Geologic Environment & Agriculture
Best Practices for Online Learning
Coping with COVID: Field Learning
Scholarship Essay Writing Tips
AIPG executive committee meeting attendees at AIPG Headquarters in Denver, Colorado on October 17, 2020 following social distancing protocol during the COVID pandemic. From left: Treasurer Matt Rhoades, Vice President Dawn Garcia, Advisory Board Member, Steve Baker, Executive Director Aaron Johnson, Ph.D., Early Career Professional Jessica Davey, Past-President Keri Nutter, Past Early Career Professional Erica Stevenson, Adam Heft, President-Elect Nancy Wolverson, Secretary Sara Pearson, and President Todd McFarland.

AIPG executive committee meeting attendees masked up.

Photography Challenge Winners

Photography and geology go hand in hand. Geologists have opportunities that many never get in a lifetime to see some of the most wondrous places, witness some of the most amazing natural events, and explore the planet from its depths to the stars. We challenged you to share these amazing experiences and will feature the winners on the cover of The Professional Geologist.

Challenge categories:

1. Amazing Vista - show off a stunning view of a geological feature.
3. Show me the Mentoring - sharing knowledge and learning from experienced geologists has proven to be a most effective way to transfer knowledge and build long-lasting relationships.
4. Why I am a Geologist - show us in a photograph what inspired you to become a geologist.

Amazing Vista
- 1st Place - Greg McKelvey, CPG-07448
- Runner Up - Robert Font, Ph.D., CPG-03953

Geological Anomaly
- 1st Place - Greg McKelvey, CPG-07448
- Runner Up - Robert Font, Ph.D., CPG-03953

Show Me the Mentoring
- 1st Place - Albert Lamarre, CPG-06798

Why I am a Geologist
- 1st Place - Greg McKelvey, CPG-07448
- Runner Up - Robert Font, Ph.D., CPG-03953

Congratulations to our winners! Thank you for entering some fantastic photos. Greg’s amazing vista photo is featured on the cover of this edition and you will see his other two in upcoming editions this year along with Albert Lamarre’s winner for show me the mentoring. In addition, their membership dues are waived for 2021. As runner-up, Robert Font’s photos will be featured in upcoming editions inside the TPG.

We will be issuing another photo challenge in the second quarter edition. We hope you consider entering!
The Professional Geologist

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The mission of the American Institute of Professional Geologists (AIPG) is to be an effective advocate for the profession of geology and to serve its members through activities and programs that support continuing professional development and promote high standards of ethical conduct.

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

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Greetings once again to all AIPG members! It has been several years since I’ve last been a part of the National Executive Committee, and as I rejoin it for 2021 and 2022, we are seeing many changes to our world resulting from a year of chaos. Covid-19 has had a huge impact on local, state and national events, the economy, and so much more. Many of our members have lost friends or family members to the virus. Nearly all AIPG events in 2020 were cancelled or were moved to a virtual platform. It has been many months since we have seen each other face-to-face. Indeed, 2020 will be known as the year without an annual meeting – a first in AIPG’s 57-year history! More recently, we’ve also had the distraction and divisiveness of the Presidential election and its aftermath, which, as I write this, the results have still not been acknowledged by all parties.

I look forward to 2021 with hope that the future will be brighter. Although Covid-19 is still raging throughout the country and the world, and things may get worse before they get better, we are starting to see a glimmer of hope. We are getting a more consistent message that wearing masks and continuing to social distance are the most significant things we can do to help prevent the spread of the virus, and hopefully the message is starting to sink in. And there are vaccines that have been developed and are nearly ready for distribution. With luck, we will be able to get back to a sense of “normalcy” and hold in-person events early in 2021.

AIPG has created a Diversity and Inclusion Committee, which is working on developing a session for the 2021 Annual Meeting and that will be widely available to the membership. Look for additional information about this in the future.

As you know, this is my first edition of TPG as Editor. I want to thank John Berry, who has served as Editor for the past four years, for the tremendous job he has done with improving the quality of TPG and providing me with guidance for taking over from him. I hope that the transition will be seamless, and that there will not be any “dropped balls” because of it. I also acknowledge all the other individuals who help produce TPG and make it what it is today, including the associate editors, those who regularly contribute articles (David Abbott, Robert Font, Rasoul Sorkhabi, and Aaron Johnson), Headquarters staff Dorothy Combs, Cathy Duran, and Wendy Davidson, and TPG Design Editor Sara Pearson.

The diversity of our members makes us strong and brings different perspectives to what we do; this may well offer different solutions to problems we may be trying to solve.

President-Elect Biden, unlike his predecessor, is promoting a “work together” approach, rather than an “us and them” mentality that we’ve seen in politics in recent years. This is something that we need to do, not just as a nation, but as an organization as well. While AIPG is comprised of members in various disciplines of geology, we are all geologists. All aspects of the science are important, as are the men and women of whatever race, creed, and background who practice it. The diversity of our members makes us strong and brings different perspectives to what we do; this may well offer different solutions to problems we may be trying to solve. Engaging in productive discussions with each other to better understand one another is a worthy goal. To this end,
The Hohokam, their culture and agriculture:

Picture, if you will, a scene taking place in what is now Phoenix at some time between more than 4,000 years ago and 600 years ago: The twenty-five Hohokam elders slowly gather in the tribal meeting hall, a semi-subterranean mud-walled, mud and palm-thatched building with its floor recessed a yard below ground. The hall is at the east foot of what is now called Sentinel Peak or A-Mountain (Figure 1), just west of the Santa Cruz River in present-day Tucson, Arizona, in the surprisingly lush Sonoran Desert.

The elders meet this week to plan pre-summer monsoon planting, crop irrigation, community ball court games, harvests, hunting excursions, marriages and the supply of salt from Sonora and the Gulf of California as well as food, fiber and the management of water in their extensive irrigation systems (Figure 2 on page 5). The Hohokam supplement their primarily plant-food diet with meat. They have no domestic animals except the dog. Since they have no livestock (unlike some neighboring southwestern peoples, who have domesticated the turkey), meat is obtained by hunting and trapping. Deer and rabbit are important meat sources, but they also eat mountain sheep, antelope, mice and squirrels.

The tribal elders meet every year during the May full moon to focus on management of the upcoming summer monsoon. Each clan’s elder represents a cluster of families eager to plant summer crops to take advantage of the semi-annual rains. The normal flows of the Santa Cruz, like the Gila and Salt Rivers to the north, provide nearly perennial fresh water, skimmed off by main, lateral and on-farm hand-dug earthen canals. The canals provide sustainable water for general family use and crop irrigation as they’ve done for hundreds, perhaps thousands, of years.

The earliest Spanish historical accounts, and geologic and hydrologic studies, indicate that the Santa Cruz River only flowed perennially in about six locations along its total length. One of those perennial flows was in the San Xavier vicinity and another at the base of A’ Mountain. Unfortunately,
by the 19th century or our era, these rivers were no longer “alive” all year.

Most of these hand-dug earthen canals are no deeper than a man is tall, and less than the width of a person’s outstretched arms. The Hohokam canals in the Tucson area range from less than a few hundred feet to a thousand feet long, whereas in the area around modern-day Phoenix, some of the 15 or so canals off the Salt River (see Figures 2 & 3) are eight times wider and twice as deep (Figure 4), because the soil there is easier to dig, and up to 20 miles long because the land is flatter. The over 500 miles of Phoenix-area canals are designed and constructed with a gradient of one to two feet per mile to sustain an erosion-safe flow velocity of about one to nearly three feet per second. They become narrower downgradient to maintain a nearly constant flow velocity. Consequently, the main canals when well-maintained may readily produce a base flow from shallow groundwater of about 25 to 75 acre-feet per day. The longest prehistoric canal identified along the Santa Cruz River (see Figure 2) is a 6.7-mile-long one that ran to the Marana Platform Mound site near the I-10 Marana Exit. The longest Hohokam canal known along the Salt River is about 27 miles long. Imagine the labor required to keep these canals alive, as they silt up quickly and need re-digging every other year or so. Only primitive hand tools made from stone, bones and trees, such as overhead-digging-sticks, were available for use - no metal drills, hoes, axes, hammers or shovels; no wheel barrows; no front-end loaders, backhoes or ditch-witches. No pulleys, gears or cables, and no theodolites or lasers, surveyor’s levels, tapes or chains.

Figure 3. Extent of Hohokam occupation.
Author: Yuchitown, 2015. Creative Commons License.
80,000 Hohokam people (10,000 to 16,000 families) to use for drinking, washing, bathing, and crop irrigation, assuming that per person consumptive water use was a few gallons a day and crop-irrigation water consumptive use for corn (maize), cotton, tobacco and deep-rooted beans, squash and peppers was a few feet per season. Crop acreages are estimated at over 100,000 acres.

But estimates made from captured base (groundwater-inflow) canal flows, and from consumptive domestic and irrigation water use, confirm that base-flow alone was insufficient to support the large population as well as the irrigated acreages indicated by the archaeological evidence. Therefore, by ancient tradition, the Hohokam prepared three times the amount of land that they expected that the farmers could normally irrigate and cultivate, so as to provide an opportunity to plant, produce, harvest and store more if the gods permitted.

Just about everyone in the villages was directly tied to community agriculture. Some families were more often successful than others because of their land’s fertility, their family’s size and ability, or their inherited secrets of crop pest and disease control, soil amendments and fertilization.

Most of the farmed land was flood irrigated along short rows, small squares or rectangular flat plots by canals (Figure 5). Some was drip irrigated using large hollowed water-filled gourds. Crops were typically corn, beans, squash, melons, peppers, cotton and tobacco. Agave plants were also stand-alone common crops.

The Three Sisters

According to Navajo legend, “The Three Sisters” is the combination of planted maize, squash and beans. The Three Sisters get along so well when they are planted together. The bean vines climb up the corn stalks for support, while the squash plants cover the ground below the beans. The large leaves of the squash plants keep out the weeds and shade the soil to keep it from drying out. Although corn plants have high nitrogen demand, bean plants are legumes and “fix” or remove nitrogen from the air and fix it in the soil, which helps to meet corn’s nitrogen demand.

Before every monsoon season the canals had to be arduously maintained and repaired. This included the re-digging of silted-in canals and the replacement of worn out or damaged portable sluices, which were made of cloth or interwoven plant stalks, or simply piled rock. The perennial big question was "should the villagers try to bring more land under cultivation, or cut back to less?"

In the Phoenix area the base flow and the recurring winter and summer floods provided sufficient water for 50,000 to

Figure 4. Archaeologist Emil “Doc” Haury in an Excavated Canal at Snaketown (S. of Phoenix) in 1964 (Rose 2014). The reddish color and its increase in intensity upwards suggest that this canal cuts an older alluvial fan with a well-developed soil profile Image source: http://waterhistory.org/histories/hohokam2).
Crop pests and diseases were controlled by taking care not to over-irrigate or to allow standing water and humidity: this attracts insects and plant rot. Soil amendments were burnt crop residue and plant debris, including mesquite leaves which are natural pesticides. Fertilizers were stabilized human manure and heavily diluted human urine which, if not stabilized and diluted, would otherwise burn the crops.

Human wastes were collected: urine in clay pots and fecal matter in baskets for stabilization prior for use as natural crop fertilizers. Otherwise, the natural alluvial soils were very low in organic matter, nutrients and fertility. Because the natural soils were well-drained, clay and silt might have been added to improve their water-retaining capacities.

Much attention was given to scheduling planting, irrigating and harvesting. Harvested crops were stored in cool dry pots and kilns, to avoid moisture that attracts insects and vermin. Planning also focused on food preparation with adequate fresh water to aid digestion. All of this was achieved without metal tools or wheels, surveying or construction equipment, written language, maps and plot plans to record these practices or for future use. Thus, much depended on the wise memory of the elders.

Here in the Santa Cruz, from Black Mountain to Cañada del Oro in the north, several thousand families lived in hundreds of clan settlements, each consisting of a few tens of families in extended family mud-walled, mud and palm-thatched-roofed, circular or oval recessed-pit adobes. Pit houses varied considerably in shape and size. They typically were circular with about 12-15 foot diameters for nuclear families or oval or rectangular at about 12-15 feet wide and 30-45 feet long with rounded corners for extended families. The clan leaders typically had larger houses with as many as 20 to 30 residents.

Although the people worked cooperatively in common and lived in sedentary villages, some were more productive and prosperous than others. The more prosperous families hired more labor from other families. They produced more excess commodities. Thus, much depended on the wise memory of the elders.

How a young girl finds a suitable husband
According to a modified Pascua Tribe Yaqui legend, a young girl might pick a husband in this manner. She dreams herself to become an eagle and throws a branch into the sky hoping to attract a male eagle. When an engaging male eagle retrieves the branch, she throws a larger and heavier branch into the sky hoping to attract a stronger male eagle. In this way, through repetition, she finally decides to mate with the strongest eagle she can identify. Then, she dreams herself back to a human girl and her chosen strongest eagle into a human man to be her husband. In this way, she assures herself she will have a strong marriage, protected by a strong husband who will father her strong children.

Where did the Hohokam go?
Where did the Hohokam, “ancient people” or “someone who is all gone,” go? Some say they died out from drought, disease, soil salinization, famine, warfare or internal social conflict. Current anthropological and archeological thinking estimates that average adult Hohokam life spans were 30 to 40 years. Infant and child mortality was high due to childhood diarrhea, malnutrition, dehydration, parasites, infections, poor medical care and lack of access to water.

A desert Southwest tale of cooperation
Every full moon, the animals would gather in an abandoned pit house to discuss the upcoming month. So many would want to attend uninvited that Coyote suggested they install a wooden gate made from ocotillo. One afternoon awaiting the full moon, Coyote, Eagle, Bluebird, Quail, Bear and Rattlesnake were disturbed by a thumping outside the gate. It was pesty cottontail Rabbit thumping on the gate to be allowed in. Coyote said, “Tell Rabbit to go away.” Bear yelled in a deep voice, “Go away.” It was quiet for a few minutes. But then, the thumping continued. Coyote said, “Throw some sand at Rabbit!” Bear picked up some sand from the pit house floor and threw it at Rabbit. In was quiet for a few minutes. But then again, the thumping returned. Finally, Coyote shouted, “Kill Rabbit!” Bear picked up a black-rock pointed spear and ran it through Rabbit. It was finally quiet for a few minutes. But yet again, the thumping returned. Finally, Coyote said, “Okay, let thumper Rabbit in the pit house.” Bear opened the gate and Rabbit’s thumping heart rolled into the house and was quiet.

The Hohokam and Geology:
All of the Hohokam territory lies within the Southern Basin and Range Province, in which crustal extension, related to changes in the subduction regime at the western margin of North America, has been approximately 100% since the early Miocene. The Phoenix and Tucson areas are less than 200 miles from the Gulf of California, thus enabling the Hohokam to trade with coastal communities for salt, dried fish and other commodities.

Crustal extension was accompanied by widespread volcanism and gave rise to linear ranges of fault-uplifted mountains between wide valleys, whose underlying grabens are filled with debris eroded from the mountains. Since it has been nearly 20 m.y. since these processes began in this part of the Basin and Range, both the mountains and the volcanic cover have been deeply eroded, exposing rocks as old as 1.8 billion years in the mountain cores. The volcanics, such as the 20-30 million-year-old andesite of Black Mountain in Tucson, and many of the ancient rocks are of mafic affinities. Soils derived from these rocks should be finer-grained, more clay- and nutrient-rich than the alluvial soils adjacent to the Salt, Gila and Santa Cruz Rivers, which are derived from the much older metamorphic rocks of surrounding and nearby mountains (Figure 2). However, no preference for these mafic-derived soils is apparent from the map of the canals (Figure 2). The alluvial soils, especially those on older alluvium that has been exposed to chemical weathering over a long period of time, were among the most suitable for Hohokam crop irrigation because they were generally flat, deep, well-drained and adjacent to the somewhat perennial or “live” streams. It is noticeable in the composite of Figure 2 that many of the Hohokam irrigation works in the Phoenix area are concentrated on these older alluvial deposits (Qm on the map), and Figure 4 illustrates the reddish tinge due to deep weathering.
Some say the Tohono O’odham “desert people” of Southern Arizona are their descendants.

Repeated and long-lasting drought most likely lies at the root of the collapse of their society: studies of tree-rings carried out at the University of Arizona suggest that there were “mega-droughts” in the southwestern USA from 0-400 AD and from 1000-1400 AD (Routson (2014) and Figure 6).

Historically, until about the late 1700s, the O’odham who lived along the Santa Cruz were known as Sobaipuri (fierce) and identified themselves as Akimel O’odham (River People) rather than Tohono O’odham (Desert People). Tohono O’odham from the desert areas farther west didn’t begin moving into the Santa Cruz Valley till late 1700s to early 1800s after the Sobaipuri had been decimated by European diseases and warfare with Apache, Janos, Jocome, and Manso groups.

Today, one can visit the Casa Grande Ruins National Monument, in Coolidge, Arizona, just northeast of the city of Casa Grande. This Monument preserves a group of Ancestral Puebloan Hohokam structures of the Pueblo III and Pueblo IV Eras. They have a marvelous gift shop. The best evidence for the canals is now preserved in old photographs in Arizona museums, publications, online websites, and occasional archaeological dig sites. Modern Phoenix farmers once readily identified Hohokam canals and often mimicked their locations for their modern irrigation canal alignments. After the centuries of use by the Hohokam they could be recognized because they retained water and the surface soils over them were darker than the natural alluvial soils because they were more silty, clayey and organic-rich. Aerial photographs, land use maps, plot plans, and environmental assessments indicate that urbanization, energy and water utility networks, transportation corridors, and modern farming have erased much of the Hohokam irrigation systems from the Salt, Gila, and Santa Cruz River Basins.

Another noticeable thing is the way that the largest group of canals fans out from the area of the outcrops that constrict the river, forming a natural weir at high stages, just west of Tempe.

