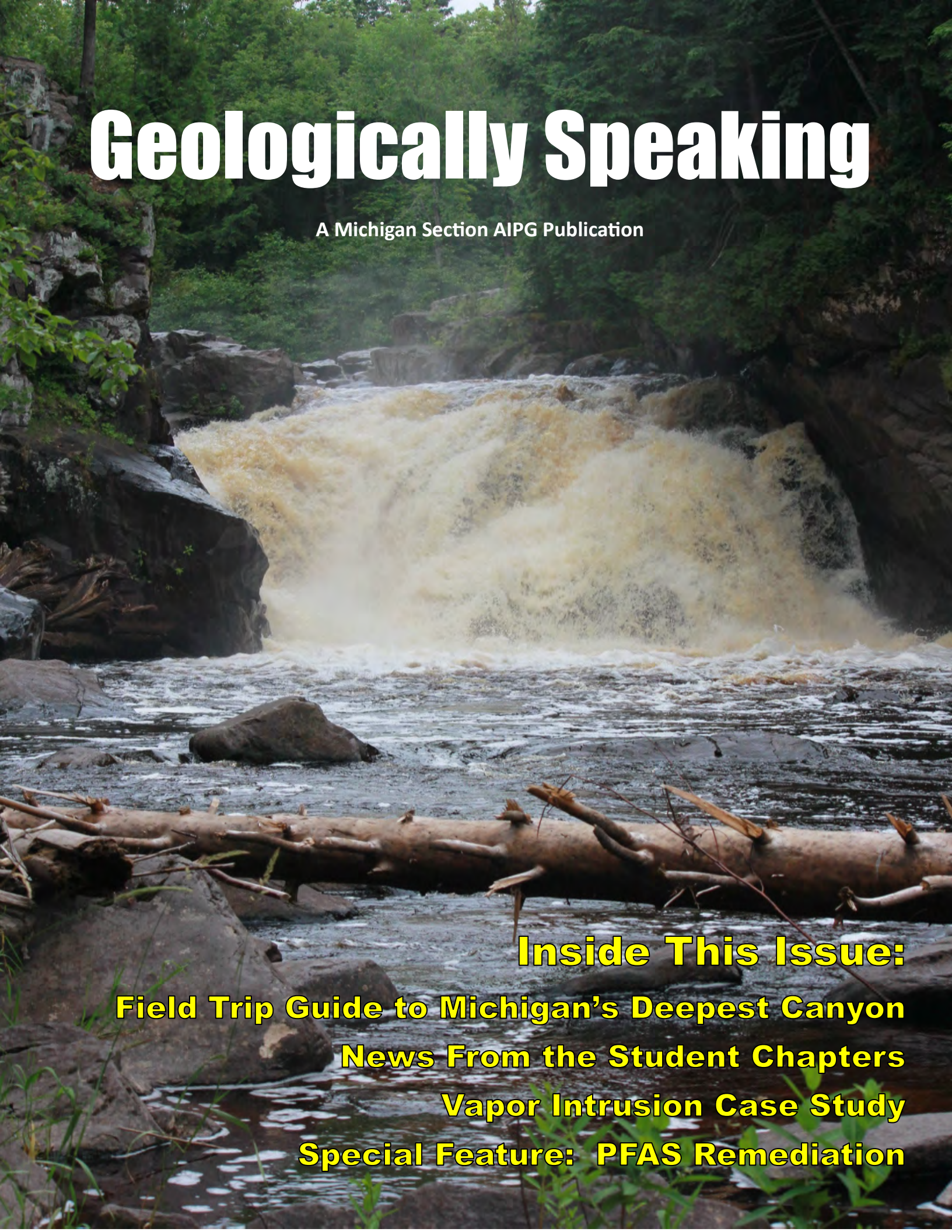

Geologically Speaking

A Michigan Section AIPG Publication

Inside This Issue:

Field Trip Guide to Michigan's Deepest Canyon

News From the Student Chapters

Vapor Intrusion Case Study

Special Feature: PFAS Remediation


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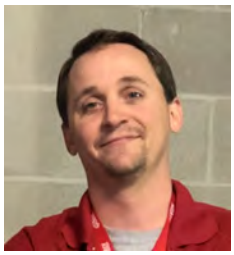

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From the President's Desk

Change is the Only Certainty Right Now

Where do I even begin? The world as we know it has been turned upside down. Things that we considered everyday norms now take thoughtful planning and care to ensure social distancing. How many of us would have dreamed that we would be living through a time where stay at home orders are happening on a worldwide scale outside the realm of science fiction? How many of us would have believed that we would work from home for weeks on end? Watching the reports of the events as they continue to unfold, and the counting of cases and fatalities becomes so difficult to hear. We know people personally who have experienced the loss of a loved one because of the Covid19 virus. Our colleague, Matt Frisch, lost his father to the virus, and we appreciated his reaching out and felt very strongly about sharing his message to our membership to donate PPE. He and his family have been in our thoughts.

I also heard the very sad news that Dr. Richard "Dick" Passero, former Western Michigan University Geology Department professor instrumental in developing the hydrogeology program, the Groundwater Education in Michigan (GEM) program, and the highly regarded hydrogeology field camp passed away from the virus. He was so influential in world of geology, the university, the lives of students, and was a genuinely good person. He will be sorely missed. Sadly, more bad news followed with the passing of another former WMU Geology Professor Dr. Richard McGehee who was the department petrologist, mineralogist, and structural geologist from 1963-1975. He too will be sorely missed.

We are facing uncertain, tough times, and they are affecting everything we do including our plans for the section activities this year. The only certainty right now is change. I am an optimistic person, though, and I do look for the silver linings in times of difficulty. In the face of change, we are learning to adapt, shift gears and be creative since we cannot rely on "we've always done it this way." I am not a fan of that mantra, anyway.

We had planned a great first quarter meeting at Eastern Michigan University to showcase their new learning facility, hold a student job fair, and hear a great presentation about Dr. Eric Portenga's research related to Isle Royale. Unfortunately, that was the same time when orders to limit the number of people participating in gatherings. We cancelled the event but have not given up on the ideas. Our plan is to reschedule the event for this fall for the third quarter meeting. Let's hope that we can meet in person by then!

We are working on launching a new student liaison committee led by our Early Career Professionals to provide greater outreach to our student members as well as provide to support to students as they transition from aca-

demia to professional.

We are rescheduling the golf outing from May to late August, but the silver lining here is that we should see some very competitive scores because all of you golfers will have been practicing most of the season.

We are disappointed that we must postpone the workshop this year, but we are just not willing to risk the health and safety of our colleagues. However, we are not just sitting back and waiting for 2021 to come around. As many of you have heard me say repeatedly, collaboration and partnership are so important for solving problems. We are working on bringing knowledge sharing to everyone in the virtual environment. Stay tuned!

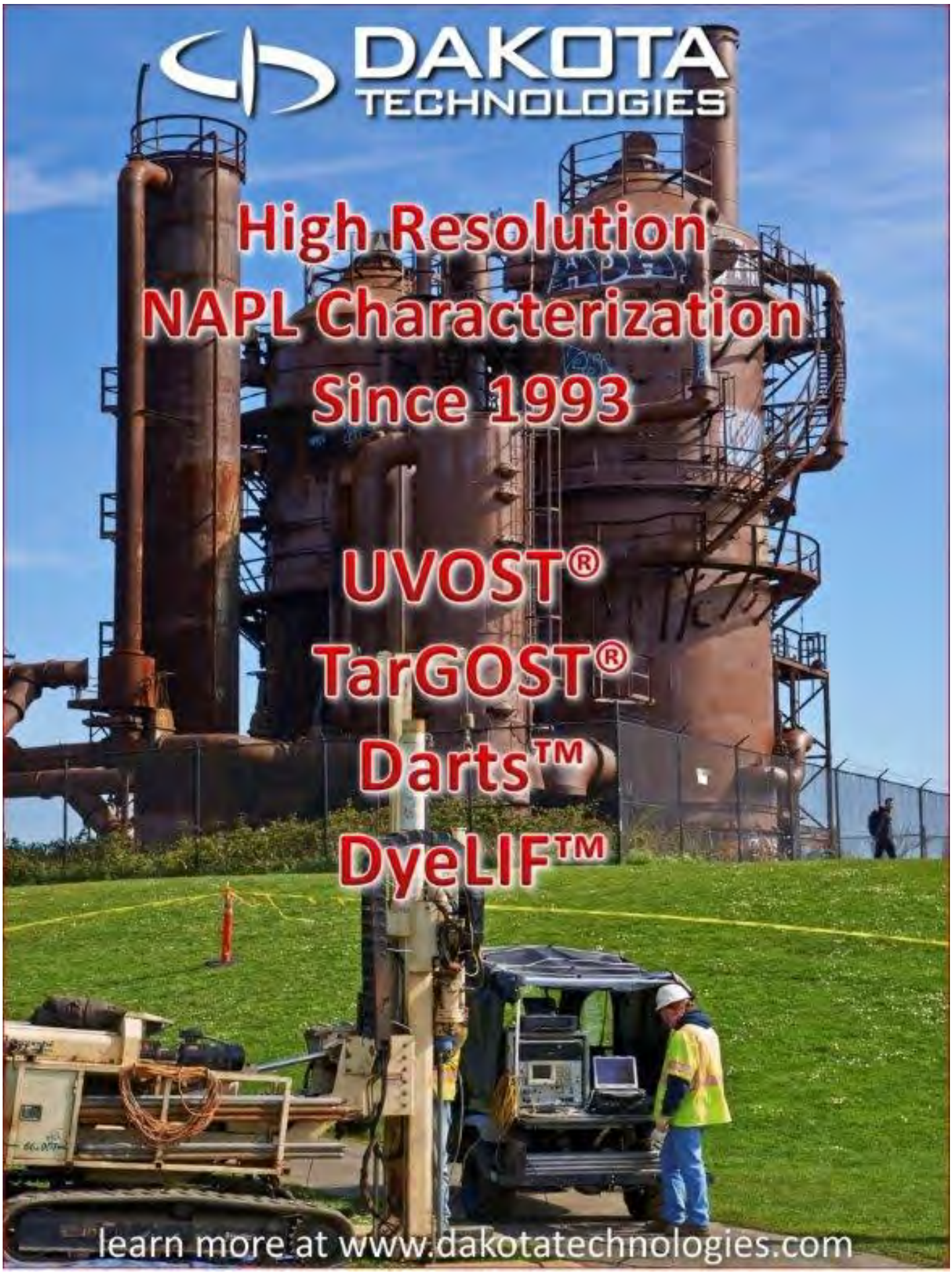
I talked about sharing our story in the January 2020 newsletter and the value of science. Another silver lining that I am observing is that the public is looking to scientists to help solve this pandemic, when previously science was viewed as a negative. While medicine is not our scientific specialty, I think that it is good news that they are looking to scientists for answers, and we can help support those scientists by talking with our families and friends about what they mean when they talk about the data, the models and the curves. Perhaps we can help calm the fear?

