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THE PROFESSIONAL GEOLOGIST

VOLUME 62 NUMBER 2 APR.MAY.JUN 2025

National Conference Guide

National Election Officer Candidates

The Del Rio Clay of North-Central Texas

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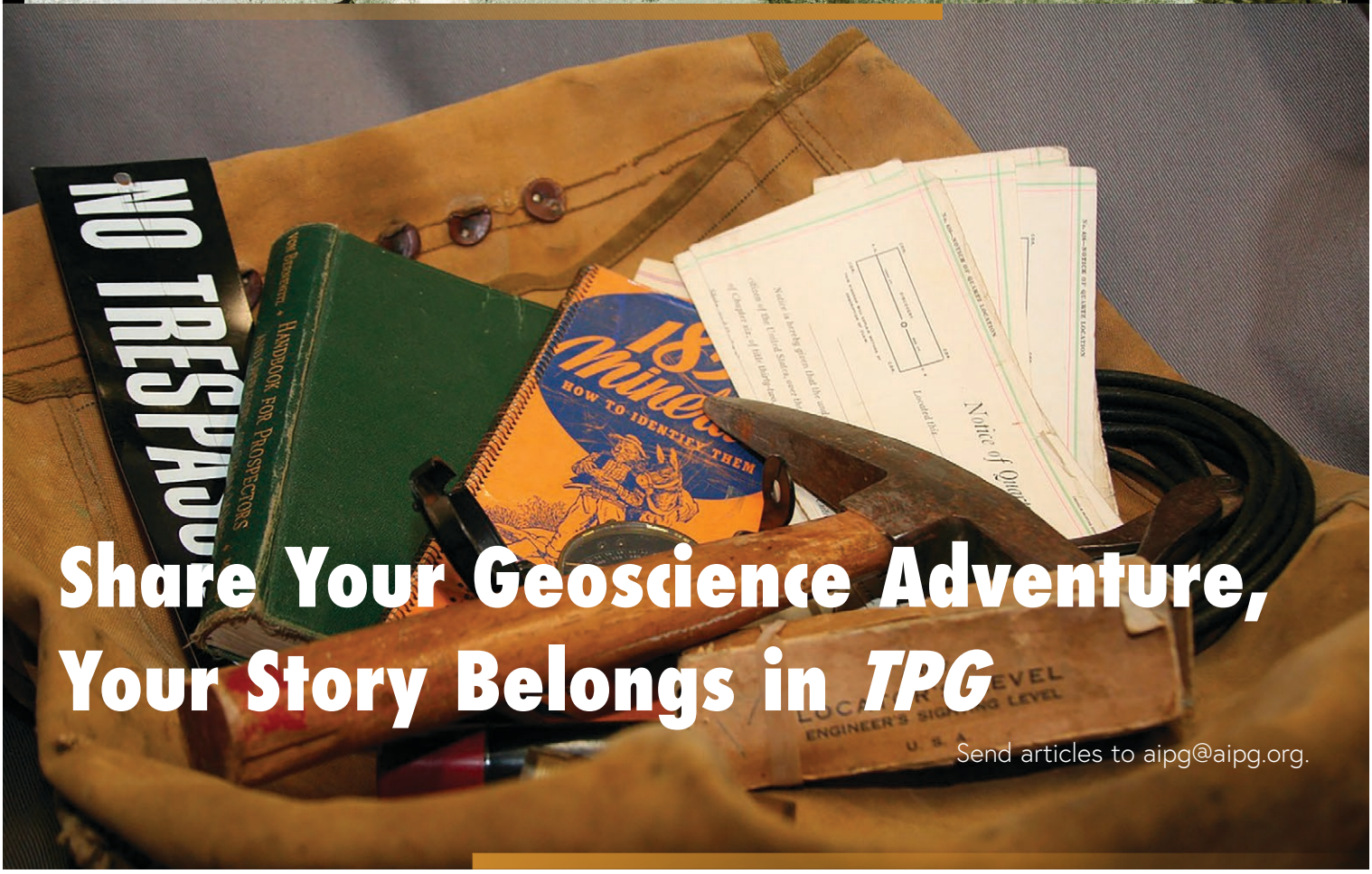
New Modeling and Estimation Methodology to Address Porphyry Drift Using Enclosed 3D Volumes



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The Professional Geologist

Volume 62 Number 2 APR.MAY.JUN 2025

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FEATURES

On the Cover: 2025 Photo Contest Winner - Fossil Hunting Finds - Linked Stromatolite Domes

Description: ***Linked Stromatolite Domes*** – The Paleoproterozoic (2.45 - 1.78 Ga) Nash Fork Formation in Wyoming's Medicine Bow Mountains contains a world-class exhibition of Stromatolites. These ancient microbial communities provide spectacular examples of hemispheroidal and domal growth structures. The photograph illustrates linked stromatolite domes, with the oblique upward view emphasizing their complex interdigitate formation. The paleontologist's hammer gives scale to the enormous domed structure.

Photograph by ***Carl F. Brink, AS-0057,*** *AIPG Michigan Section, 2018.*
2025 Photo Contest: Fossil hunting Finds. Runner Up on page 5.

DEPARTMENTS

AIPG Publication Policy, October 4, 2010. AIPG encourages submission of articles and editorials for publication in *TPG* on topics related to the science and profession of geology. Submittals shall be of interest to the members of AIPG, other professional geologists, and others interested in the earth sciences. Articles and editorials may be noted as follows at the discretion of the Editor, "The opinions, positions and conclusions presented herein are those of the author and do not necessarily reflect the opinions, positions or conclusions of the American Institute of Professional Geologists." All materials submitted for publication, including author opinions contained therein, shall include accurate and appropriate references. The Editor has the authority to solicit, edit, accept, or reject articles and editorials and other written material for publication. The Executive Committee has the authority if it so chooses to act on any particular case to support or overrule actions of the Editor regarding the solicitation, editing, acceptance, or rejection of any particular article, editorial, or other written material for publication.

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The mission of the American Institute of Professional Geologists (AIPG) is to effectively advocate for the profession of geology and support members through activities and programs that advance professional growth and promote high standards of ethical conduct.

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Communication is Still Key…

Adam W. Heft, CPG-10265

By the time you read this, we'll be almost through the first quarter of 2025. This edition of *TPG* includes a peer review article on modelling of mineralization by **Justin Cardwell,** CPG-12059, a submittal in the Tales from the Field category by **Andrew Chiles,** SA-12091, an article on the Del Rio Clay by **Robert Font,** CPG-03953, and more. And of course, we include the information you come to expect each year for the upcoming Annual Meeting (to be held this year in St. Louis, Missouri), and the candidate information for the 2025 election.

For those of you who have been members for 10 years or more, you may recall that when I served as AIPG President in 2017, the theme of my messages to you was "Communication is Key". I still believe that this is an important message, and one to which we as professionals should all pay heed.

The last edition of *TPG* included a listing of all categories of AIPG members. The list was presented by member category and alphabetized by member last name. The unfortunate thing about this list was that it was not complete. You see, because of laws in certain states, we had to have members "opt-in" to be included in the listing. Headquarters sent emails out to all members advising them of this fact and asking them to opt-in. To do so, members were asked to go to the AIPG National website, log in to their member profile, scroll to the bottom of the page where the opt-in permission was located, and select opt-in. Those who did so had their name included in the list. Those who did not, or selected opt-out were not included.

Image generated using Adobe Photoshop (2025) from the prompt communication is key.

On the surface of things, it seemed a simple thing. However, looking back, it becomes apparent that it was not. Firstly, the communication to members was sent out only twice in the space of about a month right before the deadline. It is likely that twice was insufficient notice and too closely spaced. Secondly, it only went out via email. Not all members may monitor their email regularly. Or their email address may have changed. Or the messages may have been caught in their spam filter. Or maybe they missed seeing the message or simply ignored it thinking it was something else. And thirdly, the instructions involved a multi-step process that including navigating to the member profile on the National website. Many members have difficulty in logging in or remembering their password.

So, because of these issues, only a relatively small number of all members actually saw and acted on the instructions to opt in, and we had a corresponding low percentage of members included on the list. I've since heard from a number of you (particularly several emeritus members) who expressed their disappointment on not seeing their names in print. I've also learned that Headquarters has also received a number of calls or emails in the same vein.

So this begs the question, *"Was this fair to our members?"*. In many ways, I don't think it was. There should have been more advance notice. There should have been communications in multiple ways. There should have been an easier mechanism for members to opt in.

I therefore feel that I've let some of you down and that insufficient communication was provided. I apologize for that. The numerous messages from disappointed members to me directly and to Headquarters is communication that is very clear: something must change for next time!

With that in mind, I will be discussing the issue at the February Executive Committee meeting, which by the time you read this will already be past. We will put in place multiple options for communication to reach you, our members. Not the least of which is this column but please see also the separate information piece on page 43 in this issue of *TPG*. And be sure to watch for the opportunities to opt-in for the 2026 list – I'd like to see everyone's name on it!

One final item. I'm looking to add advertisers in *TPG*. Many of you have close contacts with companies you work for or with. Please encourage them to consider placing an ad in *TPG*. I will be more than happy to talk with them about ad placements. The pricing is much less than it used to be, and the value for being able to reach our members across the nation (and even internationally) has never been greater.

Response to DEI in AIPG

Well, now I see that the DEI mindset is really entrenched in AIPG! It's odd how Ms. Schmitt described the DEI Committee as"Diversity and Inclusion." She left out Equity (by definition, providing what each individual needs to succeed). Was this a Freudian slip? Maybe she didn't want to draw attention to this part of DEI? Why? Because DEI, as it is commonly practiced, is a POLITICAL MOVEMENT. It has been deliberately morphed into a package of political policies and thought control directives whereby the word equity no longer means providing equal opportunities to succeed, but, rather, to favor certain ethnic, gender and political groups above all others.

Also, it is unfortunate that Mr. Abbott holds the belief that "in some right-wing circles, DEI is viewed as a version of political correctness that is viewed as a woke agenda." If one has been following politics for the past year, it can clearly be seen that those in left-wing circles do not believe in equality for all, but, rather, an agenda of complete power over everyone in this nation.

Mr. Abbott also believes that Governor DeSantis is a bigot for not believing in DEI and calling it "discrimination, exclusion and indoctrination." Well, sorry Mr. Abbott, but DEI, as it is largely practiced by companies, institutions and various organizations, does discriminate! The main beneficiaries of this practice have and continue to be blacks and women. Don't shake your head at me in disgust! I've experienced it myself in my former workplace and when recruiters came to my university to hire students who were about to graduate. The recruiters first hired the married students and students with children, then they hired the minorities and women during a second round and then, in the third round, they hired two out of the 13 white males who were left. Where I used to work, I saw how the administration filled vacancy after vacancy with minorities (even some dark skinned south Asian individuals) and women. My own promotion was held up until a woman with the same test score made up her mind regarding which office she wanted to work in (there were two open positions). I dare anyone to try and explain the above to me, a white male, as being payback for past injustices.

I'm sick of the whole politically correct DEI movement and I am sorry to see AIPG officers are allowing this to happen. Whether it is regarding work or a special group, people gravitate to a place because it looks comfortable and familiar to them. The guiding factors could be race, economic class, language, national origin, educational level, gender identity and more. What can I say, people are human. I've attended many geology conferences. As a curiosity exercise, I have often roughly determined how many white people, women and people of color attended these meetings. Fairly consistently, the numbers are, respectively, 78% white males, 15% women and 7% minorities. Recently, I attended a conference sponsored by the NYSCPG in Saratoga Springs, NY. There, I would say that the percentage of women was higher – maybe 24%? However, this conference attracted a lot of engineers and there usually seem to be more women in the engineering field than in the geosciences. Go figure, women are better than men in math!

DEI is damaging to a university, a company or an organization. People are forced to become a group not of their own choosing and, possibly, one that could be out of favor with those in power. Also, hiring someone because of their race, gender or other attribute, rather than their ability, compromises the performance of the university, company or organization. It behooves the officers of AIPG to break from this racist, sexist and elitist practice. However, DEI followers and practitioners are true believers. Unfortunately, I don't see this happening with AIPG. When you have bigoted, left-wing DEI advocates, such as Mr. Abbott, in positions of authority, and who serve as woke left-wing censors, the only thing we can do is vote them out!!!

Sincerely,

Raphael Ketani, PG, CPG-09003
Sunnyside, New York

AIPG Member Photo Challenge

Awards:

First place in each category:

Image published on the cover of *TPG* in 2026. Winners will receive a personalized Estwing rock hammer engraved with their name and member number or AIPG Gear of choice up to $50.

Runners Up in each category:

Images will be published inside the *TPG*. Runners up will receive AIPG gear of choice up to $30.

Challenge categories:

1. **Off the Beaten Path - Unique feature/ formation.**
2. **The Best Part - Capturing the Spirit of the AIPG National Conference.**
3. **Geologists in the Field - People at work/field trips.**
4. **Micro-Geology - Under the microscope.**

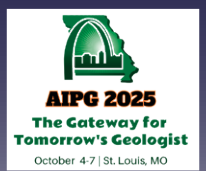
Entries must be original and taken by a member. Entry authorizes publication of the image in *The Professional Geologist* by AIPG with credit given to the photographer.

Challenge Rules:

Image requirements: digital, 300 dpi, 8.5"x11," **portrait orientation** full color.
Members are allowed one entry per category with up to four submissions (one per category).
All images must be original and taken by the member.
Submit entries via email to aipg@aipg.org.
Entries must include:

- Name
- Member number
- Section
- Title of image
- Less than 200 word description of the image
- Names of any identifiable persons in the image and permission to publish their photo
- Year photo taken

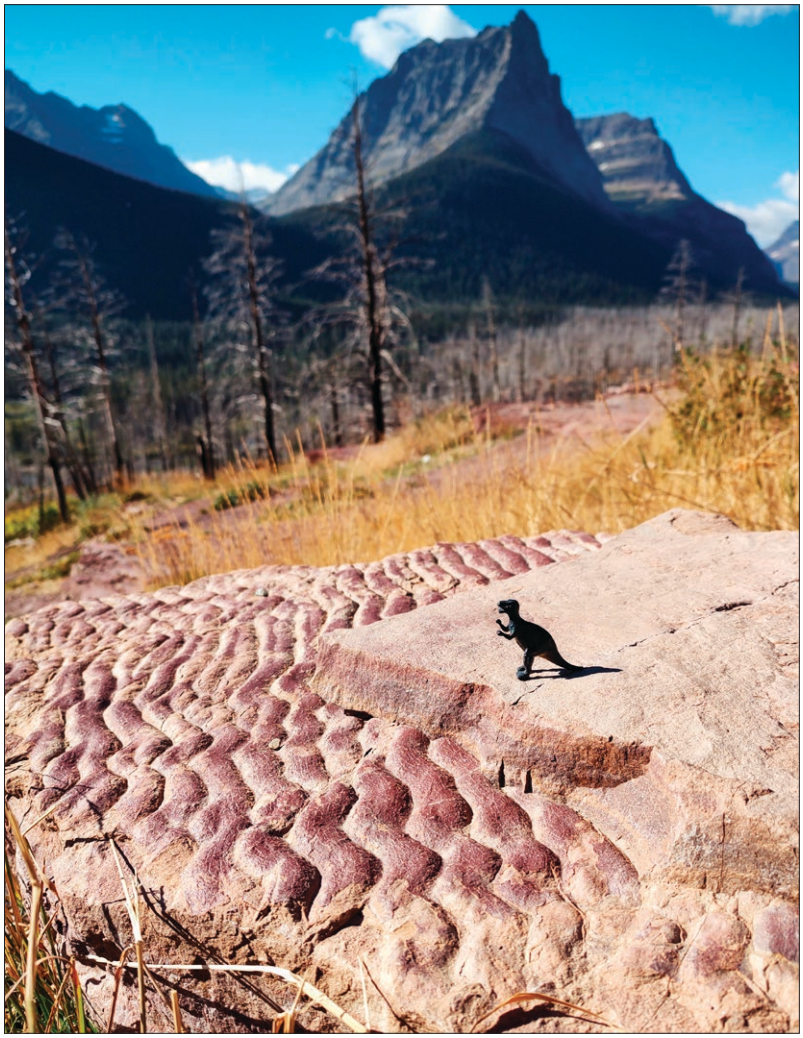
Entry deadline: **November 1, 2025**.



Above Right Photo Contest Entry:

Runner Up: 2025 Photo Contest - Ancient Life - Fossil Hunting Finds: Kristen Hasbrouck, SA-12100, Michigan Section.

Description: ***Echoes Through Time: Encounters with Ancient Ripples*** – *Ripple marks in Grinnell Formation argillite/quartzite, deposited in a Mesoproterozoic shallow sea, at Glacier National Park in Montana with an unexpected non-fossilized visitor thinking about surfing. (T-rex not to scale).*



Chemical and Textural Degradation of the Kaibab Limestone's Helium Diffusion Resistance: A Comparative Analysis of the Fort Hays Limestone

Dalton R. Seymour, SA-11597, Aurora, Colorado

Uwe Kackstaetter, PhD., MEM-2437 Denver, Colorado

Abstract

Gas migration halting properties of the Kaibab Limestone of Arizona prediction's use mineral abundances and textural characteristics in comparison with the Cretaceous Fort Hays member of the Niobrara Formation from Boulder, Colorado. Previous imaging, diagenetic work, and gas permeameter tests would confirm the relationship between mineralogy and helium diffusion and other gases, primarily due to larger d-spacing and crystal arrangements (Cherniak et al., 2015; Constentius and Payton, 2022; Danabalan et al., 2022; Freitag et al., 2022). The effect of minerals on gas migration in the subsurface is an essential part of qualifying formations for helium and hydrogen reservoir seals, or carbon capture studies. Mineralogy and textural characteristics were gathered by scanning electron microscopy and energy dispersive x-ray spectroscopy at the USGS Microbeam Laboratory in Denver, Colorado. Phase Mapping (Automated Mineralogy) yielded qualitative and semi-quantitative interpretations of mineral abundances of calcium, dolomite and silica and the expected influence on helium gas migration. Calcareous fluid-healed opening-mode fractures of 25-70 µm exist in both the Fort Hays and the Kaibab Limestone. Secondary electron images show irregularly shaped voids five to 15 µm equidistant across both sample surfaces, albeit diagenetically dissimilar. Framboids appeared in the Fort Hays with total diameters of 20-30 µm. Occurrences of fractures and voids in both samples in such dimensional similarity suggest greater study focus be made on the mineralogical differences to understand diffusive loss variability. Low concentrations of calcite (4.22%), and an abundance of dolomite (72.7%) coincide with high helium concentrations in subsurface reservoirs capped by the Kaibab Limestone.

Methods

The chemical composition of each formation was determined by the imaging of one-micron roughness polished "thick" sections – prepared slices of rock 100 µm thick, commonly used in fluid inclusion work. These sections differ from "thin" sections of a standardized 75 µm thickness, used in petrographic cross polarized light (XPL) studies. Epoxy-mounted slices of samples of each outcrop have been sized down, billeted, and sliced to one millimeter, and subsequently polished to a thickness of one-micron. Fractures intersected within an estimated five-degree angle from perpendicular to best preserve aperture observations. Scanning electron microscopy (SEM) for backscatter electron, and second return images yielded atomic identity and surface topography. Energy dispersive x-ray spectroscopy (EDS) for phase mapping was implemented for pinpoint mineralogical assaying and confirmation of pixel-assigned chemistry. The phase map resolution was 171 pixels per millimeter or 4,318 dots per inch (DPI). Minor minerals such as zircon were identified but need further calibrations for individual analysis. Services were provided by the United States Geological Survey (USGS) Microbeam Laboratory in Denver, Colorado (Figure A).

Sample Selection

The Kaibab Limestone sample was an incidental collection of the Coconino Sandstone of Arizona, selected during an earlier undergraduate research project on reservoir properties. The Fort Hays Limestone was chosen to match the Kaibab Limestone, sharing

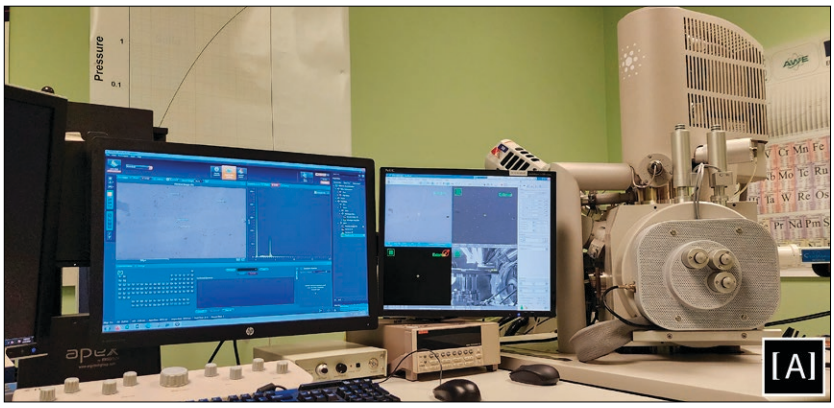


Figure A. USGS Microbeam Laboratory SEM Machine equipped with Energy Dispersive x-ray detector. Monitor at left shows a backscatter electron image, with EDX readout at the selected point. The right monitor shows BSE, SE, and SEM chamber interior (U.S. Geological Survey, 2024).

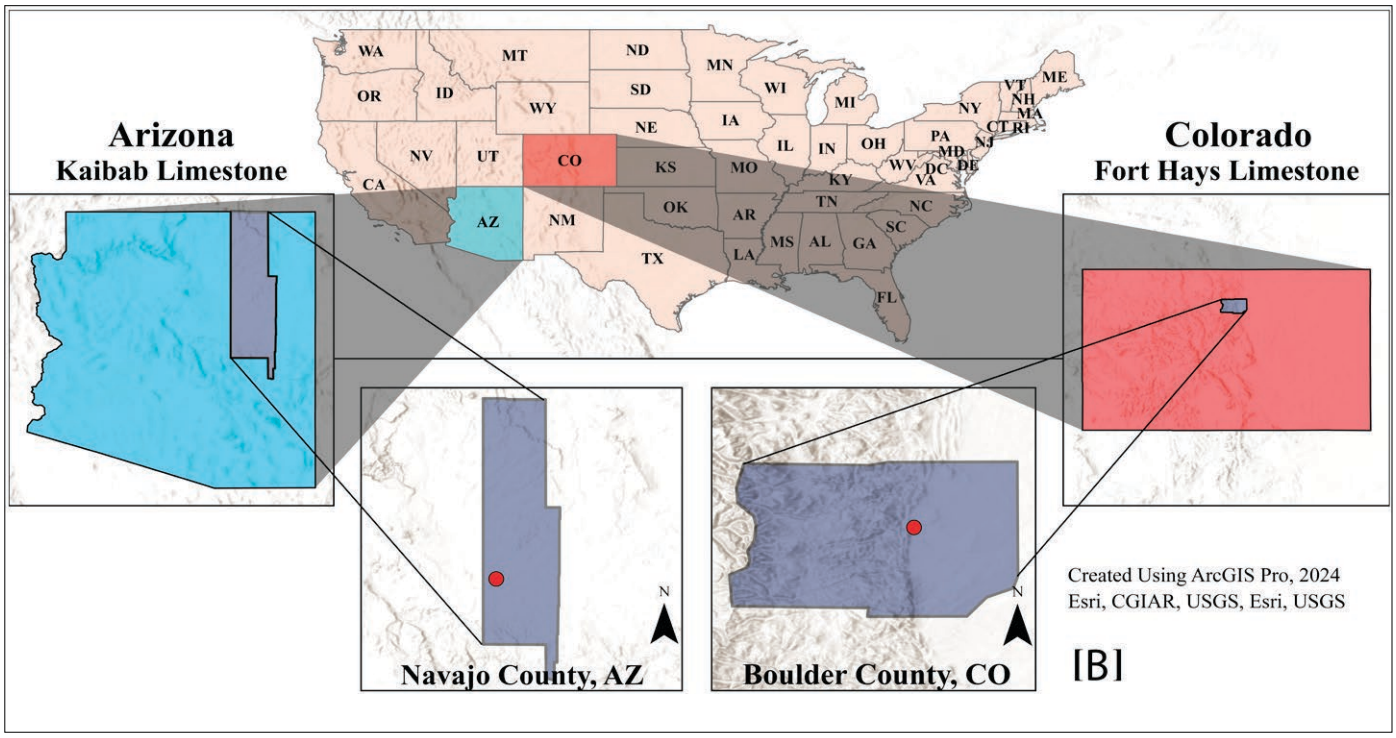


Figure B. Sample outcrop location of Kaibab Limestone in Holbrook, Arizona, Figure C.
Location of the Fort Hays Member of the Niobrara in Boulder, Colorado, Figure D. (Esri, 2024).

Figure C. Outcrop location of Kaibab Limestone in Holbrook, Arizona, showing heavy fracturing from weathering.
Beds are near horizontal at the sample site (Davey, 2022).
Figure D. Outcrop Location of the Fort Hays Limestone member of the Niobrara formation in Boulder, Colorado.
Near 45° dipping strata is a result of heavy tectonic alteration at the outcrop site (Seymour, 2024).

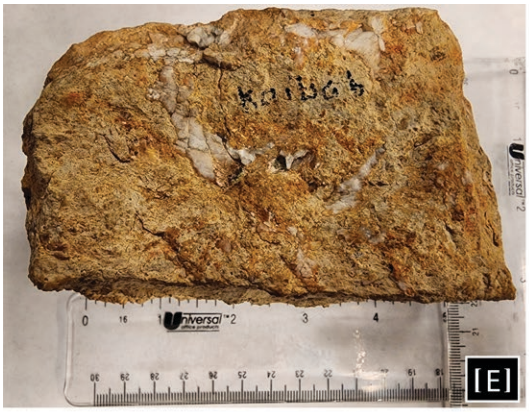
similarities in depositional environments as marine transgressive boundary formations. Further, similar structural deformities and extensive diagenesis and biogenic alteration include micro fractures, dolomitization, and micritization.

The Permian Kaibab Limestone sample from Holbrook, Arizona (Figure. C), is a sparse biomicrite and dolomitized limestone with various inclusions of chert, silt, and fine-grained sand. The Fort Hays Limestone (Figure D), from Boulder, Colorado, is a micritic limestone, with characteristic conchoidal fractures, stylolites, and micro fractures. It is a marine transgressive limestone, with minimal structures preserved after micritization.

The Kaibab Limestone sample location is near the McCauley Sinks, Holbrook, Arizona. An outcrop photo by **Jessica Cutter** (formerly Davey), MEM-3242, (Figure C), shows extensive tectonic, and weathering-induced secondary jointing within the limestone. The Fort Hays Limestone Member of the Niobrara Formation shows 45-degree dipping strata, (Figure D), exhibiting similar weather-induced surface fracturing accompanied by greater tectonic contributions to overall structural deformity.