Furthermore, the Sonoran Desert in Southern Arizona is relatively lush because it has both winter and summer rainy seasons, with about 10 to 13 inches of annual rainfall in its southern alluvial valleys, and 4 to 10 inches in its northern valleys. The surrounding uplifted mountains receive nearly twice that amount. This means that the major rivers are perennial or almost so, as was the case of the Santa Cruz River below Centennial Peak (‘A’ Mountain) in Tucson before...
urbanization. However, the high potential annual evaporation, about 80 inches, puts stress on plants soon after each rainfall, thus requiring irrigation from the rivers to provide sufficient water for a full growing season.

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This edition of TPG is the Student Issue. We have several student articles, including one on field trips to Canyon Lake Gorge in Texas, another on field-based undergraduate education during the Covid-19 pandemic, and a third on a student’s research on pegmatites. We are also including for the first time a summary of all AIPG-related scholarships (offered by National and individual Sections) to graduate and undergraduate students, complete with application deadlines.

TPG is always in need of articles from members - both students and professionals. If you have an opinion piece, an article on a timely aspect of geology, or research you are conducting, I strongly encourage you to submit it. Section news is also welcome. AIPG is your organization, and TPG is the way to make your voice heard; please use it. All geology-related topics are open for discussion and publication, and your opinion on these subjects matters.

Given the diverse backgrounds of our members, I remind our members that all submittals, and responses to articles published, must be professional and respectful of others' opinion on the subject under discussion. All submittals and responses must comply with the AIPG code of ethics.

I look forward to serving as your Editor for the next two years. If you have any questions, comments, or concerns, or ideas on content you would like to read, please feel free to contact me at adam.heft@wsp.com. I look forward to hearing from YOU!

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Letters to the Editor

October 15th, 2020

To: J. Todd McFarland, CPG-11348
AIPG President

Re: Resolution of National Executive Committee and Adjudicatory Board Sanctions

Dear Mr. McFarland and the Adjudicatory Board (and for the TPG Editor):

A productive resolution meeting was held Wednesday, October 15th. Thus: while serving as Colorado Section President during year 2019, I did not pursue a poll of AIPG Members on climate change issues. In the course of providing information and essays touching a wide variety of issues, some members of AIPG were distressed by my writing. Certainly it was not my intention, though I acknowledge that my writing caused an unpleasant reaction among some members. I wrote to encourage professional responses that would get us closer to the best answers.

Abundant thanks to participants in the resolution meeting: Ms. Helen Hickman and Dr. Ray Talkington of the Adjudicatory Board, to Mr. Larry Cerrillo for his mediation skills, to President Todd McFarland for facilitating communications, and to Dr. Aaron Johnson for his guidance toward resolution. The process has been enlightening, and AIPG will be stronger for what we have learned.

Sincerely,
Ron W. Pritchett
Colorado AIPG Legislative/Regulatory Chair 2020
CPG #7063

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Dear Editor,

At my tender age of 81, I provide an antiquated perspective, but then that is all I have to offer. My biggest fear for the future of the geological sciences is that shift away from field work -- where the rocks are exposed. Computers are great, and I am grateful for mine to do all the writing I am now doing in retirement. But I cut my teeth on field trips and mapping projects which gives one the opportunity to learn to appreciate the six dimensions of the world of geology:

1. X
2. Y
3. Z
4. Time
5. Geologic Processes
6. Interaction of the various geologic processes.

Imagine a cube moving through time with all the geologic processes going on inside. Then stop the box in the late Holocene and cut it in half. Now look at one of the cut sides and try to figure out what has been going on in the past.

That is what we do as geologists.

Regards, Bill Elliott, CPG-04194

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Dorothy Combs at AIPG National had a call at the end of November from Tom Herbert, CPG-2551, who said that the last issue of TPG was the best so far, especially Rasoul Sorkhabi’s article about “Online Teaching vs. Classroom Teaching,” which he plans to share with his academic colleagues.

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ERRATUM

The 2020 Jul.Aug.Sep. printed issue of The Professional Geologist includes references unrelated to Rasoul Sorkhabi’s article, “2020 Crash and the Shape of Oil to Come,” on page 60. The references included following the Yergin reference are in error. The online version displays the article and references correctly.
Hey Students, Want Free Money?

Each year, AIPG offers a number of scholarships to its student members. National Scholarships are open to AIPG student members in any Section, and are divided into Graduate and Undergraduate categories. Each year, up to 10 undergraduate scholarships are awarded by National AIPG, and often additional scholarships are sponsored by individual Sections. Graduate students may apply for the William J. Siok Graduate Scholarship. Details on each of these scholarship categories may be found below:

**AIPG National Undergraduate Scholarship**

**Purpose**
To assist students with college education costs and to promote student participation in the American Institute of Professional Geologists (AIPG). Up to ten scholarships will be awarded to declared undergraduate geological sciences majors who are at least sophomores. Details for applying for these scholarships are provided below.

**Scholarship Awards**
Scholarship awards in the amount of $1,000.00 - $3,000 each will be made to eligible students attending a college or university in the U.S. Scholarships are intended to be used to support tuition and/or room and board.

**Eligibility Requirements**
Any student who is majoring in geology (or earth science), is at least a sophomore, and is attending a two-year or four-year accredited college or university in the U.S. can apply. Also, the student must be either a student member of AIPG or must have applied for student membership at the time the application for the scholarship is submitted.

Each student who is awarded a scholarship agrees, by accepting the scholarship, to prepare a 600 to 800 word article for publication in The Professional Geologist. The subject of the article must be related to a timely professional issue.

**Application Process**

1. Submit a cover letter introducing yourself and tell us what you have done outside of the classroom such as research projects, officer in club, or outside activities within the community. Address your career goals in near term and longer term. Provide your academic objectives: If you are attending a two-year institute do you plan to continue to a four-year institute and complete a degree? If you attend a four-year institute do you plan to attend graduate school?

2. Submit a one page (800 words strictly enforced, 12 pt, times new roman, 1 inch margins, left justify) essay on “Why I Want to be a Geologist.”

3. Submit a copy of your transcript (unofficial) and documentation that you are a current student. Requisite standards to apply are a minimum GPA of 2.8 (on a 4 point scale) and a minimum of 12 semester credits of geology/geoscience courses with a 3.0 GPA in these courses completed at time of application.

4. Submit a letter of recommendation from a geology/geoscience professor that provides an emphasis on your performance and activities in the classroom, in the department, and your character in how you work and help other students.

The application packet can be submitted online (preferred) or emailed to aipg@aipg.org. Questions regarding the application process can be directed to (303) 412-6205 or e-mail: aipg@aipg.org. Additional details may be found at: https://aipg.org/page/UndergraduateScholarship.

Continued on p. 39
Learning in the Outdoors: Field-based undergraduate education during the COVID-19 pandemic – why not?

Jon Rotzien, Ryan Sincavage, Nuri Uzunlar, Harry Filkorn and Yann Gavillot

All of us were a bit hesitant at the thought of running an outdoor field-based undergraduate geology course in the Black Hills this summer. Even though we had organized and run field camps for years (1967 is the first field course led by the Black Hills Natural Sciences Field Station), this year was completely different. How would we design and structure the class? What would we do if someone became symptomatic? How would we even feed the students, when normally we’d just have a big camp cookout? These were just some of the challenges that made running a field camp like this one a logistical mountain climb (think Denali).

In March, most of the colleges and universities shuttered their doors, sent their students home and transitioned many of the face-to-face classroom courses to fully online classes so their students could complete the semester. But what about students of geology, a discipline where so much of our curriculum is based upon making observations and learning while in the field (sensu Oliveri and Bohacs, 2005, Field safety in uncontrolled environments: A process-based guidebook). For many reasons, fully online geology courses cannot replace the experiences of making geologic maps in the field. The fundamental skills that students learn throughout the coursework of an undergraduate geology program also require time studying rocks and the natural world in the great outdoors, the more the better. This educational pathway typically culminates in a focused and sustained five- to six-week-long geologic mapping course that completes the geology Bachelor’s degree requirements of most universities. However, dealing with pandemic-related issues to deliver field-based learning was going to be complicated. The first hurdle was to have enough planning in place to ensure the safety of the participants and thereby gain the required approvals of the state’s health officials and the Board of Trustees. To most students, field camp is a life-changing experience as they live in shared accommodations with other fellow students and faculty for five to six weeks learning about rocks and life.

The Black Hills Natural Sciences Field Station offers field courses around the world: in one year alone, nearly 21 sessions are taught, including camps in USA, Turkey, New Zealand, France, Spain, Morocco, Iceland, Ecuador, Nepal and soon other countries. As the pandemic progressed, nearly all these camps were canceled or rescheduled at first, and then ultimately canceled. However, there remained a strong demand for students who needed to complete their 3- to 6-credit field geology capstone to complete their degree. Naturally, we wanted to help our students. So we began a 5-month-long mission to build a course and assess its logistical and academic viability. Were we out of touch? Or did we really think we could engineer and plan successful logistics and contingen-
cies to deliver a field-based course this summer? Every other university said, “no thanks.”

We decided on a hybrid course, divided into 14 online course days immediately preceding the 15-day in-person field camp. It was essentially a Colorado College-type block plan experience with no days off. Each of the 14 online days featured a new topic, with a virtual exercise to complete. Overall, it took more than 30 students, nine instructors, the field station director and countless administrative staff from South Dakota Mines and Board of Regents for the State of South Dakota to make this course a successful reality. Having served firsthand as an instructor, for several of us it was ~80-200 hours to deliver one online module and many more to complete the field phase of the hybrid course. Many would say, “Why do this if it clearly took a large budget to deliver?” Simple. We did it for our students. We felt we could make a small contribution by helping them finish their undergraduate degrees and get out of school and onto their careers.

Many may not recognize the amount of consideration it takes to lead a hybrid course like this. The online course was fairly standard, except for the fact that we purposefully overloaded the course so as to keep students busy at home, in quarantine, for the 14 days prior to the start of the in-person field course. The logistics from here got a bit more complicated. For the field camp, we split the students into 10-person cohorts to prevent mixing of the student body during the course. Each cohort had two full-time instructors. On field days, vans consisted of five students and one instructor (that was also the driver). We drove with the windows down (even in the rain), masks on, with air conditioning on anything less than max to prevent recirculation. But before loading the vans, forehead temperature checks were taken (see photo upper right – in this case, we had to expand our skillsets to mimic some of the work performed by physicians). Following commutes to and from the field sites, the instructors sprayed disinfectant on all internal and external surfaces that were touched by the passengers. If a student or instructor were to become symptomatic at any time during the camp, we had plans to place the entire cohort under quarantine measures based on the guidance of relevant government and health authorities.

All campus dining was located in the cafeteria at the Surbeck Center. Students were to keep 6-ft distancing at all times, were served by staff in order to eliminate possible contamination from touching anything. Dining tables were spaced with only one person per table, with most facing toward the door. A bit unconventional, but it worked. Masks were to be worn at all times, except while eating. One of the nice things about working in the field was that we could eat our prepared brown bag lunches on hilltops overlooking the beautiful Black Hills every day we were in the field. It’s during these times that we have another reminder that we’re thankful we’re field geologists.

Based on our benchmark hybrid course during the pandemic (as far as we know, there are exceedingly few other field programs that have attempted this model this year), we forecast three main scenarios for undergraduate field-based education. First, we may see that many field camp programs cease to operate in the coming years as more and more geology courses, and courses in general, go online – especially if COVID-19 goes endemic. Secondly, we may see that field camps will actually grow over the next few years to accommodate pent up demand from the height of the pandemic. Thirdly, we feel that more camps may go to this hybrid model, since it is a nice compromise and represents about the length of time a camp can run at full throttle without testing the ultimate limits of the participants’ durability and endurance (think Colorado College block program again). Further, online portions of courses are not as costly nor otherwise prohibitive to students who may not feel as comfortable in the outdoors, or who have family and job commitments that prevent them from traveling for extended periods during the summer. We remain sanguine, if not optimistic, “...we feel that more camps may go to this hybrid model, since it is a nice compromise and represents about the length of time a camp can run at full throttle without testing the ultimate limits of the participants’ durability and endurance (think Colorado College block program again).
Our paper characterizing this experience is now being reviewed by the Journal of Geoscience Education, and we have submitted two abstracts to the Geological Society of America Annual Meeting. Ironically, this international meeting will be held online as well, so sadly no trip to the great city of Montreal will be held this year.

For the duration of the in-person field course, there were no incidences of elevated body temperatures, and no students needed to stay in for a day due to any COVID-like symptoms. Now that we have reached just over two weeks following the conclusion of the field-based part of the course, there have been no reported incidents of symptoms or infection since the students, instructors and logisticians returned home. While the challenges were numerous, we continue to be thankful for being able to get outdoors and study geology in the field this year, as well as get out of our homes, and hopefully all of our hybrid online and field course participants continue to stay healthy, happy and enthusiastic about the many benefits of field geology.

Written by Jon Rotzien, Ryan Sincavage, Nuri Uzunlar, Harry Filkorn and Yann Gavillot with guidance from the entire team of instructors representing the South Dakota Mines, Black Hills Natural Sciences Field Station on August 15, 2020, who are all thankful they briefly escaped their homes to lead a field geology course this summer in the beautiful Black Hills, USA.

The Section newsletters this Quarter are full of field trips, meetings, and seminars canceled by the COVID-19 pandemic. However, many other activities have continued, and meetings have, in some cases, gone virtual with great success: often with a higher attendance than in-person meetings have traditionally had.

**Colorado Section:**

Jim Russell has a link on p. 11 of the Colorado Section’s Fall 2020 Newsletter to his excellent Colorado Geological Road Log that is accessible free and runs on ESRI’s ArcGIS Story Map software.

**Illinois/Indiana Section:**

The Fall 2020 Newsletter of the Illinois/Indiana has an interesting update on the Federal and IL/IN state of PFAS/PFOA legislation and regulation p.7, as well as a fascinating short report on the Pogo gold deposit in Alaska by Paul Hohback, CPG 11432 (p.8).

**Wisconsin Section:**

Speaking of PFAS, the WI section is working on a webinar for 2021 on How to Read and Understand a PFAS Lab Report (working title). Watch for an announcement in early January, with the webinar to be held in late February.

**Michigan Section**

The Michigan Section has held two “lunch and learn virtual platform events featuring experts in Natural Source Zone Depletion and Establishing Soil Background for Metals. We hosted the live events inviting not only our members, but all professionals interested in the topics to join us. We offered continuing education credits and because of the virtual platform, professionals from other states as well as other countries tuned in. It was great to hear feedback, not only from our members here at home, but from members across the country. If you missed these events, we did record them, and they are available on the Michigan Section’s YouTube channel by following the links on the titles above. We are currently in the process of planning more “ (quoted from the Michigan Section Oct. 2020 Newsletter, p.7). In my mind some of the most important things about these meetings are that (1) they were open to non-AIPG Members, and (2) they were open to people across the world, and attracted people in both these categories. This is a tremendous way to make the value of our organization widely known.

**Northeast Section Virtual Fall meeting a great success:**

The NE Section has also had a successful virtual meeting. From their newsletter: “(The) NE/AIPG Fall Meeting 2020 presentation of “Remediation and Final Resolution of Environmental Impacts Associated with the Retsof Salt Mine Collapse,” by John M. Nadeau, CPG, PG, was a huge success! ...Our first-ever virtual meeting was attended by over thirty registrants. I want to thank John M. Nadeau for putting together the presentation and pulling together great content for the NE Section. The Retsof Salt Mine was the largest salt mine in North America, located in Livingston County, New York. The mine, which reached approximately 1,000 feet below ground surface, extracted salt from a natural deposit, for use as road salt and table salt. In March, 1994, the ceiling of an underground chamber collapsed, causing the mine to infill with groundwater. Mr. Nadeau described the consequences of this collapse, hydrologically, environmentally, and politically.
Coping with COVID:
Lessons from My Undergraduate Fieldwork during the COVID-19 Pandemic

Isaac Pope, SA-9950 - Centralia College

Within weeks of the new year, the world ground to a halt as COVID-19 and ensuing closures swept the globe. The resulting reorganization of the social fabric precipitated a radical change in the lives of many as work and study were transferred to homes. While some disciplines readily assimilated to the new environment, regional and global geoscience projects were cancelled or postponed until travel restrictions were lifted, funding was cut, or researchers simply lost the time. In the midst of the chaos, I was slated to begin an undergraduate research course where I would soon find many unexpected lessons awaiting me.

Closure Chaos: The Challenge Begins

While colleges prepared to close their campuses in March, I was registering for my Spring quarter research course. Under the guidance of professors Patrick Pringle and Michelle Harris of Centralia College, I was set to investigate the Puget Lowland Mima Mounds. Composed of a sandy loam containing sparse pebbles, the Mima Mounds are dome-like ellipsoids whose long axes parallel the downslope gradient of the host terraces (Tabbutt, 2016). They occur on terraces that consist of coarse-bedded gravels long interpreted as Vashon Outwash (Walsh and Logan, 2005). The mounds are a local lenticular thickening up to two meters of a continuous diamicton that forms a veneer along a single level of Pleistocene terraces (Figure 1).

Despite the attention of brilliant geologists for over a century, the Mima Mounds and their origin remain enigmatic, inciting a variety of genetic models ranging from earthquakes, vegetation, and even burrowing rodents (see Washburn, 1988, for a review). Though most authors hypothesize on the origin of the topographic mounds themselves, the mode of deposition producing the diamicton composing the mounds remains a subject of contention. In the midst of this debate, research over the past two decades by geologists Patrick Pringle, Barry Goldstein, and others revealed that a late-glacial meltwater

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Figure 1. Numbering in the thousands along several prairies in the Puget Lowland, the Mima Mounds are composed of a sandy loam diamicton overlying coarse-bedded gravels of second-stage recessional terraces commonly believed to have resulted from Vashon outwash (Walsh and Logan, 2005). In the midst of a century-long debate on the mounds’ origin, my research investigated the mound diamicton and underlying gravels to ascertain if a debris flow associated with the Tanwax flood may have been involved in this intricate story. Photograph from Logan and Walsh (2009).
have also done much to advance geologic texts. United States Geological Survey publications/references, and any available full online references, and any available full online directories to articles, citation platforms, ResearchGate.net (Goldstein et al., 2010). The deposits left by the Tanwax flood are lithologically and stratigraphically similar to the diamicton composing the Mima Mounds.

