Peer Reviewed Article: Rockett Terrace Geology & the Super Collider
On December 20, 2019, President Trump signed HR 1865 into law, granting one of the first full budgets to federal government agencies in several years. Though the proposed budget by the President included widespread budget cuts for science-related activities, the budget bill passed by the House and Senate and signed by the President actually increased science investment by the U.S. Government. Of the major civilian science-related federal agencies of interest to the geoscience community, only NOAA saw an overall reduction in their budget of 1%. Some federal agencies, such as the USGS, saw increases of 10% or more, which stands in stark contrast to the 15% reduction in the proposed budget.

Budget changes varied widely between divisions within these federal agencies. A number of these divisions that are important to the geoscience community are shown below. One of the largest changes between the proposed and actual budget is for the U.S. Department of Energy Office of Energy Efficiency and Renewable Energy which saw a 20% increase from FY19 in contrast to a proposed cut of 86%. Likewise, the relatively steady total for the U.S. Department of Energy Office of Fossil Energy masks major shifts internal to the Office, including a 17% increase in the budget for carbon capture programs.

The American Institute of Physics provides an outstanding tool for analyzing the federal science budget with their Federal Science Budget Tracker (https://www.aip.org/fyi/federal-science-budget-tracker).
On the Cover: Jordan Pond and the North and South Bubbles in the background at Acadia National Park on Mount Desert Island in Maine. Jordan Pond is an oligotrophic lake that was carved out as a result of the Wisconsinian Glaciation. The Bubbles are composed of more resistant rock that were smoothed by the glacial event. Credit: Sara Pearson, CPG-10650.
DEPARTMENTS

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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. Its was founded in 1965 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 10,000 individuals have demonstrated their commitment to the highest levels of competence and ethical conduct and been certified by AIPG.

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.

The Professional Geologist (USPS 590-810 and ISSN 0279-0521) is published quarterly by the American Institute of Professional Geologists, 1333 W. 120th Avenue, Suite 211, Westminster, CO 80234-2710. Periodicals Postage Paid at Denver, Colorado and additional mailing offices.

AIPG encourages submission of articles and editorials for publication in TPG on topics related to the science and profession of geology. Submissions shall be of interest to the members of AIPG, other professional geologists, and others interested in the earth sciences. Articles and editorials may be noted as follows at the discretion of the Editor. “The opinions, positions and conclusions presented herein are those of the author and do not necessarily reflect the opinions, positions or conclusions of the American Institute of Professional Geologists.” All materials submitted for publication, including author opinions contained therein, shall include accurate and appropriate references. The Editor has the authority to solicit, edit, accept, or reject articles and editorials and other written material for publication. The Executive Committee has the authority if it so chooses to act on any particular case to support or overrule actions of the Editor regarding the solicitation, editing, acceptance, or rejection of any particular article, editorial, or other written material for publication.
This issue of *TPG* has all the material to enable you to cast your votes for next year’s officers. The slate this year is an excellent one, and I’m sure that in some cases making a choice will be difficult, but it is really important to the future of the AIPG that you vote, for without the active participation of our members our Board will quickly become a club of “insiders”, a criticism that has recently been made of some of our sister organizations. So please vote, and not only vote, but take an active part in our affairs.

We also have some excellent articles, including one on the measures that our military, mainly our navy, is being forced to take not only to protect its installations from rising sea levels, but also to adapt one of its traditional missions of responding to natural disasters all over the world. “Traditional” is an important word here: I did not realize that the US Navy has been helping hard-hit areas since 1929, when the USS Lexington provided power to Tacoma, WA, after drought drastically reduced the supply of hydropower to the city. The ship was plugged into the electrical grid and ultimately supplied 4 million kWh. The Navy’s role in providing this kind of assistance is ongoing and unsung – perhaps more publicity is in order!

An article by Stephen Pierce illustrates both the geological knowledge generated by major projects, in this case the Superconducting Supercollider that was planned for Texas, but also the concerns that such a project may give rise to among local residents, and illustrates what they can do about it, by corresponding with project managers and asking for data.

Also in this issue we have a larger than usual set of obituaries, including those of two of our Founding Members. During my Editorship I have attempted to treat obituaries as important records: they may be the only published comprehensive recognition of our careers that some of us will receive...

An article by Stephen Pierce illustrates both the geological knowledge generated by major projects, in this case the Superconducting Supercollider that was planned for Texas, but also the concerns that such a project may give rise to among local residents, and illustrates what they can do about it, by corresponding with project managers and asking for data.

During my Editorship I have attempted to treat obituaries as important records: they may be the only published comprehensive recognition of our careers that some of us will receive...

In the cases of several of the deceased in this issue, the only accessible record of their careers is in the Funeral Home’s on-line obituary, and in the cases of those who had moved after their retirement, these are woefully limited. This has struck home with me, as I have not taken the time to write up my career, and the early part was spent overseas and is unknown to any conceivable memorialist. My father’s obituary in his profession’s journal was also extremely incomplete, since he had emigrated to Australia upon retirement without leaving any summary of his career. The writer of his obituary knew only the last part of his work, and that was the least significant in terms of lasting accomplishments – such as his work on the development of the jet engine during World War II – in my opinion. So, for the sake of your descendants, of the Institution’s corporate memory, and of future historians, please take the time to write up a short summary of your professional life, and leave it with your executor(s), along with the names and addresses of those institutions who should be notified of your passing.

Sermon over.
The California Section has been working diligently to build a 2020 Annual Conference that brings students, young professionals and long-time AIPG members into their future destiny. The AIPG 2020 annual conference theme is, “Role of Geoscientists for Resiliency, Sustainability and Opportunities in the Changing Environment.” Sacramento, California is the host city and the surrounding area is spectacular. It includes the magnificent Sierra Nevada Mountains, Lake Tahoe, Sonoma and Napa vineyards and wineries, Pacific Ocean shorelines, and the Great Valley, America’s western prolific agricultural area. These great attractions are within easy driving distance of our conference location. California is experiencing a high frequency of extreme temperature and precipitation conditions which has challenged the state’s water resources, created geohazards, impacted where we grow the nation’s food and is developing vulnerabilities along our coastlines. Other sustainability challenges exist in the Golden State with the most complex water management strategy in the U.S., and yet the potential opportunities for geologists to address these massive challenges are huge. Understanding the disrupting factors and learning about new geology-based solutions will help AIPG members to chart successful career pathways.

Whether you are exploring new opportunities, future markets for your professional services, or trying to start your professional career, this conference will provide leads, information and ideas that you will need to prepare for future work. We believe the geoscientist’s expertise has never been more important in solving our current challenges. Sessions will include new research, case studies and innovations in the field associated with resource development, geohazards, food and agriculture, energy, wildfires and deforestation, emerging contaminants and water supply. You will witness a round table panel discussing the expected 20-year and 80-year projected impacts and needed responses on the landscape and way of life in California in particular, and in the nation, more generally. The conversation will address what role geoscientists will need to fill now and into the future.

Numerous field trips have been scheduled. Field trips include an investigation of the birth of the Sierra Nevada Mountains and Lake Tahoe (Building of the Sierra Nevada Mountains and Lake Tahoe) while learning about the orogenic events that have taken place and changes that now occur due to weather and climate changes. A visit you won’t want to miss is a ride to the North Bay Wine country. You will see the Panoche Formation landslides, Sonoma volcanics and the Rodgers Creek Fault, and a destroyed and rebuilt winery caused by the 2017 wildfire. If your interests are more focused on plate tectonics, join the Mt. Diablo field trip (Mt. Diablo and California’s Evidence of Plate Tectonics) and see the Eocene sandstone, gain an understanding of the Franciscan Complex basement and traverse the structure of a landmark mountain. When you think of California, you also think of the massive water issues impacting the state. Sign up for the Oroville Dam and damaged spillway field trip and learn how California manages its water and what exactly happened during the 2017 earthen dam spillway deterioration.

A special set of mini-events will be creatively scheduled specifically for building skill sets and networking. Four mini-courses have been created; Drone Uses in Geology, Environmental Considerations associated with hydraulic fracturing, PFAs, and Wildfire mitigation plans. We want you to walk out of any of these mini-workshops fully empowered with a new skill-set that can be applied on your next project.

Come and meet the professionals that are building resiliency into our country’s resources, explore new career opportunities and learn about the latest tools and technologies used in the geoscience today. Our response to changes experienced in our climate has motivated AIPG 2020 to address the challenges and develop future opportunities today. Geoscientists will come into the spotlight in Sacramento 2020. We look forward to seeing all of you at next year’s AIPG annual conference in Sacramento!

Co-Chair
Stephen Baker, MEM-2353
AIPG National Executive Committee Board Representative

Co-Chair
James Jacobs, CPG- 7760
AIPG President of the California Section
## 2020 Conference Schedule - Sacramento, California

### Saturday, October 3, 2020

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:30 am – 12:00 noon</td>
<td>Conference Registration</td>
</tr>
<tr>
<td>8:00 am – 12:00 noon</td>
<td>AIPG Executive Committee Meeting (open to all registrants)</td>
</tr>
<tr>
<td>9:00 am – 5:00 pm</td>
<td>AIPG Student Career Workshop (free)</td>
</tr>
<tr>
<td>12:00 noon – 1:00 pm</td>
<td>AIPG Luncheon (full registrants free; students $20)</td>
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<tr>
<td>1:00 pm – 4:00 pm</td>
<td>AIPG Advisory Board Meeting (open to all registrants)</td>
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<tr>
<td>4:00 pm – 4:30 pm</td>
<td>AIPG 2020-2021 Joint Executive Committee Meeting &amp; Business Meeting (open to all registrants)</td>
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<tr>
<td>4:30 pm – 5:30 pm</td>
<td>AIPG Foundation Meeting (open to all registrants)</td>
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<tr>
<td>5:00 pm – 6:30 pm</td>
<td>Student Networking Event with Professionals (open to all registrants/cash bar)</td>
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<tr>
<td>7:00 pm – 9:00 pm</td>
<td>3rd Annual AIPG Geo-Trivia Night (open to all registrants/win prizes!)</td>
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</tbody>
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### Sunday, October 4, 2020

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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</thead>
<tbody>
<tr>
<td>7:00 am – 5:00 pm</td>
<td>Conference Registration</td>
</tr>
<tr>
<td>7:00 am – 5:00 pm</td>
<td>Field Trip — Napa County Geology and Wine Country</td>
</tr>
<tr>
<td>8:00 am – 5:00 pm</td>
<td>Field Trip — Sierra Nevada-Northern Mines Malakoff Diggins State Park/Empire Mine State Park</td>
</tr>
<tr>
<td>8:00 am – 4:00 pm</td>
<td>Field Trip — Oroville Reservoir and the Damaged Spillway</td>
</tr>
<tr>
<td>10:00 am – 4:00 pm</td>
<td>Exhibitor and Poster Set-up</td>
</tr>
<tr>
<td>5:30 pm – 8:00 pm</td>
<td>Silent Auction (to be held during the Welcome Reception-sneak peak 5:30)</td>
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<tr>
<td>6:30 pm – 8:00 pm</td>
<td>Welcome Reception — Exhibit Area Open (complimentary for all registrants)</td>
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### Monday, October 5, 2020

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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</thead>
<tbody>
<tr>
<td>7:00 am – 9:00 am</td>
<td>Mini-Workshop — Drones in Geology</td>
</tr>
<tr>
<td>7:00 am – 9:00 am</td>
<td>Mini-Workshop — Environmental Considerations Associated with Hydraulic Fracturing</td>
</tr>
<tr>
<td>7:15 am – 8:00 am</td>
<td>Section Delegate Meeting (open to all registrants)</td>
</tr>
<tr>
<td>7:30 am – 4:00 pm</td>
<td>Conference Registration</td>
</tr>
<tr>
<td>8:30 am – 5:00 pm</td>
<td>Field Trip — North Bay Geology-Flooding, Faults and Groundwater</td>
</tr>
<tr>
<td>8:30 am – 10:00 am</td>
<td>Plenary Session</td>
</tr>
<tr>
<td>10:00 am – 5:00 pm</td>
<td>Exhibits Open</td>
</tr>
<tr>
<td>10:30 am – 12:00 noon</td>
<td>Round Table Discussion on Californian’s Response to the Changing Climate</td>
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<tr>
<td>10:30 am – 4:00 pm</td>
<td>Technical Sessions</td>
</tr>
<tr>
<td>12:00 noon – 1:30 pm</td>
<td>Luncheon with Keynote Speaker (complimentary for all registrants)</td>
</tr>
<tr>
<td>5:30 pm – 8:45 pm</td>
<td>AIPG Awards Dinner on The Delta King, an authentic paddlewheel riverboat moored along the Old Sacramento Waterfront (all attendees welcome with additional fee)</td>
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### Tuesday, October 6, 2020

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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<tbody>
<tr>
<td>7:00 am – 3:30 pm</td>
<td>Conference Registration</td>
</tr>
<tr>
<td>7:00 am – 5:30 pm</td>
<td>Field Trip — Geologic Highlights of Mt. Diablo: Eocene Sandstone, Franciscan Complex Basement, and Structural Formation of a Landmark Mountain</td>
</tr>
<tr>
<td>7:00 am – 9:00 am</td>
<td>Mini-Workshop — Meeting Your Wildfire Mitigation Planning for SB901</td>
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<tr>
<td>7:00 am – 9:00 am</td>
<td>Mini-Workshop — PFAS</td>
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<tr>
<td>8:00 am – 4:00 pm</td>
<td>Field Trip — Aggregate Mining in the Lower Yuba River</td>
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<tr>
<td>8:30 am – 5:00 pm</td>
<td>Technical Sessions</td>
</tr>
<tr>
<td>10:00 am – 3:30 pm</td>
<td>Exhibits Open</td>
</tr>
<tr>
<td>12:00 noon – 1:30 pm</td>
<td>Luncheon with Keynote Speaker (complimentary for all registrants)</td>
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</tbody>
</table>
Sunday, October 4, 2020
Napa County Geology & Wine Country
7:00 am - 5:00 pm
Leaders: Jim Jacobs, CPG-07760 & Gary Pischke, MEM-3042, PG, CEG

West of Calistoga we’ll see the California Petrified Forest and giant petrified trees preserved from the 3.4 million year old eruption of Mount St. Helena, which hit the forest with a Mount St. Helena type blast. The trees in the forest are some of the largest in the world. Many of the trees were already thousands of years old when they were hit by the volcanic blast.

We’ll stop at the Calistoga Geyser and have lunch. The Calistoga Old Faithful Geyser Of California. The geyser was given this name because of the regularity of its eruptions. It is also recognized as being a good predictor of earthquakes. The highlight will be a stop at a Napa winery to discuss the rich volcanic soils which are home to one of the great wine growing regions in the world. A gondola ride and wine tasting are planned for those who would like to partake.

Review terroir as well as the recent fire damage. We’ll have a stop in the historic town of St. Helena, if time permits. Return through the California coast ranges to Sacramento.

Comfortable walking shoes, sunscreen, and a hat are recommended.


Sunday, October 4, 2020
Sierra Nevada – Northern Mines Malakoff State Park/Empire Mine State Park
8:00 am - 5:00 pm
Leader: Dave Lawler, MEM-6880

The Northern Sierra Nevada mining region is home to both “world-class” placer and lode gold deposits. Field Trip participants will have the opportunity to visit the largest historic placer mine in the region, notably the “Malakoff Hydraulic” or “North Bloomfield Hydraulic Mine”, now designated as a California State Park. Participants will visit the historic “ghost town” of North Bloomfield within the park, and several additional sites including the Malakoff Pit (where 1 cubic mile of gravels were processed for placer gold), Hiller Drain Tunnel, and abandoned mine features of the Hamilton Tunnel. The group will enjoy a lunch and lecture in the North Bloomfield townsite “picnic area.”

After lunch, the group will depart for the historic mining towns of Grass Valley and Nevada City. Nevada City was established in 1850 and nicknamed “The Queen of the Northern Mines” for its rich lode gold deposits and Victorian homes build by historic mine owners and superintendents.

The last field trip stop will be at the famous Empire Mine in Grass Valley, now designated as Empire Mine State Park. Participants will visit museum exhibits, the main production shaft area, retort gold processing facility, and Bourne Mansion. A brief lecture will be provided to summarize the significance California’s most productive historic lode mine.

Easy to Moderate hiking conditions, hiking boots required, bring suitable field attire for both cool morning and warm afternoon temperatures.
FIELD TRIPS

Sunday, October 4, 2020
Oroville Reservoir and the Damaged Spillway
8:00 am - 4:00 pm
Leaders: Steve Baker, MEM-2353; Jana Frazier, CA Dept. of Water Resources

When you have 40 million people living in a Mediterranean climate, water storage and conveyance are a necessity. Superimpose more frequent and extreme droughts and flood years with a snow pack that becomes less reliable because of the lowering winter snow levels and you have challenges that create socioeconomic impacts that can change life as it has been known.

You will learn about the rich California water history that has required re-distribution of water storage and conveyance since the early 1900s. You also will visit Oroville Dam and the well-known spillway that began to disintegrate during the 2017 extreme flood event. This national event sent a clear message to California’s Department of Water Resources that climate changes require new and improved infrastructure. You will see the Oroville water complex, Hyatt Power Plant, the Feather River Fish Hatchery, Thermalito Diversion Dam and fish barrier dam and the Oroville Dam flood control spillway, emergency spillway and intake structures.

We will eat lunch at the Lake Oroville Visitor Center, where California Dept. of Water Resources will explain how water is distributed throughout the state.

Comfortable shoes, sunscreen and a hat are recommended.

Monday, October 5, 2020
North Bay Geology-Flooding, Faults and Groundwater
8:30 am - 5:00 pm
Leader: Gary Pischke, MEM-3042, PG, CEG

If you want to really see and experience the northern portion of the San Francisco North Bay, sign up for the North Bay Geology field trip. The field trip starts at Hwy 37 where the Novato Creek flooding and erosion has taken place. As you continue north, you will visit Sonoma where you will enjoy a lunchtime discussion at a Winery. After lunch, learn about how the Sonoma Valley Basin groundwater purveyors are satisfying the groundwater basin requirements and share in their enthusiasm of current successes.

The last stop of the day will be the Napa 2014 Earthquake. You will see faulting and damage caused by this earthquake event. As the day comes to a close, you will travel back to the hotel along a route that provides an opportunity to enjoy the picturesque views of the coastal range and listen to the story of how this range first formed.

Tuesday, October 6, 2020
Geologic Highlights of Mt. Diablo: Eocene Sandstone, Franciscan Complex Basement, and Structural Formation of a Landmark Mountain

7:00 am - 5:30 pm
Leaders: Dr. Donald Medwedeff, Dr. William Schweller, and Dr. Raymond Sullivan

Mount Diablo is in the Eastern Coast Ranges of the San Francisco Bay Area, underlain by an anticline of anomalously high structural relief. Franciscan complex and Great Valley Ophiolite are exposed in its core and are flanked by Cretaceous to Pliocene sediments on its flanks. This trip combines (1) exceptional underground exposures of gently east-dipping, Eocene-shelf-sandstone at the Black Diamond Mine Regional Park, (2) Franciscan outcrops, regional-structural overviews, and grand vistas at the 3,849' summit, and (3) deformation-band-ridden, Eocene deep-water turbidite deposits on the vertically dipping SW flank.

The stops will be in state and regional parks; therefore, collecting is not permitted, and hammers are not allowed. Closed-toed shoes are recommended along with dressing in layers because of changes in elevation and underground environments. The tour in the mine includes stairs.

This trip is limited to 22 attendees.

Tuesday, October 6, 2020
Aggregate Mining in the Lower Yuba River

8:00 am - 4:00 pm
Leaders: Will Arcand and Stephen M. Testa, CPG-06464

Aggregates are one of the most important mineral commodities in the state and will undoubtedly be required for engineering responses to address extreme storms, flooding and other geologic hazards. Aggregate mining in the river valleys in northern California has historically been linked with massive placer gold mining in the state. The trip will feature modern aggregate dredge mining operations and historic gold mining practices. Mine reclamation efforts and habitat restoration efforts will be discussed.

Entrance to the Black Diamond Mine.

Overview of regional structural geology from just below the summit of Mt. Diablo.

The Yuba Goldfields in the upper right are located along both sides of the Yuba River.


AIPG 2020
Call For Abstracts

To have your abstract considered for an oral presentation or poster presentation, please complete the Abstract Submittal Form online by the deadline of June 1, 2020. Abstracts must be in Word format, single-spaced, 12 point Times New Roman, and should not exceed one page. No tables or pictures will be accepted.

You will be notified by June 17, 2020, if your abstract has been accepted. Technical presentations will be scheduled on Monday, October 5th, and Tuesday, October 6th. Posters will be presented on Monday, October 5th. Authors who wish to publish a paper in AIPG’s The Professional Geologist (TPG) can contact AIPG for additional information at aipg@aipg.org. Online submittals accepted at www.aipg.org/page/2020CACallforAbstracts.
Join the American Institute of Professional Geologists (AIPG) and the AIPG California Section for the 2020 Conference "Role of Geoscientists for Resiliency, Sustainability and Opportunities in a Changing Environment" in Sacramento, California. This is a great opportunity to promote your company and increase your brand exposure to hundreds of professionals locally and throughout the US.

