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THE PROFESSIONAL GEOLOGIST

VOLUME 62 NUMBER 4 OCT.NOV.DEC 2025

NI 43-101 Proposed Changes

Honoring Geoscience Gold

The Brinicle Formation

GIS as Art

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The Professional Geologist

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On the Cover: 2025 Photo Contest Winner - Micro-Geology - Under the Microscope

Description: ***Cannibalistic Alites*** *– Photomicrograph of Portland Cement Clinker Nodule - Large, joined crystals of blue alite (cannibalistic) and subrounded, brown-red belites with ragged textures and multidirectional lamellae extending into matrix. The well-differentiated matrix is composed of coarsely crystalline, dull gray aluminate and relatively bright, ferrite phases. Note the abundant inclusions within alite particles. The observed features are indicative of a slowly cooled clinker.*

(Clinker nodule was encased in epoxy, cut/ground/polished down to 0.25 microns with diamond paste, etched with alcoholic nitric acid (nital), and examined using reflective light microscopy.)

Photograph by ***Jeffrey Varga, CPG-10275,*** *AIPG Ohio Section, 2024.*

2025 Photo Contest: Micro-Geology - Under the Microscope. Runner Up on page 5.

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When Inspiration Strikes...

or is right in front of you all along

Adam W. Heft, CPG-10265

Summer is drawing to a close, and I for one am looking forward to the Annual Meeting in St. Louis. For those who have attended annual meetings in the past, you are familiar with the activities you can expect. From the Executive Committee, Advisory Board, and Foundation meetings to field trips, technical presentations, and the awards reception, there is plenty to do. And of course, it is an opportunity to renew friendships with other members around the country who I typically see only once a year. It is an opportunity not to be missed. And while we usually incorporate a vacation onto the trip to the Annual Meeting, this year we won't be doing so as we need to get back for a wedding a few days later.

This issue of *TPG* is the final one for the year, and we were able to get it completed and out to you a little earlier than usual. The primary reason for this is that it contains an article by Sally Gillies, non-member, on proposed changes to NI 43-101, and we wanted you to have opportunity to review this article and have time to submit comments on the proposed changes to the Canadian Securities Administrator by the October 20, 2025 deadline. Getting this issue out at the usual time would have made your window of opportunity much shorter.

In addition to this article, we provide a nice cross section of content including a summary of the AIPG field trip to Cornwall, England by **Kevin Svitana**, MEM-1840, one on brinicle formation by **Mossbah Kolkas**, CPG-10180, one on GIS as art by **Isaac Pope**, SA-9950, and an interesting *Tales from the Field* by **Bill Rowell**, CPG-10810. Also included are the Section Leadership awardees, and the National Awards recipients' comments. Hopefully, reading these will provide an inspiration for a reader to nominate an individual for one of these awards for next year.

Speaking of inspiration, I would like to share how one particular contributor has left quite an impression on me through our professional connection and friendship.

Barney P. Popkin has been a dedicated contributor regularly submitting articles for consideration for publication on a mostly quarterly basis since 2019. His unwavering commitment has been invaluable. He has written about a variety of topics with some that are thought provoking and others that reflect his personal dedication to the profession.

Many geoscientists like Barney feel that their career is more than just a job; it's a fundamental part of who they are. This deep connection to the profession is what inspires so many of our members to contribute to our publication, and we genuinely appreciate every single one. Whether they've submitted one article or many, their contribution is what makes this publication possible including individuals who have a running column in each edition of *TPG* for a much longer time, particularly, **David Abbott, Jr.**, CPG-04570 marking a major milestone of 30 years of the Professional Ethics and Practices in this issue, and **Dr. Robert Font**, CPG-03953, who is years ahead in his submissions of questions and answers to challenge you with his Test Your Knowledge column. I consider them friends as well as colleagues too. If you have read my columns or even my president's messages years ago, you know that these connections are part of the value of being an AIPG member.

However, there's more to my story about Barney.

Barney is currently a non-member, he previously held CPG-06547 and was an AIPG member for 30 years beginning in 1984. Although his retirement in 2014 as a sole practitioner of his company meant that he had limited finances and needed to drop his membership, he still felt strongly enough about AIPG that he continued to remain engaged.

So, Barney began to write and submit articles for publication in *TPG* after his retirement. These continued to arrive in my predecessor's inbox regularly and continued to be submitted to me after I became editor in 2021, with the most recent installment crossing my desk about two weeks ago.

But the thing that amazed me most about Barney is that while he continued to write articles all this time, during the last two years or maybe more, he has been battling severe chronic illness and living at home in a wheelchair. At one point, he forgot how to type, spell, use his laptop, and do simple math; he had to relearn enough to forge ahead. More recently, he also was dealing with the results of two falls. As I write this, he has been bedridden on home care hospice for a week or so. In spite of these challenges, he was able to wrap up his last article (which I have yet to review) and submit it to me. He also expressed his desire to write and submit a new article on rare earths but didn't think he'd be able to finish it.

Barney's dedication to writing articles for *TPG* sharing his passion for the profession while facing his health challenges is truly meaningful and I respect and admire my friend and colleague. Our President agreed with me, and has awarded Barney with a Presidential Certificate of Merit, which reads:

"Barney Paul Popkin has become a familiar voice in The Professional Geologist, generously sharing his wisdom and passion for geology. His deep dedication to the profession when he was a practicing Certified Professional Geologist and long after shines through as he has continued to write, facing significant health challenges with a positive attitude, and we are profoundly grateful for the inspiration and insight he has brought to our community."

I hope this brings you inspiration as it has to me.

The Scientific Method and Public Confidence in Science

I applaud President Sara Pearson for writing the article Code Red for Geoscience, which appeared in the July August September 2025 issue of *The Professional Geologist*. President Pearson mentioned many issues which affect the geosciences, and I feel it is necessary to explain one in slightly more detail below.

In the second paragraph of the left column of her article on page 33, President Pearson writes:

"We are no longer merely witnessing an 'erosion' of public confidence; we are enduring a daily barrage where established scientific consensus is casually rejected in favor of unfounded, often deliberately misleading, and long-debunked information."

Consensus has led to disregarding other well-founded findings and opinions. The topic has confused both the public and scientists alike. This is because THERE IS NO SUCH THING AS CONSENSUS IN SCIENCE! Yes, I know you are saying right now, "But many scientists agree on the same subjects (i.e. the solar system was formed 4.54 billion years ago; plate tectonics led to the current distribution of Earth's continents and builds mountains, etc., etc.)". However, the start of the Cambrian Period (e.g.) has been revised a number of times during the last 70 years. There is a subtle difference one must understand about science. It is based not on overall agreement on a subject by practitioners, but on the body of supporting data generated through the scientific method. We may have been told this many years ago back when we first took science courses in high school, such as general science, biology, chemistry and physics (sadly not earth science). However, with all the information we had to absorb, the scientific method was forgotten. To refresh everyone's memory, I Googled the words and came up with the description below. If you perform the same search, you will find that some descriptions of the scientific method are shorter and some are longer, but I believe you will find what I have listed below to be accurate: asking a question about something you observe, 2) doing background research to learn what is already known about the topic, 3) constructing a hypothesis, 4) testing the hypothesis again and again, 5) analyzing the data from these tests and drawing conclusions, and 6) communicating the results to others.

Now, let us get back to the erosion of public confidence in science. The problem is that the public expects everything in their daily environment to remain the same. You wake up in the morning, you wash, you open the front door to your apartment or house and expect to see the morning paper at your feet, eat breakfast, dress, drive to work or take mass transit, arrive at your place of work and begin your job. More or less! The public expects doctors to diagnose every health issue correctly and meteorologists to predict the weather with 100% accuracy. Frankly, I've never experienced this level of accuracy from doctors or meteorologists. In fact, I have never read or seen weather predictions that are accurate beyond seven days from the date of prediction. The public doesn't understand how science functions. Believe me, I've tried to explain the scientific method to members of my family and to non-scientists that I have met during my lifetime. Mostly, I get puzzled looks, or the individual just accepts what I have said and the conversation shortly ends. Often, the conversations end with complaints about the failure of reporters and weathermen to accurately predict the weather, preventing them from dressing for the weather.

The scientific method neither specifies nor sets strict standards regarding the amount of experimentation or testing that is required, or what amount of experimentation or testing suffices.

One must and should accept and analyze all of the data collected even if and when some of it appears to be contradictory and explain the reason as to why that is the case. Furthermore, in some instances data cannot be collected at one or more locations (e.g. atmospheric temperature data in remote areas like Siberia in connection with climate change studies), and interpolation must be used and relied on to "fill in the data set."

The above recalls to mind a story one of my graduate college professors told me. He was mapping a fault within one county of the Eastern Kentucky coal field. While conducting his traverse, the smell of sour mash became stronger and stronger in the direction he was moving. He knew he was approaching the site of a whiskey still and that the moonshiners would not take kindly to his discovering their location. After having taken a few more steps, he also realized that the moonshiners may have heard the crunching of his footsteps. So, he thought to himself "The hell with this. I'll just project the fault." He marked his location on the map he was carrying and left. Days later, he approached the fault from the opposite direction and made sure not to get too close to the still.

What can I say? Science is not always an exact discipline, and it is this inexactness that frustrates the public's understanding. Let me also say that, from my personal experience, geoscience in some instances also is not an exact science. But that, however, is precisely why I chose to become a geologist!

In closing, I believe that establishing the Geo-ACTS (Geoscience Advocacy, Credibility, Training and Standards) collaborative is a good idea. As President Pearson has written, setting the goals of the collaborative as developing and implementing strategies to combat misinformation, advocating for robust funding and educational programs, championing professional certification and uniting members in an effort to safeguard and elevate the geoscientific profession are worthy future actions for accomplishing the tasks of restoring the public's confidence in science and elevating geoscience to a position that is equal to our sister disciplines.

Sincerely,

Raphael Ketani, PG, CPG-9003

I appreciate Raphael Ketani's thoughtful letter to the Editor regarding my last column. His deeper dive into the concept of scientific consensus is exactly the kind of discussion I had hoped to prompt with my article.

I agree that in science, "consensus" is not based on a simple show of hands but on a body of supporting data generated through the scientific method. It's true that topics like the age of the Earth and plate tectonics are considered settled, but they too were the result of an iterative process of hypothesizing, testing theories, and searching for facts.

This iterative process and the inherent inexactness of science are what the public struggles with understanding. People desire certainty and a predictable outcome, like Ketani mentions a meteorologist with 100% accuracy or a doctor who can always diagnose correctly. They expect a consistent daily routine, and this mindset makes it difficult to understand a process that involves uncertainty, revisions, and even contradictory data.

As geoscientists, we understand that our field is not always an exact discipline and is highly complex. I can fully relate to that being the reason for choosing this profession. I believe Mr. Ketani's explanation of this disconnect between the scientific method and public expectations is a key insight into why public confidence has eroded. I am optimistic that Geo-ACTS will help us bridge this gap by educating the public on how science truly functions and reaffirming our profession's credibility.

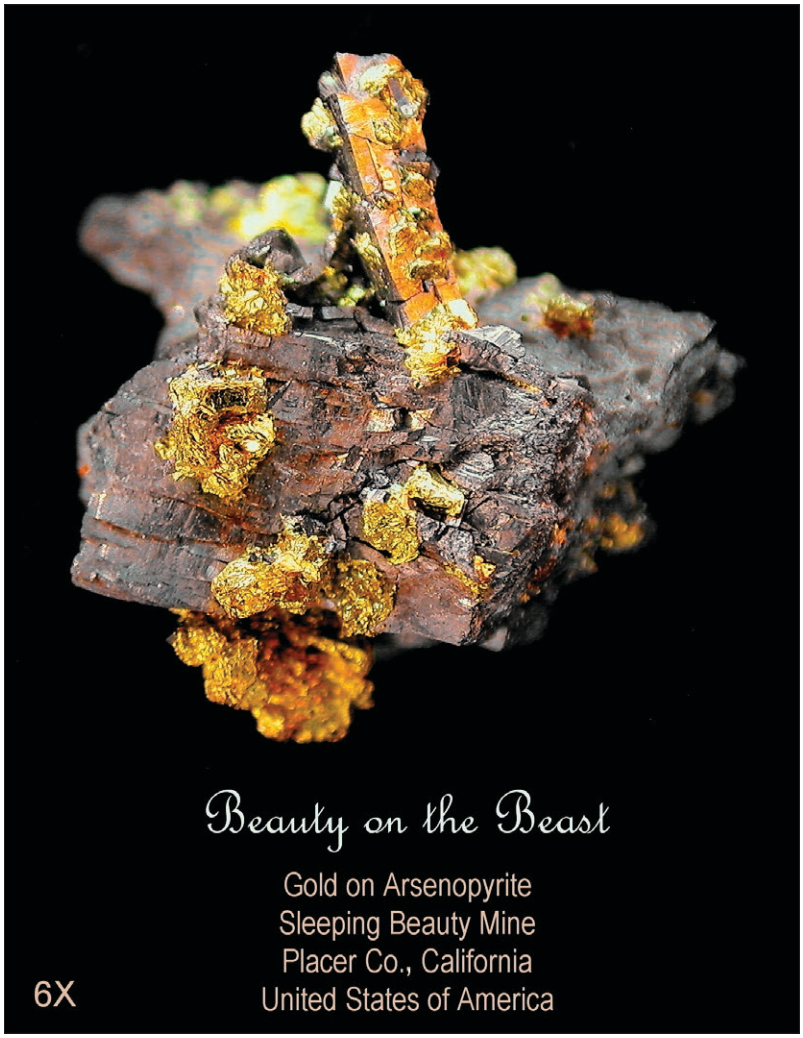
Sara Pearson, CPG-10650

Right Photo Contest Entry:

Runner Up: 2025 Photo Contest - Micro-Geology - Under the Microscope: Jim Paschis, Mem-8456, Colorado Section, 1995.

Description: ***Beauty on the Beast*** *– The sample is from the Sleeping Beauty Mine, Placer County, California, USA. The sample illustrates gray arsenopyrite overgrown with clusters of yellow gold. The title reflects the colorful and valued mineral gold as clusters overgrowing the nemesis mineral arsenopyrite: iron arsenic sulfide. It is often found with gold ores. Accordingly, mineral processing metallurgists need to be wary of its presence with regards to tailings disposal.*

The image is from "Atlas of Gold Ore Microscopy" by Jim A. Paschis, copyright 2024.



ERRATUM

Editor's Note: *A portion of this student essay appeared in the Jul/Aug/Sep 2025 edition of TPG. Unfortunately, the last three paragraphs were accidentally omitted. The entire essay is reprinted here, with apologies from the Editor.*

Avery Laws, SA-12650
Palomar Community College
California Section

"Rocks are the records geologists read to inform us of the long, dynamic history of the Earth. Complex and seemingly incomprehensible, the 1.8-billion-year geology in Joshua Tree National Park is capsulized along this round-trip, 18-mile tour road. With the Geology Tour Road Guide brochure as your primer, travel the road to better understand the foundational materials and shaping forces of this desert landscape".

As I sat in the back of the family pickup truck year after year, cruising down the dirt path of Geology Tour Road in Joshua Tree National Park, miles of rock piles blurred past. This stark, otherworldly landscape looked unlike anything I had ever seen, sparking a flood of questions: Why does Joshua Tree look so different from Yosemite or the Grand Canyon? Why are there no "real" mountains in the Plains? How were the Great Lakes formed? In school, it had been ingrained in me that biology studied plants and animals, chemistry, the elements, and math, numbers, but I never encountered a subject that explained the 'whys' and 'hows' of landscapes like those that I loved in the National Parks. I didn't know what discipline held the answers to my questions—I only knew I wanted to find them.

What I didn't realize at twelve was that the sign at the start of that road in Joshua Tree and the sights beyond it were quietly planting the seed of my love for National Parks—and for geology. The sign and rock piles became more than landmarks; they marked the beginning of my journey to understanding the physical world around me.

For years, I carried my curiosity about landscapes without knowing where to find the answers. In my second year of community college, I ended up dropping a class and needed to quickly find a replacement. A friend suggested an introductory geology course, mentioning that the professor was highly entertaining, and the class was surprisingly interesting. I was hesitant at first—geology, from what little I knew, seemed like a subject for people obsessed with rocks, and that simply wasn't me. But with few options left, I decided to give it a try. Little did I know that one decision would answer my childhood questions, introduce me to the fascinating world of our Earth, and transform my old perception of rocks into to an appreciation for their intricate past and immense impact in shaping the landscapes I have always admired.

Geology to me represents the best of what an education in science has to offer. You can read and learn about faults, the different textures of igneous rocks, anticlines and synclines, and the principles of relative dating and be able to go out in the field and see these processes and their results firsthand. Geology transforms abstract concepts into tangible realities, and unlike most sciences is applicable everywhere you go. Reading about a fault line in a textbook pales in comparison to standing before one, tracing its jagged path along the hanging wall and footwall, and imagining the immense forces that shaped it. To me, geology is the ultimate puzzle—piecing together the story of our planet's past to better understand its present and future.

It is also a science with the power to safeguard the landscapes millions of people hold dear and ensure their preservation for future generations—a purpose that perfectly aligns with my childhood dream of becoming a law enforcement ranger for the National Park Service. The geosciences and the Park Service share a common mission: to protect, preserve, survey, and educate others about the natural world. Both also continually challenge you to think critically, ask questions, engage with the environment, and make advancements for the better of the United States and Earth's scenery.

For me, becoming a geologist isn't just about the science; it's about embracing the adventure of discovery. It's about stepping outside, engaging with the world, and being able to understand and rewind landscapes histories in ways most people never fathom. Becoming a geologist not only satisfies my curiosity, but empowers me to contribute to the protection and stewardship of the places that have shaped me into who I am and will continue shaping me into who I will become. I can imagine no greater privilege than dedicating my life to uncovering the Earth's stories, as well as ensuring that its landscapes continue to inspire and educate future generations, just as they once did to me.

The Brinicle Formation: Understanding the Interaction between Salinity, Temperature, and Marine Life

Alice Chen[1] and Mossbah Kolkas, CPG 10180[1&2]

Abstract

The formation of a brinicle, commonly referred to as the "finger of death" (BBC, 2011), remains a rare and intriguing phenomenon occurring in polar marine environments. Under extreme cold conditions, salt is expelled from forming sea ice, leading to the concentration of brine within the ice matrix. These dense, super cooled brines sink into the surrounding seawater, inducing rapid freezing of the water they contact and forming downward-growing, icicle-like structures known as brinicles. As they descend, brinicles can create a frozen layer on the seafloor, posing a significant threat to benthic marine organisms by rapidly encasing or altering their habitat.

To replicate and study this process under controlled laboratory conditions, an experiment was conducted using a hypersaline solution (200 g/L), colored with blue food dye to enhance visibility. The solution was cooled to –10 °C and subsequently introduced via pipette into a small aquarium tank containing seawater with normal marine salinity (35 g/L) maintained at –2 °C. As the denser brine descended through the tank, brinicle formation was initiated and progressed vertically toward the bottom.

The development of brinicles was documented through photographic evidence and quantitative measurements. This study emphasizes the analysis of temperature gradients, salinity differences, and brinicle morphology to gain a deeper understanding of the physical mechanisms driving brinicle formation. Furthermore, it highlights the potential ecological impacts of brine outflow on benthic marine life, especially in the context of ongoing global climate change and its influence on polar ecosystems.

Introduction

The discovery of brinicles in the early 1960s revealed one of the most fascinating and lesser-known phenomena of polar marine ecosystems. Brinicles, also known as "ice stalactites" or the "fingers of death", form under unique physical conditions beneath sea ice in Polar Regions. Their formation holds significant potential for understanding not only the thermodynamic processes at play in freezing ocean environments but also the broader ecological impacts on benthic marine life.

This research investigates the physical parameters governing brinicle formation, with a focus on temperature gradients, salinity differentials, and water column dynamics. In addition, the study evaluates the ecological implications of brinicle formation, particularly for benthic species such as sea urchins, starfish, and other seafloor-dwelling organisms. It further explores the potential role of brinicles in the context of global climate change and its effect on polar ecosystems.