Results

A secondary electron image of the Kaibab Limestone shows the largest healed fractures, 20-30 μm in width, moving vertically across



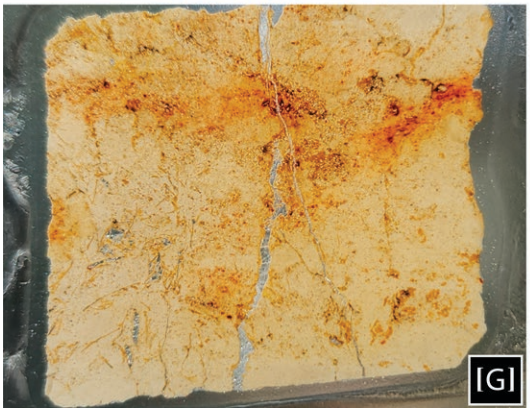


Figure E. Kaibab Limestone sample with calcite crystals on the surface. The sample is very dense, with imperceivable space between grains and inclusions, resembling dolostone. One-cm calcite crystals are present on the exterior face of the rock. Iron is prevalent throughout the sample.

Figure F. Outcrop sample of the Fort Hays Member of the Niobrara Formation. A micritic limestone, with minimal preserved structures aside from iron-filled burrows as seen in the center.

Figure G. Thick section on a petrographic microscope slide, of Kaibab Limestone, showing calcareous healed fractures, and heavy iron staining.

Figure H. Thick Section of Fort Hays Member of the Niobrara on a petrographic microscope slide, showing numerous calcareous fractures and muddy brown staining, with evenly disseminated very fine quartz grains (Seymour, 2024).

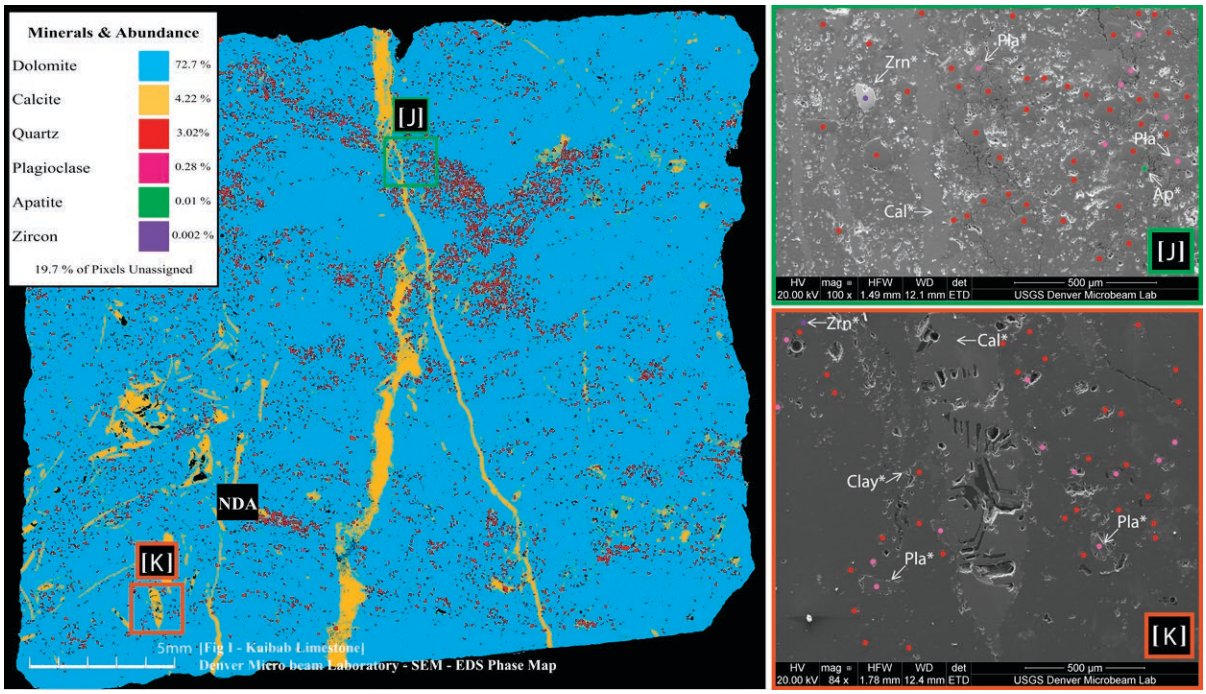


Figure I. Automated mineralogical phase map of the Kaibab Limestone in the same orientation as plain light image in (Figure G). No data was available (NDA) for a portion of the image because of machinery malfunction. Imagery provided by the USGS Microbeam Laboratory in Denver, Colorado.

Figure J. Secondary return electron SEM image, for topography, of the Kaibab Limestone. Framed at its location on the phase map. Colored dots are phase-mapped minerals color representation is preserved.

Abbreviations with asterisks are EDS Confirmed Mineralogy: [Pla] – Plagioclase,[Qtz] – Quartz, [Ap] – Apatite, [Zrn] – Zircon.

Figure K. Secondary return SEM image of an ellipsoidal fossil inclusion in the Kaibab Limestone.

Annotated as aforementioned in (Figure J) (U.S. Geological Survey, 2024).

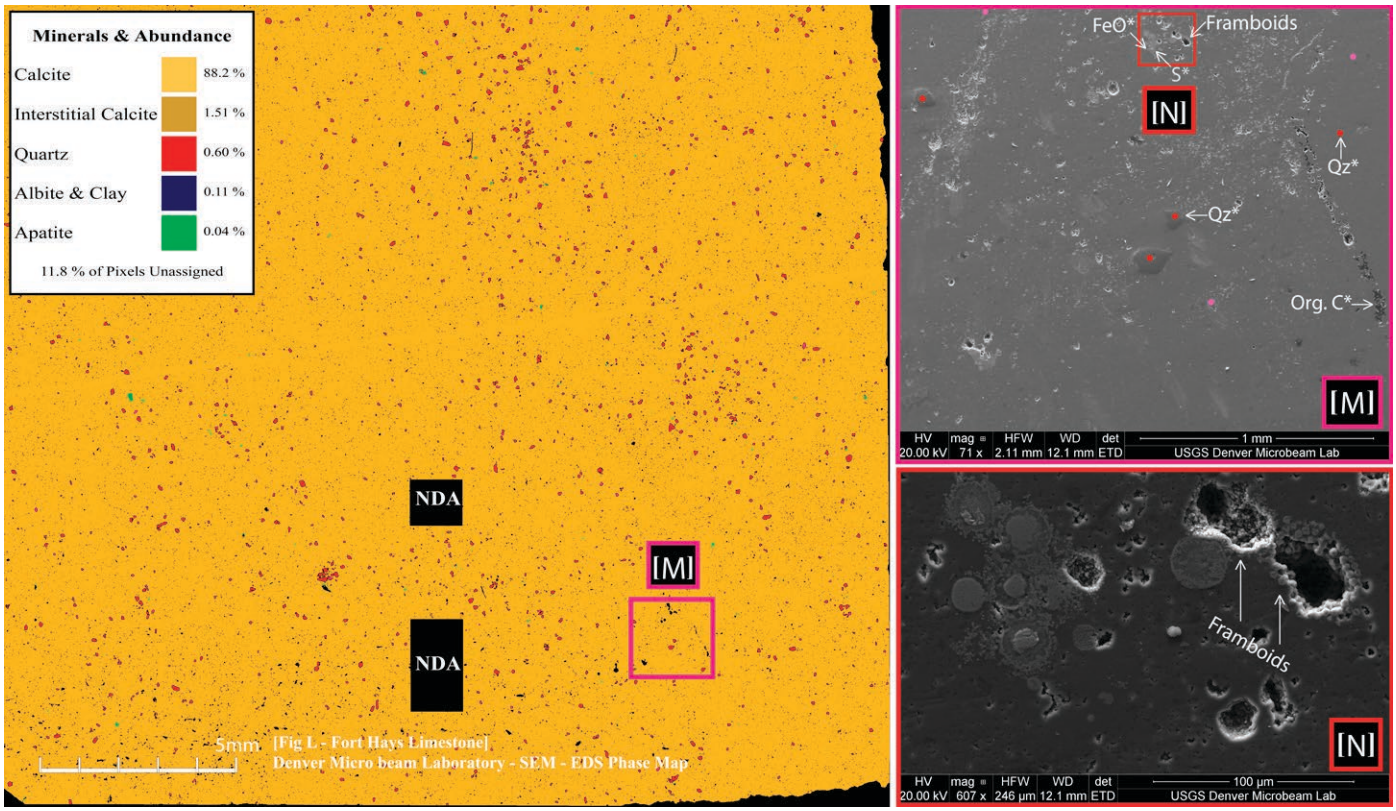


Figure L. Automated mineralogical phase map of the Fort Hays Limestone, in the same orientation as seen in the plain light image in (Figure H). NDA is missing data as a result of machinery error. The colors assigned to minerals are the same as the Kaibab Limestone Phase Map in (Figure I). Secondary return SEM image of the Fort Hays Limestone with location on phase map framed in (Figures M & N). Colored dots are phase-mapped minerals; color representation is preserved from Kaibab imagery. Abbreviations with asterisks are EDS Confirmed Mineralogy: [FeO] – Iron Oxide, [Qz] – Quartz, [S] – Sulfur, [Org. C] – Organic Carbon. Figure N. Framboids, iron sulfide accumulations, imaged at greater magnification to show cross-sectional geometry and depth (U.S. Geological Survey, 2024).

the Kaibab Limestone sample thick section in (Figure J). Surface texture is consistent across images, showing five to 15 µm voids. Secondary electron image (Figure K) of an ellipsoidal fossil inclusion in the Kaibab limestone replaced by calcite, showing void space between growth planes of calcite. Fossil inclusion is 1.45 mm x 0.30 mm, with more numerous fragments with similarly high aspect ratios. Some fractures are connected by micro fractures, and other dissolution pathways that parallel each other across the left half of the Kaibab Limestone phase map. Inclusions of plagioclase and clay particles are uncommon, but existent within the voids in the surface, possibly of diagenetic origin. Iron concentrations in Kaibab Limestone mean cathodoluminescence cannot be used, limiting resultant diagenetic data.

Fort Hays Limestone secondary electron image (Figure M) of a fractured zone as indicated on Fort Hays Phase Map (Figure L) with a possible linear organic carbon inclusion on the right third of the image. Numerous voids are generally poorly described at 72x magnification, so are imaged at 607x magnification in (Figure N). The voids are framboids and iron-sulfide aggregates, showing depth and cross-sectional geometry. Energy dispersive x-ray assay confirmed the iron and sulfur components. Note some framboid cavities are possibly the result of grain removal during the polishing procedures.

The phase map of the Kaibab Limestone outcrop sample in (Figure I) shows that 73.4% of the imaged sample is magnesium carbonate, common dolomite, light blue. The next most abundant mineral is calcite at 4.3% total abundance, light yellow. Minor mineral constituents account for 3.31% of the sample. Very fine quartz grains, colored red, between 0.063-0.088 mm make up 3.02% of the sample. Grains are subangular, with low sphericity. Patternable geometry near the top of the phase map coincides with a visibly significant concentration of iron in plain light, [Fig. E], but is otherwise evenly disseminated throughout the sample. Calcite, light yellow, can be seen filling primary fractures running vertically in (Figure I), as well as fossil inclusions in the third quadrant of the image. Unassigned pixels, 19.7%, are primarily bordering glass (Black), and otherwise non-calibrated minor contributions <0.001% of other minerals. NDA for a 1.5 mm x 1.5 mm square after imagery error.

The phase map of the Fort Hays Limestone in (Figure L), shows an 88.2% abundance of calcite, light yellow. The next most abundant mineral phase is interstitial calcite at 1.5%, dark yellow. This calcite borders quartz grains. Quartz grains, red, within the Fort Hays Limestone account for 0.60% of minerals. They are fine-grained, angular, with low sphericity, and equidistant throughout the sample. EDS Shows the presence of low counts of aluminum, and potassium accompanying this silica on the EDS spectrum. Albite and clay, dark blue, thereby are recognized to account for 0.11% of the identified minerals. Apatite accounts for the lowest abundance of identified minerals at 0.04% of the Fort Hays Limestone. No data was available for a 1.25 mm x 2 mm rectangle, and a 1.25 mm x 1 mm rectangle after imagery error. Unassigned pixels or non-calibrated minor abundances of other minerals including NDA locations account for the remaining 11.8% of pixels.

Numerous fractures are seen in the plain light thick section of the Fort Hays Limestone in (Figure H). They are indistinguishable in the

phase map. The groundmass of the sample even under significant contrast in backscatter electron images (BSE), are attributed to near-identical chemical identity.

Discussion/Conclusion

Significant abundance differences in the primary common minerals contributing to helium diffusive loss and resistance, calcite and dolomite respectively, coincide with significantly great helium concentrations in the subsurface reservoirs capped by the Kaibab Limestone. Previous imaging, diagenetic work, and gas permeameter tests would confirm the relationship between mineralogy and helium diffusion and other gases, primarily the result of larger d-spacing and crystal arrangements (Cherniak et al., 2015; Constentius and Payton, 2022; Danabalan et al., 2022; Freitag et al., 2022). Minor minerals in both samples on the larger scale are insignificantly likely to contribute to diffusive loss of helium or other gases. Fractures and micro-textures in both samples in BSE imagery are similar in healed mineralogy by calcareous fluid, and thus the greatest loss of helium can be attributed to primary mineralogy. Future investigations should focus on understanding the mineral concentration differences in optimal reservoir seals. Furthermore, healed fracture mineralogy, particularly calcareous fluids as seen in the Kaibab Limestone, should be investigated as diffusion pathways respective of that composition.

Acknowledgement

Thank you sincerely to Heather Lowers, Lab Manager & Research Geologist USGS, and Paula Leek Petrographic's for their contribution to the final stages of this undergraduate research project. My consultants and professors from a variety of affiliations: Jessica Cutter (Davey), MSU Denver, Jonathan Caine PhD., USGS, Josh McGrath PhD., MSU Denver, and Aaron Adams PhD., CCD, who made this research possible. Thank you to Brianna Lally for visual contributions to the final products. 148 hours of hard work in a single semester, ultimately, for my family whom I love.

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Seymour, D., 2024, Photographs of various subjects, including Fort Hays Limestone Outcrop, Kaibab Limestone Thick Section, Fort Hays Limestone Thick Section, Fort Hays Outcrop Sample, and Kaibab Limestone Outcrop Sample.

U.S. Geological Survey Microbeam Laboratory, 2024, Photographs and data on phase mapping automated mineralogy, and SEM and BSE imagery.

Dalton Seymour, seen here in Yellowstone, received his Bachelor of Science in Applied Geology in December of 2024. He is passionate about understanding the intricacies of modern geological issues. He has worked at the Denver USGS Noble Gas Laboratory, The Colorado State Geological Survey and in Industrial Minerals Consulting. These have deepened his desire to learn. His enthusiasm for geology has been a lifelong pursuit, fueled by new challenges.

Thank you!

University of North Dakota, School of Geology and Geological Engineering

AIPG thanks the good folks at the University of North Dakota, School of Geology and Geological Engineering, for the incredible donation of 33 boxes that was made to support the University of Sonora (Mexico). There were an estimated 500 books collected, boxed and shipped from North Dakota to Arizona.

Dr. Josh Crowell at the University of North Dakota was the ringleader for this effort. The Dean at the College of Engineering and Mines at University of North Dakota stepped up to fund the shipping costs to Arizona. **Dr. Matt Gray,** CPG-10688, is coordinating transport of the boxes to Sonora. Kudos all around to those who contributed books, time and muscle to this effort!

Dawn Garcia, CPG-08313

Fishing for Fossils – Collecting in the Green River Formation

Andrew Chiles, SA-12091

My name is Andrew Chiles, and I am a first-year master's student studying Geology at Wayne State University with a focus on paleomagnetism. My primary interest in geology lies in paleontology and fossils, which has led to me spending a lot of my free time exploring fossil sites across the country. Last summer, I embarked on a national park road trip out west with plans to collect fossils along the way. I visited sites in several states, but my ultimate destination was the world-renowned Green River Formation in Kemmerer, Wyoming.

If you've ever seen a fish fossil, there's a good chance it was from the Green River Formation, an ancient lake ecosystem. More fish fossils have been found here than any other location in the world, making it a dream destination for paleontology enthusiasts like me. Other organisms that have been found include turtles, crocodiles, amphibians, stingrays, insects, mammals, birds, and over 200 plant species from the Eocene.

The Kemmerer area is also home to Fossil Butte National Monument, which showcases many of the plants and animals found within the geologic formation. There is no collecting at the national monument, but the region features more than a handful of privately operated quarries that are pay-to-dig fossil sites. One quarry, American Fossil, boasts being the only fossil quarry in the world that allows you to keep every fossil you find, so this is where I decided to collect at.

Andrew with his fossil "catch" - a stingray.

On the morning of the quarry visit, I was off to a bit of a late start. I chose the shortest route provided by Google Maps and left my campsite for the dig. About 30 minutes away, the GPS directed me off the highway and onto a dirt road through the sagebrush. As I ventured further the dirt road turned into a two-track path descending steeply downhill. It was too late to turn around, so I cautiously navigated the potholes and bushes now covering the path as I made my way down the hillside. After a few miles of steep slopes and winding paths, I finally ascended the last hill and spotted a paved road again. Finally back on track, I quickly made my way to the American Fossil Quarry to start my hunt.

Upon arrival, I drove down into the quarry, which jutted from the side of a small mountain. Several roped-off areas were designated for collecting, and staff on site had construction equipment in operation to move around the fossil filled limestone. I registered for a four-hour dig which included all the necessary tools: a hammer and chisel. A brief demonstration revealed that the best strategy for fossil extraction is to lightly tap the chisel around the perimeter of a rock. This allows vibrations to split the limestone along bedding planes containing fossils, which serve as a weak point in the rock.

After the demo, I began to scout for promising material. The ground was littered with fragments of fish fossils left behind by collectors in search of complete specimens. I gathered anything that caught my eye, including heads, tails, or fins, and added them to my pile. After some time, I began to break open my own rocks, unveiling numerous great fish.

A couple hours in, I decided to break off from the main group and went to a corner of the quarry near the edge of the designated boundary. I was taking my time to carefully split each rock, with many proving to be completely empty. I then began hammering at a piece just slightly larger than a notebook, following a straight line around the edge of the stone. The limestone split along the line I had made except for one corner, which broke along a different plane. Peering into the limestone layer I had just uncovered, I couldn't believe my eyes and began to shake in excitement. I had just found a baby freshwater stingray (Heliobatis radians), exposing it to sunlight for the first time in over 50 million years, and I became the first human to ever lay eyes on it.

I went back with my incredible discovery to show the staff and fellow collectors. It didn't take long for a large group to gather around in awe of the specimen. The employees snapped some pictures and informed me it was the first fully intact stingray uncovered that season. Carefully, I wrapped the fossil in bubble wrap and placed it in a plastic tote bin I had brought with me. Before departing, I took advantage of rock saws that were on site and trimmed down many of my fish fossils to make transport back home easier.

My visit to the Green River Formation was the highlight of my journey and a reminder of the incredible opportunities geology provides to connect with Earth's history. With new discoveries being made every year and quarries expanding their access, this region continues to provide an incredible opportunity unlike any other. For those passionate about fossils, it's a destination not to be missed.

New Modeling and Estimation Methodology to Address Porphyry Drift Using Enclosed 3D Volumes

Justin N. Cardwell, CPG-12059

Abstract

Drift in porphyry systems has been recognized for quite some time in the literature and can pose a serious challenge to resource modelers for grade estimation. Drift can be described as 3D curvilinear changes in mineralization associated with a causative porphyry intrusion that invalidates the stationarity assumption underlying all geostatistical estimators (Sullivan et al. 2007). Current estimation methods cannot directly account for dynamic changes in mineralization for a zoned deposit and generally resort to localizing the estimate using fixed search ellipses or geospatially unique, but fixed block orientations (locally varying anisotropy [LVA]). The resulting model may produce search related artifacts, grade smearing, and estimates that may prove difficult to validate depending on the complexity of the mineralization. A new workflow has been developed that can directly account for any dynamic changes in mineralization using enclosed 3D volumes. This tool can be used to help increase confidence in and preserve the complex curvilinear nature of porphyry mineralization. A subset of copper data from an undisclosed porphyry deposit was used as a test case for the new modeling and estimation methodology to compare against LVA.

Geology Overview

The copper porphyry deposit for this study is associated with a high sulfidation epithermal portion of the system as several narrow porphyries, often referred to as pencil porphyries, have intruded into surrounding siltstones, sandstones, and conglomerates with a maximum strike length and width of approximately 550 m and 307 m respectively. At least three relatively shallow dipping post mineral thrust faults have been recognized and offset the porphyry intrusions by up to 300 m in certain locations (Figure 1). Alteration related to the intrusions is of the typical porphyry related type with an inner core of potassic alteration and an outer propylitic zone. Between is a transition from potassic K-feldspar to magnetite-biotite, actinolite-biotite, biotite, and chlorite on the margins. The core of the deposit consists of a bornite-chalcopyrite zone that transitions to a chalcopyrite-pyrite zone and an outer pyrite zone. Copper grades follow this mineral zonation with the highest grades found mostly within two porphyry units (Porphyry A and Porphyry B in Figure 1) in the bornite-chalcopyrite core. Higher grades extend outward from the porphyry units where the porphyries are widest, and grades gradually decrease with increasing distance from the cores of the porphyries.

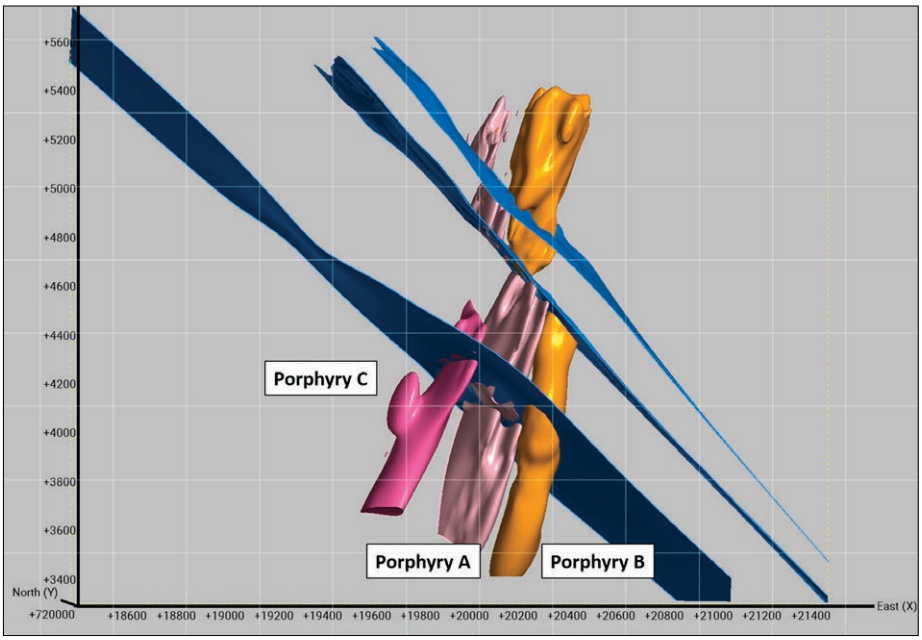

Figure 1. 3D view of modeled porphyries.

Mineralization and Domain Analysis

The focus of the study is on the hypogene portion of the porphyry system, below the deepest fault, where no copper remobilization has occurred. Since the surrounding sedimentary rocks were unreactive to porphyry fluids, the mineralized system is relatively

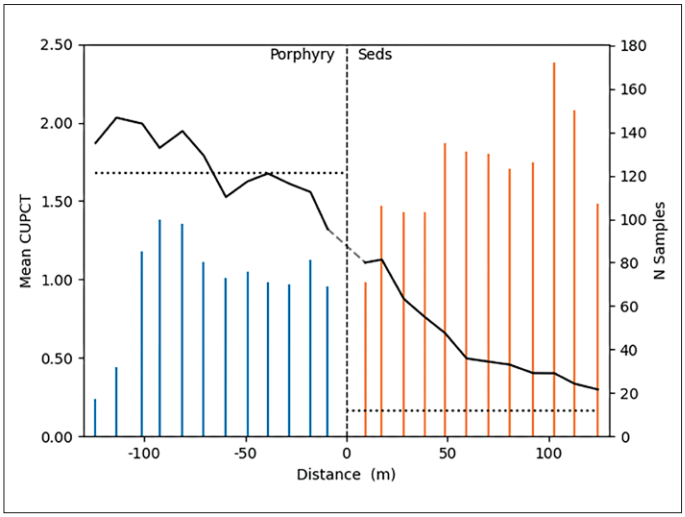

Figure 2. Contact plot for copper using 10 m composites. The left side represents the combined causative porphyries (Porphyry A and Porphyry B) and the right side represents the surrounding sedimentary host rocks. Copper grades are highest within the porphyry units, but gradually diminish away from the porphyries. The contact between the porphyries and sediments is transitional for copper grade.

uncomplicated at depth and serves as a good test case. Stockwork veining is responsible for carrying copper outward from the causative intrusions in a radial pattern, creating the observed curvilinear 3D mineralization trend commonly referred to as porphyry drift. Porphyry intrusions create a temperature gradient surrounding the igneous body, in which temperature gradually decreases as the distance from the porphyry increases. In general, the larger the porphyry body the larger and more gradual the temperature gradient. In this test case, two pencil porphyries were responsible for producing the surrounding paleo temperature gradient and are quite small volumetrically. As a result, the temperature gradient produced diminished quickly and the heat generated was not extensive beyond the porphyry boundaries. This sharp decrease in temperature precipitated copper out of solution over a relatively short distance within and radiating outwardly from the porphyries. The importance of the paleo temperature gradient in porphyry deposits has been recognized in the literature by others as Issel et al. (2019) stated that this pattern (mineralization surrounding causative porphyry) reflects the lateral temperature gradient at the time of mineralization which controlled the precipitation of Au and Ag bearing Cu-sulfides in the (porphyry) deposit.

Evidence of the paleo temperature gradient can be better understood by analyzing the geospatial distribution of copper in relation to the causative intrusions. In general, copper precipitates out of solution roughly between 400° C and 250° C (depending on pressure conditions and cooling rates), so geospatial metal distribution should roughly reflect the temperature range of copper precipitation. Generating a contact plot (Figure 2) supports this concept by enabling the visualization of the behavior of copper in relation to the primary heat source (porphyries) upon fluid exsolution. The porphyry boundary used in Figure 2 is the combination of two causative porphyries (Porphyry A and Porphyry B). It is clear from the contact plot that the highest copper grades are generally found deeper within the porphyry units while, outside of the porphyries (in the surrounding sediments), the copper grade gradually decreases with increasing distance away from the porphyries. This transition of copper grade is commonly referred to as drift and is another way of describing the metal zonation. This drift can pose a major problem for grade estimation as the concept of stationarity is invalid since, in geostatistical terms, complex geometries often violate first-order stationarity (the mean is invariant of location in the estimation domain) and the second-order stationarity (the covariance is invariant of location in the estimation domain) assumptions (Issel et al. 2019). Furthermore, the observed drift is dependent upon the geomorphological shape of the causative intrusions since the porphyries are responsible for driving heat flow and the paleo temperature gradient.

