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Understanding of Aquifer Systematics Can Aid Water Planning and Policy
W Peter Balleau, CPG-2716

Implementing Stealth Education in the Geosciences – Part 3
James F. Howard, Ph.D., CPG-2536

Underground Natural Gas Storage and the Future of Carbon Sequestration
James L. Gooding, MEM-3070

On the Cover: Photo Challenge Winner: Why I Became a Geologist: Greg McKelvey, CPG-7448, captured the sedimentary rock textures and diagenetic oxidation along Lake Powell that tell stories from the past.
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.

American Institute of Professional Geologists (AIPG) is the only national organization that certifies the competence and ethical conduct of geological scientists in all branches of the science. It adheres to the principles of professional responsibility and public service, and is the ombudsman for the geological profession. It was founded in 1963 to promote the profession of geology and to provide certification for geologists to establish a standard of excellence for the profession. Since then, more than 12,000 individuals have demonstrated their commitment to the highest levels of competence and ethical conduct and been certified by AIPG.

For AIPG news and activities go to www.aipg.org.
Participation and Outreach

Adam W. Heft, CPG-10265

Time has flown by, and although it is only mid-August, this is my last column for 2021. It seems strange to be looking forward and planning for the next year’s editions already, but this year has been very busy. Between renovating and maintaining a pair of houses, serving as National Editor and a Section Editor, and working a day job, my schedule has certainly been full.

This edition of TPG brings 2021 to a close. The cover photo of this edition is the last of the 2020 Photo Challenge Entry winners; don’t forget we are running the contest again this year. We would love to see your best shot(s); send them to aipg@aipg.org prior to November 1, 2021. This year’s photo categories are: Scenic Wonder, Geologic Disaster, Geologists in Action, and Environmental Impact. Rules for the photo challenge can be found on page 15 of this issue. I’d like to see YOUR winning photo entry on the cover of one of the 2022 editions of TPG!

As you know, the 2021 elections have been held, and the winners announced for the next slate of officers. The incoming officers are also identified in this issue. If you know any of these individuals, and if you have not yet done so, please congratulate them on their election to AIPG office; their willingness to commit their time to service to the Institute says a great deal and should not pass unnoticed.

This edition of TPG features technical articles on aquifer systems’ impact on water planning and policy, and another on underground natural gas storage and carbon sequestration. You can also find the latest installment on Stealth Education by Jim Howard as well as Tales from the Field.

Speaking of Stealth Education, what other modes of outreach are our members using? I’d like to hear what kinds of outreach our members are using. Have they been successful? How many people did your message reach? Drop me a Letter to the Editor so others can learn what else is being done, what works, and what doesn’t.

By the time you are reading this message, the 2021 Annual Meeting will be right around the corner. The California Section is hosting the meeting in Sacramento, and I for one, am looking forward to attending another Annual Meeting, particularly since we were unable to hold the meeting last year. I have been a member since 1998 (for those counting, that is 23 years). I attended my first Annual Meeting in Milwaukee, Wisconsin in 2000; how many of you remember that meeting? At that time, I knew virtually no one in the organization, but was determined to get to know some of my peers. I recall that I had signed up for a mixture of field trips and technical sessions and I believe, a short course, as well as the sponsored evening events each night. One of the members that I attended several events with had a piece of advice for me: always leave one night of the meeting open to go out and explore on your own. I recall that on the night that he and his wife were going out, they went to a local establishment called “The Safe House”. For those interested, the place had a James Bond theme, and my companion thoroughly enjoyed it. Unfortunately, I wasn’t able to join them since I had signed up for a brewery tour that evening. All these years later, I have remembered that piece of advice and have either left one night open or added additional time before or after the Annual Meeting to explore the area and take a bit of vacation. I have only missed two of the Annual Meetings since that first one – 2001 and 2003. While attending the conferences, I’ve met many members, and there is a group of people that I look forward to seeing every year and catching up with. They are more than just members I know; they have become good friends, and I have great respect for them.

Speaking of attending conferences, for those of you that are presenting in one of the technical sessions at the Annual Meeting or even another conference, have you considered preparing a technical article for publication in TPG? Submit a parallel article to share your topic with more people. Remember that the Student Issue is the next TPG edition, and students would certainly like to know about what our members are doing and the kinds of things that they might expect when they join the workforce. Send us an article describing “a day in the life of a geologist” in whatever discipline you work in. Likewise, students, our members are interested in what you are up to. What kind of research are you conducting? Is anyone working with cutting edge technology or on some new aspect of an old problem? How is your research benefiting society? What is it like coming back to in-person classes after a year of online learning? Tell your story here – this is another aspect of outreach. I will be sending out a reminder email requesting articles for the Student Issue; articles are due by November 1st.

ARTICLES WANTED!

The 2022 TPG Student Edition is coming this January!

We invite technical writings, student voice, learning experiences, student advice, field camp information, student chapter activities, K-12 topics, and more.

Submission deadline: November 1, 2021
send to: aipg@aipg.org
2022 National AIPG Executive Officer Election Results

“As President-Elect, I plan to carry out activities to enhance the value of AIPG. These will include support for section activities, opportunities for student mentoring and webinars, and continued advocacy for the geologic profession.”

2022 National President-Elect
Dawn Garcia, CPG-8313
Tucson Arizona

“To advocate for the profession of geology, to promote ethical conduct, and work towards accomplishing strategic objectives. To support and encourage young professionals and students in taking an active role in AIPG.”

2022 National Vice President
Anne Murray, CPG-11645
Stuart, Florida

“My vision as an AIPG national officer is to integrate the existing work of supporting recent graduates, student chapters and young professional initiatives with a push to identify and recruit existing professionals not currently members of the institute. In doing so the intent is to grow the pool of mentors available to the student and young professionals.”

2022-2023 National Secretary
John Sorrell, CPG-11366
Albuquerque, New Mexico

“My goal would be to help students and young professionals entering the workforce, and small universities connect with AIPG.”

2022 National Early Career Professional
Hannah Blaylock, ECP-0679
Christiana, Tennessee
Greetings Rasoul,

I just read your article in The Professional Geologist and am compelled to thank you. This has been a subject on my mind since the early days of the pandemic, and has led me to attend international symposia on the subject of the future of the geosciences. In fact, last year I helped develop an AGI survey that was distributed to member societies leaders. I understand the survey results are presently being analyzed. The scope and content of your article was spot on and should be paramount on the minds of geoscientists. I sincerely appreciate the thought/energy you invested in this important article.

Best regards,
Jonathan Arthur, Florida State Geologist

Greetings Jon,

This is indeed very nice of you to comment on my recent article.

It took some time to conduct the survey and synthesize the results in that article, but as you kindly note, it summarizes the major trends and needs in geoscience research. (The previous and current editors of The Professional Geologist were both supportive of the article and its timeliness, for which I am indeed thankful).

Thanks for drawing my attention to the AGI survey; I have not seen it, but I did read the 2020 AGI report (which I also referenced in my article).

Many thanks again for your note and email; your comment is much appreciated.

Best regards,
Rasoul

Hi Adam,

I enjoyed your intro article in the latest TPG. Regarding Whitefish – I used to be the “belligerent one”... to an extent. I always wanted to go above-and beyond. To this day, I find our country’s tort-based risk management system prevents folks from taking risks at any level and reaping the consequences. It seems to have gone way too far. Today’s restrictions too often limit where we can go and what we can do – in a certain way it limits OUR EXPLORATION. I believe the safety pendulum has swung too far.

At Whitefish – if I was by myself – I would’ve gone over the fence to remove the cairns. And I’d been the one to tell the folks (politely as possible) to get out of my photo. But I might also be the one – if no others were there - to dip under the falls. But I’m also the one that almost always has a plastic bag to pick up others left-behind trash – “leave it better than you found it”!

As I said – if I were alone - my wife often keeps me in check. But I get loose once in a while and love to EXPLORE!!!

Mark Schaaf, CPG 10723

Dear Editor,

I found the student essays outstanding. I’m so glad that these students have found the passion that brought so many of us “Old timers” into geology careers that we would not change if given the chance to do it all over again. I am also gratified at the number of young women entering our field-I could never understand why you would not encourage more than half the population to pursue the same career you love.

Terry Stransky, non-member

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Start making your travel plans for the 59th National Conference to join us in August 2022 in Marquette, Michigan on the beautiful shores of Lake Superior.

Michigan’s upper peninsula features rare geologic formations, copper country, a rich mining history that continues today using state-of-the-art methods, and summertime family friendly activities.

We invite you and your family to spend a week or more of your summer in northern Michigan reconnecting with fellow geologists, learning from local experts, and sharing in the fun of the annual meeting!
American Geosciences Institute Announces Dr. Jonathan Arthur as New Executive Director

MEM-0932, Tallahassee, Florida

From AGI news

ALEXANDRIA, Va. – The American Geosciences Institute (AGI) is pleased to announce the appointment of Dr. Jonathan Arthur as its new Executive Director. He will be joining AGI on August 1, 2021. Dr. Arthur comes to AGI from the Florida Geological Survey, where he most recently served as Director and State Geologist.

“Geoscience expertise is needed to address many societal issues, including climate change, the energy transition, infrastructure, and water and mineral resources. At the same time, we face a shortage of geoscientists entering the workforce, and we have work to do on the social justice front,” Dr. Arthur said upon accepting the appointment. “I am both thrilled and honored to join the AGI team in this time of transition and opportunity, and I look forward to working with geoscience societies on these issues.”

“Dr. Arthur brings to AGI a wealth of leadership experience and vision to the geosciences,” notes AGI President Dr. David R. Wunsch. “His innovations at both the state and national levels have long served to advance the geoscience enterprise. Dr. Arthur was selected from among an excellent slate of candidates, which is a reflection of the high regard that exists for AGI within the geoscience community and beyond.”

“Dr. Arthur is a positive leader with a passion for advancing the geosciences,” adds current AGI Interim Executive Director Sharon Tahirkheli. “We are excited to see him take the helm at AGI and are confident that the Institute under his leadership will be well positioned to thrive in the years to come.”

Serving as Director of the Florida Geological Survey since 2009, Dr. Arthur has emphasized business strategy, fiscal planning, communications, applied geoscience, data access, innovation, and survey sustainability. While at the survey, he played key roles in a variety of scientific, management, and leadership positions, and often advised state and federal programs, as well as service on the Water Science Technology Board of the National Academies of Sciences, Engineering, and Medicine.

Dr. Arthur has served the geoscience community in leadership posts as President of the Association of American State Geologists and President of the Florida Association of Professional Geologists. As a former member of the AGI Board of Directors, he served on various committees, including the Strategic Outlook Committee.

Dr. Arthur has received recognition for research, leadership, and public service from geoscience organizations including the Geological Society of America and the American Institute of Professional Geologists. He earned his Ph.D. from Florida State University in 1994.

Allan Schappert Named to the MAPTEK Hall of Fame

CPG-11758, Chandler, Arizona

Stantec press release, provided by Dawn Garcia

Allan started in the mining industry more than 40 years ago, as an exploration geologist then an underground mine production geologist.

After encouragement from his wife and a desire for warmer weather, he moved to Freeport where he was the team lead who introduced Vulcan into the Freeport Indonesia operation.

He left there to use Vulcan for resource estimation at the developing Turquoise Ridge mine in Nevada.

After Gretchell was purchased by Placer Dome, Allan worked for Harry Parker at MRDI and was using Vulcan to build resource models throughout North and South America.

In 2001 Allan moved to the Stillwater Mine in Montana and took responsibility for developing resource models for both mining complexes in production. In 2005, Allan left Stantec Consulting, and is using Vulcan on mining projects located around the world.

Dan Eyde Named SME Fellow

CPG-07647, Tuscon, Arizona

From Mining Engineering News, provided by Dawn Garcia

Daniel T. Eyde is the chief technology officer of St. Cloud Mining. He has a B.S. and B.A., and started as a geological engineer at the University of Arizona, where he became an SME student member. He served in the U.S. Marine Corps, reaching the rank of sergeant. He is a registered professional geologist in Arizona and has written extensively on industrial minerals. In 1981, he cofounded GSA Resources Inc., acquiring it in 1999. GSA merged with Zeox Corp. in 2007 and was acquired by St. Cloud Mining Co. in 2010. Eyde became chief technology officer, then president through 2017. From 2011 to 2016, St. Cloud worked on the cleanup of the Fukushima nuclear reactor in Japan.

Eyde received the SME Industrial Minerals & Aggregates Division’s Outstanding Young Scientist Award in 1989 and the Mining & Exploration Division’s Ben F. Dickerson III Award in 2020. He is an AIPG CPG and an SME founding registered member. Serving in SME, Eyde worked his way up from section chairman to the board of directors and vice president of finance. He serves on the governing council of the International Natural Zeolite Association. He holds two patents.
Colorado Section News

Colorado Science and Engineering Fair (CSEF)

from The Colorado Professional Geologist Summer 2021
Stephanie Ashley

In April, AIPG again participated in the Colorado Science and Engineering Fair (CSEF). AIPG presents special awards to outstanding middle and high school students completing projects related to geology.

The fair was cancelled in 2020 due to the Covid pandemic and this year looked a little different than normal. Instead of meeting at Colorado State University in Ft. Collins, the fair was held remotely and students met with judges through a virtual platform. This year’s judges were Stephanie Ashley, Joe Brinton, and Celine Gill. The competition was stiff! In past years, judges were able to wander around the conference hall and peruse the projects before selecting students to interview. This year, judges were able to view the project displays online before scheduling virtual interviews with individual students over the course of two days. Awards are based on the projects’ value to science and society, complexity, relation to geology, and the ability of students to present their work and answer questions.

After much deliberation, AIPG’s top award for the high school division was awarded to Maria Alder and Riley Carpenter for their project titled “Water Desalination: Crystallization of CaCO3 out of Saline Solution onto Plastic Polymers.” These two students are working to improve the process of water desalination by studying new materials to use in filtration systems that will maximize crystallization of salts while minimizing scaling. Alder and Carpenter demonstrated an impressive knack for explaining intricate topics and answering difficult questions. Their clear communication imparted their vision of why this project is so important. They tested a variety of plastic polymers with different surface textures and performed a complex statistical analysis to determine which showed the most promise for desalination systems. They have plans to expand upon their research and hopefully develop more cost-effective, efficient water purification systems that will benefit people all over the world.

The runner up in the high school division was Alden Kruse with his project titled “Something In The Water: Creating an Origami Microfluidic Device for Developing Communities.” Kruse’s passion for his project was contagious. He is trying to create a low-cost, efficient way to test for arsenic in the water, particularly for developing countries. He used folded papers imprinted with chemicals to test for arsenic.

The folding of the paper creates microfluidic channels as liquids wick through by capillary action. He evaluated a number of shapes for the paper device as well different waxes, papers, and fabrication processes to imprint the chemicals into the paper. Kruse also developed a method of using a cell phone camera to map RBG values onto an XYZ graph to remove some of the subjectivity in reading results.

Kruse is working on creating a similar device to test for other chemicals in the water as well. He hopes to work with a manufacturer to produce these low-cost, sensitive, and accurate water testing devices.

In the middle school division, Keane Hammond took the top spot with his project “The Drowning Machine: The Danger of Low Head Dams.” Low head dams can sometimes draw objects toward them and pull them under the water. Hammond built a model dam to help estimate the ratio between head height and flow rate that can create dangerous conditions around low head dams so that modifications can be made to improve safety. Whitewater parks might also be able to use this information to detect when whitewater features might present danger. Hammond’s model dam took a lot of ingenuity and this was a unique project. He is also a very polished presenter who wasn’t stymied by difficult questions.

Eva Norton and her project, “Sediment Movement” took the runner-up position for the middle school division. Norton also put her construction skills to use with her project. She wanted to evaluate how the slope of a river affects the amount of erosion in the streambed. Norton constructed a model riverbed and filled it with sand. Then she tested the amount of erosion that occurred at differing slopes.

She based the slope values that she tested on the slope of the Colorado River at various points. Norton was interested in this project because as a whitewater rafter, she wants to understand how we can maintain and improve the health of our rivers. She discussed other aspects of river morphology that need to be tested going forward.

All of these students were exceptional. The students who didn’t win the special award were outstanding as well. Seeing what these young people are capable of is inspiring. Our future will be in good hands with them.

Florida Section News

End of Session Report from FAPG Lobbyist Natalie Kato

from the Florida Association of Professional Geologists (FAPG) / Florida AIPG Section June 2021 Newsletter

The 2021 Florida Legislative Session adjourned at approximately 2:40 pm on Friday, April 30th. This was one of the earliest Sine Die times in recent memory, in a session that was in some ways, the least productive: of the 3,140 bills filed this session, only 275 passed both chambers. The $101.5 billion state budget, given a boost with almost $10.2 billion in federal stimulus money, included a pay bump and $1,000 bonus for public school teachers, $36 million to overhaul the state online unemployment portal, major environmental and water quality projects, and a cross section of local projects.

Continued on p. 11
Understanding of Aquifer Systematics Can Aid Water Planning and Policy

W. Peter Balleau, CPG-2716

Abstract

Technical methods can promote safe planning and policy for aquifer development projects. These methods have long been applied to calculate the area of surface water capture supporting pumping from new wellfields. The foreseeable capture of responsive surface water is the final source that offsets the stress of well development and leads to sustainable pumping. Such classical methods address the risks of wells going dry or of beneficial water being left unused. Simplified alternative methods involving footprints or indexes of recharge to pumping are unable to reveal the possibly undesirable outcomes.

Keywords: Aquifer Sustainability, Capture, Water Policy, Area of Influence

Introduction

Water-planning agencies often request hydrogeologists to determine sustainable aquifer conditions. However, our answers vary. There seems to be no handy rule-of-thumb for assessing aquifer sustainability. Simplifications such as to “pump the recharge” fall short, and overall effective aquifer use and forecasting remains elusive. But effective policy on aquifer use and impacts is increasingly sought, and stands as an issue of critical importance, given that groundwater is the material extracted in highest volumes from the Earth’s crust and is used as the primary source of freshwater by over two billion people (Zektser and Everett, 2004).

Despite the challenges, the basic systematics of the response to a new stress in aquifers are well-established. Groundwater use is eventually balanced by capture of adjacent surface water sources that offset the pumping amount, while pumping rates are limited by practical pumping water levels (Theis 1940; Lohman 1979; Konikow and Leake 2014). This commentary focuses on the critical role of the wellfield’s area of influence. The area necessarily expands until it incorporates adjacent surface water sources that offset the stresses imposed by the users of a given wellfield.