Additionally, if you are reading this column, you are reading a modernized version of our newsletter in an online magazine format. Again, sharing information is so important. Here is another way to do so with the goal of it being appealing and useful to our members and may become a resource for educators and Michigan geology enthusiasts. There are new features ranging from technical discussions, mini field guides, and more along with the same features that you have become accustomed to seeing. We invite you to let us know your thoughts and please consider sharing something for the next edition of *Geologically Speaking*. Send in a mini field guide so others can explore some of the interesting geologic features of the state. Do you have a case study to share? How about a discussion about fossils found in Michigan? How about how Michigan's geology was important to a historical event?

You get the idea. Michigan's geology is unique, let's celebrate it and share our story too!

So, while the only certainty right now is change, I am hoping we can make positives out of the challenges we are faced with where we can. I hope that you are doing this too. We do not know when we will return to our typical activities, but this time has given us an opportunity to reflect and be grateful for what we have, hope for strength, give support to those struggling, and help where we can.

The earth is a dynamic system that has endured constant change for billions of years and it is still here supporting us. We are geologists, let us persevere just like the earth!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CMU AIPG and Science Olympiad

My name is Dan Figac, and this is my third academic year in AIPG. I am the current President of Central Michigan University's student chapter. For years, we've volunteered with the Science Olympiad as an organization. The Science Olympiad lets middle and high school aged science enthusiasts compete in a tournament of wits to see which school is best. As volunteers, the CMU AIPG student chapter has been creating and proctoring tests for the students, and every year, we are happy to volunteer. Lauren Galien and I have been deeply involved in communicating with the organizer, Martin Eltzroth, ensuring this whole process went smoothly.

This year, we split off into groups in our chapter to get a chance to participate. Each group wrote a test for a specific subject and division (Geologic Mapping C, Fossils B & C, Dynamic Planet B&C; Division C is high school, Division B is middle school). The entire chapter participated in making the tests, and four of us were at the event, proctoring the exam. I handled Fossils B & C, Lauren Galien did Dynamic Planet B, Andrew Harrison did Geologic Mapping C, and Jacob Zieziul did Dynamic Planet B. Each of us watched over the students as they took our tests within 50 minutes. You could hear the students trying to figure things out and it was fun to grade. Of course, when some students didn't know the answer, they would sometimes fill in jokes. For example, when asked to name oceanic zones, a student simply responded with "RIP" in each of the blanks. The average score of all the exams were low, in the realm of 50% correct, but the students had fun and so did we. They even provided us with free donuts and pizza.

Participants in Science Olympiad: (Left to right, top to bottom) Daniel Moulton (Secretary), Raechel Duhaime (Member), Victoria Konieczka (Member), Grace Borst (Member), Jacob Zieziul (Publicity), Nolan Gamet (Vice President), Emily Yoder (Member), Luke Wellman (Treasurer), and

This Article continues on Page 25...

Did You Know?

This article is intended to remind members of various aspects of AIPG and benefits of membership. If there is something you would like to see featured in this column, please contact the Editor…

Do you ever wonder what AIPG does, or what membership in the organization is good for? Then read on; the following information is straight from the AIPG website...

What AIPG Does

- Professional Certification

  Certifies geologists based on their competence, integrity and ethics.

- Advocacy

  Presents testimony and position papers to federal and state legislators and agencies on matters affecting geologists and geologists' employment opportunities.

- Ombudsman

  Intervenes with regulatory boards and agencies on behalf of individual geologists, at the geologist's request.

- Publication

  Publishes a quarterly magazine, The Professional Geologist (TPG). TPG provides a forum for discussion and dissemination of professional and scientific information in all areas of geology.

  TPG is distributed to over 10,000 members, businesses, libraries, universities/colleges, and government agencies.

- Insurance

  Provides access to liability insurance for errors and omissions, designed specifically for geologists, and a full line of health, life and accident insurance.

- International Comity

  Through agreements with professional societies in other countries, provides access for its Members to professional registration, certification, or chartered status in those countries.

I'll add another item here:

Networking

As everyone has heard, "It isn't *what* you know, its *who* you know." AIPG offers the ability for you to grow your network of professional colleagues with members across the country and potentially around the world. Are you looking for a subject matter expert to help you on a project you are working on or are pursuing? Or are you looking to make a move to a new (or a first!) job? Get to know your peers in AIPG; they are more than willing to help you find what you are looking for!

One thing to note is that only the National President (or someone specifically designated by the President) is to represent the position of the Institute. Anyone may talk about the Institute and what it does, but if a public figure or member of the media asks what AIPG's position on a certain topic is, they should be referred to the President.

Section Website Reminders

The Michigan Section has created a database of geologic photographs on our website. Please submit photographs that you are willing to share to Adam Heft at adam.heft@wsp.com. Don't forget to include your name and a short explanation of what the photograph depicts. The photographs will be uploaded to the website periodically.

If you have suggestions on other items that should be included on the History page, please let a member of the Section Executive Committee know.

Minerals for Sale!

Long-time Michigan mineral collector and dealer, Bill Micols, is selling his lifetime collection of material. Bill is in Milford. For additional details, please see the full-page flyer on the following page.

SALE

50 year life time collection

Private museum with thousands of specimens;

MINERALS, FOSSILS, ARTIFACTS, CARVINGS, JEWELRY, ASIAN ANTIQUES, ETC.

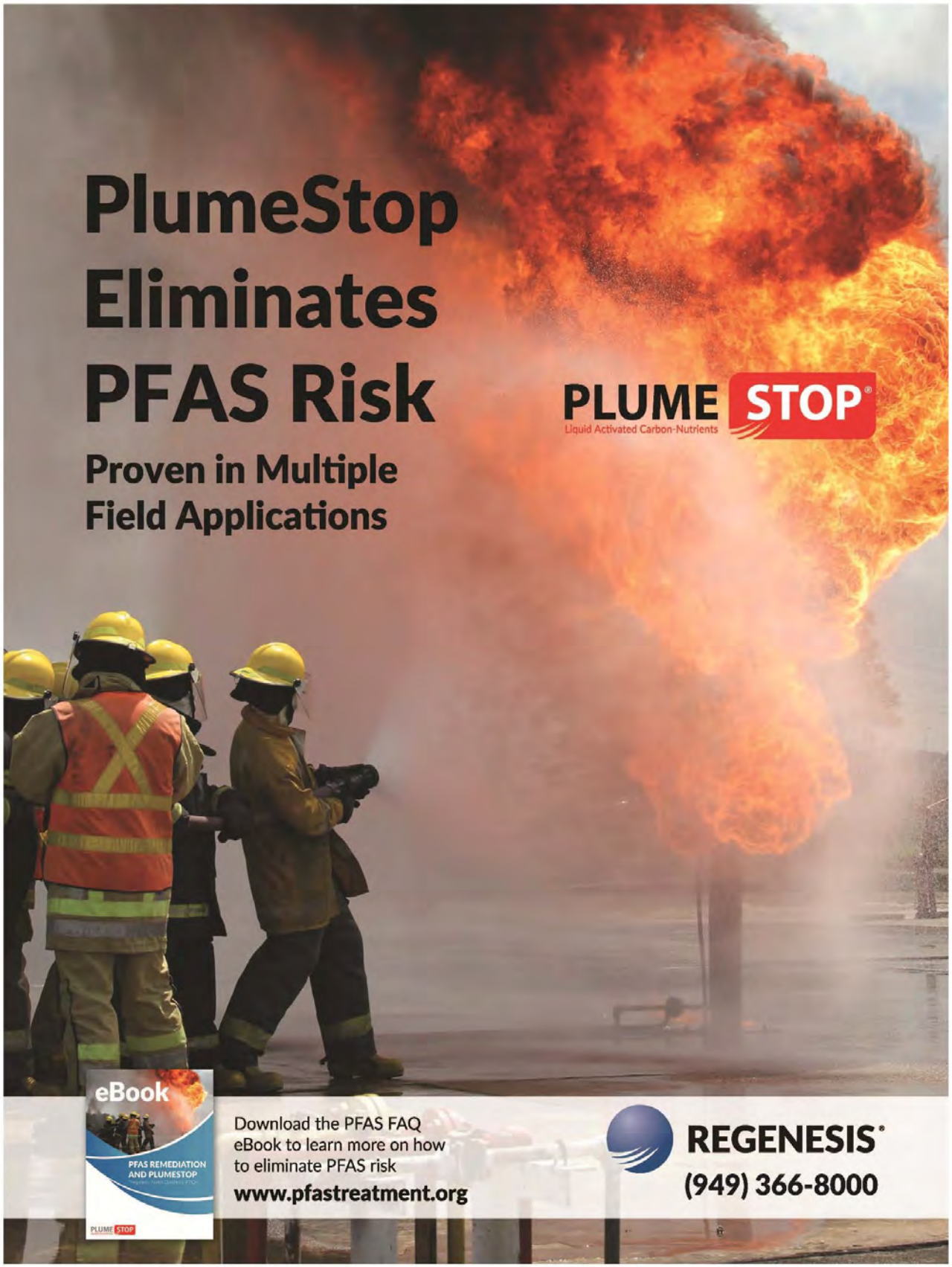
From the collections of William J. Micol, Milford, MI… Can be contacted at 1-248-842-1705 APPOINTMENT ONLY BEST PRICES GUARANTEED!!!