In order to better understand the drift component to porphyry systems, further investigation is required. Log probability plots were generated for the causative porphyries, surrounding host rocks, and combined lithologies using 10 m composites split on logged lithology codes. It can be seen from Figure 3 that the causative porphyries and the surrounding host rocks have much different grade distributions, but both have inflection points in their respective data, indicating possible changes in the copper grade populations. The inflection in the causative porphyry data is at approximately 1.7% copper while the inflection in the host rock data is at approximately 0.06% copper. The inflection in the causative porphyries is primarily due to the rapid temperature drop away from the intrusions as the highest and most consistent copper grades can be found within the porphyry units where the intrusions are thickest, and heat flow is highest. Conversely, the lowest grades within the porphyry units can be found where the intrusions are thinnest, and the heat generated is subdued. For the host rocks, the highest copper grades can be found in contact with the porphyries where the porphyries are thickest, and heat flow was highest. The lowest copper grades in the host rocks can be found at greater distances from the porphyries as the break at 0.06% copper represents the edge of copper mineralization. Overall, inflection points in the porphyries and sedimentary units indicate that each lithology may contain multiple copper grade populations. Ultimately, a likely cause for the multiple populations within each lithology unit can be explained by a relatively rapid drop in temperature immediately adjacent to the porphyries and to the thinning of the porphyry units (low heat generation and relatively low exsolved fluid volume).

The log probability plots and contact plot combined with the geological understanding of copper mineralization demonstrate that lithology cannot be used exclusively as a hard boundary (domain) for grade estimation since both high and low grades can also be found within porphyries and the surrounding sedimentary host rocks. Visual inspection by sections further supports this claim. Additionally, alteration cannot be used as hard boundaries since the temperature range at which the various alteration assemblages form do not perfectly coincide with the temperature range of copper precipitation. Hence, alteration is not a causative factor for copper mineralization but is related. Furthermore, the bornite-chalcopyrite zone in the core of the deposit contains the highest copper grades. The bornite/chalcopyrite ratio drops systematically away from the core of the deposit and cannot be represented by a distinct boundary using qualitative (logging) data. Hence, domaining porphyry systems properly can be quite challenging and prove to be elusive in many cases.

Modeling Methodology

In order to properly domain a porphyry system for grade estimation, geologists must consider alternatives. As mentioned previously, copper mineralization is related to the heat flow emanating outwards from the causative intrusions. It is this paleo temperature gradient that must be accounted for in order to achieve improved domains and appropriately distinguish between separate copper grade populations. One way to directly account for the paleo temperature gradient is to directly model the observed copper zonation (Figure 4). For this study, three solids were constructed utilizing the RBF function in Leapfrog™ software on 10 m composites. The first solid modeled represents the outer zone of mineralization

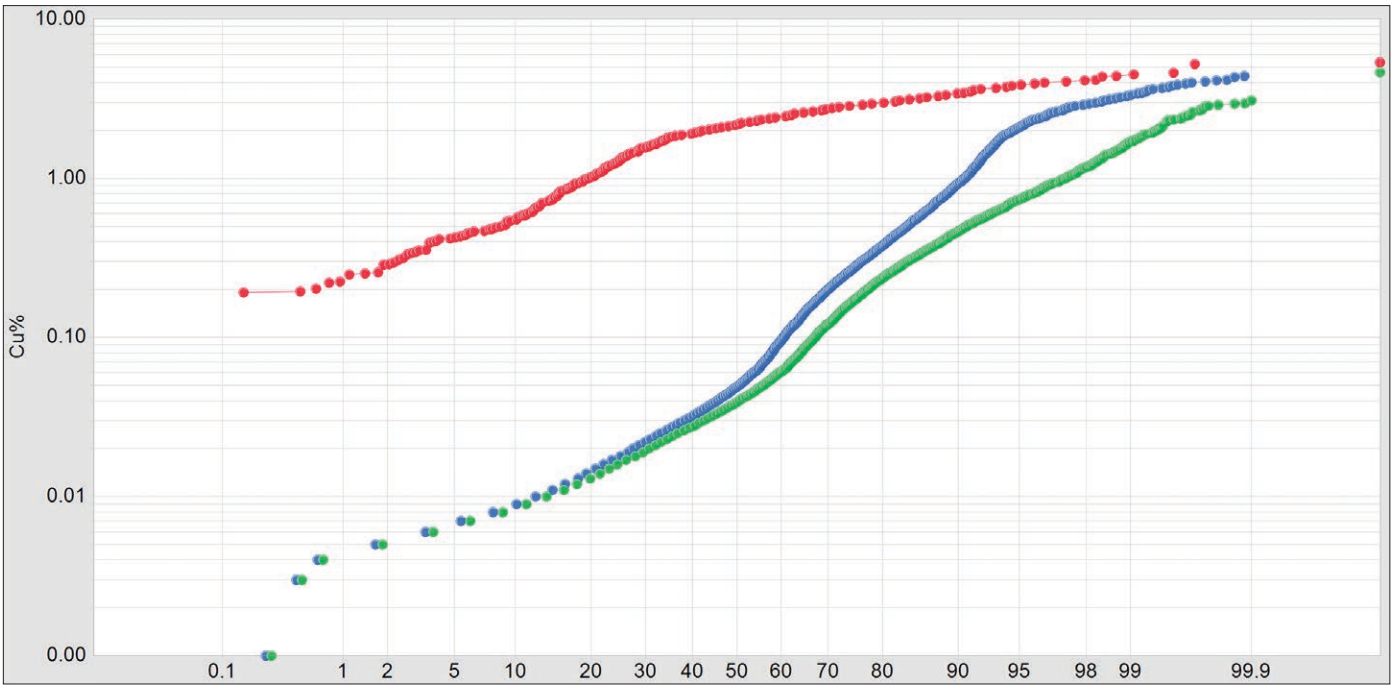

Figure 3. Log probability plot. Red dots represent the combined Porphyry A and Porphyry B, green dots represent the surrounding sedimentary host rocks, and the blue dots represent all the lithologies combined.

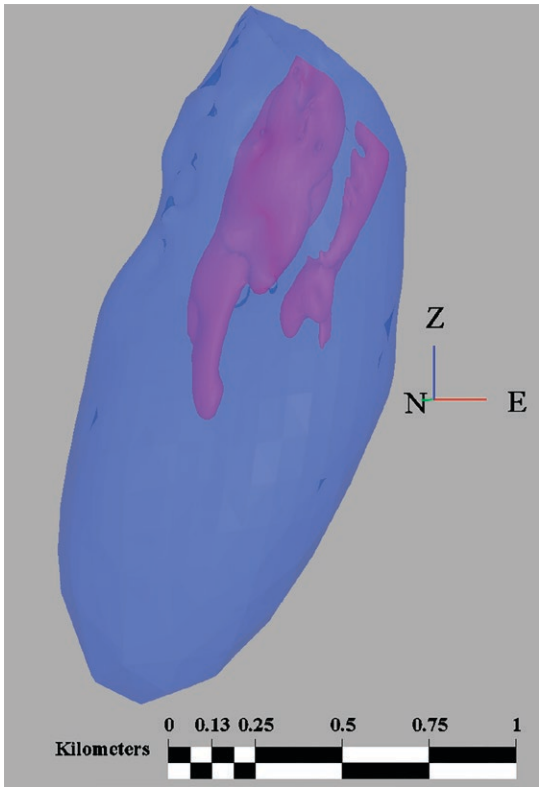

Figure 4. 3D view of modeled shells. The outer blue shell roughly represents the extent of the mineralized system at 0.1% copper. Inner red shells represent the high-grade cores of the porphyry system. These shells used a 1.7% copper cut-off for modeling purposes and include both porphyry units as well as some adjacent sedimentary units. Higher grade shells were truncated at depth where drilling stopped.

at approximately a 0.1% copper cutoff. The second and third solids modeled represent the higher grade cores to the system and roughly followed the geomorphology of the porphyries (Porphyry A and Porphyry B) where thickest (and heat flow highest), but were not coincident with the porphyries where they thinned and copper grade dropped. A roughly 1.7% copper cutoff was used for the core shells, marking the inflection point from the log probability plots. The decision to include some qualifying adjacent sedimentary units was based on the design criteria, which allows for the user to model grade zonation as it relates to the paleo temperature gradient. As a result, high paleo temperatures are closely related to, but not restricted to the porphyry units.

Grade Estimation

Traditional approaches to grade estimation in porphyry systems struggle to handle the complex curvilinear drift as it relates to mineralization. Several different methodologies have been used to address porphyry drift, but all fall short of more completely capturing the complex nature of the mineralization. For example, subdividing the mineral system into many domains with similar orientations is sometimes used, but creates estimation artifacts at the artificial boundaries. Another example is LVA, which uses unique but fixed block searches from oriented vectors, has been used on porphyry deposits before, but lacks the ability to search for composites or blocks dynamically during grade estimation. Hence, LVA suffers most where the orientation of the mineralization changes within the limits of the block search (or search for composite pair in variograms). However, with the use of Hexagon's MinePlan™ software porphyry drift can now be used to better account for geospatial changes to mineralization.

MinePlan™ allows the resource modeler to utilize any enclosed 3D volume in variogram construction and grade estimation using dynamic search paths that are defined by the shape of the modeled input solid. This is accomplished by using the modeled solid "…with the composite data to calculate geodesics. Geodesics are calculated using the Fast Marching Method. This algorithm can be thought

of as similar to superimposing a Cartesian grid on the surface and propagating a signal outward from a source point (for instance a composite). When the signal reaches a given grid point, that point is labeled with the time it took for the signal to reach the point. It is similar to Dijkstra's algorithm applied to a grid-shaped network" (Cardwell and Cartwright, 2016). For variogram construction, composites will follow the path of the modeled solid(s) to find pairs and distances will be calculated along the curvilinear path taken as illustrated in Figure 5. In this study case the composites used in variograms construction are searching along the surface of the curvilinear solids to find pairs, for copper, that roughly formed under the same geologic conditions (temperature of copper precipitation). For grade estimation, blocks will also search for composites along the shortest paths along the surface as defined by the modeled solids. Furthermore, the resource modeler can apply anisotropy and limit the search perpendicular to the solid (z-axis, which is dynamic (constantly calculated for all data points and blocks along the surface and adjusts as the shape of the solid changes dynamically in space). For this study, a maximum z-axis dynamic search of 20 m was used in order to best preserve the drift component. In other words, each block will search along a narrow dynamic bandwidth defined by the shape of the enclosed 3D volumes. A 20 m dynamic z-axis search was chosen in order to limit lateral grade smearing as the copper grade can drop by half over a few tens of meters away from the center of mineralization (Figure 2). Limiting the dynamic z-axis search prevents unnecessary mixing of high and low grade areas in order to better preserve the stationary component.

Several sensitivities were run using the dynamic search option in MinePlan™ for copper only and compared to an LVA model using RMSP software with the same kriging parameters. The maximum number of composites (10 m composites) used for grade estimation was tested using a maximum of 15, 20, and 30 samples (all used a minimum of three samples). A maximum of three composites per drill hole was also used along with a single pass maximum dynamic xy-axis search range of 300 m (dynamic search along the input surface), which roughly matched the range of the modeled variogram (not shown). Only a single estimation domain was used and a high-grade restrictor of 1.7% (limited to 10 m) was used for blocks that fell outside of the high grade core in order to limit unnecessary high-grade influence. Visual inspection of the copper estimates from the dynamic model matches the drilling quite well and it is clear that the copper porphyry drift is preserved. Conversely, without the use of solids to guide the dynamic block search, block estimates could contain undesired artifacts such as high grade

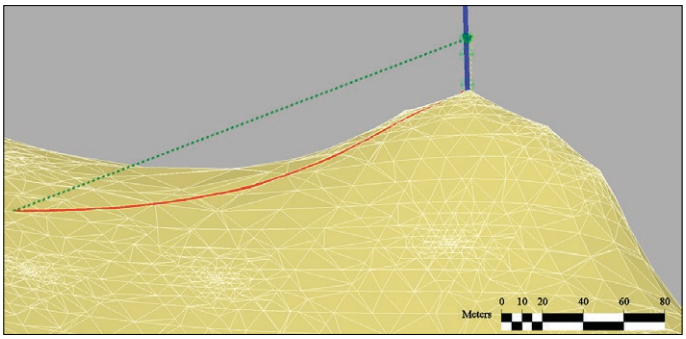

Figure 5. 3D view of the composite search with modeled outer shell (light brown) with an example drill hole (blue). The solid red line represents one possible search path for a composite along the model 3D volume in MinePlan™ (280.2 m distance along the surface). The dashed green line represents the Euclidean distance from the selected composite to the modeled 3D volume (259.6 m distance in Euclidean space). A hypothetical block near the location at the end of the red line will use this dynamic search path (and calculated distance) to find the selected composite used for grade estimation.

smearing. But by using solids to control and restrict the dynamic block searches and search paths, higher grades are restricted to a much more controlled and dynamic range within the high grade core that better reflects the geologic conditions of copper mineralization. This result can only be achieved through using solid inputs to guide the dynamic block searches. LVA, on the other hand, cannot handle changes (directionally) to mineralization that are less than the search distance used and necessarily produces estimation artifacts. Furthermore, LVA cannot search around tight changes mineralization direction and leaves many blocks uninterpolated.

Composite statistics were generated in addition to block statistics for all copper estimates, including nearest neighbor (Figure 8). All estimates matched the declustered means well for the higher grade core and boundary of mineralization solids. In addition, the global averages did not change significantly despite the change in number of composites considered. This is likely a result of the dynamic block search, which finds composites that formed under relatively similar paleo temperature conditions. Hence, changing the number of composites has little effect on the global mean since extra composites considered during estimation are generally of similar grade. Furthermore, the grade transition from the porphyries into the sediments is preserved (Figure 9). This is a key

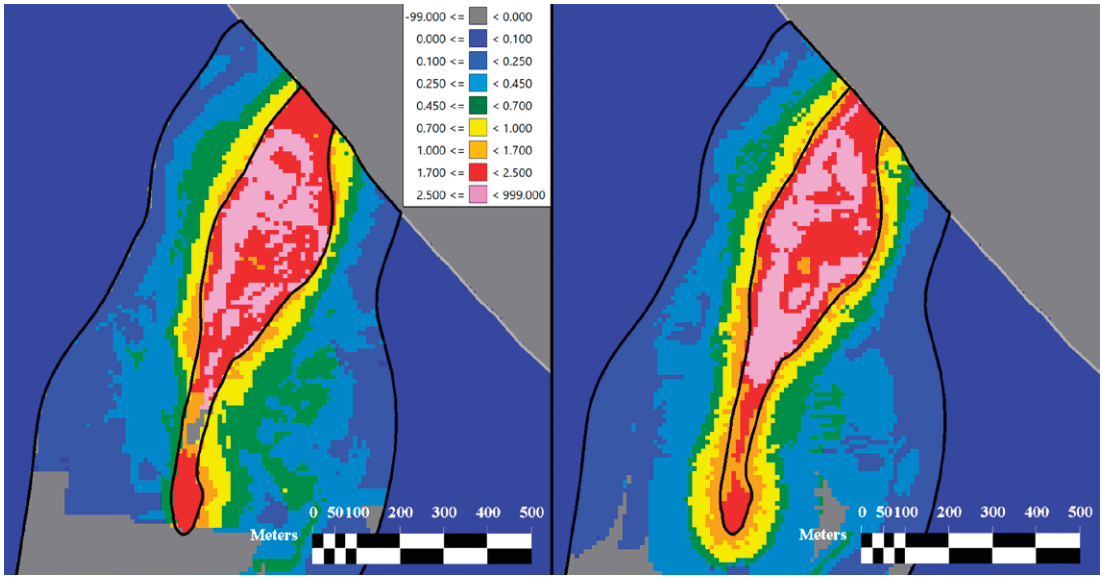

Figure 6. Cross section view of copper estimates (LVA model on left, dynamic model on right). Black lines represent the modeled solids and are used to guide the dynamic block searches for the dynamic model and to generate the LVA field for the LVA model. Drift is preserved much better in the dynamic model as copper grades follow the path of the modeled solids.

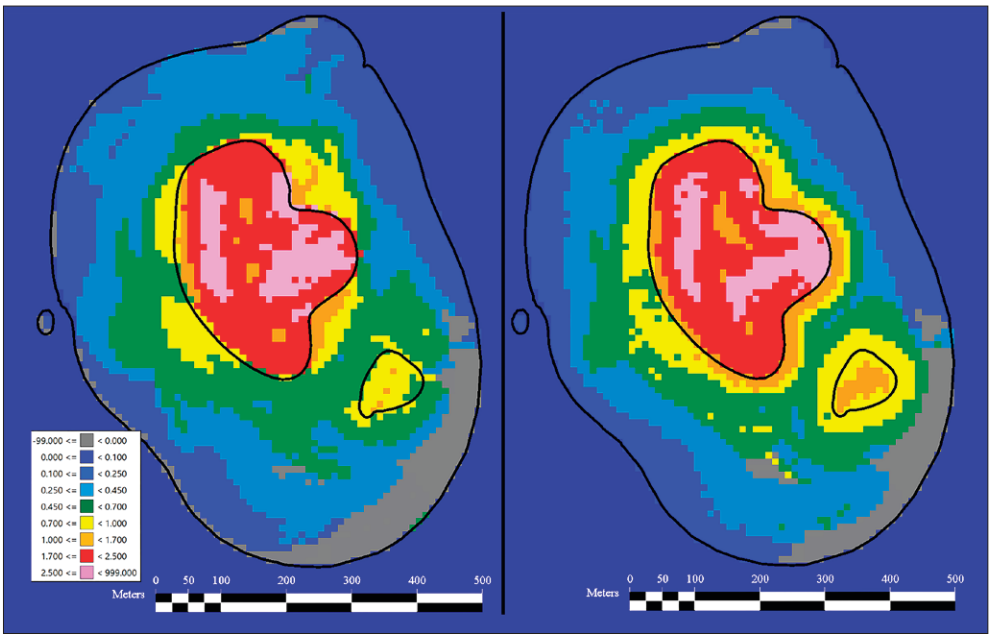

Figure 7. Level plan view of copper estimates (LVA model on left, dynamic model on right). Black lines represent the modeled solids. The dynamic model better preserves the geospatial grade distribution.

Porphyries	Valid	Minimum	Maximum	Mean	Declusterd Mean	P10	Median	P90	Std. Devn.	Co. of Variation
CU1	79,890	0.09	4.87	1.41		0.30	1.12	2.76	0.96	0.68
CUNN	79,890	0.05	5.33	1.40		0.24	1.03	2.96	1.08	0.77
CIU1	79,890	0.09	4.79	1.42		0.27	1.16	2.75	0.95	0.67
CU2	79,890	0.02	4.71	1.39		0.28	1.05	2.79	0.98	0.70
LVA	79,890	0.02	4.61	1.36		0.28	0.92	2.74	0.99	0.73
Comps	784	0.02	5.37	1.84	1.48	0.29	1.92	3.32	1.16	1.07
Sediments	**Valid**	**Minimum**	**Maximum**	**Mean**	**Declusterd Mean**	**P10**	**Median**	**P90**	**Std. Devn.**	**Co. of Variation**
CU	269,304	0.07	4.39	0.41		0.14	0.31	0.80	0.35	0.83
CUNN	269,304	0.02	5.00	0.41		0.12	0.29	0.83	0.41	0.99
CU1	269,304	0.02	4.43	0.43		0.14	0.30	0.90	0.37	0.87
CU2	269,304	0.08	4.42	0.40		0.14	0.30	0.78	0.33	0.83
LVA	269,304	0.08	4.81	0.40		0.15	0.30	0.72	0.34	0.84
Comps	1,932	0.02	4.66	0.50	0.38	0.13	0.34	1.00	0.50	1.00

Figure 8. Block and composites (Comps) statistics. The upper table was constructed using the volumes from the high grade core solids and the lower table was constructed using the volume outside of the core. LVA represents the LVA model and CU, CU1, and CU2 represent the various kriging sensitivities. CU used a maximum of 20 composites, CU1 used a maximum of 15 composites, and CU2 used a maximum of 30 composites. NN and CUNN are the nearest neighbor statistics.

result and could serve as further validation since the composite copper grades at varying distances from the causative intrusions is replicated in the block estimate using the new modeling and estimation methodology. Interestingly, the LVA model has a low mean for the higher grade core.

This new modeling and estimation methodology using a dynamic search has proven successful in handling the drift component of the test porphyry deposit and could be applied to other metals in porphyry systems such as molybdenum and gold.

Conclusion

Porphyry systems are complex geologically and can produce zoned economic deposits (drift) related to the paleo temperature gradient. Current estimation methods cannot handle the curvilinear nature of the mineralization dynamically and can require the resource modeler to resort to artificially subdividing the estimation domains or use LVA. However, through Hexagon's MinePlan™ software the resource modeler can now directly model the paleo temperature gradient (using composite grades and geologic knowledge) with enclosed 3D solids that can be used for dynamic, non-planar variogram construction and dynamic block searches for grade estimation. Large-scale complex trends (drift) can now be directly accounted for deterministically as this new methodology can help limit grade smearing and improve confidence in the kriged estimates.

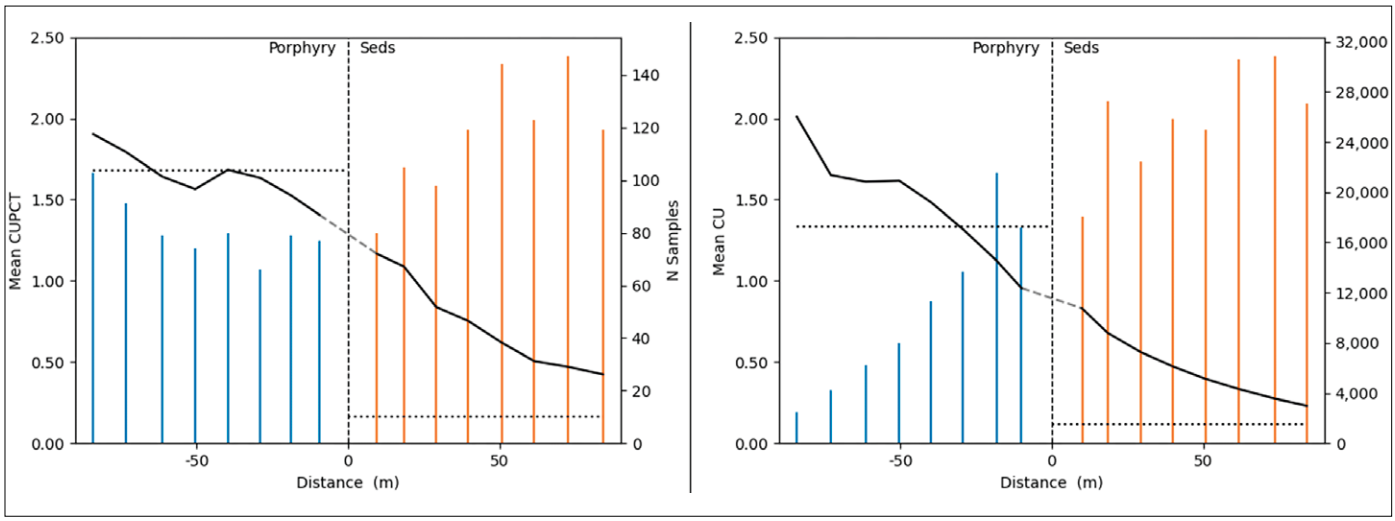

Figure 9. Left: Contact plot of composites. Right: Contact plot of kriged estimates. The new estimation methodology replicates the copper grade transition well from the causative porphyries into the surrounding sediments.

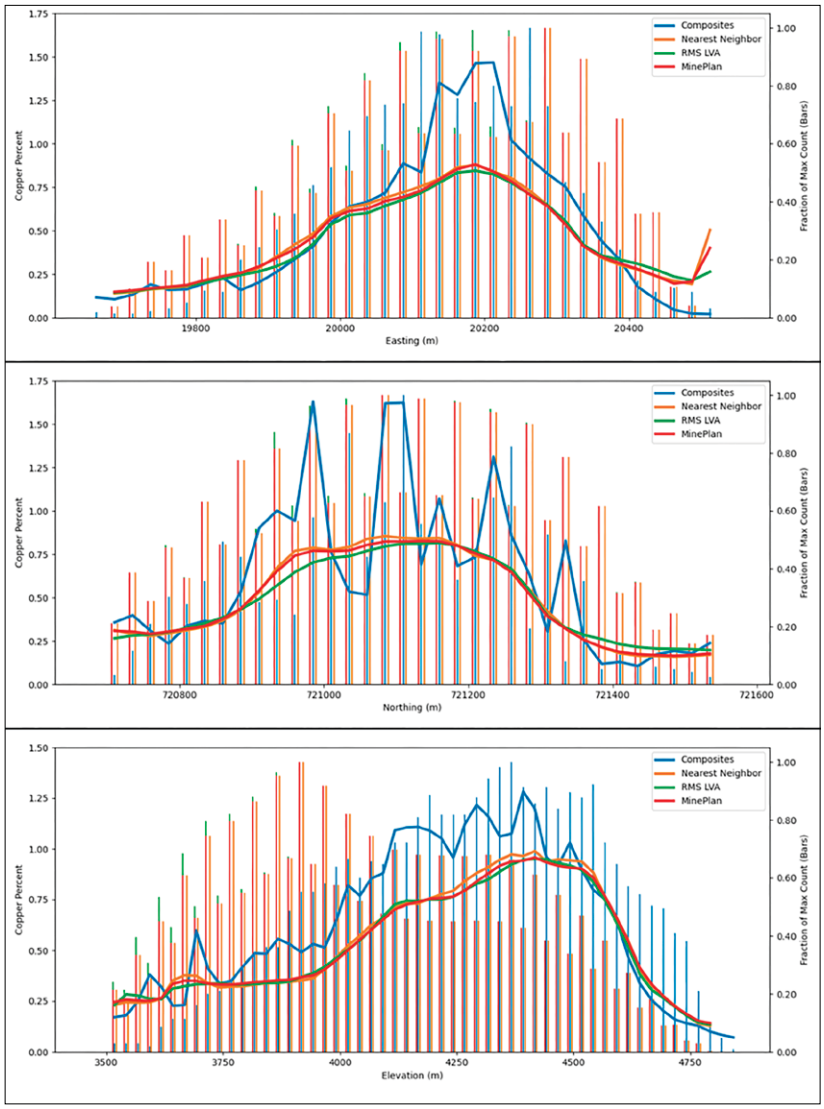

Figure 10. Swath plots by easting, northing and elevation. The dynamic model in MinePlan™ matches the nearest neighbor model well, while the LVA model appears to be slightly biased low.

