis
Vice President, Energy, Google Cloud

The conference is by invitation only and is free of charge, however space is limited and early registrations are encouraged!
Venue: *Norris Conference Center - Houston, 816 Town & Country Blvd, Suite 210, Houston, TX.*
Time*: Tuesday, March 19, 2019, 7:30am - 6pm*
Kindly RSVP by following the link in the e-mail invitation by **Friday, March 15, 2019.**
For questions about the conference or the invitation, please reply to the invitation email or call us on 713-620-4200.

Government Update

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

AGI Geoscience Policy Monthly Review (December 2018)

Nominations for Energy and Environmental Agency Positions Move Forward in Lame Duck

A series of nomination processes continued as Congress wrapped up their lame duck session—the final legislative period of this term—following the November 6, 2018 midterm elections. Nearly two years into this administration, President Donald Trump is still nominating department heads at the Federal Energy Regulatory Commission (FERC), Department of Energy (DOE), National Park Service (NPS), Environmental Protection Agency (EPA), and other federal agencies.

The Senate confirmed Bernard McNamee to be a member of FERC on December 6, 2018. At a previous Committee on Energy and Natural Resources hearing on November 15, 2018 the Democratic committee members raised concerns about McNamee's nomination because of alignment with fossil fuels and nuclear energy in preference to renewables. For example, McNamee was involved in a rejected DOE policy to support struggling nuclear and coal plants that was criticized by Democrats. After the Senate hearing, a video emerged showing McNamee criticizing renewable energy and its proponents last February at a Texas Public Policy Foundation event in Austin. Democrats attempted delay the vote, but the Senate committee approved McNamee for the position at FERC on November 27, 2018. The full Senate voted along party lines (50-49) to confirm McNamee on December 6, 2018.

Also at the November 15, 2018 meeting, the Committee on Energy and Natural Resources considered the nominations of Dr. Rita Baranwal to be assistant secretary for nuclear energy and Raymond Vela to be director of NPS. Both Baranwal and Vela were reported favorably out of the committee on November 27, 2018 and await a final confirmation vote by the Senate.

On November 16, 2018 President Trump announced that he intends to nominate Andrew Wheeler, the current acting EPA chief, to be the next EPA administrator following the resignation of Scott Pruitt. The pending nomination likely sets up a lengthy fight from Democrats in Congress over Wheeler's ties to the fossil fuel industry.

The Senate Environment and Public Works committee held a hearing on November 29, 2018 to question Alexandra Dunn, President Trump's second choice to lead EPA's chemicals office. The president's previous nominee, Michael Dourson, faced strong opposition to his ties to the chemical industry and withdrew his nomination in December 2017. Dunn is an environmental lawyer who currently serves as EPA's regional administrator for New England. She is widely expected to be approved by Senate vote.

According to the Washington Post's administration appointee tracker, there are seven nominations currently pending Senate action for DOE, three for the Interior Department, and three for EPA.

EPA and Department of the Army Announce Intent to Redefine WOTUS Rule

On December 11, 2018 the Environmental Protection Agency (EPA) and the Department of the Army proposed a revised definition of the Waters of the United States (WOTUS) rule.

The WOTUS rule, also known as the Clean Water Rule, was first published in 2015 under the Obama administration to define "waters of the United States" that qualify for protection under the Clean Water Act of 1972. The 2015 rule did not establish any regulatory requirements, but it clarified the scope of federal authority for implementing the Clean Water Act to protect the nation's water resources from pollution and destruction.

The proposed revision would limit where federal regulations apply and replace the 2015 WOTUS definition "with one that respects the limits of the Clean Water Act and provides states and landowners the certainty they need to manage their natural resources and grow local economies," according to EPA Acting Administrator Andrew Wheeler.

The proposal clearly outlines what would be considered "waters of the United States," including traditional navigable waters such as large rivers and lakes, tidal waters, and the territorial seas. It also outlines specific exclusions from the definition, such as ephemeral features, groundwater, many ditches, prior converted cropland, stormwater control features, and waste treatment systems.

A 2017 slideshow prepared by EPA and the U.S. Army Corps of Engineers (USACE) showed that at least 18 percent of streams and 51 percent of wetlands nationwide would no longer be protected under the newly-defined WOTUS rule.

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The announcement follows President Donald Trump's February 2017 executive order requiring EPA and USACE to review the WOTUS rule and come up with a proposal for rescinding or revising the rule. The executive order directed federal courts to hold off on any ongoing litigation concerning implementation of the rule pending further administrative proceedings. Complex legal battles have erupted since the WOTUS rule was finalized in 2015 and continue to cause uncertainty regarding the legality of enforcing the rule across the country. A Supreme Court ruling on January 22, 2018, lifted the nationwide hold on implementing the WOTUS rule, which prompted the Trump administration to publish another rule in February 2018 that delayed the WOTUS rule's applicability date until 2020, providing the EPA with more time to adjust its requirements.