Where in Michigan?

The January 2020 edition of the Michigan Section newsletter featured a photograph of Bond Falls near Paulding in Ontonagon County. It is comprised of Precambrian graywacke/slate of the Copps Formation. David Adler was the first to correctly identify the photograph.

This edition of *Geologically Speaking* features a new photograph **at right** - not the photo on the cover page. The first person to correctly identify what the photograph depicts (feature name, location, formation, and age) will win AIPG swag! Submit your entry to the editor; only one per person per issue please.

Beginning with this edition of *Geologically Speaking*, you will find a new feature article called "Geology in Michigan" that presents a geologic feature of interest within Michigan as a mini field guide. One of the best parts about being a geologist is field trips, and we are hoping that in your travels around the state you include these featured spots as a stop. Why not incorporate them into a family vacation or bring friends who may not be geologists and share these locations that make Michigan unique? We hope you enjoy reading about it, and more importantly, go see it in person! We invite you to share unique geologic features that you know about and submit a "mini field guide" to share with our members in future editions.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Regulatory Roundup

Significant changes in the way we are all doing business and performing our jobs have happened since the last edition of the Regulatory Roundup. Governor Gretchen Whitmer's declared State of Emergency includes the stay at home order and has created new challenges in the realm of IT, communications, telecommuting, field work, inspections, and submittals to the Department. While the Department remains open for business working within its missions to protect Michigan's environment and public health by managing air, water, land and energy resources, the order has resulted in the closing of district offices and other facilities to visits from the public and staff telecommuting.

The Department has posted helpful information on it's webpages. EGLE has established a process for handling enforcement discretion due to COVID-19 for those with questions about the department's position on this topic. The Department has stated that there is an understanding that disruptions to standard operations under the current conditions and has established an email box (EGLE-EnforcementDiscretion@mi.gov) to accept requests for regulatory flexibility. Please visit the link above for full details on the topic of enforcement discretion.

Additional Department activities during this State of Emergency are also posted on at www.michigan.gov/egle. Governor Whitmer called for water reconnections statewide and funds to help communities comply. The Department has provided a video and guidance for homeowners on how to flush their pipes when water connections are restored to ensure that the water is safe for drinking and cooking to avoid exposure to lead, copper, and other sediments.

News releases, program information, and MI Environment, the Department's blog, are also accessible via the homepage. During these times of great uncertainty, we recommend visiting the homepage frequently to find the latest information and Departmental activities.

Be sure to stay safe, follow CDC guidelines, and observe social distancing practicing and hopefully, we can limit the spread of the virus.

Proposed Rules

Natural Resources and Environmental Protection Act, PA 451 of 1994, as amended, bill search

Safe Drinking Water Act, PA 399 of 1976, as amended, bill search

Gas Safety Standards, PA 165 of 1969, as amended, bill search

Vapor Migration Between Buildings

Case Study using HAPSITE®, Differential Pressure, and Weather Station Monitoring

Authors: Sam Baushke, P.E. & Wayne Amber, Ph.D., Geosyntec Consultants

sbaushke@geosyntec.com, (734) 794-1560

wamber@geosyntec.com, (734) 794-1549

Two independent sources of vapor impacts have been identified in the vicinity of two adjacent commercial buildings: 1) tetrachloroethylene (PCE) from nearby historic dry cleaning operations, and 2) methylene chloride (MC) from existing on-site wood treatment operations at one of the two buildings subject to this assessment. Both PCE and MC have been detected in indoor air (IA) at the two adjacent commercial buildings. A focused vapor intrusion (VI) investigation was implemented to more clearly detail the VI conceptual site model and better understand vapor migration pathways between and around these adjacent buildings.

The investigation included passive soil gas sampling, building surveys, co-located IA and sub-slab (SS) soil gas sampling, bio-attenuation parameter screening, week-long differential pressure and weather monitoring, and real-time analytical sampling with a HAPSITE® during controlled manipulation of settings on heating, ventilation, and air conditioner (HVAC) systems. Investigation locations are shown on **Figure 1**.

Using data from the passive soil gas sampling survey, along with traditional vapor intrusion investigation methods, strong lines of evidence related PCE impacts to a subsurface source near the former dry cleaner. However, the presence and migration of MC impacts between buildings presented a greater challenge due to its existing use in indoor air and complex building construction/characteristics. To better understand MC sources and migration, three potential VI pathways for MC

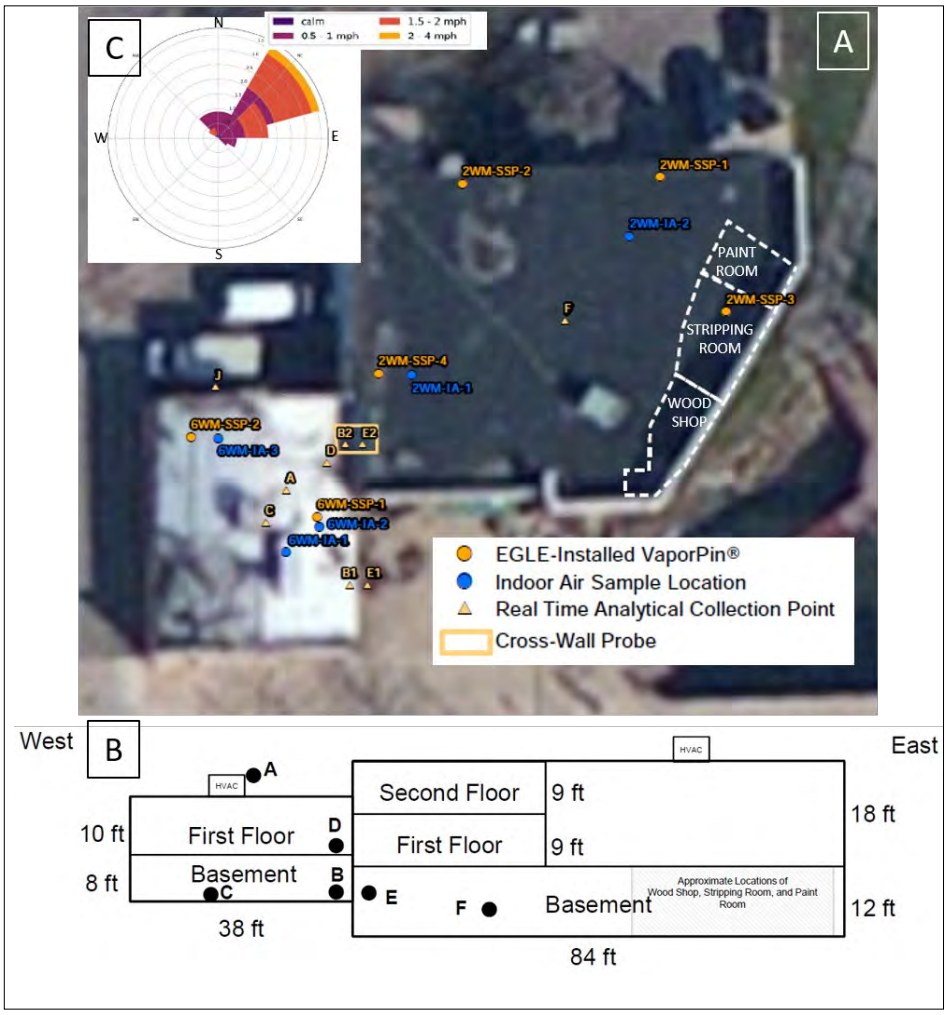

Figure 1 - Investigation Locations: (A) plan view of buildings with investigation points (B) cross-sections depicting building geometry and sample locations, and (C) wind rose depicting wind speed and direction from the roof of the building to the west during real time analytical data collection.

were evaluated using a multiple lines-of-evidence approach:

- MC is a subsurface source to IA via cracks and pores in concrete slabs,
- MC is an exterior or interior source to IA through ambient air via intakes for HVAC systems, and/or
- MC is an interior source to IA directly or via cracks and pores in the shared wall between the adjoining buildings.