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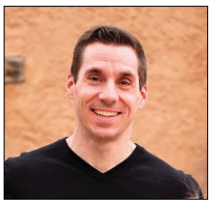

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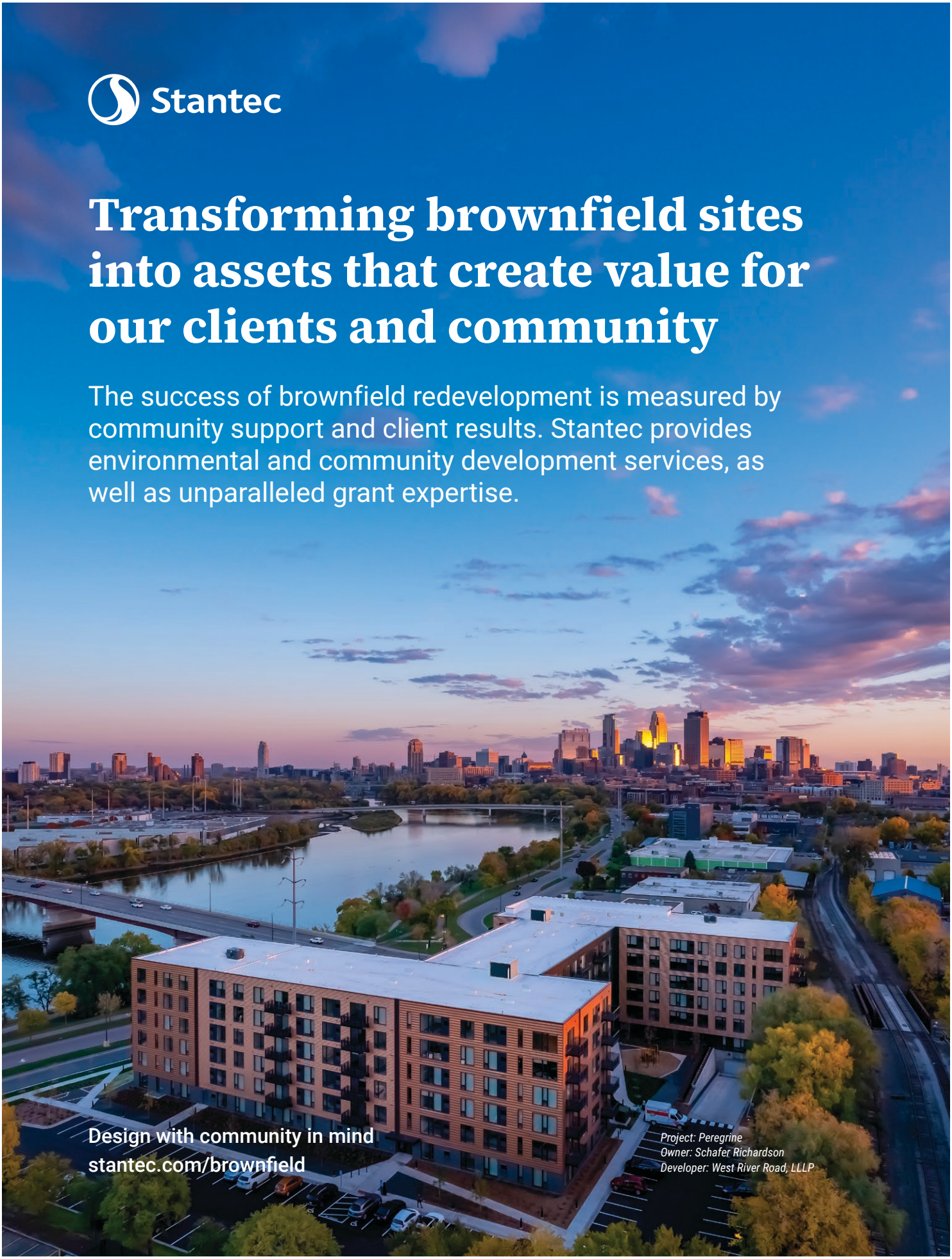

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The Del Rio Clay of North-Central Texas; A Synopsis of its Geological Attributes and Geotechnical Properties

Robert G. Font, CPG-3953

Abstract

Among the Cretaceous strata exposures in north-central Texas are those of the Del Rio Clay of the Comanche Series and Lower Cenomanian Stage. Part of the Washita Group, the formation is composed of a grayish-blue, fractured, and fissured, over-consolidated clay-shale with interbedded thin siltstone and limestone stringers. The Del Rio Clay represents a regressive-transgressive cycle with clay mineralogy ratios indicative of variable salinity conditions and deposition in brackish-water estuarine to neritic marine environments. The clay is highly fossiliferous with zones of dwarf fauna. Fossil assemblages contain abundant pelecypods, as well as ammonites, echinoids, brachiopods, and foraminifera. In terms of geotechnical properties, the Del Rio Clay has high values of Atterberg limits and indices, and low strength, permeability, and slope stability. Where studied, landslides occur as slumps along a well-defined, cylindrical slip surface. Analyses of some slumps denote failure at values close to those defined by the residual strength as determined through direct shear tests. The Del Rio Clay constitutes an important chapter in the fascinating geologic history of the Cretaceous rocks of Texas.

Keywords: Washita Group, regressive-transgressive cycle, illite to kaolinite ratios, dwarf fauna, estuarine and neritic environments, Exogyra arietina, Atterberg limits and indices, unconfined compressive and shear strengths, slope stability, slump, slip surface, residual strength, direct-shear tests

Geology

Although my initial interest in the study of the Del Rio Clay (K_{dr}) resulted from concerns pertinent to its slope instability problems, I also became fascinated by its geological attributes including depositional environment, mineralogical composition, faunal diversity, and other related factors. The K_{dr} is found across the state of Texas following the trend of the Balcones Fault Zone and the Ouachita-Marathon tectonic belt province (OTBP). The K_{dr} has been mapped and described in the Fort Worth and Denison areas, as well as in McLennan County near Waco, in Travis County near Austin, in Bexar County near San Antonio, in additional counties along the OTBP (Hays and Comal), as well as in the Edwards-Uvalde-Kinney-Val Verde-Terrel-Brewster counties of west Texas and the Permian Basin (Barnes, 1977, 1979, 1982, 1992; Flawn and Burket, 1965; Font and Williamson, 1967; Brown, 1971; Font, 2021; Hill and Vaughan, 1898; Hoover, Bases and Lock, 2008; Imlay, 1944; Ligon, 2017).

For this work, the study section is in the north-central Texas area in the vicinity of the Waco metropolitan region (Figure 1). The K_{dr} is part of the Washita Group and Comanche Series of the Cretaceous System (Table 1). The K_{dr} overlies the Georgetown Limestone (K_{ge}) and underlies the Buda Limestone (K_{bu}). Both its upper and lower contacts are unconformable in the southern and western portions of the state (Ligon, 2017). The stratigraphic section in north-central Texas is summarized in Table 2. Where the K_{bu} is missing, the K_{dr} unconformably underlies the Pepper Shale (K_{pe}) of the Woodbine Group. Locally, the K_{bu} is mostly absent and only about two feet thick where found.

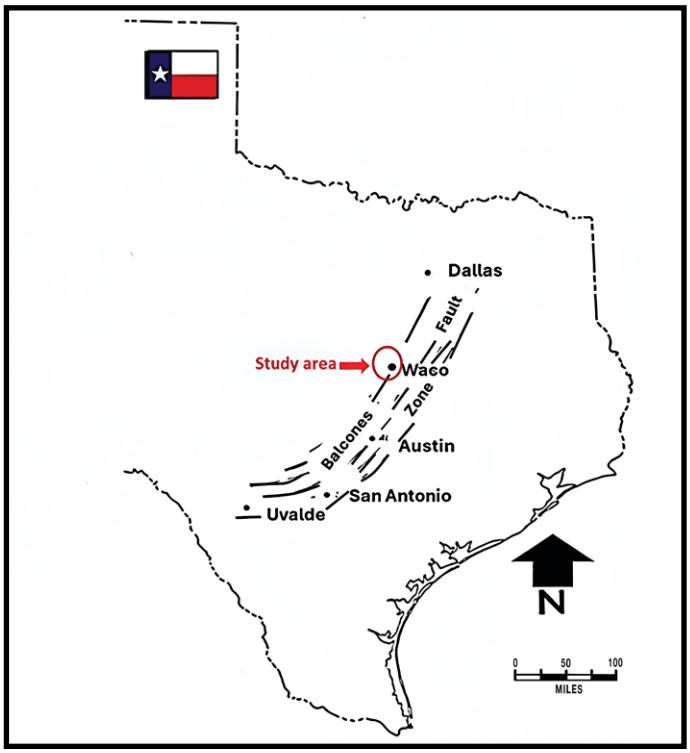


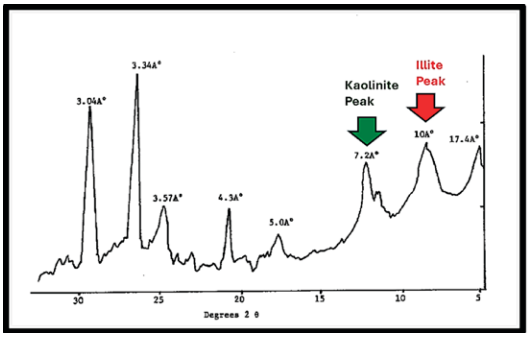
Figure 1. Location map of the study area.

Table 1 - Time-Stratigraphic and Lithologic Classification of the Del Rio Clay.

Del Rio Clay		
Time-Rock Unit	System	Cretaceous
	Series	Comanche
	Epoch	Gallic
	Stage	Cenomanian
Rock Unit	Group	Washita

Table 2 - Local Stratigraphic Section.

Series	Group	Formation	Current Thickness	Max Prob Thickness
Gulf	Taylor	Taylor Marl	250'	1,170'
	Austin	Austin Chalk	250'	295'
	Eagle Ford	South Bosque Shale.	160'	160'
		Lake Waco Formation	80'	145'
	Woodbine	Pepper Shale	70'	100'
Comanche	Washita	Buda Limestone	2'	35'
		Del Rio Clay	85'	85'
		Georgetown Limestone	210'	210'



Mineral	Percentage %
Smectite	10
Illite	20
Kaolinite	20
Quartz	10
Calcite	30
Amorphous material	10
TOTAL	100

Figure 3. Mineralogical Composition of the Del Rio Clay.

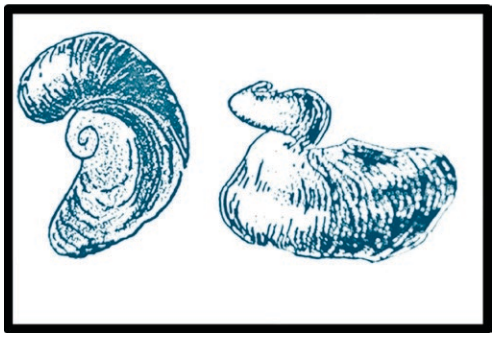


Figure 4. *Exogyra arietina* (drawings adapted from Moore, Lalicker and Fischer, 1952.

Figure 2. Grayish-blue, blocky, fractured Del Rio Clay.

Following the deposition of the K_{ge}, a minor regression and transgression resulted in the sedimentation of the K_{dr}. Faunal and mineralogical evidence indicates that the lower part of the formation represents a regression and the upper part a transgression. Dwarf faunas are abundant, suggesting changes in seawater chemistry unfavorable to normal faunal growth. The Washita Group culminated with the deposition of the K_{bu} which overlies the K_{dr}. The K_{bu} was deposited in a warm, shallow sea (Adkins, 1933; Flawn and Burket, 1965; Brown, 1971). Within the study area the K_{dr} is around eighty-five feet thick. The shale is exposed west and northwest of the city of Waco and on the higher divides between eastward-flowing tributaries of the Bosque River system. The formation consists of a grayish-blue, blocky, fractured, highly fossiliferous clay-shale containing thin beds of siltstone and limestone. The clay weathers light gray to buff (Figure 2). The mineralogical composition of the K_{dr} is about 10% smectite, 20% illite, 20% kaolinite, 10% quartz, 30% calcite, and 10% amorphous material (Figure 3). According to Hover, Bases, and Lock (2008), the K_{dr} in south and west Texas was deposited in a nearshore shallow marine to brackish-water environment subjected to periodic storm events during a time of low sea level and exposure to a terrigenous source region. The K_{dr} represents a single transgressive-regressive cycle, separate from the unconformably-overlying K_{bu}. The lower and upper parts of the formation have lower illite to kaolinite ratios than the middle section, indicating changes in salinity (Table 3). A silica-rich layer about five to eight feet below the K_{bu} is smectite-rich with an atypical illite to kaolinite ratio of about 5.0. This zone may represent storm-related landward deposition of marine sediments (Hoover, Bases, and Lock, 2008).

The fossilized fauna of the formation (Adkins, 1923; Bullard, 1953; Kennedy, Cobban, Hancock, and Gale, 2005; Moore, Lalicker, and Fischer, 1952; Udden, 1919) is highlighted in table

4 and includes *Exogyra arietina* (Figure 4), other pelecypods, echinoids, ammonites, brachiopods, and foraminifera. In McLennan County, the lower part of the formation contains *Turrilites sp.*, *Kingena wacoensis*, and *Exogyra arietina*. In this lower portion the clay is interbedded with thin siltstone and limestone stringers. The middle zone is distinguished by the presence of pyrite and hematite layers and by a lower calcite content. In this section *Exogyra arietina* is abundant above which *Gryphaea mucronata* is found. Pyrite and limonite fossils are common. The upper layers of the formation contain fewer fossils. Those found are echinoids, ammonites and *Pecten texanus* (Adkins, 1933).

Table 4 - Fossilized Fauna in the Del Rio Clay.

Del Rio Clay		
Section	Main fauna	Additional comments
Upper part	Pecten texanus (pelecypod)	Bivalves
Middle part	Gryphaea mucronata and Exogyra arietina (pelecypods)	Hematite layers Peltastes (echinoid) Pyrite and limonite fossils
Lower part	Turritelites species (ammonoid) Kingena wacoensis (brachiopod)	Echinoids Ammonites

It should be noted that the "Grayson Marl" replaces the "Del Rio Clay" in some stratigraphic charts indicating the close relationship between the two formations. In some areas, the Grayson Marl includes equivalents to both the Del Rio Clay and the Buda Limestone.

Geotechnical Properties

The geotechnical properties of the K_{dr} are summarized in Table 5. Atterberg limits and indices, unconfined compression strength, undrained, drained, and residual strengths, potential vertical rise, swell pressures, and other critical properties were determined in the laboratory and through field studies. Specifically, direct shear tests were conducted on undisturbed and remolded samples approximating and simulating field conditions (Figure 5). In short, the K_{dr} is an over-consolidated, fractured, and fissured clay-shale with low strength and permeability, high clay content, and low slope stability (Font and Williamson, 1967). The K_{dr} was once overlain by 500 to 2,000 feet of overburden (Flawn and Burket, 1965; Brown, 1971). Since the clay-shale is now exposed at the surface or buried by only a few feet of strata, it is classically over-consolidated. This is supported by values of $Ø_{cu} > Ø_d$ and by the clay's low sensitivity (Font, 2021).

Table 3 - Illite to Kaolinite Ratios in the Del Rio Clay of South and West Texas and their Implications.

The Del Rio Clay (Big Bend area of south TX near Terlingua; ~120 feet thick)		
Upper section (105 to 120 feet or 15 feet thick)	Illite to kaolinite ratio around 1.2	Lower salinity
Middle section (60 to 105 feet or 45 feet thick)	Illite to kaolinite ratio from 2.0 to 2.3	Increasing salinity
Lower section (60 feet)	Illite to kaolinite ratio from 1.0 to 1.9	Lower salinity

Table 5 - Geotechnical Properties of the Del Rio Clay.

Del Rio Clay		
Geotechnical Parameter		Value and/or Classification
Atterberg Limits and Indices	Liquid Limit	60-77
	Plastic Limit	25-30
	Plasticity Index	30-52
Clay-Shale Composition, Physical and Geotechnical Properties	Swell Pressure	2,000-8,000 pounds per square foot
	Potential Vertical Rise	1.5-2.5 inches
	Clay Content; Infiltration Capacity; Natural Slopes	90%; Low (impermeable material); <15°
	Density	90 pounds per cubic foot
Strength (Unconfined Compression Tests and Direct Shear Tests)	Unconfined Compressive Strength	3.40 pounds per square inch
	Consolidated-Undrained Tests	C_{cu} = 1.4–3.1 pounds per square inch; $Ø_{cu}$ = 11.5° to 13°
	Consolidated-Drained Tests	C_d = 1.0 pounds per square inch; $Ø_d$ = 11°
	Residual Strength Tests	C_r = 0 pounds per square inch; $Ø_r$ = 7° to 9°

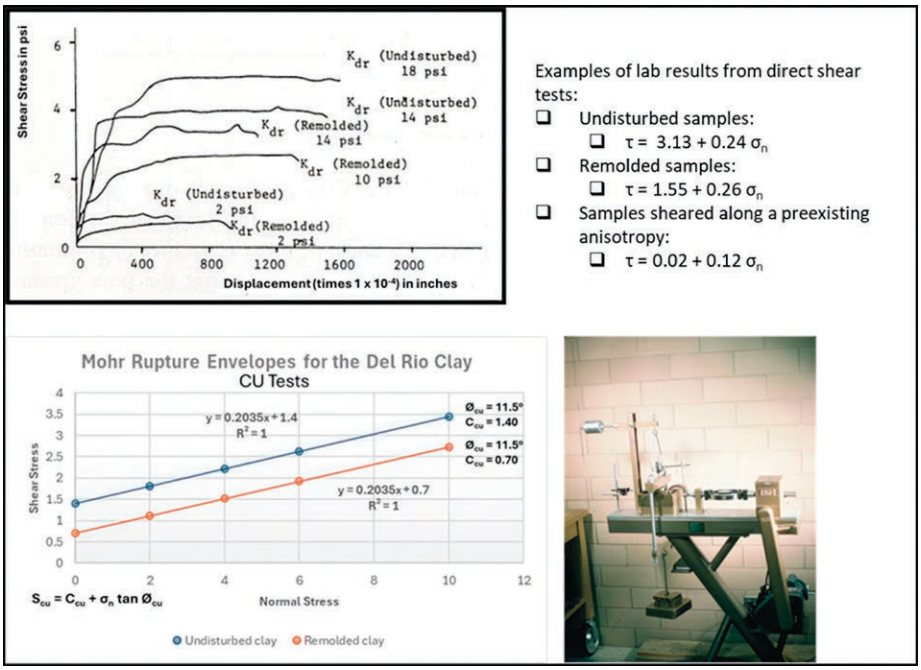


Figure 5. Strength Calculations from direct Shear Tests of the Del Rio Clay.

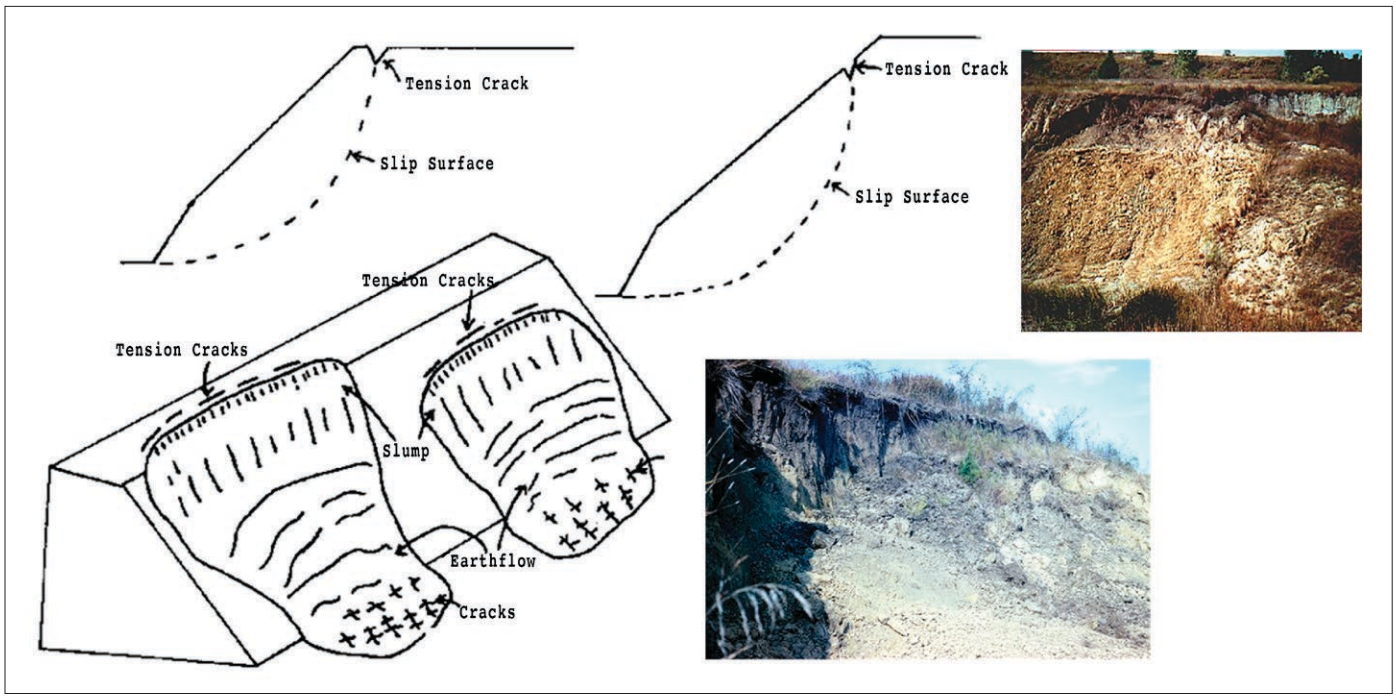


Figure 6. Slumps in the Del Rio Clay.

Slope failures in the K_{dr} are slumps along a well-defined, cylindrical slip surface (Figure 6). Typically, the slip surface initiates at a tension crack that develops on top of the slope or along the face of the slope near the top. These tension cracks can parallel fracture trends observed in the un-weathered shale. In some cases, the tension crack that defines the upper end of the slip surface forms from the widening of preexistent fractures. Although these preexisting fractures can facilitate the generation of the tension cracks, they do not control the shape of the slip surface. The cylindrical shape of the failure surface reflects the homogeneity of the shale with respect to grain size and chemical and mineralogical composition. Gullying can also contribute to the instability of the slopes and to the lateral boundaries of the slumping material. Natural slopes in the K_{dr} range from flat to 15^{o}. Steeper slope will lead to eventual problems. Factors affecting slope stability include undercutting the slope's toe, overloading the top of the slope, weathering and widening of exposed preexisting fractures, and weather-related events resulting in water saturation of the clay. Long-term slope stability is best predicted by using residual strength values.

Conclusions

The K_{dr} represents a regressive-transgressive cycle and deposition in estuarine and shallow-marine neritic environments. The formation is highly fossiliferous with zones of dwarf fauna. Abundant pelecypods including *Exogyra arietina*, as well as ammonites, echinoids, brachiopods, and foraminifera are present. The formation is characterized by high values of Atterberg limits and indices, and low strength, permeability, and slope stability. Slope failures are slumps along a well-defined cylindrical slip surface. Due to its over-consolidated, fractured, and fissured character, the formation may fail at strength values predictable by the clay's residual strength.

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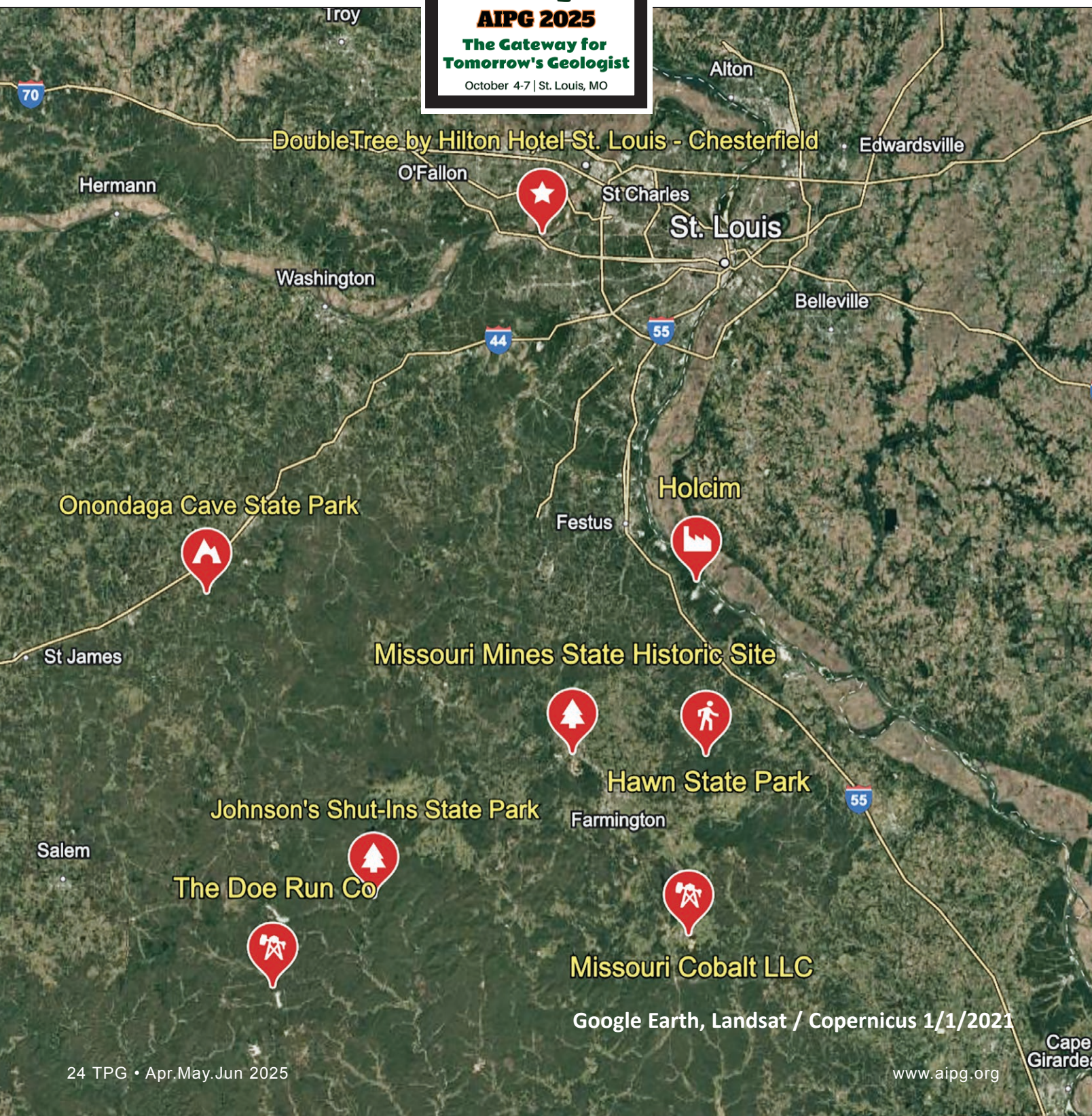
AIPG Annual Conference Guide



AIPG 2025

The Gateway for Tomorrow's Geologist

October 4-7 | St. Louis, MO

AIPG Annual Conference Schedule

Saturday, October 4, 2025

8:00 am - 12:00 pm	AIPG Executive Committee Board Meeting
8:00 am - 5:00 pm	Student / ECP Career Workshop
8:00 am - 5:00 pm	Old Miner's Day in Viburnum at the Buick Mine The Doe Run Company (on your own)
12:00 pm - 1:00 pm	Lunch Buffet
1:00 pm - 4:30 pm	AIPG Advisory Board Meeting
4:30 pm - 5:30 pm	Foundation of the AIPG Meeting
5:00 pm - 9:00 pm	Student / ECP Networking Reception and Trivia Contest

Sunday, October 5, 2025

6:00 am - 6:00 pm	Foundation of the AIPG Fundraiser - Caves, Springs and Streams in and about the Ozark National Scenic Riverways
7:00 am - 6:00 pm	Field Trip - Geology of the Basinal and Shallow-Water Carbonates of Eastern Missouri with Evidence of Cambrian Storm Events!
10:00 am - 4:00 pm	Exhibitor Set-up
6:30 pm - 8:00 pm	Welcome Reception / Foundation Silent Auction

Monday, October 6, 2025

7:00 am - 7:55 am	Section Leadership Meeting (follow-up to Saturday's Advisory Board Meeting)
7:00 am - 7:55 am	Past President's Breakfast
8:00 am - 5:00 pm	The Ultimate Explorer at the Gateway Arch and Winery Tour
8:00 am - 9:00 am	Plenary Session
9:00 am - 5:00 pm	Technical Sessions
12:00 pm - 1:30 pm	Lunch Buffet with Keynote Speaker
6:00 pm - 8:30 pm	Awards Banquet

Tuesday, October 7, 2025

6:00 am - 6:30 pm	Field Trip - The Doe Run Company's Viburnum Trend Mega-Mine Operations - The Largest Galena Deposit in the Northern Hemisphere
7:00 am - 5:00 pm	Field Trip - Missouri's Volcanos - Natural Water Park, Elephants, Monuments and Your Roof
7:00 am - 4:00 pm	Field Trip - World Class Cement Plant and Hawn State Park
9:00 am - 4:00 pm	Field Trip - United States Strategic Metals' Madison Mine Complex

Field Trips

Geology of the Basinal and Shallow-Water Carbonates of Eastern Missouri with Evidence of Cambrian Storm Events!