The central hypothesis proposes that both the rate and morphology of brinicle formation are directly influenced by the surrounding temperature gradient and salinity. It is also hypothesized that brinicles pose a threat to benthic marine life by trapping organisms in rapidly forming ice, potentially leading to localized ecosystem disruptions (Bougouffa et al., 2013; Cartwright et al., 2013). In a warming climate, polar regions are experiencing accelerated ice melt and increasingly irregular freeze-thaw cycles due to rising global temperatures. This warming, amplified in the Arctic and Antarctic, leads to more frequent and intense melting of sea ice and glaciers, especially during the cold seasons. At the same time, the formation of new ice becomes less predictable, with freezing and melting occurring in short unstable cycles rather than following the traditional seasonal pattern. These disruptions in ice dynamics result in fluctuating salinity and temperature levels in the surrounding ocean water. Such conditions promote greater brine rejection during ice formation and increase the presence of supercooled water, setting the stage for brinicle formation and potentially altering marine ecosystems in the process. As ice retreats and ecosystems become more vulnerable, the death of even small groups of benthic organisms can disrupt the food web. Brinicles can kill not only individual creatures but also threaten the fragile balance of life in these already stressed environments. If these events of unbalance increase in frequency and/or intensity,

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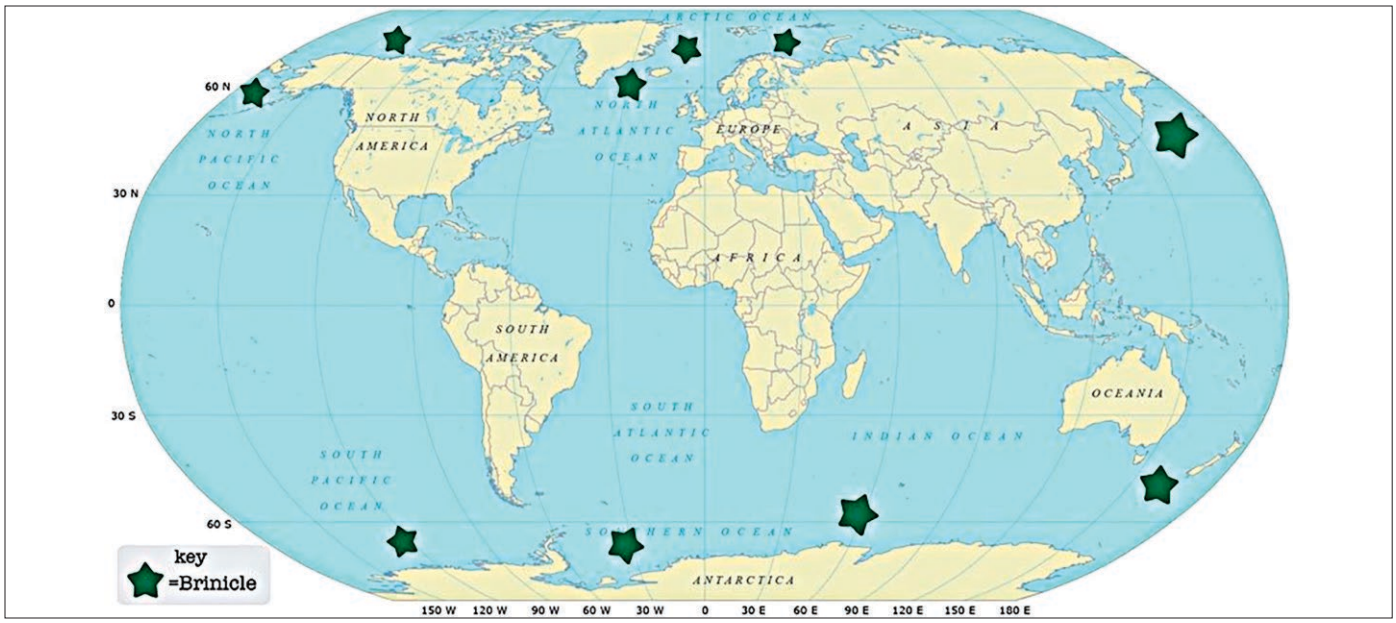

Figure 1. World geographic distribution of Brinicles

they may contribute to further biodiversity loss in ecosystems already under pressure from warming, acidification, and pollution.

Global Distribution of Brinicles

Brinicle formation is typically associated with the undersides of sea ice in shallow marine environments, particularly in regions with hypersaline conditions near coastlines or ice shelves. These phenomena are most commonly found within high-latitude zones—between 60°N to 90°N in the Arctic and 60°S to 90°S in the Antarctic. Ideal brinicle-forming environments are characterized by stable sea ice, low ambient temperatures, and ongoing salt rejection from forming ice.

Figure 2. Brinicle Formation in the laboratory. As the dense brine water infiltrates downward, the brinicles begin to form and spread vertically to the bottom of the tank. Bar scale = 8cm.

Brinicles are especially prevalent in areas with continuous sea ice development and cold, dense brine drainage. Figure 1 is a map that illustrates the world geographic distribution of brinicles based on available field data and satellite imagery (Dayton et al., 1971).

Previous Research

Felipe Gómez-Lozada et al (2023) presented a computational model simulating brinicle growth using principles of heat transfer, fluid dynamics, and phase transition. The model utilized Brinkman penalization, latent heat modeling, and Navier-Stokes equations to simulate the growth of brinicle-like structures through partial differential equations.

Teston-Martinez et al., 2023 conducted controlled laboratory experiments to recreate the tubular ice structures formed by brine plumes under sea ice. Using a 3D cell experimental setup, the researchers observed brine flow descending due to its density and forming icy tubes over time, mimicking brinicle development.

In their paper titled “Brinicles as a Case of Inverse Chemical Gardens,” Cartwright et al., 2013 described brinicles as self-assembled hollow tubes of ice, analogous to chemical gardens. However, in contrast to traditional chemical gardens—where lighter fluids rise—brinicles are formed by denser brine descending into seawater, representing an inverse dynamic.

Vance et al. (2019) proposed that brinicles may offer viable habitats for extremophile organisms (radiation-resistant bacteria, salt-loving bacteria, heat and acid loving bacteria). These types of organisms live close to hydrothermal vents in the ocean or sea floor. Russell et al. (2017) through their research suggested that brinicles might support life through localized geochemical gradients at the ice-ocean interface, particularly in extraterrestrial environments such as Europa’s subsurface ocean.

Methodology

To investigate the formation of brinicles under controlled conditions, several laboratory experiments were conducted using a prepared hypersaline solution. To mimic the natural environment of brine formation in a polar marine setting, a lab experiment was designed in which a hypersaline solution (brine) was prepared and

blue-dyed using food coloring for better visibility (Figure 2). The salinity of this solution was 200 grams/ liter. The solution was placed in the freezer at a temperature that reached to -10 °C. Meanwhile, a beaker was filled with water of a normal marine salinity of about 35 grams/liter and cooled to about -2 °C. After the cooling After the cooling processes, the cool hypersaline water was slowly released using a pipette and gradually injected to the low-salinity water tank. As the dense brine water infiltrates downward, the brinicles begin to form and spread downward to the bottom of the tank (Figure 2).

The Chemistry Underlying Brinicle Formation

Seawater is a complex aqueous solution composed predominantly of H_2O, with a variety of dissolved salts such as sodium chloride (NaCl), magnesium sulfate ($MgSO_4$), and calcium chloride ($CaCl_2$). During the initial stages of sea ice formation, water molecules organize into a solid crystalline lattice that largely rejects dissolved solutes in a process known as brine rejection. This rejection results in the concentration of salts within the unfrozen liquid phase, yielding a residual brine that is both significantly colder and more saline than the parent seawater.

As the brine increases in salinity and decreases in temperature, its density correspondingly rises, causing it to sink through the underlying seawater column. This descent is governed by the principle of *freezing point depression*, a colligative property whereby the presence of solutes lowers the temperature at which freezing occurs. The highly concentrated brine thus induces the formation of ice in its surrounding environment, facilitating the downward growth of an ice tube known as a *brinicle*.

Simultaneously, ionic dissociation of salts continues in the brine; for instance, NaCl dissociates into Na^+ and Cl^- ions. Due to the polar nature of water molecules, dipole interactions orient the partial positive hydrogen atoms toward anions (e.g., Cl^-), and the partial negative oxygen atoms toward cations (e.g., Na^+). These electrostatic interactions influence both the structural organization of the ice lattice and the ionic mobility within the brine phase.

The descending brine plume alters the local physicochemical environment, characterized by elevated salinity, reduced temperatures, and potential shifts in pH. These conditions significantly impact the solubility and bioavailability of micronutrients, including trace metals such as iron (Fe) and manganese (Mn), which are critical to marine biochemical cycles. Furthermore, the entrapment and subsequent decomposition of organic matter, due to the decomposition of freeze-trapped organisms within the brinicles may result in depletion of the dissolved oxygen and potentially leading to hypoxic microzones that pose physiological stress to surrounding marine biota (Figure 3).

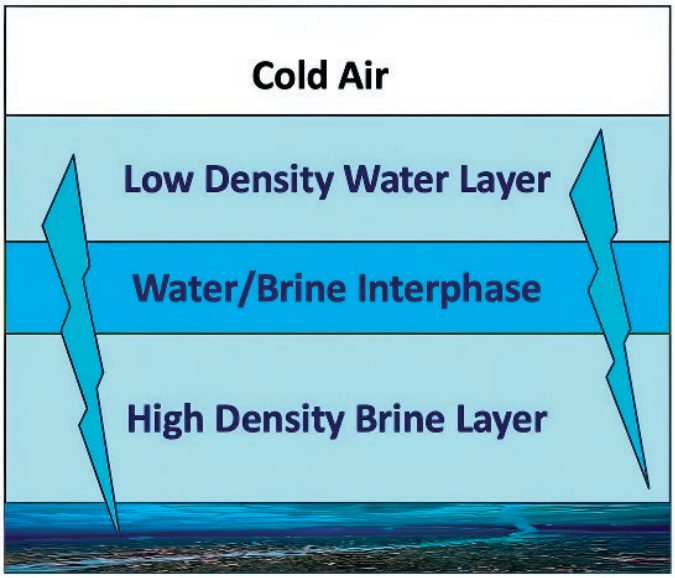

Figure 3. Sequence of oceanic brines distribution based on density and salinity separations.

The Thermohaline Ice Pump and Oceanic Water Circulation

The thermohaline ice pump is a key mechanism driving ocean circulation beneath ice shelves and plays a vital role in melting and freezing processes at the ice shelf base (Figure 4). It begins with the formation of High Salinity Shelf Water (HSSW) near the surface, where brine is rejected during sea ice formation, increasing the salinity and density of the surrounding seawater. This dense HSSW, at the surface freezing point of approximately −2°C, sinks and some of it flows into the sub-ice shelf cavity, reaching the grounding zone—the deepest part of the ice shelf. There, due to increased pressure, the in situ freezing point is lower, and the relatively warmer HSSW causes basal melting of the ice shelf. The resulting fresh meltwater mixes with the remaining HSSW to form Ice Shelf Water (ISW), which is colder, fresher, and more buoyant. This ISW then upwells along the underside of the ice shelf, and as it rises, the pressure decreases, causing the local freezing point to

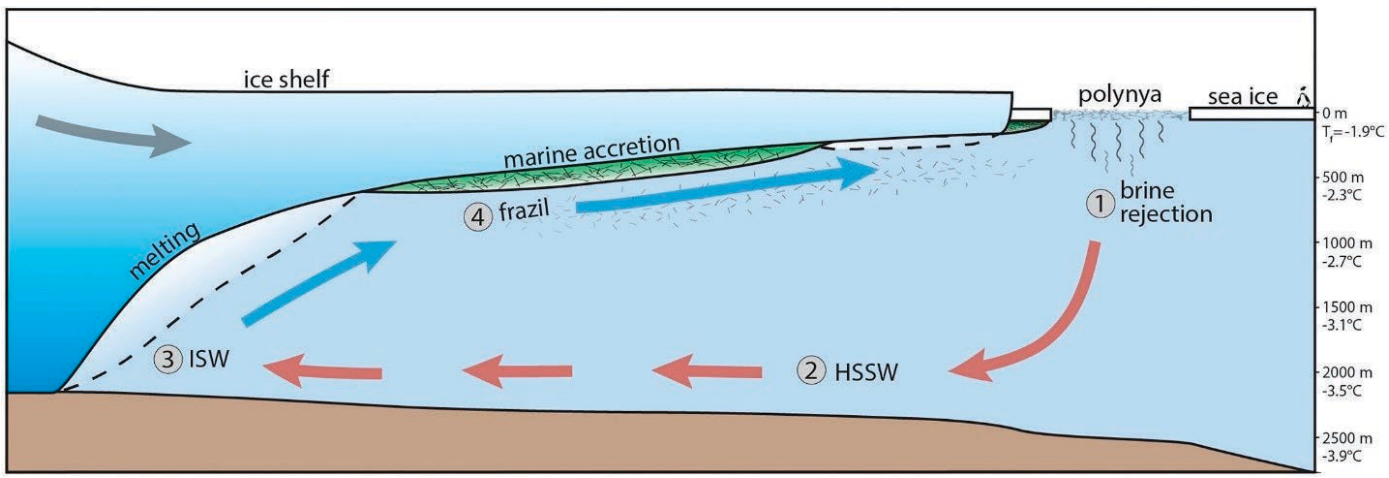

Figure 4. Ice-Ocean Interactions on Ocean Worlds Influence Ice Shell Topography (Lawrence, 2024).

increase. If the ISW remains colder than the new, higher freezing point, supercooling occurs, leading to the formation of frazil ice crystals. These crystals can accumulate and form thick layers of marine ice at the base of the ice shelf. This process, modified from Soderlund et al. (2020) and based on foundational studies by Lewis and Perkin (1986). MacAyeal (1984) has important implications for ice shelf stability, ocean circulation, and sea level rise.

Brinicles exert both beneficial and detrimental effects on benthic species and broader marine ecosystems. On the negative side, their formation can result in the freeze-trapping of benthic organisms, effectively immobilizing and freezing them to the seafloor. This leads to mortality events among species such as sea urchins, starfish, and other bottom-dwelling fauna. The resulting decomposition of these organisms consumes dissolved oxygen and releases metabolic byproducts, altering the chemical composition of the ocean floor and potentially creating hypoxic (low-oxygen) zones. Over time, this could cause localized extinctions, with cascading effects on marine food webs and benthic biodiversity.

However, the formation of brinicles also presents unique insights into the energy dynamics and thermodynamic principles of polar marine environments. The process is governed by a complex interplay of temperature gradients, salinity variation, and phase changes. Applying Bernoulli's Principle (Bernoulli, 1738) provides a useful framework for understanding the flow of brine during brinicle formation. As supercooled, hypersaline brine descends, its potential energy is converted into kinetic energy, resulting in an increase in flow velocity. This energy conversion contributes to the rapid formation of ice around the descending brine, with observed brinicle growth rates ranging between 0.2 and 0.6 cm per minute.

Atlantic Meridional Overturning Circulation and Brinicle Distribution

The Atlantic Meridional Overturning Circulation (AMOC) is a major component of the global thermohaline circulation, characterized by the large-scale movement of ocean water across latitudinal gradients in the Atlantic Ocean (NOAA, 2024). This circulation facilitates the poleward transport of warm, saline surface waters and the equatorward return flow of cold, dense deep waters. AMOC plays a crucial role in global climate regulation and biogeochemical cycling, including the redistribution of heat and nutrients throughout the Atlantic basin.

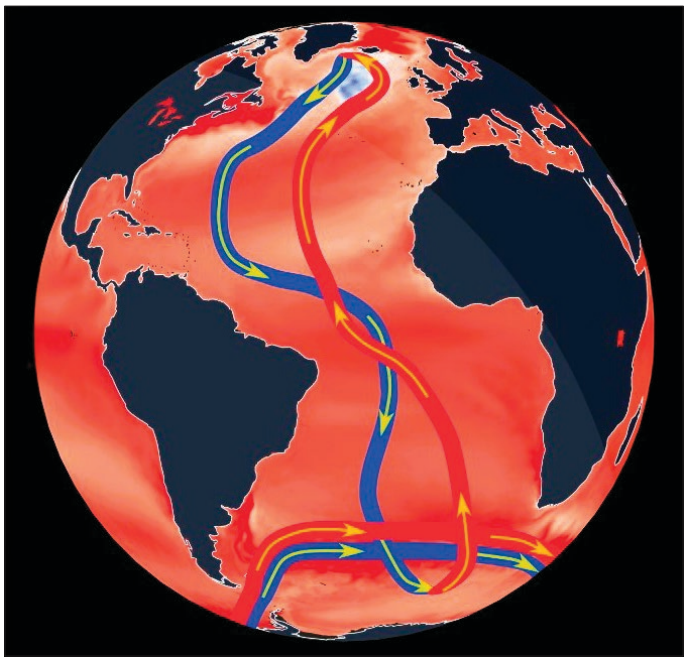

Figure 5. Atlantic Meridional Overturning Circulation (AMOC) The circulation process initiates as warm surface waters travel northward (red) and undergo progressive cooling at higher latitudes returning southward (blue) (NOAA, 2024).

The circulation process initiates as warm surface waters travel northward and undergo progressive cooling at higher latitudes (Figure 5). In polar regions, particularly during winter, surface water cools sufficiently to form sea ice. During sea ice formation, brine rejection occurs and salt is excluded from the ice crystal lattice and expelled into the surrounding water, increasing its salinity and density. This saline-enriched water sinks due to its increased density and contributes to the formation of North Atlantic Deep Water (NADW), which flows southward at depth.

This dense, saline water provides favorable conditions for the formation of brinicles, icicle-like structures, that form beneath sea ice when descending supercooled brine comes into contact with surrounding seawater, freezing it upon contact. Thus, AMOC indirectly supports brinicle development by producing the high-salinity, low-temperature conditions necessary for their formation.

However, AMOC also exerts a moderating effect on brinicle distribution through its role in thermal regulation. The poleward transport of warm water can inhibit sea ice formation by raising regional sea surface temperatures, thereby limiting the conditions under which brinicles can form. This dynamic creates a balance between brinicle-promoting and brinicle-suppressing processes governed by the strength and configuration of the overturning circulation.

Eventually, deep waters transported southward by AMOC undergo upwelling, returning to the surface and warming as part of the global conveyor belt. This upwelling completes the overturning circulation (NOAA, 2024).

Conclusion

Brinicles represent a remarkable physical phenomenon with profound ecological implications. The process of freeze-trapping benthic organisms leads to localized mortality events, disrupting the structure of marine food webs and altering the biogeochemical cycles of the seafloor. The decomposition of these trapped organisms consumes dissolved oxygen and contributes to changes in nutrient cycling and water chemistry.

Over time, such changes could lead to the decline or extinction of vulnerable benthic species, with long-term impacts on marine ecosystem stability. Simultaneously, the formation of brinicles provides valuable insights into natural thermodynamic processes, showcasing complex interactions between salinity, temperature, phase changes, and fluid dynamics.

Applying Bernoulli's Principle to the behavior of descending brine flows helps explain the increasing velocity and enhanced freezing rates during brinicle formation. This principle, coupled with the chemical processes underlying brine rejection and ice formation, illustrates how brinicles are shaped by fundamental physical laws.

Ultimately, as climate change continues to influence polar salinity and temperature gradients, the frequency and ecological impact of brinicle formation may increase. This underscores the need for continued research into their dynamics, effects on marine life, and potential analogs in extraterrestrial icy worlds.

Acknowledgments

The authors wish to express their sincere gratitude to the administration of Fort Hamilton High School for their invaluable support. In particular, we extend our appreciation to Mr. Christakos, Assistant Principal of Science; Ms. Houlihan, Principal; and the faculty members of the Science Department for their guidance and encouragement throughout the course of this work.

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Do the proposed changes to NI 43-101 impact you?

Sally Gillies, P.G.

Introduction

National Instrument 43-101 (NI 43-101) debuted in 2001 in an effort to align Canadian mining disclosure with international efforts, as well as prevent fraud in the mining sector after the Bre-X hoax of 1998. As discussions between mining companies and regulators about deficiencies in technical disclosure are usually not made public, it is necessary from time to time to update NI 43-101 to ensure the mining industry is adhering to the current requirements and interpretations.

In June 2025, the Canadian Securities Administrator (CSA) issued Notice and Request for Comment – Proposed Repeal and Replacement of National Instrument NI 43-101 Standards of Disclosure for Mineral Projects (the Notice). The Notice comprises updates and changes to NI 43-101, 43-101 Form 1 (43-101 F1) and 43-101 Companion Policy (43-101 CP). The CSA are requesting comments and feedback from the public, with the comment period closing October 10, 2025.

In reviewing the proposed changes in NI 43-101 and 43-101 F1, and additional explanatory information provided in 43-101 CP, there are some issues raised which potentially add to the burden for the Qualified Person (QP) and mining companies. There were also missed opportunities to add refinements which the mining industry has been asking for, and which would have reduced their financial and obligation burden without impacting the overarching goals of NI 43-101.

Professional Membership Requirements

Under Canadian law, the QP prepare or supervise the preparation of the technical information and approve technical disclosure. Being a QP requires both having sufficient relevant experience in their area of expertise, as well as being a member of a recognized professional association for engineers and/or geoscientists.

Many geologists and engineers either do not obtain professional membership in the early years of their career, or they accumulate significant relevant experience overseas, before emigrating to Canada. As a result, current industry practice is for companies to hire or promote an experienced geoscientist or engineer to act as a QP, and if necessary, register them with a professional association.

The updated 43-101 CP now contains guidance which require someone acting as a QP to not only have a membership with a Canadian or recognized foreign professional association, but to also have been a member for more than five years. This change could mean in the above certain circumstances, it would take an additional five years after an experienced engineer or geoscientist receives their professional designation, before they would be recognized by the regulators as an eligible QP.

At a time when the mining industry is already struggling to find experienced people to QP, this requirement would create an unnecessary hurdle for both mining companies and QPs, and a burden which does not exist in any other foreign jurisdiction.

Reporting under Foreign Codes

Currently, it is possible to disclose information prepared under a foreign mining code as long as the information is reconciled with NI 43-101. The proposed changes have removed the definition “acceptable foreign codes” in order to recognise the alignment of mineral resource, mineral reserves and mining studies across major mining jurisdictions from efforts by the Committee for Mineral Reserves International Reporting Standards (CRIRSCO).