Multiple lines of evidence demonstrate that MC impacts originated from an interior source at the eastern building. These lines of evidence included IA

and SS sampling, documented use of MC, and changes in real-time analytical data during HVAC system control and real-time analytical monitoring.

Where IA and SS samples were co-located and MC was detected in both media, the IA concentrations ranged from 70 to 100 times higher than their paired SS location (i.e., corresponding with attenuation factors of 0.010-0.014 in both buildings) and exceeded published background levels. SS concentrations of PCE ranged from 1,100 to 1,400 times higher than the paired IA concentration at most locations. (i.e., corresponding with attenuation of 0.0007-0.0009). The most conservative of these attenuation factor estimates would not have resulted in a screening level exceedance for the maximum MC concentration collected in the subsurface.

Another line of evidence was the behavior of MC and PCE during real-time HAPSITE® monitoring. Real-time monitoring during HVAC system control showed inverse concentration trends for MC and PCE between different HVAC system scenarios at interior sample locations B through D. Inverse relationships associated with changes in HVAC condition changes are consistent with separate sources of the chemical impacts (i.e., sub-surface vs. interior source). In the western building, MC concentrations appear to dilute at locations E and F during building depressurization, consistent with an interior source mixing with fresh air entering the building. PCE concentrations, however, sustained between HVAC conditions, which could indicate an increase in mass flux for PCE from the subsurface during depressurization. These conditions are consistent with PCE impacts emanating from a subsurface source.

Multiple lines of evidence support that MC impacts to IA migrate through the shared wall from the interior source at the eastern building, including outdoor air testing at Location A (HVAC intake), differential pressure between the two buildings under normal HVAC conditions, and smoke testing during venting of the eastern building.

The pathway is not likely through outdoor air, because the outdoor air pathway was assessed during real-time

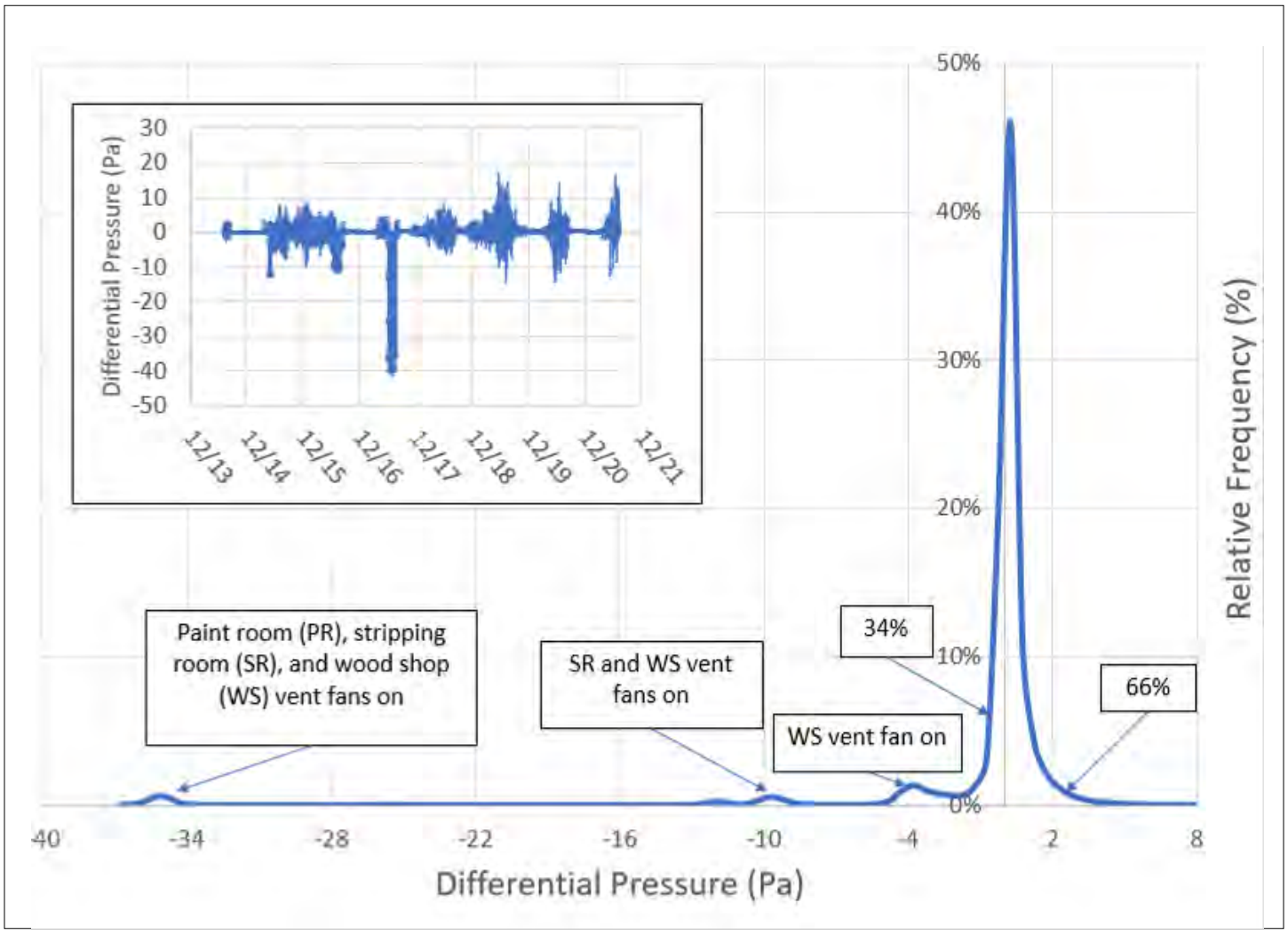

Figure 2 - Weeklong Distribution of Differential Pressure Readings Between Buildings and Differential Pressure vs Time (inset)

monitoring at Location A. Under light wind conditions (i.e., 0-3.5 miles per hour) when the wind was blowing from the northeast, and the HVAC intake was operating, the concentrations at the intake were much lower than the concentrations in IA.

Differential pressure between the two buildings showed that the driving force was most often (i.e., 66% of the time monitored) in direction from the eastern building towards the western building, except when the vent fans (wood shop, stripping room, or paint room) were on as shown on **Figure 2**. Cracks and holes between the two buildings were identified as preferential pathways. When vent fans were on in the eastern (~35 pascals of differential pressure), smoke was pulled into cracks in the basement wall of the western building.

Conclusions

A multiple lines of evidence approach – using multiple, rapid field investigation tools – was completed to facilitate analysis, discussion, and understanding of the VI conceptual site model. The data also support identification of appropriate sources for enforcement (e.g. EGLE, Department of Health, OSHA), and will inform mitigation strategies for two independent sources of PCE and MC. Recommendations for reducing exposure to MC in indoor air, included: ceasing use of MC indoors; increasing ventilation system operation frequency; reducing potential off-gassing from treated wood materials; adjusting building conditions to direct differential pressure towards the eastern building; and/or reducing preferential pathways/ permeability in the shared wall.

Students - Reminder

Your student Chapter Reports are due by May 1. Send a copy to Dorothy Combs at National at aipg@aipg.org and to Adam Heft at adam.heft@wsp.com.

Invitation to Our Members!

Do you have a case study to share?

The Michigan Section AIPG promotes knowledge sharing and would like to showcase case studies from projects where others may benefit from successes as well as lessons learned. We feel as professionals that learning from each other is a great opportunity that AIPG offers our members. AIPG offers connection with other professionals and their experiences in the work we do every day. This case study represents what we would like to offer more to our members, not only as a way to solve problems, but unify us as professional geologists. Additionally, do you have a suggestion for other types of information to share that would be of interest to our membership?

Please send your case studies and suggestions for future publication in upcoming editions of *Geologically Speaking* to the Editor.

Vote for Adam Heft for AIPG National Editor!

Adam Heft, Michigan Section's Newsletter Editor, is running for National Editor of *The Professional Geologist*.

"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.

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."

Be sure to vote for Adam and all of the National officer candidates by June 30, 2020 Online voting available, follow the link below.

2021 National Officer Ballot

Welcome New Members

The Michigan Section is continuing to grow. Please welcome the following new CPGs, Professional Members, Early Career Professionals, Associate Members, and Students:

Grace Borst, SA-10574; Emily Clor, ECP-0624; Hailey Waldron, SA-10567; Morgan Bergren, SA-10580; Karlee Foster, SA-10581; Michael Sandusky, SA-10590; Brandon St. Aubin, SA-10584; Autumn Burns, SA-10593; Benjamin Moyer, SA-10633; Ryann Scott, MEM-3171; Shawn Steckenfinger, SA-10660; Kristen Foley, SA-10705; Mark Erickson, MEM-3178; Bruce Bilgreen, SA-10697; Olivia Salvaggio, SA-10698; Patrick Howe, ECP-0655; Kathryn Strohauer, MEM-3181.

To each of our new members, welcome to our Section. We encourage you to attend Section meetings and other events. You are also invited to provide information for the Member's Corner articles.

Member's Corner

The Member's Corner includes information about the Section's membership. This is your chance to provide information on where you are and what you are doing. Simply send the information to the Editor for inclusion in this section.

No Member's Corner articles were received for this edition of *Geologically Speaking*.