Leader – Jim Palmer
Date – Sunday, October 5, 2025
Time – 7:00 am – 6:00 pm

This tour showcases the interplay of regional scale basins with the shallow water carbonate deposition of the east side of the Ozark uplift! This tour will focus on the "East Flank" geology of Missouri, where the Ozark Dome has a steep dip on the eastern side and hosts a wedge of platform facies carbonates and associated extensional fractures. This depositional environment ultimately became the ore host for the "Old Lead Belt" of Missouri that was mined until 1972. Given the uplift on this side of the St. Francois mountains, there is opportunity to see these 500 Ma rocks exposed in a variety of intriguing roadcuts! One stop near Bonne Terre, Missouri, showcases large rip-up clasts that record a very violent storm or hurricane in the rock record!

This field trip will be led by Jim Palmer, an accomplished Missouri Department of Natural Resources (retired) carbonate and clastic geologist who is still very active in the field and has experience all over Missouri. **This trip will be limited to 50 individuals.** Multiple stops keep the group proximal to these stratigraphic units of the Derby/Doerun, Davis, Bonneterrre, and Lamotte formations along with some of the pre-Cambrian units of the area. Jim's experience brings excellent detail to this rewarding trip, along with the charm of the Missouri Mines State Historic Site, which will be a portion of the trip, along with the stop for lunch. This tour will depart to the host hotel at approximately 3 pm.

This will be a surface roadcut-based tour. Light jackets and rain gear are recommended along with sturdy footwear and gloves.

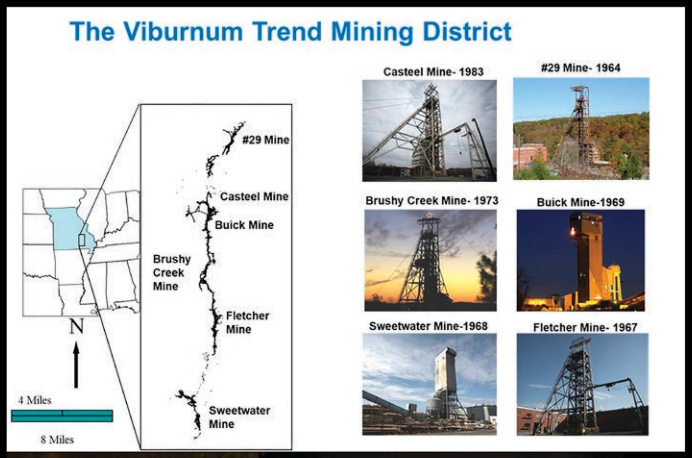
Foundation of the AIPG Fundraiser

Caves, Springs and Streams in and about the Ozark National Scenic Riverways

Leader – Jeffery Crews, Karst Geologist, Missouri Geologic Survey
Date – Sunday, October 5, 2025
Time – 6:00 am – 6:00 pm

The visit into a slice of the Missouri Ozarks starts at Onondaga Cave for a 50-minute paved path walking tour where visitors can see the Ordovician strata from the inside out and the handiwork of the dissolving and depositing waters moving through the carbonate host rock. From there we go to Maramec Spring where millions of rainbow and brown trout are raised and released in its 58 degree clear fast flowing waters for eager fly fishermen. At this location visitors will see remnants of the 1820's iron smelter located there to capitalize on the hydropower, hematite deposit and a bit of coal located nearby. On to Welch Spring emanating on the banks of the beautiful scenic Current River. After a one-fourth mile hike you will see the spring and the remnants of a health hospital of the 1920's thought to help cure consumption in the day. If time and access allow the tour will visit Devil's Well where one can look down a sinkhole direct to a cave room with a karstic lake some 100 feet below. Farther south and downstream we will visit the azure, blue waters of Round Spring which also feeds the Current River. We will then stop just a bit farther down the road for the pleasant scenery at Echo Bluff State Park where crystal-clear Sinking Creek flows along the namesake bluff formed of the Gasconade Formation. Then it is onto Alley Spring and Mill. Alley Spring is the seventh largest spring in Missouri. You will get up close to see the Alley Spring gristmill that was built in 1894. The cool waters issuing forth from Alley Spring flow through a spring branch for a half mile before entering the Jacks Fork River, another beautiful, designated National Scenic Riverway. Concluding the sight-seeing the group will head back to the hotel – a return trip of approximately three and a half hours where you can sit back, relax, and enjoy the scenic views.

No sample collecting will be allowed. Sturdy shoes are suggested for mostly horizontal easy walking paths. We may encounter some slight inclines and some gravel paths. Please be prepared for changing weather, including rain. Temperatures in the fall can range from hot (upper 80s) to quite cool (in the 30s).



The Doe Run Company's Viburnum Trend Mega-Mine Operations-The largest Galena Deposit in the Northern Hemisphere

Leader – Chris Hogan, CPG and The Doe Run Company staff geologists

Date – Tuesday, October 7, 2025

Time – 6:00 am – 6:30 pm

Join us for a tour of the Viburnum Trend Mississippi Valley Type (MVT) deposit! Located in the Bonneterre stratigraphy of southeast Missouri, this world class deposit has mined several hundred million tons of Pb, Zn, and Cu ore in its 64-year history in the 40-mile-long excavation of underground mine workings!

This field trip is proudly hosted by the Doe Run Company and will be limited to 50 individuals. We will arrive in Viburnum at approximately 9 a.m., and the group will be split into two groups of 25; this will allow a portion of the group to stay on the surface through the morning and review Trend geology with Doe Run exploration and mine geologists. The other 25 individuals will proceed to one of the Viburnum Trend mine operations and be safety trained and outfitted with personal protective equipment for an approximate 3-hour underground mine tour with SEMO division geologists. There will be detailed discussion of the ore host, along with viewing an active underground room and pillar mine along with sample collection.

Following the morning sessions for each group, lunch will be provided by the Doe Run Company. Following lunch, the tour groups will alternate to the afternoon surface exploration discussion as well as the underground tour portion to ensure all tour attendees get both sessions. This tour will depart Viburnum to head back to the host hotel at approximately 4 p.m.

There will be a surface and underground component to the tour. Light jackets recommended for the underground trip (60 degrees year-round underground). All required Personal Protective equipment and safety training will be provided by the Doe Run Company.

Missouri's Volcanos - Natural Water Park, Elephants, Monuments and Your Roof

Leaders – Ted Heath and TBD
Date – Tuesday, October 7, 2025
Times – 7:00 am – 5:00 pm

Once out of the metro area it is an additional two-hour scenic drive to and through the heart of the Ste. Francois Mountains to the town of Annapolis Missouri where the group will visit a Precambrian volcanic surface mine and processing plant. There, a variety of rhyolites are extracted and processed. With a little crushing, sorting and dyeing, these granules eventually find themselves on many of your home's roof, attached to asphalt shingles.

Then a short drive of 30 minutes the tour will arrive at Johnson Shut Ins where the pristine water of the Black River has carved through a variety of volcanic rhyolites forming cliffs, deep pools, miniature waterfalls, and hundreds of flowing crevasses that swimmers and climbers enjoy throughout much of the year. Many people believe this is the most scenic location in Missouri. Some call it God's Water Park.

From Johnson Shut-Ins to another industrial minerals site the tour will then head to Graniteville, Missouri to see the quarry from which the world renowned Missouri Red Granite is extracted. In yesteryear Missouri Red was used to pave streets, make street light posts, cover prominent buildings and handsomely mark millions of graves among many other applications. Today the operation caters to mostly manufacturers of rather large memorials and monuments.

Once satisfied with our industrial look at Missouri Red Granite, the group will head to the next stop just a few hundred yards away, Elephant Rocks State Park. The elephant rocks, which were formed from 1.5-billion-year-old granite, are giant boulders that stand end-to-end like a train of circus elephants. An easy way to see the rocks is from the trail that winds through the main area of rocks.

World Class Cement Plant and Hawn State Park

Leaders – Tom Newman, CPG, Chief Geologist, Cement Plant
Trey Anglim, Doe Run Co. Geologist, Hawn State Park
Date – Tuesday, October 7, 2025
Times – 7:00 am – 4:00 pm

An hour of travel to the southeast to Bloomsdale, MO along the mighty Mississippi River will take us to a 4000-acre cement plant and limestone mine hosting the largest kiln in the world making up the most environmentally efficient cement plant on our planet. Environmental permitting began in 1998 and construction in 2006, with the plant going on-line in 2009. Today the plant produces 4.5 million metric tons of cement annually. There is more than 100 years of limestone supply, and 2,000 acres are to be preserved as a conservation area. The mine exposes a rock record of northeasterly gently dipping strata some 500 feet thick, ranging in age from middle Mississippian to lower Ordovician, consisting of mostly carbonate rocks, some shale and a bit of sandstone. This portion of the tour is expected to take 3 hours. Following the tour, we will depart for the 5000-acre Hawn State Park about 30 minutes west of the Holcim plant.

Hills of stately pine and oak trees, sandy-bottom streams with sandstone canyons and cliffs create one of the most scenic landscapes in Missouri. Hawn State Park may be the only location in Missouri to have igneous, metamorphic, and sedimentary rocks juxtaposed essentially in one place. With a bit of geologic touring on foot to see the basal sedimentary unit and its relationship to the basement rock of Missouri, attendees can relax with lunch and take some time to stretch their legs in this amalgamation of flora, fauna, streams and rocks. The leisurely stay here is expected to be about two and one-half hours, returning to the hotel at 4:00 PM.

The cement plant requires hard hats, steel-toed shoes, visible safety vest and safety glasses (this may be provided by the plant – TBD).

United States Strategic Metals' Madison Mine Complex

Leaders – Greg Sutton, Craig Hall and USSM staff

Date – Tuesday, October 7, 2025

Time – 9:00 am – 4:00 pm

Join us for a tour of the USSM Madison Mine Complex! US Strategic Metals (USSM) will source a variety of internal and external feedstocks including underground ore, re-mined tailings, outside concentrates, and outside lithium-ion battery waste. These sources will allow us to make cobalt metal, battery grade cobalt and nickel sulfate, lithium carbonate and copper cathode metal, all crucial metals to supporting the green energy revolution and America's national defense. Also, being North America's only minable cobalt ore reserve with indigenous nickel and copper sources, we're building a closed loop supply chain for reliable, traceable, conflict-free critical metals. Current mine life is estimated at 17 Years with ongoing exploration efforts to derisk the known ore body and to extend the mine life. USSM is also in the early stages of developing a Precursor Cathode Active Material processing facility, which will finally close the US loop in the critical materials supply chain.

This will be a surface walking/light hiking and driving tour. A light jacket and sturdy footwear are encouraged. All required Personal Protective equipment and safety training will be provided by USSM.

Student / ECP Career Workshop

Technical Presentations / Student Posters

AIPG invites you to submit abstracts for oral and poster presentations for the 62nd National Conference of the American Institute of Professional Geologists. Embracing the theme "The Gateway for Tomorrow's Geologist," this year's conference seeks to inspire innovative ideas and discussions that will shape the future of geoscience. Attendees will have the opportunity to engage in cutting-edge technical sessions, participate in insightful field trips, and network with industry leaders. This event promises a unique learning experience aimed at equipping geologists with the knowledge and tools to tackle the challenges of tomorrow. Earn CEUs/PDHs for presenting and participating in the conference.

To be considered for an oral or poster presentation, please complete the Abstract Submittal Form by July 14, 2025.

Students can submit an abstract for a poster presentation and enter the poster contest to win cash prizes!

scan for abstract/poster submission information

AIPG 2025

The Gateway for Tomorrow's Geologist

October 4-7 | St. Louis, MO

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• Lunch Sponsor • Company logo on lunch signage $1,000	• Break Sponsor • Company logo on break and coffee tables $500	• Standard benefits, company logo visibility $250

CALL TO ACTION!

John M. Nadeau, PG, CPG-11181, Executuve Director NYSCPG

Reprinted from the Northeast Section Winter 2025 Newsletter.

The New York State Museum and the New York State Geological Survey (NYSGS) have been neglected to the detriment of the State's citizens, and the State's geological community. The time for action is upon us – there is legislation (https://assembly.ny.gov/leg/?bn=A08851&term=2023) that if enacted would support the Museum's mission, and by extension that of the Geological Survey. By contacting your Senator and Assembly Member (https://www.nysenate.gov/find-my-senator and https://nyassembly.gov/mem/search/), you can call for its passage. Below is the full story of how we got here, and our path forward…

There have been multiple articles written in the New York Times and the Albany Times Union over the last several months regarding the state of the Museum. I bring this to your attention in case you do not know that the NYSGS is an agency of the Museum. The last New York Times article regarding the decline of the Museum was published on October 19th (https://www.nytimes.com/2024/10/19/nyregion/state-museum-ny-albany.html) and specifically references claims made regarding the NYSGS. The article discusses ongoing state and federal investigations to evaluate whether the Museum received excessive federal funding from the United State Geological Survey (USGS). The article also mentions allegations that Museum administrative staff engaged in a timecard scheme to bilk federal funds. An investigation by the State Education Department's Bureau of Labor Relations found the allegations were unsubstantiated.

While NYSCPG is not aware of any specific allegations, we are aware of the historical success of the NYSGS and particularly the geological mapping program that has had a long-standing and productive partnership with the USGS. Despite decades of declining staff and attrition of museum scientists trained in geology, the NYSGS appears to have been having a resurgence over the last several years. Numerous presentations have been made to various professional geological organizations, along with other public presentations, on the ongoing geologic research that shows an active and productive group of researchers that are producing high-quality scientific information despite funding issues within the Museum.

Increased federal funding in recent years has resulted in an increased number of published maps which NYSCPG has previously highlighted on our website and in articles. Many of the geologists in New York, professionals and academics alike, use the maps and data prepared by the NYSGS. Not only do these maps serve as important educational products, but these geologic publications serve society to help protect water resources, find aggregates to build and repair infrastructure and help identify locations of critical minerals needed to provide vital materials to support the state and national economy. The subsurface scientific coring and exploration drilling that has resulted from the cooperative federal-state partnership is having a profound impact to improve understanding of past

Continued on p.37

Introducing: The ECP Committee

Hannah Weaver, ECP-1014

Are you an Early Career Professional (ECP) Member looking to get more involved with AIPG at the National Level? Are you a Professional Member with ideas on how to engage with early career members? Perhaps you're a CPG and are looking for an avenue to share your wealth of knowledge with geoscientists that are in their first few years on the job… Look no further - the ECP Committee may be just what you're looking for!

The National Executive Committee and 2025 National ECP Representative, Hannah Weaver, are excited to announce the creation of the ECP Committee. Over the past few years, with the leadership and enthusiasm of previous Executive Committees and National ECP Representative, **Brigitte Petras**, AIPG activities and initiatives for Students and ECP members have blossomed. So much so, that to continue to expand these opportunities, the help of a committee of other AIPG members is warranted. Thus, the ECP Committee was born.

The description of this committee is as follows, and will be listed in the AIPG Handbook:

The purpose of the Early Career Professional Committee is to increase involvement and opportunities for Student and ECP members. The committee will work on developing new, or contributing to existing, AIPG activities and ongoings focused on Students and ECP members. This committee will always include the current ECP Representative as the chair; membership will be open to all AIPG membership categories. The ECP Representative will report to the Executive Committee at their regularly scheduled meetings.

Chair: Hannah Weaver, ECP, Ohio Section

The ECP Committee will work together on goals described in the committee description. While these goals can continue to develop and change as the committee sees fit, initially the committee will focus on:

- **Developing and presenting student and ECP webinars covering new and relevant topics,**
- **Innovating ways to increase ECP membership and student chapters/members,**
- **Creating student- and ECP-related and relevant articles for the *TPG*,**
- **Assisting with the development and implementation of the Student and ECP Workshop at the Annual Conference,**
- **Promoting the AIPG Mentoring Program,**
- **Establishing new opportunities for student and ECP members to learn, connect, and develop new skills.**

The committee will meet virtually on a reoccurring basis (monthly or bi-monthly). If you're interested in joining this committee, please reach out to Hannah Weaver at hweav04@gmail.com.

Welcome

New Certified Professional Geologists!

December 11, 2024 - February 21, 2025

Section	Name	AIPG Member Number
Colorado	Dale Hernandez	CPG-12254
Florida	Kimberly Arnold	CPG-12250
Idaho	Nicholas Furlin	CPG-12249
Illinois-Indiana	Michael Halsema, Jr.	CPG-12259
Illinois-Indiana	Todd Thompson, PhD	CPG-12262
International	Frederico Cernushi, PhD	CPG-12255
Minnesota	David Schultz	CPG-12261
Minnesota	Ronald Steiner	CPG-12248
Minnesota	Benjamin Torgerson	CPG-12260
Montana	Kyle Brangers	CPG-12256
Montana	Matthew Deeks	CPG-12257
Montana	Benjamin Somps	CPG-12247
Nevada	Kevin Creel	CPG-12253
Nevada	Ashley Lobdell	CPG-12251
Nevada	Reid Yano	CPG-12252
Northeast	Mathew Sandefur	CPG-12258

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Apply online to become a Certified Professional Geologist!

Missouri's Geologic Marvels:
Uniting Expertise and Adventure at the 2025 AIPG Annual Meeting

Aaron W. Johnson, CPG-12229
awj@aipg.org

Planning for the 2025 Annual Meeting is moving forward swiftly. The organizing committee and our National Office staff are working hard to make this another great event. For the first time in nearly 25 years, the meeting will be held in Missouri, my home state. I, personally, am very excited to welcome you to the 2025 Annual Meeting in St. Louis.

The geology of Missouri is widely varied, from the 1.4 billion year-old volcanic rocks of the St. Francis Mountains to the Pleistocene glacial deposits north of the Missouri River. In between you'll find the karst terranes of the Salem and Springfield Plateaus (part of the broader Ozarks Dome), Pennsylvanian Cyclothems in the Kansas City area, and the karst terrain and world-class springs that give the Ozarks a unique hydrologic character. Beneath the surface, Missouri is host to enormous mineral wealth, most notably the Mississippi Valley-Type mineral deposits of the old Tri-State District, near Joplin in extreme southwestern Missouri, the Old Lead Belt, on the northeast side of the St. Francis Mountains, and the Viburnum Trend, the largest lead deposit in the northern hemisphere. Each of these deposits is world-class, which means that they are in the largest 10% of deposits of their type in the world. Missouri is also host to the largest cobalt reserve in the United States and regularly is among the top ten states for mineral production in the United States.

Our field trips routinely are among the highlights of the AIPG Annual Meeting and field trips for the 2025 meeting continue our tradition of high-quality, world-class field experiences for geologists. Among the highlights of the 2025 meeting will be a field trip to visit the Doe Run Company's underground operations in the Viburnum trend. This field trip will include a visit to the underground workings, at a depth of approximately 1,000 feet, along with a tour of the surface milling and processing facilities. As of this moment, sampling will be permitted, with the understanding that, "if you can carry it, you can keep it."

Missouri is also host to a world-class karst terrane, highlighted by extensive cave systems and associated springs. Our "Caves, Springs and Streams in and about the Ozark National Scenic Riverways" field trip will take participants to several sites of geological and cultural significance. Onondaga Cave and Alley Spring are two of the highlights of this field trip, which will also introduce participants to Missouri's lower Paleozoic stratigraphy.

Approximately 1.4 billion years ago, southeastern Missouri likely would have been geologically similar to Yellowstone National Park or to the Mammoth Lakes-Inyo Craters volcanic area in Mono County, California. Today, this part of Missouri is host to an extensive exposure of volcanic and plutonic rocks in the St. Francis Mountains. These rocks record a complex volcanic history and outline at least three large volcanic calderas and associated intrusive and extrusive volcanic rocks. This unique volcanic landscape is also host to a distinctive ecosystem as the plants that grow in these volcanic soils can be quite different than those that grow on the Paleozoic carbonate rocks.

Missouri is also host to a world-class karst terrane, highlighted by extensive cave systems and associated springs. Our "Caves, Springs and Streams in and about the Ozark National Scenic Riverways" field trip will take participants to several sites of geological and cultural significance. Onondaga Cave and Alley Spring are two of the highlights of this field trip, which will also introduce participants to Missouri's lower Paleozoic stratigraphy.

Other field trips will be available, and our technical program will be top-quality, as always. We cordially invite you also to attend the AIPG Awards Banquet. I would like to recognize our Meeting Chair, Matt Rhoades, as well as Chris Hogan, Deanna Wolfe, and John Bognar, for all of their hard work on the planning committee and John Howard and other members of the Missouri section for their support. Finally, none of this is possible without the hard work of Cathy Duran and Wendy Davidson.

I look forward to seeing each of you this fall in Missouri!

Aaron W. Johnson, CPG-12229

Restoring Trust in Science: Our Role as Geoscientists in the Digital Age

Sara Pearson, CPG-10650
sara.pearson@wmich.edu

In our last issue, I called on our members to educate the public, advocate for the profession, and inspire future careers in the geosciences. A vital part in meeting this challenge is to rebuild the broken trust society has in science. For over a decade, we have witnessed an erosion in the public's trust in science—a trend that has now become mainstream. With an overwhelming amount of information available at the click of a button, the lines between fact and fiction have become increasingly blurred. Influencers, often trusted by their followers, can inadvertently—or deliberately—spread misinformation. The internet, once a tool for education and enlightenment, now hosts a dizzying array of sources where facts mingle with fiction, leaving many to wonder: how do we, as scientists and geoscientists,reclaim our place as the trusted source of facts?

Meeting the Challenge Head-On

We are living in extraordinary times. The digital age has given everyone a platform, but it has also made it challenging for the public to discern accurate information from cleverly packaged misinformation. In the past, we could simply refer to well-known resources to debunk "urban myths" or false claims. Today, however, manipulated photographs generated by artificial intelligence and out-of-context quotes circulate widely, making it harder to separate truth from deception. This evolving landscape demands that we adapt our communication strategies.

The founders of AIPG recognized the power of storytelling back in 1963. They understood that stories resonate with people—they carry experiences, values, and insights that raw data cannot convey. As geoscientists, we must meet the public where they are: on Google, YouTube, and various social media platforms. When we share our work and explain its significance in relatable terms, we do more than communicate scientific facts—we rebuild trust. It isn't solely about the credentials behind our names, such as the AIPG seal of approval or the "CPG" designation; trust is earned through consistent, transparent, and respectful engagement with the community.

Driving National Priorities

In today's socio-political climate, topics such as critical minerals and resources, workforce development, and national security have taken center stage. While political debates often complicate these issues, there exists a tremendous opportunity for geoscience to shine. Our work directly supports the nation's strategic interests by ensuring a reliable supply of critical minerals, nurturing a skilled workforce, and contributing to national security through informed resource management.

Geoscience is not simply an academic pursuit; it is a critical element of the nation's economic and strategic vitality. By providing accurate, evidence-based information about resource availability and environmental risks, we help guide policies that secure our nation's future. Whether through advising on mineral extraction or assessing natural hazards, our commitment to excellence advances our profession and addresses the pressing needs of modern society. In doing so, we not only uphold the integrity of our field but also play a vital role in shaping a resilient, forward-thinking national strategy.

Breaking Down Misconceptions

Despite the critical importance of geoscience, many still view geologists as mere rock collectors or assume that our work in resource recovery inherently leads to environmental harm. Such misconceptions undermine both our profession and public understanding of how geoscience contributes to sustainable development. The reality is far more nuanced—our field is dynamic, interdisciplinary, and integral to solving some of today's most pressing challenges.

Consider the role of geoscientists in safeguarding water resources, assessing natural hazards, or providing expertise for strategic plans in building resilient communities. By applying rigorous scientific methods and innovative technology, we provide insights that inform sustainable practices and responsible resource management. As a community of professionals, we must actively counter these oversimplified views by engaging with the public, educators, and policymakers. Explaining our methodologies and sharing real stories of discovery and innovation helps demystify our work and demonstrates its far-reaching impact on society.

Building a Legacy of Trust

Every interaction with the public is an opportunity to reinforce our commitment to scientific integrity. We have the unique respon-

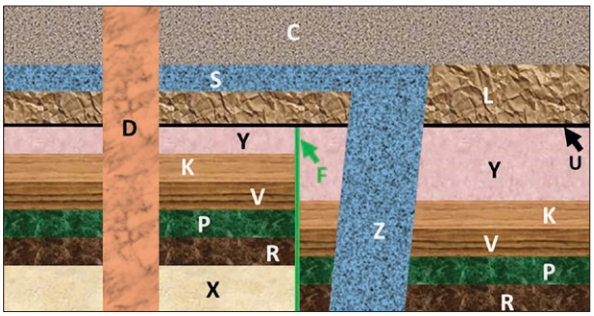
Geoscientists are equipped with the expertise to detect hazards and develop strategies that protect life and property.

Continued on p. 54

Answers on Page 41

Robert G. Font, CPG-03953
robertfontphd@gmail.com

1. Given the section to the right, which statement is not correct?



- a) Fault F is older than dike Z.
- b) Sill D is younger than bed C.
- c) Unconformity U is younger than bed K.
- d) Bed X is the oldest unit in the sequence.
- e) Come on dude, is this one of Pablo Picasso's paintings?

2. Point bars are associated with this depositional environment:

- a) Eolian.
- b) Paludal.
- c) Littoral.
- d) Fluvial.
- e) Point me to the bar, hombre! It's happy hour and that's the environment that I like to deposit myself in!

3. Which of the following would not be associated with a negative gravity anomaly?

- a) Rocks of low density near the surface.
- b) Salt domes in the subsurface.
- c) Graben structures and thick sedimentary sequences.
- d) Rocks of high density near the surface or deep-seated structures such as anticlines.
- e) Deep thinker and philosopher says: "If one considers a negative gravity anomaly as related to analytical perturbations influenced by the universal effect of the imbalance between rationalism and esoteric erudition and the abundance of…"

4. A well's location is to be drilled in the NW ¼ NE ¼ S 15 T1N R3W. As described, how many acres does this area encompass? Given an API number of 42-371-00263, what does 371 indicate?