**All sponsors and exhibitors receive the following standard benefits:**
- Your company logo will be on the AIPG Conference website with a link to your website
- Signs displayed throughout the conference will include your company logo
- Your company logo will be in conference program

**If you have a sponsorship idea you don't see on our list, we can create a custom package for your company.**

**Additional benefits with these levels:**

- **Level: $5,500** (only 1 available)
  - Company logo on conference registration bags (this benefit is only available until July 30th)
  - Two complimentary registrations to the conference
  - Complimentary exhibit booth
  - Company logo prominently displayed on cover and sponsor page of conference program
  - Marketing material will be included in conference registration bags or on a table available to registrants

- **Level: $3,500**
  - Two complimentary registrations to the conference
  - Complimentary exhibit booth
  - Company logo prominently displayed on sponsor page of conference program
  - Marketing material will be included in conference registration bags or on a table available to registrants

- **Level: $1,500**
  - One complimentary registration to the conference or exhibit booth
  - Marketing material will be included in conference registration bags or on a table available to registrants

**Sponsorships Only:**

- Opening Reception - $750
- One am or pm break (Monday or Tuesday) - $500
- Marketing Material on Sponsorship Table - $500
- Student Conference Sponsorship - $250
- All day coffee/tea (Monday or Tuesday) - $250

**TOTAL AMOUNT:** $_________ **Date:** ____________

- Check enclosed (payable to AIPG)
- Please invoice - payment due within 30 days
- Credit Card (circle one) Master Card, Visa, Discover, or American Express
  - Card Number: __________________________
  - Expiration Date: ______ CVV (3-4 digit) ________
  - Card Holders Name: ______________________
  - Signature: ________________________________

**Sponsoring Individual or Company:** ________________________________

**Contact:** ________________________________
**Address:** ________________________________
**City:** __________________________ **State:** ______ **Zip:** ______
**Phone:** ________________________________
**Contact's E-mail:** __________________________
**Company's Website Address:** __________________________

Send Sponsorship Form to:
AIPG, 1333 W. 120th Avenue, Suite 211, Westminster, CO 80234
(303) 412-6205 • Fax (303) 253-9220 • www.aipg.org, cld@aipg.org
AIPG will contact you upon receipt of this form to complete arrangements.

www.aipg.org
2020 EXHIBITOR PROSPECTUS and TERMS & CONDITIONS

The 57th American Institute of Professional Geologists National Conference will be held in Sacramento, California from October 3rd through 6th. We invite you to come and explore the diverse geology the region has to offer.

The 2020 meeting will be held at the Hilton Sacramento Arden West Hotel. Overall attendance is expected to reach more than 200 registrants. This conference will appeal to professionals in technical, educational, managerial, regulatory and legal disciplines. This is your opportunity to showcase your products and services to professionals locally, throughout the US, and internationally. The 2020 conference is open to all who have an interest in geoscience and its role in the economy and well being of the US and its neighbors.

The exhibit booths will be located at the Hilton Sacramento Arden West Hotel in a prime area for visibility and maximum exposure to a large group of professionals. The tabletop exhibit space includes a skirted table and two chairs. Exhibitors will also receive one complimentary meeting registration that includes a reception on Sunday and lunches and breaks on Monday and Tuesday.

Your company logo will be placed in the printed meeting program, on signage, and also added to AIPG’s website with a link to your website. There is limited space available so reserve EARLY!

Hilton Sacramento Arden West Information
2200 Harvard Street
Sacramento, CA 95815
(916) 922-4700
(800) 445-8667 for reservations

Exhibitor fees do not include hotel registration. For information on the hotel, please visit our website at www.aipg.org and then select Events. When registering for the hotel, be sure to mention ‘AIPG’ to receive the discounted conference rate of $135+ tax a night, which will be available until September 11, 2020. Please note that the hotel does not have a forklift on site.

Set Up / Tear Down
Exhibit set-up is on Sunday, October 4th from 12:00 noon to 4:00 pm. The evening Welcome Reception and Silent Auction will be held from 5:30 pm to 8:00 pm on Sunday in the exhibit area. Booth tear down is Tuesday, October 6th from 3:30 pm to 5:00 pm.

Space Assignments and Deadlines
Exhibit contracts and final payment of exhibit fees are due within 30 days of submittal of the agreement and no later than two weeks prior to the event. All spaces and space location requests will be assigned on a first-come, first-served basis until filled.

Acceptance of Terms
I understand that by registering for the 2020 AIPG Conference & Exhibition, I release and agree to indemnify the American Institute of Professional Geologists (AIPG), its agents, officers, volunteers and employees from any and all liability, claims, lawsuits, damages, losses, costs and expenses of any kind which arise out of or result from my attendance at the AIPG National Conference, whether or not foreseeable, including, without limitation, personal injuries to me or my guests. I also understand that submission of this registration form gives AIPG the authority to utilize any photo and/or video, or uploaded photo and/or video to the conference app, of me and/or my products, for AIPG related publications, materials, websites and promotions.

Cancellations
Cancellations of exhibit space are subject to a $50 cancellation fee, and cancellations of additional booth personnel are subject to a $25 cancellation fee if cancellation is received in writing by September 11, 2020. No refunds will be issued after September 11, 2020.
YES!! We want to be part of the AIPG 2020 National Conference “Role of Geoscientists for Resiliency, Sustainability and Opportunities in a Changing Environment,” October 3-6 in Sacramento, California. Completed forms can be sent to: 1333 W. 120th Avenue, Westminster, CO 80234, Fax: (303) 253-9220, or cl@aipg.org

___ $750.00 Exhibit Booth (includes one complimentary meeting registration)
___ $375.00 Additional Exhibitor Registrant

<table>
<thead>
<tr>
<th>Exhibitor Information</th>
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<tbody>
<tr>
<td>Name (as you wish it to appear on your badge)</td>
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<tr>
<td>Title</td>
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<td>- Sunday, October 4, 2020, 5:30 pm – 8:00 pm (reception/silent auction)</td>
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<td>- Tuesday, October 6, 2020, 10:00 am – 3:30 pm</td>
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<td>- Tear down Tuesday, October 6, 2020, 3:30 pm-5:00 pm</td>
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Please note that AIPG is not responsible for any lost or stolen items. The exhibit room will be locked at night, but we cannot guarantee security.

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<td>I, on behalf of my company, hereby acknowledge that we have received, read, and understand the 2020 Exhibitor Prospectus and Terms &amp; Conditions. Furthermore, we understand that these Terms &amp; Conditions are a part of this contract and that by signing this application, we agree to be bound by all the terms contained therein.</td>
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| Signature | Date |
The Geology/Hydrogeology of the Rockett Terrace and The Superconducting Super Collider

Author
Stephen E. Pierce, CPG-08726

Introduction

Originally to be called the Desertron (Baggott, 2012) and to have been built in west Texas, the Superconducting Super Collider (SSC) was moved quickly and quietly to Ellis County, Texas, in 1987. The SSC was to be the largest atomic accelerator on earth and was to be located in a tunnel with a 54 mile perimeter. My general concern was that it could potentially radioactively contaminate the natural springs and groundwater of the Rockett Terrace of Ellis County. These springs are historic and have never been known to go dry. Most disturbing, the collision halls where the destruction of protons and the subsequent creation of exotic atomic particles was to take place were in a tunnel directly beneath my house. Due to cost overruns congress cancelled the SSC in 1993. Since then this rural community has grown and the knowledge of its geology and hydrogeology is even more important now than it was then.

Location

The SSC was to be located in Ellis County, Texas. The SSC would surround Waxahachie and lie near the towns of Rockett and Palmer about 25 miles south of Dallas. The Rockett Terrace (RT in Fig.1) is located over the northeast quadrant of the SSC tunnel. It is bordered to the north and northeast by Brushy Creek and to the west, south, and southwest by Red Oak Creek and is arbitrarily bordered to the northwest by the constriction of the Brushy and Red Oak Creeks about 1.7 mi. north of Rockett (Figs. 2 and 3). It has an oblong shape with the long axis trending northwest to southeast, and an area of 13 mi². My home is located on the southern part of the terrace overlooking Red Oak Creek (Fig. 3). The elevation of the terrace varies from 540 ft. in the north to 470 ft. in the south with some 70 ft. of relief. The terrace is relatively flat with incised tributaries flowing primarily to Red Oak and Brushy Creeks. It was then a quiet farming community, but is now becoming a residential community.

As illustrated in Figure 2 there are nine historic springs located either on the tunnel ‘footprint’ or near it. Some springs are artesian and all are within either the Late Cretaceous Austin Chalk or younger sediments. The Rockett Terrace is located on the northeastern part of the SSC ‘footprint’.

Figure 1 - Proposed location in Ellis County, Texas, of the Superconducting Super Collider. The ‘footprint’ is shown in black and the Rockett Terrace (RT) is located, (after Reaser and Clarke 1989).

Figure 3 displays the location of the interaction hall (IR). The muon detector (M5) is located beneath my home. The letters BE-4 and BF-4 are boreholes the DOE drilled for the SSC. Although not shown on this map (but shown in Figure 7), there is a fault on my property that likely could allow radioactive particles to migrate upward from the SSC into the surface environment through fractured chalk in this fault zone.

Superconducting Super Collider (SSC)

The SSC was to have been the largest high energy particle research facility in the world. It was designed to accelerate two beams of protons traveling in opposite directions around the tunnel to nearly the speed of light. The protons in each beam would have energies of 20 TeV, giving a total collision energy of 40 TeV. With collision energies 10 times greater...
than those of other accelerators existing in 1990 exotic new particles never before encountered were expected to be found (Sanford, 1990). To achieve this feat an enormous arrangement of cascading accelerators would be required. First, an injector would put protons into a boosting linear accelerator with an energy of 0.6 GeV. The protons would then be boosted by a low energy booster (LEB) to 11 GeV, and injected into a medium energy booster (MEB) to reach 200 GeV, then into a high energy booster (HEB), accelerating to 2 TeV, and finally into the main accelerator with a perimeter of 54 miles to reach 20 TeV (Sanford, 1990), see Figure 4. The SSC would be located in a tunnel, Figure 5. Achievement of these high energies would require 10,000 super-conducting magnets consisting of focusing magnets intended to keep the protons confined to a small area and bending magnets to bend the beams of protons around the accelerator.

There would be two collision areas, called Interaction regions (IR’s), that would then examine the subatomic particles generated by the colliding beams. One IR was on the west and the other was on the east side of the collider ring. I was especially interested in the east IR because muon particles were to be detected (M5), (Coulson et al, 1992) directly beneath my home. Muons are decay products first found in cosmic rays (Close et al, 1987) and expected to be created by the SSC and detected by the muon detector (M5).

Possible radiation hazards would include loss of control of proton beams that were being guided and focused by 10,000 newly designed untried super conducting magnets, and the experimental IR’s. While constructing the tunnel beneath Waxahachie Creek water was observed and filmed entering the tunnel. The SSC would lie at an average depth of 150 ft. dipping 0.17° southeast.

Tunneling began on the western side of the SSC ‘footprint’. It was soon discovered that SSC monitoring wells located next to the tunnel began filling with water (Mace and Dutton, 1994). As can be seen in Figure 5, the SSC tunnel is 12 ft. in diameter. Over the western part of the ring the Austin Chalk crops out at surface, and tunneling began to provide excellent locations to study the faulting, thus providing a guide to interpretation of the faulting and fracturing that would be encountered later in the Austin Chalk beneath the Pleistocene-Holocene Rockett Terrace deposits.

Two segments of the SSC tunnel had already been drilled when the SSC was cancelled. There is a northwest segment (8 miles long) and a northeast segment (6 miles long, the shaded
areas in Fig. 4). In addition, Figure 4 shows that the planned tunnel would intersect many NE-SW striking faults, which are presumably related to the NE end of the Balcones Fault Zone (Fig. 6). Fractures play an important part in aiding the migration of groundwater through the Austin Chalk (Dutton et al. 1994). Although much of the Rockett Terrace is covered with alluvium, in the area near Rockett exposed cliffs show significant fractures.

Now, many years after the project was cancelled, the two tunnel segments are most likely filled water reservoirs waiting to be tapped for the benefit of the people of Ellis County.

Radiation Hazards and the Petkau Effect

Although high amounts of radiation are recognized to be dangerous, another, perhaps more insidious, danger could be from low levels of radioactively produced-free-radicals. This effect was discovered in 1971 by Dr. Petkau, the manager of the Medical Biophysics Branch of the Whiteshell Nuclear Research Establishment in Manitoba, Canada. He added small amounts of the free-radical sodium-22 ($\text{Na}^{22}$) to lipid membranes extracted from fresh beef brains (Gould, 1990). He found that the membranes burst from the exposure. Essentially, a free-radical contains a lone (unpaired) electron which makes it extremely reactive. This reaction can be observed when applying hydrogen peroxide to a cut. It decomposes to form free radicals (superoxide anions $\text{O}_2^-$) that destroy bacterial membranes, (Silberberg, 2009). What Dr. Petkau discovered was that free-radicals are most dangerous in small amounts – the Petkau Effect. One of the by-products of the atomic experiments of the SSC would be the free radical $\text{Na}^{22}$, (Baker, 1994).

GEOLGY OF THE ROCKETT TERRACE

Structural Geology

The Rockett terrace dips gently to the southeast about 0.17°. Bedrock consists of the Late Cretaceous Austin Chalk and the Ozan Marl of the Taylor Group. The faulting in the Cretaceous bedrock is of Oligocene age. These faults transect the terrace bedrock, usually striking northeast-southwest, and are the northern termination of the Balcones Fault Zone (Figure 6). One fault cuts next to my home and may have been observed by SSC borehole BF-4 in the terrace, Figure 3. The terrace is an elevated area formed from stream erosion.
Precipitation

The nearest National Oceanic and Atmospheric Administration (NOAA) rain gauge to the Rockett Terrace is in Waxahachie (32.422°N, 96.811°W) about 5.7 miles west of Palmer.

NOAA precipitation data from 1987 to 2014 and water table elevations in my well are shown in Table 2. This table is a general measure of precipitation because in reality these events are highly variable.

Generally, precipitation is highest in winter and spring. However, some heavier rain events that occur on the terrace are notable by Red Oak Creek and Brushy Creek located to the south and north, respectively.

Holocene and Pleistocene alluvial and terrace deposits unconformably overlie the Late Cretaceous bedrock. Figure 7 is a geologic map displaying the relationship of the Rocket Terrace (RT in gray). Younger Cenozoic, Late Cretaceous lithologies and SSC ‘footprint’(arc indicated by close-spaced double line in Fig. 7), and my home.

Near Rockett there is an historical marker that places a Texan civil war cavalry unit at the Rocket Springs. The springs are artesian and emerge from fractured Austin Chalk, Figures 2 and 7.

A prominent Austin Chalk fracture can be observed in a quarry near Rockett, (Figure 8). SSC BF-4 monitor well located about 1.2 miles north-northeast of my house recorded slickensides from depths of 90 – 95 ft. and 155 ft. in the Austin Chalk (BF-4 Figure 3). In addition, fractures were observed from depths 120 ft. to 121 ft.

Stratigraphy

The stratigraphy of the terrace is relatively simple. Clastic Quaternary and Holocene terrace deposits overlie Late Cretaceous Austin Chalks and Ozan Marls.

Clastic Quaternary/Holocene deposits: stream valley alluvium lies unconformably above the Cretaceous strata exposed in the nearby creeks, as shown in Fig. 9, a stratigraphic section based on that in monitor well B-4. A stratigraphic section of the terrace is shown as recorded from monitor well BF-4 in Figure 9. The bedrock in the western part of the terrace is Austin Chalk while the eastern part is underlain by the Ozan Marl of the Taylor Series. The Ozan Marl pinches-out westward.

The terrace contains at least three porous/permeable zones. The lowest of these is the permeable and porous zone in the weathered and fractured part of the Austin Chalk. A basal fluvial gravel sits atop this weathered chalk, and a third porous/permeable bed lies within the terrace deposits.

Table 1 provides some physical properties of the terrace deposits. These data ranges suggest that the terrace aquifers consist of fine sands, clayey sands, and coarse sand and well sorted gravels (Wickham and Dutton, 1991). Note the average porosity of the porosity terrace deposits is about 15%.

Table 1

<table>
<thead>
<tr>
<th>Physical Properties of Rockett Terrace Pleistocene/Holocene Deposits</th>
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<tbody>
<tr>
<td>Wickham and Dutton, 1991</td>
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<tr>
<td>Transmissivity</td>
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<tr>
<td>5-561 ft²/day</td>
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HYDROGEOLOGY

The hydrogeological environment on the Rockett Terrace consists of recharge from precipitation that is primarily rain, occasional hail, and rarely snow. Surface discharge consists of runoff through gullies draining north into Brushy Creek and south to Red Oak Creek, flowing south. Groundwater discharge occurs in the above creeks and at spring/seeps. Storage occurs in the permeable/porous terrace deposits and in the fractured Austin Chalk. No artificial irrigation is needed.

![Figure 8 - Fracture in Austin Chalk near Rockett Springs.](image)

![Figure 9. Generalized stratigraphic sketch of stratigraphy at Palmer house on Rockett Terrace. Slight modification to BF-4 is addition of Taylor Marl not present in BF-4. (After Earth Technology Corp. 1990.)](image)
race can be unusually high. Events in 1987 and September 2018 caused major flooding of the Red Oak river valley. In the September 2018 event bridges connecting the terrace to Waxahachie and Palmer were under water (figure 10). The heavy rains also drove hordes of fire ants from their nests and spread them across the floodplains. This event measured an unusually high 11.63 inches according to my VUE weather station at home.

**Table 2**

<table>
<thead>
<tr>
<th>Statistical Data on Precipitation (NOAA) and Water Table (March 1987-September 2019)</th>
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<tr>
<td><strong>Rockett Water Table</strong></td>
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<tr>
<td>Minimum Elevation: 471.8 ft. Sept., 2013</td>
</tr>
<tr>
<td>Maximum Elevation: 481.5 ft. June, 2007</td>
</tr>
<tr>
<td>Data Points: 318</td>
</tr>
<tr>
<td>Range: 9.7 ft.</td>
</tr>
<tr>
<td>Mean: 476.84</td>
</tr>
<tr>
<td>Median: 476.68</td>
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<tr>
<td><strong>Monthly Precipitation (Waxahachie, TX (1987-2014)</strong></td>
</tr>
<tr>
<td>Minimum: 0 in.</td>
</tr>
<tr>
<td>Maximum: 16.43</td>
</tr>
<tr>
<td>Mean: 3.2</td>
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<tr>
<td>Medium: 2.77</td>
</tr>
<tr>
<td><strong>Yearly Average Precipitation</strong></td>
</tr>
<tr>
<td>Mean: 38.2</td>
</tr>
<tr>
<td>Median: 27.14</td>
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</table>

**Infiltration**

Precipitation enters the groundwater through infiltration. The clay soil is an expanding montmorillonitic clay that expands during the wet months but dries and shrinks during the hot summer months producing cracks allowing rain to enter the groundwater regime, Figure 12.

**Runoff**

Since my property is on the south flank of the Rockett Terrace runoff flows to the south primarily via two gullies that flank my property and flow into Red Oak Creek (Figure 11).

**Water Table and Groundwater Flow**

The water table elevation (1987-2019) varies between 471.8 ft. and 481.5 ft., a difference of 9.7 ft. (see Table 2). From my data and observations groundwater flow occurs in two ways:

1. Discharge from permeable/porous silts and sands from within the Holocene deposits, and;

2. Discharge from basal permeable/porous basal gravels and weathered/fractured Late Cretaceous Austin Chalk and probably permeable/porous zones within the Ozan Marl.

**Spring/Seeps**

There are numerous springs and seeps on my property. The terrace slopes to the south where the springs and seeps...
(figure 13) discharge into Red Oak Creek. Springs and seeps first appear when the water table is 476.8 ft. As recorded in SSC BF-4 monitor well the Holocene Terrace deposits contain sand and fine sand as well as clay. These sands provide the unconfined and semiconfined aquifers (Mace and Dutton, 1994) of the terrace.

Although I have not directly observed the basal groundwater flow my varying water table suggests flow toward Red Oak Creek. Interestingly, for all of the 32 years I have recorded groundwater elevations here my well has never gone dry. Water table measurements were made on a hand-dug well at my home. The well was probably dug early in the twentieth century but there are no records. The water well is bell shaped. There are some 95 hand-dug wells on the terrace (Wickham and Dutton, 1991). The total depth of my well is unknown since the bottom part contains debris. The average elevation of groundwater at the well has stayed about the same since I first started monitoring the well in March, 1987 (Figure 14).

A small sample of groundwater elevations from 2009 to 2012 illustrates how groundwater elevations vary throughout the years due to individual precipitation events (Figure 15).

**The Groundwater Cycle**

Generally, the groundwater cycle in the Rockett Terrace at my well begins in the summer when groundwater elevations are at their lowest. The water table rises through the fall, reaching a maximum in the winter. With the advent of spring and the awakening of plants and trees in the spring, groundwater elevations fall, (Figures 14 and 15).
The annual water table variation of about 9.7 ft. in my well is similar to other wells monitored in 1990 (Wickham, M., Dutton, A., 1991). Given an area of 13 mi² (3.62X10⁸ ft²) a thickness of 9.7 ft. and an average porosity of 15% (Table 1) suggests that some 5.274x10⁸ ft³ of water annually flows through the Rockett Terrace aquifers. It’s difficult to imagine 3.94X10⁹ gallons of water flowing silently from February to August-September (Fig.15) through the Rockett Terrace to Brushy and Red Oak Creeks.

**Stream Flow**

During the 1990-91 field season the SSC installed 5 stream gauges, Figure 17 in Brushy and Red Oak Creeks.