The removal of the definition of “acceptable foreign codes” will not automatically translate into a reduced obligations or financial burden for dual listed mining companies. Any mining company who does not meet the requirements to be an ‘exempt foreign issuer’ in their respective foreign jurisdictions, will now be required to produce two (or more) technical reports that satisfy the subtle differences NI 43-101 and the requirement for each other jurisdictional code.

Independent Technical Report Trigger

The trigger for an independent technical report has been expanded from a material change in Mineral Resources Estimates, Mineral Reserve Estimates and preliminary economic assessment to include a 100% change in the results of any economic analysis. New 43-101 CP guidance states the requirement for economic analysis is triggered when there is a 100% or greater change in the net present value (NPV), internal rate of return (IRR), or any metric relied upon in the results of an economic analysis of a mineral project (e.g. projected capital costs, operating costs, cash flow forecasts, production rates, payback period or mine life). This may trigger costly and unnecessary updates to a technical report, as a 100% change in one of the economic variables does not always have much impact on the economic analysis, such as the doubling of forecast mine life in light of a mineral project subject of an aggressive drill program to expand the mineral resource, or a change in NPV from 2% to 4%.

Cautionary Language for Preliminary Economic Assessments (PEA)

The term PEA is being updated to “Scoping Study” as part of the efforts to harmonize with the CRIRSCO template.

The cautionary language for including Inferred Mineral Resources in a scoping study has also been updated in NI 43-101 to include, “the issuer is not using the scoping study to justify proceeding directly to a feasibility study.”

It is troubling to see that the cautionary language for a scoping study would now force a company to produce a pre-feasibility study (PFS) before a feasibility study (FS) as to do otherwise, would be breaking the law. Apart from increasing the financial and regulatory burden on the company, the decision about whether a company can proceed from a scoping study to a FS should be made by the board of a company.

It is unclear why the CSA thought it necessary to require a company to provide cautionary language which prohibits them from going from a scoping study to a FS. Currently, there is only advice in 43-101 CP stating it could be misleading for a company to go from a PEA to a production decision without an FS.

Technical Report Requirements for Acquisitions

Currently, if a company acquires a mineral project, there is a requirement to produce an updated technical report made out to the company. Usually, the technical report held by the property vendor is updated, but it may be several years old and not contain details of any recent work. As such, any updated technical report will have to includes changes to details of property ownership, more recent exploration and development and redoing the recommended work program to reflect future proposed work.

The CSA changes will permit a company to rely on previously filed technical reports when contemplating a transaction. This is a positive step that reduces the financial burden of updating a technical report and also potentially increases the speed with which a company may complete mineral project acquisitions.

However, complications may arise during a reverse takeover (RTO) as a stock exchange will usually review technical reports, in order to determine if the resulting listed company meets the exchange listing requirements.

For RTOs, the technical report is usually made out to the mineral project vendor who is taking out the listed shell company. The information in a vendor's technical report will likely not have details to satisfy exchange requirements for the report to contain information about the transaction and resulting ownership, up to date property details and obligations, results of more recent exploration and development results, and a current recommended work program. This could be an issue in aligning the technical report with the listing application disclosure, especially if the vendor is a private entity and does not have a continuous disclosure record available on SEDAR+, the CSA's web-based system for all market participants to file, disclose and search for information in Canada's capital markets (https://www.sedarplus.com).

It is uncertain at this time how the stock exchanges will find the required listing requirement information when handed a technical report which is several years old and current for the vendor but not the listed company.

QP Responsibilities in a Technical Report

The proposed updates to 43-101 CP makes it clear that if two or more QPs are jointly responsible for a particular section or item in a technical report, then each of the QPs are equally responsible for the entire section or item. For reports that contain an economic analysis, this has secondary market liability implications for the report QPs, as often there are subsections which provide a summary of all the information for the convenience of the reader. For example, multiple QPs will provide estimations in their area of expertise to tables summarizing the breakdown of economic inputs into the financial model.

Currently, common sense prevails, and if one or more QPs takes responsibility for a summary section or table, any errors in the line items are attributed to the QP who provided the potentially disputed inputs. However, if responsibility and liability is now assigned equally to all the QPs in the event of an error, this could result in laborious presentation of data, with no summary tables of pertinent costs for the intended audience of technical reports in order to allow QPs to avoid being in the untenable position of being liable for information in a summary section that was outside their area of expertise.

Relying on Other Experts in a Technical Report

Market studies are often conducted by the mining company using external marketing experts who are familiar with these opaque markets. Information on price forecasts, supply and demand forecasts, market entry strategies, competitor analysis, and the different product premiums that can be paid on certain commodity forms is well outside the expertise of engineers and geoscientists.

The information in market studies is used by the technical report QPs in many ways, including assessing the mineral resource estimate for "reasonable prospects for eventual economic extraction", establishing the battery limits for the mine, as well as working out the parameters for the financial model and economic viability of the mineral project.

In the proposed changes, the ability for QPs to be able to rely on a report, opinion or statement of a marketing expert for pricing of commodities, and for which the pricing is not publicly available, has been removed from 43-101 F1.

As the QPs are subject to secondary market liability, it is alarming to see they cannot rely on market studies for information that they themselves do not have access to, or the necessary expertise to develop.

QP Data Verification in Technical Reports

Data verification in technical reports has historically been confined to the geologist and mineral resource estimator QPs, even though the current requirements state that all QPs should provide details of their data verification. Under the proposed new rules, the CSA has made it clear all QPs are expected to state what they did with respect to data verification and provide an opinion on its adequacy of the data for the purposes used in the technical report. For many QPs this means they would have to think about their data verification for information they have relied upon in the report. This includes data verification for any test work they have completed, as well as information by the company and/or legacy results from historical work.

In addition, QPs currently disclose details of historical data verification efforts completed by previous QPs who have worked on the project. However, the proposed changes to 43-101 CP explicitly state that referencing "prior data verification conducted by others does not meet the requirements of the technical report." In projects with long histories, it is very important for a QP to be able to make a judgement call about the reliability and inclusion of historical data verification done by others. The information is often relevant to what data was used for the mineral resource estimate, and how reliable it is for the report purposes. As long as a QP is satisfied that the historical data verification by others is satisfactory for the purposes of the report, they should be permitted to include a description of that work done.

Disclosure about Environmental, Social and Governance (ESG) in Technical Reports

As part of the proposed updates, the regulators have made two noteworthy changes to ESG disclosure: (i) removed the restriction to only disclose information about ESG in reports that contain an economic analysis, and (ii) added a requirement to discuss how indigenous peoples and rightsholders will be impacted.

However, a paradox exists for readers of technical reports, where there are multiple regulatory triggers for a technical report in the early stages of a mineral project, but once a project has advanced to a PFS or FS level, the triggers to produce a technical report are significantly reduced.

Mineral projects that are still being explored and developed have many uncertainties from size and potential of mineralization, processing and recovery, infrastructure requirements through to necessary permitting and the requirement to obtain the permits.

As a result of these uncertainties, in the early stages of a mineral project, a junior mining company is involved in a delicate balance between keeping indigenous peoples, rightsholders and/or local communities informed of the mineral projects development but also not providing information that inflates their expectations, in case the mineral project is not economic. Not achieving this delicate balance can impact future relationships with the local community for both the current property owner as well as anyone else who subsequently becomes the property owner or enters the area in general.

This balance be particularly tricky when it comes to determining who are "rightsholders?" There is no definition provided in the proposed changes, so it is not clear what the limit is for discussing the impact on rightsholders. Does the discussion about rightsholders end at the property boundary? Along the access route to the mineral project? Or at the mouth of the river which has a tailings dam located at some distance upstream? Discussing impacts to rightsholders is clearly very sensitive in the early stages of a project as it is still nebulous and poorly defined.

For a producing company, there can be lengthy periods of time when an updated report is not produced for a variety of reasons, including no regulatory triggers for a technical report, unfavorable markets for raising money, to there being an operating mine with no need to raise money. Ironically, this means the intended audience for the reports now find that there is no requirement for the company to update their reports at a time when there is meaningful progress being made on ESG requirements of the mineral project.

Because of this paradox, it is important to recognize junior mining companies have the highest burden to produce technical reports on a regulatory basis but are also subject to the greatest uncertainty with respect to the future of their mineral project. There is a real danger that enhanced requirements could result in information being misconstrued by local and regional stakeholders, which could have an impact on the project's future development.

There are other avenues which might be a more suitable place for any enhanced ESG requirements, such as a company's continuous disclosure record.

Independent QPs and Third Party Sign Off

Canada is unique amongst global members of CRIRSCO in requiring independent QPs for a number of reports triggered under securities laws. The origins of the independent QP requirement

almost certainly lie in the aftermath of the Bre-X gold hoax in 1998 and subsequent loss of investor trust.

Canadian securities law also uniquely places all the burden of responsibility on individual QPs with respect to natural resource disclosure, with an outsized adherence to the QP being independent of the company. Under other Canadian securities laws, most expert generated materials (e.g. legal and accounting) are signed off by firms and not individuals.

NI 43-101 does not provide any options for a third-party firm of technical experts to sign off on behalf of their QPs, as was introduced in 2022 by the Unites States of America under SEC Code of Federal Regulations, Subpart 229.1300 (SK-1300), Disclosure by Registrants Engaged in Mining Operations. This issue becomes a tremendous financial and time burden to mining companies when they need 'expert' consents from all the QPs on a technical report for a prospectus offering. Time may have lapsed between filing the technical report and the prospectus offering. As a result, QPs may simply be unavailable to provide an expert consent at short notice as they are in the field, on leave, or have left their previous employer and are no longer able to provide individual consents.

QPs, like lawyers and accountants, have professional credentials and are affiliated with a professional association which place a similar emphasis on ethical and educational requirements as well as a mandate to protect public safety, which includes the public's investments. It is unclear why it is acceptable for legal and accounting firms to sign off on expert documentation, but not third-party technical firms.

The CSA should move to treat QPs who work on expert documents like the technical report to be in line with other experts under securities law and permit third party firms comprising mining experts (QPs) to state and sign technical reports and provide written consents.

Contributions by other specialists

Technical reports often require input from specialists with expertise outside geoscience or engineering. This includes input from business analysts, biologists, chemists, accountants, lawyers and other experts. Many of these experts are also members of professional associations that have similar requirements and obligations as the professional associations for geoscientists and engineers.

It is a missed opportunity to not leverage the creation of professional associations for individuals in these fields. While it is far from clear these experts would be willing to sign off as independent individuals given that is not required for any other form of regulatory disclosure, it does seem appropriate to find a path forward whereby these professionals can take responsibility for the content they have generally authored in the technical report, and place the burden of knowledge on the true expert.

Conclusion

It has been 14 years since changes were last made to NI 43-101 and there have been some significant changes in the mining sector since then. Overall, the CSA has made considerable effort to update NI 43-101, 43-101 F1 and 43-101 CP, with many benefits to the industry. However, some of the changes are likely to increase the burdens on the mining companies responsible for the disclosure, and QPs who create the disclosure. In other instances, there are missed opportunities to reduce the burden on mining companies and QPs without impacting the markets. Mining companies, QPs and other interested and related parties should take the opportunity to review these changes and provide feedback before October 10, 2025.

CSA Notice: https://www.osc.ca/en/securities-law/instruments-rules-policies/4/43-101/csa-notice-and-request-comment-proposed-repeal-and-replacement-national-instrument-43-101

AIPG in Cornwall England:

Granite, Schist, Copper, Tin, China Clay, and Pasties

Dr. Kevin Svitana, MEM-1840

Introduction

In 2024 AIPG began promoting a trip to Cornwall England coordinated by Down To Earth, a small English company that specializes in organizing geology focused tours. The trip occurred May 8-16, 2025, with 27 excited AIPG members and their guests, plus our esteemed guides (Chris Dorman and Colin Schofield). The attendees were impressed by the complex geology, history, culture, and hospitality of the region. The weather was fantastic with sunny, cool days and just a few brief rain showers.

Figure 1. Cornwall's Location in England. From https://en.wikipedia.org/wiki/Cornwall

The ceremonial county of Cornwall occurs on the southwestern margin of England (Figure 1), and the largest urban areas on the peninsula include Camborne and Redruth. Tricky's Hotel in Redruth served as the base location for the field trip.

Down to Earth planned an exciting itinerary for the geologic tours, which included visiting numerous unique geologic features and settings, while incorporating several historic and cultural options. Guest lecturers familiar with different aspects of Cornwall provided additional background during evening lectures, rounding out a full itinerary. The lecture topics included the geologic history of Cornwall, a description of the Cornish mineral collection and the reopening of the Cornish Metals mine in South Crofty.

Geologic Features

The following provides a brief description of some of the geological sites visited. More detailed descriptions of the locales can be found in Hall, 2005.[1]

The Lizard ophiolite complex: The Lizard Peninsula provided trip participants with a rare opportunity to view an ophiolite sequence representative of a slice of the ocean floor at the surface. For several of the participants, this was their first encounter with mafic units typical of sea floor environments.

Land's End Granite: The group traveled west of Redruth, passing Penzance enroute to Boscaswell and the Greevor Tin Mine area (described below). Stops were also made near Bottalock and Cape Cornwall to view the Land's End Granite alteration and the margins of the granite where the country rock was metamorphosed.

North Cornwall slates and metamorphic rocks: Stops in this area focused on the metamorphic rocks from the Devonian and Carboniferous. Stops included visits to slate quarries in Delabole and viewing the chevron folds in slates along the coast of Boscastle. In the Cligga Head area the granite intrusions and associated metamorphosed aureoles of the host rock were observed along with mine workings and former wolframite mine and explosives factory remnants. The gorse vegetation was indicative of acidic soils associated with the area's former activities. A similar, excellent exposure of granite intrusion and contact metamorphism was explored along the southern coast at Praa Sands beach where the intrusive granitic body is flanked by metamorphosed country rock with the degree of metamorphism decreasing laterally.

Cultural and Historic Items

The Cornwall Peninsula has been steeped with the history of metal mining since the Bronze Age.[2] Into the 1900s mining and ore processing were major sources of employment and the historical imprint on the area is evident. Remnants of steam powerhouse structures, shaft elevators and ore processing facilities are scattered across the countryside, and they stand as emblems to the

1. Hall, A. 2005. West Cornwall, 3rd ed., Geologist Association Guide Number 31, The Geologist Association.
2. Boag-Wyllie, A. 2023. A Brief History of Mining in Cornwall, https://wildernessengland.com/blog/mining-cornwall/. Accessed July 7, 2025.

Figure 3. A view of the south shoreline at The Lizard.
Photos courtesy of author except Figure 8.

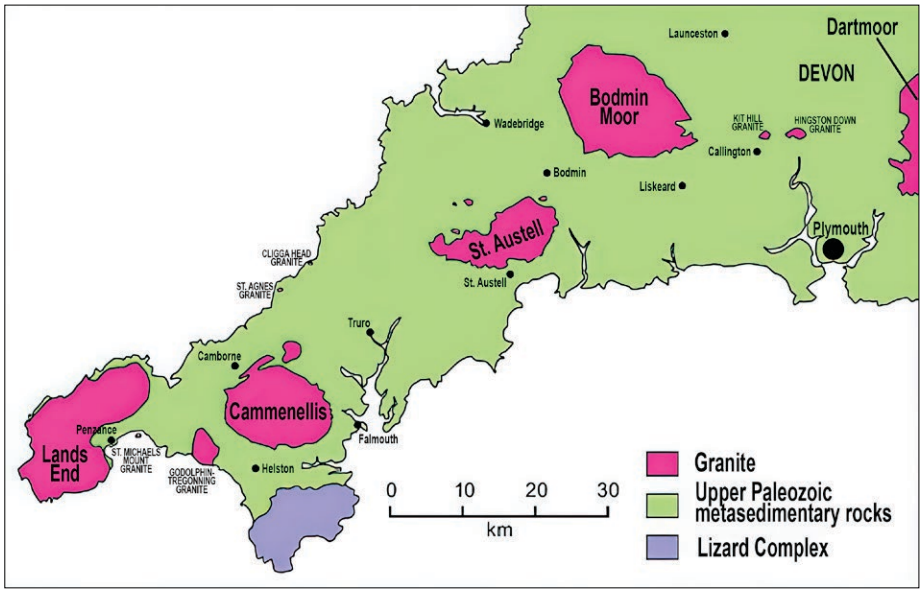

Figure 2. Geologic map and isotopic characteristics of the ca. 290 Ma Cornubian Batholith and the Devonian-Carboniferous metasedimentary rocks intruded in the Rhenohercynian Zone of SW England (isotopic data from Davies et al. 1985 and Darbyshire and Shepherd 1994; map from Edmonds et al. 1975). From: https://www.researchgate.net/figure/Geologic-map-and-isotopic-characteristics-of-the-ca-290-Ma-Cornubian-Batholith-and-the_fig6_277592656

Figure 4. Land's End Granites along the Celtic Sea near Botallack.
This is the film location for Poldark.

proud mining heritage of the Cornish people.[3] Many of the sites visited during the tour were along the coast, with stunning views of the ocean, and wildflowers growing along the coastal path. It is fascinating to see the historic tin mines perched on cliffs overlooking the water and to know that the underground workings extend out under the water.

Nowhere was this more evident than at the Greevor Tin Mine Museum near Boscaswell. The Geevor mine and processing facility, which closed in February 1990, were some of the latest mining operations to close in the historic mining district. The mine and processing facility were maintained post-closure and have since been repurposed as a National Historical Site and provides a first-hand example of mining operations typical of Cornwall.[4]

The group tour of Greevor included the control room for the elevators used to transport miners and ore from the surface to the underground workings; ore processing that included picking lines, where rock and ore were manually separated along conveyor belts; crushers to pulverize the ore; and shaking tables to separate the tin ore from other minerals. The group was allowed to enter an intact portion of the workings from a surface portal and proceed through the narrow confines of a former working adit. The visit to Greevor Mine gave the group an accurate portrait of mining operations as well as firsthand stories of the lives of those who were working at the mine prior to its closure; our guide personally knew many of the folks portrayed in the photo displays and shared their stories.

Another location that provided historical perspectives of mining was the Wheal Martyn China Clay Mine and Works[5]; this site is also a National Heritage Site (editor's note: the group learned some Cornish words. For example, "wheal" means work, and is used synonymously with "mine"). In the St. Austell area, granites have weathered into kaolin clay, also referred to as "China clay". At Wheal Martyn a museum with various operating in-the-field features, (pumps, water sluices, water wheels, etc.) provides visitors with experiential opportunities to understand the hydraulic mining process used to mine, transport and process the clay. In addition to the museum, visitors were able to observe the operating mine at Wheal Martyn.

The hydraulic mining used for China clay is like the slurry process used for gold mining. The friable rock is loosened and moved by applying large volumes of water delivered by hoses and nozzles. The fines (clay) are transported in the runoff, which is collected and transported by slurry pumps for processing. The clay recovery process consisted of various types of settling basins to precipitate and accumulate the clay and remove impurities and consolidate the wet clay prior to its drying in coal fired kilns. The museum

3. The Cornwall and West Devon Mining Landscape World Heritage Site. 2020 Cornish Mining World Heritage Site. https://www.cornishmining.org.uk/. Accessed July 7, 2025.
4. Greevor Tin Mine Webpage; https://geevor.com/
5. Wheal Martyn Clay Works Website; https://www.wheal-martyn.com/

contained numerous displays to illustrate the mining technique and processing. It also had re-creations explaining the dangers of clay processing and how the community embraced the clay industry as part of their heritage.

Other historic and cultural events included travel to Truro and Cornish cuisine. In Truro travelers visited the Truro Cathedral and viewed the extensive mineral collection at the Museum and Art Gallery of Truro as well as having time to explore the historic city.

The group was treated to numerous other opportunities to enjoy Cornwall's cuisine. Stops took advantage of local coffee shops, pubs and Cornish ice cream. A highlight for many was being treated by our host at Tricky's with a meal of Cornish pasties. If you aren't familiar, the pastie is a thick dough pastry that was a mainstay of the Cornish miners. The pastry is filled with beef, potatoes, turnips and other vegetables, sealed, then baked. This all-in-one meal was a staple of many miners' lunches.

It would be an oversight not to mention the tour and lecture at the Camborne School of Mines, located at Exeter University Penryn Campus. This is a world-renowned institution for those interested in studying mining and the geology of mineral resources. Not only does the school maintain a phenomenal mineral collection, but the laboratories and classrooms are state-of-the-art.

Summary

The trip was a true immersion into Cornwall. The centerpiece of the trip was exploring the unique geology of the peninsula and connecting how geology melds with the identity of the Cornish population. Much of the identity and personality of Cornwall is a reflection on its mineral rich environment. As demand for minerals associated with tin, copper, lithium, etc. continues to rise, so will the interest in Cornwall's resources, as evident by the current plans to reopen the Cornish Metals South Crofty mine.[6]

There were discussions regarding repeating this trip in the future. This year's attendees would agree, if repeated, the trip is highly recommended based on the content, accommodations and the welcomeness of the Cornish community.

Figure 5. Chevron folds in the schists near Boscastle.

Figure 6. Contact metamorphism between the granite intrusion and country rock at Praa Beach.

Figure 7. Exploring the mine portal at Greevor Tin Mine.