With this in mind, my project consisted of sampling the pebbles within the mounds and in the underlying coarse-bededded gravels along several terraces as well as determining the particle mineralogy to ascertain if the mound diamicton was deposited by the Tanwax flood. But alas, such studies require fieldwork! On the cusp of closures, hopes were high that the restrictions would not last long, but the pandemic had only just begun. I began my first week with a detailed literature study, but when the colleges closed so did the libraries, and without the use of library and inter-library loan access I was forced to retrieve articles through alternate means. After all, how may any scientist (or student for that matter) remain current on a subject without reading the literature?

While the pandemic may feel unparalleled in recent history, the opportunity to apply technology has been even more so. Because libraries were closed, I shifted to alternative means to obtain the information I needed (see Appendix). Like Facebook or other social media platforms, ResearchGate.net and Academia.edu facilitate the dissemination of research products by providing a platform for researchers to post online versions of their writings, while Google Scholar and Scinapse (scinapse.io) provide online directories to articles, citations/references, and any available full texts. United States Geological Survey (USGS) and state geological surveys have also done much to advance geologic studies and provide access to that research. Although the state surveys differ in online presence (such as Washington Geological Survey LiDAR files), the USGS provides all USGS publications online in the USGS Publications Warehouse and the National Geologic Map Database co-hosted by the Association of American State Geologists. Memberships in the Geological Society of America (access to a dozen journals) or Geological Society of London (access to almost 80 journals!) also allow free access to a number of non-open access works. Using these resources, I could find almost every publication I needed to complete my research.

Into the field:
Mima Mounds, Mount Adams, and Beyond

Depending on the subject, geological research can only go so far from the literature alone – one must eventually venture into the field. I soon began visiting Mima Prairie Natural Area Preserve on reconnaissance trips and applied for a permit from Washington’s Department of Natural Resources (DNR) to collect samples, but research permits were limited until some restrictions lifted. Until May, my project remained in limbo, giving me time to turn my attention eastward towards Mount Adams. In the heart of the sparsely populated Gifford Pinchot National Forest near my residence, I spent several days exploring unusual poorly sorted terraces deposits along the Cispus River, a stream that flows southward from Goat Rocks Volcanic Complex in the central Cascades until flowing west beyond the northern extremes of the Mount St. Helens hazard zone (Figure 3). Along much of its westerly-bound course, the Cispus River is bordered by terraces over thirty meters above the river, the highest level being the broadest and best developed. These terraces are composed of poorly sorted coarse gravels that are imbricated and reverse graded with a matrix-supported fabric. Early researchers suggested that the terrace gravels were produced by outwash during the Evans Creek Glaciation over twenty thousand years ago (Schuster, 1973; Swanson, 1991), but boulders more than two meters in diameter distributed randomly on several terraces defy this proglacial explanation (figure 4 on page 26). Instead, the poorly sorted terrace gravels were indicative of debris flow deposits such as from a lahar (volcanic mudflow).

With this realization, I quickly consulted my mentor John Berry of AIPG, and began investigating the area. Continued...
field visits showed that the poorly sorted gravels were ubiquitous across the terraces and suggested a minimum depth of thirty-two meters above the current river. We quickly noticed that the terraces extended slightly up Adams Creek towards Mount Adams, indicating that my hypothesized debris flow likely originated as a lahar from Mount Adams. Though my source had been identified, I puzzled over its end: to where did the lahar continue? Further west, the Cispus River entered a narrow gorge with few deposits but bordered by strath terraces extending over 35 m above the river. There were no obvious sedimentary remnants, yet a lahar should leave some record of its presence, especially one as large as the one I was studying. I pondered this dilemma as I travelled along the river.

Though nearly invisible in the field, Washington State Geological Survey’s LiDAR database revealed that the evidence was meters above my head. Gently incised into the strath terraces were anastomosing channels over thirty-five meters above the river. Not only were these channels gentler than those hosting the current river, but the braided channels were found above what is now a meandering stream. This supported my lahar interpretation: far above the current river, anastomosing channels were etched into strath terraces along a narrow gorge, forming features quite unlike anything being produced by the current river. Indeed, as seen at other volcanoes, it is only natural for a lahar or any debris flow to produce anastomosing channels! From there, the lahar would continue through the widening river valley as shown by the continuation of depositional terraces down to where the Cispus River enters the Cowlitz River Valley where they appear to have been obliterated by a younger lahar from Mount Rainier.

At the entrance to the narrow gorge along the Cispus River, the lahar appears to have been slowed by a hydraulic dam, causing the lahar to temporarily pool upriver. This provides the perfect opportunity to estimate the volume of the flow. By analyzing the area inundated contemporaneously compared to the cross-sectional area, I calculated a minimum volume of 0.31 cubic kilometers, more than four times greater than the largest previously identified lahar from Mount Adams (the Holocene Trout Lake Lahar of Vallance, 1999). Though less easily calculated than the volume, the age is bracketed above by a layer of 1.2 ka pumiceous tephra that overlies the terraces and below by the Evans Creek Glaciation (21 to 18 ka) (Schuster, 1973), which must predate the lahar because of the lack of moraines in the area. The weathering evidenced by clast rinds in the deposit noted by Swanson (1991) suggest that the lahar may not be much younger than the Evans Creek Glaciation, making this lahar not only the largest but potentially the oldest lahar from Mount Adams yet identified. By broadening the range of Mount Adams lahars beyond the pioneering work of Vallance (1999) on Holocene lahars on the southern flanks, this research stirred a number of questions for continued study, yet my gaze would soon again turn northwest to the Puget Lowland.

Procuring Permits: Sampling the Mima Mounds

By May, my professor and I were deep in research permit applications. With continued travel restrictions in Washington State, the Department of Natural Resources was limited on the number of awardable research permits. A beautiful spring made fieldwork all the more tempting, but in due course we received our permits to collect pebbles from mounds at Mima Prairie Natural Area Preserve, Rocky Prairie Natural Area Preserve, and West Rocky Prairie Wildlife Area Unit. Adding masks and social distancing skills to our usual geologic tools, we prepared to enter the field for what would turn out to be a particularly warm spring season – a poor combination with masks! Over the course of the following months, I spent five days at Mima Prairie and one day at Rocky Prairie collecting samples, while Prof. Pringle investigated West Rocky Prairie.

While I mapped curious cobbles and boulders common in some intermounds, we conducted point counts of the underlying coarse-bedded gravels and in the cross section of one mound at the DNR pit at Mima Prairie, we collected well over several hundred samples of gravel.
While in the field, we searched for Mima Mounds with plentiful Coast Mole or Mazama Pocket Gopher mounds: this recent bioturbation enables us to sample material brought up from within the Mima Mounds. We also studied each tree-throw we could find on the fringes of the prairies. While I mapped curious cobbles and boulders common in some intermounds, we conducted point counts of the underlying coarse-bedded gravels and in the cross section of one mound at the DNR pit at Mima Prairie, we collected well over several hundred samples of gravel. After finishing with our soil samples and with numerous intriguing questions begging for further investigation, it was time to make some sense of our data and report our findings.

Conferences: Taking It to a New Level

Though Centralia College’s annual Capstone Symposium for undergraduate research in June had been cancelled, we reported our preliminary results in a poster for the Centralia College Foundation, which had helped fund our research with a small grant (Pope et al., 2020b). We found that Cascade Range andesite comprised 44% of the mound pebbles at Mima Prairie and 40% of clasts in the underlying gravels, not only supporting a debris flow origin of the Mima Mound diamicton but also suggesting that the underlying gravels had been produced by an earlier water-based phase of the Tanwax flood. We continued our studies into August and completed an abstract for Geological Society of America 2020 annual meeting (Pope et al., 2020a).

While we awaited an answer on our GSA abstract, my attention turned to the upcoming virtual annual meeting of the Association of Environmental and Engineering Geologists (AEG). I prepared to present my two accepted abstracts: a poster presentation on the poorly sorted terrace deposits along the Cispus River and an oral presentation on how six applied geoscience disciplines are represented at the Cascade Range volcanoes (see Pope, 2020a and Pope, 2020b). August came and went, our GSA abstract was accepted, and before I knew it the AEG meeting had arrived – my first scientific conference just around the corner! I nervously prepared for the conference, but soon I was prepared (in writing but not mentally!) to present to some of the greatest geologists I had met. Thankfully, my oral presentation was graciously received, and my poster tied for second place in the poster competition. After meeting a number of excellent geologists and future leaders of the discipline, I finished the final preparations for another exciting presentation at GSA 2020.

Retrospective: Perseverance in Adversity

Over the course of the year, I have found 2020 to be the most tumultuous yet most exciting year in my learning experience. It has been tumultuous through the unwavering surprises of the COVID-19 pandemic and natural disasters, yet in my personal studies I have also found it to be the most exciting. I have gained experience both in the field and in presenting at scientific conferences, but more importantly I have discovered the keys to success. As useful as they are, resources online, at the college library, or even in the laboratory, may be abruptly terminated, as we saw during the pandemic in the case of libraries and laboratories. Instead, it is the gift of perseverance in adversity—the ability to think clearly and creatively to overcome any challenge, be it in one’s personal life or in the global community. While much more study is needed to answer questions raised by my studies over the year, I am confident that I have learned some of the skills needed to dive deeper into the subject. After all, with that internal “grit”, what challenge cannot be overcome?

About the Author

Writing from Western Washington, Isaac Pope is a seventeen-year-old undergraduate student with an insatiable fascination for geoscience, conducting this research as an undergraduate enrollment student (age sixteen and below) at Centralia College. In addition to his field work, Isaac has studied numerous books ranging from graduate to professional level on geoscience and mathematics, which contributed to him beginning his college studies at the age of fourteen. With publications in peer-reviewed journals, he has not only conducted much university-level research, but he is also greatly involved in education, an interest stemming from his desire to share the wonder of science and mathematics with others. Isaac’s poster entitled “Poorly Sorted Terrace Deposits of the Cispus Valley: Glacial Drift or Mount Adams Lahar?” tied for second place in the student poster competition held during AEG’s 2020 Virtual Annual Meeting, and Isaac is a Junior Candidate Fellow of the Geological Society of London.

Appendix

With the worldwide web at the fingertips of so many individuals, the accessibility of scientific research products has never been greater, yet their number and variety make some research more difficult to retrieve than others. Combined with your local public or academic library, the following online resources are a few of the many that should help you access most if not all the literature necessary for your research.

Free Article Access

ResearchGate (researchgate.net) – free platform for academics to post, search, and discuss research products.

Academia (academia.edu) – free platform for academics to post, search, and discuss research products with some plugins requiring a paid subscription.

Mendeley (mendeley.com) – free platform for academics to post, search, and discuss research products, particularly those associated with Elsevier publications.

USGS Publication Warehouse (pubs.er.usgs.gov) – extensive collection of research items produced by members of the US Geological Survey.

Searchable Article Archives

Scinapse (scinapse.io) – searchable article database containing bibliographical details, official webpages, and occasionally PDF versions of the article.

Google Scholar (scholar.google.com) – searchable article database containing bibliographical details, official webpages, and links to PDF versions of the article when available.

Map Databases

National Geologic Map Database (ngmdb.usgs.gov) – major database of national and state maps produced by a variety of entities including the US Geological Survey and state geological surveys, among others.

Organization Memberships

Geological Society of America (geosociety.org) – largest single geological society in North America publishing some of the most influential journals on geoscience.
Dear Colleague,

We invited library staff to participate in a short ad hoc survey to better understand the impacts of COVID-19 on libraries. The majority (89%) of survey respondents were from university or college libraries, and 10% of respondents were from either government libraries or special libraries (5% of respondents each). The largest change in library services since the start of the pandemic has been a decrease in purchasing and usage of print and physical materials, with 90% of respondents reporting a decrease in the purchasing of print materials and 84% of respondents reporting a decrease in the usage of physical materials. Facility impacts were also reported by most respondents, with the most commonly reported impacts being limited hours and access to the library building, the quarantining of physical materials upon return, and limited usage of physical materials. Other impacts to libraries related to the COVID-19 pandemic range from budget stresses, staffing impacts, and technology impacts.

Please visit the Geoscience Currents webpage (www.americangeosciences.org/geoscience-currents) for more information.

Geoscience Currents transmit snapshots of the many facets of the geoscience profession, in-depth case studies of how geoscience is applied, factsheets that provide rigorous introductions to a range of geoscience topics, workforce trends, and career paths. These short reports and data briefs represent collaborations with other societies, employers, and professionals. Topics for Geoscience Currents are often inspired by inquiries from the geoscience community.

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If you have research related to any of the topics listed above that you would like to share with the geoscience community, please contact us at workforce@americangeosciences.org about guest authoring a data brief, factsheet, or case study for our Geoscience Currents channel.
Field Trips to Canyon Lake Gorge, Texas

Heidi Harwick, SA-9084

Going on field trips is one of the things I truly enjoy about studying geology. Studying geologic features hands-on in the field, compared to looking at pictures of them or reading about them, provides a much deeper learning experience. Field trips are often a required part of geology courses: compared to some requirements, they are something I look forward to. Seeing something in person also sometimes results in that “aha!” moment that helps to cement a concept.

Canyon Lake is on the Guadalupe River, northeast of San Antonio in Comal County, Texas. Canyon Lake Gorge is downstream from the spillway on the eastern side of the lake, adjacent to and south of the dam. In 2002, there was a large flood event, and water flowed over the Canyon Lake Spillway. The water carved out the existing gorge and revealed exciting information about its stratigraphy, formations, and fossils.

I first went to Canyon Lake Gorge for a structural geology field trip in April 2016. We mapped and created a cross-section of the fault zone and examined structural and fault-related features. We mapped an area about 130 feet wide and 1,800 feet long, noting features and faults based on aerial photography and field observations. The gorge has many pools and depressions, with waterfalls and high, vertical banks, with approximately horizontal bedding. It exposes the Hidden Valley Fault Zone, which consists of several normal faults that strike to the northeast with a dip to the south between 55 and 80 degrees. We examined slickensides and mineral traces, and measured the trend and plunge of slickenlines to plot on stereonets. Bedding in the hanging wall of fault strands has been strongly rotated to the north, sometimes past vertical. Most exposed fault surfaces were relatively small, except for the fault scarp near the spillway that was taller than a person (8-12 feet high). Based on fault plane and lineation measurements, we calculated the principal stresses.

I had the opportunity to return to Canyon Lake Gorge during an AIPG field trip in January 2019. I looked forward to going again “just for fun” to see the gorge without having to concern myself with school obligations or taking measurements. This was part of a larger trip led by AIPG and Dr. Tom Ewing to learn more about the area’s stratigraphy (which includes the Glen Rose Formation and the Edwards Group), as well as springs and recharge features of the Edwards aquifer. We began our tour at Overlook Park, which is between the dam and the spillway and provides a spectacular view of the lake and surrounding area. We walked down to the spillway and saw the dinosaur tracks, then continued down through the gorge. I enjoyed seeing the dinosaur tracks, which I had not had the opportunity to do on my first visit, and learning more about the gorge’s lithology, fossils, and structures. The area is
beautiful, and it’s interesting to return to a location at a different time of year to see the effect of different seasons, weather, and precipitation. There was certainly a lot to see! Sedimentary structures include vugs, ripples, and cross bedding, and the rocks host a variety of fossils, including gastropods, bivalves, echinoids, and worm tubes.

Our school field trip was in April and was sunny, warm, and humid, while the January trip was overcast and cooler, making for a pleasant day hiking and being outside. I don’t mind a hard day’s work in the field, which has certainly resulted in useful data and observations that have helped me to better understand geology. However, there is a difference between jotting down a few notes and listening to a guide, as opposed to completing a graded assignment while trying to comprehend relatively new concepts. The day’s rhythm and pace are also different when you’re strolling along and looking around, versus having to stop frequently to take measurements, map, or take notes. I enjoyed this opportunity to return to the gorge and to simply listen and observe, as well as to spend time with other geologists and to hear their reactions and questions. It helps to look at things through the eyes of a group of professional geologists so I can see the same things from a different perspective and gain new insights. As a result, I got more out of the visit to the gorge the second time, because I had more experience and knowledge, could discuss observations with geologists with diverse experiences, and could see things through the more mature lens of a graduate.

I usually have to spend all day behind my desk or computer at work and school, so I truly look forward to opportunities to spend time outside appreciating nature and geology. Due to experiences like these, I can’t wait to get back outside and go back to other places around San Antonio where I’ve been before on field trips and take second looks at them!

**About the Author**

Heidi Harwick is a graduate student at the University of Texas at San Antonio (UTSA) pursuing an M.S. in Geology and a graduate certificate in Geographic Information Science. While working full-time, she completed her B.S. in Geology at UTSA in 2018. Heidi joined the staff at UTSA in 2019 and currently works as a Program Specialist at the UTSA College of Engineering Student Success Center. Prior to UTSA, she worked at Educational Testing Service as a Proposal Production Specialist for 13 years. Before moving to San Antonio in 2004, Heidi worked and lived in Southern California and served in the U.S. Marine Corps.
Emphasizing Geoscience as the True Epitome of STEM

Hailey Pantaleo, SA-9978 - University of Michigan

Abstract

While it may be obvious to those of us in geoscience just how complex and scientific geology is, not everyone knows it to be a STEM category. Until students get the chance to explore Earth Science courses, many are unaware of how much technology, engineering, mathematics, and other sciences like chemistry, biology, and physics, are involved in geology. It is an incredibly interdisciplinary study that provides the foundation for a variety of future careers. Unfortunately the opportunity to learn Earth Science prior to college is not afforded to everyone, especially students attending poorer school districts, which are disproportionately BIPOC (Black, Indigenous, and People of Color) students. Women in STEM programs also lag behind with outreach to young girls interested in geoscience. While the diversity of geoscience has increased overall in the past century from originally being only white males, there is still more outreach to be done to increase the presence of Earth Science in all communities. Emphasizing geoscience as a legitimate, challenging STEM career choice may be the first step in getting more youth interested.

