



SIPES 2023 Convention
June 12-15
Santa Fe, New Mexico



SIPES NEWSLETTER

www.sipes.org

Society of Independent Professional Earth Scientists

Anomalous Helium in Southeastern Colorado

By Edward B. Coalson and William C. Pearson, #3418
Lakewood, Colorado

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Helium accumulations are scattered across a wide area in southeastern Colorado (**Figure 1**). Reservoirs include sandstones and carbonates of Ordovician through Cretaceous ages (**Figure 2**). The majority of reported helium occurrences are in the Pennsylvanian Morrow sandstone, but some of the richest helium gases are in the underlying Mississippian and Ordovician beds (**Figure 3**).

The helium in southeastern Colorado theoretically could be primordial, originating in mantle-related magmatic sources, and/or radiogenic, originating in crustal igneous and sedimentary rocks, primarily granitics, metavolcanics, uranium-bearing shales or coals, etc. (**Figure 4**). Helium-isotope data can be used to differentiate primordial helium (higher He³:He⁴) from radiogenic helium (lower He³:He⁴). However, no isotope

data were found for this study. Instead, helium origin is inferred from the co-produced gases: hydrocarbons (HCs), nitrogen (N₂), and carbon dioxide (CO₂). It is assumed here that: 1.) CO₂ sources are magmatic; 2.) N₂ is from hydrothermal decomposition of organics and/or clays (Littke et al., 1995; Brown, 2017); 3.) HCs originate from thermal maturation of organic material; and 4.) the helium shares its origin with the dominant gas. It is recognized that the mantle is a source of N₂ and abiogenic hydrocarbons, that heating of carbonates may generate CO₂, and that helium may or may not have the same source(s) as its associated gases. Reported gas compositions suggest that magmatic, hydrothermal, and diffusional helium all are present.

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President's Column

Christopher H. Reed, #2935
Tyler, TX



Greetings, fellow earth scientists! November marks a season of change. Hope all avail yourselves to effect some change. More importantly, ski season opens.

The board of directors meeting was held in Dallas in September, with a great deal of change being affected. Carol Shiels, #3007, SIPES Past President and Dallas Chapter Delegate, has made a momentous effort to

successfully streamline our BOD Committees. She has managed to pare twenty-five committees down to a manageable five committees. She has done a fantastic job as always. Thank you, Carol! The committees are membership, conventions, education, advertising, and networking.

One of the more significant changes occurred to the convention committee, with three regular positions being dedicated to the past, current, and future representatives of the co-hosting chapters. This will help promote a smooth transition and guidance for convention preparation, possibly eliminating pitfalls through sharing of past experiences. The national convention is a strong revenue source for both national and the

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The following reports were prepared by Vice President of National Energy Neil D. Sharp, #3446, and Thomas G. Pronold, #2429. The views and opinions expressed are those of the authors. Some of the information is available in the public domain.

■ NATIONAL ENERGY



Neil Sharp

As we stand at the advent of the mid-term elections, we find the country at a bit of a crossroads, from a national energy perspective. The Biden Administration has campaigned and actively pursued a policy directed at eliminating fossil fuel utilization, domestically and globally. They have been transparent in their objectives to eradicate fossil fuels, and their policy has demonstrated a myopic approach lacking feasibility, primarily due to the short- and long-term reliance that both emerging and established nations have on fossil fuels, whether in part or in whole. Regardless, the Biden Administration is still staunchly pursuing its policy while contrarily pressing OPEC+ and its own domestic oil and gas companies to increase production and investment in order to bring more oil and gas onto the market to quell high energy prices, often trying to pit them

against one another. And if that does not work, it is not beneath the Biden Administration to turn to oppressive and sanctioned nations such as Iran and Venezuela to bring more fossil fuels onto the market in exchange for sanction relief. However, that will not work because typically those nations do not have the ability to just bring on their production in short order because years of sanctions have actually crippled them, and they do not have the personnel or acumen to bring that production back online in a timely basis. Which then just leads to rhetoric insinuating price gouging and threats of instituting tax hikes on energy companies making record profits, and price caps on direct and indirect production from particular countries that benefit from the price point created by an anti-fossil fuel policy. So, this has led to the Biden Administration pivoting to draining the Strategic Petroleum Reserve (SPR), which is currently at its lowest since the latter part of 1984 (Figure 1). The Biden Administration has been attempting to use the SPR releases to combat inflation and lower rising energy prices, and has successfully drained it by about 200 million barrels since coming into office (640 MMBO to just under 450 MMBO). That means the SPR has been drained by ~30% in less than two years. The previous administration only drained it by ~10% in its entire term. (I know the pandemic happened, but that is still aggressive). Now since the energy industry has been awake at the wheel and disciplined in returning earnings to investors and remaining operationally lean, the SPR releases have not had the desired results the Biden Administration wanted. WTI has been hovering on or near \$90/BBL, and natural gas has been in the \$6/MCF - \$7/MCF range over the past several months. You could say that due to the shale drilling boom, the need for the SPR is not as vital as it once was, and that the U.S. does not need to sit on +600 MMBO. Which is fair, but we all know that wells decline over time, and you need to continue to put money into multi-year drilling programs, which need permits. Now, if companies are running lean with a fewer amount of permits and are distributing most earnings back into investor pockets, and only a minimal amount of earnings go back into the ground, a supply shortage just gets extended. This is what we are seeing. Rig count is currently about the same as just before the pandemic and has been rather flat to date. Not to mention that shale production is slowing due to disappointing new well performances, meaning that companies are not able to get more production out of the ground, and are suffering from a technology stall (lack of investment). Draining the SPR is clearly a political move, and the lack of a sufficient oil and gas supply has precipitated from various post pandemic issues, which I am not going to touch upon (Ukrainian War, supply chain, inflation, etc.), but energy supply and prices are being extremely exacerbated by the Biden Administration's policy. This is mainly because the overall policy from the Biden Administration discourages capital investment into the fossil

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2023 BOD Meeting Date

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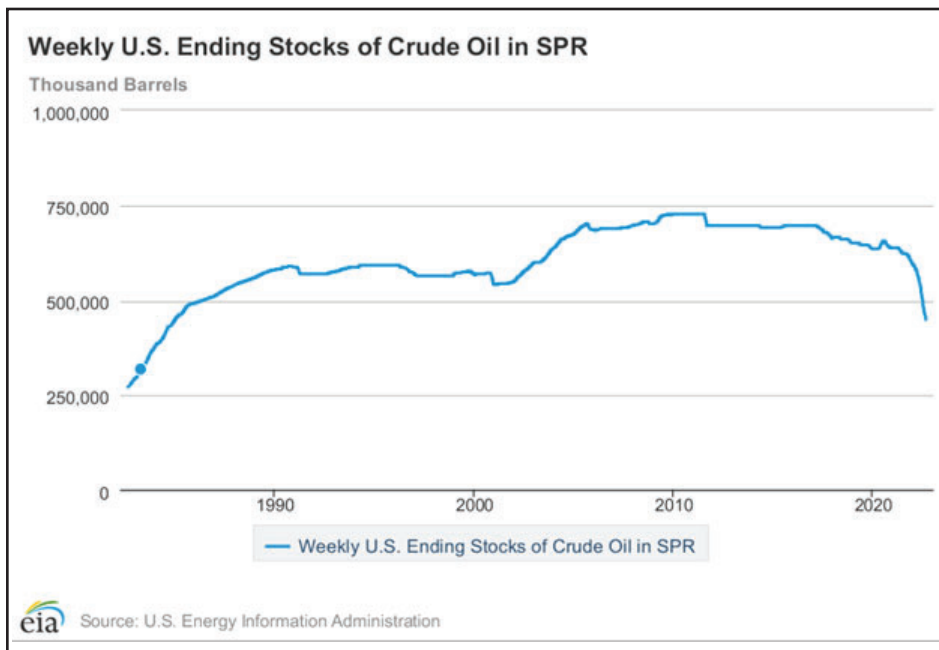


Figure 1

fuel industry unless it meets some sort of ESG standard. Why would an existing company plan to expend capital to grow and produce more, after being asked by the Biden Administration, when that same administration then turns around and simultaneously tells its voter base that it is going to eradicate the industry? This type of disingenuous posturing does nothing but create tension and sow mistrust from not only the industry, but also important international allies. Not to mention high energy prices for an extended amount of time. While public and private capital investment is being tempted back into the fossil fuel market due to high prices, projected seasonal energy shortages in important markets (i.e., Europe, NE U.S., etc.), and overall tightening supply outlook, there is still an investment reluctance because the Biden Administration policy indicates nothing but volatility in the energy market for the foreseeable future.

There needs to be an honest assessment by the Biden Administration about how necessary fossil fuels are, and how reliant we all are on them for the short and long term. Can you meet goals to reduce emissions and make our energy footprint smaller? Absolutely. Can we innovate and use technology to become

more efficient? Oh, yeah. Can it be done in a reasonable amount of time and without fossil fuels? No, sir. But we can get there if we are honest about where we are in our current and future energy dependence, domestically and internationally. We have a need that has to be sustained and we must look at our situation logically, in order to move forward with an innovative plan. Clearly, there is a demand for a cleaner and better energy plan, but we cannot just abandon the one energy source that supplies ~60-70% of our needs on a day-to-day basis. If we do, then as the current policy is demonstrating, we will have high prices, and affordability will just continue to diminish for all of us. That is the crossroads where we are as a nation, and regardless of election outcomes, our leaders need to deliver us toward a sound energy policy that can reestablish a balance in our markets and in our lives. We can not will things to change because we do not like them. If we want true change, we must be honest about the problem and embrace the truth in order to move forward. Currently, the Biden Administration has fallen short with their energy policy, and until they acknowledge and accept that they need fossil fuels, and more importantly, they need fossil fuels

to be a part of their transition plan, then we will continue to languish in an unaffordable world.

■ STATE LEGISLATIVE NEWS

California

The U.S. Bureau of Land Management (BLM) and the State of California have reached a settlement that prevents new oil and gas leasing in central California until the BLM conducts a supplemental environmental review. The settlement concludes a lawsuit brought by Governor Gavin Newsom and several other state agencies that challenged plans by the BLM to allow oil and gas activity on more than one million acres of public lands in central California. The litigation claimed that the BLM had not performed an adequate environmental review, and that the leasing of public lands did not consider the potential impact on California residents, and that it was at odds with California’s climate goals. The settlement imposes a moratorium on any new oil and gas leasing until the BLM finalizes an environmental impact statement that would supersede a 2019 review.

Colorado

The Colorado Oil and Gas Conservation Commission (COGCC) approved new financial requirements for oil and gas companies that operate within the state. These requirements complete the last major rule change mandated by SB 19-181 that overhauled state oil and gas policy to be more protective of health, safety, and the environment. The COGCC’s new requirements are structured around six different tiers or “options” through which operators can provide financial assurance to the state. The largest operators, which are considered to be at the lowest risk of abandoning wells, could continue to provide statewide “blanket” bonds set at amounts as low as \$1,500 per active well, while smaller, riskier operators will be required to provide “single well” financial assurance, at a cost of \$110,000 per well, or more. Additionally, the new

(Continued)

rules establish an annual well registration fee that is projected to raise \$10 million annually to fund the cleanup of orphaned wells. That money will be augmented by the \$10 million or more annually, that the COGCC expects to receive for orphaned well cleanup from the federal government as a result of last year's infrastructure law.