The locations of stream gauges are shown in Figure 17 and stream gauge results in Table 3. Downstream gauges (S1 and S4) show larger values than the upstream gauges because of the additional contributions of the seeps/springs and groundwater discharging from the terrace.

Red Oak Creek (Figure 18), is about 60 ft. wide. The white color in the photo suggests Austin Chalk. I use the drone to observe the geology of the creek where it is difficult to reach on foot. Also, when there are heavy rains and the creek overflows its banks surface observations can be perilous.

**Hydrochemistry**

Tritium analyses (³H) has revealed that the residence time of the terrace groundwater is less than 40 to 50 years (Wickham and Dutton, 1991). Groundwater is of calcium bicarbonate facies (Figure 19).

**Table 3**

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<tbody>
<tr>
<td>S2</td>
<td>Red Oak Creek (upstream)</td>
<td>5.4</td>
<td>46.6</td>
<td>43.1</td>
<td>13.6</td>
</tr>
<tr>
<td>S1</td>
<td>Red Oak Creek (downstream)</td>
<td>5.1</td>
<td>47.9</td>
<td>45.6</td>
<td>15.4</td>
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<tr>
<td>S3</td>
<td>Brushy Creek (upstream)</td>
<td>n.i.</td>
<td>1.6</td>
<td>0.6</td>
<td>0.09</td>
</tr>
<tr>
<td>S4</td>
<td>Brushy Creek (downstream)</td>
<td>n.i.</td>
<td>2.9</td>
<td>3.1</td>
<td>0.5</td>
</tr>
<tr>
<td>S5</td>
<td>Brushy Creek Tributary</td>
<td>n.i.</td>
<td>0.12</td>
<td>n.i.</td>
<td>n.i.</td>
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n.i. = no flow or too low to measure. For location see Figure 7 (from Wickham, Dutton, 1991)

**Results and Conclusions**

The DOE and I had differing thoughts on the potential radiation hazards posed by contamination of groundwater by radioactive nuclides migrating into the aquifers of the Rockett Terrace through naturally weathered and fractured or faulted Austin Chalk. The DOE did agree to my requests for additional groundwater studies of the areas that would be affected by the SSC. I was provided with all geological/hydrogeological reports that were available.
But most important was the additional geological/hydrogeological knowledge of the Rockett terrace gleaned from their data. Increased knowledge of the nature of the aquifers and better understanding of their hydrogeologic significance to the farming community and residents of the terrace, I think, was the most important impact the SSC had on the Rockett terrace.

About the Author

Stephen has been a geologist for some 45 years with a master’s in geology from San Diego State University. He has worked as an environmental geologist in Texas, Wyoming, Mexico, and Costa Rica.

As a petroleum geologist he has worked worldwide, including Indonesia, Sicily, Israel, Norway, Colombia, Guyana, and extensively in the Dominican Republic. At present, he is a semi-retired petroleum geologist working in East Texas.

Stephen has published two previous papers in TPG, and has written two books.

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May 12-14, 2020 - GSA Cordilleran Section, Pasadena, California

May 18-19, 2020 - GSI North-Central Section, Duluth, Minnesota

Additional volunteer opportunities are available at www.aipg.org or contact headquarters at aipg@aipg.org

Thank you to Jim deLambert from Minnesota for volunteering at the AIPG Booth at the SME 2020 Annual Conference and Expo in Phoenix, Arizona in February. (photo courtesy of Dorothy Combs).

www.aipg.org Apr. May Jun 2020 • TPG 19
I want to thank the nominating committee for recommending me for the President-Elect position for 2021. It is an honor to advocate for AIPG; its mission and its membership. I feel very strongly that the geosciences serve a critical function benefiting a greater society and I have found in AIPG the perfect vessel for supporting and driving that critical function.

For me personally, geology has been a real blessing. I have pursued geologic interests professionally, personally and academically. Pursuit of geologic interests has afforded me the opportunity to raise a family, put kids through college, travel internationally, learn a foreign language and meet and befriend people that I would have never met otherwise. My career has been anything but a steady linear progression up through the ranks. A large part of my career was focused on remediating chlorinated solvent contamination in groundwater. That morphed into developing groundwater resources associated with mining and thence into mining itself. From there, my career has come full circle back to groundwater contamination. Along this 30+ year timeline, I have been a field geologist, project manager, program manager, business unit manager, a client, an officer of a publicly-traded company, and a State Geologist. During that entire time, I was an AIPG member because I saw the value in membership and I saw the value in associating with the people I met through AIPG. Through AIPG, I have benefited personally and professionally. I want other people, especially our more junior cohort, to experience those same benefits. We don't have 30 years. So how do we deliver on those notions of increasing benefits to our members? I have a few ideas.

I feel very strongly that AIPG must be run as a business and that every person on the executive committee should have a similar mindset; a bias for growth. Maintaining the status quo or replicating the same numbers year-over-year is a formula for extinction. We need to grow the headcount and diversify our revenue stream to the fullest extent possible. How do we do that? Just like any other business, we provide answers to the needs of our members and their associates. We provide webinars, short courses, lectures, field trips and other professional development learning opportunities that our members want. We also leverage our current capabilities in terms of services to other organizations, strategic partnerships with other organizations, increased advertising revenue and resurrecting sleepy Sections to active status.

As I write this, we are witnessing the success that the Wisconsin Section is having with their PFAS conference. It is a one-day conference that addresses a real learning need that our members and their associates have. The Wisconsin Section is piggybacking on the success they had last year with their initial PFAS conference. As the current National Treasurer, I've seen the numbers and they are impressive. This grew out of a grassroots need-to-know basis where members were looking for more information in a concise format. There were many sponsors that were lined-up for the Wisconsin event. That success needs be replicated elsewhere, many times over. If I become President, I will work diligently to see us implement more one-day conferences on diverse, important topics at different locations around the country. Doing so will have a demonstrable impact on the organization.

If I become President, I will work diligently to see us implement more one-day conferences on diverse, important topics at different locations around the country. Doing so will have a demonstrable impact on the organization.

In order to engage as many of our members as possible and attract new members, we need to shift gears in our outreach and interactions with them. There are other organizations like AEG, SME and SEG that continue to grow and diversify the offerings they provide their members. We need to do the same. Successful conferences, webinars or short courses can have synergistic effects on engagement through greater interest in more frequent monthly meetings or Section activities. Because many of us are also member of other organizations, we need to maintain an awareness of what is working in other organizations to see if we can’t implement some of those same activities under our own aegis. I don’t pretend to have all of the answers. However, I have made a career out of close associations with savvy professionals and the answers are not far away nor are they difficult to implement. Thus, it is also my plan to get as much interactivity and engagement with the next incoming Executive Committee as possible. Again, a bias for action.
Hello from the North Star State! I’m honored to be nominated for AIPG President-Elect. Having gained so much professionally through my membership with AIPG, I’m grateful for this opportunity to give back to the Institute. AIPG’s success is due to the extraordinary amount of time and energy our members volunteer and the dedication of our Headquarters staff; I sincerely appreciate each one of you. I love collaborating with other individuals, organizations, and departments, and figuring out what we can do to improve, grow, and turn new challenges into opportunities.

My vision for AIPG is to grow membership by emphasizing the benefits of national and section-level participation. To support Sections, I will continue to emphasize communication by listening to Section input and assisting in growth and development. I will take opportunities as they come to promote our profession – it’s always a pleasure to share my passion for geosciences.

My professional path began during an eighth grade Earth Science class, when I decided to become a geologist or astronomer. In college, I was surprised there weren’t more geology majors - what’s not to love about a major that requires field trips?! In 2003, I began my career as a field geologist at Terracon Consultants. With the support of my fantastic mentor, Paul, and a team of great coworkers, I collected samples, logged borings, and wrote technical reports while traveling all over the great state of Minnesota. Since moving to the Minnesota Pollution Control Agency in 2006, I work as a hydrogeologist and project manager for Brownfield and Superfund redevelopment sites. I’ve coordinated an assessment grant program since 2010. I enjoy organizing complicated projects into manageable steps and getting them done. My experience managing timelines and budgets, writing technical guidance and policy, and collaboration with project parties will help me be an effective President of the Institute.

I began attending Minnesota Section of AIPG meetings sixteen years ago. The Minnesota Section’s field trips and monthly technical talks have been fantastic for networking and professional development. I became an AIPG Professional Member in 2006, a licensed Professional Geologist in Minnesota in 2011, and accomplished my goal of becoming an AIPG Certified Professional Geologist in 2015. I know we have many members that don’t live/work near section meeting locations. In MN, we’ve begun webcasting our meetings, and I will work to share that information and encourage other sections to try webcasting. AIPG’s partnership with AGI for the Geoscience Online Learning Initiative (GOLI) keeps improving, and as President, I will prioritize improving the breadth and quantity of our high quality web-based talks, which connect members near and far.

I’ve served in leadership roles within the Minnesota Section since 2011 and AIPG National since 2016. I’ve enjoyed learning from, and collaborating with, other professionals at section meetings and national conferences, exploring local geology on field trips, discovering how AIPG partners with other organizations, talking with hundreds of geoscience majors, and advocating for our profession whenever possible. Since 2017, I’ve served on the Advisory Board for the Earth Science Department, University of Minnesota – Twin Cities. The connection between geoscience college programs, ASBOG, and our licensure regulations is so important. As President, I will continue to strengthen our relationship with ASBOG and work with the AIPG committee on bringing our new CPG-A membership category into effect.

I have held leadership roles in non-geological capacities, serving on homeowners associations and co-leading the Minnesota Dystonia Support Group. My husband has dystonia and we lead state and national advocacy efforts supporting dystonia medical research. Through these other experiences, I’ve learned to have a deep appreciation for compromise, teamwork, and the value of vision.

As President, I will focus on maintaining and growing our membership. I believe this can be done by:

• highlighting member benefits in a more visible way
• sharing successful Section-level events and outreach programs on a national level (outside of the National Conference)
• providing member testimonials
• communicating membership benefits to early and middle career professionals
• communicating membership benefits to members looking for jobs and/or switching career paths

As President, I will continue the great work on initiatives and priorities already underway, including:

• updating our position statements
• growing our online presence with GOLI talks
• continuing the development of the CPG-A membership category
• growing accessibility options
• maintaining and strengthening cooperative agreements with sister societies

I have much to contribute to AIPG; years of knowledge, experience, and skills that will serve me well in the role of president. If elected, my drive to learn and collaborate will serve the Institute well. If you have questions for me as you’re filling out your ballot, please reach out. You can email me at shanna.schmitt@state.mn.us. Thank you for your consideration, I appreciate it!
As Vice President I would assist AIPG’s Advisory Board in discovering each Section’s strengths and accomplishments and then help struggling Sections develop a simple action plan. The action plan would outline how to use their past Section or personal successes to attract resources and partners to grow AIPG awareness in their area. Small task(s) and timelines for completing tasks would be developed to give the Sections encouragement that they are making a real difference in the geoscience world. Section plans and accomplishments would be shared with National and other Sections at the end of the year to provide ideas to all Sections.

Many times, we find ourselves concentrating on our weakness and our lack of resources, which only brings about a deeper sense of discouragement and apathy in our organizations and lives. When I first started to attend AIPG’s National Conferences in 2011, I heard many Sections blame the lack of membership involvement and resources to accomplish things that were important to the member(s) that were still involved in AIPG. I’ve heard some of the same discouragement in recent years, but I’ve been encouraged by many Sections that have started to concentrate on their strengths and take small steps to grow AIPG awareness in their local areas.

Even Sections that have only a few (or just one) active members have found ways to: sponsor an event with other geoscience partners, expand a college outreach program, offer to review graduating students resumes, or offer presentations to schools/organizations that have geoscience topic interest. A small group or even one person can accomplish a positive difference if they concentrate on expanding and sharing their strengths.

One of the activities that has helped the Wisconsin Section has been strategic planning with our board members. We took time to review and discover our strength of partnership development. Our active members have large geoscience networks that are interested in getting the importance of geoscience education and application out to the entire State.

We studied our network’s newsletters and social media sites and were able to identify the specific topics that were of primary interest to them. We then choose top topics that were of interest to our Section members and our networks and invited our networks to partner in offering workshops, webinars and seminars on these topics.

AIPG awareness and value have been increasing in Wisconsin since we’ve partnered with National AIPG and others in hosting: Frac Sand Mining workshop and webinar, Groundwater Sampling webinar, and PFAS workshop and seminar. Our student and early career professional member-
Hello fellow AIPG members. I am honored by the potential to represent AIPG at the National level. I would like to give thanks to the Nominating Committee for this opportunity, and, if elected will work hard to uphold the ideals of the organization and to interact with State Sections to support the growth of AIPG. I feel that my experience, motivation, and strategic ideas make me the ideal candidate for the position of Vice President. If elected, I will draw upon the skills I have developed during my professional career and tenure with the Ohio Section to deliver the same dedication and passion for geology and AIPG at a national level.

Throughout my childhood I was naturally curious about science and my parents nurtured this by enrolling me in numerous math and science programs offered by our school system. Additionally, my dad was very involved at the state and national level with professional organizations similar to AIPG. I fondly recall many family vacations centered on his national conferences at locations around the United States. Unbeknownst to me, these educational opportunities and travels laid the groundwork for my future as a geologist. Trips to places such as Arizona, Colorado, Pennsylvania, Washington, and Wyoming revealed the physical world beyond the glacially scoured plains of the Midwest. From these experiences, I developed an understanding of both the diversity of the geologic world and the core professional and personal value of involvement in organizations such as AIPG.

In college, my love for geology was cemented in my first geology course. My professor, Dr. Kenneth Foland, brought a depth of knowledge and passion to the science that inspired me to pursue a career in geology. Throughout college my passion for geology only grew thanks to the broad assortment of courses, encouraging professors, and, of course, frequent field trips to a myriad of geologically interesting places including a six week field camp in central Utah! Following college, I found my home in environmental consulting where I am continually motivated and challenged by the diverse array of projects and clients.

I joined the Ohio Section Executive Committee in 2009 as a Member-At-Large based upon the recommendation of a coworker with whom I shared the sense of volunteerism and desire to “give back” to the profession. Since my initial recruitment, I have been involved with the Ohio Section of AIPG for over 11 years. This included six years as Treasurer and the three-year cycle of President-Elect, President, and Past-President. I have also served on or led several ad-hoc committees focusing on social media presence, sponsorship development, and the ever-changing website. During this time we continued to improve how the Ohio Section operates with the primary purpose of providing value to our members and student chapters. Specific examples of my achievements within the Ohio Section include a modernization of the Treasurer’s position through implementing electronic banking and billing and point-of-sale (POS) payments for events. Also, as part of our business development committee, I led development of a sponsorship program for our newsletters, meetings, and events. Revenue from these initiatives has been used to directly subsidize member and student activities. Currently, I serve as the chairperson of the Website Committee, and am assisting with planning a PFAS seminar to be offered in August 2020.

The primary role of the National Vice President is to evaluate the status, condition, problems, and concerns of each State Section, and to foster communication between National and State initiatives. If elected as the National Vice President, I will work directly with the other state sections to assess and summarize common successes and challenges. Using this information I will develop a simplified strategic plan that can be utilized by State Sections to address various issues.

Additionally, the most gratifying aspect of my experience at the Ohio Section has been my involvement with the student Sections. One of the most important goals of our organization is to provide mentorship to our student chapters as they represent the future of our profession and membership base. The unbridled enthusiasm, optimism, natural curiosity, and scientific prowess of the students is inspirational and reminds us of why we got into geology in the first place. With the student chapters, I helped foster mentoring opportunities through the organization of field trips and activities, presentations, section meetings, and development of scholarship opportunities.

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When Keri Nutter called me in early February and asked me to consider the nomination for Treasurer, I had to ask how many potential nominees declined before me— I imagined someone frustratingly pulling cards from a Rolodex as they worked their way past the Es and Fs, landing on “Grifasi”, quick sigh, then “why not?” And that wasn’t the first time I had asked that question. When Jean Patota called me six years ago to ask if I would have interest in being on the Northeast Section AIPG Executive Committee (ExCom), I said the same thing. I recycle jokes.

On a serious note, I am delighted to have been nominated for this position. When I signed up to be Secretary of the Northeast Section AIPG ExCom in 2015, I really had no idea where it would lead me. Similarly, when I fell in love with geology back in that Kindergarten classroom in sunny Southern California, I would never have imagined that love blooming into what it has become today. I do feel very lucky to be a member of this profession and to have found my feet in AIPG.

The geology seed was planted for me at an early age. I was fortunate to have a grandfather who immersed me in the outdoors—places like Joshua Tree, the Salton Sea, the Mojave, and the San Bernardino National Forest. Over time that seed grew into a B.S. in Geology from the University at Albany followed by some time in a stable isotope/paleoclimatology lab. As a professional, my career began on Griffiss Air Force Base in 2001 in Rome, NY where I learned the basics of soil and groundwater remediation. There was a two-year moment (2003 to 2005) where I left the “industry” to become an Earth Science and math teacher, via the New York City Teaching Fellowship. What followed my short career as a big city teacher was a deep dive into geotechnical engineering in the five boroughs as well as New Jersey. I was fortunate in that time to work on several exciting projects—The Second Avenue Subway, The TUNNEL, the I-95 Widening Project, the Portal Bridge Capacity Enhancement, and many smaller projects through the NYC Department of Design and Construction. Fast forward to today, I just wrapped up my 10th year at FPM Remediations where I manage remediation projects all over the country.

I received my CPG in 2011 and became more involved with AIPG in 2015. Since then, I’ve moved from Secretary to President-Elect to President (current) of the Northeast Section AIPG. Should my campaign for National Treasurer bear fruit, I’ll be simultaneously serving as Past-President of the Northeast Section AIPG. In addition to that role, I’m also currently serving a two-year term as Treasurer of the PTO for the school in Syracuse, NY, that my two children attend. For those of you who have served in other school PTOs, I’m sure you would agree that being treasurer on that board has quite possibly prepared me for this role better than any professional geology board could.

As Treasurer, I will, first and foremost, support ongoing efforts to engage new membership as well as maintain existing membership. One major focus for the Northeast Section AIPG is to identify and support student organizations throughout our region. I recently ran a presentation for the Geology Department at SUNY Geneseo that focused on the New York State licensure process, finding employment in the geosciences, as well as the benefits of membership with AIPG. It is through engagement like this that AIPG can reach the next generation of geoscientists. As Treasurer, I would work with the National ExCom to provide the necessary support to our Sections in an effort to strengthen our student/young professional outreach capabilities.

As Treasurer, I will, first and foremost, support ongoing efforts to engage new membership as well as maintain existing membership. One major focus for the Northeast Section AIPG is to identify and support student organizations throughout our region. I recently ran a presentation for the Geology Department at SUNY Geneseo that focused on the New York State licensure process, finding employment in the geosciences, as well as the benefits of membership with AIPG.

Beyond direct engagement with students, I would like to grow National AIPGs capacity to support students through scholarship opportunities via larger and increased quantities of awards. Of course, this requires a focused increase in fundraising which requires time— but time that will be well spent.

Potential projects aside, my primary focus would be to serve and support the National ExCom as per the by-laws as well as the established expectations of Treasurer.

In closing, I would like to thank Keri for considering me for this nomination. I look forward to serving at Treasurer on the AIPG ExCom and am appreciative of your consideration.
I am humbly honored to be nominated for the 2021 AIPG National Executive Committee Treasurer position. This position, I believe, is important to the overall successful and responsible functioning of AIPG. I have served as a board member on a family foundation for the last ten years where I have a shared responsibility to wisely steward the financial resources of the foundation in both an investment and giving capacity. If elected, I believe my foundation board experience will positively impact my ability to serve as an effective Treasurer to the AIPG National Executive Committee. I view serving in the Treasurer position as an opportunity to give back to an organization that I believe in.

Being a member of AIPG has enriched my professional growth as an applied environmental hydrogeologist. My vision for AIPG is to spark, encourage, challenge the upcoming generation of applied geology professionals to meet the world’s evolving challenges. Committed young geology professionals are needed to address responsible resource development with environmental stewardship in the context of an increasing world population, climate change, and finite resources.

My love for geology began with visiting the mountains and multiple national parks during summer family vacations as a kid. Like many, I did not go to college seeking to become a geologist but quickly caught the bug my sophomore year with my first geology course in historical geology. I soon embarked on a path to equip myself for a career as a petroleum exploration geologist by completing a Bachelor’s in geology, working on Oklahoma deep gas rigs, and completing a Master’s degree in clastic sedimentology.

Life circumstances, however, taught me a valuable lesson in the boom-and–bust cycle of our cherished vocation. My job prospects in the petroleum industry disappeared in late 1985 as my fiancée and I were finishing our graduate studies in geology. After a short active duty stint with the Army, I secured my first position as an environmental geologist in 1987 with no prior hydrogeology coursework. Early in my career I learned the tools of an environmental hydrogeologist through night courses, correspondence courses, short courses, conferences and on-the-job training. My career has entailed employment with four environmental consulting firms with a variety of diverse projects across the country.

I first joined AIPG in 1994 to gain the credentials of the CPG registration and quickly came to value network of professional colleagues at other firms that I developed through attendance at our local Illinois/Indiana sectional meetings. Around ten years ago I increased my engagement in AIPG at both the sectional and national meetings. Within my section, I joined our local board and have served as the field trip coordinator and am currently serving as the section’s Vice President. Through serving as our section’s representative, speaker, and field trip participant at national meetings, I have come to value a broader network of professional colleagues from many different sectors of our profession.