Figure 8. The group at the Camborne School of Mines, Exeter University Penryn Campus. *Photo courtesy of Robin Shail.*

6. Holly, S, 2025. South Crofty Tin Project, https://cornishmetals.com/projects/uk/south-crofty/. Accessed July 6, 2025

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Celebrating Excellence

AIPG Honors the Gold Standard of Geoscience Professionalism

Since 1963, the American Institute of Professional Geologists (AIPG) has set the gold standard for excellence, ethics, and professionalism in the geosciences. Geoscientists play a critical role in tackling today's most pressing challenges—resource development, environmental protection, and public health—and AIPG ensures they are recognized for their leadership and impact.

The Honors and Awards Program celebrates members who go above and beyond in advancing the profession, the Institute, and society. Each year, the Honors and Awards Committee, led in 2025 by National Vice President Chris Hogan, CPG-11960, selects exceptional leaders who embody AIPG's mission.

AIPG currently bestows seven prestigious honors:

- **Ben H. Parker Memorial Distinguished Service Medal**
- **Martin Van Couvering Service to the Institute Award**
- **John T. Galey, Sr. Public Service Medal**
- **Honorary Membership Award**
- **Outstanding Achievement Award**
- **John Stewart Memorial Early Career Professional Award**
- **Presidential Certificate of Merit**

These awards recognize excellence at every stage—from early-career accomplishments to lifetime contributions—demonstrating the diverse ways geoscientists shape the profession and society. You can read about them in the following pages.

Nominations for the 2026 awards are now open through January 15, 2026. Details, past recipients, and forms are available on the AIPG National website or by contacting AIPG National Headquarters.

As you renew your dues this year, take a moment to reflect on colleagues who exemplify AIPG's gold standard of professionalism. Nominate them, celebrate their achievements, and help honor those driving our profession forward.

Thank you to our Awards Committee members: Chris Hogan, David M. Abbott, Jr, CPG-04570, Shanna Schmitt, CPG-11781, Anne Murray, CPG-11645, Todd McFarland, CPG-11348, and Dennis Pennington, CPG-04401.

Recipients of the Presidential Certificate of Merit

AIPG celebrates the incredible teamwork of our members who have reviewed a record number of CPG applications this year. Your commitment, attention to detail, and efficiency ensure that we continue to uphold the highest standards of professionalism. Thank you!

National Screening Chair

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West NSC Chairperson

Barbara Murphy

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Michael Feinstein
Andrew Feltman
Randall Ferguson
Chris Hogan
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Gwyn Rhys-Evans
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Capitol – Mark J. Schaaf
CO – Douglas C. Peters
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IL/IN – David T. Heidlauf
MI – Derrick A. Lingle
Robin S. DeWyre
Mark R. Zayatz
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Northeast – Dennis G. McGrath
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OH – Craig A. Cox
SD – Thomas V. Durkin
Tim Cowman
Mark R. Nelson
TN – J. Todd McFarland
TX – Michael D. Campbell
Regina M. Capuano
Henry M. Wise

Barney Paul Popkin *(Arizona) has become a familiar voice in The Professional Geologist, generously sharing his wisdom and passion for geology. His deep dedication to the profession when he was a practicing Certified Professional Geologist and long after shines through as he has continued to write, facing significant health challenges with a positive attitude, and we are profoundly grateful for the inspiration and insight he has brought to our community.*

Ron Wallace *(Georgia) for his dedication as the Education Committee chair leading the review of inspiring student essays on why they want to become a geoscientist and also the requests for CEUs for professional development opportunities. Ron's long-time support and dedication to education is outstanding.*

In a remarkable 30-year tenure, we thank **National Ethics Chair Emeritus, David M. Abbott, Jr.,** *(Colorado) for his dedication to providing 195 professional ethics columns that have consistently challenged the membership and inspired a commitment to ethical conduct.*

Dr. Robert Font's *(Texas) challenging Questions and Answers column, the popular geology quiz, has been a staple for more than 20 years in every TPG issue. We are incredibly grateful for his deep commitment, as he has already prepared columns for the next two years, ensuring his valuable contributions will continue.*

Michael D. Lawless, CPG-9224

Virginias Section

Recipient of the Ben H. Parker Memorial Distinguished Service Medal

The Ben H. Parker Memorial Distinguished Service Medal is the most prestigious award given by the Institute. Established in 1969, it honors Ben H. Parker, a dedicated leader who worked to improve the quality of geology, geologists, and their services. The medal is awarded to individuals with a long history of distinguished service to the profession.

> "One of the benefits of AIPG is the ability to interact with geologists from across the many disciplines within the profession."

I can honestly say I was shocked to receive the email notifying me that I had been selected for this prestigious award. It is quite an honor to see my name alongside previous winners. I did not become involved with AIPG for the awards but initially as a way to build my career and later as a way to give back to the profession that has been so rewarding to me.

When I joined AIPG, I was working for a very small environmental consulting company; there were three of us. I looked to AIPG for a chance to network with other geologists as well as the possibility of becoming a CPG. I was aware of the need for a current CPG to sponsor me and at that point I did not know any CPGs. I contacted the then-President of the Virginia Section, Tony Scales. Tony agreed to meet with me and act as my sponsor for the CPG application process. He invited me to a field trip at the Willis Mountain Kyanite Mine where I met many other AIPG members.

What struck me most about Tony and the other AIPG members I met both that day and over the years is the willingness to help young professionals (and even their older colleagues) develop a career, build a network and mentor them in many ways.

The relationships begun that day have developed into lifelong friendships. After becoming involved in the Section leadership, I began to become involved at the National level. There, I found the same collegial, friendly reception. Whether discussing baseball over frosty beverages or taking an early morning drive to see the sunrise at the Grand Canyon, a lot of good stories have been generated.

One of the benefits of AIPG is the ability to interact with geologists from across the many disciplines within the profession. This is not only interesting and intellectually stimulating but also affords us the opportunity to build a network across these disciplines for both personal benefit and the benefit of colleagues. Building an international network is a significant benefit as well, through meeting the international colleagues who attend our meetings and I was honored to represent AIPG at EFG meetings in Germany and Slovenia.

Thank you to the Honors and Awards Committee and the Executive Committee. There are too many individuals within AIPG who have helped me over the years to mention by name (and I don't want to leave anyone out) but let me recognize a few. Former Executive Director Bill Siok was a great mentor earlier in my career and we had great times (and good Scotch) working together during my year as President. I have gotten to know Aaron Johnson better each year as we work together and he certainly has AIPG moving in a positive direction. Stepping into the position of Chair of the Foundation (because I missed a meeting!) could have been much more daunting than it was, but thanks to Barb Murphy and all her efforts to rebuild and re-invigorate the Foundation it was a seamless transition. Thanks to the Trustees of the Foundation for their help in raising and distributing funds to advance the geosciences. Most of the Trustees have served in numerous leadership positions within AIPG and are excellent examples of the adage that you what you get out of an organization is proportional to what you put in.

Thank you again for this award.

John L. Berry, CPG-04032

Texas Section

Recipient of the Martin Van Couvering Memorial Service to the Institute Award

The Martin Van Couvering Memorial Service to the Institute Award, established in 1979, honors the Institute's first president. Van Couvering dedicated himself to making the presidency a full-time job during the Institute's first two years. His dynamic leadership and organizational skills built the solid foundation on which the Institute has grown. The award recognizes those who have given outstanding service to the Institute.

I am deeply honored to receive the Martin van Couvering Award, for which I feel unqualified.

For years while actively employed I took the AIPG for granted. It was only after Wendy Davidson asked me if I was interested in becoming the editor of *The Professional Geologist* that I realized how much work it took on the part of many devoted individuals to keep the AIPG running and relevant. I feel in hindsight that I could have done a much better job as editor if I had been more actively involved beforehand. The present editor has brought many improvements to *The Professional Geologist.*

When the Texas Board of Professional Geoscientists came up for sunset review and was faced with active opposition from politicians who are on principle opposed to any kind of professional association or professional regulation, I realized how tenuous is the license that society gives us to operate as a self-governing profession, with or without state supervision. It is important to me that any occupation that claims to be a profession has some way to bar the performance of that profession by people who are unqualified by training or experience, and to discipline practitioners for incompetent or unethical behavior.

As I write this I am traveling by bicycle and public transport across eastern Europe, where the evidence for unethical and incompetent performance by engineers and economists during and since the Communist era is everywhere evident. I was told repeatedly in Romania that the eventual cost of any project is more than an order of magnitude more than the true cost, because everyone involved has to have his take 'on the side'. It is clear on almost every road that either the foundation engineering was inept, or that the materials used were substandard: contractors took their baksheesh by supplying lower than specified quality materials. The same for the railways and many buildings. The result is enormous costs to society in terms of delays to logistics and travel (e.g. 4 hours for a 50 km train ride) or to completion of projects (hundreds of miles of partially completed modern rail tracks and half-completed buildings).

The series of monthly webinars that I started to help the Texas Section of AIPG rebuild its scholarship funds after they had been depleted due to lack of supervision has been successful in spite of my failures as an organizer. I hope that it helps to spread awareness of the AIPG, both within and beyond Texas. I also hope that it attracts new members when attendees become aware of what AIPG offers in terms of educational resources and support of the upcoming generation. I have the same hopes for the scholarships that National awards. I would really appreciate any offers from AIPG members to speak for this series.

Again, my thanks to the Nominations Committee for this award. And my encouragement to any member sitting on the sidelines to reflect on what AIPG offers, and how much more it could potentially offer, to students, early professionals and established geoscientists. Don't be like me and wait until retirement to become actively involved: use your insights and experiences now to contribute actively to the only organization that offers ethical training, nationwide and even international official recognition to working geoscientists, financial and experiential help to students and especially early professionals, and many educational opportunities.

"...use your insights and experiences now to contribute actively to the only organization that offers ethical training, nationwide and even international official recognition to working geoscientists, financial and experiential help to students and especially early professionals, and many educational opportunities."

Brigitte Petras, ECP-0851

Ohio Section

Recipient of the John Stewart Memorial Early Career Professional Award

The John Stewart Memorial Early Career Professional Award was established in 2019 to honor John Stewart. He generously gave his time to AIPG and encouraged the professional growth of geologists early in their careers. This award recognizes an Early Career Professional member who has demonstrated a commitment to the geologic profession and to AIPG, especially by mentoring and helping to advance other early career members.

> "The future of our profession relies on us, so I ask that we make sure we keep encouraging, engaging, and listening to our Early Career Professionals..."

I am so honored and grateful to receive this award from AIPG National - an organization that means so much to me and our profession. My professional career with AIPG really began when one of my foundational mentors encouraged me to start a college geology club that was affiliated with a professional organization. I'm really grateful for that guidance since it has led to being a part of such an influential professional geology community.

Since then, I've had inspiring experiences as two years as the national early career professional representative and as a member-at-large for the Ohio section.

I truly cherish the innumerable connections and collaborations with like- minded individuals that better the geology community. The future of our profession relies on us, so I ask that we make sure we keep encouraging, engaging, and listening to our Early Career Professionals and remind your companies of the values of AIPG. If a mentor had not told me to get active with AIPG, I would have missed these invaluable experiences. I know these experiences - learning, sharing, leading, collaborating - through AIPG elevates and enriches our profession. I deeply appreciate this recognition and all your support. Thank you.

Recipient of the Student Chapter of the Year Award

Congratulations to Western Michigan University's (WMU) AIPG Student Chapter on being awarded the prestigious Student Chapter of the Year for the third year in a row! This remarkable achievement, a "3-peat," highlights their consistent dedication to geoscience education and engagement.

Under the guidance of their outstanding WMU staff advisor, Tom Howe, the student chapter has demonstrated a passion for geology that makes a meaningful impact on campus and beyond. Their activities include students from all majors, and their infectious enthusiasm creates an appreciation for the geosciences among majors and non-majors alike. Their success is evident in their weekly meetings, innovative committee work, and successful outreach efforts at events like Bronco Bash, Geoloween, and Waldo Fest. This award is a testament to the students' hard work and commitment to growing their field.

Rockhounding event at Lake Michigan.

Gem Sluicing activity on campus.

R. Douglas Bartlett, CPG-8433

Arizona Section

Recipient of the Award of Honorary Membership

Since 1984, AIPG has conferred Honorary Membership to those who have an exemplary record of distinguished service to the profession and to the Institute.

My career has spanned more than 48 years as a geologist and, if you include my school years as a geology major, more than 52 years. That is a long time to pursue any profession. I could not be happier with the choice I made my first semester of my undergraduate Freshman year in 1973! I have enjoyed every minute of those 52 years and still to this day love going to work. My goal every day is to learn something new, and I am constantly challenged by this field and the never-ending changes that continually occur.

My success as a geologist and hydrogeologist has been greatly shaped by my involvement with AIPG and the other societies I have participated in. The community of professionals that I have met along the way have helped to broaden my understanding of our science but have also provided the opportunity to develop life-long friendships that I cherish. I have had the opportunity to travel all over the world to attend various professional conferences and have met geologists that have opened my eyes to the challenges faced throughout the world. It is easy to become professionally myopic without that opportunity to travel and mingle with others. AIPG is essential to a broad, well-rounded career in the geosciences and thereby provides an invaluable service to us all!

Any successful career requires the support and encouragement of many people and I have many to thank – too many for tonight's ceremony. But there are a few I would like to recognize: my parents inspired me to try new things and branch out with my interests from an early age. They have departed this earth but remain in my heart! My many managers at Dames & Moore showed me how exceptional consulting is done – in particular: Glenn Haldeman (who took a chance on a very green 22 year old geology graduate), BG Randolph (who taught me to write technical reports), Bill Greenslade (who urged me to join AIPG early in my career); Jim Hussey (who encouraged me to think out of the box on environmental remediation projects), Gary Rogers (who showed me how to be a considerate, compassionate manager of staff), and of course my long-time colleague and friend throughout my career, Barbara Murphy. In addition, I need to thank Mike Alter for sticking by my side on so many, many interesting, challenging projects. He is an exceptional consultant and friend!

Finally, I want to thank my wife and life partner, Lori. We have literally been together 24 hours per day for the last 39 years! Our partnership has yielded two wonderful boys (men) and a consulting company that I am truly proud of! Her love and encouragement is the backbone of my success.

"The community of professionals that I have met along the way have helped to broaden my understanding of our science but have also provided the opportunity to develop life-long friendships that I cherish."

Recipients of the Student Chapter Award for Excellence

WAYNE STATE UNIVERSITY

EASTERN MICHIGAN UNIVERSITY

Jonathan Arthur, MEM-0932

Capitol Section

Recipient of the Outstanding Achievement Award Major Contribution to the Profession

The Outstanding Achievement Award for Major Contribution to the Profession was established in 1989. This award is given to an individual, whether a member or non-member of AIPG, who has made a significant contribution to the geology profession. The award is not necessarily given every year; it is only awarded when the Awards Committee recommends an exceptional candidate to the Executive Committee.

> "Reflecting on this moment, I think back to my fourth-grade self, who passionately declared in an essay, "I want to be a geologist… I'll never change my mind."

I am deeply honored to receive the American Institute of Professional Geologists' Outstanding Achievement Award for Major Contribution to the Profession. This recognition is profoundly meaningful to me.

Reflecting on this moment, I think back to my fourth-grade self, who passionately declared in an essay, "I want to be a geologist… I'll never change my mind." That unwavering conviction has guided me throughout my life, transforming this chosen profession from a career into a lifelong calling. It has been an incredible privilege to serve and contribute to the field of geoscience.

From my early days as a geology research and teaching assistant to serving as Florida's 6th State Geologist, and now as Executive Director of the American Geosciences Institute, I've had the opportunity to educate students, develop outreach and education materials, conduct pivotal research, and work alongside many talented professionals—mentors, friends, colleagues, and others—who have challenged, taught, and inspired me. I share this award with them, as they have been the guideposts along my career path.

My work has always been centered on the intersection of geoscience and public service. Whether mapping aquifer vulnerability, responding to sinkhole crises, understanding water quality issues related to managed aquifer recharge, or communicating science to decision-makers and the public, I have always believed geoscientists must serve society with integrity, purpose and effective communication.

At AGI, I am proud and privileged to lead an Institute dedicated to strengthening the geoscience enterprise—a cause I am deeply passionate about. Whether improving the workforce pipeline, enhancing global geoscience knowledge through GeoRef, providing robust geoscience education and outreach, or elevating geoscience's role in policy, resource sustainability, and prosperity, AGI works to support our professional community. Organizations like AIPG are essential partners in this shared mission, and I'm grateful to work alongside them.

Despite challenges confronting our field, I remain deeply optimistic about the continued positive impact and growth of our profession. Our work is as vital as ever. From ensuring water security and energy access to building resilience in the face of natural hazards and threats to environmental sustainability, geoscientists are needed—not just in labs and field sites, but in boardrooms, classrooms, courtrooms, and communities.

Thank you once again for this recognition. I accept it with gratitude, humility, and a renewed commitment to our profession, the people it serves, and the planet we all share.

I truly cherish the innumerable connections and collaborations with like- minded individuals that better the geology community. The future of our professional relies on us, so I ask that we make sure we keep encouraging, engaging, and listening to our Early Career Professionals and remind your companies of the values of AIPG. If a mentor had not told me to get active with AIPG, I would have missed these invaluable experiences. I know these experiences - learning, sharing, leading, collaborating - through AIPG elevates and enriches our profession. I deeply appreciate this recognition and all your support. Thank you.

Recipients of Section Leadership Awards

The AIPG Section Leadership Award was established by the Executive Committee in 2013 to recognize one or more of our members who have demonstrated a long-term commitment and have been long-term contributors to AIPG at the section level.

Paul Putzier, CPG-07798, Minnesota Section

Paul has been actively involved in the AIPG Minnesota Section for many years. He's held many leadership positions within our section over the years.

Paul has encouraged younger geologists to participate in Minnesota Section events and join AIPG. He has volunteered on several committees throughout the years, most recently the student resume review committee.

He has served as Minnesota Section Vice President in 1997 and 2011, President in 1999, and has served as a Director several times (1994-1995, 1996-1997, 2013, and 2020-2021).

Nominated by: Shanna Schmitt, CPG-11781

Jennifer Wolff, CPG-10034, Minnesota Section

Jennifer has been actively involved in the AIPG Minnesota Section for many years. She's held many leadership positions within our section over the years.

Jennifer has encouraged younger geologists to participate in section events and join AIPG.

Jennifer served as our Minnesota Section Vice President in 2003, helped with the annual conference in 2006, and has served on various committee throughout the years.

Nominated by: Shanna Schmitt, CPG-11781

Robert Reichenbach, CPG-09090, Michigan Section

I am nominating Robert Reichenbach in order to recognize his many years volunteer service in support of organizing the annual golf outing for the AIPG Michigan section. He played a pivotal part in coordinating this outing for approximately 17 years.

Bob's contributions to the geologic profession in Michigan are significant and are three-fold. First, the funds raised at the annual golf outing are used for AIPG scholarships. The success of the outing is key to sustaining this benefit for young students. Second, in 2009, Bob founded Environmental Resources Group, a thriving environmental consulting company contributing to Michigan's economy, providing career opportunities for geologists, environmental scientists, fellow CPGs, and more. Third, Bob continues to provide mentorship to numerous geoscientists in his career, improving their knowledge of the profession, and facilitating the professional networking opportunities during the golf outings.

Bob's leadership was in the coordination of the annual golf outings and in growing a Michigan geoscience business.

Nominated by: Bridget Klueger, CPG-10369

Deanna Wolfe, MEM-3086, Missouri Section

Deanna has served as the president of the Missouri Section for 2 years now and has done a fantastic job in her role. She has promoted outreach of geosciences in various activities and opportunities throughout Missouri, such as the Missouri Geological Consortium hosting student presentations, and helping with the Executive Committee meeting plannings and field trips to Doe Run Mining Co.

She is part of the team planning the AIPG 2025 National Conference, which will be held in St. Louis, MO (home turf!) She networks with governmental agencies and stays up-to-date on geoscience-related matters happening at the state government level (such as Earthquake Hazard and Preparedness week AKA "Shaking Hands" and the proposal to reinstate the Bureau of Mines). She does a great job communicating to other members of the section.

Deanna is great at answering questions about AIPG and the Missouri Section, and about career-related guidance. She was very welcoming when I attended my first in-person section meeting, and I know I'll be participating more in the future thanks to her!

Nominated by: Patrick Szopinski, SA-8499X

Honors and Awards

2026 Call for Nominations

The 2026 AIPG Awards Committee is seeking nominations for future honorees who exemplify the qualities of leadership and dedication to service upheld as the highest standards and values of the Institute. The qualifications for these awards can be found below. Nominations are due January 15, 2026. Submit online at https://aipg.org/page/Awards or scan the QR code on page 15.

Leadership

Ben H. Parker Memorial Medal

The Institute's most distinguished award was established by the Executive Committee in 1969 in posthumous honor of a truly great leader, who devoted much of his life to improve the quality of geology and geologists and the services they provide. The medal is awarded to individuals who have long records of distinguished and outstanding service to the profession.

The most important criterion is a continual record of contribution to the profession of geology. A wide variety of contributions can be considered, such as (a) the education and training of geologists, (b) professional development of geologists, (c) services to the Institute, (d) leadership in the surveillance of laws, rules, and regulations affecting geology, geologists, and the public, and (e) activity in local and regional affairs of geologists.