Texas

Texas Comptroller Glen Hegar unveiled a list of publicly traded financial institutions that boycott energy companies. These companies were noted by Mr. Hegar to be subject to the divestment provisions outlined in Texas Government code Chapter 809, and that these firms were found to be using investments essentially owned by Texas, to directly push shareholder initiatives that run contrary to the interests of the State of Texas. The companies listed were: Blackrock Inc., BNP Paribas SA, Credit Suisse Group AC, Danske Bank A/S, Jupiter Fund Management PLC, Nordea Bank ABP, Schroders PLC, Svenska Handelsbanken AB, Swedbank AB, and UBS Group AG. More information can be found at the Comptroller's website: <https://comptroller.texas.gov/purchasing/publications/divestment.php>

West Virginia

West Virginia Treasurer Riley Moore recently published West Virginia's Restricted Financial Institution List (RFIL). Companies on the RFIL are listed as ineligible for state banking contracts. The companies listed were: Blackrock, Inc., Goldman Sachs Group Inc., JP Morgan Chase & Co., Morgan Stanley, and Wells Fargo & Co. West Virginia lawmakers had previously passed SB 262 which authorizes the state treasurer to disqualify any financial institution on the RIFL. The companies listed were found to have policies aimed at weakening the West Virginia energy industry, tax base, and job market, and that the companies had clear conflict of interests in handling taxpayer dollars.

■ ENVIRONMENTAL REPORT

Oil Field Methane Emissions



Tom Pronold

In April of this year, the U.S. Department of Energy Office of Scientific and Technical Information released a report entitled, "Quantification of Methane Emissions from Marginal (Low Production Rate) Oil and Natural Gas Wells." The Department of Energy studied this with the objective to measure methane emissions from marginal well sites at various basins across the United States. The goal was to collect and evaluate representative, defensible, and repeatable data and draw quantifiable conclusions on the extent of emissions from marginal wells across oil and gas-producing regions of the U.S., and to compare these results to published data on the emissions from nonmarginal wells.

The processes involved in producing natural gas as well as oil, which contains natural gas, involve several steps including separating, cleaning, transporting, and making the fluids available for end use. To minimize methane leaks, technologies for monitoring, measuring, and mitigating emissions must be developed and widely applied to every part of this infrastructure.

There are over 990,000 oil and natural gas wells in the U.S., of which approximately 783,000 (79 percent) are considered "marginal" in terms of their profitability to operators, or low production, defined as producing less than 15 barrels of oil equivalent (BOE) per day of combined oil and natural gas. Marginal oil-producing wells account for approximately 900,000 BOPD, the rough equivalent of the daily releases from the Strategic Petroleum Reserve. In 2018 and 2019, the five states with the largest reported numbers of marginal gas wells were Texas, Pennsylvania, West Virginia, New Mexico, and Oklahoma, and the five states with the most reported marginal oil wells were Texas, Kansas, California, Oklahoma, and Louisiana (EIA, 2020).



Summary of Interesting Facts and Findings

1. The 783,000 marginal wells mentioned above account for 50% of oil and natural gas methane emissions, amounting to 1.0 million tons/year (well below the inflated 4.0 million tons per year by environmental lobbyists such as the Environmental Defense Fund).
2. Marginal wells are defined as having production of less than 15 boed, however, 83% of marginal wells produce less than 6 boed. The EPA proposes that well sites emitting 3 tons/year or less, be subjected to different, less intensive Leak Detection and Repair (LDAR) requirements.
3. LDAR programs are developed on the concept that leaks must be found and repaired. Emission locations at low production well sites are predictable—tanks, separators and improperly maintained wellhead equipment.
4. The report provides for an effective, low-production well leak management program that is far less costly than the

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expensive optical gas imaging (OGI) programs currently required by EPA. Routine AVO (Audio-Visual-Olfactory) inspections of tanks to eliminate open thief hatches and deteriorated seals and separators to assure proper operation of control valves. Routine AVO inspection of wellheads to assure proper operation of equipment and valves. Periodic simple testing like soap bubbles to check for leaks. Use of production rates and equipment counts to determine the applicability of the program rather than costly emissions calculations that are not currently done for low-production wells.

After carbon dioxide, methane is the most abundant greenhouse gas (GHG) warming our planet, and methane emissions contribute significantly to the GHG intensity of natural gas.

The Paris Accord and the War in Ukraine

“Climate change is the defining crisis of our time, and it is happening even more quickly than we feared. But we are far from powerless in the face of this global threat. As Secretary-General António Guterres pointed out in September, “the climate emergency is a race we are losing, but it is a race we can win.” This quote from the United Nations web page (<https://www.un.org>) sets out the alarming notion that we are “falling behind” in the war on CO₂ emissions. The UN Report points out that “The last four years were the four hottest on record. According to a September 2019 *World Meteorological Organization* (WMO) report, we are at least one degree Celsius above preindustrial levels and close to what scientists warn would be “an unacceptable risk.” The 2015 Paris Agreement on climate change calls for holding eventual

warming “well below” two degrees Celsius, and for the pursuit of efforts to limit the increase even further, to 1.5 degrees.” Even without the disruption caused by the war in Ukraine, countries that are a party to the Paris Accord are still falling short of the goals. The relative contribution to CO₂ emissions by continent is depicted in the slide below.

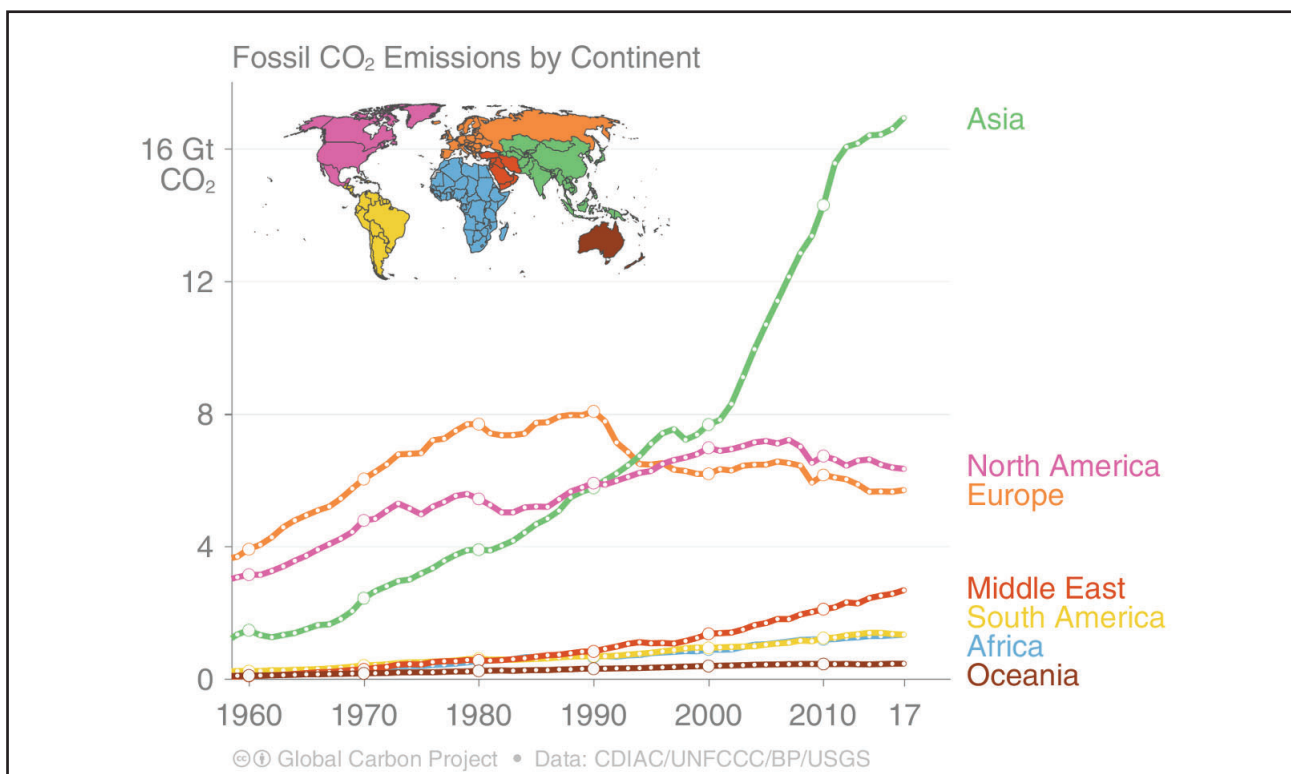
As you can see, North America and Europe show declining emissions from around 1990 forward, with Asia growing almost off the chart since 2008. The key, therefore, in holding down CO₂ emission growth, lies with countries in Asia.

The European curve is likely to change upward with the sanctioning of Russian oil and natural gas. While it is true that much of the European storage facilities are full or near full, it still might not be enough to get them through the winter. Some countries do not have enough storage to accommodate their country’s winter demands.

As an alternative to high-cost natural gas, many Europeans are laying up supplies of firewood to bridge the home fuel heating gap should it be needed. In Germany, they are dismantling a wind farm to expand the Garzweiler lignite mine. Low-grade lignite, although not ideal, will provide the necessary, reliable base fuel for heat and electricity, in lieu of the potentially intermittent wind power. When you are faced with freezing in the cold, you will burn just about anything to stay warm, and the Europeans are doing just that. The lignite mine is slated to be replaced by wind power by 2030, so this is just a stop-gap measure, however, we will see.

The war in Ukraine has been an environmental disaster. Bombing has destroyed key infrastructure necessities such as

(Continued)



water supply and sewage treatment facilities. Forest fires have resulted from bombings and battles fought in the forested regions of the Carpathian Mountains. Forest fires spread out of control this summer on the Kinburn spit, a nature reserve at the western end of the Crimean peninsula. Local fire chiefs said the Russian military refused them admittance. The heavy bombing has left those affected areas burned and littered with toxic munitions.

The Ukrainians remain dauntless, as it is a grassroots nationwide effort to clean up the mess left behind. Up from the ashes come national heroes such as Patron, a Jack Russell Terrier pictured below on a Ukrainian Postage Stamp. His name translates to “Ammo,”



and he was trained by his owner, Myhailo Iliev, a Major in the Civil Protection Service. He has detected over 350 unexploded ordnates and land mines, and serves as a useful teaching tool for children who are forced into dangerous areas. He was awarded the nation’s highest military service award in a ceremony attend-

ed by Canadian Prime Minister Justin Trudeau. There are many YouTube videos about him and he has his own Instagram page.

The un-woke Ukrainian Postal Service also has a stamp depicting the incident occurring on the first day of the invasion. Nineteen Ukrainian soldiers were stationed at an outpost called Snake Island, twenty-five miles from Romania, and



were ordered to lay down their weapons or face destruction by the Russian warship. In their official message back, they suggested the Russians perform something that is anatomically impossible, thereby setting the tone for the nationwide Ukrainian response to the incursion. Originally reported as killed, the nineteen Ukrainian heroes were captured and later exchanged for eleven Russian merchant marines captured from a sinking ship, according to a March article from *The Times of Israel*.

The war will end, and Ukraine will rebuild as a bright shining beacon of freedom and enterprise in eastern Europe. Hopefully, sooner than later.

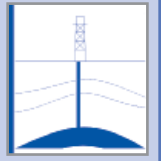
NOMINATIONS ARE NOW OPEN – for SIPES 2023 AWARDS

Nominations are now open for SIPES **Honorary Membership** and SIPES **Outstanding Service Awards**. Qualifications for the society’s two highest awards are available in the SIPES Constitution, located on the SIPES website — www.sipes.org. Lists of previous award winners are posted here.

Please email nominations and supporting details to Dan Earl Duggan at danearl@dxwells.com by January 16, 2023. Winners will be honored at the Awards Banquet during the 2023 Convention in Santa Fe, New Mexico. All nominations are considered for three years.