Interesting Geology Links

The Editor has received links to various interesting geology-related sites. Some of the more interesting links are included here. If you have any links to geology-related sites that you would like to share, please forward them (with a citation, if applicable) to the Editor.

Thanks to Mark Francek of Central Michigan University for sharing via the "Earth Science Site of the Week" emails. This edition features a few "fun" links

Lahars from an Eruption of Nevadodel Ruiz Sweep Down River Valleys and Destroy Communities: https://twitter.com/USGSVolcanoes/status/1194764110778568704

Aquifers: Map of the Principle Aquifers of the United States: https://water.usgs.gov/ogw/aquifer/map.html

Tsunami Caused by Volcanic Sources: https://www.youtube.com/watch?v=AXHN14IHtLY

2020 AIPG MICHIGAN SECTION ANDREW MOZOLA SCHOLARSHIP

The Michigan Section of the American Institute of Professional Geologists (AIPG) is committed to supporting undergraduate scholarships and has established the Andrew Mazola Memorial Scholarship to support undergraduate students majoring in geology with college education costs while encouraging student participation in AIPG.

Application Deadline and Award Date

Completed applications must be received by June 1, 2020. The scholarship awardee will be notified no later than June 30, 2020.

$4,000 AWARD FOR AN UNDERGRADUATE STUDENT ENROLLED IN AN ACCREDITED MICHIGAN COLLEGE OR UNIVERSITY

ELIGIBILITY REQUIREMENTS:

- At least a Sophomore
- Must be a student member of AIPG at the time of application
- Must have an overall GPA of 3.0 and a 3.5 or better in geology

Students!

Why do you want to be a Geologist?

What was it that sparked your interest?

What are your career goals?

Do you participate in activities outside of the classroom that are geology related?

Apply today!

Basis of Awards

The scholarship award will be based on content and creativity of the cover letter, the letter of recommendation, and transcripts, as judged by the Scholarship Committee. Financial need is not a consideration for the basis of the award.

Application Process

1. Submit a cover letter introducing yourself and tell us why you want to be a geologist.

2. Submit a copy of your transcript (unofficial is acceptable) as documentation that you are a current student, and documentation indicating you have declared a major in geology/geoscience.

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

The application packet should be submitted to:

Attn: MI-AIPG Scholarship Committee Chair
Mr. Timothy B. Woodburne, CPG
Prein & Newhof
3355 Evergreen Drive, NE
Grand Rapids, MI 49525
e-mail: twoodburne@preinnewhof.com

Questions? Please contact Tim Woodburne at (616) 364-8491 or via e-mail.

...Continued from Page 8

We didn't stop there. When on a conference call with the Michigan section AIPG, other student chapters chimed in saying they too were working with the Science Olympiad. So, I reached out to the other Michigan student chapters and send them copies of our test along with pointers on creating their own. Working together, the students of the Michigan section AIPG are helping STEM-enthusiastic students to learn important concepts well before college.

We've been proud to volunteer with the Science Olympiad and will gladly keep participating for years to come.

Wayne State University Update

The Wayne State University AIPG Student Chapter has had an interesting year. Most of it was spent planning our annual field trip and working to revive old outreach programs. We are working on developing programs for schools to come and learn about geology in Wayne State's Mineral Museum and participate in hands-on activities. Over spring break, members took notes on the interactive displays at the St. Louis Science Center to hopefully implement some of those activities in our own programs. We decided to postpone our joint Geoscience Club and AIPG summer trip to Yellowstone National Park, but we believe this will help next year get started on a more secure footing. We held bi-weekly meetings, bake sales, and had workshops planned for the remainder of the semester which have sadly been postponed.

Our membership has expanded this year to include several non-majors and minors whose interest and love for geology and the earth everyone shares. I believe we are very lucky to be at Wayne State surrounded by a group of wonderful, kind, and caring people who share this enthusiasm and love for the planet!

Geology in Michigan – Sturgeon River Gorge Falls

Latitude: 46°38'32.87"N; Longitude: 88°41'36.79"W

Section 16, T49N, R35W, Houghton County

Directions

Figure 1: Map showing the location of the Sturgeon River Gorge Area in relation to L'Anse. Source: Google Earth Pro.

Figure 2: Map showing a close up of the Sturgeon River Gorge Area. Source: Google Earth Pro.

From the Broad Street/US-41 intersection in L'Anse, go south on US-41 approximately 7.7 miles and turn right onto Baraga Plains Road/Prison Camp Road. Proceed west 5.95 miles to the "T" intersection, which is still Baraga Plains Road. Head south for 1.36 miles to Gorge Cut-off Road and turn right (west). Follow the road for about 1.64 miles to the "T" intersection with Forest Service Road 553 and turn left. Continue straight/southwest for 1.05 miles to Forest Service Road 2200 (Sturgeon Gorge Road). Turn Right and follow the road north for 2.5 miles to the hairpin bend to the right (northeast). Take the first left onto Forest Service Road 193 (NF 2210) and drive for 0.6 miles Figure 1 and 2 depict the location. The parking lot for the falls gorge is on the right-hand side of the road. You will need to cross the road and follow the trail to the falls and gorge. The unimproved trail (Photo 3) is approximately one mile in length to the falls, and has some significant elevation changes. The trail comes out onto the top of the falls, but you can continue downstream.

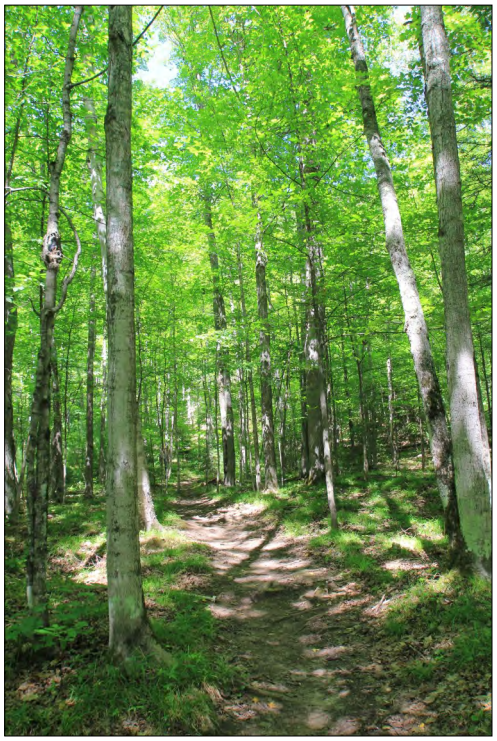

Photo 3: Sturgeon River Gorge trail.

Once you reach the gorge area, you will note that the river has a small, two-foot drop over a sandstone ledge (Photo 4). The river narrows and enters a basalt gorge with a three-foot drop (Photo 6). The main falls is an approximately 20 foot-drop over basalt (cover page photo). The river channel widens after the main falls and flows between sandstone cliffs. Sandstone outcrops for about a half-mile downstream.

Michigan's Deepest Canyon

The Sturgeon River Gorge is Michigan's deepest can-

Photo 4: Sturgeon River and the two-foot sandstone ledge.

yon. Situated within the 14,000-acre Sturgeon River Gorge Wilderness Area of the Ottawa National Forest, there is plenty to explore including stunning waterfalls, rapids, ponds, oxbows and terraces along a 13-mile section of the river. In addition, the North Country National Scenic Trail runs immediately adjacent to the wilderness on its eastern boundary. Outdoor enthusiasts can plan on hiking, primitive camping, canoeing, white-water kayaking, hunting, and fishing.

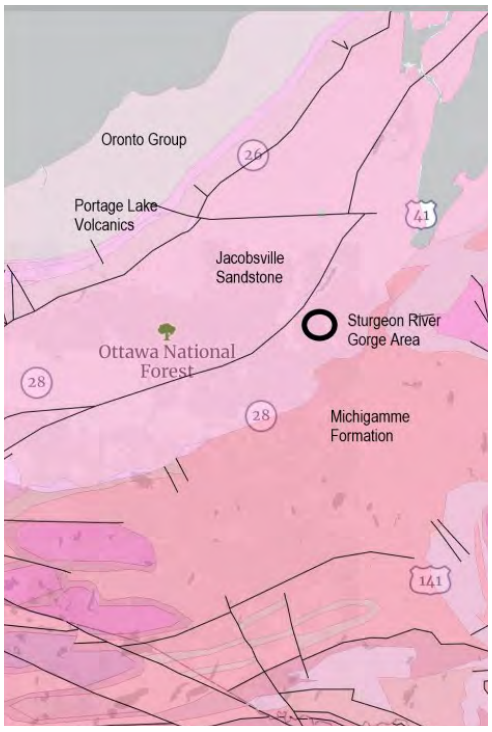

Figure 5: Map showing the bedrock geology of the region. Source: Rockd app.