Having enjoyed a great education and employment as an applied geologist, I now want to focus some of my time investing in the future generation of geologists to support their education and employment as young professionals. Locally, I support and am engaged with my undergraduate geology department where my wife has served as an adjunct geology instructor for the last 20 years. As a recruiter of young geology professionals for my firm, I find it challenging that the current generation of students seem more attracted to policy-based environmental science versus more traditional hard geoscience programs. I also am concerned about the recent trend of many respected geology graduate programs of eliminating their Master’s degree track. I have long viewed the Master’s degree as the preferred applied geologist working degree. I am concerned that the current educational pipeline will not be adequate to supply the applied geological workforce needs of the future.

Looking forward, I believe AIPG should encourage responsible resource development, environmental stewardship, balancing energy types and needs with CO₂ footprint and client change and supporting access to life giving clean drinking water around the world. I believe these aspirational themes are many of the issues that the younger generation highly value and AIPG embracing these themes has the potential to make membership and participation in our organization more relevant and desirable to the next generation of applied geology professionals.

If elected, I believe my foundation board experience will positively impact my ability to serve as an effective Treasurer to the AIPG National Executive Committee. I view serving in the Treasurer position as an opportunity to give back to an organization that I believe in.
It’s an honor to receive a nomination for the role of Early Career Professional in the 2021 AIPG National Executive Committee. Thank you for your endorsement, and the privilege to be considered for this important strategic position.

As a student, it is an incredible opportunity to meet people in the profession. My journey started with AIPG shortly after I started my doctoral classes at Florida Atlantic University. It was my second year of the Ph.D. program, and I was anxious to see what the professional community was doing. Not much time passed before other students had shown interest and wanted to learn more about the geology profession.

We held lectures, field excursions, and everything we could get our hands-on. To highlight some of our activities:

- Data processing workshops for determining estimates of evapotranspiration, it is the most elusive parameter in a water budget
- Dr. Cliff Voss, Birdsall-Dreiss Distinguished Lecturer, spoke about Density-Driven Groundwater Flow: Seawater Intrusion, Natural Convection, and Other Phenomena.
- Trips to old pit mines to view marine depositional environments, it’s Florida!

It was then I found myself playing an active role in developing activities with the Florida section, FAPG.

My participation increased by being part of the process. I became a regional coordinator and got involved by attending the meetings by phone and at the quarterly events. The meetings resembled what some may regard as a war room. I walked into an organization whose daily mission was to protect the profession. Several Florida state legislators were introducing bills to deregulate the profession, beginning with removing the geology business licensing. There was a need to increase the frequency of communication to the members and beyond. Having a web/technical background, I volunteered to help manage the email and marketing.

Legislative updates and fundraising were the primary themes. We had an incredible lobbyist who I will never forget. My task was to support the delivery of critical messaging to aid with raising funds to support our lobbying activities and advising Florida P.G.’s with speaking points so they could effectively engage state legislators. We successfully defeated the bills, and the language was not introduced into law. We were successful in 2018, and again a similar deregulation bill died on the floor in 2019. And still, in 2020, the future of licensure and scope of the practice remains vulnerable.

What I have been doing is focusing my efforts in Florida to rebuild the FAPG board. Task completed. We are a team and in the process of creating two additional committees for supporting the legislative and education agendas.

Now I am the first to admit; the practice is not easy. Each state has its own policies, which in turn govern what and how natural resources are managed and protected. Geology comprises all of the other sciences and links to our every-day lives. It is the crucial variable in the human equation. The more we understand the geology and its processes, the more significant achievements we can have in our societies.

I am passionate about advancing the profession, and it’s what drives me. The subject of Geology is broad and offers considerable potential for those who chose this incrementally rewarding pathway.

Some of the activities I plan to support:

- Pair early career members and students with professionals
- Encourage early-career / professional co-authorship
- Promote early-career / professional middle school visits
- Promote co-authorship between government, academia and the professional
- Promoting as soon as a geologist is qualified, they should take the ASBOG test.
- To encourage more faculty / professional collaboration.

These activities will aid in enhancing collaboration between the professional, students, and academia.

I look forward to giving back and providing the same support to current and future early career professionals.
Candidate for AIPG National Early Career Professional

Taylor Murray, ECP-0407
Scottsdale, Arizona

It is such an honor to be nominated for the position of Early Career Professional for the 2021 AIPG National Executive Committee. First of all, I would like to thank the AIPG and its professionals for all of the support and guidance in my early career. If it weren’t for AIPG I would not be where I am today. I look forward to sharing the support and resources I found as a Student member and now as an Early Career Professional member with our future geoscientists.

My interest in AIPG began while attending Florida State University. Starting the first Florida AIPG Student Chapter was really rewarding for me. It gave me a solid understanding of what it means to be a professional geologist by underscoring the value of mentorship, professionalism, ethics, and licensure. Learning from professional members as a student is the first step in carrying on the legacy and vision of AIPG.

AIPG can really help the transition from being a student to jump-starting a professional career. I truly believe the foundation of my success is directly attributable to the networking and mentorship opportunities I was exposed to and continue to seek. I also landed an amazing job as a staff hydrologist at Clear Creek Associates in Scottsdale, AZ when I met my now bosses and mentors, Doug and Lori Bartlett, at an Executive Committee meeting in Portland, OR. All I am going to say is that a follow up email goes a long way and is exactly what got this Florida girl out in the desert. After almost a year and a half in my new position, I have gained important field experience and knowledge in hydrogeology and I remain an active AIPG member here in my new state of Arizona.

The Early Career Professional acts as the official spokesperson for Student and Early Career Professional members with the purpose of advancing the geological sciences and the profession of geology. My vision for the role is to encourage students and early career professionals to be actively involved in AIPG. Providing mentorship as well as networking, internship, and job opportunities will continue to bridge the gap between universities and AIPG. Serving as a resource for active and prospective student chapter members will also be important in encouraging and supporting ASBOG GIT preparation and certification.

I would like to see Student and Early Career Professional members become aware of and use the many resources that AIPG has to offer like the GOLI on-line learning courses offered in affiliation with the American Geosciences Institute. If elected I will also encourage Student and Early Career Professional members to contribute articles to TPG, it’s a great way to get published. I would also like to focus on the continuation and development of mentorship and networking opportunities to aid in the interactions between our generation of young professionals and the seasoned professional members of AIPG. The experience, guidance, and wisdom of AIPG professional members are invaluable. It is so important that we support, listen to, and learn from our peers as the future of AIPG depends on our dedication and active participation.

The ever increasing need for professional geologists emphasizes the importance of student and early career membership and the value that AIPG can provide in shaping and supporting new careers, and in offering a strong professional community.

If elected I will commit to making the Student Day presentation at the national conference a success, making marked progress in engaging student chapters, developing opportunities for and participating in networking and mentorship workshops and events, and representing AIPG at conferences like GSA. Students, recent graduates, and early career professionals are the future leaders of AIPG and the geosciences. The ever increasing need for professional geologists emphasizes the importance of student and early career membership and the value that AIPG can provide in shaping and supporting new careers, and in offering a strong professional community. I believe my experience and the incredible value AIPG has brought to me so far will be key in communicating with students and early career professionals alike.

In closing, I am excited for the opportunity to be a part of the National Executive Committee that not only represents the many disciplines of the geology profession but also has recently diversified to include Early Career Professional representation. It would be an honor to continue the work of those who have served before me including my friend and mentor Brandy Barnes. I am eager to learn, serve, and grow through what promises to be an exceptional experience.

Thank you for your consideration and I look forward to serving as the strong voice representing our students and early career professionals and I promise to uphold the vision and standards of the AIPG. I am proud and grateful to be a part of the AIPG family. It is not only a valuable and leading organization for professional geologists; it is a place where I have found opportunity, mentorship and wonderful friendships and connections that will last a lifetime.
I was pleased to be asked by the AIPG National Nominating Committee whether I would continue my service to AIPG by accepting a nomination for 2021 National Editor. I believe strongly in AIPG as an organization that supports professional geologists and has much to offer those of us who have selected this career. I am grateful for all the opportunities I have had to give back on both the section and national levels. I look forward to the opportunity to once again join the National Executive Committee, and would like to thank the Nominating Committee and the Executive Committee for approving my nomination.

Each of these members has something to offer AIPG and each other, and *The Professional Geologist* can and should be a way to engage and strengthen our membership; it is a forum to communicate complex concepts between our members and others, and help forge professional relationships that can last an entire career.

During my 21 years as an AIPG Certified Professional Geologist, I have taken an active role as a leader and participant in the Michigan Section and National activities, because I feel that you only get out of an organization what you put in. I plan to continue this practice for many more years in whatever capacity presents itself.

While serving as National President in 2017, my primary message to members was that Communication is key. I still believe this, and what better way to continue to get this message out to members than by serving as National Editor? The Editor’s primary responsibility is the publication of *The Professional Geologist*, which I believe is the critical vehicle for this message to reach its full potential to help advance the profession.

AIPG encompasses individuals at all levels of their careers in all aspects of the field of geology, from highly regarded seasoned professionals to early career professionals that are just beginning to make their mark. And of course, students who are looking to the professionals for guidance and are also conducting cutting-edge research. Each of these members has something to offer AIPG and each other, and *The Professional Geologist* can and should be a way to engage and strengthen our membership; it is a forum to communicate complex concepts between our members and others, and help forge professional relationships that can last an entire career. As relevant topical information impacting the profession comes to any of our members’ attention, I’d encourage them to share their knowledge with others and forward it for circulation and/or for inclusion in *The Professional Geologist*.

If you haven’t checked out the Michigan Section’s newsletter, I encourage you to do so. I’ve served as the Michigan Section Editor since 2007. A copy of all the newsletters may be found online at: http://mi.aipg.org/newsletters.htm. Over the years of producing the newsletters, I’ve striven to make improvements in both the content and appearance that would benefit and better inform our members. These improvements will continue with future editions, and I’d like to take this effort to the national publication.

The last few years has seen *The Professional Geologist* revamped with a fresh look and great content. There have been several high-quality peer-reviewed articles in recent editions. If elected as Editor, I will do my best to keep all our members informed about what is going on within AIPG and our profession, as well as to help get our message out to the world around us. *The Professional Geologist* is an excellent forum for knowledge sharing. I believe this is one more great benefit that AIPG has to offer members and can help retain existing and attract new members.

I can’t emphasize enough the value that communication on important topics brings. If elected, I will work with the current Editor to help ensure a smooth, seamless transition to deliver the high-quality publication that our members have come to expect. In addition, I would welcome input from our members, including opinion pieces, as a means of creating a professional dialogue between members on a variety of topics.

I feel that my experience at the state and national levels would continue to benefit AIPG. It is our organization, and it becomes what we give back. I have proven my dedication to the organization and look forward to continued commitment to making AIPG the best supporter of professional geologists. I anticipate the opportunity to serve AIPG as the next Editor, and would be honored if you would consider voting for me. Please contact me if you have any questions; my email address is adam.heft@wsp.com. Thank you for your consideration.
**Statement of Purpose or Goals you have for AIPG:** My overarching goal is to add to the value proposition that AIPG poses to its members. That is to say, to add to the various learning experiences (webinars, seminars, short courses, lectures) that we present. In doing so, our members will see a tangible value in continued membership and participation.

**Universities Attended**
- **University of Phoenix - Denver**
  - Degree: MBA
  - Date: 1992
- **Washington State University**
  - Degree: M.S. Geology
  - Date: 1984
- **University of Missouri – Kansas City**
  - Degree: B.S. Geology
  - Date: 1981

**Company**
- **Rhoades Associates**
  - Title: Principal Geologist
  - Dates: 2019-Present
- **United Battery Metals Corp.**
  - Title: CEO, President & Director
  - Dates: 2016-2019
- **NM Bureau of Geology & Mineral Resources**
  - Title: State Geologist
  - Dates: 2015-2016
- **WorleyParsons Corp.**
  - Title: Principal Hydrogeologist
  - Dates: 2007-2015
- **Maxim Technologies, Inc.**
  - Title: Principal Hydrogeologist
- **Harding Lawson Associates**
  - Title: Associate Hydrogeologist
  - Dates: 1990-1998

**AIPG Activities**
- **AIPG National Treasurer**
  - Dates: 2019-2020
- **AIPG National Conference Chairman**
  - Dates: 2013
- **AIPG Colorado Section President**
  - Dates: 2010

**Company**
- **Mittelhauser / Clayton Group Services**
  - Title: Senior Project Manager
- **CCJM**
  - Title: Environmental Geologist
- **US Army Reserves – Field Artillery Captain**
  - Dates: 1982-1992

**AIPG Activities**
- **AIPG Minnesota Section Secretary/Treasurer**
  - Dates: 2011-2014
- **AIPG Minnesota Delegate at National Conference in Alaska**
  - Dates: 2015
- **AIPG Minnesota Delegate at National Conference in Nashville**
  - Dates: 2017

**Company**
- **Terracon Consultants, Inc.**
  - Title: Field Tech/Staff Geologist
  - Dates: 2003-2006
- **WorleyParsons Corp.**
  - Title: Principal Hydrogeologist
  - Dates: 2007-2015
- **Wright Engineering, Inc.**
  - Title: Project Geologist
  - Dates: 2000-2002
- **US Army Reserve – Field Artillery Captain**

**AIPG Activities**
- **AIPG Minnesota Section Newsletter Co-Editor**
  - Dates: 2018-Present
- **AIPG Minnesota Section Leadership Award**
  - Dates: 2018
- **AIPG Minnesota Section Webmaster**
  - Dates: 2015

**Company**
- **United Battery Metals Corp.**
  - Title: CEO, President & Director
  - Dates: 2016-2019
- **NM Bureau of Geology & Mineral Resources**
  - Title: State Geologist
  - Dates: 2015-2016
- **WorleyParsons Corp.**
  - Title: Principal Hydrogeologist
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  - Title: Principal Hydrogeologist
- **Harding Lawson Associates**
  - Title: Associate Hydrogeologist
  - Dates: 1990-1998

**AIPG Activities**
- **AIPG National Treasurer**
  - Dates: 2019-2020
- **AIPG National Conference Chairman**
  - Dates: 2013
- **AIPG Colorado Section President**
  - Dates: 2010

**Company**
- **Mittelhauser / Clayton Group Services**
  - Title: Senior Project Manager
- **CCJM**
  - Title: Environmental Geologist
- **US Army Reserve – Field Artillery Captain**

**AIPG Activities**
- **AIPG Minnesota Section Newsletter Co-Editor**
  - Dates: 2018-Present
- **AIPG Minnesota Section Leadership Award**
  - Dates: 2018
- **AIPG Minnesota Section Webmaster**
  - Dates: 2015

**Company**
- **United Battery Metals Corp.**
  - Title: CEO, President & Director
  - Dates: 2016-2019
- **NM Bureau of Geology & Mineral Resources**
  - Title: State Geologist
  - Dates: 2015-2016
- **WorleyParsons Corp.**
  - Title: Principal Hydrogeologist
  - Dates: 2007-2015
- **Maxim Technologies, Inc.**
  - Title: Principal Hydrogeologist
- **Harding Lawson Associates**
  - Title: Associate Hydrogeologist
  - Dates: 1990-1998

**AIPG Activities**
- **AIPG National Treasurer**
  - Dates: 2019-2020
- **AIPG National Conference Chairman**
  - Dates: 2013
- **AIPG Colorado Section President**
  - Dates: 2010

**Company**
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  - Title: Senior Project Manager
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- **AIPG Minnesota Section Newsletter Co-Editor**
  - Dates: 2018-Present
- **AIPG Minnesota Section Leadership Award**
  - Dates: 2018
- **AIPG Minnesota Section Webmaster**
  - Dates: 2015
Election of officers shall be by a ballot. The ballot shall be sent to all Members. Election shall be by the majority of all qualified ballots cast. In order to be counted, ballots must be received at Institute Headquarters on a date named by the Executive Committee, which date shall be no later than June 30.

Only AIPG CPGs, Members and Young Professionals are authorized to Vote.

An email to vote electronically will be sent out in March. Email or ballot votes must be received at headquarters by JUNE 30, 2020. Your name and AIPG Member number must be included for the ballot to be valid.

Vote Online or Mail Ballots to:

AIPG
1333 W. 120th Avenue, Suite 211
Westminster, Colorado 80234-2710
CANDIDATE FOR AIPG NATIONAL 2021-2022 EDITOR

Adam W. Heft

CPG-10265
Holt, Michigan

Statement of Purpose or Goals you have for AIPG: My goals as Editor are to help communicate the state of the profession to members, remind members of the value of AIPG membership, and to keep The Professional Geologist relevant and timely.

Universities Attended

<table>
<thead>
<tr>
<th>University</th>
<th>Degrees Granted</th>
<th>Dates</th>
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<tbody>
<tr>
<td>Michigan State University</td>
<td>M.S. Geology</td>
<td>1993</td>
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<tr>
<td>Central Michigan University</td>
<td>B.S. Geology and Earth Science</td>
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Company

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<tr>
<th>Company</th>
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<tr>
<td>WSP USA</td>
<td>Senior Supervising Geologist</td>
<td>2017-Present</td>
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<td>Parsons Brinckerhoff</td>
<td>Senior Supervising Geologist</td>
<td>2009-2017</td>
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<tr>
<td>Fitzgerald Henne &amp; Associates</td>
<td>Project Manager</td>
<td>1994-2009</td>
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<tr>
<td>Peterson Environmental Services</td>
<td>Field Geologist</td>
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AIPG Activities

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<tr>
<th>Activity</th>
<th>Dates</th>
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<tbody>
<tr>
<td>Co-chair of the 58th National Annual Meeting</td>
<td>2018-Present</td>
</tr>
<tr>
<td>National Past President</td>
<td>2018</td>
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<tr>
<td>National President</td>
<td>2017</td>
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<tr>
<td>National President-Elect</td>
<td>2016</td>
</tr>
<tr>
<td>Section Leadership Award</td>
<td>2014</td>
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<tr>
<td>Michigan Section Delegate to the Advisory Board</td>
<td>2014</td>
</tr>
<tr>
<td>AIPG booth volunteer for the GSA regional meeting</td>
<td>2013</td>
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<tr>
<td>Michigan Section Delegate to the Advisory Board</td>
<td>2011</td>
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<tr>
<td>National Secretary</td>
<td>2010-2011</td>
</tr>
<tr>
<td>National Advisory Board Representative</td>
<td>2009</td>
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<tr>
<td>Michigan Section Newsletter Editor</td>
<td>2008-Present</td>
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<tr>
<td>Presidential Certificate of Merit</td>
<td>2008</td>
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<tr>
<td>Significant Contribution to the Michigan Section Award</td>
<td>2007</td>
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<tr>
<td>Chairman of the 44th Annual Meeting</td>
<td>2004-2007</td>
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<tr>
<td>Michigan Section Assistant Newsletter Editor</td>
<td>1999-2007</td>
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</table>

CANDIDATE FOR AIPG NATIONAL 2021-2022 EARLY CAREER PROFESSIONAL

Troy P. Bernier

ECP-0448
Charlotte, North Carolina

Statement of Purpose or Goals you have for AIPG: I plan to support, pairing early career members and students with professionals, encouraging early-career / professional co-authorship, promoting early-career / professional middle-school visits, promoting co-authorship between government, academia and the professional, and encouraging more faculty/professional collaboration.

Universities Attended

<table>
<thead>
<tr>
<th>University</th>
<th>Degrees Granted</th>
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<tbody>
<tr>
<td>Florida Atlantic University</td>
<td>Doctoral Candidate</td>
<td>2012-Present</td>
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<tr>
<td>University of North Carolina</td>
<td>M.S. Geology</td>
<td>1995</td>
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<td>York College</td>
<td>B.S. Geology</td>
<td>1992</td>
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<td>University of Montana</td>
<td>Field Trip Course</td>
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Company

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<tr>
<td>Syn Terra Corp</td>
<td>Professional Geologist</td>
<td>2019-Present</td>
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<tr>
<td>Hydrocarbon Imaging Services Inc.</td>
<td>Consultant</td>
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<tr>
<td>H2O Resource, Inc.</td>
<td>Consultant</td>
<td>2012-Present</td>
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AIPG Activities

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<th>Activity</th>
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<tbody>
<tr>
<td>Florida Association of Professional Geologists, President</td>
<td>2019-Present</td>
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<tr>
<td>Florida Association of Professional Geologists, Secretary</td>
<td>2018</td>
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<tr>
<td>American Institute of Professional Geologists, Section Leadership Award</td>
<td>2018</td>
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</table>

CANDIDATE FOR AIPG NATIONAL 2021-2022 EARLY CAREER PROFESSIONAL

Taylor Murray

ECP-0407
Scottsdale, Arizona

Statement of Purpose or Goals you have for AIPG: To serve the Executive Committee and members with the purpose of advancing the geological sciences and the profession of geology. To increase awareness of AIPG benefits to students and early career professionals by supporting the transition from academia to the professional world of geology. Finally, to help strengthen and diversify the AIPG membership base.

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<tr>
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<tr>
<td>Florida State University</td>
<td>B.S. Geology</td>
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Company

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<th>Company</th>
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<tbody>
<tr>
<td>Clear Creek Associates</td>
<td>Staff Hydrologist II</td>
<td>2018-Present</td>
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<td>Aquifer Maintenance</td>
<td>Staff Geologist</td>
<td>2016-2018</td>
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<td>Performance Systems</td>
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<td>Florida Geological Survey</td>
<td>Technician</td>
<td>2014-2016</td>
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<tr>
<td>J.L. A Geosciences</td>
<td>Intern</td>
<td>2013-2014</td>
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AIPG Activities

<table>
<thead>
<tr>
<th>Activity</th>
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<tbody>
<tr>
<td>AIPG Booth Volunteer at National GSA Conference</td>
<td>2019</td>
</tr>
<tr>
<td>AIPG National Conference Student Day Presenter</td>
<td>2017</td>
</tr>
<tr>
<td>AIPG FSU Student Chapter Founder/President</td>
<td>2013</td>
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</table>
Building the Future of Geology
Support the Foundation of the AIPG

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 young professional workshops, 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 be able 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. Your continued support is greatly appreciated. Thank you.