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*Many thanks to the members listed below
for their continuing support of our society.*



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local chapters. Most importantly, the national convention promotes professional bonds, associations, and long-time friendships between members. The convention committee will work alongside the national office, toward providing successful, affordable, and enjoyable meetings for all. I urge all members to participate.

During the BOD meeting, national staff showcased the new Richardson headquarters office. Once again, Carol Shiels and John Stephens of our Dallas Chapter were instrumental in assisting national staff to make the move from the Greenville Avenue office.

The BOD joined the Dallas Chapter at their regular meeting with our own Monte Meers, #3463, of the Fort Worth

Chapter, presenting an excellent lecture on soil geochemistry and the occurrence of commercial hydrocarbon production. Monte would probably be more than happy to field inquiries.

Please consider the 2023 National Convention in Santa Fe being co-hosted by the Oklahoma City Chapter. It has always been an excellent gathering. Hope to see you there!

SIPES Membership Directory Photos

If we do not have a photo on file for you, that space is filled with the SIPES logo. Please review your directory entry, advising us of any updates, and emailing your photo, if necessary, to the SIPES office at sipes@sipes.org.

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DENVER

After a summer break, the Denver Chapter resumed its monthly meeting schedule beginning on September 29, with Ron Bell presenting “Drone Enabled Geoscience Mapping for Resource Exploration, Infrastructure Mapping, and Environmental Site Assessments.”

The use of “Unoccupied Airborne Vehicles (UAVs) is becoming widespread, including military applications, security monitoring, recreational uses, and geologic mapping. There are numerous examples where collecting geoscientific data via a UAV provided the best quality data at the lowest per data point cost. The financial benefit derived from automating the data collection process, and with the removal of the human error factor cannot be understated. Ron presented a variety of data examples from Colorado and current trends in improved aviation and sensors.

Ron began his career in geophysics after receiving a B.S. in Applied Physics from Michigan Technological University



At the September meeting are (L to R) Vice Chair Bill Pearson, guest speaker Ron Bell, and Chair Gary Thompson.

and has accumulated over thirty years of experience in the collection, processing, visualization, and interpretation of ground magnetic and electromagnetic data, as well as other geophysical data. In 2014, he began investigating the application of drones for geoscience mapping. Since 2016, he has successfully executed numerous drone magnet-

ic surveys to precisely locate legacy oil and gas wells and pipelines, and has mapped the geology for groundwater exploration, geothermal, mineral, and hydrocarbon resources.

Jerry Cuzella
Secretary

HOUSTON

In June, Mario Gutierrez of Vibe Energy Systems, spoke on “Bitcoin and Independent Oil & Gas: How the Stars Align in Texas.” Mario is a formally trained geologist that has transitioned into becoming a Bitcoin entrepreneur. Bitcoin is an area that many SIPES members have probably heard about, but



Junior member Mario Gutierrez, speaking at the June meeting.

likely do not have much understanding on a technical level. Mario’s presentation was an excellent breakdown of what Bitcoin/Bitcoin mining is, practical uses of it and how those of us in the oil and gas industry can use Bitcoin mining to turn otherwise wasted natural gas into a source of revenue.

Geologist and river guide, Tom Helm, presented “Buffalo Bayou Geology” in July, and shared his knowledge of Pleistocene outcrops visible along Buffalo Bayou, and how our Houston bayou network and near surface geology is a record of Brazos River deltaic deposition related to Late Pleistocene glacial cycles.

There was no August meeting held.

Our chapter is continuing to provide a wide variety of speakers, and were excited to welcome Jaime Diez, Libertarian candidate for Texas RRC to speak at our September luncheon. Jaime told us the story of his past experiences that led him



Texas RRC Libertarian candidate Jaime Diez speaking in September.

to decide to run for RRC. It is important to give more attention to the policies of the RRC because their actions not only affect the enforcement of regulations already on the books, but public perception of the oil and gas industry, which can have ripple effects in the future for further regulation.

Scott Leaseburge
Secretary

CORPUS CHRISTI

The Corpus Christi Chapter resumed meetings on September 27, after a summer hiatus. Dr. Jim Lee, Ph.D. Economics and Regents Professor at



Professor Jim Lee, guest speaker at the September meeting.

Texas A&M University, Corpus Christi, was our speaker. His talk was entitled “Evaluation of the Global Oil Markets – Implications of South Texas.”

After an October meeting and a holiday gathering in November, regular monthly meetings will resume in January 2023.

Dawn Bissell
National Director

LAFAYETTE

Our first meeting after the summer break (no meetings in June, July, or August) was held on Wednesday, September 14 at the Petroleum Club in Lafayette. We were excited to have Terrence Chambers, director of the Energy Efficiency and Sustainable Energy (EESE) Center at the University of Louisiana at Lafayette, come in and give us an overview of the sustainable energy research and education programs at UL Lafayette. Dr. Chambers emphasized that many of their research labs are interested in partnering with industry and business clients to promote new ideas and innovations in sustainable energy.

OKLAHOMA CITY

The Oklahoma City Chapter does not have meetings through the summer. Our speaker for September was Steve Agee, Dean Emeritus of Meinders School of Business at Oklahoma City University. Dr. Agee worked for many years in the oil business before beginning his academic career. He is considered to be the foremost expert in Oklahoma on the business and economic side of the oil and gas business. His presentation touched on the current state of the



Lafayette Chapter new member James Walker.

We also added James F. Walker, #3599, as a full member of our local chapter.

King Munson
Chair

national economy and what the future may hold for our industry. Even though we are being beat up by the current administration, he does not see any significant change in the demand for energy derived from fossil fuels for the foreseeable future. The coming winter may put an end to attacks on energy companies by the short-sighted policies of environmental groups and politicians.

Greg Riepl
Chair

NEW ORLEANS

Our New Orleans Chapter takes a summer break for the months of June, July, and August.

We did have a September meeting to kick off our fall session of 2022. This lunch meeting was held at our long-standing location, Andrea’s restaurant in Metairie (a suburb of New Orleans), on Tuesday, September 20, with about thirty-two in attendance. Our speaker was Eric Smith of Tulane University Energy Institute. His talk was entitled “The Changing World of Energy.” We were unable to video record his talk (due to technical issues), but we do have his PowerPoint presentation that we hope to post and make available on our chapter website. (Most of the talks for the past few years have been recorded and can be viewed at our chapter website - <https://sipesneworleans.homestead.com/>)

The New Orleans Chapter will be changing its lunch venue beginning in October 2022. For over fifteen years we have been having our lunch meetings on the third Tuesday of the month at Andrea’s Restaurant in Metairie. However, in August 2022, Andrea’s sold the restaurant to a developer and the restaurant has now closed. For the month of October, on a trial basis, we will be having our meeting on Thursday, October 20, at another restaurant called Bistro Orleans, only several blocks north of Andrea’s. November’s lunch meeting location and time will depend on our experience at the Bistro Orleans. Please check our website and the most current newsletter for current location and time if you plan to attend, or email Eric Broadbridge at eric@northcoastoil.com.

Eric Broadbridge
Membership Chair/Treasurer

SIPES Speaker Gifts

The SIPES National Office has various speaker gifts available for purchase — from coffee cups to geode bookends, and more!



Please call or email the SIPES office at (214) 363-1780 or sipes@sipes.org for more information.

IN MEMORIAM

We regret to note the passing of the following members:



Dudley W. Bolyard, #1765
of Centennial, Texas
who died on
November 3, 2022



David G. Koger, #3597
of Fort Worth, Texas
who died on
August 21, 2022



John V. Walter, #1411
of Dallas, Texas
who died on
October 29, 2022

Leo C. Carr, #867
of Midland, Texas
who died on
April 26, 2022



W.C. Rusty Riese, #3355
of Katy, Texas
who died on
October 6, 2022



Gar C. Willis, #3270
of Bellaire, Texas
who died on
April 4, 2022



WICHITA

The Wichita Chapter has not held an in-person meeting since March of this year. After taking the summer off, the chapter opened the season with a climate talk from current Kansas State Senator for District 10, Mike Thompson. Senator Thompson is a career meteorologist, having forty-five years of experience in the field, including forty years broadcasting on five different television stations. His talk, entitled “Current State of Energy Legislation and Climate Review in Kansas,” highlighted the scientific data, largely refuting claims that anthropologic activity is affecting the climate. With questions and answers, the talk lasted fifty-five minutes.

Wichita will continue to offer interesting virtual meetings. There were no new members added over the summer.

Tom Pronold
Chair

FORT WORTH

In Fort Worth, our new year is off to a great start. Our new slate of officers is in place, with Dennis Browning moving up as chair, Jim West as vice chair, and Ron Stillwell is just settling in as treasurer. Josh Luig has stepped up to take over as membership chair. Thank you to all our volunteers!

In September, Jeff Jones told us about the evolution of a small business in Albany, Texas, which grew into an impactful private equity company. In 1998 at the QEP, founders recognized an untapped business opportunity to provide private equity capital to entrepreneurs in the upstream oil and gas sector. Mr. Jones explained to the group how over time the QEP vision and scope expanded to recognize emerging opportunities across the energy value chain as

a result of the increasing focus on sustainability. Today, QEP pursues a disciplined yet creative approach to investing across the Sustainable Energy Ecosystem. Quantum continues to believe their biggest competitive advantage is the ability to attract and provide value-added support to the entrepreneurs they partner with to build great companies.

Near the end of the meeting, the discussion on sustainability and climate blossomed into an energetic conversation among several of our members. It is fantastic when a presentation can stir thought and debate.

We are looking forward to seeing what Jim West will tee up for us at future meetings! Our thanks to the Petroleum Club of Fort Worth for providing an excellent venue and great service.

With Josh Luig now in place as our new chapter membership chair, we are looking to make 2022-23 a banner year for reaching out to prospective members, both independents, and company-affiliated, qualified persons. If you know of anyone in the Fort Worth area considering joining SIPES, please have them contact Josh.

In closing, and with great sadness, we would like to note the passing of two long-time SIPES members over the past year: William Temple of Austin, Texas passed away in March 2022, and Dave Koger of Fort Worth, Texas passed away in August 2022.

Thank you on behalf of the Fort Worth SIPES Chapter.

Michael O’Donnell
Secretary

SIPES 59TH ANNUAL MEETING & 2023 CONVENTION

JUNE 12-15

Santa Fe ♦ *New Mexico*

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MAKE PLANS NOW TO ATTEND!