Geology

This location features two separate geologic formations of Precambrian age: The Middle Keweenawan Portage Lake Volcanics and the Jacobsville Sandstone. The Sturgeon Falls cataract is comprised entirely of the Portage Lake Volcanics, while the Jacobsville Sandstone is encountered a short distance up-

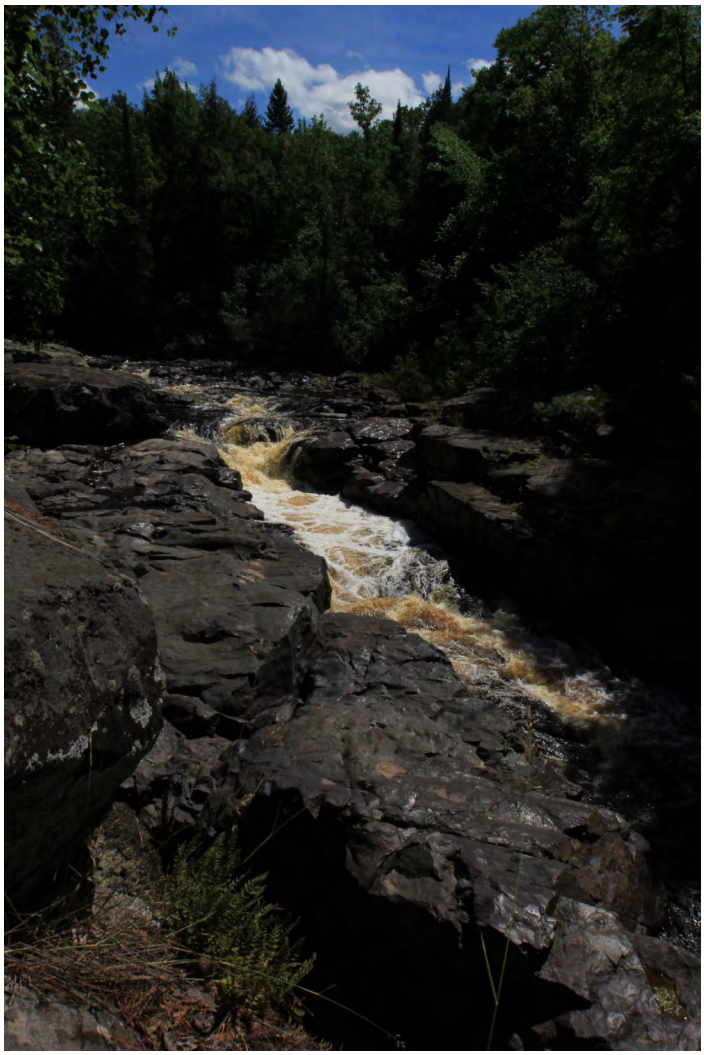

Photo 6: Sturgeon River and the three-foot drop into the basalt area.

Photo 7: Downstream contact between the Portage Lake Volcanics and the Jacobsville.


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Photo 7: Jacobsville Sandstone and boulders of the Portage Lake Volcanics downstream of the main falls.

stream (south) and downstream (north) of the main falls. The current versions of the bedrock maps (Figure 5) do not correctly represent the geology of the outcrops at the Sturgeon River Gorge area, as the Portage Lake Volcanics are not shown.

The Portage Lake Volcanics formed during middle Keweenawan time, approximately 1.1 billion years ago. Hundreds of basaltic flows formed a series thousands of feet thick. During cooling, each flow evolved quantities of gas, which formed bubbles and rose to the top of the flow. As the flow cooled, some of the gas became trapped within the flow tops and formed vesicles. Later infilling of the vesicles produced amygdaloids.

Photo 8: Jacobsville Sandstone downstream of the main falls.

The Portage Lake Volcanics at this location is fine-grained basalt flow material with three amygdaloidal zones. The basalt strikes northeast-southwest with a 10- to 15-degree dip to the northwest. The amygdules are filled with quartz, chlorite, calcite, chalcedony, and epidote. The flows are reportedly 45 percent andesine, 20 percent augite, 25 percent chlorite, five percent ilmenite, and two percent epidote. The lath-shaped andesine is altering to epidote and kaolinite.

Photo 9: Mining Jacobsville Sandstone at the Kerber-Jacobs Quarry circa 1897. Source: Wikipedia.

The Jacobsville Sandstone is generally a coarse-grained feldspathic sandstone stained red by iron, reddish to reddish brown in color, and having white “reduction zone” spots around bedding planes, joints, and other more permeable parts of the rock. It is believed to have formed between about 600 and 950 million years ago.

The contact between the Portage Lake Volcanics and the Jacobsville Sandstone at the Sturgeon River Falls shows that the Portage Lake Volcanics were tilted, weathered, and eroded prior to deposition of the Jacobsville.

Rock Fun Facts

The Portage Lake Volcanics are found primarily in the western Upper Peninsula from the tip of the Keweenaw Peninsula southwest through Ontonagon and Gogebic Counties. It was the host rock (along with the Copper Harbor Conglomerate) to the significant native copper deposits mined from about 1840 to the 1960s. Approximately 95 percent of all copper mined came from a zone about 26 miles long, and primarily within northern Houghton County. It is estimated that 13 billion pounds of copper were mined from Michigan’s copper district. Despite this enormous amount of mined copper, it is believed that two-thirds of the copper deposit remain in the ground!

The Jacobsville Sandstone is found immediately east of the Portage Lake Volcanics along the eastern side of the Keweenaw Peninsula, through Ontonagon and Gogebic Counties, as well as along the Lake Superior south shore from L'Anse to Sault Ste. Marie. It was widely used in the late 1800s and early 1900s as a building stone for important buildings (courthouses, churches, banks, prominent hotels, etc.) throughout the state and in the northeastern US as far away as New York. Some examples include the Calumet Theatre, Saint Ignatius Loyola Church in Houghton, and the original Waldorf-Astoria Hotel in New York City. The Jacobsville Sandstone was popular as a building material because of its strength, durability, and aesthetic appeal; it's fire-proof qualities were thoroughly tested in the great Chicago fire where walls constructed of Jacobsville Sandstone stood intact without a crack, scale, or blemish caused by the great heat of the fire when nearby structures fronted with marble crumbled and fell to the ground. The Jacobsville Sandstone has been designated by the International Union of Geological Sciences as a Global Heritage Stone Resource.

References

Google Earth, www.google.com/earth/.

Michigan Academy of Arts, Sciences, and Letters and Michigan Geological Society, *Copper Country Field Trip*, June 1947.

Michigan Basin Geological Society, *Annual Field Excursion: Geologic Features of Parts of Houghton, Keweenaw, Baraga, and Ontonagon Counties, Michigan*, p. 42, 1961.

Michigan Department of Natural Resources, *1987 Bedrock Geology Map of Michigan*, 1999.

Rockd app, Macrostrat Lab, Department of Geoscience, University of Wisconsin - Madison.

The Trust for Public Land, Sturgeon River Gorge, https://www.tpl.org/our-work/sturgeon-river-gorge.

Wikipedia:https://en.wikipedia.org/wiki/Jacobsville_Sandstone.

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ASBOG Exam Update

The March 20, 2020 Fundamentals of Geology ASBOG exam at Central Michigan University was cancelled due to the Covid-19 pandemic. The 27 students who were signed up to take the exam are automatically registered to take it on the next date. The exam will be offered on October 2, 2020 at CMU. Registration for the exam closes in mid-August. If you are interested in registering for the exam, please contact Dr. Larry Lemke at Lemke1ld@cmich.edu Details are provided in the following link: se.cmich.edu/asbog and will be provided in the next edition of *Geologically Speaking*.

Member Input Sought

The Section Executive Committee is seeking input from members on a variety of topics. Do you have any suggestions regarding speakers/presentation topics that you would like to hear? What about field trips or other events? Some place you'd like to see us go, or something you think the membership would enjoy doing? Then make your voice heard; please send your suggestions to one of the members of the Executive Committee; any of the six members would be glad to hear from you. AIPG is your organization. Please help keep it relevant and interesting for all by participating.

Support our Sponsors!

The Section Executive Committee would like to remind its members to support the companies advertising in this publication. Consider working with these companies, and when you speak with their representatives, let them know that you saw their ad in the Michigan Section's *Geologically Speaking*.


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Annual Meeting Planning

The Michigan Section AIPG will be hosting the 2021 Annual Meeting in Marquette on August 14-17, 2021. The planning committee is growing but needs your help! The committee is co-chaired by Adam Heft and Sara Pearson. If you are interested in helping with the planning of the 2021 Annual Meeting or would like to be on the planning committee, please email either Adam or Sara at adam.heft@wsp.com or pearsons@michigan.gov.

As one of the most active AIPG Sections, Michigan wants to have an exciting program and a highly successful Annual Meeting with many attendees. If you have any suggestions or ideas that will make the 2021 Annual Meeting one to remember, please pass them along.

Look for periodic updates on the status of the Annual Meeting planning in future editions of *Geologically Speaking*!

Update Your Information!

Please be sure that you continue to receive the Section's *Geologically Speaking* publication and other announcements. Submit an updated e-mail address to Adam Heft at adam.heft@wsp.com. If you move or change places of employment, don't forget to send your new contact information to both the Section and to National. If you are not receiving announcements directly from the Editor, it is because your email address is not up to date with the Michigan Section.

Please help the Editor by making sure that your email address doesn't bounce when the next announcement is sent. And be sure to cc Dorothy Combs, National AIPG Membership Director at aipg@aipg.org when you update your contact information. Thank you!

Michigan Tech at the Eben Ice Caves

On Saturday, January 25th, the Student Chapter at MTU took a day trip to the Eben Ice Caves near Munising, Michigan. The Eben Ice Caves are located in Hiawatha National Forest, just south of Munising, on the land of a farmer, who graciously allows people to walk through his fields to get to a trail that leads to these seasonal attractions. These caves are formed from water dripping down from a ledge over the winter. The water eventually forms icicles long enough to reach the ground, which forms a tunnel for people to walk through and explore (Picture 1). This is a popular attraction for people in the area to get out and relax in the middle of winter.