Service to the Institute

Martin Van Couvering Memorial Award

Established in 1979 by the Executive Committee in posthumous honor of the first president of the Institute. Martin Van Couvering made the presidency a full-time occupation for the first two years of the Institute's history. His dynamic leadership, diplomacy, and organizational abilities established the solid foundation from which the Institute has grown. Few, if any, have given so much to the Institute.

The most important criterion for the Martin Van Couvering Memorial Award is service to the Institute. A wide-variety of contributions to the Institute may be considered. By far the most important contribution a geologist can make to the Institute is that of time. It is the contributions by individuals to the Section, the committees, and special projects that enable the Institute to enhance the practice of geology.

Service to the Public

John T. Galey, Sr. Memorial Public Service Award

AIPG's Public Service Award was established in 1982 in recognition of one of its primary purposes: service to the public. In 1992, it was renamed after John T. Galey, Sr., in posthumous honor of our fourth President, whose long professional career was a continuum of service to both the geological profession and the general public.

Recognition of public service is important because so many Members have distinguished themselves as experts in the field to governmental agencies and the serving the needs of the public.

The application of geology to the needs of the general public may be in many different forms. Recipients of this award have outstanding records of public service.

Honorary Membership

Honorary Membership

Since 1984, AIPG has conferred Honorary Membership to those who have an exemplary record of distinguished service to the profession and to the Institute.

John Stewart Memorial Early Career Professional Award

The John Stewart Memorial Early Career Professional Award was established by the Executive Committee in 2019 in posthumous honor of John Stewart, who graciously gave his time and experience to AIPG and in encouraging geologists in their early careers and professional growth. This award is to honor an Early Career Professional member who has demonstrated an ongoing commitment to the geologic profession and AIPG at the section and/or national level, and in particular, to mentoring and aiding in the advancement of Early Career Professional members in their early careers and within AIPG.

This award is to assure that active and ambitious Early Career Professional member geologists are honored as the future of AIPG.

Emerging Leaders

Advancing Geosciences

Outstanding Achievement Award Major Contribution to the Profession

The Outstanding Achievement Award Major Contribution to the Profession was established by the 1989 Executive Committee to honor a non-member of AIPG who is widely recognized as a major contributor to the profession of geology. The award is not necessarily given annually, but only when the Awards Committee recommends an outstanding candidate to the Executive Committee for their consideration.

In 2013, the Executive Committee voted to expand the scope of the award to include candidates engaged in all types of media that inform or enlighten the public on the roles of professional geologists and the geosciences in society. This award may be for work in any media that inform or enlighten the public on the roles of professional geologists and geosciences in society. This award may be for work in any media such as visual (television, film, webcasts), auditory (radio, pod casts) or printed (books, articles, websites). The work must have been completed within five years preceding the award nomination and the nominee may be an individual, a group, or a company.

AIPG Section Leadership Award

The AIPG Section Leadership Award was established by the Executive Committee in 2013 to recognize one or more of our members who have demonstrated a long-term commitment and have been long-term contributors to AIPG at the section level. AIPG has many sections where one or more individuals have demonstrated exceptional leadership for their section and in many instances kept the section together and moving forward. These individuals are commonly not known at the National level or by AIPG members outside of their sections; however, their contributions have been vital to their sections and they perform this work because of their commitment to our profession and AIPG. All active section members are eligible. It is not required to be a current or past section officer. The award will consist of a plaque (or similar) that will be presented to the awardees at the annual meeting of AIPG.

Based on the above criteria the Awards Committee may select multiple nominees for the award.

Section Leaders

Nominations due January 15, 2026

https://aipg.org/page/Awards

Early Career Professional Spotlight: Sienna Meekhof

Hannah Weaver, ECP-1014

I would like to recognize Sienna Meekhof, ECP-0983, from the AIPG Michigan Section, as an ECP Spotlight for this quarter. Sienna was selected for this honor because of her engagement with AIPG and enthusiasm for her career and geology. Her selection for the ECP spotlight was supported by many members of the ECP Committee who recognize the positive impact she has on all AIPG members she interacts with.

I first got acquainted with Sienna when she answered the call for volunteers to join the ECP Committee. Even before she joined this committee, Sienna had been actively involved in AIPG, beginning with her time as a student and continuing through her early career. Sienna is an active member at both the National and Section level of AIPG, and is a dynamic member of the active AIPG Michigan Section.

The intention of the ECP Spotlight series is to provide a platform to recognize outstanding early career professionals and inspire students and other new professionals to find their own path to success. By showcasing the talent and ideas of early career professionals, I'm hopeful that this spotlight series will also encourage professionals in other career stages.

Tell us about yourself.

I am a Senior Staff Geologist in the Geotechnical Group at SME in Lansing, Michigan and have been in consulting for the past three years. I specialize in trenchless utility installation projects as well as geophysical projects (Seismic methods such as microtremor array measurement (MAM), multichannel analysis of surface waves (MASW), and Refraction surveys and 1D and 2D Electrical Resistivity Tomography (ERT)). I graduated with my Bachelors in Geology in 2021 from Michigan Technological University and will be starting graduate school this fall at Ohio University for my Masters in Geological Sciences. During my time at Michigan Tech, I was on the executive committee for the AIPG Student Chapter and continued my involvement professionally. I took on the AIPG Michigan ECP role for the 2023-2024 academic year and started my role on the AIPG Michigan Executive Committee as Secretary in 2025. I really enjoy consulting because I love being able to take my knowledge of geological processes and use it to problem solve in local communities and being able to share that knowledge with the public.

Tell us more about your current role.

As mentioned above, my current role is a Senior Staff Geologist in the Geotechnical Group at SME out of our Lansing office, however I have completed projects in Indiana, Kentucky, and Ohio and have proposed on projects in Pennsylvania. I took the Fundamentals of Geology exam in 2023 and received my GIT license in Kentucky and Pennsylvania (Indiana does not currently have a GIT program). I am working toward getting my PG license in Indiana, Kentucky, and Pennsylvania and anticipate taking the Practice of Geology exam in 2027. The projects I work on throughout the Midwest are primarily utility installation (open-cut and trenchless) for water mains, sewers, and gas pipelines. I also use various geophysical methods to support geotechnical projects, such as seismic MAM/MASW for site class/building design categories, MASW/Refraction for 2D imaging, finding top of bedrock, and computing dynamic soil properties such as shear modulus, poisons ratio, and modulus of elasticity, 1D Electrical Resistivity Tomography (ERT) for substation calculations, and 2D ERT for subsurface anomaly and karst exploration.

Sienna in the field performing a US Army Core of Engineers Dynamic Cone Penetrometer.

I also am very involved in AIPG on a local and national level. I am very grateful that SME supports my involvement in professional organizations and has allowed me to take on the roles as ECP and Secretary for the Michigan Section Executive Committee, National Membership Committee, and National ECP Committee. I have also just recently become involved with the Michigan Basin Geological

Society (MBGS) and am excited to continue to expand my network with other geologists locally.

Do you have any professional achievements/awards you'd like to mention?

At SME, I have received a Client Delight award, a Moxie award, and two ONE|SME awards. The Client Delight is given to someone who was "commended by a client for performing extremely high-quality work" and going above and beyond "a client's needs and expectations". A Moxie award is for team members who "are recognized for their exemplary performance and perseverance". Finally, the ONE|SME is awarded to team members or projects that have gone out of their way to utilize or help other services/groups throughout the company.

How did your education and student opportunities help you in your career?

I truthfully thought I was going to find a career in academia and had a couple of undergraduate research projects during my time at Michigan Tech. However, I also had an opportunity to be a Geotechnical Co-op (a six-month internship with college credit) at SME during my Junior year and fell in love with the consulting side of things- each project is like a mini-research project that I get to see through from start to finish. My time is spent 50-50 in the field and in the office and I get to see something new every day. I am so grateful for both my undergraduate research and my co-op because I think they both made me well-rounded and showed me how to apply my passions to my career. I am also grateful for the opportunity to be on the Michigan Tech AIPG Student Chapter executive committee because it taught me how to network and got my foot in the door for professional organizations. I didn't realize how valuable that time was, and that not every student gets that exposure in school, until I began working full time.

Sienna in the field performing electrical resistivity (ERT).

What's one of your favorite AIPG experiences?

I have been attending the AIPG National Conferences every other year since 2019, and again I think it's something I took for granted as a student. I make any excuse I can now to go to these conferences. I think that these are great for personal networking and taking fun field trips to see geology I probably wouldn't have the opportunity to on my own, but I've also been successful in recruiting students for interviews at SME and have even found some companies that I could subcontract or reconnected with other geologists that I've worked with before. I've attended the Student/ECP Professional Development Day every conference I've been to, and it has been so worthwhile to go through it as a student and as an ECP. Each year, I come in with a new perspective as my life/career changes and each year I'm able to grow and take away something new.

One of my other favorite AIPG experiences would also have to be a shout out to the Illinois/Indiana Section. They sent out an invitation to surrounding states for a field trip they held at the Indiana Dunes National Park. I attended with a couple other Michiganders, and it was not only a great day to learn about the dunes and local Indiana geology, but it was so cool that the Illinois/Indiana Section was able to bring together AIPG members from all over for a day. I thought it showed great collaboration and was something positive that the rest of us can take away/learn from.

Do you have any advice for professionals (early career and/or mid-to-senior professionals)?

To the young professionals/late students- don't be afraid to make mistakes and please don't let the fear of mistakes stop you from trying new things and meeting new people. As a student, I struggled a lot with this. If a professor or professional wasn't overly enthusiastic, I tended to walk away rather than put myself out there because I was afraid of how I would be perceived, I was afraid of messing up or getting scolded. As a student/ECP, now is your chance to make mistakes and put yourself out there. No one is expecting you to be perfect, but what they do expect is that you show up, work hard, and try to learn. As a professional now, I love answering questions students/ECPs have, and I am willing to talk through any career questions they may have but working full time I realize the student needs to take more initiative. We all have a lot on our plate as professionals and students, but ultimately as a student/ECP it's your career and therefore your responsibility to initiate- I don't think I learned that lesson too late in life but I also wish I would have realized it sooner.

To the mid-to-senior professionals- I know it can be really difficult to take time out of your day (as I said, we all have a lot on our plate!) but some of the best mentors/team leaders I've had were always will to take a pause, if not right then and there they would circle back after completing their task, to talk through questions, concerns, or sometimes just life. As a young professional, just setting up a time to sit down and get coffee or lunch means the world. It makes us feel valued, heard, and like we are truly a part of your team. It's something even I have to remember as I slowly take on a mentoring role!

Legends of the Game, Leaders in the Profession:
The Meaning of Elite

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The dog days of summer are upon us. August marks the end of vacation for school kids and the end of summer field season for many geologists. College and professional football training camps are open and talking heads are busy sharing their insights on sports radio and sports-themed tv talk shows. Even casual fans can name the latest draft pick or the big-time recruit who is primed to star for their favorite team. In August, hope springs eternal as fans eagerly await the first game of the season. August combines potential and optimism; it is one of the most exciting times of the year for fans of American football.

I have been a fan of the Missouri Tigers and Kansas City Chiefs since I was a kid in elementary school. My childhood was filled with the exploits of Lennie the Cool, and The Sikeston Train, and Kellen Winslow, and Joe Delaney. Missouri's 35-31 win over the Nebraska Cornhuskers in 1978 was **THE** most exciting football game I had ever heard. Heard, because the rabbit ears on our TV wouldn't allow us to see the game. We (my dad and I) listened on the radio as James Wilder, the Sikeston Train, ran roughshod over Tom Osborne's #2 ranked Huskers, **IN LINCOLN**. Wilder and his teammate, Kellen Winslow, went on to become all-pro players in the NFL. They were elite players, the very best at their respective positions. I'm sure every fanbase can name their own legendary players, those who were truly elite, the best of the best.

> *I believe that the Certified Professional Geologist is an elite credential. It signifies that those who hold it have chosen to adhere to the highest standards of professionalism and to be bound by the highest ethical standards.*

I've been thinking a lot about what it means to be elite. Fifty years ago, to be elite was to be the best of the best. If something was elite, it was of the highest quality. If a person was elite, they were among the very best at what they did. Football fans wanted elite players on their teams. To be considered elite was the ultimate compliment. Today, it seems as though the term 'elite' has taken on a different meaning. I regularly hear pundits speak of the elite with disdain. The political elite. The wealthy elite. The Hollywood elite. It's as if being elite has somehow become an insult. Even so, to be elite is a rare quality, one that implies a certain level of excellence.

If you will forgive a brief digression, I must say that I love investigating misattributed quotes. One of my all-time favorites is "a mine is a hole in the ground with a liar at the top." It's been famously misattributed to both Will Rogers and Mark Twain. Sadly, there is no trustworthy attribution for this quote. The closest comes from *The Autobiography of John Hays Hammond*, which credits Mark Twain with saying a mine is, "a hole in the ground owned by a liar." However, even though Hammond was a friend of Twain, there is no written source to confirm this version of the quote. Another of my favorites is "We are what we repeatedly do. Excellence, then, is not an act, but a habit." This quote is regularly misattributed to Aristotle, but it was penned by the philosopher Will Durant, who wrote it as a summary of Aristotle's views. I love this quote because it recognizes that we can choose to be excellent, a la' Bill and Ted.

The idea that excellence is a choice is central to being elite. Simply possessing athletic ability is not enough to make someone elite. Neither is having a high IQ, or excellent eyesight, or quick reflexes. Being elite requires a combination of ability and commitment. It requires that one be committed, every day, to one's chosen endeavor.

I believe that the Certified Professional Geologist is an elite credential. It signifies that those who hold it have chosen to adhere to the highest standards of professionalism and to be bound by the highest ethical standards. It is a visible statement that holders of the CPG choose, every day, to hold themselves to the highest professional standards. While we may not have amazing nicknames like Lennie the Cool and The Sikeston Train, we are also elite, among the best of the best, and we choose to meet that standard.

Over the past couple of years, we've made some changes to the CPG application process. Applications are now available fully electronically. Larry Austin has retired as National Screening Committee Chair, and Barbara Murphy has taken over. We have expanded the number of members of the National Screening committee, and we've streamlined the way the National Office processes applications. As a result, we've been able to shorten the time it takes to become a CPG without compromising the quality of the Certification. The credential continues to represent the highest ethical and professional standards in our industry. If you haven't yet applied for your CPG, I strongly encourage you to do so, even if you work in a state that has a statutory registration requirement. I believe that publicly and voluntarily holding yourself to the highest standards is an important part of daily excellence.

Whatever you do, I wish all of you (and your sports teams unless they are playing Missouri or Kansas City) a fulfilling and successful fall.

With best regards,

Aaron W. Johnson, CPG-12229

Standing on the Shoulders of Giants:

Why Geo-ACTS is the Next Step

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Where We've Been — And Why It Matters

Over the past year, my columns have focused on the elements that define the purpose of AIPG: professionalism, scientific integrity, and building public trust. These elements are key components of our Code of Ethics, which guided our founders in 1963, and they are just as relevant — if not more so — today.

Geoscience is about solving mysteries and telling Earth's story. Using the principles of uniformitarianism, we study modern processes like erosion, deposition, and volcanic activity to interpret the past, test hypotheses, revise theories, and build upon the visionary work of those who came before us. As Executive Director, **Aaron Johnson,** CPG-12229, reminded us in his column in the 2025 Jul/Aug/Sep issue of *TPG* quoting Stephen Hawking, we stand on the shoulders of giants.

And through AIPG, we've carried that tradition forward — educating the public, advocating for the profession, and inspiring future geoscientists. Our expertise touches everything from critical minerals and seasonal weather resilience to water security and hazard mitigation. In every way, geoscientists are central to shaping a sustainable, resilient future.

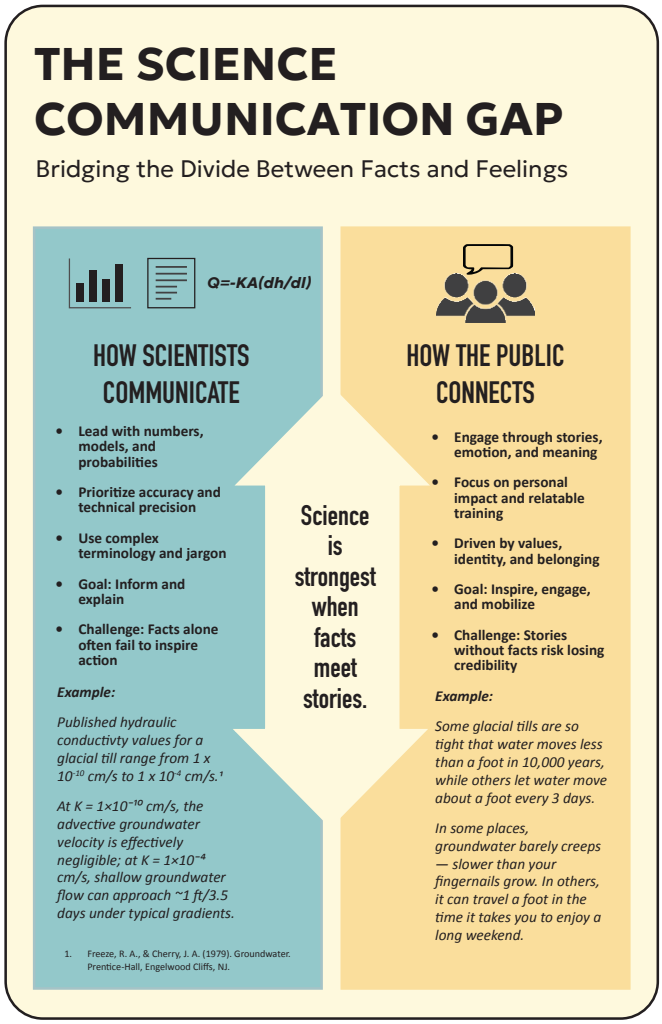
What Challenges Us — Why We Must Act Now

But as I have pointed out, we face a growing challenge: the erosion of public trust, the spread of misinformation, and the dilution of professional credibility.

This tension between science and acceptance isn't new. Galileo's support of the Copernican model placed him under house arrest for life. Alfred Wegener's theory of continental drift, proposed in 1912, took 50 years of work by several geoscientists, making discoveries to support the theory along the way until plate tectonics finally gained acceptance in the 1960s. The scientific process has always been iterative — and sometimes messy.

However, today's environment is different. In the digital age, misinformation spreads faster than facts. We're seeing AI-generated "experts," unvetted "certifications," and even pseudoscientific programs like one advertised as an "accredited geobiology certification" — which claims training in dowsing and electromagnetic fields affecting health work alongside geology. These erode public understanding and confuse policymakers about what real science is.

History also shows us the power — and the danger — of controlling information. In 1950, *Scientific American* had 3,000 copies of an issue seized and burned because it included technical content about the hydrogen bomb, which was information already widely understood by nuclear scientists worldwide, as well as a message for arms control. As Dan Vergano wrote in his August 1, 2025 opinion article published in *Scientific American*, "Speaking out for science is worth the criticism it brings."[1] I believe this to be true, and I am inspired by those who stood up to the challenge in 1950. Today, we



Continued on p. 35

1. Vergano, Dan. "U.S. Science Has Weathered Attacks Before—and Won." *Scientific American*, August 1, 2025. https://www.scientificamerican.com/article/u-s-science-has-weathered-attacks-before-and-won/.

Answers on Page 39

Robert G. Font, CPG-03953
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1. The following term best describes a process involving tilting, rotation, and large-scale stretching of competent strata over less competent lithologies (such as clays or shales):

a) Swabbing.
b) Cambering.
c) Denudation.
d) Décollement.
e) Chi lo sa?

2. The Chilean earthquake of 1960 (~ 9.5 on the moment-magnitude scale) generated a tsunami that reached Hawaii. It took about 14 hours for it to reach the islands at 10,600 km from the epicenter. At what velocity did the tsunami travel and what is the calculated mean water depth?

a) ~473 mph and ~15,000 ft.
b) ~473 mph and ~ 12000 ft.
c) ~694 ft/sec and 20,000 ft.
d) ~694 ft/sec and 18,000 ft.
e) Run for the hills, dude! Don't stick around with your surfboard!

3. Peridotite is the parent rock of this low-grade metamorphic rock. The metamorphic process may be related to hydrothermal solutions concentrated during the final stage of magmatic crystallization or to high-temperature seawater solutions drawn down into subduction zones.

a) Hornfels.
b) Prehnite.
c) Eclogite.
d) Serpentinite.
e) I don't know, man; with peridotite for a parent and after hydrothermal solutions do their number on you, the result ain't good!

4. What does the term "geophagous" refer to?

a) A Cambrian trilobite.
b) The positive spike indicating a reflection coefficient calculated as one passes from a slow-velocity layer to an underlying one of faster velocity.
c) An organism that feeds on soil.
d) Plant growth with respect to the force of gravity.
e) Summa cum laude scholarship recipient at D.U.M.B. University says: Man, this one is so easy; it's obviously a geological phagous!

