WEST TEXAS GEOLOGICAL SOCIETY

BULLETIN

March - April 2024 VOLUME 63, NUMBER 4

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(2023-2026) - Robert Nail, Troy Tittlemier

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From the 2023-2024 Secretary ~ Joey Dishron

Hello WTGS members,

As I am writing this, it is a mild but windy February day here in Midland. Punxsutawney Phil did not see his shadow, so I am hopeful that by the time you read this, we are all enjoying springtime.

This year marks my 13th year as a working geologist and my 10 th year working in the Permian Basin. As I reflect upon the last 10 years, it is amazing to me what the geoscience community and the petroleum industry has accomplished. I was working at XTO Energy in their Midland Basin division. We had just finished a 12 well Wolfcamp B delineation drilling program and were debating if the Lower Spraberry Shale would work. As most know, the Lower Spraberry didn't just work, it exceeded expectations. We then went on to see the industry test the Middle Spraberry, Jo Mill, Wolfcamp C, D (Cline) and now some operators are finally having success in the Barnett/Woodford. The Delaware Basin saw the same progression, but at a larger scale within the Wolfcamp and Bonespring intervals and now has some of the lowest break-evens in the industry.

It's because of talented geoscientists like you that we have seen the Permian Basin become the powerhouse it is today. Since 2014, we have seen production increase 4-fold to almost 6 MBO/D and 24 BCF/D. Amazing! However, because of technological advances and increased efficiencies, the rig count is about ½ of what it was 10 years ago. AAPG reports that they are at a record low membership, not seen since the 1970's. Majors and large oil independents' summer intern programs are a fraction of what they were 10 years ago. The folks who get hired from that already small pool is slim. To put it simply, we are not replacing ourselves.

It is up to us, seasoned geoscientists, to convince company senior management of our importance. As we look at exploration and production in the Permian Basin for the next 10 years, it is imperative that we have a talented and skilled workforce to continue to provide clean, abundant, American-made energy for the world.

We have two great luncheons coming up in March and April. I encourage you to attend and broaden your local network. In April, we will also hold a two-day completions workshop by Bob Barree. Bob is most famous for developing the fracture simulation software GOHFER. This is a great opportunity for you to broaden your skillset. See you around the patch!

Take care,

Joseph B. Dishron
Secretary, WTGS 2023-24

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A Geologic Adventure across Australia and New Zealand
By David J. Entzminger

For years I have enjoyed reading Jesse's Jaunts in the WTGS bulletin. His adventures inspired me to share my trip to Australia and New Zealand in November and December, 2023, from a geologist's perspective.

Adventurers, and especially geologists, traveling to Australia are drawn to both Uluru (Ayers Rock), Figure 1, the massive arkosic-sandstone monolith in the middle of the Australian outback and the Great Barrier Reef. In New Zealand, the Alps on the Southern Island and geothermal activity on the Northern Island are awe inspiring.

Figure 1. Uluru, southern part of the Northern Territory, Australia.

My wife, Melanie, and I spent 30 exciting days crisscrossing Australia and New Zealand. As a geologist, my eye caught the ever-changing landscapes. As the geology of these two countries did impress me; we enjoyed Melbourne's wonderful nightlife, dining and culture as well as Sydney's sophistication and history.

The Australian Outback is wild and scenic, similar to parts of West Texas and Southeast New Mexico. As some would say, "beauty is in the eye of the beholder." You can see forever, and the sunrises and sunsets are marvelous, Figure 2. We experienced a dust storm, or haboob, (Figure 3) just like I have seen around Midland, Texas. One of the adventures on our trip was camping in the Outback. Dingoes (wild dogs) visited our campsite as we were having dinner. They were just being curious and looking for scraps of barbequed kangaroo and camel that we enjoyed over the campfire that night.

Figure 2. Sunrise in Australian Outback.

Figure 3. Dust storm (Haboob) in Australian Outback between Alice Springs and Uluru.