The proposed revision will undergo a sixty-day comment period before EPA proceeds to finalize it. The new rule will almost certainly face challenges in court. States and environmental groups have already sued the Trump administration over its move to delay implementation of the original WOTUS rule, suggesting that legal action will ramp up as efforts to weaken the environmental regulation continue.

White House Releases 2018-2023 STEM Education Plan

The White House unveiled its five-year strategic plan for science, technology, engineering, and mathematics (STEM) education on December 4, 2018. The report, entitled "Chartering a Course for Success: America's Strategy for STEM Education," outlines the administration's goals and approaches for advancing STEM education and workforce over the next five years.

The 2018-2023 plan highlights the federal government's role in promoting STEM education by working with private partnerships and removing barriers to participation in STEM careers, especially for women and other underrepresented groups. It acknowledges that the innovation capacity, prosperity, and security of the United States depends on an effective and inclusive STEM education ecosystem, and envisions a future "where all Americans will have lifelong access to high-quality STEM education and the United States will be the global leader in STEM literacy, innovation, and employment."

The report describes three aspirational goals: (1) building strong foundations for STEM literacy, (2) increasing diversity, equity, and inclusion in STEM, and (3) preparing the STEM workforce for the future. It further outlines four pathways to achieving those goals: (1) developing and enriching strategic partnerships, (2) engaging students where disciplines converge, (3) building computational literacy, and (4) operating with transparency and accountability.

A press release accompanying the report tied the goals of the report to President Donald Trump's ongoing commitment to expanding STEM education and employment opportunities, such as a presidential memorandum signed in June 2017 directing the Department of Education to make STEM and computer science education a top priority.

"My Administration will do everything possible to provide our children, especially kids in underserved areas, with access to high-quality education in science, technology, engineering, and math," President Trump said in the press release.

The report was compiled by the Office of Science and Technology Policy's National Science and Technology Council, as required by the America COMPETES Reauthorization Act of 2010 (P.L. 11-358), and builds on the 2013-2018 strategic plan released by the Obama administration.

President Trump Approves Earthquake Hazards Bill

On December 11, 2018 President Donald Trump signed a bill to reauthorize the National Earthquake Hazards Reduction Program (NEHRP) through fiscal year 2023.

NEHRP was created to facilitate research, planning, decision-making, and mitigation efforts related to seismic activity between government agencies. The National Institute of Standards and Technology (NIST) is the lead agency responsible for NEHRP planning and coordination alongside the Federal Emergency Management Agency (FEMA), the National Science Foundation (NSF), and the United States Geological Survey (USGS).

The National Earthquake Hazards Reduction Program Reauthorization Act of 2018 (S. 1768) provides the first reauthorization of NEHRP since 2004. In addition to authorizing appropriations for the program for five years, the bill clarifies specific agency authorities under NEHRP, revising the responsibilities of NIST as the lead agency and those of FEMA, NSF, and USGS. The legislation explicitly authorizes USGS to issue earthquake warnings and other awareness products and to update its management plan for the Advanced National Seismic System (ANSS). It also calls for a comprehensive assessment of the nation's earthquake risk reduction strategy.

The Senate passed the bill on September 27, 2018 followed by the House on November 27, 2018 sending the bill to the President's desk for final passage into law, coincidentally just before a magnitude 7.0 earthquake struck Anchorage, Alaska on November 30, 2018. ■

HGS *Bulletin* Instructions to Authors

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

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

Figures, maps, diagrams, etc., should be digital files using Adobe Illustrator or Adobe Photoshop. Files should be saved and submitted in .ai, .eps, .tif or .jpg format. Send them as separate attachments via email or CD if they are larger than 5 MEGs each, accompanied by figure captions that include the file name of the desired image. DO NOT EMBED them into your text document; they must be sent as separate files from the text. DO NOT USE POWERPOINT, CLIP ART or Internet images (72-DPI resolution) as these do not have adequate resolution for the printed page and cannot be accepted. All digital files must have 300-DPI resolution or greater at the approximate size the figure will be printed.

Photographs may be digital or hard copy. Hard copies must be printed on glossy paper with the author's name, photo or figure number and caption on the back. Digital files must be submitted in .tif, .jpg or .eps format with 300-DPI or greater resolution at the printing size and be accompanied by figure captions that are linked by the file name of the image. The images should be submitted as individual email attachments (if less than 5 MB) or on CD or DVD.