The core items of concern to water policy and planning commonly include:

a) the practical amount of wellfield withdrawal for use,
b) the wellfield area of influence,
c) the change in aquifer water levels, and
d) the surface water impacts.

Aquifer dynamics require a physical response to the stress caused by pumping. An expanding drawdown cone releases water from storage (aquifer depletion) while the cone generally expands radially from the well toward any hydraulically-connected boundary features. Those boundaries are where the groundwater and surface water intersect. The altered flux at the boundary features is called capture or surface water depletion. The majority of well abstractions are expected to be sourced in the long term by captured surface water (Konikow and Leake 2014). Declining water levels do not necessarily imply “overdraft.” Some decline is a necessary part of the transition toward a rebalanced system.

A possible constraint on drawdown is the practical pumping water level (PWL). That limitation can arise from economics, well construction, or the shallow floor of the aquifer. Wellfield yields decline if a PWL constraint is reached. Declining yields also do not necessarily imply “overdraft.” Sometimes, a new steady state is pending at lower pumping rates.
The net benefit to the many water users of a given aquifer lies in access to the volume of water produced from the transitional period when aquifer storage contributes to basin yield and from the benefit gained from distributed wells that access water offset from distant sources without bearing the cost of transport. Hydrogeologic information also benefits planning by alerting users to situations where established pumping trends must decline before reaching sustainable, though lower, water levels.

**Historical Benchmarks**

Hydrogeologists have sought to communicate these principles for generations. Theis (1940, p. 277) wrote that “recharge is governed (1) by the rate at which water is made available... by the flow of streams, or (2) by the rate at which water can move vertically downward through the soil to the water table.” Theis also discussed the availability of “rejected” recharge, which is added to groundwater where space is made available in formerly waterlogged areas. For a time, our science applied analytical models (Theis 1941; Glover 1974) to calculate surface water depletion rates. These days, numerical models such as MODFLOW (Harbaugh, 2005) represent those governing factors laid out by Theis.

Franke and Reilly (1987) reported on the effects of alternative boundary conditions for the generalized flow domain of aquifers and surface water. They showed that aquifers are “open” systems, with new water added to the aquifer under the stress of development. It is revealing to see in their experiments the large portion of well production supported by newly-induced water, rather than from the baseline of “old” recharge moving through the aquifer. They show clearly that pre-development “natural” recharge is unaltered by development processes, either in advancing or retarding an eventual balance. Knowing recharge is of no help to the core questions (items a–d, above) of concern.

Where the attractive simplicity of the policy to “pump the recharge” persists as guidance for planning (such as in the Western Water Policy Review Advisory Commission 1998; or in the European Commission 2009), then wells and streams might incidentally sustain, but they also run the risk either of going dry (where PWL is limited), or of beneficial water resources potentially going unused (where abundant boundary sources are available). Thus, to simply pump the recharge does not control potentially undesirable outcomes.

The time required to approach a new balance with boundary sources might range across many orders of magnitude for various settings. As a rule, wells in Quaternary alluvium near mainstem rivers can be assumed to stabilize quickly, whereas wells in thick basins hundreds of kilometers from surface water (e.g., Thar Desert, High Plains) can be expected to drawdown for centuries and are likely to reach a PWL limit that requires declining (but not zero) future system yields. Between those extremes on the spectrum of distance, effective planning seeks some forward-looking calculations. Historical success in this effort has been seen by way of the approaches outlined below.

**Hydrogeologic Procedure for Policy Support**

The area of influence of a well-field expands at a rate depending on aquifer diffusivity (the ratio of transmissivity to specific yield), time, and the boundary locations encountered.

Six parameters suffice for addressing the hydrologic conditions of concern. Existing information or serviceable estimates are widely available on the following:

1. the map layout of interrelated water features,
2. the available surface supply for potential capture,
3. the vertical conductance of aquifers below streambeds,
4. targeted pumping rates from wells or wellfields,
5. aquifer diffusivity, and
6. practical pumping water levels (PWL) in wells

The scope of these general elements to be examined is outlined here. The technical approach is to be fitted to specific cases. The first task is to inventory the surface-water available to capture.

- Begin with mapping the aquifer, wellfield and stream reaches, springs, wetlands, and evapotranspiration (ET) areas in a region centered on the wellfield.
- Then, estimate the base flow, ET, and the rejected recharge amounts available for each surface water feature. Allow for past and committed depletions.
- Categorize each surface water feature as water-limited or vertical-conductance limited to avoid overstating supplies.
- Project the wellfield pumping rate to define the stress to be balanced. Pumping rate may grow, remain steady, or decline with time.
- Accumulate the availability of capturable water at the water features in radial order of distance from the wellfield to identify the set of nearby features that prospectively balance the pumping rate.

Where the groundwater conditions are part of the question, then the aquifer hydraulic properties must be investigated:

- Aquifer transmissivity and specific yield (i.e., the aquifer diffusivity).
- Calculated or simulated time for the radius of influence to enclose the maximum radius of capturable supply.
- Similarly, calculate or simulate the drawdown pattern. [These tasks can be done numerically or very simply in accordance with Cooper-Jacob (1946).]
- Plot the contours of drawdown inside the radius enclosing the offsetting sources.
- Estimate the practical PWL for wells in terms of drawdown below static (non-pumping) water levels. Reduce pumping-rate targets if the expected drawdown exceeds constraints on PWL.
- Calculate the time for the system to approach balance as the cone progressively deepens and depletes the set of offsetting sources. The time to approach balance is orders of magnitude longer than the time for the cone to reach the features.

This second sequence of ground-water tasks is best done with numerical models, but the Theis (1941) and Glover (1974) papers give analytical formulæ. At this point in the technical approach, the planning questions (a–d, above) can be addressed.

Finally, hydrologists might assist the planners to manage other basin-wide objectives such as downstream obligations, waters required for habitat or ecological needs, salt management or other issues, and to design a policy for managing the overall impact of depletion (i.e., water replacement, augmentation, control levels, retirement of rights, reduced pumping).
This general procedure has been applied for decades. A great many places have advanced models that facilitate integrating the above steps. There are historical examples of decision support using analytical methods that have been borne out by later post-audits of data and by repeat models. Examples include the intensively-studied Gnangara aquifer for municipal supply in Western Australia (Balleau 1972) and the equally significant Albuquerque Basin wellfield in New Mexico (Reeder et al. 1967). The conditions anticipated for both were initially projected using analytical calculations. The early projections were verified decades later (Vogwill et al. 2008; McAda and Barroll 2002). Seward et al. (2014) provide case studies of applying the radius of influence for planning purposes.

Hydrogeologists can support water planning and water policy with projections that answer the important questions. They have done so. It is critically important to recognize that distant areas of the aquifer, the basin, or the hydrologic system outside the quasi-radial area of influence do not contribute to restoring balance.

Current efforts sometimes apply simple measures such as footprints (Gleeson et al. 2012) or indexes of recharge to pumping (Scanlon et al. 2012). Those approaches cover large aquifer and drainage basin areas not focused on the area of influence of wellfields. Where the stress is not tied to the adja- cent supply available to respond via capture, then those efforts must mislead. Safe outcomes require plans that account for the location of wellfield stress and the corresponding area of hydrologic response. Footprints and indexes might have a role to play when tied to the availability of supply to be captured inside the limited area of response to a specific wellfield stress. The useful comparison is between withdrawals and available capture within a responsive distance, not between withdrawals and the natural recharge to the entire aquifer or basin area.

Conclusions

1. Aquifers display systematic responses to the stress of development. These responses can be anticipated for use in basin water planning and policy.

2. Critical concerns involve the dewatering of the aquifer and the depletion of interrelated surface water and wetlands as a foreseeable effect of beneficial use of aquifers for water supply.

3. This technical comment is offered to promote further thinking about the ways that hydrogeologists address or aid in answering questions of aquifer policy and planning. Attention is directed toward understanding the radial area that encloses surface water features balancing wellfield withdrawal.

References


Glover, R. E., 1974, Transient Ground Water Hydraulics: Department of Civil Engineering, Colorado State University, 413p.


Despite the low overall number of bills passed this session, the Governor, as well as leadership in both the House and Senate, were able to pass many of their top priorities. The Governor’s “anti-riot” bill, HB 1, passed early in the session, as did lawsuit immunity for business from COVID-related claims. A long-awaited update to the Seminole Gaming compact was also a top priority of the Governor’s, and will likely be ratified in a special session that begins the week of May 17th. On the legislative side, Senate President Wilton Simpson achieved his goal of passing an update to agritourism, while Speaker Chris Sprowls successfully passed legislation to combat the effects of sea level rise, and a bill to allow home-based businesses to operate without local government regulation. Other high-profile bills that passed included an overhaul to the state elections code, a bill aimed at regulating “big tech” social media companies, a bill to allow home-based businesses, and insurance reform. Notably, priority legislation related to data privacy failed to pass, after significant pressure from business groups.

For FAPG, this was a hugely successful session. The details are outlined below.

Legislative Review of Occupational Regulations-FAILED

SB 344/HB 471 required that the legislature, over the next five years, review the regulations and licensing structure associated with a wide swath of regulated professions in the state, including PGs. The original version of both bills would have repealed Chapter 492 (regulating professional geologists) on July 1, 2025, unless the legislature acted before then to enact legislation allowing the profession to continue. Other professions, including landscape architects, architects, and engineers, were also subject to the same timeline. This bill was not heard at all in the House, but did receive one hearing in the Senate. During the Senate hearing, an amendment was adopted that required that all professions in the bill be reviewed by 2026, but did not require the legislature affirmatively pass a bill in order for the profession to continue to be regulated.

This amendment was widely supported by groups affected by the bill (including the design professions).

The legislative review of occupations will likely continue to be a priority for Speaker Designate Paul Renner (R-Palm Coast), and will almost certainly return next year.

Petroleum Restoration Program Funding: $125 million in total program funding

During the initial round of appropriations, the legislature appropriated $75 million in funds from the Inland Protection Trust Fund to the program. During the budget conference process, the budget chairs (Senator Kelli Stargel and Representative Jay Trumbull) agreed to put another $50 million into the program. These additional funds came from the federal stimulus money and are non-recurring.

From the Florida Geological Survey

In case you missed it, Florida Department of Environmental Protection’s (FDEP’s) Florida Geological Survey (FGS) has improved access to geoscience data and information through delivery of online maps and datasets, including lithologic and geophysical records.

The Geologic Data Enterprise System (GEODES) offers a cloud-based solution that allows users to drill down into the data by visiting the online interface, or by visiting its associated online map. Upon loading the map, zoom in to view thousands of points representing samples archived in the FGS Geologic Collections Facility. Click on a point and scroll down to select links to additional data, including lithologic descriptions and geophysical logs.

The FGS team is still working to bring forward legacy lithologic data, such as the typewritten descriptions from the 1980’s and earlier. For access to these older descriptions, visit our “Greenbooks” page and search by county and well number. Links to the scanned notebooks are found in the “Volume” column.

Thanks to matching funds from the U.S. Geological Survey - National Geological and Geophysical Data Preservation Program, scans of field notebooks dating back to 1906 are also available, as well as a library of images of geologic information, locations and activities within the FGS ResourceSpace. The latter website recorded more than 1.3M image visits in the last 12 months.

Not everything the FGS accomplishes is published, however, it is indeed useful. Among these resources are FGS contract deliverables, including those we receive and those we produce. You are invited to visit our webpages that provide access to coastal-related reports and reports related to Florida’s aquifer systems (including aquifer storage and recovery), geomorphology and land-based geophysics.

Finally, the link (https://floridadep.gov/fgs/data-maps/content/fgs-geologic-data) provides access to three dozen GIS datasets including potentiometric maps, aquifer vulnerability, STATEMAP geology, subsurface maps, and more. Happy data and information mining!
The 2022 AIPG Awards Committee is seeking nominations for future recipients of the Ben H. Parker Memorial Medal, the Martin VanCouvering Memorial Award, the John T. Galey, Sr. Memorial Public Service Award, and Honorary Membership. The qualifications for these awards can be found below. Nominations for these awards, accompanied by supporting statement, should be sent to AIPG Headquarters, c/o Honors and Awards Chair, 1333 W. 120th Avenue, Suite 211, Westminster, Colorado, 80234-2710.

BEN H. PARKER MEMORIAL MEDAL

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

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

MARTIN VAN COUVERING MEMORIAL AWARD

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

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

AWARD OF HONORARY MEMBERSHIP

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

JOHN T. GALEY, SR. MEMORIAL PUBLIC SERVICE AWARD

The American Institute of Professional Geologists’ Public Service Award was established by the Executive Committee in 1982 in recognition of one of its primary purposes: service to the public. In 1992, it was renamed the John T. Galey, Sr., Memorial Public Service Award, in posthumous honor of our fourth President, whose long professional career was a continuum of service to both the geological and the general public.

Recognition of public service is important because so many Members have distinguished themselves and the Institute by giving expert testimony to governmental commissions and committees, and by providing geological expertise where it was needed by the public at large.

The application of geology to the needs of the general public may be in many different forms. Recipients of this award have outstanding records of public service on the national, state, or local level well beyond their normal professional responsibilities.

JOHN STEWART MEMORIAL EARLY CAREER PROFESSIONAL AWARD

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

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

OUTSTANDING ACHIEVEMENT AWARD MAJOR CONTRIBUTION TO THE PROFESSION

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

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

Nominations may be made online, e-mail, or fax by January 15, 2022.

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

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

The AIPG Section Leadership Award is administered by the Executive Committee of AIPG. The selection of the winning member(s) will be decided by the AIPG Awards Committee. The deadline for submittal of nominees for the AIPG Section Leadership Award, to AIPG National Headquarters, is January 15th of each year. The nomination form for AIPG Section Leadership Award is presented below. The awardees will be announced in April so they may attend the annual meeting.

AIPG Section Leadership Award Nomination Form

https://aipg.org/sectionleadershipaward

Name of Candidate: ___________________________ Section: ___________________________

Address: ____________________________________________

Telephone Number: ___________________________

Fax: ___________________________

E-Mail: ___________________________

Name of Person Making Nomination: ___________________________ Section: ___________________________

Address: ____________________________________________

Telephone Number: ___________________________

Fax: ___________________________

E-Mail: ___________________________

Date: ___________________________

Signature: ___________________________

Supporting Statement (In brief here, but please attach a detailed letter of support) ___________________________

Return to: AIPG
Awards Committee
1333 W. 120th Avenue, Suite 211
Westminster, Colorado 80234-2710
or E-mail to aipg@aipg.org

DEADLINE: Completed nominations must be received by January 15, 2022.
The Foundation of the American Institute of Professional Geologists needs your financial support. Every donation helps the Foundation to contribute toward building the future of geology. The Foundation supports a variety of programs of the AIPG that includes student scholarships, student and early career workshops, internship funding, educational programs aimed at practitioners, the public, and policy makers, and some special needs requested by AIPG or other professional organizations. The Foundation is proud to serve AIPG and the geosciences by providing financial support for these programs. If you have any questions or comments about the Foundation, please contact me or any of the other Trustees of the Foundation for additional information.

Donations may be made by check payable to The Foundation of the AIPG and mailed to 1333 W. 120th Ave., Suite 211, Westminster, CO 80234-2710 or pay by credit card on the AIPG web site.

Be sure to check the Foundation web page on the AIPG web site https://aipg.org/page/Foundation for information about the Foundation, on awarded student scholarships, and for the list of our generous donors in 2020. Your continued support is greatly appreciated.

Thank you.

Barbara H. Murphy, RG, CPG
Chairperson, Foundation of the AIPG
480-659-7131 office phone; bmurphy@geo-logic.com

The Foundation of the American Institute of Professional Geologists is a 501(c)(3) organization.
Contributions are tax deductible. EIN 45-2870397
The American Institute of Professional Geologists (AIPG) has a history of effective and outstanding service to the profession of geology. From its beginning in 1963, the Institute has emphasized the role that professional geologists play in this fascinating, changing, and highly complex world in which we live.

In an Institute such as this, there are so many highly motivated geologists contributing to the profession, the Institute, the public, and the nations in which we live and work that the identification of a select few for particular awards is a monumental task. The continued success of the Honors and Awards Program is dependent on an accessible nominating process and a diligent screening of those nominated. This is done by the Honors and Awards Committee.

Currently, there are seven honors bestowed by the Institute: Ben H. Parker Memorial Distinguished Service Medal, Martin Van Couvering Memorial Service to the Institute Award, John T. Galey, Sr., Memorial Public Service Medal, Award of Honorary Membership, Outstanding Achievement Award, John Stewart Memorial Early Career Professional Award, and Presidential Certificate of Merit.

Descriptions of the awards, past recipients, and the nomination forms can be found on the AIPG National website or contact the AIPG National Headquarters office.

This year the Honors and Awards Committee selected a group of very deserving individuals whose outstanding leadership and contributions to the organization and advancement of the geosciences. We congratulate the honorees on the following pages.

Nominations for 2022 are being accepted online or via mail now through January 15, 2022. Information on how to submit your nominations for a national or section leadership award is available on pages 12 and 13 of this edition of TPG.

When you pay your dues this year, please consider submitting a nomination recognizing a colleague for their contributions to the organization and the geoscience profession. Professionals in the geosciences are making a difference every day in the lives of people across the world, further advancing our knowledge of the earth and its processes, and finding better solutions to managing our environment. We look forward to seeing them nominated in 2022.

**Challenge categories:**

1. **Scenic Wonder** - show us a beautiful landscape.
2. **Geologic Disaster** - geologic processes in action impact communities.
3. **Geologists in Action** - people at work.
4. **Environmental Impact** - manmade effects on the environment.

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

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**Challenge Rules:**

Image requirements: digital, 300 dpi, 8.5”x11”, portrait orientation full color. Members are allowed one entry per category with up to four submissions (one per category).

All images must be original and taken by the member. Submit entries via email to aipg@aipg.org.

Entries must include:

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

Entry deadline: **November 1, 2021**.

**Awards:**

First place in each category:

Image published on the cover of TPG in 2022. Membership dues will be waived for winner for 2022 and donated to the Foundation of the AIPG in the winner’s name. AIPG will donate $100 for a winning student entry to The Foundation of the AIPG.

Runners Up in each category:

Images will be published in the TPG in a special feature album. Runners up will receive AIPG gear of choice.
I would like to thank the Honors and Award Committee for nominating me and the Executive Committee for this honor. I first found out in February when I read the Executive Committee meeting reports. The first thing I did was to tell my wife how surprised I was. Since February I’ve had a lot of time to think about it and to see the list of past recipients, many of which I know. I pulled my copy of “A History of AIPG 1963 - 2003” to read about Dr. Parker. In his 1961 AAPG Presidential Address he talks about the need for a professional organization and within two-years he was one of the original organizers of AIPG.