SIPES Chapter Meeting Information

CORPUS CHRISTI

Chair: Rajan Ahuja
V-Chair: TBA
Secretary: Brent Winborne
Treasurer: Dan Pedrotti
Meets: Joe's Crab Shack
Last Tuesday of month

DALLAS

Chair: Michael Adams
V-Chair: Neil Barman
Secretary: Carole Popa
Treasurer: John Stephens
Meets: Prestonwood Country Club
3rd Tuesday

DENVER

Chair: Gary Thompson
V-Chair: Bill Pearson
Secretary: Jerry Cuzella
Treasurer: Melanie Westergaard
Meets: Wynkoop Brewing Co.
4th Thursday

FORT WORTH

Chair: Dennis Browning
V-Chair: Jim West
Secretary: Michael O'Donnell
Treasurer: Ron Stillwell
Meets: Fort Worth Petroleum Club
1st Wednesday

HOUSTON

Chair: Matt Boyce
V-Chair: TBA
Secretary: Scott Leaseburge
Treasurer: Luis Carvajal
Meets: Petroleum Club
3rd Thursday

LAFAYETTE

Chair: King Munson
V-Chair: TBA
Secretary/
Treasurer: Houston Elkins
Meets: Petroleum Club
2nd Wednesday

MIDLAND

Chair: Brian Miller
V-Chair: Mike Raines
Secretary: George Friesen
Treasurer: Jerry Elger
Meets: Midland Country Club
3rd Wednesday

NEW ORLEANS

Chair: Louis Lemarié
V-Chair: Toby Roesler
Secretary: TBA
Treasurer: Eric Broadbridge
Meets: Bistro Orleans
3rd Thursday

OKLAHOMA CITY

Chair: Greg Riepl
V-Chair: Michael Bone
Secretary: Cody Griffin
Treasurer: Terry Hollrah
Meets: The Petroleum Club
Chase Tower, 35th Floor
1st Wednesday

SAN ANTONIO

Chair: Tom Kirby
V-Chair: Lee Billingsley
Secretary: Doug McGookey
Treasurer: Tim McGovern
Meets: Petroleum Club
3rd Thursday

WICHITA

Chair: Tom Pronold
V-Chair:
Secretary:
Treasurer:
Meets: Time and Location TBD



OIL AND GAS (AND MORE)

NAPE'S ENERGY EXPANSION

NEW! BITCOIN MINING PAVILION

Bitcoin mining is an emerging energy source that has captured the interest and curiosity of our industry. NAPE Summit is the largest venue for oil and gas professionals to establish partnerships and explore how to make bitcoin mining part of an effective asset management strategy.

RENEWABLE ENERGY PAVILION

The Renewable Energy Pavilion is a dedicated space for those with renewable interests on our expo floor.

Both pavilions will showcase energy-producing properties and educate attendees on recent developments and trends.

ENERGY BUSINESS CONFERENCE

The action kicks off Wednesday after breakfast with business and technical track sessions, followed by a luncheon with Devon Energy Corp. President and CEO Rick Muncrief, combined afternoon sessions for all attendees and the governors panel with Gov. J. Kevin Stitt and Gov. Mark Gordon.



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Houston

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WELCOME NEW MEMBERS

In accordance with the SIPES Constitution, By-Laws and Code of Ethics, the following list includes new members who have been unanimously approved by the SIPES Membership Committee. These members have completed the 30-day waiting period and we welcome them as new members of the Society.

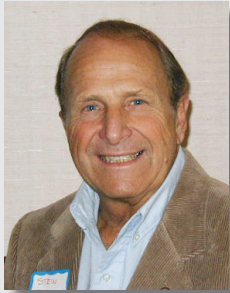
Dan Earl Duggan, National Membership Committee

SIPES No.	Name	Chapter	Sponsors		
2297	Rebecca L. Dodge	Midland	Reinstatement		
3104	Jerry L. Gilbert	San Antonio	Reinstatement		
3594	Thomas Donahoe	At-Large	Reciprocal - DPA		
Ltd.	Randall L. Hunt	At-Large	M. Boyce	J. Allen	J. Vandenbrink
3596	Joseph P. Smith II	At-Large	M. Boyce	J. Allen	J. Vandenbrink
3601	Norman E. Wells, Jr.	Midland	M. Raines	S. Robichaud	F. Behnken
3602	David R. Paddock	Houston	Reciprocal - DPA		
3603	Thomas A. Sikes	Midland	Reciprocal - DPA		
3604	Jeffrey D. Bryden	Midland	Reciprocal - DPA		
Ltd.	George J. Ulmo	Midland	C. Smith	J. Elger	W. Robinson
3605	Robert F. Lindsay	Midland	M. Party	S. Shaw	S. Robichaud
3606	Jeffrey M. Shultz	Midland	W. Creech	M. Party	E. Sebring
3607	P. Austin Nye	Corpus Christi	Change from Ltd.		
3608	Randall A. Young	Lafayette	B. Brennan	B. Gidman	T. Helms
Ltd.	Terry L. Williamson	Midland	W. Creech	J. Amezcua	C. Smith
Ltd.	Christopher M. Robinson	Houston	S. Hartzell	S. Jackson	M. McCuen
Jr.	Dylan Wiemer	Midland	W. Creech	M. Maddox	J. Small
3609	Sasha W. Gumprecht	Houston	Change from Jr.		
3610	Alan Pennington	Houston	Change from Ltd.		
Jr.	Stephen C. Zagurski	Dallas	M. Adams	E. Rhea	D. Williamson



Stewart Chuber, #221

December 22, 1930—July 1, 2022



Stewart Chuber of Schulenburg, Texas, passed away peacefully from this life on July 1, 2022 in the early afternoon with family members nearby at St. Marks Hospital in La Grange, Texas at the age of 91.

Stewart is preceded in death by his wife, Martha (Muffin) Anne Chuber, and his son, Jeffrey August Chuber. He is survived by his daughter, Valerie

Anne Chuber Salazar, and son-in-law, Angel A. Salazar.

Stewart was born on December 22, 1930, in Queens Village on Long Island, New York, to August and Florence Chuber. He was the youngest of three siblings. Stewart and his two siblings, Bruce and Carol, were always encouraged by their parents to do their best at any endeavor that they undertook in life. This was a life skill that Stewart practiced his whole life.

Stewart graduated from South Side High School in Rockville Centre Long Island, New York. He played football and baseball, and was awarded four letters as a member of the junior varsity and varsity football teams. Stewart also boxed in the Golden Gloves amateur boxing program, winning a jewel-studded golden glove and two medals at the age of 17.

Stewart was an avid pilot and received his pilot's license in 1956. He flew collectively hundreds of hours throughout his lifetime. Stewart continued to fly right up to days prior to his passing. He would fly his plane on the weekends, looking out into the peaceful horizon with a birds-eye view of the geological landscape.

His older brother, Bruce, suggested he study geology or geophysics in college. Stewart took the 2,000-mile journey from Long Island, New York to Golden, Colorado, to a new life and new beginnings at the Colorado School of Mines. Who knew that it would lead to a journey in geology that spanned seven decades.

At Mines, Stewart joined the Alpha Tau Omega fraternity and worked in their house as a hasher for a reduced room rate. He also worked as a barber and worked for the railroad to support himself while attending Mines.

Stewart continued to play football his first year, but was too small to go on any further. He was on the boxing team for three years and on the swim team. He joined the staff of the Mines newspaper "The Oredigger," where he later became editor.

Stewart graduated from Mines in 1952. He furthered his education at Stanford University in California for his master's and doctoral degrees. Stewart met the love of his life, Martha (Muffin) Anne Riggs, in a square dance band in 1953. They were both attending Stanford and working on their master degrees. They were married on June 6, 1953. They were married for 64.5 years.

Stewart graduated with his master's degree from Stanford in 1953. After receiving his master's degree he worked for about three years for Mobil Oil Company (of Canada). While working for Mobil, Stewart and Anne traveled to Libya in December 1953 for work. Stewart worked near Garian, Libya, Tripoli and Sirte Basin in central Libya. Stewart found his work in Libya as an incredible experience. They were surface mapping in the desert, an area of 340,000 square miles which is the size of Texas and Oklahoma combined.

Stewart and Anne returned to Sacramento, California from Libya. Working in the Sacramento Valley Stewart continued to work for Mobil where he finished his doctoral research at Stanford. Mobil provided Stewart a small salary and jeep to use to do subsurface work. Mobil had helped him substantially. Stewart completed his field work for his doctoral thesis in 1961, and was very grateful to Mobil.

Stewart left Mobil and started working for Franco Western Oil Company in Bakersfield, California. He worked for Franco about one year when he was then asked to transfer to Franco Western out of Midland.

This move from California to Texas was a whole new beginning for Stewart, and the world of geology for him and his family. Stewart, Anne and their son Jeffrey, born in 1961, made the move. Valerie was born in 1964, while they were in Texas. They became Texans with a little bit of Yankee accent.

In 1965, Stewart left Franco Western which was bought by Mobil, to begin a consulting relationship with Butes Gas & Oil. In 1968, Butes Gas & Oil offered Stewart a job in the Gulf Coast area in Houston. Stewart was their Upper Gulf Coast manager. He wasn't just the manager, but was their entire staff for the region.

The Gulf Coast region became an area of expertise for Stewart. He worked as an independent and also worked for various oil and gas companies. He excelled at generating prospects and selling drilling deals.

In 1978, working as an independent, Stewart, Anne and family moved to Schulenburg, where he became a part of the community for forty-four years. Stewart worked extensively in the Hallettesville area out of the Gulf Coast region. He started generating prospects and became associated with Howell Drilling.

Stewart and Anne formed and started Mascot Oil and Fayette Exploration on November 14, 1980. Mascot Oil was the operating company for Fayette Exploration. Later, Tx Lavaca Pipeline Inc. was established with a joint ownership with Frank Migl of Hallettesville, Texas. Currently, both companies, Mascot Oil & Fayette Exploration, are still operational, along with Texas Lavaca. In his golden years, Stewart continued working and generating prospects, as it was never a job to him, but a hobby that he loved and enjoyed very much right up to his passing.

One of the comments we received on Stew's passing — "If anybody got their money's worth out of ninety years of life, it was Stew Chuber." He will be greatly missed by many SIPES members and the national staff — as he never met a stranger! ■

ANOMALOUS HELIUM CONTINUED

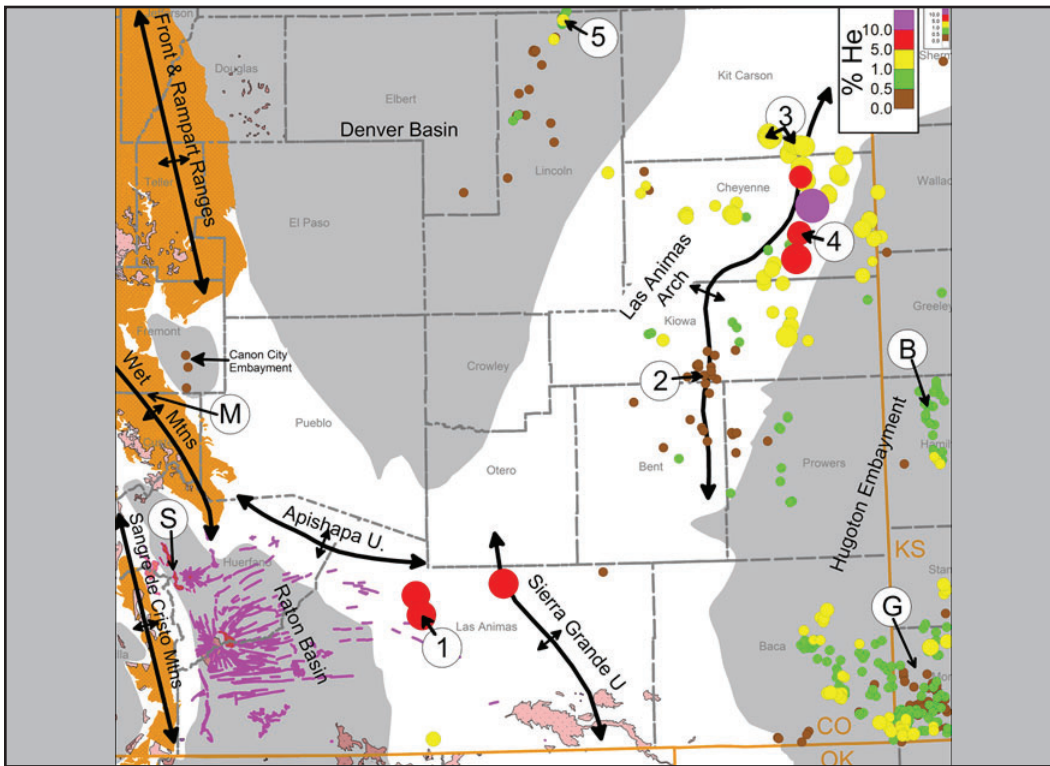


Figure 1. Geological provinces of southeastern Colorado and high-helium gases. Ochre/stippled shading is Precambrian outcrops. Pink/stippled shading is Tertiary volcanic outcrops. Magenta lines are intrusive dikes that radiate out from the intrusive Spanish Peak. Outcrop data are from Tweto (1979) and Bass (1947). Fields referred to in the text are: 1 = Model; 2 = McClave; 3 = Lookout-Smoky Hill-Pennypacker trend; 4 = Ladder Creek; 5 = Arikaree Creek; B = Bradshaw, G = Greenwood; S = Sheep Mountain/Oakdale trend. M = McKinley Mountain thorium locality.