Barbara 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

Official AIPG 2020 Ballot National Officer Election

President-Elect
President in 2021

- Matthew J. Rhoades, CPG-07837
- Shanna A. Schmitt, CPG-11781

Treasurer
Term of office 2021-2022

- Michael G. Grifasi, CPG-11489
- David T. Heidlauf, CPG-09365

Editor
Term of office 2021-2022

- Adam W. Heft, CPG-10265

Vice-President
Term of office 2021

- Christine F. Lilek, CPG-10195
- Brent R. Smith, CPG-11130

Early Career Professional
Term of office 2021

- Troy P. Bernier, ECP-0448
- Taylor Murray, ECP-0407

Name

AIPG Member Number

Vote online or mail in this ballot
This timely, riveting and informative book seeks to present a balanced account of how much sand has contributed to humanity and how we and the environment are paying for it. The author, a journalist, lists the enumerable uses of sand in its various forms. (I once evaluated the silica arch brick of a tunnel kiln that had been in operation for about 35 years continuously at above 1440 degrees Centigrade.) He relates that the sand in concrete and the silicon of computer chips and other uses got us to where we are today. "...the invisible but fundamental ingredient that makes up the bulk of the built environment in which most of us live."

There are chapters concerning history, infrastructure, high tech, fracking, beach nourishment and dredging, man-made islands, desertification, booming urbanization and future needs.

Beiser provides a history of the development and use of cement, sand and gravel in concrete and asphalt (two composite materials that were finally accepted after they survived the San Francisco 1907 earthquake much better than did other materials), as well as the use of steel reinforcement to enable rapid urbanization and fill the need for good roads at the turn of the 20th Century. This part of the book is a lively concatenation of the involvement of well-known people including Thomas Edison, Henry Kaiser and President Eisenhower. Beiser discusses the role of, among others, Galileo, Libby and Owens in the development of the glass industry.

He presents a considerable amount of documentation about the growth of the enormous amount of sand used (e.g. construction sand, now worth $130 billion per year worldwide) and its growing value in infrastructure, beach replacement, the building of artificial islands and for fill to expand the shorelines of cities. He has traveled everywhere to get first-hand experience concerning each issue, and to collect personal stories. He went to Wisconsin to interview people on both sides of the fracking sand issue. He visited Dubai to learn about the value and issues of building islands over coral reefs and oyster beds in the Arabian Gulf to expand the available land area. One expert said that China’s dredging has caused the most rapid loss of coral reefs in history. Beiser went to India to discuss with farmers and sand miners the problems associated with illegal sand mining. In China he visited areas with desertification. In North Carolina he asked about the mining of pure quartz and associated minerals – the quartz is used for silicon production. He went along during a bridge inspection in California.

Beiser makes the point that there are different grades of sand and quartz, based on its purity, rounding, and sorting, for different uses, and that each has a different value. For example the USA produces ten times more construction grade sand than industrial sand, but recently the estimated value of the larger amount of construction material is $7.2 billion while the industrial sand is worth $8.3 billion.

He reports that recently 92 million tons of silica sand per year was used in the United States, with 75 percent used for fracking and only 7 percent going to the glass industry. Texas newspapers indicate that the larger fracked wells use 25,000 tons of sand - a lot of this has been from Minnesota and Wisconsin (In some cases they have to frack the well as many as 18 times). The sand must have certain properties, which the sand in Minnesota and Wisconsin surface deposits meets, but the fracking industry can also get usable sand from other areas such as Texas.

At the same time dams in California are intercepting 80 percent of the fluvial sediment that would eventually reach the beaches, and it is expected that by 2100 two-thirds of the beaches there may have been eroded bare of sand. Levees and canals, as well as dams, have reduced the flow of sand in Egypt, China and the Mississippi. Sand mining and dredging, a considerable amount of it illegal, in Vietnam, South Africa, Kenya, San Francisco, Morocco, Algeria, Crimea, Malaysia, Indonesia, Cambodia and Jamaica has reduced beaches significantly, which can enhance storm damage and property loss. Vacation beaches everywhere have been artificially nourished many times – fifty times for Virginia Beach, Virginia. There are also efforts to reduce storm damage by means other than the replenishment of sand beaches and the use of walls, such as by the rebuilding of wetlands and natural barriers, including intertidal reefs.)
Bill Feyerabend, CPG-11047

Geology was Bill Feyerabend’s ticket from a small Idaho farming town to a career which has crisscrossed the Americas with stops in Africa, China and the Middle East. He has participated in discoveries of gold, base metals, industrial minerals and lithium brines and is currently deeply involved with bringing a gold project forward.

This is about an inevitable in life. Not death nor taxes, but the aging geologist. Geology is a much more interesting occupation than 8-5 M-F office or factory work. It means many things: going places, being outdoors and the interesting intellectual challenges of unravelling new geo-puzzles. It is so different and interesting that it becomes our core identity: “I am a Senior Geologist with ___ or I am the Project Manager on _____."

The problem is that geology requires physical capabilities that begin to escape us as we age. Knees go bad from rocky hillsides. Lungs and liver begin to go bad after too many smoky back hills bars. There comes a time when you have to decide whether or not to hang up the boots and hand lens and lose your identity.

Or do you?

Statement of hooey:

“There are no second acts in American lives.” - F. Scott Fitzgerald

You can choose to retire and let it slip away or you can evolve, build on a lifetime of experience and build a new core identity. Here is an example of your strength. Somewhere in your 50s or 60s, while the younger guys are feverishly out running up and down hills mapping details, you begin to see the deeper patterns. Here is an example of what you can do in a few days which would take a young geologist weeks with oversight. There is a historic drill resource in the white box, but the mineral system is much larger and may have additional potential. That is valuable information.

The opportunity to do that type of work does happen, but not that often in my experience. It is a side income. Here is a solution: move up the food chain and become your own prospect generator. That builds on your strength which is your experience and deep understanding. This article is for those interested in that potential and mid-career geologists interested in laying the framework for that later in life. Even more, having researched a couple of properties can be just the ticket to getting your foot in the door after a mid-career job loss.

So where would you look? Stay reasonably close to home. We all want to explore for cobalt in Alaska or gold in Kazakhstan, but there is always a need for a quick trip to resolve some small thing. Travel costs can kill you. My personal rule is two days’ drive maximum.
Geographical limits usually limit you to a couple of commodities available in that area. It is good to have worked up a couple of targets for each commodity. Market favorites rotate and when the market flutters away from one property's commodity, file your data away for another day. It is useless to fight the market and it will come back around – someday. Know your commodity. Read and go to conferences. The SME Mine Finance Forum in New York put clearly in my mind why the markets for graphite, lithium and cobalt were dynamic because of renewable energy while other commodities were in a ‘secular’ recession. Secular is a good word to know if you want to sound like you know what you're talking about. I have also learned to make good contacts by talking to everyone and anyone. At the booths, ask how they began and where they got initial funding. Chat up anyone standing around with a cup of coffee in their hand. I once got work from starting a conversation at a luggage carousel. Contacts are invaluable for how to do things and who to talk to as you expand your universe.

So where are you going to find your next opportunity? Keep track of mines that produced and have shut down. There always is additional peripheral and satellite exploration that needs to be done. I was on the discovery hole at the Mesquite mine in southern California, but never bonded with Yuma, AZ. When Newmont shut it down, it was the folks at New Gold who justifiably benefited and not me. There is a huge amount of online data available. I pay no attention to size, but pay close attention to stratigraphy and structure. Chimney Creek, NV was found by selected samples and I can think of a couple of deposits where you could easily straddle the discovery outcrop. Look where structural flexures and receptive stratigraphy can turn that small outcrop into your retirement fund. Again, chat people up. It is amazing what can fall in your lap. Finally, remember the Golden Rule. Do not fall in love with one prospect. More often than not geologists who do that lead difficult lives. If you are an open person, life is an endless series of opportunities. Act like it.

When you have something, you will need to establish a land position. It can be as small as five or ten claims. Remember that state land can often be leased cheaply. The point is to make your land position as large as possible with the smallest possible cost – hence state land. You want a reference for an area of protection within a non-compete non-disclosure (NCND) agreement – you can find examples of those online. It is quick and cheap to form a corporation. Put everything in a corporation you have formed in that state at reasonable cost, or in Nevada or Wyoming if needed, and keep good records. The idea is to have your personal assets behind the protection of the corporate shield plus it sounds good to say you have X asset in Y standalone corporation licensed to do business in that state.

Be prepared before you shop it around. Have a teaser of 1-2 MSWord pages or a 5-10 page PowerPoint presentation which promotes the commodity and geology, but is very hazy on the exact location. Have a NCND agreement ready which you have gotten online or from an attorney for $500-750. Once an interested party has signed the NCND, have a more detailed presentation ready to go. I try to cover all the points in the 43-101 Technical Report format. That usually takes a +10 page Word document or 20-30 page PowerPoint. Know the answer to one question – how much have you spent? They surely will ask that. I keep a monthly spreadsheet which is just an amplification of a standard expense report with a column under each category for cash and each credit card and enough rows each day that individual expenses are never clumped. My accountant loves it and keeping it up monthly makes tax time a non-event. Plus I know the answer to that question - $29,645.36.

Record Keeping

So who are you going to shop it to? Here are some handy search sites for Canadian companies:


Work your network and constantly work to expand it by going out of your way to meet people at professional gatherings and conferences. Jump on any chance to expand the geographic range of your contacts. When I lived in Winnemucca, I was envious of the sophisticated world view of the guys in Reno. Now I know that the view from Reno is sometimes different than the view from Vancouver, Toronto or New York which can be different from the view from Australia and Asia now that Canadians can think of nothing but bitcoin and legal pot. Remember the golden rule of sales: NO is not NO until NO is explicitly said. Call and write back. And pucker up, baby, because you will be kissing a lot of frogs.

Continued on p. 39
The Value of Diversity

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

When I attend meetings, one of the subjects that most often arises, in both formal structured discussions and in informal conversations, is diversity. These discussions often focus on what we can do to enhance diversity or to encourage the participation of underrepresented populations in the geosciences. Invariably, statistics are cited, and we lament the lack of diversity in the geosciences. It’s true that more men than women are working geologists and that the United States population of geoscientists is overwhelmingly people of Caucasian or European descent. We have work to do in these areas, and we should actively seek to recruit everyone with an aptitude for our science to study and eventually practice geology.

Webster’s defines diversity as “the condition of having or being composed of differing elements” and includes the word ‘variety’ as a synonym. Recently, I read a paper by Marilyn Loden and Judy Rosener (1991) in which they described two major dimensions of diversity. The first, or primary, dimension can be thought of as those things about ourselves that we cannot change. Examples include race, ethnicity, gender, sexual orientation, physical characteristics, age, mobility, and other innate qualities. Secondary dimensions of diversity include things that we have some ability change, or that we’ve experienced. These dimensions of diversity include things like religious beliefs, education, military experience, marital status, whether we have kids, where we’ve lived, hobbies, or a myriad of other life experiences. These secondary dimensions of diversity have in common that we have some degree of choice in gaining these dimensions and to some extent, we can change these dimensions should we wish to do so. We may choose to take a photography course, enlist in the military, study a particular religion, or move to a rural area. All of these dimensions, primary and secondary, are types of diversity. What Loden and Rosener showed clearly, is that each of us as individuals have much in common with each other, yet we are also uniquely different.

We have work to do in these areas, and we should actively seek to recruit everyone with an aptitude for our science to study and eventually practice geology.

Why then, has diversity become such a prominent topic, not just in geology, but in most aspects of western society? The answer likely is both simple and complex. Today’s world is interconnected to a degree that has never before been seen in human history. Businesses operate in the international space and must tailor their offerings to meet the needs of the markets in multiple countries. Diversity can help managers determine how best to operate in another country. On a trip to Sweden a few years ago, I became homesick, so I decided to stop into a McDonald’s restaurant to get a taste of home. I was fascinated to see some items that were very much like home…and others that definitely reflected the Swedish palate. Other advantages of a diverse workplace are more complex and often less obvious. The number of articles that have been written about the advantages of diversity in the workplace are so abundant that to read them all would take a lifetime. I’ve read a fair few, and I see a few common themes.

1. **Diverse teams are more productive and perform better.** Numerous studies have shown that teams that boast a broad range of experiences, expertise, working methods, and cultural diversity have better problem-solving approaches and outcomes.

2. **Diversity drives innovation.** Diversity often helps entrepreneurs better understand the needs of potential customers and clients with whom the entrepreneur shares a common background.

3. **Diversity enhances recruitment.** In today’s competitive labor market, research indicates that diversity is an important aspect when potential recruits evaluate job offers. A recent survey by Glassdoor found that two-thirds of potential employees stated that diversity was important when they considered job offers.

4. **Diversity helps with employee retention.** When employees are valued for their unique contributions, they are more likely to remain loyal when other offers arise. In addition, in workplaces where the cultures, perspectives, and experiences of employees are mutually valued, workplace conflict is lessened. Some studies (e.g. Harvard Business Review, 2018) have found that diversity of gender, religion, and ethnicity have specifically been shown to improve employee retention.

5. **Diversity can help build relationships with communities.** Many companies work across state or national borders. Diversity can help companies better market themselves and avoid costly public relations blunders. I’m a car guy, and I’ve long heard the story (probably apocryphal) that when Chevrolet decided to export the Nova to Spanish speaking countries, the sales numbers we very low. A bit of targeted research found that in Spanish ‘no va’ means ‘not going’ or ‘doesn’t go.’ That’s not exactly the message that Chevrolet might want attached to a car. A more recent example: when KFC expanded to China, their marketing line “Finger lickin’ good” was translated as “so good you will eat your fingers off.”

Continued on p. 45
A Diverse and Inclusive Membership Will Strengthen Our Organization

J. Todd McFarland, CPG-11348
todd.mcfarland@woodplc.com

Members of the American Institute of Professional Geologists are dedicated to the highest standards of personal integrity and professional conduct. This is the first sentence in the preamble to the AIPG Code of Ethics. In the 12 years I have been a member of this organization, the members I have encountered have embraced these standards. We can all agree that a geologist who acts without integrity does not have a place in this organization and will not have a long career as a geoscientist. Although integrity is the bedrock of a strong geoscientist, professional conduct seems to be open to interpretation.

Members shall respect the rights, interests, and contributions of their professional colleagues. This is Standard 4.1 of our Code of Ethics and primarily focuses on giving due credit for work done by others and not plagiarizing other communications. However, we should also respect the interests of our professional colleagues. We don’t have to agree with those interests, but we should be able to disagree respectfully. How many “arguments” have you been a part of sitting around a table with a group of geologists discussing a complex series of folds and faults after a day in the field? We are geoscientists and we are passionate about our work. Disagreements in our methods to approaching a problem or to the solution itself should only be opportunities to improve our results. What it should not be is an attack on a person because they don’t think, look, or act like you. I have gained so much insight in this field through disagreements that were discussed in a professional and constructive manner.

Members should encourage and assist in the development of a diverse and inclusive workforce. This is Standard 4.3 or our Code of Ethics and embracing this standard will only strengthen our organization. Our workforce is changing, so if we don’t embrace this change, our organization risks stagnation. As noted in the AGI Geoscience Current Participation of Women in the Geoscience Profession\(^1\) (November 2019), in 1985 26% of geoscience undergraduate degrees and 24% of geoscience graduate degrees were conferred on women. In 2017 those percentages are 43% for geoscience undergraduate degrees and 39% for geoscience graduate degrees. The 2020 AIPG Executive Committee is comprised of a women majority for the second year in a row. In a recent survey conducted by the Diversity and Inclusion Committee of the Society of Economic Geologists,\(^2\) 50% of respondents that identified as female and non-binary have had a negative experience or felt alienated in the organization. Additionally, males that completed the survey reported a sense of disenfranchisement based on “the old boys club” that continues to run the organization and nominate and receive awards. Prospective members that don’t see their identities represented in our organization will not feel a sense of belonging and will likely not become long-term members.

Review of a recent article in the New York Times appropriately titled “Earth Science Has a Whiteness Problem”\(^3\) indicated less than 10% of doctoral degrees in the geosciences go to recipients of color. In addition, people of color hold less than 4% of tenured or tenure-track positions in geoscience departments. What is even more surprising is that the article referenced a series of e-mails sent to affiliates of the Lamon-Doherty Earth Observatory at Columbia University that said, “black people were genetically inferior and did not belong in academia.” Although the sender was not associated with the university, it shows that this ignorance still exists in our society. I hope you all agree that this ignorance has no place in AIPG.

My current responsibilities include hiring geologists to support our field projects. I don’t hire men or women that are black or white or gay or straight, I just hire the best geologists who have applied for the position. Specifically, I am trying to hire geologists who will ultimately take my job. Why would I want to do that? Because it will make the company better and recruiting geologists from a diverse and inclusive background will only make this organization better. They may not look like me, act like me, or think like me and that is okay. A diverse and inclusive environment also leads to another benefit - diversity of thought. Michelle Kim, the co-founder of Awaken, concludes that “diversity of thought should be achieved as a result of diverse representation.\(^4\) The way we think, problem-solve, communicate, lead, and see the world are shaped by our lived experiences.”

I have said this before but will say it again - students and early career professionals should be receptive to the wealth of knowledge that professional members can convey as this knowledge can be invaluable to your careers. However, this is a two-way street. Be open to what others have to say. If you disagree, do it professionally. We will be developing a Diversity and Inclusion Position Statement for AIPG. I look forward to a diverse and inclusive AIPG where all are encouraged to express their thoughts and opinions in a professional environment.

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2. SEG Discovery, How Good Are We? – Assessing the Results of Our Survey, No. 120, January 2020
1. We collect a nice green specimen of “amazonite.” Which choice below describes its chemical composition?
   a) KAlSi₃O₈
   b) SiO₂
   c) Cu₂CO₃(OH)₂
   d) Be₃Al₂Si₆O₁₈
   e) Man, what’s up with these letters and tiny, itsy-bitsy numbers?

2. In our studies of coastal processes, what defines a “neap tide?”
   a) A tide where the difference between high and low tide is least, occurring twice a month when the sun and moon are at right angles to the earth.
   b) A tide where there is the greatest difference between high and low water, when the tide-generating force of the sun acts in the same direction as that of the moon; thus, reinforcing it.
   c) The rising or incoming tide which occurs in the time between when the tide is lowest and the time when the following tide is highest.
   d) The period between high tide and the next low tide during which the sea is receding.
   e) Hey hombre, this “neap tide” reminds me that it’s time for “nap time.”

3. “Gastornis” refers to:
   a) An extinct genus of large flightless birds that lived during the Paleocene and Eocene epochs.
   b) An extinct genus of saber-tooth felines.
   c) A genus of elephant-sized ground sloths that lived during the Pliocene and Pleistocene epochs.
   d) An extinct genus related to the alligator which lived during Cretaceous time.
   e) Dude, I thought that “Gastornis” is what one gets after eating too many refried beans.

4. What is the “Greenwich Meridian?”
   a) It is the line of 180 degrees longitude.
   b) It is the “prime meridian.”
   c) It is the zero-degree latitude line.
   d) It’s a great restaurant in “the Village” in lower Manhattan.
   e) Compadre, I’m getting this one right and I’m not getting skunked!

5. As we expand our knowledge of the geology and geophysics of extraterrestrial bodies, we find a renewed interest in the planet Mars. The red planet has a radius (rₘₐₚ) of 3.37 x 10⁶ m, a mass (Mₘₐₚ) of 6.4169 x 10²³ kg, it lies at a distance (rₛₘₚ) of about 2.266 x 10¹¹ m from the sun and it orbits around it in a time (T) of 1.88 years. If the sun has a mass (Mₛ) of 2.0 x 10³⁰ kg and the gravitational constant (G) is 6.67 x 10⁻¹¹ m³kg⁻¹sec⁻², calculate the gravitational force (F) that the sun exerts on Mars, the acceleration of gravity (g) at the surface on Mars and the speed (v) with which Mars moves around the sun:
   a) F ≅ 4.2 x 10²³ N; g = 25.8 msec⁻²; v = 13,100 m/sec⁻¹
   b) F ≅ 1.6 x 10²¹ N; g = 3.7 msec⁻²; v = 24,009 m/sec⁻¹
   c) F ≅ 3.6 x 10²² N; g = 9.8 msec⁻²; v = 29,487 msec⁻¹
   d) Dude, yu furgit dat I are a gigiligist and nut a mutimuthtician!
   e) Good grief man, I feel I’ve been swallowed by a black hole…
Evolve, continued from p. 35

Now comes the part most geologists are not good at: negotiating. Karass offers negotiating seminars around the country and that opened a new world to me. Start high and allow yourself to be talked down, but always be prepared to walk. Your property is worth a million, just not upfront. Current deal terms are no longer secret. Get a feel for the current market from sedar.com, tech reports and quarterly financials. ALWAYS get a royalty, work commitment and condition that you personally are given credit. Remember that negotiations always take longer and sometimes a lot longer than you want. Always handle your financial affairs so you can stand the drought.