5. In our studies of paleontology and marine science, the term "fluke" refers to:

a) The tail of an aquatic mammal or dinosaur with two triangular lobes made of skin, connective tissue, with bones in the middle.
b) The soft fleshy tube-like structure equipped with chemoreceptors found in some mollusks which "taste" or "smell" the water.
c) A type of marine fauna defined by radial symmetry and a water-vascular system derived from a central cavity.
d) A concentration of closely spaced extension fractures in marine guyots.
e) Me, answering this question correctly, dude!

President's Message, Continued from p. 33

are hearing about the dismissal and rejection of professional expertise in favor of self-proclaimed knowledge, often without evidence of credentials. Repeating misinformation is a common tactic used by self-proclaimed experts, relying on the idea that if something is said often enough — and loudly enough — it eventually appears believable and factual.

And yet, even when accurate information exists, facts alone aren't enough. Take the example of tobacco advertising: Marlboro Man campaigns and Virginia Slims ads were wildly successful because they were selling an identity and emotion, while public service warnings about health effects from tobacco use were based on data and fear and struggled to compete. More recent ads featuring the stories of people who experienced damaging health effects from smoking have been more impactful. This is something we need to consider in our communications. We, as scientists, tend to lead with numbers and models — but the public connects with stories, values, and meaning. The info graphic I included on page 33 illustrates this comparison in communication styles.

I was reminded of this during the Litli-Hrútur volcanic eruption in Iceland in 2023. My husband **Adam Heft**, CPG-10265, and I hiked alongside hundreds of others to witness the eruption. Volunteers warned hikers about toxic gases and monitored wind shifts with meters. When alarms went off, we immediately turned back — but many continued toward the danger, some believing their cloth masks would protect them. It was a powerful reminder that knowing isn't the same as understanding. Furthermore, earlier on in the eruption, we saw reports on television of men trying to climb the side of the forming cone. Without context, people often misjudge risk — and that gap can have real consequences.

Moving Forward — The Power of the Geo-ACTS Collaboration

Therefore, we must act — together. That's why I proposed Geo-ACTS: Geoscience Advocacy, Credibility, Training, and Standards.

- Geo-ACTS is designed to unite AIPG, sister organizations, educators, and industry leaders under one collaborative effort to:
- Speak with a louder, unified voice on geoscience issues that influence policy and public understanding.
- Combat misinformation and make credible science more accessible to the public.
- Champion professional certification so the public can distinguish trusted experts from pseudoscience.
- Strengthen K-12 education and workforce development by preparing the next generation of geoscientists.
- Build partnerships that elevate geoscience education and credibility, like our newly proposed collaborations with:
  - The National Earth Science Teachers Association (NESTA) to engage K-12 educators and inspire students.
  - ABET, where we are exploring partnership to expand accreditation for geology programs nationwide — critical as universities shutter programs while the public and private sectors demand for skilled professionals rises.

Geo-ACTS gives us the structure and shared voice to bring these efforts together under one umbrella — enabling us to better advocate, educate, and lead.

A Call to Action — And My Personal Pledge

This is my final column as AIPG President, but my work — and our work — is far from over. The challenges facing our profession — from misinformation to declining educational pathways — require us to act boldly, collaboratively, and globally.

Therefore, I invite you to join me. Share your expertise. Engage with policymakers, educators, and the public. Be the trusted voice in the conversations shaping our planet's future. Through Geo-ACTS, we can restore public trust, elevate our profession, and ensure that geoscience is a respected and vital force in society.

And today, I make my personal pledge to you and to our profession:

I will continue to champion Geo-ACTS well beyond my presidency. I am committed to uniting geoscientists, strengthening education, combating misinformation, and raising the visibility and credibility of our science. I will continue to collaborate with our members, our sister organizations, educators, and policymakers — because this effort demands more than leadership during a single term.

I am so appreciative for having already heard from some members and our sister organizations that they are ready to step up and join the collaborative with lots of ideas, and I know I will hear from more of you as we move forward.

Together, we are building momentum. Together, we can amplify our collective voice. And together, we can ensure that AIPG and the geoscience profession remain trusted, respected, and vital for generations to come.

We stand on the shoulders of giants — and now it's our turn to lead, boldly and unapologetically.

GEO-ACTS

Geoscience Advocacy • Credibility
Training • Standards

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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Thirty years and counting

PE&P Column 1 appeared in the November 1995 *TPG* (*TPG* was published monthly at the time). It's worth reprinting some of that column. "I've titled this column 'Professional Ethics & Practices' because although different, professional ethics and practices tend to be closely related subjects. Good professional practices can be employed to avoid ethical problems. Consideration of ethical issues often prompts suggestions for good professional practices.

"For example, I read a lot of geologic reports, some professionally done, some not so. I'm surprised at the number of undated reports. Even more reports omit a description of the scope of work performed. Reports lacking such basics are more frequently the subject of inquiries into professional competence and are more easily misused by the unscrupulous. The suggested professional practices, namely dating your reports and including a scope of work are obvious results of such reviews."

Producing this column over the years has benefited from the input of many people. Thank you to those who have contributed in one way or another. No one knows everything there is to know about geologic ethics and practices, and geologists tend to be rather opinionated besides. Contributions and discussion need to come from all AIPG members, including students. An added advantage of contributing is that your name is included in the text so you can copy that column to demonstrate your contribution to picky Professional Development Program reviewers. Please feel free to contribute. I would prefer to be far more of a compiler than the editor.

Political differences and the PE&P column

In the last column, 194, Thomas Rankin called my comments on DEI as being a controversial political issue about which some people have strong opinions, sometimes opposing the position I've taken. The longest running political topic discussed in this column over the years involves discussion of various aspects of state licensing of geologists. These various aspects of state licensing have been included in 41 columns (21% of the total).

Towards the resolution of issues or problems

As a society, we want to work for the good. William Deresiewicz points out, "One of the problems with the concept of the good, one of the dilemmas it forces upon us, is that it points to 'real and competing ends.' As the philosopher Isaiah Berlin has argued, the characteristic ideals of liberal society—freedom, equality, justice—are to some degree irreconcilably in conflict. Freedom often leads to inequality; equality often demands the diminishment of freedom."[1] If I am free to lead the (whatever), I am unequally above the other members of (whatever). In columns 163 (Jul '17) and 165 (Jan '18), I addressed the issue of equal pay for equal work in the geosciences. It is clear that different geoscience specialties receive different pay levels.

I recognize that this is a problem, and I don't have a satisfactory solution. This last sentence reflects an important point about thinking. Deresiewicz notes that on many modern college campuses, nobody wants to think, that is to reflect, contemplate, analyze, and study an issue or a problem in order to, perhaps, reach a solution. What are the underlying assumptions, beliefs, and ways of doing things that are supposed to, but fail to resolve the issue or solve the problem? To ask these questions requires an admission of ignorance about the totality of the issue or problem. I address an aspect of this process in "'Best practices,' a dangerous term" (*TPG*, Nov '03). I addressed other aspects of the process in two articles in PE&P column 184 (Jan '2023), "Whatever happened to multiple working hypotheses?" and "Seeing things as they are, not as you wish they were." Addressing, asking, and perhaps arriving at a solution to a problem requires both mastery of the subject matter involved and the experience and wisdom (a willingness to think independently) to recognize that the problem exists and then work towards a solution.

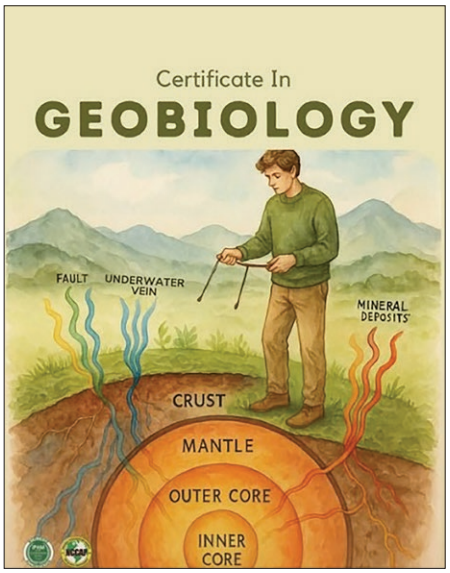
1. Deresiewicz, William, "Change your mind first: college and the urge to save the world" (2018) The End of Solitude: selected essays on culture and society: Henry Holt and Co.. .

Equal time for opposing views—not necessarily

The news media make a big thing of presenting opposing viewpoints or at least asking for them. For political issues, this is viewed as an important aspect of free and responsible reporting. But this concept doesn't apply to all situations. Should those charged with a crime be given the opportunity to justify their actions? In some cases, maybe, but generally not. Standard 2.2 and the three Rules thereunder address the need to make truthful and candid communications to the public and enjoin against making false, sensational, exaggerated, or unwarranted statements. This injunction is repeated in Rule 4.2.1, which also states that, "Differences of opinion occur and statements regarding opinions should be restricted to and based on logical and scientific principles and shall be made in a respectful and professional manner." The Ten Commandments should not be used as a scientific alternative to evolutionary theory. The Ten Commandments have an entirely different and nonscientific purpose. The geobiology concept discussed as the next topic in this column is not presented as good science but as an example of outrageous pseudoscience.

The fluoridation of drinking water resulted from the recognition in 1909 that kids in Colorado Springs, CO notably lacked cavities and that the natural fluoride level in the Colorado Springs water supply was high. In fact, today it is so high that it requires dilution before distribution to the public. Geoscientists know that apatite, a primary mineral in tooth enamel, is composed of $Ca_{10}(PO_4)_6(OH,F,Cl)_2$ and that the fluorine-containing variety is the hardest. Although the dental professional may economically benefit from the removal of fluoride in drinking water, the National Dental Association, the American College of Prosthodontists, and other professional groups endorse the fluoridation of drinking water. Excessive amounts of fluoride in drinking water can be harmful, but this does not refute the benefits of having the recommended amounts of fluoride (0.7 to 1.2 ppm; a number of Colorado cities' drinking water naturally contains this amount of fluoride as the result of draining granitic terrain). In the Stanley Kubrick's 1964 movie, *Dr. Strangelove or How I learned to Stop Worrying and Love the Bomb*, General Jack D. Ripper justifies his initiation of a nuclear attack on the Soviet Union by stating, "A foreign substance [fluoride] is introduced into our precious bodily fluids without the knowledge of the individual. Certainly without any choice. That's the way your hard-core Commie works." This is not an opinion based on logical and scientific principles. It is funny and part of the overall humor of *Dr. Strangelove* but it is not a legitimate argument against fluoridation of drinking water. The following topic on geobiology certification is another example where equal time is unwarranted (except for the humor).

Geobiology Certification



Peter Dohms, CPG-7141, sent an email stating: "David: This popped up on my Facebook feed today. Is it geology" and should AIPG say something? Geobiology Certification - Alma Oasis". So, I clicked on the link and discovered the details on Alma Oasis' "Geobiology Certification." *Geobiology* is defined: "Geobiology explores the interactions between living beings and their terrestrial environment." Okay, most of us will accept that, although we would likely use other wording. Then the website continues: "**Become a Skilled Geobiologist**—Thanks to this training, you will be able to perform a thorough analysis of any type of location, from land to apartments, in order to assess its energetic qualities. You will learn to consider all the energetic influences (cosmo-telluric, electromagnetic, and others) to provide personalized advice to those who seek it. This training will enable you to establish a more harmonious relationship with your environment and improve your quality of life. You will learn to live in tune with nature and cultivate your well-being. You will become an engaged and responsible participant in your environment, able to positively influence the spaces you occupy. In doing so, you'll be empowered to help others improve their lives as well." Huh?

Then the modules for the course are listed:

- Module 1 – Introduction To Geobiology and Dowsing
- Module 2 – History of Geobiology and Using a Pendulum
- Module 3 – Telluric Networks, The Lobe-Antenna and Cosmo-Telluric Chimneys
- Module 4 – Radioactivity, Faults, Groundwater Currents and The Lecher Antenna
- Module 5 – Electromagnetic Pollution and Detailed Site Analysis
- Module 6 – Harmful Building Materials, Wave Types, and The Energetic Perspective
- Module 7 – Memories of a Place and Radionics
- Module 8 – Deepening Your Geobiology Practice

These modules definitely do not reflect either recognized geology or biology. Again, go to the website and see for yourself the "truthfulness" of everything on the web.

The limited teaching about geology in museums and many schools

Sara Pearson's (CPG-10650) "Code Red for Geoscience" President's Message in the Jul/Aug/Sep '25 *TPG* addressed the need to increase our efforts to defend the credibility of geoscience and to act for our future. Unfortunately, much of what we learn in school and in natural history or science museums is often very limited and frequently unappealing. We learn about dinosaurs in second grade, which is okay. (We can pronounce and spell *Diplodocus, Triceratops,* and *Tyrannosaurus* even though our readers contain simple, mostly single-syllable words.) In museums, we view collections of minerals and fossils. That's what I saw and was not particularly interested. What about learning about the natural resources on which life depends, such as aggregate, concrete, paint, and metals? Where does wallboard come from? Why do rivers have the shapes they do? There are some excellent student labs on creating cosmetics from clay and iron oxides. Knowing that the glitter in metallic paint and some cosmetics is made of ground muscovite can be a real eye-opener. I've never been much of a col-

> *What about learning about the natural resources on which life depends, such as aggregate, concrete, paint, and metals?*

lector. I fell in love with geology when I found out that geology was responsible for the form of the land around me. Okay, growing up in Colorado and traveling to places like the Grand Canyon, the Tetons, Yellowstone, and Kilauea (erupting volcanoes are really exciting from a safe distance) meant that I saw the geologically spectacular landforms. I've always been fascinated by maps.

As a Boy Scout and teenage mountaineer, I learned to use topographic maps. In my first Rocks 1 lab, one of the exercises employed a topographic map. We were told that a dike of a given width outcropped at point X on the map. We were asked to draw the trace of the dike. I looked at the topography and saw no topographic expression of the dike. I asked the lab instructor about my dilemma and learned that the point of the exercise was drawing two parallel lines at the correct strike azimuth—I wasn't expected to know about topographic expression at that point. (Before college, I had many times driven past the Spanish Peaks of southern Colorado with their swarms of radiating dikes forming walls across the countryside—look them up on Google Earth.)

Stratigraphic successions of formations are lists of names. What is interesting about the Grand Canyon is that the sandstones and limestone formations form cliffs while the shales form slopes. The meandered river course was superimposed. The point is that we need to educate our children and the public about geology by appealing to what is interesting to them.

What can we do? That depends on the individual situation. One of my more successful talks concerned the origin of one of the altars of my church (a resurrected hot spring deposit) and the rocks used elsewhere in the construction, including pointing out some fossils in the Indiana Limestone from which most of the church was constructed. I haven't given the talk and trip around the campus for several years, but people still remember it. You can do something similar. Remember, what is interesting to the attendees, not just you.

Watch out for AI trying to think for you and taking your data

After composing a three- to four-line email, the AI component of the email program converted my message into three to four paragraphs of questionable text. I was able to delete this abomination before the message was sent. I was on a Zoom call during which several participants expressed concern that new AI components on their company computers appeared to be harvesting all the content on their hard drives regardless of the sensitivity of the data.

These two examples highlight worrisome aspects of AI. AI companies want access to as much data as possible to refine their programs. But should they actually have access to everything? I think not. The point is to be cautious about how the increasing presence of AI in our programs may be adversely affecting us. I'm not an expert and would appreciate receiving your comments and suggestions on this topic.

Answers:

1. The answer is choice "b" or "cambering."

Swabbing is a common well stimulation technique where a special tool is used to clean out the borehole and start the well flowing. Swabbing also allows the evacuation of the hole's fluid content to reduce the hydrostatic head sufficiently to permit oil to flow into the borehole.

Denudation is the process where moving water, wind and ice erode the Earth' surface leading to a decrease in elevation and relief of landscapes and landforms. Erosion is the transport of rock and soil from one location to another, whereas denudation is the sum of the processes, including erosion, that result in the lowering of the Earth's surface.

Décollement is a gliding plane between two rock masses, or a basal detachment fault. Décollements may be associated with both compressional and extensional tectonic settings.

Scusa, dude, non sono Italiano!

2. The answer is choice "a" or "~473 mph and ~15,000 ft."

The calculations follow:

$10{,}600 \text{ km} = 6625 \text{ miles} = 3.498 \times 10^7 \text{ feet}$ (1)

$14 \text{ hours} = 14 \times 60 \times 60 = 50{,}400 \text{ sec}$ (2)

$V = 6625 \text{ miles}/14 \text{ hours} = 473.21 \text{ mph} = 694.05 \text{ ft/sec}$ (3)

$V = (gD)^{½}$ or $V^2 = gD$ and $D = V^2/g$ (4)

$g = 32 \text{ ft/sec}^2$ (5)

$D = (694.5 \text{ ft/sec})^2/(32 \text{ ft/sec}^2) = 15{,}053 \text{ ft}$ (6)

$V = (gD)^{½}$ is what we use for shallow water wave theory. Although the depth here is not shallow at all (~15,000 ft) we can get away by using $V = (gD)^{½}$ since the ratio of water depth to wavelength is very small. In tsunami, wavelength may be on the order of tens or hundreds of kilometers and may reach 1,000 km (625 miles or 3.3×10^6 feet). Thus, even for water depths of around 15,000 ft, the water depth to wavelength ratio can be as small as 0.0045. Equations (3) and (6) give us the answers that we seek.

3. The answer is choice "d" or "Serpentinite."


Serpentinite

Hornfels is a rock formed through contact metamorphism, typically involving fine-grained parent rocks, such as clays and shales that come into contact with hot igneous bodies. The temperature range is from about 300 to 800 degrees centigrade with pressures of less than 2 kilobars. The hornfels facies includes the low-temperature albite-epidote hornfels, the medium-temperature hornblende hornfels, the high-temperature pyroxene hornfels, and the ultra-high-temperature sanidinite facies.

Prehnite is an indicator of the prehnite-pumpellyite metamorphic facies that occurs due to subseafloor alteration of oceanic crust at divergent plate boundaries. It is transitional between the zeolite and greenschist metamorphic facies. It occurs at a temperature range of 250 to 350 degree centigrade and at pressures of 2 to 7 kilobars. Prehnite is an inosilicate of calcium and aluminum, or $Ca_2Al(AlSi_3O_{10})(OH)_2$.

Eclogites are high-pressure metamorphic rocks characterized by sodium-rich pyroxenes and pyrope-rich garnets. These rocks occur at pressures above 10 kilobars and at temperatures ranging from about 400 to 1,000 degrees centigrade.

4. The answer is choice "c" or "An organism that feeds on soil." Earthworms are examples.

Sorry, no Cambrian trilobite here.

The term "geophagous" has no relationship to the reflection coefficient. Remember that, concerning the latter, at each boundary between two different rock types (with different physical properties), down-going sound waves will be reflected to the surface. Knowing from a sonic log the velocities of the formations and velocity changes at formation boundaries, we can calculate the reflection coefficient or the reflectivity at those contacts. The reflection coefficient depends on the difference in the acoustic impedance (velocity x density) of two adjacent layers divided by the sum of these. If one passes from a slow layer to a fast one, the reflection coefficient is positive and swings to the right. But if one passes from a fast layer to a slow one, the reflection coefficient is negative

and swings to the left. In essence, the magnitude of the reflection coefficient dictates reflection strength (amplitude). The direction (positive or negative) dictates polarity (peak or trough).

Choice “d” is referred to as “geotropism.” For example, the downward growth of roots is positive geotropism, and the upward growth of plant shoots is negative geotropism.

5. The answer is choice “a” or “The tail of an aquatic mammal or dinosaur with two triangular lobes made of skin, connective tissue, with bones in the middle.” “Platecarpus”, for example, was a late Cretaceous type of mosasaurus with this type of tail. Modern-day whales also exhibit fluke tails.

Choice “b” refers to the “siphon” found in gastropods.

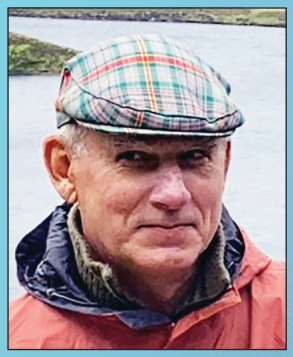
Choice “c” describes echinoderms (sea urchins, sea cucumbers, sea lilies, sand dollars, starfish, brittle stars) also characterized by hard, spiny, or warty skin.

Sorry, none of this refers to guyots (flat-top sea mounts) or extension fractures (parallel to the major principal stress, σ_1).

2026 National AIPG Executive Officer Election Results

President-elect 2026
Douglas C. Peters
CPG-08274
Lakewood, Colorado

Vice President 2026
Mark Schaaf
CPG-10723
Hanover, Maryland



Secretary 2026-2027
Mark J. Howell
CPG-09563
Danville, Indiana

Early Career Professional 2026
Skylar Vertes
ECP-1122
Hendersonville, North Carolina

Editor 2026-2027
Adam Heft
CPG-10265
Portland, Michigan

From Wisconsin to the Andes:

Gold, Geology, and a Reluctant Horseman

Bill Rowell, CPG-10810

Above the clouds with the Gualcamayo deposit (before mining) in the background to the right.

When I began my career as a geologist in the 1980s, the mineral exploration business was booming throughout North America. Major mining companies and numerous Canadian juniors staked mineral claims wherever there was perceived potential for gold or base metal discoveries. A shortage of geologists meant that anyone with a few years of experience could easily find new jobs offering more money and/or better working conditions. After several years commuting to remote exploration camps in northern Ontario's greenstone belts, I accepted an offer to join a volcanogenic massive sulfide exploration program in Wisconsin's relatively civilized Northwoods.