Now that I’m retired it’s a good time to look back and reflect on my career, but more importantly on how rewarding it has been to work on behalf of AIPG in their mission and all the friendships I have gained throughout the years. I was probably at an AAPG annual convention where I visited AIPG’s booth and first met Susan Landon and sat in the booth going through the membership directory looking for members that I knew that I could ask to recommend me for membership. It was 1991 when I finally became a CPG. Soon after I moved to Georgia I was active in Georgia’s Ground Water Association and the Atlanta Geological Society. It wasn’t until 1997 I was elected to the AIPG Georgia Section Executive Committee and vice-president in 2001. When I became section president in 2002 the section had very little money. Dr. Yo Sumatojo and I started teaching a fate and transport groundwater modeling class using Bioscreen to raise money for the section. It wasn’t until 2008 that we had our first Innovative Remediation Conference. Our section vice-president Eric Lowe and treasurer Glen Faulkner, our charter member, were instrumental in getting it organized and making it the success it has been to date. With money raised we have been able to currently give a total of $4,000.00 each year in scholarships to students.

Some of the activities I’ve been proud of include speaking to students on career opportunities, doing direct push demonstrations and showing how to screen and collect soil samples, developing a monitoring well and collecting groundwater samples. I would like to thank Jim Fineis, whose company installed most of the wells drilled with no cost to our section. Over the years we visited numerous remediation sites and landfills, and the last five years teaching in the classroom the proper way to contour potentiometric surfaces maps and benzene iso-concentration maps.

Each year AIPG has a booth at the regional and National GSA meetings. I have been fortunate to have co-chaired with a few special people where we had a session at GSA on geology careers for recent graduates. Starting in 2007 in Savannah, I co-chaired with Eric Lowe, in 2012 in Charlotte with John Stewart, in 2015 in Chattanooga with Todd McFarland, and in 2017 in Richmond with Mike Lawless; Mike and I had also planned a session in 2020 in Reston that was canceled.

When I was National President in 2013, the Executive Committee approved the Student Chapter of the Year Award and the Section Leadership Award. I was on a field trip with the Illinois/Indiana Section and spoke to Jeff Groncki and he said we needed to recognize individuals at the section level that may never attend an AIPG annual conference but kept the section going. It was that conversation that led to the award. I would like to thank the staff at AIPG headquarters for many years of working together when I was on the Executive Committee, Education Committee, and section activities and for their friendship.

I thank you all for this award and it is truly an honor to receive it. Finally, I would like to especially thank my wife for her support. Thank you.
If you find a career that you love, you will never work a day in your life. I cannot say that I’ve felt like that every day when working. Sometimes I think that I am suffering and don’t get paid enough, but there are certainly days that I feel like one who has been blessed to be at that time and moment. I imagine that many geologists relate to that feeling of loving geology and being passionate about what we do. It is not a career based on money or glamour, but for the passion that we have for being geologists. Not a career for everyone, but all those variations in what geologists do for their jobs means that there are niches and slots for a diverse set of workers.

I have found myself in a variety of companies, from small offices under a single owner to Fortune 500 companies. It was a rude awakening finding out exactly how cyclic the natural resource business is, since I entered university during a petroleum boom cycle that imploded the semester before my graduation. Having the tenacity to stick out the downtimes without leaving the field entirely can be difficult. If I had found something that I liked anywhere as much as geology, I could have been one of the many alumni who are no longer working in geology. It is a bit of a shock for someone starting out to see my CV and look at the list of employers. And then to realize how many of those job exits were related with a company that was downsizing. I have been laid off more times than I care to remember and endured almost as many company acquisitions and mergers. Let us just say: What does not kill you makes you stronger. The school of hard knocks meant that I needed to find ways to stand out to employers.

AIPG has been an incredible part of my professional life. I have found the next job through AIPG contacts; I have been mentored by AIPG contacts; and I have found stimulation and professional development that would never have been available through my employer. I am lucky to be part of an active, supportive section. Membership in AIPG has given me so many benefits. I am so appreciative of others who have given of their time, money, and efforts.
The American Institute of Professional Geologists’ Public Service Award was established by the Executive Committee in 1982 in recognition of one of its primary purposes: service to the public. In 1992, it was renamed the John T. Galey, Sr., Memorial Public Service Award, in posthumous honor of our fourth President, whose long professional career was a continuum of service to both the geological and the general public.

Thank you for the honor of receiving the 2021 John T. Galey, Sr., Memorial Public Service Award. I am truly humbled to be in the company of some of the people who have supported and inspired me, who have helped shape my thinking, and who have helped me realize the potential of our profession to truly make a difference. Thank you to AIPG and the Florida Section; I am fortunate to consider so many members my friends who, through many enlightened conversations, have educated me through the lens of their diverse backgrounds, experiences and points of view and who crazily answer the phone when I am in need of advice. In particular, I would like to acknowledge David Abbott and Troy Bernier for your nominations. I am touched by your having considered me qualified for this very meaningful award and also for sharing your respective wisdom over the years. Jon Arthur, my longtime colleague and advisor, I am proud of your accomplishments during your tenure as Florida State Geologist and of your new role as Executive Director of the American Geosciences Institute. I know you will lead well and work hard to support the geosciences nationally.

I want to recognize my colleague and business partner at Wellspring Water Solutions, Philippe Martin. His contributions have been many and his insight and collaboration invaluable. Phil and I share a more than 35-year friendship and have had the great fortune to work together in the early days of our careers and now as seasoned hydrogeologists. His sincere embrace of my sometimes overactive enthusiasm has propelled our international volunteering on water projects to now include a consultancy, providing many of the most rewarding experiences of my life and, I hope, his. I never tire of hearing him say at the start of a new project and with a sparkle in his eye “Well here’s another fine mess you got us into!” Here’s to the laughs and the long hours of work to bring clean water to people desperately in need.

There is no way to avoid reflection in this moment of honor and gratitude and I’d like to share in a small way how I got here; because frankly to me its magical, and it all began with a single word: “yes”.

Several years ago, I got a call from Helen Hickman. Many of you know Helen through her tenure on the executive board. I met Helen in the late 1980’s when we were both new to James M. Montgomery Consulting Engineers, Inc., and the newly formed water resource group in southeast Florida. We worked together for 15 years before our separate professional paths took us in differing directions. Helen had later assumed the role of president of the then struggling AIPG Florida Section (aka FAPG). She asked if I would serve with her to revitalize the organization. A couple of years later Helen moved on to the national level leaving me to tend to FAPG as president. I was grateful for her council during the next eight years of her past presidency as we battled to keep our state licensure and worked to propel our profession forward. Inviting me into AIPG and putting me to task had unwittingly opened the door to many opportunities I had not imagined. I have had the pleasure of working with all kinds of very talented people from various industries, I’ve coordinated FAPG committees, recruited board advisors, enlisted the first board Young Professional (Brandy Barnes), collaborated with lobbyists, networked with other state and national organizations, educated state representatives and senators about the geosciences, raised money, and rewrote statutes – we did a lot of good work and moved the needle in a positive direction for Florida’s PG’s. In 2018 and 2019 I was also honored to serve on AIPG’s National Executive Committee as secretary. My personal and professional growth was exponential during this period and the knowledge, experience, insight and support I was able to bring home to FAPG was invaluable.

Recently I have relinquished my role as past president and have the honor of assuming a new one as advisor. FAPG is in good hands under the leadership of Clint Noble (current president) and Troy Bernier (past president) along with a full complement of other great board members. Looking back, I would say it was a challenging time and I wouldn’t change a thing. I am looking forward to joining the national board once again next year, this time as Vice President and I am even more excited for that opportunity, as it will be greatly enriched by the fact that I will be serving with my daughter Taylor Murray in her final year as Early Career Professional.

Thank you sincerely for the honor of this public service award, I accept it with great humility knowing that I am here because of the many who stand with me in the pursuit of truly making a positive difference.
Jessica Davey
MEM-3242
Colorado Section

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

I am extremely humbled to have been nominated for and receive the John Stewart Memorial ECP Award. I have worked so hard to become a part of the AIPG community, starting back in 2013 when I helped to set up the MSU Denver student chapter, through a challenging 2021, navigating the COVID pandemic, as President of the Colorado Section. When I was asked to run as Young Professional (now Early Career Professional) for 2020, I was optimistic about pulling together a more supportive AIPG community for graduating students; my plans were derailed when COVID hit us, but I feel good about the direction AIPG is going with more ECPs getting involved. AIPG is a very supportive group comprised of such an amazing group of people, and to be recognized in this way is an incredible honor.

Stephen Baker
MEM-2353
California Section

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

First and foremost, I would like to thank AIPG and each of you for the AIPG Award of Honorary Membership. Participating in an organization that stands on the principles of professional responsibility and public service is a set of virtues that I truly attempt to emulate.

It has always been a pleasure working with AIPG staff, our members, and students at various universities in the United States and India. Through my many interactions at meetings, conferences, field trips and student section meetings, I have recognized that the strengths we have as an organization originate from its members. AIPG has both a wealth of experience and professional wisdom in our senior members and a diverse set of earth science disciplines in our membership. Each creates an uncommon capacity to cross-pollinate the application of these disciplines in communities across the planet. These traits, along with a desire to support our students and early career professionals, yields an organization that has become a pillar of the earth science community. The vision that I see in the near future for AIPG is an organization of mentorship and a credential program that is sought after by businesses and institutions across the industry. I thank you very much for allowing me to contribute to the great history of the American Institute of Professional Geologists.
Neil Shubin, Ph.D.

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

Nomination

Neil Shubin is the Robert R. Bensley Professor of Organismal Biology and Anatomy, Associate Dean of Organismal Biology and Anatomy and Professor on the Committee of Evolutionary Biology at the University of Chicago and is the Provost of the Field Museum of Natural History. In 2006, he and his colleagues Ted Daeschler and Farish Jenkins discovered Tiktaalik roseae, the evolutionary “fish with feet” that represents a transitional species between fish and amphibians. This discovery and its implications were the central theme of Shubin’s book “Your Inner Fish: A Journey Into the 3.5-billion-year History of the Human Body.” Dr. Shubin is a member of the National Academy of Sciences and the American Philosophical Society. He is being nominated for his work hosting the PBS Documentary Series “Your Inner Fish” which aired in 2014. This three-part series is an excellent overview of the evolution of humanity, investigating our ‘fishy ancestors’ our ‘reptilian progenitors’ and our ‘inner apes.’ You can find these episodes at http://www.pbs.org/your-inner-fish/home/ He also is being nominated for his newest work, “Some Assembly Required” (release date March, 2020) which uses traditional fossil-based paleontology and cutting-edge DNA technology to address some of the biggest questions in paleontology and evolutionary biology. More information on “Some Assembly Required” can be found here: https://www.penguinrandomhouse.com/books/540510/someassembly-required-by-neil-shubin/9781101871331/.

Contributions to the geologic profession?

Dr. Shubin and his colleagues are widely renowned for their discovery of Tiktaalik Roseae, a transitional form between fish and amphibians. The story of this discovery provided a test for evolutionary theory as we understand it, and brought paleontology, paleogeography, and sedimentary geology together and into the public eye in 2006. Subsequently Dr. Shubin published his 2009 book, “Your Inner Fish” bringing the story of that discovery and the implications for our understanding of human evolution to a wide audience. In 2013, Dr. Shubin published “The Universe Within: Discovering the Common History of Rocks, Planets, and People.” This book focused on how molecular clues in the human body give insight into why we are the way we are, tracing the 14-billion year history of our universe from the ‘Big Bang’ to the evolution of humans. In 2015, Dr. Shubin hosted the PBS miniseries, “Your Inner Fish” telling the story of human evolution from our fish ancestors to our more modern ape cousins. His latest book “Some Assembly Required” is scheduled for release in March 2020. “Some Assembly Required” combines traditional fossil-based paleontology with state-of-the-art DNA analysis to answer fundamental questions about the origins of animals and humans in a way that will bring these questions to a wide, non-specialist audience.

Demonstrated leadership?

Dr. Shubin is the Associate Dean of Organismal Biology and Anatomy and Professor on the Committee of Evolutionary Biology at the University of Chicago and the Provost of the Field Museum of Natural History.

Nomination submitted by: Dr. Aaron Johnson, AIPG Executive Director

Be sure to check the next edition of TPG for Dr. Shubin’s acceptance of this award.

Arizona

William Greenslade
CPG-02505
Phoenix, Arizona

William “Bill” Greenslade of Matrix New World Engineering, was recently recognized by the Arizona Hydrological Society (AHS) with its Lifetime Achievement Award. The award honors individuals who have contributed to AHS or to the science of hydrology within Arizona and/or who have received national recognition for their contributions in the field. The award was presented to Bill at the AHS symposium in Tucson on September 29th. Steve Noel and Doug Bartlett, who are AIPG AZ Section members and AHS members, made the presentation.

Bill has more than 50 years of experience on hydrologic and environmental projects in Arizona and the Southwest. He received his BS (geological engineering) in 1965 and MS (hydrology) in 1967 from the University of Nevada’s MacKay School of Mines. He is a licensed Professional Engineer (Geological) in Arizona, a licensed Professional Geologist in Arizona and California, and an AIPG Certified Professional Geologist. Bill served on the Arizona Board of Technical Registration (BOTR) from 1999–2002 and was Vice-Chair from 2001–2002 and Chairman from 2002–2003. He currently serves on the Legislation and Rules Committee and on the BOTR’s Enforcement Advisory Council. Bill is a long time member of AIPG, has served as Arizona Section President, and is the current Treasurer of the Arizona Section.

Bill’s professional accomplishments include conducting in-depth studies of the relationship between groundwater pumping and baseflow in many Arizona stream/river systems, including the Little Colorado, Verde, Salt, River, Gila, Santa Cruz, and San Pedro Rivers, as well as tributary creeks. Recently, he developed a groundwater flow model for the Big Chino Valley to support an application for modifying the City of Prescott’s Designation of Assured Water Supply (DAWS), successfully defending the model in appeals court. He has also assisted several Native American tribes with water supply studies and water rights disputes. Among these cases are the Northern Arizona Indian Water Rights Settlement Agreement to resolve claims that the Navajo Nation and Hopi Tribe may have to the Little Colorado River and to surface water and groundwater in the LCR watershed. He has also provided testimony on ground/surface water interrelationships in central Arizona alluvial basins for the Gila River adjudication proceedings.

Throughout his 28-year career with Dames and Moore, Bill served as both principal investigator and project manager. He directed and participated in more than 50 investigations at 18 nuclear power plant sites, which included evaluating the potential for contaminant transport, and participated in studies of environmental compliance, dewatering, stormwater diversion, and leachate collection systems for mines. He joined Southwest Groundwater Consultants (now Matrix New World Engineering Southwest Groundwater) in 1997, where he serves as Principal Hydrogeologist.

Nominated by Dawn Garcia, CPG-8313, Barbara Murphy, CPG-6203, and Doug Bartlett, CPG-8433

California

William Motzer, Ph.D.
CPG-08635
Moraga, California

Dr. Bill Motzer is a great role model as an engaged professional geologist who is always willing to help out and mentor students and professionals in California. He has provided leadership services for the California Section as a field trip leader and lecturer. Professionally, as an expert witness, Bill shows his integrity in the court room on geochemistry cases. He has also written numerous articles and guidebooks.

Bill has been active with the AIPG California Section for over a decade and has been an advisor to the section leaders. He has given inspiring lectures to the AIPG California Section and has contributed to the planning of the 2020-2021 Sacramento Meeting.

He has mentored California AIPG students and professionals alike through leading engaging field trips and giving interesting lectures for the California Section. He has also been part of the 2020-2021 Sacramento Meeting Team.

Nominated by James A. Jacobs, CPG-7760
I'm nominating Carlton (Trey) V. Howard, III (CPG-10582) for the AIPG Section Leadership Award. Trey has been actively involved in the AIPG Minnesota Section for many years and he served as Secretary/Treasurer for several terms in the mid-2000s.

Trey helped organize and lobby the effort to license geology in Minnesota in the mid-1990s. Trey’s involvement with the Minnesota Section has been notable and has helped make the Minnesota Section a thriving community.

Nominated by Shanna Schmitt, CPG-11781

It is my pleasure to nominate Dennis McGrath, CPG for your consideration as a recipient of the 2021 AIPG National Leadership Award. Over the last 24 years he’s provided leadership, service, and a professional presence at section meetings, events, and colleges/universities. I hope you will find his legacy of selfless service to the Northeast Section of AIPG as compelling as we do.

His history of service to the Section over the last 20 years is easily seen in the vitae, below:

NE/AIPG SECTION
EXEC. COMMITTEE 1997-PRESENT
SECTION SECRETARY 1997-1998
SECTION VICE PRESIDENT 1999-2000
SECTION PRESIDENT 2001-2002
SECTION PAST-PRESIDENT 2003-2004
SECTION SUB-COMMITTEES:
AIPG Annual Meeting –
Nominating 2001-2007
Public Affairs 2001-PRESENT
Scholarship 2007-PRESENT
Section Meetings 1999-2012

Dennis is the scholarship chair of the NE Section Angelo Tagliacozzo Memorial Geologic Scholarship. In the 30 years since inception, the NE Section has grown the scholarship trust fund to an impressive $380,000 through the direct solicitation of its members, corporate sponsors, and various fundraisers. Dennis has led the Scholarship Sub-Committee for over 10 years, and in that time, has transition submission to an online platform, established a co-chair position, selects the annual Sub-Committee’s, and formalized the application review and scoring process.

The total distribution each year is determined on the Scholarship Sub-Committee’s evaluation of the applications submitted, and are awarded primarily on the basis of financial need and academic qualifications; career goals, projects/accomplishments/educational plans, and faculty recommendation letter. In 2020 we were able to award nine outstanding undergraduate students $20,000 with the help of Dennis and the selection Sub-Committee. The Angelo Tagliacozzo Memorial Geologic Scholarship is the most impactful professional engagement we undertake on an annual basis as a section. His stewardship of the Angelo Tagliacozzo Memorial Geological Scholarship and his leadership of the Scholarship Sub-Committee has been remarkably consistent and professional. His impact on the lives of nearly 100 geology students however, has been profound.