Photo 1: Club members enjoying their time at Eben Ice Caves.

The group hiked about a mile with snowshoes and yak tracks, which included passing through a cornfield, walking over logs, and jumping over creeks to get to the farthest cave. On the walk back, we stopped at the larger ice cave (Picture 2). From the last cave back to the main trail was a steep downhill, so we took off our snowshoes and slid down the hill. This cut down on travel time; however, some people had difficulty stopping.

This trip was a fun group activity where we could hang out, relax, and enjoy the warmer weather. It was great to see what the upper peninsula offers in its beauty for all seasons. We plan to do similar trips to explore the area in the colder months.

Photo 2: Evelyn Jobe at Eben Ice Caves.

Photo 3: Sienna Meekhof & Elana Barth exploring the caves.

Photo 4: Entrance to the Eben Ice Caves.

Coming Events

May 1-3, 2020: 61st Anniversary Rock and Mineral Show. Kalamazoo County Expo Center. Information is available at: www.kalamazoorockclub.org. THE 2020 SHOW HAS BEEN CANCELLED.

July 14, 2020: MAEP Golf Outing, Mystic Golf Course, Milford. Details at: https://www.maep.org/events.

August 6, 2020: Ohio Section AIPG PFAS Workshop, Columbus, Ohio. Please contact Robert Andrews, Ohio Section AIPG President at: reandrews@earthlink.net for details.

RESCHEDULED:
August 25 2020: 16th Annual Michigan Section AIPG Golf Outing at Lyon Oaks Golf Course. Complete details in this edition of *Geologically Speaking*.

September 9-10, 2020: Michigan Environmental Compliance Conference, Lansing. Info at: https://www.michigan.gov/egle/0,9429,7-135-3308_3333-514064--,00.html.

October 3-6, 2020: 57th Annual AIPG Meeting to be held in Sacramento, California. The Role of Geoscientists for Resiliency, Sustainability and Opportunities in a Changing Environment. The meeting venue will be the Hilton Sacramento Arden West.

October 9-11, 2020: Detroit Gem, Mineral & Fossil Show. Macomb Community College Expo Center, South Campus, 14500 East 12 Mile Road, Warren.

October 11-17, 2020: Earth Science Week.

October 27-28, 2020: Great Lakes PFAS Summit, Lansing.

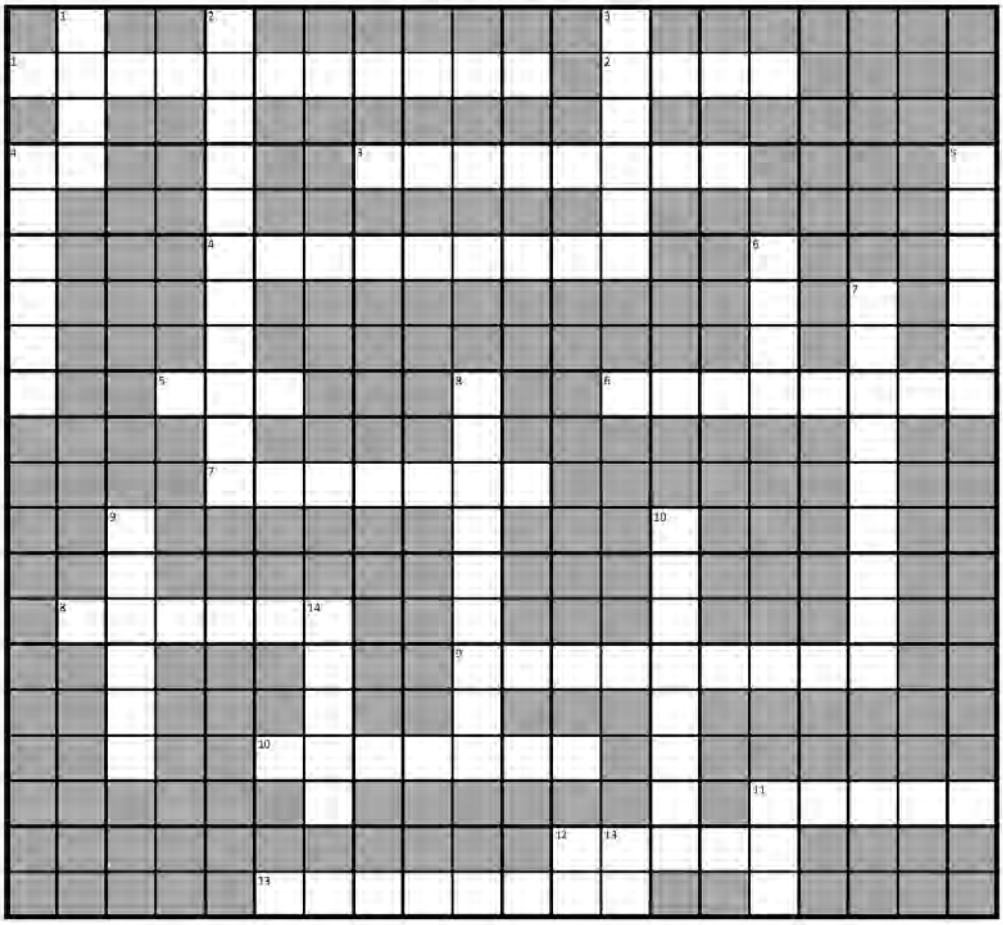
December 1-3, 2020: Great Lakes Water Infrastructure Conference, Novi. Info at: https://www.michigan.gov/egle/0,9429,7-135-3308_3333-500683--,00.html.

December 3, 2020: Michigan Section Annual Meeting, Weber's Inn, Ann Arbor.

RESCHEDULED:
June 14-16, 2021: Michigan Section's 10th Annual Environmental Risk Management Workshop: "The Data Tell the Story" at the Ralph A. MacMullan Conference Center, Roscommon, Michigan.

August 14-17 2021: 58th Annual AIPG Meeting to be held in Marquette, Michigan; dates TBD. See article in this edition of *Geologically Speaking* regarding meeting planning.

Geology Crossword



Across
1 Ancient History
2 Yooper Main Drag
3 Plagioclase solid solution mineral
4 Cemented beach
5 Copper host rock
6 First Sate Geologist
7 Green mineral
8 Black igneous rock
9 Filled vesicles
10 Potato chip
11 Watercourse
12 To stuff onself
13 Big fish

Down
1 Ferrous metal
2 Town in the Keweenaw
3 Clinopyroxene mineral
4 Canada's Capitol
5 Often "grand"
6 Ethical organization
7 Glaucoma
8 H_2O gravity
9 SiO_2
10 Pegmatite Mineral
11 2010 movie
12 ___ Forth
13 Not off
14 To follow

*The solution to this geology crossword will be included in the next edition of *Geologically Speaking*.

16th Annual AIPG Michigan Section Golf Outing
Tuesday AUGUST 25, 2020

The 16th Annual AIPG Michigan Section Golf Outing promises to be another successful event. Proceeds generated from the outing benefit the AIPG K-12 Education Grant fund, which provides thousands of dollars to a variety of worthy projects every year. Your generosity has been and will continue to be the key to enabling organizations and schools to provide meaningful educational programs and activities in the Geosciences.

This event also offers our sponsors exposure to many of the most influential professionals in our industry.

The outing is moving back to **Lyon Oaks Golf Course** in Wixom, Michigan.

Place: Lyon Oaks Golf Course
52251 Pontiac Trail
Wixom, MI 48393

Event: 18-Hole Scramble

Date Change: AUGUST 25, 2020

Registration: 8:00 to 9:15 am
Shotgun Start: 9:30
Rainout Date: August 27, 2020 (based on availability)

Registration

Register/Pay by July 30, $600/foursome, $170/Individual
Register/Pay after July 30, $700/foursome, $190/Individual

Golfer 1: _____

Golfer 2: _____

Golfer 3: _____

Golfer 4: _____

Accepted forms of payment include:
Eventbrite-search AIPG Michigan
https://www.eventbrite.com/e/aipg-mi-section-16th-annual-golf-outing-tickets-88107946239?aff=ebdssbdestsearch

or
Make Checks to:
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c/o ERG
28003 Center Oaks Ct., Suite 106
Wixom, Michigan 48393
Attn: Bob Reichenbach bob.reichenbach@ergrp.net

CALL 248-773-7986, or
FAX 248-924-3108 to reserve your place!
The AIPG-MI Section is a nonprofit
501(c)(6) Organization.

Please provide the point of contact for your foursome:

Company: _____

Contact: _____

Email: _____

Phone: _____

Includes: Continental Breakfast, green fees, range balls, lunch at turn, networking opportunities, and DINNER. Also includes: 50-50 and Grand Prize raffles along with other prizes including, $10,000, vacations, or sets of clubs for a "Hole in One", Putt-4 Dough $2,500, men's and women's Longest Drive and Closest to Pin contests, and goodie bags for all participants.

16th Annual AIPG Michigan Section Golf Outing
Tuesday AUGUST 25, 2020

Sponsor Package Information

Executive Copper Sponsor - $2,500
- **1 foursome** and 33% discount for additional golfers
- Highest Visibility Signage at the Event
- Corporate recognition at the awards presentation

Exclusive Dinner Sponsor- $1,800
Investment includes:
- **1 foursome** and 33% discount for additional golfers
- Signage at the Dinner
- Corporate recognition

Beverage Sponsor - $1,000 (2 available)
Investment includes:
- Signage at the club house and on the Beverage Cart or Oasis.
- Corporate recognition

Breakfast/Luncheon Sponsor - $800
Investment includes:
- Signage at the grill/tent.
- Corporate recognition

Hole-in-one Sponsor - $500 (4 available)
Will have visible exposure on a Par 3 Hole.
If a golfer hits a hole-in-one, the prize will be, either $10,000, a golf vacation or a deluxe set of irons.