After our camping adventure, we traveled to Yulara to experience the majesty of Uluru (Ayers Rock) and Kata Tjuta (Mount Olgas). The use of the aboriginal names for features and areas is common in Australia. Both of these geologic features are prominent structures in the vast desert region of the Australian Outback. Uluru is a sacred site for the Anangu aboriginal people. It is seen as a resting place for ancient spirits. Kata Tjuta is sacred. Its remoteness was used by the Anangu men to take their young boys and give them a chance to become men. The vertical, arkosic-sandstone bedding of Uluru, Figure 4, is distinct from the horizontal-conglomerate layers at Kata Tjuta, Figure 5. Not many folks can say they experienced an exclusive News Breaking weather storm while trekking around Uluru. We survived the hail and rain with gusts of over 50 mile-an-hour winds while sheltering under a thatched hut near the Mutitjulu waterhole. Following the storm, we witnessed extraordinary waterfalls coming off Ayers Rock, Figure 6. Shortly after being mesmerized by these waterfalls, we enjoyed a double rainbow in the background over Uluru.

The origins of Uluru and Kata Tjuta date back about 500 million years when the Australian continent was formed. As the large crustal blocks merged to create the island of Australia they developed a Himalayan-sized, mountain range called the Petermann Range. This granite range eroded, shedding the conglomerates that formed Kata Tjuta and the sandstones at Uluru. Deformation twisted the horizontal layered sediments at Uluru into vertical beds that we see today, Figure 4. The red color of the area is from the oxidation of the iron-rich rocks. https://www.abc.net.au/news/science/2017-06-27/how-did-uluru-and-kata-tjuta-form/8572068 .

Figure 4. Uluru or Ayers

Figure 5. Walpa Gorge Walk at Kata Tjuta, conglomerate layers exposed in

Figure 6. Waterfalls on Ayers Rock.

One of my trip highlights was snorkeling on the Great Barrier Reef, Figures 7a and 7b. The colors of the corals and fish were so brilliant. The Great Barrier Reef is an UNESCO site hosting the world's largest collection of coral reefs with 400 types of coral, 1500 species of fish and 4,000 types of mollusks. Our trip included a discussion with a marine biologist from Quicksilver. She talked about reef bleaching. Quicksilver's work shows that the reefs have experienced bleaching but the media and climate people have not provided the entire story. Reefs along the Great Barrier Reef are currently very much alive and doing well. Quicksilver does a lot of reef protection and research, https://quicksilver-cruises.com/information/reef-restoration . Their data shows large storms do much of the damage on the reefs. They are experimenting with artificial structures to help protect the reefs from storms, and their groundbreaking research using in vitro fertilization (IVF) to repopulate the corals is showing promise.

Figure 7a. Great Barrier Reef stretching 1,429 miles along the northeastern coast of Australia, picture from https://whc.unesco.org/en/list/154/ .

Figure 7b. Patch reefs within the Great Barrier Reef on the edge of continental shelf during the Quicksilver Adventure.

The landscape of the South Island of New Zealand, especially around Queenstown, reminds me of areas in the Teton National Park and Glacier National Park, Figure 8a and 8b. New Zealand sits along the Ring of Fire creating geothermal and tectonic activity. We saw some of the remains of the February 2011 massive 6.2 earthquake while visiting Christchurch and Hokitika.

New Zealand's Southern Alps extend along the western side of the South Island. They are rugged peaks over 12,000 feet high that have been cut by glaciers during the last ice age forming some amazing U-shaped valleys, Figure 9. Deep V-shaped valleys are currently being carved by rivers through the area. Like Alaska, there are many braided rivers coming out of the mountains that are fed by the abundance of rainfall and remaining glaciers, Figure 10.

A trip to Milford Sound is worth the adventure to experience this fjord that is fed by the Tasman Sea on the west side of the South Island of New Zealand. Milford Sound is one of two places on earth you can experience a rain forest, a glacier and a fjord; the other location is in Patagonia. During our cruise on the sound, we saw remnants of the five glacial periods, marine wildlife like seals and penguins, and the Alpine fault. The Alpine Fault line extends about 600km along the spine of the South Island between Milford Sound and Marlborough. This fault connects two "subduction" margins where the ocean floor descends into the Earth's mantle. New Zealand straddles the boundary between the Pacific and Australian tectonic plates. As the plates collide, they push up the land, forming these rugged mountains. The Southern Alps are one of the most rapidly rising mountain ranges in the world. They started forming between 100-300 million years ago. The Southern Alps consist of greywacke containing narrow bands of siltstone in the east and grading into schist west of the main divide.