"Up your game. It is said that investors have to like you, trust you and respect you. Business is a relationship. They want to know who you are.

Up your game. It is said that investors have to like you, trust you and respect you. Business is a relationship. They want to know who you are.

Things like a personal website and a Facebook page are not ego, they are tools. I have mine and they are useful. The day after we signed my first deal, the company CEO was on the phone wanting to know how they could introduce me to the market. Imagine that – a geologist is a marketing asset. Fortunately I already had those so the conversation was very short and they were content.

They also need to like you. While there are geologists who are really wonderful people, many of us need to touch up our field geologist personality. I am as guilty as any. When I saw that I was interfering with me, a very few counseling sessions and general awareness of the issues made a big difference in my life.

You will need to communicate with non-technical investors. Re-boot how you communicate by getting some experience writing for regular audiences. Toastmasters changed my life. My Australian partner used my geologic ideas to sell my lithium brine idea, but he also told me that he usually keeps geologists to an appendix at most or will not work with them. The paleo-fluid geochemical studies of an orogenic gold deposit will make investor's eyes glaze over. Tell them the project is four short and they were content.

A record of professional and community involvement helps build trust. Be especially careful to keep your ethical nose clean and join one or more self-regulating groups like AIPG or SME. The annual 43-101 format technical report class at PDAC is really helpful. An opportunity to apply for a seat on the Arizona Oil and Gas Commission fell into my lap a while ago. That is not something a mining guy normally thinks about, but I applied and have been a commissioner for over a year.

Be fiscally conservative. In the current environment, prudence should be part of your career beginning on Day 1. Remember the good times can end in a snap. Pay off credit cards at the end of every month. Everyone wants you to have a 4X4 pickup to do their work. Those come now with a seven year loan. As you think about seven years, consider that my experience is that you will be under- to unemployed 40-50% of the time. I also have $40,000 in unpaid invoices. Be very careful about how you indebt yourself. The name of the game is to survive the bust so you can enjoy the boom.

You cannot do this without your health and it starts to become an issue as you get older. You can kind of judge what your thirties will be like extrapolating from your twenties. That is often not true from your fifties or sixties on. Chronic issues begin to appear and my experience is that non-traditional treatments like stretching, diet change, chiropractor and acupuncture are sometimes much more helpful than getting another prescription from the doc. Explore and be open to new ways to keep going. Without some degree of health, none of this is possible.

To summarize:

- Keep track of opportunities
- Develop new opportunities from published info
- Establish a land package
- Be prepared with all needed to shop and sell it
- Be commodity conversant
- Attending conferences is a baked-in cost
- Continually work to expand your network
- Build a professional and ethical career
- Be prepared to sell yourself
- Maintain your health
- Be fiscally conservative

We all get paid to do things. As a field geologist, we work solo and use our hand lens, mapping and logging skills. We need a sense of stratigraphy and structure and we need to hike like a jackalope. As a property generator, we work with other people while referencing those skills, but we also need people and communication skills, a knowledge of properties and commodities, an expanding network of contacts, knowledge of negotiating and agreement norms. We do not need to hike like a jackalope.

The evolution from field geologist to property generator is why geology is such an interesting profession. It is simply one more set of skills built on the experience you have accumulated during a lifetime. You still get to go places and be outdoors. You still get new puzzles to figure out. Best of all, it extends your shelf life so you can enjoy what potentially is the most interesting and personally, professionally and financially rewarding phase of your life.

GOOD LUCK WITH YOUR EVOLUTION.
Answers:

1. The answer is choice “a” or \([\text{KAlSi}_3\text{O}_8]\). Amazonite is a green tectosilicate (e.g., microcline or potassium feldspar).

Choice “b” may refer to aventurine or green silicon dioxide. Choice “c” is the formula for malachite or a copper carbonate hydroxide mineral. Choice “d” is the formula for beryl. Green beryl and emerald are both members of the beryl family. Aquamarine is a green-blue or blue variety of beryl.

2. The answer is choice “a” or “A tide where the difference between high and low tide is least, occurring twice a month when the sun and moon are at right angles to the earth.” Neap tides occur just after the first quarter or third quarter moon.

Choice “b” describes a “spring tide.” These take place just after the full or new moon. Choice “c” refers to what we may call “flood tides,” whereas choice “d” defines an “ebb tide.”

3. The answer is choice “a” or “An extinct genus of large flightless birds that lived during the Paleocene and Eocene epochs.”

Choice “b” fits the description of “Smilodon” or saber-tooth cat from the Pleistocene epoch. Choice “c” may describe the giant ground sloth endemic to South America of the genus “Megatherium.” Choice “d” matches the 33-foot to 50-foot long “Deinosuchus” or “terrible crocodile” of Cretaceous time.

4. The answer is choice “b” or equivalent to the “prime meridian.” It is the line of zero degrees longitude that runs from the North pole to the South pole and passes through Greenwich, England, a sector of London.

Choice “a” refers to the “international date line” which passes through the middle of the Pacific Ocean and roughly follows the 180° line of longitude; it deviates from it to pass around some territories and island groups. Of course, choice “c” refers to the “equator.”

5. The answer is choice “b” or “\(F = 1.6 \times 10^{21} \text{ n}; g = 3.7 \text{ m sec}^{-2}; v = 24,009 \text{ msec}^{-1}\).” The proof now follows:

\[
F = G \frac{M_m M_s}{r_{sm}^2} \quad (1)
\]

\[
F = (6.67 \times 10^{-11} \text{ m}^3\text{kg}^{-1}\text{sec}^{-2}) \times [(6.4169 \times 10^{23} \text{ kg} \times 2.0 \times 10^{30} \text{ kg}) / (2.266 \times 10^{11} \text{ m})^2] \quad (2)
\]

\[
F \approx 1.6 \times 10^{21} \text{ mkgsec}^{-2} \text{ or } 1.6 \times 10^{21} \text{ N} \quad (3)
\]

Equation (3) is the gravitational force that the sun exerts on Mars or about 1.6 \(\times 10^{21}\) newtons.

The acceleration of gravity at the surface of Mars is:

\[
g = \frac{G M_m}{(r_m)^2} \quad (4)
\]

\[
g = [(6.67 \times 10^{-11} \text{ m}^3\text{kg}^{-1}\text{sec}^{-2}) \times (6.4169 \times 10^{23} \text{ kg})] / (3.37 \times 10^6 \text{ m})^2 \quad (5)
\]

\[
g \approx 3.7 \text{ m sec}^{-2} \quad (6)
\]

Equation (6) is the value that we are after or about 3.7 meters per second per second.

The speed at which Mars moves around the sun (assuming a circular orbit) is:

\[
v = 2\pi r_{sm} / T \quad (7)
\]

\[
v = (2)(3.1416)(2.266 \times 10^{11}\text{m}) / 5.93 \times 10^7 \text{ sec} \approx 24,000 \text{ msec}^{-1} \quad (8)
\]

Thus, equation (8) gives us a speed \(v \approx 24,000\) meters per second at which Mars travels around the sun.

The numbers in choice “a” correspond to the planet Jupiter and those in choice “c” to planet Earth.
Field trips and field camp

Several articles in the Jan/Feb/Mar ‘20 issue of the TPG address the importance of field trips and field camp to one’s geoscience education. **Valarie Smith**, SA-1869, describes the worst and best experiences of her field camp experience in her article “It is the greatest love/hate relationship you will ever have - field camp; an experience no student should ever miss.” **Michael May**, MEM-0586, notes the usefulness of field trips in providing opportunities to examine actual rocks as a substitute for or definitely as an extension of one’s field camp experience. **Ryan Shell**, SA-7165, and **David Peterman**, SA-5297, recount various field trip experiences and their importance in their geoscience education. **Keith Torrence**’s, CPG-11647, and **Birgit Hagedorn**’s “Designing a hands-on environmental sampling training course for students that meets the requirements of industry” reports on their training course that provides their students with practical training needed by industry and better prepares their students for employment in the environmental field. Each of these four articles reinforces the old adage, he who sees the most rocks wins.

I always enjoy reading student’s reflections on their field camp experiences in each year’s Jan/Feb/Mar TPG. The “love/hate” relationship **Valarie Smith** had with field camp describes a frequent reaction. I was particularly struck by **Shirley Tsotsoo Mensah**’s (SA-7566) reflections in her, “My field camp experience (as an international student),” (Jan/Feb/Mar ’19 TPG) because Mensah had no previous field-type outdoors or camping experience. **Stephanie Jarvis**’ (ECP-0125) “In the field” (Apr/ May/Jun ’15) and **Kristina Portabib**’s (SA-3410) “A capstone experience” (Sep/Oct ’13) provide excellent reflections on field camp, participants’ preparation or lack thereof for working in the field, and the experiences of fellow students with differing geoscience interests and backgrounds. These articles are worth reviewing and are available through the AIPG website.

I grew up in Colorado and camping and hiking were part of growing up. I was an active Boy Scout, skier, and a Junior Member of the Colorado Mountain Club, for whom I taught basic mountaineering and rock climbing. Most of my family’s vacations involved driving around the west to places like the Grand Canyon, the Tetons, Yellowstone, and all over Colorado including trips past the Spanish Peaks with their dramatic radiating dikes. There was also a trip to Hawaii and Kilauea. I’ve always been fascinated with maps and had learned to read and use topographic maps. Due to the influence of natural history museum collections, I thought geology was collecting fossils and minerals and I wasn’t particularly attracted to either. But in my first Rocks 1 lab, I was given a worksheet with a topographic map on which was a point labeled X and was instructed that “X” was the west side of a dike of so many feet wide and a strike of Y°. I pondered this map for a while and then went to the lab instructor explaining that I saw no topographic expression of a dike; was the intent of the exercise simply to draw two parallel lines with the given strike. The reply was, “Yes. You’re not yet expected to know about differential erosion.”

Part of learning any academic subject is learning the technical terms and understanding their meanings. I’d seen lots of dipping and folded rocks. I’d clambered over rock glaciers and moraines and looked over glaciated terrains from the summits of many mountains. I’d been to half the places pictured in my textbook. It turned out that I already knew a lot of geology without knowing it. By the time I took field geology, I’d felt an earthquake, walked on a glacier, seen an erupting volcano, and climbed Devil’s Tower. Being outdoors was no

1. G.K. Gilbert’s 1906 list of three things every geologist should do or experience. The earthquake was one of the Denver Rocky Mountain Arsenal M4 quakes of the late 1960s. I slept through the 1959 M7.3 Yellowstone quake that created Hebgen Lake, I was on the ground in the Colter Bay Campground, Teton National Park, many of my fellow campers were shaken awake.
problem and I could focus on the mapping and other parts of field camp.

Contrasting my own growing up experiences with those of other geoscientists shows that I had (unknowingly) far better preparation and training than most others by the time I took Rocks 1. My background certainly helped me as I began my geoscience career. But my fellow students quickly learned the basics. As we went forward, those with experience in a subject or technique, however obtained, helped those needing help (drafting comes to mind—we had to hand draw maps and cross sections with India ink back then). Each of us has strengths and weaknesses.

Nancy Price (SA-0382) reflected on this point in her “Field Safety—Revisited” (May/Jul ’08) when she asked, “What about those students who want to be geologists but have absolutely no experience in the outdoors or with animals? If you grow up in a big city, like New York City, you have no reason to know outdoor survival techniques. You will learn how to use the subway and where not to go at night, but you probably won’t need to know how to keep warm in sub-freezing temperatures or that during the monsoon season flashes are a possible hazard in the arid canyon lands of the west. Last time I checked, having outdoor experience isn’t a prerequisite for becoming a geologist. It is reasonable to expect students to learn survival skills over their career as a student, but we cannot assume that people come equipped with the knowledge of things that the more experienced outdoorsman thinks is common sense.” Pairing the outdoor experienced with the outdoor inexperienced as field partners is one solution.

**Self-assessment for continuing professional development (CPD)**

I’ve spent a lot of time over the past few years examining various professional organizations’ continuing professional development (CPD) programs in order to design easily used CPD logs for reporting to those programs that require reporting of some minimum amount of CPD on a periodic basis. I’ve been working with the Australasian Institute of Mining and Metallurgy’s (AusIMM) professional development (PD) program both suggesting improvements and as an assessor of PD logs submitted for review over the past two years. But assessing one’s PD needs and determining how to meet them has not been a previous point of CPD program focus: it should be.

The Geological Society of London’s (GSL) “Continuing Professional Development” Regulations (17/1/17) address “Planning and Reporting CPD Activities” in Section 5.3 and recommend:

- Using the principles of Plan, Act, Reflect as an annual cycle with one’s CPD needs, plans, activities, and reflections all being recorded.
- At the beginning of each year evaluate your personal needs for CPD in relation to current and planned professional activities, as is required by many employers’ management schemes.
- At the end of the year, review and reflect on the extent to which planned CPD objectives were achieved. Record and analyze the conclusions of this review as an input to planning CPD needs for the next year.

The GSLCPD program recognizes that where one is in one’s career affects the types of CPD that should be undertaken. GSL CPD audits include examination of the “start of year plan, the records of all CPD activities undertaken (with evidence), including a contemporary evaluation, and an end of year reflection on the value and progress made towards goals set.” The AusIMM is working on developing a “Self-assessment and gap analysis tool” designed to assist members in determining their current CPD needs and ways in which this can be accomplished through meetings, webinars, etc. While this tool can never hope to be completely comprehensive, it attempts to provide useful assistance, particularly to younger members.

An important part of anyone’s CPD program should include identification of gaps in one’s professional skills and then doing something to fill the gap. For example, years ago an older AIPG colleague noted that the most important non-technical course he ever took was basic accounting so that he could understand how financial statements were assembled, a fundamental management skill. So, I took a basic accounting course at a local community college. The course was at a convenient, early evening time and was taught be a practicing CPA. Most class members had full-time jobs, many in the accounting area and brought interesting examples of accounting issues to the class. Accounting is far more than double entry bookkeeping. If you haven’t taken a basic accounting course, I encourage you to do so. What other knowledge or skill do you need to learn or hone? How about learning or improving your foreign language skills? Are you familiar with big data analysis? What are you going to do about gaps in your professional skill set?

**Big data analysis and machine learning: are these the next big things?**

Articles in the November 2019 *Geoscientist* and December 2019 AAPG *Explorer* brought into focus what may be the next big things for geoscientists. The November issue of the GSL’s *Geoscientist* contained two articles of interest, “The continuing journey of geological discovery” is a rapid review of the evolution of geoscience research from the beginning, Hutton, through plate tectonics, and a suggestion of where we might go. “On the cusp of a revolution” suggests that the
AI machine learning and big data analysis will become increasingly important parts of geoscience in the coming years.

ability to analyze big data sets with AI (artificial intelligence or machine learning), etc. will be the next big thing. The AAPG Explorer’s December issue had two articles on machine learning. One describes how big data analysis is sweeping the seismic world. The second was on the use of machine learning to identify hidden caves in Guatemala using LIDAR input. AI machine learning and big data analysis will become increasingly important parts of geoscience in the coming years. Students and young professionals should be learning about big data analysis in order to stay professionally competitive in the coming years.

Why should geologists be licensed? An ASBOG perspective

Erick Weiland’s, CPG-6892, and Jason Patton’s article, “Why should geologists be licensed? An ASBOG perspective,” in the Jan/Feb/Mar ’20 TPG is the latest in a series of articles on the subject of the geologic licensing in the TPG and this column over the years.2 Weiland and Patton point out that the difference between peer-review certification like that provided by AIPG and state licensing is that a state license can be revoked for negligence, incompetence, or malpractice. This is true. But the record of state actions alleging negligent, incompetent, or geologic malpractice is notable for the paucity of such actions; see Bonham, Oliver, Abbott, David, and Waltho, Andrew, 2017, An international review of disciplinary measures in geoscience—both procedures and actions: Geoscience Canada, v. 44, p. 181-190. https://doi.org/10.12789/geoscanj.2017.44.126. Investigating, gathering the required evidence, and bringing such an action is something most state Attorneys General’s offices are loath to do. Such actions require time and expertise. Cases involving mining or oil and gas fraud can be and are brought by state securities agencies and the US Securities and Exchange Commission. AIPG does bring disciplinary actions against members when appropriate information is provided to the Institute; see AIPG’s annual summary of actions, https://aipg.org/page/DisciplinaryProcedureActions.

Another problem with an ASBOG license is that most states will only bring actions where both the licensee and the site of the negligent, incompetent, or geologic malpractice is within the borders of the licensing state. There are various legal reasons for this restriction. This led the Canadian Securities regulators to drop an ASBOG license as providing evidence that one is a qualified person for the purpose of National Instrument 43-101 for mining company disclosure. I wish the ASBOG states would do a better job on dealing with geologic licensee’s negligence, incompetence, or malpractice. And we all need to do a better job of informing the public about unethical practice (Abbott, D.M., Jr., 2016, How do we inform the public about unethical practice (abs.): Geological Society of America Abstracts with Programs. Vol. 48, No. 7, https://gsa.confex.com/gsa/2016AM/webprogram/Paper278060.html; the presentation slides are available on this website).

In situ rock strength and the Schmidt hammer

A brief note in the November 2019 Geoscientist described the Schmidt hammer, which can be used to test in situ rock compressive strength in the field. Rock quality data collection is a standard part of mine core logging for rock mechanic information. Will a mine opening stay open or collapse? A rather important question. The November note referred to a July 2019 Geoscientist article, “Bumps in the Med: landscape evolution in Calabria, Italy” by Caria Pont, who used a Schmidt hammer to study the rock strength of knickpoints in the evolving streams of the area. A Schmidt hammer could be a valuable field tool for a variety of studies. Several models are available from different makers including one that can be paired with iOS or Android devices. If you’ve used a Schmidt hammer, please submit your comments on its usefulness.

2. See the index to the Professional Ethics & Practices columns, https://aipg.org/page/EthicsIndex, under the topics “licensing” and “licensing exams.”
Professional societies in science play an important role in community support and organization, dissemination of research work, and advancement of knowledge. The oldest scientific societies in modern history began in the 17th century in Italy, Germany, France, and England. An example is The Royal Society of London for Improving Natural Knowledge (simply called The Royal Society) which was founded in 1660. In the 19th century, as various disciplines of science branched out from what was previously called natural philosophy or natural history, a number of learned societies or academic associations also appeared. Some of those related to geoscience include The Geological Society in London (1807), British Science Association (1831), American Association for Advancement of Science (initially started in 1848 as the Association of American Geologists and Naturalists), American Institute of Mining, Metallurgical and Petroleum Engineers (AIME, 1871), and Geological Society of America (GSA, 1888). In the 20th century, geological societies appeared in many countries (and even states and provinces) around the world. Moreover, specialization and refinement in geosciences led to more focused societies such as the Seismological Society of America (1906), American Association of Petroleum Geologists (AAPG, 1917), Society of Economic Geologists (1919), Society for Sedimentary Geology (formed in 1927 as Society of Economic Paleontologists and Mineralogists, SEPM), American Geophysical Union (AGU, 1919), Society of Exploration Geophysics (1930), American Geoscience Institute (AGI, 1948), American Institute of Professional Geologists (AIPG, 1963) and many other specialty societies in various fields of geoscience.

The first textbooks in geology also appeared at the turn of the 19th century: Charles Lyell’s *Principles of Geology* (3 volumes, 1830-33) was the most widely used textbook, went through 12 editions up to 1875. In the 19th century, geological education began in a number of colleges and universities in Europe and America. Today, geology education is a global phenomenon as it trains students for various professions from mineral and energy exploration to groundwater management, environmental assessment, natural hazard mitigation, construction engineering, and academic teaching and research.

Membership in a professional society is crucial for building your career; the membership gives you access to publications, conferences, news, and networking in your field of activity. Today, earth science teachers have access to a large number of professional societies at provincial, national and international level as well as in their specific fields of expertise or interest—sedimentology, paleontology, structural geology, groundwater, meteorology, and so forth. But there are also professional societies that are active specifically in earth science education, some of which are introduced here.

**National Association of Geoscience Teachers (NAGT)**

*Website: www.nagt.org*

Founded in 1938, NAGT has currently a membership of about 1,400 which includes K-12 teachers and college and university faculty as well as educators working with the general public through museums and science centers. NAGT fosters “improvement in the teaching of the earth sciences at all levels of formal and informal instruction, to emphasize the cultural significance of the earth sciences.” It publishes *Journal of Geoscience Education*, a peer-reviewed quarterly journal in geoscience education research at the undergraduate and pre-college levels, and *In the Trenches*, a quarterly print and digital publication for members designed to provide a forum for geosciences education dialogue targeting educators in the classroom. The NAGT e-News is a quarterly electronic magazine for its members.

NAGT also offers webinar, workshops, and Section conferences. Activities in the Sections are at grassroots level; ten regional Sections cover the USA and Canada. The NAGT/USGS Cooperative Summer Field Training Program, established in 1965, has trained thousands of student interns.

NAGT collaborates with GSA and AGU on some of their sessions at their annual conventions. NAGT offers several awards including Outstanding Earth Science Teacher Award (for pre-college teachers), Neil Miner Award (for teaching), James Shea Award (for writing or editing), Robert Christman Award (for...
distinguished service), Dorothy LaLonde Stout Professional Development Awards (for lifelong dedication to geoscience education), Journal of Geoscience Education Awards (for outstanding paper and outstanding reviewer), Outstanding Teaching Assistant Awards (up to 30 each year at different Sections), Geo2YC Division Outstanding Adjunct Faculty Award (for adjunct faculty members in community colleges), and Geoscience Education Research Division (GER) Awards. NAGT also gives student scholarships for field courses.