Tee Box or Hole/Flag Sponsor - $280
(36 available)
Investment includes:
- Tee box signage and
- Pin Flag with logo

Skill Sponsor – $400
Investment includes:
(4 available)
"Longest Drive", "Closest to Pin" awards to Male/female for each.

Practice Tee Sponsor – $300
Investment includes:
(1 available)
Exclusive Signage at the Practice Tee

Putt-4-Dough Sponsor – $400 Signage on the putting area, corporate* recognition during the event (includes contest coordination at the turn and following golf provided by you). Provides interaction with all participants.

Team Photo Sponsor:
$300 SPONSOR FEE – Signage and option to provide a photographer from your organization.

Goodie Bag Sponsor - Give-away items for 120 or more golfers

Colloidal Activated Carbon Used to Reduce PFAS and Chlorinated Solvent Concentrations in Groundwater to Below Detection Limits at a Michigan Army National Guard Site

Ryan Moore, REGENESIS (San Clemente, CA)
Patricia Byrnes Lyman, Michigan Army National Guard (Lansing, MI)

REGENESIS®

OVERVIEW

Camp Grayling in Crawford County, Michigan is a year- round training center for the Michigan Army National Guard (MIARNG). The Michigan Department of Military and Veteran Affairs (DMVA) have been remediating chlorinated solvent impacts in the site groundwater from historical operations at the facility since the late 1980's. In 2016, the DMVA became aware of the potential contamination of PFAS and began testing groundwater. PFAS was found commingled with a chlorinated solvent plume that was migrating towards the property boundary. After reviewing potential options the DMVA decided to test an in situ reactive barrier application of colloidal activated carbon.

The goals for this pilot project were to utilize an approach that could both protect the Grayling community from exposure and be cost-effectively expanded to a full-scale application.

HIGHLIGHTS

- New, innovative approach using colloidal activated carbon barrier to eliminate PFAS exposure pathway and protect the community.
- Highly collaborative effort amongst interdepartmental groups.
- Economical and effective pilot study design.
- Remediation efforts were conducted with transparency for the surrounding Grayling community.
- Thorough investigation and quick response to the PFAS contamination.
- Five rounds of post-application monitoring show that PlumeStop has reduced PFAS and PCE to below target levels in each of the downgradient wells.

Core samples shown pictured illustrate effective PlumeStop distribution at a range of depths shown

BACKGROUND

Camp Grayling is the premier, full-spectrum joint training center in Crawford County, Michigan. As the largest National Guard training installation in the US, Camp Grayling provides year-round training support for the Michigan Army National Guard along with military commanders and civilian leaders to meet their readiness requirements. Camp Grayling training US multi-reserve troops and Michigan National Guards corpsmen and women for every major war over the last 100 years.

When PFAS contamination was discovered, the first priority was to eliminate the risk that the contamination posed to the community. This is an extremely difficult class of contaminants to manage because the EPA regulatory guidelines for PFOS and PFOA compounds is set at 70 parts per trillion, which is comparable to a small drop in an Olympic-sized swimming pool.

The MVDVA proactively initiated a pilot demonstration of a new colloidal activated carbon technology called PlumeStop. Colloidal activated carbon (CAC) was selected because of the expected rapid reductions of PFAS by removal from the dissolved mobile phase and well-established uses for chlorinated solvent sites. Colloidal activated carbon effectively increases the retardation factor of PFAS migration contaminants by multiple orders of magnitude and eliminates the exposure to down-gradient receptors. In addition, colloidal activated carbon was selected due to its expected lower total project costs when compared to operating a mechanical system over a similar time.

ABOUT PLUMESTOP

PlumeStop is an ***In situ*** technology that rapidly reduces dissolved-phase plumes. PlumeStop behaves as a colloidal matrix binding to the aquifer matrix, rapidly removing contaminants from groundwater, and expediting permanent contaminant biodegradation. The benefit to PlumeStop's dispersive properties is its ability to sorb contaminants, quickly removing them from the mobile phase while providing a high surface area matrix which proves favorable for microbial coloniza on and growth.

Key Benefits:

- In Situ remediation technology that rapidly reduces dissolved-phase plumes in days/weeks
- Distributes widely under low injection pressures
- Colloidal biomatrix completely biodegrades contaminants in-place
- Achieves stringent groundwater clean-up standards
- Provides a long-term means of addressing matrix back–diffusion
- Eliminates excessive time and end-point uncertainty associated with groundwater remediation

PROJECT TIMELINE

November 2016: Initial Testing Results Detect PFAS in On-site Groundwater

January 2017: First Town Hall Meeting to Inform Local Residents and Announce the Residential Well Sampling Plan

April 2017: Michigan Army National Guard Begins Collecting Residential Well Water Samples for PFOS/PFAS Analyses

May 2017: EGLE Supplies Bottled Water to Residents

July 2017: Second Town Hall Meeting Announces Plan to Supply Point-of-Use Filters

September 2017: Third Town Hall Meeting

November 2017: Sampling Begins at Lake Margrethe Due to EGLE Foam Sampling Results and The Fourth Town Hall is Held to Address Lake Margrethe PFOS/PFOA Results

June 2018: Fifth Town Hall Meeting is Held to Present Initial Results From the National Guard Bureau (NGB) Preliminary Assessment Investigation

July-August 2018: The NGB and the MIARNG Plan Pilot Test

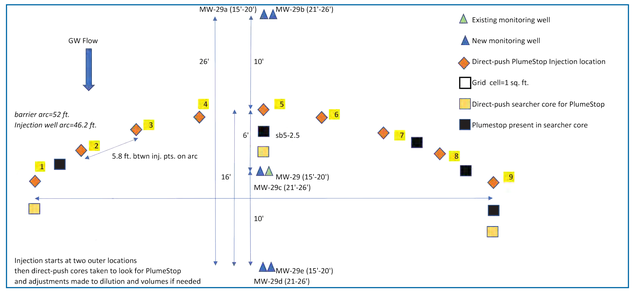
September 2018: The NGB Starts the CERCLA + Site Investigation

October 2018: PlumeStop Application Event

2019: Ongoing Performance Monitoring

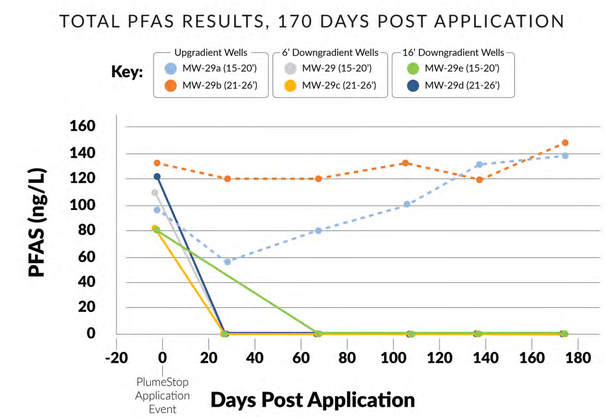
PILOT TEST

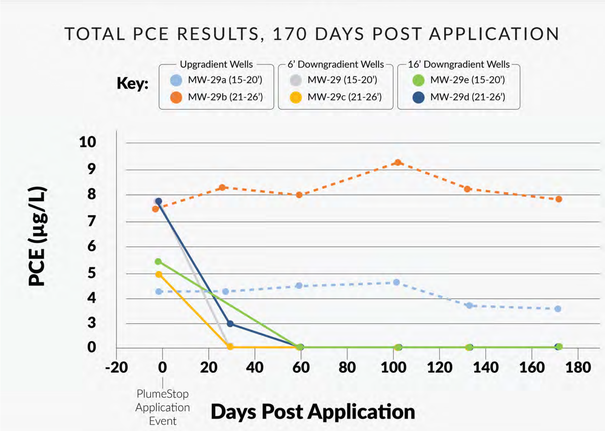
REGENESIS and the Michigan DMVA team rapidly developed an effective pilot design using a multi-target approach to address both the PCE and TCE contaminants as well as the PFAS compounds. The pilot test injection was designed as an arc consisting of 9 direct push injection locations upgradient of the existing monitoring well, MW- 29. REGENESIS tested numerous injection variables such as flow rate, screen size, injection volume, pressure CAC in order to refine the approach and optimize the horizontal and vertical distribution. The small-scale of the pilot test kept costs low as it minimized the amount of materials needed for the injection while still confirming the success of the product under this site's specific hydrogeologic conditions.



RESULTS

The mass flux and predictive competitive sorption modeling demonstrated a theoretical PFAS retardation span of greater than 50 years. Results from monitoring the field activities demonstrate distribution of the colloidal activated carbon has been achieved using low pressure injection methods. Furthermore, the post-application groundwater monitoring results demonstrate PFAS and chlorinated solvent concentrations have been reduced to below laboratory detection limits. The contaminant concentrations reductions in groundwater were achieved within one month after the field activities and have been sustained for over 170 days. This study indicates that an in-situ application of colloidal activated carbon is a viable alternative to address the risk associated with PFAS contamination in groundwater.





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