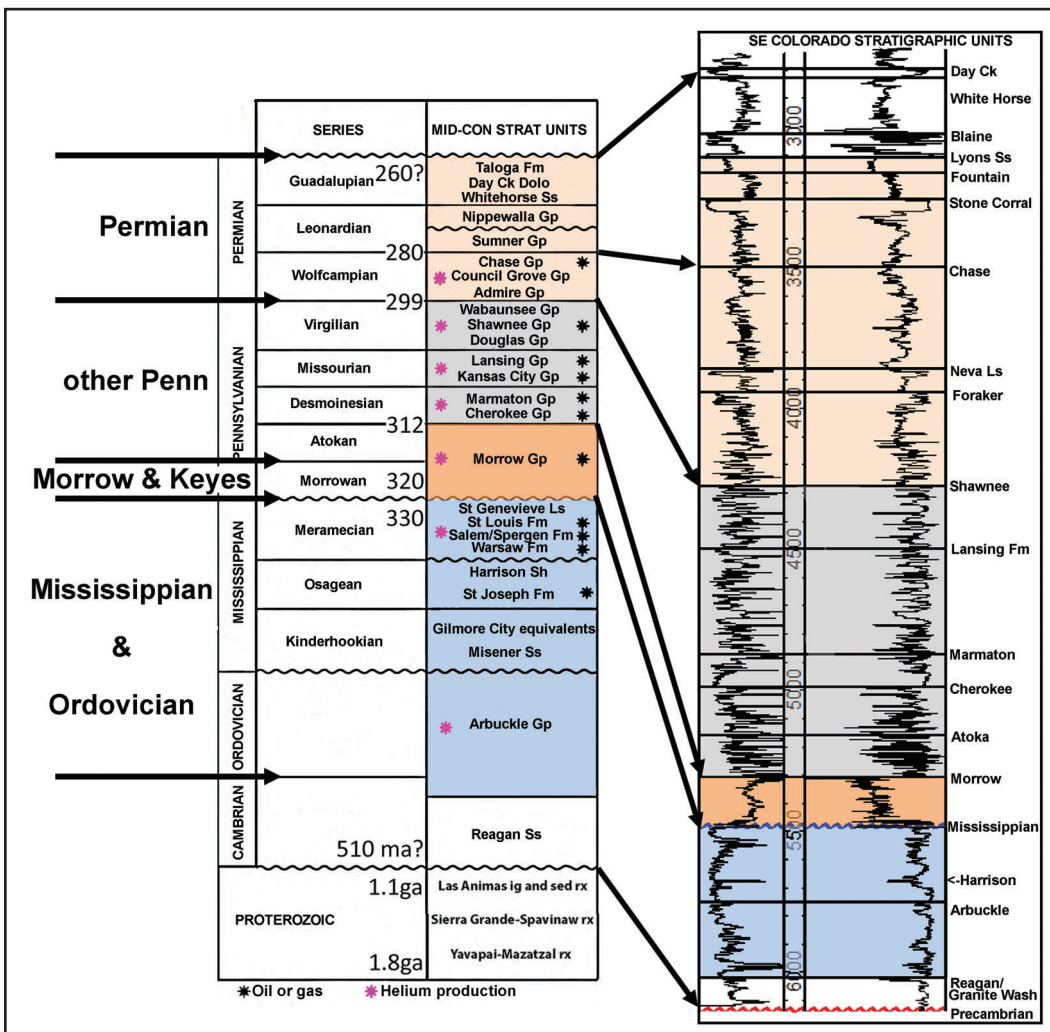


Figure 2. Paleozoic formations, southeastern Colorado. LEFT: Commonly used names in the Midcontinent region, and four zones used to characterize gas analyses (see Figure 3 LEFT). Modified from Keighin (1995) and Ewing (2019). RIGHT: Example sonic log with names commonly used in the Rocky Mountain region.

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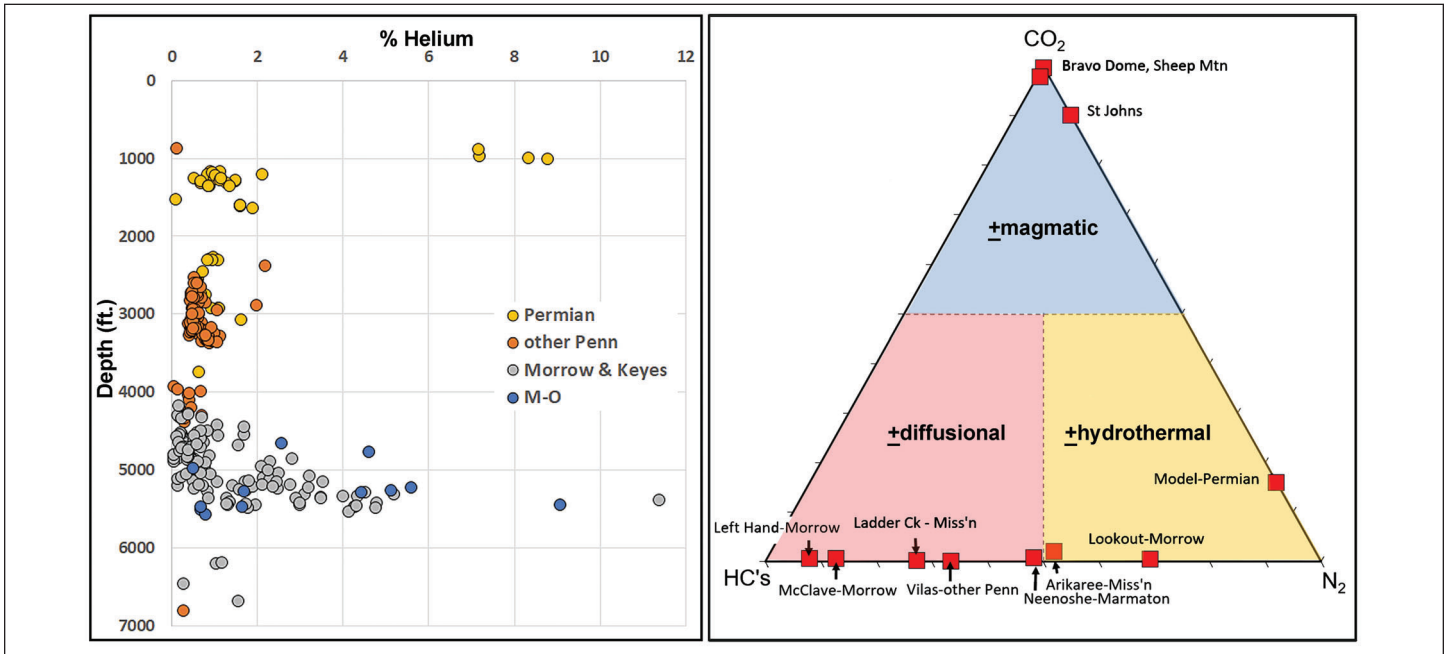


Figure 3. LEFT: Helium percentage versus depth and zone for published gas analyses. RIGHT: Ratios of HC:CO₂:N₂ provide clues to the origin of the gases and by extension the origin of the helium. HC's (hydrocarbons) and N₂ are presumed to originate from thermal stress on organic- or clay-rich rocks. CO₂ is assumed to be from magmas out of the mantle or upper crust. St. Johns and Bravo Dome CO₂ fields are in Arizona and New Mexico, respectively. They are not discussed further here.

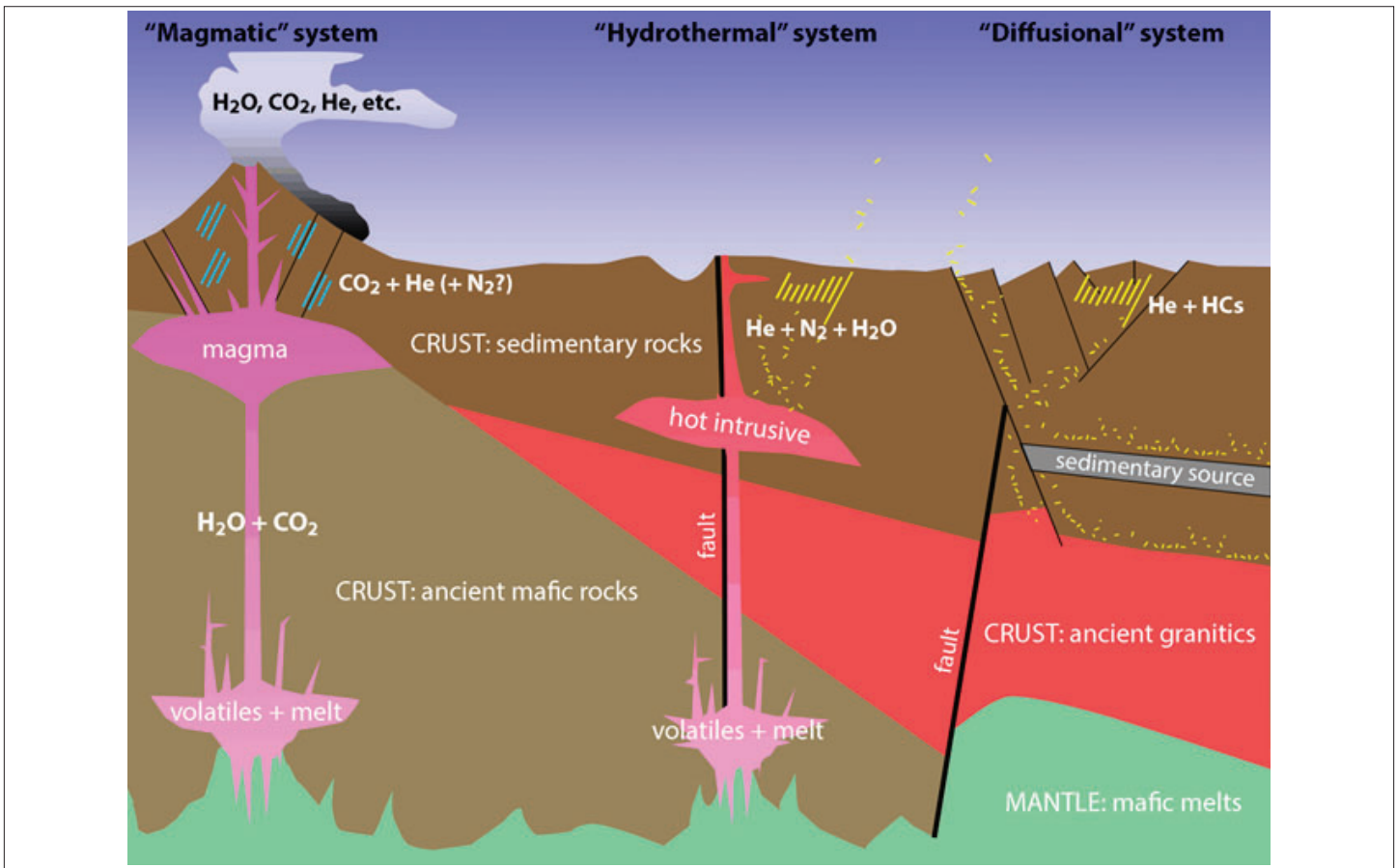


Figure 4. Models for helium sourcing and migration. Gas pay is in the uppermost part of the Lyons Sandstone; perforations are shown by the magenta box in the depth track of the well log. Figure inspired by Werner et al., 2019 and McDowell et al., 2021.