Five years ago, I attended my first Northeast Section AIPG meeting, and met Dennis for the first time. Being extremely shy and knowing only one person in the room he was quick with introductions and instantly made me comfortable. I received an email following the meeting asking if I would like to get involved in the section and a few months later became the NE secretary. I had expressed interest in the scholarship and that same year he made a spot for me on the Sub-committee and got me engaged in reviewing the applications. If it wasn’t for Dennis’ encouragement, support, and positive attitude I would not be as involved as I am today with AIPG.

Dennis served from 2001-2007 in an official capacity on the Nominating Sub-Committee, but old habits die hard. Dennis continues to serve to this day as the single most persuasive advocate for the NE-AIPG executive committee, and he identifies prospects and reaches out to active members to fill our ballot every year. His singular dedication to this one task has continuously staffed our ranks and provided fresh ideas (and members) to the executive committee for two decades.

In my short time with the NE Section, Dennis has contributed to our success in many other ways. He always helps with...
meeting location selection, he has a deep understanding of the by-laws and procedures, and he has valuable institutional knowledge that he is always willing to share with a smile and a nod. As the head of the Public Affairs Sub-Committee, he regularly attends the GSA meetings and does long hours of booth duty, handing out materials and recruiting new student members.

_Nominated by Jennifer Rhee, MEM-2805_

Ohio

Robert Andrews  
CPG-11975  
Lockbourne, Ohio

It is with great pleasure that I nominate Robert Andrews CPG-11975 for the 2021 AIPG Section Leadership Award. Robert has been involved with the Ohio Section of AIPG since 2014, and has since proven to be an exceptional leader and organizer. When he was recruited as a Member-At-Large he hit the ground running assisting the Ohio Section Executive Committee with organizing chapter dinner events, and facilitating the use of online registration for section meetings, and greatly expanding the Section revenue by increasing the number of advertisers. 2014 was also a big year as the Section worked to revise the out-of-date Section bylaws, for which Robert provided valuable input and a fresh perspective.

In 2017, Robert was elected Treasurer and continued in this capacity through 2018. Robert continued his efforts on behalf of the Section by assisting with summer field trips to Ohio Caverns and to the Shale Hollow Nature Preserve, and assisting with other Section initiatives. In late 2018, Robert was elected for the 3-year term that includes President-Elect, President, and Past-President.

Starting in 2019, as President Elect Robert assisted the Section with an array of dinner meetings with excellent guest speakers including Dr. Patrick Burkhart, Professor at Slippery Rock University and Thomas E. Jordan, PhD who spoke regarding Predictive Landslide Susceptibility Modeling. Robert was integral of all of 2019’s efforts. He also assisted in organizing and conducting the Section’s first “annual” golf-outing in June 2019.

In 2020, Robert led the Ohio Section to another successful year as President. Under Robert’s leadership the Section conducted a winter meeting and golf outing. A planned September meeting and PFAS seminar were cancelled due to Covid-19. Robert organized our first virtual Annual Meeting with an excellent talk from Dr. Joe Hannibal on the provenance of 18th century millstones in Ohio. Robert is serving as president-elect and past president in 2021, and has agreed to serve as president again in 2022.

On a professional front, Robert has continued to grow and excel as a Professional Geologist. He continues his vital wellhead protection work with the City of Columbus with the conviction and morality of a Professional Geologist. With that it is my honor to nominate Robert for the Section Leadership Award.

_Nominated by Thomas Jenkins, CPG-7892_

Wisconsin

Jack Travis, Ph.D.  
CPG-7378  
Sturgeon Bay, Wisconsin

Dr. Travis has a long record of distinguished and outstanding service to the profession of geology. He has provided: (a) education and training of geologists, (b) professional development of geologists, (c) service to the Institute, (d) leadership in the surveillance of laws, rules, and regulations affecting geology, geologists, and the public, and (e) activity in local and regional affairs of geologists.

Service to the Institute

Dr. Travis was an active member of the Wisconsin Section of AIPG during our separation from the Minnesota-Wisconsin Section in the 1980’s. Wisconsin was proceeding with developing professional licensing for geologists in the State and Dr. Travis encouraged geologists to support this professional licensing effort by supporting a Wisconsin Section of AIPG. Wisconsin promulgated the professional geologist license in 1995. Dr. Travis and the Wisconsin Section of AIPG helped these individuals apply for and obtain their PGs as well as promoting CPG certification through AIPG.

In the year 2000, Dr. Travis was the chairman for the National AIPG Conference in Milwaukee. It took several years before 2000 to pull together this large and diverse conference under the direction of Dr. Travis. “Learning from the Past – Directions for the Future” AIPG Conference was held from October 10 – 14, 2000 at the Milwaukee Pfister Hotel. The conference featured: 4 Short Courses: Ethics, Liability, and Litigation.
in Geology, Geographic Information Systems for Geologists, Unraveling Glacial Hydro stratigraphy, and ISO 14000 and Geology. It also provided 3 Geology Field Trips: Sand & Gravel Pits, Quarries and Suburban Growth, Slope Stability and Shoreline Protection, and a tour of Geology of Badger Army Ammunition Plant. The guests to the conference were provided four Fun Guest Trips: Milwaukee in a Nutshell, Historic Cedarburg Visit, Arts and Artist Tour, and a Holy Hill Tour. Plus, the conference included a Brewery Tour and an Edelweiss Boat Trip for all the National Executive board members! The Technical Sessions included: Geology Education and the Next Ten Years, Urban Growth and the Fate of the Extractive Industries, Environmental Corrective Action – What We Learned and What is Next for Slope Stability, New Techniques in Subsurface Investigations, and the Role of Geology in Property Transfers and Brownfield Development.

In the first decade of the 20th century, Dr. Travis created and led very helpful field trips for Wisconsin Section of AIPG Annual Meetings. He was also instrumental in working with the Wisconsin Department of Natural Resources and University Extension to be Wisconsin Section of AIPG’s representative for developing the geology portion of the Wisconsin Master Naturalist (WMN) training program. Included in the training is an extensive Wisconsin Geology section developed by Dr. Travis. Since 2013, the WMN program has reached 163,993 individuals with naturalist programming throughout the State. The program has representatives in 66 of 72 Wisconsin counties and has a total of 863 Master Naturalists and 100 trained instructors that teach the Master Naturalist course.

Dr. Travis continues service to the Wisconsin Section of AIPG to this day, suggesting activities and new articles for Wisconsin Section of AIPG newsletter and was very helpful planning the hosting of National Executive Board meeting here in Wisconsin in June 2019.

Education and Training of Geologists

Dr. Travis taught many environmental geologists, engineering geologists, geological engineers, and geotechnical engineers during his tenure as a geology professor at University of Wisconsin - Whitewater. He was able to provide these geoscientists with a wide range of tools to solve environmental problems and conflicts. The students learned how to gather information such as soil type, rock structure, and groundwater flow and then utilize it to understand geological site conditions. Field surveys, maps, well logs, bore holes, ground-penetrating radar, aerial photos, geologic literature were used to reveal potential natural hazards in an area and develop plans for remediating contaminated sites.

His success as a Geology Professor did not end when he retired from University of Wisconsin - Whitewater but continued as he gathered these valuable lessons into an Environmental Geology Field Workbook, which was published in 2019 by Waveland Press, a distinguished college textbook publisher. The workbook contains materials gathered from geologists and environmental scientists Dr. Travis met and stayed in contact with his entire career.

Professional Development of Geologists

During Dr. Travis’s time as a Geology Professor at the University of Wisconsin - Whitewater, he took the time to attend and present papers at conferences and seminars. An example of one such paper was entitled: Luther, F.R., (1992), The Waterloo Quartzite at the old Portland Quarry: in the 56th Annual Tri-State Geology Field conference Guidebook to the Geological setting of Whitewater, Wisconsin and surrounding Area, Jack Travis, ed. P51-61.

Leadership in Surveillance of Regulations Affecting Geologists and the Public

Dr. Travis has worked hard the past decade explaining the problem of karst topography to Door County citizens, businesses and representatives. A lack of topsoil above the dolomite means that contaminants cannot be filtered out before they can reach the groundwater supply. Without adequate topsoil, water and anything else that is soluble quickly passes through the soil to the bedrock where it is quickly transported down through fractures. Dr. Travis has explained that there is no practical remedy to this situation other than cognizance and careful monitoring and restriction of what goes onto the surface of the peninsula. He has recommended finding the right balance in implementing restrictions in this area. In the last couple years, information provided by Dr. Travis has helped Door County and the Wisconsin Department of Natural Resources fine tune the Wisconsin manure spreading regulations.

Active in Local and Regional Affairs

In 2010, Dr. Travis, received the Friends of Wisconsin State Parks Hero Award in honor of his service as the President of the Newport Wilderness Society and environmental and geology programs given to the Society’s members for many years. Dr. Travis conducted numerous specialized training and lectures such as: Identifying Rocks and Fossils, Addressing climate change, Energy Status of the United States, Ancient Sand Beaches, and Contaminated Soil and Ground Water. His work with the Newport Wilderness Society also included geologic articles in their newsletters and publishing pamphlets focusing on history, geology, or native plants and animals of the area. An example of one of the pamphlets is entitled: “Fossils of the Niagara Escarpment”. He also has served on the Board of Directors for Friends of Wisconsin State Parks from 2015 to 2018.

The Section Leadership Award has always been awarded to individuals who have long records of distinguished and outstanding service to the profession. Dr. Travis fits those criteria indeed!

Nominated by Christine Lilek, CPG-10195

AIPG Gives Away Free Money for College

AIPG is a strong supporter of education and offers scholarships to aspiring geologists. From the sections to National to the Foundation of the AIPG, free money is just an essay away.

Apply online at aipg.org for national scholarships and check the section websites for more scholarships from your local section.

The national scholarship deadline is February 1, 2022.
Individuals and sections are encouraged to purchase extra copies of the Student issue to provide to colleges and universities with geology departments. This is a great way to introduce students to AIPG and encourage formation of student chapters.

The cost of the Student Issue is discounted from $5.00 to $3.00 for quantities of 10 or more. Amount due ($3.00 x Quantity) + Shipping and Handling.

**Shipping & Handling**
- Orders up to $15.00 add $8.00
- Orders of $15.01 to $30.00 add $10.00
- Orders over $30.00 add $12.00
If weight order exceeds 10 lbs., additional postage will apply.

Please send your order with payment to AIPG Headquarters no later than December 1, 2021.

Name:_________________________________________________________________________________________________
Mailing Address:_______________________________________________________________________________________
City/State/Zip:_________________________________________________________________________________________
Number of Student Issues (TPG Jan/Feb/Mar 2022):______________________________________________________
Check enclosed:________________________________________________________________________________________
Credit Card:___________________________________________________________________________________________
Expiration Date:____________________________ CVV:_____________________________
Billing address for card if different from above.
Address:_______________________________________________________________________________________________
City/State/Zip:_________________________________________________________________________________________
Please invoice _________________________ AIPG Section for additional Student Issue TPGs.

You may mail this form in with your payment, or email completed form to dkc@aipg.org.
EXECUTIVE DIRECTOR’S MESSAGE

Adapting to Overcome Challenges

Aaron W. Johnson, MEM-2783
awj@aipg.org

It’s late August as I write this note. In northern Colorado, summer is fading and a hint of fall is in the air. For the first time since I’ve lived in Colorado, a yearling black bear has taken up residence in our neighborhood. Garbage cans are fair game. Open garage doors beckon this young bear to investigate. We’ve had more than one homeowner step outside to find our ursine friend pilfering dog food or bird seed, or digging through the garbage at the curb. Having grown up in southern Missouri, bear interactions are a relatively new experience for me. We’ve been forced to change some of our habits to insure our families and the bear can adapt to this new reality.

At AIPG, we are adapting, too. Back in April, we were optimistic that the end of the COVID pandemic was near, and that the business of the Institute would return to something nearer normal. Cue the Delta Variant and the attendant surge of COVID cases. Our long-awaited return to something that approached normalcy is now being postponed. Still, the work of AIPG goes on. The new SK 1300 guidelines, which were implemented by the Securities and Exchange Commission on January 1, 2021, have reaffirmed the value of the CPG credential. The AIPG staff have worked diligently to insure AIPG conforms to the new requirements that have been put forward. We have reached an agreement with the Institute of Geologists of Ireland (IGI) to provide reciprocity for holders of the CPG and the IGI’s Professional Geologist credential.

Every day we focus on ways to add value to your membership in AIPG. Our goal is to find new ways to make AIPG a relevant, important, valuable part of your professional life.

I want to thank all of you who have sent videos to be included on our YouTube channel. These recordings provide a snapshot into the professional lives of geologists and help to make the public aware of the kinds of things geologists do. The videos are informative, humorous, timely, and very often make an important connection between geology and the health, safety, and economic vitality and welfare of our modern society. Thank you. Keep them coming. As of this time we have more than 150 subscribers and are on pace to have more than 150 hours of content viewed by the public. This effort is part of a larger effort to make more people aware of what it is that geologists do, and how we help to create the conditions under which our modern society can thrive.

The future is not without its challenges. COVID continues to create uncertainty. By the time you read this, our Annual Meeting will be imminent, and the annual meetings of the Geological Society of America and many others will have come and gone. Some, undoubtedly, will have been canceled. Others will have gone forward, albeit with some restrictions or under a hybrid model. Attending and hosting meetings such as these is one of our crucial activities. We are able to raise awareness of AIPG, recruit new members, interact with other geologists, and equally importantly to talk with policy makers to insure our leaders have an understanding of the role geology and geologists play in society. When meetings such as these are cancelled, postponed, or moved to an online version, our ability to promote AIPG suffers.

Through all these challenges and changes, one thing remains certain. You, our members, are the lifeblood of our organization. You provide leadership, vision, and support. You are the best recruiters for AIPG, and it is by your example and with your encouragement that the next generation of geologists will become members of AIPG and leaders in our profession. With your guidance and energy, AIPG will continue to be a leading organization that advocates for the safe, professional, ethical practice of geology on behalf of our members and for the public.

Wishing you a happy and healthy fall,

Aaron
The End of My Presidency

Nancy J. Wolverson, CPG-11048
nancyjeanw@aol.com

It is early August 2021, and this will be my last President’s Message. It seems odd writing my final message in the middle of the year, but that is the way it is set up. The 2021 Executive Committee will have another meeting in October and a final hand-off meeting in December.

It has been an honor representing the membership of AIPG as we slowly recover from the “pandemic year”. The National Office has been returning to in-person work and all members, and the public, should have full access, as they had prior to the pandemic.

Late last year I put together a list of activities I hoped to implement during 2021:  1. Create a Plan to Increase Membership, 2. Set up a Mentoring Program for AIPG Members, 3. Modify the Executive Committee Meeting Format to Encourage Discussion, 4. Update and Expand the Executive Committee Handbook, and 5. Complete Numerous Tasks Initiated in Previous Years. These seemed like reasonable goals before the year began, but at this point in the year, seem like daunting tasks. With several months remaining to work towards these goals, I wanted to update the membership on the status of each and explain what is planned before year end.

**Create a Plan to Increase Membership:** This has turned into the most daunting task initiated during 2021. The Membership Committee has been formed and will be a Standing Committee of the Institute. Matt Rhoades, 2021 President-Elect, has agreed to Chair the Membership Committee and will add additional members and initiate creation of a multi-year plan. The committee will focus on increasing membership in all member categories, outreach and enhancement of member benefits. Please contact me (nancyjeanw@aol.com) or Matt (rhoadesgeol@gmail.com) if you would like to join the effort to increase membership in AIPG.

**Set up a Mentoring Program for AIPG Members:** After discussion with the Executive Committee regarding the type of program we want, we are well on our way to setting one up by the end of the year. We have previously asked members if they want to be mentors, and we will encourage those volunteers to continue as we begin with the new format. The program will be for members only and accessed through the member’s portal of the website. We are still working on how the details of how the program will look on the website but hope to have it set up and running by the end of 2021.

**Modify the Executive Committee Meeting Format to Encourage Discussion:** I have been on the Executive Committee for the last five years and the meeting format has been the same throughout that time. My goal was, and continues to be, adding more topics for discussion into each meeting. The modified format includes all of the previous items plus discussion on topics important to one or more of the Executive Committee members. Additionally, all Standing and Ad Hoc Committees will present updates of their activities.

**Update and Expand the Executive Committee Handbook:** Keri Nutter, 2019 AIPG President, put together an Executive Committee Handbook that is used as a guide for the members. In early 2021, I added several things to the book, and have asked each Executive Committee member to review and suggest changes to the descriptions of their offices by November 1, 2021. My plan is to incorporate all the edits/additions/suggestions and present an updated version to the incoming 2022 Executive Committee at our final 2021 Executive Committee meeting in December. It should continue to be reviewed and updated yearly, as necessary.

**Complete Numerous Tasks Initiated in Previous Years:** There were several tasks initiated in previous years that I hope to have finalized by the end of 2021. Position papers on various topics that were last updated over ten years ago are being reviewed and some have been finalized with revised versions posted to the AIPG website. Updating the website to be more user friendly is critical to increasing our membership. Several changes are being discussed and will be incorporated by year-end. This should be an ongoing process, with suggestions passed along to the 2022 Executive Committee. **Coordination and follow-through for the Ad Hoc Committees** is needed to avoid repetition of activities. Ad Hoc Committees are created by the President of the Institute to conduct specific activities. To facilitate coordination, a summary of activities for each Ad Hoc committee will be given to Matt Rhoades, 2022 President, at the end of 2021.

AIPG was created to promote the profession of geologists and that is still what makes the organization great, and the CPG membership category is our primary distinction from other geoscience organizations. If we solely take our lead from other organizations, we lose what makes AIPG special. I will continue to work with the 2022 Executive Committee, as necessary, in an effort to make the organization more efficient, responsive and current.

I encourage everyone to consider joining the Executive Committee. If you are interested, you can contact me (nancyjeanw@aol.com or 775-770-4615) or your State Chapter for more information. AIPG will be best served with all voices being heard.

Hope to see you at the Annual Meeting in Sacramento, California October 23-26, 2021.
1. We are studying the properties and strength characteristic of various types of clays. The ratio of the unconfined compressive strength of an undisturbed sample to that of a remolded one at the same water content and porosity defines the clay’s:
   a) Activity ratio.
   b) Sensitivity.
   c) Ultimate strength.
   d) Ductility.
   e) Mad geotechnical scientists says: I like the unconfined compression test because I can squeeze the living daylights out of a sample and watch it get short and fat and break and squash and flow and burst and ooze and....