- a) 60 acres, 371 = city.
- b) 40 acres, 371 = county.
- c) 60 acres, 371 = well number.
- d) 40 acres, 371 = lease number.
- e) "Green acres is the place for me; farm living is the life for me."

5. A folded thin bed is seen at an outcrop. The geometry of the fold can be approximated by the equation $y = 0.5 x^2$. From the hinge point at 50 feet vertical distance along the hinge line, how far apart are the limbs?

- a) 20 feet; the structure is anticlinal.
- b) 10 feet; the structure is synclinal.
- c) 20 feet; the structure is synclinal.
- d) 10 feet; the structure is anticlinal.
- e) Rather than going out on a "limb", sometimes I "fold" when I'm playing cards, dude. That may "hinge" on how bad my cards are and….

Call to Action, Continued from p. 31

climate, aquifers, and geothermal potential and will likely provide vital information for predicting future climate change.

The NYSCPG's mission includes the strengthening and advancement of the geological sciences as a profession; promoting the protection of public health, the public welfare, and the environment; and promoting high standards of ethical conduct within the profession. NYSCPG views the federal resources awarded to the Museum to produce maps and collect high quality geologic data as a solid investment that is benefiting both the state and its citizens. The maps produced by the NYSGS help promote geology to the public and can be used to promote the protection of the public and the environment. We also believe that the NYSGS staff operate with an appropriate standard of care and high ethical standards and any investigation will show that allegations made against NYSGS staff to be unfounded and that they will be allowed to continue their critical work moving forward.

Where does that leave us, the professional geologists of New York, and what can we do to ensure that additional geological data continues to be collected and managed by qualified, competent geoscientists? Professional geologists have been aware of the financial struggles and lack of staffing of the Survey and Museum since the State Geologist role was vacated in 2010. Almost every state in the union has a Chief Scientist and State Geologist, except New York. New York is the 4th most populous State and has a diverse landscape and highly variable geologic settings constructed from ancient tectonic events that occurred more than a billion years ago to glacial deposits as recent as 13,000 years old. The roles of the State Geologist are to manage the NYSGS; provide unbiased scientific information to state agencies; prepare and manage federal grants; oversee staff that conducts field work, curate the current mineral collections, and maintain the subsurface core collection; maintain the Empire State Organized Geologic Information System (ESOGIS); provide educational opportunities for the public; and serves as a technical resource to the State in response from catastrophic flooding, landslides, droughts and other emergency-related events.

As professional geologists we must request that a State as large and geologically complex as New York should maintain this key position within the Museum, which was founded by the original scientific efforts of the NYSGS in 1836. The Chief Scientist-State Geologist position typically directs and oversees the NYSGS technical staff, and the time to re-establish this key vacant role has come.

How do we accomplish this? It is election season, and candidates are canvasing neighborhoods and hosting town meetings. I call upon the geologic community to become as vocal as we did to ensure licensure passage a decade ago. The bill referenced at the beginning of this article (A08851) proposed to increase the county clerk fees from $15 to $25 with the revenue going to fund the Museum. Reach out to your elected officials and ask them to support that measure and in turn specifically fund the NYSGS and re-establish the State Geologist role. If you are unsure who your representatives are, please check out https://www.nysenate.gov/find-my-senator and https://nyassembly.gov/mem/search/.

There is an adage that the "squeaky wheel gets the grease," and it is time for our profession to make some noise.

Topical Index-Table of Contents to the Professional Ethics and Practices Columns

A topically based Index-Table of Contents, "pe&p index.xls" covering columns, articles, and letters to the editor that have been referred to in the PE&P columns in Excel format is on the AIPG web site in the Ethics section. This Index-Table of Contents is updated as each issue of the TPG is published. You can use it to find those items addressing a particular area of concern. Suggestions for improvements should be sent to David Abbott, dmageol@msn.com

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Are the geosciences racist?

Kathryn Yusoff, an academic at Queen Mary University of London, wrote that the hard science subject of geology was "riven by systemic racism" and colonialism. The theft of land, mining, and other geological aspects of colonialism led "toward the white supremacy of the planet" and resulted in "geotrauma" (in a November 16, 2024 article in The Telegraph (British) newspaper). In the same article, critics slammed the decolonization agenda" as "anti-scientific" and said the "exploitation" of the land was almost as old as mankind itself, and not race-dependent. Chris McGovan, the chairman of the Campaign for Real Education, said: "Geology is no more racist than 'fish 'n' chips'! It is an entirely neutral term. Those seeking to decolonize the curriculum are, in fact, building their own sinister empire of thought control and intolerance. "Applied to exploitation it involves mining, and this is almost as old as mankind and not race-dependent, as tourists are reminded when they visit our prehistoric flint mines such as Grime's Graves, the English Heritage site in Norfolk."

In column 192 I noted that when I joined the profession 50 years ago, most geoscientists were men, although significantly more women started taking geoscience courses at that time. Now, the profession is more evenly balanced on gender, but it still lacks significant numbers of non-whites. But does this fact equate to racism? I don't think so. The "correlation" that the percentage of white geoscientists equates to racism does not prove the point. Did those geoscientists participating the colonization of countries around the world share their fellow colonizers' views on imperialism and look down on the indigenous peoples? Probably to some degree, but this view was not due to the geologic profession but rather the general attitudes of their countrymen. In my experience, geoscientists are more respectful of the Indigenous peoples in the areas they work. They needed the local knowledge and skills. As noted in the following instructions on proper attire for geologists appearing the first Memoir of the British Geological Survey (1846) and reproduced in the *Great Devonian Controversy.*[1]

> [Geologists] working on foot, wearing outdoor clothing, and being frequently soaked to the skin, ...could find that their gentlemanly status went unrecognized by their social equals, particularly since, ...they appeared to be engaged in that most menial of occupations, stone breaking. ... Yet their relative disguise, and their evident readiness to share the hardships of outdoor life, seem to have enabled them to elicit valuable local information from the lower classes much more easily. ... Conversely, the wearing of formal attire while "stonebreaking," which later became de rigueur among those employed by on the Geological Survey in Britain, created a social discrepancy that must have puzzled the idle bystander.

So are geoscientists racists? They are not because of their geoscience training and practice.

Safety Gear Sources

Having the appropriate types of personal protective equipment (PPE) is increasingly part of fieldwork. This starts with hard hats, hard-toe boots, safety glasses, and high-visibility vests. Even students (and other field trip participants) are being required to have these PPE basics. Because of individual sizing, you have to buy your own, particularly the boots. **Shanna Schmitt** (CPG-11781) noted that she has difficulty finding safety glasses that are small enough for her, while in contrast, her husband, who is big, sometimes has difficulty finding extra-large hats that fit. The PPE list has gotten longer over the course of my career; I expect this will continue. **Marian Kramer**, MEM-2463, told me that when she worked for Chevron in California on drill rigs, she was required to have fire-resistant (FR) outerwear. Because women tend to be in the minority of people needing PPE equipment, particularly clothing and boots, finding items that fit can be a problem. Even in metro Denver, there are not that many suppliers. A problem can occur when you realize that you need a particular PPE item tomorrow. Given more time, or thinking ahead, you have more choices from various websites but be aware of any company policies or other requirements or restrictions.

Rings of Fire Book Review Comments

The January 2025 issue of the TPG contained my review of the book, Rings of Fire by Larry Hughes. **Peter Dohms**, CPG-7141, sent me the following note about his examination of an Iceland spar quarry in Taos County, New Mexico.

David; I read your review of the book Rings of Fire (etc.) with a great deal of interest, looking for a mention of an Iceland spar quarry that I visited about 55 years ago in New Mexico. Variously termed the "Iceberg Mine," the "Iceberg Quarry," or the "Iceland Spar Quarry," it was described in a reference that I had in my possession at the time. Another geologist and I were conducting reconnaissance of Taos County as part of New Jersey Zinc's exploration program for bulk-tonnage copper and copper-moly prospects. I can't recall if the reference in question was a New Mexico Survey publication, or if it was a New Mexico Geological Society guidebook. Anyway, the Harding Quarry was described and, almost as an afterthought,

1. *The Great Devonian Controversy: The Shaping of Scientific Knowledge among Gentlemanly Specialists* by Martin S.J. Rudwick, 1988, Univ. Chicago Press.

the author mentioned the small quarry of optical-grade calcite located a very short distance (measured in yards) south of the Harding Quarry. Interestingly, the author stated that the Iceland spar quarry was the source of the optical-grade calcite that was used as the heart of the Norden Bombsight. I had to go look.

I managed to drive onto the floor of the Harding Quarry (a tarantula migration was underway at the time, and I had to use care to avoid stepping on them—there were hundreds); parking, I looked at the giant spodumene crystals that were exposed in the highwall (up to 30 feet long, but only an inch thick). After I assured myself that no copper was visible anywhere in the quarry, I made a short traverse and found the Iceland spar quarry. Though it was mostly filled in, I managed to collect a dozen or so cleavage fragments of the optically clear calcite. In subsequent years, I was able to amaze and amuse colleagues by showing how the calcite would "split the image" of printed text.

It was a morning that was by far the most memorable element of that week-long trip. I've looked briefly online just now but was unable to locate the reference I was using that day. I found a web page with a very nice description of the Iceland spar quarry, and the cross-section matches my recollection. Here is the URL: Mineral & Exploration: Spodumene and Iceland Spar from the Harding Mine, New Mexico, USA.

Thank you for that book review, and for triggering my trip down memory lane.

Greenland: The Ice at the End of the World

The Ice at the End of the World: An Epic Journey into Greenland's Buried Past and Our Perilous Future by Jon Gertner: a review. Greenland is a remote, mysterious island five times the size of California but with a population of just 56,000. The ice sheet that covers it is 700 miles wide and 1,500 miles long and is composed of nearly three quadrillion tons of ice. For the last 150 years, explorers and scientists have sought to understand Greenland—at first, hoping that it would serve as a gateway to the North Pole and later coming to realize that it contained essential information about our climate. Locked within this vast, frozen white desert are some of the most profound secrets about our planet and its future. Greenland's ice doesn't just tell us where we've been. More urgently, it tells us where we're headed.

In T*he Ice at the End of the World*, Jon Gertner explains how Greenland has evolved from one of Earth's last frontiers to its largest scientific laboratory. The history of Greenland's ice begins with the explorers who arrived here at the turn of the twentieth century—first on foot, then on skis, then on crude, motorized sleds—and embarked on grueling expeditions that took as long as a year and often ended in frostbitten tragedy. Their original goal was simple: to conquer Greenland's seemingly infinite interior. Yet their efforts eventually gave way to scientists, including Alfred Wegner, who built lonely encampments out on the ice and began drilling—one mile, two miles down. They aimed to pull up ice cores that could reveal the deepest mysteries of Earth's past, going back hundreds of thousands of years. The US Army Air Corps built the Thule Air Base in northwestern Greenland in World War II to facilitate air transport to Europe, a base maintained today.

Today, scientists from all over the world are deploying every technological tool available to uncover the secrets of this frozen island before it's too late. As Greenland's ice melts and runs off into the sea, it not only threatens to affect hundreds of millions of people who live in coastal areas, it will also have drastic effects on ocean currents, weather systems, economies, and migration patterns. Gertner chronicles the unfathomable hardships, amazing discoveries, and scientific achievements of the Arctic's explorers and researchers with a transporting, deeply intelligent style—and a keen sense of what this work means for the rest of us. The melting ice sheet in Greenland is, in a way, an analog for time. It contains the past. It reflects the present. It can also tell us how much time we might have left.

What Drives Us to Value Ethics?

Contributed by ***Sara Pearson*** *(CPG-10650).*

At its core, I believe the value of ethics in our profession is driven by a deep-seated commitment to the public good. Professional geologists have a unique responsibility: our work not only advances scientific knowledge but also has profound impacts on society, public policy, and environmental stewardship. This responsibility demands that our advice, opinions, and actions are guided by rigorous scientific methods and an unwavering dedication to truth.

Ethics in geoscience is more than adherence to a set of rules; it is a reflection of our accountability to the communities we serve and the natural world we study. Our ethical framework is the foundation upon which trust is built. When the public knows that geologists are committed to honesty and integrity, they are more likely to support decisions that affect everything from infrastructure projects to environmental conservation.

Moreover, personal integrity and professional accountability are intertwined. The drive to value ethics often comes from an internal compass—a commitment to doing what is right even when it is challenging. This inner drive motivates professionals to engage in continuous learning, to question assumptions, and to approach every problem with both healthy skepticism and an openness to new ideas.

One of the key roles of the AIPG is to serve as a bridge between the rigorous world of geoscience and the broader public. This bridge is built on the pillars of ethics, competency, and integrity. It requires us to communicate our findings in a way that is both accessible and faithful to the underlying science.

Educating the public—and our policymakers—about the nature of scientific inquiry is crucial. We must explain that while science is not always black and white, its gradual progression toward a more refined understanding is what enables breakthroughs and informed decision-making. When the public understands that change in science is a sign of progress rather than inconsistency, trust can be fortified.

Empowering Change Through Constructive Engagement

Contributed by ***Sara Pearson*** *(CPG-10650).*

In our mission to promote ethical behavior and informed decision-making, it is vital to recognize that shame is not the answer to changing behavior. Shame might prompt a temporary emotional reaction, but it ultimately only makes people feel bad about themselves, rather than inspiring them to adopt more constructive or scientifically grounded behaviors.

Meaningful and lasting change comes not from shaming individuals into submission but from empowering them through education, constructive dialogue, and a shared commitment to the public good. By engaging people with respect and empathy, we foster an environment where individuals are more receptive to learning and growth. This positive reinforcement builds confidence and encourages a proactive approach to understanding complex scientific issues—an approach that is far more likely to yield sustainable change than tactics based on guilt or humiliation.

At the heart of sparking lasting change is ethical leadership. It is about setting an example, not just for fellow professionals

but for society at large. As experts, we have the opportunity—and the obligation—to lead by example, demonstrating that adherence to ethical standards is not a hindrance but a catalyst for innovation and trust.

By remaining steadfast in our commitment to competency, ethics, and integrity—and by choosing to empower rather than shame—we not only protect the legacy of our founding members but also inspire future generations of geologists to pursue excellence in all facets of their work. In doing so, we ensure that the insights we offer are respected, that public policy is informed by accurate data, and that our natural world is well understood, resources are managed, and hazards are identified.

In an ever-changing world, the enduring principles of ethics, competency, and integrity are more than relics of the past—they are the guiding lights of the present and the future. The founding members of the AIPG envisioned an organization that would safeguard the integrity of geoscience, and their vision continues to resonate today. As science faces unprecedented challenges from misinformation, public skepticism, and even tactics that rely on shame, our commitment to ethical practice and empowerment remains our strongest asset.

Let us continue to champion these values—not only to advance our profession but to inspire trust and drive meaningful, lasting change. In doing so, we honor our past, serve our present, and secure a future where expertise, ethical leadership, and constructive engagement guide us all.

OUR VISION

Advocate for the profession of geology and certify the competency, integrity, and ethics of professionals on domestic and international levels.

OUR MISSION

Effectively advocate for the profession of geology and support members through activities and programs that advance professional growth and promote high standards of ethical conduct.

OUR VALUES

Competence ★ Integrity ★ Ethics ★ Equity, Diversity, Inclusion & Belonging ★ Environmental, Social and Governance frameworks

An AIPG GEO-Human-Interest Story

What are the Odds?

John L. Bognar, CPG-8341

A few years ago in downtown Denver, Colorado, Past National President **John Bognar**, CPG-8341, and Past National President **Matt Rhoades,** CPG-7837, were introduced by mutual friend **Tom Cavanaugh,** CPG-10493, while at dinner. Bognar and Rhoades began the usual questioning of each other's history. What is your geologic area of practice? Who did you work for? Where did you work? And then the question, "Where are you from originally?". Both said Missouri. What part of Missouri? The response by both was "the St. Louis area". What part of the St. Louis area? Both responded – originally in the northern section of St. Louis County? What town? Both responded Florissant, MO. By this time Rhoades and Bognar now knew of a previously unknown close connection. Tom Cavanaugh sat there shaking his head in amazement!

The discussion went on to the point of discovery that Rhoades and Bognar had grown up literally just a couple of blocks from each other in Florissant, as boys had played each other's teams in baseball and frequented the same neighborhood park. The park had an iconic battle tank used in World War II that was there for the kids to enjoy and climb all over. They both learned that they had taken their earliest swimming lessons at the park's pool and had given Santa Claus their wish list upon guaranteeing him of good behavior that year – as Santa made his yearly stop at the park's administration building. Rhoades and Bognar had these mutual experiences some six decades ago.

This past November (2024) Rhoades and Bognar met for lunch in Florissant at a small blue-collar sports bar and afterward, took a tour of the old neighborhood, which still sported its mid-century modern architectural suburban style. It was a rather amazing afternoon of pleasantries as the coincidences of yesteryear continued to be uncovered.

When asked the question of each other – "What about growing up in Florissant, MO put you on the path to eventually become the National President of the American Institute of Professional Geologists?", Rhoades and Bognar both smiled and said, "Not a darn thing, this must just be an amazing coincidence."

Answers:

1. The answer is choice "b" since D is not a sill, but a tabular discordant pluton or dike. For the schematic stratigraphic section shown here, please refer to the table below:

Relative Age	Geologic Feature
Youngest	Dike D
	Bed C
	Dike Z and Sill S
	Bed L
	Unconformity U
	Fault F
	Bed Y
	Bed K
	Bed V
	Bed P
	Bed R
Oldest	Bed X

2. The answer is choice "d" or "fluvial." Point bars are deposited on the inside of stream meanders. Water velocity is slower along the inside of the meandering channel because it doesn't have to travel as far as the water on the outside of the bend. This allows sediment to settle out and be deposited as point bars. In contrast, water moves faster along the outside of the meandering stream channel creating an erosional side or a cut bank. Point bars are generally crescent shaped.

In an eolian environment, wind is the main mode of sediment transport. The paludal environment includes swamps, marshes, bogs (e.g., wetlands). Barrier bars are common in the littoral (coastal) and nearshore marine environments and exhibit roughly linear morphologies.

Point bar in Central Texas.

3. The answer is choice "d" or "Rocks of high density near the surface or deep-seated structures such as anticlines." These are related to positive gravity anomalies. Choices "a", "b" and "c" tend to relate to negative gravity anomalies.

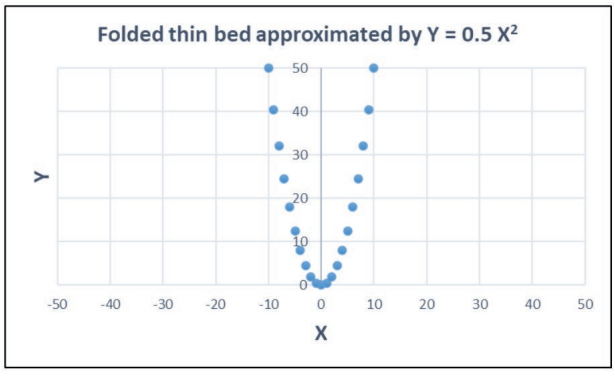
4. The answer is choice "b" or "40 acres, 371 = county."

In the Township-Range System, one section is equivalent to one square mile or 640 acres. Our well is to be drilled in Section 15 of Township 1 North and Range 3 West. The NW ¼ of the NE ¼ is one quarter of 160 acres or 40 acres. The API number 42-371-00263 reflects the state (42 = Texas), county (371 = Pecos) and the unique well number 00263.

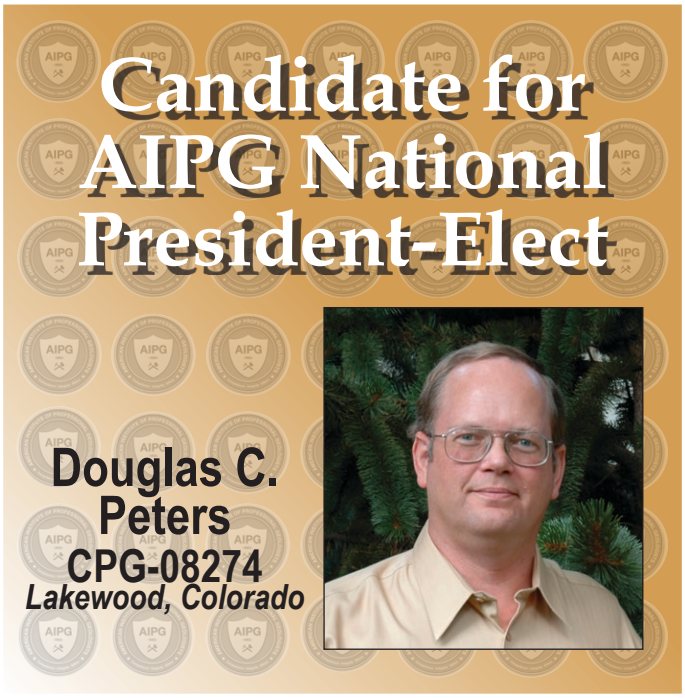
5. The answer is choice "a" or "20 feet; the structure is synclinal."

The equation $Y = 0.5\ X^2$ is that of a parabola with general formula: $Y = a\ (X-h)^2 + k$. In our example, the equation simplifies to $Y = a\ X^2$. Note that the parabola opens upward since "a" is positive (a = 0.5). Thus, the tightly folded thin bed is part of a synclinal structure. Please refer to the table and graph shown below for $Y = 0.5\ X^2$:

Y	X	Width at Y
0	0	
0.5	±1.0	
2.0	±2.0	4.0
4.5	±3.0	
8.0	±4.0	8.0
12.5	±5.0	
18.0	±6.0	12.0
24.5	±7.0	
32.0	±8.0	16.0
40.5	±9.0	
50.0	±10.0	20.0



At a given Y value, the horizontal distance between the limbs is 2|X|.



I am honored to have been asked to run for President-Elect and would consider it a great privilege to serve if elected. The three-year sequence of terms is a little daunting, but one must be willing to step up and serve a worthy organization wherever possible.

Many in the Colorado Section, especially the Denver Metro Area, know me from interactions on events over the years. More may know me from my approximately weekly compilations of "geo-events" that I have sent to members and interested parties for 26 years. My exposure outside of the region of Colorado has not been as abundant. So to help you know me better, I will give a synopsis of my schooling and work history.

My academic and work background has been varied to say the least. During grad school for my geology thesis, I worked on a remote sensing project for the USGS focused on alteration mineral mapping applied to uranium roll front deposits and host rocks in the Powder River Basin of east-central Wyoming. The mining engineering thesis was done as a consulting project for Climax Molybdenum Co. and specifically for staff at the Henderson molybdenum mine in Colorado. This involved a large physical model for simulating rock flow in sublevel caving and somewhat in block caving methods for bulk underground mining.

> "... the networking is one of the primary reasons for belonging to a geological or trade association. I feel that this broader environment is being missed by those who do not join such societies, and in particular AIPG because of the diversity of technical fields represented by our members."

After school, I began working on coal mine stability research at the U.S. Bureau of Mines Denver Research Center. Ironically, coal was perhaps the field I thought was least likely to be where I would work when I was an undergrad. Never say never! That structural geology research applied to underground mines eventually changed to environmental topics including subsidence over abandoned coal mines and acid-generating potential of metal mine wastes.

My Peters Geosciences consulting work after the Bureau closed in 1996 mostly remained in the environmental realm. This included historical analysis and geologic modeling for an inactive uranium mine in Washington and remote sensing technology demonstration projects on mine and mill wastes for the EPA in Idaho and NASA in Colorado and Utah.

Toward the end of those efforts, I got together with a group of like-minded geology and engineering folks (two having emigrated from Afghanistan) and put together two new companies to try and get development, exploration, and mining projects going in that war-torn and very underdeveloped country. We ended up having little success beyond coming in, as part of a proposal team, as #2 on what one day may be one of the biggest copper mine developments in Asia.

We also started a precious metals exploration company in the Western U.S., named ARNEVUT Resources Inc. (stands for Arizona-Nevada-Utah). We got our first property in 2007 and made intermittent progress (after a name change to TUVERA Exploration Inc. in 2014) on it through 2024 when we worked out a deal with a Canadian junior exploration company to take it over. Management positions in two other precious metals exploration companies (Strategic Minerals Inc. and Magma Gold Corp.) also came along in the intervening years.

I remain working for TUVERA and Magma trying to make progress with our exploration properties and hopefully advance at least one of them to a working mine someday. My consulting is done for these two companies and other small projects as they come along.

As you will see from my biographical information, posted online for each candidate, I have been active for a long time with the Colorado Section. This has led to a broad network of friends and acquaintances both within the section and in AIPG in general. There has always been a flow of information, both ways, that has enriched my career and life. After all, the networking is one of the primary reasons for belonging to a geological or trade association. I feel that this broader environment is being missed by those who do not join such societies, and in particular AIPG because of the diversity of technical fields represented by our members. Getting that sense of tangible and intangible benefits across to nonmembers and particularly students remains an important point of advocacy for the AIPG President and all members, especially CPGs.

We have the benefit in Colorado of having many members, compared to some sections, and have had very active volunteers, some serving for many years in a row or intermittently. A number of our sections have to deal with broadly spread out members or simply low numbers that make it hard to have regular events that can be supported by the available members and geological communities. As possible, I would like to work on improving section viability where help is needed during my term. Ultimately we would like to see all sections succeeding, but it can be a hard hill to climb as membership changes with time.

Official AIPG 2025 Ballot National Officer Election

President-Elect
President in 2027

☐ Doug Peters, CPG-08274

Secretary
Term of office 2026-2027

☐ Mark Howell, CPG-09563

☐ Hong Spores, CPG-11327

Editor
Term of office 2026-2027

☐ Adam Heft, CPG-10265

Vice-President
Term of office 2026

☐ Adam J. "Joey" Rosenfelder, CPG-11632

☐ Mark Schaaf, CPG-10723

Early Career Professional
Term of office 2026

☐ Skylar Vertes, ECP-1122

Name

_____

AIPG Member Number

_____

Vote online or mail in this ballot

YES! I want my name printed in the TPG!

Attention Members!

Due to privacy laws, we must now ask for your permission to publish your name in *The Professional Geologist.* We understand many were disappointed when the member directory omitted their names this year, so we're excited to announce that the list will be featured again in the first quarter 2026 edition.

You are opting in to have your name and member type published in *TPG* once a year.

To expand our communication beyond email, we're inviting *TPG* readers to complete and mail in this form. We see the need to communicate with our members using a variety of ways. If you are mailing in your ballot to vote for national officers, you can take this opportunity to give permission to have your name published in one-step. We would be honored to proudly showcase your name as a member of the Gold Standard of Geoscience professionals. Don't miss this opportunity to be featured!

☐ **Yes, Print my name in *TPG*!**

Name

_____

AIPG Member Number

_____

AIPG Member Type

_____

Mail to:
AIPG Headquarters
1333 W. 120th Avenue, Suite 211
Westminster, CO 80234

Mail in this form to have your name printed in the member directory.

Candidate for AIPG National Vice President

Adam J. "Joey" Rosenfelder
CPG-11632
Columbia, Missouri

> "As Vice President, I would bring a vision of AIPG broadening its impact as the preeminent professional geologist organization through outreach, mentoring, and professional training/ development opportunities. Over the past several years, AIPG has done a fantastic job of outreaching to universities across the country, resulting in an explosion of student-adjunct membership and over 50 student chapters."