(Continued)

Example Fields

Five fields exemplify helium occurrences in southeastern Colorado (Table 1). Other fields close to the area, i.e., Bradshaw and Greenwood fields, are

treated by Brown (2019). Reservoir trap geometries, seal rocks, porosities and permeabilities are “conventional,” and were discovered by conventional oil and gas exploration geology.

Model Field is the earliest reported discovery of helium in the area. The trap is anticlinal (Figure 5), formed after upper Cretaceous Niobrara/Codell deposition, possibly during late Eocene

(Continued)

Table 1. Five example fields in southeastern Colorado that contain elevated percentages of helium gas.

1. Representative compositions of produced gas from literature and COGCC reports. HCs = hydrocarbons.
2. Field production as of early 2022 estimated from literature and IHS and COGCC databases.
3. Rough estimates of helium produced. Except for Model Field, actual helium refined and sold is not estimated.

Field	Prod. Year	Trap	Reservoir	Head Seal	Gas Composition (%) ¹				Field Production ²		
					He	CO ₂	N ₂	HCs	Oil (bbl)	Gas (BCF)	He (MMCF) ³
Model	1927-1940	Anticlinal	Eolian sandstone	Sand and shale	8	15	77	0	5	0.66?	53
McClave	1952-now	Stratigraphic	Fluvial sandstone	Shale	0.4	0.6	8	91	<90,000	>60	>240
Lookout	1969-2015	Stratigraphic	Fluvial sandstone	Shale	4	≤1	30	65	12,400	7.4	296
Ladder Ck	1969-now	Anticlinal	Marine dolomite	Tight limestone	5	≤1	48	51	3,500,000	0.23	12
Arikaree Ck	2012-now	Fault blocks	Marine dolomite	Tight limestone	0.6	3	50	46.4	2,700,000	0.68	4

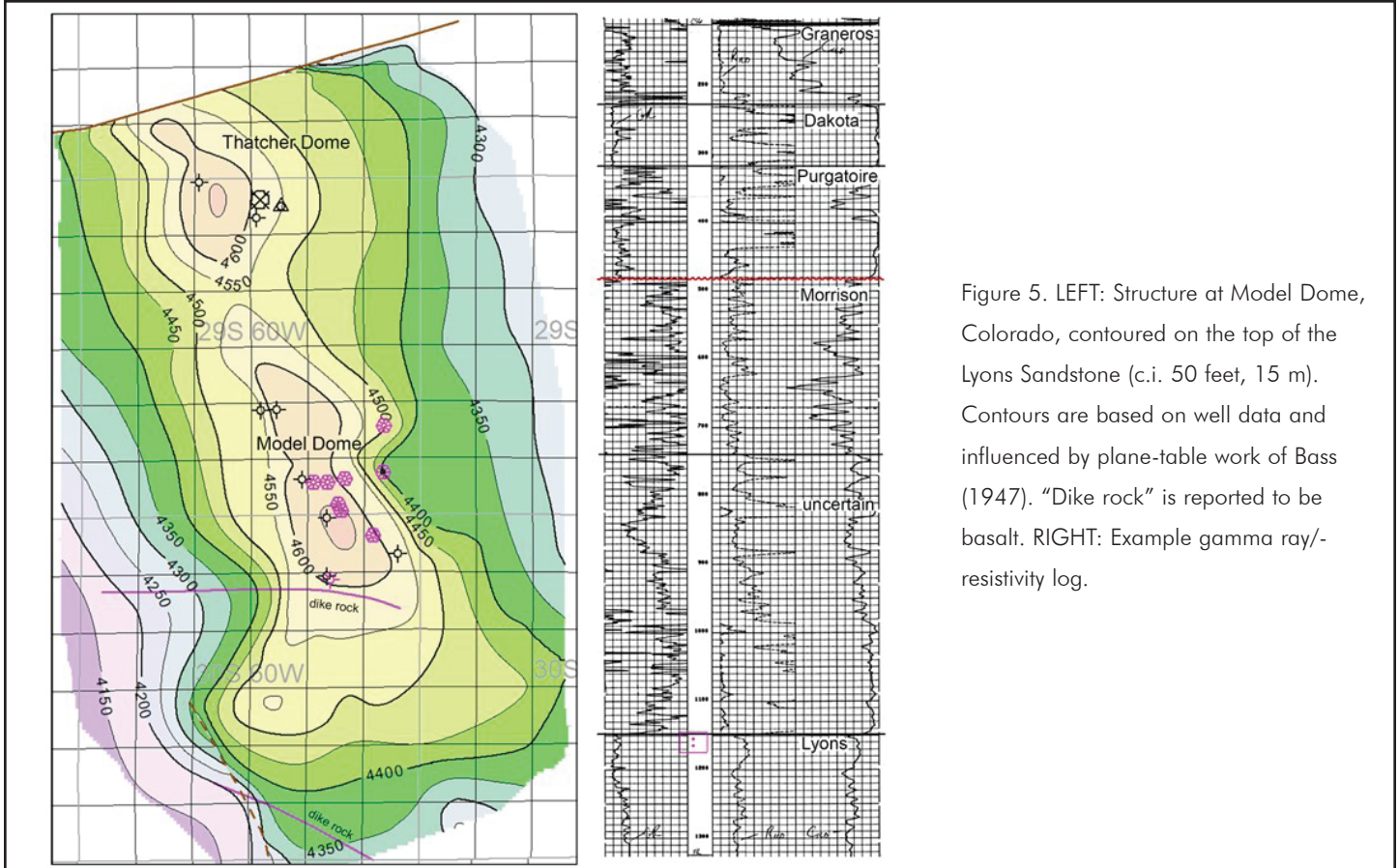


Figure 5. LEFT: Structure at Model Dome, Colorado, contoured on the top of the Lyons Sandstone (c.i. 50 feet, 15 m). Contours are based on well data and influenced by plane-table work of Bass (1947). “Dike rock” is reported to be basalt. RIGHT: Example gamma ray/-resistivity log.

ANOMALOUS HELIUM CONTINUED

or early Oligocene. The helium reservoir is the Permian Lyons (syn. Glorieta) sandstone. The reservoir is over 150 feet (45 m) thick; is porous, permeable, and continuous throughout the field (Clair and Bradish, 1956); and is only partially filled with gas. The head-seal is shale.

Eight field wells produced 53 MMCF (1.5 Mm³) of helium prior to 1940 when the U.S. government nationalized the field (Jones and Murray, 1976). Maximum reported helium content is 11% (IHS, 2022). In 1968, an infill well was drilled and abandoned, suggesting that the field be pressure-depleted. No wells currently produce. No hydrocarbons were found in the Model trap. This suggests that effective source rocks in the Raton Basin did not contribute gas to the Model trap.

Outcrops of Tertiary basaltic intrusives on the Model anticline indicate a probable magmatic source for the helium. The intrusives appear to be part of the Clayton/Raton volcanic complex of intrusives that were emplaced between 10 Ma and 3,000 ya (New Mexico Museum of Natural History and

Science, 2021), although they also may be part of the Eocene Spanish Peaks complex. Nitrogen may have been hydrothermally generated from phyllite beds in the Precambrian Las Animas Formation (**Figure 6**) or from local Cretaceous shales.

Blue Star Helium, Twin Bridges Resources, Vecta Oil & Gas, and others are actively seeking helium in the vicinity of Model Field. Blue Star Helium's Enterprise 16#1 well, drilled 15 miles west of Model Dome in 2021, is reported to be a discovery (see Blue Star's website).

In 1952, Continental Oil Company drilled the first well in McClave-Morrow Field based on standard hydrocarbon exploration geology (Meisse, 1982). McClave is a garden-variety stratigraphic trap formed by at least two stratigraphic levels of west-east trending Morrow fluvial sandstones draping over the crest of the Las Animas Arch (**Figure 7**).

McClave is the biggest Morrow gas field in the study area. More than 150 wells have produced c. 1200 BTU gas

with very minor condensate (IHS, 2022). Strachan Exploration Inc., Thomas L. Spring LLC, and others still operate about 30 producing wells. Consistently low percentages of helium are found in McClave and nearby Kicking Bird fields. If the average helium percentage has been 0.4%, then McClave Field may have produced over 240 MMCF (6.8 Mm³) of helium, although it is not known how much helium has actually been separated and sold.

The consistency of helium percentages suggests a common helium source. It seems unlikely that the helium came from basement sources; of 100 wells drilled deeper, none reported producible gas below the Morrow. Also, the regionally interpreted basement lithologies (quartzite, metaconglomerate, biotite schists) suggests low helium potential from the basement rocks. The helium in McClave Field may have been sourced along with hydrocarbons in thermally very mature Morrow shales of the Denver or/and Hugoton basins.

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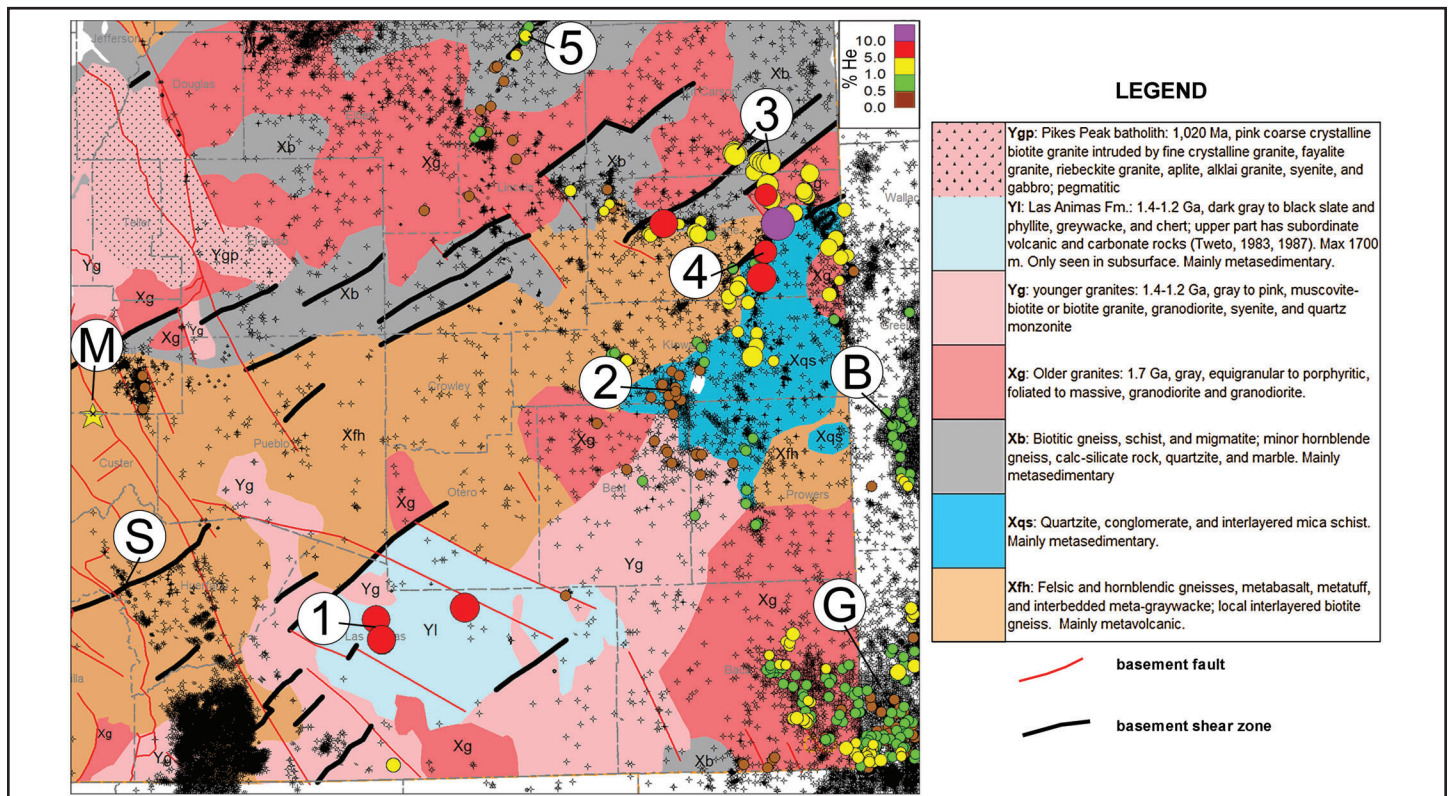


Figure 6. Regional interpretation of basement faulting and lithologies, modified from Sims et al. (2001). Localities labeled as in Figure 1.