2. In exploration geophysics, seismic inversion refers to:
   a) Seismic processing steps to attenuate the presence of “diffractions.”
   b) The combined processes of “demultiplex” and “muting.”
   c) Transforming seismic reflection data into quantitative rock properties.
   d) Eliminating or minimizing the occurrence of multiples from the seismic record.
   e) Analyzing and interpreting seismic sections while standing on your head.

3. Of the choices given below, which one indicates a marine gastropod whose range is from Cretaceous to present day?
   a) Turritella.
   b) Exogyra.
   c) Orbitolina.
   d) Gryphaea.
   e) Hey hombre, the only gastropods that I care about are the escargot that I can eat along with a good bottle of Pinot Noir or Chardonnay....

4. This iron ore [Fe\(^{2+}\)Fe\(^{3+}\_2O\(_4\)] crystallizes in the isometric system, has a hardness of 5.5 to 6.5, a specific gravity of 5.175 and a black streak:
   a) Pyrite.
   b) Goethite.
   c) Hematite.
   d) Magnetite.
   e) Kant saay, mann. Ay lusst maii miminairuloogie buuk nd ay kant fayndet.

5. In rock mechanics and geophysical applications consider stable, isotropic, linearly elastic materials. Let (k) indicate the bulk modulus, (E) the Young’s modulus and (δ) Poisson’s Ratio. A critical relationship between these important elastic properties is given below:
   \[ k = \frac{E}{3(1-2\delta)} \]
   What is the highest possible value or upper limit of δ?
   a) 1.00
   b) 0.50.
   c) 2.00.
   d) 0.75.
   e) Don’t know nothing about this Poisson thing, dude. I like geology because I can get out of the office and go out to the field, smash stones with my hammer, write my name on the rocks, take a few selfies, eat some wings, drink some.... Field trips rules!
Honesty and Trust

I began drafting this topic in mid-June when the Center for Disease Control’s guidance changed to allowing those who were fully vaccinated to go without masks in most indoor and outdoor settings. As welcome as this ending of mask mandates was, many remained concerned that those who had not in fact been fully vaccinated, including those who objected to vaccination due to personal freedom and other issues, would stop wearing masks as well. Because no accepted means of vaccination verification other than a picture of one’s vaccination record (an easily faked document) existed, we simply trusted that those who weren’t wearing masks had in fact been vaccinated—an assumption many were unwilling to make. For those with this concern, many continue to wear masks indoors and in other situations even though they were fully vaccinated. The summer’s surge of the pandemic of the unvaccinated justified the skepticism that the unvaccinated would wear masks, or the assumption many held that those who didn’t were running a fraudщит scheme; the fact that Amanda Knox’s conviction for murder in Italy stemmed from the observation that she didn’t act in the manner expected of a normal, innocent person; and the problems arising in sexual assault cases, especially those where alcohol is involved, where the issue of consent is at issue. The cases include Chamberlain’s interactions with Hitler over Czechoslovakia—Chamberlain thought Hitler was honest and trustworthy; the story of Ana Montes, a senior DIA analyst for Cuba for many years who was actually a Cuban agent the whole time; Bernie Madoff, the well-known Wall Street insider who “couldn’t be” but really was running a massive Ponzi scheme; the fact that Amanda Knox’s murder trial in Italy stemmed from the observation that she didn’t act in the manner expected of a normal, innocent person; and the problems arising in sexual assault cases, especially those where alcohol is involved, where the issue of consent is at issue.

This situation highlights the normal assumption that people are honestly telling us about their education, experience, competencies, and all manner of other things. Only in certain circumstances is verification of some sort required. For example, those applying for AIPG Certification must request that their colleges and universities send AIPG certified copies of transcripts. This requirement stems from the fact during the 1990s that too many job applicants’ resumes were not being truthful about their educational background. Statements from sponsors and employment verifiers are also required. Reviewing this information requires the time of Screening Committee members. The effort helps ensure the veracity and acceptability of AIPG Certification. However, in most circumstances such verification is not required; we assume we are being told the truth. Most of the time this is okay. However, we hopefully are open to indications that we are being deceived and that when this is suspected, we start appropriate verification steps. But do we?

The day I started this topic was also the day that AIPG sent out a survey regarding planned attendance at the Annual Meeting in Sacramento. As stated in the introduction to this survey, “AIPG will host its National Conference as an in-person-event experience where all individuals onsite, including attendees, guests, speakers, staff, and venue personnel, remain safe and comfortable throughout our event.” AIPG will have to trust that those attending the Annual Meeting will honestly disclose their vaccination status and wear masks, or not, as appropriate.2 Canon 1 of the AIPG Code of Ethics addresses honesty, personal integrity, and professional conduct. Canon 2 addresses protecting the public’s health, safety, and welfare. Mask wearing in professional settings like professional meetings involves both these Canons.

Talking to Strangers: what we should know about the people we don’t know, Malcolm Gladwell, 2019, was Matt Rhoades’ (CPG-7837) selection for the AIPG Book Club this past summer. Gladwell explores a number of fascinating cases demonstrating the problem we have in understanding or making sense of people we do not know. The cases include Chamberlain’s interactions with Hitler over Czechoslovakia—Chamberlain thought Hitler was honest and trustworthy; the story of Ana Montes, a senior DIA analyst for Cuba for many years who was actually a Cuban agent the whole time; Bernie Madoff, the well-known Wall Street insider who “couldn’t be” but really was running a massive Ponzi scheme; the fact that Amanda Knox’s murder trial in Italy stemmed from the observation that she didn’t act in the manner expected of a normal, innocent person; and the problems arising in sexual assault cases, especially those where alcohol is involved, where the issue of consent is at issue.

In our interactions with strangers, most of us default to assuming that we are being told the truth, that is, we assume that strangers are honest unless there are dramatic red flags, and not always then. We have illusions that others are being as transparent as we believe ourselves to be. And we do not understand the importance of the context in which the stranger is operating and so fail to understand what the

2. What the actual suggestions or requirements for mask wearing at the Annual Meeting will be are unknown as this column is being written.
Answers:

1. The answer is choice “b” or “sensitivity.”

The activity ratio of a soil or sediment is the ratio of its plasticity index over the percentage of its clay fraction
\( A_r = \frac{I_p}{\%\text{clay}} \).

The ultimate strength of a soil or rock is the maximum stress the material can withstand before eventually failing. It is the highest point reached on the stress-strain curve.

The ductility of a soil or rock is the total percent deformation it achieves before rupture occurs. Ductile behavior is equivalent to plastic deformation.

2. The answer is choice “c” or “Transforming seismic reflection data into quantitative rock properties.”

Choice “a” mainly relates to the process of “migration” which is critical in attenuating “diffractions.” When seismic energy hits a discontinuity (such as a subsurface fault plane), a burst of energy will be transmitted in all directions forming an arch-like (hyperbolic) pattern. These “diffractions” may look like geologic structures, but they are not real. “Migration” involves geometric repositioning. In “migration” events are corrected and mapped to their proper position in space.

In choice b”, the processing step of “demultiplex” allows the field recorded data to be separated into trace sequential order. Data is rearranged so that all samples for any given channel are in sequence from time zero to the end of the record. The output is a “trace” in sequential form. In the processing step known as “muting” traces are muted eliminating the shallow parts of longer traces (those further away from the source). The idea is to exclude that part of the trace that contains more “noise” than “signal”.

In choice “d”, attenuation or elimination of “multiples” is achieved in processing steps such as “deconvolution” and “stacking.” Seismic energy bouncing more than once from the same reflector has the same travel time as energy traveling to a much deeper reflector. This results in an apparent, phantom, deeper reflector that may be thought of as being a real horizon. These phantom reflectors are known as “multiples.” “Deconvolution” is a processing step performed to improve the vertical resolution of seismic data by compressing the basic wavelet. The process is used to minimize “multiples” and enhance the reflection events. Generally, it is applied before “stacking”, but it is also sometimes done after “stacking”. It is performed to obtain the idealized impulse response of the earth model. “Stacking” constitutes another crucial processing step, where individual traces are combined into one trace for each common depth point (CDP). “CDP” suppresses “multiples.”

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

Exogyra and Gryphaea are extinct pelecypods of the oyster family.

Exogyra lived in the Jurassic to Cretaceous time span.

Gryphaea ranged from Triassic to mid Paleogene but was mostly restricted to the Triassic to Jurassic periods.

Orbitolina refers to a foraminifer with a conical siliceous test with agglutinated sandy particles that lived in Cretaceous times.

4. The answer is choice “d” or “Magnetite.”

Please refer to the table shown below.

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Crystal</th>
<th>Hardness</th>
<th>Specific Gravity</th>
<th>Streak</th>
<th>Chemical Formula</th>
<th>Gravity</th>
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</thead>
<tbody>
<tr>
<td>Magnetite</td>
<td>Isometric</td>
<td>5.5-6.5</td>
<td>5.18</td>
<td>black</td>
<td>Fe(^{2+})Fe(^{3+})O(_4)</td>
<td>Iron Oxide</td>
</tr>
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<td></td>
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<td>Fe(_3)O(_4)</td>
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<tr>
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<td>Orthorhombic</td>
<td>5.0-5.5</td>
<td>3.3-3.4</td>
<td>yellow-yellowish-brown</td>
<td>Fe(^{3+})O(OH)</td>
<td>FeO(OH)</td>
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<tr>
<td>Goethite</td>
<td>Hexagonal</td>
<td>5.5-6.5</td>
<td>5.26</td>
<td>red</td>
<td>Fe(_2)O(_3)</td>
<td>Iron oxide</td>
</tr>
<tr>
<td>Pyrite</td>
<td>Isometric</td>
<td>6.0-6.5</td>
<td>4.95-5.10</td>
<td>greenish-black to brownish-black</td>
<td>FeS(_2)</td>
<td>Iron sulfide</td>
</tr>
</tbody>
</table>
stranger is communicating. *Talking to Strangers: what we should know about the people we don’t know* is something we all should read. The approach AIPG will take regarding mask wearing at this fall’s annual meeting is an example of a default to the truth that we expect people to be honest. Usually, but not always, our expectation of honesty works out.

Recognizing deception requires being open to the possibility that someone is trying to deceive us. As Stephen J. Gould observed, “One often needs a proper theory to set a context for the exposure of fraud. Piltdown Man [discovered in 1912-1913] fooled some of the world’s best scientists for generations, and I will never forget what W.E. Le Gros Clark, one of the three scientists who exposed the fraud in the early 1950s said to me when I asked him why this resolution had not occurred earlier. Even an amateur, like myself, has no trouble for seeing the Piltdown bones for what they are—the staining is so crude; the file marks applied to the orangutan teeth in the lower jaw are so obvious, yet so necessary to make the teeth seem human in the forger’s plan, for the cusps of ape and human teeth differ so greatly. Le Gros Clark said to me: “One needed to approach the bones with the hypothesis of fraud already in mind. In such a context, the fakery immediately became obvious.”

I found that approaching claims of ore-rich veins with the hypothesis of fraud was frequently true in my 21 years investigating natural resource frauds as a geologist for the US Securities and Exchange Commission. The most “successful” con men I encountered were incredibly and convincingly sincere. They passionately believed the “truths” used to describe their schemes. I have no doubt they could have passed polygraph tests with flying colors. Because I had already identified the red flags of their frauds before meeting them, I could not be convinced. But a good many highly intelligent people were taken, invested their money, and lost it all. Even senior mining professionals who had no experience with mining frauds were sometimes convinced of the veracity of the promoter’s claims, at least initially.

**Can an individual’s freedom be limited?**

At the end of his Editor’s Corner, “Are Rules Just Meant to be Broken?” in the Jul-Aug-Sep 2021 *TPG, Adam Heft* (CPG-10265) describes observing numerous individuals (some with small children) who had climbed over a fence intended to keep people from clambering over the Whitefish Falls in Michigan’s Upper Peninsula. Heft asked, “Are there ethical issues in connection with the situation?” My answer is “yes.” The situation described by Heft strikes me as an example of the “personal freedom to do whatever I want” versus “protection of the public’s safety” conflict that has characterized debates over mandatory mask wearing during the Covid-19 pandemic. At their most basic level, all moral and ethical rules (and laws) place limits on an individual’s right to do whatever he/she/they wants or stipulate that we do something like requiring possession of a driver’s license if we wish to legally drive or, in some cases, require geoscientists to participate in mandatory Continuing Professional Development programs. So, who has the right to make rules, ethical or otherwise, and are people obliged to follow them? Certainly, these debatable questions come down to, “Can an individual’s freedom be limited?” The existence of rules answers this question as “yes.” Whether a particular rule applies to everyone can be debated.

In his 2004 *Common Morality: deciding what to do* (column 99, Sep ’05) Bernard Gert describes morally justified exceptions to common moral rules. For example, self-defense is recognized as an exception to the “do not murder” rule. Surgeons are allowed to violate

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**Answers:** (cont.)

5. The answer is choice “b” or “δ = 0.50.”

It is important to remember that the Young’s modulus (E), bulk modulus (k) and shear modulus (μ) of stable, isotropic, linearly elastic materials have positive values.

Given:

\[ k = \frac{E}{3(1-\nu)} \]

note that when \( \nu = 0.50 \), then:

\[ k = \frac{E}{3[1 - (2 * 0.50)]} = \frac{E}{3(1 - 1)} = E/0 = \infty \]

Also note that at values of \( \delta > 0.50 \), k would be a negative quantity.

For most rocks, \( \delta \) values range from 0.15 to 0.40. The table below outlines \( \delta \) values for some common rock types.

<table>
<thead>
<tr>
<th>Rock Type</th>
<th>Average Poisson’s Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basalt</td>
<td>0.14-2.00</td>
</tr>
<tr>
<td>Diabase/Gabbro/Granite</td>
<td>0.125-0.250</td>
</tr>
<tr>
<td>Syenite</td>
<td>0.250</td>
</tr>
<tr>
<td>Dolomite/Limestone</td>
<td>0.080-0.200</td>
</tr>
<tr>
<td>Sandstone</td>
<td>0.066-0.125</td>
</tr>
<tr>
<td>Shale</td>
<td>0.110-0.430</td>
</tr>
<tr>
<td>Gneiss</td>
<td>0.091-0.250</td>
</tr>
<tr>
<td>Marble</td>
<td>0.250-0.380</td>
</tr>
<tr>
<td>Quartzite</td>
<td>0.230</td>
</tr>
<tr>
<td>Schist</td>
<td>0.010-0.200</td>
</tr>
</tbody>
</table>

---

3. Fraud involves theft by lying.

supports an objection.

A morally well justified argument that to this analysis. I invite contribution of by an epidemic or pandemic by getting to protect the health of everyone affected freedom ignore the general moral rule

Claims about the violation of personal outweighed the risks of myocarditis.

that the benefits of Covid-19 vaccination Moderna vaccines. The CDC concluded

only came to light following millions in number than the average incidence, tis, cases of which were slightly higher results of the vaccination of millions. The emergency authorizations for use of the side effects of vaccines that the CDC's

for not justifying an exception. Claims virus to those who cannot be vaccinated, remaining an unprotected vector for the exception. In the Covid-19 vaccination who is hurt falls within the emergency

Whitefish Falls rules to rescue someone of which were slightly higher results of the vaccination of millions. The emergency authorizations for use of the side effects of vaccines that the CDC's

My analysis of both the Whitefish Falls rules and mandates requiring Covid-19 vaccination indicates that exceptions to these rules are generally not morally justified. Violating the Whitefish Falls rules to rescue someone who is hurt falls within the emergency exception. In the Covid-19 vaccination case, the potential harm caused by remaining an unprotected vector for the virus to those who cannot be vaccinated, like children, is a significant reason for not justifying an exception. Claims that surgical grade masks don't work are contrary to standard medical advice and evidence.5 Claims about unknown side effects of vaccines that the CDC's emergency authorizations for use of the vaccines were largely disproven by the results of the vaccination of millions. The exceedingly rare side effect of myocarditis, cases of which were slightly higher in number than the average incidence, only came to light following millions of vaccinations with the Pfizer and Moderna vaccines. The CDC concluded that the benefits of Covid-19 vaccination outweighed the risks of myocarditis. Claims about the violation of personal freedom ignore the general moral rule to protect the health of everyone affected by an epidemic or pandemic by getting vaccinated. There are those who object to this analysis. I invite contribution of a morally well justified argument that supports an objection.

Sketch-based geologic 3D modelling

Jacquemyn, et al.’s 2021 paper, “Sketch-based interface and modelling of stratigraphy and structure in three dimensions” in the Journal of the Geological Society,6 presents an alternative to 3D modelling based on mathematical computerized methods. The sketch-based system uses manually drawn two-dimensional drawings of vertical cross sections and horizontal maps to rapidly create complex three-dimensional (3D) surfaces and geologically realistic 3D geologic models. Supplementary executable and source code to implement this process is available.

Jacquemyn, et al. assert, “current [computer-based] modelling tools often require specialist knowledge to capture the features of interest and are slow to create or update. Therefore, they are not intuitive to use and are inaccessible to non-specialists or different disciplines.”

Sketch-based modelling requires the geoscientist drawing the sections and maps to think about the geology and can overcome the “creative results” of computer modelling, particularly in areas with less sampling and drilling control. A combination of “supervised” modelling using both computer and sketch-based methods may lead to more accurate results. Accurate and appropriately spaced data is required for any good model; see Abbott, D.M., Jr., 2021, Honesty—Avoiding the Misuse of Models: webinar for the Georgia Section, AIPG, 2/18/21; AIPG YouTube, https://www.youtube.com/watch?v=yk_G1D92dG4, 55.46 minutes.

Should a “Reasonableness” standard be added to the AIPG Code of Ethics?

The International Mineral Property Valuation Standards Template (includes Petroleum) (IMVAL Template), 4th ed., April 2021 is based on “three fundamental principles that must be followed in undertaking Valuations and Valuation Reports: Competence, Materiality, and Transparency. In addition to these fundamental principles, Objectivity, Independence, and Reasonableness may also apply under national codes or standards.” The Reasonableness standard states that, “The Valuer must ensure the Reasonableness of the Valuation. Any Valuation, assumptions applied, and any method relied upon should be reasonable within the context of the purpose of the Valuation and the Basis of Value. A method applied to the subject Mineral Property should be within the expected capability and consideration of an assumed likely buyer or lessee of the property.” The IMVAL Template’s Reasonableness standard can be easily modified to apply to any geoscience professional report. A reasonableness standard is not included in the CRIRSCO Template or other mineral property reporting standards. Should a Reasonableness standard be added to the AIPG Code of Ethics?