I am truly honored to be nominated for the office of National AIPG Vice President and would like to thank the nominating committee for this opportunity. Since joining AIPG as a CPG member in 2013, I have been drawn to active participation, serving as President of the Missouri Section in 2016 and 2019. While I did not intend on jumping into a local leadership role so early on, I cannot overstate how rewarding those experiences were, both professionally and personally. Those leadership roles introduced me to a fantastic group of dedicated professionals in the Missouri Section, many of whom I now consider friends and mentors. Representing the Missouri Section at National AIPG Conferences in Anchorage, AK and Nashville, TN introduced me to a whole new group of dedicated professionals – not to mention some great experiences!

As a geologist for the United States Department of Agriculture – Natural Resources Conservation Service (USDA-NRCS), I am privileged to work with farmers and ranchers to conserve and manage natural resources on private lands and strengthen our nation's flood protection and water supply infrastructure. I have been with USDA-NRCS for my entire career and was extremely fortunate to be mentored early-on by two consummate professionals that taught me the important role geologists play in all facets of conservation engineering. While they taught me a great deal on the technical side of the job, some of the most important skills they imparted were in how to be a true professional. Part of being a true professional is the ability to utilize your technical knowledge to be a positive influence. This includes being able to convey information to a diverse audience, from the lay-person landowner to the senior geotechnical engineer, with the heart of a teacher. Having all the technical knowledge in the world is of little use if it cannot be communicated effectively. Perhaps their greatest impact on my career was instilling a sense of duty to serve the broader profession; to become an active and vocal advocate. Of course, they strongly encouraged me to become a member of AIPG!

As Vice President, I would bring a vision of AIPG broadening its impact as the preeminent professional geologist organization through outreach, mentoring, and professional training/ development opportunities. Over the past several years, AIPG has done a fantastic job of outreaching to universities across the country, resulting in an explosion of student-adjunct membership and over 50 student chapters. AIPG's presence at the university level is mutually beneficial, as we get brand recognition and membership numbers while the students (and faculty) have a direct connection to local professionals from their area keeping them informed of the ever-changing expectations and requirements for entering the workforce. AIPG has made significant strides in this effort in recent years, including the important addition of a 'Early Career Professional' member to the National Executive Committee and several workshops and events geared toward the young professional. Getting the students to sign up for free membership is one thing, but as we have seen, transitioning those student-adjuncts after graduation to Early Career Professional and Professional/CPG membership categories is quite another. This student to early career professional connection is very important to the Institute's future.

Equally important, perhaps more so, is the direct outreach we can all do individually to the young professionals previously unaffiliated with AIPG that we know and work with. One of the proudest accomplishments I had during my Missouri Section leadership tenure was reaching out to an impressive young professional geologist that I had worked with on a water supply reservoir project in north Missouri and asking her to consider joining AIPG. She took me up on that, joined AIPG, and now serves as our Missouri Section President. This simple act (and her willingness to jump in!) brought a spark of new enthusiasm and leadership to the section that we will hopefully build on in the coming years.

In the office of Vice President, I look forward to working with the various sections to understand what their issues are, what is working well that can be passed on to the other sections, and how the National Executive Committee can assist in strengthening each. I appreciate this opportunity to share my vision with the AIPG membership, and I thank you for your consideration for this office.

With continued gratitude, I am excited as a nominee for the AIPG National Executive Committee Vice President role for 2026. Thank-you to the nominating committee for their endorsement.

I am very excited to potentially extend my involvement with AIPG's Executive Committee as AIPG's Vice President. So often, it is all about the people. Being apart of AIPG's Executive Committee is no different => GREAT PEOPLE. There is so much time/work/effort spent by AIPG advocating directly and indirectly for the geology profession. Over the last four years, it has been a fun and fulfilling experience being involved with the people, the organization, and the work that makes AIPG such a great professional organization. I look back fondly at the opportunities to support AIPG and look forward to continuing in the years to come. I started on the Advisory Board in 2022 and was Treasurer in 2023 and 2024. I am also the AIPG representative for the Capitol Section and help with the Mentoring Program and other activities.

My love for geology is a genetic thing – my dad was a mining engineer and exploration geologist. He got me involved with the adventures and excitement of geology-related opportunities when I was a teenager growing up in Canada. I was involved with geophysical surveys, splitting core, supporting sampling programs before I even understood or appreciated the broad expanse of geology. I completed my undergraduate Earth Sciences/Geology degree at the University of Waterloo. Most summers I continued to expand my geology skills with various mineral exploration opportunities. From Waterloo, I went on to the Mineral Exploration graduate program at Queen's University in Kingston, Ontario. One of the graduate field trips was a three week tour of the Great Basin. We typically visited two mines a day and checked-out national parks of geological interest on weekends. I fell in love with Nevada – the raw, open geology. I was determined to find my first geology career opportunity in "The Mining State"! I landed a job and spent three years in Winnemucca, Nevada at the former Chimney Creek Mine. From there an opportunity emerged to work overseas. For over four years, I supported various mineral exploration projects in South America and Africa. I look back at my mineral exploration/mining opportunities with absolutely no regrets. So many adventures, great people, and fascinating rocks!!

> "There are so many important areas that AIPG is involved and supporting - from education to government policy, to climate change, energy, mineral exploration/development, resource management, conservation, coordination with other worldwide geoscience organizations and so many other important efforts."

In the late 1990s and early 2000s, I transitioned my geology background into environmental assessment and remediation. I moved from searching for gold deposits to defining the extent of bedrock groundwater contaminant plumes. My geology journey continues and looking back, it has provided so much. A few years ago, I realized it was time to give back!

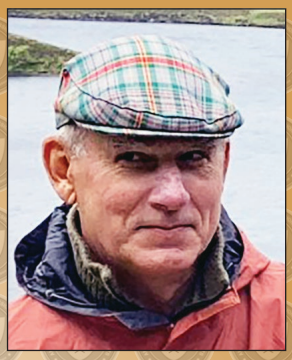
Finding my way to an active role in AIPG started with an underlying desire to both promote geology as a viable/needed career option and draw a few young STEM-centric students towards geology. I contacted AIPG initially in search of a "WHY GEOLOGY?" presentation to deliver at local high schools. I was also curious about AIPG's support and guidance for geology students and young geology professionals. As I started to interact with AIPG, I became aware of the AIPG mentoring program and have since greatly enjoyed the opportunities to support geology undergraduates and early-career professionals with their career and/or graduate school decisions. I truly believe looking for and providing mentoring support to young geologists is a critical component to both strengthening the future of AIPG and attracting AIPG's next generation of leadership.

There are so many important areas that AIPG is involved and supporting – from education to government policy, to climate change, energy, mineral exploration/development, resource management, conservation, coordination with other worldwide geoscience organizations and so many other important efforts. I look forward to the opportunity to continue my involvement with AIPG and support all fields of geology and the broader geosciences.

If elected as AIPG National Vice President, I look forward to (i) providing continued leadership and support with AIPG's ongoing support of geologists and other geoscience professionals, (ii) supporting, reviewing, and strengthening AIPG's membership retention and growth strategies for the next generation of geologists and other earth science professionals, (iii) ensure AIPG is available to ALL geologists in the US and beyond, (iv) broadly encouraging geoscience students to become members in AIPG and increase their awareness of the AIPG mentoring program, (v) supporting responsible resource development in developing North American-based strategic mineral supply; (vi) promoting appropriate environmental stewardship; (vii) endorsing the advancement and development of all energy types, (viii) continuing support and expansion of the Mentoring Program, and (ix) broadening AIPG's international visibility.

I very much look forward to the opportunity to serve and support AIPG, the Executive Committee and the membership at-large as the AIPG's National Executive Committee Vice President. Thank-you for your time and consideration. Explore AIPG! There's a lot to discover!

Candidate for AIPG National Secretary



Mark J. Howell
CPG-09563
Danville, Indiana

It is an honor to be nominated for the position of secretary of AIPG, the leading organization for professional geologists. Our profession faces challenges that result from shifting global resource requirements, policy uncertainties related to those requirements, and changing curricula in the geoscience departments of our universities. At the same time, there are exciting times ahead for geoscientists. We will be called to solve problems never tackled before, not only from a technical perspective but in a broader, more holistic sense. I believe AIPG will continue its vital role during these times and will share in both the challenges and excitement. My vision is to help AIPG in its support of a dynamic and shifting geoscience profession.

The need to transition to sustainable energy has increased the public visibility and geopolitical role of strategic minerals. At the same time, the role of conventional petroleum and coal remain very much in debate. I expect the result will be continued, broad swings in policy at local, federal and global scales. Unfortunately, this will result in strong but uneven demand for geoscience professionals, and a concomitant swing in the supply of geoscience professionals.

Other challenges stem from the changing nature of the geoscience professional. The demographics of the workforce tends to have greater numbers at the extremes of the senior and junior age groups, and a thinning of personnel at the middle of the group. At the same time, there has been a reduction in the number and/or geologic focus of university earth science programs. Upcoming generations often have spent less time outdoors and seem more comfortable inside with a computer than outside with the mosquitoes. Yet the solution to many geological problems will still require boots on the ground and nose on the core.

I am excited for the future of professional geologists. Geoscientists will be called to explore and develop energy resources while being challenged to innovate environmentally responsible ways to get resources to market. Companies will need to recognize and respect a labor force that is more attuned to well-being and diversity. The requirement for geoscience education will be essential to educate students, politicians, regulators and the general public. New tools exist to help with these challenges, in data acquisition, processing, interpretation — and perhaps soon, cognition.

AIPG will continue to have a vital role as the profession evolves. I believe one of the most important will be a role in the onboarding of students and early career workers into their professional practice. Our continuing education and mentoring programs will be valuable means of transferring professional knowledge as older workers leave a workforce that will be thinned by the age gap. I believe AIPG is well positioned to support geoscience firms and individuals with learning opportunities related to technical issues as well as business practices.

This work, always combined with our emphasis on competence, integrity and ethics will keep AIPG as the leading organization for professional geologists. I look forward to the challenges and excitement. Thank you for the opportunity to contribute to this organization.

> "AIPG will continue to have a vital role as the profession evolves. I believe one of the most important will be a role in the onboarding of students and early career workers into their professional practice. Our continuing education and mentoring programs will be valuable means of transferring professional knowledge as older workers leave a workforce that will be thinned by the age gap."

I am grateful to the Nomination Committee for their confidence and for allowing me this opportunity to run for AIPG Secretary. I have been a member for the last 15 years and have proudly been a CPG for most, if not all, of that time. The dedication I see in this organization is second to none. So many professionals at both the local and national levels have poured their time and energy into advancing our profession and upholding the quality of work in our field. I hope to be selected to help contribute and add value to the organization.

To start, I have been in this profession for over 24 years. My educational background includes a Bachelor of Science in Geology from the University of Minnesota, Twin Cities, and a Master of Business Administration from the University of St. Thomas. I believe this combination of science and business backgrounds pairs well together and has given me an advantage for work in the consulting field as a Senior Hydrogeologist. I am a licensed Professional Geologist in Minnesota and have been with my current employer, HDR Engineering since I graduated from college. While I have not had the opportunity to bounce around to various employers to gain different experiences, I've been privileged to work alongside incredible colleagues from similar and varied backgrounds throughout our nation and across the globe. I am the national practice leader for Phase I ESAs for our firm of over 13,000 employees. I am responsible internally for upholding the quality of our work, training our staff, and staying current on changing regulations and standards.

> "I believe having representation from all areas of our professional community is essential. This is something I would like to help advance in my role on the AIPG executive board."

While with AIPG, I served as Vice President for the Minnesota Chapter. I was grateful for the connections I made through AIPG and was energized by a community of geologists who were passionate about what they do. I've also been able to serve on other professional boards, such as the University of Minnesota's Earth & Environmental Sciences Advisory Board (Board Member) and the Minnesota Association of Environmental Professionals (Director-at-Large). My experiences on both these boards have given me access to what is essential to emerging professionals and the challenges of other related fields. This insight has been invaluable to my own professional growth, and I intend to bring it to the AIPG board if elected.

My strengths include communication, leadership, and attention to detail. I can take in technical information and make it digestible for various audiences. I know what it is like to work with highly technical people and people who want to understand enough science to make a business decision. Education and mentorship are also critical to me. I haven't forgotten what it's like to be green and fresh out of college. Access to experienced professionals and mentorship can make a difference for a budding geologist. The workforce is constantly changing, and differences between junior-level and senior-level geologists can sometimes be polarizing. How can we help as a professional organization to capture the institutional knowledge of our most senior professionals and make sure it is passed on to future leaders? Differences in workstyles, communication, demographics, work-life balance, and even remote work have brought forth changes to our work that are constantly evolving. I believe having representation from all areas of our professional community is essential. This is something I would like to help advance in my role on the AIPG executive board.

I believe that an organization's strength is defined by the engagement of its leaders, members, and contributors. I want to help uphold the quality expected from AIPG and continue to grow the benefits to our members. Even though I have not held a national position, my professional experience has been coast to coast. I have worked with peers from all over our country. I would love to bring my experience to AIPG in the national role as Secretary. I appreciate your consideration.

Join the AIPG Website Workgroup!

OUR OBJECTIVES

- Website Enhancement
- Brand Recognition
- Resource Sharing

WHY PARTICIPATE?

- Influence AIPG's Digital Future
- Opportunity to meet and work with members.
- Support Section Autonomy

Contact Robert Andrews at reandrews@earthlink.net

Candidate for AIPG National Early Career Professional

Skylar Vertes
ECP-1122
Hendersonville, North Carolina

I am truly honored to accept the nomination for the AIPG Early Career Professional (ECP) Representative of the Executive Committee. This nomination is not only a privilege but also an opportunity to give back to an organization that has significantly shaped my career. I am eager to represent and support early career professionals and students as they navigate the exciting and evolving field of geoscience.

As someone in the early stages of my professional journey, I understand the challenges and uncertainties that accompany this phase. From exploring career paths to developing technical expertise and building a professional network, these formative years are crucial. AIPG has provided me with mentorship, resources, and a strong professional community, and I am committed to ensuring that other ECP and student members experience the same support and opportunities. Effective leadership involves actively listening to and representing the needs of the community. As an Early Career Professional in Geology, my vision for this position is to serve as a bridge between the emerging voices in the field and the broader geological community. I aim to foster an inclusive environment where early career professionals can thrive by providing platforms for networking, mentorship, and collaboration.

By championing their unique perspectives and needs, I envision a future where the contributions of early career geologists are valued and integrated into the ongoing evolution of the profession. My goal is to ensure that AIPG remains a dynamic, forward-thinking organization that not only supports the growth of its members but also leads the way in advancing the field of geology. Through innovation, inclusivity, and active engagement, I am committed to inspiring the next generation of geologists to make meaningful contributions to both the profession and the world.

My background includes experience in various aspects of geoscience, where I have applied geological expertise to support sustainability, research, and problem-solving in diverse settings. I believe that integrity and ethical responsibility are fundamental to the practice of geoscience and should be emphasized from the start of every geoscientist's career. I greatly respect AIPG's dedication to ethical standards and professional integrity, and I am committed to fostering these values among early career and student members.

If elected, I will focus on the following objectives:

1. Strengthening Student and Early Career Engagement

Developing new outreach initiatives to engage students and early career professionals, ensuring they have access to resources and opportunities within AIPG.

Facilitating both virtual and in-person networking events that create connections between students, early career professionals, and experienced geologists.

Hosting career-focused panels and workshops featuring industry experts to provide guidance on transitioning from academia to the professional world.

2. Building a Stronger Professional Foundation for Early Career Geologists

Introducing hands-on training and certification programs that equip early career professionals with critical technical and leadership skills.

Providing study resources, peer mentorship, and expert-led preparation sessions to support professional development and technical competency.

Establishing a mentorship network that pairs students and early career professionals with experienced AIPG members for career guidance, technical advice, and professional growth.

3. Strengthening Geoscience Representation and Ethical Leadership

Developing ethics-focused discussions and resources to encourage responsible decision-making and integrity in the geoscience profession.

Encouraging active participation from students and early career professionals in AIPG-led outreach, advocacy campaigns, and public awareness initiatives to elevate the voice of geoscientists.

My goal as the ECP Representative is to enhance engagement among early career professionals and students, providing them with the resources and support necessary to excel in the geoscience field. I am dedicated to fostering meaningful mentorship connections, expanding professional development opportunities, and advocating for the value of geoscience in society. By strengthening outreach, training, and ethical leadership, I aim to ensure that AIPG continues to be a valuable resource for emerging geoscientists. AIPG has provided me with invaluable opportunities for growth, networking, and professional development. Serving as the ECP Representative would allow me to contribute to the organization in a meaningful way, helping to shape the future of geoscience and support those entering the field. I am excited about the possibility of working alongside my peers to expand resources, promote ethical leadership, and foster a strong community within AIPG.

Thank you for considering my nomination. I am eager for the opportunity to serve and contribute to the continued success of AIPG and its members.

Late in 2023 I was asked by our then President Dawn Garcia whether I would stand for a third term as National Editor. Her comments to me were that I've done a great job during my current and previous term as Editor, and that she hoped I'd be willing to consider the opportunity to extend my service to AIPG yet again. She acknowledged that the position of Editor is perhaps the most challenging position on the Executive Committee and that the job I've done so far shows that I'm up for it.

But this was put on hold for a year when, while preparing the Apr/May/Jun 2024 edition of *TPG*, I discovered that the Editor was supposed to stand for election in odd numbered years, not the even as it had been the last several terms. Having brought this to the attention of the rest of the Executive Committee, our 2024 President Shanna Schmitt decided to solve the problem by appointing me to serve as Editor in 2025 and putting the election cycle back in the correct year. And after reiterating Dawn's comments about the job I'd been doing asked if I'd still consider serving for a third term as Editor.

I had to give serious consideration to what I'd been asked. There are several factors that I had to think about before making the decision. First, and easiest to answer is whether I wanted to serve AIPG in this capacity. Given that I've been doing so for four years, it was a bit of a no-brainer. Nothing had changed in this regard; I've enjoyed serving as your Editor and bringing you the latest news and relevant content in The Professional Geologist. This consideration was an easy "yes".

> "I look forward to the continued commitment to make AIPG the premier supporter and gold standard of professional geologists, and I anticipate the opportunity to continue to serve AIPG as your Editor. "

Next was the consideration of whether I have the time. Not only to serve in the position, but to put in the level of effort the position deserves. This was a bit more difficult to answer. Time is precious to all of us, and there are demands from our career, our family and friends, and our volunteer efforts. In addition, Sara and I have been working on a number of home improvement projects (yes, we do almost all of these ourselves). These of course demand additional time, particularly when something doesn't go quite as planned and you find there are additional things that must be completed before the project you were focused on can be completed. Murphy's law, right? But even with all these competing demands for my time, there is almost always a way to make things work out so that everything you want to do can be completed. I've found that it often comes down to scheduling; I've learned that making lists and establishing deadlines is very helpful. And given that I've been able to make everything work over the last few years, I felt that I can continue to manage time so that everything gets done on schedule. If you recall from some of my past Editor's columns, one of the things I really dislike is to blow a deadline. So far, each of the editions of *TPG* since I've been Editor have been out on schedule – that is, by the beginning of the month of the quarter for which the edition is for – except for one. And that was beyond my control because certain critical information for the edition was not available when it should have been. So yes, I have the time.

The third consideration is a bit more nebulous and harder to put into words. It has to do with completing something you've started. I'm not one to leave a project half finished, even if it takes a little while to get it done. *TPG* can't be directly compared to that, because when one edition is completed, the project isn't over – there is always the next issue. But I've also been working on improving our publication: it's appearance, content, and what I'll call its "sufficiency". And by that, I mean the degree to which TPG pays for itself. Traditionally, our members' dues have paid for the publication, and while this is true, I feel that by soliciting advertisers in our industry, *TPG* can become a source of non-dues revenue. If you've been paying attention to each edition of *TPG* over the last few years, you've probably noticed changes in the format, layout, and content. More recently, I've been working on soliciting advertisers. The Jan/Feb/Mar 2024 had the first of those ads appear. So, while I think the layout of *TPG* has improved, there is still room for improvement, and I think it may take another term as editor to get it to the point where I'm satisfied with what I've done and how it looks. Something that my grandfather instilled in me when I was young was "if a job is worth doing, it is worth doing well." I hope that I'm living up to that credo.

I feel that my experience over the last few years serves me well in continuing to benefit AIPG through my service. I look forward to the continued commitment to make AIPG the premier supporter and gold standard of professional geologists, and I anticipate the opportunity to continue to serve AIPG as your Editor. I would be honored if you would consider voting for me yet again. Please contact me if you have any questions or if you would like to discuss an article or other content you would like to submit for publication; my email address is adam.heft@wsp.com. Thank you for your consideration.

CANDIDATE FOR AIPG NATIONAL 2026 PRESIDENT-ELECT

Douglas C. Peters

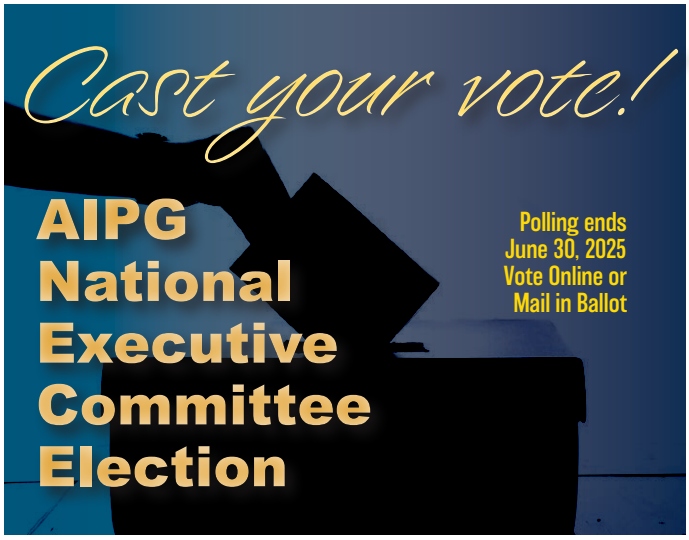
CPG-08274
Lakewood, Colorado

Statement of Purpose or Goals you have for AIPG: To maintain financial stability of the Institute and pursue where possible new or expanded sources of revenue for both the Institute and Foundation over the next three years. To work with the Executive Committee and other volunteers to increase membership and recognition of value of AIPG membership among students and early career professionals leading to eventual CPG membership. Also to encourage further cooperative efforts with other societies and relevant organizations..

Universities Attended	Degrees Granted	Dates
Colorado School of Mines	M.S. Mining Engineering	1981-1983
Colorado School of Mines	M.S. Geology	1977-1981
University of Pittsburgh	B.S. Earth & Planetary Sciences	1973-1977

Company	Title	Dates
Magma Gold Corp.	CEO & President	2014-present
TUVERA Corporation	President & CEO	2013-Present
ARNEVUT Resources, Inc.	President & COO	2007-2014
Strategic Mining Corp.	Interim President & CEO, VP Exploration	2011-2012
Afghan Minerals Inc.	Secretary/Treasurer	2004-2010
Afghan American Engineering, LLC	Principal and Treasurer	2003-2012
Peters Geosciences	Owner	1996-Present
US Bureau of Mines	Principal Investigator	1984-1996
Climax Molybdenum Co.	Consultant	1981-1982
US Geological Survey	Geologist	1978-1980
Engineering Mechanics Inc.	Lab Tech . & Field Inspector	1973-1977(summers)

AIPG Activities	Dates
Presidential Certificate of Merit Award	2024
Annual Conference Committee - Technical Program Chair	2024
Section Leadership Award	2014
Annual Conference Committee - Technical Program Co-Chair	2018
Teller Committee	2000-2016
Colorado Section Screening Board Co-Chair	2023-Present
Colorado Section Events E-Mail Editor	1996-Present
Colorado Section Annual Field Trip Organizer/Coordinator	2018,2019
Colorado Section Newsletter Editor	2013-2015
Colorado Section Advisor	2019-2021
Colorado Section President-Elect, President, Past-President	1998-1999, 2004-2006, 2017-2019
Colorado Section Secretary	1997



CANDIDATE FOR AIPG NATIONAL 2026-2027 EDITOR

Adam Heft

CPG-10265
Portland, Michigan

Statement of Purpose or Goals you have for AIPG: My goals as Editor are to continue to communicate the state of the profession to members, continue to solicit and publish relevant technical articles, remind members of the value of AIPG membership, and to continue to make improvements in the *The Professional Geologist*.

Universities Attended	Degrees Granted	Dates
Michigan State University	M.S. Geology	1990-1993
Central Michigan University	B.S. Geology and Earth Science	1985-1990

Company	Title	Dates
WSP USA	Senior Supervising Geologist	2017-present
Parsons Brinkerhof	Senior Supervising Geologist	2009-2017
Fitzgerald Henne & Associates	Project Manager	1994-2009
Peterson Environmental Services	Field Geologist	1993-1994

AIPG Activities	Dates
National Editor	2021-present
National Committee Conference Chairman (44th & 59th)	2007 & 2022
Martin Van Couvering Memorial Award recipient	2020
National President Elect, President, Past President	2016-2018
Section Leadership Award	2014
Michigan Section Delegate to the Advisory Board	2011 & 2014
AIPG booth volunteer for the GSA regional meeting	2013 & 2023
National Secretary	2010-2011
National Executive Committee Member - Advisory Board	2009
Michigan Section Newsletter Editor	2008-present
Presidential Certificate of Merit	2008
Significant Contribution to the Michigan Section Award	2007 and 2024
Michigan Section Assistant Newsletter Editor	1999-2007

CANDIDATE FOR AIPG NATIONAL 2026 EARLY CAREER PROFESSIONAL

Skylar Vertes

ECP-1122
Hendersonville, North Carolina

Statement of Purpose or Goals you have for AIPG: My goal as the ECP Representative is to enhance engagement among early career professionals and students, providing them with the resources and support necessary to excel in the geoscience field. I am dedicated to fostering meaningful mentorship connections, expanding professional development opportunities, and advocating for the value of geoscience in society. By strengthening outreach, training, and ethical leadership, I aim to ensure that AIPG continues to be a valuable resource for emerging geoscientists.

Universities Attended	Degrees Granted	Dates
Colorado School of Mines	M.S. Mineral & Energy Economics	2022-2023
Tulane University	B.S. Public Health, minor in Geology and marine biology	2018-2022

Company	Title	Dates
Stantec	Mineral Economist & Risk Coordinator	1/2024-Present

CANDIDATE FOR AIPG NATIONAL 2026 VICE PRESIDENT

Adam J. "Joey" Rosenfelder

CPG-11632
Columbia, Missouri

Statement of Purpose or Goals you have for AIPG: My purpose in seeking this position is to help AIPG parlay recent successes in student-adjunct recruitment and young professional outreach into a resurgence in professional membership numbers and active participation. There are many exciting things going on at the national level and in sections across the country, and I think there are other innovative ways for AIPG to broaden its impact as the preeminent professional geologist organization through outreach, mentoring, and professional training/development opportunities.