ANOMALOUS HELIUM CONTINUED

McClave helium percentages are the lowest seen in Morrow helium reservoirs. It is possible that there has been leakage of Morrow gas through imperfect head seals (Nelson and Simmons, 1995; cf., Wilson, 1997), with perhaps greater leakage of helium than of hydrocarbons.

In 1969, Tiger Oil Company drilled the first well in Lookout-Morrow Field based on conventional subsurface geological mapping (Hundley-Goff, 1982). The well tested 6,000 MCFGD (0.17 Mm³ per day). Tiger reported the gas as “mostly CO₂,” then plugged the well. In 1978-1979, Citation Oil and others suc-

cessfully twinned the Tiger well and quickly drilled three additional gas wells. Four other wells produced minor oil and gas from Mississippian rocks with no reported helium. Before their abandonment in 2015, four Lookout-Morrow gas wells produced 7.4 BCFG and minor oil
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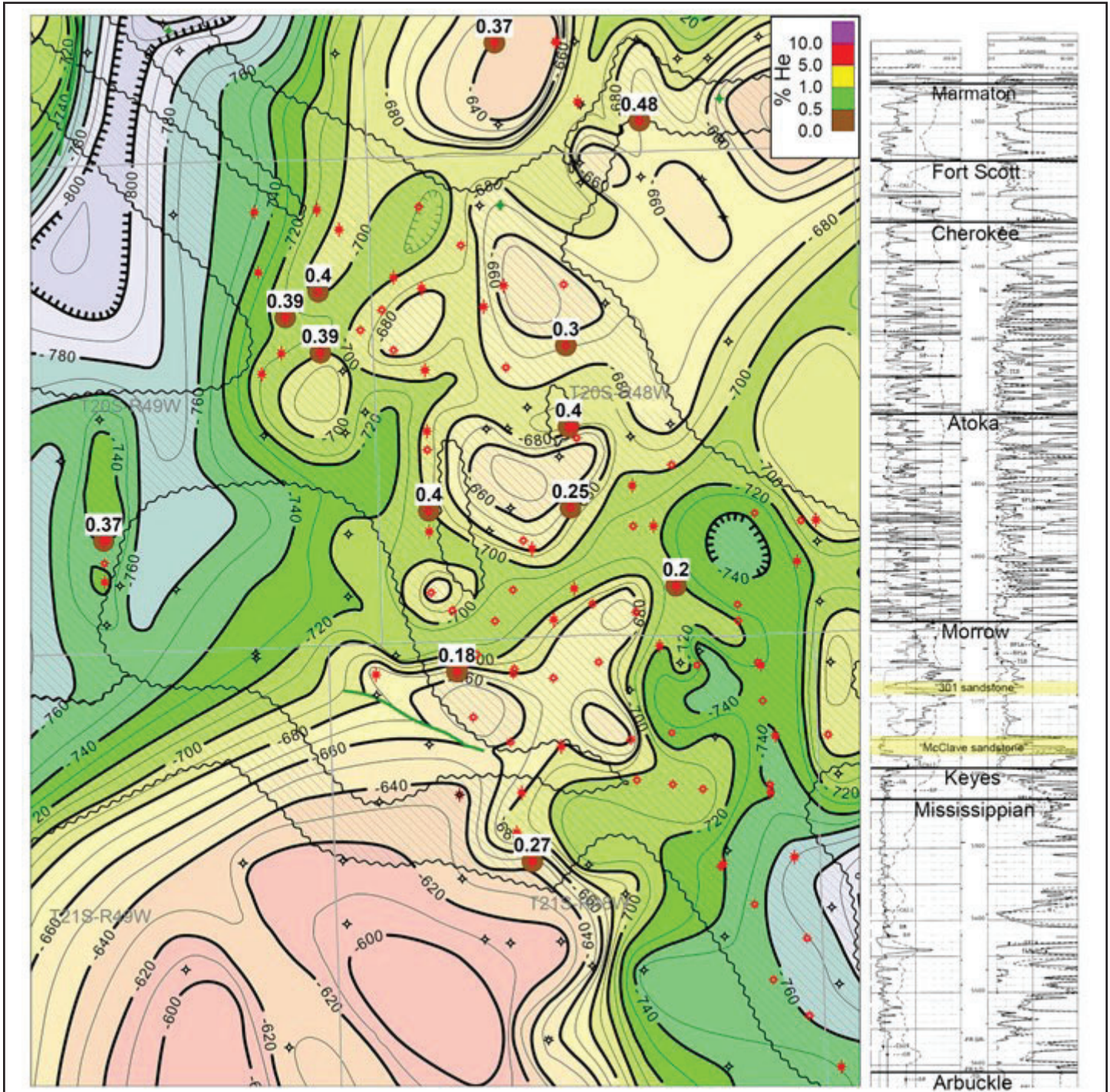


Figure 7. LEFT: McClave and Kicking Bird fields. Color-fill is structure contoured on the Morrow shale (c.i. 10 ft., 3 m). Hachuring indicates distribution of the main Morrow valley-fill sandstone (“McClave” sandstone). McClave Field is a combination structural/stratigraphic trap. RIGHT: Example gamma ray-resistivity log. Two stratigraphic levels that produce helium are shaded yellow.

ANOMALOUS HELIUM CONTINUED

of 51-69° API gravity (COGCC, 2022; IHS, 2022). The gas carried 3-5% helium. If the produced gas averaged 4% helium, then total helium production may have been more than 250 MMCF (7.1 Mm³).

Gas is trapped where Morrow valley-fill sandstones drape over two small anticlines (**Figure 8**), creating three separate gas pools. The head seal is Morrow marine shale. Pennypacker and

Smoky Hill Morrow fields, located two miles and 10 miles west of Lookout Field respectively, have very similar Morrow gas contents and trapping geometries (not illustrated). The consistency of helium contents in these three fields, the associated hydrocarbon gas, the high gravity oil, and the high nitrogen contents suggest the major gas source was sedimentary rocks, perhaps Morrow shales in the Denver Basin.

Helium also might have evolved from granitic basement mapped near the field that migrated vertically along faults into the Morrow. The gamma ray log from a well located within 6 miles (9.6 km) of the field (Continental Oil, #1 Lowe, Sec. 1, T11S, R46W, API 05063050020000) displays elevated readings in either Reagan Sandstone or the Precambrian basement, indicating a possible local helium source in or near the basement.

In 1969, Plains Operating Company and Inexco Oil Company drilled the first well in Ladder Creek-Spergen Field based on conventional geological subsurface mapping (Wicker and Olgaard, 1982). Ladder Creek is a structural trap for oil (**Figure 9**). The Mississippian Spergen reservoir rocks are oolitic dolomites of penedepositional origin (Canter and Coringrato, 1988). The field still produces oil and gas.

In 1997, Union Pacific Resources Company built a helium plant to process the gas from this and other nearby fields. The Ladder Creek Helium Plant is now owned and operated by Tumbleweed Midstream; Tumbleweed encourages local helium exploration (Mark Germinario, pers. comm.).

More than 40 Ladder Creek Field wells have produced primarily oil of 36-38° API gravity, with associated 543 BTU gas carrying 4 to 5% helium (Wicker and Olgaard, 1982). More than 10 MMCF (0.28 Mm³) of helium may have been produced to date.

The source(s) of the oil and gas are uncertain. The high N₂ content suggests generation of gas from shales. Thick Morrow source shales lie stratigraphically above the reservoir rocks, requiring gas migration either stratigraphically downward or else structurally upward along faults. The thickest known underlying shale, the Mississippian Harrison Formation, is only 8-10 feet (3 m) thick. Rocks below the Mississippian are an enigma; only one well penetrated as deep as the Ordovician Arbuckle Formation. Sims et al. (2001) map Precambrian metavolcanic gneiss underlying this area, a possible helium source.

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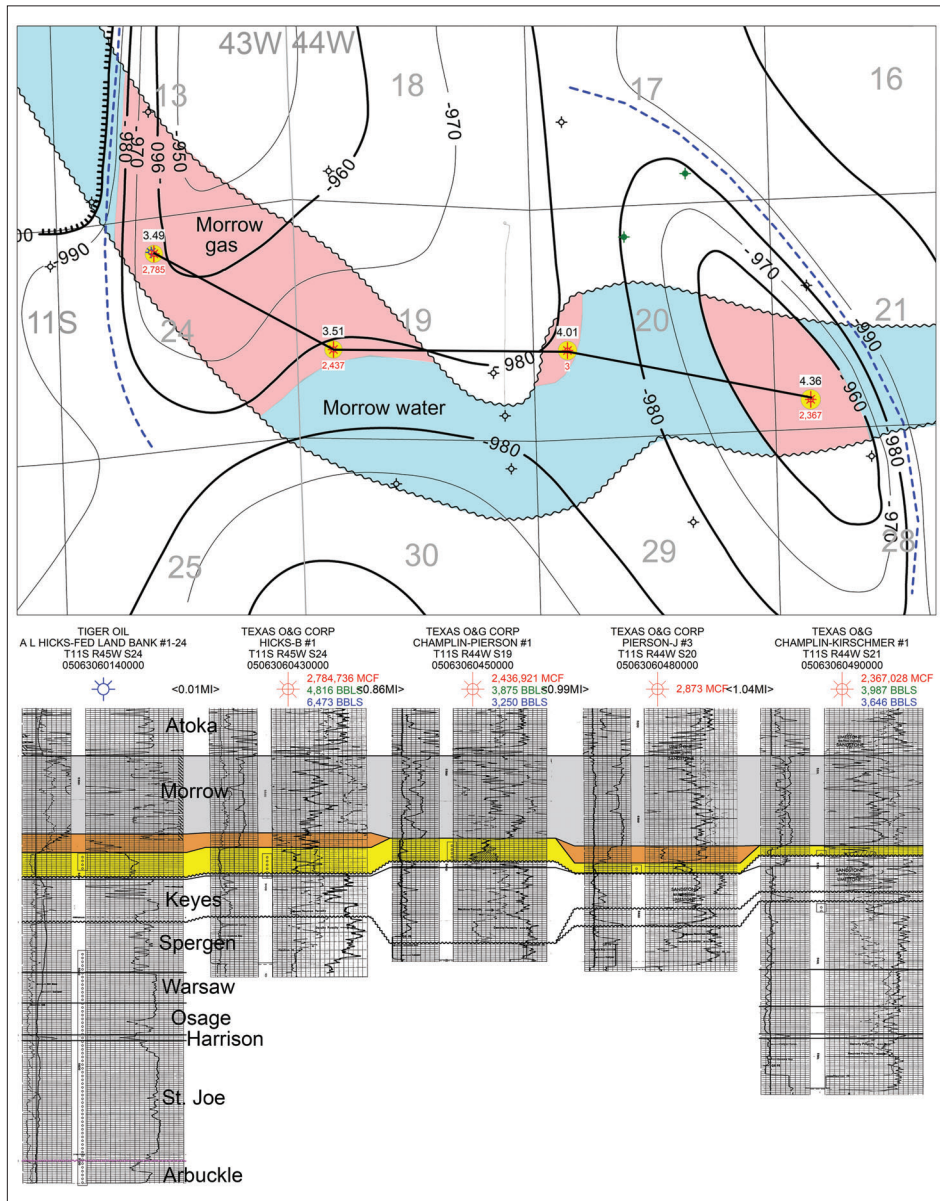