The proposed general Reasonableness standard would be. “The author(s) of geoscience reports or presentations must ensure the Reasonableness of all contained conclusions and recommendations. ‘Reasonableness’ means that other qualified and experienced geoscientists with access to the same information would consider the author(s)’ interpretations and conclusions to be with a reasonable range of variation. Any standards used, assumptions applied, and any method relied upon should be reasonable within the context of the purpose of the report or presentation. Any method applied in the subject report or presentation should be within the expected capability and consideration of an assumed likely buyer of the report or presentation.”

The purpose of a Reasonableness standard is to assure that any geoscience reports or presentations reflect a realistic assessment of the purposes of report or presentation, particularly from the perspective of the assumed reader of the report or presentation. Conceptually, while several reports on the same topic would be expected to fall within a normal distribution of conclusions, the Reasonableness standard would help ensure that a particular report is less than one standard deviation from this normal distribution. What do you think? Please contribute your comments and suggestions regarding the need for a reasonableness standard.

5. The lack of a flu season last fall and winter (2019-2020) is attributed to the mask wearing and social distancing recommended to fight off Covid-19.

As defined in previous articles in this series, Stealth Education is the practice of inserting aspects of the geosciences into topics normally considered as non-geoscience related, by emphasizing their role as causative or influential elements in human physical or cultural development or interaction.

I want to re-emphasize the fact that the primary target of the Stealth Education approach is the general public whose representatives control, through the vote, the development of national and local policy, in particular, primary and secondary school curriculum development.

Attaining this objective requires individuals within our professional organizations to utilize their collateral interests outside our traditional areas of activity, engaging the general public in discussions that would allow the introduction of geoscience background into their fields of interest or career groups.

Scientists of all types, including geoscientists, are normally encouraged to use their available time and resources in improving their professional expertise to attain success in their chosen subfield. Therefore, as a result of both educational emphasis and professional growth, most geoscientists are relatively unaware of the collateral effects of the geosciences upon the general public and on other fields of endeavor outside their own specialty fields of study.

The goal of these editorials is to expand the awareness of our Geoscience professionals on the diverse impacts which various aspects of the geosciences have had in the past. Many of these principles continue to affect modern societal development, particularly in policy and decision-making with respect to resource utilization, development of economic goals and international policy.

To properly implement the Stealth Education approach, the presentations should not necessarily emphasize the geosciences in their titles. Instead, presentations should use title topics that appeal to their target audience.

A good example of Stealth Education can be found in a series of mystery novels by author Toni Dwiggins, who utilizes Forensic Geology as a key element in the themes of her books. These books include solid geologic information woven into a mystery format suitable to the general public.

In addition to presenting geology as a real science, she introduces elements in her novels that illustrate how the geosciences impact both past and future problems of modern culture, e.g. increased salinity in the Colorado River and its impact on agriculture. In the process, she presents factual geoscience information as key elements in problem-solving while maintaining an entertaining mystery venue for non-geoscience audiences. I especially recommend the novels Volcano Watch, River Run and Quicksilver as examples of applying forensic geology to problem-solving in a manner appealing to the general public.

In this editorial, the example is designed for audiences interested in Central American and Caribbean History. The primary theme is centered on the rise and fall of the Spanish Empire in the Americas allowing opportunities for expansion of the discussion into several basic elements of the geosciences.

As a general theme, the emphasis on Spain’s interest in conquering the Americas was the presence of gold and silver. In an historical context, the gold and silver was needed to fund the ongoing wars between Spain, the Moslem Empire and the various elements involved in the Protestant Revolution. As a result, the growth and expansion of Spanish power in the area was heavily oriented toward acquiring mineral resources.
Integrating the geosciences into this scenario begins with the origins of the desired minerals and illustrating why these areas were so rich in the target resources. The following illustration can be used to provide entrees to this type of discussion. A good way to capture audience attention is to show some of the treasure that was the goal of the Spanish conquest as shown in Figure 1 from the Museo del Oro in Bogota, Colombia.

Since the acquisition of gold and silver was a driving force for the Spanish Conquistadores, it is appropriate to introduce the sources of gold and silver so abundant in Central and South America. Figure 2 provides an excellent entree into the discussion of volcanism, magmatic segregation, placer and in-situ mining, and the relationship between plate tectonics, volcanic activity and other geoscience factors common to the subduction boundaries and consequent volcanism.

As shown in Figure 2, volcanic activity associated with subduction has a major influence on the origin of the ore bodies containing metallic minerals. This figure illustrates the role of magmatic differentiation in the emplacement of metallic ores, particularly gold, silver, copper, mercury and other late-stage, low temperature products of magmatic cooling. This relationship can be used to discuss the presence of precious minerals in western North America, the Mediterranean, South Pacific, Alaska, India, Canada, Africa and Central America. However, since the main emphasis of this discussion is the Spanish Empire in Central and South America, figures 3 and 4 on the following page are used to illustrate the distribution of volcanoes in Central and South America, the source of the gold and silver resources which drove the Spanish conquests.

The relationship between volcanoes and plate tectonics can be introduced in Figure 3. Elements of this figure can also provide entrees for discussion of earthquake origins and controls on their location, intensity and frequency in presentations where those topics are of potential interest to a given audience (California, the Balkans, Canada, Alaska, Japan, the Mediterranean and middle eastern countries, etc).

The Spanish Empire in the Americas as shown in figure 5 on page 36 was extensive and, by 1819, covered most of the Americas. The driving force for this expansion was the search for gold and silver, necessary to finance Spain’s world-wide role as Defender of the Catholic Faith against Islam and the Protestant Revolutionaries.
title refers to a Muiscan ritual in which a new Cacique or chief was initiated by covering his body with gold dust which he washed off by diving into Lake Guatavita, located just north of present-day Bogota, Colombia. Thus the searches for El Dorado and the Seven Cities of Cibola were actually triggered as exploratory expeditions to find the supposed treasure-laden Cities of Gold.

The location of major cities and ports in the New World were heavily influenced by the character of the North Atlantic Gyre. Since this was an era of sailing ships, movement of ships and supplies was slow by today's standards, about one and a half knots. With the aid of current flow in the southern side of the North Atlantic Gyre, that speed could be increased by up to two knots, reducing the transit time between Spain to the new world by up to 50%, as long as they stayed within the latitudes affected by the current systems (see figure 6, page 44.)

Thus the searches for El Dorado and the Seven Cities of Cibola were actually triggered as exploratory expeditions to find the supposed treasure-laden Cities of Gold.

This made the establishment of port cities at impact points of the current systems very important and led to the establishment of major bases at Cartagena, Colombia and Havana, Cuba in the Americas and Cadiz, Spain on the European leg of the journey (see figure 7, page 37). In like manner, Pacific ports, e.g. Panama, City and Acapulco, provided favorable locations for transhipment of Incan silver to the relatively narrow Isthmus of Panama and then to the Caribbean for trans-loading at Porto Bello, Panama. The city of Vera Cruz, Mexico was established as a transhipment port for silver from western Mexico to Havana, which was the primary supply center and departure point for the treasure fleets enroute to Spain.

Most of the area claimed by Spain is characterized by active volcanoes and is rich in both gold and silver ore bodies. The initial conquest of the area was driven by discovery of stockpiles of gold and silver accumulated over centuries by the Aztecs, Inca, Muiscas, Quimbayas, Sinu and other indigenous tribes.

Most of the Spanish expeditions into North America were actually attempts to discover additional gold reserves, stimulated by mistranslations of “El Dorado” as a “City of Gold” instead of the proper translation “The Golden Man”. This

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Figure 3. Distribution of Volcanoes and Earthquake epicenters in Central America- After Richard Rhoda and Tony Burton, January 10, 2010 – Figure 2-2 in Geo-Mexico, the geography and dynamics of modern Mexico, Paperback available through Amazon.net.

Figure 4. Progression of Cocos Plate movement under Central America (After Luca Ferrari, 2004, Slab detachment control on mafic volcanic pulse and mantle heterogeneity in central Mexico: Geology, Vol. 32, Pgs. 77-80.)
It is always useful to insert some spectacular slides into a presentation to wake up those who tend to nod off whenever the lights go dim. Figures 8a and 8b are examples of the types of visuals that can perform that function. The altars shown were intended to demonstrate the wealth extracted from the Americas by the Spanish and are a display of power used by Spain to intimidate potential enemies. Today they are excellent examples of Spanish arrogance and profligate use of the treasure they found in the New World civilizations.

They also illustrate the value attributed to the minerals extracted from the Central Americas and northern South America during the Spanish occupation. Figure 8a (page 37) shows the importance of Cadiz, Spain as a main port of debarkation for treasure fleets from the New World while figure 8b, the Altara del Oro (Golden Altar) in Panama City, Panama is an indicator of the importance of that city as a receiving and transhipment port for treasure from the Incan Empire in South America. Both were intended to flaunt the power of the Spanish Empire in the New World.

The presence of the altar of solid silver in Cadiz, Spain can also be used to introduce the concept of fluvial transport variability. The original treasure shipments from the New World were taken directly up the Guadalaquivir River to Seville, the capital of Spain at that time. However, reduction of flow resulted in increased siltation in the river. When the siltation reached the point that ocean-going ships could no longer navigate the river to Seville, Cadiz then became the primary transshipment point to shallow-draft barges which transported the cargoes of the treasure ships to Seville.

The slides in this editorial are examples of the types of features which provide opportunities for insertion into presentations on travel, history, military strategy, piracy, anthropology, metalworking, ship building (Galleon development), precious gems, cultural change (horses, which were not present in the New World, were introduced to the New World by the Spanish), development of religious schisms in Europe, and many other topics which can be best determined by the background of the geoscientist involved.

Keep in mind that the primary goal of Stealth Education is to make the geosciences understandable and demonstrate their potential value to those people who control the future.
in the news (earthquakes, hurricanes, floods, volcano eruptions, tsunamis, or other phenomena) as appropriate and timely to the subject and the audience at hand.

References


Luca Ferrari, 2004, The Geochemical Puzzle of the Trans-Mexican Volcanic Belt: Mantle Plume, Continental Rifting, or Mantle Perturbation Induced by Subduction? Figure 1 – Simplified map of Neogene volcanism and faults in central Mexico www. Mantleplumes.org.


Map of the Spanish Empire in Central and North America in 1819, (Wikimedia Creative Commons). The map was created with ADOBE Photoshop using information from the United States Geological Survey, an agency of the United States Department of Interior 1810, 1820 and from the Secretary of the Public Education of Mexico (Secretaría de Educación Pública de México) with 500 años de documentos.

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Richard Rhoda and Tony Burton, 2010 – Figure 2-2 in Geo-Mexico, the geography and dynamics of modern Mexico, Paperback available through Amazon.net.


Seville, in Wikipedia, the free encyclopedia.
Changing Face of Geology Textbooks

Rasoul Sorkhabi, Ph.D., CPG-11981

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

College and university textbooks are the first tools in the training of geologists, geochemists and geophysicists. Research on the history and evolution of geology textbooks is scarce; although, such studies would show how and why the textbooks have changed through time and how this knowledge can improve the writing and publication of future textbooks in geology, and hence the quality of geology education. This article is a small effort along this line of thought.

From Charles Lyell to Arthur Holmes

The term “geology” (geologie in French and German, and geologia in Italian) as the name of a new branch of natural science appeared in 1778-79 in the writings of J. A. De Luc and H. B. de Saussure. In the late 18th and early 19th centuries, geology emerged as an independent field out of what was previously called natural philosophy, natural history, and mining. James Hutton, who is regarded as one of the founding fathers of geology, entitled his 1788 book The Theory of the Earth, and it was so hard to read that his friend John Playfair decided to popularize it in a new book, Illustrations of the Huttonian Theory of the Earth (1802).

Although several books using “geology” in their titles appeared in the early 19th century, it was Charles Lyell’s Principles of Geology that dominated the discourse and remained the most influential geology textbook throughout the 19th century. First published in 1830-33 (by John Murray in London) in three volumes, Lyell’s Principles of Geology went through twelve editions. The last edition in 1875 (in two volumes) was published posthumously. Indeed, very few geology textbooks have enjoyed such a long-standing presence in academia. Lyell’s textbook even influenced public thinking and popularized geology. Lyell wrote his book mainly to articulate and argue for the principle of uniformitarianism – the idea that the processes we observe today also occurred in the past so much so that the past history of Earth can be interpreted by the present processes and observations (“the present is the key to the past”). Indeed, the subtitle of Lyell’s book read: “Being an attempt to explain the former changes of the Earth’s surface by reference to causes now in operation.” This was an extension of Hutton’s and Playfair’s thinking and writings.

Lyell also wrote a more educational and manual textbook, Elements of Geology, first published in 1838 (also by John Murray) with a seventh-edition in 1871. However, his Principles of Geology remains a classic and has even been published in our time by Penguin Classics (abridged edition in 1997) and Yale University Press (all three volumes, 2009).

One reason for the popularity of Lyell’s book was his vivid, accessible, and narrative style of its prose. The same is also true for Charles Darwin’s Origin of Species, published in 1859, but is still read as a classic in science. (Darwin, by his own confession, was influenced by Lyell and carried a copy of Principles of Geology on his voyage on the Beagle.) This style of writing is largely absent from the current textbooks.

Moreover, what sets apart Lyell’s textbook from many of the current geology textbooks is that its author was himself a pioneering and world-known geologist and that his book did not simply offer a standard knowledge-base of geology but also incorporated Lyell’s own observations and research, and reported on research results of other geologists. This style of writing was also true for some other popular geology textbooks in the 19th century: For example, Archibald Geikie’s 990-page Text-Book of Geology, which resulted from his lectures at the University of Edinburgh and was first published in 1882 (by Macmillan) with a third edition in 1893. Perhaps this style of writing could only be used in the 19th century when geology was an infant science. Nevertheless, in the 20th century, one of the few geology textbooks (so far as I know) that followed Lyell’s suit was Arthur Holmes’ Principles of Physical Geology, whose title was also inspired by Lyell’s book. Holmes published the first edition of his book in 1944; its second edition came out in 1965 (the year he died); the third edition in 1978 (revised by his wife Doris Reynolds Holmes); and the fourth edition in 1993 (rewritten by Donald Duff). In the 1944 edition of his textbook, Holmes included a chapter on continental drift (a taboo at that time) and discussed his idea of how a continent may break up by the mantle convection currents and a new ocean would form between the two drifting continental blocks. This notion was later rediscovered as sea-floor spreading in the 1960s. Indeed, few geology textbooks today would offer such original and new thoughts.

American Response

Textbooks by Lyell, Geikie, and Holmes, all written and published in the UK, were used in universities on both sides of the Atlantic. An American counterpart to Lyell’s textbook, in statute and popularity, was James Dwight Dana’s Manual of Mineralogy, first published in 1848, and its later editions were published even after Dana’s death in 1895, by his geologist son Edward Dana, and later by W.E. Ford, C.S. Hurlbut, and lately by Cornelis Kelin who released its 23rd edition in 2007! Dana also wrote Manual of Geology (1863, third edition in 1880) with a subtitle, “Treating of the Principles of the Science
with Special Reference to American Geological History, for the Use of Colleges, Academies, and Schools of Science.”

In the first half of the 20th century, William John Miller (1880-1965), a professor at Smith College in Northampton, Massachusetts, was one of the most prolific and popular authors of geology textbooks in North America. Miller’s textbooks were published by D. Van Nostrand Company in New York and all went through several editions: An Introduction to Historical Geology, with Special Reference to North America (1916, sixth edition in 1952); An Introduction to Physical Geology, with Special Reference to North America (1924, sixth edition in 1949); An Introduction to Geology (Physical and Historical), with Special Reference to North America (1916, fifth edition in 1942); and Elements of Geology, with Special Reference to North America (1931 and 1939).


**Plate Tectonic Revolution**

One of the characteristics of the many of geology textbooks published in North America during the early-mid 20th century was their dismissal of Alfred Wegener’s idea of continental drift. Most American authors instead promoted the geosynclinal idea that was developed by James Hall and James Dana in the late-19th century modelled on the Appalachian basins and mountains. Wegener’s idea of continental drift was rediscovered with new evidence from sea-floor mapping (mid-ocean ridges, transform faults, and subduction zones) as plate tectonics in the 1960s. Beginning with the 1970s, geology textbooks increasingly attempted to incorporate plate tectonics. For instance, Earth by Frank Press and Raymond Siever (W.H. Freeman, 1974) in physical geology, and Evolution of the Earth by Robert H. Dott, Jr., and Roger Batten (McGraw-Hill, 1971) in historical geology.

In the past five decades, a large number of authors have produced physical and historical geology textbooks that have used plate tectonics as a unifying paradigm to explain igneous activities, metamorphism, earthquakes and volcanic eruptions, mountain-building events, and so forth (in the same way as the 19th century geology textbooks attempted to interpret geology in terms of uniformitarianism, cooling-contracting Earth or geosynclines). The modern textbooks, however, have evolved in some other manners as well. They have become larger formats (9 x 11 inches, in contrast to the previous 7 x 10 inches). They are profusely illustrated with color photographs and diagrams (in contrast to black-and-white images of the previous textbooks). And with the advent of the Internet and online sources, they have become digital packages (in contract to print-only textbooks) and provide links to the relevant website and audiovisual materials. With the growth of the environmental movement in the last five decades, textbooks on environmental geology and natural hazards have joined the traditional physical and historical geology categories.


Despite remarkable advances in publishing, as far as the content and coverage are concerned, the current textbooks in a given field remain highly similar. They all present a set of established knowledge-base in their respective fields. Pick any one of them; it will suffice for teaching a basic course on general, physical, historical or environmental geology. Moreover, even though the textbooks go through new editions every three to five years, their contents and concepts change little; new research results or debates are rarely incorporated. The revised editions are largely for digital re-packaging, updating some sources or numbers, or replacing some illustrations. Of course, discoveries significant enough to make us rewrite textbooks (such as the discovery of a meteorite impact at the Cretaceous-Paleocene boundary by Louis Alvarez and his and son Walter in 1980) do not happen every year. And it takes perhaps a decade or so for a discovery or new idea to become established and find its way into textbooks (as we have seen in the case of plate tectonics and mantle plumes). Luckily, we all now have access to online sources, and important research results are fast transmitted through the Internet. In this way, geology instructors are in a unique position to engage the students with new developments, debates, and discoveries. They do not need to wait for textbooks.