Keywords: Sand, slopes, monitoring, stability, apparent cohesion

While majoring in Earth sciences with a focus in geology as a young woman, I didn’t know if I was technically considered a woman in STEM. “STEM”, the umbrella term for Science, Technology, Engineering, and Mathematics, always felt like something totally separate from geology. It was not until college that I realized just how involved geology was with all of the categories of STEM.

In high school I believed that geology was the sole focus of Earth sciences, and as such, I and many others I knew excluded this field from the umbrella of “STEM” as it didn’t seem to “fit in”. Science, to me at the time, felt like medicine, chemistry, biology, astronomy, and physics. For a long while I was under the impression that geologists mainly identified rocks in the field and worked for oil companies. I recently took a small poll on Twitter about whether or not Earth Science is a part of STEM, and found that approximately 13% of my 39 respondents do not think it is. However, I can understand where this belief comes from. Until college, it had never crossed my mind that geology would incorporate math, engineering, and technology, and that it was such an advanced form of science people study it in laboratories. And until college, it had never occurred to me that geoscientists must account for biology, chemistry, and physics combined to fully understand geology itself.

There are a few courses at my university that particularly stood out to me and made me recognize geology/geoscience as a legitimate STEM category. My freshman year of college, I took an introductory geology course. In our laboratories, I was surprised to end up performing taste, scratch, and chemical tests on rocks. In my junior year, I took both Geochemistry and Geobiology, in which we performed chemical laboratory experiments and discussed how important biological events contributed to geologic anomalies, such as the banded iron formations that we see today. These were the courses that first showed me how truly scientifically involved geology is.

In my sophomore year of college, I took an introductory environmental science course, in which we learned about the processes involved in oil mining, renewable power sources, and dam building. I learned how important understanding the geology of an area was when mining and doing construction projects. The complexity of it all helped me realize how Earth science is intricately intertwined with many engineering feats.
In Memoriam

Charles William Welby, CPG-01033
Lexington, North Carolina
October 9, 1926 - September 22, 2020

Member Since 1965

Charles William Welby, 93, of Lexington, NC, formerly of Raleigh, passed away on September 22nd, 2020. He delighted in his career as a geologist and as a volunteer for the community, government entities and professionally. He was born in Bakersfield, CA, on October 9, 1926 to Harry Sheldon Welby and Mary Cook Barnes Welby. He was preceded in death by his wife of 60 years, Eleanor Morse Welby. He is survived by two daughters, Mary Louise Welby (Robert “Hersh” McNeil) of John Day, Oregon, and Nancy Welby Check (Jeffrey) of Lexington, as well as five grandchildren.

Charles grew up in Taft, CA, and graduated from Taft High School in 1944 and the University of California, Berkeley in 1948. He earned a master's degree at UC, Berkeley (1949) and a Ph.D. at the Massachusetts Institute of Technology (1952). Geology was a lifelong enthusiasm, ignited by experiencing the spectacular geology of Yosemite and by growing up in the oil fields of Taft; he continued to enjoy "geologizing" with friends and family throughout retirement.

Charles started his career with the California Company in Jackson, MS, and New Orleans, LA. He joined the faculties of Middlebury College, Middlebury, VT; Trinity College, Hartford, CT; Rensselaer Polytechnic Institute, Troy, NY; University of Southern Mississippi, Hattiesburg, MS; and North Carolina State University from 1965 until he retired as Professor Emeritus in 1997. He enjoyed teaching environmental geology, paleontology, and hydrogeology among other geology courses.

His research interests were varied and included paleoecology and fossil studies (including describing new species from the Lake Champlain, VT, area), environmental hazards, groundwater behavior and processes, shoreline erosion, sciences like geology. Before I began taking geoscience courses, I questioned if they would even look good on a transcript. I was worried that it would appear that I was simply taking easy courses for credits, as I had been led to believe from my peers that geoscience is an easier topic to study. Getting into college was my main driving force in high school. But when I began, I constantly found myself challenged, and yet enjoying the content I was learning. The more I delved into geoscience classes, the more rigorous they became too. After taking about 3 solid years of geoscience coursework, I can now do things in a laboratory, in a math class, and on computers that I never thought I could do. While I had the great opportunity to get to explore Earth sciences in high school enough to jump into them in college, not everyone has this privilege. Students in poorer areas, who are often disproportionately BIPOC, are not always afforded the chance to take Earth science courses at their public schools. These students may have a genuine interest and show promise for these topics, but never have the opportunity to study them. Also, in my experience, women in STEM programs for geology and Earth sciences are not as heavily promoted compared to other STEM categories, like robotics and computer science. Both of these factors, coupled with the fact that some may not view geoscience as a category of STEM, may be dissuading students from the Earth sciences. If parents are pushing their children to study STEM topics, but do not view Earth sciences as a STEM topic, their children may not get the chance to research geoscience.

It is my belief that “Women in STEM” and “BIPOC in STEM” organizations need to become more involved in the Earth sciences, particularly geology/geoscience. In the past three years at the University of Michigan, I had no idea there even was a “Women in STEM” organization, as it was housed in the chemistry and biology departments and not in the geoscience building on campus. This is one of the biggest changes I’d like to see in geoscience. While I am proud to learn about how much geoscience diversity has grown in the last century, it would be amazing progress if more young female and BIPOC students could get involved in geoscience, a true STEM field. This would undoubtedly inspire more high school students to pursue the Earth sciences as well. As a young female geoscientist, I am striving to be a part of this change in this ultimate STEM career, and am excited to witness others join in geology!
and remote sensing. He researched the groundwater of the NC Piedmont and used early LANDSAT satellite data to analyze land use. He authored, co-authored, or edited over 30 scientific papers and special reports; regularly presented research results at professional meetings; chaired numerous section and sub-section meetings; and was an invited speaker at international conferences. Charles, with others, consulted on groundwater for the Leakey’s at Olduvai Gorge in the 1970s, and on nuclear plant localities in the Philippines. He was a licensed geologist in California, South Carolina, and North Carolina, where he supported the formation of the North Carolina Board for Licensing Geologists and was an expert witness on groundwater issues.

He was elected a fellow in both the Geological Society of America and the American Water Resources Association; was an active member and/or officer of Sigma Xi, the Scientific Research Honor Society, the Association of Environmental & Engineering Geologists, the American Association of Petroleum Geologists, the American Institute of Professional Geologists, and others; and, also, actively supported local chapters.

It is requested that memorials be made in Charles’ memory to the N.C. State College of Sciences Foundation for the Charles & Eleanor Welby Geology Scholarship Endowment, P.O.

John Maclyn Ewing, CPG-01784
Metairie, Louisiana
August 9, 2020

Member Since 1968

John M. Ewing, 92, died on Sunday, August 9, 2020. He is survived by his daughters, Virginia E. Potocki and her husband, William E. Potocki, of New Iberia, LA; Renee deV. Andrews and husband, Dr. Walter S. Andrews of Kansas City, KS. Mr. Ewing was a WWII veteran, serving in the U.S. Army with the rank of Spec 4. He was a graduate of Case Western Reserve in Ohio and the University of Michigan with a Master’s degree in Geology. He was a resident of Metairie since 1965. In lieu of flowers, donations may be made to the National WWII Museum. For expressions of sympathy, please visit www.tharpsontheimerfh.com.

Gordon A. Clopine, CPG-06125
Beaumont, California
November 28, 1936 - May 17, 2018

Member Since 1982

We have received this message from Sara Clopine, wife of Gordon Clopine.

“It is with sadness that I tell you that Gordon died on May 17, 2018. He truly loved his profession and affiliation with your professional organization.”

Gordon Alan Clopin, age 81, passed away on May 17, 2018, at his home in Beaumont, CA. Gordon was born November 28, 1936 in Los Angeles, California to Walter Gordon and Sarah Elizabeth Donahue Clopine. He earned a bachelor’s degree in geology from the University of Redlands in 1958 and a master’s degree in geology from the University of Houston. After 36 years with the San Bernardino Community College District, he retired from Crafton Hills College as vice president of administrative services. Gordon also taught courses at the University of Redlands and the University of California, Riverside. He touched the lives of countless students, faculty, and staff during his career, thoroughly enjoying every day.

In addition to college teaching and administration, Gordon founded his geological consulting firm, Clopine Geological Services. He was a member of the American Institute of Professional Geologists and a Fellow with the Geological Society of America.

Gordon’s friends and family are collecting donations to endow a scholarship with the Crafton Hills College Foundation to honor Gordon’s memory. Donations can be made at www.craftonhills.edu/foundation; enter Gordon Clopine Memorial Scholarship as Designated Program. Or by check payable to Crafton Hills College Foundation 11711 Sand Canyon Rd., Yucaipa, CA 92399.

Neal Mcrae Parker, CPG-06297
Parrish, Florida
May 20, 2020

Member Since 1983

Neal M. Parker, Sr., age 78, passed away on May 19, 2020 in Parrish, FL. He was a loving husband, married to Charlotte for fifty-two years. Neal was a Professional Geologist for over forty years. In lieu of flowers, please make any donations to Moffitt Cancer Center or Tidewell Hospice.

Samuel Arthur Friedman, CPG-06535
Norman, Oklahoma
September 22, 2020

Member Since 1984

Sam Friedman was born in Brooklyn, N.Y., and passed away on September 22, 2020 in Norman, Oklahoma, at the age of 93. He earned a BS in Geology from Brooklyn College in 1950, and a Master’s degree from Ohio State University in 1952. Sam began his professional career as a coal geologist with the Indiana Geological Survey, and in 1967 moved to the U.S. Bureau of Mines in Knoxville, TN.

From 1971-1995 he was a coal geologist at the Oklahoma Geological Survey and Adjunct professor at the University of Oklahoma, becoming an acknowledged expert on the stratigraphy and sedimentology of the middle Pennsylvanian period. Sam published 98 technical papers on Geology.

Sam was a CPG of AIPG and a Senior Fellow of the Geological Society of America as well as a member of the Energy Minerals Division (EMD) of the AAPG. He received the Distinguished Service Award of the Coal Geology Division, GSA (1992), Distinguished Founders Award of EMD(1993), the Gordon Wood, Jr., Memorial Award of the Eastern Section of AAPG (1994), the Distinguished Service Award of the AAPG(1995), and the Distinguished Alumni Award of Brooklyn College of CCNY, among others. He was also a member of SEPM and the Society for Organic Petrology.

Sam served on innumerable committees and panels for the GSA, the ASTM, the AAPG and the AIPG.

He is survived by his wife, Evelyn Friedman, his children Aaron and Mother M. Benedykta, as well as his stepchildren Jim Healey, Siobhan Miller and Kate Bailey.
Douglas Adams, in *The Hitchhiker’s Guide to the Galaxy*, asserts that the answer to the ultimate question about life, the universe, and everything is 42. He also notes that if you do not understand the question, you will not understand the answer. This article reverses that Geology 101 maxim, “the present is the key to the past,” by believing that the past—the experiences of those who have been out of school for a couple of decades or more—has something to tell you about your futures.

You have begun your geoscience career by majoring in the subject. Perhaps you have already acquired experience in the field through summer and/or part-time jobs. Regardless of the specialty you are pursuing, you can expect that the cyclic nature of the business will result in your having several employers. If the experiences of those who went before you provide any guidance, it indicates that in order to stay employed, you must be flexible enough to switch specialties, perhaps more than once. For example, moving from the petroleum business to hydrology or environmental geology can build on the realization that fluids moving through rocks behave in similar ways. The analysis of fractured crystalline rock aquifers has similarities to the movement of mineralizing solutions through similar rocks. Coal is not only a fuel itself; it contains another fuel, methane. The point being that basic geologic skills are needed regardless of your current or future specialty. Some of you may even have done some specialty switching in school because of job opportunities or research support.

*Reflections on a Geologic Career*, which is available for free at the AIPG website, www.aipg.org under “AIPG Publications,” contains a variety of papers addressing the issue of finding and retaining professional positions. Download a copy and read it for a wealth of practical advice. The authors provide answers to questions they wished they had known when they were your age. Key points are expecting that change will occur, being flexible, and networking through active participation in professional societies. An advantage AIPG offers as a professional society is that its members are from all specialties and employers, so you become part of a broader network when it comes time to switch specialty.

But your professional career is only a part of your life—at least I hope so. Joining with a spouse is a common big step in life. Some of you have already taken this step or have specific plans for doing so. For others of you, this is still something in your future, but probably enough of your friends have coupled up so that marriage is less of a theoretical concept than it was in high school.
Being part of a couple has a distinct impact on your career. You no longer have the flexibility you had when you were single. Do you want to travel as much? Where can your partner find work in his or her chosen field? Teachers, family practice MDs, and nurses are examples of professions with greater job mobility than many others. Investment bankers generally do not. If your job moves you to a different town, can your partner find suitable satisfying work as well?

Whose career opportunities will be pursued when? Some couples have had successful marriages despite the frequent or prolonged absence from home by one or both partners, but this seems to be the exception rather than the rule. Does one of you work for a firm providing family health coverage? One of the problems of hooking up with another geoscientist is that you both will be in similar job cycles. But marrying someone in another profession does not guarantee against both of you being simultaneously caught in downturns. I know this from personal experience.

Being part of a couple usually leads to two other life characteristics (features or bugs, depending on how you look at them), a house and children. The mortgage must be paid every month. Children have lots of ever changing needs and wants, most of which cost money. Your job provides the income but its location affects your style of life. Relocations are disruptive to a greater or lesser degree. Some locales have greater job opportunities than others. The same is true of educational, cultural, and other characteristics. Some people pick a place to live and do whatever is required to live in that place. Others follow their career, relocating whenever relocation is required.

While only you can provide answers to the issues discussed above, they are very real issues that you should carefully consider in planning your career. A planned career is far more likely to be successful and rewarding than an unplanned one.

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About the Author

David Abbott is a consulting mining geologist and geoscience ethics columnist. He specializes in the due diligence review of mineral reserve and resource estimates, in the review of disclosures about natural resource disclosures, and the review of mineral exploration and development programs for precious and base metals, and industrial minerals. He has been writing about geoscience professional ethics and practices since 1989, has published 176 Professional Ethics & Practices columns, and numerous articles for various geoscience societies. He has been a consultant since February 1996. AIPG has awarded him the Ben H. Parker Distinguished Service Award, the Martin Van Couvering Service to the Institute Award, Honorary Membership, and the John T. Galey, Sr. Public Service Award.

Mike Alfieri Named Senior Hydrogeologist at Water Science Associates

FORT MYERS, Fla. (Dec. 9, 2020) – Water Science Associates has named Mike Alfieri, P.G. MEM-0974, senior hydrogeologist for the hydrogeological consulting firm. Alfieri will join executive leaders Kirk Martin and Roger Copp in developing creative, sustainable and scientifically based solutions to water resource challenges across Florida. In response to the growing hydrological needs throughout the Southwest area, Alfieri and Copp will also establish a Tampa-based office to expand support services for clients in the region.

A nationally certified and registered hydrogeologist with more than 23 years of experience, Alfieri will manage hydrogeological and water resource engineering teams in the evaluation, planning design, permitting, and construction of water supply wells, deep injection wells, and managed aquifer recharge systems. He will also provide a wide range of technical skills in groundwater flow and transport modeling, statistical analysis of hydrologic data, water supply development, and resource management.

A professionally licensed geologist in 13 states, Alfieri is an established subject-matter expert recognized in the U.S. federal court and state of Florida court systems, having been retained numerous times by legal counsel for various clients. He is currently a board member and past chair of the Florida Board of Professional Geologists and the chairman of ASTM Sub-Committee on well design, maintenance and construction. Alfieri is also a published author to numerous peer-reviewed journal articles, conference proceedings, and an academic textbook, “The Karst Systems of Florida: Understanding Karst in a Geologically Young Terrain.”

“Mike is a perfect fit for our corporate growth strategies,” said Kirk Martin, president of Water Science Associates. “His well-established technical talents and client focus will be an added strength to the Water Science Team.”

Built on decades of experience, technical excellence, innovative thinking, and personal service, Water Science Associates provides water resources management and development services from planning, investigation, design, construction, and compliance for public and private water and wastewater utilities, high-quality land development projects, mining operations, and agricultural interests.

For more information, call 239-204-5300 or visit www.waterscienceassociates.com.
In June 1983 I was busted in West Texas! Intrigued by the potential for discovering gold in Proterozoic rocks there, another geologist and I went exploring in the Van Horn area southeast of El Paso where we experienced the long arm of the law. As we drove along, we saw an outcrop in a field a little way off the highway, so we decided to stop, climb over the fence, and satisfy our simple and honest desire to learn something about the outcrop. No harm in that, is there? Well, yes there is! Unlike in other states, all land in Texas is privately owned (how come we didn’t know that?!), and the ranch owner didn’t take kindly to our beating on the rocks on his private property.

Upon returning to our vehicle after a short traverse, we were met at the fence by the rancher’s daughter and her trusty shotgun; it was pointed right at me from just a few feet away. Clad in a dirty, white T-shirt and raggedy jeans, her body language meant business—she was wound tighter than a spring. “What do you think you’re doing? This is private property,” she said with an intense sneer on her face. It was obvious this sturdy, rough-looking blonde was not to be trifled with. Her older brother was called, the constable was called, the sheriff was called, and then her father arrived. He mumbled something about his land, paying taxes, and “Who do you think you are?” and the constable informed us in no uncertain terms that we had trespassed on the rancher’s land and violated his privacy. The sheriff arrived in a cloud of dust and told us, “This old boy doesn’t want anybody on his ground. We’ll let the judge decide. You can either follow me or ...” Whereupon we were escorted with lights flashing the entire twenty miles to the Hudspeth County courthouse and jail in Sierra Blanca, Texas. On our escorted drive to town, my fellow geologist and I tried to guess how much it would cost to get out of this mess, and we wondered if we would have enough cash in our pockets to pay the fine. This was late on a Friday afternoon and we didn’t think the company office would have time to wire money to us. We certainly were not looking forward to being guests for the weekend at the Hudspeth County jail.