Figure 8a and 8b. New Zealand's Southern Alps between Queenstown and Milford Sound.

Figure 9. U-shaped valley in Milford Sound

Figure 10. Braided river, between TeAnu and Milford Sound.

We visited Hokitika, New Zealand on the western coast of the southern island where the nephrite Jade or Greenstone is found, Figure 11. Pounamu, as it is named in Māori, was a very early and valuable form of tender. With the advent of the iron age, jade's use for making tools diminished and it became primarily valued for its rarity and beauty. The government of New Zealand gave ownership of the Greenstone to the Māori, native people of New Zealand; therefore, to acquire or process this valuable stone one must buy it from a Māori.

Figure 11. Greenstone at a rock shop in Hokitika, New Zealand

New Zealand's North Island provides an abundance of opportunities to experience geysers, femorals, mud pools and hot springs, Figure 12a and 12b. These geothermal features are very prominent near the city of Rotorua. The sulphur smell, rotten-egg aroma, throughout the area around Rotorua reminds me of how the earth has a strange way of sharing its resources. The bright-yellow color on the surfaces around some of the femorals and geysers is sulphur deposits.

Figure 12a. Geyser near Rotorua, New Zealand.

Figure 12b. Waimangu Area, femoral spewing steam and sulphur, Rotorua, New Zealand.

The geology of Australia and New Zealand is amazing but getting to learn about the culture of the Aboriginal and Māori people was educational, Figure 13 and Figure 14. Experiencing the UNESCO sites, World Heritage Sites and cities of Melbourne, Sydney, Christchurch, Queenstown and Auckland was wonderful. The opportunity to snorkel on the Great Barrier Reef, see a Cane Toad race, zip line over the tree canopy, and jet boat up the Dart River gave me thrills of a lifetime. Until you get a chance to travel to these islands, I hope you enjoyed this adventure through my words and pictures.

Until we meet again. Best Wishes, David Entzminger.

Figure 13. Kuku Yalanji cleansing ceremony. These Australian natives have lived around the Daintree Rainforest area for more than 50,000 years.

Figure 14. Māori war dance in Rotorua, New Zealand.

CALENDAR

Sun	Mon	Tue	Wed	Thu	Fri	Sat
					1	2
3	4	5	6	7	8	9
10	11	12 TASTING WTGS LUNCHEON	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

WTGS Luncheon
Bush Convention Center
11:30 am, $25.00/50.00

PBS-SEPM
Bush Convention Center
11:30 am

SIPES
Midland Country Club
11:15 am

SPWLA Permian Basin
ClayDesta
6th Floor Conference
11:30 am

- **WTGS Luncheon - Tuesday, March 9, 2024**
  Elvind Moen - Commit Well Solutions - "*Sustainably Maximizing Production Recocery Through Innovative Formation Damage Treatment*"

- **SIPES Midland Chapter - March 20, 2024**
  Mark Andreason- *"Helium Exploration Workflow In the Four Cor ners Area - Navajo Nation"*

- **PBS-SEPM Luncheon - March 19, 2024**
  Jacob Covault/Zoltan Sylvester - BEG

- **SPWLA Permian Basin Chapter - March 26, 2024**
  TBA

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- Core Analysis
- Geochemistry
- Reservoir Models
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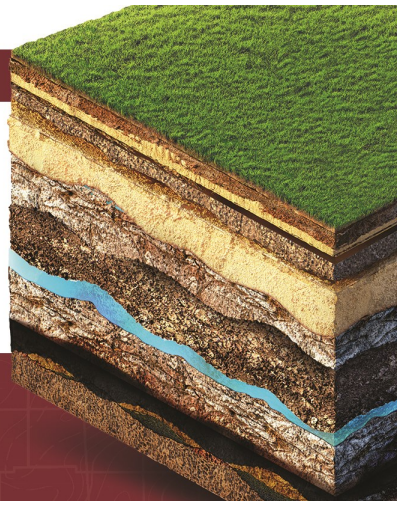

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Sun	Mon	Tue	Wed	Thu	Fri	Sat
	1	2	3	4	5	6
7	8	9 WTGS LUNCHEON	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

- **WTGS Luncheon - Tuesday - April 9, 2024**
  Chris Smith - Advanced Hydrocarbon Stratigraphy - *"Identifying Pay Zones"*