Annual membership includes regular ($75), student ($35), and retired ($55). The digital copies of NAGT are free for the members but those wishing to receive print copies have to pay additional costs.

National Earth Science Teachers Association (NESTA)
Website: www.nestanet.org

Founded in 1985, NESTA's purpose is to advance, stimulate, improve and coordinate Earth science education. It is an organization made up of and governed by classroom teachers. NESTA published a quarterly journal, The Earth Scientist, and a monthly email newsletter, NESTA E-News, for its members. NESTA offers events throughout the year for teachers, including NESTA national and regional conferences, which include lectures, field trips, and workshops. NESTA gives Jan Woerner & Harold B. Stonehouse Lifetime Achievement Award and Thomas B. Ervin Distinguished Service Award. Annual membership is $40; student membership is free.

Earth Science Teachers' Association (ESTA)
Website: https://earthscience.org.uk/

Based in UK, ESTA's mission is to "advance education by encouraging and supporting the teaching of Earth sciences at all levels, whether as a single subject such as Geology, or as part of Science or Geography or other courses." It publishes Teaching Earth Sciences (two issues a year) and holds an annual conference. ESTA works with other educational organizations and boards in the UK to develop curriculums, training, and certificate courses in earth science.

Annual membership includes individual (£40), student (£20), retired (£20), and institutional (£400).

National Center for Science Education (NCSE)
Website: https://ncse.ngo/

NCSE is a non-profit membership organization based in Oakland (California) whose stated mission is to educate the press and the public on the scientific and educational aspects of controversies surrounding the teaching of evolution and climate change, and to provide information and resources to schools, parents, and other citizens working to keep those topics in public school science education. Founded in 1981, NCSE claims 4,500 members, including scientists, teachers, clergy and citizens who care about geoscience education in schools. NCSE acts as an information and support center for activities of people fighting creationists in school education. It publishes Reports of the National Center for Science Education, a bimonthly journal containing peer-reviewed articles, book reviews, and news.


Executive Director’s Message, continued from p. 36

In 2001, while working on a project investigating the origin of TCE in groundwater in a small town in southwest Missouri, the company I was working for was having a terrible time getting access to water samples from private wells. The project geologist was from Los Angeles and was immediately viewed with suspicion by southwest Missouri farmers. At a staff meeting one morning, the problem was raised, and I volunteered to go along. Being from southwest Missouri, having the same soft drawl, using the same slang, and occasionally knowing some of the same people, put families at ease, and made it much easier to gain access to samples. These examples, and numerous others, illustrate that diversity is inherently valuable. As such, we must recognize and respect diversity, both primary and secondary. We can work to become more aware of the diverse population of geologists, and recognize that we can improve diversity with respect to gender, race, and ethnicity without devaluing other aspects of diversity. Each of us is a unique individual with a specific combination of characteristics that brings primary and secondary diversity to our workplace and communities. Because diversity applies to and describes all of us, it is in our best interests to recognize the value and contributions of the diverse people with whom we work and play.

I hope each of you has a wonderful and productive spring.

Aaron


In Memoriam

Ralph H. Espach, Jr., CPG-1581
Loveland, Colorado
May 10, 2019

Member Since 1967

He was a beloved father and petroleum geologist who was born in Bartlesville, OK, and earned his degree from Columbia College in New York. He married a Southern belle, Becky Lelan White, in 1959 and took her well-sitting for a honeymoon.

Ralph spent most of his professional career as an independent geologist in Oklahoma City, working off the foundation he had received from the Chevron Company. Ralph and Rebecca retired from Oklahoma City in 2008 and moved to Loveland, CO, where he spent the rest of his life. Their cabin in the Snowy Range of Wyoming was his most precious possession. It connected him to Sam Knight1, to his mother “Frankie”, and to the mountains and woods that he grew up with as a boy in Laramie, Wyoming.

Ralph is survived by his three children, Heidi, Holly, and Ralph.

1Dr. Samuel H. ‘Doc’ Knight (1892-1975) was a much beloved head of the Department of Geology at the University of Wyoming, Laramie: he taught there from 1916 - 1966. He earned his Ph.D. at Columbia University in New York, and established the University of Wyoming Geology Field Camp, in the Medicine Bow Mountains west of Laramie, in 1925. This was one of the most popular and rigorous field camps in the country until Doc Knight’s retirement in 1966: he was a legend among the thousands of students from all over the world who attended the camp.

Warren Arnold Evenson, CPG-4980
Charleston, West Virginia
1945 - July 10, 2019

Member Since 1981

Warren Arnold Evenson, 73, of Cross Lanes, born in 1945, passed away Wednesday, July 10, 2019, at Hubbard Hospice House, Charleston. He was buried in Donel C. Kinnard State Veterans Cemetery, Dunbar.

Dr. Marvin L. Ivey, Sr. Col., USAR (Ret.)
CPG-2758
Largo, Florida
January 17, 1932 - April 5, 2019

Member Since 1975

Marvin Ivey, 87, passed away in Largo, Florida, on Friday, April 5, 2019. Born on January 17, 1932 in Orlando, Florida, he was the son of Elbert M. Ivey and Martha D. Ivey. The Ivey Family were early homesteaders in what is now downtown Orlando. In 1946, he was a Boy Scout achieving the level of Eagle Scout and he also was a Page in the U.S. House of Representatives and had lunch with President Truman in the White House. He graduated from Orlando High School and from the University of Florida where he was a member of Theta Chi Fraternity and the Army ROTC Program. After receiving his bachelor’s degree, he served two years of active duty as a young officer and then returned to the University of Florida to earn a master’s degree and Doctorate in Education. He then moved his family to Pinellas County where he was a Professor and Science Department Chairman at St. Petersburg Junior College for 28 years before retiring in 1987. During that time, he continued his service in the Army reserves and retired in 1981 having attained the rank of Colonel. As a lifelong student, he returned to school to earn a law degree from Stetson University and was Licensed as an Attorney in 1979 and practiced Law from 1987 to 1994. In 1994, after retiring for a second time, he spent three months sailing in the South Pacific. His love of travel took him to all seven continents. He was an avid scuba diver for 60 years, diving reefs around the world. As an Earth Scientist he had insight into and concern for the environment and was a lifetime member of the Wilderness Society, the International Oceanographic Foundation, a life fellow of the American Association for the Advancement of Science and the Florida Association of Science Teachers. He was a lifetime member of the University of Florida Alumni Association, Mensa and Intertel, Phi Delta Kappa, and the Geological Society of America. He served on the board of the College Fund of Pinellas County, was an active member of Anona United Methodist Church, and the Optimist Club of St. Petersburg. He was part of the question writing team for the Florida High School Academic Tournament. Marvin was known for his dry sense of humor and quiet dignity. He is survived by his wife of 66 years, Bette Ra Perry Ivey, his children Marvin Lee (Sonny) Ivey, Jr. and his wife Cynthia Ivey, and Susan Ivey Restani and her husband Ray Restani. In lieu of flowers, the family is requesting donations be made in Marvin’s honor to the College Fund of Pinellas County, Inc., P.O. Box 673, Clearwater, Florida 33757 or Anona United Methodist Church Youth Program, 13233 Indian Rocks Road, Largo, Florida 33774.

Forrest H. Muire, Jr., CPG-0347
Midland, Texas
May 12, 1927 - January 19, 2019
AIPG Charter Member

Member Since 1965

Forrest Hopkins Muire, Jr. left this earth on January 19, 2019. He was born on May 12, 1927 in Cincinnati, Ohio, the son of Forrest Hopkins Muire and Dorothy Louise Stacy Muire. His educational experience began at pre-school at Northwestern University in Chicago. His father was transferred to Dallas, Texas. He attended Bradford School and Texas Country Day School (now St. Marks School). Forrest was a four-year letterman on the football team and captain of the team, cadet unit captain and
Senior class president. After high school, Forrest enlisted in the Navy pilot training program in May, 1945 and was stationed at the naval flight training base in Arlington, Texas. He remained in the service until WWII ended. After naval service he enrolled in Southern Methodist University, graduating with a BS in geology in 1949. Following graduation, he went to work for Rayflex Exploration. While at SMU, he met Beverly Jean Carter on a blind date at a SAE/Tri-Delta mixer. They would often eat ice cream when Forrest always took the first bite from both cones. Forrest and Beverly married on February 23, 1951 at Highland Park Presbyterian Church, Dallas, Texas. During his work with Rayflex the young couple moved 24 times until finally residing in Wichita Falls, Texas in 1955. He began his career with Continental Oil Company at that time. Wichita Falls was their first “permanent home”. His career then took him to Abilene, before they finally settled in Midland in 1965. He ended his career with Conoco in 1980. Forrest and his family joined First Presbyterian Church where he was an Elder and Deacon. He sang in the choir, was a Sunday school teacher, a volunteer carpenter and lawnmower operator and had many other duties. One of Forrest’s passions was Boy Scouting. He was Scoutmaster of Troop 85, Chairman the Buffalo Trails Council Round Table, conducted adult Woodbadge courses at Philmont and received the Silver Beaver Award. He also volunteered for the Girl Scouts, Hospice, Meals on Wheels, and the Bowie School mentor program. After retirement, he pursued his love of golf and fellowship with his friends. He enjoyed gardening, yard work, home repair and a daily walk through the neighborhood with his bride. Their neighbors and the neighborhood children brought them tremendous joy and delight. Forrest is survived by his wife of 67 years, Beverly, and his four children: Forrest Carter Muire (Nancy Betts, deceased), Sally Muire Kvasnicka (David Kvasnicka), John Stacy Muire (Kit Muire) and Jennifer Muire Holcombe (Todd Holcombe, deceased), seven grandchildren and five great-grandchildren. Memorial service will be held 10:00 a.m. Saturday, January 26, 2019 at First Presbyterian Church with Dr. Steve Schorr officiating. A reception in the fellowship hall will follow the service. In lieu of flowers, donations may be made to Philmont Scout Ranch (17 Deer Run Road, Cimarron, NM 87714, Attention PTC), Philmont disaster relief; First Presbyterian Church Midland, Texas Deacon’s fund, or the charity of your choice. Published in Midland Reporter-Telegram on Jan. 24, 2019

Paul R. Sock, CPG-07097
Detroit Lakes, Minnesota
August 2, 1957 - March 7, 2020

Member Since 1986

Paul R. Stock, 62, Detroit Lakes, MN, died Saturday, March 7, 2020, in Essentia Health, Fargo, ND. Paul retired from the Minnesota Pollution Control Agency Petroleum Remediation Program a few years ago. He is remembered by his co-workers as an instrumental member of the program and mentor to many.

According to his co-workers, “Paul left a legacy of hard work and dedication to Minnesota’s environment and natural resources and will be missed by many.”

David M. Streetsmith, CPG-11376
Midland, Texas
May 12, 1927 - April 14, 2019

Member Since 2010

David Morgan (Street) Streetsmith, 54, passed away unexpectedly on April 14th, 2019 at his home on Cricklewood Circle in Lansdale, PA. Born June 3rd, 1964, in Syracuse, NY, David leaves behind two children from his marriage to Lisa (Smith) Streetsmith.

A graduate of Hugh C. Williams High School in Canton, NY. David played on the hockey team and ran cross-country. He went on to attend St. Lawrence University in Canton, NY, majoring in Geology, and graduated with a Bachelor of Science degree. He worked in the fields of Hydrogeology and Environmental Remediation.

Albert L. Thalman, CPG-00983
Newcastle, Oklahoma
January 30, 1929 - December 12, 2019

William “Bill” John Wayne, CPG-0250
Lincoln, Nebraska
November 5, 2019
AIPG Charter Member

Member Since 1964

William “Bill” John Wayne CPG-0250, a Founding Member of AIPG and professor emeritus of geology in the Department of Earth and Atmospheric Sciences, died Nov. 5, 2019, in Lincoln, Nebraska. He was 97.

Bill was a prime mover in the Iowa/Nebraska Section of AIPG from 1982 to 2005. He was President of the Section from 1982 through 1986, and Chair of the Screening Board from 1982-2002. He also served on the Section’s Regulatory and Legislative Committee (1982-85), was Membership Chair (1984-86), Program Chair (1989-1993) and Newsletter Editor (1990-93). Bill represented the Section on the National Advisory Board in 1985 and 1986.

Bill joined the Department of Earth and Atmospheric Sciences at the University of Nebraska in 1968 and became emeritus in 1993, though he continued publishing research until as recently as 2011.

His work investigated materials at the surface of the Earth and the processes that shape, modify and move them. This included geomorphology, Quaternary stratigraphy and paleoecology, land and freshwater mollusks recovered from Quaternary sediments, and the application of geologic data to engineering problems and land-use planning. Wayne’s research was published in numerous books and journals.
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

John Berry, CPG-04032, Editor
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www.aipg.org Apr May Jun 2020 • TPG 49
A young man stood alone as he gazed across the dismal sight. Streets had been flooded, houses destroyed, and lives altered beyond repair. This sudden calamity happened on an April day in 1967 when a tornado unexpectedly landed in Oak Lawn, a suburb of Chicago. Seventeen-year-old David A. Johnston was given the job of photographically documenting the resulting carnage (thirty-seven dead and nearly five hundred injured) for the Worth-Palos Reporter. Little did he know that this would not be the last calamity that he would witness, or that his own death would occur during one of the greatest volcanic eruptions of the twentieth century.

That final disaster, in the spring of 1980, resounded across the scientific community when the hitherto innocuous spring ended with a violent volcanic eruption on May 18. Forty years later, the eruptions of Mount St. Helens in Washington State continue to capture our imaginations as geologists use them to continue to gain important insights into this rare geologic process. In 1980 numerous scientists together forged a better understanding of volcanoes through their studies of the awakening volcano; some were even killed as they furthered the boundaries of knowledge. One of those killed was the volcanologist Dr. David A. Johnston (figure 1), whose efforts to better understand and communicate the volcanic hazards to the public significantly reduced the casualties resulting from the eruption. Relatively little is known about Johnston’s formative years, but what is known chronicles a series of transformations that molded the legendary volcanologist of Mount St. Helens, a hero to those who follow in his footsteps of seeking the knowledge required to ensure public safety around these tempestuous geologic hazards.

The formative years

Born on December 18, 1949, David Johnston was the eldest child of Tom and Alice Johnston, a loving couple who had seen much hardship in their own lives. Having lost his father during the Great Depression, Tom relied upon his tightly knit family to support him through his youth but served his country well in the United States Air Force during World War II. On the other hand, Alice’s childhood was plagued by both her parents’ abuse of alcohol, and by her father’s eventual abandonment of the family when she was thirteen, followed by the death of her younger brother when she was in her twenties. While Johnston himself could claim no such hardship, he was self-critical and viewed himself as inadequate. He was often the youngest and smallest in school, with a terror of public speaking stemming from his reserved, perhaps shy, personality that occasionally surfaced in his professional career. He set high standards of accomplishment for himself and was perhaps too harsh on himself when he did not succeed in meeting them.

He therefore applied himself vigorously to his studies and to sports, especially cross-country running, which not only helped him alleviate stress but also afforded him the time for personal reflection. The Boy Scouts provided another avenue for growing his fascination with the natural world and for socializing within a community of like-minded students. The stronger the challenge, the greater his tenacity became, molding an important facet of his character.

The tornado of 1967 became an important turning point in Johnston’s life (Holmes, 2019, p. 7). This disaster occurred without warning, as it happened three years before the system of warning sirens was developed, and extinguished dozens of lives. As a photographer for the Worth-Palos Reporter (now simply The Reporter), Johnston was one of the first to see the damage that was wrought in the affected neighborhoods. This left an imprint on him for the remainder of his life and motivated him years later as he worked at the forefront of saving lives from an unpredictable volcanic eruption.

From photojournalism to geology
Having worked for the Worth-Palos Reporter during high school, Johnston deemed it logical to pursue photojournalism at the University of Illinois, although it was not long before he turned to follow his interest in geoscience. Johnston’s fascination with ecosystems eventually led him into the field of volcanology, where he soon completed two internships in the summers of 1971 and 1972 under geologist Pete Lipman of the United States Geological Survey (USGS). Having studied a variety of extinct vents in the San Juan Mountains volcanic field in Southwest Colorado during these internships, Johnston selected Cimarron Volcano there as the subject of his PhD thesis at the University of Washington, which he began in 1973. After nearly finishing his PhD, Johnston was pried away from the San Juan Mountains by his friend Doug Lalla to study, as Lalla put it, “a real volcano, not one of those dead ones.” Through the summer of 1975, Johnston acted as a field assistant investigating active volcanism at Mount St. Augustine in Alaska, gaining great experience working around active volcanoes: experience that would prove to be indispensable later at Mount St. Helens.

Excited by this introduction to active volcanism, Johnston switched his PhD thesis project to St. Augustine,disappearing from the eyes of his professors, who had invested in the San Juan Mountains volcanic field. He ultimately reached a compromise with them under which he would publish his research on the San Juan Mountains volcanic field in addition to his new project, allowing him to throw himself into his studies on the possible use of changes in the extraction of volatiles (gases dissolved in magma) to predict impending eruptions.

Onward to USGS!

After completing his PhD at the University of Washington in 1978, Johnston was hired by the USGS on probationary terms before he would be considered for a permanent position. Thrilled with the opportunity and determined to win a permanent job at the Survey, Johnston continued his groundbreaking work on volatile gas emissions, becoming recognized as a world authority through contributions in premier journals (e.g., Johnston, 1980). He was based at the USGS office at Menlo Park, California, but spent brief stints at the Novarupta Volcano (Alaska) in both 1978 and 1979 studying the aftermath of the 1912 eruption. He later served as a consultant on the potential development of geothermal energy in the Portuguese Azores during the summer of 1979. Johnston’s persistence and exemplary work earned him a permanent position at the USGS that would entail further work on the Alaskan Volcanoes beginning June 1, 1980, but he would first have to face the awakening of the Cascade Volcanoes.

The initial rumblings

During the interim between jobs, Johnston found himself at a meeting near Seattle, Washington, as seismometers detected earthquakes at Mount St. Helens. Rather than returning to Menlo Park, Johnston decided to use his remaining time to join his mentor Steve Malone in the seismology lab at University of Washington. Malone determined that these strong earthquakes were originating just below the northern flank of Mount St. Helens, indicating that a tongue of magma could be ascending to the surface and threatening to erupt.

Despite these warnings, one could scarcely sense any other signs of unrest at the surface. Lofty rising above old-growth forests, the snowmelted Mount St. Helens epitomized tranquility and serenity. At more than 9,600 feet above sea level, the quiescent peak beckoned climbers and skiers, while the placid Spirit Lake below sported fishing and camping in and around the adjoining old-growth forest. Surrounding this paradise was abundant logging that fueled the growth forest. Surrounding this paradise was abundant logging that fueled the Washington economy. Beneath the volcano’s deceptively peaceful demeanor, however, was a history of upheavals that had radically altered this landscape and that warned of future catastrophes. Geologists Rocky Crandell and Don Mullineaux of the USGS had for nearly two decades been doing groundbreaking research documenting the complicated history recorded by extensive deposits of tephra and lahars. In their seminal work published in 1978, Crandell and Mullineaux pronounced that, “the current quiet interval will not last as long as a thousand years; instead, an eruption is more likely to occur... perhaps even before the end of this century.” No one could have predicted just how imminent such an eruption truly was until Malone’s seismographs showed that the interior of the volcano was becoming very active.

In a matter of days after these initial rumblings, USGS scientists from across the country, among them Crandell, Mullineaux, Johnston and Pete Lipman, were summoned to Mount St. Helens. As one among several studies that were instituted, Johnston began applying his pioneering work on volatiles to try to predict the future volcanism of Mount St. Helens. On March 27, the mountain had its initial steam explosion, a precursor to the eruption to come.

Meanwhile, political turmoil surfaced as thousands flocked to Mount St. Helens despite the hazardous conditions. A red zone was mapped around the volcano and closed to public access, while areas beyond constituted a “blue zone” that allowed continued business in the area but restricted over-night stays. Almost immediately, residents balked at the restricted access. Spirit Lake had been closed just as summer vacationing was approaching, and local businesses were severed from the touristism that fueled their livelihood. Pressures increased as steam explosions shook the mountain through April.

USGS scientists began observing unusual movements along the north face of Mount St. Helens (figure 2). The northern flank was deforming into a broad bulge, termed a cryptodome, as magma intruded the cone through a side vent. Not only was this bulge growing at alarming rates (between 5 and 50 feet per day), but three parallel cracks had formed through the top of the cryptodome. Barry Voight, a professor from Penn State University and renowned expert on landslides, was worried that should the northern slopes fail, a monumental landslide would plunge into the valley north of the volcano and expose the shallow magma. If this happened, the enormous interior pressure would force the magma out laterally as a horizontally directed blast wave full of incandescent ash, as well as triggering eruption, but sulfur dioxide dissolved in flows. Although some USGS scientists agreed, others were unconvinced of this possibility. It would be only a matter of days before Voight’s concerns were vindicated.

Throughout this time, Johnston was applying the Correlation Spectrometer (COSPEC) to measure the volatile emissions (primarily sulfur dioxide) being expelled from Mount St. Helens. A prominent increase in sulfur dioxide concentrations could warn of an impending eruption, but sulfur dioxide dissolves readily in water, which was plentifully circulating throughout the peak, as evidenced by the steam explosions. Thus, Johnston needed to physically collect gas samples in situ to obtain an accurate reading and volunteered to retrieve samples from the water ponded in a lake within the graben forming between the summit and the subsiding northern flank. Johnston thought that the previous steam eruptions in this summit graben may have provided active conduits from which he could obtain undiluted samples, but the unstable summit posed a hazard, especially during a strong earthquake. Newspapers soon heralded Johnston for what they viewed as a daring feat, but he defended his excursion as a necessary action. Nonetheless, the gas samples remained mysteriously low in sulfur dioxide despite the continued subsurface activity.
Three views of the mountain from Johnston Ridge before and after the eruption.