The decider of our fate, the judge, was attired in a rumpled, gray, cotton suit that matched the worn paint on the concrete floor of his office. He was a genteel, scholarly enforcer of the law, and justice was expeditiously dispatched. “Guilty!” After duly admonishing us, he fined us ninety-six dollars each, which we were able to cover. After saying our “sorrys” and “We’ll never do it again,” we hightailed it out of the state and never conducted exploration in Texas again!

Someone once said that bad decisions make for good stories, and that was certainly demonstrated here.

Here’s an opportunity to tell us more about your experiences as students: what you are learning and researching, field experiences, graduate school pursuits, and transitioning from student to career professional. The Professional Geologist regularly publishes articles on these topics and geology education in the Classroom Earth feature. You are invited to share your perspectives for this feature. Please submit articles to the editor at aipg@aipg.org.
ETHICS TRAINING

Introduction
This paper was developed during 2008 and presented to Texas licensed geologists to satisfy three purposes.

1. Completing the one-hour annual ethics training required by the Texas Board of Professional Geoscientists (TBPG) to maintain good standing as a licensed Texas geologist.

2. Giving fellow geologists a comparative list of ethical practices required by four geological entities in Texas including the Texas Commission on Environmental Quality (TCEQ) which is a Texas commission that regulates geologic practices in the state, the Texas Board of Professional Geoscientists (TBPG) which is The Texas Professional Geologist Licensing Agency, the Association of Environmental and Engineering Geoscientists (AEG) and the American Institute of Professional Geologists (AIPG) which are both national geological associations.

3. Presenting two examples of working circumstances that would require ethical consideration.

These requirements provide guidelines to work within proper ethical parameters and to complete projects with acceptable quality. It becomes evident that ethics and quality are basically “two sides of the same coin.”

The Paper is organized into three major sections including:

1. What are Good Ethics?
2. What are the Ethics Regulations?
3. What Ethical Situations Do We Encounter?

1. What are Good Ethics?

Webster’s Dictionary:
Moral principles of right or good behavior.

Rules or standards of conduct governing the members of a profession.

Mother’s rule:
If you can’t do it in front of your mother, your boss, or your spouse, don’t do it.

Newspaper rule:
If you don’t want to see it in tomorrow’s newspaper, don’t do it.

2. What are the Ethics Regulations?

The following section includes ethics requirements of four geologic entities including TCEQ, TBPG, AEG, and AIPG. Although each organization has a different method of presenting their ethical requirements, they are generally similar and the main purpose is to ensure that geologists plan and implement projects in an ethical manner. All entities require that geologic study is performed by persons competent to provide that service and that procedures and resultant reporting follows acceptable geologic and regulatory practices. Some of the more important requirements include determinations based on adequate and complete study using methods that would point out circumstances or data that could result in failure as well as success.

Each geologic entity has procedures to determine if properly trained geologists are providing various services and procedures or principles to guide the promotion of the study of geology.

There are three main differences in the entities. Generally, the TCEQ is an agency of the State of Texas mandated to regulate geologic activity of companies that provide industrial services. The TBPG is the Texas agency mandated to license and regulate professional requirements of geologists working in the state. Both the AEG and the AIPG are geologic associations that provide educational and associated activities to ensure that licensed geologists have opportunities to advance the science of geology and to further the input of geologic procedures in the planning and implementation of engineering, environmental, and educational programs in the state. It is to be noted that the following lists are condensed and paraphrased from the requirements of the four entities. They include the important material; however, the reader is advised to review the ethics requirements as published by the four entities to obtain the complete information. Any exclusion, omission, or misinterpretation by the author is unintentional.

2.1: Texas Commission On Environmental Quality (TCEQ): Operating Policies And Procedures, Section 12.08: Employee Ethics (Paraphrased)

12.08.01. Policy: TCEQ Mission: Protect Human Health and The Environment Consistent With Sustainable Economic Development. In order to fulfill the public trust, TCEQ employees must treat public and private interests fairly and even-handedly.

12.08.02. Conduct: Strive for excellence, public confidence, no conflict of interest, integrity, impartiality, courtesy, honesty, and adherence to statutes, rules, and regulations.

12.08.03. Guidelines: Concerning Outside Activities And Conflicts Of Interest:
- Inappropriate conduct and interests: Making investments or engaging in business relationships with outside customers who have a direct interest in TCEQ decisions.
- Personal gain: TCEQ confidential information used for personal gain is subject to criminal penalties (penalcode §39.06)
• General list of unethical issues to be understood by TCEQ employees: No lending, borrowing, accepting contributions, gifts or benefits from “interested persons;” no misuse of company property for personal use; outside employment only if approved by ethics staff; volunteer work may be provided if no perceived or actual conflict of interest.

• Revolving Door: No former employee in the pay groups A17, B9, or higher may receive pay from, or represent, an “interested person, on any particular matter before the agency following employment at the agency if that former employee worked on that particular matter while employed by the agency. (See General Rule: Subject Matter Rule.)

• Confidential Information: Any information designated as confidential shall not be disclosed to “interested persons.”

• Penalties: Penalties for ethics violations may be imposed upon employees or former employees, and range from disciplinary action to, in some cases, criminal penalties.

2.2: Texas Board Of Professional Geoscientists (TBPG): Title 22, Part 39, Chapter 851, Subchapter B: Code Of Professional Conduct (Paraphrased)

Rule §851.101(a): General: Code of Conduct is binding on all license holders.

A license holder shall:

Rule §851.102(a): Be qualified by education and experience, and act with reasonable care and competence.

Rule §851.103(a): Provide complete and unbiased information on geoscience projects protective of the safety, health and welfare of the public.

Rule §851.104: Neither perform actions that will deceive the public nor omit information that is required for completeness of geologic study. Do not accept anything of significant value as an inducement to secure geoscience work.

Rule §851.105: Prior to accepting geoscience work, provide any potential employer with personal business or financial interests which may actually or perceptually affect decisions, conclusions, or recommendations.

Rule §851.106: Abide by all provisions of the geoscience act. Do not aid or abet any non-licensed person from practicing and sign-off/sealing of geoscience work.

Rule §851.107: Only practice as a licensed geoscientist if currently licensed.

Rule §851.108: Provide the licensing board with any information regarding personal criminal conviction. This applies to applicants and license holders.

Rule §851.109: Do not abuse alcohol or drugs in a manner that would impair the ability to provide geoscientific work in a manner protective of safety, health, or welfare of the public.

Rule §851.110: Shall be subject to a board determination and possible enforcement action if any statutory provisions or rules are violated.

Enforcement actions may be initiated by a formal complaint in writing and may result in actions ranging from a reprimand to suspension of a license for a period not to exceed five years.

2.3: Association Of Environmental & Engineering Geologists (AEG): Principles Of Ethical Behavior (Paraphrased)

Preface:

• Serve the public with scientific knowledge, experience and good judgement.

• Protect health, safety and welfare of the public with honesty, fairness and high quality work.

Article I: Responsibility to the Public

Health, Safety and Welfare.

I. Mitigate geologic hazards.

• Be Trustworthy.

• Serve in public positions where your knowledge may benefit the public.

• Disclose whether conclusions and recommendations are based on fact or opinion.

• Practice in a legal and ethical manner.

Article II: Responsibility to Clients and Employers

II. Practice with loyalty to clients consistent with legal and ethical standards.

Place priority on quality of work.

• Maintain undivided loyalty to clients consistent with their obligations to the public.

• Uphold clients’ trust by practicing with professional and fiscal responsibility.

• Respect confidentiality between client and self.

• Disclose to client any actual or perceived conflict of interest.

• Do not misrepresent professional credentials or capabilities.

• Accept work only if qualified.

• Alert client if another professional’s work is required.

• Express professional opinion only if supported by fact or experience.

• Tell client if the consequences of their work may negatively impact the health, safety or welfare of the public or negatively impact the success of their project.

Article III: Responsibility to Colleagues

III. Interact with honesty and integrity.

• Show professional respect and courtesy.

• Avoid plagiarism, and give credit to others for their work.

• Share professional knowledge.
• Tell colleagues if you are seeking information to use in a lawsuit or claim.

Article IV: Responsibility to the Profession

IV. Advance the profession of environmental and engineering geology
• Set a professional example for all.
• Upgrade technical capabilities through continuing education and professional activities.
• Encourage academic development.
• Encourage qualified persons to enter the field of environmental and engineering geology.
• Advertise and solicit geologic services.

2.4: American Institute Of Professional Geologists (AIPG): AIPG Policies And Procedures, Code Of Ethics (Paraphrased)

AIPG Code Of Ethics Has Three Parts That Include Five Canons (Broad Principles) Sectioned Into Standards (Goals) Such As 1.0, 2.1, 2.2, And Rules (Mandatory Conduct) Which Are Detailed As Subsections In The Code Of Ethics.

Following Are Sections That Summarize The Principles, Goals And Rules.

1.0. Maintain integrity and professional conduct.
1.1. Protect human health, Safety and welfare and avoid actual or appearance of impropriety. Uphold all laws and regulations.
1.2. Be accurate, truthful and candid in all communications with the public.
1.3. Provide impartial service to the public.
1.4. Provide employers with information on any potential conflict of interest.
1.5. Protect customers’ interests and do not use customers’ information for personal gain without written permission.
1.6. Provide competent professional information based upon personal knowledge, education or experience, and provide customers with names of other professionals for information, if appropriate.
1.7. Be diligent and timely in performing work.
1.8. If customers actions conflict with professional or ethical standards, either correct the actions or resign.
1.9. Give credit to other professionals’ work.
1.10. Be accurate, truthful, and candid in all communication regarding professional colleagues. Recognize that differences of professional opinions are common, and do not provide false, exaggerated, misleading, unwanted, or defamatory communication about professional colleagues.
1.11. Strive to improve The Profession of geology by improving professional knowledge, cooperating with colleagues, and encouraging development of geologic sciences. Encourage colleagues to further professional practices. Disallow and/or report unprofessional or unethical behavior.

3. What Ethical Situations Do We Encounter?

Following are two possible scenarios and considerations for proper ethical actions.

Example 1. In evaluating a property for cleanup actions, laboratory results from 15 different drilling points demonstrate that one out of the 15 is anomalous and above regulatory limits. What do you do?

The answer is somewhat gray. First, it is an anomaly when compared to results from other data points; therefore, it may be a false positive. Second, the mean value of all data points may be acceptably within the range of regulatory requirements. If the 15 samples are taken on a grid pattern with drill spacing close enough to demonstrate that they are representative of the area under question, this average may be ethically acceptable. This could be appropriate in the case of determining soil contamination; however, it would be unacceptable in the case of determining groundwater contamination. The reason for this is that persons walking or working on the surface would only encounter the contaminated area during a short period of time. If it is groundwater contamination, a person could drill a drinking water well at the point of contamination and ingest an unhealthy amount of contaminated water. The ethical procedure would be to make a complete report to proper regulatory authorities including all results and conclusions. Then, decisions may be made to either obtain additional data or to accept the results of the study with a conclusion as to whether cleanup is required or not.

Example 2. Under a similar scenario, an ore body, rather than a cleanup, may be under evaluation. Assume that one sample out of 15 has analytical results that, when averaged with the other 14, causes the average grade of ore to be 50% higher than the average grade without using that one value. What do you do?

The answer to this question is rather clear to experienced mining geologists who have undergone financial successes as well as setbacks or failures. This type of anomalous data point is truly part of the ore body, but can be considered a “nugget” hole. Going back to early gold mining days, nuggets of gold could be found downstream of the actual ore body.

The nuggets were evidence that an ore body did in fact exist, but more evidence was needed to start the costly process of mining. Additional investigative work may have resulted in finding the actual ore body and mining it out. Any data point that, by itself, results in upgrading the average value of an ore body by more than 10% must be considered an anomaly and treated as such in calculating the average grade of the ore body. It also must be remembered that the data point is real. The ethical procedure is to allow some value to this data point in calculating the grade of the ore body.

In the writer’s 15 years of mining experience, this procedure would include using all data points to determine the areal extent of the ore body. This includes assigning a “proven” area around each drill hole such as a circle or ellipse of influence. Connecting all these circles by tangent lines yields a “connect the dots” area that could be the ore body. A specific “proven” area/volume may be assigned to the anomalous drill hole with the rest of the area/volume assigned as the larger portion of the ore body. An example may be to have 14 data points with a value of 10 and one data point with a value of 80.

The resultant mean is 14.6. The writer has learned that this value would exceed the produced value. If a specific percentage value is assigned to the anomalous data point, a more realistic result may be obtained. For instance, a calculation of?
99% of 10 plus 1% of 80 results in an ore body value of 10.9. Experience has show that this overall value would be closer to the actual produced value.

Some evaluators have concluded that the anomalous value should be left out of the calculation and others have concluded that the anomalous value should be used to determine a “simple” mean value. The writer has experienced in numerous cases that the ethical procedure for calculating the average mining grade and for determination of mining feasibility is to use the above-procedure of assigning a small value to anomalous data points. This could also be considered an example of using good quality or a conservatively realistic approach to mining evaluation.

Final Thoughts

Ethical procedures and actions are required on a regular basis when providing any service or product. It is imperative that all decision makers plan and implement projects with a goal of producing that service or product in a timely manner with quality and integrity.

Government agencies and business entities require completion of services that impact the needs and wants of the general public. Ethics is an integral part of the implementation of any service.

When geologists are involved in this implementation, they must consider what they should do when a decision requiring an ethical determination is required. What do you want to see in tomorrow’s newspaper if you are required to make that determination?

About the Author

George FitzGerald, CPG-06582 is the first geology graduate from Humboldt State University, Northern California in 1968. His career includes 39 years in mining and environmental geology; including technical and economic feasibility studies for uranium and copper mine development and operations, licensing of radioactive material disposal facilities, and remediation of hazardous waste disposal facilities throughout the United States. Currently, George is retired and consulting on mining and remedial projects, including appropriate ethical and quality assurance practices.
As 2020 draws to a close, I find myself reflecting on an unprecedented year. The COVID pandemic changed the way the world functions, and fundamentally changed the way we, as a society, go about our daily business. The importance of the internet has never been more pronounced, especially in my house, where two teenagers with online school (and online social lives) share the internet with two adults who juggle conference calls, video conferences, cloud-based file management, and other work requirements. To compound our frustration, we have DSL-based internet, and are the very last house on that line, which means that during peak demand, our internet speeds fall to levels consistent with the dial-up service of the late 1990’s. Still, we make do the best that we can, and generally, we’ve been able to meet and exceed the demands of school, work, and our limited social lives.

I’ve also been reflecting on what it means to be a geologist in times such as these. Unsurprisingly, I’ve found that nearly all of my colleagues have been declared essential personnel. The business of cleaning up train wrecks and other messes, of exploring for raw materials, and providing energy solutions continues. Geologists provide a service that helps to build the foundation upon which modern society rests. However, since we are a small group of people much of society does not see the work we do. Our reward is a job that we mostly love in a field that gives us a tremendous variety of working environments.

My friend and colleague, Vitor Correia, often says that “Geologists are solution providers.” What he means is that as society decides what things it values, it is geologists who provide the fundamental materials and services to make those values a reality. If society decides that it wishes to move to an energy system that incorporates more renewable energy, it will be geologists that find the cobalt, and copper, and nickel, and lithium, and other materials that are required to make that transition happen. If society decides that PFAS’s must be addressed, it will be geologists that figure out how to trace and clean up those substances. As our reliance on computer and internet technologies increases, we geologists will explore for critical rare earth elements, for gold, and platinum, and we will provide the crucial geological information to determine where to site communication and power lines, and other critical infrastructure. Our work as geologists helps to underpin the future.

Note: We often do this work in concert with engineers but given our longstanding friendly rivalry with engineers, I’ll only mention them in passing, and just this once.

In his 1788 papers and in his 1795 book, Theory of the Earth, James Hutton outlined the principle of Uniformitarianism, which often is summarized as the simple phrase, “The Present is the Key to the Past.” In what I’ve come to think of as the ultimate irony, we geologists, who study a field that is so firmly rooted in understanding the past, now hold the key to the future. We might just as well say, “The Past is the Key to the Future.” As society determines its values, our knowledge of the past will help us provide the solutions of the future. As a result, geologists will have tremendous opportunities moving forward. Of course, numerous uncertainties will exist, and we will have to navigate those uncharted waters. However, much as the Clean Air and Clean Water Acts ultimately created the modern environmental consulting field, changes in technology and shifts in societal values will create new opportunities for geologists.

If 2020 has taught me anything, it is that people are resilient and creative, and we find ways to survive and thrive, even in the face of significant adversity. Among professions, it is my opinion that geologists are uniquely positioned to find opportunity during periods of significant change. I believe that we are entering a period of such change, and that our profession is positioned to provide the solutions that society will require as we move forward.

I wish each of you a warm, safe, and productive winter.

Aaron
Interpretation of Data and a Look Ahead to 2021

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Welcome to 2021! That is not how I would normally start a President’s Message, but it is the only positive way to move on from 2020. How each of us dealt with a truly unusual year will be a lively topic of conversation for years to come. COVID-19 has had, and will continue to have, significant impacts on business and the economy, while we look forward to a bumpy recovery.