- **SIPES Midland Chapter -April 17, 2024**
  TBA

- **PBS-SEPM Luncheon - April 16, 2024**
  TBA

- **SPWLA Permian Basin Chapter - April 23, 2024**
  TBA

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March 12, 2024 WTGS Luncheon

Bush Convention Center

Lunch: 11:30 AM **Cost**: $25 in person (pre-register)

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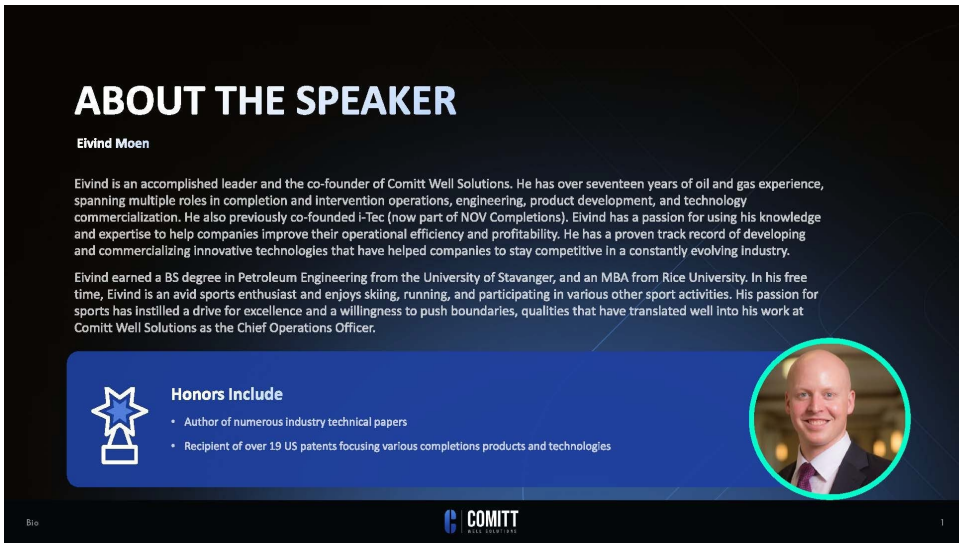
Sustainably Maximizing Production Recovery Through Innovative Formation Damage Treatment

As oil and gas wells age, they often encounter formation damage that reduces productivity and increases operational costs. Traditional solutions, such as bullheading chemical treatments from the surface, can provide a temporary boost in production but ultimately fail to address the root cause of the formation damage. A new, data-driven process has been developed to sustainably improve the productivity of sub-par producing oil and gas wells. This approach leverages historical experience and analytical methods to evaluate candidate selection, wellbore cleanout methods, chemical treatment selection, and retreatment methods to provide the best economic returns.

The process has been successfully applied in several field case studies, with notable results achieved compared to traditional solutions based on bull heading chemical treatments from surface. One case study involved a horizontal well in the Midland Basin, where production dropped by 50% in just 75 days after the initial completion. HCL acid was initially bullheaded down the backside of the production string, but a month after the production fell below the original levels, indicating an unsuccessful treatment. The new process was then used to conduct flow assurance evaluation, design optimization, and treatment execution. The analysis identified sulfide scaling as the cause of the restricted well flow, and an optimized chemical program was designed. A wellbore cleanout was performed, followed by individually retreating each stage with the downhole hydraulically activated system. The entire retreatment on all 68 stages was performed on a single trip, successfully eliminating all the skin damage and attaining a 100% sustained production recovery.

The novelty of this approach lies in the ability to deliver a focused treatment with the optimum chemical solution in an existing wellbore on a single trip. This significantly increases operational reliability and reduces downtime, while maximizing the budget spend and decision-making efficiency.



April 9, 2024 WTGS Luncheon

Bush Convention Center

Lunch: 11:30 AM **Cost**: $25 in person (pre-register)

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Identifying Pay Zones and Understanding Petroleum Systems in Petrophysically Difficult to Interpret Plays by Analyzing Volatiles from Cuttings and Core with Rock Volatiles Stratigraphy

Christopher Smith (PhD) - Senior Chemist - Advanced Hydrocarbon Stratigraphy

Rock volatiles stratigraphy (RVS) has been pioneered and developed by Advanced Hydrocarbon Stratigraphy since 2010 to provide actionable information to oil and gas operators based on detailed geochemical analysis of volatile components present in geological samples though recently this has expanded to include helium, geothermal, and CCS applications. Samples analyzed are typically cuttings and core, which can be unpreserved and several decades old, but muds and produced fluids are also analyzed on the same instrumentation allowing for direct comparisons.