**Open Textbooks**

In recent years, there have been a few attempts by college professors to produce online, open, and free geology textbooks for their students. Because they do not enjoy the technical support of a major publishing company, open geology textbooks may not have high sophistication in their coverage and presentation as the mainstream commercial geology textbooks do. However, this is only a matter of time. Open geology textbooks will grow and will become more attractive to instructors, students, and colleges, mainly because they are free and save lots of money for students. This will compel commercial textbooks to offer new packages to the instructors, students, and colleges. An open geology textbook that I have used since its appearance in 2017 is the one developed at Salt Lake Community College.2

Since the ancient Sumerians and Egyptians began writing on clay tablets and papyrus some 5,000 years ago, humanity has come a long way to today’s digital platforms. The face of textbooks will continue to change. However, two things are certain and will remain the same. First, new knowledge and sound writing will be needed. Second, good teachers will always be in demand. A good teacher, as a German proverb says, is better than two books. The same textbook will speak differently in the hands of two different teachers.
### Table 1. A list of geology textbooks widely used in North America

<table>
<thead>
<tr>
<th>Title</th>
<th>Authors</th>
<th>Publisher</th>
<th>Edition</th>
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<tr>
<td><strong>Earth Science</strong></td>
<td></td>
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<tr>
<td><em>Understanding Earth</em></td>
<td>J. Grotzinger &amp; T.H. Jordan</td>
<td>W.H. Freeman</td>
<td>2019 (18th ed)</td>
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<td>Earth’s Natural Hazards: Understanding Natural Disasters and Catastrophes</td>
<td>D.M. Best &amp; I. A. Uktins</td>
<td>Kendall Hunt</td>
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<td>E. Bryant</td>
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about Robin Williams's struggle with LBD. To learn more about it, watch the documentary "Robin's Wish" to see the struggle he endured from this insidious disease. It quickly progressed. It was hard for all who knew and loved him supported them and had their backs.

Roy graduated from Miamisburg High School in 1968, received a degree in geology from Miami University in Oxford, Ohio, and his masters' degree in hydrology from Wright State University. He then moved to Richland, Wash., in 1972 to work for Atlantic Richfield Hanford Company, later Rockwell Hanford Operations, as a senior hydrologist. Roy had 40 years’ experience in the environmental sciences and nuclear/hazardous waste industry. He was a sought-after expert about Hanford and U.S. Department of Energy environmental management issues. His career focused upon geohydrology, risk management, and science-policy linkages, writing, and lecturing. Roy presented at scientific conferences in Russia, Vienna, Prague, and across the U.S.

He managed numerous programs, projects, and line organizations spanning applied environmental technology to basic science. Roy authored 50 publications, including two award-winning books about Hanford. His best-known work is “Hanford: A Conversation about Nuclear Waste and Cleanup,” published in 2003.

Roy joined the Pacific Northwest National Laboratory (PNNL) in 1987 after working as a field geohydrologist with the prime contractors on the Hanford Site. He retired in 2012 as a Chief Environmental Scientist addressing vadose zone characterization and remediation challenges facing the Hanford Site.

He was a respected manager and mentor throughout his career, beloved by his staff and coworkers, and he always supported them and had their backs.

He was diagnosed with Lewy Body Dementia in 2019, which quickly progressed. It was hard for all who knew and loved him to see the struggle he endured from this insidious disease. To learn more about it, watch the documentary “Robin's Wish” about Robin Williams's struggle with LBD.

Honoring our members and their careers is important to AIPG. Every member has contributed to the field in one way or another. Help us honor their memory and be sure to notify headquarters of the passing of a member.

aipg@aipg.org

James Hollingshead, MEM-1466
Maitland, Florida
October 11, 1961 - July 17, 2020

Member Since 2008
The following is excerpted from the Orlando Sentinel

James Hollingshead passed away peacefully on Friday July 17th, 2020; he was deeply loved by his family and friends and will be sorely missed.

James was a kind, gentle soul who made everyone feel at ease. He had a great sense of humor, making people laugh with his wry wit and jokes. He also had an amazing knowledge of and memory for music, enjoying a wide range of genres; it was common to hear him playfully quizzing friends and family on music trivia. Some of that talent apparently went to his daughter Leah, who majored in music in college.

James was born on October 11, 1961 in Denver, Colorado. At age 2, he moved to central Florida with his family when his dad was transferred here to work for Martin Marietta as an aerospace engineer. James grew up in Winter Park, attending Winter Park High School and then heading to the University of Florida, where he obtained his Bachelor’s degree in Geology. He continued to be an avid Gator fan, enjoying games, Homecoming, and visiting daughter Christy when she carried on the tradition and attended UF as well.

James worked in environmental consulting during the first part of his career. In 1998, he transitioned to the public sector to work as a hydrologist for the St. Johns River Water Management District, where he spent many rewarding years managing a dedicated team of hydrologists and scientists.

He was known for being fair and kind in his interactions with staff, colleagues and clients, as well as for his intelligence and depth of knowledge of the Florida aquifer. He was also known for his ability to defuse challenging situations with his humor and wit.

Max A. Krey, CPG-02298
Grand Junction, Colorado
1922 - July 3, 2020

Member Since 1971
The following is excerpted from the Daily Sentinel

Max was born on the family farm north of the small town of Zenith, Kansas, to Cephas Marion and Carrie Mary Krey in 1922. His older sister, June L. (David Hancock), and older brother, Fred Junior (Maxine Lavielle), taught him about farm life and tried to keep him out of trouble.

A 1940 graduate of Sylvia High School, he enjoyed playing football, roller skating, and other outdoor sports. He attended Kansas State University in 1940 to study civil engineering. Max was inducted into the Army in 1942, and served the 655th Engineer Topographical Battalion, doing aerial photography until discharged in 1946. He then re-enlisted in the Air Force Reserve as a First Lieutenant until discharged in 1956. It was during this time that he returned to Kansas State University,
IN MEMORIAM

Jon R. Lovegreen, CPG-04379
Irvine, California
1947 - December 6, 2020

Member Since 1978

The following is excerpted from a posting by one of Jon’s sons, Alan Lovegreen, and provided by Stephen Testa.

Jon Richard Lovegreen, a geologist, environmental consultant, loving husband, father, and grandfather, died of natural causes on Dec. 6, 2020 in Southern California. He was 73.

The eldest of four, Jon was born in Quincy, Illinois to Mary and John Lovegreen, and spent his early years in the Midwest. His family moved repeatedly when he was young, “something on the order of eleven times in eleven years,” he once wrote, eventually settling in the Fruit Basket of the World – Reedley, California. There Jon met his high school sweetheart and future wife, Laurie Manty, whom he sat next to “in successive rows in assembly.”

He attended Reedley Community College in the late 1960s and then went on to USC on a variety of scholarships. Upon graduating with a B.S. in Geology in 1970, he and Laurie married. Their honeymoon was a cross-country trip to the East Coast (in a red Fiat 850 coupe!) so that he could attend Columbia University for graduate school.

At Columbia, Jon worked as an engineering geologist and field geologist while Laurie taught fifth grade in New Jersey. He served as a micropaleontologist for the Lamont-Doherty Geological Observatory aboard the R/V Vema in 1972. He vividly recalled retrieving cores in the Indian and Atlantic oceans as the Vema maneuvered around storms, and was struck by the optical phenomena of the green flash at sunset. Jon backpacked through Africa and met Bob Incerti in Tanzania, which was the beginning of a half-century friendship.

Jon graduated from Columbia in 1973 with an M.S. in Geology after completing a substantial thesis titled and covering the Paleodrainage History of the Hudson Estuary. He then worked for Woodward-Clyde Consultants doing fault and earthquakes studies for large engineering projects like hydroelectric systems, powerplants, high rise buildings, tunnels, railroads, and pipelines; the work was worldwide – Iran, Switzerland, South Korea, Argentina, Greece, Algeria, Egypt, and India, as well as throughout the United States.

A lifelong traveler, during these years Jon constantly put new pins in the world map by backpacking through Africa, performing aerial surveys of seismic potential in protected airspace in the Middle East, and touring Europe with Laurie. He loved many places from these early travels: Mauritius, the Alaskan Range, Bermuda, St. Thomas V.I., Cape Cod, Boston, Upstate New York. Later he would add the Seattle area, San Juan Islands, Palm Springs, Mammoth Lakes, Southern England’s Jurassic Coast...

In the early 1980s, as “large engineering projects became a thing of the past,” he moved into the environmental field, working at early semiconductor facilities where releases of solvents into the groundwater prompted many of the underground storage tank regulation and environmental regulations of California. Then, in 1985, he and another scientist cofounded the California company Applied Geosciences Inc. Jon helped design some of the early leak detection and monitoring systems that were used to create remediation programs for aerospace facilities, transportation facilities, and coatings manufacturers. Joe Frey, who worked with Jon at Woodward-Clyde and then at Applied Geosciences, remembered fruitful early morning breakfast meetings at a diner in Tustin and remarked that [Jon] “set the standards.” Some of his publications that he authored or coauthored during that time reflect this shift from fault studies and reservoir-induced seismicity to his next career phase dealing with petroleum hydrocarbon investigation and remediation. In addition to his regulatory and technical expertise, Jon’s bedside manner also helped his clients understand the stakes. Dave Ridley recalls how he loved speaking with Jon “because he had this great ability to put himself in [others’] shoes (as if he was investing his own money in the deal).

After ten years of Applied Geosciences he went on to work for the consulting firm ATC and, in 2003, began serving as the Division and District Manager of Vertex Engineering Service Inc.’s Southern California office. He then completed his career as Manager of the Private Practice Group within Tetra Tech, Inc. Pam Andes describes how Jon would swap family photos and spend car rides to regulatory agencies or a lunch together talking about their families. Likewise, Jim Kennedy notes how “he always enjoyed talking to him, learning from him, surviving the crush of a transaction with him,” and said that Jon “was a guy you could trust and a guy whose judgment you could trust. And you could have a laugh with him amidst all the talk of contaminants, risks and remediation.”

His friends and colleagues found him to be “the consummate environmental professional [...] calm, thorough, thoughtful (even professorial!), prepared and value-adding.” Jon “was always excited and wanted to solve the many mysteries that a job would present.” In addition to the profound satisfaction he found in his work, Jon also took pleasure in the merriment and friendship that welled up from the same source.

His colleagues recall some of these times and impressions. Imagine a fresh-out-of-college-hire, Paul Roberts, in the ‘80s, having to wing it for a meeting with the Mayor of Santa Fe...
Says and other suits because Jon was late, only to have the man stride into the room dressed as a pirate...it was Halloween...and seamlessly pick up the presentation next to his mortified employee! Or how about Jon road-tripping to Portland with Trammell-Crowe’s Robert Chute to “1) identify [...] & dispose[e] of what turned out to be 106 separate hazardous waste streams of chemicals, and 2) test, clean & ensure the building was safe for occupancy,” with the bonus acquisition of 3) ‘Project Multnomah Whiskey Library’ in downtown Portland, which also required considerable sampling and oversight.

Malcolm M. Roeber, CPG-02149
Creede, Colorado
December 6, 2019

Member Since 1970

The following was obtained from Newsbreak.com.

“Mac” Malcolm M. Roeber Jr. of Creede, Colorado peacefully passed Dec. 6, 2019, at Lovelace Heart Hospital in Albuquerque, New Mexico. Mac was surrounded by his family and is survived by his wife China, daughters Joyce and Diana, and son Wayne.

Martin A. Vaughn, CPG-01972
Tulsa, Oklahoma
February 27, 1927 - March 5, 2019

Member Since 1969

The following is from the Ninde Funeral & Cremation website:

Martin Allen Vaughn, WWII Army veteran, born February 27, 1927 in Shawnee, OK, died March 5, 2019 and is survived by his wife, Nancy. He loved the Young Men’s Bridge Club, art, music, poetry and his huge family of 9 children, 19 grandchildren, 6 great grandchildren and many dear friends. He graduated cum laude from Oklahoma Baptist University to become a geologist and work for Phillips Petroleum for 30 years, then joining Mustang Production, then the Mabee Foundation. He was a lifelong member of AAPG, AIPG, and the Society of Exploration Geophysicists.

John W. Williams, CPG-06615
San Jose, California
August 2021

Member Since 1984

The following was written by Jim Jacobs, C.P.G., California Section President; Photo credit: Margaret Williams, John’s wife.

John W Williams was a professor emeritus of engineering geology, Department of Geology, San José State University and former department chair, a position he held for 25 years. He earned his PhD degree in geology at Stanford University after receiving an undergraduate degree in geology at the College of William and Mary in Virginia. Following graduation from Stanford, he worked as an engineering geologist from 1971 to 1976 with the California Division of Mines and Geology (California Geological Survey). He joined the Department of Geology at San Jose State University in 1976 where he served until his retirement in 2006. Dr. Williams was a licensed geologist, certified engineering geologist, certified hydrogeologist in California and held licenses in several other states. His areas of expertise and practice focused on slope stability and seismic issues as they impact the safe utilization of land. He served as thesis advisor for many graduate students and wrote approximately one hundred publications, numerous volunteered professional talks, and many invited national and international presentations. He was elected president of the Association of Environmental and Engineering Geologists (AEG) and the National Association of State Boards of Geology (ASBOG) and was a Fellow of the Geological Society of America. He was president and a founding officer of the Engineering Geology Foundation (1996-2000), and the Association of State Boards of Geology Foundation (ASBOG Foundation) (2007-2010).

John received numerous awards for his extensive volunteer service to the teaching and profession of geology. Here are a few of the selected awards:

- Floyd T. Johnston Service Award Association of Environmental and Engineering Geologists (1998)
- Meritorious Service Award Engineering Geology Division Geological Society of America (1992)
- San José State University – Dean’s Award for Exemplary Teaching, Dean’s Award for Exemplary Leadership, elected to faculty membership in Phi Kappa Phi national honor society
- Fellow – Geological Society of America

John had an illustrious career teaching geology students at the university level. In addition, he mentored young and old professionals through his inspiring lectures, his professional society activities, and by the power of his example. Through the AIPG California Section activities, both the UC Davis and UC Santa Cruz geology students were lucky to hear Dr. Williams’ heart-felt presentations on non-technical issues of geology. The UC Davis talk was focused on the challenging areas of being a professional geologist related to ethics and personal relationships. During the Davis, California talk, he went over several technical projects he had worked on in detail and then dove into the non-technical but important ethical considerations.

A born teacher, he was inspiring and patient in listening to student questions and answering them thoughtfully. On occasion, he participated in the AIPG Washington, D.C. Fly-in and a chance to work with other professional geologists and meet their respective Congressional members. He was also active in Sacramento and met with state representatives as part discussions for continuing professional licensure for geologists.

John is to be remembered as kind and patient. John gave a rousing pre-COVID 19 live talk in late November 2019 to UC Santa Cruz geology students, shortly before the AIPG Student Section was formed. In the talk, he described the essential steps along the pathway to a successful career in applied geology. John provided students with a boots-on-the-ground view of what it takes to find professional success in the field of geology. In his own words, he gave the following terrific advice for students, and AIPG members:

Continued on p. 52
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

Adam Heft, CPG-10265, Editor
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**CEUs: 0.10**

Presented by:

**AIPG**

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aipg@aipg.org
Doing minerals exploration field work provides vast opportunities to learn about the part of the world that you are in that extends well beyond just the geologic setting. I experienced many such fascinating educational adventures while conducting exploration for molybdenum in Montana in the late 1970s.

Late on a summer afternoon in 1978, I was sitting atop the Castle Mountains near White Sulfur Springs with my eager field assistant Steve Richardson. Having examined the rocks on the way up, we then watched huge cumulus clouds rise like fury in the late afternoon heat, as if they were boiling. “That could generate a tornado,” Steve commented. A few days later while hiking up one of the mountain valleys there, we were surprised to see that all the trees on one side of the valley had been knocked down in one direction, and those on the other side were lying in the opposite direction. We surmised that a tornado must have passed through there in the not too distant past, but not that week. Even though this happened more than forty years ago it stands out to me as clearly as if it were yesterday.

Later that summer as we were driving adjacent to the nearby Crazy Mountains we passed through the small community of Ringling, Montana, named after the Ringling brothers of Ringling Brothers Circus fame. At one time the Ringlings owned ranch land in the area amounting to about one-hundred thousand acres; they even considered establishing their circus headquarters there, but didn’t. Who knew!

During the summer of 1979 three of my summer field hands and I departed from our exploration office in Missoula, Montana, and drove to the area around Lewistown, Montana—almost the geographic center of the state—where we looked at several mineral properties in the Judith Mountains. Over a three-week period we mapped and sampled eleven areas of potentially favorable geology and examined some old underground workings in the Central Montana Alkalic Province. None of these prospects was worth pursuing any further, but the sight of the wide-open countryside of the northern Great Plains’ vanishing prairie off to the east was well worth the visit. Had our vision been better, we could have seen Minneapolis from the summit of the Judith Mountains; there was nothing to impede our eastward view for 750 miles, except for the curvature of the Earth. While standing on the high peaks of the Judith Mountains we imagined what it must have looked like below us in the mid-1800s when thousands upon thousands of buffalo roamed those vast plains. It would have been a sea of black.

On our drive back to our office our route took us through Three Forks, Montana, the location of the headwaters of the Missouri River west of Bozeman, Montana. Here, the Jefferson, Gallatin, and Madison Rivers, named by the Lewis and Clark Expedition as they passed through the area in 1805, merge to create the Missouri River, that mighty river draining the east side of the Northern Rockies. This storied river carries sand and silt from the Rockies north and eastward across Montana, through the Great Plains’ wheat fields of North and South Dakota, past Council Bluffs, Iowa, then to the Mississippi River where it eventually is deposited as the vast delta at New Orleans. Because of the conveyor belt action of the Missouri River, the Mississippi River delta is comprised in large part of detritus from the Rocky Mountains. Terrain that is being worn down in one place (Montana) is being built up in another (Louisiana). Without this process, there would have been no land on which to build the city of New Orleans. This is geology in action!

Let me end this by telling you about what could have been very frightening. For a while we explored around the town of Lincoln near the Continental Divide in Lewis and Clark County. We did not know it at the time, but this is where Ted Kaczynski, the Unabomber, was living as a recluse in a remote cabin. This domestic terrorist was fabricating mail bombs which he used in his nationwide bombing campaign against people involved with modern technology. From 1978 to 1995 he ended up killing three people and injuring 23 others. It’s a good thing we did not run into him!
Geology must be in my blood. That’s because my great-grandfather owned and operated a brickyard in Bath, New Hampshire, the town in which I grew up. And what did he make the bricks from – from clay contained in glacial varves deposited in Glacial Lake Hitchcock. Eustache Lamarre was born in 1869 near the St. Lawrence River in Quebec, and in 1886 at age 17 he moved to northern New Hampshire where he mined clay for brickmaking over a period of about 25 years.