In an attempt to keep your attention, I will start with a discussion of my pet peeve: data acquisition and interpretation. Geologists observe, collect, record, and then interpret data during all aspects of their careers. How we complete these tasks determines the quality and duration of the interpretation. As scientists, we should observe, collect and record with as few preconceived notions as possible while bringing our geological experience and breadth of knowledge with us to every project, task and decision. The collection of data often becomes a narrowly defined task that can put restrictions on what is observed by specifying criteria to be looked for and recorded, often by using “boxes” to be filled. No matter how well the boxes are defined, they are limited to the knowledge base at the time of definition, thus not allowing for new or different data to be recorded. Often the collection of data is relegated to the least experienced person on the project and they are often told that everything must fit in a box. Any interpretation is only as good as the data collected.

And now I want to take you back to your academic years when you learned the principles of superposition, original horizontality, relative age dating, among others. You should have also learned the method of Multiple Working Hypotheses by T. C. Chamberlin (1890), who wrote very eloquently about the method, the difficulties of using it and why it is so important. The method is one for “primary or creative study” and is most applicable to the fields of study where new data is being constantly added. It states simply that facts (data) should be evaluated against every rational interpretation, a set of hypotheses should be developed, and then each hypothesis should be evaluated without favoring any. The method can avoid forcing facts to fit a theory or model.

I believe that we often rush to interpretation by using models to guide our data collection rather than by using all the data to guide us to all possible interpretations. I am often amazed that the first question at an outcrop or mine is “What type of deposit is it?” before discussion of the specific geological features that can be observed or gleaned from the outcrop or data. By starting with a model, you are only repeating what others have said and not being creative or evaluating all available data. Ideally, the Multiple Working Hypotheses method of evaluating data removes some of the bias and preconceived notions from interpretations. In summary, data collection should not be restrictive, but should allow for the possible existence of criteria not previously recognized. Interpretations should be based on evaluation of all rational theories rather than starting with a model and collecting data to support that model.

To each one of you who thinks that I am directing my comments on data and interpretation to you, to your geoscience specialty, or to any specific specialty, the answer is yes and no. I am directing it at all specialties equally. Geoscientists need to ensure that the data used for interpretation is complete and defensible, and that interpretations are based on all the data, not just the data that fits a model. Models can be useful tools but if we do our job correctly, the models will constantly be improved as new data is added.

Is our concept of the role of AIPG tied to a model that is no longer relevant? Are we perhaps not seeing needs that can be filled and opportunities that AIPG could provide because we are blinded by what has been done in the past? What data we use and how it is interpreted is critical to keeping AIPG relevant and valuable for our current and future members.

My main focus as 2021 President of AIPG is membership. We must have a clear concept of the value of membership to attract new members and to keep our current members active. New members include all levels of membership, and how we attract them and retain current members in each member category varies greatly. We need to define the best way to approach each category. It is our duty to ensure that AIPG membership requirements meet the needs of those geologists that use their membership for their professional careers and that they remain consistent with similar organizations in the US and worldwide.

Many of our members have been working geologists for over 40 years, while the newest student members are just deciding on their career path. They work in specialized fields of geoscience across a broad spectrum of industries, state and federal agencies and academia. AIPG needs all of their voices to better understand the needs of the geoscience community.

To maintain and increase membership in all categories, AIPG must increase its visibility and distinguish itself from other geologic organizations. We need new voices and ideas from all geological specialties and geographic areas. Please contact me if you would like to help guide AIPG on the National level.

Reference:
Chamberlin, T.C., 1890. The Method of Multiple Working Hypotheses; Science, February 7, 1890.
1. Two minerals that crystallize first from the cooling of an original mafic magma include:
   a) Olivine and quartz.
   b) Olivine and anorthite.
   c) Orthoclase and quartz
   d) Horroblend and bitetite

2. “Covalent bonding” defines:
   a) A linkage formed by shifting electrons from one atom to another.
   b) A linkage maintained by weak residual charges between atomic sheets.
   c) A linkage formed by sharing electrons.
   d) An online dating site for chemists.

3. This hydrocarbon from the alkane family is represented by the formula C₃H₈:
   a) Propane.
   b) Ethane.
   c) Butane.
   d) Stinkane.

4. A core shows Kimmeridgian strata overlying Campanian rocks. What can we conclude?
   a) The stratigraphic sequence reveals a nonconformity.
   b) The stratigraphic section is inverted.
   c) The stratigraphic sequence contains Triassic and Jurassic lithologic units.
   d) The rocks must be really ugly, dude.

5. Consider an inclined earth block of a given lithologic unit with volume “bcd” that slides over a detachment surface. Let:
   • “b”, “c” and “d” = length, width and thickness of the block, respectively.
   • “w” = weight of the block; “θ” = slope angle; “F_h” = horizontal force acting on the block.
   • “µ” = the coefficient of friction along the detachment surface.
   • “p” = rock density; “g” = acceleration of gravity.
   What is the horizontal stress “σ_h” required to move the earth block?
   a) σ_h = bpg (µ · tan θ) / (1 + µ tan θ)
   b) σ_h = bpg (µ · sin θ) / (1 + µ tan θ)
   c) σ_h = bpg (µ + tan θ) / (1 + µ cos θ)
   d) Dude, I beecame a gigiligist not todoo dis kiind uf zing.
Diversity and inclusion webinars

I’ve seen ads for and have participated in a couple of webinars on diversity and inclusion and unconscious bias sponsored by different geoscience organizations over the past six months or so. I’ve found them interesting and informative. AIPG has an ad hoc committee addressing diversity and inclusion issues. Standards 4.3 and 4.4 of the AIPG Code of Ethics specifically address diversity and inclusion as does the AIPG Events Code of Conduct. Participating in such webinars counts (or should count) towards Continuing Professional Development requirements.

The ethics of hosting and recording technical presentations via Zoom.

The increasing number of technical talks being offered by various geoscience and other groups via Zoom and other teleconferencing programs over the past nine months has been a great way of providing professional development opportunities while maintaining social distancing and eliminating geographic constraints—time zones are something else. I appreciate this development and have taken advantage of some of the opportunities presented.

However, recently the CPG speaker at one of these sessions expressed his concern on learning just before giving a talk that he thought was strictly for a student group was in fact being offered to a wider group of professionals and that the session was being recorded. As the speaker wrote the leader of the student group, “As you evolve professionally you will appreciate that your time and intellectual property is your stock in trade. Spreading some bread on the waters is called sharing (or advertising), but having your product disseminated gratis...or even for profit to the recorder is another thing entirely.” So, let your speaker know when arranging for the talk who will be in attendance. Inform the speaker if you intend to record the presentation and what will be done with the recording. If the recording will be made publicly available, and, particularly if sold, the speaker should receive some royalty income.

Updated Geological Society of London Code of Conduct

In June 2020, the Geological Society of London (GSL) updated its Code of Conduct. Some of the changes are interesting. In §4.4 reference is made to other professional organizations’ Code of Conduct with which GSL Fellows must comply including the AGI’s Guidelines for Ethical Professional Conduct. This is because the GSL is an AGI member. GSL Fellows who are members of the European Federation of Geologists or the America Association of Petroleum Geologists must comply with their respective Codes of Ethics. This requirement applies to all grades of GSL Fellowship “or whether they are acting in a professional or personal capacity.” The explicit extension of the Code of Conduct to personal activities is new and noteworthy. Section 5 of the GSL Code states, “Positive behaviours should always govern the way Fellows act both within and outside of the workplace. Acting professionally and ethically is the bare minimum requirement of anyone working within the sciences, as outlined by the Universal Ethical Code for Scientists. Actions by Fellows, including posts on social, business or other media in the public domain, that are abusive, discriminatory or defamatory, may be perceived as bringing the Society into disrepute and will not be tolerated. There are disciplinary regulations and procedures in place to maintain the Society’s high professional standards.” The updated GSL Code also incorporates guidance on the GSL’s Code of Publishing Ethics and the GSL’s Code of Conduct for Meetings and Other Events.

Some specific items in the new GSL Code warrant comment. Item 7 (of 17 total items) states, “A Fellow who is not Chartered must, if called upon to act in an expert professional capacity, ensure that a client or employer is aware of their status and that their professed competence has not been independently verified.” I urge that “by the Society” should be added to this item. Having a competence credential from another organization should be recognized, for example, an AIPG Certification or a US State geoscience license.

“Acting professionally and ethically is the bare minimum requirement of anyone working within the sciences, as outlined by the Universal Ethical Code for Scientists.”

Item 11 states, “Fellows must not be negligent in the practice of geology, and must take all reasonable precautions to avoid any act of commission or omission which might endanger life, adversely affect the health and safety of others, result in needless financial loss, or endanger or damage the natural and/or built environment.” As I observed in my article, “Natural resources and sustainability: geoethics fundamentals and reality,” in the last edition of TPG, society needs natural resources to sustain our lifestyles (even cave men needed flint, clay for pots, and pigments for cave wall art) and extraction of those resources necessarily involves some amount of environmental
Answers:

1. The answer is choice “b” or “Olivine and anorthite.” Olivine \([\text{Mg, Fe}_2\text{SiO}_4]\) is the first mineral to crystallize in a cooling mafic magma from the ferromagnesian series. Similarly, anorthite \([\text{CaAl}_2\text{Si}_2\text{O}_8]\) is the calcium-rich variety of plagioclase feldspar that crystallizes first in a cooling mafic magma.

Orthoclase \([\text{KAlSi}_3\text{O}_8]\) and quartz \([\text{SiO}_2]\) are products of late stages of magmatic crystallization. Olivine and anorthite are generally found in mafic igneous rocks, whereas orthoclase and quartz are commonly encountered in felsic igneous rocks.

Olivine and quartz do not usually occur together.

Choice “d” may be found at celebration parties where a variety of adult beverages are consumed and when one steps on the dog’s tail.

2. The answer is choice “c” or “A linkage formed by sharing electrons.” It constitutes the strongest type of chemical bond. Choice “a” pertains to ionic bonding. Choice “b” describes “van der Waal’s bonding.”

3. The answer is choice “a” or “Propane.”

Ethane \([\text{C}_2\text{H}_6]\) and butane \([\text{C}_4\text{H}_{10}\)] are also part of the alkane family of hydrocarbons, along with methane \([\text{CH}_4]\), the simplest member of the family.

I remember “stinkane” when I lived close to an oil refinery.

4. The answer is choice “b” or “The stratigraphic section is inverted.” Kimmeridgian and Campanian strata are upper Jurassic and upper Cretaceous, respectively. Since the Kimmeridgian rocks overlie the Campanian lithologic units, the section must be inverted.

A nonconformity defines and unconformable surface that separates igneous or metamorphic rocks from overlying sedimentary strata. This is not our case here.

Triassic rocks do not apply in our example, since we have only mentioned Jurassic and Cretaceous lithologies as seen in our full-diameter core.

5. The answer is choice “a” or \(a_h = \text{bpg} \left(\mu - \tan \theta\right) / 1 + \mu \tan \theta\). The proof now follows:

The volume and weight of the block are:

\[
\begin{align*}
v &= \text{bed} \\
w &= \text{bcdp}g
\end{align*}
\]

The horizontal stress required to move the block is:

\[
\sigma_h = \frac{F_h}{cd}
\]

The coefficient of friction is:

\[
\mu = \frac{\sum F_s}{\sum F_n}
\]

\[
\mu = \frac{x + x' - y - y'}{y - x'}
\]

\[
\mu = \frac{w \sin \theta + F_h \cos \theta}{w \cos \theta - F_h \sin \theta}
\]

Then, solving the above equation for \(a_h\):

\[
\begin{align*}
\mu &= \frac{bcdp \sin \theta + o_h \cos \theta}{bcdp \cos \theta - o_h \cos \theta}
\mu &= \frac{cd (bpg \sin \theta + o_h \cos \theta)}{cd (bpg \cos \theta - o_h \sin \theta)}
\mu &= \frac{bpg \sin \theta + o_h \cos \theta}{bpg \cos \theta - o_h \sin \theta}
\mu \text{bpg} \sin \theta - \mu o_h \sin \theta = bpg \sin \theta + o_h \cos \theta
\mu \text{bpg} - \mu o_h \tan \theta = bpg \tan \theta + o_h
\mu o_h \tan \theta = \mu bpg - bpg \tan \theta
\mu o_h (1 + \mu \tan \theta) = \mu (bpg + \mu \tan \theta)
\mu o_h = \frac{bpg (\mu \tan \theta)}{1 + \mu \tan \theta}
\end{align*}
\]

This last equation is the answer that we seek and our choice “a.” Thus, the horizontal stress required to move our earth block can be expressed in terms of the length of the block, the density of the rock, the acceleration of gravity, the coefficient of friction along the detachment surface and the angle of the sloping surface.
Continued from p. 41

degradation. Item 11 needs the insertion of “unnecessary” or a similar term prior to “endanger” and “damage.”

Item 15 states, “Fellows must prevent avoidable risk to both physical and cyber security.” Physical safety is an important aspect of geoscience work and includes the lab as much as the field. PE&P column 175 in the Jul/Aug/Sep '20 TPG contains a couple of topics on safety in the field. Cyber security is a newer and legitimate concern. What should the minimum standards for professional geoscience practice be? The use of anti-virus and anti-malware programs, separate strong passwords for each site requiring one (use a password manager), and perhaps required use of 2-step (or 2-factor) authentication would be on my list of potential minimum cyber security standards. I would appreci ate contributions to this column or as stand-alone articles from those of you with more cyber security knowledge. Are more statements about safety needed in the AIPG Code of Ethics? Contribute your thoughts.

Computer files security in a Covid-19 world of home offices

The impact of Covid-19 on the geoscience world is that far more of us are working from home a good deal of the time. Doing so requires access to relevant company (or whatever business entity you are part of) files. Maintaining the security of these files is vital and it begins with your having good security for your home and traveling computer system(s) (if they differ). There are a variety of ways of doing this and different companies have differing methods. Antivirus and antimalware programs; using a password manager for creating and using unique and strong passwords for every entity or program requiring a password; using a virtual private network; and a good, offsite backup program are musts. Two-factor authentication procedures add a bit more time to log-ins but provides you the single best thing you can do to protect your data and identity. Use of cloud-based file sharing has advantages until you don’t have access to the cloud for one of a variety reasons. Keeping duplicate copies of needed files on a thumb drive or portable hard drive provides access when the net is down or unavailable. Printing PDF copies of all final reports and maybe all final document eliminates the metadata inherent in word processing programs. These are just some of the things all of us should be doing, but are we?

Disaster by choice: how our actions turn natural hazards into catastrophes

Disaster by choice: how our actions turn natural hazards into catastrophes by Ilan Kelman, 2020, Oxford University Press, was reviewed by Brent Wilson in the August issue of The Geoscientist. Floods, forest fires, earthquakes, volcanic eruptions, tsunamis, landslides, debris flows, and many others are examples of natural hazards. As Wilson points out, “The thing that makes a natural hazard a disaster is when it impacts on human populations, taking assets or (worse yet) lives.” Kelman’s book provides many examples of disasters stemming from lack of preparedness due to individual actions or lack of a political will. Kelman points out that disasters are not natural. Societies and humanity create them. Likewise, societies and humanity can take steps to avert them through building codes, zoning regulations, and other actions although such restrictions may be very politically unpopular. The topic, “Protecting the public’s health, safety, and welfare—but does the public want protection?” in columns 102 (Mar/Apr ’06), 104 (Jul/Aug ’06), and 109 (May/ Jun ’07) and Roy Shlemon’s article, “The hazard of geologic hazards to geology,” (Apr ’99, p. 9-10) address similar and related issues.

Ethics, the Importance (and Difficulty) of Being Earnest

“Ethics, the Importance (and Difficulty) of Being Earnest” is the title of a webinar that was presented by Robert Prentice of the Center for Leadership & Ethics and the University of Texas Austin McCombs School of Business on October 20, 2020. Prentice addressed general and common ethical issues. He began by noting the importance of humility. Inattention to situations with potential ethical issues and self-deception are common human characteristics. This can allow minor ethical issues to slide into big ones. We must be humble when reflecting on our own ethical awareness. Prentice notes that the overwhelming finding of behavioral ethics on the past decade is this: most people want to think of themselves as good people. And yet, most people frequently act unethically, usually in minor ways. While we want to think of ourselves as rational beings, Mr. Spock or Mr. Data we’re not.1 However, research clearly demonstrates that a variety of factors affect human decision making, including: social and organizational pressures, cognitive biases, and situational factors.

Social and organizational pressures include obedience to authority; what does the boss or other authority figure

1. Prentice and I are assuming most readers are aware of the characters from Star Trek and Star Trek: the Next Generation, and various other parts of the Star Trek franchise.
want you to do? Conformity bias: to what extent are you willing to believe or go along with actions that agree with your general beliefs. What questionable things are you doing because everyone else is? Overconfidence including the Lake Woebegone assertion that all children are above average is another social and organizational pressure. Are your driving or professional abilities truly above average? Is your moral behavior truly above average?

Cognitive biases include how an issue is framed or what its focus is. The problems at Enron arose from a constant focus on Enron’s stock price. The space shuttle Challenger explosion resulted from a top down focus on getting the mission off and putting a teacher in space thus removing focus from the engineering question of rubber O-ring elasticity and low temperatures. The slippery slope that leads from increasingly routine acceptance of minor ethical lapses gradually leading to less minor and even major ethical lapses. Because of self-serving biases, we tend to conflated what is good for us with what is good for everyone. We get bonuses for good performance (how is performance measured?) It is hard to admit one’s mistakes.

Situational factors include time pressure. We’ve got to get this report out now! There is no more time for check-sure. We’ve got to get this report out now! Overconfidence including the Lake Woebegone assertion that all children are above average is another social and organizational pressure. Are your driving or professional abilities truly above average? Is your moral behavior truly above average?

In summary, Prentice urges us to constantly be alert to possible ethical issues. Prentice’s webinar can be viewed at https://geo-search.com/training-videos/webinar-videos/.

US Geoheritage efforts

The eighth fundamental value of geoethics is “Enhancing geoheritage, which brings together scientific and cultural factors that have intrinsic social and economic value, to strengthen the sense of belonging of people for their environment.”