The RVS technique applies vacuum extraction to rock samples to provide quantitative information on entrained hydrocarbons (HC), organic and inorganic acids, noble gases, air components, various sulfur compounds, biodegradation compounds, stimulation compounds and water. Two vacuum extractions, at 20 and 2 mbar, are applied to the same rock sample to obtain readily extracted and more tightly held compounds. Analytes are concentrated on liquid nitrogen cold traps (CT). When the CT is warmed after collection the analytes are released by sublimation point to a mass spectrometer for analysis. Non-condensable gases like methane and helium are analyzed prior to warming. Analysis at different vacuum extraction pressures allows for calculation of relative permeability indices, understanding surface/fluid interactions, and evaluating environments where compounds reside.

Past work in the Permian for RVS has included examinations of the Wolfcamp and the Avalon shales in both the Midland and Delaware basins. In the cases of these tight shales the HC resource is retained in the rock in a relatively representative manner allowing for an X-marks the spot style approach to understand resource concentration and composition using cuttings samples sealed at the well site. Examples of selecting optimal landing zones based on resource content and rock properties from RVS for the Wolfcamp and identifying by-passed pay in the Avalon/Brushy Canyon are discussed.

More recently RVS has been used to study other shale targets and the Bonesprings. In the case of the Bonesprings RVS data analysis greatly benefits from signatures and methodologies developed for non-source rock plays including the Austin Chalk, the Miss Lime in the STACK (OK), the North Slope of Alaska, the Gulf of Mexico, and Trinidad. These signatures and methodologies from outside the Permian basin, developed in many cases for more conventional play types and problems, have found great use in applications such as pay zone identification in plays that petrophysical analyses miss, assessing water content, identifying oil migration conduits, evaluating relative permeability of oil vs water, and evaluating gas mediated resource fractionation and reservoir pressure loss. Examples of these signatures from the plays that they were developed in will be shown and discussed.

Bio: Christopher Smith has been a Senior Chemist with Advanced Hydrocarbon Stratigraphy (AHS) since January 2019 and moved to Midland in 2022 working on data analysis, instrumentation, client engagements, and business development. Most of his analysis work focuses on the Permian, the Anadarko and Arkoma basins in Oklahoma, the North Slope in Alaska, and the Marcellus. Since 2020 a significant portion of Christopher's work has been geared toward expanding the uses of AHS's unique patented technologies into non-traditional fields for AHS beyond oil and gas – these include successful engagements and projects with academia, government, and operators on subsurface studies in carbon capture and sequestration, helium exploration, and geothermal power. Additionally, he has pushed AHS to be involved in scientific studies on permafrost in the Artic and the paleo environment before, during, and after the Chicxulub impact. Prior to working for AHS, he received his PhD in analytical chemistry from the University of Arizona with focuses on instrumentation, data analysis programing, spectroscopy, electrophysiology, surfactants, and surface modification chemistries. He also completed a MA in history at the University of Tulsa as a Henneke Research Fellow in 2012. He completed his undergraduate work cum laude in 2011 with degrees in chemistry, history, and biochemistry also from the University of Tulsa.

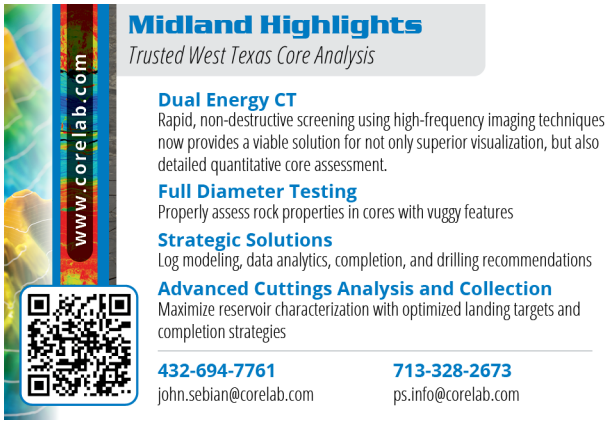
Call for Financial Support
West Texas Geological Society 100 Year Anniversary:
A Core Workshop of Early Permian Basin Field Discoveries

Robert F. Lindsay & Robert C. Trentham

In January 2026 the West Texas Geological Society will celebrate its 100th Anniversary. It has been over a century since the earliest field discoveries were made in the Permian Basin. With the support of the West Texas Geological Society, a Core Workshop is planned to revisit early field discoveries.