By the early 1990s, public opinion and political agendas had begun to turn against resource industries, particularly mining. Within just a few years, the U.S. mineral exploration industry had contracted to companies primarily focused on the southwestern U.S. In the tight job market that became the new normal, I was barely making a living on short-term contracts and began to consider the possibility that I might have to hang up my rock hammer and find stable employment in another field.

I was spared from this life-altering decision by an older colleague who offered me a job as a geologic advisor for an ongoing gold exploration program in Argentina. My specific assignment was to teach recent Argentinian geology graduates how to evaluate a project area efficiently. According to management, the number of rock and silt samples collected during exploration campaigns was lower than expected relative to the time spent in the field.

The proposed work schedule was a cycle of two months in Argentina, followed by one month at home. The arrangement wasn't family-friendly for someone with a wife and four children under seven, but after a lengthy period of irregular employment, my options seemed limited to either this offer or a new career.

There was little I could do to prepare. My small library of geology journals and books included several articles about Chile's ore deposits, but I couldn't find any information about Argentina. In the mid-1990s, we had computers for data crunching and word processing, as well as primitive dial-up email, but effective search engines were still a development for the future. Argentina's geology, topography, climate, and culture would remain a mystery until I experienced them first-hand.

The door-to-door trip from our small farmhouse in northern Wisconsin to the Minas Argentinas office in San Juan took 24 hours but crossed only two time zones. In Argentina, San Juan is viewed as a backwater city, but I was favorably impressed by the frequent plazas, tree-lined streets, and wide ceramic-tiled sidewalks. Unfortunately, plate tectonics has not been kind to the city; major earthquakes in 1944 and 1977 destroyed much of the colonial architecture that adds historical charm to Argentina's better-known tourist destinations.

The Minas Argentinas office was a square stone building with four floors surrounding a central open space that extended from the second floor to the roof. The design ensured that everyone's

From 2005 to 2007, I went back to Argentina to do reconnaissance exploration around the Gualcamayo deposit. The photo is me and a baqueano.

Helicopter dropping part of a drill rig into Quebrada Diablo for the first round of drilling at Gualcamayo. Gives some idea of scale.

A visiting consultant and I at the Las Flechas high sulfidation epithermal gold prospect near the Chilean border. Elevation is about 15,400 ft. A good photo for elevation perspective.

conversations and musical tastes were shared throughout the office. A wide stone staircase wound from level to level, with noticeable temperature changes felt on each floor. The building had an air conditioner, but recurring afternoon power outages meant it was not operational when most needed.

After a brief introduction to the office staff, I headed down to the noisy basement level where geologists and techs were preparing field gear for a three-week exploration program to evaluate the company's Rio Castano/Retamal prospect, located 210 km northwest of San Juan. I learned from the English-speaking expediter that I was part of the exploration team and that we would be leaving early the following morning because one of the roads was single-lane and only open to west-bound vehicles until noon.

Our convoy of two almost new diesel Toyota Hi-Lux pickups set out at dawn, packed with nine geologists and two locals employed as drivers. From San Juan, we drove north through the Precordillera, a tectonically active geological terrane that separates the Patagonian Desert from the eastern side of the Andes. The landscape features open desert vistas abruptly terminated by distant walls of limestone and sandstone thrust upward by collisional tectonic forces originating 350 km to the west along the Peru-Chile Trench. Geologists from the southwestern U.S. would recognize the climate and topography as reminiscent of the Basin and Range Province.

This was my first experience with living geology. Most of my previous exploration projects focused on long-dead Precambrian rocks deposited by geological events that ceased more than a billion years ago. Ridges of barely consolidated conglomerates, exposed in fault scarps along our route, looked as though they could have formed during my lifetime.

After about an hour of travelling through the desert, we turned west against the grain of the north-south oriented thrust ridges and followed a narrow unpaved road carved into the southern bank of the east-flowing San Juan River. This was the one-way road we needed to complete before traffic started moving in the opposite direction.

The relief was not extreme, but evidence of rockfalls from the steep cliffside and washouts along the gorge drop-off on the passenger side kept my eyes fixed on the road ahead. Frequent memorials with weathered plastic flowers and wooden crosses were a reminder of the road's history of fatalities.

The San Juan River dissects the 30 km width of the Precordillera thrusts, then branches into braided tributaries on an arid high plain that marks the geological boundary between the Precordillera and Cordillera Frontal. We followed the southern tributary to the rustic town of Calingasta, then headed north through postcard-worthy views of vivid, erosion-sculpted Precordillera stratigraphy and distant snow-capped Andes peaks. For the final 25 km, we left the road and followed the Castano River to our campsite. Although the drive was off-road, the river's mountain meltwater and rocky bottom are excellent habitat for trout, and trails made by fly fishermen smoothed the ride.

The campsite was a flat, 50-meter-wide area on the eastern side of the river. Other than a few small trees along the riverbank, vegetation was limited to patches of sparse grass. Abundant horse and cow dung scattered around the campsite indicated that it was also a favorite spot for grazing free-range livestock.

Shortly after we arrived, a small transport truck delivered our cooks, camping gear, and exploration supplies. It took a few hours to unload and set up the camp about thirty meters from the riverbank. Once camp construction was completed, we gathered in the office tent to discuss exploration plans for the following day.

The elevation of the 10 x 6 km project area rose from about 5,700 ft along the river to 8,500 ft at higher points near the western boundary. Access to the rugged interior was facilitated by east-west-oriented quebradas that tempered the topography enough for horses to transport people and, more importantly, rock and silt samples. In addition to providing access, the slopes of the quebradas enhanced outcrop exposures.

The exploration target was epithermal gold. I had never seen an epithermal deposit; my only knowledge came from textbook descriptions of near-surface mineralization related to large-scale hydrothermal convection systems driven by hot underlying magma. Fortunately, I was the geologic advisor, a title with ambiguous decision-making responsibilities.

Several geologists had been part of previous exploration campaigns and were able to develop a work plan. Essentially, the strategy for every exploration program consisted of two parts. The simplest yet most effective method for finding gold in this terrain was to collect silt samples from the typically dry quebrada bottoms. If gold mineralization is present in any of the surrounding rocks, it will be reflected in the geochemistry of drainage samples. By conducting gold analyses on three kg silt samples collected at approximately 200-meter intervals, we could identify anomalous areas for follow-up exploration.

The second part of the two-pronged approach involved mapping the geology of the project area and collecting outcrop samples for geochemical analysis. I hoped to offer some useful guidance for this more subjective aspect of the exploration program.

As darkness fell, three baqueanos arrived with a string of horses and set up a tentless camp by the river. A baqueano is a local outdoorsman who acts as a guide and provides horses and mules for transportation. Within their territory, certain trees or rocks can hold the same significance as rooms or furniture in a childhood home. I would later learn that many baqueanos were quite lost if they ventured beyond the narrow boundaries of their domain.

It was after eight when the cook's helper announced that dinner was ready. I was hungry and hoped to dig into something substantial, but I was a bit disappointed that my first camp meal in Argentina consisted of well-done beef, sliced tomatoes, soda bread, and canned peaches with dulce de leche for dessert.

During dinner, we decided breakfast would be at 7:30 AM. Normally, 7:30 would be considered a late start, but our campsite was located on the western side of a time zone geared for Buenos Aires, 950 km to the east. In this mismatched location, there was no sign of dawn until after 7:30 AM.

Each geologist had a small dome tent with enough space to stow duffel bags and lay a thin rubber mat beneath a sleeping bag. I crawled into my tent and, after two long days of travel, slept soundly. When I crawled out into the chill of the seven o'clock darkness, the baqueanos were chatting quietly around a crackling fire as they sipped yerba mate from a shared metal straw stuck into an ornate gourd. The cooks' alarm went off, and after what sounded like good-natured grumbling, they headed to the cook shack to fire up the generator and start breakfast. The geologists' tents remained quiet.

I started to get anxious as the designated time for breakfast approached, and there was still no sign of the geologists. Just when it seemed I might have to start knocking on tents, they began to emerge behind the sound of zippers opening. As each geologist stood up, I could see why getting ready might have taken longer than expected. They were the best-dressed field geologists I had ever seen. Their shirts and pants were perfectly pressed and color-coordinated, leather field boots were shined, and for several of them, impressive wide-brimmed hats topped off the ensemble. Compared to the dapper geologists filing into the cook tent, I looked like a vagrant prospector.

We quickly finished a simple breakfast of coffee, yerba mate, soda bread, Ades orange drink, and little cookies, and were back on schedule for an eight o'clock start. We grabbed our backpacks and piled into the two running trucks parked at the river's edge. If still waters run deep, the rushing water by our camp was the best place to make the crossing. The drivers held the view that less time in the water minimized the possibility of trouble and attacked the crossing at a higher speed than I expected. As water piled up on the upriver side of the truck, we were jostled by a few larger boulders but made it to the other side with no discernible damage.

The baqueanos had moved the horses across the river and herded them to the entrance of a large quebrada that we had chosen as our starting point. The horses were saddled and loosely tethered to small bushes. I stood at the edge of the group and watched as the baqueanos paired each geologist with a suitable horse. When all the geologists were in the saddle, one of the baqueanos led a boney gray horse over to where I was standing and, with a nod, invited me to mount.

Being part of a team of geologists and guides about to ride into the mountains to explore for gold would be a memorable moment for any geologist. It is for me, but not in a positive way. My only experience on the back of a horse was about nine years earlier when my wife caught and saddled a couple of retired workhorses at her uncle's sheep farm in New Zealand. The only instruction I could remember from her one-minute riding lesson was to mount from the left side.

Trying to look as though I knew what I was doing, I walked over to the left side of the patient horse. The baqueano handed me the reins, and I lifted my left leg, expecting to slide my foot into the stirrup. My confident facade quickly faded when I realized they were not ordinary stirrups. Instead of typical U-shaped metal stirrups, they resembled the front half of a bulky wooden shoe. I attempted to put my foot into the opening several times but only managed to kick the stirrup into a swinging motion that made it increasingly difficult. A baqueano saw that the horse was becoming skittish and came over to hold the stirrup while I tried to insert my foot. Even with his help, it was not easy. The stirrup was made for someone with smaller feet or wearing pointed boots. Barely an inch of my hiking boot fit into the opening, and it was

Continued on p. 47

2005 drill rigs at Gualcamayo after roads were put in.

Vocational Education in Geology

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Undergraduate college enrollment in the USA peaked in 2010 at 21.28 million students in both public and private colleges. This year the enrollment stood at 18.4 million, about 0.56 million over 2024, but still nearly 3 million fewer than that in 2010. The decline in college enrollment began long before the Covid-19 pandemic and reflects some fundamental trends and changes in society. The decline in college student enrollment has particularly hit geoscience programs because the oil and gas industry – traditionally a major employer of geology and geophysics graduates – does not hire as it used to. Moreover, many students do not want to major in "dirty, dangerous" fossil fuels or mining. As a result, some geoscience programs have been terminated, suspended or merged with other departments in universities. These are major challenges facing the geoscience community. As educators, we must consider the needs, difficulties and aspirations of the generation that is of age for higher education and workforce.

Generation Z and Education

Generation Z (Zoomers) born between 1997 and 2012, spanning ages 12 to 27 are currently school or college students or have taken entry-level jobs. Gen Z accounts for about 69 million people in the USA. Although it is always unfair to brand a whole generation in a few words and labels, several surveys show some trends, challenges, and thinking among Gen Z, including the following:

1. About 80 percent of Gen Zs consider college education important. However, only 36 percent have confidence in quality college education.
2. Most are studying or (if possible) want to pursue a four-year bachelor's or a two-years' associate degree. Nevertheless, they prefer a job to earn money than following an ambitious long-term education.
3. Many are concerned about affordability of college education; they lack financial resources and do not want to be in college debt for years after graduation.
4. Only about a quarter of Gen Z high school students feel that they are well prepared to enter and succeed in college.
5. Interestingly, they trust teachers and science much more than tech companies, courts, and police.

In short, the traditional ladder of higher education of BS, MS, and PhD to become an expert does not appeal to most Gen Z. It is high time that universities and college design and offer training certificates and short-term degrees on practical fields to attract Gen Z and develop workforce. In this regard, geology may enjoy huge potential as it embraces many useful, applied, and job-oriented fields.

Technical Colleges

There are already a large number of technical, trade, and vocational colleges in the US, but they mainly offer programs in nursing, medical laboratory technician, pharmacy technician, veterinary assistant, hotel business management, accounting, carpentry and cabinetry, plumbing, electrical, automotive, welding, computer support, audio-video media, graphic design, and so forth.

Universal Technical Institute, founded in 1965 and headquartered in Phoenix, Arizona, is one of the largest technical colleges in North America operating on 16 campuses. No geology-related field is offered by UTI.

Very few universities and colleges offer geology-related vocational programs. Let's look at some of these.

The Ohio State University has certificate programs in marine science, hydrogeology, petroleum geology, and natural history museum.

North Dakota Tribal College in Bismark is a four-year college. Environmental engineering is among its associate degree programs.

Uintah Basin Technical College in Utah (catering to Ute tribal people) has programs in lease operations and oil well control, obviously to train workforce for local jobs and companies.

Dine College in Arizona (catering to Navajo tribal people) has programs in environmental science and agroecology.

Vocational Geology

Geology includes a large number of practical fields that can be tailored and targeted toward two-year associate degrees with fast job potential. The AIPG as a professional society can play a trans-

1. "Statistical snapshot: Generation Z and education": https://www.aecf.org/blog/generation-z-and-education
   "10 trends in the era of Generation Z college students": https://www.leadsquared.com/industries/education/generation-z-college-students/

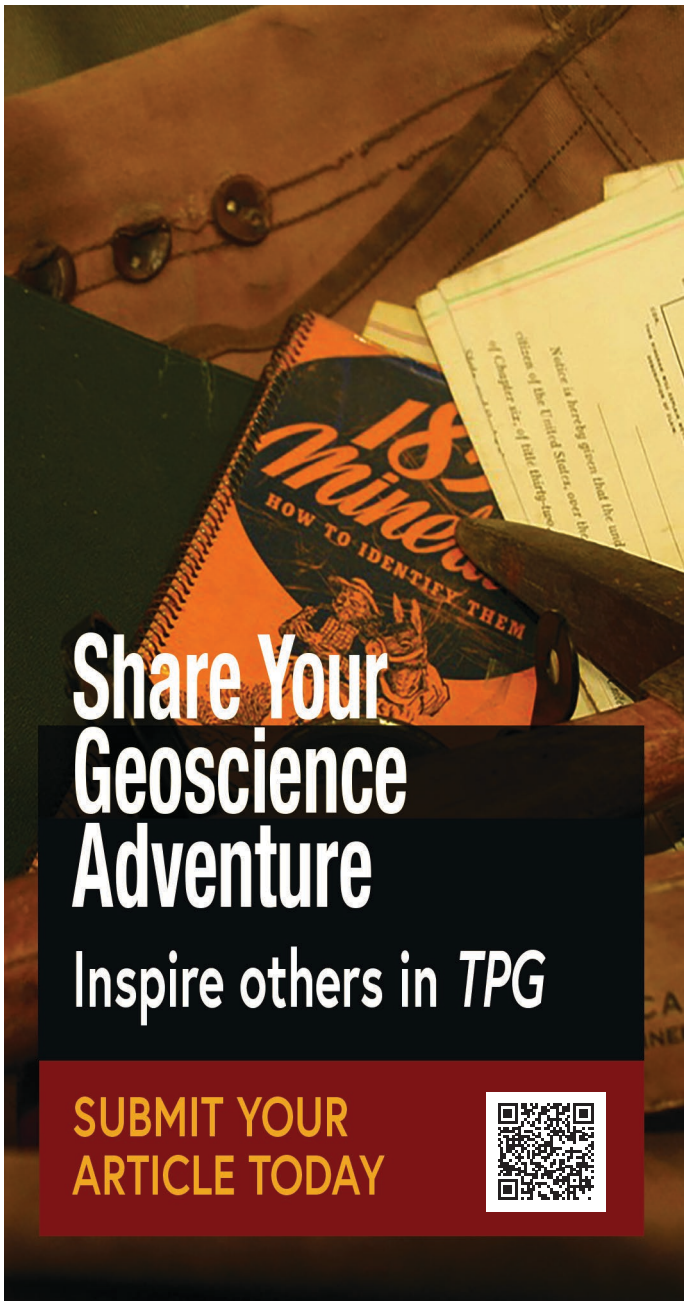
formative role in promoting and standardizing vocational geology education.

The following eleven fields are good examples of fast-track degrees to train geology technicians:

1. Pedology (soil science)
2. Hydrogeology
3. Gemology
4. Mining geology (ore deposits)
5. Well-site/mud log geology
6. Environmental chemistry (water, soil, wall paints, etc.)
7. Geological mapping technician
8. Geospatial mapping/GIS
9. Remote sensing
10. Geophysical technician
11. Geostatistics and Geodata science

It is important to note that Gen Z has been raised in a digital age with social media and smartphones. New pedagogical methods need to be designed in geoscience education. However, I do not think that all-online courses (as offered on some websites) can really train skilled graduates in applied geology disciplines.

Finally, the image of geology also needs to be improved; we need new narratives so that students view geoscience as contributing to the well-being of society through jobs available and on demand. This means that colleges offering applied geology programs should have close relations with industries and be engaged in mentoring as well as training.



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Mike Lawless

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

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Tales from the Field, continued from p. 43

only with a helpful boost from the baqueano that I managed to sprawl into the saddle.

The saddle was a simple metal frame covered with a sheepskin. It was comfortable enough, but there was nothing for a novice equestrian to hold onto for balance. I gripped the reins in my left hand, the braided leather lead in my right, and tried to sit upright under the weight of judgmental eyes.

Once everyone was mounted, we divided into two teams of four. I joined the team that would start mapping at our rendezvous quebrada, while the other group headed north to begin at the next quebrada.

Instead of saying "giddy-up" or making clicking sounds to get the horses moving, the riders made exaggerated kissing noises. When the response to this command was not very enthusiastic, the air began to whir with the sound of twirling leads. As leather smacked down on their rumps, the horses bolted forward. My horse remained stationary until a baqueano came up from behind and cracked a lead onto its backside. I was momentarily airborne as the startled horse lurched forward.

As we rode up the quebrada incline, a sudden realization that I was probably out of my depth triggered a wave of anxiety. I was the geologic advisor for a gold exploration program, but I had no experience with epithermal deposits. I couldn't speak Spanish, and most of the geologists knew only a few words of English. Worst of all, I was falling behind because my horse was making a game out of trying to scrape the greenhorn fool off his back on every passing bush and boulder. My attempts to control him by yanking on the reins only seemed to make him more obstinate. It wasn't until a shouting baqueano came galloping up from behind that, like a naughty child caught in the act by a parent, his demeanor grudgingly improved.

With the horse no longer a distraction, frequent porphyry outcrops bordered by alteration halos drew my attention back to geology. By the time we reached the steep western end of the quebrada, I regained a measure of confidence by convincing myself that, even in this foreign environment, I could maintain some credibility by using my mapping and sampling experience to set a good example.

Although we had only been riding for about 20 minutes, my knees ached as I tried to straighten them after my feet hit the ground. By the time I finished tying my horse to one of the larger bushes along the edge of the quebrada, the unexpected, intense pain had vanished, and I was able to walk normally.

The two silt samplers knew the routine and began digging and sieving their first drainage sample. The mapping geologists had a brief meeting and then headed to opposite sides of the quebrada. I decided it would be best to work independently and familiarize myself with the rocks before trying to converse with the other geologists.

I began by climbing about ten meters up a talus-covered slope to investigate a conspicuous, lighter-colored outcrop. It was silicified porphyry with disseminated pyrite that looked interesting enough to sample. Once I began the process, it became clear why silt and rock sample production had been lower than expected during previous exploration campaigns.

The sampling protocol included recording UTM coordinates obtained from brick-sized, six-channel GPS units. In open areas with a broad view of the sky, acquiring coordinates that might be accurate to +/- 50 meters could take five minutes. At the bottom of a quebrada, where sky visibility was limited, it took considerably longer. Today, quick acquisition of coordinates accurate to within a few meters is the norm, but prior to 2000, the U.S. Department of Defense intentionally built inaccuracy into civilian GPS systems.

I was surprised that the sampling problem was obvious and easily remedied. In western Argentina's nearly treeless mountain and desert landscape, sample locations could be plotted with sufficient accuracy on air photos used for mapping. An aluminum tag and ample flagging tape would ensure that the sample site could be easily located if follow-up work was warranted.

Solving a key part of my assignment alleviated much of the stress that had built up since landing in Argentina three days earlier. With that issue resolved, I could focus on working with the Argentinian geologists who, despite evidence to the contrary, seemed to believe I knew what I was doing. Although language barriers limited the scope of our discussions, I found them to be knowledgeable and diligent. It was only inexperience that kept them from realizing that the sampling procedures were impractical.