“Geoheritage” is a generic but descriptive term applied to sites or areas of geologic features with significant scientific, educational, cultural, and/or aesthetic value. Scientifically and educationally significant geoheritage sites include those with textbook geologic features and landscapes, distinctive rock or mineral types, unique or unusual fossils, or other geologic characteristics that are significant to education and research. Culturally significant geoheritage sites are places where geologic features or landscapes played a role in cultural or historical events. Aesthetically significant geoheritage sites include landscapes that are visually appealing because of their geologic features or processes. Many geoheritage sites are tourist destinations that provide local and regional economic benefits. (Rationale for the Geological Society of America’s Position Statement on Geoheritage)

This past fall America’s Geoheritage Workshop II: Identifying, Developing, and Preserving America’s Natural Legacy presented a series of webinars on geoheritage issues. The America’s Geoheritage Workshop is organized by the National Academies of Sciences, Engineering, and Medicine Board on International Scientific Organizations-U.S. National Committee for Geological Sciences and is sponsored by AASG, AGI, GSA, NAGT, NESTA, NPS, & USGS and is supported by NSF. America’s Geoheritage Initiative 2020-2021 “will explore possible approaches to systematically identify, standardize, coordinate, and promote geoheritage sites across America, and help build a vibrant U.S. geoheritage community that can effectively reach out to the full range of stakeholders who may be interested in using, protecting, and enjoying America’s common geological heritage now and in the future.”

William J. Siok Graduate Scholarship Program

Purpose

To assist graduate students with college education costs and to promote student participation in the American Institute of Professional Geologists (AIPG). One scholarship will be awarded to a declared graduate student in an accredited geoscience program with an emphasis in environmental geoscience and/or hydrogeology. Details for applying for this scholarship are provided below.

Scholarship Awards

Scholarship award is in the amount of $1,000.00 to an eligible graduate student attending a college or university in the U.S. Scholarships are intended to be used to support tuition, room and board, and/or research.

Eligibility Requirements

Any graduate student who is majoring in the geosciences in the U.S. can apply. Also, the student must be either a student member of AIPG or must have applied for student membership at the time the application for the scholarship is submitted.

The student who is awarded the scholarship agrees, by accepting the scholarship, to prepare a 600 to 800 word article for publication in The Professional Geologist. The subject of the article must be related to a timely professional issue.

Application Process

1. Submit a cover letter introducing yourself and tell us what you have done outside of the class room such as research projects, officer in club, or outside activities within the community. Address your career goals in near term and longer term.

2. Submit a one page (approximately 750 words) essay on a topic the AIPG Education Committee will decide on annually. The 2020 scholarship essay topic is:

   Focus on a single theme of your choice, and explain how the profession of geology, over the coming decade, should best contribute to addressing a problem for the wellbeing of the public. In your essay explain (1) Why your theme choice is significant and (2) How professionals educated in geology are essential to contributing successfully to addressing the problem. Try to be as specific as possible in addressing Item #2.

3. Submit a copy of your transcript (unofficial) and documentation that you are a current student. Requisite standards to apply are a minimum GPA of 2.8 (on a 4 point scale) and a minimum of 12 semester credits of geology/geoscience courses with a 3.0 GPA in these courses completed at time of application. Those credits can come from previous grad or undergrad studies.

4. Submit a letter of recommendation from a geology/geoscience professor that provides an emphasis on your performance and activities in the classroom, in the department, and your character in how you work and help other students.

The application packet can be submitted online (preferred) or emailed to aipg@aipg.org. Questions regarding the application process can be directed to (303) 412-6205 or e-mail: aipg@aipg.org.

In addition to the scholarships offered by National, seven Sections (Colorado, Georgia, Michigan, Minnesota, Northeast, Pennsylvania, and Texas) offer additional scholarships to AIPG students residing or going to school in their Section. The scholarships offered range from one to eight, and from $500 to $5,000. Details on the individual scholarships are summarized in the table on page 43.

Essay Writing Tips from the AIPG Education Committee

Ron Wallace, CPG-08153 • AIPG Education Committee Chair

Each spring AIPG awards a number of undergraduate and graduate scholarships. An essay is one part of the application for the scholarships. As one of the members on the Education Committee that reviews the essays, I thought I’d give a little guidance on the essay and the entire process. The applications are due in February, so start getting your application package ready early because you need to include a copy of your academic record and a letter of recommendation from one of your professors. The cover letter is for the committee to be able to learn something about you and what you have done in the university setting. It can include information such as research projects, laboratory work, or teaching labs and outside interest. We want to know what awards you’ve received, leadership positions you have held, or other organizations in which you are an active member. Also, what near term goals you have and what you think you will be doing after your academic education has been completed.

The Education Committee considers the essay to be the most important part of the entire application. I recommend you think about it for some time and then write down some key points that you want to cover. The essay is intended to be quite different from the cover letter, so don’t repeat information from the cover letter in the essay. The subject of the essay for the undergraduates is “Why I Want to be a Geologist”. Most students write either that they were interested in geology from a young age or they had a geology class and a lightbulb went off and they were hooked. Your individual story is important and the committee wants to hear how you became interested in geology. Talk about your process either from a very young age or maybe later in college when you made the decision to major in geology or earth science. Now that you realize that you want a degree in geology the second part of the essay is why you want to be a geologist and what is the drive behind it. This is the point where you can discuss areas of geology in which you are interested in working, whether there is some cause that drives you, or problem you want to be involved in solving.

The graduate essay is designed for you to focus on a single issue that is important to the public and how the knowledge of geology can help solve that problem. Your essay may be on a subject that you know is important but it may be in an area you do not plan to pursue professionally. You may want to research the subject you choose for background data and different aspects of geology that can help solve the problem. Because the essay is approximately one page, you need to be concise in your discussion.

The Education Committee wishes student applicants the very best while they are fulfilling their education and hope you have a rewarding professional career in geology.
In response to the 2020 pandemic, universities, colleges, and schools have largely incorporated digital tools and web-based platforms in their educational formats. For instance, the University of Utah (where I have worked for the past 18 years) have classified their courses into five types:

1. In-person courses: Traditional, class-based, fully in-person classes with a scheduled room and meeting time.
2. Online courses: Classes conducted primarily online, through Canvas.
3. Hybrid courses: Classes that blend same-time in-person meeting and flexible online instructions.
4. Interactive video classes (IVC): Fully digital classes that use same-time delivery using web video technology (such as Google Meet, Skype, Zoom, etc.)
5. IVC-hybrid: A mixture of in-person and same-time interactive video classes.

Even before the pandemic, Canvas was an important part of in-person classes (for sharing lecture notes and other educational materials with students, posting grades, and so forth). Nevertheless, the 2020 pandemic has surged online meetings and web-based classes. It is expected that even after the pandemic these digital tools, now that they are tested and established, will be increasingly used. What are the best practices in online learning (or e-learning)? How to optimize web-based techs and procedures to maximize learning outcome? These questions not only face colleges but also face students who spend enormous sums of money (and time) on their education. This article briefly explores these issues.

One particular difficulty in assessing “online” education is that its definition is somewhat vague (Figure 1 below). Traditional in-person classes, because they have developed over centuries, have a clear definition; they are fixed-place, fixed-time (synchronous), and interactive. However, online or web-based education potentially includes a wide range of tools and procedures, some of which may not be accessible.

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

Rasoul Sorkhabi, Ph.D., CPG-11981

Figure 1.
or fully utilized. Therefore, one has to decode and deconstruct the term “online” education to better understand how best we can practice it.

**Subject Types**

The first important factor that a student should consider is the nature of the course he or she is planning to study. Practical courses in sciences and engineering are best conducted in live (in-person) classes because they require instruments and materials, and also hands-on training, experiments, and supervision by the instructor are essential. One cannot become, for instance, a mountain climber, pilot, organic chemist, environmental geologist, civil engineer, or a surgeon simply by reading textbooks and listening to lectures. Most popular online courses are related to information and computer technologies, business, management, education, and humanities.

**To Commute or Not to Commute**

Perhaps the best advantage of online education is that students and instructors do not need to commute to a physical classroom. This indeed saves time (as well as money) for commuting. You can read or watch lecture materials from the comfort of your room. Nevertheless, this is not an absolute advantage. Some students believe that commuting and walking has its own health benefits while sitting in front of a computer monitor for long periods of time is not a healthy practice. Moreover, while the physical classroom focuses our attention on the lecture and discussions, gazing at the computer screen requires greater mental strength to maintain your attention and not be distracted by other (probably more entertaining) internet offerings. In other words, online classes obviously save us time but this advantage should not be oversold or generalized.

**Age Groups and Information Technology**

During the 2020 pandemic and lockdowns, many parents complained that their young children in schools had an extremely hard time to attend online classes for hours each day; the students easily got bored, emotionally stressed, and did not consider online lectures as real or natural (but somewhat like games). Online schooling can also be a burden on parents who have to devote their time to this task; and in turn, teachers may find parents’ participation somewhat intruding or may not feel comfortable facing both students and parents in a teaching session. Screen boredom may also be true for some other people or they may not take online classes very seriously for lack of personal interactions.

Online education is most suitable for people with full-time jobs (Figure 2) who cannot attend in-person classes in week days and have little time to commit to the workload of a full semester. People with mobility or sensory impairment will also utilize online education more than others.

<table>
<thead>
<tr>
<th>Subject Types</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>School children</td>
<td></td>
</tr>
<tr>
<td>College students</td>
<td></td>
</tr>
<tr>
<td>Full-time workers</td>
<td></td>
</tr>
<tr>
<td>Senior citizens</td>
<td></td>
</tr>
</tbody>
</table>

Older people may not have great desire or technology knowledge to handle online classes efficiently; they may value face-to-face social interactions much more than isolated computer classwork.

Online learning requires high-speed internet and up-to-date computers (equipped with printer, webcam and other software) which may not be available in every country or in every part of a country for infrastructural or financial reasons. This technological inequality may adversely affect students from disadvantageous areas.

**Credits and Credibility**

Online education saves money. Online courses are usually less expensive than in-person classes because the latter require a proper physical space (campus and buildings). Nevertheless, saving money should not come at the expense of credibility. It is important to evaluate the history and reputation of the educational institution before registering for a course. In this regard, it is important to categorize online education into (1) courses offered by mainstream universities, colleges and schools, which are properly accredited, and (2) those offered by various educational and training companies offering courses for professional development. If your purpose is simply to learn a subject for your hobby or for improving professional skills, there are a vast number of online courses available at very low prices. This is indeed an advantage of the global digital age we are living in: We can learn a subject in a convenient way and at a low budget. However, if your purpose is to get educational credit units (CEUs, for professional licensing or for transferring to a formal university education) or graduate with a valid and valuable degree, then accreditation, brand, and reputation of the educational institution should be seriously considered. Indeed, employers will give more importance to certification from established colleges and universities; they will also value hands-on training more than abstract, text-based online courses.

1. Erin Richards, This is hell: Parents and kids hate online learning, but they could face more of it. USA Today, June 29, 2020. https://www.usatoday.com/story/news/education/2020/06/29/back-to-school-reopen-online-classes/3251324001/; Schools want to end online classes for struggling kids, but Covid-19 cases may send everyone home. USA Today, November 14, 2020: https://www.usatoday.com/story/news/education/2020/11/14/covid-cases-school-closing-online-class/6260149002/
Flexibility of Schedule

Another often cited advantage of online education is that the student has maximum flexibility in terms of time and pace to finish the course. This will actually depend on the nature and operative techniques of online courses. It is true that in traditional correspondence courses, the student could take and finish the course in a year or so at his or her own pace. However, university-based online courses also have deadlines for submitting assignments and taking exams; interactive video classes also require students to attend the class virtually. In fact, a loose course schedule without a timeline and deadlines will not benefit the student because people may resort to procrastination, be overwhelmed by taking on a huge workload in the last day, and thus fall behind.

Even for online courses, it is preferable to set aside a regular time and quiet place for your studies in order to create a proper environment and vibe for maximum learning.

Discipline and Learning Outcome

There is a clear relationship between discipline and learning outcome. Indeed, the word “discipline” refers to being a disciple (from Latin discipulus, meaning “pupil.”) Having interest and devotion helps learning. In my classes I have consistently noticed that those students who regularly attend the class and do their assignments on time also do very well in exams and get high grades. Often say to students that before they sign up for a course, they should make sure that it will really work for them; dropping a course in the middle of a semester or performing poorly in a class is a waste of time and money. Online classes require more self-discipline and time management than in-person classes.

In a 2012 survey of community colleges in California, Ray Kaupp found that withdrawal rates for online classes were twice that of in-person classes. This corroborates similar surveys conducted by Connie McKissack of Tennessee State University and Ron Eskew of Hilbert College.

Diverse Types of Learning

Learning skills are different. Some students learn best graphically; some prefer reading and word-based thinking; some love stories; some find quantitative knowledge and calculations more engaging; and some learn best through exercises and practical knowledge. It is important that students are exposed to and experience all these different methods and tools, and instructors thus need to balance the syllabus, study materials and assignments to offer diverse learning opportunities: textual readings, discussions; case-based narratives; audiovisual materials, statistical data, and exercises and practices. Students can also maximize their learning by opting for courses or instructors that best match their learning skills or request instructors to give them additional assignments.

Designing the type and quantity of assignments is always a challenging skill for instructors. For online classes, the instructor may tend to give too many assignments because the students are not attending a traditional class. Such temptations need to be constrained so that online students are not overwhelmed by a heavy load of assignments.

Even before the 2020 pandemic, several millions of students in higher education in the US were taking online classes. According to the US National Center for Education Statistics, of 19.9 million total college and university students in the US in Fall 2018, about 3.3 million (16.6%) were exclusively enrolled in online courses and 3.7 million (18.6%) took at least one online course. Even after graduation and during employment, online education plays an important role in career and professional development. A survey of 2,500 companies conducted by the American Society for Training and Development found that those companies with comprehensive training programs had 218% higher revenue per employee and 24% higher profit margins.

Online education will increasingly be popular (especially during pandemics or other similar crises). However, compared to millennia-old face-to-face education, it will take time to perfect the art and techniques of online teaching.

and learning. Online education has brought about tremendous opportunities for learning; it is here to stay; however, it will evolve into hybrid formats in which educational institutions will integrate the best parts of in-person and web-based education.

In short, the best practices for online learning are: (1) the subject should be largely text based; (2) the institution should be credible and reputable; (3) the course should have interactive components with the instructor and other students; (4) the syllabus should have a well-defined table of contents, and an itemized timeline for assignments, exams, and completion of the course; (5) the student should have self-discipline and be skillful in time management; and (6) the student as well as the instructor should have access to high-speed internet and computers with up-to-date software and audiovisual tools.

Continued from p. 39

Scholarships Available to Geoscience Students

AIPG Scholarships

<table>
<thead>
<tr>
<th>AIPG Section</th>
<th>AIPG Scholarship Name</th>
<th>Eligibility</th>
<th>Number Awarded</th>
<th>Amount</th>
<th>Website Location</th>
<th>Submittal Deadline</th>
</tr>
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<tbody>
<tr>
<td>National</td>
<td>William J. Siok Graduate Scholarship</td>
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<td>National</td>
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<tr>
<td>Colorado</td>
<td>Rex Monaghan Geological Scholarship</td>
<td>Colorado Grad/undergraduates</td>
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<td>$1,000 each</td>
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<tr>
<td>Georgia</td>
<td>Georgia Section Scholarships</td>
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<td>1</td>
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<td>Northeast</td>
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AGI Scholarships

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AWG Scholarships*

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<th>Website Location</th>
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<td>Minority Scholarship</td>
<td>Minority Female Undergraduate Student</td>
<td>1 or more</td>
<td>$6,000</td>
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<td>Jean Harris Chrysalis Scholarship</td>
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<td>$2,000 + membership</td>
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*Association for Women Geoscientists has additional awards and offers some in partnership with National Association of Geoscience Teachers. Check their websites!
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
Want to purchase minerals and other oil/gas interests. 
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P.O. Box 13557, Denver, CO 80201.

This service is open to AIPG Members as well as non-members. The Professional Services Directory is a one year listing offering experience and expertise in all phases of geology. Prepayment required. Advertising rates are based on a 3 3/8” x 1 3/4” space.

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Professional Development
AGI Webinar Series: 
Professional Geologist Licensure Requirements and the ASBOG National Geology License Examinations
CEUs: 0.15

Featured Speakers:
Laurie Racca, PG 6980
Randy Kath, MEM-3236
Jack Warner

The purpose of professional licensing is to ensure a minimum level of competency for practitioners in a given field in order to protect the public. Having a license to practice geology is a requirement in the majority of United States, Canada and several other countries. In contrast to other professions, a disconnect has developed between applied geologists and academia. Professional licensing requirements are a fact of life for applied geologists. Unfortunately, many faculty members have limited understanding of the licensing requirements that their students must deal with once they graduate.

This course provides an overview of geology licensure qualification requirements in the United States and explores the national licensing examinations for geologists prepared by the National Association of State Boards of Geology (ASBOG®). Speakers also demonstrate how data from the ASBOG® Fundamentals of Geology examination can be used as a curriculum assessment and curriculum modification tool.

To watch this webinar, go to:
https://www.americangeosciences.org/workforce/goli
COVID has changed the way we communicate with each other whether you are working or learning remotely or as usual from the office or field. Like it or not, it is not business as usual and we are all trying to find ways to adjust to this “new normal”. Young professionals and students are particularly vulnerable at a time when guidance and a sense of belonging are so important. Traditional mentoring, internships, event participation, and field camp programs have been replaced with remote access and social distancing. So how do we make this transition from the way we used to do things to a new safer and interactive method of communication?

AIPG is actively working to open channels within the organization to better support members by finding ways to share resources and keep communications productive and inclusive. Although meetings and conferences are now virtual, ease of access has allowed for an increase in participation along with the opportunity for discussions with a broader membership base. AIPG’s LinkedIn and recently added YouTube channel have also proved to be useful tools for members to access information, open up discussions, and to stay up to date with the current events in the geoscience world.