In identifying early cored wells, several cores were found to require additional work. As an example, core from Westbrook Field (1st discovery of commercial oil in the Permian Basin) and Artesia Field (3rd discovery) have not been slabbed. These cores require funding for core slabbing, boxing, photography, etc. for inclusion in the core workshop. We anticipate a few additional cores may need similar preparation. All cores will require a minimum of core photography and thin section preparation to adequately describe the core for inclusion in the core workshop. Donations of core analysis, drilling history, etc. would also be of great value to the core workshop.
We estimate the cost of core preparation to be a minimum of $25,000. Funding will be managed by the West Texas Geological Society.
Below are 23 key fields that have been identified. These field discoveries opened the Permian Basin to additional exploration and development, and established it as a Super Basin:

Westbrook (1920) UCLFK
Big Lake (1923) GRBG
Big Lake (1929) ELLN
Artesia (1924) GRBG-SADR
McElroy (1925) GRBG *
McCamey (1925) GRBG-SADR *
Wheat (1925) BCYN *
Penwell (1925) SADR
Empire (1926) YTES
Maljamar (1926) GRBG
Hendricks (1926) YTES
Yates (1926) SADR
Waddell (1927) GRBG-SADR
Shipley (1928) ?
Kermit (1928) ?
Pecos Valley (1928) YTES *
Vacuum (1929) GRBG-SADR
Keystone (1929) YTES
Eunice Monument (1929) GRBG *
North Ward-Estes (1929) YTES/QUEN *
Sand Hills (1931) TUBS
Sand Hills (1935) MCKT, SIMP
Goldsmith (1935) SADR *
*Fields with cores identified and available



The Core Workshop will be published as a pdf volume. If you have information on any of these fields, please consider contributing a write-up to the publication.

If you would like to contribute a core to the WTGS Core Workshop, the core will be temporarily housed at the University of Texas at the Permian Basin (UTPB) for description by the core workshop organizers, UTPB graduate students, or core contributors themselves. Upon completion of the WTGS Core Workshop donated cores will be returned to the core contributors. If the core contributor would like, cores can be housed permanently at UTPB at no expense. We envision creating a core inventory where these cores, thin sections, etc. would be available for study by any company, university, or individual.

Please contact us with any questions you may have about financial support. Please earmark your contribution for the WTGS 100-Year Core Workshop, and send to it to the attention of Shellie Crossland at the West Texas Geological Society, PO Box 1595, Midland, TX 79702.

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PaleoScenes No. 14

LUCK...who needs it?

by Jeff Smith

Not us! We geologists are very educated, highly intelligent professionals who do not need luck to succeed in our profession. There are some areas of life where luck does seem to intervene and most of the ones I remember are all for the better.

For instance in the early 1970's, Dresser Atlas had an office on the ground floor of Wilco Tower and had a whole bunch of reps there who were all into fishing and they had a two story home that they rented down on Lake Amistad. Some of them had boats and they had some guides who were on retainers and they would take customers like myself fishing all the time. There was a new guy hired named Gerry Stone and he decided he wanted to be like the rest of them, but he'd never been fishing. He bought a boat and he had a son about eleven or twelve years old, so Gerry called me and said that he'd bought a boat and he knew I was real good at fishing so would I go down there with him and his son to teach them how to fish. I said that my wife's youngest brother, who was twelve years old, was visiting and he'd never been fishing in his life so it worked out to be a great deal. Here's Gerry and his son, and me and my brother-in-law so we've got two young boys and we get down there and I'm thinking that if we're out on this boat (it was a 17' outboard) with three people who have never fished, we are all going to end up with hooks everywhere. I told Gerry that we needed to go up to the far end of the Devil's River arm where I knew there was an area where we could pull the boat up on the bank and we could fish from the shore. That way we wouldn't be hooking each other and getting hooks in our eyes and everywhere else.