Figure 8. Lookout-Morrow Field. UPPER: Structure is contoured on top of the Morrow (c.i.= 10 ft., 3 m). Wavy lines indicate margins of a trend of Morrow erosional valley-fill sandstone. Helium percentages posted next to well symbols. Dashed blue lines are basement faults inferred from steep Morrow dips. LOWER: Stratigraphic cross section using porosity logs is datumed on the Morrow shale (shaded gray). Morrow valley-fill deposits are sandstone (yellow) and sandy shales (orange).



Figure 9. LEFT: Structure map, Ladder Creek-Spergen Field contoured on top of Mississippian Saint Louis formation (c.i. 50 ft., 15 m). Blue numbers are reported percentages of helium. Helium plant is in Section 25, T14S, R43W. RIGHT: Type neutron log. Helium production is from the stratigraphic interval indicated by the black rectangle.

Aeromagnetic data display a prominent circular feature in the basement lying a few miles east of the field (Figure 10). It is interpreted as a Proterozoic impact crater or volcano. Impact-related basement fractures and/or Phanerozoic faulting interpreted on the west side of the anticline suggest possible pathways for helium movement from the basement.

In 2012, Running Foxes Petroleum and Nighthawk Production LLC drilled the discovery well at Arikaree Creek.

The prospect was based on aeromagnetism and 3-D seismic (Tedesco, 2015).

The trap is unusual for southeastern Colorado in being related to transpressive basement faulting of probable Permo-Pennsylvanian age (Figure 11; Tedesco, 2015). Mississippian Spergen dolomite forms the main reservoir; reservoirs stratigraphically above the Spergen provide minor production. Fifteen wells produce 36° API gravity oil and 800 BTU gas (COGCC, 2022). Helium ranges from 0.4% to 1.5% of the

gas. Assuming 0.6% helium gas, the field may have produced over 4 MMCF (113 Mm³) of helium.

Tedesco (2015) opines that Spergen porosity may be hydrothermally enhanced. The intense faulting suggests that helium and hot water may have leaked upward out of the Precambrian basement lying only 150-250 feet (50-76 m) below the Mississippian rocks. If so, then the helium also might be hydrothermal. The basement displays elevated gamma-ray readings, supporting a basement source for helium. Using the method and parameters of Brown (2010), only 40 feet (12 m) of granite wash or granite could generate 700 MMCF (19.8 Mm³) of helium per square mile since the Permian, accounting for the reported helium volumes.

Regional Considerations

Although only about 250 basement tests are reported for the study area, several have gamma-ray logs indicating radioactive rocks in or near the basement that may be helium sources. Although there are not enough deep wells to reliably map basement lithologies on the scale of drilling prospects, Sims et al. (2001) used both well and geophysical control in their mapping, and interpreted a SW-NE trend of metavolcanic gneissic rocks stretching from the Wet Mountains eastward to just south of the Lookout-Morrow Field (Figure 6). In the McKinley Mountain area of the Wet Mountains this gneiss hosts hundreds of late Precambrian to Cambrian-age dikes rich in uranium and thorium in an area of more than 22 square miles (5,700 Ha) (Christman et al., 1954). Such intrusives certainly would be sources of radiogenic helium.

Conclusions and Questions

Helium exploration may be conducted very similarly to hydrocarbon exploration, with some extra consideration of the timing of genesis and migration. Perhaps helium accumulation is aided by solution into other formation fluids; even though helium solubility in pure

(Continued)

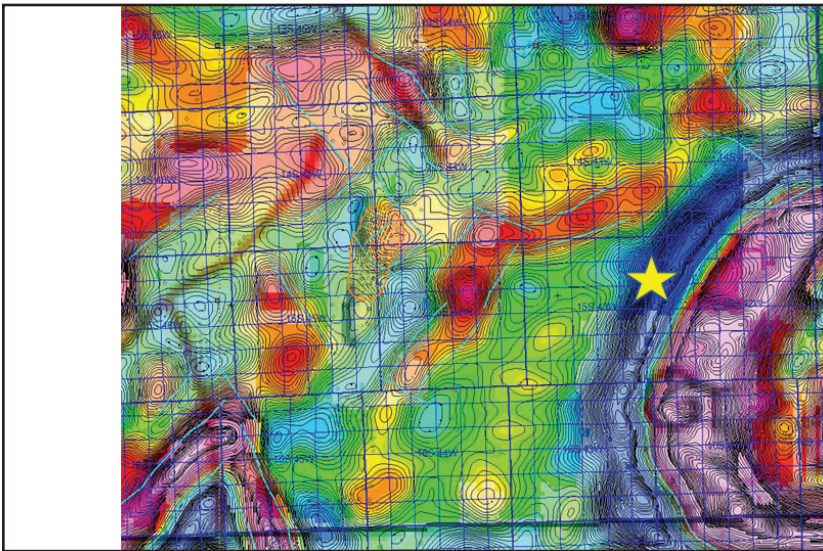


Figure 10. Total-magnetic-intensity aeromagnetic data, Ladder Creek area. Yellow star shows the crest of the Ladder Creek anticline. Curved feature that underlies Ladder Creek Field is interpreted to be an astrobleme or volcanic feature in the Precambrian basement. Aeromagnetic data courtesy of Applied Geophysics, Inc.

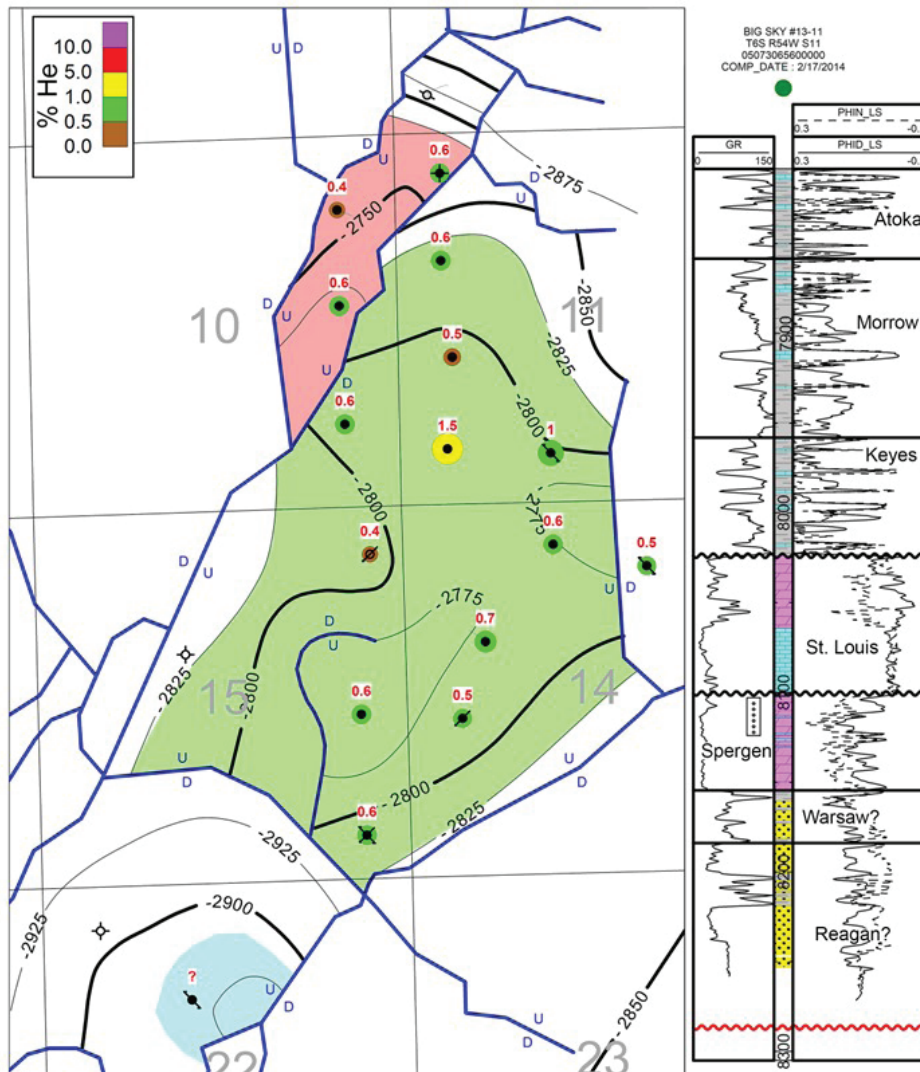


Figure 11. LEFT: Arikaree Creek Field structure contoured on Mississippian (c.i. 25 ft., 7.6 m). Faults are from Tedesco, 2015. Contours are drawn from well control and influenced by seismic data from Tedesco (2015, 2021). Shading indicates discrete oil pools. Bubbles indicate helium percentages. RIGHT: Type log. Lithologies in depth track are interpreted from well logs.

water is very low, its solubility is enhanced by the presence of nitrogen, oil, and natural gas (Wiebe and Gaddy, 1935; Clever, 1979; Beerbower, 1980; Kharaka and Specht, 1988). The fact that helium in this area is always associated with these other fluids suggests that commercial helium accumulations may require their presence.

Questions remain. Why are there many fields from which helium production is not reported? How can a structure such as Lookout Field report helium in one closure and not from another closure on the same anticline? Is helium being produced but not recognized? Is helium content related more to variations in source rocks, or to variations in fracturing/faulting, seal capacities, basement lithology, dilution by associated gases, or other factors? Will helium escape more easily from traps than do the associated gases? Will helium fractionate and migrate within traps and become gravity-segregated?

As noted, the tendency is for the richest percentages of helium in southeastern Colorado to be found in the deepest reservoirs, and to be associated with faulting. Multiple faulted closures can be mapped in Mississippian and deeper beds on the Las Animas Arch that have not reported helium. Does that represent a play opportunity?

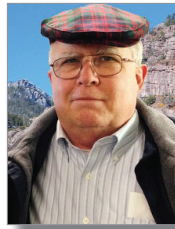
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References are available by request of the senior author. Email edcoalsonge@gmail.com.

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After graduating in 1970 from the University of Wyoming with an M.S. in hard-rock geology, **Ed Coalson** started as a junior geologist for Amoco Production Company in Denver.

In 2012 he earned a Ph.D. in geology from the Colorado School of Mines. He

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September 14, 2022

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