For student and early career professionals, finding your footing and establishing yourself professionally can be a challenge all on its own and with the way the past year has gone it may seem impossible. But not to worry! You have already taken an important step by becoming involved in a professional organization, so now what?

Here are a few ways to stay connected:

- Check out AIPG’s website, LinkedIn, and YouTube channel for the latest updates, events, and interviews.
- Engage in local, regional and national organization webinars and events.
- Participate in video meetings and discussions. If you haven’t already, be sure to get a camera and mic to give yourself the opportunity to be a part of the discussion, ask questions, and find ways to get involved. Actively participating in video calls gives members a chance to put a face with the name, open up lines of communication, and support those who are presenting or hosting an event.
- Re-energize your participation in AIPG state sections and student chapters. Reach out to your state section to connect with professionals and get more involved in your area. Host virtual meet ups with your student chapter to have meetings, organize virtual study groups to prepare for the ASBOG, game nights, or watch parties for your favorite geology movies and documentaries.
- Seek out volunteer opportunities.
- Schedule time to have a one on one with a mentor, professor, or professional.
- Join AIPG and AGI in the Geoscience Online Learning Initiative (GOLI).
- Write an article for TPG.

Networking is invaluable to our industry and in maintaining a sense of community. Being engaged, ready to learn, and open to opportunity will give you a huge leg up when it comes to networking. You will increase your chances of connecting with professional members greatly and may even find yourself a mentor or even your next job! This year has been a real challenge but we will continue to adapt and find innovative ways to come together.
o, you ask, “What does membership in AIPG do for me? Why should I become involved? I’m very busy with classes and personal activities and have little or no time to spend on another organization...” These questions have been asked by numerous students ever since the student membership category was added to the bylaws.

The old adage, “You only get out of something what you put into it,” is as true today as it has ever been. If you signed up as a student member because your friends did, or because it seemed like a good idea at the time, but you never participate in any activities or otherwise take advantage of any of the benefits of membership, then all you get out of your membership is a line on your resume. That may or may not provide any tangible benefit to you in your future career – you be the judge of that.

If, on the other hand, you want to actively participate, but don’t know what that might entail, I offer some examples. Most AIPG Sections have events throughout the year, including field trips, meetings (often with technical presentations, social hour, and a meal) and other activities. Who doesn’t enjoy a field trip to an often spectacular location to learn about the rock formations or structures? Sometimes these are at a mine or quarry that you otherwise wouldn’t get a chance to enter, and may allow you an opportunity to collect a sample of the minerals or ore. How cool is that?!

The point is, during any of these events, you have the opportunity to learn from, and get to know, professionals, many of whom are potential employers, colleagues, or regulators that you may be working with in the future. Yes, you say, but what good will that do me? None of these people are going to remember me or care that I was on a field trip with them. What good will that do me? None of these people are going to remember me or care that I was on a field trip with them. That may or may not provide any tangible benefit to you in your future career – you be the judge of that.

You might be surprised to learn that these seemingly inconsequential connections might be all that it takes to land you that first position. Or that better job you wanted. Don’t believe me? Then consider the following examples. The first situation was several years ago during a period when the market was depressed, and it wasn’t easy for new graduates to find a position in geology. As our Section’s Editor, I was working on our newsletter and was going to finalize it the following day. I was contacted by the faculty sponsor of one of our Section’s student chapters asking whether I knew of any firms that were currently hiring. One of their Department’s recent graduates (who was an AIPG student member) had been out of school for about six months hunting for a position, without success. I told him that I didn’t know of any that had open positions, but if the individual wanted to contact me and place a short “seeking employment” ad in our newsletter and could get it to me that day, I’d be happy to include it in the edition. Suffice it to say, that ad resulted in the former student being contacted by one of our members about a position they had just opened. He was interviewed and hired within two weeks of the release of that newsletter.

A second situation occurred during one of our Section meetings. We typically have between six and 30 students attend our meetings. It might be because of the technical presentation that follows dinner. Maybe it is because attendance (and the meal!) at our Section meetings is free to student members. Or it might be because we work hard to publicize our meetings to our students and encourage them to attend. In any event, we encourage the students to circulate and talk with members during the social hour before dinner. On this particular evening, one of our students reported sitting with a fellow student who was seated next to “a well-dressed stranger.” The student’s friend and the stranger struck up a conversation over dinner about work and school, and after knowing each other for about 20 minutes, the stranger offered the student a paid internship.

During one of our first Section meetings several years ago, we had our first significant student member turnout – about 20 students from the local student chapter. We were expecting about 50 total members at that meeting. The students arrived as a group during the early part of the social hour. After registering and getting their name tags, they split themselves up two or three to a table, grabbed their choice of tasty beverages, and engaged the handful of professionals in the room at that time in conversation. They weren’t prompted to do so by any of the members, but rather by their own motivation to network with potential employers. Afterwards, I heard from some of our longtime members about how impressed they were with these students, and how interested the students were to talk with them.

Another old adage also applies here: “It’s not what you know, it’s who you know.” You never know whether that person you talked with over dinner or at a summer field trip might remember you down the road when you are applying for a job with their company. I’ve been told that the best geologists are the ones that have seen the most rocks. Alternatively, the geologist with the most rocks wins. I’ll add that the student that has talked with the most professionals wins. So get out there and make yourself known!

Student Involvement in AIPG - Is it worth it?

Adam W. Heft, CPG-10265

www.aipg.org
COVID has altered each of us in personal and professional ways but a pandemic has not weakened the commitment of the California Section to produce the 2021 AIPG Annual Conference on October 23-26, 2021. The California Section has been working diligently to bring students, young professionals and long-time AIPG members into their future destiny. The AIPG 2021 annual conference theme is, “Role of Geoscientists for Resiliency, Sustainability and Opportunities in the Changing Environment.” Sacramento, California is the host city and the surrounding area is spectacular. It includes the magnificent Sierra Nevada Mountains, Lake Tahoe, Sonoma and Napa vineyards and wineries, Pacific Ocean shorelines, and America’s western source of nuts, fruits and vegetables. These great attractions are within easy driving distance of our conference location. California is experiencing a high frequency of extreme temperature and precipitation conditions which has challenged the state’s water resources, created geohazards, impacted where we grow the nation’s food and is developing vulnerabilities along our flooding coastlines. Other sustainability challenges exist in the Golden State, the state with the most complex water management strategy in the U.S. Therefore, the potential opportunities for geologists to address these massive challenges are huge. Understanding the disrupting factors and learning about new geology-based solutions will help AIPG members to chart successful career pathways. Whether you are exploring new opportunities, future markets for your professional services or are trying to start your professional career, this conference will provide leads, information and ideas that you need to prepare for future work. We believe the geoscientist’s expertise has never been more important in solving our current challenges. Sessions will include new research, case studies and innovations in the field associated with resource development, geohazards, food and agriculture, energy, wildfires and deforestation, emerging contaminants and water supply. You will witness a round table panel discussing the expected 20-year and 80-year projected impacts and needed responses on the landscape and way of life in California in particular, and in the nation, more generally. The conversation will address what role geoscientists will need to fill now and into the future. Three of our field trips will include traveling through the birth of the Sierra Nevada Mountains, the California’s infamous water conveyance system including the Oroville Dam and Reservoir and a visit to the North Bay Wine country. A special set of mini-events will be creatively scheduled specifically for building skill sets and networking. The AIPG California section will arrange opportunities with internship and employment sources from agencies, consulting firms and businesses. Come and meet many different types of geoscientists at the Gold Rush Mixer that brings curious students and professionals together with a multidisciplinary group of seasoned industry personnel.

Come and meet the professionals that are building resiliency into our country’s resources, explore new career opportunities and learn about the latest tools and technologies used in geoscience today. Our response to changes experienced in our climate has motivated AIPG 2021 to address the challenges and develop future opportunities today. Geoscientists will come into the spotlight in Sacramento 2021. We look forward to seeing all of you at next year’s AIPG annual conference in Sacramento!

Co-Chair
Stephen Baker, MEM-2353

Co-Chair
James Jacobs, CPG-7760
AIPG President of the California Section
The Pegmatite Puzzle: Insights from Mineral Intergrowth Textures

My name is Emily Yoder and I am currently a junior at Central Michigan University, double majoring in Geology and Geography (Geographic Information Science concentration). I have been a student member of AIPG since Spring 2019 and am currently the CMU Student Chapter Secretary. During my sophomore year, I became involved in undergraduate research on mineral intergrowths in pegmatites with Dr. Sirbescu. My favorite parts of research have been learning new concepts and research methods, as well as growing as a writer. This past spring, I wrote a proposal for CMU’s Undergraduate Summer Scholars Program scholarship and grant, and was incredibly honored to receive this funding for my research for Summer 2020. My current goal is to attend graduate school to study volcanology, so I am thankful for this opportunity to learn important skills for my future. I highly recommend becoming involved in undergraduate research for any students who are considering it and am glad to be able to share my research here!

Pegmatites are intrusive igneous rocks of granitic composition with unique textural features. Notably, they can have coarse crystals of 2.5 cm to over 10 m in length and special mineral intergrowth textures. The cooling rate of pegmatites is debated because extrapolating the slow cooling rates for common intrusive igneous rocks to the coarse crystals found in pegmatites suggests an incredibly long duration of crystallization, perhaps as long as the age of the Earth. Some theories suggest that pegmatites formed by a long, slow cooling process. However, other models of pegmatite crystallization use geologic and experimental evidence to show that cooling actually occurs far more rapidly and at unusually low (undercooled) temperatures. As a familiar example, pure water can be placed in a freezer and undercooled to a temperature far below its freezing point and remain a liquid, then crystallize to unusual ice needles within seconds. Similarly, pegmatite-forming magma may cool below its typical crystallization temperature when it intrudes much colder host rocks (the freezer) and crystals with unusual textures may grow rapidly. While typical granites form around 700°C, studies have proposed that crystallization in pegmatites may occur as low as 400°C.

The key to solving this pegmatite puzzle may be found in a skeletal intergrowth between quartz and tourmaline, which has been the focus of the research I am currently working on with Dr. Sirbescu at CMU. We are studying samples from the granitic Emmons pegmatite in Oxford County, Maine. Emmons is about 260 Ma, rich in exotic lithium-cesium and tantalum minerals, and zoned, meaning mineralogy and texture varies distinctly from the outer edge of the pegmatite to its core. Crystallization begins at the outermost zones in contact with the surrounding host rock. The quartz-tourmaline intergrowth is found in the hanging wall zone, where tourmaline up to 45 cm long has grown towards the core, perpendicular to the host rock. This oriented ‘comb texture’ is especially visible in the field (Fig. 1). From these more ideal (euhedral) crystals, tourmaline continues to branch out into anhedral shapes, with each individual crystal like a tree and its branches. What is puzzling is that the tree “trunk” and branches are in optical continuity, so they are a single tourmaline crystal, best viewed in thin sections (Fig. 2). Quartz intergrows with the skeletal tourmaline branches. As they grow simultaneously from the magma, the two minerals seem to be competing for space.

Both tourmaline and quartz can also trap microscopic fluid and melt inclu-
bands are an important indicator of the stages of crystallization by color variations under the microscope (Fig. 2). These color quartz, and (2) single crystals have growth zones indicated its point of attachment towards its branching intergrowth with its widening shape clearly indicates direction of growth from of the pegmatite.

Melt inclusions are well-preserved in Emmons tourmaline and quartz, which is a good evidence that the minerals were growing rapidly (at disequilibrium). My objective is to extract and melt inclusions are significant because they indicate when melt was present during crystallization and may give clues about the melt’s composition. Numerous fluid and melt inclusions are well-preserved in Emmons tourmaline and quartz, which is a good evidence that the minerals were growing rapidly (at disequilibrium). My objective is to extract information from these inclusions about the composition, pressure, and temperature conditions during rapid crystallization of the pegmatite.

Tourmaline is especially important in my study because (1) its widening shape clearly indicates direction of growth from its point of attachment towards its branching intergrowth with quartz, and (2) single crystals have growth zones indicated by color variations under the microscope (Fig. 2). These color bands are an important indicator of the stages of crystallization and can reveal the relative timing of fluid and melt inclusions. For example, trails of inclusions that cut across growth zones were formed later than inclusions that stop at the edge of a growth zone, similar to the cross-cutting principle used for relative dating.

After initial qualitative observations, we started collecting microthermometric data to understand the temperature and pressure conditions during the pegmatite’s formation. Microthermometry consists of measuring temperatures at which phase changes take place in fluid inclusions during freezing-heating cycles on a microscope stage. For the Emmons samples, I carefully monitored the inclusions as I froze the samples down to about –100°C and heated them up to about 350°C. Essentially, the temperature data we obtained allows us to estimate the composition and density of the fluid trapped in the bubbles, as well as the temperature-pressure conditions during quartz-tourmaline crystallization. We can correlate this data with the locations of inclusions and propose a model for the pegmatite’s formation.

Currently, we are processing the raw fluid inclusion microthermometric data and have already found on average 415°C trapping temperatures for an estimated pressure of 300 MPa. That is very low, indicating that the pegmatite magma was highly undercooled in the hanging wall. Going forward, we are planning to collect qualitative and quantitative data from a continuous sequence of samples from the pegmatite border towards the core, in order to understand whether the processes and conditions were changing during crystallization. We hope to solve the puzzle of these unusual textures and present this research at a 2021 national or international conference.

References


COVID-19 Impacts to Academic Department Operations (Summer – Fall 2020)

This data brief examines the continued impacts on geoscience academic departments by the COVID-19 pandemic, including budgets, staffing and enrollments, promotion and tenure guidelines, and planning for the next academic term.

**Budget cuts**

Overall, budget impacts for 2020-2021 academic year were less severe than expected for most geoscience academic departments with 35% of departments reporting no budget cuts and 46% reporting cuts of 20% or less. Nearly half of departments that expected budget cuts early in the pandemic reported that cuts were as expected, while just over a third of departments reported less severe cuts than expected, and 16% of departments reported cuts that were worse than expected.

By June, 58% of geoscience academic departments reported no additional impacts to staffing, and by August, 93% of departments reported the same.

**Departmental staffing**

Most impacts to departmental staffing such as salary and benefits reductions, staff and faculty furloughs and layoffs occurred by the end of May 2020. Over the summer, some departments reported furloughs and reduced hours for staff.

In terms of faculty travel and field activities, in July, 65% of departments reported faculty on travel or in the field but by October this percentage declined to 44%. This decline is likely in part due to the resumption of classes during the Fall term. Most departments with faculty on travel or in the field reported travel was allowed to limited locations.
In addition, since May 2020, the percentage of departments reporting faculty not traveling or doing field work due to personal decisions increased from 13% to 29%. Since June, the percentage of departments reporting restrictions on travel and field activities from government policies declined, while the percentage reporting restrictions from departmental or institutional policies fluctuated between 18% and 37%.

**Changes to promotion and tenure guidelines**

Responses from departments and faculty were pooled to better understand what changes, if any, are being made to promotion and tenure guidelines to address the impacts from the pandemic on faculty productivity. Just over half of academic departments (53%) reported to have changed their promotion and tenure guidelines. Of those departments who changed their guidelines, 81% allowed for promotion clock extension, usually of a 1-year duration. Two-thirds of departments offering promotion clock extensions required faculty to request the extension while 23% automatically applied the extension to tenure-track faculty, and 12% of departments did not specify the extension condition. Other changes to the promotion and tenure guidelines included eliminating teaching evaluations during the pandemic, with most departments providing faculty with the option of disregarding Spring 2020 student and teaching evaluations, and the inclusion of pandemic impact statements on promotion reviews.

Of the faculty who reported that their departments changed the promotion and tenure guidelines, 13% opted to take advantage of the changes. The most common change that was requested was promotion clock extensions.

**Enrollments**

In October changes in enrollments relative to last academic year both at the institution-wide level as well as within the department were canvassed. Over half of departments reported that enrollments were lower than last year at their institution, while 45% of departments reported enrollments were similar to last year in introductory geoscience courses, labs and geoscience majors. Nearly one-quarter of departments reported increased enrollments relative to last year at their institution, while the percentage of departments reporting increased enrollments within the department ranged from 18% in geoscience majors to 31% in introductory geoscience courses.

**Planning for the next term**

Institutional planning for the next academic term has increasingly focused on the use of three in-person instructional formats: limited class sizes, social distancing, and altered
schedules (i.e., early start, early end, or split in-person/online) along with the use of online instruction to provide for the continuation of instruction over the current academic year. In October, over half of geoscience departments reported plans for using these three in-person instructional formats for the next academic term (61% limited class sizes, 58% social distancing, and 56% altered schedules), while 30% of departments reported plans for online only instruction for at least some of their courses.

If you are interested in reading more AGI’s Geoscience Currents bulletins about COVID’S affects on business, AGI has also posted COVID-19 Impacts to Geoscience Businesses (Summer – Fall 2020) which can be found with other bulletins on the trends in the geosciences at AGI’s website.

To find the bulletin above go to: https://www.americangeosciences.org/geoscience-currents/covid-19-impacts-geoscience-businesses-summer-fall-2020

There is also an option to subscribe to the bulletins to receive them directly.

Much of this can be attributed to the decline in the percentage of departments reporting concerns that were extremely driven by COVID-19 over workplace safety (60% to 40%), the ability to attract and retain students (17% to 3%) and an increase in those reporting concerns that were extremely driven by COVID-19 for the ability of the department to adapt to new teaching methods (23% to 30%).

We will continue to provide current snapshots on the impacts of COVID-19 on the geoscience enterprise throughout the year. For more information, and to participate in the study, please visit: www.americangeosciences.org/workforce/covid19

Funding for this project is provided by the National Science Foundation (Award #2029570). The results and interpretation of the survey are the views of the American Geosciences Institute and not those of the National Science Foundation.
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