So I got my brother-in-law, Billy, set up. I put a yellow Pico Perch on his line and showed him how to cast. He expressed his doubts that the lure would catch anything, but I assured him that it was a very good lure and that yes, it catches fish. I told him to throw it out there in a little bit of current and then let it drift a bit. I then turned my back to get my stuff ready and right away he's saying that he's stuck on something. So I turn around and the rod is bent nearly double, but the line is

moving all over the place and I said, "You're not hung up, you've got a big fish on the line!"

It ended up being a long fight, but he got it in and it was a very large striped bass which had been stocked in Lake Amistad about a year earlier. Later we ended up going down to Fisherman's Wharf to weigh it and he had set a new lake record! They called all the guides, they called the newspaper, everyone was there seeing the very large striped bass caught on the very first cast a young man had ever made in his life. He got his picture in the Del Rio newspaper, the San Angelo newspaper. He didn't catch another fish the whole weekend, but that one had set a new lake record. I believe we can attribute that one to luck!

For several decades a group of us went to Kodiak Island in Alaska (as I've described in a previous bit of prose) to "study geology," but on the occasional day off we might have done a little fishing. One year my brother, Steve, went along with us-one time, that was all-and he caught the biggest King Salmon that anyone has ever caught in our whole group. Another time on our "geological studies" in Alaska a young man from Midland who worked for Core Lab, Jay Leeber, went with us. There is a fish that is very difficult to catch. It only lives in really, really deep water. We have good friends in Kodiak who have been there for more than two decades and they have never caught one and it's called a Tiger Rock which is a type of rock fish, a sea bass, that's orange with black stripes on it. We have friends who have been up there for over 25 years and never caught one, but Jay puts a hook down and comes up with two of them!

Going way way back, a very, very good geologist named Nolan Hirsch who had hit lots of oil and gas and I was lucky enough to be in on several of his deals where he hit big Fusselman wells. There were some years where some of us would go up to Vermejo Ranch where I had done a lot of field work to go fishing. Nolan and his wife wanted to go with us. At Vermejo we all caught lots of fish, but we were up there for

three days and Nolan didn't catch a single fish. Everyone else was hauling them in, but Nolan didn't catch a one. So the next year he went up to Vermont and took a school from Fenwick. So we do the trip up to Vermejo. First day out Nolan doesn't catch a single fish. Then we did a deal where they had two lakes up there called the Glacier Lakes that were two little tarns that were filled with cutthroat and brook trout. We'd go up there and do a day picnic. We'd take frying pans, potatoes, onions, etc. We were going to go up there and catch a bunch of brookies and do a fish fry. So I showed Nolan and his wife Sue what was the best way to catch those. Nolan takes off and goes his own direction while Sue said she'd stay with me. I rigged up a five foot casting rod and put a Panther Martin lure on it and in ten straight casts she came in with a brook trout. We head back over to where we're going to have our fish fry and so as I was cleaning her first fish I pulled out my Swiss Army knife which had a very, very sharp blade, but it was not a locking blade. As I was cleaning her first fish, Nolan came over and said he wanted to clean her fish. So he watched how to do it and I warned him to be very, very careful because the blade did not lock. I turned my back, took one step and I hear "yeowwww!" I turn around and his finger was practically sliced off. Nolan needed some luck! He didn't need it in geology, but he sure did in the fishing world.

We patched him up and had a nice fish fry. The next day Nolan did catch one very nice rainbow trout so in two years he got one rainbow trout and almost lost a finger, but he and Sue had a wonderful time with us so sometimes luck does matter.

We geologists do not need luck in our business. When I came here with Mobil in 1970, we had one geologist, Ed McGlasson, whose only job was to get all the logs he could on all the wells-we used scouts back then-to make sure he kept track of the Fusselman formation because everyone knew that unless you had the dolomite you had no chance. The limestone was never going to be productive. So Ed kept track of where they could find the dolomite in the Fusselman. I have a friend who actually sold the prospect for Fusselman and the dolomite was there and it was wet, but it had real good show on the mudlog up in the limestone. Hardly any porosity, though, so they nearly plugged the well. They decided what they heck, let's test it. Now I don't know if you'd call this luck, but they ended up with a field making 10,000 bbls/day from Fusselman limestone. I would say that was a lot of luck!