Figure 2 - After months of summit deformation, a prominent cryptodome and summit graben formed as a result of magma ascending a side vent beneath the northern flank of Mount St. Helens, as can be seen from this image taken from Coldwater II on May 17, 1980. Photograph courtesy of the United States Geologic Survey (in the public domain).

Figure 3 - Blanketing the immediate valleys with a veneer of landslide deposits over two hundred feet thick, the landslide and lateral blast of Mount St. Helens obliterated life up to fourteen miles from the volcano. Fifty-seven individuals, including Johnston, were killed during the eruption. Courtesy of the United States Geologic Survey (in public domain); imaged dated September 1980.

Figure 4 - Nearly four decades after the eruption, the landscape has undergone a radical recovery; a nascent dacitic dome has grown in the crater, while life again flourishes along the volcano’s flanks and in the surrounding valleys. Courtesy of Madisyn Mercy Pope; image dated July 2019.
To monitor the growth of the swelling cryptodome, USGS geologists needed an observation post in the field from which they could make accurate surveys, eventually selecting a site at “Coldwater II” (now memorialized as Johnston Ridge) 4.6 miles north of the mountain. Harry Glicken, a young PhD student and assistant to Johnston, had begun operating the new base in early May, but Johnston suspected that an eruption was imminent based on evidence of further magmatic ascension and was concerned for Glicken’s safety because previous eruptions were known from the geologic mapping to have reached the ridge, despite the great distance. Notwithstanding Johnston’s pleading with Glicken to choose a safer locale to work, Glicken would not leave his mentor if he had a choice. However, Glicken had to return to California in mid-May for a meeting with his thesis advisor Richard Fisher, and on Saturday night, May 17th, Johnston helped him pack for departure; it would be the last meeting. Johnston was to take the shift at Coldwater II that night (figure 1), while Don Swanson, a volcanologist with experience from the Hawaiian Volcano Observatory, would replace him at nine the following morning, Sunday, May 18.

Eruption

Broad, clear skies greeted Johnston on May 18 as he began his morning report, but at 8:32 a.m., a 5.1-magnitude earthquake jolted Mount St. Helens, causing the north slope to fail. Johnston quickly called the temporary USGS base in Vancouver, Washington: “Vancouver, Vancouver. This is it!” There was no response but the click of the radio repeater, located over thirteen miles north of Mount St. Helens, as it relayed his message to Vancouver. Impatient with excitement, Johnston continued: “Vancouver! This is Johnston, over!” The repeater clicked again, but when Vancouver responded, it was too late. Neither a reply from Johnston nor the usual click of the repeater returned. Answers, however, were soon forthcoming as a pillar of ash jetted into the sky, signaling the beginning of the onslaught.

The eruption had begun with a tremendous landslide, the largest in recorded history, which had exposed the shallow magma. This flashed to vapor instantly, generating a horizontal blast northward towards Johnston, just as Voight warned; this blast had destroyed thousands of acres of old-growth forest and obliterated all life up to fourteen miles north of the volcano. The radio repeater station thirteen miles north of the mountain had been destroyed. A Plinian ash column soon grew upwards nearly sixteen miles into the stratosphere and continued throughout the succeeding nine-hour eruption. Occasionally, portions of this ash cloud would collapse under their own weight and form pyroclastic flows that incinerated everything in their path. These flows quickly melted glaciers and generated lahars that destroyed numerous bridges and homes while transporting great bulldozers and logging equipment many miles downstream. As the ash began to settle, fifty-seven people, including Johnston, were pronounced dead or missing while hundreds of lives were changed forever (figure 3).

Aftermath

The suddenness of the eruption astounded the USGS team. Just like the unheralded onslaught of the Oak Lawn Tornado in 1967, the Mount St. Helens eruption abruptly ended dozens of lives. The members of the USGS team continued their work in a perpetual daze of desperation and defeat resulting from the sudden loss of life, chief of which being their cherished colleague Johnston. Each geologist in turn persevered in their work in the hope that it would minimize damage while Glicken suffered survivor guilt as he berated himself for leaving his mentor. Trudging through their work over the succeeding months and years, they slowly established a synthesis of the events of Mount St. Helens. Continued minor eruptions allowed the geologists to identify seismic indicators that could be used to accurately predict an eruption within hours of the event. Armed with a sense of duty, Glicken dissected the landslide with incredible insight, resulting in an unparalleled examination of such deposits that would make him a recognized leader in the subject.

Regardless of their depth, all wounds require time to heal. The continued minor eruptions of Mount St. Helens formed a nascent dacite dome in the crater while life concomitantly began to return as elk, birds, and numerous plant species repopulated the devastation and pocket gophers churned through the debris (figure 4). Over the passing years, stories from the survivors began to be revealed, such as those chronicled in Waitt (2014). Among these, Mindy Brugman and Carolyn Driedger recounted how Johnston had saved their lives on May 17 by prohibiting them from remaining on Johnston Ridge overnight. Accompanied by her friend Driedger (a USGS hydrologist), PhD student Brugman had hoped to camp overnight upon the ridge to continue her previous studies of the glaciers of Mount St. Helens the following morning. Johnston, however, persuaded them to return to Vancouver for the night and join the USGS staff meeting the following day, when Brugman could request the helicopter she needed for research purposes. While they were en route to the staff meeting Sunday morning, Brugman and Driedger realized the truth of Johnston’s words as a plume of ash rose rapidly over the horizon. Besides these two, countless others were saved as this brave geologist warned others of the impending danger, even when it forced him into dangerous positions such as those of May 17 and 18. Because of his heroic actions at Mount St. Helens, Coldwater II has been named Johnston Ridge while the subsequently instituted Cascade Volcano Observatory was memorialized in Johnston’s honor.

Johnston: Hero and Legend

Examining Johnston’s life can be compared to reading a sentence suddenly terminated by a dash. As an early career professional, Johnston had accomplished much. His interests were far reaching and had carried him across oceans; they ranged from developing geothermal energy potential on the Azores to scaling Novarupta in order to piece together the eruption of 1912. Such fascination with volcanology from a variety of standpoints led Johnston to investigate both ancient and recent volcanism, publishing work that formed the foundation of numerous researches for many years after his death (e.g. Kamata et al, 1991). His colleagues esteemed Johnston for his exemplary work, confident in his abilities beyond being a leader in the use of volcanic gases for predicting volcanic eruptions. However, those who knew Johnston remember him for far greater qualities. Johnston was not only tenacious in his perseverance and dedicated in his work, but also considerate and kind with a genuine interest in the well-being of others. Coupling his fascination with science with his desire for the safety of others, Johnston was truly a luminary not only in the advancement of volcanology as a science but also as a discipline bettering the welfare of humanity. As high school friend Jim Newquist testified in the concluding thoughts of a longer poem:

**Good friend, Dave,**
**We walk the same path.**
**Goodbye for now,**
**My life was blessed**
**For the pleasure of knowing you.**

Acknowledgements

Following the death of David A. Johnston, Lipman and Mullineaux (1981) dedicated their edited volume with a tribute to Johnston, while Thompson (2000) further provided a personalized
examination of Johnston’s work within the context of the Mount St. Helens eruption. Waitt (2014) catalogued the various interviews of Johnston before the eruption, but it is the recent work of Holmes (2019) which has most elucidated the various facets of both Johnston’s personal and professional life. Likewise, I dedicate this article to the memory of Johnston, whose work continues to inform researchers of today yet who would have humbly declined the offer of such a dedication. I thank my mentors Prof. Patrick Pringle (Centralia College) and Dr. George Mustoe (Western Washington University) for their careful reviews of this article.

About the Author

Isaac Pope is a young undergraduate student with an insatiable fascination of geoscience, accumulating a considerable reading list of graduate-level texts since the age of fourteen. Not only has he conducted much university-level research on both geological and mathematical topics, but he is also greatly interested in education stemming from his desire to share the wonder of science and mathematics with others.

References


The Future of Geology and the Military: at the CO₂ Frontier

Author

Thomas S. Spalding, CPG-09973

Introduction

The United States Department of Defense (DoD) and the United States Agency for International Development (USAID) often jointly conduct humanitarian relief efforts that contribute to a global goal for a more peaceful, democratic and resilient world (Byrne, 2016). Both coordinate work efforts. In the past some of these efforts were directed to long-term improvements, but now the impacts of global warming cause relief missions that address immediate emergencies to crowd the agenda. Between 2009 and 2018 in the East Asia and Pacific area (EAP) USAID responded to 110 disasters (USAID, 2018).

Thus, relief and recovery techniques are evolving. The nature of response is changing from merely palliative measures (disaster response) to the provision of roadmaps for nation-state self-reliance. The emphasis is on building “resilience.” USAID administrator Mark Green has said “The purpose of Foreign Aid is to end the need for its existence.” The last section of this paper deals with some solutions to long term global warming, including discussion of the subsurface injection of CO₂ in cement manufacture and of nuclear power options.

The Home Front: Risk Quantification for Sustaining Coastal Military

Installation Assets and Mission Capabilities

Direct climate impacts on the military include those on the home of the Atlantic Fleet at Norfolk, VA. As greenhouse gas emissions increase, sea levels are rising (Demsey, 2014). Geomorphic and shoreline factors have been assessed at Norfolk in order to project likely impacts from the expected stressors on the base. Fig. 2 on the following page shows the areal extent of the risk modelling (Burks-Copes et al., 2017),

Figure 1 - Five year average temperature deviation (from baseline years: 1951-1980), which includes 2018 data, fourth warmest year in the 140-year record (NASA's Scientific Visualization Studio/Kathryn Mersmann). Statistical measures of data set error: less than +- 0.05 degrees Celsius. (Lenssen, 2019 and, Schmidt, 2019).
and depicts geomorphological risks. The study allowed the Corps of Engineers to identify which systems were vulnerable at what degree of Sea Level Rise (SLR). Recent work for Fiji of a similar nature can be found below.

**Risk of Damage to Norfolk, VA, Installations**

“Our results showed that the probabilities of damage to infrastructure and losses in mission performance increased dramatically once 0.5 meters of SLR was experienced, indicating a “tipping point” or threshold that should be considered when undertaking future planning or operational activities on the installation.” (Burks-Copes et al., 2017).

**Benefits**

The analytical framework described herein can be used to evaluate relative performance of existing conditions, future no-action conditions, as well as structural and non-structural risk-mitigating alternatives to sustain critical assets and mission capabilities at an actionable scale under a wide range of

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**Figure 2 - Norfolk Study Area (Burk-Copes, 2017).**

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**Figure 3 - DoD theatre designations. USINDOPACOM zone is in dark blue.**
SLR and storm scenarios.” (Burks-Copes et al., 2017. p.2)

**Mitigation Planning World-Wide**

In response to congressionally mandated mitigation planning, the DoD released, on July 29, 2015, the “Report on Security Implications of Climate Change,” which identified the most serious and likely climate-related risks. Regional theatres of action (“combatant commands” as shown in Figure 3) will engage with climatic stresses.

For example, USPACOM (United States Commander Pacific Fleet, now USINDOPACOM), was requested by Congress to process and describe timelines and resource needs as follows:

- Humanitarian disaster response/relief;
- Security cooperation;
- Building partner capacity; and
- Sharing best practices for mitigation of installation vulnerabilities.

USPACOM responded by developing a visual display tool that will overlay historic disaster data, climate, population and geographic data, and assist in developing capability to effectively respond, in concert with Canada, Australia, New Zealand and UK, to these needs. Of course the DoD cannot prepare for every risk, but managing climate change risk prudently is now part of the SOP (DoD, 2015). In USPACOM, island nations will be affected. The activity of one specific relief agency, USAID, is governed by agreement between it and the DoD (Lenhardt, 2015).

U.S. Navy involvement in noteworthy humanitarian missions predates USAID and dates back to 1929, when USS Lexington (Fig.4) generated and delivered 4,250,960 kWh to the city of Tacoma (Stewart, 2014). After drought caught the city unawares and drastically reduced the hydropower available to it, the ship was ordered to make up the difference. This kind of humanitarian effort has continued, using the ships listed in Figure 5. These ships also operated in support of military installations. Similarly, the modern DoD has been advised to incorporate a resilient energy technology in installation planning (Judson, et al., 2016). “Islanding” installations from the bulk grid is the intention and may include strategies with batteries, generators, and combined heating and cooling plants with micro gas turbines to continuously power certain parts of the installation (for example food refrigeration and frozen storage, computing centers etc.). Judson, et al. (2016) explore “Micro-gridding”. The 1929 posting of the USS Lexington to Tacoma (Fig.4) is an early instance of a micro-grid created to resiliently balance a renewable power source. Creative responses can be added to the disaster toolkit (Demsey, 2014); see Figure 6.

**Case History:**

**Fiji 1992-1997**

An investigative report (UNDAC, 1998) provides economic data and a workmanlike, thorough backdrop for a disaster situation in Fiji, which experienced six major natural disasters in six years: drought in 1992, Tropical Cyclones (TC) Joni and Kina, in 1992/93, and TC Gavin and June in 1996, followed by another drought in 1997/98. For Fiji, impacts of these events were found to be:

- GNP fell - 4%
- Water shortages destroyed the $125M cane crop.
- Relief measures: a monthly cost of $3.3 million
- 54,000 families receiving supplementary food ration
- 400,000 people on emergency water deliveries

**Figure 5 - Ships that have supplied power or are suitable for supplying power, and the occasions on which they have been used. Note Sturgis for Nuclear Power (Stewart, 2014).**
• Needs for Hydrogeological assistance to understand application of reports
  o Small Water system development, drainage system relief
  o Further requests for assistance (for example, ship-board desalination for remote location, emergency).
  o Locate small poly tanks strategicaly

In the 1990’s, Fiji UN responders were looking for Navy vessels that could supplement water supplies for remote locations and had sufficient power to run reverse osmosis purification systems.

Resilience: A Common Effort

On August 5, 2019, USAID announced a Pacific Island resilience effort hosted in Fiji. USAID courses adapt and strengthen the management skills needed to design and implement disaster resilience projects. In practice, resilience means adapting to changing conditions, as opposed to “catastrophe”, which triggers the deployment of critical emergency, recovery, and response missions. Resilience is found in Defense Support to Civil Authority (DSCA) missions like Hurricane Sandy; these ignore jurisdictional “fence lines” (Judson, 2016).

In Fiji, 11 nations will participate in USAID's “Ready”, a five-year project (Percle, 2019). These nations will become more accessible to International Donors as a result of the training they receive. The projects they will develop and propose will require Green Bonds to finance. The Fijian Lami Town proposals are a good example.

Lami Town is located across a bay from the capital of Fiji. In 2013 the UN developed a technical report for Lami detailing climate change/flooding mitigation tools with costs. These were engineering and natural solutions to mitigate recurrent flooding and were prioritized, but at that time, local conditions and the lack of local expertise left some questions (Nalini, et al., 2013). Lami also manufactures cement, a potent source of CO₂. Figures 6 and 7 present some of the analytical work done and appear to represent a “due diligence” approach usable as the science evolves.

On May 19, 2019, UN Secretary-General António Guterres spoke (Guterres, 2019) to the Fijian parliament. In his speech he notes:
  • Fiji became the first emerging market to issue a sovereign green bond (Whiley, 2017)
  • Fiji introduced an Environment and Climate Adaptation Levy
  • Fiji launched a rural electrification program to reduce emissions from diesel generators.

Military missions will be developed to deal with climate change. For example, Stewart (2014) points out that modern ships have a different power arrangement than those of the WWII era. A mission like that of the USS Lexington at Tacoma cannot efficiently offer relief these days (Stewart, 2014). Ships have changed. Therefore, more versatility has to be built into Navy ships, allowing shore power transfers.

Towards the Taming of CO₂:

For instance, fail-safe, proliferation-safe nuclear versions of the “power barge” are on the drawing board (Fig.8). A 4th generation Molten Salt Nuclear Reactor (MSR) can balance a wind or solar PV set up, resiliently replacing power for the short term emergency, and adding urban/rural electrification in some cases. A MSR can use Uranium exclusively or Uranium/Thorium, but in this special instance, the use of thorium reduces the production of radioactive by-products (Jorgensen, 2015). Thus, a Thorium MSR solves the issues of proliferation, safety, waste and the problem of uranium scarcity.

Figure 8 shows one vision for a Thorium Molten Salt Reactor (TMSR) whose deployment has been advanced
in thorium circles by ThorCon (ThorCon Company, 2019) among others. ThorCon expects to provide electric power at $0.03 per kWh. The distinguishing technology of molten salt reactors is 1) the design does not require high pressure and 2) with the fuel entrained in a molten salt, it cannot explode like the high pressure water reactors at Fukushima Daiichi. The first working Molten Salt Reactor was built at Oak Ridge Laboratory, and in 1954, the Air Force installed it in an airplane (Fig.9). The working models were never brought to commercial scale by the United States (Mathieu, 2009).

Thorium commonly occurs in sediments. Monazite is the host mineral and is found in bulk in beach sands. The largest supplies of monazite are along the eastern shore of India. The Indian Parliament, on July 27, 2019, prohibited non-governmental exploration or development of the resource (Hindu Business Line, 2019). There are also large monazite resources in Brazil, South Africa, Madagascar and Australia. TMSR are being designed in India, China and Indonesia. Moreover, Indonesia in conjunction with ThorCon sees merit in the Oak Ridge reactor design. Bill Gates and a Canadian concern, TerraPower have made investments in TSMR as well (Wang, 2018).

Early pioneers of MSR technology, the US Military may revisit the civilian market and find complimentary resilient technology. Clearly, adjustments are coming to nuclear power, induced by international actors and by climate change.

**Energy Intensive Commodities:**

**CO$_2$ lithification using basalt.**

Bill Gates identifies cement manufacture as an important CO$_2$ emission category (Gates, 2019). Like energy, cement is a desirable commodity. For millennia, the use of cement has created improvement in society. It is a very resilient building material.

Columbia University has been researching CO$_2$ disposal in basalt (Broecker, 2018). Representative equations for the reactions are:

1. **In Ultrabasic Rocks:**
   
   \[ Mg_2SiO_4 + 2 CO_2 \rightarrow 2MgCO_3 + SiO_2 \]
   
   - Forsterite
   - Magnesite
   - Quartz

2. **In basic rocks such as basalt**
   
   \[ MgSiO_3 + CO_2 \rightarrow MgCO_3 + SiO_2 \]
   
   - Enstatite
   - Magnesite
   - Quartz

In iron-bearing members of the Olivine and Pyroxene solid-solution series the products carbonate would be...
members of the magnesite-siderite solid solution series. Basalts and Ultramafic rocks are extremely common and widespread: Figure 10 shows only the LIPs (large igneous provinces), but smaller occurrences of both basalt and ultrabasic rocks occur almost universally.

Power plant or other CO₂ emissions would be entrained in water and injected into the formation at 150 psi. Experience at one injection site in Iceland found that, after 100 days, there was a 10-fold reduction in CO₂ but that mineralization was plugging available pore space. Gadikota (2014) looked at fluid/mineral interaction using a laboratory reactor and found the results would vary by local conditions. Olivine readily reacted with CO₂, but the emplacement of new minerals made micro-fractures and permeability degradation possible. The risk of the formation rejecting the CO₂ early in the program was a potent one (Gadikota, 2014).

Forbes has published some cost figures for CO₂ disposal into basalt: $30 to $130 dollars per ton, with the highest cost being the water needed for the 25/1 water-to-CO₂ mix (Burns, 2016). Costs for several sectors were examined by Leeson (2017) and vary from $30-$70/ton CO₂. Cement represents 27% of industrial CO₂ production (Leeson, 2017) and annual global cement-manufacturing emissions are 1.306 x 10⁹ tons CO₂. Cement costs vary from $20-$28 per ton. Basalt can potentially absorb more than 10,000-1,000,000 Gt of carbon via mineral carbonation. Basalt is plentiful: major provinces are shown in Fig.10.

Broecker noted the permeability problem in basalt and suggests fracking (Broecker, 2018). EIA states that oil field experience shows well cost is $6,000,000, including a horizontal section perforated and injected with propping agents (EIA, 2016).

**Conclusion**

Many geologic tasks are performed for the military by contractors, and this work is often identical in nature to the geological work performed under contract for many cities. Military installations support missions but also supply utilities, schools and residences for thousands. The geological work goes on, as does the preparation of airmen, soldiers, marines and sailors.

With appropriate intelligence information in hand, Figure 1 shows the CO₂ theatre of operation. As the deep hues of red suggest, NASA notes that warming is more pronounced in the Arctic (Schmidt, 2019). Disappearing Arctic Ice (Coats, 2019) is prima facie proof of climate change. For a number of decades, America has been in dialog with itself about man-made global warming (Broecker, 1975) and the green-house gases that are its cause (Pierrehumbert, 2011). If the reader wishes to examine more background for man-made climate change, Broecker has written an autobiography (Broecker, 2012). Broecker, who coined the phrase “global warming,” passed away on February 18th, 2019.

**Disclaimer**

The opinions expressed in this article are solely those of the author and do not represent those of the US Government, or of the US armed forces.

**References**


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