HGS *Bulletin* Advertising

The *Bulletin* is printed digitally using InDesign. Call the HGS office for availability of ad space and for digital guidelines and necessary forms or email ads@hgs.org. Advertising is accepted on a space-available basis. **Deadline for submitting material is 6 weeks prior to the first of the month in which the ad appears.**

Random Inside Ad Placement Black & White Prices Shown – Color add 30% to prices below					**Specific Page Color Ad Placement**					
No. of Issues	Random Eighth Page	Random Quarter Page	Random Half Page	Random Full Page	Inside Front Cover Full Page	Inside Back Cover Full Page	Page 2 Full Page	Outside Back Cover Half Page	Back of Calendar Full Page	Calendar Quarter Page
10	$950	$1,350	$2,550	$4,750	$8,000	$7,500	$7,050	$6,850	$6,650	$3,000
9	$800	$1,300	$2,500	$4,700						
8	$750	$1,250	$2,250	$4,300						
7	$600	$1,100	$2,200	$3,850						
6	$550	$950	$1,800	$3,500						$2,000
5	$500	$800	$1,600	$3,000	$4,700	$4,500	$4,350	$4,000		
4	$450	$650	$1,300	$2,500						
3	$300	$550	$950	$2,000						$1,000
2	$250	$400	$700	$1,500						
1	$150	$250	$450	$1,000	$1,500	$1,400	$1,250	$1,000	$1,250	$850
Professional Directory Section Business Card Ad: 10 Issues – $160 ($30 for each additional name on same card)										

Website Advertising Opportunities

There are currently 5 opportunities to help spread the word about your business or event and generate traffic to your website or campaign. Please submit all ad materials five (5) days prior to the go-live date for testing.

Placement	Rate	Specifications/Description
HGS Website Home Page Banner Ad	$800 – Monthly $1800 – 3 Months $2800 – 6 Months $3600 – 12 Months	275 x 875 pixels; home page top banner ad. All Home Page Banner Ads rotate every 10 seconds.
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Geo-Jobs	$50 – 14 days $100 – 30 days $300 – 3 Months $600 – 6 Months $1200 – 12 Months	Posting of job opportunities on HGS website. Click the Geo-Jobs tab to get started. Must be filled out completed and the dates set appropriately.
Vendor Corner	$250 *4 Pack option with 1 FREE bonus event for $1000.00 available. Send request to vendorcorner@hgs.org.	Company logo, company website, and company description will be highlighted on HGS Calendar website event. This is an opportunity to display company wares, gain personnel exposure and hand out product information at HGS dinner meetings.
Event/Short Course Calendar Ad	$100 – Monthly	An event ad posted within the HGS website calendar under the Events tab.
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Application to Become a Member of the Houston Geological Society

Qualifications for Active Membership

1) Have a degree in geology or an allied geoscience from an accredited college or university; or
2) 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 five (5) years.

Qualifications for Associate Membership (including students)

1) Be involved in the application of the earth or allied sciences.
2) Be a full-time student enrolled in geology or in the related sciences.

Apply online at www.hgs.org and click on Join HGS

Annual Dues Expire Each June 30. (Late renewals – $5 re-instatement fee)

Annual dues are $30.00; emeritus members pay $15.00; students are free.

Mail this application and payment to:

Houston Geological Society

14811 St. Mary's Lane, Suite 250 • Houston, TX 77079-2916

Telephone: 713-463-9476 Fax: 281-679-5504

Payment method:

❑ Check, ❑ VISA, ❑ MasterCard, ❑ American Express, ❑ Discover

Card # _____

Expiration Date: _____ Card I.D. _____

(Card I.D. – 3 or 4 digit number on front or back of card)

To the Executive Board: I hereby apply for ❑ Active or ❑ Associate membership in the Houston Geological Society and pledge to abide by its Constitution and Bylaws. ❑ Check here if a full-time student.

Name: _____

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Home Phone: _____ ***Spouse's Name:*** _____

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Job Title: _____

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Work Phone: _____ ***Fax Number:*** _____

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Professional Affiliations: _____

❑ AAPG member No.: _____

Professional Interest:

❑ Environmental Geology ❑ North American E&P (other than Gulf Coast)

❑ International E&P ❑ Gulf Coast E&P (onshore & offshore)

School _____

Degree _____ ***Major*** _____ ***Year*** _____

School _____

Degree _____ ***Major*** _____ ***Year*** _____

Earth Science Work Experience _____

_____

_____

_____

Applicant's Signature _____ ***Date*** _____

Endorsement by HGS member (not required if active AAPG member)

Name: _____

Signature _____ ***Date*** _____

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