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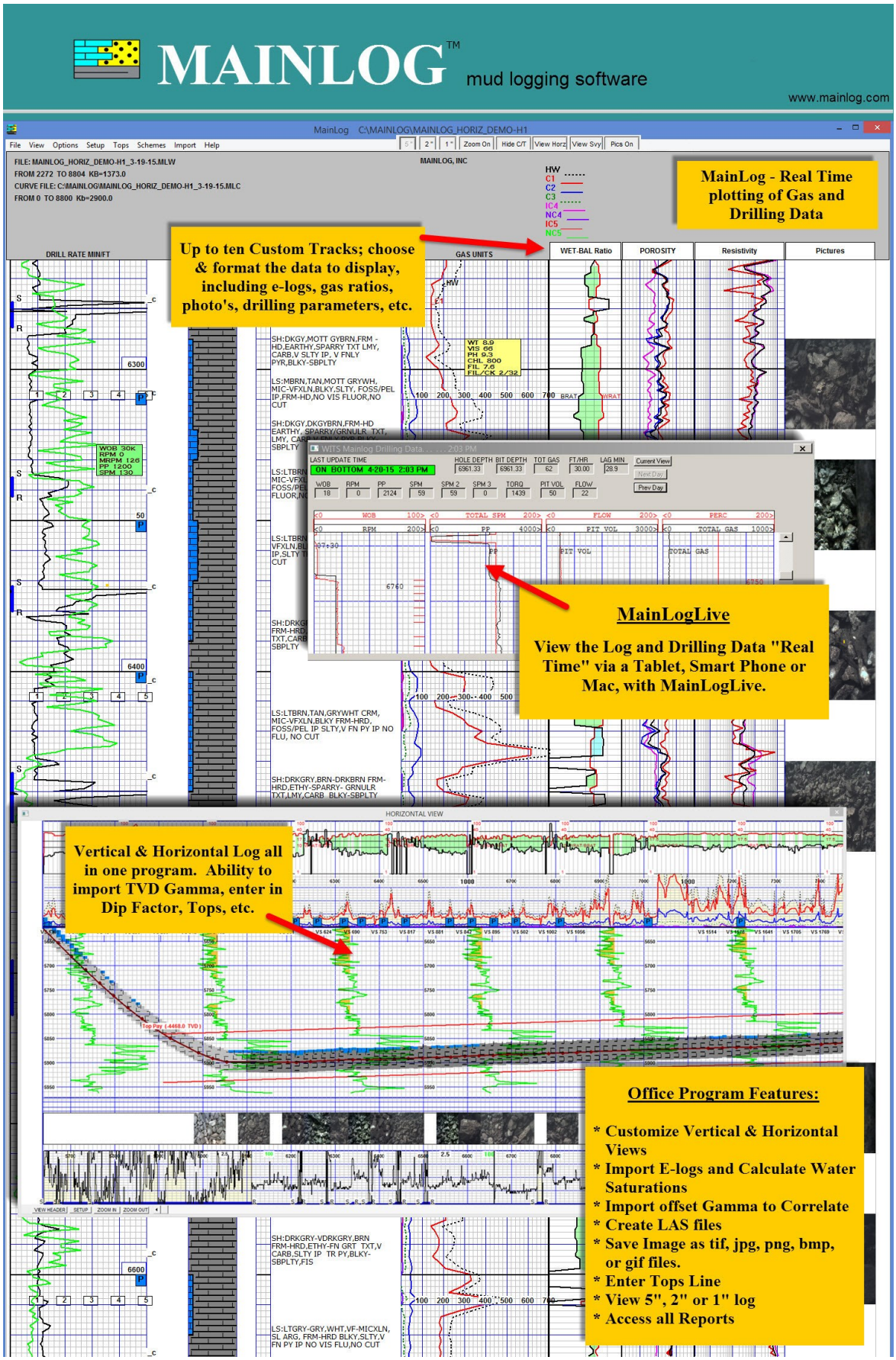
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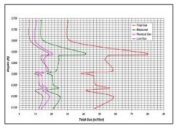

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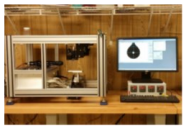

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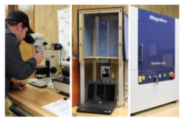

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