When we returned to the San Juan office, I was eager to inform management that we could easily improve sampling production. The reaction to my proposed solution was unexpected. The managers were exploration geologists with decades of fieldwork experience, but all of it was long before the advent of GPS units. In the company office, they had come to rely on the misleading sense of accuracy provided by UTM coordinates and were reluctant to change. It took a somewhat contentious discussion to persuade them that, although GPS units seemed like they should be effective exploration tools, they were more than doubling sampling time without improving location accuracy. We reached a compromise solution: if obtaining coordinates took longer than five minutes, we could plot the location on an air photo. In practice, we reduced the waiting time to about two minutes.

Over the next three years, we collected thousands of rock and soil samples from gold prospects in the high Andes and Patagonian Desert. In 1997, we discovered a distal-disseminated gold deposit that became the Gualcamayo Mine. The discovery remains my most significant achievement as an exploration geologist. When I think back to that period of my career, I also take some satisfaction in remembering that, despite their best efforts, none of the many horses and mules I rode through the rugged landscape managed to rub or buck me out of the saddle.

GIS As Art:

The Need to Develop Engaging Maps

Isaac Pope, SA-9950

In many ways, GIS has taken the geosciences by storm. These "Geographic Information Systems" are fundamental for managing and analyzing large spatial datasets in hydrology, mineral exploration, geologic hazards, and many other fields. Many professionals are integrating GIS into their toolkits and universities are developing programs, such as the Colorado School of Mines' graduate program in GIS and Geoinformatics or Missouri University of Science and Technology's newly introduced Geospatial Engineering program. Data analysis and processing is probably one of the most emphasized subjects in the geoscience-focused GIS community, but what is often overlooked is the importance of developing aesthetically pleasing maps. Many GIS programs offer powerful tools that can transform our maps from simple figures to refined artwork.

This concept of "GIS as Art," as alluded to in the title, is important for creating work that truly stands out. GIS will one day be an assumed skillset for many geoscience professionals, and simply knowing how to create a map will not be enough to compete. In many ways, considering GIS as a work of art can help bring clarity to our maps and make them more convincing for audiences. Let us consider a few examples.

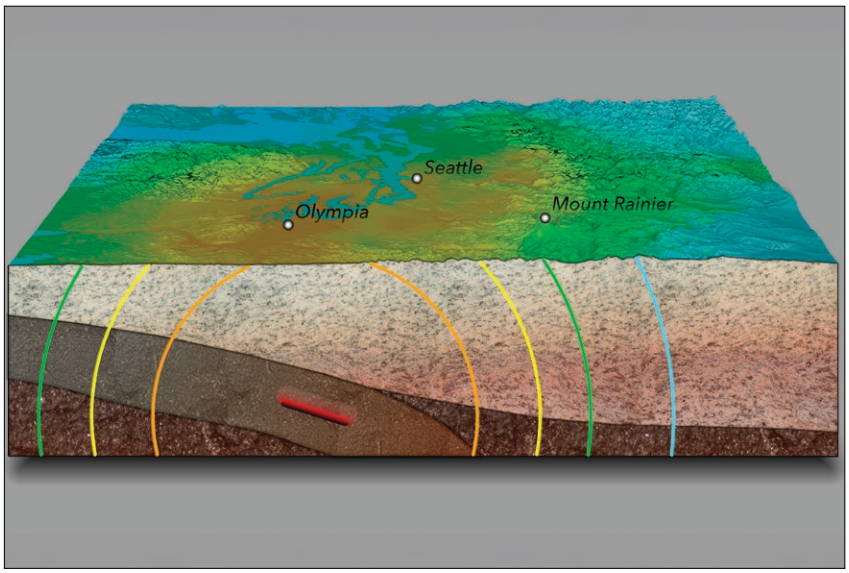

Figure 1. Block model of the US Geologic Survey's ShakeMap that relates an earthquake's source, seismic waves, and shaking intensity in a cohesive 3D model.

First, GIS as art better engages and attracts audiences, especially non-specialists. Have you ever had the experience of wandering a poster hall at a meeting or conference, and there was one particular map or figure that arrested your attention from across the room? Just as in this case, a well-balanced and aesthetically pleasing map can help attract someone's attention and encourage them to engage with the content. A drab map will be less likely to keep someone's interest; the result may be that the person decides to move on to another poster. Of course, a map could be overdone. Bright clashing colors can certainly draw attention but run the risk of repulsing your audience, making them less willing to engage with your content. Instead, developing balanced maps that are pleasing to the eye can draw your audience in to learn more.

Second, GIS as art can help translate complex subjects into approachable forms of media for non-specialists. Be it in industry or academia, most of the people you encounter will not be experts in your discipline, and consequently may find it challenging to understand the products you produce. Approaching your product as a piece of art that conveys a message can open pathways to illustrating complex concepts. For instance, the ShakeMap is a color-coded map developed by the US Geological Survey (USGS) to illustrate earthquake shaking intensity across an area (Wald, 2023). Figure 1 shows a ShakeMap for the 2001 Nisqually Earthquake as a block model to help relate an earthquake's source, the propagating seismic waves, and resulting shaking into a 3D conceptual model.

Third, GIS as art can reveal details that are otherwise hidden or obscured from view. For instance, I was originally unaware that the San Andreas fault is commonly found along a mountain-rimmed valley associated with transpression along the plate boundary, but this is immediately clear in the diorama shown in Figure 2.

Fourth, GIS as art can help provide context for the topic at hand. Figure 3 shows a map of landslide hazard estimate for the 2023 M7.8 earthquake in Türkiye (Görüm et al., 2023). This map displays the automatically generated USGS Ground Failure product in an aesthetically pleasing fashion that contextualizes the area of impact in the surrounding geography. A corner inset further helps the reader identify where the area of interest is.

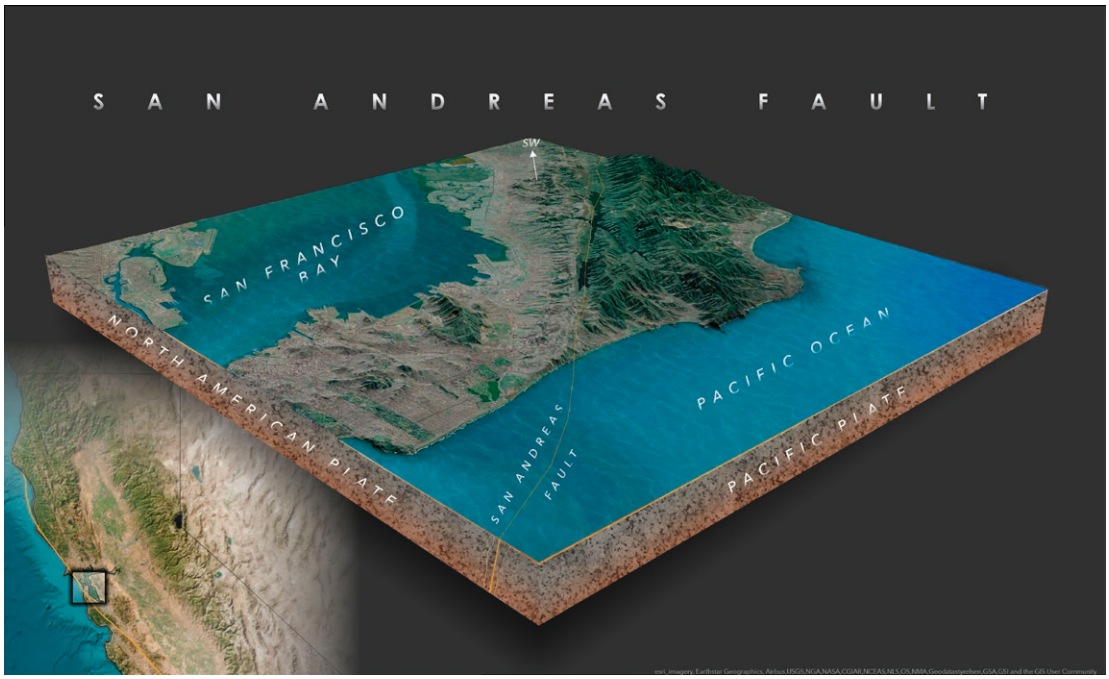

Figure 2. Diorama of the San Andreas Fault along the San Francisco Bay. Note that the fault traces along a valley rimmed by mountains resulting from transpression along the plate boundary.

These examples illustrate the power of approaching GIS not only as a computational tool but as a way to better engage our audience. Of course, every tool has its shortcomings. Ultimately, our job as scientists and engineers is to communicate the data and/or implications of the data to the audience as faithfully as possible. In so doing, it is vital that our maps enhance the message rather than detract from it. Some scientific illustrators have argued that colorful figures are detrimental to science because of their ability to impress viewers and distract them from analyzing the quality of the work being conveyed (Wong, 2011b). This somewhat stoic approach to scientific illustration recognizes the possibility that data can be manipulated through excessive editing or masked by unnecessarily vibrant figures. The purpose of GIS as art is to communicate and translate the information so that our viewers can make informed decisions. When developing your maps, ask yourself: "is the style of this map in any way impeding how someone could make sense of this data for themselves?"

By the same token, it is important that maps are not overly complicated. Including that additional shadow or detail may enhance the image aesthetically, but does it make understanding this diagram more challenging? Sometimes, the more aesthetically interesting option simply adds too much detail (e.g., satellite imagery vs gray reference map) that overwhelms the viewer and takes away from the true subject at hand.

Finally, viewing maps is a truly personalized experience, and can vary widely across individuals. Color deficiency is one such example, where as much as 10% of the US population are unable to detect some color that is generally discernable by the dominant population (Wong, 2011a). Our eyes have cone cells (photoreceptors) that detect red, green, and blue, but color deficient vision arises when certain mutations turn off certain cone cells, making a person unable to detect the color that those cone cells should detect. For some people, it is only one color, like red, that cannot be detected, while in rare cases (1:32,000) a person is completely unable to detect color. This is important to remember when designing maps because our own experience viewing the map may not be shared by everyone who views it. Figure 4 shows the same map as in Figure 3 but as seen by someone with Deuteranopia color vision deficiency.

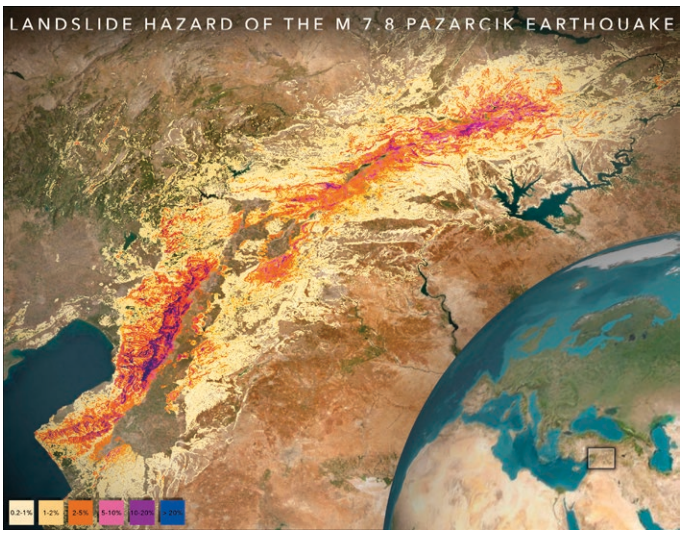

Figure 3. Map of landslide hazard estimate from the 2023 M7.8 earthquake in Türkiye. This provides a more aesthetically interesting and contextualized view of the Ground Failure product automatically generated by the US Geological Survey.

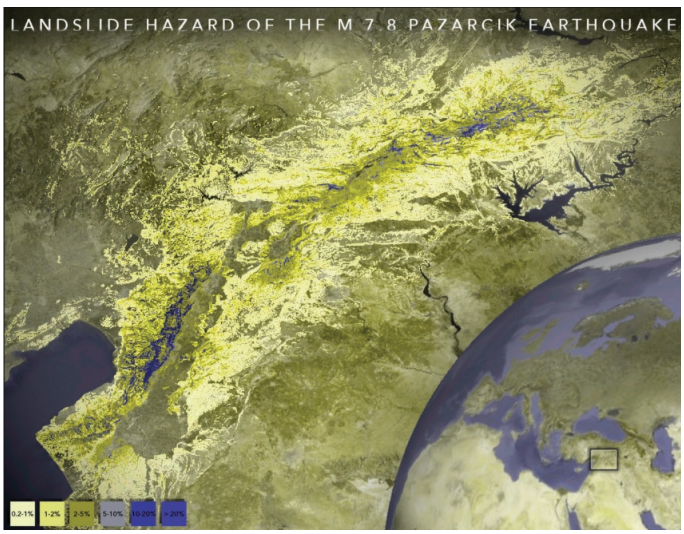

Figure 4. The map shown in Figure 3 but as it would appear to someone with Deuteranopia color vision deficiency.

With up to 10% of the US population having some form of color deficiency, it is important to consider the impact of your color choices in your maps (Crameri et al., 2020), as it may very well decide who can understand your work and thereby who is willing to hire you. Fortunately for us, we need not guess at how someone else may experience color. Many GIS programs (e.g., ArcGIS, QGIS, etc.) offer Color Vision Simulators where you can test your map under various color vision deficiencies, helping you to better craft your map.

Learning how to approach your GIS project as a form of art can be challenging. As with all abilities, it is important to hone the skills and learn how to navigate the pitfalls you may encounter on your journey like the ones described above. However, the benefits are multitudinous. Not only will your maps stand out from the competition, but they will better translate the complexities of your work to non-specialists and highlight important points necessary for decision-making. Individuals like Esri's John Nelson provide a wealth of information online on how to begin your journey. Happy map-making!

About the Author

Isaac Pope holds a Master's in GIS from Colorado School of Mines and worked as a Research Physical Scientist (Pathways intern) at the US Geological Survey where he focused on earthquake risk communication. He now works as a GIS consultant and is a PhD student at Missouri University of Science and Technology.

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In Memoriam

Arthur Wilmore Tipton Jr., CPG-02053

Peoria, Arizona

March 29, 2025

Member Since 1969

Obituary and photo obtained from the Neptune Society website

Arthur W. Tipton passed away at age 96 on March 29, 2025. Tip as he was known to his friends and family, was the father of Scott and Robert Mark (Rhonda) and the husband of Aurora Leon Tipton.

Tip was an avid reader; he passed while his son Scott read to him from one of his favorite books. Tip was a geologist and graduated from Texas Western College in 1958 with a degree in Bachelor of Sciences in Geology. After he returned from serving in the Korean War for the US Army, Tip worked in a variety of mines surveying mineral deposits. After his last job with the EPA on environmental restoration of closed mines, he moved to Peoria, Arizona where he lived his last 25 years. Tip was a member of The American Institute of Professional Geologists for over 50 years, as well as a member of The Engineering and Mining Journal, which he enjoyed and read faithfully. Tip was laid to rest on April 28th at the National Memorial Veterans Cemetery in Phoenix, Arizona.

Dr. Bruce A. Black, CPG-02392

Farmington, New Mexico

July 8, 2025

Member Since 1972

Obituary and photograph obtained from the July 15, 2025, Albuquerque Journal.

Bruce Allen Black, a long-time resident of Farmington, New Mexico passed away on July 8, 2025. Bruce was born August 20, 1936 in Albuquerque, New Mexico to Ruth E. (French) and Harmon Black who preceded him in death. Rear Admiral Black received his second star and was the Commander of the Naval Reserve Intelligence Command of the United States for five years.

Bruce A. Black graduated from Highland High School in 1954 in Albuquerque, New Mexico and joined the Naval Reserve as a seaman recruit in 1953. He received his Bachelors Degree from the University of Texas El Paso. Upon graduation in 1959, he married the former Marjorie Manget Watkins, his wife of 66 years. Bruce received his Masters Degree and his PhD in Geology from the University of New Mexico. After working for Shell Oil Company, he established his own company, Black Oil, as an independent consulting geologist. Most recently, he was the President of Black Exploration, LLC in Farmington, New Mexico. He designed and created Kokopelli Cave, a unique Bed and Breakfast. He loved to fly his airplanes and fish the mountain streams.

Bruce served on the Board of the New Mexico Museum of Natural History during its establishment in Albuquerque. He also served as the President of the Rocky Mountain Section of the American Association of Petroleum Geologists and member the Board of San Juan Regional Medical Center.

In addition to his parents, Bruce was preceded in death by his brother, James H. Black and wife Eleanor Black. He is survived by his wife of over 66 years, Marjorie, their children Leigh Irvin (Joel) and Bruce Harmon Black as well as grandchildren, Ashleigh (husband Vincent Gomez), Marilei Black and Alice and Tasha Irvin, and Great-Granddaughter Ruth Gomez.

A Celebration of Life will be held at a later date. Contributions may be made to New Mexico Right to Life, The Wounded Warriors Project, San Juan College Foundation, or an organization of your choice.

Donald J. Adams, CPG-07633

Fort Worth, Texas

November 28, 2024

Member Since 1989

Obituary and photo excerpted from the Dignity Memorial website.

Don J. Adams was called home to his Lord and Savior on Thursday, November 28, 2024, with his family by his side, after a courageous 15-month battle with Mesothelioma. Don was a man of faith and family with a heart as vast as the geological formations he studied. He saw the potential in everyone he met and genuinely sought to help them become better versions of themselves.

Don was born on September 7, 1935, in Lyons, Kansas to Arthur L. Adams and Irene R. Adams. He grew up in a farming community in central Kansas where he developed his love for the land, hunting, and fishing at his beloved Lake Kanopolis. In his youth, he played both baseball and football, was a Boys State representative for Kiwanis International, and a member of Boy Scouts Jamboree. Even then, his leadership qualities and genuine interest in others shone through.

Following graduation from Lyons High School, Don attended the University of Kansas, where he was a geology major and a member of the Phi Kappa Psi fraternity. A left-handed pitcher for the KU baseball team, he proudly cheered "Rock Chalk!" throughout his life. He often reminisced about his college days, making lifelong connections. Don received both his Bachelor's and Master's degrees in geology from KU.

Before beginning his Fellowship in Geology in 1959, Don was drafted into the Army for their Critical Skills program, where he served at Fort Leonard Wood and received an honor as an expert marksman in the M-1 rifle. This experience further fueled his sense of adventure and service. In 1961 while Don was living in Amarillo, he had the incredible experience of hosting a social for Duke Ellington at his apartment. Don was stunned that several people declined to spend time with one of the greatest musicians based on race. Don truly had a unique ability to connect with people, to find common ground and build relationships, whereby leaving a positive impact on everyone he met.

"The Earth holds endless wonders," Don would say, and his love of geology and career in the oil and gas business took him on great adventures, with his favorite being Alaska. His Alaskan adventures were treasured memories — living in tents and Quonset huts while hiking and helicoptering to sites in the unspoiled wilderness. He often spoke of the awe-inspiring beauty of the Alaskan landscape and the camaraderie he found with his fellow geologists. Don worked for independent geologists, as well as for major oil and gas companies during his career, including Phillips 66, Monsanto, Edwin L Cox, Tuthill and Barbee, USPCI, and Cameron Cole. He was known as a mentor and friend to his colleagues, always willing to lend a hand and offer guidance.

Don met his wife Kathy on his first weekend in Denver through mutual friends. Their first date was on July 4th in the foothills of the Rocky Mountains, and they married on November 16, 1963. Together they raised two daughters, Amy and Stephanie, and celebrated 51 years of a Christ-centered marriage. They were a team, dedicated to building a loving and supportive family.

After Kathy passed in 2014, Don relocated to Fort Worth to be closer to his daughters and grandchildren, who brought him immeasurable joy. He was a constant figure in the lives of his grandchildren, attending their many activities and sporting events, showing up and becoming a role model to emulate. He poured his love and wisdom into his grandchildren, nurturing their dreams and celebrating their achievements. In Fort Worth, Don made friends through Arborlawn United Methodist Church, where he was a member of both the Chancel and Silver Singers choirs and Faith Bible Sunday School class, a member of a wonderful Kiwanis group, RECA Bible Study, and volunteered mentoring fourth graders with Academy 4. He continued to invest in others, leaving a legacy of kindness and support.

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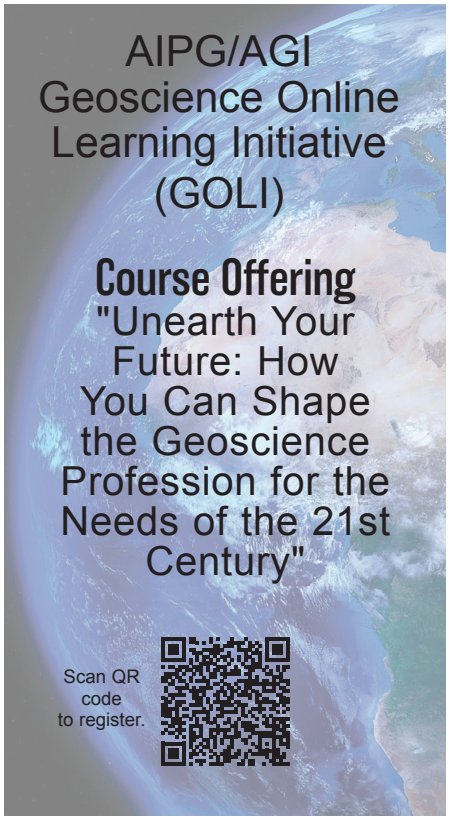
Comments on proposed rule: Modernization of Property Disclosures for Mining Registrants

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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