Universities Attended	Degrees Granted	Dates
Northwest Missouri State University	B.S. Geology: Environmental	2004

Company	Title	Dates
US Department of Agriculture - Natural Resources Conservation Service	Geologist	2004-present

AIPG Activities	Dates
Missouri Section President- Elect, President	2018-2019
Missouri Section President-Elect, President, Past-President	2014-2017
Annual Meeting Missouri Section Delegate	2015 & 2016

CANDIDATE FOR AIPG NATIONAL 2026 VICE PRESIDENT

Mark Schaaf

CPG-10723
Hanover, Maryland

Statement of Purpose or Goals you have for AIPG: To provide commitment and support to AIPG in its continuing support of geologists and other earth science professionals. Areas of interest include: (i) supporting, reviewing, and strengthening AIPG's membership growth strategies, (ii) AIPG's mentoring program (iii) broadening AIPG's international visibility.

Universities Attended	Degrees Granted	Dates
Queen's University, Canada	M.S. Geology	1989
University of Waterloo	B.S. Geology	1990

Company	Title	Dates
Kleinfelder	Senior Program Manager	2005-present
Terracon	Project Manager	2000-2005
Golden Star	Senior Exploration Geologist	1993-1998
Goldfields	Mine Geologist	1990-1993

AIPG Activities	Dates
Mentoring Committee	2024-2025
National Treasurer	2023-2024
National Advisory Board Representative	2022

CANDIDATE FOR AIPG NATIONAL 2026-2027 SECRETARY

Mark J. Howell

CPG-09563
Danville, Indiana

Statement of Purpose or Goals you have for AIPG: My vision is to help AIPG in its support of a dynamic and shifting geoscience profession.

Universities Attended	Degrees Granted	Dates
Wright State University	M.S. Geological Sciences	1988
Wright State University	B.S. Geological Sciences	1985

Company	Title	Dates
Xenon Geosciences	President, Geologist, Geophysicist	1997-present
Earth Exploration	Senior Geologist, Geophysicist	2001-2009
Terran Corporation	Senior Geologist	1994-1997
DLZ Corporation	Senior Geologist	1991-1994
Miami Geological Services	President, Geologist	1989-1991
Keck Consulting	Staff Geologist	1988-1991

AIPG Activities	Dates
National Advisory Board Representative	2024
Illinois - Indiana Section - Secretary	2023-2024
Illinois - Indiana Section - Legislative Affairs Committee	2004
Ohio Section - President-Elect, President, Past-President	2001-2003

CANDIDATE FOR AIPG NATIONAL 2026-2027 SECRETARY

Hong Spores

CPG-11327
Minneapolis, Minnesota

Statement of Purpose or Goals you have for AIPG: To continue looking for meaningful ways to add value for our members. Strategize ways to increase engagement at all levels of membership, because the past (retirees), present (professionals), and future (students) all play a critical role in advancing this organization.

Universities Attended	Degrees Granted	Dates
University of St. Thomas	M.B.A.	2008
University of Minnesota, Twin Cities	B.S. Geology	2000

Company	Title	Dates
HDR Engineering, Inc.	Senior Hydrogeologist Phase I ESA Practice Leader	2000-present

AIPG Activities	Dates
Minnesota Section Vice President	2016-2017

Electronic voting available via email. Watch your inbox to vote online.

Mail in ballot available on page 43 of this issue.

Mail to:

AIPG Headquarters
1333 W. 120th Avenue, Suite 211
Westminster, CO 80234

Earth Science News is Most Popular:

Implications for Geoscience Education

Rasoul Sorkhabi, Ph.D., CPG-11981

Dr. Rasoul Sorkhabi is a professor at the University of Utah's Energy & Geoscience Institute, Salt Lake City.
Email: rsorkhabi@egi.utah.edu

Abstract

The popular science magazine *Discover* in its January-February issue each year reports on the major science discoveries of the previous year. A survey of science news items covered in these annual reviews of *Discover* for the period 2013-2025 (13 years) shows that earth science news occupies top rank relative to other sciences in 11 out of the 13 years. This indicates the enormous popularity of earth science among the media and public, and should be an encouraging factor in geoscience education, research, and workforce development.

Motivation

How popular, relevant or important is earth science? This question has significant implications for geoscience education, employment, funding, research, public support, and workforce development. One way to address this question is to assess how much earth science news is covered in popular magazines. For this purpose, I surveyed the annual review issues of *Discover* magazine (2013-2025) (Figure 1) to create a metric for the reporting of significant and popular science news items for various disciplines. The good news is that earth science news appears to rank top and remains highly popular with the readers for the 13 years surveyed.

Method and Results

Discover is a bimonthly popular science magazine that has been published since 2010 by the Wisconsin-based Kalmbach Media (also publisher Astronomy and Deep Sky). It was launched in 1980 by Times Inc. before its sale to Kalmbach Media. *Discover* publishes science articles and news, mainly written by science journalists, that are easier to read than *Scientific American* or *American Scientist*. Its circulation via both subscription and its online website reaches over 500,000 people. The January-February issues of *Discover* are usually devoted to reporting the major science discoveries of the previous years. These special issues, called "Year in Science," included "100 Top Stories" until 2019. After 2019, the special issues entitled "The State of Science," cut down on the number of discoveries but expanded on the article length for each story. For this survey, I used the January-February issues of *Discover* published for the period 2013-2025 (13 years, Figure 1) in order the assess the number of news stories in earth sciences (*sensu lato*) relative to other sciences. The results are shown in Table 1.

I tabulated the *Discover's* science stories under nine categories: (1) Mathematics and Physical Sciences, (2) Space Science and Astronomy, (3) Earth, Environment and Energy, (4) Archeology and Paleontology, (5) Medicine and Life Sciences, (6) Neuroscience and Behavioral Sciences, (7) Technology as related to Culture and Entertainment, (8) Policy issues, and (9) Other. Of these, "Earth, Environment, and Energy" category as well as "Archeology and Paleontology" category belong to the Earth Science in a broad sense. Note that most of the discoveries related to "Archeology" were concerned with the evolution of humans – an interdisciplinary field called both human paleontology or physical anthropology, and hence included in "Earth Science" in this survey. The results show that the Earth Science category topped the list for the years 2014,

Figure 1. Cover images of the January-February issues (2013-2025) of Discover which is usually devoted to top science news stories of the previous year.

Table 1 - "Best Discoveries of Science" reported by the Discover magazine (January-February issues, 2013-2025).

Disciplines	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Math & Physical Sciences	5	9	11	8	7	10	8	3	5	0	0	0	0
Space & Astronomy	18	15	15	17	16	14	17	7	3	3	4	2	3
Earth, Environment & Energy	11	13	14	11	9	13	22	8	3	10	6	8	5
Archaeology & Paleontology	11	8	11	19	17	19	15	7	5	6	5	6	4
Medicine & Life Sciences	33	23	19	23	22	24	19	13	8	9	9	7	9
Neuroscience / Behavior	6	13	11	10	13	8	6	5	0	0	2	2	3
Technology & Society	14	9	13	5	7	8	5	4	3	0	2	3	0
Policy	1	4	6	3	8	4	9	0	1	4	4	3	0
Other	1	6	0	4	1	0	0	0	0	0	0	0	0

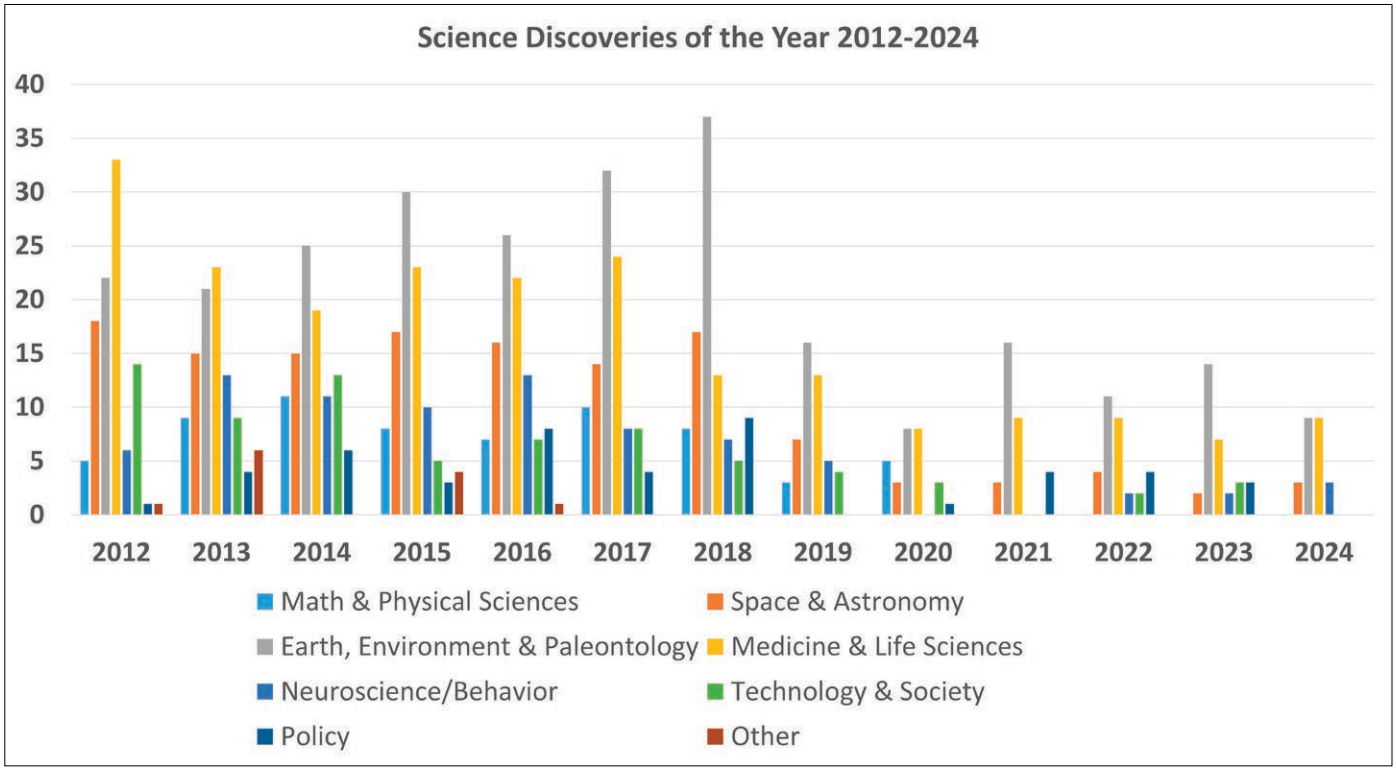


Figure 3. "Best Discoveries of Science" reported by the Discover magazine (January-February issues, 2013-2025) and categorized by subject.

2015, 2016, 2017, 2018, 2019, 2021, 2022, and 2023 (9 out of 13 years); it was second to Medicine and Life Science for the years 2012 and 2013 and was even with Medicine and Life Sciences for the years 2020 and 2025 (Table 1 and Figure 2).

Although there is some subjectivity in selecting the "best" science discoveries for a given year, it is reasonable to assume that the editors of *Discover* consider the importance of the discoveries as well as the interest of the public – their readers. Among the earth science news items, climate change, human origins, and the dinosaurs are most frequently covered.

A Random Harvest

As a case study of popularity of earth science news, let's take a look at the relevant stories covered in the January-February 2025 issue of *Discover*.

1. Because of global warming, Venezuela's last glacier, Humboldt Glacier, dwindled to an ice field in 2024.
2. Two studies in 2024 estimated subsidence rates of coastal towns in China and the USA.
3. The term Anthropocene was not approved as an official geologic epoch by the International Union of Geological Sciences.
4. The Florida Museum of Natural History published an online database and images of over 130,000 vertebrates that are very useful references and information sources for biologists and paleontologists.
5. Recent research shows incipient ocean floor subduction in the Atlantic Ocean because of plate tectonic "invasion" from the Mediterranean Sea.

6. New archeological finds show adornments made by Ice Age people in today's Czech Republic some 30,000 years ago.

7. Soft tissues are rarely fossilized. But several skin impressions alongside patches of carbonized reptilian tissues from the Last Permian were found in sedimentary rocks in a cave in Oklahoma.

8. A research study in 2024 reported 100-Ma fossilized trunks of gymnosperm trees and tracks from Alaskan dinosaurs and birds, revealing the region to have been warm and wet during mid-Cretaceous times.

9. The ape *Gigantopithecus*, 10-foot tall and weighing up to 660 pounds, has been recognized as the biggest primate ever to live. The ape appeared about 2.3 Ma. A study of teeth and jawbones from *Gigantopithecus* found in southern China's cave deposits indicate that *Gigantopithecus* became extinct between 295,000 and 215,000 years ago due to major environmental change from thick forests with abundant fruit to shrubby dry grassland.

Implications

The results of this survey show that there is an enormous interest among the public in earth science. This is also consistent with our common observations and school studies indicating that a large number of children are curious to learn about gemstones and fossils (e.g., Tulip et al., 1994; Trend, 2005).

The popularity of earth science among the public is in a sharp contrast with the current position of geoscience courses in high schools and universities. In 2015, the American Geoscience Institute collected data on high school science graduation requirements for all states in the USA. The survey found that while 22 states *accepted* an Earth and Space Science course for graduation, only two states *required* a year-long Earth/Environmental Science course, whereas the number of states which required Life Science and Physical Science courses for graduation were 50 and 30, respectively (Center for Geoscience and Society, 2015). Moreover, the number of university graduates in geoscience has dwindled in recent years (Keane et al., 2022), and some universities have even slashed or merged geoscience departments (Nature Reviews, 2021). A recent report by UNESCO and American Geophysical Union (Capello et al., 22023) has even suggested a "crisis identity" in geoscience.

Against this backdrop, the fact that coverage of earth science news is highly popular opens a window of opportunity for geoscience educators to tap into this public interest and incorporate it in designing and teaching popular courses, public support for research projects, policy debates, and contributions to our culture as a whole. According to a joint position statement by the National Earth Science Teachers Association (NESTA) and the National Association of Geoscience Teachers (NAGT), teaching earth Science "offers experience in a diverse range of interrelated scientific disciplines; it is closely related to the student's natural surroundings and offers students subject matter which has direct application to their lives and the world around them" (NESTA and NAGT, 2015).

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President's Message, Continued from p. 35

sibility to bridge the gap between complex scientific research and everyday understanding. This begins with clear communication—explaining how we study the earth and its processes, how we ensure the reliability of our data, and how our findings inform policy decisions that affect millions of lives.

In today's digital world, it is more important than ever to build a legacy of trust. We must be the voices of truth and reason in a landscape saturated with uncertainty. By demystifying our work and sharing our passion for the earth sciences, we not only highlight the importance of our field but also demonstrate our commitment to ethical conduct and professional excellence.

Imagine a future where every public discussion about environmental risks, resource management, or natural hazards features insights from geoscientists who are experts in their field and champions of transparency and integrity. Each lecture, social media post, or interview is a chance to showcase the value we bring to national priorities such as critical mineral supply, workforce development, and security. In doing so, we reinforce our role as indispensable contributors to the well-being and progress of our society.

Call to Action

Now, more than ever, it is imperative that we renew our commitment to educate, inspire, and build trust. Let us embrace modern communication channels while upholding the traditions of rigorous scientific inquiry and ethical responsibility. Whether through engaging public talks, interactive online sessions, or written articles, every effort counts in re-establishing the public's confidence in science.

As geoscientists, we have a duty not only to uncover the mysteries of the earth but also to ensure that our findings are accessible, credible, and relevant to the challenges of our time. By stepping up as trusted experts and communicators, we can restore the public's trust in science, empower informed decision-making, and pave the way for a future where scientific integrity guides national and global progress.

Building the Future of Geology

Support the Foundation of the AIPG

At the heart of the American Institute of Professional Geologists is our commitment to shaping the future of the geosciences—and the AIPG Foundation makes that vision possible. Your generous support fuels programs that empower tomorrow's leaders in geology through:

- **Student Scholarships and Graduate Awards:** In 2024, your donations enabled us to provide life-changing undergraduate scholarships and the prestigious William J. Siok Graduate Student Scholarship.
- **Workshops and Educational Programs:** From student and young professional workshops to innovative educational initiatives for practitioners, the public, and policymakers, your contributions drive the growth and success of our community.
- **Pioneering Field Experiences:** We proudly supported the American Geosciences Institute in launching a dynamic field experience program for K-12 geoscience teachers, inspiring young minds to explore the wonders of geology.

Every donation directly builds the future of geology. Your support transforms passionate learners into tomorrow's experts, ensuring our field continues to thrive and innovate.

Looking ahead to the National Conference in St. Louis, we're excited to unveil new fundraising initiatives, including a silent auction and an exclusive field trip to Missouri's remarkable karst features. These events not only celebrate our rich geological heritage but also enable us to expand our educational programs and outreach.

Join us in igniting the spark of discovery. Your donation is more than a gift—it's an investment in the future of our profession. For more information on how you can help or to discuss donation opportunities, please contact us or visit the AIPG website.

Thank you for being an essential part of our journey and for your unwavering commitment to the geosciences.

Mike Lawless

Michael D. Lawless, CPG, PG
Chairperson, Foundation of the AIPG
540-557-1319 office phone

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In Memoriam

Robert D. Gunn, CPG-02632

Whichita Falls, Texas

March 6, 1925 - August 3, 2024

Member Since 1979

Obituary and photograph obtained from the Lunn's Colonial Funeral Home website.

After having lived a remarkably full life, Robert DeMarle Gunn passed away peacefully on August 3, 2024, at the age of 99. The elder son of Florence Keller Gunn and William DeMarle Gunn, Bob began life on March 6, 1925, in St. Paul, Minnesota, but it would be in Texas that he would make his mark and live out the last seven and one-half decades of his life as an independent exploration geologist. The path would begin with a BA in geology from the University of Minnesota that led to a job with the Texas Company (Texaco) in Wichita Falls in the spring of 1949. In a relatively short time, he took the natural turn of someone of his temperament and founded Gunn Oil Company in 1958, serving as Chairman of the Board for more than sixty years. One of the highlights of his career was negotiating an agreement with Anne Burnett Tandy during the late 1960s to drill for oil on the Four Sixes Ranch headquartered in Guthrie, Texas.

Over the years Bob became a well-known figure in the oil industry and held several national leadership posts, including president of the American Association of Petroleum Geologists (AAPG), founding member of the Board of Trustees of the AAPG Foundation, and Director of the Independent Petroleum Association of America. He was the recipient of the AAPG's highest award, the Sydney Powers Memorial Medal, and honored as an industry legend during ceremonies commemorating the AAPG's 100th anniversary. His contribution to the field was noted by his alma mater during the 1980s when he was awarded an Outstanding Achievement Award in a scientific discipline.

Known for being a long-time supporter of the Boys and Girls Club of Wichita Falls, he coached several Boys Club football teams during the early years, including those on which his sons Bill and Vince played, and, remarkably, sat on the Club's Board for fifty years. In 2021 at the age of 96, he once again stepped forward when he and his wife Carol agreed to serve as Honorary Chairs of the Boys and Girls Club's comprehensive Capital Campaign to raise funds for long-discussed projects close to Bob's heart. The campaign was a success, and, to his delight, Bob lived to see the completion of the new Eastside Boys and Girls Club on Rosewood Street.

As a team, Bob and Carol were instrumental in raising the funds to build the Bridwell Tower complex at United Regional Hospital. They also were committed to the mission of the North Texas Area United Way, receiving the organization's Lifetime Community Service Award in 2007. In recognition of their contributions to the life of the city, in 2013 the Wichita Falls Board of Commerce and Industry, and the Times Record News named them Wichitans of the Year.

Bob loved the natural world and was athletic from an early age, moving from trick bicycle riding to football and track and later to snow skiing, cycling, and jogging. Airplanes and flying were life-long interests, too, fostered, in part, by his time in the U. S. Army Air Corp during WW II.

He had legions of friends—the P2 crowd of the old days, skiing buddies on the slopes of Colorado, goose hunters in Texas, the Mavericks gang— and he took risks that for exploration geologists come with the territory. Some paid off; others had to be paid off. He reared four children with his wife Frances O'Connor Gunn on Kessler Avenue in Wichita Falls and in Vail, Colorado, and Whitefish Lake, Minnesota; and in June 2001 he began a new period in his life with his marriage to Carol Carlson Dean, a union that he said brought new purpose to his life and drew him closer to his Catholic faith. It was a big life, a Texas-sized life—a remarkably full life, indeed. And when God's call came, he was ready.

In addition to his parents, Bob was preceded in death by his brother Richard Gunn of Minneapolis, Minnesota; sons William (Bill) C. Gunn of San Francisco, California, and Vincent (Vince) C. Gunn of Wichita Falls, Texas; and daughter-in-law Nancy Story Gunn of Fort Collins, Colorado.

He is survived by his wife Carol Carlson Gunn of Graford, Texas; daughter Emily Gunn of Pine River, Minnesota, and her children William and Robert Woodruff; daughter Sheila Gunn McCormack of Natick, Massachusetts, and her children Conor and Hallie McCormack; daughter-in-law Ann Kritser Gunn of Wichita Falls, Texas, and her children Julie Strihan and Charles and Christopher Gunn; daughter-in-law Maggie Gunn of San Francisco, California, and Bill's children Suzanne and Greg Gunn; and by Carol's children, Kelly Dean Yandell and husband Pitts of Dallas, Texas, and their children Lily and Ford and William Carlson Dean and wife Amy Morrison Dean of Nichols Hills, Oklahoma, and their children Laurel and Blythe. Nineteen great-grandchildren also survive him.

Ira P. May, MEM-01620

Baltimore, Maryland

March 26, 1954 - January 16, 2024

Member Since 2009

Obituary and photograph obtained from the Sagel Bloomfield Danzansky Goldberg Funeral Care website.

Ira Philip May, a senior geologist at the Maryland Department of the Environment and resident of Towson, MD, passed unexpectedly on January 16, 2024.

Ira is survived by his wife of 33 years, Yvette Cumerma May and his son Stephen May and daughter-in-law Lina Reyes. He is predeceased by his brother Kenneth, his mother Evelyn and his father Leopold.

Ira was born in Brooklyn, NY on March 26, 1954, grew up in Silver Spring, MD and graduated from the Johns Hopkins University in 1976 with a B.S. in Geology and from the University of Delaware in 1978 with a M.S. in Geology. On May 27, 1990, he married Yvette, a librarian, and welcomed his beloved son Stephen on May 3, 1991.

Ira was a devoted father who loved nature, reading the newspaper, observing outcroppings on the side of the road, politics, sports and foreign films. He was passionate about environmental causes and volunteered his time to clean up ground water contamination in Ukraine and the Philippines as well as to serve proudly on the Board of Directors of the Society for the Preservation of Nature in Israel. He was an active and integral member of the Beit Tikvah Congregation in Baltimore. He will be remembered for his kindness and generosity and will be deeply missed by his friends, family and all those who knew him.

Tip Top Toehold

Peter Dohms, CPG-07141

> *The plane-table topo map of that area was found to resemble a big toe, so we dubbed the project the "Tip Top Toehold."*

The year was 1967, and I was a junior geologist working for a well-known legacy mining company based in Tucson, Arizona. Our office had recently completed the development drilling of a 100 million ton porphyry copper deposit and was engaged in an ongoing active exploration program for more such deposits. In other words, we were hunting elephants in elephant country.

One day, word came down from on high in the headquarters office that the newly hired Executive Vice President of the company wanted our office to conduct exploration for small, vein-hosted gold-silver deposits in the southern Bradshaw Mountains of central Arizona. We later learned that he had worked in this district as a young man and carried fond memories of that time in his life. That earlier time period was in the 1930s, after the price of gold had been increased from $20.67 per troy ounce to $35.00 per troy ounce - many gold mines suddenly became economic and continued production until they were closed in WW II.

Our Manager of Western Exploration phoned his boss, the Manager of Exploration, at the headquarters office with a series of objections - the 30+ years that had passed made such deposits economically unattractive; the program we were conducting at the time would suffer; geologists working in the Tucson office were unfamiliar with the intricacies of vein deposit geology and economics; drilling for such targets was notoriously difficult, etc. Back came a letter from the Executive V.P. which was promptly shared with everyone in the office. I was so impressed with the 58-word sentence at the heart of the letter that I transcribed it in my field notebook and have carefully preserved it ever since.

"I agree wholeheartedly with most of the data presented in previous reports and feel that the only possibility of the area being able to develop an economic operation is the possible determination of a means of extracting the values from their place in the ground by the adaptation of previously proven methods as applied to small vein deposits." Translation: "Do what I asked and we'll let the Mining Department figure it out." Rank hath its privileges.

So, we went looking. The terrain was difficult in the Tip Top District; it was a good two hours one-way by sturdy, field-capable four-wheel drive truck from Black Canyon City, the closest town. We mapped and sampled vein outcrops in the field, mapped and sampled existing underground workings, and even dragged out the old plane-table to map one "less-unattractive" area. The plane-table topo map of that area was found to resemble a big toe, so we dubbed the project the "Tip Top Toehold." After several reports detailing discouraging assay results, our effort was allowed to quietly die.

Giving Gold

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In Appreciation of Generous Supporters in 2024

The AIPG Foundation extends our heartfelt thanks for the generous donations received in 2024. We are truly grateful to our individual and corporate donors for supporting our mission. Your contributions empower us to advance important initiatives—from student scholarships and workshops to innovative programs that benefit the entire geoscience community.

Your generosity is making a real difference. Every donation, regardless of size, fuels our efforts to nurture the next generation of geoscientists and uphold the values of excellence within AIPG. To learn more about our work and future initiatives, please visit www.aipg.org/foundation.

As a reminder, the AIPG Foundation is a 501(c)(3) organization, and all contributions are tax deductible. Thank you for standing with us and investing in the future of the geosciences.

Thank you!

Mike Lawless

Michael D. Lawless, CPG, PG
Chairperson, Foundation of the AIPG
540-557-1319 office phone; mlawless@trccompanies.com

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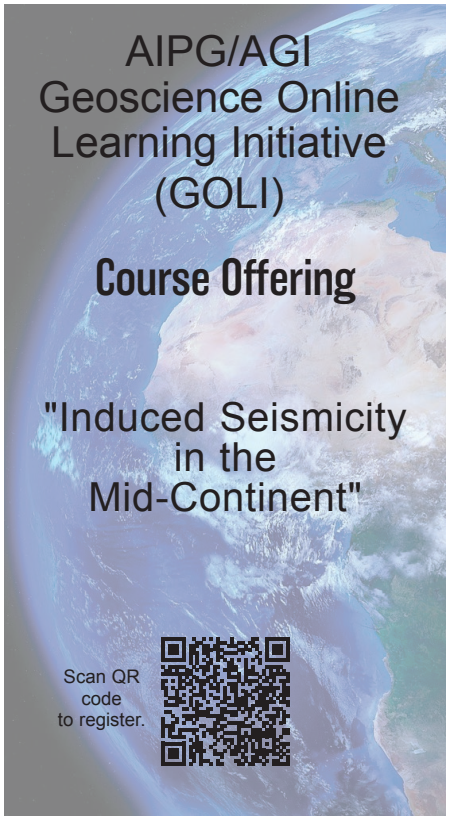
Professional Member	663	649
Professional Member/Non-Practicing	44	43
Early Career Professional	155	144
Associate Member	43	41
Student Adjunct	831	924
TOTALS	**4,319**	**4,239**

Comments on proposed rule: Modernization of Property Disclosures for Mining Registrants

Comments on the U.S. Security and Exchange Commission's (SEC's) proposal are available at https://www.sec.gov/comments/s7-10-16/s71016.htm



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