The brickyard was located in a corner of Bath adjacent to the north-south-trending Connecticut River Valley. At its northern end, the Connecticut River is the border between New Hampshire and Vermont, and the river extends southward to empty into Long Island Sound. During the Ice Age the Laurentide Ice Sheet covered all of Canada and parts of the northern United States. When the ice sheet started melting and began its final retreat around 15,000 years ago, glacial meltwaters dumped large volumes of sand and gravel at its southern extent in central Connecticut, thus creating a terminal moraine that served as a dam. As the glacier continued to retreat north through New England, meltwater became trapped behind this sediment dam, forming Glacial Lake Hitchcock. Over the course of about 4,000 years, the lake gradually extended up the Connecticut River drainage as far north as northern New Hampshire and Vermont, a distance of about 200 miles and was as much as 20 miles wide. The lake was named in honor of the influential 19th century geologist Edward Hitchcock from Amherst College. The lake is often referred to as New England’s Greatest Glacial Lake.

Glacial Lake Hitchcock deposited annual layers of sediments, called varves - silt and sand in the summertime (due to glacial meltwater) and clay in the wintertime (as the lake froze). In the historical past the clay-rich portions of the varved lake deposits were mined from clay pits by European and Canadian settlers who mixed the clay with a small amount of sand as a binder, shaped it into bricks in wooden forms, and set them out to dry. After partial drying, the bricks were fired in a kiln and used to make the traditional red bricks still seen today in many of the historic buildings in the Connecticut River Valley. This became an important early industry in New England, and my great-grandfather was one of those industrialists. He employed up to 25 workers at his brickworks, mostly French-Canadians, and his bricks were shipped as far away as Massachusetts. The brickyard closed in 1922.

Fascinating to me is the fact that the Lamarre Brickyard was one of the areas that geologist Robert W. Sayles studied as a professor at Harvard! He visited the brickyard many times and in 1919 his study of glacial deposits was published under the title, “Seasonal Deposition in Aqueoglacial Sediments.” Sayles presented evidence from the Lamarre Brickyard and other places along the Connecticut River that the glacial varves represented yearly deposition of sediment, with a coarser-grained summer contribution and a finer-grained winter component. By counting the number of varves, one can determine how long the glacial lake existed. In 1919, not everyone accepted this as fact. So in my book the Lamarre Brickyard is famous for contributing to the science of glacial geology!

Even though Eustache Lamarre’s brickyard was long gone when I arrived, I passed by its location many times on my way to high school. That school building was built of bricks made at the Lamarre Brickyard. So the geology in the bricks must have permeated me.
Underground Natural Gas Storage and the Future of Carbon Sequestration

James L. Gooding, MEM-3070

Abstract

Facilities which are currently used for underground natural gas storage (UNGS) provide a distinctive perspective on the effective design, operation and geographic distribution of future facilities for carbon dioxide sequestration (CDS) in geologic reservoirs. Indeed, saline aquifers, which have been identified previously as potential targets for CDS, are situated at depth below the surface footprints of many U.S. UNGS facilities. A strawman design concept for a hybrid UNGS-CDS facility highlights advantages for maximizing use of existing UNGS field and pipeline right-of-way (ROW) footprints while achieving additional benefits of geology-based CDS.

Keywords: Carbon sequestration, climate mitigation, gas storage, underground storage

Introduction

UNGS offers a long-baseline perspective which can usefully inform ongoing considerations about the use of geologic reservoirs for CDS. UNGS has served as a critical element of the energy infrastructure of the United States since 1915 (FERC, 2004) while CDS, as a mitigation for greenhouse gas (GHG) emissions, has taken on increasing significance since the early 2000s (Dooley, et al., 2006).

UNGS assets across the U.S. have assured that natural gas was available to industrial, commercial and residential consumers during periods when spikes of high demand exceeded available production from gas fields. As of 2019, there were a total of 457 UNGS facilities distributed throughout the U.S. with a total gas storage capacity of more than 9,200 billion cubic feet (Bcf) (Table 1).

Natural gas, and UNGS, will continue to play important roles in energy reliability as the energy production by wind and solar assets grows to replace reliance on fossil fuels (Energy Futures Initiative, 2019). Although UNGS remains necessary and important, it is reasonable to

<table>
<thead>
<tr>
<th>Reservoir Type</th>
<th>Number of Individual Storage Facilities</th>
<th>Number of Individual Gas Injection-Withdrawal Wells</th>
<th>Total Gas Storage Capacity (Bcf)</th>
</tr>
</thead>
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<tr>
<td>Aquifer</td>
<td>54</td>
<td>1,718</td>
<td>1,371</td>
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<td>Hydrocarbon Reservoir</td>
<td>351</td>
<td>12,244</td>
<td>7,162</td>
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<td>Salt Cavern</td>
<td>52</td>
<td>111</td>
<td>699</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>457</strong></td>
<td><strong>14,073</strong></td>
<td><strong>9,232</strong></td>
</tr>
</tbody>
</table>

Notes:
A. Data from annual regulatory reports (PHMSA, 2020).
B. A storage facility consists of the underground storage reservoir, wells used to inject or withdraw gas plus surface-support equipment, including gas compression and treatment.
C. Other wells not counted here include observation wells which are used to monitor reservoir condition and performance including any gas migration.
D. Total capacity includes working gas (the volume available for receipt or delivery of commoditized gas) plus the base or pad gas (the volume required to keep the working gas pressurized and usable). The actual amount of capacity used at a given time depends on market supply and demand.
ask what role UNGS might play in a future low-carbon economy — especially whether UNGS infrastructure could be eventually re-purposed for CDS or at least used as a model for how CDS infrastructure might work.

**UNGS and CDS: Comparison and Contrast**

**Underground Storage Concepts.** UNGS and CDS have overlapping but non-identical technical requirements (Table 2). The main difference is that UNGS relies upon fully reversible injection and withdrawal of gas to fulfill the commercial purpose of the associated facilities whereas CDS presumes a one-way injection into permanent isolation. Otherwise, UNGS and CDS both depend upon suitable geology and the availability of pipelines to transport the gaseous commodity from points of origin to points of underground injection.

UNGS is a mature and profitable industry while CDS has been demonstrated mostly as pilot projects with limited commercial significance (NETL, 2015). The most well-known and situational application of CDS has been for enhanced oil recovery (EOR) (NETL, 2010) where economic benefits were clear. At least in the U.S., non-EOR applications of CDS have been mostly proof-of-concept experiments, especially for capture of GHG emissions from coal-fired electric-power plants.

**Geology.** For UNGS, sedimentary geology is dominant as many of the storage reservoirs are the depleted remnants of formerly productive oil or gas plays, especially involving sandstone or limestone host rocks. However, CDS wells have been constructed in a wider variety of rock types, including coal and basalt (NETL, 2012). For CDS reservoirs, porosity and permeability are key and any chemical reactivity (including mineralization reactions), which might further immobilize the carbon dioxide, is considered a desirable attribute.

Although some UNGS storage reservoirs are sufficiently saturated with water to be classified as aquifers, drier reservoirs usually are more effective for natural gas storage. In contrast with UNGS, saline aquifers are frequently discussed as advantageous to CDS, based on the widespread occurrence and typically deep isolation of saline aquifers (Hovorka, 1999). In addition, the density and chemistry of saline water tends to retard carbon dioxide mobility.

**Wells and Pipelines.** UNGS and CDS wells span similar ranges of depth and operating pressure (Figure 1) although other differences involve the phase behavior of carbon dioxide compared with natural gas. To achieve increased transportation efficiency, where economic return is a significant consideration, CDS for EOR compresses carbon dioxide to a supercritical fluid (NETL, 2010) which places special requirements on pipeline infrastructure. However, if requirements for economic return are relaxed, compressed gaseous carbon dioxide can be transported through pipelines which more closely resemble those used for natural gas (Peletiri et al., 2018). Indeed, the existing network of natural gas transmission pipelines in the U.S. has been used as one possible model for a future network of carbon dioxide pipelines (Dooley et al., 2009).

One notable difference facing pipelines and wells used for CDS rather than UNGS is that carbon dioxide is cor-

---

**Table 2. UNGS and CDS Characteristics**

<table>
<thead>
<tr>
<th>Storage Characteristic</th>
<th>Underground Natural Gas Storage (UNGS)</th>
<th>Carbon Dioxide Sequestration (CDS)</th>
</tr>
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<tbody>
<tr>
<td>High Permeability Reservoir</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Very Low Gas Migration</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Reversible Injection/Withdrawal</td>
<td>●</td>
<td>○</td>
</tr>
<tr>
<td>Sedimentary Geology</td>
<td>●</td>
<td>○A</td>
</tr>
<tr>
<td>Proximity to Transmission Pipeline</td>
<td>●</td>
<td>○B</td>
</tr>
</tbody>
</table>

**Criticality:** ● Required ○ Optional

**Notes:**

A. Saline aquifers belong almost entirely to sedimentary geology. Finding suitable reservoirs in non-sedimentary geology is highly situational.

B. Proximity to transmission pipeline is optional only if the CDS location is immediately adjacent to the source of the carbon dioxide. Otherwise, transportation of the carbon dioxide (possibly over long distances) becomes necessary.

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**Figure 1. Pressure-Depth Relationships in Gas Storage Wells by Reservoir Type.**
CARBON SEQUESTRATION

rosive — especially under supercritical-fluid conditions and with water vapor present — so that pipelines and wells which carry carbon dioxide can expect issues of mechanical integrity which are more demanding than those affecting conventional UNGS infrastructure (NETL, 2012).

**UNGS and CDS: Strawman Design Concept**

The locations and operational experience of existing UNGS facilities, rather than their associated natural gas storage capacities, are the most significant attributes which can inform the design of future CDS operations. Indeed, the total U.S. natural gas storage capacity of 9,232 Bcf (Table 1) is equivalent to approximately 0.47 metric gigatons (Gt) of carbon dioxide ¹ — only about 9 percent of the annual emission of carbon dioxide in the U.S., which is more than 5.4 Gt (EPA, 2020). Therefore, simply re-purposing existing UNGS storage capacity for CDS would not provide a significant mitigation of GHG emissions.

However, many UNGS facilities are located above saline aquifers (Figure 2) which have been independently recognized for their CDS storage potential (Hovorka, 1999). For deep saline aquifers in the U.S., the CDS storage capacity has been estimated as ranging from 2,379 Gt to 21,633 Gt of carbon dioxide (NETL, 2015). Although those saline aquifers are not involved in current UNGS operations, many of the candidate saline aquifers could be reached by drilling from surface footprints of UNGS facilities.

Using as an example a UNGS facility built into a depleted oil or gas reservoir (the most common type of UNGS reservoir), a strawman design concept for a hybrid UNGS-CDS facility (Figure 3) can be leveraged on the following principles:

- Maximize beneficial use of existing UNGS surface and ROW footprints.
- Streamline regulatory oversight of the hybrid UNGS-CDS storage facilities.

The same principles could be used for UNGS facilities built in solution-mined salt caverns although the relative configurations of UNGS and CDS wells would be different.

**Beneficial Use of UNGS Surface and ROW Footprints.** ROW issues, including litigation over eminent domain used by governments to convert private property to commercial use, are usually the most contentious issues in any new industrial infrastructure project. Maximum beneficial use of existing UNGS ROWs means substantially reducing, if not eliminating, land and environmental impacts of CDS infrastructure construction. CDS wells could be drilled and completed within the same fields used by the UNGS wells. Similarly, any new CDS pipelines could take advantage of ROWs already owned by natural gas pipelines.

**Beneficial Use of Existing Gas Transmission Pipelines.** Re-use of existing gas transmission pipelines would provide a number of benefits:

1. The estimated carbon dioxide volume assumes a gas phase where 1 Gt = 19,642 Bcf.
natural gas pipelines, where appropriate, could substantially reduce the need for new pipeline construction. Given reasonable economic incentives — especially if GHG emissions become regulated through a carbon market price or tax (FERC, 2020) — pipeline operators might convert selected natural gas pipelines to carbon dioxide pipelines. Such conversions could be made easier if the carbon dioxide could be transported as a compressed gas rather than a supercritical fluid, thereby minimizing impacts on pipeline design and operations. Upon gas-pipeline delivery to the hybrid UNGS-CDS facility, the carbon dioxide could be compressed into a supercritical fluid before injection into the saline aquifer.

Streamlined Regulatory Oversight. Combining UNGS and CDS operations into a shared facility could simplify regulatory oversight. Currently, regulatory oversight of commercial operations of U.S. natural gas pipelines and UNGS facilities are distributed between federal and state agencies. Interstate pipelines, and UNGS facilities connected to interstate pipelines, are commercially regulated by the Federal Energy Regulatory Commission (FERC) whereas intrastate pipelines and intrastate UNGS facilities are commercially regulated by the individual states in which the intrastate facilities reside. Both for intrastate and interstate UNGS facilities, safety and operational integrity is regulated by the Pipeline and Hazardous Materials Safety Administration (PHMSA) although PHMSA can delegate authority to states with qualified agencies.

If carbon dioxide becomes regulated through either a market price or tax, the federal government most likely will retain primacy for commercial regulation (FERC, 2020) of CDS pipelines and storage facilities although eventual delegation of authority to individual states might be possible. PHMSA already administers safety rules for supercritical carbon dioxide pipelines so inclusion of compressed-gas carbon dioxide pipelines should be straightforward.

Hybrid UNGS-CDS facilities most likely would be regulated by FERC (commercial) and PHMSA (safety) unless or until programs were established to delegate regulatory oversight to individual states. However, primacy of FERC and PHMSA would encourage uniform standards which would otherwise be difficult to establish through unilateral actions of individual states. More uniform and standardized rules should improve safety and reliability as well as reduce costs.

Conclusions and Recommendations

If CDS is to play a meaningful role in GHG mitigations, an effective system must be built to transport carbon dioxide from its points of capture to the points where sequestration in geologic formations can be reliably accomplished. The existing UNGS network in the U.S. is a relevant and informative model for a candidate CDS network. At least some UNGS facilities might become candidates for hybrid UNGS-CDS operations, mainly because of existing pipeline connectivity and CDS-favorable saline aquifers at depth.

Refinement of hybrid UNGS-CDS concepts should involve the following assessments:

- Geographical pairing of candidate carbon dioxide point emitters (fossil-fuel electric-power plants or industrial manufacturing plants) with candidate CDS injection sites defined by existing UNGS facilities.
- Geological evaluation of candidate UNGS sites with regard to accessibility, capacity and containment of deep saline aquifers which are suitable for CDS.
- Logistical, engineering and economic analysis of options for converting selected natural gas pipelines to carbon dioxide pipelines.
- Design of streamlined regulation of hybrid UNGS-CDS facilities to assure safety, reliability and economic sustainability.

For each candidate UNGS-CDS site, the detailed geological assessment will be an essential element before other assessments can be made meaningful.

About the Author

James L. Gooding is Managing Director of Geoclime, LLC in Seabrook, Texas USA. Geoclime provides quality and risk management consulting to energy, water, science and engineering projects where geotechnical elements are involved. He is a licensed Professional Geoscientist (Texas) and a Certified Manager of Quality / Organizational Excellence (American Society for Quality).

References

In Memoriam, continued from p. 43

“Attaining a successful career in applied geology involves more than just satisfactorily completing a number of classes in the academic setting and earning a degree. Appropriate course work in geology is essential to a successful career, but the knowledge gained from this course work must be supplemented by additional activities. Steps essential to achieving a successful career in applied geology include:

• work and field experience - get a part-time job in geology while you are in school.
• know your faculty members, who offer guidance and will be writing your letters of recommendation and clueing you into opportunities for employment.
• recognize that initial employment opportunities may not be in the immediate geographic area and that your career is likely to take you to a wide variety of geographic locations.
• improve oral and written communication skills - taking opportunities to give oral presentations.

• understand and practice the skills to become an effective team player.
• become known in the geoscience community by participating in professional societies and other organizations, starting this activity as a student member.
• recognize the importance of and work toward achieving the appropriate professional licenses. Not having these licenses is likely to be a career roadblock.
• ethical challenges will develop in one’s professional career that must be dealt with appropriately.
• take advantage of leadership opportunities.
• develop a pattern of continuing education to keep up with advances in the science.

John will be remembered for his brilliance, his kindness toward others, and his patience. For those who met and knew John, we will miss his great geology lectures and recall with fondness that he provided a great example of what it means to be an outstanding professional geologist.
Geoscience Salaries Remain Robust in 2020

Overall geoscience-related salaries increased by 2% between 2019 and 2020, which was in line with other science and engineering occupations. The greatest increases in median salaries within the geosciences were geoscience natural science managers (7% increase) and soil and plant scientists, atmospheric and space scientists, and geographers (each with a 5% increase). Median salaries for geologic and petroleum technicians declined by 1% while median salaries for petroleum engineers remained unchanged between 2019 and 2020.

Salaries for geoscience-related occupations (darker colors in the figure below) generally were higher than salaries for broad occupational categories (lighter colors in the figure below). The only geoscience occupations with lower median salaries than broad occupational categories were cartographers and photogrammetrists, geoscience civil engineering technicians, environmental engineering technicians, surveying and mapping technicians, environmental science technicians, soil and plant scientists, and conservation scientists.

Note: Broad occupational categories are shown in lighter colors and geoscience-related occupations are shown in darker colors.

Credit: AGI; data derived from the U.S. Bureau of Labor Statistics, Occupational Employment Statistics

AGI Geoscience Currents: www.americangeosciences.org/geoscience-currents
Written and compiled by Leila Gonzales and Christopher Keane, AGI
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AIPG Member Bucket List

- Attend a National annual conference
- Attend a Section meeting/field trip
- Share your expertise; give a presentation
- Be a mentor/mentee
- Write an article for *TPG and/or section newsletter*
- Donate to the Foundation of the AIPG
- Host an AIPG book club meeting
- Score 100% on Dr. Font’s "Test Your Knowledge"
- Make a YouTube video about "what geologists do"
- Participate in a student science fair/classroom activity
- Participate on an AIPG committee
- Prepare and give/take a GOLI course
- Collect the most rocks/minerals/fossils
- Travel to all of the geologically significant locations
- Have fun being a geoscientist and meeting others
- Invite and encourage a colleague to join AIPG
- and so much more... *What is on YOUR list?*